



ELECTRICAL SAFETY

Integrated Water Services, Inc.
(the Company)



Purpose

The purpose of this Electrical Safety program is to set forth procedures for the safe use of electrical equipment and tools at Integrated Water Services.

Scope

This program applies to all Integrated Water Services employees. Contractors providing electrical services to the Company are doing so knowing that they bring the higher level of expertise to bear. Contractors must follow their written electrical safety procedures.

When work is performed by a subcontractor on a company site, the contractor's written safety program shall take precedence for their employees. However, subcontractors may adopt this procedure for their use.

Definitions

Affected Personnel: Personnel who normally use and work with electrical equipment, tools, and appliances, but who do not make repairs or perform lock out/tag out procedures.

Appliances: Electrical devices not normally associated with commercial or industrial equipment such as air conditioners, computers, printers, copiers, coffee pots, microwave ovens, toasters, etc.

Circuit Breaker: A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined over current without injury to itself when properly applied within its rating.

Disconnecting Means: A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Disconnecting Switch: A mechanical switching device used for isolating a circuit or equipment from a source of power.

Double Insulated Tool: Tools designed of non-conductive materials that do not require a grounded, three wire plug.

Ground: Connected to earth or some conducting body that serves in place of the earth.

Grounded Conductor: A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

Ground Fault Circuit Interrupter (GFCI): A device whose function is to interrupt the electric circuit to the load when a fault current to ground exceeds some predetermined value that is less than that required to operate the over current protective device of the supply circuit.

Insulated: A conductor encased within material of composition and thickness that is recognized as electrical insulation.

Premises Wiring: That interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all its associated hardware, fittings, and wiring devices, both permanently and temporarily installed, which extends from the load end of the service drop, or load end of the service lateral conductors to the outlet (s). Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment.

Qualified Person: One that has been trained in the repair, construction and operation of electrical equipment and the hazards involved.

Strain Relief: A mechanical device that prevents force from being transmitted to the connections or terminals of a cable or extension cord.

Class I Locations: Are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.



- Class 1 Division 1 - Is a location (a) in which hazardous concentrations of flammable gases or vapors may exist under normal operating conditions; or (b) in which hazardous concentrations of such gases or vapors may exist frequently because of repairs or maintenance operations or because of leakage; or (c) in which a breakdown or faulty operation or equipment or processes might release hazardous concentrations of flammable gases or vapors, and might also cause simultaneous failure of electrical equipment.
- Class 1 Division 2 - Is a location (a) in which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the hazardous liquid, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in of abnormal operation of equipment or (b) in which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or (c) that is adjacent to a Class 1, Division 1 location, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

Class II locations: Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations include the following:

- Class II, Division 1 - A Class II, Division 1 location is a location (a) in which combustible dust is or may be in suspension in the air under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures; or (b) where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes, or (c) in which combustible dusts of an electrically conductive nature may be present.

NOTE: This classification may include areas of, areas where metal dusts and powders are produced or processed, and other similar locations that contain dust producing machinery and equipment (except where the equipment is dust-tight or vented to the outside).

- These areas would have combustible dust in the air, under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures.
- Combustible dusts that are electrically nonconductive include dusts produced in the handling and processing produce combustible dusts when processed or handled.
- Dusts containing magnesium or aluminum are particularly hazardous and the use of extreme caution is necessary to avoid ignition and explosion.

Class II, Division 2: A Class II, Division 2 location is a location in which: (a) combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or (b) dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment, and dust accumulations resulting there from may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

NOTE: This classification includes locations where dangerous concentrations of suspended dust would not be likely but where dust accumulations might form on or in the vicinity of electric equipment. These areas may contain



equipment from which appreciable quantities of dust would escape under abnormal operating conditions or be adjacent to a Class II Division 1 location, as described above, into which an explosive or ignitable concentration of dust may be put into suspension under abnormal operating conditions.

Responsibilities

Safety Director

- The HSE Director will develop electrical safety programs and procedures in accordance with OSHA requirements and/or as indicated by events and circumstances.

