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# ADDENDUM 2

*Replace Annex A and Annex B with the attached.*

# Annex A
(normative)

## Covered Task List

The Covered Tasks listed below were identified by API and may be adopted by the Operator as described in 4.2.1 of this document.

The tasks in bold text are included in Annex B, the remaining tasks are in development.

| COVERED TASK NUMBER | Covered Task Name |
|---|---|
| **1.1** | **Measurement of Structure-to-Soil Potentials** |
| **1.2** | **Conduct Close Interval Survey** |
| **1.3** | **Test to Detect Interference** |
| **1.4** | **Inspect and Perform Electrical Test of Bonds** |
| **1.5** | **Inspect and Test Electrical Isolation** |
| **2.1** | **Verify Test Lead Continuity** |
| **2.2** | **Repair Damaged Test Lead** |
| **2.3** | **Install Test Leads by Non-Exothermic Welding Methods** |
| **2.4** | **Install Test Leads by Exothermic Welding Methods** |
| **3.0** | **Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance** |
| **4.1** | **Troubleshoot Rectifier** |
| **4.2** | **Repair or Replace Defective Rectifier Components** |
| **4.3** | **Adjustment of Rectifier** |
| **5.1** | **Examine for Mechanical Damage on Buried or Submerged Pipe** |
| **5.2** | **Examine for External Corrosion on Buried or Submerged Pipe** |
| **5.3** | **Inspect the Condition of External Coating on Buried or Submerged Pipe** |
| 7.1 | Visual Inspection of Atmospheric Coatings |
| 7.2 | Prepare Surface for Coating Using Hand and Power Tools |
| 7.3 | Prepare Surface for Coating by Abrasive Water Blasting |
| 7.4 | Prepare Surface for Coating by Abrasive Blasting Methods Other Than Water |
| 7.5 | Apply Coating Using Hand Application Methods |
| 7.6 | Apply Coating Using Spray Applications |
| 7.7 | Perform Coating Inspection |
| **8.1** | **Measure Pit Depth with Pit Gauge** |
| **8.2** | **Measure Wall Thickness with Ultrasonic Meter** |
| **8.3** | **Measure Corroded Area** |
| **9.1** | **Install Bonds** |
| **9.2** | **Install Galvanic Anodes** |

| | |
|---|---|
| **9.3** | **Install Rectifiers** |
| **9.4** | **Install Impressed Current Groundbeds** |
| **9.5** | **Repair Shorted Casings** |
| 9.6 | Install Electrical Insulating Device |
| 10.1 | Insert and Remove Coupons |
| 10.2 | Monitor Probes (On-Line) |
| 11.0 | Monitoring and Controlling the Injection Rate of the Corrosion Inhibitor |
| 12.0 | Visual Inspection of the Internal Pipe Surface |
| **14.1** | **Locate Line** |
| **14.2** | **Install, Inspect, and Maintain Permanent Marker** |
| **14.5** | **Install, Inspect, and Maintain Temporary Marker** |
| **15.1** | **Visually Inspect Surface Conditions of Right-of-Way** |
| **16.1** | **Inspect Navigable Waterway Crossing** |
| **19.1** | **Valve Body Winterization or Corrosion Inhibition** |
| **19.2** | **Valve Lubrication** |
| **19.3** | **Valve Seat Sealing** |
| **19.4** | **Valve Stem Packing Maintenance** |
| **19.5** | **Adjust Actuator/Operator, Electric** |
| **19.6** | **Adjust Actuator/Operator, Pneumatic** |
| **19.7** | **Adjust Actuator/Operator, Hydraulic** |
| **20.0** | **Inspect Mainline Valves** |
| **21.1** | **Repair Valve Actuator/Operator, Pneumatic** |
| **21.2** | **Disassembly/Re-assembly of Valve** |
| **21.3** | **Internal Inspection of Valve abd Components** |
| **21.4** | **Repair Valve Actuator/Operator, Hydraulic** |
| **21.5** | **Repair Valve Actuator/Operator, Electric** |
| 22.1 | Inspect Tank Pressure/Vacuum Breakers |
| 22.2 | Inspect, Test, and Calibrate HVL Tank Pressure Relief Valves |
| 23.1 | Maintain/Repair Relief Valves |
| 23.2 | Maintain/Repair Pressure Limiting Devices |
| 24.1 | Inspect, Test and Calibrate Pressure Limiting Devices |
| 24.2 | Inspect Test and Calibrate Relief Valves |
| 25.1 | Inspect, Test and Calibrate Pressure Switches |
| 25.2 | Inspect, Test and Calibrate Pressure Transmitters |
| **27.1** | **Routine Inspection of Breakout Tanks (API 653 Monthly or DOT Annual)** |
| **27.2** | **API 653 Inspection of In-Service Breakout Tanks** |
| **27.3** | **API 510 Inspection of In-Service Breakout Tanks** |
| 30.0 | Test Overfill Protective Devices |

| | |
|---|---|
| 31.0 | Inspect and Calibrate Overfill Protective Devices |
| **32.0** | **Observation of Excavation Activities** |
| **38.1** | **Visually Inspect Pipe and Pipe Components Prior to Installation** |
| **38.3** | **Visually Inspect that Welds Meet DOT Requirements** |
| **38.4** | **NDT - Radiographic Testing** |
| **38.5** | **NDT - Liquid Penetrate Testing** |
| **38.6** | **NDT - Magnetic Particle Testing** |
| **38.7** | **NDT - Ultrasonic Testing** |
| **39.0** | **Backfilling a Trench Following Maintenance** |
| **40.1** | **Fit Full Encirclement Welded Split Sleeve (Oversleeve, Tight Fitting Sleeve, etc.)** |
| **40.3** | **Apply Composite Sleeve** |
| **40.4** | **Install Mechanical Bolt-On Split Repair Sleeve** |
| 40.5 | Install Weldable Compression Couplings |
| **40.6** | **Install and Remove Plugging Machine** |
| 40.7 | Hot Tapping a Hole 2 in. or Under |
| **40.8** | **Installing a Tap Larger Than 2 Inches on a Pipeline** |
| 40.9 | Installation and Removal of a Completion Plug |
| **41.0** | **Conduct Pressure Test** |
| 42.7 | Welding |
| **43.1** | **Start-up of a Liquid Pipeline (Control Center)** |
| **43.2** | **Shutdown of a Liquid Pipeline (Control Center)** |
| **43.3** | **Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Control Center)** |
| **43.4** | **Remotely Operate Valves on a Liquid Pipeline System** |
| 44.3 | Inspect, Test, and Calibrate Computational Pipeline Monitoring (CPM) Leak Detection System |
| 44.4 | Inspection, Testing, Corrective and Preventative Maintenance of Tank Gauging for Leak Detection |
| 44.5 | Prove Flow Meters for Hazardous Liquid Leak Detection |
| 44.6 | Maintain Flow Meters for Hazardous Liquid Leak Detection |
| 44.7 | Inspect, Test and Maintain Gravitometers/Densitometers for Hazardous Liquid Leak Detection |
| 44.8 | Inspect, Test and Maintain Temperature Transmitters |
| **63.1** | **Start-up of a Liquid Pipeline (Field)** |
| **63.2** | **Shutdown of a Liquid Pipeline (Field)** |
| **63.3** | **Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Field)** |
| **63.4** | **Locally Operate Valves on a Liquid Pipeline System** |

# Annex B
(normative)

## Covered Task Standards

Annex B is expected to include all of the updated Task Standards. As of the publication date of API 1161, 2nd Edition, this annex includes only those Task Standards approved by the governance group by ballot. This annex will continue to incorporate Task Standards as addenda as they are developed and approved by API. The Task Standards in this annex directly correlate to Annex A (Covered Task List), but will be published in no particular order.

The expected completion date for this annex is 18 months from publication of RP 1161 Rev. 2. At that time, this annex will be incorporated in full into the document.

As available, OQ Task Standards will be available at no cost on API's website and are accessible at:

http://www.api.org/1161TaskLists

Users of this document are directed to visit this website periodically to obtain the updated Task Standards as they are made available for publication.

## OQ Task Name

Task 1.1 – Measurement of Structure-to-Soil Potentials

## 1.0 Task Description

This task involves taking a structure-to-soil reading with a half cell during an annual survey or cathodic protection analysis. The task begins with equipment selection and ends with documenting the results.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Cathodic protection systems used to understand the purpose and expected results of the measurement, including the type of reference cell to use in combination with a high impedance volt-ohm meter (VOM)

- Copper/copper sulfate half cells are used as the reference cell for most pipelines buried in soil
- Saturated KCI calomel reference electrodes
- Saturated silver/silver oxide half cells used in sea water

An example of a minimum requirement is a negative voltage of 850 millivolts for a copper/copper sulfate half cell.

Consideration must be made to account for IR drop when measuring structure-to-soil potentials. Voltage drops other than those across the structure-to-electrolyte boundary must be considered.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Voltage is less than minimum requirements | Verify the cathodic protection level and implement mitigation if insufficient. |
| Erratic or floating readings | Determine the cause of the erratic readings and repair the test leads or equipment, as needed. |
| Reverse polarity of readings | Document and implement corrective actions. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Select the instrumentation (test leads, voltmeter, and reference electrode) to be used. | Incorrect or faulty equipment will not provide accurate results. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Identify the correct test point locations where measurements will be taken. | The reference electrode must be located to obtain accurate results. A structure may have several locations for taking measurements. |
| 3 | Correctly connect the test leads to the voltage meter and reference cell. | Improper connection of test leads will lead to inaccurate potential measurements. |
| 4 | Measure the structure-to-soil potential. | This step takes the actual potential difference between the soil and the structure being tested. |
| 5 | Field-analyze readings to ensure that they are within the desired range of readings, including a check of the polarity. | Readings should be reviewed as they are taken to ensure that readings 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. |
| 6 | Document the readings as required by operator's procedure. | Documentation is critical to future analysis and identification of problem areas. |

## OQ Task Name

Task 1.2 – Conduct Close Interval Survey

## 1.0 Task Description

This task includes use of equipment to obtain and record structure-to-soil potential readings at specific intervals along the length of a located pipeline. The task begins after the pipeline is located and ends when data from the designated area is recorded.

Data analysis is not part of this covered task.

Examples of close interval surveys may include, but are not limited to, the following:

- “ON” survey
- Interrupted survey
- Depolarized survey

Locate Line is a separate covered task (Reference Task 14.1).

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- The specific survey being conducted and the designated spacing between readings. Spacing determines the amount of data collected and the accuracy of the data profile. The location of the pipeline and appurtenances (road crossings, test stations, river crossings, foreign crossings, casings, valves, isolation devices, rectifiers, galvanic anodes, aerial markers, bonds, pump stations, etc.) typically found in alignment sheets or system mapping should be marked on the survey for validation of the line and its location.
- “ON” Survey – Measures the potential difference between the structure and the ground surface as the cathodic protection current is applied.
- Interrupted (On/Off) Survey – Measures the potential difference between the structure and the ground surface as the cathodic protection current is switched on and off.
- Depolarized (Off) Survey – Measures the potential difference between the structure and the ground surface after the cathodic protection current has been switched off long enough for the structure-to-soil to stabilize.
- Data Logger – A digital device used to record multiple structure-to-soil potentials.
- Current Interrupter – A device that stops/interrupts the transfer of an electric charge used to cycle rectifiers, anodes, bonds, etc., on and off.
- “Instant Off” Potential – The polarized half-cell potential of an electrode taken immediately after the cathodic protection current is stopped. This process closely approximates the potential without IR drop.
- IR Drop – The voltage or potential difference as a result of current flow. From Ohm’s Law, V=IR. When evaluating structure-to-soil measurements, IR drop is the voltage drop other than the drop across the structure-to-soil boundary.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Erratic or floating readings | Determine the cause of the erratic readings, and repair the test leads or equipment, as needed. |
| Reverse polarity of readings | Document and notify the appropriate operator personnel immediately. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the test point locations where connections will be made. | To ensure that potentials taken are on the intended pipeline and are the most accurate readings. |
| 2 | Correctly connect the test leads, the voltage meter or data logger, and reference cell. | Improper connection of equipment will lead to inaccurate potential measurements. |
| 3 | Verify that current sources are operational (on for “ON”/interrupted surveys and turned off/disconnected for depolarized survey). | All current sources must be operational for an “ON”/interrupted survey, and all sources must be off or disconnected for a depolarization survey. |
| 4 | Place the reference cell directly above the pipeline being surveyed. | The reference electrode must be in contact with the electrolyte to obtain accurate results. |
| 5 | Select the instrumentation to include survey wire, voltmeter, data logger, reference electrodes, etc. to be used. | Incorrect or faulty equipment will not provide accurate results. |
| 6 | For interrupted surveys, install current interrupters at all identified current sources. They should be set at the operator-determined time cycle and synchronized. | Current interrupters are necessary to obtain accurate “instant off” potentials. Time cycle selection is important to prevent excessive depolarization of the structure when performing an interrupted survey. Synchronization is important to get an accurate “instant off” potential. |
| 7 | Measure the structure-to-soil potential according to the desired intervals for this survey. | This step takes the actual potential difference between the soil and the structure at specified intervals to establish a potential profile of the pipeline. |
| 8 | Verify data is recorded. | Readings are continuous and a lack of data may be a sign of equipment failure or faulty electrode location. |
| 9 | Document the readings as required by operator’s procedures. | Documentation is critical to future analysis and identification of problem areas. |

## OQ Task Name

Task 1.3 – Test to Detect Interference

## 1.0 Task Description

This task involves testing a cathodically protected structure for interference from other sources. The initial approach and physical assessment is to assess structures in related proximity to each other and their respective cathodic protection systems. This task begins with testing for direct current (DC) or alternating current (AC) interference and ends with documenting the results.

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance is a separate covered task (Reference Task 3.0).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2. This knowledge must include, but is not limited to, the following:

- Determining interference by analyzing abnormal DC currents or potentials or the presence of AC currents or potentials.
- Communicating with foreign structure owners for collaboration of testing. Working with other cathodic system owners enables the interruption of their systems and coordination for testing for both cathodic systems.
- Interrupting a cathodic protection system to detect its influence on other structures. Installation of current interrupters on either or both systems is necessary to determine the extent of system interference.
- Troubleshooting cathodic protection systems.
- Documenting the readings and recommendations for future reference.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| The reading is outside of expected parameters. | Check for possible causes of unexpected readings such as reverse polarity, broken bond, or change in cathodic system. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Select and show correct use of the instrumentation, test leads, and reference electrodes. | Incorrect equipment and/or improper usage will not provide accurate results. |
| 2 | Assess the area for other cathodic protection systems or sources of electrical interference. | Potential sources of electrical interference can be the sources of cathodic interference. |
| 3 | Measure the structure-to-soil potential. | This step takes the actual potential difference between the soil and the structure pipe being tested. |
| 4 | Field-analyze readings to ensure that the readings fall within the desired range. | Readings should be reviewed as they are taken to ensure readings fall within the desired range. This may include a comparison to historical data at that location. |
| 5 | Interrupt rectifiers to determine if interference exists. | Interrupting one of the structure's cathodic protection systems can help detect its influence on other structures. |
| 6 | Document all results. If interference is found, take corrective action. | Documentation is critical to future analysis and identification of problem areas. Corrective action may involve making notifications. |

## OQ Task Name

Task 1.4 – Inspect and Perform Electrical Test of Bonds

## 1.0 Task Description

This task involves the visual and electrical inspection of connections related to the electrical connection (bond) of two or more structures. The inspection is to include testing for electrical continuity and the direction and magnitude of current flow. This task begins with identifying the location of the bond(s) and ends with the collection of data.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

How to identify the location and type of bond that is currently in place. Types of bonds may include critical and non-critical interference bonds. Other bonds that may be inspected include continuity bonds.

- Continuity bond – A connection, usually metallic, that provides electrical continuity between structures that can conduct electricity.
- Critical bonds are bonds whose failure would jeopardize the integrity of a pipeline.
- Interference bond – An intentional metallic connection, between metallic systems and contact with a common electrolyte, designed to control electrical current interchange between the systems.

Voltmeters or multi-meters are used to take a voltage reading across a shunt. Bond currents are measured by taking a millivolt reading across a shunt, where the shunt is a defined resistance. This voltage reading is then divided by the shunt's resistance value to equal the current passing through the shunt (bond).

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Change in the current flow and/or direction across the bond (reverse polarity) | Ensure that readings were taken correctly, and notify operator personnel, as required. |
| Broken bond connection | Repair or request a repair and document. |
| Erratic or floating readings | Determine the cause of the erratic readings, and repair test leads or equipment as needed. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the bond locations where measurements will be taken. | To ensure that potentials and current measurements are taken at the correct location. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Conduct a visual inspection of the bond test station for physical damage to the bond station, a damaged shunt, loose connections, disconnected wires, arcing across terminal, etc. | Faulty equipment can cause inaccurate results. |
| 3 | Select the instrumentation, including volt-ohm meter, ammeter, test leads, or reference cell. | Incorrect equipment and/or improper usage will not provide accurate results. |
| 4 | Make connections with the test equipment to take and record readings. | Equipment improperly connected or scaled incorrectly may yield faulty data. |
| 5 | Measure the potentials for each of the structures at the bond location. | This step allows for comparison of the pipe-to-soil potentials of each structure. |
| 6 | Identify the shunt type and size. | This step is required to calculate current flow. |
| 7 | Measure the direction and magnitude of current flow between the structures. | A change in current magnitude or current direction may indicate a need for further testing. |
| 8 | Field-analyze the readings to ensure that they are within a desired range of readings, including a check of the polarity. | Readings should be reviewed as they are taken to ensure that readings fall within desired range with the correct polarity. This is not meant to be an engineering analysis. This may include a comparison to historical data at that location. |
| 9 | Document readings as required by operator's procedures. | Documentation is critical to future analysis and identification of problem areas. |

## OQ Task Name

Task 1.5 – Inspect and Test Electrical Isolation

## 1.0 Task Description

This task involves the inspection and testing of electrical isolation to assure that isolation is adequate. The task begins with identification of the isolation device and ends when measurements have been taken and recorded.

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

How to identify the location and type of isolation device. Types of isolation devices may include insulated flanges, couplings, unions, monolithic insulating pipe joints, and non-metallic pipe and structural members.

Casings need to be electrically isolated from the carrier pipe so as not to shield carrier pipe from cathodic protection.

Proper use of equipment, which may include a reference cell and voltmeter or isolation (flange) tester. Most tests for isolation are based on potential differences in structures using a reference cell and voltmeter.

NOTE: Using the ohmmeter setting to check the effectiveness of an isolation joint is not reliable because of the parallel resistance paths through the soil.

Isolation (flange) testers are based on high radio frequency and can be used to validate the isolation of flange joints or for troubleshooting shorted joints. These testers are not typically used for other isolation joints other than flanges.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Erratic or floating readings | Determine the cause of erratic readings and repair the test leads or equipment, as needed. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the isolation locations and isolation device where measurements will be taken. | This step is to ensure that measurements are taken at the correct location. |
| 2 | Conduct visual inspection of the isolation location for things such as physical damage to the test station, a damaged shunt, loose connections, disconnected wires, arcing across a terminal, etc. | Verifies that there is no visual damage. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Select the instrumentation, including voltmeter, isolation (flange) tester, test leads, or reference cell. | Incorrect equipment and/or improper usage will not provide accurate results. |
| 4 | Make connections with the test equipment to take and record readings. | Incorrect equipment and/or improper usage will not provide accurate results. |
| 5 | If using a reference cell, measure the potential for each of the structures. The reference cell should remain in the same location during the measurements. | This step allows for a comparison of pipe-to-soil potentials in order to help determine if structures are isolated. If the difference in potential is approximately 100mV or greater, the isolation is effective. If the reading is less than 100mV, further testing may be necessary. |
| 6 | Check for continuity on flanges using an isolation/flange tester. | Verifies electrical isolation or lack of continuity between flanges. |
| 7 | Document the readings as required by operator's procedures. | Documentation is critical to future analysis and identification of problem areas. |

## OQ Task Name

Task 2.1 – Verify Test Lead Continuity

## 1.0 Task Description

This task involves the electrical inspection of test leads connected to a structure. This task begins with identification of the test lead wire and ends when a determination is made about whether valid data may be obtained using the test lead wire. The inspection is to include testing for electrical continuity between the structure and the test station.

Install Test Leads by Non-Exothermic Welding Methods (Reference Task 2.3).

Install Test Leads by Exothermic Welding Methods (Reference Task 2.4).

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of:

- Measurement of a structure-to-soil potential taken at a test station that does not meet expected results (lower than anticipated, unstable, or erratic) may be indicative of a broken test lead.
- Using a multimeter to measure resistance between a structure and a test lead wire to determine if continuity exists.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Test lead wire is damaged or missing | Notify operator personnel as required. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the test lead to be tested. | This step is to ensure that measurements are taken on the intended test lead. |
| 2 | Select the proper instrumentation (voltmeter, reference electrodes, etc.) to be used and verify the proper operation. | Incorrect or faulty equipment will not provide accurate results. |
| 3 | Connect the voltage meter and/or reference cell. | Improper connection of equipment will lead to inaccurate potential measurements. |
| 4 | Measure the structure-to-soil potential and/or continuity. | This step determines the potential and/or continuity of the structure and test lead. A potential may be compared with historical data in order to determine continuity. |
| 5 | Record all required information per operator's procedures. | Up-to-date records are essential for maintaining a corrosion control system. |

## OQ Task Name

Task 2.2 – Repair Damaged Test Lead

## 1.0 Task Description

Test leads that do not exhibit continuity should be repaired if possible or replaced. This task involves the repair or replacement of test leads connected to a structure. This task begins when test lead damage has been identified and ends when repair or replacement has been completed.

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

Verify Test Lead Continuity is a separate covered task (Reference Task 2.1).

Install Test Leads by Non-Exothermic Welding Methods is a separate covered task (Reference Task 2.3).

Install Test Leads by Exothermic Welding Methods is a separate covered task (Reference Task 2.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

- Measurement of a pipe-to-soil potential taken at a test station that does not meet expected results (lower than anticipated, unstable, or erratic) may be indicative of a damaged test lead.
- Test lead is a connection to the structure being tested, usually a wire in a supporting stand or test station, with an easy connection point for structure-to-soil measurements.

## 3.0 Skill Component

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

<table>
<tr><th>Step</th><th colspan="2">Action</th><th>Explanation</th></tr>
<tr><td>1</td><td colspan="2">Identify the test lead damage. Perform a visual inspection of the aboveground wire and components.<br>If the test station is intact, continuity must be verified.</td><td>The test lead connection may be loose, corroded, or disconnected; the wire may be broken; or the test station may be damaged or moved.</td></tr>
<tr><td rowspan="2">2</td><td colspan="2">Can the test lead damage be repaired?</td><td>Repair that can be made in the test station or in the immediate area may not require excavation of the pipeline.</td></tr>
<tr><td>Yes – Continue with Step 3.</td><td>No – Continue with Step 4.</td><td></td></tr>
<tr><td>3</td><td colspan="2">Repair the test lead damage. This repair may require reconnecting the lead to the test station or faceplate by stripping the insulation and reconnecting.</td><td>This step corrects the damage if it can be repaired above ground or in the immediate area of test station.</td></tr>
</table>

| Step | Action | Explanation |
|---|---|---|
| 4 | Replace the test lead by connecting to the structure by exothermic weld or non-exothermic connection. If a structure appurtenance is not available, excavation is necessary to expose the pipe.<br><br>The lead should be routed loosely to relieve soil stress during backfill and then connected to the test station or termination point. | This step corrects the damage if the test lead is to be replaced. |
| 5 | Verify that the test leads function properly and are no longer damaged. Obtain a structure-to-soil potential to confirm that the test lead wire is functional. A continuity measurement between the test lead wire and the structure may also be obtained. | Checking the test lead repair is done by taking a structure-to-soil potential and/or by verifying continuity. |
| 6 | Document actions and readings. | Proper documentation is critical to future analysis and identification of problem areas. |

## OQ Task Name

Task 2.3 – Install Test Leads by Non-Exothermic Welding Methods

## 1.0 Task Description

This task involves the proper usage of equipment to install test leads on a structure by methods other than exothermic welding. This includes making an electrical connection by mechanical means which may include magnetic coupling, conductive epoxy, clamp, and/or split bolt connectors. The task begins after the test point is properly located and ends when the connection is made.

