



Power Protection and Control Technician and Technologist Occupational Standards



This project was funded by the Government of Canada's Sector Council Program
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The Electricity Sector Council provides support to this dedicated team by working with industry employers and other stakeholders to research and resolve human resource and workplace development issues.

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Power Protection and Control Technician and Technologist Occupational Analysis Profile

Disclaimer: Please note that some of the tasks detailed in this document will require the services of a registered tradesperson depending upon the province of work. Provincial regulations change from time to time, employers and employees should consult your provincial appropriate licensing authority for clarification regarding which tasks may be affected. It is the responsibility of the individual employer/employee to ensure they act within the regulation for their jurisdiction.

A Work Safely	A.1	A.2	A.3	A.4	A.5	A.6
	Follow corporate, provincial and federal regulations and policies	Attend safety meetings	Conduct tailboard meetings	Communicate health and safety concerns to supervisor and/or Joint Health and Safety Committee	Use and maintain personal protective equipment	Operate motorized vehicles
B Test and Commission Relay Protection and Metering	A.7	A.8	A.9	A.10	A.11	A.12
	Establish a safe work area	Follow limits of approach regulations	Perform tests on energized equipment and circuits	Work safely around water	Use insulated and non-insulated work platforms	Complete required safety training
B Test and Commission Relay Protection and Metering	B.1	B.2	B.3	B.4	B.5	B.6
	Wire check protection schemes and metering circuits	Test PTs and CTs and associated cabling	Operate test equipment	Connect test equipment to relays and meters	Interface microprocessor relays and meters to PC	Apply settings to relays and meters

B.7	B.8	B.9	B.10	B.11	B.12
Isolate protection schemes and metering circuits	Test electromechanical relays and meters	Test electronic relays and meters	Test microprocessor relays and meters	Function test protection schemes and metering circuits	Perform protection and metering load readings

B.13	B.14
Conduct fault analysis	Repair or replace relays and meters

C Test and Commission Controls

C.1	C.2	C.3	C.4	C.5	C.6
Check wiring of control systems	Develop and maintain HMI	Set-up and maintain auto synchronizers	Maintain SCADA	Commission and maintain RTUs	Repair RTUs

C.7
Function test, maintain and troubleshoot generation plant control systems

D Test and Commission Communication Systems

D.1	D.2	D.3	D.4	D.5	D.6
Check wiring of communication system	Operate communication test equipment	Interface PC to communication system	Test data circuits	Test power line carrier equipment	Test microwave equipment

	D.7	D.8	D.9	D.10	D.11	D.12
	Test fibre optic equipment	Test neutralizing/isolating transformer	Test multiplexer systems	Analyze communication system test results	Repair communication systems	Replace communication systems
E Plan	E.1	E.2	E.3	E.4	E.5	
	Review and implement scope of work	Design	Submit outage request	Develop job plan	Coordinate testing	
F Communicate	F.1	F.2	F.3	F.4	F.5	
	Use verbal communication	Use communication devices	Communicate with controlling authorities and other departments	Use written communication	Transfer technical knowledge to others	
G Document	G.1	G.2	G.3	G.4	G.5	G.6
	Create test plans	Prepare maintenance procedures	Create/maintain prints	Maintain databases	Assist with preparation of final commissioning reports	Prepare and/or present training materials
	G.7	G.8	G.9			
	Write equipment evaluation reports	Write fault analysis reports	Manage daily paperwork			

H Demonstrate Personal Competencies

H.1	H.2	H.3	H.4	H.5	H.6
Follow a code of ethics	Read, comprehend and apply technical information	Be a self starter	Work independently	Be a team player	Make decisions
H.7	H.8	H.9	H.10	H.11	H.12
Demonstrate leadership	Participate in continuous learning	Demonstrate confidence	Demonstrate organizational skills	Train and mentor others	Use computers

Power Protection and Control Technicians and Technologists Occupational Standards

Area of Competence A: Work Safely

Task A.1: Follow corporate, provincial and federal regulations and policies

Subtasks:	Supporting knowledge and abilities:
a) Identify corporate, provincial and federal regulations and policies required for workplace safety	<ul style="list-style-type: none"> • Follow company, provincial and federal regulations and policies • e.g., working alone policy
b) Identify contact person when workplace safety regulations and policies are violated	<ul style="list-style-type: none"> • Inform immediate supervisor of violation/incident • Complete appropriate forms/documentation for incident or near miss
c) Provide information about incident/violation	<ul style="list-style-type: none"> • Document information using appropriate corporate forms

Task A.2: Attend safety meetings

Subtasks:	Supporting knowledge and abilities:
a) Identify requirements for safety meeting attendance	<ul style="list-style-type: none"> • Follow corporate policies and procedures
b) Chair safety meetings as required	<ul style="list-style-type: none"> • Prepare materials/conduct research • Follow-up as required
c) Make safety presentations as required	
d) Attend tailboard conferences	<ul style="list-style-type: none"> • Complete tailboard conference forms • Follow corporate policies and procedures
e) Review environmental procedures and ISO standards	<ul style="list-style-type: none"> • Follow corporate policies and procedures • Know where to locate appropriate information when required

Task A.3: Conduct tailboard meetings

Subtasks:	Supporting knowledge and abilities:
a) Coordinate with all members in your work group	<ul style="list-style-type: none"> • Review job plan to highlight specific hazards
b) Coordinate with all groups working in a particular area	<ul style="list-style-type: none"> • Review each work groups' job plan to highlight specific hazards

