


Implement on: 5/1/18	Version: 2 Supersedes: v1	See Also: SA111110, SA000022, NFPA 70E
	<h1>POLICY</h1>	
Approved by: Rich Wallen		Regulation: WAC 296-45

HY010100 - ELECTRICAL SAFETY PROGRAM

This policy and related documents (the SOP) establishes the authority, responsibility, and process for electrical safe work practices in power production facilities.

Approved Spring 2018

HY010100 – Electrical Safety Program (ESP) Version History*

Document #	Ver.	Date	Revision
HY010100 - ALL	0	6/1/17	Initial issue
HY010100-POL	1	6/27/17	>208V 3-Phase clarification added to statement #3.
	2	5/1/18	Rule #2 clarified; document titles changed in rule #3; 'Hazard' changed to 'Electrical' in rule #4; Text deleted from rule #5; New rule #6 – maintenance; new rule #7 – risk reduction; rule #8 – audit clarified; new rule #9 – investigations.
HY010100A-FRM	1	11/16/17	Sections 4, 5, & 7 heavily revised. Comments section added (new #8).
HY010100A-LST (Definitions)	1	5/1/18	Added definitions: Blind Penetration, Class 2 Circuits, Fault Current, Fault Current Available, Incident Energy, Maintenance (Condition of), Shock Hazard, Testing, and Working On. Definitions revised: Arc Flash Boundary, Arc Flash Hazard, AHJ, Electrical Hazard, Electrically Safe Work Condition, Qualified Person, Restricted Approach Boundary, and Working Distance.
HY010100A-PRO (Requesting Inspection of EE)	1	5/1/18	Retitled: Inspecting (instead of Reviewing) Electrical Equipment. Trigger revised; revisions in each step.
HY010100A-REF (ESP Description)	1	5/1/18	Normal Operation revised (Sections 1.0 & 7.1), AHJ duties revised (Section 2.4), LAB added (Section 2.6), Table citation revised (Sections 3.3 & 3.4), text deleted (Sections 4.1, 6.0.3, 6.1.2, 7.3, 7.4), Equipment maintenance section added (4.2), shock and arc flash requirements clarified (Section 6.0), Blind penetration (7.2) clarified; PPE standard amended and exception deleted (Section 8.0), New section 9.0: risk control; Section 10: ESP audits expanded; references added (Section 11.0).
HY010100A-STD (Committee Charter)	1	5/1/18	Electrical Engineering representative added as voting committee member.
HY010100A-TSK (Inspecting Electrical Equip. for use)	1	5/1/18	Retitled: Inspecting Electrical Equipment for Use, Trigger revised to include modifying electrical equipment. Reformatted with Pre-purchase/mod and new Post-purchase/mod sections. Supersedes HY010100F-TSKv0
HY010100B-JOB (PM Duties)	1	5/1/18	Training requirements increased for PM.
HY010100B-PRO (Working On/ Near Ener. Eq.)	1	5/1/18	Steps 8, 15, 16 text deleted. Additional job briefing required if changes occur during work which can affect safety, Step 16a.
HY010100B-STD (Arc Flash Risk Assessment)	1	5/1/18	Retitled. >208V 3-Phase added to Sections I & II. Section II 'analysis' replaces 'analyses'. Table citations revised. Section IV retitled; references amended in Section V.

Continued inside back cover

Implement on: 5/1/18

Version: 2
Supersedes: v1

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POLICY

Approved by: 

Regulation: WAC 296-45

HY010100-POL – ELECTRICAL SAFETY PROGRAM (ESP)

This policy and related documents (the SOP) establishes the authority, responsibility, and process for electrical safe work practices in power **generation** facilities.

1. Personnel Shall Be Trained And Qualified Consistent With Assigned Tasks

See *General Training Requirements* (HY010100B-LST) and *ESP Program Description* (HY010100A-REF).

2. No Electrical Equipment Will Be Installed, Modified, Or Used Until Inspected By Authority Having Jurisdiction


See *Requesting Inspection of Electrical Equipment* (HY010100A-PRO) and *Electrical Safety Program Description* (HY010100A-REF).

3. An Incident Energy Analysis Will Be Conducted On All 3-Phase Electrical Equipment Operating $\geq 208V$

Single phase power is exempt from this requirement.
See *Electrical Equipment Arc Flash Risk Assessment* standard (HY010100B-STD) and *Conducting Arc Flash Risk Assessment* (HY010100C-PRO).

4. An Electrical Risk Assessment Shall Be Performed And Documented For All Work Containing Electrical Hazards

Including both an arc flash and a shock risk assessment, in accordance with NFPA 70E. See *Completing An Electrical Risk Assessment*, HY010100C-TSK.

Implement on: 5/1/18	Version: 2 Supersedes: v1	See Also: HP010100, SA000017, SA111110, SA111119, NFPA 70E
		<h1>POLICY</h1>
Approved by: Rich Wallen		Regulation: WAC 296-45

5. An Energized Electrical Work Permit Is Required When Working On Or Around Exposed Energized Parts \geq 50V

And when there is increased risk of injury from exposure to arc flash hazard. See *Requesting Work On/Near Energized Equipment*, HY010100B-PRO.

6. The Condition Of Maintenance Shall Be Considered In The Risk Analysis Of An Electrical Hazard

See *Electrical Safety Program Description* (HY010100A-REF)

7. Risks Shall Be Reduced Wherever Possible Using A Risk Control Method Hierarchy

See *Completing Electrical Risk Assessment* (HY010100C-TSK), *Completing EEWP* (HY010100D-TSK), and *Electrical Safety Program Description* (HY010100A-REF)

8. The Electrical Safety Program & Field Work Shall Be Audited For Compliance

See *Electrical Safety Program Description* (HY010100A-REF) and *Inspecting Electrical Work* (HY010100E-TSK).

9. Electrical Incidents Shall Be Investigated

Including near misses that could have resulted in an injury, fatality, or damage to health. ESP Committee delegate shall participate in the Safety department investigation of Power Production electrical-related incidents.

10. The ESP Committee Shall Be The Authority For The ESP

The ESP Committee will interpret and adjudicate NFPA 70E as it applies to this SOP.

The ESP Committee will review this SOP in its entirety at least every 3 years and make revisions as appropriate.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA 70E,
HP010100

REFERENCE

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HY010100A-REF – ELECTRICAL SAFETY PROGRAM (ESP) DESCRIPTION

1.0 PURPOSE AND SCOPE

The Electrical Safety Program (ESP) Program (HY010100) applies to Grant County power production facilities and gives the requirements for electrical safe work practices and electrical safety training.

Compliance with HY010100 ensures a workplace free from unplanned exposure to electrical hazards for all employees of Grant County PUD and its contractors.

This Program also minimizes the risk of electrical hazards to Grant County equipment and facilities.

This Program implements specific requirements of the following:

- NFPA 70E-2015/2018, *Standard for Electrical Safety in the Workplace*
- Institute of Electrical and Electronics Engineers (IEEE) 2017 *National Electrical Safety Code (NESC)*
- Code of Federal Regulations (CFR), Title 29, Occupational Safety and Health Administration (OSHA), 1910 Subpart S (29 CFR 1910), Electrical
- 29 CFR 1926, Subpart K, Electrical
- Washington Administrative Code (WAC) 296-45, Electric Power Generation, Transmission, and Distribution

NOTE: This Program does not contain all requirements of the above documents. In the event of a conflict between HY010100 and the requirements listed above, the conflict would be resolved by the ESP committee per its charter (HY010100A-STD).

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

This SOP does **not** cover any of the following:

- Installations or work involving automotive, watercraft, and similar equipment
- Installations under the exclusive control of NESC for the purpose of metering, transmission, and distribution of electrical energy
- Clearance activities: Switching and Clearance (See HP010100, *Hydro Switching And Clearance Tagout System*), provides requirements for power plant Safe Clearances and shall take precedence over similar requirements in NFPA 70E if there is a conflict.
- Telecommunications workers performing work under 29 CFR 1910.268

Grant County PUD complies with the National Electric Safety Code (NESC) and 29 CFR 1910.269, *Electric Power Generation, Transmission, and Distribution*. The PUD participates in the Program by providing technical advice on matters relating to Grant County Utility systems.

Definitions of terms and acronyms specific to this Program are found in HY010100A-LST or NFPA and CFR source documents listed in Section 11.0, *References*.

Normal Operation of electric equipment shall be permitted where all the following conditions are satisfied:

- The equipment is properly installed.
- The equipment is properly maintained.
- The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
- The equipment doors are closed and secured.
- All equipment covers are in place and secured.
- There is no evidence of impending failure.

NOTE: To meet the requirements of "Normal Operation" it is the responsibility of the AHJ to ensure the equipment is installed, maintained, and used in accordance with

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

NOTE, cont'd:

instructions included in the listing and labeling and in accordance with manufacturer's instructions. If necessary, AHJ will provide operating instructions in agreement with manufacturing instructions to Operations.

For proper use of modified equipment, see HY010100A-TSK.

2.0 ROLES AND RESPONSIBILITIES

2.1 Electrical Safety Program Coordinator

The Electrical Safety Program Coordinator duties shall include record keeping, providing admin support to the ESP committee and more.

See *Electrical Safety Program (ESP) Coordinator*, HY010100A-JOB.

2.2 Grant County Contractors

The Grant County PUD Contractors and subcontractors whose work includes, ongoing services, electrical installations, demolition, modifications are required to abide by NFPA 70E and the ESP. A complete copy of the program will be shared with the contractor by the project manager.

See *Project Manager Electrical Safety Program (ESP) Liaison*, HY010100B-JOB.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

2.3 Electrical Safety Program (ESP) Committee

The ESP Committee shall be the collective interpretive authority for the ESP, as per its Charter (see *Electrical Safety Program [ESP] Committee Charter*, HY010100A-STD).

2.4 Authority Having Jurisdiction (AHJ)

The AHJ shall **enforce**, apply, and interpret all required documents stated in Section 1.0, *Purpose and Scope*, as they relate to this Program (HY010100). The AHJ shall also conduct and document inspections, specific AHJ decisions, and interpretations. See *Authority Having Jurisdiction (AHJ)*, HY010100C-JOB.

2.5 Construction/Maintenance/Operations/Engineering Managers

Power Production Managers and supervisors have the duty and responsibility to ensure their employees:

- Are trained and qualified to the level of their work assignments,
- Use approved PPE appropriate to the electrical hazard,
- Use safe work practices as described herein.

In addition, the supervisors and managers will select a primary representative and alternate who will participate on the ESP Committee. See *Power Production Manager/Supervisor*, HY010100D-JOB.

The Supervisor of job titles shown in 2.6 will conduct at least one inspection of energized work and one inspection of installed or modified electrical equipment every two years, to verify the ESP is understood and followed. See *Inspecting **Electrical** Work*, HY010100E-TSK.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

2.6 Qualified Electrical Workers (QEW)

By definition, the following employees are qualified electrical workers:

- Power production electrician
- Power production I&C technician
- Power Plant operator
- Supervisor of any of the above employee job titles

Qualified Electrical Worker (QEW) shall use PPE and safe work practices appropriate to a shock hazard, maintain required level of training for QEW status, be responsible for any unqualified persons permitted inside the LAB or AFB. See *Qualified Electrical Worker (QEW)*, HY010100E-JOB.

2.7 Power Production Personnel

All power production personnel shall:

- Comply with applicable requirements of this Program.
- Immediately report all electrical shocks, other than obvious static shocks, to supervisor and be medically evaluated.

3.0 PERSONNEL TRAINING

Consistent training is critical to successful implementation of the ESP. All training shall meet the requirements pre-approved by the ESP Committee.

Individual training equivalencies, waivers, and extensions shall be approved, documented and provided to ESP Committee by the Grant County PUD Training Manager.

Training and/or retraining shall also comply with RCW/WAC.

Personnel may perform or supervise electrical work only to the level for which they have been trained and qualified in accordance with this Section.

See *ESP General Training Requirements*, HY010100B-LST.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

3.1 General Power Production Employee

Power Production employees shall receive electrical training (initial and annual refresher) through completion of the Electrical Safety module to be located in the eLearning Center.

3.2 Non-Electrical Worker

In addition to the training described in 3.1, above, the non-electrical worker will attend Electrical Safety for Non-Electrical Worker training at initial assignment and every 3 years thereafter.

3.3 Qualified Electrical Worker (QEW)

Instead of training mentioned in 3.1 and 3.2, this section, the Qualified Electrical Worker (see HY010100E-JOB) will be trained as follows:

1. First Aid/CPR/AED (#S-08-02-778), every 2 years
2. Electrical Safety Program & NFPA 70E, every 3 years
3. WAC 296-45, every 3 years

In addition, licensed electrician shall maintain state license through continuing education (24 CEU hours in 3-year cycle).

QEWs shall use safety techniques, know applicable policies and procedures, use proper PPE (including arc flash, insulating, and shielding materials), and understand insulated tools and test equipment.

NOTE: A person may be considered qualified with respect to certain equipment and methods, but unqualified for others.

A Qualified Electrical Worker is not permitted to work within the Limited Approach Boundary (LAB)/Arc Flash Protection Boundary (AFPB) of exposed energized electrical conductors and circuit

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

parts operating at ≥ 50 volts, until completing training in all of the following:

- The skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts.
- The approach distances specified in NFPA 70E Tables 130.4(D)(a) for AC systems, and Table 130.4(D)(b) for DC systems, and the corresponding voltages to which the Qualified Electrical Worker will be exposed.
- The decision-making process necessary to be able to perform the job safety planning, identify electrical hazards, assess the associated risk, and select the appropriate risk control methods including PPE.
- Selecting an appropriate test instrument and shall demonstrate how to use a device to verify the absence of voltage, including interpreting the indications provided by the device, and understanding the limitations of each specific test instrument that may be used.

