

# Apprenticeship and Industry Training

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## Cathodic Protection Technician Competency Profile

21013 (2013)

Alberta 



Apprenticeship and  
Industry Training

ALBERTA ENTERPRISE AND ADVANCED EDUCATION

Cathodic protection technician: competency profile

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## Designated Occupations

A **designated occupation** is an occupation that has been designated under the *Apprenticeship and Industry Training Act* on the recommendation of industry and the Alberta Apprenticeship and Industry Training Board. Designated occupations are described by work skills and competencies.

An Alberta occupational certificate may be granted to an individual who has acquired and demonstrated the standardized competencies for that occupation as established by industry and approved under *the Apprenticeship and Industry Training Act*. Competencies may be acquired through a training program, prior certification demonstrating proof of competencies, or evidenced skills and work experience. Requisites for an occupational certificate are recommended by the occupational committee for that occupation and approved under the authority of the *Apprenticeship and Industry Training Act*.

Acquisition of an occupational certificate is voluntary and an individual is not prohibited by legislation to perform work in a designated occupation.

The holder of an occupational certificate for **Cathodic Protection Technician** will be able to install, commission, monitor, evaluate, maintain, repair and assist in the design of cathodic protection systems. Cathodic protection systems are used by industry to protect metal structures such as bridges and pipelines from the environmental corrosion effects of soil and water; these systems use electricity (impressed current) or specialized metals (galvanic anode) to deliver this protection.

## Apprenticeship and Industry Training System

### Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

### Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The Board's primary responsibility is to establish the standards and requirements for training and certification in programs under the *Apprenticeship and Industry Training Act*. The Board also provides advice to the Minister of Enterprise and Advanced Education on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member Board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

### Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees for the designated trades, and occupational committees for the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All industry committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

### Occupational Committees

The Board may, for each designated occupation, establish or recognize an occupational committee to make recommendations to the Board with respect to matters concerning competency standards and requirements for certification in each designated occupation. Where an occupational committee is established, the Board appoints a presiding officer and an equal number of employer and employee representatives. An occupational committee may have anywhere from three to nine members.

### Occupational committees:

- make recommendations to the Board about:
  - standards and certification in their occupation
  - assessment of competencies for certification in their occupation
  - the designation of trades and occupations
  - regulations and orders under the *Apprenticeship and Industry Training Act*
- determine standards and the requirements for certification and what will be accepted as evidence of competencies, e.g., on-the-job training, work experience, formal instruction or certification programs provided by industry, private or public institutions
- consult with other committees established or recognized by the *Apprenticeship and Industry Training Act* about training and certification and facilitate cooperation between designated trades and occupations as well as new designations
- promote certification and the pursuit of careers in the occupation
- consult with organizations, associations and other stakeholders that have an interest in the occupation and with employers and employees in the occupation
- carry out functions assigned by the Board

### Provisional Committees

Before the designation of a new trade or occupation comes into effect, the Board may establish a provisional committee to review and make recommendations to the Board in respect of the application for that trade or occupation. Where a provisional committee is established, the Board appoints a presiding officer and an equal number of employer and employee representatives. When the designation of the trade or occupation comes into effect, the provisional committee is dissolved and a provincial apprenticeship committee or occupational committee is established.

### Provisional committees established for a proposed designated occupation:

- make recommendations to the Board about:
  - the scope and work of the occupation
  - the requirements for certification
  - the availability of people to serve on an occupational committee
- consult with industry (organizations, associations, employers, employees) on:
  - the scope of the proposed occupation
  - the training and certification needs of employers and workers
  - the proposed standards and requirements for training and certification in the proposed occupation
- consult with relevant provincial apprenticeship committees and occupational committees about potential overlap between applicable trades and occupations and the proposed designated trade or occupation
- communicate with industry at large on any other matters that may be before the provisional committee
- develop, for recommendation to the Board:
  - competency profiles
  - examinations and other tools by which the skills, knowledge and competencies of individuals can be assessed to ensure they meet industry's standards
- provide advice to the Board on:
  - standards and requirements with respect to the competency of individuals in the proposed occupation
  - whether on-the-job training, work experience, formal instruction or certification programs provided by industry, private or public institutions would benefit the proposed occupation

## **Cathodic Protection Technician Provisional Committee Members at the Time of Publication**

Ms. D. Elliot .....	Turner Valley .....	Employer
Mr. C. Gordon .....	Calgary .....	Employer
Mr. S. Larocque.....	Edmonton .....	Employer
Mr. D. Zadery .....	Calgary .....	Employer
Mr. G. Cole .....	St. Albert.....	Employee
Mr. J. Hartley.....	Edmonton .....	Employee
Mr. D. Marr .....	Spruce Grove .....	Employee
Mr. D. Warnke .....	Calgary .....	Employee

### **Alberta Government**

Alberta Enterprise and Advanced Education works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to employees and employers
- certify individuals who meet industry standards

### **Safety**

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance on the work site. These responsibilities are shared and require the joint efforts of government, employers, employees, and the public. It is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

### **Alberta Apprenticeship and Industry Training Board Safety Policy**

The Alberta Apprenticeship and Industry Training Board strongly supports safe learning and working environments and promotes the practice of proper safety procedures both in training and in the workplace.

### **Workplace Responsibilities**

The employer is responsible for:

- training employees in the safe use and operation of equipment
- providing and maintaining safety equipment, protective devices and clothing
- enforcing safe working procedures
- providing safeguards for machinery, equipment and tools
- observing all accident prevention regulations

The employee is responsible for:

- working in accordance with the safety regulations pertaining to the job environment
- working in such a way as not to endanger themselves, fellow employees or apprentices

## **Workplace Health and Safety**

Individuals working in a trade or designated occupation are at risk of being exposed to safety hazards and must therefore understand Occupational Health and Safety legislation when dealing with personal safety and the safety of others at the workplace.

Occupational Health and Safety is a branch of the Alberta government (Alberta Human Services) and promotes workplace health and safety through the Occupational Health and Safety Act by:

- offering explanations on the minimum legislated standards
- providing health and safety advice and information to employers and workers
- ensuring compliance with the minimum legislated standards through partnerships, complaint resolution, investigations of incidents and targeted inspections

### **Procedures for Recommending Revisions to the Competency Profile**

Enterprise and Advanced Education has prepared this competency profile in partnership with the Cathodic Protection Technician Provisional Committee.