Task A.4: Communicate health and safety concerns to supervisor and/or Joint Health and Safety Committee

Subtasks:	Supporting knowledge and abilities:
a) Identify local Joint Health and Safety Committee members	<ul style="list-style-type: none"> • Use corporate resources to determine local committee members
b) Identify concerns to supervisor and members	<ul style="list-style-type: none"> • Document concern to supervisor and member • Notify co-workers if needed. For example: in safety bulletins or e-mails

Task A.5: Use and maintain personal protective equipment

Subtasks:	Supporting knowledge and abilities:
a) Identify locations where personal protection equipment is required	<ul style="list-style-type: none"> • Follow corporate/government policies and guidelines
b) Identify personal protective equipment requirements to enter specified environments	<ul style="list-style-type: none"> • Follow corporate/government policies and guidelines • Obtain authorization from specified field safety officer and supervisor, if required
c) Obtain personal protective equipment training	<ul style="list-style-type: none"> • Inform field safety officer and supervisor of non-existent or improper training of equipment. For example, fall arrest training, confined space training
d) Identify expiry dates on specified equipment	<ul style="list-style-type: none"> • Inform field safety officer and supervisor of equipment concerns
e) Identify 'wear and tear' issues on equipment	<ul style="list-style-type: none"> • Inform field safety officer and supervisor of equipment concerns

Task A.6: Operate motorized vehicles

Subtasks:	Supporting knowledge and abilities:
a) Demonstrate ability to operate motorized vehicles	<ul style="list-style-type: none"> • Possess required licenses • Obtain licenses, as required
b) Complete driving programs	<ul style="list-style-type: none"> • e.g., defensive driving, collision avoidance, skid control, vehicle backing
c) Secure equipment and loads	<ul style="list-style-type: none"> • Use appropriate barriers and tie downs

Task A.7: Establish a safe work area

Subtasks:	Supporting knowledge and abilities:
a) Identify requirements for safe work area	<ul style="list-style-type: none"> • Follow completed job plan steps • Use corporate resources to identify hazards and risks found on job plan
b) Complete tailboard conference to identify risks	
c) Create a safe work environment	<ul style="list-style-type: none"> • Follow completed job plan steps, and eliminate/ control/ minimize hazards found on job plan

Task A.8: Follow limits of approach regulations

Subtasks:	Supporting knowledge and abilities:
a) Identify voltage level	<ul style="list-style-type: none"> • Determine specific voltage level information about equipment
b) Identify limits of approach requirements	<ul style="list-style-type: none"> • Follow corporate/government regulations regarding limits of approach

Task A.9: Perform tests on energized equipment and circuits

Subtasks:	Supporting knowledge and abilities:
a) Identify voltage level	<ul style="list-style-type: none"> • Determine specific equipment voltage level
b) Identify requirements for safe work area	<ul style="list-style-type: none"> • Follow completed job plan steps • Use corporate resources to identify and barricade hazards found on job plan
c) Identify limits of approach requirements	<ul style="list-style-type: none"> • Follow corporate guidelines regarding limits of approach
d) Follow applicable test procedures	

Task A.10: Work safely around water

Subtasks:	Supporting knowledge and abilities:
a) Identify requirements for safe work area	<ul style="list-style-type: none"> • Follow completed job plan steps • Use corporate resources to identify/eliminate/control/minimize hazards found on job plan
b) Follow applicable test procedures	

Task A.11: Use insulated and non-insulated work platforms

Subtasks:	Supporting knowledge and abilities:
a) Identify requirements for safe work area	<ul style="list-style-type: none"> • Follow completed job plan steps • Use corporate resources to identify and eliminate/control/minimize hazards found on job plan
b) Operate equipment classified as insulated and non-insulated work platforms	<ul style="list-style-type: none"> • e.g., ladders, scissor lifts, bucket trucks, scaffolding, iron stairs and catwalks • Ensure proper certification for operation of non-insulated work platforms • Log hours of use of insulated and non-insulated work platform

Task A.12: Complete required safety training

Subtasks:	Supporting knowledge and abilities:
a) Complete safety training/certification	<ul style="list-style-type: none"> • Complete training as per corporate policies and/or provincial/federal guidelines • e.g., WHMIS, First Aid, CPR, fire safety, work permit training, grounding and bonding code training, risk management/job planning training

Area of Competence B: Test and Commission Relay Protection and Metering

Task B.1: Wire check protection schemes and metering circuits

Subtasks:	Supporting knowledge and abilities:
a) Read prints	<ul style="list-style-type: none">• Interpret all types of electrical drawings
b) Use multi-meter	<ul style="list-style-type: none">• Ensure proper use and care• Follow manufacturer's procedures for use
c) Use megger	<ul style="list-style-type: none">• Ensure proper use and care• Follow manufacturer's procedures for use
d) Document issues and results	<ul style="list-style-type: none">• Follow company and customer policies, guidelines, and procedures

Task B.2: Test PTs and CTs and associated cabling

Subtasks:	Supporting knowledge and abilities:
a) Verify that PTs and CTs meet specifications	<ul style="list-style-type: none"> • Check manufacturer's drawings against design specifications
b) Conduct/Ensure apparatus testing is completed	<ul style="list-style-type: none"> • e.g., Doble testing, ratio, polarity and saturation • Ensure all testing is complete before apparatus is energized
c) Perform current and potential injections (primary and secondary)	<ul style="list-style-type: none"> • Understand electrical theory. For example, knowledge of ratios and Ohm's Law • Understand how to properly isolate CT and PT circuits
d) Megger and perform DC resistance to prove secondary cables	<ul style="list-style-type: none"> • e.g., from the device to the protection and metering panel
e) Verify grounding	
f) Conduct on-load measuring test once energized	