An Electrical Worker, who is undergoing on-the-job training under the direct oversight of a Qualified Electrical Worker, and who has demonstrated an ability to perform duties safely at his or her level of training, shall be considered qualified for the performance of those duties.

A vendor under the direct oversight of a Project Manager ESP Liaison or Qualified Electrical Worker shall be considered qualified for the performance of their contracted duties.

3.4 Qualified Electrical Worker Supervisor

In addition to the basic training requirements (HY010100B-LST), the supervisor of electrician, or I&C technician, or power plant operator shall complete the same training as for Qualified Electrical Worker listed in section 3.3, above.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

A Qualified Electrical Worker (QEW) Supervisor supervises and directs Qualified Electrical Workers conducting the technical aspects of electrical work.

The QEW Supervisor shall be qualified to supervise both ongoing work on the equipment and methods being used. Therefore, a QEW Supervisor shall have skills and knowledge related to the construction and operation of electrical equipment and installations that they oversee.

A QEW Supervisor shall have the following confirmed by the District's NFPA 70E Authority Having Jurisdiction(s) (AHJ) or designee to have the:

- Ability to distinguish exposed energized electrical conductors and/or circuit parts from other parts of electric equipment.
- Knowledge in the selection of an appropriate test instrument to verify the absence of voltage, including interpreting the indications provided by the device, and understanding the limitations of each specific test instrument that may be used.
- Ability to recognize electrical shock hazards, arc flash hazards, and appropriate controls.
- Knowledge in the proper use of the special precautionary techniques, applicable policies and procedures, PPE (including arc flash, insulating, and shielding materials), and insulated tools and test equipment.
- Knowledge of the approach distances specified in NFPA 70E, Tables 130.4(D)(a) and 130.4(D)(b) and the corresponding voltages to which the Qualified Electrical Worker will be exposed.

QEW Supervisor is not considered a Qualified Electrical Worker unless they meet the requirements of Section 3.3, *Qualified Electrical Worker*.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

3.5 Specialized Training

Additional training is required for personnel who install, maintain, remove, dispose of or otherwise work directly with:

1. Battery or battery bank operating over 50V or with stored capacity exceeding 1 kWh. Battery Safety Training is required.
2. Capacitor or capacitor banks rated greater than 200 μ F in circuits greater than 100V. Capacitor Safety Training is required.

4.0 ELECTRICAL EQUIPMENT

4.1 Listing, Labeling, & Approval Requirements

1. Approval

All electrical equipment installed, **modified** or used in Power Production facility shall be **inspected** by a NFPA 70E authority having jurisdiction (AHJ) **to verify compliance with applicable installation codes and standards, prior to being placed in service.**

See *Requesting **Inspection** of Electrical Equipment For Use* (HY010100A-PRO).

- a. Electrical equipment shall be approved and acceptable for PUD use if it has been accepted, certified, listed, labeled, or otherwise determined to be safe by an OSHA Nationally Recognized Testing Laboratory (NRTL) (as indicated by an NRTL label applied by the manufacturer).
- b. If 4.1.1.a is not met, and there is an Underwriters Laboratories (UL) standard for the piece of equipment, it shall be field evaluated and labeled by an OSHA recognized NRTL representative.
- c. For equipment that does not comply with 4.1.1.a or 4.1.1.b, inspection and/or testing shall be completed using the Electrical Equipment **Inspection** Form (HY010100C-

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

FRM) when required by the AHJ and labeled using the AHJ Approval for Non-NRTL Equipment. See Figure 1, below.



AHJ APPROVAL FOR NON-NRTL EQUIPMENT

AHJ Report Number _____

Manufacturer _____

Serial Number _____

Evaluated by (print/sign) _____ Date: _____

HY010100E-FRM

Figure 1. Non-NRTL Approval Label (HY010100E-FRM)

EXCEPTION: *Non-NRTL certified equipment that operates at less than 50 volts (such as cable assemblies, instruments, security systems, low voltage lighting, communication systems, etc.) may be approved by the AHJ using an informal method, if it is determined that a NRTL-certified alternative is not readily available to meet the application.*

NOTE 1: Condition 4.1.1.c is reserved for use in unique situations or for special needs that do not satisfy NRTL requirements (for example: legacy equipment or built on site).

NOTE 2: Legacy equipment and Non-NRTL equipment in use prior to the implementation of the ESP (06/01/2017) may remain in service and do not require reevaluation, so long as it has not been modified, found to be defective or damaged, and does not present a hazard to the workers.

NOTE 3: See the OSHA website (<http://www.osha.gov/dts/otpc/nrtl/index.html>) for a list of OSHA recognized NRTLs.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

NOTE 4: Equipment of the same manufacturer and model number that has been previously evaluated by an NRTL may be approved by the AHJ using the 4.1.1.c option.

Equipment shall be suitable for its intended purpose and location and used in accordance with the manufacturer's instructions and any instructions or requirements of the NRTL listing or labeling.

All electrical multi-meters, including the external test leads, used on electrical equipment that operates at 50 volts or more shall be approved per paragraph 4.1.1.

The standard multi-meter will be rated Category III or higher.

4.2 Equipment Maintenance

Electrical equipment must be properly maintained in accordance with manufacturer's instructions or accepted industry standards (such as NFPA 70B) in order to ensure the accuracy of the arc flash calculations and survey, as well as to meet the requirements for Normal Operation of equipment.

Exceptions to manufacturer's maintenance instructions will be documented in the asset management database, including rationale and alternative maintenance plans.

If the proper condition of maintenance cannot be verified, additional safety precautions may be needed.

5.0 ELECTRICAL SAFE WORK PRACTICES

In general, for electrical work in and around the powerhouse, spillway, and dam appurtenances, employees will comply with the following practices:

1. **An electrical** risk evaluation, including both an arc flash and a shock risk assessment shall be performed and documented for all work on equipment operating $\geq 50V$ in accordance with NFPA 70E and this Program. See *Completing An Electrical Risk Assessment* (HY010100C-TSK).

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

This assessment shall be documented on the Electrical Risk Assessment (ERA) Form (HY010100A-FRM) and/or Energized Electrical Work Permit (HY010100B-FRM).

2. All electrical equipment, circuit conductors, and circuit parts shall be considered energized until placed in an electrically safe work condition in accordance with *Hydro Switching and Clearance Tagout System* (HP010100).
3. Before starting work, match the equipment ID to the work order to confirm correct location.
 - a. Use visual indicators to verify equipment is in the expected position.
 - b. Test equipment to confirm it is in de-energized condition.
4. If there is no accessible exposed point to take contact voltage measurements to confirm the absence of voltage, planning considerations shall include approval of alternate methods of verification (e.g., proximity probes, non-contact probes, circuit tracers, current sensing probes).
5. Appropriate signs, tags, barricades, or an attendant shall be used to warn and protect employees from hazards that may cause injury due to electric shock or arc flash.
 - a. Barricades, safety signs, or attendant(s) are required if work occurs inside AFB of energized equipment.
 - b. If the attendant is required to be within the LAB or AFB, they shall be a Qualified Electrical Worker with appropriate PPE.
6. Where work is performed on equipment that is de-energized and placed in an electrically safe work condition in a work area where look-alike equipment (other energized equipment that is similar in size, shape, and construction) exists, one of the alerting methods listed below shall be employed to prevent the employee from entering look-alike equipment:

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

- a. Safety signs and tags
 - b. Barricades (used to establish a safe work boundary)
 - c. Attendant(s)
7. Insulated tools and equipment shall be used, stored, maintained, and tested per the manufacturer's instructions or industry standards.
 8. Non-conductive ladders (i.e., fiberglass, wood) are to be used for electrical work or near electrical installations.
 9. Electrical PPE and other protective equipment shall meet the requirements of Section 8.0, *Electrical PPE*.
 10. All test instruments shall be visually inspected for external damage before each use. Damaged or defective test equipment shall be removed and replaced, never used.
 - a. Test instruments shall be designed, rated, and approved for their intended use.
 - b. Test operate test instruments on known equipment prior to use in a 'live/dead/live' process to ensure proper function of test equipment.

6.0 WORK INVOLVING ELECTRICAL HAZARDS

All electrical hazards to which an employee may be exposed shall be put into an electrically safe work condition in accordance with *Hydro Switching and Clearance Tagout System* (HP010100) **except** where de-energizing would create additional hazards or increased risk, or would be infeasible.

Each piece of equipment operating >50V and not put into a de-energized state must be evaluated for shock risk by completing an ERA or EEWP.

Each piece of equipment operating $\geq 208V$ 3-phase and not put into a de-energized state must be evaluated for arc flash boundary

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

through an incident energy analysis. See *Electrical Equipment Arc Flash Risk Assessment* (HY010100B-STD).

Electrical equipment with:

- exposed energized parts $\geq 50V$, or
- where there is an increased risk of injury from an exposure to an arc flash hazard, or
- equipment that operates at less than 50 volts where the capacity of the source and any overcurrent protection between the energy source and the worker are considered,

And

It is determined that there will be increased exposure to electrical burns or to explosion due to electric arcs, may be accessed only by Qualified Electrical Worker and under the following conditions:

1. Perform Work with an Energized Electrical Work Permit (EEWP)

When working within the LAB or the AFB of energized electrical conductors or circuit parts that are not placed in an electrically safe work condition (e.g., for the reasons of increased or additional hazards, increased risk, infeasibility, or $< 50V$ per NFPA 70E), justification and authorization shall be documented on an approved **EEWP** (HY010100B-FRM) and shall require Plant Manager approval. See *Working On/Near Energized Equipment* (HY010100B-PRO).

The EEWP shall be included in the work documents (e.g., work package, technical procedure).

2. Perform Work with Exemptions to an EEWP

Some routine power production electrical work is exempted from EEWP requirement.

Such tasks are listed in *Work Exempted From EEWP* (HY010100C-LST) and still require a completed *Electrical*

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

Risk Assessment (HY010100A-FRM) prior to starting work.

3. **Barrier Use**

Temporary physical or mechanical barriers are required outside a **Limited** Approach Boundary (**LAB**) while work is performed on energized equipment.

Temporary barriers may remain in place for the duration of the work but must be reviewed and confirmed adequate by a Qualified Electrical Worker each day when work is being performed. Document on Job Brief or ABC form.

NOTE: If work is unfinished at shift end, the equipment must be returned to safe condition (no exposed energized parts).

This use of temporary protective measures to prevent inadvertent contact with energized conductors or circuit parts shall be documented (both installation and removal) on ERA or EEWP forms.

An unqualified person may not cross the LAB or AFB barrier unless all of the following conditions are met:

- a. A qualified electrical worker (QEW) is available to act as escort, and
- b. The QEW advises the unqualified person of possible electrical hazards present inside the LAB or AFB, and
- c. The unqualified person agrees to stay within arm's length of QEW while inside the boundary, and
- d. **Under no circumstances shall unqualified person be permitted to cross RAB.**

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

6.1 Working Within Limited Approach Boundary (LAB) or Arc Flash Boundary (AFB) Of Energized Equipment

Whenever possible, equipment will be de-energized and in a safe work condition according to *Hydro Switching and Clearance Tagout System* (HP010100).

When the work poses a greater hazard to de-energize, or is infeasible de-energized, an electrical risk assessment must be completed. See *Requesting Work On/Near Energized Equipment* (HY010100B-PRO).

If the electrical risk assessment confirms that a Work Permit is needed, then *Completing An Energized Electrical Work Permit* (HY010100D-TSK) must also be done.

Conductive articles of jewelry and clothing (e.g. watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed energized conductors or circuit parts.

1. Special Circumstances

When calculated incident energy exceeds 40 cal/cm^2 , and de-energizing equipment is not feasible, alternate work methods and controls shall be documented on EEWP and have been authorized in advance by Power Plant Manager (or designee).

2. Unqualified Persons

Under no circumstances shall unqualified person(s) be permitted to cross the AFB of energized equipment without proper PPE and an escort of a Qualified Electrical Worker (QEW).

Unqualified persons shall not be permitted to enter unescorted those areas that are required to be accessible to QEWs, unless the electrical conductors and

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

equipment involved are in an electrically safe work condition.

Where there is a specific need for an unqualified person(s) to cross the LAB, a QEW shall first advise that person of the possible hazards, and continuously escort the unqualified person(s) while inside the LAB.

Under no circumstance shall the escorted unqualified person(s) be permitted to cross the Restricted Approach Boundary (RAB).

3. Qualified Electrical Worker (QEW)

At least two Qualified Electrical Workers shall be assigned to any work occurring inside the AFB or the Restricted Approach Boundary of exposed parts operating at more than 300 volts phase-to-phase or phase-to-ground.

A Qualified Electrical Worker has the right to request an evaluation to determine if additional Qualified Electrical Worker(s) are needed when performing a task that presents a shock hazard or arc flash hazard to ensure employee protection.

7.0 DEVICES & PRACTICES

7.1 Overcurrent Protective Devices

Normal Operation of electric equipment shall be permitted where all the following conditions are satisfied:

- The equipment is properly installed.
- The equipment is properly maintained.
- The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions.
- The equipment doors are closed and secured.
- All equipment covers are in place and secured.
- There is no evidence of impending failure.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

NOTE: To meet the requirements of "Normal Operation" it is the responsibility of the AHJ to ensure the equipment is installed, maintained, and used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions. If necessary, AHJ will provide operating instructions in agreement with manufacturing instructions to Operations.