Verify Test Lead Continuity is a separate covered task (Reference Task 2.1).

Locate Line is a separate covered task (Reference Task 14.1).

Prepare Surface for Coating Using Hand and Power Tools is a separate covered task (Reference Task 7.2).

Apply Coating Using Hand Application Methods is a separate covered task (Reference Task 7.5).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

- Proper connection preparations such as cleaning metallic surfaces and/or connecting wires.
- Proper size clamps or split bolt connectors for a given wire size.
- Manufacturer's specifications if using a conductive epoxy.
- Manufacturer's recommended safety procedures.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the location where the test lead will be installed. | This step is to ensure that work is done on the intended pipeline or pipe component. |
| 2 | Determine the size of wire to be used. | The normal gauge of a general test wire is per operator specifications. If the test station is to be used for an interference bond between two facilities, the wire gauge will be greater to eliminate any unwanted wire resistance. |
| 3 | Determine the method to attach the wire to the pipeline or facility. | The actual method used will be based on the existing structure. |

| Step | Action | Explanation |
|---|---|---|
| 4 | Prepare the pipe surface for wire installation. | Ensures that the surface profile meets the manufacturer or operator's specifications. If foreign materials are not removed, it could cause a failure to bond or to be electrically continuous. |
| 5 | Install the wires to the structure using magnetic connection, epoxy adhesive or clamp method verifying metal to metal continuity. | The actual connection is dependent on operator requirements and the test lead location. |
| 6 | Document installation as required by the operator's procedures. | |

## OQ Task Name

Task 2.4 – Install Test Leads by Exothermic Welding Methods

## 1.0 Task Description

This task involves proper usage of the equipment to install test leads on a structure by exothermic weld. The task begins after the test point is properly located and ends when the connection is made.

Exothermic welding, generally known as thermite welding, is a process using a graphite mold into which a charge-containing mixture of copper alloy and magnesium starting powder is poured. The mixture is ignited with a flint gun, melts, and drops down, welding the wire to the structure.

Pin Brazing is another means of thermite welding using electrical current to melt solder to provide a connection.

Prepare Surface for Coating Using Hand and Power Tools is a separate covered task (Reference Task 7.2).

Apply Coating Using Hand Application Methods is a separate covered task (Reference Task 7.5).

Locate Line is a separate covered task (Reference Task 14.1).

Measure Wall Thickness with Ultrasonic Meter is a separate covered task (Reference Task 8.2).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

- Manufacturer's specifications indicate the proper size mold and charge for different size wires and structures. Different alloy charges are used for steel and cast/ductile iron structures. A charge is the mixture of a copper alloy and magnesium starting powder.
    - Contact between hot molten metal and moisture or contaminants may result in spewing of hot material. Moisture and contaminants in mold and materials being welded are to be avoided.
    - The exothermic weld device must be used according to the manufacturer's procedure. This process involves heat above 2500° Fahrenheit, and all safety concerns must be addressed.
- Manufacturer's specifications for the Pin Brazing Method include the use of equipment which uses lower temperatures (approximately 600° Fahrenheit).
- The wall thickness of the pipe or pipe component must be verified and meet minimum requirements for the device being used.
- Surface to be welded must be cleaned to bare metal. Outside contaminants will prevent adherence of weld.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Burn through of the pipe wall causing a release and/or fire | Stop all hot work. Respond according to operator's emergency response procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the location where the test lead will be installed. | This step is to ensure that work is performed on the intended location. |
| 2 | Remove a window of paint or coating from the section of pipe to be welded. | An exothermic weld needs to adhere to bare pipe. |
| 3 | Ensure that actual wall thickness has been determined and meets minimum operator requirements. | Sufficient wall thickness is necessary to maintain pipe integrity and personnel safety. |
| 4 | Prepare the pipe surface to receive an exothermic weld. | This step is to ensure that the surface profile meets manufacturer or operator specifications. If foreign materials are not removed, it could cause the exothermic weld to fail. |
| 5 | Remove sufficient insulation from wire and crimp the copper sleeve to bare the wire, as required. | Insulation must be removed to ensure proper adhesion to the pipe. Some smaller gauge wires require a copper sleeve. |
| 6 | Select and prepare the proper weld mold with a properly sized charge.<br>If using pin brazing, this step does not apply. | Different wire sizes and applications require the use of different molds and weld charge. |
| 7 | Insert the wire, and place the graphite mold on the desired location to be welded. Insert the appropriate charge into the mold.<br>If using pin brazing, this step does not apply. | Centering the wire in the mold helps to ensure proper adhesion. |
| 8 | Ignite the charge to create the exothermic weld. Hold the graphite mold firmly in place until the weld sets according to the manufacturer's specification.<br>If using pin brazing, this step varies. For this method, the wire is held in place as the pin brazing current is applied. | This begins the weld process.<br>NOTE: Charges may be ignited electronically or with a sparking device.<br>Pin brazing uses electric current to melt solder material to adhere the wire to structures. |
| 9 | Carefully remove the slag with a hammer and wire brush. Verify adhesion of weld. File the sharp edges off of the exothermic weld. | This step ensures the integrity of the weld and prepares the surface to be coated. |

## OQ Task Name

Task 3.0 – Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance

## 1.0 Task Description

This task includes the physical measurement and documentation of electrical output of a rectifier. The task begins with the identification of the rectifier and ends with the documentation of data after measurement.

This task does not include data analysis.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 1 to include, but is not limited to, the following:

- Using voltmeters
- Using clamp-on ammeters
- Calculating current from shunt factor and voltage measurement—current output may be calculated based on shunt factor (ratio) and voltage drop across the shunt
- Validating of display meters with observed readings and with remote read devices, if applicable
- Understanding the importance of proper rectifier output polarity
- Providing accurate documentation of gathered data and appropriate communication, if necessary

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Reading outside of expected parameters, such as reverse polarity or inoperable rectifier | Take action, if qualified, or notify appropriate personnel of the observed condition for further analysis and/or repair. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the rectifier. | |
| 2 | Determine the voltage by connecting a voltmeter across the output terminals of the rectifier.<br>▪ Connect the positive lead to the rectifier positive terminal.<br>▪ Connect the negative lead to the rectifier negative terminal. | Obtaining accurate voltage and polarity are essential to maintaining cathodic protection. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Obtain the shunt factor by reading the value labeled on the shunt and dividing the amp value by the mV value. | Obtaining a shunt factor is essential to calculate current from millivolt reading obtained from a shunt. |
| 4 | Determine the current on a pre-installed shunt by reading the millivolt drop across the shunt and multiplying by the shunt factor. | Obtaining accurate current is essential to determining the effectiveness of a cathodic protection system. |
| 5 | Check voltage and current readings against display meters and/or remote monitoring devices, if applicable. | Validating remote devices and display meters is necessary to ensure accurate data is being received. |
| 6 | Record all required readings per operator’s procedures. | Up to date records are essential to maintaining a corrosion control system. Notify operator personnel if readings are non-existent or reversed in polarity. |

## OQ Task Name

Task 4.1 – Troubleshoot Rectifier

## 1.0 Task Description

This task begins when a rectifier is found inoperable and ends when the faulty rectifier component is identified for replacement and documentation is completed.

Repair or Replace Defective Rectifier Components is a separate covered task (Reference Task 4.2).

Adjustment of Rectifier is a separate covered task (Reference Task 4.3).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of troubleshooting a rectifier and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- Understanding of basic electricity, electrical circuits, and electrical schematics.
- Understanding the operation of rectifiers and the principles of converting AC current to DC current.
- Understanding component operation such as AC supply, circuit breakers or fuse, transformers, rectifier elements (selenium stack or diode array), shunts, adjustment links, DC output terminals, remote monitoring units, and surge protection.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Check for proper operation of components to determine faulty component.<br>Consult manufacturer's manual for detailed information. | Proper operation of components is necessary for rectifier operation. |
| 2a | Check the AC voltage input. If none, check circuit breaker or fuse. | If circuit breaker or fuse is faulty, identify it for replacement. |
| 2b | Verify power to the transformer, and check voltage from the output of the transformer. | If there is no voltage from the output, then the transformer is identified for replacement. |
| 2c | If the transformer output is present, then check the DC voltage at the rectifier element (selenium stack or diode array) output. | If no DC voltage is present, then the rectifier element (selenium stack or diode array) is identified as faulty. |
| 2d | Check the DC voltage output. If none, check the circuit breaker or fuse. | If the circuit breaker or fuse is faulty, identify it for replacement. |
| 2e | If no components are found at fault, check all wires and wiring connections, including lightning arrestors and surge protection. | Identify any bad wires or connections as faulty. |
| 3 | Document faulty components. | Black Box. |

## OQ Task Name

Task 4.2 – Repair or Replace Defective Rectifier Components

## 1.0 Task Description

This task begins after a faulty component has been identified and ends when the rectifier is operational and documentation is complete.

Troubleshoot Rectifier is a separate covered task (Reference Task 4.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of rectifier operation and rectifier components such as the following:

- Understanding component operation such as AC supply, circuit breakers, transformers, rectifier elements (stack), shunts, display meters, adjustment links, DC output terminals, remote monitoring units, and surge protection.
  - A transformer is a device used to change available voltage or current levels to desired power needs. Adjustment links (taps) are used as connectors on the secondary side of the transformer to allow different voltage settings to be selected for a desired output.
  - Rectifier elements or stacks are devices designed to allow current flow in one direction only. These stacks are used to convert alternating current to direct current in a rectifier.
  - Shunts are calibrated resistor links that allow current measurement in a rectifier.
  - A remote monitoring unit (RMU) is a device that transmits rectifier readings to a remote site via wireless media.
- Understanding the operation of rectifiers and the principles of converting AC current to DC current.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Prior to performing any of the following steps, de-energize and verify the external AC supply to the rectifier is off. | To avoid electrical shock and personnel injury. |
| 2a | If the AC breaker is at fault, complete the following on the primary AC breaker:<br>▪ Disconnect wires from the supply to the breaker.<br>▪ Disconnect wires from the breaker to the rectifier.<br>▪ Replace the defective breaker with a new breaker, if necessary.<br>▪ Connect wires from the breaker to the rectifier.<br>▪ Connect wires from the AC supply to the breaker. | Proper operation of the rectifier's AC breaker is essential to protect the rectifier components during power surges, electrical shorts, or component failures. |

| Step | Action | Explanation |
|---|---|---|
| 2b | If AC fuses are faulty, complete the following on the primary AC fuses:<br>▪ Remove the fuse or fuses.<br>▪ Replace the defective fuse or fuses with a correct size fuse. | Proper operation of the rectifier's AC fuses is essential to protect the rectifier components during power surges, electrical shorts or component failures. |
| 2c | If the transformer is faulty, complete the following on the transformer:<br>▪ Disconnect wires from the rectifier AC breaker to the transformer.<br>▪ Disconnect wires from the transformer to the coarse and fine tap panels.<br>▪ Replace the defective transformer with a new transformer.<br>▪ Connect wires from the transformer to the coarse and fine tap panel.<br>▪ Connect wires from the transformer to the AC rectifier breaker. | Transformers are required to reduce the primary AC voltage to a lower adjustable AC voltage. |
| 2d | If the rectifier element is faulty, complete the following on the rectifier element (stack):<br>▪ Disconnect wires from the fine and coarse tap panel to the stack.<br>▪ Disconnect wires from the rectifier element to the positive and negative DC output terminals.<br>▪ If the stack is selenium, remove the stack and replace it with a new stack.<br>▪ If the stack is silicon, remove the defective diodes and replace with new diodes.<br>▪ Connect wires from the stack to the positive and negative DC output terminals.<br>▪ Connect wires from the fine and coarse tap panel to the stack. | Rectifier stacks are required to change the AC current to the DC current. |
| 2e | If the DC fuses are faulty, complete the following on DC fuses:<br>▪ Remove the fuse or fuses.<br>▪ Replace the defective fuse or fuses with a correct size fuse. | Proper operation of the rectifier's DC fuses is essential to protect rectifier components during power surges, electrical shorts, or component failure. |
| 3 | Record all required information. | Up-to-date records are essential to maintaining a corrosion control system. |

## OQ Task Name

Task 4.3 – Adjustment of Rectifier

## 1.0 Task Description

This task begins with a defined need of rectifier adjustment based on cathodic protection system requirements and ends with proper adjustment of the rectifier and documentation.

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance is a separate covered task (Reference Task 3.0).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- Basic electricity and electrical circuits
- Understanding of rectifier operation and adjustment methods (typically a mechanical adjustment link on the transformer output)
- Use of voltmeter and electrical measurements
- Measuring the structure-to-soil potential (DC and AC) (Covered Task 1.1). These measurements are used to determine cathodic protection and necessary current adjustments to the rectifier.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Inability to achieve target output | Notify appropriate personnel for cathodic protection (CP) system analysis. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify rectifier needing adjustment. | |
| 2 | Determine the action to be taken. Either increase or decrease the output current with consideration of the entire system components, such as pipe-to-soil readings, bonds, etc. | Adjustments made to one rectifier may impact other system components. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Increase/decrease the fine tap setting in progressive steps until the desired settings have been achieved.<br>NOTE: Power should be off before making these adjustments.<br>Tap settings are current-carrying connections and should be tightened prior to re-energizing the rectifier. | When the required output current is obtained, the adjustment is complete. |
| 4 | If the fine tap setting reaches its limit, set the fine tap to the lowest setting and increase or decrease the coarse tap setting by 1 tap.<br>NOTE: Power should be off before making these adjustments.<br>Tap settings are current-carrying connections and should be tightened prior to re-energizing the rectifier. | Incremental adjustments will prevent the current from exceeding design limits. |
| 5 | Adjustments should be based on indicators such as pipe-to-soil readings, historical data, or design criteria. | Rectifiers are part of an overall CP system and must be adjusted based on system requirements. |
| 6 | Record all required information per operator's procedures. | Up to date records are essential to maintaining a corrosion control system. |

## OQ Task Name

Task 5.1 – Examine for Mechanical Damage on Buried or Submerged Pipe

## 1.0 Task Description

Each time a pipeline is exposed, the operator must perform an inspection/examination of the pipe and the coating for evidence of damage and/or abnormalities. This task is to verify whether mechanical damage like dents, gouges, etc. exist on the pipeline and to ensure proper documentation and reporting have occurred. This task begins after the pipeline surface has been prepared for inspection and ends after inspection results are documented and reported.

Measure Pit Depth with Pit Gauge is a separate covered task (Reference Task 8.1).

Measure Wall Thickness with Ultrasonic Meter is a separate covered task (Reference Task 8.2).

Examine for External Corrosion on Buried or Submerged Pipe is a separate covered task (Reference Task 5.2).

Inspect the Condition of External Coating on Buried or Submerged Pipe is a separate covered task (Reference Task 5.3).

Measure Corroded Area is a separate covered task (Reference Task 8.3).

Coating tasks are separate covered tasks (Reference 7-Series Tasks).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Mechanical Damage**
Visible physical damage to the metallic surface of the pipeline that, at a minimum, may include one or more of the defects listed below.

**Dent**
A depression in the surface that has been created by external forces on the pipeline with no visual evidence of metal loss.

**Buckle**
A bend, bulge, or kink that can cause flattening or changes in the curvature of the pipe.

**Gouge**
A groove in which metal has been removed or displaced from the surface.

**Scratch**
A thin, shallow cut or mark on the surface.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually observe the exposed pipe for integrity issues such as evidence of a release or significant metal deformation. | Helps ensure that the pipeline is safe for operation and continued task performance. |

| Step | Action | Explanation |
|---|---|---|
| | If the observation identifies integrity issues that are not safe, discontinue the task and make immediate notifications. | |
| 2 | Confirm that the pipeline surface has been prepared for the mechanical damage inspection. | Proper surface preparation is critical to identifying and locating all types of mechanical damage present on the exposed pipe. |
| 3 | Inspect the exposed pipeline to determine if mechanical damage exists. | Inspection for mechanical damage is critical to identify potential risks that need further assessment to avoid future leaks or failures. |
| 4 | Identify the type(s) and location(s) of mechanical damage.<br><br>There are a variety of methods to describe the location of the damage. One of the more common methods is to locate the damage circumferentially with respect to a clock face. The location of the seam weld and the longitudinal distance to the nearest girth weld are also typically reported. | The type(s) and location(s) of the damage are used to determine later actions such as whether repairs are needed, and if so, what kind of repair is needed. |
| 5 | Document the findings, and make notifications. | Follows the operator’s policies/procedures for appropriate documentation, notification protocol, and actions required. |

## OQ Task Name

Task 5.2 – Examine for External Corrosion on Buried or Submerged Pipe

## 1.0 Task Description

Each time a pipeline is exposed, the operator must perform an inspection/examination of the pipe and the coating for evidence of corrosion. The inspection verifies whether external corrosion exists on the pipeline. This task begins after the pipeline surface has been prepared for inspection and ends after inspection results are documented and reported.

Measure Pit Depth with Pit Gauge is a separate covered task (Reference Task 8.1).

Measure Wall Thickness with Ultrasonic Meter is a separate covered task (Reference Task 8.2).

Measure Corroded Area is a separate covered task (Reference Task 8.3).

Examine for External Corrosion on Buried or Submerged Pipe is a separate covered task (Reference Task 5.2).

Inspect the Condition of External Coating on Buried or Submerged Pipe is a separate covered task (Reference Task 5.3).

Measure Corroded Area is a separate covered task (Reference Task 8.3).

Coating tasks are separate covered tasks (Reference 7-Series Tasks).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**General Corrosion**
An electrochemical reaction that takes place uniformly over the surface of steel, thereby causing general thinning of the component that could lead to eventual failure of the material.

**Pitting**
An electrochemical reaction that creates metal loss of the outer surface in small, crater-like depressions which have the potential to cause rapid wall loss.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually observe the exposed pipe for integrity issues such as evidence of a release or significant metal deformation.<br><br>If the observation identifies integrity issues that are not safe, discontinue the task and make immediate notifications. | Helps ensure that the pipeline is safe for operation and continued task performance. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Confirm that the pipeline surface has been prepared for the external corrosion inspection. | Proper surface preparation is critical to identifying and locating all types of external corrosion present on the exposed pipe. |
| 3 | Examine the exposed pipe for any areas of external corrosion. | Inspection for external corrosion is critical to identify potential risks that need further assessment to avoid future leaks or failures. |
| 4 | Identify the type(s) and location(s) of any corrosion on the pipeline.<br><br>There are a variety of methods to describe the location of the corrosion. One of the more common methods is to locate the corrosion circumferentially with respect to an analog clock face. The location of the seam weld and the longitudinal distance to the nearest girth weld are also typically reported. | The type(s) and location(s) of the corrosion are used to determine later actions such as whether repairs are needed, and if so, what kind of repair is needed. |
| 5 | Document the findings, and make notifications. | Follows the operator’s company policies/procedures for appropriate documentation, notification protocol, and actions required. |

## OQ Task Name

Task 5.3 – Inspect the Condition of External Coating on Buried or Submerged Pipe

## 1.0 Task Description

Each time the pipeline is exposed, the operator must perform an inspection/examination of the pipe and the coating. The inspection should verify whether the coating is intact (free from damage and/or degradation) and is adequately bonded to the pipe's surface. This task begins after the coated pipeline is exposed and ends after coating inspection results are documented and reported.

Examine for Mechanical Damage on Buried or Submerged Pipe is a separate covered task (Reference Task 5.1).

Examine for External Corrosion on Buried or Submerged Pipe is a separate covered task (Reference Task 5.2).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Pipeline Coating Types**
Pipeline coating types, at a minimum, may include one or more the following:

**Asphalt Coatings**
A pipeline coating that consists of a naturally occurring material which is derived either by mining (e.g., Gilsonite), or it is a residue from the distillation of asphaltic petroleum. Asphalt coatings vary in their chemical and physical characteristics. Asphalt properly applied to steel or concrete surfaces has good adhesion properties, can be applied to thickness up to 100 to 200 mils, and is chemically stable with good resistance to water, most chemicals, and salts.[1]

**Coal Tar Coatings**
A pipeline coating that is manufactured by dissolving processed coal tar pitch, or a blend of these pitches, in suitable solvents. The coating is cured by evaporating the solvents. Coal tar coatings are made in different consistencies; those without any inert filler and those which contain inert materials to build film thickness. Coal tar coatings have good resistance to weak acids, alkalis, salts, seawater, and other aggressive atmospheres. This coating provides protection by the exclusion of moisture and air from the underlying surface.[1]

**Extruded Coatings**
A dual layer pipeline coating that consists of an extruded polyethylene topcoat applied over a rubberized asphalt adhesive. Typically, the polyethylene coating or jacket is "yellow" in color. The nature of the high density polyethylene outer jacket is formulated to protect the asphalt adhesive during handling and installation. While applied in thin layer, the asphalt adhesive provides the primary protection from corrosion consistent with the properties of an asphalt coating.[2]

**Fusion-Bonded Epoxy Coatings**
A pipeline coating that consists of a powdered epoxy applied to a heated pipe by electrostatic methods (i.e., the powdered coating is attracted to the pipe by using the principles of static electricity). The powder gels and flows with the heat and then will cure and harden during cooling. The process creates a tight physical bond between the coating and the metal.[3]

**Petrolatum Coating Products**
Rust preventative products that contain petrolatum, which is a smooth, semisolid blend of mineral oil with waxes crystallized from residual-type petroleum lubricating oil. The wax molecules contain 30 to 70 carbon atoms and are straight chains with a few branches or napthene rings.

**Shrink Sleeve Products**
A shrink sleeve is a polymer sleeve that is applied to the pipe, most usually over a girth weld, and heated according to a specific procedure to cause the sleeve to shrink into place on the pipe, causing the adhesive to bond to the pipe and to the adjacent coatings it overlaps.

**Tape Coatings**
The tape system consists of a primer applied directly to the pipe surface, an inner-wrap tape layer that provides a corrosion barrier and an outer-wrap tape layer that provides mechanical protection.

## Coating Abnormalities

**Coating Abnormalities** — Change or failure of the coating attributed to one or several of the following: formulation related (e.g., checking, cracking, discoloration and similar phenomena), improper coating selection, incompatibility with the surface over which it is applied, improper or poor surface preparation, improper application (e.g., inadequate thickness, pinholes, overspray, improper drying, and improper curing), adhesion related, structural surface issues (e.g., sharp edges, crevices, skip welds, and back-to-back angles), and exterior forces (e.g., chemical exposure, abrasion, reverse impact, and severe weathering).[1]

**Bonding**
The joining of the coating system and the pipeline in a manner where they are adhered or united by means of adhesive, heat, or pressure.