Task B.3: Operate test equipment

Subtasks:	Supporting knowledge and abilities:
a) Use various voltage and current sources for manual and automated testing	<ul style="list-style-type: none"> • Choose appropriate test equipment for the task • Be aware of the effects of injecting voltages and currents
b) Use portable testing equipment	<ul style="list-style-type: none"> • e.g., multi function meters (DMM), scopes, and recorders • Follow company's/manufacturer's procedures for use and care
c) Document issues and results	<ul style="list-style-type: none"> • Follow company policies, guidelines, procedures and industry standards

Task B.4: Connect test equipment to relays and meters

Subtasks:	Supporting knowledge and abilities:
a) Set up test equipment	<ul style="list-style-type: none"> • Interface with computer if applicable
b) Connect voltage and current leads	<ul style="list-style-type: none"> • Identify gauge of leads required
c) Connect sensing inputs/outputs, analog outputs	<ul style="list-style-type: none"> • Follow test plan/procedure

Task B.5: Interface microprocessor relays and meters to PC

Subtasks:	Supporting knowledge and abilities:
a) Identify communication protocols	<ul style="list-style-type: none"> • e.g., RS 232, Ethernet, RS-485, MODBUS, DNP
b) Use relay specific software	<ul style="list-style-type: none"> • e.g., SEL, ABB, Areva, GE, Nxt Phase
c) Configure computer communication ports	<ul style="list-style-type: none"> • e.g., modem, network protocols
d) Document issues	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures and industry standards

Task B.6: Apply settings to relays and meters

Subtasks:	Supporting knowledge and abilities:
a) Obtain and/or create issued settings from appropriate group (i.e., engineering group)	<ul style="list-style-type: none"> • Be aware of who is responsible for creating relay and meter settings
b) Apply setting using computer method	<ul style="list-style-type: none"> • Utilize relay/meter specific software and understand relay functions • Make modifications to devices to operate as required
c) Apply setting using manual method	<ul style="list-style-type: none"> • Interpret relay/meter manual information to apply settings • Make modifications to devices to operate as required
d) Confirm applied setting with issuing group and that settings are appropriate for application	<ul style="list-style-type: none"> • Recognize function and application of settings • Follow company and customer policies, guidelines, and procedures
e) Return in-service settings to issuing group	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines, and procedures
f) Analyze and document issues	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines, and procedures

Task B.7: Isolate protection schemes and metering circuits

Subtasks:	Supporting knowledge and abilities:
a) Read prints	<ul style="list-style-type: none"> • Interpret all types of electrical drawings
b) Follow manufacturer's and customer's isolation processes	<ul style="list-style-type: none"> • Understand how to properly isolate CT and PT circuits • e.g., ABB test switch, Westinghouse test skid, GE PK block
c) Follow company procedures to isolate protection scheme/metering circuit	<ul style="list-style-type: none"> • Use checklists • Use visual aids • Follow protection plan, if required • Communicate with appropriate authorities, e.g., system operator
d) Identify work area by use of flags, cover-up material and work permit tags	<ul style="list-style-type: none"> • Follow company safety guidelines, policies and procedures
e) Document issues	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures

Task B.8: Test electromechanical relays and meters

Subtasks:	Supporting knowledge and abilities:
a) Determine appropriate test equipment	<ul style="list-style-type: none"> • Utilize knowledge of specific electromechanical relay/meter to determine test equipment required and test method • Types of testing include: voltage, frequency, timing, current, and phase shifting testing, etc. • Read test equipment manuals
b) Calibrate and make fine adjustments	<ul style="list-style-type: none"> • Utilize manual dexterity when working with electromechanical relays/meters • Identify tools required to make adjustments
c) Analyze and document issues and test results	<ul style="list-style-type: none"> • Verify test results against desired standards Initiate corrective action, as required • Follow company and customer policies, guidelines and procedures

Task B.9: Test electronic relays and meters

Subtasks:	Supporting knowledge and abilities:
a) Determine appropriate test equipment	<ul style="list-style-type: none"> • Utilize knowledge of specific electronic relay/meter to determine test equipment required and test method • Types of testing include: voltage, frequency, timing, current, and phase shifting testing, etc. • Read test equipment manuals
b) Calibrate and make fine adjustments	<ul style="list-style-type: none"> • Utilize manual dexterity when working with electronic relays/meters • Identify tools required to make adjustments
c) Analyze and document issues and test results	<ul style="list-style-type: none"> • Verify test results against desired standards Initiate corrective action, as required • Follow company and customer policies, guidelines and procedures

