

Department of Labor and Industries
Apprenticeship Section
PO Box 44530
Olympia WA 98504-4530



Request for Revision of Standards


TO: Washington State Apprenticeship & Training Council

FROM: Inland Power and Light Co Apprenticeship Committee #2243

Please update our Standards of Apprenticeship to reflect the following changes:

- Additions shall be underlined (underlined).
- Deletions shall be struck through (~~struck through~~).
- See attached.

Form must be signed by Committee Chair and Secretary or Program's Authorized Signer

<input type="checkbox"/> Chair	Date	<input type="checkbox"/> Secretary	Date
<input checked="" type="checkbox"/> Authorized Signer	03.13.2023		
Print Name: Travis Englehart	Print Name:		
Signature: 	Signature:		

Approved By: Washington State Apprenticeship & Training Council
Signature of Secretary of the WSATC:
Date:

Attach additional sheets if necessary

<u>Occupational Objective(s):</u>	<u>SOC#</u>	<u>Term [WAC 296-05-015]</u>
<u>SUBSTATION MAINTENANCE TECHNICIAN</u>	<u>49-2095.00</u>	<u>8000 HOURS</u>
<u>METERMAN</u>	<u>43-5041.00</u>	<u>6000 HOURS</u>

Sponsor Introductory Statement (Required):

The following Standards were prepared by the Inland Power and Light Co Apprenticeship Committee, and the International Brotherhood of Electrical Workers Local Union 77 (IBEW), assisted by the Office of Apprenticeship, Employment and Training Administration, U.S. Department of Labor, and the Washington State Department of Labor and Industries Apprenticeship Section. When approved by and registered with the Registration Agency, these Standards will govern the training of competent, qualified journeymen level workers.

II. MINIMUM QUALIFICATIONS:

Other: ~~Applicants must have completed 6 months as a Utility Groundman.~~

Applicants must possess a valid driver's license.

Lineman applicants must have a valid Washington State issued class A CDL.

III. CONDUCT OF PROGRAM UNDER WASHINGTON EQUAL EMPLOYMENT OPPORTUNITY PLAN:

A. Selection Procedures:

1. Applications can be downloaded online at inlandpower.com/careers or picked up in-person at 10110 W Hallett Rd, Spokane, WA 99224, and can be submitted in-person or via email to hr@inlandpower.com
2. Applicants meeting the minimum qualifications will be eligible for interview.
3. Interviews will be based on alignment between their work experience, knowledge, skills, and abilities and the requirements and core competencies of the job. They will be scored and placed on a list of ranked applicants.
4. Records of interviews are maintained, including interview questions, the general nature of the applicant's answers, and summary interview conclusions.
5. As job openings occur apprenticeship offers will be offered to the top person on the ranked list.

B. Equal Employment Opportunity Plan:

1. The Sponsor will make targeted outreach and recruitment efforts to attract qualified women, minorities, protected veterans and individuals with a disability as applicants and maintain a log of requests for accommodations and resolution of those requests.
2. Positions will be listed with the Washington State Employment Security Department (WSED). The WSED will also receive an annual notification that the cooperative is a federal contractor and requests the referral of qualified applicants.

3. All employment applications, advertisements and solicitations for employment will communicate that the Sponsor is an equal opportunity employer with an affirmative action plan.

IV. TERM OF APPRENTICESHIP:

The term of Lineman and Meterman apprenticeships shall be a minimum of 6000 hours of reasonably continuous employment. The term of Substation Maintenance Technician apprenticeships shall be a minimum of 8000 hours of reasonably continuous employment.

V. INITIAL PROBATIONARY PERIOD:

The initial probationary period for an apprentice ~~Lineman~~ shall be the first 1200 hours of apprenticeship employment.

VI. RATIO OF APPRENTICES TO JOURNEY LEVEL WORKERS

E.

The ratio of ~~Lineman~~ apprentices to Journey-Level workers shall always be at least one (1) Journey-Level worker for each one (1) apprentice.