Superintendent

- Superintendents are responsible for ensuring that only qualified employees and qualified contractors perform electrical repairs or installations.
- Superintendents are also responsible for ensuring all applicable electrical safety programs are implemented and maintained at their locations.

Employees

- Employees are responsible to use electrical equipment, tools, and appliances according to this program, for attending required training sessions when directed to do so and to report unsafe conditions to their supervisor immediately.

Only qualified persons may work on electric circuit parts or equipment that have not been deenergized. Such persons shall be made familiar with the use of special precautionary techniques, PPE, insulating and shielding materials and insulated tools.

Safe Work Practices

Safe work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contact when work is performed near or on equipment or circuits which are or may be energized.

Inspections

- Electrical equipment, tools, and appliances must be inspected prior to each use.
- The use of a hard fixed GFCI or a portable GFCI adapter shall be used with all portable hand tools, electric extension cords, drop lights and all 110-volt equipment.
- Faulty equipment, tools, or appliances shall be removed from service immediately and tagged "Out of Service", dated, and signed by the employee applying the tag.

Repairs

- Only Qualified Personnel, who have been authorized by the department supervisor or manager, may make repairs to supply cords on electrical tools and to extension cords.
- The names of employees authorized to make repairs will be posted in the workplace.
- Only certified electricians shall be allowed to make repairs to electrical equipment and wiring systems.
- The supervisor obtaining the services of a certified electrician is responsible for verifying the electrician's credentials.



- Employees shall not enter spaces containing exposed energized parts unless qualified and proper illumination exists to enable employees to work safely.
- If employees are subject to handle long dimensional conductor objects (ducts or pipes), steps for safe work practices shall be employed to ensure the safety of workers.

Extension Cords

- Use only three-wire, grounded, extension cords and cables that conform to a hard service rating of 14 amperes or higher, and grounding of the tools or equipment being supplied.
- Only commercial or industrial rated-grounded extension cords may be used in shops and outdoors.
- Cords for use other than indoor appliances must have a rating of at least 14 amps.
- Cords must have suitable strain relief provisions at both the plug and the receptacle ends.
- Work lamps (drop light) used to power electrical tools must have a 3 wire, grounded outlet, unless powering insulated tools.
- Adapters that allow three wire, grounded prongs, connected to two wire non-grounded outlets are strictly prohibited.
- Cords must have a service rating for hard or extra-hard service and have S, AJ, ST, SO, SJO, SJT, STO, or SJTO printed on the cord.
- Cords may not be run through doorways, under mats or carpets, across walkways or aisles, concealed behind walls, ceilings or floors, or run through holes in walls, or anywhere where they can become a tripping hazard.
- High current equipment or appliances should be plugged directly into a wall outlet whenever possible.
 - All extension cords shall be plugged into one of the following:
 - A GFCI outlet;
 - A GFCI built into the cord;
 - A GFCI adapter used between the wall outlet and cord plug.
- All extension cords and or electrical cords shall be inspected daily or before each use, for breaks, plug condition and ground lugs, possible internal breaks, and any other damage. If damage is found, the extension cord or electrical cord shall be removed from service and repaired or replaced.

Outlets

- Outlets connected to circuits with different voltages must use a design such that the attachment plugs on the circuits are not interchangeable.

Multiple Outlet Boxes

- Multiple outlet boxes must be plugged into a wall receptacle.
- Multiple outlet boxes must not be used to provide power to microwave ovens, toasters, space heaters, hot plates, coffeepots, or other high-current loads.

Double Insulated Tools

- Double insulated tools must have the factory label intact indicating the tool has been approved to be used without a three-wire grounded supply cord connection.
- Double insulated tools must not be altered in any way, which would negate the factory rating.



Switches, Circuit Breakers, and Disconnects

- All electrical equipment and tools must have an on and off switch and may not be turned on or off by plugging or unplugging the supply cord at the power outlet.
- Circuit breaker panel boxes and disconnects must be labeled with the voltage rating.
- Each breaker within a breaker panel must be labeled for the service it provides.
- Disconnect switches providing power for individual equipment must be labeled accordingly.