For proper use of modified equipment, see HY010100A-TSK.

1. Operating Circuit Breakers

An employee who operates a circuit breaker shall be authorized by their facility management and have knowledge in the safe operation of the equipment and the hazards involved.

2. Reclosing (Re-Energizing) Circuits After Protective Device Operation

After a circuit is de-energized by an overcurrent protective device (e.g., tripped circuit breaker, blown fuse), the circuit shall not be manually re-energized until it has been determined by a Power Plant Operator(s) that the equipment and circuit can be re-energized safely.

NOTE 1: Overcurrent protective devices may be, but are not limited to, fuses, circuit breakers, and overloads.

NOTE 2: GFCI breakers may be reset once by worker. Subsequent trips may not be reset until the circuit has been verified safe.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

7.2 Blind Penetrations

This section addresses drilling, saw cutting and other blind penetrations and excavations greater than >1.5" into surfaces containing or likely to contain concealed electrical lines, conduits, cables, or parts.

If the presence and location of electrical circuits or conductors cannot be accurately identified and completely de-energized, appropriate mitigating controls shall be used for penetrations greater than 1.5 inches.

See *Drilling, Cutting, Excavating Above Cables/Conduits*, HY010100G-TSK.

7.3 Batteries or Battery Banks Operating $\geq 50V$ or Having Stored Capacity exceeding 1 kWh

Only Qualified Electrical Workers trained in the proper handling maintenance and repair of batteries or battery banks and associated hazard recognition, shall be assigned the task of working on them.

When performing work on batteries where chemical exposures may exist, the following chemical resistant PPE shall be made available to employees;

- Goggles and face shield
- Gloves
- Protective apron
- Protective footwear

Portable or stationary water facilities shall be available for rinsing eyes and skin in accordance with American National Standards Institute (ANSI) Z358.1.

Do not use tools or conductive objects that may short circuit any battery components.

Before making or breaking connections within a group of cells, open the battery system disconnecting means to minimize the possibility of arcing.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

7.4 **Capacitors > 100V or Capacitor Banks rated > 200 μ F**

This section applies to circuits greater than 100V with the associated capacitor or capacitor bank rating greater than 200 μ F.

Only Qualified Electrical Workers trained in the proper handling and storage of power capacitors and hazard recognition shall be assigned the task of removing/servicing/installing such units.

Access to capacitor areas shall be restricted until all capacitors have been discharged, shorted, and grounded or verified to be less than 50 volts.

Any residual charge from capacitors shall be removed by shorting the terminals before servicing or removing.

Capacitors shall be discharged using an appropriate voltage rated shorting probe. If capacitors have been removed from the circuit or are being transported, the terminals shall be continuously short circuited using no smaller than a #14 AWG conductor.

Automatic discharge and grounding devices shall not be relied upon.

Shorting probes shall be inspected before each use.

Capacitor terminals shall be considered "charged" until the terminals are shorted or verified to be less than 50 volts.

8.0 **ELECTRICAL PERSONAL PROTECTIVE EQUIPMENT (PPE)**

Electrical PPE includes, but is not limited to, the equipment and clothing necessary to protect personnel performing electrical work from hazards involving electrical shock, arc flash, batteries, and any other electrical hazards that may be encountered.

NOTE: PPE for non-electrical hazards (e.g., battery acid) shall also be considered.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

Electrical PPE and other protective equipment that has an expired testing date or fails visual or functional inspection shall be removed from service and replaced.

All electrical PPE items must conform to and be marked in accordance with NFPA 70E 130.7(C)(14).

All PPE shall be:

- Maintained in a safe, reliable condition.
- Stored in a manner that protects against physical damage, moisture, dust, or other deteriorating agents.
- Visually inspected before each use.
- Periodically inspected or tested in accordance with manufacturer's instructions and/or the applicable ANSI or American Society for Testing and Materials (ASTM) standard(s).

All personnel are to be provided, and shall use, PPE appropriate for potential shock or arc flash hazards to which they may be exposed. All parts of the body inside the AFB shall be protected.

Personnel shall be instructed in the proper use and maintenance of PPE, prior to use.

Voltage-rated rubber-insulating equipment shall be marked with the issue and test dates. The equipment shall not be used if the testing interval listed in Table 1, next page, has expired. Equipment may be returned to service after satisfactory re-testing is completed.

TABLE 1. Electrical PPE Testing Interval

Rubber-Insulating Equipment	Maximum Test Interval
Blankets	Before first issue; every 12 months thereafter
Covers	If insulating value is believed degraded
Gloves	Before first issue; every 6 months thereafter
Line hose	If insulating value is believed degraded

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

TABLE 1. Electrical PPE Testing Interval

Rubber-Insulating Equipment	Maximum Test Interval
Sleeves	Before first issue; every 12 months thereafter

Voltage rated gloves, preferably with leather protectors, shall be used when there is a danger of injury from electric shock due to contact with energized electrical conductors or circuit parts.

- An inspection shall be performed prior to using gloves and immediately following any incident that is suspected of having caused damage.
 - Check date on gloves to verify it is within periodicity.
 - Visually inspect for cracks, holes, tears, foreign substances, and other visible defects.
 - Perform air leakage test on gloves.
 - Gloves found with any defects that may affect its insulating properties shall be removed from service.
- Voltage rated insulating sleeves shall also be used when there is an additional danger of arm injury from electric shock due to contact with energized electrical conductors or circuit parts.
- Gloves exposed to chemicals, damaged, or requiring periodic testing, cleaning and sanitizing shall be returned to the Tool man.

Personnel who operate circuit breakers, electrical disconnect switches, and similar switchgear equipment, under normal operation shall wear, at a minimum:

- Minimum 8 cal/cm² arc-rated AR clothing
- Hearing protection
- Non-melting (untreated natural fiber) pants and long-sleeve shirt
- Safety glasses (or equivalent)
- Leather or insulating gloves

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

Personnel shall wear appropriate layers of Arc Rated (AR) clothing wherever there is potential exposure to an arc flash above the threshold incident-energy level for a second-degree burn (1.2 cal/cm²).

9.0 RISK CONTROL METHODS

Risk assessments shall implement preventive and protective risk control using the following hierarchy:

1. Eliminate
2. Substitute
3. Engineering Controls
4. Awareness
5. Administrative Controls
6. PPE

10.0 PROGRAM AUDITS

The Electrical Safety Program shall be audited to verify that the principles and procedures of the ESP are in compliance with the latest edition of NFPA 70E. Audits shall be performed at intervals not to exceed 3 years and shall be conducted by a delegate of the Electrical Safety Program Committee.

Field work shall be audited to verify that the requirements contained in the procedures of the Electrical Safety Program are being followed by personnel. Audits shall be performed at intervals not to exceed 1 year and shall be conducted by a delegate of the Electrical Safety Program Committee.

When the auditing determines that the principles and procedures of the Electrical Safety Program are not being followed, the ESP Committee, employee supervisor, and/or contractor project manager(s) shall be informed and shall take actions to correct any observations or findings, including appropriate revisions to the training program or revisions to the ESP.

See *Inspecting Electrical Field Work* (HY010100E-TSK).

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E, HP010100
<h1>REFERENCE</h1>		
Approved by: Rich Wallen		

Deficiencies found in contract work shall be documented in accordance with the contractors' corrective action system.

11.0 REFERENCES

29 CFR 1910, Subpart S, "Electrical."

29 CFR 1926, Subpart K, "Electrical."

29 CFR 1910.269, "Electric Power Generation, Transmission, and Distribution"

WAC 296-45, "Electric Power Generation, Transmission, and Distribution"

IEEE 2017, "National Electrical Safety Code (NESC)."

NFPA 70E-2018, "Standard for Electrical Safety in the Workplace."

HP010100, Hydro Switching and Clearance Tagout System

SA000022, Job Site and General Area Review

SA111110, FR Clothing

SA111119, Protective Grounding

SA121203, Conducting A Job Brief

American National Standards Institute (ANSI) Z358.1, *Emergency Shower and Eye Wash Station Requirements*.

American National Standards Institute (ANSI) Z535, *Series of Standards for Safety Signs and Tags*.

IEEE 1584 – Guide for Performing Arc Flash Hazard Calculations.

Revised Code of Washington 19.28, Electricians and Electrical Installations.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL,
SA111110

STANDARD

Approved by: *R. Sub*

Regulation: WAC 296-45-325

HY010100B-STD – ELECTRICAL EQUIPMENT ARC FLASH RISK ASSESSMENT

I. REQUIREMENT

Each piece of equipment operating $\geq 208V$ 3-phase and not put into a de-energized state must be evaluated for arc flash boundary through an incident energy analysis.

This evaluation will determine the actual boundaries (i.e. Limited and Arc Flash) and will inform the employee which PPE to use.

Once the assessment is complete, a warning label must be affixed to the equipment and be readily accessible to employees who may work on (or inside shock boundary of) the energized equipment.

NOTE: If work is required on equipment without an arc flash hazard label, notify supervisor and Power Production Engineering.

II. INCIDENT ENERGY ANALYSIS

Incident energy analysis shall be performed by (or under the direction of) Power Production Engineering for all power production facilities after a major system modification and/or electrical equipment operating at $\geq 208V$ 3-phase newly installed or modified.

The incident energy analysis shall be reviewed at least every 5 years to account for changes in the powerhouse electrical distribution system that could affect the results of the previous analyses.

In order to determine the likelihood of occurrence of an Arc Flash incident for AC or DC systems, refer to NFPA 70E Table 130.5(C).

An incident energy analysis is required for each of the following:

- Tasks not listed in NFPA 70E Tables 130.7(C)(15)(a) and 130.7(C)(15)(b)

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, SA111110
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

- Tasks with less than the minimum working distance
- Power systems with greater than estimated maximum available short-circuit current
- Power systems with longer than the maximum fault clearing times
- Tasks with less than the minimum working distance.

A. Incident Energy Analysis Method (preferred)

This is a specific calculation where power system parameters, including utility system, cable, and transformer impedance, are used to determine available three-phase fault currents on portions of the power system.

From this data, arcing fault currents can be determined, and based on clearing times of protective devices, incident energy (in cal/cm²) is calculated at the working distance.

See *IEEE 1584, Guide for Performing Arc Flash Calculations*.

PPE shall be selected based on the incident energy calculations.

B. NFPA 70E Tables 130.7(C)(15)(a) and 130.7(C)(15)(b)

When arc flash PPE is required, these Tables are used to determine the PPE category in the absence of an incident energy calculation.

The maximum available short-circuit current, maximum fault clearing times, and minimum working distances for various ac equipment types or classifications are listed in the table.

C. Incident Energy Analysis Documentation

Arc flash incident energies will be documented in tables as follows:

- HY010100D-LST = Priest Rapids Dam
- HY010100E-LST = Wanapum Dam
- HY010100F-LST = Potholes East Canal Small Hydro
- HY010100G-LST = Quincy Chute Small Hydro

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, SA111110
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

- HY010100H-LST = Wanapum Switchyard [NESC]

D. Required Labeling

If an incident energy analysis has been performed, and an arc flash hazard exists, the equipment shall be labeled according to this standard.

The label must contain the available incident energy prior to work being performed plus the following information:

- Arc Flash Boundary (AFB)
- Working distance
- Incident energy at the working distance
- Nominal system voltage
- Calculation number and date

If equipment is likely to be worked on while energized but an incident energy analysis has not yet been performed, and an arc flash hazard exists, then the equipment shall be labeled with an orange WARNING and contain a reference to NFPA 70E tables for PPE determination prior to performing work. See Figure 1, below.

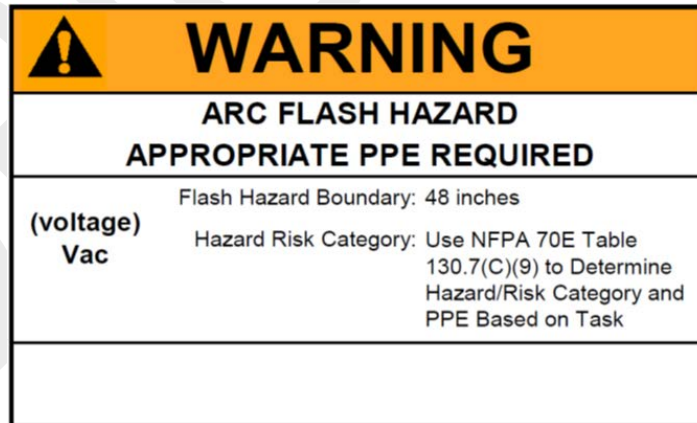


Figure 1. Warning Label, No incident energy analysis.

Use of the label (shown in Figure 1, above) is temporary. All equipment so labeled will be prioritized for incident energy analysis and relabeled with a permanent label (see Figures 2 & 3, next page).

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, SA111110
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

Where the calculated incident energy is 40 cal/cm² or below, the equipment shall be labeled with a completed orange "WARNING" label. See Figure 2, below.