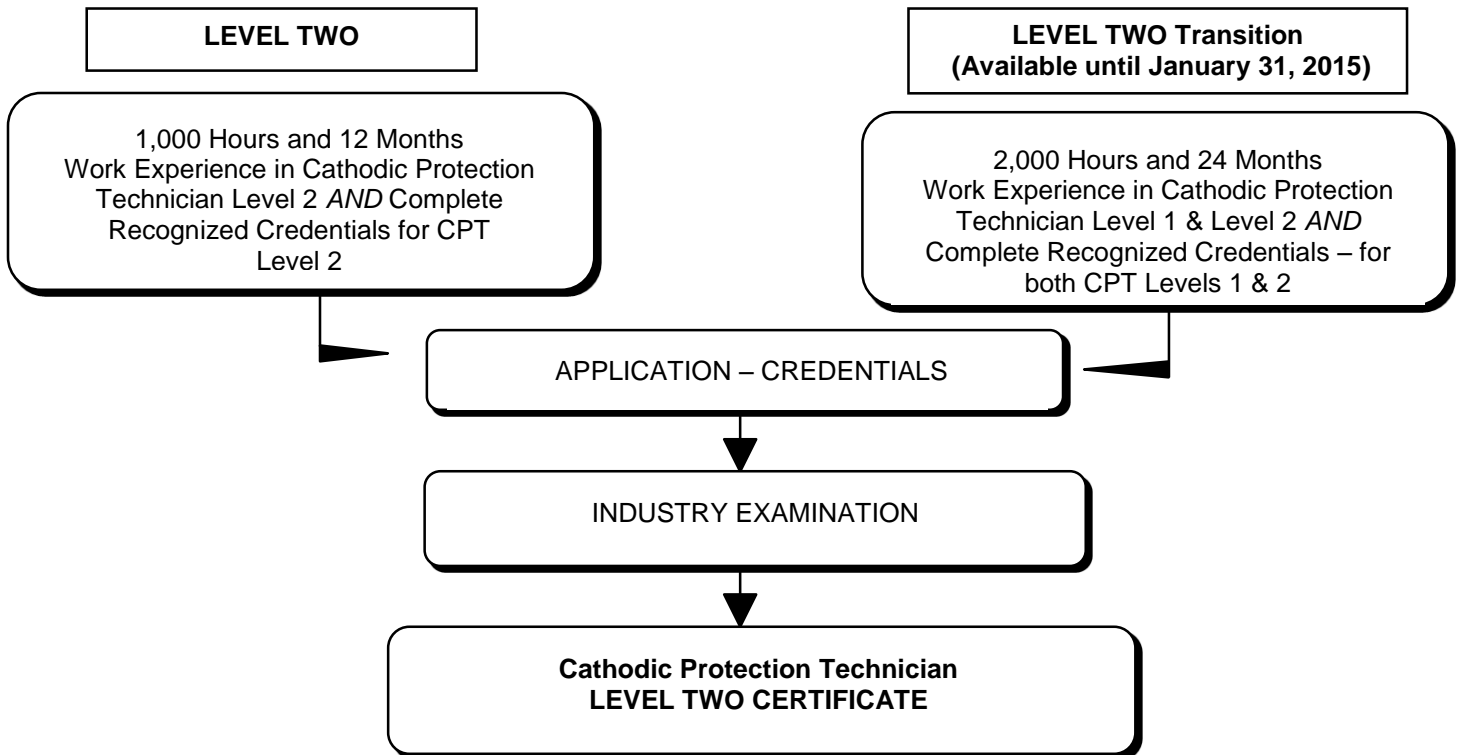
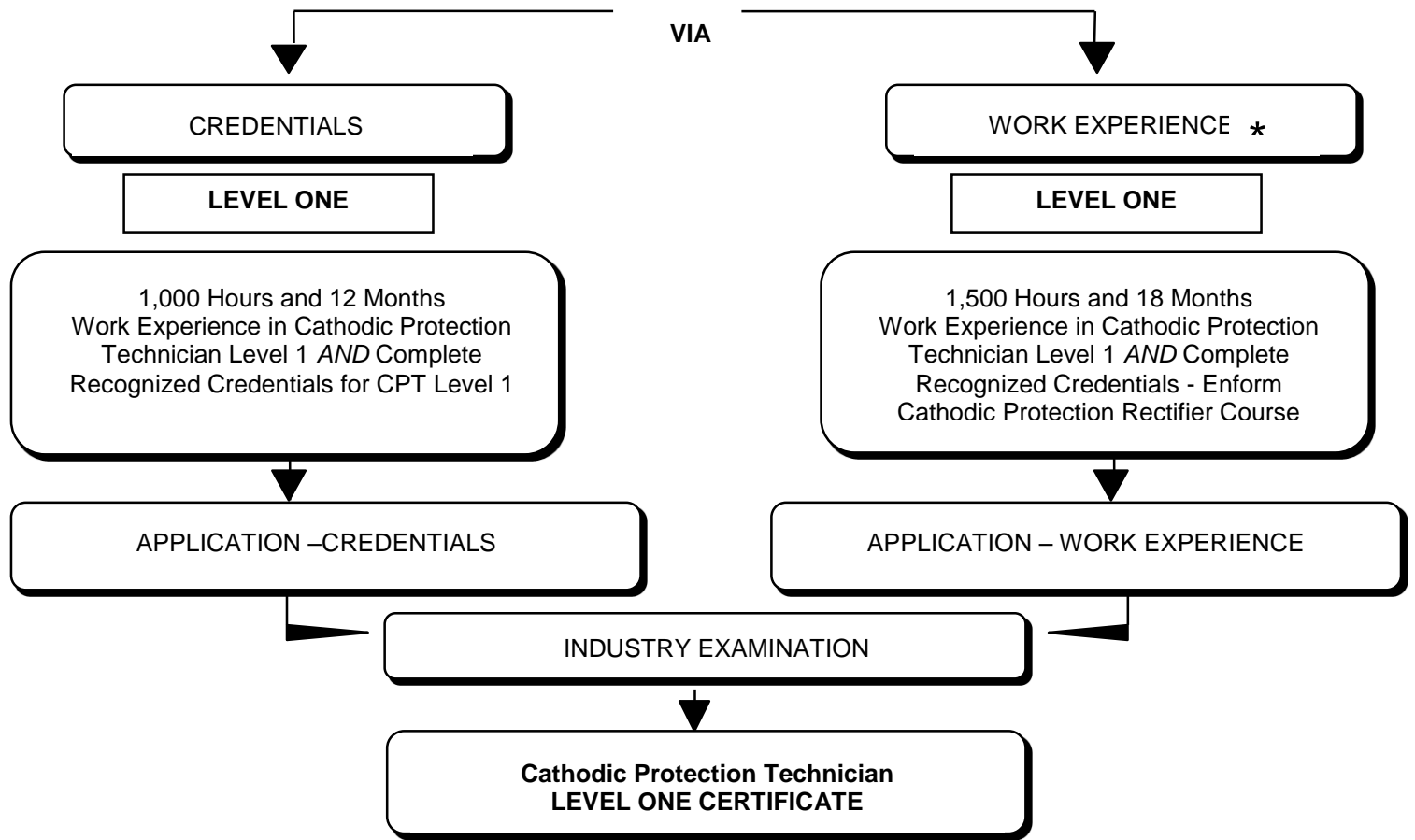
This competency profile was approved on November 2, 2012 by the Alberta Apprenticeship and Industry Training Board on the recommendation of the Cathodic Protection Technician Provisional Committee. The valuable input provided by representatives of industry is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Cathodic Protection Technician Occupational Committee  
c/o Industry Programs and Standards  
Apprenticeship and Industry Training  
Alberta Enterprise and Advanced Education  
10th floor, Commerce Place  
10155 102 Street NW  
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Cathodic Protection Technician Occupational committee.

**CATHODIC PROTECTION TECHNICIAN – ROUTE FOR CERTIFICATION**



\* NOTE: Work Experience route for Level 2 is not available. Industry encourages individuals to complete necessary training courses.



**Cathodic Protection Technician  
Competency Profile  
LEVEL ONE**

**SECTION ONE**

<b>CATHODIC PROTECTION CONCEPTS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	CP Theory and Principles	Galvanic Anode Systems	Impressed Current Systems
	<b>D</b>		
	Factors That Affect CP Performance		

**SECTION TWO**

<b>CATHODIC PROTECTION PLANS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Obtaining Supporting Data	Reviewing Historical Data	Scheduling Project Activities
	<b>D</b>		
	Assessing Project Activities		

**SECTION THREE**

<b>REGULATIONS AND STANDARDS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Occupational Health & Safety (OHS)	Workers' Compensation Board	Trade Regulations
	<b>D</b>	<b>E</b>	<b>F</b>
	Industry Standards	Electrical Code	Employer Standards

**SECTION FOUR**

<b>PREPARING FOR DAILY WORK ASSIGNMENTS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Fitness for Work	Tools and Equipment	Pre-Trip Inspections
	<b>D</b>	<b>E</b>	<b>F</b>
	Test Instruments	Personal Protective Equipment	Hazard Assessment
	<b>G</b>		
	Safe Work Permits		

**SECTION FIVE**

<b>CONDUCTING TESTS AND GATHERING DESIGN DATA</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Site Facilities Above and Below Ground	Structure to Electrolyte Potentials	Electrolyte Resistance
	<b>D</b>	<b>E</b>	<b>F</b>
	DC and AC Current Flows in Structures	Electrical Continuity Test	Stray Current Interference

**SECTION SIX**

<b>INSTALLING CP COMPONENTS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Test Station Installation	Anode System Installation	DC Cable Installation
	<b>D</b>	<b>E</b>	<b>F</b>
	Structure Connections	Ancillary Electrical Devices Installations	DC Power Sources
	<b>G</b>	<b>H</b>	<b>I</b>
	DC Connections to Power Sources	Remote Monitoring Systems	Bonding

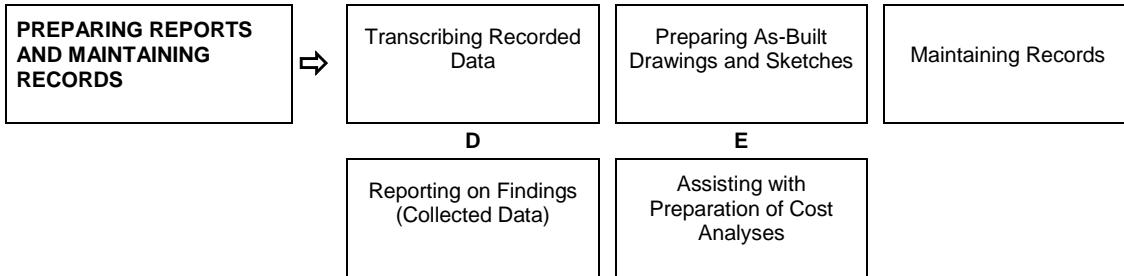
**SECTION SEVEN**

<b>EVALUATING CP SYSTEMS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Physical Condition of CP Systems	DC Power Source	Current Interrupters
	<b>D</b>	<b>E</b>	<b>F</b>
	Structure-to-Electrolyte Potentials	Continuity	Current Flows
	<b>G</b>	<b>H</b>	<b>I</b>
	Stray Current Interference	Testing Data Accuracy	Adjustments
	<b>J</b>	<b>K</b>	<b>L</b>
	Underground Facilities	Close Interval Surveys	Deficiencies

**SECTION EIGHT**

<b>MAINTAINING CP SYSTEMS</b>	<b>A</b>	<b>B</b>	<b>C</b>
	Informing Client and On-Site Personnel of CP Concepts	Assessing Condition of CP Systems and Surroundings	Obtaining/Verifying DC Power System Outputs
	<b>D</b>	<b>E</b>	<b>F</b>
	Basic Troubleshooting of CP Systems	Adjusting DC Power System Outputs	Calibrating DC Meters
	<b>G</b>	<b>H</b>	<b>I</b>
	Repairing Cathodic Wiring	Monitoring Stray AC and DC Current Interference	Repairing DC Power Systems
	<b>J</b>		
	Remote Monitoring Systems		