Portable Ladders

- Only approved, non-conductive ladders may be used when working near or with electrical equipment, which includes changing light bulbs.
- Ladders must be either constructed of wood or fiberglass.
- Portable ladders shall have non-conductive side rails.
- Wood ladders should not be painted, which can hide defects, except with clear lacquer.
- When using ladders, they shall be free from any moisture, oils, and greases.

Overhead Lines

- When working near overhead lines, a clearance distance of 10' must be maintained or the lines will be de-energized and grounded. The lines shall be deenergized and grounded or other protective measures shall be provided before work is started.
- When working near overhead lines, unqualified persons must maintain a clearance distance of 10 feet. 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 feet (305 cm);
 - For voltages to ground over 50kV - 10 feet (305 cm) plus 4 inches (10 cm) for every 10kV over 50kV.
- Vehicles and/or mechanical equipment must maintain a clearance distance of 10 feet (or greater) from energized overhead lines. 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. (305 cm) is maintained. If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10kV over that voltage.
- When possible, power lines shall be de-energized and grounded or other protective measures shall be provided before work is started.
- Minimum approach distance to energized high power voltages lines for unqualified employees is 10 feet.
- Minimum approach distance for qualified employees shall be followed as per 29 CFR 1910.333(c)(3)(i) Qualified – Table S5 Selection and Use of Work Practices - Approach Distances for Qualified Employees – Alternating Current). Approach distances are 10' for 50kV plus 4" for every additional 10kV.

Confined or Enclosed Workspaces

- When an employee works in a confined or enclosed space that contains exposed energized parts, the employee shall isolate the energy source and turn off the source and lock and tag out the energy source (Only qualified electricians can work on an exposed energy source).
- Insulating shields/barriers are used where necessary. Protective shields, protective barriers or insulating materials as necessary shall be provided.



Enclosures, Breaker Panels, Illumination and Distribution Rooms

- A clear working space must be maintained in the front, back and on each side of all electrical enclosures and around electrical equipment for a safe operation and to permit access for maintenance and alteration.
- Proper illumination before employees are permitted to enter work areas containing exposed energized parts. Employees may not enter spaces containing exposed energized parts unless illumination is provided that enables the employees to work safely.
- Housekeeping in distribution rooms must receive high priority to provide a safe working and walking area in front of panels and to keep combustible materials to the minimum required to perform maintenance operations.
- All enclosures and distribution rooms must have “Danger: High Voltage – Authorized Personnel Only” posted on the front panel and on entrance doors.
- Flammable materials are strictly prohibited inside distribution rooms (Boxes, rags, cleaning fluids, etc.)

Lock Out/Tag Out

- Lockout/Tagout is used before performing electrical work while any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both.
- No work shall be performed on or near exposed energized parts. This applies to work performed on exposed live parts (involving either direct contact or by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.
- If any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both.
- Conductors and parts of electrical equipment that have been deenergized but have not been locked or tagged out shall be treated as live parts.
- Only authorized personnel may perform lock out/tag out work on electrical equipment.
- Authorized personnel will be trained in lock out/tag out procedures.
- Affected personnel will be notified when lock out/tag out activities are being performed in their work area.

Energized Electrical Work

Under NFPA 70E, there are only two instances in which an employee can work on live parts. In these situations, an Energized Electrical Work Permit shall be completed and approved by the superintendent, the Superintendent, Project Manager Regional Vice President, and the VP HSE as required by the permit.

1. When de-energizing would interrupt essential life support, emergency alarms or ventilation systems.
2. When the organization can demonstrate that de-energizing the system would introduce additional or increased hazards or that it is infeasible due to equipment design or operational limitations.

When working on energized electrical systems, NFPA 70E requires the following:

1. **Risk Assessment:** Before beginning work, conduct a thorough risk assessment to identify potential hazards associated with the task and the electrical system.
2. **Hierarchy of Controls:** Follow the hierarchy of controls, which prioritizes hazard elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE), in that order.