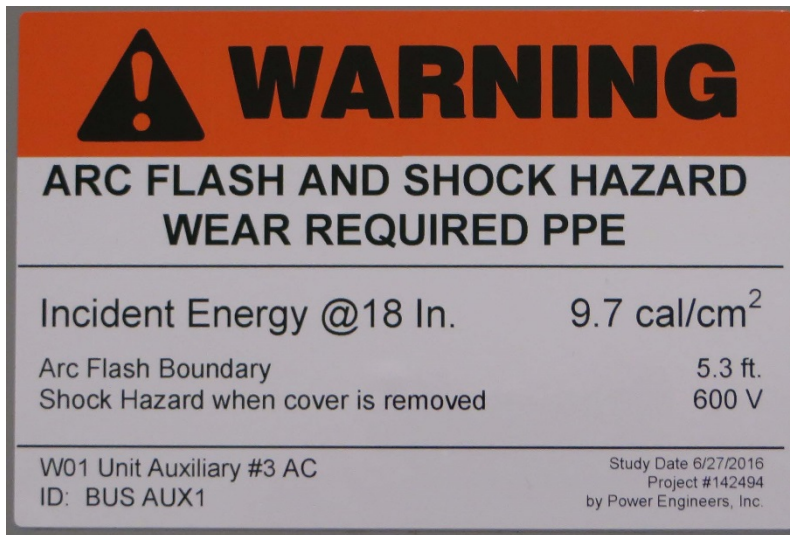


Figure 2. Warning Label

Where the calculated incident energy exceeds 40 cal/cm², the equipment shall be labeled with a completed red "DANGER" label. See Figure 3, below.

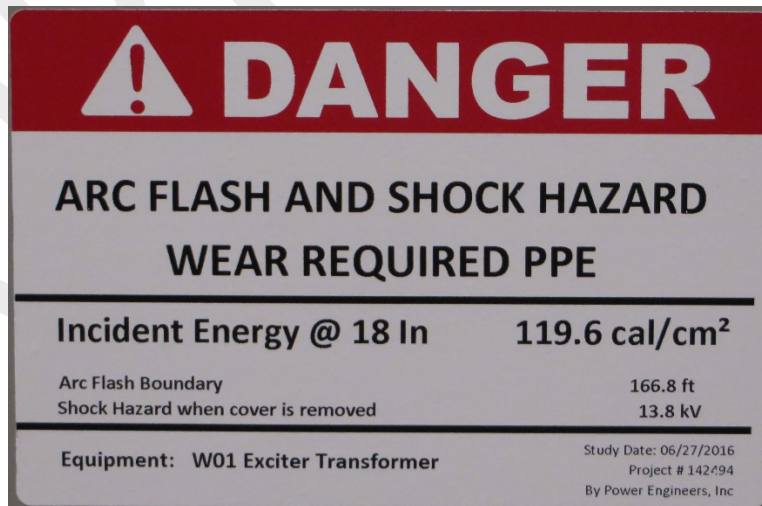


Figure 3. Danger Label

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, SA111110
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

AFB labels will be affixed to equipment according to ANSI labeling standards.

III. RESPONSIBILITY

Power Production Engineering is responsible for conducting or overseeing incident energy analyses and tracking electrical equipment hazard label needs throughout Power Production facilities.

Equipment without the labels shown in Section II, and which operate $\geq 208\text{V}$ 3-phase will be tracked by Power Production Electrical Engineer Supervisor (or designee) until such time as the deficiency is corrected.

IV. REVIEW OF **ARC FLASH CALCULATIONS**

All arc flash calculations will be reviewed/revised at least every 5 years by Power Production Electrical Engineering Supervisor.

V. REFERENCES

- 1) IEEE 1584 – *Guide for Performing Arc Flash Hazard Calculations*.
- 2) NFPA 70E-**2018**, *Standard for Electrical Safety in the Workplace*.
- 3) American National Standards Institute (ANSI) Z535, *Series of Standards for Safety Signs and Tags*.
- 4) **29 CFR 1910.269, Electric Power Generation, Transmission, and Distribution**
- 5) [Revised Code of Washington 19.28](#), *Electricians and Electrical Installations*
- 6) [WAC 296-45](#), *Electrical Power Generation, Transmission, and Distribution*

STANDARD

HY010100C-STD – GENERAL REQUIREMENTS FOR ELECTRICAL SAFETY- RELATED WORK PRACTICES

I. REQUIREMENT

All employees, both qualified and unqualified, shall adhere to the electrical safety-related work practices contained herein as they apply to:

- Test instruments
- Portable cord- and plug-connected electronic equipment (including extension cords)
- Ground fault circuit interrupters (GFCI)
- Overcurrent protection devices

II. TEST INSTRUMENTS AND EQUIPMENT

A. Testing

Only qualified persons shall perform tasks such as testing, troubleshooting, and voltage measuring on electrical equipment operating at voltages $\geq 50V$.

B. Rating

Test instruments, equipment, and their accessories shall be as follows:

- Rated for circuits and equipment where they are utilized
- Approved for the purpose
- Used in accordance with any instructions provided by the manufacturer

Implement on: 5/1/18	Version: 0	See Also: HY010100-POL, SA111119, NFPA 70E
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

C. Design

Test instruments, equipment, and their accessories shall be designed for the environment to which they will be exposed and for the manner in which they will be used.

D. Visual Inspection and Repair

Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before each use.

If there is a defect or evidence of damage that might reasonably expose an employee to injury, the defective or damaged item shall be removed from service and replaced or repaired.

Defective or damaged equipment shall not be used until repaired and tested by qualified person(s) and rendered safe to operate.

E. Operation Verification

When test instruments are used for testing the absence of voltage on conductors or circuit parts operating at voltages $\geq 50V$, the operation of the test instrument shall be verified on any known voltage source per manufacturer's instructions, before and after an absence of voltage test is performed.

III. PORTABLE CORD- AND PLUG-CONNECTED ELECTRIC EQUIPMENT

This section also applies to cord sets (extension cords).

A. Handling and Storage

Portable equipment shall be handled and stored in a manner that will not cause damage. Flexible electric cords connected to equipment shall not be used for raising or lowering the equipment.

Implement on: 5/1/18	Version: 0	See Also: HY010100-POL, SA111119, NFPA 70E
<h1>STANDARD</h1>		
Approved by: Rich Wallen	Regulation: WAC 296-45-325	

Flexible cords shall not be fastened with staples or hung in such a fashion as could damage the outer jacket or insulation.

B. Grounding-Type Equipment

Grounding-type equipment shall comply with the following:

- A flexible cord used with grounding-type equipment shall contain an equipment grounding conductor.
- Attachment plugs and receptacles shall not be connected or altered in a manner that would interrupt continuity of the equipment grounding conductor. Additionally, these devices shall not be altered in order to allow use in a manner that was not intended by the manufacturer.
- Adapters that interrupt the continuity of the equipment grounding conductor shall not be used.

See *Protective Grounding* (SA111119) for more details.

C. Visual Inspection and Repair

Before each use, portable cord- and plug-connected equipment shall be visually inspected for external defects (such as loose parts or deformed and missing pins) and for evidence of possible internal damage (such as a pinched or crushed outer jacket).

EXCEPTION:

Stationary cord- and plug-connected equipment and flexible cord sets (extension cords) that remain connected once they are put in place and are installed such that the cord and plug are not subject to physical damage during normal use shall not be required to be visually inspected until they are relocated or repaired.

If there is a defect or evidence of damage that might reasonably expose an employee to injury, the defective or damaged item shall be removed from service and replaced or repaired.

Implement on: 5/1/18	Version: 0	See Also: HY010100-POL, SA111119, NFPA 70E
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

Defective or damaged equipment shall not be used until repaired and tested by qualified person(s) and rendered safe to operate.

When an attachment plug will be connected to a receptacle, the relationship of the plug and receptacle contacts shall first be checked to ensure that they are of mating alignment.

D. Conductive Work Locations

Portable electric equipment used in highly conductive work locations (such as those inundated with water or other conductive liquids) shall be approved for those locations.

In job locations where employees are likely to contact or be drenched with water or conductive liquids, ground-fault circuit-interrupter (GFCI) protection for personnel shall also be used.

Task risk assessment can also include identifying when the use of portable tools and equipment powered by sources other than 120V AC, such as batteries, air, and hydraulics, should be used to minimize the potential for injury from electrical hazards for tasks performed in conductive or wet locations.

E. Connecting Attachment Plugs

Employees' hands shall not be wet when plugging and unplugging flexible cords and cord- and plug-connected equipment if energized equipment is involved.

Energized plug and receptacle connections shall be handled only with insulating protective equipment if the condition of the connection could provide a conductive path to the employee's hand (e.g., if a cord connector is wet from being immersed in water).

Locking-type connectors shall be secured after connection.

Implement on: 5/1/18	Version: 0	See Also: HY010100-POL, SA111119, NFPA 70E
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

F. Manufacturer's Instructions

Portable equipment shall be used in accordance with the manufacturer's instructions and safety warnings.

IV. GROUND-FAULT CIRCUIT-INTERRUPTER (GFCI) PROTECTION

Employees shall be provided with ground-fault circuit-interrupter (GFCI) protection as described herein. Listed cord sets or devices incorporating GFCI protection for personnel identified for portable use shall be permitted.

GFCI protection devices shall be tested in accordance with manufacturer's instructions.

A. Maintenance and Construction

GFCI protection shall be provided when an employee operates or uses cord sets (extension cords) or cord- and plug-connected tools related to maintenance and construction activity supplied by 125V, 15-, 20-, or 30-ampere circuits.

When employee operates or uses equipment supplied by >125V, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

B. Outdoors

GFCI protection shall be provided when an employee is outdoors and operating or using cord sets (extension cords) or cord- and plug-connected equipment supplied by 125V, 15-, 20-, or 30-ampere circuits.

When employee working outdoors operates or uses equipment supplied by >125V, 15-, 20-, or 30-ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented.

Implement on: 5/1/18	Version: 0	See Also: HY010100-POL, SA111119, NFPA 70E
<h1>STANDARD</h1>		
Approved by: Rich Wallen	Regulation: WAC 296-45-325	

V. OVERCURRENT PROTECTION DEVICES

Overcurrent protection of circuits and conductors shall not be modified, even on a temporary basis, beyond what is permitted by applicable portions of electrical codes and standards dealing with overcurrent protection.

VI. RESPONSIBILITY

A. Prior to Purchase

- 1) The Project Manager or Planner is responsible for:
 - Ensuring proposed portable equipment, electric hand tools, test equipment, GFCI, overcurrent protection devices, etc. are labeled and/or meet NRTL/UL standards, ESP standards, and other requirements listed herein, and
 - Documenting the ESP compliance as part of contract and turnover activities and/or asset management.

NOTE: The Authority Having Jurisdiction (AHJ) may be requested to conduct a formal review of proposed purchase, or equipment's compliance with ESP at the discretion of the Planner, Project Manager, Supervisor, or any PUD employee.

- 2) Planner or Project Manager's supervisor is responsible for ensuring maintenance activities and capital projects comply with the ESP.

B. After Purchase

Power Production Electricians are responsible for overseeing, testing, and maintaining the equipment covered within this standard.

Implement on: 5/1/18	Version: 0	See Also: HY010100-POL, SA111119, NFPA 70E
<h1>STANDARD</h1>		
Approved by: Rich Wallen		Regulation: WAC 296-45-325

VII. COMPLIANCE REVIEW

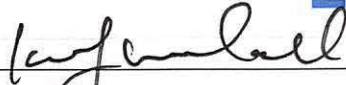
Adherence to the requirements of this standard shall be verified and documented on a quarterly basis by an assigned Qualified Electrical Worker or ESP Committee Designee.

VIII. REFERENCES

- 1) NFPA 70E-2018, *Standard for Electrical Safety in the Workplace.*
- 2) American National Standards Institute (ANSI) Z535, *Series of Standards for Safety Signs and Tags*
- 3) 29 CFR 1910.269, *Electric Power Generation, Transmission, and Distribution*
- 4) [Revised Code of Washington 19.28](#), *Electricians and Electrical Installations.*
- 5) [WAC 296-45](#), *Electric Power Generation, Transmission, and Distribution*

LIST

Approved by:



HY010100B-LST – ESP GENERAL TRAINING REQUIREMENTS

Power Production employees will complete ESP training appropriate to job assignment, and:

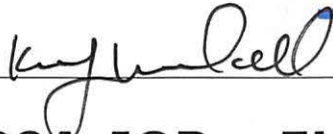
GENERAL

1. Workers who face a risk of exposure to electrical hazards shall have electrical safety training commensurate to their assigned duties. The degree of training provided shall be determined by the risk to the employee.
2. Documentation of training shall be available to supervisors/managers through the LMS database.
3. Initial NFPA 70E training shall include a hands-on element(s) to reinforce learning objectives.
4. Training offering Continuing Education Units (CEU) certified by the State of Washington, will be given preference so that PUD licensed electricians may maintain license.
5. Personnel shall be instructed on the proper use and maintenance of PPE prior to use. This OJT will be documented.
6. Comply with requirements of the ESP.

All Employees except Qualified Electrical Workers

1. An Electrical Safety training given at initial job assignment.
2. Annual electrical safety refresher training thereafter.