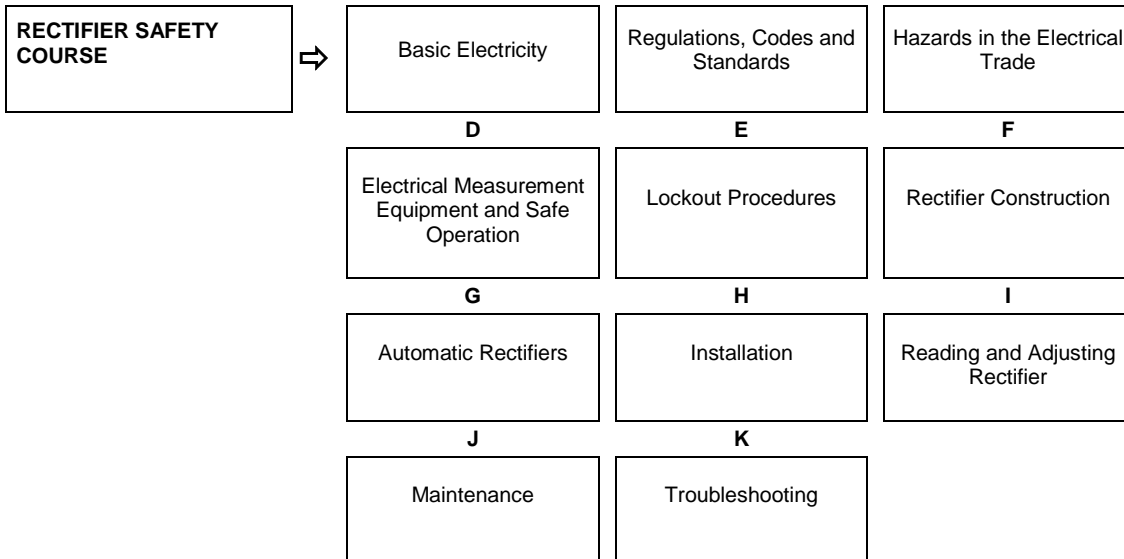
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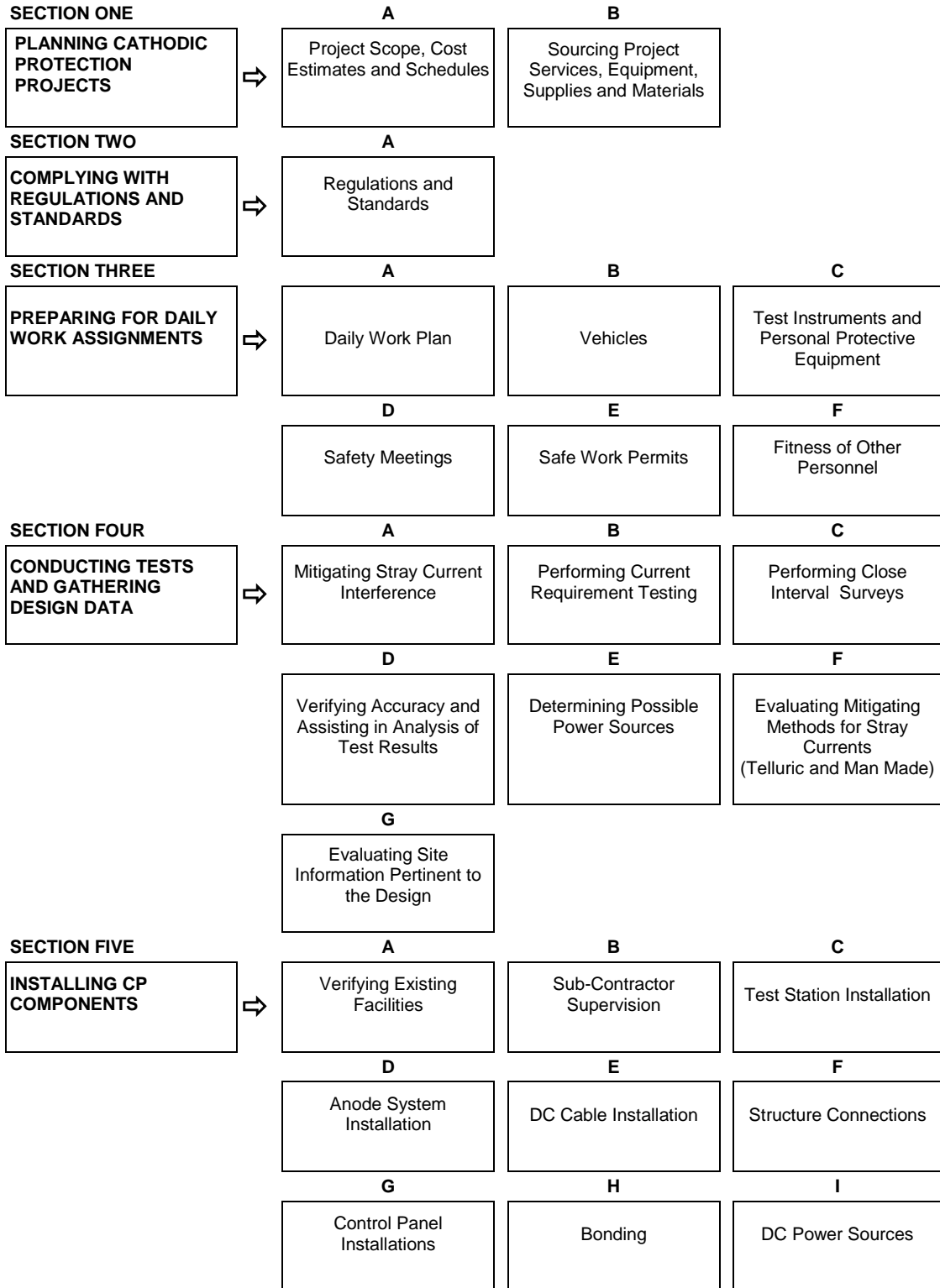
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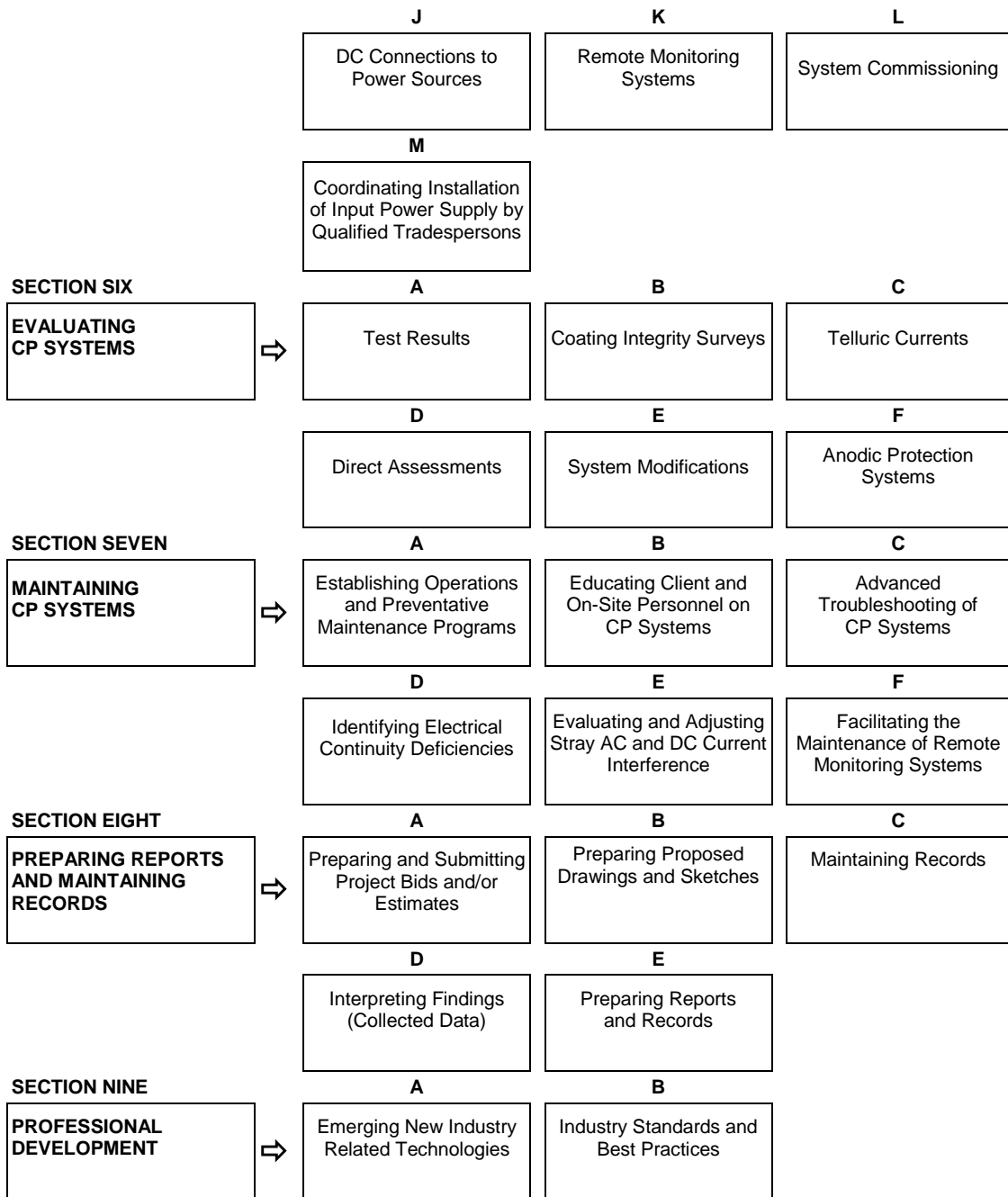


**SECTION ELEVEN**



**Cathodic Protection Technician  
Competency Profile  
LEVEL TWO**





**Cathodic Protection Technician  
Competency Profile  
LEVEL ONE**

A CERTIFIED CATHODIC PROTECTION TECHNICIAN WILL BE ABLE TO DEMONSTRATE THE FOLLOWING COMPETENCIES.

**SECTION ONE:..... CATHODIC PROTECTION CONCEPTS .....**

**A. CP Theory and Principles**

**Competency: Define CP theory and principles.**

1. Explain and interpret the definition of CP.
2. List structures or environments where CP is applicable.

**B. Galvanic Anode Systems**

**Competency: Explain the application of galvanic CP systems.**

1. Describe applications where galvanic anodes would be considered.
2. List the types of anodes used in galvanic CP systems.
3. Describe the advantages and the limitations of galvanic CP systems.
4. List the components of galvanic CP systems.

