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Question 1413

When measuring the potential of a structure located near a high-voltage AC transmission line, a technician notices significant fluctuations. What is the standard industry practice for accurate recordkeeping in this scenario?

A. Recording the DC potential and the AC voltage magnitude separately.
B. Averaging the highest and lowest DC peaks and recording the mean value.
C. Recording only the DC potential measured during the night when power loads are low.
D. Utilizing a solid-state decoupler and recording the "steady-state" DC value only.

Answer: A

Explanation: Industry standards (such as NACE SP0177) require that both DC potentials and AC voltages be monitored and recorded where AC interference is suspected. This is necessary to assess both the level of cathodic protection and the risk of AC corrosion or safety hazards.

Question 1414

During the inspection of incoming materials for a large-scale ICCP installation, the technician notices that the supplied anode lead wire is *THHN/THWN* instead of the specified *HMWPE* insulation. The contractor argues that the *THHN* wire has a higher temperature rating and is more flexible for conduit pulls. How should the technician proceed?

A. Reject the material because *THHN* insulation is susceptible to rapid degradation when exposed to chlorine and nascent oxygen

B. Accept the THHN wire as it provides superior thermal protection for high-output systems

C. Reject the material because the THHN wire gauge is typically smaller than the equivalent HMWPE rating

D. Accept the wire only if it is installed within a continuous schedule 80 PVC conduit system

Answer: A

Explanation: HMWPE (High Molecular Weight Polyethylene) is specifically designed for direct burial in CP applications because it resists the aggressive chemical environment created by anodic reactions, such as the evolution of chlorine gas or oxygen. THHN/THWN insulation is not rated for chemical resistance in soil or water environments and will fail rapidly when exposed to the byproducts of the CP current discharge, leading to a severed circuit.

Question 1415

A technician is performing a soil resistivity test using the Wenner Four-Pin method and a Soil Resistance Meter. If the meter displays "Over Range" or "High Resistance Error," what are the most likely equipment-related causes? (Select All that Apply)

A. Extremely high contact resistance between the pins and the soil

B. Broken or poorly connected lead wires to the pins

C. The soil is saturated with moisture and salts

D. The pins are spaced too closely together (less than $1m$)

Answer: A,B

Explanation: "Over range" in resistivity testing usually indicates an open circuit

(broken wire) or so much resistance at the pin/soil interface that the meter cannot drive enough current to get a reading. Saturated soil would result in a very "low" reading, not "high."

Question 1416

A CP2 Technician is tasked with managing the spare parts inventory for a large-scale ICCP system. Which components should be prioritized for on-site stock to minimize system downtime? (Select three answers)

A. Spare Mixed Metal Oxide (MMO) anode strings
B. Various sizes of Shunts (e.g., 0.01 Ω and 0.1 Ω)
C. Replacement high-speed clearing fuses for rectifier circuits
D. Spare silicon modular diode bridges or stacks

Answer: B,C,D

Explanation: Rectifiers are the most common point of failure. Fuses and diodes are sensitive to power surges and are easily replaced in the field. Shunts are critical for measurement and can be damaged or corroded. While anodes are vital, they are usually "permanent" installations; replacing a deep-well or buried anode string is a major construction project, not a routine field repair, so they are rarely kept as "spare parts" on-site.

Question 1417

A technician is using a shunt to measure the output of a rectifier. The shunt is rated at [50 Amps / 50 mV]. The voltmeter reads [12.5 mV]. What is the current output?

A. 25.0 A

B. 50.0 A

C. 6.25 A

D. 12.5 A

Answer: D

Explanation: A shunt provides a linear relationship between current and voltage. The shunt factor is $[50\ \text{A}/50\ \text{mV} = 1\ \text{A/mV}]$. Therefore, a reading of $[12.5\ \text{mV}]$ corresponds to $[12.5\ \text{mV} \times 1\ \text{A/mV} = 12.5\ \text{A}]$.

Question 1418

An amphoteric metal, such as lead or aluminum, is being protected by an ICCP system. The technician measures a "polarized" potential of -1.250 V CSE. Why might this level of protection be detrimental to the structure?

A. The protective oxide film will dissolve due to high pH at the interface

B. The system will suffer from anodic interference from nearby structures

C. The metal will undergo rapid pitting due to chloride ion migration

D. Excessive hydrogen evolution will cause hydrogen embrittlement

Answer: A

Explanation: Amphoteric metals are susceptible to corrosion in both low and high pH environments. Excessive cathodic protection current causes an accumulation of hydroxyl ions at the cathode surface, significantly increasing the local pH. For metals like lead and aluminum, this high alkalinity dissolves the protective film, leading to "cathodic corrosion."