Approved by:



JOB

HY010100A-JOB – ELECTRICAL SAFETY PROGRAM (ESP) COORDINATOR

Employee assigned ESP coordinator duties at request of ESP Committee shall:

1. Maintain a list of Authorities Having Jurisdiction (AHJs) for each power plant location.
2. Provide administrative support for the ESP Committee.
3. Document decisions, recommendations of the ESP Committee on ESP Sharepoint page.
4. Share meeting minutes, lessons learned, ESP Committee decisions, and other information related to electrical safety via ESP Sharepoint page.
5. Knowledge of PUD records and records management.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA
70E

JOB

Approved by:



HY010100B-JOB – PROJECT MANAGER ELECTRICAL SAFETY PROGRAM (ESP) LIAISON

Prior to and during the course of onsite contractor work covered by the ESP, the contract Project Manager;

1. Complete training every 3 years in:
 - Electrical Safety Program and NFPA 70E, *Standard for Electrical Safety in the Workplace*
2. Advises contractor (and its subcontractors as appropriate) to appoint electrically knowledgeable point of contact (POC) employee to the ESP Committee, as needed.
3. Informs contractor that personnel, to the lowest sub-tier contractor, who may face a risk of electrical hazard in the completion of the contract, are trained and qualified to perform the assigned work in accordance with this program or NFPA 70E.
4. Confirms contractor has been given and agrees to follow GCPUD's electrical safety program as described in the ESP (HY010100) while under contract to perform services, maintenance, construction, and/or demolition activities for the PUD.
5. Verifies contractor uses approved PPE for electrical work as specified in the ESP.
6. Confirms contractor is aware of and agrees to use safe work practices as described in the ESP and NFPA 70E, including assigning work to the level of employee qualifications.
7. Confirms that electrical equipment and supporting equipment (e.g., light poles, power poles) are AHJ-approved installations, using appropriate technical standards and approved instructions and

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA
70E

JOB

Approved by: Rich Wallen

	procedures. See <i>Requesting Inspection of Electrical Equipment</i> (HY010100A-PRO).
8.	Investigates, reports, and trends contractor electrical incidents and shares the information with the ESP Committee in a timely manner.
9.	Participates on the ESP committee as a non-voting member, when required.

JOB

Approved by:



HY010100C-JOB – AUTHORITY HAVING JURISDICTION (AHJ)

Employee assigned AHJ duties at ESP Committee request shall:

1. Complete training every 3 years in:
 - Electrical Safety Program and NFPA 70E, *Standard for Electrical Safety in the Workplace*,
 - WAC 296-45
2. Upon request,
Conduct and provide written verification of hands-on observation that qualified electrical worker (QEW) and/or QEW supervisor:
 - Can distinguish exposed electrical conductors and/or circuit parts from other parts of electrical equipment,
 - Has knowledge of the selection of an appropriate test instrument to verify the absence of voltage, including interpreting the indications provided by the device, and understanding the limitations of each specific test instrument that may be used.
 - Ability to recognize electrical shock hazards, arc flash hazards, and appropriate controls.
 - Knowledge of proper use of the safety techniques, applicable policies and procedures, PPE (including arc flash, insulating, and shielding materials), and insulated tools and test equipment.
 - Knowledge of the approach distances specified in NFPA 70E, Table 130.4(D)(a) and the corresponding voltages to which the Qualified Electrical Worker will be exposed.
3. Apply and interpret:
 - NFPA 70E-2018, *Standard for Electrical Safety in the Workplace*
 - Institute of Electrical and Electronics Engineers (IEEE) 2017 National Electrical Safety Code (NESC)

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA 70E

JOB

Approved by: Rich Wallen

	<ul style="list-style-type: none">• Code of Federal Regulations (CFR), Title 29, Occupational Safety and Health Administration (OSHA), 1910 Subpart S (29 CFR 1910), Electrical• 29 CFR 1926, Subpart K, Electrical• 29 CFR 1910.296, <i>Electric Power Generation, Transmission, and Distribution</i>• WAC 296-45, <i>Electric Power Generation, Transmission, and Distribution</i>
4.	Document specific AHJ decisions and interpretations made during course of work, job, or contract (HY010100C-FRM, HY010100D-FRM, asset management database).
5.	Perform documented inspections of installations and modifications of electrical systems and equipment and record in asset management database .
6.	Share documents listed in #4, & #5, above with ESP Committee.
7.	Working knowledge of plant electrical systems.
8.	Incident energy calculation experience.

Implement on: 3/5/18	Version: 2	See Also: HY010100-POL
	Supersedes: v1	
LIST		
Approved by: <i>ALND</i>	Standard: NFPA 70E	

HY010100J-LST – AUTHORITY HAVING JURISDICTION (AHJ)

The following employees have been assigned AHJ responsibilities:

	Existing System				Capital Project				Employee	Contact	Assignment		
	PEC	PR	QC	WD	PEC	PR	QC	WD			Start	End	
1			X	X					Branden Meltingtallow Electrical Engineer			3/30/17	3/5/18
2	X	X							Amy Johnson Electrical Engineer			3/30/17	3/5/18
3					X	X	X	X	John Philipp Electrical Engineer			4/19/17	9/28/17
4	X	X	X	X	X	X	X	X	Ian Jones Electrical Engineer Supervisor	X3127 509-754-5088 509-750-0330c ijones@gcpud.org		9/28/17	

JOB

Approved by:

**HY010100D-JOB – POWER PRODUCTION
MANAGER/SUPERVISOR**

All power production supervisors and/or managers shall;

1. Comply with either 1a or 1b.

1a. If directly supervising electricians, or I&C technicians, or power plant operators, completes the following training/knowledge:

- First Aid/CPR/AED, at least every two years,
- Electrical Safety Program and NFPA 70E, *Standards for Electrical Safety in the Workplace*, every 3 years
- WAC 296-45 training, every 3 years

And as verified in writing by AHJ:

- Can distinguish exposed electrical conductors and/or circuit parts from other parts of electrical equipment,
- Knowledge in the selection of an appropriate test instrument to verify the absence of voltage, including interpreting the indications provided by the device, and understanding the limitations of each specific test instrument that may be used.
- Ability to recognize electrical shock hazards, arc flash hazards, and appropriate controls.
- Knowledge of proper use of the safety techniques, applicable policies and procedures, PPE (including arc flash, insulating, and shielding materials), and insulated tools and test equipment.
- Knowledge of the approach distances specified in NFPA 70E, Tables 130.4(D)(a) and 130.4(D)(b) and the corresponding voltages to which the Qualified Electrical Worker will be exposed.

OR 1b. All other power production supervisors/managers, completes training in:

- An Electrical Safety module training, annually OR

Implement on: 5/1/18

Version: 1
Supersedes: v0


See Also: HY010100-POL

JOB

Approved by: Rich Wallen

	<ul style="list-style-type: none">• Electrical Safety for Non-Electrical Worker training every 3 years.
2.	Participate on or assign representative to the Electrical Safety Program (ESP) Committee.
3.	Require all workers under their direction to follow safe work practices as described in ESP (HY010100) and NFPA 70E.
4.	Never assign work which exceeds personnel qualification to perform.
5.	Annually review training records to ensure all personnel under their direction are trained in accordance to ESP (HY010100) requirements.
6.	Annually review records to ensure all PPE for electrical work is available to and used by workers exposed to electrical hazards.
7.	Supervisor of Qualified Electrical Worker shall Conduct and document periodic inspections of work conducted in accordance with the ESP to ensure ongoing compliance with the program.

Approved by:

**JOB**

HY010100E-JOB – QUALIFIED ELECTRICAL WORKER (QEW)

All electricians, I&C technicians, power plant operators, and their supervisors shall;

1. Have a journeyman electrician State license, or meet one or more of the following criteria:
 - Be established Power Plant Operator, Electrician, or I&C Technician working for Grant PUD before the implementation date of the Electrical Safety Program (HY010100)
 - Completed a District-approved apprenticeship program
 - Have a journeyman operator card/status recognized by the District and Union.
2. Complete training in:
 - First Aid/CPR/AED at least every two years
 - Electrical Safety Program Training and NFPA 70E, *Standard for Electrical Safety in the Workplace*, at least every three years
 - WAC 296-45 training at least every three years
3. If licensed electrician through Washington State, Maintain existing electrician license through continuing education:
 - 8 ceu hours of NFPA 70 code update, and
 - 4 ceu hours on RCW and related WAC, and
 - 12 ceu hours of additional, state-approved courses, to equal a total of 24 ceu hours every 3 years.
4. Use safety techniques, know applicable policies and procedures, select PPE (including arc flash, insulating, and shielding materials), and understand insulated tools and test equipment.
5. Complete additional training (as specified in HY010100A-REF) prior to working within LAB or AFB.

JOB

Approved by: Kevin Marshall

6.	Conduct, understand, and follow Electrical Risk Assessment (HY010100A-FRM) before each and any job assigned which includes working with electrical equipment.
7.	Ensure unqualified person does not cross LAB/AFB. When acting as escort, assures that unqualified person is using appropriate PPE before crossing the AFB.
8.	Identify potentially unsafe electrical condition(s) and notify supervisor/foreman.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL

STANDARD

Approved by:



HY010100A-STD – ELECTRICAL SAFETY PROGRAM (ESP) COMMITTEE CHARTER

I. COMMITTEE CHARGE

The Electrical Safety Program (ESP) Committee is established to serve as the collective interpretive authority for the Electrical Safety Program, hereinafter called the ESP.

The Committee shall provide:

- Technical support and advice to the AHJ(s)
- The opportunity for all Power Production projects, facilities, and contractors to be represented by a designated point of contact (POC)
- Periodic meetings to serve as open forums for discussion of issues presented by ESP POCs and other stakeholders
- Discussions of electrical events or trends across the industry

II. COMMITTEE MISSION

Ensure consistent and standard application of the ESP to promote and maintain a safe work environment. The Committee will share best practices, lessons learned, and seek advice and input from members and participants.

III. COMMITTEE MEMBERSHIP

A. Voting Membership

The Committee shall be comprised of a representative from each of the following groups:

- Safety

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>STANDARD</h1>		
Approved by: Rich Wallen		

- Power Production Operations
- Power Production Electricians and I&C Technicians
- Power Production Maintenance Engineering
- Power Production Plant Management
- Power Production Engineering Electrical Section

These 6 representatives comprise the consensus decision-making membership.

An alternate member shall be identified to serve during any absence of a primary representative. The alternate shall have the same authority as the primary representative.

A Committee member's length of duty may be indefinite.

B. Non-Voting Membership

Power Production Contractors may select a point of contact (POC) employee to attend ESP Committee meetings as non-voting member.

IV. COMMITTEE STRUCTURE

A chair and co-chair shall be elected by a simple majority of the voting membership of the Committee every two years. The chair and co-chair may be re-elected to their respective positions.

A. Chair Responsibilities

- Schedule and conduct meetings
- Facilitate meetings in an orderly fashion
- Limit disruptions
- Ensure meeting agendas are prepared
- Ensure meeting summaries are documented
- Function as a point of contact and spokesperson for the Committee
- Interface with other safety program committees as necessary

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>STANDARD</h1>		
Approved by: Rich Wallen		

- Ensure an action item list is maintained and members complete their assignments in a timely manner
- Coordinate assignments of sub-committee(s)
- Communicate with the Senior Management Team (SMT) as needed

B. Co-Chair Responsibilities

- Act as the Chair when the Chair is absent
- Perform roles and responsibilities as delegated by the Chair

C. Committee Member Responsibilities

- Provide the chairperson with the identity of an alternate Committee member who is designated as the organizational representative
- Attend and participate in meetings when scheduled or notify their alternate when unable to attend
 - Alternates are responsible to attend and participate in meetings when the primary cannot attend
 - If the primary and alternate are both unable to attend, the Chair shall be notified
- Foster communication between the Committee and affected organizations relative to issue identification, interpretations, and consensus resolution
- Maintain lines of communications between management, workers, and the ESP Committee
- Assist management and safety personnel with electrical safety questions, assessments, incident investigations, critiques, fact finding meetings, and other electrical safety issues
- Distribute meeting summaries and other electrical safety information throughout represented organizations.
- Communicate regularly with craft workers, supervisors, safety professionals, and management regarding electrical safety issues, concerns, and lessons learned

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>STANDARD</h1>		
Approved by: Rich Wallen		

- Ensure that electrical safety questions, concerns, and requests for interpretations are brought to the appropriate technical board for discussion and resolution
- Promote and coordinate electrical safety initiatives within the Power Production division
- Maintain a safety focus when addressing issues
- Maintain current knowledge of the requirements of the ESP
- Maintain working knowledge of appropriate electrical safety codes, standards, and procedures
- Participate in issue discussions representing respective organization
- Bring up issues or speak in discussions only after being recognized by the chairperson
- Listen respectfully
- Refrain from:
 - Facility, craft, job function, or contractor biases when participating in discussions.
 - Interrupting others
 - Disruptive side conversations

D. ESP Coordinator

- Record committee meeting minutes
- Provide administrative support to the committee

V. COMMITTEE FUNCTIONS

The functions of the Committee shall be:

- Elect a chair and co-chair
- Assist Power Production with the maintenance of the written ESP (HY010100)
- Communicate and submit ESP changes to affected Power Production personnel
- Review and verify that training is consistent and appropriately covers the content of the ESP

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>STANDARD</h1>		
Approved by: Rich Wallen		

- Develop lines of inquiry for contractor use during independent assessments
- Evaluate trends in performance and recommend actions for improvement
- Review electrical safety related events, issues, and lessons learned as appropriate
- Share electrical events or trends across the industry
- Ensure distribution of lessons learned as necessary
- Collaborate to resolve worker issues, concerns, or events in a way that maintains site-wide consistency.
- Foster and encourage input and feedback from all workers.
- Evaluate and recommend resolution for issues/disputes pertaining to the ESP
- Recommend topics/information for communication to the workforce
- Provide ESP status to the Senior Management Team (SMT) when requested
- Adjudicate disagreements between AHJs

VI. COMMITTEE MEETINGS

The Committee shall:

- Meet regularly as necessary, but no less than quarterly, via scheduled meetings
- Hold special meetings to address urgent or emerging issues
- Record and retain meeting minutes and action items, and distribute to the membership
- Document and maintain records of committee decisions

A. Meeting Agenda

- The chairperson shall ensure an agenda is prepared for each meeting, using input from the membership, and forward a copy to all members in advance of the meeting time and date

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>STANDARD</h1>		
Approved by: Rich Wallen		

- Action items shall be assigned and tracked

B. Quorum

The Committee shall be considered to have a quorum when all Committee members, or their alternates, are present.