**C. Impressed Current Systems**

**Competency: Explain the application of impressed current CP systems.**

1. Describe applications where impressed current CP systems would be considered.
2. List the types of anodes used in impressed current systems.
3. List the power sources that could be considered to power impressed current systems.
4. Describe the advantages and limitations of impressed current systems.
5. List the components of impressed current systems.

**D. Factors That Affect CP Performance**

**Competency: Explain CP system performance.**

1. Describe how a structure's surface area and coating affects CP.
2. Explain how the electrolyte's conductivity and make-up affects CP.
3. Explain the relationship between CP and a structure's and electrolyte's temperature.
4. Describe current shielding and its effect on CP.

**SECTION TWO: .....CATHODIC PROTECTION PLANS .....**

**A. Obtaining Supporting Data**

**Competency: *Understand the scope of the project.***

1. Identify project information sources.
2. Review pertinent background information.

**B. Reviewing Historical Data**

**Competency: *Demonstrate an understanding regarding the effect pertinent historical information has on the project.***

1. Determine which historical information sources need to be assessed.
2. Review those historical records.

**C. Scheduling Project Activities**

**Competency: *Assist in identifying and scheduling project activities.***

1. Use the scope of project information and pertinent historical information to establish work activities.
2. Identify personnel requirements and schedule project related activities.
3. Assist others as required to meet objectives.

**D. Assessing Project Activities**

**Competency: *Prepare for project activities.***

1. Detail activities and gather specific equipment required.
2. Arrange for vehicles, accommodations, meals, etc.
3. Determine the project's duration and assess what effect that will have on personnel, equipment and other project logistics.

**SECTION THREE: .....REGULATIONS AND STANDARDS .....**

**A. Occupational Health & Safety (OHS)**

**Competency: *Comply with OHS regulations.***

1. Determine if the work being proposed falls under federal or provincial OHS requirements.
2. Determine which sections of the OHS Act, regulations and code apply to the work being proposed.
3. Understand fully the OHS requirements for the work that is to be performed.

**B. Workers' Compensation Board**

**Competency: *Comply with WCB requirements.***

1. Locate a copy of the current Workers' Compensation Act.
2. Understand fully the WCB requirements for the work proposed.

**C. Trade Regulations**

**Competency:** *Comply with relevant trade regulations.*

1. Comply with the *Alberta Apprenticeship and Training Act* and applicable trade regulations.
2. List trades that may overlap with the proposed CP work.
3. From a trade perspective, understand the boundaries (responsibilities/restrictions) related to the proposed work.

**D. Industry Standards**

**Competency:** *Undertake projects using current industry standards (e.g., CSA, IRPs, CGA, NACE International, etc.)*

1. Review the current standards and recommended practices that are applicable to the work activities being performed.
2. Understand the sections that apply to the work activities.

**E. Electrical Code**

**Competency:** *Comply with CSA's Canadian Electrical Code (CEC).*

1. Locate a copy of the current CSA Canadian Electrical Code.
2. Review the sections of the CEC that apply to the work that is being proposed.

**F. Employer Standards**

**Competency:** *Understand employer policies, practices and specifications and how they may differ from regulations and codes.*

1. Compare task specific employer policies, practices and specifications to relevant regulations, codes and industry practices.
2. Use the most stringent policy, practice or specification for each project task.

**SECTION FOUR: ..... PREPARING FOR DAILY WORK ASSIGNMENTS.....**

**A. Fitness for Work**

**Competency:** *Assess personal fitness for work.*

1. Develop checklists to assess the physical and mental requirements for new tasks proposed and/or when available use existing task checklists.
2. Determine if you are physically and mentally able to perform the tasks proposed.
3. Review what options are available if it is determined that you or others on the team are physically or mentally unable to complete the tasks.



**B. Tools and Equipment**

**Competency:** *Match tools and equipment with needs of assigned work.*

1. List the tools and equipment necessary to perform the tasks.
2. Gather all of the tools and equipment available and advise the supervisor regarding any missing or damaged equipment.
3. Review what options are available for the day if it is determined that tools and/or equipment is lacking.

**C. Pre-trip Inspections**

**Competency:** *Conduct pre-trip inspections.*

1. Conduct pre-trip inspections of tools, procedures, vehicles and other aspects of the project to ensure that all is ready for the day's activities.
2. Verify that when required, off-road vehicle/equipment is suitable for operation in the terrain anticipated.
3. When required, generate documentation on the condition of the vehicles and equipment with a checklist and/or photographs.

**D. Test Instruments**

**Competency:** *Verify operation of test instruments.*

1. Test and calibrate (when applicable) all instruments required for the day's tasks.
2. Check that consumables used in conducting the work are in sufficient supply.
3. Review how to properly operate any specialized test instruments prior to the start of the task.
4. Check that manuals are available for all instruments being used for the task.
5. Ensure that adequate backup of essential test equipment is available and is operating properly.

**E. Personal Protective Equipment**

**Competency:** *Verify condition of and maintain personal protective equipment.*

1. Identify what personal protective equipment (PPE) will be required for the day's tasks.
2. Verify that the condition of the PPE to be used is fit for service and replace/repair where needed.
3. Assess all specialized PPE for its fitness, calibration and certification.

**F. Hazard Assessment**

**Competency:** *Conduct job hazard assessment.*

1. Identify the health and safety hazards.
2. Identify ways to control the hazards.
3. Implement measures to control the hazards, or if the hazards cannot be controlled, decide on next steps.

**G. Safe Work Permits**

**Competency:** *Confirm conditions of safe work permits.*

1. Confirm that the contents of a safe work permit properly cover the work being performed.
2. Check that all required permits are in place and at the work site(s) before work begins.
3. Be prepared to comply with all requirements of the safe work permits.
4. Ensure others comply with the safe work permit conditions.

**SECTION FIVE: ..... CONDUCTING TESTS AND GATHERING DESIGN DATA .....**

**A. Site Facilities Above and Below Ground**

**Competency:** *Identify structures that may comprise a CP system.*

1. Understand through drawings, sketches and photographs the placement of all above grade and below grade structures associated with the facilities that are impacted by the design.
2. Identify the structures that are to be included in the design. Identify the structures that are not a part of the intended CP circuit but could be impacted by the design.
3. Verify accuracy of the drawings, sketches and photographs that depict the structures.

**B. Structure to Electrolyte Potentials**

**Competency:** *Measure structure-to-electrolyte potentials.*

1. Describe typical points where structure-to-electrolyte potentials would be measured when a design for a CP system is being conducted.
2. List factors that could affect the validity of the measured structure-to-electrolyte potentials and detail means to address those factors.
3. Describe how to use structure-to-electrolyte potentials to determine if a structure is electrically continuous or electrically insulated from another structure.
4. Understand fully how to measure native (also known as static) and polarized structure-to-electrolyte potentials as well as how to determine the amount of polarization.
5. Explain how to measure ac structure-to-electrolyte potentials and also detail the response necessary when hazardous ac structure-to-electrolyte potentials are encountered.

**C. Electrolyte Resistance**

**Competency:** *Measure electrolyte resistance.*

1. Describe why knowing how the soil resists the flow of electricity is important in designing CP systems.
2. Describe the relationship between soil resistivity and corrosivity.
3. Describe the common Wenner 4-pin method of determining soil resistivity and how to calculate layer resistivity.
4. Describe the use of a soil box for soil resistance measurement.
5. Compare the four-pin soil resistance testing equipment to the induction type equipment.

**D. DC and AC Current Flows in Structures**

**Competency:** *Measure dc and ac current in a structure.*

1. Explain the benefits of knowing how CP current is distributed in a system and how that knowledge can be used to gauge coating effectiveness.
2. Describe tests available to determine current flow in a CP system.
3. Explain the concerns associated with ac induction on a structure resulting from an overhead electrical power line.
4. Describe ac current attenuation tests as they pertain to pipeline coating quality.

**E. Electrical Continuity Test**

**Competency:** *Determine the status of electrical continuity and electrical insulation.*

1. Describe methods available to test the effectiveness of electrical insulators.
2. Describe methods available to confirm electrical continuity or discontinuity between structures.
3. Explain methods available to establish electrical continuity between structures.
4. Explain methods available to establish electrical isolation between structures.

**F. Stray Current Interference**

**Competency:** *Identify stray current interference sources.*

1. Explain stray current interference.
2. Describe test methodologies available to test for stray current interference.
3. Describe immediate steps to be considered when interference is detected.

**SECTION SIX:..... INSTALLING CP COMPONENTS .....**

**A. Test Station Installation**

**Competency:** *Understand the installation of test stations.*

1. Describe locations/scenarios where test stations are required.
2. Describe the various types of test stations.
3. List structure connection methods and the associated advantages and disadvantages of each method.
4. List steps associated with installing a test station.

**B. Anode System Installation**

**Competency:** *Understand the installation of anode systems.*

1. Describe the importance of ensuring that construction specifications and drawings be followed.
2. Describe the typical backfill material used for impressed current anode beds and the typical backfill material used for sacrificial anode beds.
3. Describe the differences between horizontal shallow, distributed, semi-deep and deep anode systems and the advantages/limitations of each.
4. List the steps associated with installing an anode system.

**C. DC Cable Installation**

**Competency:** *Understand the installation of anode and structure cable installation.*

1. Detail the colour convention used for positive and negative cables in the CP industry.
2. Describe the concerns associated with damaged insulation on a positive cable.
3. Describe jurisdictional responsibilities for installing dc cables below grade and above grade.

**D. Structure Connections**

**Competency:** *Understand the installation of cable to structure connections.*

1. Understand the importance of making a clean metal-to-metal connection to the structure.
2. Describe the typical methods/materials used for making structure connections to below grade piping.
3. Describe the typical methods/materials used for making structure connections to above grade piping.

