Underwater – Measure Structure-to-Electrolyte Potentials

1.0 Task Description

This task consists of using measurement equipment to take a reading of the potential between the underwater structure or pipeline and electrolyte (fresh or salt water) and record data. This task begins with equipment selection. This task ends with documentation and post calibration of the reference electrode. This task is similar to Task 1.1 (Measure Structure-to-Soil Potentials) but contains steps or equipment that are unique to an underwater environment.

2.0 Knowledge Component

Current potential readings measure the voltage differential between the underwater structure or pipeline and the reference electrode.

An individual performing this task must have knowledge of:

- Cathodic Protection Systems
- Types of reference electrodes and environment
  - Copper-copper sulfate used in soil and freshwater
  - Silver-silver chloride used in saltwater
  - Zinc used in soil and saltwater
- Voltage values for each reference electrode to achieve adequate protection
- Considerations that must be made to account for IR drop. Voltage drops other than those across the structure-to-electrolyte boundary must be considered
- External influences that can affect the accuracy of the reference electrode
  - Temperature
  - Light
  - Electrolyte concentration
  - Electrolyte contamination or electrode polarization

Terms applicable to this task are as follows.

Pneumofathometer

A depth-measuring device consisting of an open-end hose fixed to the diver, with the surface end connected to a gas supply and pressure gauge (usually marked in Feet of Seawater or FSW). The gauge measures the pressure required to discharge water to the diver's depth.

AOCs associated with the performance of this task include:

AOC Recognition	AOC Reaction
Damaged coating; scratches, dents, and gouges.	Implement mitigation measures per operator's procedures.
Missing or broken test points and leads.	Repair the test leads or equipment as needed.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps:

Step	Action	Explanation

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1	Select the instrumentation (test leads, voltmeter, and reference electrode) to be used.	Incorrect or faulty equipment will not provide accurate results.
2	Identify the correct test point locations for proximity and/or contact measurements. Verify using drawings, maps, survey data, pneumofathometer readings, diver video, or dive supervisor/diver communications.	The reference electrode must be correctly located to obtain accurate results. A structure may have several locations for taking measurements
3	Prepare the reference electrode and calibrate the test equipment.	Damaged equipment or improper connection of equipment will lead to inaccurate potential readings.
4	Install the ground lead.	Improper or damaged ground lead will lead to inaccurate potential measurements. Proximity and dual element probes require a ground lead when taking readings. Contact probes have a built-in grounding tip. The ground lead, or continuity clamp, is a mechanical connection that provides electrical continuity by connecting the voltmeter and the structure.
5	Take proximity and/or contact readings and record readings.	Place the probe a few inches to a few feet away from the structure or pipeline for proximity readings. Place the tip of the contact probe on the surface of the structure or pipeline for contact readings. Readings should be reviewed as they are taken to ensure that measurements fall within the desired range with the correct polarity. This is not meant to be an engineering analysis or to account for IR drop considerations. This may include a comparison to historical data at that location. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
6	Confirm calibration of the reference electrode after the dive to ensure accurate readings.	
7	Document the readings as required by operator's procedure.	Documentation is critical to future analysis and identification of problem areas.