C. Decisions

Rather than majority vote, the committee shall use a consensus decision-making process in which all members discuss, develop and agree to support a decision in the best interest of the whole.

Failure to reach consensus on any decision will be cause for the issue to elevate to the Senior Management Team (SMT).

The SMT shall provide a decision or direction to the ESP Committee at its next scheduled meeting.

VII. COMMITTEE REVIEW

The Committee shall review this charter standard no later than the third quarter of the calendar year and recommend revisions, as appropriate, to be decided upon in the fourth quarter of the same year.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA 70E

PROCEDURE

Approved by:



HY010100A-PRO – REQUESTING INSPECTION OF ELECTRICAL EQUIPMENT

Prior to procuring or modifying stationary electrical equipment/devices and prior to placing said devices in service:

Project Manager (contracted work) or Planner (PUD work)	1.	Requests Authority Having Jurisdiction (AHJ) review proposed use prior to purchase of new electrical equipment or prior to modification to existing electrical equipment.
Authority Having Jurisdiction (AHJ)	2.	Completes Section I of <i>Inspecting Electrical Equipment for Use</i> Task (HY010100A-TSK).
	3.	Confirms equipment is suitable for intended purpose and install location or modification, and will be or is used according to manufacturer's instructions and any requirement of NRTL listing or labeling.
	OR 3a.	Determines necessary adjustments to the procurement plan or modification plan as condition for approval.
	OR 3b.	Rejects equipment or equipment modification as not suitable (by purpose, location, etc.).
	4.	Informs Project Manager/Planner of decision, including any special operating conditions, labeling, etc. as a condition of approval.
Project Manager or Planner	5.	Proceeds as instructed by AHJ.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>PROCEDURE</h1>		
Approved by: Rich Wallen		

Project Manager or Planner	6.	Prior to placing equipment in service, Notifies AHJ that equipment is ready for final inspection.
Authority Having Jurisdiction (AHJ)	7.	Inspects equipment as outlined in Section II of Inspecting Electrical Equipment for Use (HY010100A-TSK).
	8.	Records decision and inspection results, including confirmation that install or modification conforms to requirements, in asset management database and on Electrical Equipment Inspection Form (HY010100C-FRM).
	9.	Notifies Project Manager or Planner of final inspection results.

Implement on: 5/1/18

Version: 1
Supersedes: v0,
HY010100F-TSKv0

See Also: HY010100-POL, NFPA
70E, NFPA 70B

TASK

Approved by:



HY010100A-TSK – INSPECTING ELECTRICAL EQUIPMENT FOR USE

When asked to inspect new electrical equipment or to inspect modification of existing electrical equipment, the Authority Having Jurisdiction (AHJ):

SECTION I: BEFORE PURCHASING, INSTALLING, or MODIFYING

1. **Documents** inspection on Electrical Equipment Inspection Form (HY010100C-FRM) through step 3 (including signing equipment reviewer section).
2. **Confirms** equipment has been accepted, certified, listed, labeled, or otherwise determined to be safe for use in which it is intended by OSHA Nationally Recognized Testing Laboratory (NRTL), as indicated by manufacturer-applied NRTL label.

2a. **Checks** equipment will be used in accordance with instructions included in the listing and labeling, and in accordance with manufacturer instructions.

OR 2b. **Verifies** equipment of same manufacturer and model number previously evaluated by NRTL.

OR If no NRTL label, but Underwriters Lab standard for equipment exists,

3. **Schedules** field evaluation of electrical equipment by NRTL representative.

NOTE: Consult OSHA website for list of NRTLs
<http://www.osha.gov/dts/otpca/nrtl/index.html>.

OR If no NRTL label plus no UL standard,

4. **Checks** non-NRTL box of *Electrical Equipment Inspection* form (HY010100C-FRM) review section.

Implement on: 5/1/18	Version: 1 Supersedes: v0, HY010100F-TSKv0	See Also: HY010100-POL, NFPA 70E, NFPA 70B
<h1>TASK</h1>		
Approved by: Rich Wallen		

SECTION II: AFTER EQUIPMENT INSTALLED or MODIFIED, BUT BEFORE PLACED IN SERVICE

1.	Continues completion of Electrical Equipment Inspection Form (HY010100C-FRM) begun in Section I of this task.
2.	Checks appropriate box (no-NRTL label, installed, or modified) to the right of Inspection Type.
3.	Confirms equipment installed or modified as originally proposed by requestor.
4.	Verifies electrical equipment install or modification meets applicable installation codes and standards.
5.	Checks documented maintenance plan(s) adhere to manufacturer's instructions or accepted industry standards to meet requirements for normal operation. See NFPA 70B.
6.	Confirms equipment doors (when present) are closed and secured, covers are in place and secured, no evidence of impending failure.
7.	Ensures equipment is NRTL labeled and installation conforms to manufacturer's recommendations. Skip to step 10.
OR	If no NRTL label or installation method voids NRTL label or equipment was modified,
8.	Confirms equipment is AHJ approved by the completion of: <ul style="list-style-type: none"> • Electrical Equipment Inspection Form (HY010100C-FRM) • AHJ Approval Label (HY010100E-FRM) applied
9.	If legacy modified equipment and/or non-NRTL labeled and in use prior to 6/1/17, Confirms and documents equipment (HY010100C-FRM) may remain in service without additional reevaluation, <i>as long as</i> : <ol style="list-style-type: none"> a. it has not been modified, and b. it has not been found defective or damaged, and c. it does not present a hazard to workers.

Implement on: 5/1/18	Version: 1 Supersedes: v0, HY010100F-TSKv0	See Also: HY010100-POL, NFPA 70E, NFPA 70B
<h1>TASK</h1>		
Approved by: Rich Wallen		

	9a. Schedules reevaluation of equipment if all conditions listed in Section II step 9 (a, b, c) previous page, are not met.
	9b. Labels equipment upon approval using <i>AHJ Approval For Non-NRTL Equipment</i> (HY010100E-FRM).
10.	Requests or confirms a clearance on equipment if inspection identifies a hazard, unsafe condition, or other concerns which may cause injury or damage if equipment is placed in service.
11.	Completes equipment inspection form (HY010100C-FRM), including inspection details, date equipment to be placed in service, note any comments in step 19. NOTE: Describe any unsatisfactory condition, including proposed correction.
12.	Brings all deficiencies, hazards, or concerns identified during inspection to attention of project manager, maintenance supervisor, or ESP committee member, as appropriate.
13.	Signs and dates Equipment Inspection Form approver line of HY010100C-FRM and files in AHJ records.

PROCEDURE

Approved by:



HY010100C-PRO – CONDUCTING ARC FLASH RISK ASSESSMENT

Prior to energizing electrical equipment which operates $\geq 208V$ 3-phase, or at staff request for review of Arc Flash hazard, or 5 years after last hazard analysis,

NEW EQUIPMENT

Project Manager (PM), or Maintenance Electrical Engineer	1. Conducts incident energy analysis in accordance with <i>Electrical Equipment Incident Energy Analysis</i> standard, HY010100B-STD. Go to step 4.
	OR If such assessment is beyond PM's skill or expertise, 1a. Submits request for identifying incident energy boundary to power production electrical engineer supervisor.
Electrical Engineer Supervisor	2. Assigns electrical engineer to conduct/oversee incident energy analysis to determine the AC and/or DC voltage to which personnel will be exposed, including boundary requirements and necessary PPE to minimize possibility of electric shock to personnel.
Electrical Engineer (EE)	3. Performs arc flash risk assessment and determines incident energy for equipment in accordance with <i>Electrical Equipment Arc Flash Risk Assessment</i> standard, HY010100B-STD.
EE or PM	4. Updates ARC Flash Hazard tables as appropriate: <ul style="list-style-type: none"> • PRD=HY010100D-LST • WD= HY010100E-LST • PEC= HY010100F-LST

Implement on: 5/1/18	Version: 2 Supersedes: v1	See Also: HY010100-POL, NFPA 70E
<h1>PROCEDURE</h1>		
Approved by: Rich Wallen		

		<ul style="list-style-type: none"> • QC= HY010100G-LST • WAN SWYD= HY010100H-LST
EE or PM	5.	Shares updated hazard tables with Maintenance and Operations supervisors.
	6.	Meanwhile, Creates/Requests new labels.
Plant Maintenance /Operations Supervisor (or designees)	7.	Reviews updated information to verify existing work procedures are still valid for new incident energy information.
	7a.	Requests job plan update if work procedures need revision.
	8.	Assigns personnel to hang labels on equipment.
	9.	Informs Engineering of missing labels for equipment that requires work, <u>or</u> if there are concerns about the listed incident energy.
Electrical Engineering Supervisor	10.	Tracks equipment labeling deficiencies and prioritizes arc flash studies to ensure AFB labels can be placed on equipment as quickly as possible.

PROCEDURE

Approved by:



HY010100B-PRO – WORKING ON/NEAR ENERGIZED EQUIPMENT

When work may be required on or inside LAB or AFB of energized equipment or system,

Electrical Planner (if work is planned),
Electrical Foreman (if work is emergent)

1. **Reviews** job plan of approved electrical work order for accuracy, urgency, alternatives which may allow equipment to be de-energized.
2. **Confirms** need for work on energized equipment/system or inside the posted LAB or AFB boundary of equipment/system.
 - 2a. **Consults** with engineer, power plant operator, electrician, or others as needed to refine job plan to reduce shock risk.
3. **Completes** Electrical Risk Assessment (HY010100C-TSK) and **forwards** to electrical foreman.

Electrical Foreman

4. **Reviews** work order and associated completed ERA form.
5. If ERA indicates **Energized Electrical Work Permit (EEWP)** is required, **Meets** with Chief Power Plant Operator, and/or maintenance supervisor as needed to review job plan and identify work boundaries.
 - 5a. **Adjusts** job plan when possible to safely conduct work, based on input from Operations and others.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>PROCEDURE</h1>		
Approved by: Rich Wallen		

Electrical Foreman (EF)	6.	If ERA indicates energized electrical work permit is NOT required, Assigns Qualified Electrical Worker(s) to complete the work. Go to step 16.
	7.	Completes Energized Electrical Work Permit (see HY010100D-TSK).
	8.	Forwards signed EEWP and ERA to electrical engineer for review and signature.
Electrical Engineer (EE)	9.	Reviews completed EEWP and signs Electrical SME line in section 10 of permit.
	OR	9a. Meets with Electrical Foreman to resolve issues.
	10.	Forwards signed EEWP to Chief Operator for review and signature.
Chief Operator	11.	Reviews completed EEWP and signs Chief Operator line in section 10 of permit.
	OR	11a. Meets with EF/EE to resolve issues.
	12.	Forwards signed EEWP to Power Plant Manager for review and signature.
Power Plant Manager (or designee)	13.	Reviews completed EEWP and signs Manager line in section 10 of permit.
	OR	13a. Meets with personnel to resolve issues.
	14.	Forwards signed EEWP to electrical foreman so work can be scheduled.
Electrical Foreman	15.	Assigns qualified electrical worker(s) (QEW) to complete the EEWP .

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>PROCEDURE</h1>		
Approved by: Rich Wallen		

Electrical Foreman, QEW assigned to complete energized work	16. Reviews EEWP (or the completed ERA, if permit not required) with crew as part of job briefing.
	16a. Conducts additional job safety planning and job briefing if changes occur during the work that might affect worker safety.
QEW assigned to complete energized work	17. Posts ERA and completed EEWP (when needed) at jobsite while work is ongoing. NOTE: Foreman's office is acceptable alternate posting site.
	18. Forwards ERA, EEWP (if completed) with job brief to maintenance supervisor for review & filing, once job is completed.