**E. Ancillary Electrical Devices Installations**

**Competency:** *Understand the installation of ancillary electrical devices (e.g., interference control, ac mitigation, polarization cells, etc.)*

1. Ensure all cables and components within a panel are identifiable and properly labelled.
2. List the typical components within an interference control panel and detail their function.
3. Ensure connections within a panel are sound and protected from loosening with time.
4. Understand that there are different types of control panel enclosure compositions and that certain environments could preclude using a particular material.

**F. DC Power Sources**

**Competency:** *Understand the installation of dc power sources.*

1. List typical dc power sources used for impressed current CP systems.
2. List the typical mounting options for CP rectifiers.
3. List the data that must be known in order to calculate the input power requirements of the dc power source.

**G. DC Connections to Power Sources**

**Competency:** *Understand the installation of dc cables to power sources.*

1. List safety items that need to be checked prior to connecting dc cables to power sources.
2. Detail the importance of ensuring that the anode lead cable(s) is connected to the positive terminal(s) within the dc power source and that the structure cable(s) is connected to the negative terminal(s).
3. Verify correct polarity of dc connections prior to energizing power source.

**H. Remote Monitoring Systems**

**Competency:** *Understand the installation of remote monitoring systems.*

1. Explain some of the advantages and limitations of remote monitoring systems.
2. List typical communication options available for remote monitoring systems and detail their advantages and limitations.

**I. Bonding**

**Competency:** *Understand electrical bonding requirements.*

1. Describe piping configurations where continuity bonding is required to tie all buried pipelines in a system into the CP circuit.
2. Explain why a stray current interference bond is fundamentally different than a continuity bond.
3. Ensure all structure connections (above grade and below grade) associated with electrical bonds are properly made.

**SECTION SEVEN: ..... EVALUATING CP SYSTEMS.....**

**A. Physical Condition of CP Systems**

**Competency:** *Assess the physical condition of the CP system and surroundings on a scheduled basis.*

1. Describe what to visually check for when assessing a CP system's physical condition.
2. Identify changes to the area around the CP system, especially those that could impact the system's effective operation.
3. Identify sounds, smells or heat emanating from the dc power source that could indicate a safety concern and also an improperly operating system.

**B. DC Power Source**

**Competency:** *Verify that the dc power source outputs are properly functioning.*

1. List means of determining acceptable evidence of proper CP system functioning.
2. Understand when discrepancies between dc power source readings and measured readings warrant further action such as meter calibration, repairs or component replacements.
3. Describe what steps, especially first steps, are to be taken when there is evidence that the CP system is not operating properly.

**C. Current Interrupters**

**Competency:** *Understand current interruption.*

1. Understand the technical rationale associated with interrupting DC power source(s).
2. List the advantages and disadvantages of having permanently installed current interrupters.
3. Describe safety concerns associated with installing a portable current interrupter into an electrical circuit of a CP rectifier.
4. Detail safety concerns associated with connecting a portable current interrupter to other dc power sources (thermo-electric generators, solar-powered CP systems, electrical bonds to foreign CP systems, sacrificial anode systems, etc.).
5. Describe means that are available to verify synchronous current interruption.

**D. Structure-to-Electrolyte Potentials**

**Competency:** *Use structure-to-electrolyte potentials to assist in evaluating the CP system's effectiveness.*

1. Describe typical points where structure-to-electrolyte potentials would be measured when a CP system is being evaluated during an annual survey.
2. List factors that could affect the validity of the measured structure-to-electrolyte potentials and detail means to address those factors.
3. Describe how to use structure-to-electrolyte potentials to determine if a structure is electrically continuous (or, conversely, electrically insulated) from another structure.
4. Understand fully how to measure native (also known as static) and polarized structure-to-electrolyte potentials as well as how to determine the amount of polarization.
5. Explain how to measure ac structure-to-electrolyte potentials and also detail the response necessary when hazardous ac structure-to-electrolyte potentials are encountered.

**E. Continuity**

**Competency:** *Determine the status of electrical continuity and electrical insulation.*

1. Describe methods available to test the effectiveness of electrical insulators.
2. Describe methods available to confirm electrical continuity between structures.
3. Explain methods available to establish electrical continuity between structures.
4. Explain methods available to establish electrical isolation between structures.

**F. Current Flows**

**Competency:** *Measure dc and ac current in a structure.*

1. Explain the benefits of knowing how CP current is distributed in a system and how that knowledge can be used to gauge coating effectiveness.
2. Describe tests available to determine current flow in a CP system.
3. Explain the concerns associated with ac induction on a structure resulting from an overhead electrical power line.
4. Describe ac current attenuation tests as they pertain to pipeline coating quality.

**G. Stray Current Interference**

**Competency:** *Test existing stray current interference mitigation devices and evaluate any new possible interference sites.*

1. Explain stray current interference.
2. Describe test methodologies available to test for interference.
3. Describe immediate steps to be considered when interference is detected.

**H. Testing Data Accuracy**

**Competency:** *Verify the accuracy of test data.*

1. List the steps to take to check the recorded data's accuracy.
2. List the steps to take to check the accuracy of dc current source outputs.

**I. Adjustments**

**Competency:** *Adjust dc power supply outputs.*

1. List the steps required to safely adjust the output of a rectifier.
2. List the steps required to safely adjust the output of a resistance controlled bond panel.
3. List the steps to adjust the output of a thermo-electric generator (optional).

**J. Underground Facilities**

**Competency:** *Establish location of underground facilities.*

1. Take appropriate measures to ensure the CP system evaluation tests are being made on the correct structure.
2. Describe typical procedures that need to be followed to ensure CP evaluation test data is being obtained on the appropriate point on the structure.

**K. Close Interval Surveys**

**Competency:** *Perform close interval surveys.*

1. List common types of CP related close interval surveys.
2. List the common equipment required in order to perform a close interval potential survey.
3. List the steps to perform a close interval soil resistivity survey.
4. Describe the factors that can affect the accuracy of a close interval potential survey.
5. Describe the factors that can affect the accuracy of a close interval soil resistivity survey.

**L. Deficiencies**

**Competency:** *Identify and address deficiencies.*

1. Describe the most common criteria used to evaluate CP system effectiveness.
2. Explain what steps to take if established criteria is not met.
3. List common approaches that need to be considered in order to correct areas that are sub-CP criteria.

## SECTION EIGHT:..... MAINTAINING CP SYSTEMS .....

**A. Informing Client and On-Site Personnel of CP Concepts**

**Competency:** *Demonstrate an appropriate level of knowledge and the ability to communicate that knowledge to a diverse audience with various levels of expertise/familiarity, e.g., field operator, secretary, CP technician, engineer, electrician, etc.*

1. Understand and communicate what CP components comprise the system.
2. Understand and communicate how the system will operate.
3. Understand and communicate how the system is maintained.
4. Assess client understanding and address client concerns and needs.

**B. Assessing Condition of CP Systems and Surroundings**

**Competency:** *Understand the current status of the system, the surrounding facilities, and any changes which may have occurred since the last maintenance inspection.*

1. Describe what to visually check when assessing a CP system's physical condition.
2. Look for changes to the area around the CP system, especially those that could impact the system's effective operation.
3. Understand that certain sounds, smells or heat emanating from the DC power source could denote safety concerns and be a first clue to improperly operating CP systems.

**C. Obtaining/Verifying DC Power System Outputs**

**Competency:** *Confirm that all dc power system outputs are within specified targets.*

1. List means of determining acceptable evidence of proper CP system functioning.
2. Understand when discrepancies between dc power source readings and measured readings warrant further action such as meter calibration, repairs or component replacements.
3. Understand what steps are to be taken, especially first steps, when there is evidence that the CP system is not operating properly.

**D. Basic Troubleshooting of CP Systems**

**Competency:** *Identify which part (or parts) of the CP system is not functioning correctly.*

1. Follow a logical test sequence to isolate which aspect(s) of the entire CP system is not functioning properly. The investigation will cover the following subsystems:
  - a) external power supply
  - b) CP current source
  - c) anode circuit (including sacrificial anodes if used)
  - d) cathode circuit (including protected structures)
2. Document the identified problem(s) along with what corrective actions were, or need to be, taken.



**E. Adjusting DC Power System Outputs**

**Competency:** *Ensure outputs of the CP system are correct.*

1. Follow a logical sequence to adjust the dc power source output when the need is indicated. A general logical sequence is to:
  - a) adjust output per work procedure
  - b) measure output
  - c) establish whether the new output is acceptable
  - d) readjust as warranted
  - e) record 'as-found' and 'as-left' readings

**F. Calibrating DC Meters**

**Competency:** *Ensure that the permanent on-site meters provide the correct measurement.*

1. Activate the permanent meter(s) and observe outputs.
2. Measure the same outputs with an independent, calibrated meter.
3. Compare results.
4. Adjust the permanent meter to be within its specifications.
5. Update calibration records for the permanent meter(s).

**G. Repairing Cathodic Wiring**

**Competency:** *Repair all identified wiring deficiencies.*

1. De-energize and lockout/tag the power supply per procedure (for impressed current systems).
2. Perform the repair.
3. Verify that the repairs are effective.
4. Remove lockout/tag and re-energize the power supply per procedure (for impressed current systems).
5. Document repairs completed.

**H. Monitoring Stray AC and DC Current Interference**

**Competency:** *Ensure that stray ac and dc current interference mitigation systems are operating properly.*

1. Plan test(s) for the specific situation (i.e., know equipment and system layout and mitigation scheme involved).
2. Observe, validate, and record the measurements.
3. Make adjustments, perform repairs, or replace as needed.
4. Document 'as-found' and 'as-left' readings as well as all changes made or repairs performed.