**Coating Disbondment**
Failure of the bond between the coating and the pipe's surface.

**Cracking – As It Relates to Coatings**
A physical separation to otherwise bonded coating that has an appearance of fissures.

**Holiday**
An undesirable discontinuity or break in the coating system. Electronic testing devices detect flaws in the protective coating.

**Biological**
Bacteria and fungi are the primary microorganisms that can act on coatings. There are two types of action. One is the activity of a microorganism due to dirt and contamination on the coating. In this case, the bacteria or fungi merely live on the surface of the coating and do not necessarily affect its protective nature. The second type is where the microorganisms actually uses the coating for food and derive their energy from it. Under certain conditions, coatings can be rapidly disintegrated by this type of action.[1]

## Coating Methods

**Spiral Wrap**
A method used to apply coating in a continuous fashion around the circumference of the pipeline.

**Cigarette Wrap**
A method used to apply coating one wrap at a time around the circumference of the pipeline.

**Coating Overlap**
The amount one wrap of coating overlaps the adjacent wrap of coating.

**Manufacturer Applied Coating**
This application of the pipe coating is done in a coating mill or similar location under controlled environmental conditions. On-site testing is performed to ensure that the surface of the pipe is properly prepared, that the temperature of the pipe is controlled, that the applied coating

thickness meets specifications, and that the pipe is free of coating voids or holidays. Additional on-site laboratory testing may include the following: cathodic disbondment testing, bend testing, adhesion testing, and abrasion/impact test. The pipe is shipped to the installation site in a pre-coated condition with the ends of the pipe prepared to facilitate welding and joining procedures.

**Field-Applied Coating**
The application of the pipe coating is done in the field under variable environmental conditions. Typically, this includes the field coating of welded joints and/or fittings during original construction; or when required, during routine maintenance activities as the pipeline is exposed and the coating has been removed or repaired. The field coating may or may not be the same material as the parent pipe coating – but the application process and physical properties need to be compatible. Field coatings typically have a wider tolerance of surface preparation condition. The coating is typically hand applied but can be machine applied. Coating thickness and adhesion to the pipe surface can vary based on the consistency of the application.

[1]Munger, Charles G., *Corrosion Prevention by Protective Coatings*, National Association of Corrosion Engineers, 1984
[2]Open domain, Microsoft Explorer, (www.brederoshaw.com/solutions/yellow_jacket.htm)
[3]National Center for Construction Education and Research (NCCER), Pipeliner Training and Assessment Program (PTAP), Contren Learning Series, Module 61107-02, *Apply and Repair External Coatings on Buried and Submerged Pipe*

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually observe the exposed pipe for integrity issues such as evidence of a release or significant metal deformation.<br><br>If the observation identifies integrity issues that are not safe, discontinue the task and make immediate notifications. | Helps ensure that the pipeline is safe for operation and continued task performance. |
| 2 | Identify the type of existing coating. | It is necessary to be able to identify the type of coating that exists on the pipe so that a proper coating inspection can be conducted. |
| 3 | Examine the exposed coated pipe and determine if there are any flaws or abnormalities in the coating. | Inspection of the coating is critical to identify potential risks that need further assessment to avoid future leaks or failures. |
| 4 | Identify the type and location of coating damage, if any.<br><br>There are a variety of methods to determine location of the damage. One of the more common methods is to locate the damage circumferentially with respect to an analog clock face. The location of the seam weld and the longitudinal distance to the nearest girth weld are also typically reported. | The type and location of the damage are used to determine later actions, such as whether repairs are needed, and if so, what kind of repair is needed. |
| 5 | Document the findings and make notifications. | Follows the operator’s policies/procedures for appropriate documentation, notification protocol, and actions required. |

## OQ Task Name

Task 8.1 – Measure Pit Depth with Pit Gauge

## 1.0 Task Description

This task is used to measure the wall loss that can occur from mechanical damage or corrosion utilizing a mechanical pit gauge, dial gauge or equivalent instrument. In the case where the pipeline has been opened, internal corrosion can be assessed in the same manner. This task begins when the steel surface of the pipe is exposed and prepared for inspection and ends when measurements are documented and proper notifications are made.

Measure Corroded Area is a separate covered task (Reference Task 8.3).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The definition applicable to this task is as follows:

**Wall Loss**
Removal of metal caused by either mechanical damage (e.g. gouge or groove) or corrosion (e.g., general or pitting).

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually observe the exposed pipe for integrity issues such as evidence of a release or significant metal deformation.<br>If the observation identifies integrity issues that are not safe, discontinue the task, and make immediate notifications. | Helps ensure that the pipeline is safe for operation and continued task performance. |
| 2 | Clean and remove debris from the area to be measured. | The presence of debris will interfere with obtaining an accurate reading. |
| 3 | Calibrate the pit gauge, or verify that the gauge is working properly. | Ensures accurate measurement by verifying that the pin on the depth indicating arm has not been damaged. |
| 4 | Position gauge flush and longitudinally across area to be measured, holding firmly against the surface ensuring that the pit gauge is supported on non-corroded surfaces.<br>NOTE: If the surface is irregular due to surface conditions such as girth weld, a bridging bar may be used for a platform reference for the gauge. | Ensures that measurement is from the pipe surface. |
| 5 | Move the depth indicator until it contacts the deepest part of the wall loss. | Necessary to determine maximum wall loss. |

| Step | Action | Explanation |
|---|---|---|
| 6 | Read and record depth and longitudinal length measurements. | Measurements are used to evaluate the impact on operating pressure. Measurements are typically recorded in mils (thousandths of an inch). |
| 7 | Repeat several measurements to verify the deepest area of wall loss. | Verifies overall average of wall loss depth. |
| 8 | Document the findings and make notifications. | Follow operator’s policies/procedures for appropriate documentation, notification protocol, and actions required. |

## OQ Task Name

Task 8.2 – Measure Wall Thickness with Ultrasonic Meter

## 1.0 Task Description

Performing this task involves the use of an Ultrasonic Thickness (UT) Meter to accurately collect and record a wall thickness reading on the pipeline or related appurtenance. This task begins when a steel pipe surface is exposed and prepared for inspection and ends when measurements are documented and proper notifications are made.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Calibrate**
The process of assuring an instrument's accuracy by comparing the instrument's reading to a known wall thickness. Some instruments may require adjusting the sound velocity to match the material being measured.

**Couplant**
A substance (typically a liquid or gel) used to transmit the sound waves between the transducer and pipeline during ultrasonic examination.

**Transducer**
A device or element that transmits a signal from the outer surface and receives that signal from the backwall (inner wall surface) to obtain a measurement of wall thickness.

**Nominal Wall Thickness**
The expected wall thickness determined by alignment sheets or other records.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually observe the exposed pipe for integrity issues such as evidence of a release or significant metal deformation.<br><br>If the observation identifies integrity issues that are not safe, discontinue the task, and make immediate notifications. | Helps ensure that the pipeline is safe for operation and continued task performance. |
| 2 | Assemble, check, and calibrate UT meter for proper operation. | Proper assembly and calibration are required to obtain accurate readings. |
| 3 | Prepare, clean, and remove debris from surface to be measured. | Debris will interfere with accurate readings and need to be removed. |
| 4 | Apply a couplant to the area to be measured. | The use of a couplant is necessary to maintain consistent contact and allow sound waves to be transmitted with the surface for accurate readings. |

| Step | Action | Explanation |
|---|---|---|
| 5 | Measure wall thickness by placing the transducer firmly into the couplant and ensuring it is oriented to the pipe surface according to manufacturer's instructions. | Proper placement of the transducer is necessary to obtain accurate readings. |
| 6 | Observe meter display to obtain a measurement of wall thickness. | Ensure that the unit of measure is correct and that the display indicates a stable reading was obtained. |
| 7 | Repeat several measurements to confirm nominal wall thickness. | Verifies overall wall thickness and ensures measurements are not affected by internal corrosion or laminations. |
| 8 | Document the findings and make notifications. | Follow operator's policies/procedures for appropriate documentation, notification protocol, and actions required. |

## OQ Task Name

Task 8.3 – Measure Corroded Area

## 1.0 Task Description

While conducting this task, the individual creates a visual representation of the pipeline segment after the corrosion has been identified, including all areas of localized corrosion. This task begins when the steel pipe surface has been exposed and prepared for inspection and ends when measurements are documented and proper notifications are made.

Measure Pit Depth with Pit Gauge is a separate covered task (Reference Task 8.1).

Measure Wall Thickness with Ultrasonic Meter is a separate covered task (Reference Task 8.2).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**General Corrosion**
An electrochemical reaction that takes place uniformly over the surface of the steel, thereby causing a general thinning of the component that can lead to eventual failure of the material.

**Pitting**
An electrochemical reaction that creates metal loss of the outer surface in small, crater-like depressions which have the potential to cause rapid wall loss.

**Interaction**
If two or more locations of localized corrosion are located in close proximity, the combination of effects may cause a loss of wall strength and must be recognized. The distance between areas and the dimensions of the localized corrosion determine the wall strength required based on pipe type, nominal wall thickness, and diameter.

**Localized Corrosion**
Individual areas of pitting or general corrosion areas at discrete sites that may also contain pitting. Areas of localized corrosion in the area of girth or longitudinal welds should be identified and documented.

**Profile**
Graphic (depth and length) representation of the affected area and/or individual pit measurements ("peaks and valleys") that includes a level of detail necessary to provide a profile of the pipe surface (this is sometimes called a "river bottom profile").

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually observe the exposed pipe for integrity issues such as evidence of a release or significant metal deformation.<br><br>If the observation identifies integrity issues that are not safe, discontinue the task and make immediate notifications. | Helps ensure that the pipeline is safe for operation and continued task performance. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Obtain proper tools for the work assignment, which may include a tape measure, pit gauge, ultrasonic gauge, metallic ruler, bridging bar, or other measuring devices to take accurate measurements. | Necessary equipment and tools required to complete task. |
| 3 | Prepare, clean, and remove debris from the surface to be measured. | Coatings, primer, and surface deposits may interfere with accurate readings and need to be removed. |
| 4 | Create a representation of the pipe surface to be inspected so that corroded areas on the pipeline can be accurately represented. Identify the long seam and the nearest girth weld as reference points and identify corrosion in proximity. | Typically, the pipeline is represented on paper as split at 12:00 or 6:00 (of an analog clock face) and flattened to represent the pipe as a rectangle. The format is determined based on operator's policy. |
| 5 | Overlay a grid on each area of localized corrosion. | Grids are used to represent areas of general corrosion to provide additional detail for assessment. |
| 6 | Measure longitudinal length of each area of localized corrosion. | This measurement is required for assessment of pipeline integrity. |
| 7 | Measure circumferential width of each area of localized corrosion. | Used to properly identify the localized corrosion on the overall representation. |
| 8 | Measure the distance between each area of localized corrosion. | Used to properly identify the localized corrosion on the overall representation. This is also used to determine the interaction between discrete areas of localized corrosion. |
| 9 | Obtain profile measurements of the corrosion region.<br>The profile measurements can be represented as the remaining wall thickness or actual pit/general corrosion depth. | This must be performed by an individual qualified on Task 8.1 "Measure Pit Depth with Pit Gauge" and/or Task 8.2 "Measure Wall Thickness with Ultrasonic Meter." |
| 10 | Obtain and determine nominal wall thickness. | This must be performed by an individual qualified on Task 8.2 "Measure Wall Thickness with Ultrasonic Meter." |
| 11 | Identify areas of greatest wall loss within each area of localized corrosion and obtain pit depth measurements. | This must be performed by an individual qualified on Task 8.1 "Measure Pit Depth with Pit Gauge" and/or Task 8.2 "Measure Wall Thickness with Ultrasonic Meter." |
| 12 | Document the findings and make notifications. Denote all areas of localized corrosion, distances between those areas and pit depth readings on the representation. | Follow the operator's policies/procedures for appropriate documentation, notification protocol, and actions required. |

## OQ Task Name

Task 9.1 – Install Bonds

## 1.0 Task Description

The purpose of a cathodic protection bond is to connect two or more structures electrically to better use cathodic protection systems and prevent possible structure damage caused by interference. This task begins with the defined need of a bond on cathodic protection system requirements and ends with installation of the bond.

Test to Detect Interference is a separate covered task (Reference Task 1.3).

Install Test Leads by Non-Exothermic Welding Methods is a separate covered task (Reference Task 2.3).

Install Test Leads by Exothermic Welding Methods is a separate covered task (Reference Task 2.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- Types of bonds, critical and non-critical. Critical bonds are bonds that, if disconnected, may be detrimental to one of the structures. Critical bonds are determined by an operator's procedures.
- Installing interference bond facilities at the location of current discharge, if possible.
- Bonds are metallic connections between structures. Exothermic (thermite) welding, pin brazing, or bolt-on connections may be used to connect bond wires/cables and test leads to the structures. Bond leads and test leads are terminated in a test station to allow inspection.
- Shunts are commonly used between the structures to determine the current amplitude and polarity between the structures.
- Blocking diodes may become necessary to prevent current flow in the opposite direction, such as when bonding to DC traction systems.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Discover broken or damaged test lead or bond cable | Notify operator personnel for repair, as required. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the structures to be connected. | Structures to be bonded must be properly identified and marked for connections. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Install the test leads and bond cables/wires on both structures at the location of current discharge. | Test leads are not used for current-carrying connections. In addition to bond cables/wires being installed, test lead wires may also be installed on both structures to avoid taking potentials on a current-carrying connection. |
| 3 | Attach the test leads and bond cables/wires by exothermic (thermite) weld, pin brazing, or other method, which will yield a permanent, low resistance connection. | A very low resistance path for current return is required for optimal current transfer. |
| 4 | Terminate the test leads and bond cables/wires inside of the test box/station that is accessible to both structures. | Affected parties need to be able to monitor the bond. |
| 5 | Install shunts for measurement of current flow and resistance (as required to limit current interchange) inside of the test box/station. | It is important to monitor the magnitude and direction of current flow. |
| 6 | Install blocking diodes, as required. | Occasionally it becomes necessary to prevent current flow in the opposite direction, such as when bonding to DC transit systems. |
| 7 | Conduct tests to determine the effectiveness of the installed interference bond. | It is important to determine that all negative effects of the interference have been mitigated. |
| 8 | Document readings as required by the operator’s procedures. | Documentation and communication of the bond installation is critical to future testing. |

## OQ Task Name

Task 9.2 – Install Galvanic Anodes

## 1.0 Task Description

Galvanic anodes are installed to provide cathodic protection for buried or submerged metallic structures. Galvanic anodes may be used for stray current mitigation. This task begins with determining the location and method of installation as designed and ends when the anode is installed and connected.

Install Test Leads by Non-Exothermic Welding Methods is a separate covered task (Reference Task 2.3).

Install Test Leads by Exothermic Welding Methods is a separate covered task (Reference Task 2.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- Knowledge of connection methods. Connections are made in a test station with a lead connected to the structure being protected and across a shunt for measurement and testing. Isolation of galvanic anodes may be necessary for additional testing of the structure.
- Knowledge of the different types of galvanic anodes and their applications. Galvanic anodes may be used for direct cathodic protection, shielding of electrical interference, spot protection, or AC mitigation. Applications may be in various soil conditions, underwater or offshore, or where power for implied systems is unavailable.
- Galvanic anodes are typically supplied in special backfill (hydrated gypsum, bentonite clay, and sodium sulfate). This backfill must be wet for the anodes to start discharging current.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Discover broken or damaged test lead or bond cable | Notify operator personnel for repair, as required. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Galvanic Anodes – Determine the most suitable location within design considerations. | A location that has high sub-surface moisture content is preferred. Moisture in the electrolyte is essential for proper operation of the anode. |
| 2 | Place the anode in an electrolytic environment that is moist. | Vertical anodes can be located in augered holes while horizontal anodes may require backhoe excavation. Excavations should be sufficiently deep so that ground water levels will not dry out. Anode holes should be at least as deep as the pipeline. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Install the anode by placing in an augered hole or horizontal excavation.<br><br>NOTE: Anodes must be removed from the manufacturer’s protective packaging before installation. | Care needs to be exercised to minimize damage to the anode or its prepackaged backfill. |
| 4 | Wet down the anode prior to backfilling or prior to installation in the ground. | Galvanic anodes are typically supplied in special backfill (hydrated gypsum, bentonite clay, and sodium sulfate). This backfill must be wet for the anodes to start discharging current. |
| 5 | Uncoil the anode pigtail and extend fully, being careful not to damage or kink wire. | The anode lead wire (pigtail) comes coiled at one end of the anode bag. Care must be taken to ensure that this lead wire is not damaged. This will prevent premature failure. |
| 6 | If the design is for direct connection, then the test lead is connected directly to the pipe. Install shunts for measurement of current flow and resistance (as required to limit current interchange) inside of the test stations. | Connection to the pipe is necessary for anode operation; connection to the pipe via a shunt is important to monitor the magnitude of current flow. |
| 7 | Backfill carefully with native soil backfill. Use rock-free backfill to pad the anode and the anode lead wire. | Care must be taken in the backfill process to ensure that the anode and its lead wire are not damaged. |
| 8 | Document installation as required by operator’s procedures. | Documentation is necessary to maintain record of installed anode locations. |

## OQ Task Name

Task 9.3 – Install Rectifiers

## 1.0 Task Description

The installation of impressed current cathodic protection rectifiers is essential in protecting facilities against external corrosion. This task begins with the location selection and initial installation of connections to the structure being protected and the groundbed. This task ends when rectifier is installed, connected to the structure/anodes, and the installation is documented.

Adjustment of Rectifier is a separate covered task (Reference Task 4.3).

Install Test Leads by Non-Exothermic Welding Methods is a separate covered task (Reference Task 2.3).

Install Impressed Current Groundbeds is a separate covered task (Reference Task 9.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- Understanding of basic electricity and electrical circuits.
- Type of rectifier being installed, air cooled, oil cooled explosion proof, solar powered, etc.
- Mounting requirements, pole mount, or rack mount.
- Termination at the proper terminal is essential. Crossing the wires (connecting the anode groundbed to the negative and the structure to the positive) can have disastrous consequences.

No task-specific abnormal operating condition (AOC) identified; only general AOCs are applicable.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify, as designed, the rectifier for the location and service. | Rectifiers are available for non-hazardous and for hazardous locations. They can be air-cooled, oil-cooled or explosion proof. They can be supplied for either single phase or three-phase service with input voltages as high as 480 volts AC. Rectifiers can be designed for a myriad of DC output voltage and current configurations. |
| 2 | Mount the rectifier securely at the designated location. | Rectifiers may be mounted on poles, posts, walls, panels, concrete pads, etc., and must be mounted securely using appropriately sized fasteners. Insecure fastening could lead to damage and bodily injury.<br>NOTE: Installation must meet all applicable building and electrical codes. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Connect the AC power feed wires through an appropriately sized conduit in accordance with the applicable sections of the National Electric Code, the National Electric Safety Code, and local electric and building codes. | The AC supply to a rectifier is usually made through a safety switch or circuit breaker panel. It is important to consult the applicable codes and requirements to prevent electrical shock. The AC conduit is usually connected to the "knockout" supplied for that purpose. |
| 4 | Terminate the AC feed wires at terminals on circuit breaker or AC input connection wires. | Refer to the installation portion of the rectifier manual for AC termination. |
| 5 | Connect the DC conduits to the rectifier. | DC conduits are used to house the DC output cables from their termination at the DC output terminals to a point underground from which the cables usually run directly buried to the groundbed (Positive) and structure (Negative).<br><br>NOTE: In hazardous areas, seal conduits may be required below the rectifier. |
| 6 | Install the DC cables from the anode groundbed and the structure in their respective conduits, and terminate on their respective terminals.<br><br>NOTE: The positive cable is connected to the anodes and the negative is connected to the structure. | It is imperative that care be taken during this phase of the installation. Termination at the proper terminal is essential. Crossing the wires (connecting the anode groundbed to the negative and the structure to the positive) can have disastrous consequences. |
| 7 | Test and verify that cables are correctly installed. | Incorrect cable connections will cause the pipeline or structure that is intended to be protected to become an anode causing it to rapidly corrode. |
| 8 | Document installation as required by operator's procedures. | Documentation is necessary to maintain record of rectifier installation. |

## OQ Task Name

Task 9.4 – Install Impressed Current Groundbeds

## 1.0 Task Description

Impressed current groundbeds are installed to provide cathodic protection for buried or submerged metallic structures. This task begins with verification that site location, material, and method of installation all comply with design requirements. The task ends when the impressed current anodes are installed and that documentation has been completed as required.

Design of impressed current groundbeds is not included in this covered task.

Adjustment of Rectifier is a separate covered task (Reference Task 4.3).

Install Rectifiers is a separate covered task (Reference Task 9.3).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of cathodic protection systems and components comparable to NACE Certification Level CP 2 to include, but is not limited to, the following:

- Knowledge of connection methods. Impressed current anodes are connected together to form an anode bed. Connections are made based on configuration and design of the bed which may include a termination box with a lead connected to the positive lead of the rectifier. Shunts may be used for measurement and testing of individual anodes. Isolation of individual anodes may be necessary for additional testing of the anodes.
- Impressed current anodes are installed in special backfill (coke breeze or other fill material).
- A header cable is a cable or wire to which the anode lead wires are connected.
- A splice connection is the electrical connection between the anode lead wire and the header cable/wire or between anodes. These splice connections must be carefully insulated to prevent the connection from oxidation.
- Adjustment of the rectifier is performed after the anode system is energized to set cathodic protection levels.

No task-specific abnormal operating condition (AOC) identified; only general AOCs are applicable.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify that the location and materials are in accordance with design criteria. | Impressed current anodes are usually installed in rights-of-way that are separated from the pipeline. Locations are selected using criteria such as soil resistivity, topography, proximity to other structures, and geography to determine location. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Lay out the number, spacing and configuration of the anodes at a selected location in accordance with design criteria (i.e., remote vs. distributed). | Remote (Deep Well or Conventional):<br>Install vertically or horizontally as designed for the location and typically more than a hundred feet away from pipeline.<br>Distributed:<br>Locate in close proximity to the structure and typically installed a minimum of ten feet from the structure. |
| 3 | Excavate a vertical hole or horizontal ditch for anode installation.<br>NOTE: If coke breeze or other fill material is required by design to enhance current flow, it must be installed during the installation of the anodes. | Excavation techniques may include ditching, augering, drilling, etc.<br>Anodes are also installed as replacement for expended anodes.<br>Anodes must be installed in the soil or submerged in water that is electrically continuous with the pipeline backfill. (Common electrolyte.) |
| 4 | Carefully install anode in the excavated hole.<br>Ensure that anodes are placed flat in horizontal installation or centered in bore for vertical installation.<br>NOTE: Do not lift or lower the anode by its lead wire to prevent damage to the anode. | Anodes are to be lowered carefully into the excavations, being careful not to damage the anode, its lead wire, or the lead wire to anode connection. Any damage will lead to premature failure. |
| 5 | Install the anode header cable between the groundbed and the rectifier. | Care must be observed during this process, as any damage to the cable insulation will lead to premature failure of the groundbed. DC current will be discharged at any breaks in the cable insulation. |
| 6 | Backfill the vertical hole or horizontal ditch. | Anodes must be installed in the soil or submerged. Backfill material must be free of rocks and debris to prevent damage to cable insulation. |
| 7 | Document installation as required by operator’s procedures. | Documentation is necessary to maintain record of groundbed installation. Documentation must include the number of anodes and the manner or spacing of installation. |

## OQ Task Name

Task 9.5 – Repair Shorted Casings

## 1.0 Task Description

The pipe and the pipe casing are designed to be electrically isolated from each other to allow cathodic protection for the pipe. Electrically shorting the casing to the pipe draws protection away from the pipe and may not allow adequate protection in the cased area. This task begins when the pipeline casing end(s) have been exposed and ends when the pipeline casing is tested for isolation.