VII. APPRENTICE WAGES AND WAGE PROGRESSION:

c. Wage Progression Schedules:

~~Lineman~~ Apprentice wages are pursuant to the Collective Bargaining Agreement between IBEW Local 77 and Inland Power and Light CO. Percentage of wages are effective January 1, 2022 and all occupation classifications are based on the Journeyman Lineman rate.

1. Lineman

2. Meterman

<u>Step</u>	<u>Hour Range or competency step</u>	<u>Percentage of journey-level wage rate</u>
<u>1</u>	<u>Step 1 (0-6 months)</u>	<u>75%</u>
<u>2</u>	<u>Step 2 (7-12months)</u>	<u>77%</u>
<u>3</u>	<u>Step 3 (13-18 months)</u>	<u>79%</u>
<u>4</u>	<u>Step 4 (19-24 months)</u>	<u>82%</u>
<u>5</u>	<u>Step 5 (25-30 months)</u>	<u>86%</u>
<u>6</u>	<u>Step 6 (31-36 months)</u>	<u>92%</u>

3. Substation Maintenance Technician

<u>Step</u>	<u>Hour Range or competency step</u>	<u>Percentage of journey-level wage rate</u>
<u>1</u>	<u>Step 1 (0-6 months)</u>	<u>75%</u>
<u>2</u>	<u>Step 2 (7-12 months)</u>	<u>77%</u>
<u>3</u>	<u>Step 3 (13-18 months)</u>	<u>79%</u>
<u>4</u>	<u>Step 4 (19-24 months)</u>	<u>82%</u>
<u>5</u>	<u>Step 5 (25-30 months)</u>	<u>86%</u>
<u>6</u>	<u>Step 6 (31-36 months)</u>	<u>92%</u>
<u>7</u>	<u>Step 7 (37-42 months)</u>	<u>100%</u>
<u>8</u>	<u>Step 8 (43-48 months)</u>	<u>104%</u>

VIII. WORK PROCESSES:

B. Substation Maintenance Technician:

Approximate Hours

<u>1. Layout of new construction & installations from engineering drawings and troubleshooting.....</u>	<u>300</u>
<u>2. Installation, adjustment, testing, repair & maintenance of substation equipment</u>	<u>1500</u>
<u>3. Wiring and testing of control, meter, & relay circuits & equipment.....</u>	<u>900</u>
<u>4. Installation, testing, repair & maintenance of power transformers</u>	<u>450</u>
<u>5. Substation inspections</u>	<u>200</u>
<u>6. Shop repair and testing of electrical equipment</u>	<u>400</u>
<u>7. Installation, testing & maintenance of batteries, battery charger & miscellaneous control equipment</u>	<u>350</u>
<u>8. Safety meetings, first aid & CPR training, care & inspection of safety equipment .</u>	<u>100</u>
<u>9. Installation, testing, repair & maintenance of voltage regulators / load tap changers & accessory equipment.....</u>	<u>250</u>
<u>10. Substation switching and protective grounding.....</u>	<u>250</u>
<u>11. Installation, testing, repair & maintenance of power circuit breakers.....</u>	<u>250</u>
<u>12. Miscellaneous topics including environmental (mineral oil, PCB handling, etc.), fabrication (metal and wood, equipment assembly, concrete work), animal guarding, equipment operation</u>	<u>1550</u>

13. Installation, maintenance, adjustment, testing & repair of substation and overhead line control equipment, relays, and meters1500

Total Hours:8000

C. Meterman Approximate Hours

1. Residential Metering1500

- a. Single phase self-contained meters
- b. Single phase transformer rated meters
- c. Meter tampering and current diversions
- d. Recording instruments
- e. Customer relations

2. Commercial and Industrial Metering.....2500

- a. 3-phase self-contained non-demand
- b. 3-phase transformer rated
- c. 3-phase contained demand meters
- d. 3-phase transformer rated demand meters
- e. Power factor meeting
- f. Recording instruments

3. Meter shop.....1800

- a. Portable instruments
- b. Current and potential devices
- c. Panel mounted instruments
- d. Meter numbering and recording
- e. Meter testing using portable and bench testing equipment
- f. Primary metering instrument mounting
- g. Computer and metering software use