Task B.10: Test microprocessor relays and meters

Subtasks:	Supporting knowledge and abilities:
a) Determine appropriate test equipment	<ul style="list-style-type: none"> • Utilize knowledge of specific microprocessor relay/meter to determine test equipment required and test method • Types of testing include: voltage, frequency, timing, current, and phase shifting testing, etc. • Read test equipment manuals
b) Verify inputs and outputs	<ul style="list-style-type: none"> • Understand the interfaces between different elements within a multi-function relay/meter
c) Retrieve information from relay/meter	<ul style="list-style-type: none"> • For example: fault records, angles, voltages, currents, power flow, status
d) Verify PSL functioning appropriate for setting	<ul style="list-style-type: none"> • Apply logic theory to required relay/meter manufacturer's functionality • Utilize knowledge of electronic and digital theory • Utilize background knowledge of the fact that technology is moving toward IED technology (Intelligent Electronic Device)
e) Analyze and document issues and test results	<ul style="list-style-type: none"> • Verify test results against desired standards • Initiate corrective action, as required • Follow company and customer policies, guidelines and procedures

Task B.11: Function test protection schemes and metering circuits

Subtasks:	Supporting knowledge and abilities:
a) Verify proper operation of all components of protection scheme and/or metering circuits (e.g., local and end-to-end or zone tripping)	<ul style="list-style-type: none"> • Simulate system conditions for the desired output (e.g., trip breaker, alarm contacts, open switches and auxiliary tripping devices, communication scheme) • e.g., metering may be configured in three phase, two wire, three wire, etc. • e.g., over-current, differential system fault conditions • Follow company and customer policies, guidelines and procedures
b) Analyze test results	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures • Confirm correct operation of protection scheme/ metering circuit as per company standard
c) If desired output not obtained, initiate troubleshooting process	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures

Task B.12: Perform protection and metering load readings

Subtasks:	Supporting knowledge and abilities:
a) Measure energized circuits	<ul style="list-style-type: none"> • Use single or three phase power measuring device
b) Adhere to rules and procedures on live equipment	<ul style="list-style-type: none"> • Follow company, manufacturers and related utilities', and customers' policies, guidelines, and procedures
c) Analyze results	<ul style="list-style-type: none"> • Verify results with control center, metering group, etc. • Take appropriate action if device is not performing according to system parameters
d) Document issues and test results	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines, and procedures

Task B.13: Conduct fault analysis

Subtasks:	Supporting knowledge and abilities:
a) Retrieve fault records from various devices	<ul style="list-style-type: none"> • e.g., SERs, DFRs, PSDR, IEDs, Portable recording devices
b) Analyze and document issues	<ul style="list-style-type: none"> • Utilize knowledge of operation of the Bulk Electrical System • Determine proper operation of relay setting and protection scheme for type of fault • Apply electrical power theory
c) Prepare report	<ul style="list-style-type: none"> • Understand and analyze bulk power system

Task B.14: Repair or replace relays and meters

Subtasks:	Supporting knowledge and abilities:
a) Test relay/meter	<ul style="list-style-type: none"> • Utilize specific knowledge of relays/meters • Read manufacturer's instruction leaflets
b) Determine probable cause of failure	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures
c) Correct failure	<ul style="list-style-type: none"> • Recognize when to repair or to replace components respective to each type of relay/meter (electro-mechanical, electronic, and microprocessor) • Follow company and manufacturers' policies, guidelines, and procedures
d) Document issues and test results	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures

Area of Competence C: Test and Commission Controls

Task C.1: Check wiring of control systems

Subtasks:	Supporting knowledge and abilities:
a) Read prints	<ul style="list-style-type: none"> • Interpret all types of electrical drawings
b) Use multi-meter	<ul style="list-style-type: none"> • Ensure proper use and care • Follow manufacturer's procedures for use
c) Use megger	<ul style="list-style-type: none"> • Ensure proper use and care • Follow manufacturer's procedures for use
d) Document issues and results	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines, and procedures

Task C.2: Develop and maintain HMI

Subtasks:	Supporting knowledge and abilities:
a) Develop system requirement	
b) Program device based on system requirements	
c) Verify HMI program	<ul style="list-style-type: none"> • Ensure device operates as designed
d) Ensure security issues are followed for HMI	<ul style="list-style-type: none"> • e.g., locking out the HMI to prevent settings from being changed
e) Troubleshoot issues with HMI	<ul style="list-style-type: none"> • e.g., telemetry issues, control issues

Task C.3: Set-up and maintain auto synchronizers

Subtasks:	Supporting knowledge and abilities:
a) Apply settings to auto synchronizers	<ul style="list-style-type: none"> • Read and interpret manual • Test inputs and outputs
b) Test auto synchronizers	<ul style="list-style-type: none"> • Test governor and exciter response • Test breaker close times • Test voltage regulator response
c) Troubleshoot issues with auto synchronizers	

Task C.4: Maintain SCADA

Subtasks:	Supporting knowledge and abilities:
a) Verify points and telemetry data with SCADA technician	<ul style="list-style-type: none"> • Actuate local devices to verify remote indications
b) Modify SCADA functionality	<ul style="list-style-type: none"> • e.g., program control points, alarm points, telemetry points, status points

Task C.5: Commission and maintain RTUs

Subtasks:	Supporting knowledge and abilities:
a) Test control points	
b) Test alarm points	
c) Test telemetry points	

Task C.6: Repair RTUs

Subtasks:	Supporting knowledge and abilities:
a) Test control points	<ul style="list-style-type: none"> • Utilize specific knowledge of RTUs • Read manufacturer's instruction leaflets
b) Determine probable cause of failure	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures
c) Correct failure	<ul style="list-style-type: none"> • Recognize when to repair or to replace components
d) Document issues and test results	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures

Task C.7: Function test, maintain and troubleshoot generation plant control systems