**I. Repairing DC Power Systems**

**Competency:** *Repair all identified deficiencies on or in the dc power system.*

1. De-energize and lockout/tag the DC power supply per procedure (for impressed current systems).
2. Perform the repair(s) and verify that the repairs are effective (pre-energization checks).
3. When effective repairs have been completed, remove lockout/tag and re-energize the power supply per procedure (for impressed current systems) and verify that the repairs are effective (energized checks).
4. Document repairs performed.

**J. Remote Monitoring Systems**

**Competency:** *Apply knowledge of remote monitoring systems in performing various tasks associated with maintaining CP systems.*

1. Establish how to access interface (onboard, via software, third party support, etc.)
2. Obtain measurements and status information from the rectifier via the remote monitoring system.
3. Obtain and interpret exception reports, alarms, canned and custom reports from the remote monitoring systems.
4. Activate control functions (e.g., automatic and/or coordinated current interrupter functions, adjusting output currents, etc.) through the remote monitoring interface in order to perform various tasks.
5. Validate sample measurements and status information from the rectifier to the database.
6. Document any corrective actions performed on the remote monitoring system (if applicable).

**SECTION NINE: .....PREPARING REPORTS AND MAINTAINING RECORDS .....**

**A. Transcribing Recorded Data**

**Competency:** *Collect essential information accurately as per industry standards.*

1. Follow project or company specific rules and procedures for compiling, organizing, and storing information.
2. Following project or company specific procedures, perform quality assurance and quality control (QA/QC) checks on the information, while analyzing the data, in order to prepare informal and formal report

**B. Preparing As-Built Drawings and Sketches**

**Competency:** *As-built drawings are accurate and available to all parties. Adequate field sketches are prepared and photos taken for specific situations as needed. Field sketches and photographic information are to be clear, understandable, and well documented.*

1. Prepare as-built drawings.
  - a) For existing installations:
    - i) Collect and review existing drawings.
    - ii) When executing tasks, validate existing drawings, perform field mark-ups of existing systems to incorporate any changes or correct any errors. All changes are to be traceable (date and contact information required).
  - b) For new installations:
    - i) Obtain issued for construction drawings or use available site layout drawings to prepare as-built mark-ups. If no drawings exist, prepare complete field drawings. All as-built markups and field drawings are to be traceable (date and contact information provided).
  - c) Submit mark-ups or field drawings to others for back draft.
  - d) Support back drafting and QA/QC activities as needed.
2. Prepare sketches depending upon the situation and need and submit as required.
3. Take pictures depending upon the situation and need and submit as required.

**C. Maintaining Records**

**Competency:** *Maintain collected essential information in compliance with established procedures.*

1. Follow project or company specific rules and procedures for storing information so that information can be found quickly and is protected from corruption.
2. Where trended information needs to be augmented with current information, add the new information.

**D. Reporting on Findings (Collected Data)**

**Competency:** *Inform stakeholders on findings based on the collected data.*

1. Assist in the preparation of various job related reports such as:
  - a) safety reporting (pre-job meetings, vehicle inspection, on-the-job safety planning/response, post mortems, safety issue follow up, incident reporting, hazards ID's etc.)
  - b) progress reporting (may use written, email, telephone media; could be on a daily, weekly, or monthly basis)
  - c) immediate reporting of critical field findings
  - d) scheduled/regular reports on routine field findings
  - e) hours, mileage, consumables, and expense reporting
  - f) reporting associated with third party services and contractors
2. Assist in preparing and presenting informal and formal technical reports to stakeholders.

**E. Assisting with Preparation of Cost Analyses**

**Competency:** *Understand the aspect of working within schedule and budget constraints.*

1. Assist with or perform cost analyses such as:
  - a) cost tracking and coding per company or client system
  - b) manage daily or special work activities using work scope and project/supervisory approval criteria
  - c) review historical and current project costs in order to prepare quotes, budgets, trends and justifications
  - d) evaluate schedule, resource, and logistical needs and options
  - e) obtain informal (small) quotes for goods and services
  - f) prepare work scopes and bills of material for jobs
  - g) provide input into evaluating cost alternatives in order to support the decision making process
  - h) prepare summaries, cost reports, cost estimates, and schedules as needed for final reports, quotes, etc.

**SECTION TEN: .....PROFESSIONAL DEVELOPMENT .....****A. New and Emerging Industry Related Technologies**

**Competency:** *Be aware of new and emerging industry related technologies.*

1. Participate in the following learning opportunities:
  - a) in-house training (lunch-and-learns, seminars)
  - b) informal learning on-the-job (including mentoring)
  - c) internet based learning resources
  - d) formal industry conferences, workshops and seminars
  - e) presentations on interesting technologies
  - f) formal certification training courses
  - g) product or tool related training from vendors and suppliers (test instruments, office software, etc.)
  - h) peer network(s)
2. Advance new technologies and approaches by:
  - a) being an active and life-long learner
  - b) taking the initiative to try new tools and technologies within the context of assigned work activities and employee development plans (e.g., a guided process by mentors or supervisors)
  - c) assisting in evaluating the new tools and technologies success
  - d) communicating the experiences gained to others (become a champion of the new approaches and tools).

**B. Industry Standards and Best Practices**

**Competency:** *Be aware of past, present, and emerging regulations, standards and best practices.*

1. Participate in learning opportunities such as:
  - a) in-house training (lunch-and-learns, seminars)
  - b) informal learning on-the-job (including mentoring)
  - c) internet based learning resources
  - d) formal industry conferences, workshops and seminars
  - e) presentations on regulations, standards, and best practices
  - f) formal certification training courses
  - g) peer networks(s).

**SECTION ELEVEN:..... RECTIFIER TRAINING COURSE.....****A. Basic Electricity**

**Competency:** *Understand the electrical characteristics of ac and dc circuits and major components as used in cathodic protection systems.*

1. Describe an electric current.
2. Describe voltage.
3. Describe resistance.
4. State and apply Ohm's Law.
5. Compare the three circuit properties, resistance, inductance and capacitance with respect to their current limiting effects.
6. Explain the effects of ac on the resistance of a circuit.
7. Use the Pythagorean Theorem to solve right triangles.
8. Use trigonometric functions to solve right triangles.
9. Solve problems involving the addition of phasors.

**B. Regulations, Codes and Standards**

**Competency:** *Understand why and how the Canadian Electrical Code Part I, and the Alberta Electrical STANDATA are used to provide minimum standards for electrical installations in the province as well as work allowed to be completed by a Cathodic Protection worker under the existing authorization.*

1. Explain the purpose of the Canadian Electrical Code, Part I.
2. Describe the procedures for the acceptance of the Canadian Electrical Code by the provinces and the local authorities.
3. Describe the function of the electrical STANDATA.
4. Describe the organizational layout of the CEC.

5. Locate specific information in the CEC using a variety of methods.
6. Identify those responsible for an electrical installation.

**C. Hazards in the Electrical Trade**

**Competency:** *Demonstrate knowledge of safe work practices, safety procedures and responsibility for safety in the workplace by recognizing possible hazards related to the cathodic protection industry.*

1. Describe the workplace safety programs in Alberta and safety procedures relating to the electrician trade.
2. Identify and describe the safe use of common hand tools and equipment related to the electrician trade.
3. Identify and describe the safe use of common power and specialty tools related to the electrician trade.
4. Identify and describe lockout procedures.

**D. Electrical Measurement Equipment and Safe Operation**

**Competency:** *Identify and understand the safe use and care of measurement tools related to the trade.*

1. State the applications of various meters.
2. List the precautions that must be observed when using meters.
3. Interpret the readings of analog meters.
4. Interpret the readings of digital meters.
5. Recognize the connections for various meters.

**E. Lockout Procedures**

**Competency:** *Demonstrate knowledge of safe work practices with regards to lockout procedures and safely establish de-energized status.*

1. Identify and describe lockout procedures.

**F. Rectifier Construction**

**Competency:** *Identify and analyze the basic components of a rectifier. Describe rectifier operating characteristics, interpret rectifier nameplate information and recognize the types of rectifiers that are available.*

1. Describe the principles of operation and applications of a cathodic protection system.
2. Explain the operation of a rectifier circuit in a cathodic protection system.

**G. Automatic Rectifiers**

**Competency:** *Identify and analyze the basic components of an automatic rectifier.*

1. Describe automatic rectifier operating characteristics.

**H. Installation**

**Competency:** *Identify and analyze basic scope of responsibility and limitations of the cathodic protection worker with respect to installations of rectifier panels. Certified electricians must perform installation.*

1. Describe the installation of a cathodic protection system.

**I. Reading and Adjusting the Rectifier**

**Competency:** *Demonstrate knowledge of reading rectifiers, documenting such readings and safely adjusting to the rectifiers' output.*

**J. Maintenance**

**Competency:** *Demonstrate knowledge of safe maintenance practices, safety procedures and responsibility for safety in the workplace.*

**K. Troubleshooting**

**Competency:** *Demonstrate knowledge of safe troubleshooting practices, safety procedures and responsibility for safety in the workplace.*

1. Troubleshoot a cathodic protection system.

**Cathodic Protection Technician  
Competency Profile  
LEVEL TWO**

A CERTIFIED CATHODIC PROTECTION TECHNICIAN WILL BE ABLE TO DEMONSTRATE THE FOLLOWING COMPETENCIES.

**SECTION ONE:..... PLANNING CATHODIC PROTECTION PROJECTS .....**

**A. Project Scope, Cost Estimates and Schedules**

**Competency: Effectively prepare for projects.**

1. Describe project management.
2. Explain the following elements within a project management plan:
  - a) project scope
  - b) budget
  - c) schedule.
3. List items to track when tracking project expenses.
4. Explain rate schedules and usage in regards to project management.