4. Safety100

- a. Safety meeting attendance
- b. First aid training & CPR
- c. Care and inspection of safety equipment
- d. WISHA safety standards

5. Miscellaneous100

TOTAL HOURS: 6000

IX. RELATED/SUPPLEMENTAL INSTRUCTION:

A. The methods of related/supplemental training must be indicated below (check those that apply):

() Supervised field trips

- () Sponsor approved training seminars (Specify):
- (X) Sponsor approved online or distance learning courses (specify): **For Lineman apprenticeship: Online courses included in Northwest Line Construction Industry JATC 487 program**
- (X) State Community/Technical college: **For Lineman apprenticeship: Courses included in Northwest Line Construction Industry JATC 487 program, offered in collaboration with North Idaho College. For Meterman apprenticeship: Harris Institute of Technical Training 3 Year Electricity Metering RSI Program for Electric Utility Metering Apprentices.**
- (X) Private Technical/Vocational college
- (X) Sponsor Provided (lab/classroom)
- (X) Other (specify): **For Lineman apprenticeship: Northwest Line Construction Industry JATC 487 line school offered in collaboration with North Idaho College; Camp Rilea**

C. Additional Information:

Lineman RSI Hours Per Year

1st Year: 196 Hours (Classroom Study: 96 Hours, Camp Training: 100 Hours)

2nd Year: 190 Hours (Classroom Study: 96 Hours, Camp Training: 94 Hours)

3rd Year: 176 Hours (Classroom Study: 96 Hours, Camp Training: 80 Hours)

Substation Maintenance Technician RSI Hours Per Year:

1st Year: 160 Hours

2nd Year: 170 Hours

3rd Year: 160 Hours

4th Year: 160 Hours

Meterman RSI Hours Per Year:

144 hours per year

X. ADMINISTRATIVE/DISCIPLINARY PROCEDURES:

A. Administrative Procedures:

3. Sponsor Procedures:

c. Apprentices seeking advanced standing or credit who are either a non-IBEW Journey-level worker or were part of an apprenticeship program not registered with the Washington Department of Labor & Industries must meet the following requirements:

- i. Must provide official, undisputable documentation of work experience and/or on the job training completed.**
- ii. Must provide reliable and adequate verification to substantiate previous employment and experience.**
- iii. Apprentices will be evaluated using consistent, standard, nondiscriminatory means, and registered at the appropriate period of apprenticeship based on previous work experience and related training.**

Department of Labor and Industries
Apprenticeship Section
PO Box 44530
Olympia WA 98504-4530



Journey Level Wage Rate

From which apprentices' wage
rates are computed

TO: Washington State Apprenticeship & Training Council

FROM: Inland Power and Light Co. Apprenticeship Committee #2243

Occupation:	County(ies):	Journey Level Wage Rate:	Effective Date:
Substation Maintenance Technician	Spokane, Stevens, Pend Oreille, Lincoln, Grant, Adams, Whitman, Garfield, Asotin, Columbia, Franklin, Walla Walla	\$ 57.10	01/01/2023
Meterman	Spokane, Stevens, Pend Oreille, Lincoln, Grant, Adams, Whitman, Garfield, Asotin, Columbia, Franklin, Walla Walla	\$ 57.10	01/01/2023
		\$	
		\$	

Sponsors must submit the journey-level wage at least annually or whenever changed to the Department.

Form must be signed by Committee Chair and Secretary or Program's Authorized Signer

<input type="checkbox"/> Chair	Date	<input type="checkbox"/> Secretary	Date
<input checked="" type="checkbox"/> Authorized Signer	03-13-2023		
Print Name: Travis Englehart		Print Name:	
Signature: 		Signature:	

Department of Labor and Industries
Apprenticeship Section
PO Box 44530
Olympia WA 98504-4530



Apprenticeship Related/Supplemental Instruction (RSI) Plan Review

For L&I Staff Use Only	
Christina Chance 3/14/2023	Teri Gardner 3-14-23
Christina Chance 3/13/2023	Teri Gardner 3-13-23
Christina Chance 3/6/2023	Teri Gardner 3-6-23
L&I Apprenticeship Consultant	L&I Admin