Subtasks:	Supporting knowledge and abilities:
a) Verify proper operation of all components of control scheme	<ul style="list-style-type: none"> • Simulate system conditions for the desired output (e.g., breaker reclosers, governors, capacitor bank controls, exciters, load shedding schemes, transfer schemes, reduction)
b) If desired output not obtained, initiate troubleshooting process	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures • Use PLC or software to troubleshoot control system problems

Area of Competence D: Test and Commission Communication Systems

Task D.1: Check wiring of communication system

Subtasks:	Supporting knowledge and abilities:
a) Read prints	<ul style="list-style-type: none"> • Interpret all types of electrical drawings
b) Use multi-meter	<ul style="list-style-type: none"> • Ensure proper use and care • Follow manufacturer's procedures for use
c) Use megger	<ul style="list-style-type: none"> • Ensure proper use and care • Follow manufacturer's procedures for use
d) Document issues and results	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines, and procedures

Task D.2: Operate communication test equipment

Subtasks:	Supporting knowledge and abilities:
a) Use various frequency sources	<ul style="list-style-type: none"> • Choose appropriate test equipment for the task • e.g., signal generators
b) Use portable testing equipment	<ul style="list-style-type: none"> • e.g., frequency selective meters, multi-meters, power level meters, optical time-domain reflectometers, optical power meters, noise measuring sets, high speed data circuit analyser • Follow company's/manufacturer's procedures for use and care
c) Document issues and results	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures

Task D.3: Interface PC to communication system

Subtasks:	Supporting knowledge and abilities:
a) Identify communication requirements	<ul style="list-style-type: none"> • Protocols and specific software • e.g., RS 232, RS-485, hyperterminal, network management software
b) Use communication specific software	<ul style="list-style-type: none"> • e.g., HP, Motorola, RFL, network management software, Alcatel, ABB
c) Configure computer communication ports	<ul style="list-style-type: none"> • e.g., modem, network protocols
d) Document issues	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines and procedures

Task D.4: Test data circuits

Subtasks:	Supporting knowledge and abilities:
a) Use communication noise test	<ul style="list-style-type: none"> • e.g., noise measuring test set (Autotims), Bit Error Rate (BER) tests. • Know expected results and standards for various circuits being tested
b) Analyze results and compare to the standards for the specific circuit type	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines, and procedures • Know various circuit specifications to determine what is in specification and what requires adjustments
c) Initiate appropriate action	<ul style="list-style-type: none"> • Know what can be corrected in field and what requires manufacturer repairs
d) Document results and issues	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines, and procedures

Task D.5: Test power line carrier equipment

Subtasks:	Supporting knowledge and abilities:
a) Use various frequency sources	<ul style="list-style-type: none"> • e.g., signal generators, frequency selective level meters, power level meters
b) Use frequency selective meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure frequency selective meters approved and calibrated by instrument services
c) Use multi-meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure multi-meters approved and calibrated by instrument services
d) Use power level meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure power level meters approved and calibrated by instrument services
e) Analyze results and compare to the standards for the specific circuit type	<ul style="list-style-type: none"> • Determine when readings are out of specification and require adjustment
f) Initiate appropriate action	<ul style="list-style-type: none"> • Determine when adjustments can be made to bring system to specification and when components need to be replaced or repaired
g) Document results and issues	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures

Task D.6: Test microwave equipment

Subtasks:	Supporting knowledge and abilities:
a) Use various frequency sources	<ul style="list-style-type: none"> • e.g., signal generators
b) Use frequency selective meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure frequency selective meters approved and calibrated by instrument services
c) Use multi-meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure multi-meters approved and calibrated by instrument services
d) Use power level meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure power level meters approved and calibrated by instrument services
e) Use Bit Error Test Kit	<ul style="list-style-type: none"> • e.g., Firebert 6000
f) Analyze results and compare to the standards for the specific circuit type	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures
g) Initiate appropriate action	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures
h) Document results and issues	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures

Task D.7: Test fibre optic equipment

Subtasks:	Supporting knowledge and abilities:
a) Read prints	
b) Use various frequency sources	<ul style="list-style-type: none"> • e.g., signal generators, power meter/light source
c) Use optical time-domain reflectometer (OTDR)	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure OTDR approved and calibrated by instrument services • Use proper fibre cleaning and connection practices
d) Use multi-meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure multi-meters approved and calibrated by instrument services
e) Use power level meters	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Ensure power level meters approved and calibrated by instrument services
f) Use firebird, fibre level meter, and a light source	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Adhere to safety aspects of fibre optic awareness
g) Use fibre optic test equipment	<ul style="list-style-type: none"> • Follow manufacturer's instructions for use, set-up and troubleshooting • Adhere to safety aspects of fibre optic awareness
h) Use PC and specific software to interact with test equipment	<ul style="list-style-type: none"> • e.g., Sonet, networks, gateways (hardware)
i) Analyze results	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures

j) Interpret results and compare to the standards for the specific circuit type	<ul style="list-style-type: none"> • Use knowledge of specific circuit specifications
k) Initiate appropriate action	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures
l) Document results and issues	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures

Task D.8: Test neutralizing/isolating transformer

Subtasks:	Supporting knowledge and abilities:
a) Read prints	
b) Use specific test equipment	<ul style="list-style-type: none"> • e.g., Gohm
c) Analyze results	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures • Know equipment specifications for different classes of protections to determine if readings are acceptable
d) Interpret results and compare to standards	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures
e) Initiate appropriate action	<ul style="list-style-type: none"> • Know the danger of high voltage hazards associated with NT work
f) Document results and issues	<ul style="list-style-type: none"> • Follow company, manufacturer and customer policies, guidelines and procedures