3. **Permitting Process:** An Energized Electrical Work Permit (EEWP) shall be completed prior to working on energized electrical systems, including obtaining proper authorization and documentation as required by the permit. The required EEWP Permit is located at the safety support center located at www.iws.support in the Permits tab.
4. **Qualified Personnel:** Only qualified electrical workers who have received appropriate training and are familiar with the hazards associated with energized electrical work should perform the tasks.
5. **Proper Tools and Equipment:** Ensure that tools and equipment used for working on energized electrical systems are insulated, properly rated, and suitable for the task.
6. **Lockout/Tagout (LOTO):** Implement LOTO procedures whenever possible to de-energize electrical systems before performing work. Work on energized systems should be the exception rather than the norm.
7. **Arc Flash and Shock Protection:** Use appropriate arc flash and shock protection measures, including wearing flame-resistant clothing, arc flash personal protective equipment (PPE), insulated tools, and voltage-rated gloves and sleeves.
8. **Work Practices:** Follow safe work practices, such as maintaining a safe distance from energized parts, using barriers and shields to prevent accidental contact, and minimizing the risk of arc flash and arc blast hazards.
9. **Continuous Monitoring:** Continuously monitor the work environment for changes that could increase the risk of electrical hazards and adjust work practices accordingly.
10. **Training and Education:** Ensure that all personnel involved in working on energized electrical systems receive comprehensive training on electrical safety procedures, hazard recognition, and emergency response.

Adhering to these rules helps mitigate the risks associated with working on energized electrical systems and promotes a safe working environment for electricians and other personnel involved in electrical maintenance and operations.

Contractors

- Only approved, certified, electrical contractors may perform construction and service work on Integrated Water Services or client property.
- It is the Manager/Supervisors responsibility to verify the contractor's certification.

Fire Extinguishers

- Approved fire extinguishers must be provided near electrical distribution centers.
- Water type extinguishers shall not be located closer than 50 feet from electrical equipment.

Electric Shock-CPR

- If someone is discovered that has received an electric shock and is unconscious, first check to see if their body is in contact with an electrical circuit. Do not touch a person until you are sure there is no contact with an electrical circuit.



- When it is safe to contact the victim, begin CPR if the person's heart has stopped or they are not breathing.
- Call for help immediately.

Electric Welders

- A disconnecting means shall be provided in the supply circuit for each motor-generator arc welder, and for each AC transformer and DC rectifier arc welder which is not equipped with a disconnect mounted as an integral part of the welder.
- A switch or circuit breaker shall be provided by which each resistance welder and its control equipment can be isolated from the supply circuit. The ampere rating of this disconnecting means may not be less than the supply conductor ampacity.

Equipment Grounding

- All gas compressors, air compressors, separators, vessels, etc. shall be grounded by means of using a lug and ground strap, nominal in size to a ½" bolt or larger, attached to a ground rod six feet or longer.
- Equipment bonding jumpers shall be of copper or another corrosion-resistance material.
- The transfer of hazardous or flammable material from a metal or plastic container with a flash point of 100 degrees F or less shall have a ground strap from the container and attached to the skid or a ground rod placed in the ground.

Assured Grounding

Where applicable, workers shall use ground fault circuit interrupters (GFCI) to protect personnel from electrical shock while working. In the absence of GFCI's for ground-fault protection, The Assured Grounding Program must be followed.

Assured Grounding Program

Instead of using GFCIs, a project can develop and implement an assured grounding program for equipment used on a project. The objective is to prevent electrocution by ensuring grounding wire is electrically continuous from the power tool to the power source.

The assured grounding program consists of a written program, daily visual inspections and a method to detect a faulty grounding wire in an extension cord or hand tool. A sample program is included at the end of this chapter. In addition to hand tools and extension cords, receptacles also must be tested.