Program Name Inland Power and Light Co. Apprenticeship Committee #2243	
Occupation Meterman	
Term/OJT Hours 6000	Total RSI Hours 432
Training Provider Harris Institute of Technical Training – Brad Harris	

By the signature placed below, the **program sponsor** agrees to provide the prescribed RSI for each registered apprentice and assures that:

1. The RSI content and delivery method is and remains reasonably consistent with the latest occupational practices, improvements, and technical advances.
2. The RSI is coordinated with the on-the-job work experience.
3. The RSI is provided in safe and healthful work practices in compliances with WISHA and applicable federal and state regulations.
4. The RSI Plan is maintained, updated and submitted to the Department a minimum of once every 5 years (WSATC Policy 2015-01; rev, 10-21-21).
5. The RSI will be conducted by instructors who meet the qualification of the “competent instructor” as described in WAC 296-05-003:
 - a. Has demonstrated a satisfactory employment performance in her/her occupation for a minimum of three years beyond the customary learning period for that occupation; and
 - b. Meets the State Board for Community and Technical Colleges requirements for a professional technical instructor (see WAC 131-16-080 through -094), or be a subject matter expert, which is an individual, such as a journey worker, who is recognized within the industry as having expertise in a specific occupation; and
 - c. Has training in teaching techniques and adult learning styles, which may occur before or within one year after the apprenticeship instructor has started to provide the related technical instruction.
6. If using alternative forms of instruction, such as correspondence, electronic media, or other self-study, instruction shall be clearly defined.

Signatures on next page

Form must be signed by Committee Chair and Secretary or Program's Authorized Signer

<input type="checkbox"/> Chair	Date	<input type="checkbox"/> Secretary	Date
<input checked="" type="checkbox"/> Authorized Signer	3/6/2022		
Print Name: Travis Englehart		Print Name:	
Signature: <i>Travis Englehart</i>		Signature:	

Training Provider Signature

Approved By (Print Name): Brad Harris	Title: President
Signature of the Training Provider: <i>Bradley W. Harris</i>	
Date: 3-6-23	

If additional training providers are needed, go to page 4.

SBCTC

Print Name:	Title:
Signature of the Program Administrator:	
Date:	
<input type="checkbox"/> SBCTC recommends approval <input type="checkbox"/> SBCTC recommends return to sponsor	

Program Name Inland Power and Light Co Apprenticeship Committee	Occupational Objective Meterman
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Note: The description of each element must be in sufficient detail to provide adequate information for review by the SBCTC and Review Committee. To add more elements, click on the plus sign that appears below the "Description of Element/Course" field.

Describe minimum hours of study per year in terms of (check one):

- ☒ 12-month period from date of registration.
☐ Defined 12-month school year.
☐ 2,000 hours of on-the-job training.

Element/Course: 1 st Year - Section 1 (sessions 1-22)	Planned Hours: 72
Mode of Instruction (check all that apply) <input type="checkbox"/> Classroom <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Harris Institute of Technical Training - Brad Harris	
Description of element/course: <ul style="list-style-type: none"> • Self-Contained Single Phase Metering 1 and 2 • Electricity Meter Safety 1 • Definitions and Vocabulary 1 • Electricity 1 • Electricity Metering Principles 1 • Mathematics for Electricity Metering 1 • Single Phase Distribution Transformers 1 • Demand Metering 1 • Customer Relations 1 • Field Test Instruments and Equipment 1 • Revenue Protection 1 • Rates, Tariffs and Policies 1 • Safe Procedures for Installing and Removing Single Phase Self-Contained Meters • First Check Point Assessment (6 Month Equivalent) 	

Element/Course: 1 st Year - Section 2 (sessions 23-44)	Planned Hours: 72
Mode of Instruction (check all that apply) <input type="checkbox"/> Classroom <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Harris Institute of Technical Training - Brad Harris	
Description of element/course: <ul style="list-style-type: none"> • Instrument Rated Single Phase Metering 1 and 2 • Electricity Meter Safety 2 • Definitions and Vocabulary 2 • Electricity 2 • Electricity Meter Principles 2 • Instrument Transformers 1 • Mathematics for Electricity Metering 2 • Single Phase Distribution Transformers 2 • Demand Metering 2 • Rates, Tariffs and Policies 2 • Field Test Instruments and Equipment 2 • Second Check Point Assessment (12 Month Equivalent) 	