Task D.9: Test multiplexer systems

Subtasks:	Supporting knowledge and abilities:
a) Test synchronous optical networking (SONET)	<ul style="list-style-type: none"> • Be aware of proper equipment operation • Follow company, manufacturer and customer policies, guidelines and procedures
b) Test inverse multiplexor (IMUX) shelves	<ul style="list-style-type: none"> • Be aware of proper equipment operation • Follow company, manufacturer and customer policies, guidelines and procedures
c) Test JMUX shelves	<ul style="list-style-type: none"> • Be aware of proper equipment operation • Follow company, manufacturer and customer policies, guidelines and procedures

Task D.10: Analyze communication system test results

Subtasks:	Supporting knowledge and abilities:
a) Analyze levels	<ul style="list-style-type: none"> • Use system block diagrams and level specifications
b) Analyze noise levels/transmission impairments	<ul style="list-style-type: none"> • Use circuit specifications to determine is levels are within specifications or if corrective action is required
c) Analyze bit errors	<ul style="list-style-type: none"> • Use circuit specifications to determine if levels are within specifications or if corrective action is required

Task D.11: Repair communication systems

Subtasks:	Supporting knowledge and abilities:
a) Test communication device	<ul style="list-style-type: none"> • Utilize specific knowledge of communication devices
b) Read manufacturer's instruction leaflets	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures
c) Determine probable cause of failure	
d) Correct failure	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures
e) Document issues and test results	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures

Task D.12: Replace communication systems

Subtasks:	Supporting knowledge and abilities:
a) Order approved replacement communication devices	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures
b) Obtain equipment outage	
c) Isolate the communication system	
d) Replace the communication system	
e) Apply settings to communication system	
f) Test communication system	
g) Function test the scheme	
h) Restore the communication system	
i) Analyze test results against company and manufacturer's standards	
j) Document issues and test results	<ul style="list-style-type: none"> • Follow company and manufacturers' policies, guidelines, and procedures

Area of Competence E: Plan

Task E.1: Review and implement scope of work

Subtasks:	Supporting knowledge and abilities:
a) Read prints	<ul style="list-style-type: none"> • Interpret all types of electrical drawings
b) Review maintenance requirement or commissioning scope	
c) Gather required information	<ul style="list-style-type: none"> • e.g., standards, settings, existing procedures
d) Determine overall test requirements	
e) Create procedures	<ul style="list-style-type: none"> • When a new installation
f) Document issues and results	<ul style="list-style-type: none"> • Follow company and customer policies, guidelines, and procedures
g) Attend weekly/monthly meetings with other departments to coordinate work	

Task E.2: Design

Subtasks:	Supporting knowledge and abilities:
a) Create design drawings	<ul style="list-style-type: none"> • Be aware of relay protection and control
b) Create cable schedule from design drawings	
c) Create materials list	<ul style="list-style-type: none"> • e.g., wires, plugs, cables, relays, terminals, fuses
d) Conduct coordination studies	<ul style="list-style-type: none"> • Utilize appropriate software (e.g., PSAF Fault, Cyme TCC (Time Curve Characteristic))

Task E.3: Submit outage request

Subtasks:	Supporting knowledge and abilities:
a) Submit request to controlling authorities well in advance of required date	<ul style="list-style-type: none"> • Document time requirement • Provide background technical information upon requests
b) Provide information about what, when and why equipment is needed	<ul style="list-style-type: none"> • Understand operation of Bulk Electrical System • Follow company maintenance practices
c) Answer questions from controlling authorities as required	
d) Document issues	

Task E.4: Develop job plan

Subtasks:	Supporting knowledge and abilities:
a) Identify the job	<ul style="list-style-type: none"> • Follow company policies, guidelines and procedures
b) Identify who will be doing the job	
c) Provide basic job steps	
d) Identify associated job hazards	
e) Identify methods to eliminate or control the job hazards	
f) Identify resources and other groups in the job	<ul style="list-style-type: none"> • e.g., material, equipment, manpower, other groups • Follow company policies, guidelines and procedures
g) Identify other departments working in area	
h) Identify and discuss the hazards with other departments working in area	<ul style="list-style-type: none"> • Follow company policies, guidelines and procedures

Task E.5: Coordinate testing

Subtasks:	Supporting knowledge and abilities:
a) Coordinate with other departments within the company	<ul style="list-style-type: none"> • Identify what, when, why and how long testing will occur • Follow company policies, guidelines and procedures
b) Coordinate with customers	<ul style="list-style-type: none"> • Identify when, how and why the testing will occur • Follow company policies, guidelines and procedures
c) Interact with manufacturers	<ul style="list-style-type: none"> • To provide information about equipment • Follow company policies, guidelines and procedures
d) Coordinate with controlling authorities	<ul style="list-style-type: none"> • Identify what, when, why and how long testing will occur • Follow company policies, guidelines and procedures
e) Document agreed upon action plans	
f) Ensure all parties are in agreement to proceed with testing	
g) Execute testing	