**B. Source Project Services, Equipment, Supplies and Materials**

**Competency: Complete projects according to scope and budget.**

1. Identify the technical skill sets required to complete the project and source personnel accordingly.
2. Identify and gather the equipment and job-specific instruments required to complete the tasks.
3. Arrange for supplies, vehicles, accommodations, etc. as required to schedule the work.
4. Order work related materials in a timely manner so as to not jeopardize the schedule.

**SECTION TWO:..... COMPLYING WITH REGULATIONS AND STANDARDS.....**

**A. Regulations and Standards**

**Competency: Identify and understand the regulations and codes applicable to the project.**

1. Describe the process used to determine which regulations, codes or standards are applicable to a specific project.
2. Verify that the intended personnel, methods, equipment and materials for the project comply with the applicable regulations/standards.



## SECTION THREE: ..... PREPARING FOR DAILY WORK ASSIGNMENTS.....

**A. Daily Work Plan****Competency: *Be responsible for daily work plan.***

1. Develop a clear understanding of what needs to be accomplished over a period of time.
2. Develop a list of tasks for crew members.
3. Describe options available to obtain labour to match the task skills.
4. Manage daily costs.

**B. Vehicles****Competency: *Assess maintenance and repairs to vehicle and off-road equipment.***

1. Ensure vehicles are fit for service.
2. Regularly inspect accessory equipment such as fire extinguisher, First Aid kits, roadside flares, tow ropes and other task specific accessories.
3. Ensure that ATVs, snowmobiles, boats and other task specific off-road equipment are inspected and are fit for service and that proper documentation is prepared.
4. When required, co-ordinate third party repairs and maintenance.

**C. Test Instruments and Personal Protective Equipment****Competency: *Facilitate repairs and ensure calibration of CP test instruments and personal protective equipment.***

1. Ensure that CP test equipment calibrations are current.
2. Regularly inspect CP test equipment for damage/wear.
3. Facilitate CP test equipment repairs and replacement when warranted.
4. Co-ordinate procurement of standard and task specific PPE equipment.
5. Ensure that PPE equipment is properly calibrated and is fit for service.
6. Facilitate PPE equipment repairs and replacement when warranted.

**D. Safety Meetings****Competency: *Be responsible for the daily safety meeting.***

1. Ensure that daily and tailgate safety meetings are held as required.
2. Review the task specific hazards and mitigate as required to minimize risk.
3. Ensure that an appropriate emergency response plan is prepared and that personnel understand the plan.

**E. Safe Work Permits**

**Competency:** *Be responsible for obtaining all required safe work permits.*

1. Explain the reasoning behind a safe work permit.
2. Describe specialized CP instruments and procedures that are commonly included in safe work permits.
3. Understand fully the contents of a safe work permit before signing.
4. Notify each crew member regarding the scope of the safe work permit, emphasizing work and/or equipment restrictions.

**F. Fitness of Other Personnel**

**Competency:** *Assess personal fitness of other personnel.*

1. Understand that OH&S reasonable care and safety requirements pertain to all workers on a job.
2. Ensure tasks do not exceed the skill or fitness levels of the crew members.
3. Understand that not all symptoms related to alcohol and/or drug abuse are easily identifiable.

**SECTION FOUR: ..... CONDUCTING TESTS AND GATHERING DESIGN DATA .....**

**A. Mitigating Stray Current Interference**

**Competency:** *Resolve stray current interference conditions.*

1. Identify possible sources of stray current.
2. Describe the two main types of stray current interference.
3. List stray current interference indicators.
4. Conduct appropriate tests to determine if a stray current interference condition is indicated.
5. Resolve all detected stray current interference situations to the satisfaction of all involved structure owners.
6. Describe the role that electrolysis coordinating committees play in resolving stray current interference issues.

**B. Performing Current Requirement Testing**

**Competency:** *Identify CP requirements of the facilities in question.*

1. List items that could either render the CP current requirement test results invalid or negate an attempt to conduct current requirement tests.
2. Provide sufficient direct current to the to-be-protected structure so that either the selected criterion for CP is attained at all points on the structure or in sufficient quantities so that the current required can be calculated with reasonable accuracy from the results.

**C. Performing Close Interval Surveys**

**Competency:** *Collect data that assists the CP system design.*

1. List the typical close interval surveys (CIS) to be considered when performing a design survey.
2. Ensure that land owners have granted land access to any right-of-ways that would have to be accessed during the CIS(s).
3. Identify the CIS procedure to be followed, including equipment specifications and methodology.
4. Conduct the CIS(s).

**D. Verifying Accuracy and Assisting in Analysis of Test Results**

**Competency:** *Provide accurate and representative test results and assist in the analysis of the test results.*

1. Verify that all design survey procedures have been followed.
2. Verify that all equipment is properly calibrated.
3. Describe common techniques available to test that the data obtained is accurate.
4. Assist in the engineering analysis of the data.

**E. Determining Possible Power Sources**

**Competency:** *Select electrical power sources for the CP system.*

1. List the types of power sources that could be considered.
2. Assist in economic, safety and technical analyses of the various power source options for the CP system.

**F. Evaluating Mitigating Methods for Stray Currents (Telluric and Man Made)**

**Competency:** *Control the effects of stray currents on the structures.*

1. Identify the type of stray current interference that requires mitigating: telluric current or man-made.
2. List common available methods that could be employed to prevent stray current interference.
3. List common available methods that are used when stray current interference situations cannot be prevented.
4. Identify the best method to either prevent or control any stray current interference situations identified during design surveys.

**G. Evaluating Site Information Pertinent to the Design**

**Competency:** *Provide the best design with no effects on other structures, or when there are to be effects, they are controlled.*

1. Obtain pertinent site plans, route maps, piping and instrument diagrams/drawings, etc. in order to assist in placing all CP components appropriately.
2. Using all available drawings, test data and other gathered information evaluate possible locations for the system components, including but not necessarily limited to: power source(s), anode bed(s), cable routes, test stations and structure connections.

## SECTION FIVE: ..... INSTALLING CP COMPONENTS .....

**A. Verifying Existing Facilities****Competency: Verify locations of pre-existing and designed facilities.**

1. List available sources of information to be consulted to determine the location of facilities before going to the site.
2. List direct and indirect methods available to verify the location of on-site buried structures.
3. Describe ground disturbance procedures to be followed when working near or over buried facilities.

**B. Sub-Contractor Supervision****Competency: Supervise sub-contractors (e.g., mechanical, hydrovac).**

1. Ensure sub-contractors are available to perform the work in accordance with both the cost and time schedule.
2. Understand what documentation is required from sub-contractors before they can be employed.
3. List what service and/or product documentation is to be provided to the sub-contractor.
4. Understand the level of supervision required and ensure that an appropriate schedule for monitoring activities is adhered to.

**C. Test Station Installation****Competency: Install test stations.**

1. Identify locations for installing CP test stations.
2. Discuss different pipeline connection methods and types of test stations.
3. Develop a list of required materials including coating repair materials.
4. Identify required 'ground-disturbance' preparation work.
5. Describe the required equipment and procedures for 'day-lighting' and mechanical excavating.
6. List steps to confirm effective operation of the test station prior to backfilling.
7. List steps to confirm all ground disturbance/crossing agreement requirements have been satisfied.
8. Describe the documentation required to be collected prior to leaving the site.

**D. Anode System Installation****Competency: Install anode systems.**

1. Develop a list of required materials.
2. Develop a list of required tools, equipment and sub-contractors.
3. Identify required 'ground-disturbance' preparation work and safety considerations.
4. Follow the proper installation procedure.

5. List steps to confirm that the anode bed has been installed properly.
6. List typical information to be recorded on 'as-built' drawing.

#### **E. DC Cable Installation**

**Competency:** *Install positive and negative cables.*

1. Discuss key factors related to selecting the route of system cabling.
2. Ensure that installed CP cables meet all local and national codes.
3. List materials and equipment required to install above ground and buried cable runs.
4. Describe all work boundaries pertaining to installing AC and DC cables.
5. Detail the key difference between splicing CP negative cables versus CP positive cables.

#### **F. Structure Connections**

**Competency:** *Install structure connections (e.g., mechanical, thermite, high-energy).*

1. Describe considerations to be made when determining the most suitable connection method for a particular structure, including structures in hazardous and non-hazardous areas.
2. Detail the possible advantages/disadvantages of mechanical and thermite/high-energy connections.
3. Describe how to make acceptable mechanical and thermite/high-energy connections.
4. Detail the advantages and disadvantages of below-grade vs. above-grade structure connections.
5. List tests available to determine the effectiveness of a structure connection.

#### **G. Control Panel Installations**

**Competency:** *Install control panels (e.g., interference control, ac mitigation, polarization cells, etc.).*

1. Describe factors to be addressed when installing a control panel in a hazardous and non-hazardous area.
2. Describe the purpose and components of a 'splitter' panel.
3. Describe the objective of an interference control panel and list the steps for adjusting the components to achieve the desired results.
4. List the different types of ac mitigation devices and their principles of operation.
5. Detail criteria to assess whether the installed equipment has been installed properly.

#### **H. Bonding**

**Competency:** *Install bond cables.*

1. Detail factors to be considered when selecting the type of structure connection and gauge (size) of bond cable to be used.
2. Describe how to install a CP bond cable properly.
3. List tests available to confirm if a CP bond is effective.

**I. DC Power Sources**

**Competency:** *Install dc power sources.*

1. Describe boundaries between the CP worker and the electrical trade as it pertains to installing dc sources.
2. List the required steps, including electrical contractor assistance (when applicable), associated with installing a dc power source.