Element/Course: 2nd Year - Section 3 (sessions 45-68)	Planned Hours: 72
Mode of Instruction (check all that apply) <input type="checkbox"/> Classroom <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Harris Institute of Technical Training - Brad Harris	

Description of element/course:	<ul style="list-style-type: none"> Self-Contained Three Phase Metering 1 and 2 Electricity Meter Safety 3 Electricity 3 Meter Vocabulary and Definitions 3 Application of Single Phase AMI Metering Principles Electricity Meter Principles 3 Self-contained and Instrument Rated Metering Commonalities Three Phase Distribution Transformer Connections 1 Mathematics for Electricity Metering 3 Pulse Metering 1 Customer Relations 2 Demand Metering 3 Revenue Protection 2 Field Test Instrument & Equipment 3 Rates, Tariffs and Policies 3 Third Check Point Assessment (18 Month Equivalent)
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Element/Course: 2nd Year - Section 4 (sessions 69-92)	Planned Hours: 72
Mode of Instruction (check all that apply) <input type="checkbox"/> Classroom <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Harris Institute of Technical Training – Brad Harris	

Description of element/course:	<ul style="list-style-type: none"> Instrument Rated Three Phase Metering 1 and 2 Meter Safety 4 Electricity 4 Meter Vocabulary and Definitions 4 Mathematics for Electricity Metering 4 Electricity Meter Principles 4 Pulse Metering 2 Three Phase Distribution Transformer Connections 2 Demand Metering 4 Application of Three Phase AMI Metering Principles Instrument Transformers 2 Rates, Tariffs and Policies 4 Field Test Instrument & Equipment 4 Meter Communications 1 Fourth Check Point Assessment (24 Month Equivalent)
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Element/Course: 3rd Year - Section 5 (sessions 93-106)	Planned Hours: 72
Mode of Instruction (check all that apply) <input type="checkbox"/> Classroom <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Harris Institute of Technical Training – Brad Harris	
Description of element/course:	<ul style="list-style-type: none"> High Voltage Metering 1 and 2 Reactive Metering 1 and 2 Meter Safety 5 Electricity 5 Meter Vocabulary and Definitions 5 Mathematics for Electricity 5 Electricity Meter Principles 5 Three Phase Distribution Transformer Connections 3 Customer Relations 3 Meter Communications 2 Totalizing Metering Pulse Metering 3 Telemetry Metering Fifth Check Point Assessment (30 Month Equivalent)

Element/Course: 3rd Year - Section 6 (sessions 106-108)	Planned Hours: 72
Mode of Instruction (check all that apply) <input type="checkbox"/> Classroom <input type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Harris Institute of Technical Training – Brad Harris	
Description of element/course: Review Focused for Retention: <ul style="list-style-type: none"> • Electricity Meter Principles • Field Metering Safety • Electricity • Meter Vocabulary and Definitions • Customer Relations • Mathematics for Electricity • Demand Metering • Pulse Metering • Single and Three Phase Transformer Connections • High Voltage Metering • Field Test Equipment; Rates, Tariffs and Policies • Instrument Transformers • Reactive Metering • Meter Communications • Totalizing Metering • Exit Exam and Certification 	

Additional Training Providers (if necessary)

Click or tap here to enter text.

Print Name Training Provider

Click or tap here to enter text.

Title of Training Provider

Click or tap here to enter text.