Question 1419

In the context of CP2 documentation, what is a "diary" or "daily log" used for that a standard "data sheet" is not?

A. It is a duplicate of the data sheet used as a backup.
B. To provide a narrative of the day's events, including unplanned obstacles, interactions with landowners, and general site observations.
C. To list the serial numbers of the batteries used in the voltmeter.
D. To record the technician's personal opinions about the company.

Answer: B

Explanation: While data sheets capture specific technical values, a diary or daily log provides the context surrounding the data collection. This narrative is crucial for understanding why certain data might be missing or why a survey took longer than expected, and it serves as a legal record of the technician's activities.

Question 1420

When documenting an abnormal condition, such as a rectifier found with a blown fuse, what additional field data should be recorded? (Select two)

A. The brand of the replacement fuse
B. The "As-Left" potentials after replacing the fuse
C. The total number of rectifiers on the entire pipeline system
D. The "As-Found" potentials at the nearest test station

Answer: B,D

Explanation: "As-Found" and "As-Left" data are critical for documenting the impact of the failure and the success of the repair. The fuse brand is an O&M detail but not a primary data component for interpretation. The total number of rectifiers on the system is part of the system map, not specific to this site's documentation.

Question 1421

When performing a survey on a structure with multiple reference electrode locations, why is the "Remote" potential recorded? (Select All that Apply)

A. To confirm that the reference electrode is outside the gradient of the anode bed
B. To evaluate the "Remote Earth" potential for interference studies
C. To determine the extent of the CP current's reach
D. Because the technician forgot where the pipeline was located

Answer: A,B,C

Explanation: Remote potentials help determine if the structure is protected globally and if the electrode is far enough away from local groundbed gradients to get a true representation of the structure-to-soil potential.

Question 1422

Which of the following statements accurately describe the relationship between pH, resistivity, and soil corrosivity? Select All that Apply.

A. Soils with resistivity above $10,000$ ohm-cm are always considered non-corrosive

regardless of pH.

B. High chloride concentrations can lower resistivity while simultaneously disrupting passivity on stainless steels.

C. Acidic soils ($pH < 5$) generally increase the solubility of protective corrosion products.

D. Very low pH values promote the hydrogen evolution reaction as the primary cathodic process.

Answer: B,C,D

Explanation: Lower pH values signify a higher concentration of hydrogen ions, which facilitates the reduction reaction and prevents the formation of stable, protective carbonate or oxide scales. While high resistivity usually correlates with lower corrosivity, it is not an absolute rule; localized "hot spots" or acidic pockets can still cause significant corrosion. Chlorides act as aggressive ions that increase the electrolyte conductivity (lowering resistivity) and can penetrate passive films.

Question 1423

What is the primary risk of using a reference electrode with a cracked ceramic plug in a high-chloride soil environment?

A. The electrode will become a "perfect" conductor, shorting out the DMM.

B. The copper sulfate will leak out, potentially causing localized corrosion on the pipeline.

C. The electrode will develop a high internal resistance, making it unusable.

D. Chloride ions will migrate into the electrode, reacting with the copper sulfate to form copper chloride and shifting the reference potential.

Answer: D

Explanation: A cracked or overly porous plug allows for the contamination of the internal electrolyte. In chloride-rich soils, chloride ions move into the electrode. This changes the half-cell chemistry from a pure $Cu/CuSO_4$ reaction, resulting in a false potential reading that could lead a technician to believe a pipe is protected when it is not.

Question 1424

When performing a DCVG survey, what does a "Lateral" measurement help to determine? (Select one)

A. The exact center of the coating holiday
B. The depth of the pipeline
C. The direction of the current flow in the electrolyte
D. The magnitude of the IR drop in the pipe steel

Answer: A

Explanation: In DCVG, the technician uses two reference electrodes. By moving the electrodes laterally (perpendicular to the pipe) and finding the point of zero potential gradient, the technician can precisely locate the holiday directly beneath the probes.

Question 1425

When performing a potential measurement, why is the input resistance of the voltmeter important? (Select two)

A. Low input resistance causes the meter to display a higher-than-actual potential
B. Low input resistance can lead to a "voltage divider" effect with the reference electrode contact resistance
C. High input resistance prevents the meter from drawing current from the cell being measured
D. Low input resistance results in a lower-than-actual potential reading

Answer: C,D

Explanation: A voltmeter with low input resistance will draw significant current from the high-resistance circuit (the soil/electrode interface). This causes a voltage drop across the contact resistance, meaning the meter only measures a fraction of the actual potential. High input resistance (typically $10\,M\Omega$ or more) ensures that almost no current flows, providing a more accurate measurement of the open-circuit potential.