Measurement of Structure-to-Soil Potentials is a separate covered task (Reference Task 1.1).

Inspect the Condition of External Coating on Buried or Submerged Pipe is a separate covered task (Reference Task 5.3).

Install Test Leads by Exothermic Welding Methods is a separate covered task (Reference Task 2.4).

Locate Line is a separate covered task (Reference Task 14.1).

Monitoring Excavation Activities is a separate covered task (Reference Task 32.0).

Backfilling a Trench Following Maintenance is a separate covered task (Reference Task 39.0).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

- Basic knowledge of casing systems including end seals, insulators, and vent connections.
  - Casings are oversized pipe required in some instances to reduce external load on the pipeline, such as railroad crossings, interstate highways, etc.
  - End seals are kits composed of rubber, vinyl, or other composites to seal the pipeline/casing interface to prohibit water and contaminants from infiltrating the casing.
  - Isolating spacers are installed on the pipeline to prevent metallic contact with the casing. Spacers must have sufficient mechanical strength to withstand installation and to maintain isolation.
  - Vent connections are made to provide an atmospheric outlet to the casing to prevent pressure buildup and access to test the casing atmosphere. One vent is attached on the bottom of the pipe and one is attached on the top to allow insertion of non-metallic material.
- Metallic shorts are caused by metal to metal contact between the pipe and casing.
- Electrolytic shorts are caused by material in casing that provides a current path between the pipe and casing such as water or soil.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexplained hydrocarbon encountered | Take action, if qualified, and notify personnel of observed condition, as required. |
| Fire/explosion | Take action, if qualified, and notify personnel of observed condition, as required. |
| Pipeline damage | Take action, if qualified, and notify personnel of observed condition, as required. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Clear a workable area and support the pipeline as needed. | This provides sufficient working room for seal work, coating repair, etc. Supporting the pipeline may be necessary to prevent sagging or future damage. Factors that could affect the support could include things such as diameter, length, product, etc. |
| 2 | Remove the end seal. | This exposes the carrier pipe at the casing end. |
| 3 | Inspect the ends of the carrier pipe and casing to determine whether metallic contact is visible. | Inspect for location of metal contact which may be near end seal or other location in casing. |
| 4 | If pipe has settled, then center the carrier pipe within the casing if possible.<br>NOTE: Pipeline/casing support must be performed in accordance with engineering procedures or work plans to prevent damage to pipeline. | This is to ensure there is no contact with the carrier pipe and casing. If pipe has to be lifted, follow procedures for moving in-service pipe.<br>On long casings, cutting off excess casing may eliminate the casing short. |
| 5 | If coated pipeline, ensure coating is bonded to carrier pipe.<br>NOTE: Inspect the Condition of External Coating on Buried or Submerged Pipe is a separate covered task (Task 5.3). | Coating is necessary for good cathodic protection and isolation. |
| 6 | Install casing insulator (isolating spacers) and centering cradle while providing adequate support. | Isolating spacers are used to maintain electrical isolation of the carrier pipe from the casing. Adequate support reduces strain on a pipeline that could cause a pipeline rupture or metallic contact between the carrier pipe and casing. |
| 7 | If no metallic contact is found, an electrolytic condition may be the cause of elevated potentials on the casing. | Potentials on a casing may be elevated due to an electrolytic condition. |
| 8 | Resolution of electrolytic condition may require removal of the electrolyte material in the casing if possible. Resolution of an electrolytic condition may not be necessary. | Excess material in casing should be removed (blown out) if possible while end seals are removed. |
| 9 | Replace the end seal. | |
| 10 | Install the test leads as required.<br>NOTE: Install Test Leads by Exothermic Welding Methods is a separate covered task (Task 2.4).<br>NOTE: Measurement of Structure-to-Soil Potentials is a separate covered task (Task 1.1). | Test leads on both the carrier pipe and casing may be required for testing casing isolation.<br>NOTE: Conduct a Pipe-to-Casing Potential Difference test to determine that pipe and casing are isolated. |
| 11 | Document repair as required by operator's procedure. | |

## OQ Task Name

Task 14.1 – Locate Line

## 1.0 Task Description

This task includes establishing the location of a pipeline. This task requires the use of maps, drawings, and locating equipment. A variety of line locating tools and methods can be used to locate a line; this task is not specific to any one tool or method.

This task begins when the need to locate a line has been identified and ends when the correct line segment has been located.

Install, Inspect, and Maintain Permanent Marker is a separate covered task (Reference Task 14.2).

Install, Inspect, and Maintain Temporary Marker is a separate covered task (Reference Task 14.5).

NOTE: If this qualification is performed on a pipeline subject to regulation by 49 *CFR* Part 192 or 195 and potholing is used for verification, an individual qualified for Task 32 “Observe Excavation Activities” must observe or perform the potholing activity.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**One-Call Notification System**
A communication system in which a call center receives notices from excavators of intended excavation activities and transmits the notices to operators of underground pipeline facilities and other underground facilities that participate in the system.

**One-Call Ticket**
This is usual for documentation of a One-Call request. It includes an assigned number for tracking the ticket and all associated documentation. One-Call laws vary from state to state.

**Potholing**
The practice of digging a hole to uncover a pipeline to verify its location. Daylighting and bell-holing are alternate terms for potholing.

**Probing**
The practice of contacting the pipeline with a bar or rod to verify its location. When probing, care must be taken to avoid damaging pipeline coating.

Locator readings may be impacted by pipeline depth, type of soil, and soil density.

When using handheld electronic line locators, interference (stray signals from surrounding pipelines, underground or overhead power lines, metal fencing, railroad, etc.) may be encountered. When locating a pipeline in a multiple pipeline corridor, it may be advantageous to directly connect the locating signal to the pipeline and/or use a multi-frequency pipeline locator, initially setting the frequency range to its lowest setting. Using the low setting prevents the signal from jumping to (identifying) other pipeline facilities. Drastic changes in voltage and/or depth readings may indicate that an adjacent pipeline has been located.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unplanned or pre-existing release of hazardous liquid or gas which could lead to unintentional ignition or other adverse events. Evidence of a release may include, and not be limited to, the following:<br>• Odor of hazardous gas or liquids<br>• Dead vegetation<br>• Audible cues<br>• Sheen on water<br>• Bubbles | Stop task activities, move to a safe distance, and notify appropriate pipeline personnel. Appropriate notifications may include the following:<br>• Contacting pipeline personnel<br>• Activating the 911 Emergency System |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Receive a One-Call Ticket and describe the content and requirements of the ticket. | The individual must be able to use the One-Call Ticket to determine at a minimum:<br>• The date the locate must be completed by<br>• The area to be marked |
| 2 | Receive the most current drawings and/or maps and identify the pipeline to be located. | Drawings and/or pipeline maps are used to assist in locating the pipeline. |
| 3 | Check to ensure locating equipment is in proper working order in accordance with the manufacturer's recommendations. | Equipment needs to be operating properly for an accurate locate. Ensure the locating equipment is properly charged and calibrated. |
| 4 | Conduct a visual assessment to determine site conditions that could affect task performance. | Some rights-of-way are restricted or site conditions may impede access. Examples may include physical obstructions, traffic, soil conditions, hazards, standing water, trenches, etc. |
| 5 | Use line locating equipment to determine the approximate location of the line. | Line locating equipment will only identify the approximate location. Exact location will be verified in Step 6. |
| 6 | Verify the location by potholing and/or probing. | Verification must be performed by the evaluator or other qualified individual.<br>NOTE: If this qualification is performed on a jurisdictional pipeline and potholing is used for verification, an individual qualified for Task 32 "Observe Excavation Activities" must observe or perform the potholing activity. |

## OQ Task Name

Task 14.2 – Install, Inspect, and Maintain Permanent Marker

## 1.0 Task Description

The task begins with verification that the line has been located. This task consists of installing, inspecting, and maintaining permanent pipeline markers in required locations. Permanent markers visually communicate the location of the pipeline. Line markers must meet the specifications outlined in applicable regulations. The task ends when the line is accurately marked with permanent marker(s).

Locate Line is a separate covered task (Reference Task 14.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Signs should be located directly over the pipeline if possible, but offset orientation is permissible.

Markers should be installed as follows:

- At public road crossings
- At railroad crossings
- At above ground locations in areas that are accessible to the public
- In sufficient number along the remainder of each buried line so that its location is accurately known

Markers are not required for buried pipelines located:

- Offshore or at crossings of or under waterways and other bodies of water
- In heavily developed urban areas such as downtown business centers where:
    - The placement of markers is impractical and would not serve the purpose for which the markers are intended
    - The local government maintains current substructure records

At a minimum, markers should contain the following information on a background of sharply contrasting color:

- The word “Warning,” “Caution,” or “Danger,” followed by the words “Petroleum (or the name of the hazardous liquid transported) Pipeline” or “Carbon Dioxide Pipeline,” all of which, except for markers in heavily developed urban areas, must be in letters at least 1″ high with an approximate stroke of ¼″.
- The name of the operator and a telephone number at which the operator can be reached at all times.

If applicable, ensure that a One Call has been placed prior to installing a marker. A One-Call notification system means a communication system in which an operational center receives notices from excavators of intended excavation activities and transmits the notices to operators of underground pipeline facilities and other underground facilities that participate in the system.

One-Call laws vary from state to state.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unplanned or pre-existing release of hazardous liquid or gas, which could lead to unintentional ignition or other adverse events. Evidence of a release may include and not be limited to the following:<br>• Odor of hazardous gas or liquids<br>• Dead vegetation<br>• Audible cues<br>• Sheen on water<br>• Bubbles | Stop line-marking activities, move to a safe distance and notify appropriate pipeline personnel. Appropriate notifications may include the following:<br>• Contacting pipeline personnel<br>• Activating the 911 Emergency System |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify that the line has been located. | Ensures accurate placement of the marker. |
| 2 | Determine proper marker location(s). | Markers warn the public and prevent damage to the pipeline. |
| 3 | Verify the appropriate marker for the location and product. | Markers need to have the correct product identification and information required by the regulation. |
| 4 | Securely install the mounting apparatus and marker.<br>**Caution: When applicable, probe or pothole prior to installing a post to help ensure that the pipeline is not damaged.** | Ensure markers have a good solid foundation. |
| 5 | Inspect the signs for correct information, visibility, and orientation. Replace the sign if a marker is missing, damaged, or the incorrect information is shown. | Ensures information on marker is in good condition, visible, legible, and in accordance with regulatory requirements. |

## OQ Task Name

Task 14.5 – Install, Inspect, and Maintain Temporary Marker

## 1.0 Task Description

The task begins with a location request which may include a One Call. This task consists of installing, inspecting, and maintaining temporary pipeline markers. Temporary markers visually communicate the location of the pipeline on the surface of the right-of-way (ROW). Operators must provide for temporary marking of buried pipelines in the area of excavation activity before, as far as practical, the activity begins.

Installation is the placement of new markers or replacement of existing temporary markers. The task ends when the line is accurately marked.

NOTE:

1) State laws regarding marking requirements may vary.

2) Locate Line is a separate covered task (Reference Task 14.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**One Call**
A system through which anyone can notify owners/operators of lines or facilities of proposed excavation so that the owners/operators can mark the lines and undertake other damage prevention measures.

**One-Call Ticket**
Documentation of the One-Call request. It includes assigned number identification for tracking the ticket and all associated documentation. One-Call laws vary from state to state.

**White Lining**
Under certain state laws and/or best practices recommended by organizations such as the Common Ground Alliance, excavators designate the ground of an area to be excavated using white paint, white flags, white stakes, or any combination of these.

Some state laws require that the operator make a "positive response." Positive response is communication with the excavator prior to excavation to ensure that all contacted owners/operators have located their underground facilities and have appropriately marked any potential conflicts within the areas of planned excavation. Positive response may be accomplished by fax, phone, pager, written correspondence, email, or other electronic means that allows an excavator to know, prior to the beginning of the excavation, that underground pipelines have been located and marked or that there are no underground pipelines in the vicinity of the excavation.

Temporary markers must be replaced if they are damaged or missing as long as the One-Call Ticket is active.

Types of markers include flags, painting, chalk, stake chasers ("whiskers"), stakes, etc. Marker selection may depend on existing and expected conditions such as weather, traffic, construction, and local requirements.

The ANSI uniform color code for marking underground hazardous liquid and gas pipeline facilities is yellow.

Markers should be placed as close as practicable over the pipeline. Markers should be installed in sufficient number along the buried line so that its location is accurately known.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unplanned or pre-existing release of hazardous liquid or gas, which could lead to unintentional ignition or other adverse events. Evidence of a release may include and not be limited to the following:<br>• Odor of hazardous gas or liquids<br>• Dead vegetation<br>• Audible cues<br>• Sheen on water<br>• Bubbles | Stop line-marking activities, move to a safe distance and notify appropriate pipeline personnel. Appropriate notifications may include the following:<br>• Contacting pipeline personnel<br>• Activating the 911 Emergency System |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Receive a One-Call Ticket and describe the content and requirements of the ticket. | The individual must be able to use the One-Call Ticket to determine at a minimum:<br>• The date the locate must be completed by<br>• The area to be marked |
| 2 | Verify that the line has been located within the proposed excavation area. | Ensures accurate placement of the marker.<br>If there is difficulty determining the proposed excavation area, ensure the One-Call center or excavator is contacted for clarification of the proposed excavation area. |
| 3 | Adequately mark the pipeline so that its location is accurately known. Temporary marker(s) should be located directly over the pipeline. | When a temporary marker cannot be located directly over the pipeline, an offset marker shall be installed according to operator and state requirements. |

## OQ Task Name

Task 15.1 – Visually Inspect Surface Conditions of Right-of-Way

## 1.0 Task Description

The task begins with accurately identifying the right-of-way to be inspected. This task consists of performing an inspection of surface conditions on, or adjacent to, the pipeline right-of-way. The purpose of the inspection is to identify and observe for indications of leaks, construction activity, and other factors affecting safety and operation. Methods of inspection may include walking, driving, flying, or other appropriate means of traversing the right-of-way. The task ends with completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The following conditions that could pose an immediate threat to persons, property, or the environment, resulting in a typical reaction that would include stopping right-of-way surveillance activities, moving to a safe distance, and notifying appropriate pipeline personnel.

- Indications of a release:
  - Vapor cloud or frost ball on or near a right-of-way
  - Sheen on or bubbles in the water on a right-of-way
  - Dead vegetation or wet spot
  - Odor of hazardous gas or liquids
  - Audible cues (hissing, roaring, etc.)
- Flooding, washouts, erosion, or exposure that could immediately damage or affect the stability of a pipeline
- Fire or explosion near the right-of-way

The conditions that could impact the safety or integrity of the pipeline, resulting in a typical reaction that would mandate prompt notification and reporting include the following:

- Construction or excavation equipment or other signs of construction activity on or near a right-of-way
- Soil movement such as a landslide, mudslide, or sinkhole
- Sagging aboveground pipe at a span
- Damaged, leaning, or failing pipe support system
- Unusual materials, equipment, and/or foreign objects on or near the right-of-way
- Damage to pipeline facilities or suspicious activity that might indicate vandalism or terrorist actions

The conditions that could impact the pipeline, resulting in a typical response that would include reporting:

- Vegetation overgrowth/excessive canopy that may obstruct view of right-of-way
- Damaged or missing line marker(s)
- Soil movement such as subsidence or settling
- Tripped anchors on aboveground pipe
- Damage to coatings or insulation on aboveground pipe or components

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Accurately identify the right-of-way to be inspected from alignment sheets and/or pipeline maps. | Ensures the correct line is being inspected and dictates the mode of inspection (aerial patrol, walking the right-of-way and vehicle patrol). |
| 2 | Perform the visual inspection/patrol of the right-of-way. | |
| 3 | Make proper notifications. | Appropriate reaction to observations may help prevent damage and/or release. |
| 4 | Complete required documentation. | All regulatory-required inspections must be documented. |

## OQ Task Name

Task 16.1 – Inspect Navigable Waterway Crossing

## 1.0 Task Description

The purpose of navigable waterway crossing inspection is to detect areas of potential pipe exposure and/or damage and to collect and record information to document the location of the pipeline.

This task starts with notification of the line to be inspected and ends with the completed documentation.

Locate Line is a separate covered task (Reference Task 14.1).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Navigable Waterway**
A waterway that is used or could be used for commerce.

**Depth of Cover**
The vertical distance from the top of the pipe to the soil/water interface.

Operation of specialized locating equipment to determine depth of cover.

Except for offshore pipelines, each operator shall, at intervals not exceeding 5 years, inspect each crossing under a navigable waterway to determine the condition of the crossing.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Response |
|---|---|
| Vessel anchored over the pipeline | Make proper operator notifications. |
| Visible sheen or other indications of product release | Immediately make proper operator notifications. |
| Waterway bank erosion | Immediately make proper operator notifications. |
| Debris lodge against pipeline | Immediately make proper operator notifications. |
| Pipe movement or suspension pipeline | Immediately make proper operator notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Locate pipeline adjacent to navigable water way crossing. | Establishes a reference point |

| Step | Action | Explanation |
|---|---|---|
| 2 | Determine the depth of the submerged pipeline by using a probe or specialized electronic equipment. | Determines the amount of cover and verifies the condition of the crossing |
| 3 | Document findings:<br>• Location of exposed or unsupported pipe<br>• Depth of cover | Required by regulation 49 *CFR* 195.404 |

## OQ Task Name

Task 19.1 – Valve Body Winterization or Corrosion Inhibition

## 1.0 Task Description

This task involves the activities required to protect a valve against freezing and/or internal corrosion. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Body or Body Cavity**
The principle pressure-containing part of a valve where the closure element and seals are located.

**Body Bleed (Blowdown)**
Opening a body drain or vent to bleed off (reduce) internal body pressure or double seated valves in either the full open or closed position.

**Drain and Vent Plug**
A mechanical device used to vent or bleed off internal valve body pressure.

**Leak-by**
For double-seated valves, this is an internal valve leak condition in a gate or ball valve where hazardous liquid can leak past either the upstream or the downstream seal into the valve body, thereby pressurizing the valve body. (NOTE: For single-seated valves, see leak-through below.)

**Leak-through**
A condition in a gate or ball valve where hazardous liquid can leak past both valve seats causing the valve to leak from the high-pressure side to the low-pressure side when it is closed. For single-seated valves, such as check valves, a condition where hazardous liquid can leak by the valve seat causing the valve to internally leak when it is in the closed position.

## 3.0 Skills Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br>Ensure that obstructions are not blocking accessibility to the valve.<br>Verifies that the documentation to ensure proper maintenance procedures for the particular valve is maintained. |
| 3 | Verify proper isolation of the valve. | |

| Step | Action | Explanation |
|---|---|---|
| 4 | Position the valve for blowdown (depressurizing), isolating the valve body from the line pressure. | The individual must follow the manufacturer's recommendations and/or the operator's procedures. |
| 5 | Blowdown (depressurize) the valve body; drain non-petroleum material (such as water or sediment) from the valve body. | Flush until clean product is observed.<br>AOC: Unexpected release or discharge of contaminated liquid.<br>AOC: Sediment obstructs proper drain valve seating. |
| 6 | Check for leak-by and leak-through sealing of valve. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br>NOTE: In the event that the valve fails to seal, proper notification must be communicated as per the operator's procedure. |
| 7 | Connect the injection equipment. | AOC: Unexpected release or discharge of hazardous liquid resulting from faulty connection.<br>AOC: Failure of injection hose (burst or leak). Check valve will prevent back-flow or exposure to hydrocarbon. |
| 8 | Operate the injection equipment, and inject appropriate antifreeze and/or corrosion inhibitor. | |
| 9 | Perform necessary notifications upon completion of the task. | |
| 10 | Document task results as per the operator's procedures. | |

## OQ Task Name

Task 19.2 – Valve Lubrication

## 1.0 Task Description

This task involves the activities required to lubricate the components of a valve. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Valve Operator**
A mechanical valve component that utilizes motion to open and close a valve.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected release of hazardous liquid | Stop operation and secure equipment, if safe to do so. Immediately notify the operator and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br>Ensure that obstructions are not blocking accessibility to the valve.<br>Verifies that the documentation to ensure proper maintenance procedures for the particular valve is being maintained. |
| 3 | Lubricate the valve stem, bearings, and associated components with the appropriate lubricant. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br>AOC: Improper use of grease gun could result in lubrication fitting failure and potential product release. |
| 4 | Perform the necessary notifications upon completion of the task. | |
| 5 | Document task results as per the operator's procedures. | |

## OQ Task Name

Task 19.3 – Valve Seat Sealing

## 1.0 Task Description

This task involves verification of valve sealing and the injection of seat sealing products into a valve to control leak-by and leak-through as needed to maintain proper valve function. This task begins upon closure of the valve according to the manufacturer's instructions and concludes upon opening the valve following verification and injection, as needed, of sealing compound.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The definition applicable to this task is as follows:

**Sealant**
Material injected into the valve seats to provide a temporary seal.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Release of product in the event a drain valve is left open | Close the drain valve. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered upon arriving at the valve | If the leak cannot be isolated safely at the site, the control center should be contacted to isolate or shut down the line. |
| The valve does not fully seat upon closure and allows leak-through | Notify the operator according to operator's procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify the nameplate and manufacturer data. | |
| 2 | Verify the valve is closed according to the manufacturer's instructions.<br><br>NOTE: Manual control of the valve must be established to prevent inadvertent actuation of the valve during the performance of this task. | This step ensures that the valve is in the proper position to accept the sealant. |
| 3 | Depressurize the valve body. | AOC: Release of product in the event a drain valve is left open. |

| Step | Action | Explanation |
| --- | --- | --- |
| 4 | Identify the appropriate type and amount of injection sealant. | Sealants vary by manufacturer and application. This step ensures that the proper amount of sealant is used without damaging the valve. |
| 5 | Inject appropriate sealant into seats. | This step ensures that the sealant is compatible with the valve. |
| 6 | Check for leak-by and leak-through sealing of valve. | Inspects as per the manufacturer's or operator's procedures.<br>NOTE: In the event the valve fails to seal, proper notification must be communicated as per the operator's procedure. |
| 7 | After confirming that a tight seal has been established, flush sealant from the injection ports and seats with grease cleaner/penetrant. | Sealants will dry out if not properly flushed and could plug injection passages. |

## OQ Task Name

Task 19.4 – Valve Stem Packing Maintenance

## 1.0 Task Description

This task involves identification of a valve stem seal and the injection of injectable packing into the valve stem seal gland to control leak-out as needed to maintain proper valve function and integrity. This task begins with identifying the type of valve stem seal and ends with verification that there is no visible leakage.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Energized**
Maintain pressure of the injectable packing.

**Injectable Packing**
Bulk material injected into the stem seal gland to provide a temporary or permanent seal, depending on the type of stem seal.