Area of Competence F: Communicate

Task F.1: Use verbal communication

Subtasks:	Supporting knowledge and abilities:
a) Speak clearly	<ul style="list-style-type: none"> • Use effective interpersonal skills • Understand operational limitations of cell phones, two way radios
b) Speak at audience level	<ul style="list-style-type: none"> • Be aware of whom you are speaking to
c) Organize thoughts	
d) Listen	<ul style="list-style-type: none"> • Listen and respond to audience response
e) Use and understand technical terminology	

Task F.2: Use communication devices

Subtasks:	Supporting knowledge and abilities:
a) Utilize various communication devices	<ul style="list-style-type: none"> • e.g., cell phones, walkie-talkies, VHF radios, e-mail
b) Follow company policies and procedures regarding communication device use	<ul style="list-style-type: none"> • e.g., pull off to the side of the road or use a hands-free set • Be aware of the information being transmitted over the telephone

Task F.3: Communicate with controlling authorities and other departments

Subtasks:	Supporting knowledge and abilities:
a) Be concise	<ul style="list-style-type: none"> • Stay on topic • Know proper terminology
b) Be assertive	<ul style="list-style-type: none"> • Follow through
c) Ask questions to ensure understanding	<ul style="list-style-type: none"> • Utilize good listening and questioning skills
d) Adjust language	<ul style="list-style-type: none"> • Be aware of whom you are speaking to

Task F.4: Use written communication

Subtasks:	Supporting knowledge and abilities:
a) Write clearly	<ul style="list-style-type: none"> • Be concise and to the point
b) Apply basic grammar skills	
c) Write detailed technical reports	<ul style="list-style-type: none"> • Use proper format for report writing • Adhere to company policy and procedures

Task F.5: Transfer technical knowledge to others

Subtasks:	Supporting knowledge and abilities:
a) Instruct junior personnel on the job	<ul style="list-style-type: none"> • Demonstrate effective technical and mentoring skills with peers and trainees

Area of Competence G: Document

Task G.1: Create test plans

Subtasks:	Supporting knowledge and abilities:
a) Acquire prints	
b) Acquire equipment manuals	<ul style="list-style-type: none"> • Search manufacturer's websites for additional information and updated materials
c) Create test, if required	<ul style="list-style-type: none"> • Understand functionality of device under test • Program test parameters in test equipment • Utilize knowledge of software

Task G.2: Prepare maintenance procedures

Subtasks:	Supporting knowledge and abilities:
a) Acquire prints	
b) Acquire equipment manuals	<ul style="list-style-type: none"> • Search manufacturer's websites for additional information and updated materials
c) Conform to government and industry standards	<ul style="list-style-type: none"> • e.g., NERC, IEEE, NPCC
d) Read materials to extract relevant information	<ul style="list-style-type: none"> • e.g., functions of device, device inputs and outputs, available communication protocols, software requirements
e) Write or modify existing procedure for device set-up and re-verification	<ul style="list-style-type: none"> • e.g., monitoring telemetry and status, control

Task G.3: Create/maintain prints

Subtasks:	Supporting knowledge and abilities:
a) Complete field mark ups	<ul style="list-style-type: none"> • Utilize AutoCAD skills
b) Verify that drawing revisions match field wiring	<ul style="list-style-type: none"> • Ensure accuracy of drawings
c) Update drawings or send drawings out to be updated	
d) File drawings in appropriate location	<ul style="list-style-type: none"> • Follow print filing system used within company

Task G.4: Maintain databases

Subtasks:	Supporting knowledge and abilities:
a) Identify types of relays	<ul style="list-style-type: none"> • e.g., serial numbers, make, model, style
b) Identify types of meters	<ul style="list-style-type: none"> • e.g., serial numbers, make, model, style
c) Identify types of communication devices	<ul style="list-style-type: none"> • e.g., NSD570's
d) Identify and update re-verification schedule	<ul style="list-style-type: none"> • Know system requirements for scheduling (e.g., NERC) • Follow company policies and procedures related to scheduling
e) Save relay and meter settings to computer database	<ul style="list-style-type: none"> • Use computer and database skills
f) Save relay and meter test results to computer database	<ul style="list-style-type: none"> • Use computer and database skills • Notify appropriate personnel of test results

Task G.5: Assist with preparation of final commissioning reports

Subtasks:	Supporting knowledge and abilities:
a) Record results and method of control testing	<ul style="list-style-type: none"> • Identify required system checks
b) Record results and method of function testing	<ul style="list-style-type: none"> • Identify required system checks
c) Record results of relay testing	<ul style="list-style-type: none"> • Document results on appropriate form
d) Record results of metering testing	<ul style="list-style-type: none"> • Document results on appropriate form
e) Gather manuals	<ul style="list-style-type: none"> • e.g., equipment manuals, manufacturer's acceptance test results

Task G.6: Prepare and/or present training materials

Subtasks:	Supporting knowledge and abilities:
a) Commission new equipment or installations	<ul style="list-style-type: none"> • Bench test equipment, if possible (e.g., panel meters, relays)
b) Read and comprehend various materials	<ul style="list-style-type: none"> • Utilize equipment manuals, commissioning procedures, manufacturer's website, blueprints
c) Write maintenance and/or training documents	<ul style="list-style-type: none"> • Prepare materials to suit audience
d) Review documents	<ul style="list-style-type: none"> • Revise or obsolete documents when necessary

Task G.7: Write equipment evaluation reports

Subtasks:	Supporting knowledge and abilities:
a) Test equipment	<ul style="list-style-type: none"> • Refer to manufacturer's manuals and software • Utilize company test equipment
b) Measure results	<ul style="list-style-type: none"> • Document test results on a spreadsheet
c) Compare results to manufacturer's specifications	<ul style="list-style-type: none"> • Interpret manufacturer's specs against test results
d) Document findings from tests in report	
e) Make recommendations regarding purchase of equipment	