Approved by:



TASK

HY010100C-TSK – COMPLETING AN ELECTRICAL RISK ASSESSMENT (ERA)

When work is planned on or near energized equipment (or inside the AFB), the assigned Electrical Planner (or Foreman or maintenance engineer):

1. **Walks** down equipment/system to visually inspect the area, including noting any posted LAB and AFB labels.
2. **Identifies** hazards (such as likelihood of human error, high incident energy, overlapping arc flash boundaries, difficult or restricted access/egress, etc.)
3. **Evaluates** level of shock and arc flash risk(s) posed by identified hazards. Likelihood of harm + potential severity of harm = estimated level of risk. (The likelihood of the occurrence of harm plus the severity of that harm. The level of risk determines if it is reasonable to conclude that freedom from harm can be achieved or if further risk control is needed.)
4. **Implements** risk control measures using the following hierarchy:
 - Eliminate (for example, electrically safe work condition)
 - Substitution (example, use lower risk equipment?)
 - Engineering controls (example; design the hazard out)
 - Awareness (signage)
 - Administrative controls (example, second person needed, LOTO, training, qualification)
 - PPE
5. **Documents** the ERA on Electrical Risk Assessment form (HY010100A-FRM).
6. **Enters** work order or clearance number in section 1 of form.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>TASK</h1>		
Approved by: Rich Wallen		

7.	Enters equipment ID as listed in maintenance database and/or posted on equipment, including physical location in section 2 of form.
8.	Selects justification for work in or near LAB or AFB in section 3 check boxes.
8a.	Enters explanatory detail in section 3d.
9.	If work includes any EEWP exempted activities (see HY010100C-LST), Checks appropriate box in section 4. NOTE: 4h = when working on equipment that operates <50V but where the capacity of the source and any overcurrent protection between the source and the worker are considered and no increased exposure to electrical burns or explosion due to electric arc is a reasonable expectation.
10.	Assesses arc flash risks, including:
10a.	Identifies arc flash hazard(s).
10b.	Estimates likelihood and severity of injury or damage to health, considering electrical equipment design, overcurrent protective device and its operating time, and equipment operating condition.
10c.	Chooses additional protective measures (if needed) based on hierarchy of risk control (see step 4, page 1) and the following: <ul style="list-style-type: none"> • Safe work practices • Arc flash boundary • PPE to be used within the arc flash boundary
11.	Completes section 5 of ERA.
11a.	Checks box 5a if equipment operates <208V, 3 phase.
11b.	Checks box 5b if equipment has no label and operates ≥208V, 3 phase.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>TASK</h1>		
Approved by: Rich Wallen		

11.	When there is no incident energy label on equipment, 11c. Requests calculation from engineering or maintenance engineering and completes box 5b: <ul style="list-style-type: none"> • Calculated number • AFB • Working Distance • Incident energy
12.	Assesses shock risks, including: <ul style="list-style-type: none"> 12a. Identifies shock hazard(s). 12b. Estimates likelihood and severity of injury or damage to health, considering electrical equipment design, overcurrent protective device and its operating time, and equipment operating condition. 12c. Chooses additional protective measures (if needed) based on hierarchy of risk control (see step 4, page 1) and the following: <ul style="list-style-type: none"> • Voltage to which personnel will be exposed, • Boundary requirements, • PPE and other protective equipment required to protect against shock the hazard.
13.	Completes Section 6 of ERA. <ul style="list-style-type: none"> 13a. Enters nominal voltage in box 6a. <p>NOTE: For the purpose of shock risk assessment, DC voltages shall be considered equivalent to AC voltages.</p> 13b. Checks equipment voltage approach boundary, box 6b section and circles corresponding RAB in 6d column. 13c. Checks appropriate LAB column header under 6c: <ul style="list-style-type: none"> • O.L. if overhead lines present, and/or • Fixed for all other <p>If nominal voltage >15kV,</p>

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>TASK</h1>		
Approved by: Rich Wallen		

13d.	Enters appropriate value from NFPA 70E tables 130.4(D)(a) or 130.4(D)(b) into line >15kV.						
14.	<p>Checks all PPE in section 7 that apply after completing shock and arc flash risk assessments, according to posted AFB label and Table 130.5(G) of NFPA 70E:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">PPE Recommended Based on Incident Energy Analysis</th> </tr> <tr> <th style="width: 50%;">Incident Energy ≥ 1.2 to 12 cal/cm²</th> <th style="width: 50%;">Incident Energy >12 cal/cm²</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;"> <ul style="list-style-type: none"> • AR clothing w/ arc rating equal to or greater than est. incident energy • Long-sleeve shirt and pants or coverall or arc flash suit • Arc-rated face shield and arc-rated balaclava or arc flash suit hood • Arc-rated outerwear (jacket, parka, rainwear, hard hat liner, etc.) • Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves w/leather protectors • Hard hat • Safety glasses or safety goggles • Hearing protection • Leather footwear </td> <td style="vertical-align: top;"> <ul style="list-style-type: none"> • Arc-rated clothing with an arc rating equal to or greater than the est. incident energy • Long-sleeve shirt and pants or coverall or arc flash suit • Arc-rated arc flash suit hood • Arc-rated gloves or rubber insulating gloves w/leather protectors • Hard hat • Safety glasses or safety goggles • Hearing protection • Leather footwear </td> </tr> </tbody> </table>	PPE Recommended Based on Incident Energy Analysis		Incident Energy ≥ 1.2 to 12 cal/cm ²	Incident Energy >12 cal/cm ²	<ul style="list-style-type: none"> • AR clothing w/ arc rating equal to or greater than est. incident energy • Long-sleeve shirt and pants or coverall or arc flash suit • Arc-rated face shield and arc-rated balaclava or arc flash suit hood • Arc-rated outerwear (jacket, parka, rainwear, hard hat liner, etc.) • Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves w/leather protectors • Hard hat • Safety glasses or safety goggles • Hearing protection • Leather footwear 	<ul style="list-style-type: none"> • Arc-rated clothing with an arc rating equal to or greater than the est. incident energy • Long-sleeve shirt and pants or coverall or arc flash suit • Arc-rated arc flash suit hood • Arc-rated gloves or rubber insulating gloves w/leather protectors • Hard hat • Safety glasses or safety goggles • Hearing protection • Leather footwear
PPE Recommended Based on Incident Energy Analysis							
Incident Energy ≥ 1.2 to 12 cal/cm ²	Incident Energy >12 cal/cm ²						
<ul style="list-style-type: none"> • AR clothing w/ arc rating equal to or greater than est. incident energy • Long-sleeve shirt and pants or coverall or arc flash suit • Arc-rated face shield and arc-rated balaclava or arc flash suit hood • Arc-rated outerwear (jacket, parka, rainwear, hard hat liner, etc.) • Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves w/leather protectors • Hard hat • Safety glasses or safety goggles • Hearing protection • Leather footwear 	<ul style="list-style-type: none"> • Arc-rated clothing with an arc rating equal to or greater than the est. incident energy • Long-sleeve shirt and pants or coverall or arc flash suit • Arc-rated arc flash suit hood • Arc-rated gloves or rubber insulating gloves w/leather protectors • Hard hat • Safety glasses or safety goggles • Hearing protection • Leather footwear 						
15.	Documents all other risk control measures in comment area (section 8) of ERA (such as barriers, attendants).						
16.	If only EEWP exempt work for this job, Checks NO box, Section 9.						
17.	Completes signature line and date, section 10.						
18.	If EEWP required, Checks Section 9 YES box and gives completed form to electrical foreman for EEWP completion.						
OR	If no EEWP required,						
19.	Posts completed ERA form with Job Brief at jobsite.						

TASK

Approved by:



HY010100D-TSK – COMPLETING AN ENERGIZED ELECTRICAL WORK PERMIT (EEWP)

When non-exempt work is planned on or near energized equipment, the assigned Electrical Foreman:

1. **Reviews** the ERA form (HY010100A-FRM) completed for the **proposed** work.
2. **Walks** down equipment/system to visually inspect the work area, including noting any posted AFB labels.
3. **Identifies** hazards (such as likelihood of human error, high incident energy, overlapping arc flash boundaries, difficult or restricted access/egress, etc.)
4. **Evaluates** level of shock and arc flash risk(s) posed by identified hazards. Likelihood of harm + potential severity of harm = estimated level of risk. (The likelihood of the occurrence of harm plus the severity of that harm. The level of risk determines if it is reasonable to conclude that freedom from harm can be achieved or if further risk control is needed.)
5. **Implements** risk control measures using the following hierarchy:
 - Eliminate (for example, electrically safe work condition)
 - Substitution (example, use lower risk equipment?)
 - Engineering controls (example; design the hazard out)
 - Awareness (signage)
 - Administrative controls (example, second person needed, LOTO, training, qualification)
 - PPE
6. **Enters** work order number in section 1 of **EEWP** (HY010100B-FRM).
7. **Enters** work location in section 2 of **EEWP**.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>TASK</h1>		
Approved by: Rich Wallen		

8.	<p>Enters equipment ID as listed in maintenance database and/or posted on equipment section 3 of EEWP.</p> <p style="text-align: center;">NOTE: Enter enclosure ID (if other than MCC or switchgear) here</p>
9.	Describes work to be performed in section 4 (or attaches job plan to EEWP).
10.	Checks appropriate justification in section 5 (all that apply) of EEWP .
11.	Writes explanation for why energized work must be done in section 5e of EEWP .
12.	Assesses shock risk, including:
12a.	Identifies shock hazard(s).
12b.	Estimates likelihood and severity of injury or damage to health, considering electrical equipment design, overcurrent protective device and its operating time, and equipment operating condition.
12c.	<p>Chooses additional protective measures (if needed) based on hierarchy of risk control (see step 5, page 1) and the following:</p> <ul style="list-style-type: none"> • Voltage to which personnel will be exposed, • Boundary requirements, • PPE and other protective equipment required to protect against shock the hazard.
13.	Using information from completed ERA, equipment AFB label, and/or 70E tables 130.7(C)(15)(a) or 130.7(C)(15)(b), Completes sections 6a-c, voltage and LAB & RAB boundaries.
14.	Assesses arc flash risks, including:
14a.	Identifies arc flash hazard(s).

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>TASK</h1>		
Approved by: Rich Wallen		

14.	14b. Estimates likelihood and severity of injury or damage to health, considering electrical equipment design, overcurrent protective device and its operating time, and equipment operating condition.
	14c. Chooses additional protective measures (if needed) based on hierarchy of risk control (see step 5, page 1) and the following: <ul style="list-style-type: none"> • Safe work practices • Arc flash boundary • PPE to be used within the arc flash boundary
15.	Checks flash hazard method used in section 7a.
16.	Enters drawing number(s) used (if any), including manufacturer name in section 7b. EXAMPLE: Harza 138E904 WFD 1200
17.	Completes sections 7c, 7d, and 7e, only if different from section 3.
18.	Using information from completed ERA and/or equipment AFPB labels, Enters data in sections 7f, 7g, 7h, and 7i.
19.	If no flash hazard assessment done and 'Neither' is checked in box 7a, Requests calculations by EE be completed for sections 7j and 7k.
20.	Completes risk assessment section 7l, including proposed additional protective measures based on hierarchy of risk control (see step 5, page 1) not covered in section 8.
21.	Enters names of qualified electrical workers assigned to perform the work in section 8a, including whether they have completed training (yes/no/N/A) for the work.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>TASK</h1>		
Approved by: Rich Wallen		

22.	Identifies which assigned personnel have current CPR/First Aid certification in section 8b, including CPR/First aid training (Y/N/N-A).
23.	If appropriate for this work, Identifies person in section 8c who is assigned to stand by for emergency response, including training indication (Y/N/N-A).
24.	Completes sections 8d, 8e, 8f, 8g, and 8h. NOTE: If control measures used (8g=Y), indicate type of measure.
25.	If one or more clearances in place to de-energize equipment, Enters clearance number(s) in section 8i and check 'yes' box.
26.	If no clearances possible, Checks the 'No' box in section 8i, leave clearance number field blank.
27.	Completes sections 8j, 8k, as needed.
28.	Completes sections 9a-d as thoroughly as possible using all available data (hazard calculations, AFB labels, and NFPA 70E tables).
29.	Signs Section 10 QEW line of the form.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA 70E

LIST

Approved by:



HY010100C-LST – ELECTRICAL WORK EXEMPT FROM ENERGIZED ELECTRICAL WORK PERMIT

The following work requires a completed Electrical Risk Assessment (HY010100A-FRM) but is exempt from EEWP when a Qualified Electrical Worker enters LAB of energized electrical conductor or circuit parts, or enters the AFB to perform any of the following:

Task	
1.	Testing (see Definitions, HY010100A-LST)
2.	Troubleshooting (see Definitions, HY010100A-LST)
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. Including; <ul style="list-style-type: none">➤ Installing temporary protective measures, such as:<ul style="list-style-type: none">• Voltage rated protective shields/barriers,• Voltage rated rubber insulating equipment,• Voltage rated plastic guard equipment➤ When escorting an unqualified person across LAB or AFB➤ Thermography, ultrasound➤ When crossing LAB or AFB for visual inspection only➤ Housekeeping and non-electrical tasks
4.	Safe condition/safe-to-work check
5.	Working on Class 2 circuits
6.	Racking in/out circuit breaker in accordance with industry standard and District SOP
7.	Clearance activities

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

8.	<p>When working on equipment that operates at less than 50 volts where the capacity of the source and any overcurrent protection between the energy source and the worker are considered and it is determined that there will be no increased exposure to electrical burns or to explosion due to electric arcs.</p> <p style="text-align: center;"><u>NOTE:</u> This assessment (increased exposure to electrical burns) should be documented on the Electrical Risk Assessment (HY010100A-FRM).</p>
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TASKApproved by: **HY010100B-TSK – WORKING WITHIN A LAB
OR AFB**

When work is assigned inside a limited approach boundary or arc flash boundary of energized equipment, the Qualified Electrical Worker (QEW):

1. No EEWP required,
Reviews completed Electrical Risk Analysis (see ERA form HY010100A-FRM), to be kept at jobsite during ongoing work.

NOTE: Alternately, the completed ERA may be posted in the Foreman's office.
- OR** EEWP required,
 - 1a. **Reviews** completed Energized Electrical Work permit.
 2. **Reviews** work order and **walks** down equipment to be worked on.
 3. **Requests** evaluation for more QEW, when needed to ensure employee protection.
 4. **Attends** electrical hazards brief given by Foreman/Supervisor, or designee.
 5. **Chooses** personal protective equipment (PPE) including clothing and tools appropriate to the risk documented on ERA or EEWP. (See *GCPUD PPE Levels, AR Clothing, Protective Equipment & Approach Boundary, SA111110E-LST.*)
 6. **Inspects** all PPE prior to use to ensure good condition and testing (when required) up-to-date.
 - 6a. **Removes** PPE from service when it is damaged, torn, or untested/lacks testing documentation.
 7. When exposed parts operate >300V phase-to-phase or phase-to-ground,

Implement on: 6/1/17	Version: 0	See Also: HY010100-POL
<h1>TASK</h1>		
Approved by: Kevin Marshall		

	Uses at least two Qualified Electrical Workers to complete work.
8.	<p>Prior to and during the work, Uses appropriate signs, tags, barricades, or an attendant to warn and protect employees from hazards that may cause injury due to electric shock or arc flash.</p> <p style="text-align: center;">NOTE: If an attendant is required to be within the LAB or AFB, they shall be a Qualified Electrical Worker with appropriate PPE.</p>
8a.	Uses alerting methods (signs, tags, barricades, or attendant) on energized nearby look-alike equipment to distinguish it from de-energized equipment.
9.	Returns equipment to safe condition (no exposed energized parts) by shift end, even if work incomplete.