**Stem Seal**
Seal surrounding the valve stem that prevents leakage.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Stem leak, body/bonnet leak, or piping connection leak may be encountered upon arriving at the valve. | If the leak cannot be isolated safely at the site, the control center should be contacted to isolate or shut down the line. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify the nameplate and manufacturer data. | |
| 2 | Identify the type of valve stem seal. | This step determines the type of packing maintenance required. |
| 3 | Identify the appropriate type of injectable packing to be injected. | Stem packing varies per manufacturer and application. |
| 4 | Inject the appropriate injectable packing into valve stem packing gland. | Ensure that the injection pressure does not exceed the manufacturer's instructions. |

| Step | Action | Explanation |
|---|---|---|
| 5 | Operate the valve to observe stem movement. | This step ensures that the valve operates properly with no visible leakage and that the packing remains energized.<br>NOTE: Performance of this step requires a person to be qualified to operate the valve. |

## OQ Task Name

Task 19.5 – Adjust Actuator/Operator, Electric

## 1.0 Task Description

This task involves setting/adjustment of valve actuator limit switches and torque switches. This task begins with an initial notification and ends with completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Block and Bleed**
The capability of obtaining a seal across the upstream and downstream seat seals of a valve when the body pressure is bled off to atmosphere through blowdown valves or vent plugs. This feature is useful when testing for integrity of seat seals and in accomplishing minor repairs under pressure.

**Double Block and Bleed**
A valving arrangement or valve type (e.g., General Twin Seal or Grove Tru-seal) that ensures no flow in a line even though the valve may leak. It consists of two block valves in the main line with a small bleeder valve draining the line between the block valves.

**Function Test**
Operate the valve to assure that it is performing its intended function as designed. This may include manually operating the valve or by the use of mechanical assistance such as an actuator/operator.

**Hand Clutch**
A mechanical means of disengaging the motor drive and engaging the hand wheel.

**Leak-by**
For double-seated valves, this is an internal valve leak condition in a gate or ball valve where hazardous liquid can leak past either the upstream or the downstream seal into the valve body, thereby pressurizing the valve body. (NOTE: For single-seated valves, see leak-through below.)

**Leak-through**
A condition in a gate or ball valve where hazardous liquid can leak past both valve seats causing the valve to leak from the high-pressure side to the low-pressure side when it is closed. For single-seated valves, such as check valves, a condition where hazardous liquid can leak by the valve seat causing the valve to internally leak when it is in the closed position.

**Limit Switch**
A switch designed to cut off power automatically at or near the limit of travel of a moving object controlled by electrical means.

**Mechanical Stop**
A fixed or adjustable rigid mechanical device that prevents a valve actuator/operator from exceeding a fixed limit in the open or closed position.

**Seat**
The part of a valve against which a closure element (gate, plug, ball, or clapper) makes contact contributing to a tight shut-off. In many ball and gate valves, the seat is a floating member containing a soft seating element (usually an O-ring).

**Torque Switch**
A switch designed to sense the amount of torque being applied to a machine by an electric motor and to cut off power if torque exceeds a preset limit, preventing damage to the motor.

**Valve Actuator**
A valve component that converts hydraulic, pneumatic, or electrical energy into mechanical motion to open and close a valve.

**Valve Operator**
A mechanical valve component that utilizes motion to open and close a valve.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected valve movement | Return the valve to the proper position, if safe to do so. Immediately notify the operator and execute applicable emergency procedures. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator and execute applicable emergency procedures. |
| Unexpected release of hazardous liquid | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator and execute applicable emergency procedures. |

## 3.0 Skills Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br><br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br><br>Ensure that obstructions are not blocking accessibility to the valve.<br><br>Verifies that the documentation to ensure proper maintenance procedures for the particular valve is being maintained. |
| 3 | Verify the proper isolation of the valve and actuator prior to performing an adjustment. | |
| 4 | Verify the proper valve position, i.e., open or closed. | |
| 5 | Properly set the limit switches. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br><br>AOC: Improper setting of the limit switches could damage the actuator or valve. |

| Step | Action | Explanation |
|---|---|---|
| 6 | Properly set the torque switches. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br><br>AOC: Improper setting of the torque switches could damage the actuator or valve. |
| 7 | Perform functional testing to check the operation of the valve as per applicable procedures, including remote operation, if capable. Verify the valve status indication at all display points throughout the system. | This step ensures that the valve and status are in proper working order.<br><br>NOTE: This is a separate covered task. |
| 8 | Perform necessary notifications upon completion of the inspection. | |
| 9 | Document inspection results as per the operator's procedures. | |

## OQ Task Name

Task 19.6 – Adjust Actuator/Operator, Pneumatic

## 1.0 Task Description

This task includes the setting/adjustment of the pneumatic actuator adjustment mechanisms and components. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Block and Bleed**
The capability of obtaining a seal across the upstream and downstream seat seals of a valve when the body pressure is bled off to atmosphere through blowdown valves or vent plugs. This feature is useful when testing for integrity of seat seals and in accomplishing minor repairs under pressure.

**Double Block and Bleed**
A valving arrangement or valve type (e.g., General Twin Seal or Grove Tru-seal) that ensures no flow in a line even though the valve may leak. It consists of two block valves in the main line with a small bleeder valve draining the line between the block valves.

**Function Test**
Operate the valve to assure that it is performing its intended function as designed. This may include manually operating the valve or by the use of mechanical assistance such as an actuator/operator.

**Leak-by**
For double-seated valves, this is an internal valve leak condition in a gate or ball valve where hazardous liquid can leak past either the upstream or the downstream seal into the valve body, thereby pressurizing the valve body. (NOTE: For single-seated valves, see leak-through below.)

**Leak-through**
A condition in a gate or ball valve where hazardous liquid can leak past both valve seats causing the valve to leak from the high-pressure side to the low-pressure side when it is closed. For single-seated valves, such as check valves, a condition where hazardous liquid can leak by the valve seat causing the valve to internally leak when it is in the closed position.

**Seat**
The part of the valve against which the closure element (gate, plug, ball, or clapper) makes contact contributing to a tight shut-off. In many ball and gate valves, the seat is a floating member containing a soft seating element (usually an O-ring).

**Valve Actuator**
A valve component that converts hydraulic, pneumatic, or electrical energy into mechanical motion to open and close a valve.

**Valve Operator**
A mechanical valve component that utilizes motion to open and close a valve.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task::

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected valve movement | Return the valve to the proper position, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Unexpected release of hazardous liquid | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br>Ensure that obstructions are not blocking accessibility to the valve.<br>Verifies that the documentation to ensure proper maintenance procedures for the particular valve is being maintained. |
| 3 | Verify the proper isolation of the valve and actuator prior to performing adjustment. | |
| 4 | Verify the proper valve position, i.e., open or closed. | |
| 5 | Properly set the adjustment mechanisms for full open and closed positions. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br>AOC: Improper setting of the adjustment mechanisms could damage the actuator or valve. |
| 6 | Verify that the position status indication matches the valve position. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br>AOC: Improper setting of the position indication could damage the actuator, valve, or piping. |

| Step | Action | Explanation |
|---|---|---|
| 7 | Perform functional testing to check the operation of the valve as per applicable procedures, including remote operation if capable. Verify valve status indication at all display points throughout the system. | This step ensures that the valve and actuator are in proper working order. NOTE: This is a separate covered task. |
| 8 | Perform the necessary notifications upon completion of the inspection. | |
| 9 | Document the inspection results as per the operator's procedures. | |

## OQ Task Name

Task 19.7 – Adjust Actuator/Operator, Hydraulic

## 1.0 Task Description

This task involves setting/adjustment of a hydraulic actuator adjustment mechanism and component. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Block and Bleed**
The capability of obtaining a seal across the upstream and downstream seat seals of a valve when the body pressure is bled off to atmosphere through blowdown valves or vent plugs. This feature is useful when testing for integrity of seat seals and in accomplishing minor repairs under pressure.

**Double Block and Bleed**
A valving arrangement or valve type (e.g., General Twin Seal or Grove Tru-seal) that ensures no flow in a line even though the valve may leak. It consists of two block valves in the main line with a small bleeder valve draining the line between the block valves.

**Function Test**
Operate the valve to assure that it is performing its intended function as designed. This may include manually operating the valve or by the use of mechanical assistance such as an actuator/operator.

**Leak-by**
For double-seated valves, this is an internal valve leak condition in a gate or ball valve where hazardous liquid can leak past either the upstream or the downstream seal into the valve body, thereby pressurizing the valve body. (NOTE: For single-seated valves, see leak-through below.)

**Leak-through**
A condition in a gate or ball valve where hazardous liquid can leak past both valve seats causing the valve to leak from the high-pressure side to the low-pressure side when it is closed. For single-seated valves, such as check valves, a condition where hazardous liquid can leak by the valve seat causing the valve to internally leak when it is in the closed position.

**Seat**
The part of the valve against which the closure element (gate, plug, ball, or clapper) makes contact contributing to a tight shut-off. In many ball and gate valves, the seat is a floating member containing a soft seating element (usually an O-ring).

**Valve Actuator**
A valve component that converts hydraulic, pneumatic, or electrical energy into mechanical motion to open and close a valve.

**Valve Operator**
A mechanical valve component that utilizes motion to open and close a valve.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected valve movement | Return the valve to the proper position, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Unexpected release of hazardous liquid | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br><br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br><br>Ensure that obstructions are not blocking accessibility to the valve.<br><br>Verifies that the documentation to ensure proper maintenance procedures for the particular valve is being maintained. |
| 3 | Verify the proper isolation of the valve and actuator prior to performing adjustment. | |
| 4 | Verify the proper valve position, i.e., open or closed. | |
| 5 | Properly set the adjustment mechanisms for full open and closed positions. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br><br>AOC: Improper setting of the adjustment mechanisms could damage the actuator or valve. |

| Step | Action | Explanation |
|---|---|---|
| 6 | Verify that the position status indication matches the valve position. | The individual must follow the manufacturer’s recommendations and/or the operator’s procedures.<br><br>AOC: Improper setting of the position indication could damage the actuator, valve, or piping. |
| 7 | Perform functional testing to check the operation of the valve as per applicable procedures, including remote operation if capable. Verify the valve status indication at all display points throughout the system. | This step ensures that the valve and actuator are in proper working order.<br>NOTE: This is a separate covered task. |
| 8 | Perform the necessary notifications upon completion of the inspection. | |
| 9 | Document the inspection results as per the operator’s procedures. | |

## OQ Task Name

Task 20.0 – Inspect Mainline Valves

## 1.0 Task Description

This task involves performing an inspection to ensure a valve is in good working order, which means the valve's performance meets all the necessary functions. The task also includes verification the proper security controls are in place. This task begins with initial notification and ends with completion of required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The type and operating features of the valve, e.g., ball valve, gate valve, manual, or motor actuation.

**Local Functionality Test**
This test consists of a partial or full opening or closing of the valve within operational parameters. The inspection is performed at the valve site and may be completed manually and/or with the motor actuator.

**Remote Functionality Test**
This test is performed remotely, i.e., from the control center, and consists of a full opening or closing of the valve within operational parameters.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| A stem leak, body/bonnet leak, or piping connection leak may be encountered upon arriving at valve | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Unintended closure or opening of valve | Immediately return the valve to the proper position, and notify the operator. |
| Breach of perimeter security, valve access control, or other access control | Secure site, if safe to do so. Notify the operator of any security breaches. |
| Valve fails to operate properly during inspection resulting in pressure outside of normal operating limits | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the inspection has been scheduled and communicated and that the operational status has been confirmed. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Ensure that the valve is correctly labeled. | This step ensures that the proper valve is inspected and labeling is consistent with the operator's documentation. |
| 3 | Inspect the valve security and access control. | This step ensures appropriate control and accessibility of valve, e.g., gates, fences, signs, barbed wire, locks, manhole covers, chains, doors, or valve enclosures. |
| 4 | Inspect the condition of the valve. | This step ensures that there are no visible leaks, damage, or corrosion of the valve, components, or flanges. |
| 5 | Inspect the valve position indicator. | This step ensures that the position indicator is intact and operational. |
| 6 | Perform functional testing to check operation of the valve as per applicable procedures, including remote operation if capable. | This step ensures that the valve is in proper working order.<br>NOTE: Performance of this step requires a person to be qualified to operate the valve. |
| 7 | Re-establish proper valve status and security controls. | This step ensures that the valve and/or valve site are secured against unauthorized access. |
| 8 | Perform the necessary notifications upon completion of the inspection. | |
| 9 | Document the inspection results as per the operator's procedures. | |

## OQ Task Name

Task 21.1 − Repair Valve Actuator/Operator, Pneumatic

## 1.0 Task Description

This task involves the disassembly, diagnosis of component failure, repair or replacement, and reassembly of a valve actuator. This task addresses the repair of a pneumatic actuator according to the applicable procedures and is conducted to maintain the integrity of the valve actuator, which means the actuator meets all the necessary functions. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Applicable Procedures**
May include, but are not limited to, the valve manufacturer’s instructions, operator’s procedures, drawings, other job aids, etc.

**Integrity Test**
A test to ensure the actuator operates properly and does not leak after re-assembly.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected valve movement | Return the valve to the proper position, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the proper isolation of the valve and actuator prior to repair or disassembly. | |
| 3 | Repair or disassemble the actuator following applicable procedures. | The individual must follow the manufacturer’s instructions for the applicable valve. |
| 4 | Diagnose and repair or replace worn or damaged parts per the manufacturer’s specifications. | The individual must follow the manufacturer’s instructions for the applicable valve. |

| Step | Action | Explanation |
|---|---|---|
| 5 | Reassemble the actuator per applicable procedures. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 6 | Perform a test to ensure proper actuator integrity. | This step ensures that the pneumatic source does not leak and the actuator operates properly. |
| 7 | Re-establish the proper actuator status and security controls. | |
| 8 | Perform the necessary notifications upon completion of the repair. | |
| 9 | Document the repair results per the operator's procedures. | |

## OQ Task Name

Task 21.2 − Disassembly/Re-assembly of Valve

## 1.0 Task Description

This task involves the disassembly and re-assembly of valves, diagnosis of valve component failure, and repair or replacement of parts, as necessary. This task addresses the repair of a valve according to the applicable procedures, and is conducted to maintain the integrity of the valve, which means the valve performance meets all the necessary functions. This task begins with the initial notification and ends with the completion of required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Applicable Procedures**
May include, but are not limited to, the valve manufacturer's instructions, operator's procedures, drawings, other job aids, etc.

**Integrity Test**
A test to ensure the valve operates properly and does not leak after re-assembly. The DOT valve inspection is a separate covered task.

**Valves**
The type, operating features and repair methods of the valve, e.g., ball valve and gate valve.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Release of product in the event that the valve body pressurizes during task performance. | Isolate the valve, if safe to do so. Immediately notify the operator. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered upon arriving at the valve. | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Ensure that the valve has been isolated according to applicable procedures. | This step prevents release of hazardous energy and ensures worker safety. |
| 3 | Disassemble the valve following applicable procedures. | The individual must follow the manufacturer's instructions for the applicable valve. |

| Step | Action | Explanation |
|---|---|---|
| 4 | Diagnose and repair or replace worn or damaged parts per the manufacturer's specifications. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 5 | Reassemble the valve per applicable procedures. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 6 | Perform a valve integrity test. | This step ensures that the valve operates properly and does not leak. |
| 7 | Perform the necessary notifications upon completion of the valve repair. | |

## OQ Task Name

Task 21.3 – Internal Inspection of Valve and Components

## 1.0 Task Description

This task involves the on-site internal inspection of a valve body and its components. This task begins with verification of the valve nameplate and ends with completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Body or Body Cavity**
The principle pressure-containing part of a valve in which the closure element and seals are located.

**Body Bleed**
Opening a body drain or vent to bleed off (reduce) internal body pressure, or double seated valves in either the full open or closed position.

**Block and Bleed**
The capability of obtaining a seal across the upstream and downstream seat seals of a valve when the body pressure is bled off to atmosphere through blowdown valves or vent plugs. This feature is useful when testing for integrity of seat seals and in accomplishing minor repairs under pressure.

**Double Block and Bleed**
A valving arrangement or valve type (e.g., General Twin Seal or Grove Tru-seal) that ensures no flow in a line even though the valve may leak. It consists of two block valves in the main line with a small bleeder valve draining the line between the block valves.

**Drain and Vent Plug**
A mechanical device used to vent or bleed off internal valve body pressure.

**Function Test**
Operate the valve to assure that it is performing its intended function as designed. This may include manually operating the valve or by the use of mechanical assistance such as an actuator/operator.

**Leak-by**
For double-seated valves, this is an internal valve leak condition in a gate or ball valve where hazardous liquid can leak past either the upstream or the downstream seal into the valve body, thereby pressurizing the valve body. (NOTE: For single-seated valves, see leak-through below.)

**Leak-through**
A condition in a gate or ball valve where hazardous liquid can leak past both valve seats causing the valve to leak from the high-pressure side to the low-pressure side when it is closed. For single-seated valves, such as check valves, a condition where hazardous liquid can leak by the valve seat causing the valve to internally leak when it is in the closed position.

**Packing**
The pliable sealing material inserted into a valve stem stuffing box, which when compressed by a gland, provides a tight seal about the stem.

**Seat**
The part of the valve against which the closure element (gate, plug, ball, or clapper) makes contact contributing to a tight shut-off. In many ball and gate valves, the seat is a floating member containing a soft seating element (usually an O-ring).

**Valve Actuator**
A valve component that converts hydraulic, pneumatic, or electrical energy into mechanical motion to open and close a valve.

**Valve Operator**
A mechanical valve component that utilizes motion to open and close a valve.

### Abnormal Operating Conditions (AOCs)

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| A stem leak, body/bonnet leak, or piping connection leak may be encountered | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Unexpected release of hazardous liquid | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br><br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br><br>Ensure that obstructions are not blocking accessibility to the valve.<br><br>Verifies that the documentation to ensure proper tolerances and measurement procedures are used for the particular valve being inspected. |
| 2 | Verify the proper isolation of the valve prior to performing inspection. | AOC: Unexpected release of or exposure to hazardous liquid. |
| 3 | Inspect the valve and components. | The individual must follow the manufacturer's recommendations and/or the operator's procedures.<br><br>Inspection may include but is not limited to the following:<br>• Components for condition and acceptable tolerances<br>• Condition of seals/elastomers<br>• Proper installation of seat/stem seals<br>• Valve stem and nut/seats and seat pockets/seals for the extent of wear<br>• Condition of closure device (gate, ball, plug, etc.)<br>• Fasteners are tightened to specified limits and torque procedure<br>• Condition of valve body and coatings |

| Step | Action | Explanation |
|---|---|---|
| 4 | Perform the necessary notifications of results of the inspection and items for repair upon completion. | Ensures arrangements for repairs and functionality test according to covered task for Disassembly/Re-assembly of Valve. |
| 5 | Document the inspection results per operator's procedures. | |

## OQ Task Name

Task 21.4 − Repair Valve Actuator/Operator, Hydraulic

## 1.0 Task Description

This task involves the disassembly, diagnosis of component failure, repair or replacement, and re-assembly of valve actuator. This task addresses the repair of a hydraulic actuator according to the applicable procedures and is conducted to maintain the integrity of the valve actuator, which means the actuator meets all the necessary functions. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Applicable Procedures**
May include, but are not limited to, the valve manufacturer's instructions, operator's procedures, drawings, other job aids, etc.

**Integrity Test**
A test to ensure the actuator operates properly and does not leak after re-assembly.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected valve movement. | Return the valve to the proper position, if safe to do so. Immediately notify the operator, and execute the applicable emergency procedures. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered. | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute the applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |
| 2 | Verify the proper isolation of the valve and actuator prior to repair or disassembly. | |
| 3 | Repair or disassemble the actuator following applicable procedures. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 4 | Diagnose and repair or replace worn or damaged parts per the manufacturer's specifications. | The individual must follow the manufacturer's instructions for the applicable valve. |

| Step | Action | Explanation |
| --- | --- | --- |
| 5 | Reassemble the actuator per applicable procedures. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 6 | Perform a test to ensure proper actuator integrity. | This step ensures that the hydraulic source does not leak and the actuator operates properly. |
| 7 | Re-establish the proper actuator status and security controls. | |
| 8 | Perform the necessary notifications upon completion of the repair. | |
| 9 | Document the repair results per the operator's procedures. | |

## OQ Task Name

Task 21.5 − Repair Valve Actuator/Operator, Electric

## 1.0 Task Description

This task involves the disassembly, diagnosis of component failure, repair or replacement, and re-assembly of valve actuator. This task addresses the repair of an electric actuator according to the applicable procedures and is conducted to maintain the integrity of the valve actuator, which means the actuator meets all the necessary functions. This task begins with the initial notification and ends with the completion of the required documentation.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

**Applicable Procedures**
May include, but are not limited to, the valve manufacturer's instructions, operator's procedures, drawings, other job aids, etc.

**Integrity Test**
A test to ensure the actuator operates properly after re-assembly.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected valve movement. | Return the valve to the proper position, if safe to do so. Immediately notify the operator, and execute the applicable emergency procedures. |
| A stem leak, body/bonnet leak, or piping connection leak may be encountered. | Stop operation and secure the equipment, if safe to do so. Immediately notify the operator, and execute the applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that the proper notifications have been made. | This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed. |

| Step | Action | Explanation |
|---|---|---|
| 2 | Verify the valve number and nameplate data. | If the nameplate is missing, it is to be replaced per operator's specifications.<br>Ensure that the proper valve is located, especially before operating the valve to preclude any upsets.<br>Ensure that obstructions are not blocking accessibility to the valve.<br>Verifies that the documentation to ensure proper maintenance procedures for the particular valve is being maintained. |
| 3 | Verify the proper isolation of the valve and actuator prior to repair or disassembly. | |
| 4 | Repair or disassemble the actuator following applicable procedures. | The individual must follow the manufacturer's and/or the operator's instructions for the applicable valve. |
| 5 | Diagnose and repair or replace worn or damaged parts per manufacturer's specifications. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 6 | Reassemble the actuator per the applicable procedures. | The individual must follow the manufacturer's instructions for the applicable valve. |
| 7 | Perform a test to ensure proper actuator integrity. | This step ensures that the actuator operates properly. |
| 8 | Re-establish the proper actuator status and security controls. | |
| 9 | Perform the necessary notifications upon completion of the repair. | |
| 10 | Document the repair results per the operator's procedures. | |

## OQ Task Name

27.1 – Routine Inspection of Breakout Tanks (API 653 Monthly or DOT Annual)

## 1.0 Task Description

This task involves performing routine tank inspections in accordance with the latest DOT-approved edition of API 653. The interval of the inspection shall not exceed 1 month.

API 653 Inspection of In-Service Breakout Tanks is a separate covered task (Reference Task 27.2).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The purpose of this task is to evaluate the condition of a breakout tank by visually determining the condition of the tank and its components.

There are three primary types of atmospheric steel aboveground breakout tanks:

1. **External/opentop floating roof tanks** – An open-topped cylindrical aboveground steel shell equipped with a roof that floats on the surface of the stored liquid. The roof rises and falls with the liquid level in the tank. There is a rim seal system between the tank shell and roof to reduce rim evaporation.

   The roof has support legs hanging down into the liquid. At low liquid levels the roof eventually lands and a vapor space forms between the liquid surface and the roof, similar to a fixed roof tank. The support legs are usually retractable to increase the working volume of the tank.