Task G.8: Write fault analysis reports

Subtasks:	Supporting knowledge and abilities:
a) Obtain relay targets	<ul style="list-style-type: none"> • Know where to obtain relay target information
b) Obtain relay fault record	<ul style="list-style-type: none"> • Know where to obtain relay target information
c) Check SCADA alarms	<ul style="list-style-type: none"> • Know where to obtain SCADA information
d) Obtain SER documentation	<ul style="list-style-type: none"> • e.g., DFR, TFR, PLC, SCADA
e) Compile report based on results in investigation	<ul style="list-style-type: none"> • Utilize knowledge of electrical system

Task G.9: Manage daily paperwork

Subtasks:	Supporting knowledge and abilities:
a) Record information	• e.g., OTO's, logbooks, tailboards, timecards
b) Fill out purchase requisitions	
c) Document maintenance/ commissioning results	• e.g., equipment transfer
d) File results	

Area of Competence H: Demonstrate Personal Competencies

Task H.1: Follow a code of ethics

Subtasks:	Supporting knowledge and abilities:
a) Work safely	<ul style="list-style-type: none"> • Follow corporate safety rules and regulations • Follow occupational health and safety act
b) Conduct self in professional manner	<ul style="list-style-type: none"> • Show respect for job and others
c) Honour corporate privacy rules	

Task H.2: Read, comprehend and apply technical information

Subtasks:	Supporting knowledge and abilities:
a) Utilize knowledge of interfacing between computer and electronic test equipment	<ul style="list-style-type: none"> • Refer to technical training
b) Develop tests for relay calibration	<ul style="list-style-type: none"> • Utilize relay theory
c) Modify PLC programs	<ul style="list-style-type: none"> • Utilize PLC ladder logic
d) Find applicable information in manufacturer's materials	

Task H.3: Be a self starter

Subtasks:	Supporting knowledge and abilities:
a) Look for solutions to assigned tasks	<ul style="list-style-type: none"> • Utilize practical experience
b) Recognize problems and search for solutions	<ul style="list-style-type: none"> • Familiarize self with local equipment
c) Recognize system shortcomings and suggest improvements	

Task H.4: Work independently

Subtasks:	Supporting knowledge and abilities:
a) Choose best methods to complete assigned tasks	<ul style="list-style-type: none"> • Be self-motivated
b) Respond to emergency calls	<ul style="list-style-type: none"> • Identify trouble and if further resources are required
c) Identify and repair faulty equipment	

Task H.5 Be a team player

Subtasks:	Supporting knowledge and abilities:
a) Work with composite crews	
b) Organize meetings	

Task H.6: Make decisions

Subtasks:	Supporting knowledge and abilities:
a) Determine if equipment under test is within required specification	<ul style="list-style-type: none"> • Follow company policy on acceptable accuracy limits
b) Troubleshoot to identify problem	
c) Determine if equipment can be returned to service safely	<ul style="list-style-type: none"> • Recognize the effects of equipment on Bulk Electrical System

Task H.7: Demonstrate leadership

Subtasks:	Supporting knowledge and abilities:
a) Accept challenges	<ul style="list-style-type: none"> • Use problem-solving skills
b) Show initiative	
c) Exhibit confidence	
d) Inspire and motivate	
e) Be accountable	<ul style="list-style-type: none"> • Take responsibility for your actions

Task H.8: Participate in continuous learning

Subtasks:	Supporting knowledge and abilities:
a) Attend courses offered by equipment manufacturers	<ul style="list-style-type: none"> • Exhibit a willingness to learn about new equipment and tasks
b) Choose appropriate courses based on job description	<ul style="list-style-type: none"> • Recognize what courses are required for the present and future
c) Complete in-house training	<ul style="list-style-type: none"> • Recognize what courses are required for the present and future

Task H.9: Demonstrate confidence

Subtasks:	Supporting knowledge and abilities:
a) Move ahead with decisions made	• Acquire correct documentation to support decision
b) Recognize when to step back and consult a peer before continuing	• Rely on past history and work experience
c) Remain calm during an emergency outage	• Demonstrate understanding of complete system
d) Have knowledge of subject matter	
e) Recognize personal limits	• Know when to ask for assistance

Task H.10: Demonstrate organizational skills

Subtasks:	Supporting knowledge and abilities:
a) Multi-task effectively	
b) Accommodate all requests for assistance	• Utilize good communication skills (oral and written)
c) Demonstrate time management skills	• Complete all assigned tasks in a timely fashion

Task H.11: Train and mentor others

Subtasks:	Supporting knowledge and abilities:
a) Train other employees	• Utilize good communication skills (oral and written)
b) Recognize when others are in need of assistance	
c) Demonstrate patience when working with new employees	
d) Develop mentoring skills	

Task H.12: Use computers

Subtasks:	Supporting knowledge and abilities:
a) Use manufacturers' and in-house software	<ul style="list-style-type: none"> • Maintain working knowledge of communication protocols and configurations
b) Use spreadsheets	<ul style="list-style-type: none"> • Understand macros and formulas
c) Use word processing software	
d) Use databases	<ul style="list-style-type: none"> • Utilize knowledge to create and edit databases
e) Use presentation software	
f) Use the Internet	