**J. DC Connections to Power Sources**

**Competency:** *Connect dc cables to power sources.*

1. List methods for ensuring connections to a dc power source are mechanically and electrically sound.
2. List checks to be conducted if a discontinuity in the positive or negative cable is suspected.

**K. Remote Monitoring Systems**

**Competency:** *Facilitate the installation of remote monitoring systems.*

1. List required materials and tools associated with the installation of a remote monitoring system.
2. List the steps associated with installing a system, including the services of electrical sub-contractors and providers of communication media.
3. Perform tests and apply manufacturer's performance criteria to assess accuracy of data obtained via remote monitoring.

**L. System Commissioning**

**Competency:** *Commission CP systems.*

1. Describe pre-commissioning checks to verify all cathodic components have been properly installed and are ready to be energized.
2. Describe commissioning tests to ensure the DC power source is capable of providing full design output and target current and/or target potentials.
3. Describe criteria to be used to determine if the desired level of protection on design structures has been achieved.
4. Describe tests to determine if any adverse effects are experienced on non-design structures.
5. Describe how target operating parameters are to be set and communicated to others involved in monitoring the system.
6. Describe where warning signs need to be posted and as-built drawings stored to comply with the CSA Canadian Electrical Code.

**M. Coordinating Installation of Input Power Supply by Qualified Tradespersons**

**Competency:** *Utilize qualified tradespersons to ensure that the dc power source will function as designed.*

1. Define what services/materials are to be supplied by qualified tradesperson.
2. List typical information required by a tradesperson to ensure that the CP system is provided with sufficient and uninterrupted input power.

3. Develop a schedule to ensure that the input power supply is installed and lock-outs removed prior to time of commissioning.

**SECTION SIX:..... EVALUATING CP SYSTEMS.....**

**A. Test Results**

**Competency: *Analyze test results.***

1. Evaluate field data against criteria employed.
2. Evaluate data from various sources to ensure that the analysis of the results is correct.
3. Identify deficiencies and propose options for corrective action.
4. Propose recommendations for CP improvements along with supportive data such as cost estimates.

**B. Coating Integrity Surveys**

**Competency: *Understand coating integrity surveys.***

1. Describe situations where coating surveys might be recommended.
2. Describe the various techniques available to assess the coating of a buried pipeline.
3. List factors that affect the accuracy of coating surveys.
4. Describe what options are available once locations of coating flaws are found.

**C. Telluric Currents**

**Competency: *Compensate for any telluric current.***

1. Describe telluric currents, their cause and the types of structures most likely to be affected by telluric currents.
2. Describe techniques available to monitor telluric activity.
3. Describe methods used to compensate the gathered data during significant telluric current events.

**D. Direct Assessments**

**Competency: *Understand direct assessments (i.e., visual, physical).***

1. Describe the four-step process associated with the direct assessment technique available to evaluate external corrosion of pipelines.
2. List commonly used indirect survey techniques and discuss when a certain survey technique might be applicable or, conversely, when it may not be applicable.
3. List indirect survey results that would indicate that immediate action is warranted vs. those that indicate scheduled action is more appropriate.
4. Describe the direct examination and post assessment ECDA steps.

**E. System Modifications**

**Competency:** *Justify CP system modifications.*

1. Describe situations where target outputs need to be modified.
2. Identify areas that need to be addressed in order to add to the assurance that the CP system is operating effectively.
3. When required, prepare cost estimates and/or other economic analyses to assist in justifying modifications.
4. Present options for correcting stray current interference situations.

**F. Anodic Protection Systems**

**Competency:** *Understand anodic protection systems.*

1. Describe the principles of an anodic protection system.
2. Describe passivity.
3. Describe situations where anodic protection is typically used.

**SECTION SEVEN: ..... MAINTAINING CP SYSTEMS .....****A. Establishing Operations and Preventative Maintenance Programs**

**Competency:** *Create and maintain scope, schedule, and budget for ongoing operations and preventative maintenance programs. Secure and engage resources, equipment and services.*

1. Review CP systems and equipment to determine the operations and maintenance scope, service frequencies and costs.
2. Conduct review and approval cycles with stakeholders.
3. Implement the approved operations and maintenance plan. This includes:
  - a) obtain authorization to commit funds
  - b) source appropriate resources (personnel, equipment, tools, vehicles, etc.)
  - c) coordinate resources
  - d) monitor activities and troubleshoot issues.
4. Report progress and status to stakeholders as required.

**B. Educating Client and On-Site Personnel on CP Systems**

**Competency:** *Demonstrate an appropriate level of knowledge and ability to educate stakeholders in regard to corrosion and corrosion control. Stakeholders can be a diverse audience (various levels of expertise/familiarity). Stakeholders will view the Level 2 cathodic protection technician as a 'trusted advisor' on one or more subject areas.*

1. Be prepared to discuss technically complex aspects of CP systems, operations, maintenance, corrosion failures and CP system troubleshooting approaches.
2. Assess client understanding and address client concerns and needs.



**C. Advanced Troubleshooting of CP Systems**

**Competency:** *Identify which part (or parts) of the CP system is not functioning correctly and the underlying cause or causes. Perform appropriate follow up actions.*

1. Use systematic approaches to address problems encountered, to address recurring issues and when required perform technical studies to determine/prove reasons for failure.
2. Assess interdependencies and interactions.
3. Identify design issues (e.g., safety issues, failures of components, inadequately rated components, etc.).
4. Understand/identify broader issues affecting corrosion and corrosion control (e.g., soil condition changes, change in product streams, ac interference concepts, etc.)
5. Document the identified problem and analyses, and what corrective actions were, or need to be, taken.

**D. Identifying Electrical Continuity Deficiencies**

**Competency:** *For complex or ambiguous situations, guide the application of electrical continuity tests and interpret and apply the results.*

1. Based on collected data or other information, perform appropriate electrical continuity testing using the appropriate test procedure(s).
2. Propose solutions for electrical continuity deficiencies identified.

**E. Evaluating and Adjusting Stray AC and DC Current Interference**

**Competency:** *Ensure that stray ac and dc current interference mitigation systems are operating properly.*

1. If the criteria changes:
  - a) based on collected data or other information, determine if existing acceptance criteria are still valid for the specific application.
  - b) and changes are required, review with stakeholders recommendations to change criteria.
  - c) and if changes are required, adopt, deploy, and document new criteria.
2. If the measurements change unexpectedly:
  - a) review measurement history and other pertinent technical details.
  - b) if appropriate, perform enhanced testing to aid in interpreting the measurements.
  - c) analyze results.
  - d) decide on any corrective actions, implement corrective actions, and document.

**F. Facilitating the Maintenance of Remote Monitoring Systems**

**Competency:** *Provide support to stakeholders using and maintaining remote monitoring systems on CP installations.*

1. Advise when parameters are outside of tolerance or other remote monitoring issues are indicated.
2. Oversee re-configuration, modifications, and re-commissioning of remote monitoring systems. Review and maintain acceptable target ranges and other parameters for use in remotely monitored systems.

3. Support and engage support services to keep remote monitoring systems operational.
4. Ensure that corrective actions performed on the remote monitoring system are documented.

**SECTION EIGHT: .....PREPARING REPORTS AND MAINTAINING RECORDS .....**

**A. Preparing and Submitting Project Bids and/or Estimates**

**Competency:** *Submit bids and estimates in accordance with the technical and commercial requirements of the stakeholders.*

1. Assist in preparing project bids and/or cost estimates.
2. Assist in understanding and meeting the commercial terms and conditions.
3. Prepare and/or review itemized quotations and estimates for materials, equipment, labour, consumables, financial instruments, taxes, fees, permits, etc.
4. Participate when required in final negotiations, obtaining final approvals (all parties) and the awarding of the contract.

**B. Preparing Proposed Drawings and Sketches**

**Competency:** *Create appropriate proposed drawings and sketches utilizing various sources.*

1. Develop and communicate a conceptual design or idea.
2. Perform validation and quality control checks as needed.

**C. Maintaining Records**

**Competency:** *Maintain the collected essential information in compliance with established procedures.*

1. Follow project or company specific rules and procedures for recovering information so that existing information is found quickly and not corrupted.
2. Where trended information needs to be augmented with current information, add the new information.

**D. Interpreting Findings (Collected Data)**

**Competency:** *Interpret findings based on the collected data, create/perform follow up actions, and report to stakeholders as appropriate.*

1. As appropriate for the type of reported information, review the findings, apply experience/judgment based criteria decide upon further actions, then act as needed.
2. Ensure that data, reports, drawings, repair documentation, etc. are properly stored for easy retrieval and future use.

**E. Preparing Reports and Records**

**Competency:** *Prepare cost analyses.*

1. Prepare work scopes and bills of material for jobs.
2. Obtain, analyze and validate historical and current project costs in order to prepare quotes, budgets, trends, invoices and justifications.
3. Evaluate schedule, resource, and logistical needs and options.

4. Obtain, analyze, and validate quotes for goods and services.
5. Evaluate alternatives in order to support the decision making process.
6. Prepare summaries, cost reports, cost estimates, schedules, and final reports as needed.

**SECTION NINE:.....PROFESSIONAL DEVELOPMENT .....**

**A. Emerging New Industry Related Technologies**

**Competency:** *Have an awareness of new and emerging industry related technologies.*

1. Learn about new and emerging technologies related to the CP industry.
2. Teach, lead, mentor and promote activities that lead to a better understanding of advanced CP related topics.

**B. Industry Standards and Best Practices**

**Competency:** *Have an awareness of past, present, and emerging regulations, standards, and best practices.*

1. Review regulations, standards and best practices regularly in order to ensure that the practices and procedures used meet the applicable standards.
2. Participate, when possible, in the development of new or the updating of existing regulations, standards and best practices.



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