2. **Fixed/cone roof tank** – A closed-top cylindrical aboveground steel shell with either a cone roof supported principally either by rafters on girders and columns or by rafters on trusses with or without columns, a self-supporting cone roof that is supported only at its periphery, or a self-supporting dome roof formed to approximately a spherical surface that is supported only at its periphery.

3. **Internal floating roof tanks** – These tanks are cone roof tanks with a floating roof inside that travels up and down along with the liquid level.

Definitions applicable to this task are as follows:

**Chime Ring**
The outside edge of the tank bottom that extends past the weld of the tank shell. The chime ring should be visually inspected for signs of settlement, corrosion, and evidence of leaks.

**Secondary Containment**
An impoundment, such as a dike, that could contain spilled product on site. The impoundment may be constructed of concrete, earth, steel, or solid masonry and is designed to be liquid tight. Dikes should not be compromised by erosion, excavations, or excessive vegetation.

**Reinforcing Plate/Pad/Repad**
Steel reinforcement plates installed around shell openings to provide the shell with added strength required for the installation of a shell appurtenance. Repads should be visually inspected for corrosion and coating condition.

**Shell**
The vertical, cylindrical walls of a tank. The shell shall be visually inspected for distortions, signs of settlement, corrosion and condition of coating, and insulation systems, if applicable.

**Shell Appurtenances**
Manways, reinforcement plates, nozzles, sampling ports, temperature probes, mixers, and auto-gauge systems. Shell appurtenances shall be visually inspected for corrosion, coating condition, and evidence of leaks.

**Tank Foundation/Ring Wall**
Perimeter concrete ring providing support for the tank shell. Foundations shall be inspected for signs of settlement and foundation condition.

**Roof**
The top external surface of the tank. The roof shall be visually inspected for evidence of leaks and coating condition. External floating roof tanks should be inspected for excessive water or other material that may cause a condition that could affect the integrity of the tank.

**Telltale/Weep Hole**
A threaded penetration of the reinforcing plate that is used to determine if the shell has developed a leak in the area where the reinforcing plate covers the shell. Weep holes should be inspected for evidence of leaks.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Visually inspect the following for evidence of leaks:<br>• Mixer seals<br>• Flanges<br>• Manways/nozzles<br>• Chime<br>• Roof/pontoons<br>• Welds/rivets<br>• Telltales/weep holes on reinforcing pads<br>• Sheen on water in containment area | Leaks indicate an integrity issue and immediate response according to operator’s policies is required.<br>Response actions may include stopping operation and securing equipment, if safe to do so, immediately notifying the operator, and executing applicable emergency procedures. |
| 2 | Visually inspect the shell for the following defects:<br>• External visual inspection for paint and corrosion defects<br>• Inspect the chime area for corrosion<br>• Reinforcement plate/padding around manways and/or valves<br>• Inspect for shell distortions—look for deflection or deformation of the shell<br>• Insulation condition, if applicable | Visual inspection of the shell is performed to identify coating condition, areas of pitting, or corrosion and distortions. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Visually inspect for settlement around the perimeter of the tank and the condition of the foundation:<br>• Check that rainwater runoff from the shell drains away from tank.<br>• Inspect for broken concrete and cracks.<br>• Inspect for cavities under the foundation and vegetation against the bottom of the tank. | Visual inspection of the foundation is performed to identify conditions such as settlement or lack of support under the tank shell/floor. Surface water should be kept away from the tank to prevent corrosion or erosion of the foundation. |
| 4 | Visually inspect the secondary containment system for impoundment integrity. | The tank dike wall must be maintained so that the containment area capacity remains as designed. |
| 5 | Visually inspect the tank roof for the following:<br>• Coating condition, holes, pitting, and corrosion<br>• Standing or pooling water or product<br>• Floating roof out of level | Large standing water areas on a floating roof indicate inadequate drainage design or, if to one side, a non-level roof with possible leaking pontoons. Floating roofs can sink and possibly impact the integrity of the tank floor if excessive weight from water/product on top of the roof is not removed. Significant sagging of a fixed-roof deck indicates potential rafter failure. |
| 6 | Document the findings of the inspection | Submit a completed inspection form according to operator’s procedures |

## OQ Task Name

Task 27.2 – API 653 Inspection of In-Service Breakout Tanks

## 1.0 Task Description

This task involves performing an internal or external inspection of an in-service breakout tank in accordance with the latest DOT-approved edition of API 653. This inspection shall be performed by an *authorized inspector* as defined by API 653.

An in-service breakout tank is one that has been commissioned.

Routine Inspection of Breakout Tanks is a separate covered task (Reference Task 27.1).

## 2.0 Knowledge Component

An individual performing this task must provide documentation of the American Petroleum Institute (API) Authorized Inspector Certification for API 653. For atmospheric and low-pressure steel aboveground tanks, the inspector shall have certification as an authorized inspector for those tanks under API 653.

## 3.0 Skill Component

The certificate demonstrates task performance proficiency. No other steps are required for OQ qualification.

| Step | Action | Explanation |
|---|---|---|
| 1 | Inspect the physical integrity of aboveground steel breakout tanks in accordance with the latest DOT-approved edition of API 653. | Authorized Inspector Certification required in accordance with the latest DOT-approved edition of API 653. Conditions that are found to be unacceptable according to the latest DOT-approved edition of API 653 shall be documented and provided to the operator. |

## OQ Task Name

Task 27.3 – API 510 Inspection of In-Service Breakout Tanks

## 1.0 Task Description

This task involves performing an internal or external inspection of an in-service breakout tank in accordance with the latest DOT-approved edition of API 510. This inspection shall be performed by an *authorized inspector* as defined by API 510.

An in-service breakout tank is one that has been commissioned.

Routine Inspection of Breakout Tanks is a separate covered task (Reference Task 27.1).

## 2.0 Knowledge Component

An individual performing this task must provide documentation of the American Petroleum Institute (API) Authorized Inspector Certification for API 510. For steel aboveground breakout tanks built to API Standard 2510, the inspector shall have certification as an authorized pressure vessel inspector for API 510.

## 3.0 Skill Component

The certificate demonstrates task performance proficiency. No other steps are required for OQ qualification.

| Step | Action | Explanation |
| --- | --- | --- |
| 1 | Inspect the physical integrity of aboveground steel breakout tanks in accordance with the latest DOT approved edition of API 510. | Authorized Inspector Certification required in accordance with the latest DOT-approved edition of API 510. Conditions that are found to be unacceptable according to the latest DOT-approved edition of API 510 shall be documented and provided to the operator. |

## OQ Task Name

Task 32.0 – Observation of Excavation Activities

## 1.0 Task Description

This task consists of observing excavation activities to help prevent damage to buried pipelines. Excavation refers to the removal of earth by any means when that removal could expose or damage a buried or submerged pipeline. This task **does** **not** apply to horizontal/directional drilling, but **does** apply to vertical drilling (including drilling to collect soil samples) whenever pipelines are present.

This task begins after the pipeline(s) has been properly located and marked and when the removal of earth first begins. The task ends when all intended earth removal has been accomplished. This task is intended for individual(s) at the site responsible for the observation of the excavation.

Backfilling a Trench Following Maintenance is a separate covered task (Reference Task 39.0).

NOTE: This task is NOT intended to satisfy OSHA requirements for Competent Persons for Excavation Activities.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The pipeline operator's control center or local operations personnel must be notified so that operations personnel are aware of the excavation and can take appropriate actions.

A current One-Call Ticket must be on record, if required by operator's Damage Prevention Program. One Call is a system to notify owners/operators of lines or facilities of proposed excavation so that the owners/operators can mark the lines and undertake other damage prevention measures. The excavation activities should not continue if there is not a current One-Call Ticket, when required.

The pipeline and all other buried structures must be located and marked by stakes, paint, or some other customary manner (line locating is a separate covered task). The excavation activities should not continue if any known structures are not marked. The positioning of equipment (profile) at the excavation site must not produce any undue stress on a buried structure.

The individual performing this task must be aware of the marked area to be excavated and digging criteria including tolerance zone and hand digging or other noninvasive excavation requirements. The tolerance zone is an area equal to half the nominal diameter of the underground pipeline plus a distance defined by the operator or state on either side of the outside edge of the underground pipeline facility on a horizontal plane (sometimes referred to as "clearance"). Tools must be appropriate for the excavation, including but not limited to, the following:

- Backhoe (if required by operator's procedures, teeth on the backhoe bucket may need to be covered with a flat bar to prevent accidentally piercing the pipeline; the bucket must be of an appropriate size)
- Jackhammer
- Hydro-vac
- Vacuum excavator
- Shovels and hand tools

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Pipeline is unintentionally hit during the excavation with no release of product. | Stop excavation activities. Notify appropriate local operations personnel. If damage could result in an emergency situation, notify proper authorities, and request a line shut down, if necessary. |
| Pipeline is unintentionally hit during the excavation, resulting in a release of product. | Stop excavation activities. Follow operator's emergency response procedures for notification. If damage could result in an emergency situation, notify proper authorities, and request line shut down, if necessary. |
| Unplanned or pre-existing release of hazardous liquid or gas, which could lead to unintentional ignition or other adverse events. | Stop excavation activities and assess the extent of the release. Depending on the situation, take action according to the operator's emergency response plan. |
| Discovery of unexpected physical damage to the pipeline system, including scraping, displacement, nicks, leaks, dents, gouges, grooves, destruction, or partial or complete breaks of an underground pipeline or of any protective coating, casing, conduits, cathodic protection, or any other protective or communications device of a pipeline. | Stop excavation activities. Report damage to appropriate operations personnel for further assessment, if necessary. |
| Discovery of an undocumented pipeline in the area of excavation. | Stop excavation activities. Ensure proper notifications are made to the appropriate One-Call Center, local operations personnel, and/or other appropriate agency. Notation or notification should be made so that the operator can update alignment sheets and/or pipeline maps. |
| Improper support for the pipeline during excavation could lead to pipeline damage. | Stop excavation activities if necessary, and ensure proper support. |

If an area is left unattended, the area should be secured in accordance with an operator's procedures. Methods of securing an excavation may include temporary fences, metal plate, markers, or other appropriate methods.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure that notification has been made to the control center or local operations at the beginning of work. | Operations personnel should closely monitor pipeline pressure and flow during excavation activities. |
| 2 | Identify an appropriate location for excavated material (soil) to ensure that it is placed in a location that could not affect the integrity of the pipeline. | Provide adequate distance from the excavation to ensure the stability of the excavation, prevent excessive stress on the pipeline, and prevent pipeline damage because of cave-in. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Identify the marked and potentially unmarked hazards surrounding the excavation site (including underground hazards). | Observes for irregularities. Ensures hazards are avoided and prevents damage to the line or any appurtenances. |
| 4 | Determine and communicate to excavator the required tolerance zone. | Adherence to tolerance zones provides assurance that the pipeline will not be hit. |
| 5 | Ensure that the tolerance zone is maintained during excavation. Require hand digging or other non-invasive excavation methods of the remaining soil within the tolerance zone. | Use of hand tools, vacuum excavation or other non-invasive methods minimizes damage when excavating near the pipe. |
| 7 | Notify control center or local operations at the completion of work. | Ensure the line is monitored during and after excavation activities. |
| 8 | Document the excavation per operator procedures. | Documentation about the excavation may include, but is not limited to, the following:<br>• Date<br>• Location (line segment, mile post, etc.)<br>• Name of excavator<br>• Purpose of excavation<br>• Scope of excavation (size, extent, etc.)<br>• One-Call information, if required<br>• Depth of cover |

## OQ Task Name

Task 38.1 – Visually Inspect Pipe and Pipe Components Prior to Installation

## 1.0 Task Description

This task involves the on site visual inspection of pipe and components that are to be installed in the pipeline system. The purpose of the inspection is to ensure that the pipe and components are not damaged in a manner that could impair their strength or reduce their serviceability and to ensure that the pipe and components are rated for intended service.

The task does not include an assessment of damage and any determination of the measures that should be taken to mitigate the damage found during an inspection.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Component**
Any part of a pipeline which may be subjected to pump pressure including, but not limited to, pipe, valves, elbows, tees, flanges, and closures.

**Maximum Operating Pressure (MOP)**
The maximum pressure at which a pipeline or segment of a pipeline or a component may be normally operated. Inspection shall include assurance that the pipe and/or component is compatible with MOP for the system in which it is to be installed.

**Corrosion**
Surface rust or pitting are examples of conditions that may be identified during a visual inspection.

**Mechanical Defects**
Buckles, dents, cracks, gouges, out of round pipe, or other defects that might reduce the strength of the pipe or pipe component. A crack is a surface flaw or defect characterized by break without complete separation; fissure. A gouge is a surface flaw characterized by the removal of steel from the pipe or component.

**Buckled or Wrinkled Bends**
Bends must have a smooth contour. Buckles and wrinkles are physical defects that are characterized by bulging or warping of the pipe.

Coating defects that can be visually identified such as cuts, scratches, or other defects characterized by a visually determined loss of coating (holiday).

Each length of pipe with a nominal outside diameter of 4½ in. (114.3 mm) or more must be marked on the pipe or pipe coating with the specification to which it was made, the specified minimum yield strength or grade, and the pipe size. The marking must be applied in a manner that does not damage the pipe or pipe coating and must remain visible until the pipe is installed.

Each valve must be marked on the body or the nameplate with at least the following:

1. Manufacturer's name or trademark
2. Class designation or the maximum working pressure to which the valve may be subjected

3. Body material designation (the end connection material, if more than one type is used)
4. Nominal valve size

Butt-welding type fittings must meet the marking and end preparation required by the operator's specification.

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Inspect pipe and components for:<br>• Corrosion<br>• Defects such as cracks, grooves, gouges, dents, or out of round pipe<br>• Coating damage<br>• Bends inspect for buckles and/or wrinkles | The inspection of pipe and components prior to installation does not include an assessment of the damage and a determination of the measures necessary to mitigate the damage. |
| 2 | Ensure component is rated for intended service. | Inspector must know the design MOP for the system and ensure through visual verification of the markings on the pipe and components that the pipe or component is compatible. |
| 3 | Communicate the inspection results. | A satisfactory outcome of the inspection must be achieved. If not, the condition must be noted and resolved. |

## OQ Task Name

Task 38.3 – Visually Inspect that Welds Meet DOT Requirements

## 1.0 Task Description

This task involves visually inspecting welds to ensure they are in accordance with the latest DOT-approved edition of API 1104 and the applicable qualified welding procedure and to identify any defects that may affect the integrity of a pipeline tie-in or component replacement.

NDT – Magnetic Particle Testing is a separate covered task (Reference Task 38.6).

NDT – Radiographic Testing is a separate covered task (Reference Task 38.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

This inspection of welds and identification of conditions as defined by the latest DOT edition of API 1104 and the operator's applicable written welding procedure are limited to conditions that can be identified visually and include the following:

- Arc Burn – The gouging effect imparted to the surface of the pipe whenever an electric arc is inadvertently struck, typically adjacent to a weld, when starting to weld.
- External Undercut (EU) – A groove melted in parent material adjacent to the cover pass and left unfilled by weld material.
- Pin Hole or Porosity (POR) – A condition when the surface of the weld is in a semi-molten stage and gas produced by the welding process rises to the surface of the molten puddle and escapes. This condition leaves the appearance of pin holes on the surface of the weld. Acceptable porosity limits are determined by radiography.
- Slag – Slag is the residue left on a weld bead from the flux. It shields the hot metal from atmospheric contaminants that may weaken the weld point. Slag can also be globules of molten metal that are expelled from the joint and then re-solidify on the metal surface.
- Weld (Cap) Height – The distance the completed weld extends beyond the height of the parent material. The weld dimensions, including the weld height, are determined by the written welding procedure.

The Qualified Welding Procedure is a tested and proven detailed method by which sound welds with suitable mechanical properties can be produced. The procedure shall be written, and records shall include the results of qualifying tests. An individual performing this task must be knowledgeable of the operator's applicable written welding procedure.

## 3.0 Skill Component

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

| | Action | Explanation |
|---|---|---|
| 1 | Identify any conditions that do not meet the qualified welding procedure or the latest DOT-approved edition of API Standard 1104. Conditions may include the following:<br>• Arc burn<br>• External undercut (EU)<br>• Pin hole/porosity<br>• Slag<br>• Weld (cap) height – inadequate or excessive | • Arc burns are not acceptable and must be repaired<br>• The depth of EU adjacent to the final bead on the outside of the pipe shall not be more than $^{1}/_{32}$ of an inch or 12.5% of the pipe wall thickness (whichever is smaller). There shall not be more than 2 inches of EU in any continuous 12 inch length of weld.<br>• Surface pinholes are an indication of porosity<br>• Slag and weld splatter can mask surface imperfections<br>• Acceptable weld dimensions, including the minimum and maximum weld height, are determined by the applicable qualified welding procedure. |
| 2 | Communicate the inspection results. | A satisfactory outcome must be achieved. If not, the condition must be noted and resolved. |

## OQ Task Name

Task 38.4 – NDT – Radiographic Testing

## 1.0 Task Description

This task involves verifying that welds meet the specifications of the latest DOT approved edition of API Standard 1104 utilizing radiography and to identify any indications and imperfections that may affect the integrity of a pipeline tie-in, component installation/replacement, or pipeline repair.

Visually Inspect that Welds Meet DOT Requirements is a separate covered task (Reference Task 38.3).

## 2.0 Knowledge Component

An individual performing this task must provide documentation of certification through the American Society for Nondestructive Testing, Recommended Practice No. SNT-TC-1A, ACCP certification for radiography (RT) or any other recognized national certification program that shall be acceptable to the operator for the test method used.

## 3.0 Skill Component

The certificate demonstrates task performance proficiency. No other steps are required for OQ qualification.

| Step | Action | Explanation |
|---|---|---|
| 1 | Evaluate completed welds utilizing radiography to ensure they meet the requirements of the latest DOT-approved edition of API 1104. | Certification required to Level II or III in accordance with the recommendations of American Society for Nondestructive Testing (ASNT), Recommended Practice No. SNT-TC-1A, ACCP for RT or any other recognized national certification program that shall be acceptable to the operator for the test method used. |

## OQ Task Name

Task 38.5 NDT – Liquid Penetrant Testing

## 1.0 Task Description

This task involves verifying that welds meet the specifications of the latest DOT-approved edition of API Standard 1104 utilizing liquid penetrant testing and to identify indications and imperfections that may affect the integrity of a pipeline tie-in, component installation/replacement, or pipeline repair.

Visually Inspect that Welds Meet DOT Requirements is a separate covered task (Reference Task 38.3).

## 2.0 Knowledge Component

An individual performing this task must provide documentation of certification through the American Society for Nondestructive Testing, Recommended Practice No. SNT-TC-1A, ACCP certification for Liquid Penetrant Testing (PT) or any other recognized national certification program that shall be acceptable to the operators for the test method used.

## 3.0 Skill Component

The certificate demonstrates task performance proficiency. No other steps are required for OQ qualification.

| Step | Action | Explanation |
|---|---|---|
| 1 | Evaluate completed welds utilizing liquid penetrant testing to ensure they meet the standards of the latest DOT-approved edition of API 1104. | Certification required to Level II or III in accordance with the recommendations of American Society for Nondestructive Testing (ASNT), Recommended Practice No. SNT-TC-1A, ACCP for PT or any other recognized national certification program that shall be acceptable to the operators for the test method used. |

## OQ Task Name

Task 38.6 – NDT – Magnetic Particle Testing

## 1.0 Task Description

This task involves verifying that welds meet the specifications of the latest DOT-approved edition of API Standard 1104 utilizing magnetic particle testing and to identify any indications or perfections that may affect the integrity of a pipeline tie-in, component installation/replacement, or pipeline repair.

Visually Inspect that Welds Meet DOT Requirements is a separate covered task (Reference Task 38.3).

## 2.0 Knowledge Component

An individual performing this task must provide documentation of certification through the American Society for Nondestructive Testing, Recommended Practice No. SNT-TC-1A, ACCP certification for magnetic particle testing (MP) or any other recognized national certification program that shall be acceptable to the operator for the test method used.

## 3.0 Skill Component

The certificate demonstrates task performance proficiency. No other steps are required for OQ qualification.

| Step | Action | Explanation |
|---|---|---|
| 1 | Evaluate completed welds through magnetic particle testing to ensure they meet the requirements of the latest DOT-approved edition of API 1104. | Certification required to Level II or III in accordance with the recommendations of American Society for Nondestructive Testing (ASNT), Recommended Practice No. SNT-TC-1A, ACCP for MP or any other recognized national certification program that shall be acceptable to the operator for the test method used. |

## OQ Task Name

Task 38.7 – NDT – Ultrasonic Testing

## 1.0 Task Description

This task involves verifying that welds meet the specifications of the latest DOT-approved edition of API Standard 1104 utilizing ultrasonic testing and to identify any indications and imperfections that may affect the integrity of a pipeline tie-in, component installation/replacement, or pipeline repair.

Visually Inspect that Welds Meet DOT Requirements is a separate covered task (Reference Task 38.3).

## 2.0 Knowledge Component

An individual performing this task must provide documentation of certification through the American Society for Nondestructive Testing, Recommended Practice No. SNT-TC-1A, ACCP certification for ultrasonic testing (UT) or any other recognized national certification program that shall be acceptable to the operator for the test method used.

## 3.0 Skill Component

The certificate demonstrates task performance proficiency. No other steps are required for OQ qualification.

| Step | Action | Explanation |
|---|---|---|
| 1 | Evaluate completed welds utilizing ultrasonic testing to ensure they meet the requirements of the latest DOT-approved edition of API 1104. | Certification required to Level II or III in accordance with the recommendations of American Society for Nondestructive Testing (ASNT), Recommended Practice No. SNT-TC-1A, ACCP for UT or any other recognized national certification program that shall be acceptable to the operator for the test method used. |

## OQ Task Name

Task 39.0 – Backfilling a Trench Following Maintenance

## 1.0 Task Description

This task begins with observation and monitoring of the backfilling or replacement of soil or other material into a trench/ditch and over a pipeline after maintenance or repairs. When a trench for a pipeline is backfilled, it must be done in a manner that provides firm support under the pipe and prevents damage to the pipe and its coating from equipment or the backfill material. This task ends when the pipe is covered such that further backfilling would not cause damage to the pipe.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Backfill material must be free of rocks, roots, and any other foreign material that could damage pipe coating or cause uneven loading of pipe.

- Visual inspection of backfill material to identify foreign objects that could cause damage to the pipeline system and make it unsuitable for backfilling around the pipeline. Material should be free of the following:
    - Items that could affect compaction such as roots, stones, cans, packing boxes, brush, broken skids, broken tools, refuse, etc.
    - Items that could affect cathodic protection systems such as cans, hand tools, welding rods, clamps, scrap metal left in the ditch, etc.
    - Items that could affect coating systems such as large rocks, sharp objects, soil contaminated by hydrocarbons, or large chunks of hard-packed clay or dirt.
    - Items that could contain organic or corrosive materials that could cause localized pipe wall corrosion such as battery acid, nitrate material, caustic matter, etc.

Pipe and pipe coating must be continuously monitored during backfilling to ensure that they are not damaged. Pipe must be properly supported after any temporary supports are removed.