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Title of Training Provider

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Organization of Training Provider

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Organization of Training Provider

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For L&I Staff Use Only	
Christina Chance 3/14/2023	Teri Gardner 3-14-23
Christina Chance 3/13/2023	Teri Gardner 3-13-23
Christina Chance 3/6/2023	Teri Gardner 3-6-23
L&I Apprenticeship Consultant	L&I Admin

Apprenticeship Related/Supplemental Instruction (RSI) Plan Review


Program Name Inland Power and Light Co. Apprenticeship Committee #2243	
Occupation Substation Maintenance Technician	
Term/OJT Hours 8000	Total RSI Hours 650
Training Provider Inland Power and Light Co. Apprenticeship Committee	

By the signature placed below, the **program sponsor** agrees to provide the prescribed RSI for each registered apprentice and assures that:


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Signatures on next page

Form must be signed by Committee Chair and Secretary or Program's Authorized Signer

<input type="checkbox"/> Chair	Date	<input type="checkbox"/> Secretary	Date
<input checked="" type="checkbox"/> Authorized Signer	3/6/2023		
Print Name: Travis Englehart	Print Name:		
Signature: 	Signature:		

Training Provider Signature

Approved By (Print Name): Matt Kane	Title: Operations Manager
Signature of the Training Provider: 	
Date: 3/6/2023	

If additional training providers are needed, go to page 4.

SBCTC

Print Name:	Title:
Signature of the Program Administrator:	
Date:	
<input type="checkbox"/> SBCTC recommends approval <input type="checkbox"/> SBCTC recommends return to sponsor	

Program Name Inland Power and Light Co Apprenticeship Committee	Occupational Objective Substation Maintenance Technician
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Note: The description of each element must be in sufficient detail to provide adequate information for review by the SBCTC and Review Committee. To add more elements, click on the plus sign that appears below the "Description of Element/Course" field.

Describe minimum hours of study per year in terms of (check one):

- ☒ 12-month period from date of registration.
☐ Defined 12-month school year.
☐ 2,000 hours of on-the-job training.

Element/Course: 1 st Year	Planned Hours: 160
Mode of Instruction (check all that apply) <input checked="" type="checkbox"/> Classroom <input checked="" type="checkbox"/> Lab <input checked="" type="checkbox"/> Online <input type="checkbox"/> Self-Study	
Provided by: Inland Power and Light Co - Apprenticeship Committee	
Description of element/course: <p>Basic Electricity - 80hrs: Classroom 40hrs and Online 40hrs</p> <ol style="list-style-type: none"> 1. Fundamentals of Electricity <ol style="list-style-type: none"> a. Principles of Matter b. Electrical Conductors, Insulators and Semiconductors c. Producing Electricity 2. Electrical Circuits <ol style="list-style-type: none"> a. Ohm's Law b. Resistors c. Electrical Power d. Decimals and Scientific Notation e. Circuit Theories 3. Alternating Current <ol style="list-style-type: none"> a. AC vs. DC b. AC Circuit c. Inductive Reactance d. Capacitive Reactance 4. Introduction to Transformers <ol style="list-style-type: none"> a. Transformer Construction b. Transformer Ratings c. Wye Connection d. Delta Connection <p>Substation Maintenance I - 80hrs: Classroom 40hrs and Lab 40hrs</p> <ol style="list-style-type: none"> 1. Safety For Technicians 2. Components of a Power System 3. Substations Breaker Configurations 4. Substation Components 5. Metering in Substations 6. Relaying in Substations 7. Disconnect Switches Maintenance and Testing. <ol style="list-style-type: none"> a. Components b. Interlocking c. Motor-Operated Mechanisms d. Vacuum Interrupters e. Maintenance Requirements f. Electrical Testing 8. Switchgear Maintenance & Testing <ol style="list-style-type: none"> a. Arrangement of Components b. Maintaining the Insulation System c. Maintaining Auxiliary Components 	

- d. Electrical Testing of Switchgear
- 9. Circuit Breaker Fundamentals
 - a. Circuit Breaker Functions
 - b. Ratings
 - c. Principles of ARC Interruption
 - d. Breaker Insulation Media
 - e. Contacts
 - f. Insulation Requirements
 - g. Circuit Breaker Controls
 - h. Methods of Operation
- 10. Circuit Breaker Maintenance and Testing
 - a. Overall Maintenance
 - b. ITE/ABB Circuit Breaker
 - c. Square D Vacuum Circuit Breaker
 - d. Electrical Testing
- 11. MV Switch & MV Bus
- 12. MV Air Breaker Maintenance
- 13. MV Vacuum Breaker Maintenance
- 14. Power Factor Testing Circuit Breakers