Question 1426

What is the purpose of "bleeder resistors" in a rectifier cabinet equipped with large filter capacitors? (Select two)

A. To improve the voltage regulation of the power supply.
B. To prevent a safety hazard for technicians working on the unit.
C. To provide a path to discharge the capacitors when the power is turned off.
D. To protect the diodes from reverse current from the battery/structure.

Answer: B,C

Explanation: Filter capacitors can store a lethal charge even after the AC power is disconnected. Bleeder resistors are connected in parallel with the capacitors to provide a slow, safe discharge path for this stored energy, ensuring the unit is safe

for maintenance.

Question 1427

When plotting an E log I curve, the point where the extrapolated anodic and cathodic Tafel slopes intersect represents:

A. The open circuit potential of the anode
B. The theoretical corrosion potential and corrosion current
C. The total circuit resistance
D. The reversible potential of the cathodic reaction

Answer: B

Explanation: In corrosion science, the intersection of the extrapolated linear portions (Tafel regions) of the anodic and cathodic polarization curves identifies the corrosion potential (E_{corr}) and the corrosion current density (i_{corr}) for the system under the specific environmental conditions tested.

Question 1428

A technician is performing CP testing on a pipeline located in a trench that is $1.6\ \text{meters}$ ($5.25\ \text{feet}$) deep. The soil is classified as Type C (sandy, unstable). What safety requirement must be met before the technician enters the trench?

A. Work can proceed as long as a "competent person" is watching from the top
B. The technician must wear a harness attached to a tripod at the surface
C. A ladder must be placed within $7.6\ \text{meters}$ ($25\ \text{feet}$) of the worker
D. The trench must be equipped with a shoring or shielding system

Answer: D

Explanation: OSHA requires that any trench deeper than 1.5 meters (5 feet) be protected by shoring, sloping, or shielding, especially in Type C soil which is the least stable. While a ladder is also required for egress, the structural integrity of the trench wall is the primary life-safety concern to prevent cave-ins.

Question 1429

Which type of rectifying element is characterized by a higher forward voltage drop and lower efficiency, but is often preferred in high-surge environments due to its self-healing properties?

A. Platinum electrodes
B. Silicon diodes
C. Germanium diodes
D. Selenium cells

Answer: D

Explanation: Selenium rectifiers were standard before silicon became dominant. They have a higher voltage drop (approx. 1 V per cell) which generates heat and reduces efficiency. However, they are robust against voltage surges because they can "heal" small puncture points in the selenium layer.

Question 1430

When measuring the potential of a pipeline in the presence of telluric currents, which equipment approach is most effective? (Select two)

A. Using a high-impedance analog voltmeter to smooth the fluctuations
B. Utilizing a stationary "base" reference cell and recording simultaneous data
C. Validating the readings with a handheld DMM set to the "Min/Max" function
D. Using multiple synchronized data loggers to record potentials over 24 hours

Answer: B,D

Explanation: Telluric currents cause long-period fluctuations. A single reading is meaningless. Recording data over a long period (24h) allows for averaging or identifying "quiet" periods. Using a base station allows for telluric cancellation (subtracting the base fluctuations from the survey data).

Question 1431

During the field installation of an impressed current system, the technician notes that the soil resistivity is much higher than the original design survey indicated. What are the appropriate supervisory actions? (Select two answers)

A. Increase the output voltage of the rectifier to its maximum setting to force the current through the soil
B. Request a change order to install deeper anodes or use chemical soil treatment (e.g., bentonite/gypsum)
C. Propose changing the backfill from coke breeze to native soil to save costs since the design is already compromised
D. Contact the design engineer to recalculate the number of anodes needed to maintain the target circuit resistance

Answer: B,D

Explanation: If field conditions (resistivity) differ from the design, the system may not be able to deliver the required current within the rectifier's voltage limits ($V = IR$). The technician must coordinate with the engineer to either add more anodes (parallel resistance) or improve the local environment. Simply maxing out the voltage can lead to equipment overheating or coating damage (over-protection) at the drain point.

Question 1432

When measuring potential gradients to locate a stray current source, which setup is required? (Select two)

A. Two reference electrodes connected to a high-impedance voltmeter
B. Reference electrodes placed in a "side-drain" or "cross-line" configuration
C. A single reference electrode moved in a circular pattern around a test station
D. One reference electrode connected to the structure and one to a remote ground

Answer: A,B

Explanation: Potential gradient measurements (cell-to-cell) involve two reference electrodes to measure the voltage drop across the soil. In "side-drain" configurations, one electrode is over the pipe and the other is offset at a right angle; this determines if current is flowing toward or away from the pipe at that specific location.

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