- Allow extra compaction at road crossings or other locations where heavy loads may cross a pipeline.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Response |
|---|---|
| **Pipeline System Damage:** Coating damage from coarse materials. | Remove coarse materials from backfill, and notify appropriate personnel for repair of coating, if necessary. |
| **Pipeline System Damage:** Pipeline damage from a bucket or other equipment inadvertently contacting a pipe (e.g., dent, gouge, scrape, etc). | Perform inspection of damaged area. Notify appropriate personnel for repair of a pipeline, if necessary. |
| **Pipeline System Damage:** Pipeline stress resulting from pipe movement (e.g., pipe sag). | Notify appropriate operator personnel. |
| | Level pipe and support properly. An engineering plan may be required. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Inspect trench for presence of foreign objects or debris. Remove any objects that could cause damage to the pipe or coating. | Visual inspection will determine if objects of foreign material are in the trench. |
| 2 | Perform a visual inspection of backfill material. Identify foreign objects that could cause damage to the pipeline system. Remove any objects that could cause damage to the pipe or coating. | Visual inspection will determine if large objects of foreign material are in the backfill material and whether the backfill material has smaller but potentially damaging material. |
| 3 | Determine whether backfill material is suitable for backfill directly around pipeline. Non-coarse material must be used near the coating. If excavated material is not suitable to refill the trench, replace with suitable material or use a rock shield. | Unsuitable backfill material may damage the pipe coating and potentially the pipe. |
| 4 | As fill material is added to a trench, continue to observe material. | Some soil types compact better than others. |
| 5 | Ensure soil compaction for proper pipe support during backfilling operations. Tamping is required to compact soil. | If soil used for support is not compacted, a pipe will move, adding stress to the pipe. |
| 6 | Continue to backfill equally along both sides of the pipe until adequate cover is achieved. | |
| 7 | When applicable, compact soil using backhoe or roller equipment. | Settlement could mean increased risk to pipeline by third-party damage. |
| 8 | Crown the backfill according to procedures. | Crowning is usually performed to compensate for settlement of backfill. |
| 9 | Backfilling must be documented as required. | |

## OQ Task Name

Task 40.1 – Fit Full Encirclement Welded Split Sleeve (Oversleeve, Tight-Fitting Sleeve, etc.)

## 1.0 Task Description

The full encirclement welded split sleeve is a type of repair used for covering anomalies on a pipeline with two halves installed around the circumference of the pipeline in preparation for welding. Full encirclement split sleeves are designed to be installed on an in-service pipeline.

This task begins with the preparation of the carrier pipe and installation of the sleeves. The task ends with confirmation that the sleeves are correctly installed and the proper welding gap has been established.

This task does not include the welding of the split sleeves or sleeve type determination.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

The full encirclement welded split sleeve is a permanent pressure-containing repair applied to a leaking or non-leaking defect.

This type of sleeve may also be applied to reinforce the wall of the carrier pipeline where a defect exists. The length of the sleeve varies according to the extent of the defect to be repaired.

Definitions applicable to this task are as follows:

**Full Encirclement Sleeve**
Rolled steel formed in two halves to encase the pipeline. The pressure rating of the sleeve must be equal to or greater than the carrier pipe.

**Type A Sleeve**
A steel split sleeve that only requires welding of the longitudinal seams of the sleeves. It is installed under compression.

**Type B Sleeve**
A steel split sleeve that requires welding the longitudinal seams of sleeves and welding the ends of the sleeves to the carrier pipe.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Anomaly or other defect on carrier pipe outside the area of application. | Notify the operator or appropriate individual. |
| Unexpected release of hazardous liquid or gas. | Stop operation, and secure equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Fire or explosion resulting from ignition of hazardous liquids or gas. | Stop operation, and secure equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Confirm surface has been properly prepared according to applicable covered task. | Coating removal and surface preparation is performed under Covered Tasks 13.1, 13.2, or 13.3. |
| 2 | Confirm pipe surface has been inspected for dents, gouges, or other irregularity according to applicable covered task. | Inspection of the pipe surface is performed under Covered Tasks 5.1, 5.2, or 5.3. |
| 3 | Confirm proper type of sleeve to be installed. | Ensures proper type of sleeve will be installed.<br><br>Type A sleeves are installed to reinforce the carrier pipe.<br><br>Type B sleeves are installed for pressure-containing purposes. |
| 4 | Fill defects as needed, with operator-approved material. Filler material shall be applied following manufacturer's recommendations. | Restricts flexion of carrier pipe to maintain integrity. |
| 5 | If the installation is to be a Type B sleeve, confirm acceptable wall thickness has been measured in the seal welding zones according to the applicable covered task. | Ensures integrity of carrier pipe at location of split sleeve ends to be welded for a Type B sleeve.<br><br>AOC: Potential loss of pressure or product resulting from breach of thin carrier pipe wall. Stop operation, and secure equipment, if safe to do so. Inspect equipment and readjust or reset, as necessary.<br><br>Wall thickness measurement is performed under Covered Task 8.2. |
| 6 | If the installation is to be a Type A sleeve, follow the welding procedure to ensure the proper fit. | The welding procedure determines the techniques to apply compression to the sleeve and may include pre-heating and mechanical compression. |
| 7 | Verify proper sleeve length and material grade per operator procedures. | Ensures sleeve meets operator standards, manufacturer's specifications, and industry codes. |
| 8 | Prepare and fit the sleeve to the pipeline. | Ensures proper coverage of defect and fit of the sleeve. |
| 9 | Use lifting device and chains or clamps to achieve a proper fit and an equal welding gap for the longitudinal seam, as necessary. | Ensures proper coverage of defect and fit of sleeve.<br><br>Improper use of the lifting device could result in damage to the carrier pipe. |

## OQ Task Name

Task 40.3 – Apply Composite Sleeve

## 1.0 Task Description

The application of composite material, in the form of multiple layers of woven fiber wrap or rigid fiber sleeves, are acceptable alternatives to steel split sleeves for permanently repairing corrosion and mechanical damage defects. Composite sleeves are designed to be applied to an in-service pipeline. The process also includes the application of filler material to eliminate voids and dents in the carrier pipe surface prior to applying the composite sleeve.

Composite sleeve manufacturers have structured curriculum, training, and certification processes to ensure installers have the knowledge and skills necessary to install their product in accordance with their specifications.

This task begins with confirming the preparations of the pipe as required by the manufacturer prior to applying the composite material and ends with a completed application as defined in the manufacturer's procedures.

## 2.0 Knowledge Component

An individual performing this task must have knowledge that composite material must be installed according to the manufacturer's procedures. The material consists of woven fiber cloth wrapped around the carrier pipe or rigid fiber sleeves shaped to fit the circumference of the carrier pipe. A chemical bonding system is used to adhere the material to the carrier pipe to establish the repair.

The definition applicable to this task is as follows:

**Composite Material**
A high-strength glass or carbon fiber material or laminate that is wrapped around a pipe and adheres to the surface with an adhesive or resin bonding system.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Anomaly or other defect on carrier pipe outside the area of application. | Notify the operator of suspected defect. |
| Unexpected release of hazardous liquid or gas. | Stop operation, and secure equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Ensure the carrier pipe surface is cleaned and prepared according to manufacturer's procedures. | Ensures proper adhesion/bonding of material to pipe surface. |
| 2 | Fill defects, as needed, according to composite material manufacturer's procedures. | Restricts flexion of carrier pipe to maintain integrity. |
| 3 | Apply composite material according to manufacturer's instructions. | Follow manufacturer's procedures for all steps such as applying adhesive, wrapping, and sealing the material. |

## OQ Task Name

Task 40.4 – Install Mechanical Bolt-On Split Repair Sleeve

## 1.0 Task Description

This task includes installing a mechanical bolt-on repair device on an in-service pipeline. The mechanical bolt-on device is a type of pipeline repair used for covering anomalies with a full encirclement component secured onto the pipeline. The mechanical bolt-on repair device is designed to be installed on an in-service pipeline. This type of device is considered a pressure-containing repair and can be used on a leaking defect. This task begins with the preparation of the carrier pipe required by the device manufacturer's procedures prior to installing the device and ends with confirmation that the device has sealed properly.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

- Mechanical bolt-on repair devices (Type B) are designed for application on a pipeline and its flanged assemblies. The mechanical bolt-on repair device may be used as a temporary or permanent repair applied to a leaking defect. A permanent repair will require seal welding.
- The bolts used to secure the repair device must be tightened in the proper torque sequence and value to properly establish a satisfactory seal. The bolting sequence and torque must be completed according to the manufacturer's specifications.
- Bolt-on repair devices should be delivered with specifications identifying the pressure rating, material grade, and other details that must be verified to ensure compatibility with the pipeline operating pressure and service.

Terminology associated with this task is as follows:

**Bolt-On Repair Device**
A device, including sleeves or clamps, that is equipped with seals that are bolted together around the pipeline circumference to repair defects, including leaks. This type of device is available in various designs, lengths, and diameters and may be welded to the pipeline for permanent installation.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Anomaly or other defect on carrier pipe outside the area of installation. | Notify the operator of the suspected defect. |
| Unexpected release of hazardous liquid or gas. | Stop the operation, and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Fire or explosion resulting from ignition of hazardous liquids or gas. | Stop the operation, and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Potential loss of product resulting from breach of thin carrier pipe wall. | Stop the operation, and secure the equipment, if safe to do so. Inspect the equipment and readjust or reset, as necessary. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Prepare the carrier pipe for a proper fit of the sealing elements according to the manufacturer's instructions. | Ensures the sealing integrity of the repair device. |
| 2 | Prior to installing the device on the carrier pipe, confirm that an acceptable wall thickness has been measured in the seal welding zones if the installation is to be permanent. | Ensures that a qualified person has measured the wall thickness of carrier pipe.<br>Ensures the integrity of the carrier pipe in anticipation of welding, if necessary. |
| 3 | Install the repair device, and tighten the bolts using the proper sequence and torque per manufacturer's specifications. | Ensures the proper location and sealing integrity of the repair device. |

## OQ Task Name

Task 40.6 – Install and Remove Plugging Machine

## 1.0 Task Description

This task involves installation and operation of a plugging machine to allow for isolation of a section of a pipeline and for removal of the plugging machine. The fitting referenced in this task has been installed by a person qualified to perform the respective task, prior to installing the plugging machine. This task begins with the installation of the plugging machine on the valve and ends with the removal of the plugging machine from the valve.

## 2.0 Knowledge Component

An individual performing this task must have knowledge that a plugging machine is installed on an operating pipeline to temporarily isolate a section of the pipeline. The plugging machine serves as a temporary block valve.

Definitions applicable to this task are as follows:

**Completion Plug**
A plug designed to seal the opening created by a hot tap. The plug will allow installation and removal of the tapping machine or plugging machine and valve.

**Fitting**
A component welded or clamped to the pipeline upon which a valve is bolted to allow tapping and plugging.

**Plugging Machine**
A machine installed onto a valve for the purpose of inserting a plug to isolate a pipeline segment or divert the flow.

**Valve**
The component installed on the fitting to control product flow while inserting the plug into the pipeline and during removal of the plug and plugging machine.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Loss of pressure or product due to a malfunction of the plugging machine, valve, or other related equipment. | Stop operation, and secure the equipment, if safe to do so. Inspect the equipment and readjust or reset, as necessary. |
| Pipeline pressure exceeds the rated capacity of the plug. | Stop operation, and secure the equipment, if safe to do so. Immediately notify the operator or appropriate individual. Inspect the equipment and readjust or reset, as necessary. |
| Inadequate supports for the plugging machine causes stress and pipeline damage. | Stop operation, and secure the equipment, if safe to do so. Immediately notify the operator or appropriate individual. Inspect the equipment and readjust or reset, as necessary. |

| AOC Recognition | AOC Reaction |
|---|---|
| Unexpected release of hazardous liquid or gas. | Stop operation, and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |
| Fire or explosion resulting from ignition of hazardous liquids or gas. | Stop operation, and secure the equipment, if safe to do so. Immediately notify the operator, and execute applicable emergency procedures. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Install the plugging machine and other fittings and appurtenances as required by manufacturer's specifications. | This step allows for the insertion of the plug into the pipeline and for pressure equalization. |
| 2 | Install the appropriate support for the plugging machine, as necessary. | This step ensures that the weight of the plugging machine does not overstress the pipe. |
| 3 | Equalize the pressure on either side of the valve. | Equalizing pressure across the valve enables operation of the valve. |
| 4 | Open the valve. | This step allows the plugging machine access to the pipe. |
| 5 | Operate the plugging machine to lower the plug into place. | Plug insertion will stop the product flow. |
| 6 | Monitor the pipeline pressure upstream and downstream of the plug. | This step ensures that it does not exceed manufacturer's specifications. |
| 7 | Confirm maintenance repairs are complete. | |
| 8 | Equalize the pressure on either side of the plug. | Equalized pressure will allow retraction of the plug. |
| 9 | Retrieve the plug from the pipe. | The plug is retracted into the plugging machine. |
| 10 | Close the valve and relieve the pressure from the plugging machine. | The plugging machine is isolated from the product flow. Ensures that the valve is fully closed. |
| 11 | Drain the plugging machine before removal. | |
| 12 | Remove the plugging machine from the valve. | |

## OQ Task Name

Task 41.0 – Conduct Pressure Test

## 1.0 Task Description

This task consists of the activities required for pressure testing steel pipelines and components of a pipeline prior to it being placed in service. The pressure test provides verification that the pipeline does not leak after withstanding the required pressure for the specified time period. Pressure testing is conducted for purposes such as the following:

- Maximum operating pressure certification or integrity management
- Testing for certification
- Testing of replacement pipe for sections being relocated, replaced, or otherwise changed
- Conversion of service

This task begins with isolation of the pipeline segment to be tested and ends with the release of test pressure according to the operator's procedures.

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Pressure testing is normally conducted with water as the test medium (hydrostatic testing). Except for offshore pipelines, liquid petroleum that does not vaporize rapidly may be used as the test medium under the following conditions: a) the pipeline test section is outside of cities and populated areas, b) buildings within 300 feet of test section are unoccupied when test pressure is greater than a pressure which produces a hoop stress of 50% specified minimum yield strength, and c) surveillance and continuous communication is maintained along the test section.

Test pressure must be maintained for four continuous hours at a pressure equal to at least 125% of the MOP. Pipelines that cannot be visually inspected for leakage must maintain an additional four continuous hours of test pressure equal to 110% of the MOP.

A pressure test plan must be prepared that identifies the name of the operator and the person conducting the test (including name of test company, if applicable). The following documentation must be included with the plan: a) date and time of the test, b) pressure recording charts, c) test instrumentation calibration data, d) minimum and maximum test pressures, e) minimum time duration of the test, f) description of the facility tested and the test apparatus, and g) temperature of the test medium or pipe during the test period. In the event elevation differences in the test segment exceed 100 feet, a profile of the pipeline identifying the elevations and test sites must also be included with the plan documentation.

The testing instrumentation calibration must be current and certified prior to the test. All pipe, components and test equipment must be capable of withstanding the required maximum test pressure as required by the test plan. Pressure discontinuities, including test failures that appear on the pressure recording charts must be explained in the pressure test plan.

Definitions applicable to this task are as follows:

**Hydrostatic Testing**
The application of pressure to a pipeline utilizing water as the test medium.

**Maximum Operating Pressure (MOP)**
The maximum pressure at which a pipeline or segment of the pipeline may be normally operated under 49 *CFR* Part 195.

**Pressure Testing**
The application of pressure to a pipeline segment or pipe utilizing water or non-HVL product as the test medium. Air or an inert gas may be used as the test medium on a low-stress pipeline.

**Test Instruments**
Calibrated equipment such as deadweight testers, temperature recorders, temperature probes, or pressure recorders that are used to conduct a pressure test.

**Test Medium**
The liquid or gas used to transmit a pre-determined force throughout an isolated pipeline segment for the purpose of determining the ability of the pipeline to withstand a specified pressure.

**Test Normalization**
To factor the thermal effects of a temperature increase or decrease on the test medium and the pipe.

### Abnormal Operating Conditions (AOCs)

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| Valve failure, pipe failure, gasket failure, threaded fitting failure, or weld failure. | Assess damage, and notify appropriate operator personnel. |
| Pipe or component failure during a test or the presence of air in the test medium. | Determine the cause of deviation, and take appropriate steps to correct. Make any necessary operator notification. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Confirm the pipeline segment has been isolated for the test according to the specified procedures. | Ensures affected pipeline segment is prepared to accept test pressure. |
| 2 | Confirm calibration and certification of testing instrumentation is current. | Ensures proper measurement of test parameters. |
| 3 | Connect a pump or compressor to the pipeline segment. | Ensures connections are secured for tightness. |
| 4 | Install temperature probes and connect the temperature and pressure recording devices. | Allows for accurate measurement of test parameters. |
| 5 | Fill and vent the pipeline segment with the test medium, and allow the temperature to stabilize. | Ensures removal of air from pipeline segment.<br>Allows test normalization to minimize fluctuations. |
| 6 | Increase pipeline pressure according to specified procedures. | Performs at specified intervals. |
| 7 | Observe and record pressure and temperature according to specified procedures. | Documents pressure discontinuities. |
| 8 | Document test results. | |
| 9 | After confirming the test was successful, release pressure according to specified procedures. | Ensures completed documentation. |

## OQ Task Name

Task 43.1 – Start-Up of a Liquid Pipeline (Control Center)

## 1.0 Task Description

This task begins with identifying and verifying that the intended flow path is configured in accordance with applicable operating procedures and includes start up of pumping unit(s) and monitoring operational data. This task ends when the line segment reaches steady state and pressure and flow alarms have been set.

Shutdown of a Liquid Pipeline (Control Center) is a separate covered task (Reference Task 43.2).

Monitor Pressures, Flows, Communications and Line Integrity and Maintain Them within Allowable Limits on a Liquid Pipeline System (Control Center) is a separate covered task (Reference Task 43.3).

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Alarm**
SCADA generated visual and/or audible alert that indicates an operating parameter has been exceeded. An alarm receipt requires the controller to take action.

**Leak Detection System – Computational Pipeline Monitoring (CPM) and Non-CPM**

- CPM leak detection – An algorithmic approach to detect hydraulic anomalies in pipeline operating parameters. The CPM leak detection system generates an alarm when a leak event is probable and/or notifies a controller when a condition approaching a leak event is detected.
- Non-CPM leak detection – SCADA tools that utilize analog and other data to detect deviations from normal operations that may indicate a leak. Leak detection, as performed by a pipeline controller, may involve comparisons of pressures, expected flow rates, and over/short rate of change alarms.

**Line Fill**
A line fill is the actual volume of product in a pipeline segment that may vary depending on product density, pressure, and temperature.

**Line Pack**
Line pack is a condition where product vaporization and product mixing is reduced or eliminated. Line pack is a function of the elevation profile, volume of product, pressure and volatility of the product. Line pack is reached when minimum pressures are held throughout the line section.

**MOP**
Maximum operating pressure means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated.

**Pipeline Hydraulics**
Characteristics of fluid flow in a pipeline. Pipeline hydraulics may be affected by the following:

- Elevation profile of the given pipeline
- The product characteristics, including drag reducing agents (DRA)
- Operational changes, including start-ups and shutdowns.

**Steady State**
The point when pressures and flows are relatively constant over time and comparable to historical operational data for that particular segment.

**Supervisory Control and Data Acquisition (SCADA)**
A computer-based system or systems used by a controller in a control room that collects and displays information about a pipeline facility and may have the ability to send commands back to the pipeline facility.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task. These conditions are typically indicated by an alarm.

| AOC Recognition | AOC Reaction |
|---|---|
| **Activation of a Safety Device**: Pressure relief, emergency/abnormal shutdown, high pressure shutdown, case pressure/temperature shutdown, etc.<br>These devices are typically designed to operate and reduce or eliminate a hazardous situation. | If a safety device activates, the controller should investigate the cause of the safety device activation and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Receipt of a Safety-Related Alarm**: Each operator defines safety-related alarms. | If a safety-related alarm is received, the controller should investigate the cause of the safety-related alarm and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Communications, Control System, or Power Interruption or Failure**: Loss of SCADA or electrical services on all or part of the pipeline. | Ensure that back-up systems are activated. Follow trouble-shooting procedures, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Flow Rate Deviation (Unexplained):** High flow, low flow, or no flow. | Investigate the cause of the flow rate deviation, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Pressure Deviation (Unexplained):** Pressure increase, decrease, or lack of a pressure reading. | Investigate the cause of the pressure deviation, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Status Change (Unintended):** Changes in unit status or valve position. | Investigate the cause of the status change, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Tank Level Outside Safe Limits** | Shut down operation. Investigate the cause of the tank exceeding safe limits and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Notify all origin and delivery facilities of an impending start-up and verify sufficient capacity at the receipt/delivery point. | Allows field personnel and shippers to perform necessary functions. |
| 2 | Verify that the intended flow path is configured in accordance with applicable operating procedures. | Verification may be by SCADA or by other communications. |
| 3 | Determine the operating pressures, flows, line packs, and line fill for the pipeline under similar conditions. | Refer to operator's procedures, documentation, and historical trends. |
| 4 | Determine which pumping units will be started to provide a scheduled flow rate. | Follows operator's procedures. Refer to pumping schedule, documentation, and historical trends. |
| 5 | Verify that pumps and other equipment are in a ready state. | |
| 6 | Start pump(s) according to written operating procedures. | |
| 7 | Monitor pressures and flow rates after start-up, and make adjustments to achieve a steady state. | |
| 8 | After steady state has been achieved, set pressure and flow alarms. | |

## OQ Task Name

Task 43.2 – Shutdown of a Liquid Pipeline (Control Center)

## 1.0 Task Description

This task involves shutting down any part of a pipeline system in a manner designed to assure safe operation. This task begins with identifying the part of the pipeline system to be shutdown. The task includes verifying all necessary valve alignments, making the required communications, and monitoring pressure and flow rates to ensure operation within safe design limits. This task ends when the identified part of a pipeline system reaches static or steady state.

Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them within Allowable Limits on a Liquid Pipeline System (Control Center) is a separate covered task (Reference Task 43.3).

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

Locally Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 63.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Alarm**
SCADA generated visual and/or audible alert that indicates an operating parameter has been exceeded. An alarm receipt requires the controller to take action.

**Leak Detection System – Computational Pipeline Monitoring (CPM) and Non-CPM**

- CPM leak detection – An algorithmic approach to detect hydraulic anomalies in pipeline operating parameters. The CPM leak detection system alerts a controller when a leak event is probable and/or notifies a controller when a condition approaching a leak event is detected.
- Non-CPM leak detection – SCADA tools that utilize analog and other data to detect deviations from normal operations that may indicate a leak. Leak detection, as performed by a pipeline controller, may involve comparisons of pressures, expected flow rates, and over/short rate of change alarms.

**Line Pack**
Line pack is a condition where product vaporization and product mixing is reduced or eliminated. Line pack is a function of the elevation profile, volume of product, pressure and volatility of the product. Line pack is reached when minimum pressures are held throughout the line section.

**MOP**
Maximum operating pressure means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated. Parts of a pipeline system should be shut down in a manner not to exceed a pipeline segment's MOP.

**Pipeline Hydraulics**
Characteristics of fluid flow in a pipeline may impact shutdown operations. Pipeline hydraulics may be affected by the following:

- Elevation profile of the given pipeline.
- The product characteristics, including drag reducing agents (DRA)
- Operational changes

**Pressure Surge**
Pressure surge is a wave resulting when a fluid in motion is forced to stop or change direction suddenly. This commonly occurs in a pipeline when a valve is suddenly closed at the end of a pipeline system and a pressure wave propagates in the pipe.