Element/Course: 2nd Year

Planned Hours: 170

Mode of Instruction (check all that apply)

☒ Classroom ☒ Lab ☒ Online ☐ Self-Study

Provided by: Inland Power and Light Co – Apprenticeship Committee

Description of element/course:

Basic Electrical Print Reading – 40hrs Classroom

- 1. Electrical Drawing Fundamentals
 - a. Categories and Types of Electrical Drawings
 - b. Drawing Sizes
 - c. Drawing Sections
- 2. Single-Line Diagrams
 - a. Symbols
 - b. Device Numbers
 - c. Abbreviations
 - d. Practical Exercise
 - e. Interpretation
- 3. Elementary Diagrams
 - a. Purpose
 - b. Symbols
 - c. Abbreviations
 - d. Interpretation
- 4. Wiring Diagrams
 - a. Information
 - b. Symbols
 - c. Abbreviations
 - d. Device Numbers
 - e. Interpretation

Substation Maintenance II – 80hrs: Classroom 40hrs and Lab 40hrs

- 1. Transformer Data and Nameplates
- 2. Transformer DC Testing
 - a. DC Testing
 - b. Insulation Testing
 - c. Winding Resistance Testing
- 3. Transformer AC Testing
 - a. AC Testing
 - b. Power Factor Testing
 - c. Transformer Bushing testing

- d. Core Excitation Current Testing
- e. Turns Ratio Testing
- 4. Transformer Oil Testing (Lab)
 - a. Insulating Liquids
 - b. Liquid Sampling
 - c. Sampling for Gas-In-Oil Analysis
 - d. Silicone Insulating Fluid
 - e. Dielectric Breakdown Voltage Test
 - f. Liquid Insulating Power Factor
- 5. Transformer Gas Testing (Lab)
 - a. Gas Detection
 - b. Oxygen Testing
 - c. Combustible Gas Testing
 - d. Gas Analysis Interpretation
- 6. Transformer Nameplate Data Exercises (Lab)
- 7. Transformer DC Testing (Lab)
 - a. Insulation Resistance
 - b. Transformer Winding Resistance Testing
 - c. Dual Core Winding Resistance Testing
 - d. Core Ground Testing
- 8. Transformer AC testing (Lab)
 - a. Transformer Turns Ratio Testing
 - b. Transformer Power Factor Testing
 - c. Transformer Core Excitation Testing
 - d. Bushing Testing
 - e. CT Multi-Tap Testing
- 9. Transformer Oil Testing (Lab)
 - a. Visual Examination
 - b. Liquid Insulating Power Factor Testing
 - c. Oil Dielectric Testing

Infrared Thermography I – 50hrs: Classroom 40hrs and Online 10hrs

- 1. Introduction to Infrared Thermography
 - a. Definition
 - b. Infrared Thermography Benefits
 - c. Heat and Temperature
 - d. Heat Transfer Modes
 - e. Heat Conductions
 - f. Convection and Radiation
 - g. Effects of Winds
- 2. Radiosity Concepts
 - a. Reflectivity
 - b. Transmissivity
 - c. Absorptivity
 - d. Emissivity
 - e. Spatial Resolution Concepts
- 3. Operating Infrared Equipment
 - a. Infrared Imagers: How They Work and Differences
 - b. Operation of Infrared Thermal Imager
 - c. Temperature Range, Level, and Span
 - d. Measurement Tools
 - e. Color Palettes
 - f. Object Parameters
 - g. Finding the Emissivity of a Sample
- 4. Applications of Thermography

Mode of Instruction (check all that apply)

☒ Classroom ☒ Lab ☐ Online ☐ Self-Study

Provided by: Inland Power and Light Co – Apprenticeship Committee

Description of element/course:

Substation Grounding and Bonding – 40hrs Classroom

1. Fundamentals of Grounding and Bonding
 - a. Basic Electrical Concepts
 - b. Hazards of Electricity
2. Basics of Grounding and Bonding
 - a. Grounding and Bonding
 - b. Grounding vs. Bonding
 - c. Identifying Grounding, Bonding and Ground Components
3. Use and Identification of Grounded Conductors
 - a. Connection to Grounded System
 - b. Neutral Conductors
 - c. Identifying Grounded Conductors
 - d. Identification of Terminals
 - e. Polarity of Connections
4. Requirements of Grounding and Bonding
 - a. Connection of Grounding and Bonding equipment
 - b. Protection of Ground Clamps and Fittings
 - c. Clean Surfaces
 - d. Exercise – Identifying Grounded & Ungrounded Systems
5. System Grounding
 - a. Alternating-Current (AC) Systems To Be Grounded
 - b. Circuits Not To Be Grounded
 - c. Buildings or Structure Grounding
 - d. Generators
 - e. High-Impedance Grounded Neutral Systems
 - f. Calculating the Size of Equipment and Transformers
6. Bonding
 - a. Services
 - b. Bonding for Over 250 Volts
 - c. Bonding in Hazardous Locations
 - d. Lightning Protection Systems

Battery Maintenance and Testing – 40hrs Classroom

1. Introduction to Batteries
 - a. Batteries in the Industry
 - b. Battery Banks
2. Battery Safety for Technicians
 - a. Battery Room Requirements
 - b. Battery Risk Assessment
3. Battery Maintenance and Testing (Lab)
 - a. Visual Inspections
 - b. Maintenance Procedures
 - c. Battery Inspection
 - d. Specific Gravity Testing
 - e. Strap Resistance testing
 - f. Internal Resistance testing
 - g. Fault Testing
4. Troubleshooting (Lab)

Advanced Transformer, Breaker and Regulator/LTC Maintenance and testing – 80hrs: Classroom 40hrs and Lab 40hrs

1. Electromechanical Condition Assessment
2. Low Voltage Turns Ratio
3. Leakage Reactance
4. HV Turn Ratio Test and Excitation Current (Lab)
5. Sweep Frequency Response Analysis (SFRA) Transformer Insulation: Solid and Liquid (Lab)
6. Instrument Transformer Testing (Lab)

7. Power Factor Testing (Lab)
8. CT Multi-Tap Testing (Lab)
9. Instrument Transformer and Bushing DFR (Lab)
10. Contact Resistance (Lab)
11. Contact Replacement (Lab)
12. Vacuum Circuit Breaker testing (Lab)
13. Bushing Replacement (Lab)

Element/Course: 4th Year

Planned Hours: 160

Mode of Instruction (check all that apply)

☒ Classroom ☒ Lab ☐ Online ☐ Self-Study

Provided by: Inland Power and Light Co – Apprenticeship Committee

Description of element/course:

Protective Relay Maintenance – 80hrs: Classroom 40hrs and Lab 40hrs

1. Electrical Fundamentals
2. Basic Relays
3. Instrument Transformers
 - a. CT
 - b. PT
 - c. Connections
 - d. Ratios
 - e. Polarity
 - f. Connections
 - g. Nameplate Data
4. Introduction to Relaying
 - a. Class of Relays
 - b. Protection Zones
 - c. Fundamentals of Electro-Mechanical Design
 - d. Relay Construction
 - e. Protective Relay Testing and Maintenance
 - f. Testing Techniques
5. Introduction to Transformer Differential Relays
 - a. Applications
 - b. Operating Principles

Protective Relay and Feeder Protection – 80hrs: Classroom 40hrs and Lab 40hrs

1. Feeder Protection Fundamentals
 - a. Causes of Faults
 - b. Protection Requirements
 - c. Feeder Protection Application
 - d. Instrument Transformers
2. SEL 651R
 - a. Relay Connections
 - b. Event Record Data Management
 - c. Meter Checks
 - d. Relay Settings
3. SEL 751A
 - a. Relay Connections
 - b. Event Record Data Management
 - c. Meter Checks
 - d. Relay Settings
4. Cooper Form6
 - a. Relay Connections
 - b. Event Record Data Management
 - c. Meter Checks
 - d. Relay Settings

Additional Training Providers (if necessary)

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