ORIGINAL

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL

Approved by:



TASK

HY010100G-TSK – DRILLING, CUTTING, EXCAVATING ABOVE CABLES/ CONDUITS

Before cutting or drilling >1.5" into equipment, floors, wall, or structural elements where a likelihood of contacting energized electrical lines or parts exists, the assigned Foreman:

1. **Reviews** applicable drawings, other documentations to identify exact location of electrical hazards and/or other subsurface obstructions.

2. **Requests** a clearance on **likely** energy sources beneath the surface where work will occur.

3. **Completes** an electrical risk assessment (HY010100C-TSK).

OR If assigned Foreman is mechanical foreman,

3a. **Requests** electrical foreman or qualified electrical worker complete an ERA for the work.

4. **Conducts** (or **requests**) a below-surface scan when penetrating **impervious** surface, to map out/identify electrical hazard.

5. If work requires drilling,
Requires workers to use a drill stop.

AND If using water during drilling,
5a. **Requires** workers to use GFCI circuit.

6. **Reminds/Requires** workers performing blind penetrations to use appropriate PPE, including:

- Appropriate voltage-rated gloves with protective outer leather gloves, and
- Nonconductive safety glasses with side shields

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL
<h1>TASK</h1>		
Approved by: Rich Wallen		

- | | |
|----|---|
| 7. | Ensures or Requires that workers barricade/flag work area to prevent inadvertent entry by personnel during penetration activities. |
|----|---|

ORIGINAL

TASK

Approved by:



Regulation:

HY010100E-TSK – INSPECTING ELECTRICAL FIELD WORK

At least annually the **ESP Committee designee**:

1. **Wears** PPE appropriate to the work to be inspected.
2. **Conducts** inspection of powerhouse energized work inside an Arc Flash Boundary (AFB).
3. **Uses** **Electrical Equipment** Inspection form (HY010100C-FRM) to document inspection.
4. Request workers to safely halt work and exit the AFB before conducting inspection from this point.
Verifies qualified electrical worker(s) (QEW) have completed training as required by ESP and to the level of the work assigned.
- 4a. **Verifies** unqualified worker, if any, inside the AFB has appropriate ESP training.
5. **Confirms** worker(s) are using PPE appropriate to the work.
6. **Verifies** Electrical Risk Assessment (HY010100A-FRM) was completed and posted with the Job Brief.
7. If Energized Electrical Work Permit (HY010100B-FRM) required for work,
Confirms EEWP completed, approved, and posted.
- AND** 7a. **Verifies** work area appropriately barricaded to prevent unescorted entry into the LAB/AFB by unqualified personnel.
- AND** 7b. **Confirms** QEW using appropriate Voltage Rated PPE if working in the Restricted Approach Boundary.
8. If procedural or other deficiencies found during inspection,

TASK

Approved by: Rich Wallen

Regulation:

8	Stops all work until situation is made safe.
	8a. Schedules (or conducts) remediation.
	8b. Notifies employee's foreman, supervisor, or project manager of exact deficiency(ies).
	8c. Documents remediation or remediation plan on inspection form comment section . NOTE: If remediation includes revision of Electrical Safety Program SOP (HY010100), the power plant manager or ESP committee member shall receive a copy of the inspection form with suggested edits to the ESP .
9.	Signs and dates completed inspection form.
10.	Sends completed & signed form with any additional attached documents to ESP Committee for review and filing.

NOTE: A camera is recommended to document good practices as well as problems that may be observed. Photos may be attached to completed inspection form.

Implement on: 5/1/18

Version: 1
Supersedes: v0

See Also: HY010100-POL, NFPA 70E

LIST

Approved by:



HY010100A-LST – ESP DEFINITIONS & ACRONYMS

See [Hydro Glossary](#) for more Power Production definitions and acronyms.

Term	Definition
AFB	Arc Flash Boundary. When an arc flash hazard exists, an approach limit from an arc source at which incident energy equals 1.2 cal/cm ² .
AHJ	Authority Having Jurisdiction. Individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure. Employee who reviews/approves all powerhouse electrical installations and/or devices.
AR	Arc Rating. Indicates a garment has an arc rating and the level of protection has been determined through testing.
Arc Flash Hazard	A source of possible injury or damage to health associated with the release of energy caused by an electric arc (greater than or equal to 1.2 cal/cm ² at the defined working distance, typically 18 inches).
ASTM	American Society for Testing and Materials.
Blind Penetration	Activities including drilling, saw cutting, and excavations into surfaces where a likelihood of accidentally contacting concealed energized electrical conduits, lines, cables, or parts exist.
CEU	Continuing Education Unit.
CFR	Code of Federal Regulations.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

Term	Definition
Class 2 Circuit	<p>The NEC defines a Class 2 circuit as that portion of the wiring system between the load side of a Class 2 power source and the connected equipment. Due to its power limitations, a Class 2 circuit is considered safe from a fire initiation standpoint and provides acceptable protection from electrical shock.</p> <p>Power for Class 2 circuits is limited either inherently (in which no overcurrent protection is required) or by a combination of a power source and overcurrent protection.</p> <p>The maximum circuit voltage is 150VAC or VDC for a Class 2 inherently limited power source. The maximum circuit voltage is 30VAC and 60VDC for a Class 2 power source limited by overcurrent protection.</p>
EEWP	Energized Electrical Work Permit.
Electrical Hazard	<p>A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, or arc blast injury.</p> <p>NOTE: <i>Class 2 power supplies, listed low voltage lighting systems, and similar sources operating at less than 50 volts are examples of circuits or systems that <u>are not</u> considered an electrical hazard.</i></p>
Electrically Safe Work Condition	<p>A state in which an electrical conductor or circuit part has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to verify the absence of voltage (applicable safe condition checks and safe-to-work checks complete), and, if necessary, temporarily grounded for personal protection.</p>
ERA	Electrical Risk Assessment.
ESP	Electrical Safety Program.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

Term	Definition
Exposed	[as applied to energized electrical conductors or circuit parts] is 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.
Fault Current	The amount of current delivered at a point on the system during a short-circuit condition.
Fault Current, Available	<p>The largest amount of current capable of being delivered at a point on the system during a short-circuit condition.</p> <p>NOTE: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault.</p> <p>If the DC supply is a battery system, the term <i>available fault current</i> refers to the prospective short-circuit current.</p>
FR	Flame-Resistant.
GFCI	Ground-Fault Circuit Interrupter.
Incident Energy	The amount of thermal energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. Incident energy is typically expressed in calories per square centimeter (cal/cm ²)
LAB	<p>Limited Approach Boundary.</p> <p>An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists. Only Qualified Electrical Workers (or person escorted by QEW) are permitted inside an LAB</p>
LOTO	Lockout/Tagout.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

Term	Definition
Maintenance, Condition of	The state of the electrical equipment considering the manufacturers' instructions, manufacturers' recommendations, and applicable industry codes, standards, and recommended practices.
Modification	Making any physical change to the electrical equipment installation, not to include like-for-like replacement.
NESC	National Electrical Safety Code.
NFPA	National Fire Protection Association.
Non-Electrical Worker	Personnel who face higher than normal risk of exposure to electrical hazards. Including workers who operate electrical hand tools such as a drill or grinder.
NRTL	Nationally Recognized Testing Laboratory.
O.L.	Overhead Line(s). A wire, cable, or bundled conductors supported by messenger cables, with or without insulation, supported by insulators mounted on or hung from cross arms located near the tops of poles, towers, or other structures.
OSHA	Occupational Safety and Health Administration.
POC	Point of Contact.
PPE	Personal Protective Equipment.
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 identify the hazards and reduce the associated risk.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

Term	Definition
QEW	Qualified Electrical Worker. Licensed Electrician, or Journeyman: <ul style="list-style-type: none"> a. Electrician, b. I&C Technician, c. Power Plant Operator d. Supervisor of a, b, or c
RAB	Restricted Approach Boundary. An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock due to electrical arc-over combined with inadvertent movement. Only Qualified Electrical Workers are permitted inside the RAB.
RCW	Revised Code of Washington.
Shock Hazard	A source of possible injury or damage to health associated with current through the body caused by contact or approach to energized electrical conductors or circuit parts. NOTE: Injury and damage to health resulting from shock is dependent on the magnitude of the electrical current, the power source frequency and the path and time duration of current through the body. The physiological reaction ranges from perception, muscular contractions, inability to let go, ventricular fibrillation, tissue burns, and death.
SME	Subject Matter Expert.
Testing	Taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment except for removing/replacing device cover or enclosure cover.

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

Term	Definition
	<p>Examples of testing include voltage/current measurements, calibrations, resetting overload devices, replacing fuses, and similar activities in electrical enclosures that cannot be de-energized and when the RAB will not be crossed.</p> <p>The following testing for the purposes of verifying control circuits may also occur: jumpers may be connected or wires may be lifted on 120 VAC or 125 VDC control circuits energized without EEWP. Examples of verifying circuits include: rotary cam limit switches, relay checks, instrument checks, PLC wiring. This is limited to testing/start-up activities and does not apply to new construction work such as rewiring new components and removing old components. Operations must be notified before such testing activities occur.</p>
Troubleshooting	<p>An assessment done without using tools except for those needed to remove/replace device cover or enclosure cover.</p> <p>NOTE: Troubleshooting boundary ends when the equipment is manipulated with tools (tighten bolts, reconnect wires, etc.).</p>
UL	Underwriters Laboratories.
WAC	Washington Administrative Code.
Working Distance	<p>The distance between a person's face and chest area and a prospective arc source.</p> <p>NOTE: Incident energy increases as the distance from the arc source decreases. See NFPA 70E 130.5(C)(1) for further information.</p>

Implement on: 5/1/18	Version: 1 Supersedes: v0	See Also: HY010100-POL, NFPA 70E
<h1>LIST</h1>		
Approved by: Rich Wallen		

Term	Definition
	Typical working distances for different classes of electrical equipment are defined in IEEE-1584, <i>Guide for Performing Arc Flash Hazard Calculations</i> . For this program, the working distance can be obtained by looking at the equipment's incident energy analysis.
Working On (energized electrical conductors or circuit parts)	Intentionally coming in contact with energized electrical conductors or circuit parts with the hands, feet, or other body parts, with tools, probes or with test equipment, regardless of the PPE a person is wearing. There are two categories of 'working on': <i>Diagnostic (testing)</i> is taking readings or measurements of electrical equipment with approved test equipment that does not require making any physical change to the equipment; <i>repair</i> is any physical alteration of electrical equipment (such as making or tightening connections, removing or replacing components, etc.).

Continued from inside Front Cover

HY010100 – Electrical Safety Program (ESP) Version History*			
Document #	Ver.	Date	Revision
HY010100C-JOB (AHJ)	1	5/1/18	Step 3: NFPA 70E citation revised to 2018 and OSHA CFR 1910.296 citation added. Crane & motor vehicle citations removed. Step 4, database replaces spreadsheet.
HY010100C-LST (Work Exempt from EEWP)	1	5/1/18	Deleted: calibration/adjustment, Voltage & current measurement, Removing/replacing electrical cover, Resetting overload devices (entire sentence); Added thermography, ultrasound and housekeeping/non-electrical tasks, to exemptions from EEWP. Reduced from 14 to 8 exemptions. #8 clarified.
HY010100C-PRO (Conducting Arc Flash Risk Ass.)	1	6/27/17	>208V 3-Phase added to lead in trigger statement.
	2	5/1/18	New title. Step 3 revised – arc flash risk assessment.
HY010100C-STD (Portable Equip & GFCI)	0	5/1/18	Proposed new Standard for Test instruments, portable cord- and plug- equipment, GFCI, and overcurrent protection devices
HY010100C-TSK (Completing ERA)	1	5/1/18	Revised lead-in job titles. New hazard assessment (steps 2, 3, 4, 8, 11, 14). Additional changes to steps 6, 9, 13, 14, 15d, 18-20 reflect changes to the ERA form.
HY010100C-FRM Inspection Form	1	5/1/18	Retitled, Approver section added. Supersedes HY010100D-FRM and HY010100F-FRM.
HY010100D-JOB (Supervisor Req)	1	5/1/18	Step 1 Revised for clarity. Step 1a table citation revised to reflect 2018 changes to NFPA 70E.
HY010100D-TSK (Completing EEWP)	1	5/1/18	New hazard assessment steps (3, 4, 5, 12, 14), risk hierarchy added to Step 20. Changed EEW to EEWP throughout. Table citation revised in step 13.
HY010100E-TSK	1	5/1/18	Electrical replaces 'energized' in title, Form title revised in step 3. Trigger revised to ESP committee designee. Step 8c Note revised.
HY010100F-TSK	1	5/1/18	Withdrawn (superseded by A-TSK revisions).
HY010100J-LST (AHJ List)	1	9/28/17	Ian Jones replaces John Philipp as AHJ for capital projects.
	2	3/5/18	Ian Jones designated sole AHJ.
HY010100G-FRM	0	5/1/18	New label for tracking modified electrical equipment.
HY010100G-TSK (Blind Penetrations)	1	5/1/18	Trigger revised to match language in NFPA 70E 2018 130.10; step 2 'known' replaced by 'likely'; text deleted from steps 3 & 6; step 4 'concrete or masonry' replaced by 'impervious'.

*When differences exist between online and print versions of this SOP, the online version prevails. All changes between approved versions are highlighted in yellow. When the only change is a text deletion, the step number itself will be highlighted (ex. 5.).

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