**Static State**
Static state refers to an inactive or shutdown pipeline where product is not flowing.

**Steady State**
The point when pressures and flows are relatively constant over time and comparable to historical operational data for that particular segment. Steady state refers to a condition on an active or flowing pipeline.

**Supervisory Control and Data Acquisition (SCADA)**
A computer-based system or systems used by a controller in a control room that collects and displays information about a pipeline facility and may have the ability to send commands back to the pipeline facility.

## Abnormal Operating Conditions (AOCs)

The following AOCs could be encountered while performing this task. These conditions are typically indicated by an alarm.

| AOC Recognition | AOC Reaction |
|---|---|
| **Activation of a Safety Device:** Pressure relief, emergency/abnormal shutdown, high pressure shutdown, case pressure/temperature shutdown, etc.<br><br>These devices are typically designed to operate and reduce or eliminate a hazardous situation. | If a safety device activates, the controller should investigate the cause of the safety device activation and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |
| **Receipt of a Safety-Related Alarm:** Each operator defines safety-related alarms. | If a safety-related alarm is received, the controller should investigate the cause of the safety-related alarm and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |
| **Communications, Control System, or Power Interruption or Failure:** Loss of SCADA or electrical services on all or part of the pipeline, as indicated by SCADA displays or as a result of field communication. | Ensure that back-up systems are activated. Follow trouble-shooting procedures, and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |
| **Flow Rate Deviation (Unexplained):** High flow, low flow, or no flow, as indicated by SCADA displays or as a result of field communication. | Investigate the cause of the flow rate deviation, and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |
| **Pressure Deviation (Unexplained):** Pressure increase, decrease, or lack of a pressure reading, as indicated by SCADA displays or as a result of field communication. | Investigate the cause of the pressure deviation, and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |
| **Status Change (Unintended):** Changes in unit status or valve position, as indicated by SCADA displays or as a result of field communication. | Investigate the cause of the status change, and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Notify all origin and delivery facilities of an impending shutdown, if applicable. | Allows field personnel to perform necessary local and/or non-automated functions. |
| 2 | Identify the pumping units that will be shut down. | |
| 3 | Shut down the identified part of the pipeline system according to written operating procedures. | Procedures may include steps to maintain appropriate pressure on shutdown to minimize contamination of products. |
| 4 | Monitor pressures and flow rates during shutdown, and make adjustments to achieve desired static/steady state. | |
| 5 | When pump shutdown is completed, verify valve status and static/steady state have been achieved. | |

## OQ Task Name

Task 43.3 – Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Control Center)

## 1.0 Task Description

This task includes the activities for monitoring and maintaining pipeline conditions (such as pressures, flow rates, and tank levels) within allowable limits according to regulation and operator's procedures. The task begins when a pipeline reaches steady state and ends when the start up or shutdown of the pipeline begins.

Start-Up of a Liquid Pipeline (Control Center) is a separate covered task (Reference Task 43.1).

Shutdown of a Liquid Pipeline (Control Center) is a separate covered task (Reference Task 43.2).

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Alarm**
SCADA generated visual and/or audible alert that indicates an operating parameter has been exceeded. A controller must be able to interpret the alarm, determine the impact to safe pipeline operation, and respond accordingly.

**Leak Detection System – Computational Pipeline Monitoring (CPM) and Non-CPM**

- CPM leak detection – An algorithmic approach to detect hydraulic anomalies in pipeline operating parameters. The CPM leak detection system generates an alarm when a leak event is probable and/or notifies a controller when a condition approaching a leak event is detected.
- Non-CPM leak detection – SCADA tools that utilize analog and other data to detect deviations from normal operations that may indicate a leak. Leak detection, as performed by a pipeline controller, may involve comparisons of pressures, expected flow rates, and over/short rate of change alarms.

**Line Fill**
A line fill is the actual volume of product in a pipeline segment that may vary depending on product density, pressure, and temperature.

**Line Pack**
Line pack is a condition where product vaporization and product mixing is reduced or eliminated. Line pack is a function of the elevation profile, volume of product, pressure, and volatility of the product. Line pack is reached when minimum pressures are held throughout the line section.

**MOP**
Maximum Operating Pressure means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated.

**Supervisory Control and Data Acquisition (SCADA)**
A computer-based system or systems used by a controller in a control room that collects and displays information about a pipeline facility and may have the ability to send commands back to the pipeline facility.

**Pipeline Hydraulics**
Characteristics of fluid flow in a pipeline. Pipeline hydraulics may be affected by the following:

- Elevation profile of the given pipeline
- The product characteristics, including drag reducing agents (DRA)
- Operational changes

**Steady State**
The point when pressures and flows are relatively constant over time and comparable to historical operational data for that particular segment.

### Abnormal Operating Conditions (AOCs)

The following AOCs could be encountered while performing this task. These conditions are typically indicated by an alarm.

| AOC Recognition | AOC Reaction |
|---|---|
| **Activation of a Safety Device:** Pressure relief, emergency/abnormal shutdown, high pressure shutdown, case pressure/temperature shutdown, etc.<br>These devices are typically designed to operate and reduce or eliminate a hazardous situation. | If a safety device activates, the controller should investigate the cause of the safety device activation and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Receipt of a Safety-Related Alarm:** Each operator defines safety-related alarms. | If a safety-related alarm is received, the controller should investigate the cause of the safety-related alarm and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Communications, Control System, or Power Interruption or Failure:** Loss of SCADA or electrical services on all or part of the pipeline. | Ensure that back-up systems are activated. Follow trouble-shooting procedures, and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Flow Rate Deviation (Unexplained):** High flow, low flow, or no flow. | Investigate the cause of the flow rate deviation and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Pressure Deviation (Unexplained):** Pressure increase, decrease, or lack of a pressure reading. | Investigate the cause of the pressure deviation and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Status Change (Unintended):** Changes in unit status or valve position. | Investigate the cause of the status change and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Tank Level Outside Safe Limits** | Shut down operation. Investigate the cause of the tank exceeding safe limits and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |

## 3.0 Skill Component

To demonstrate proficiency of this task an individual must perform the following steps. These actions are not performed in sequence and can happen simultaneously:

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify that the pressure and flow rates have stabilized (steady state). | Allow time for packing line. |
| 2 | Set appropriate operating limits such as pressure, and flow rate. | Each pipeline has its own normal operating parameters. If operating limits are not set appropriately, safe operating parameters may be exceeded. |
| 3 | Continuously monitor SCADA information such as alarms, trending, pressure, flow rates, rate of change (ROC), line fill, tank levels, and communication status. | Each pipeline has its own normal operating parameters. By analyzing data, a controller can take actions to avoid alarm conditions. |
| 4 | Adjust set-points on control points to achieve and maintain desired flow rates or pressures. | |
| 5 | Communicate, as necessary, with field personnel and shippers regarding pipeline operations. | Communication with field personnel and shippers may be necessary to effect changes or to notify of changes. |
| 6 | Utilize the leak detection system to continuously monitor for leak indications. | Leak detection indications require a controller to take some sort of remedial action which may include system shutdown and internal notifications. |
| 7 | Respond to alarm. | Each pipeline has its own alarm response protocols. |
| 8 | Document and/or report information, as appropriate. | Documenting provides data for compliance, historical review and trending. |

## OQ Task Name

Task 43.4 – Remotely Operate Valves on a Liquid Pipeline System

## 1.0 Task Description

This task begins with identification of the valve to be operated and includes the remote operation of that valve. This task ends when the proper valve position has been indicated. Remote operation of the valve is defined as manipulation of the valve's position from a location that is not in direct proximity to the valve.

Locally Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 63.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of how valve indication is identified by some type of Supervisory Control and Data Acquisition (SCADA), Human Machine Interface (HMI) icon, or other indicator that changes appearance when the valve position changes.

Items to be considered prior to operation of valves include the following:

- Impacts to the pipeline operation such as pressure, flow, and tank levels
- Operation of incorrect valves could cause an unsafe condition

How communication with either local operations or control center may be required prior to or after valve operation.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| **Pressure Deviation (Unexplained) –** Pressure display(s), alarms, or other pressure indicators show the unexplained pressure deviation. | Make the condition safe to the extent possible and according to operator's procedures. Assess the condition for safety, environmental, or physical damage.<br>Reactions could include:<br>• Shutting down the system (if qualified)<br>• Returning the valve to its original position<br>• Operating an appropriate valve<br>• Isolating damaged equipment<br>• Making appropriate notifications |
| **Flow Deviation (Unexplained) –** Flow gauges, flow recorders, alarms, tank levels, or other flow indicators show the unexplained flow deviation. | Make the condition safe to the extent possible and according to operator's procedures. Assess the condition for safety, environmental, or physical damage.<br>Reactions could include the following:<br>• Shutting down the system (if qualified)<br>• Returning the valve to its original position<br>• Operating an appropriate valve<br>• Isolating damaged equipment<br>• Making appropriate notifications |

| AOC Recognition | AOC Reaction |
|---|---|
| **Valve Position Indication (Unexpected) –** SCADA, HMI, or other valve position/status indicators show unexpected valve position indication. | Troubleshoot communications and valve control functions as appropriate.<br>Make appropriate notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the valve to be operated. | Use appropriate references to help ensure correct identity of valve. |
| 2 | Communicate with field operations or the control center prior to valve operation (if required by operating procedure). | The control center has ultimate responsibility and authority for actions that affect the safe operation of a pipeline. |
| 3 | Remotely operate valve | |
| 4 | Ensure proper valve position, and communicate (if required by operating procedure) with field operations or the control center after valve operation. | Valve position is indicated by some type of SCADA, HMI icon, or other indicators that will change appearance when valve position changes. |

## OQ Task Name

Task 63.1 – Start-Up of a Liquid Pipeline (Field)

## 1.0 Task Description

This task begins with identifying and verifying that the intended flow path is configured in accordance with applicable operating procedures and includes communicating with a control room to confirm a flow path is open for the intended operation. This task ends when the control room assumes control of the operation.

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

Locally Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 63.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Alarm**
SCADA or HMI-generated visual and/or audible alert that indicates an operating parameter has been exceeded. An alarm receipt may require a controller or operator to take action.

**Human Machine Interface (HMI)**
A software application that presents information to an operator about the state of a process and to accept and implement an operator's control instructions. Typically, information is displayed in a graphic format.

**MOP**
Maximum operating pressure means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated.

**Supervisory Control and Data Acquisition (SCADA)**
A computer-based system or systems used by a controller in a control room that collects and displays information about a pipeline facility and may have the ability to send commands back to the pipeline facility.

**Abnormal Operating Conditions (AOCs)**
The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| **Activation of a Safety Device:** Pressure relief, emergency/abnormal shutdown, high pressure shutdown, case pressure/temperature shutdown, etc.<br><br>The operator should receive or observe an audible or visual indication from the HMI or other systems. | If a safety device activates, the operator should investigate the cause of the safety device activation and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |
| **Communications, Control System or Power Interruption or Failure:** Loss of SCADA communication to control room or electrical services. | Ensure that back-up systems are activated. Follow trouble-shooting procedures, and take appropriate action to mitigate the situation.<br><br>Make appropriate notifications. |

| AOC Recognition | AOC Reaction |
|---|---|
| **Flow Rate Deviation (Unexplained):** High flow, low flow, or no flow.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems | Investigate the cause of the flow rate deviation, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Pressure Deviation (Unexplained):** Pressure increase, decrease, or lack of pressure reading.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems | Investigate the cause of the pressure deviation, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Status Change (Unintended):** Changes in unit status or valve position.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems. | Investigate the cause of the status change, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Communicate with the control room the intended start-up configuration. | Allows control room and local operator to confirm start-up. |
| 2 | Verify with the control room that the intended flow path is configured in accordance with applicable operating procedures. | Verification may include local piping alignment and confirmation of remote flow path configuration from control room. |
| 3 | Verify that pumps and other equipment are in a ready state. | |
| 4 | Start pump(s) according to written operating procedures. | |
| 5 | Monitor pressures and flow rates after start-up. | |
| 6 | Communicate with the control room to verify that it has assumed control of the operation. | |

## OQ Task Name

Task 63.2 – Shutdown of a Liquid Pipeline (Field)

## 1.0 Task Description

This task involves shutting down any part of a pipeline system in a manner designed to assure safe operation. This task begins with identifying the part of the pipeline system to be shut down. The task includes communicating with a control room to confirm intended shutdown and may include verifying all necessary valve alignments, making required communications, and monitoring pressure and flow rates to ensure operation within safe design limits. This task ends when the control room assumes control of the operation or when the identified part of a pipeline system reaches static or steady state.

Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them within Allowable Limits on a Liquid Pipeline System (Control Center) is a separate covered task (Reference Task 43.3).

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them within Allowable Limits on a Liquid Pipeline System (Field) is a separate covered task (Reference Task 63.3).

Locally Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 63.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Alarm**
An alarm is a visual and/or audible alert that indicates a parameter has been exceeded. A qualified individual must be able to interpret an alarm, determine the impact to safe pipeline operation, and respond accordingly.

**Human Machine Interface (HMI)**
A software application that presents information to an operator about the state of a process and to accept and implement an operator's control instructions. Typically, information is displayed in a graphic format.

**MOP**
Maximum operating pressure means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated. Parts of a pipeline system should be shut down in a manner not to exceed a pipeline segment's MOP.

**Pipeline Hydraulics**
Characteristics of fluid flow in a pipeline may impact shutdown operations. Pipeline hydraulics may be affected by the following:

- Elevation profile of the given pipeline.
- The product characteristics, including drag reducing agents (DRA)
- Operational changes

**Pressure Surge**
Pressure surge is a wave resulting when a fluid in motion is forced to stop or change direction suddenly. This commonly occurs in a pipeline when a valve is suddenly closed at the end of a pipeline system and a pressure wave propagates in the pipe.

**Static State**
Static state refers to an inactive or shutdown pipeline where product is not flowing.

**Steady State**
The point when pressures and flows are relatively constant over time and comparable to historical operational data for that particular segment. Steady state refers to a condition on an active or flowing pipeline.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task. These conditions are typically indicated by an alarm.

| AOC Recognition | AOC Reaction |
|---|---|
| **Activation of a Safety Device:** Pressure relief, emergency/abnormal shutdown, high pressure shutdown, case pressure/temperature shutdown, etc.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems. | If a safety device activates, the operator should investigate the cause of the safety device activation and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Communications, Control System, or Power Interruption or Failure:** Loss of HMI communication to control room or electrical services. | Ensure that back-up systems are activated. Follow trouble-shooting procedures, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Flow Rate Deviation (Unexplained):** High flow, low flow, or no flow.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems. | Investigate the cause of the flow rate deviation, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Pressure Deviation (Unexplained):** Pressure increase, decrease, or lack of pressure reading.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems. | Investigate the cause of the pressure deviation, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |
| **Status Change (Unintended):** Changes in unit status or valve position.<br>The operator should receive or observe an audible or visual indication from the HMI or other systems. | Investigate the cause of the status change, and take appropriate action to mitigate the situation.<br>Make appropriate notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Communicate with the control room the intended shutdown configuration. | Allows the control room and local operator to confirm shutdown. |
| 2 | Identify which pumping units will be shut down, if any. | |

| Step | Action | Explanation |
|---|---|---|
| 3 | Shut down the identified part of the pipeline system according to written operating procedures. | Procedures may include steps to maintain appropriate pressure on shutdown to minimize contamination of products. |
| 4 | Monitor pressures and flow rates during shutdown, and make adjustments to achieve desired static/steady state. | |
| 5 | When shutdown is complete, verify that valve status and static/steady state have been achieved. | |

## OQ Task Name

Task 63.3 – Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them within Allowable Limits on a Liquid Pipeline System (Field)

## 1.0 Task Description

This task includes the activities for monitoring and maintaining pipeline conditions (such as pressures, flow rates, and tank levels) within allowable limits according to regulations and operator's procedures. The task begins when a part of the pipeline system reaches steady state and ends when shutdown of part of the pipeline system begins.

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

Locally Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 63.4).

Start-Up of a Liquid Pipeline (Field) is a separate covered task (Reference Task 63.1).

Shutdown of a Liquid Pipeline (Field) is a separate covered task (Reference Task 63.2).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Definitions applicable to this task are as follows:

**Alarm**
An alarm is a visual and/or audible alert that indicates that a parameter has been exceeded. A qualified individual must be able to interpret an alarm, determine the impact to safe pipeline operation, and respond accordingly.

**Line Pack**
Line pack is a condition where product vaporization and product mixing is reduced or eliminated. Line pack is a function of the elevation profile, volume of product, pressure and volatility of the product. Line pack is reached when minimum pressures are held throughout the line section.

**MOP**
Maximum operating pressure means the maximum pressure at which a pipeline or segment of a pipeline may be normally operated.

**Pipeline Hydraulics**
Characteristics of fluid flow in a pipeline. Pipeline hydraulics may be affected by the following:

- Elevation profile of the given pipeline
- The product characteristics, including drag reducing agents (DRA)
- Operational changes

**Steady State**
The point when pressures and flows are relatively constant over time and comparable to historical operational data for that particular segment. Steady state refers to a condition on an active or flowing pipeline.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task. These conditions are typically indicated by an alarm.

| AOC Recognition | AOC Reaction |
|---|---|
| **Activation of a Safety Device:** Pressure relief, emergency/abnormal shutdown, high pressure shutdown, case pressure/temperature shutdown, etc.<br>These devices are typically designed to operate and reduce or eliminate a hazardous situation. | If a safety device activates, the controller should investigate the cause of the safety device activation and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Activation of an Alarm** | If an alarm is activated, the qualified individual should investigate the cause of the alarm and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Loss of Communications, Control System, or Power Interruption/Failure** | Ensure that back-up systems are activated. Follow trouble-shooting procedures and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Flow Rate Deviation (Unexplained):** High flow, low flow, or no flow. | Investigate the cause of the flow rate deviation and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Pressure Deviation (Unexplained):** Pressure increase, decrease, or lack of pressure reading. | Investigate the cause of the pressure deviation and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Status Change (Unintended):** Changes in unit status or valve position. | Investigate the cause of the status change and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |
| **Tank Level Outside Safe Limits** | Shut down operation. Investigate the cause of the tank exceeding safe limits and do what is necessary to mitigate the situation.<br>Make appropriate notifications. |

## 3.0 Skill Component

To demonstrate proficiency of this task an individual must perform the following steps. These actions are not performed in sequence and can happen simultaneously:

| Step | Action | Explanation |
|---|---|---|
| 1 | Verify that the pressure and flow rates have stabilized (steady state). | Allows time for packing line. |
| 2 | Set appropriate operating limits such as pressure and flow rate while ensuring that MOP is not exceeded. | Each pipeline has its own normal operating parameters. If operating limits are not set appropriately, safe operating parameters may be exceeded. |

| Step | Action | Explanation |
|---|---|---|
| 3 | Monitor operating information such as alarms, trending, pressure, flow rates, rate of change (ROC), line fill, tank levels, and communication status. | Each pipeline has its own normal operating parameters. By analyzing data, a qualified individual can take actions to avoid or respond to alarm conditions. |
| 4 | Adjust set-points on control points to achieve and maintain desired flow rates or pressures while ensuring that MOP is not exceeded. | |
| 5 | Communicate, as necessary, with field and control room personnel and shippers regarding pipeline operations. | Communication may be necessary to effect changes or to notify of changes. |
| 6 | Document and/or report information, as appropriate. | Documenting provides data for compliance, historical review, and trending. |

## OQ Task Name

Task 63.4 – Locally Operate Valves on a Liquid Pipeline System

## 1.0 Task Description

This task begins with identification of the valve to be operated and includes the local operation of the valve. The task ends when proper valve position has been indicated. Local operation of the valve is defined as manipulation of the valve's position from a location that is in close proximity to the valve. Direct observation shall be used to confirm the valve's position.

Remotely Operate Valves on a Liquid Pipeline System is a separate covered task (Reference Task 43.4).

## 2.0 Knowledge Component

An individual performing this task must have knowledge of the following:

Valve position indication – Each valve, other than a check valve, must have some method to indicate the valve's position. Examples include the following:

- Rising stem
- Arrow
- Handle position
- Open/close flag or display

Items to be considered prior to operation of valves include the following:

- Impacts to the pipeline operation such as pressures, flows, and tank levels. Pressure surges and hydraulic shock/hammer are examples of conditions that can result from valve operation.
- Operation of incorrect valves could cause an unsafe condition
- Creation of thermal traps by shutting in segments of pipeline systems where it could be over pressured because of an increase of product temperature

How communication with either local operations or control center may be required prior to or after valve operation.

**Abnormal Operating Conditions (AOCs)**

The following AOCs could be encountered while performing this task:

| AOC Recognition | AOC Reaction |
|---|---|
| **Pressure Deviation (Unexplained) –** Pressure display(s), sound, vibration, alarms, or other pressure indicators show the unexplained pressure deviation. | Make the condition safe according to the extent possible and according to operator's procedures. Assess the condition for safety, environmental, or physical damage.<br>Reactions could include the following:<br>• Shutting down the system (if qualified)<br>• Returning the valve to its original position<br>• Operating an appropriate valve<br>• Isolating damaged equipment<br>• Making appropriate notifications |

| AOC Recognition | AOC Reaction |
|---|---|
| **Flow Rate Deviation (Unexplained) –** Flow gauges, alarms, tank levels, or other flow indicators show the unexplained flow deviation. | Make the condition safe to the extent possible and according to operator's procedures. Assess the condition for safety, environmental, or physical damage.<br>Reactions could include the following:<br>• Shutting down the system (if qualified)<br>• Returning the valve to its original position<br>• Operating an appropriate valve<br>• Isolating damaged equipment<br>• Making appropriate notifications |
| **Valve Position Indication (Unexpected) –** Valve position indicators show unexpected valve position indication. | Confirm valve position. Investigate and resolve source of discrepancy between valve position and indicator. Proper valve indication is required. Ensure appropriate notifications are made before resuming safe pipeline operation. |
| **Valve Inoperable –** Valve will not operate as intended or will not fully close/open.<br>Examples:<br>• Valve indicator does not show the intended position.<br>• Unexpected pressure and flow outcomes.<br>• Inoperable operator/actuator or hand wheel<br>• Excessive differential pressure across valve prohibits its operation. | Make the condition safe to the extent possible and according to operator's procedures. Assess condition for safety, environmental, or physical damage.<br>Reactions could include the following:<br>• Re-try operation<br>• Relieve excessive differential pressure<br>• Shut down system (if qualified)<br>• Make appropriate notifications |
| **Unexpected Presence of Hazardous Liquid or Vapor –** Incorrect valve operation could lead to an unintended release of product that could be observed by sight, smell, sound, or alarms. | Minimize the situation if it can be done safely.<br>Make appropriate notifications. |

## 3.0 Skill Component

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

| Step | Action | Explanation |
|---|---|---|
| 1 | Identify the valve to be operated. | Uses appropriate references to help ensure correct identity of valve. |
| 2 | Communicate with field operations or the control center prior to valve operation (if required by operating procedure). | The control center has ultimate responsibility and authorization for actions that affect the safe operation of a pipeline. |
| 3 | Locally operate valve. | Valves may be operated manually and/or by a motor-operated actuator. |
| 4 | Ensure proper valve position and communicate (if required by operating procedure) with field operations or the control center after valve operation. | The control center has ultimate responsibility and authorization for actions that affect the safe operation of a pipeline. |