The written program should describe the procedures for equipment testing and must be implemented by a competent person. Testing should be conducted on each piece of equipment every three months, as well as before first use or return to service after repair. In order to ensure a grounding wire is electrically continuous throughout the extension cord or power tool, a continuity test must be conducted. There are several different types of continuity testers on the market, but they pretty much work in the same manner. On one end of the tester, there is typically an alligator clip that attaches to the grounding pin of a tool that is not double insulated or the extension cord. The other end of the tester has a metal probe that plugs into the extension cord or is touched to a metal part of the power tool. If the light on the tester illuminates, the ground is continuous, thus passing the continuity test. If the light does not illuminate, the power tool or extension cord must be removed from service until it is repaired. Circuit testers are simple plug-in devices that light up different bulb sequences to indicate if a circuit is wired properly. This is critical because it allows a user to test if the hot wire is connected to the hot terminal of an outlet; the neutral wire is connected to the neutral terminal; and the ground is continuous.



Assured Grounding test results must be recorded on the Assured Grounding Test Log form located at the Forms tab of the safety support center. The log keeps track of the date each piece of equipment is tested and its service and maintenance history. The tape indicates the status of the equipment—for example, whether a piece of equipment or an extension cord needs repair or has passed its most recent test.

Equipment is tested every three months, and when a piece passes its test, it should be tagged with: white for winter, green for spring, red for summer and orange for fall. Brown tape should be used to identify any equipment that needs repair, and it then can be replaced once the piece has been fixed and passed its test.

White: December, January, February

Green: March, April, May

Red: June, July, August

Orange: September, October, November

An assured equipment grounding program requires compliance with a strict inspection and administrative process to document the condition of power tools and extension cords. It can be easy to miss a step and increase your chance for an injury or an OSHA citation. The better practice is always to use portable GFCIs to protect all tools present on the job site.

Ground Fault Circuit Interrupters

All 120-volt, single-phase 15 and 20 ampere receptacle outlets on construction or maintenance sites, which are not part of the permanent wiring of the building or structure, and which are in use by employees, shall have approved ground fault circuit interrupters for personnel protection.

- All hand portable electric tools and extension cords shall use a GFCI.
- Additionally, approved GFCI's shall be used for 240-Volt circuits in the same service as described above.
- GFCI's must be used on all 120 volt, single-phase 15 amp and 20 amp receptacles within 6 feet of a sink, damp areas or on installed outdoor equipment.
- The GFCI must be the first device plugged into a permanent receptacle.
- The GFCI must be tested before each use.

Training

All employees are provided Electrical Awareness training.

Employees who face the risk of electric shock but who are not qualified persons shall be trained and familiar with electrically related safety practices. All employees shall be trained in safety related work practices and clearance distances that pertain to their respective job assignments.

Qualified employees must adhere to the approach distances in Table S5 of CFR 1910.333 (below).

Voltage Range (phase to phase)	Minimum Approach Distance
Over 300V, not over 750V.....	1 ft. 0 in. (30.5 cm).
Over 750V, not over 2kV.....	1 ft. 6 in. (46 cm).
Over 2kV, not over 15kV.....	2 ft. 0 in. (61 cm).
Over 15kV, not over 37kV.....	3 ft. 0 in. (91 cm).



Over 37kV, not over 87.5kV.....3 ft. 6 in. (107 cm).

Over 87.5kV, not over 121kV.....4 ft. 0 in. (122 cm).

Over 121kV, not over 140kV.....4 ft. 6 in. (137 cm).

Personal Protective Equipment & Safeguards for Personnel Protection

- Conductive apparel shall not be worn unless it is rendered non-conductive by covering, wrapping or other insulating means. Conductive items of jewelry or clothing shall not be worn unless they are rendered non-conductive by covering, wrapping or other insulating means.
- Employees working in areas where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.
- Equipment shall be maintained in a safe, reliable condition. Such protective equipment shall be periodically inspected and/or tested.
- If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected. (An example might be an outer covering of leather used for the protection of rubber insulating material.)
- Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.
- Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.
- Each employee shall use insulated tools or handling equipment if they might make contact with conductors or parts. The program shall state that if the insulating capability of insulated tools or handling equipment is subject to damage, the insulating material shall be protected.
- Ropes and handlines used near exposed energized parts shall be nonconductive.
- Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries while that employee is working near exposed energized parts. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with the live parts.
- Alerting techniques used to warn and protect employees from hazards which could cause injury due to electric shock, burns or failure of electric equipment parts can take the form of safety signs and tags, barricades & attendants.