Recommended Practice for Pipeline Operator Qualification (OQ)

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Recommended Practice for Pipeline Operator Qualification (OQ)

1 Scope

The purpose of this recommended practice (RP) is to provide guidance for developing and maintaining an operator qualification (OQ) program. This document is comprised of the RP along with normative and nonmandatory, informative annexes.

This RP is applicable for all pipelines, both onshore and offshore, subject to 49 *Code of Federal Regulations (CFR)* Part 192 and/or Part 195. References to 49 *CFR* Part 192 are applicable to gas-transmission-only tasks, and references to 49 *CFR* Part 195 are applicable to liquid-only tasks. Operators may choose to use all, part, or none of this document as applicable to their operations.

Operators should be aware that the OQ regulation is applicable only to United States Department of Transportation (DOT) jurisdictional pipelines. For purposes of this document, the word "pipeline" is used interchangeably with pipeline, pipeline facility, pipeline system, and any and all jurisdictional pipeline components as defined in 49 *CFR* Part 192 and Part 195.

Annexes F and G have been added to this edition to address management of change and abnormal operating conditions.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API 510, *Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration*

API Standard 653, *Tank Inspection, Repair, Alteration, and Reconstruction*

API Standard 1104, *Welding of Pipelines and Related Facilities*

API Recommended Practice 2350, *Overfill Protection for Storage Tanks in Petroleum Facilities*

ASME *Boiler and Pressure Vessel Code* [1], *Section IX*: *Welding and Brazing Qualifications*

ASNT Recommended Practice SNT-TC-1A [2], *Personnel Qualification and Certification in Nondestructive Testing*

U.S. DOT Title 49, *Code of Federal Regulations* (*CFR*) Part 192 [3], *Transportation of Natural and Other Gas by Pipeline*

U.S. DOT Title 49, *Code of Federal Regulations* (*CFR*) Part 195, *Transportation of Hazardous Liquids by Pipeline*

U.S. DOT Title 49, *Code of Federal Regulations* (*CFR*) § 191.23, *Reporting Safety-related Conditions*

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1 ASME International, 2 Park Avenue, New York, NY 10016-5990, www.asme.org.

2 American Society for Nondestructive Testing, PO Box 28518, 1711 Arlingate Lane, Columbus, OH 43228, www.asnt.org.

3 Department of Transportation. The *Code of Federal Regulations* is available from the U.S. Government Printing Office, Washington, DC 20402, www.gpo.gov/fdsys.

3 Terms, Definitions, Acronyms, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following definitions apply.

NOTE When identical terms are defined within the task standard and in this section, the task standard definitions apply.

3.1.1
abnormal operating condition
AOC
A condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may:

— indicate a condition exceeding design limits; or

— result in a hazard(s) to persons, property, or the environment.

NOTE As defined in 49 *CFR* § 195.503 and 49 *CFR* § 192.803.

3.1.2
accident
A failure in a pipeline system in which there is a release of the hazardous liquid or carbon dioxide transported, resulting in any of the following.

a) Explosion or fire not intentionally set by the operator.

b) Release of 5 gal (19 L) or more of hazardous liquid or carbon dioxide, except that no report is required for a release of less than 5 bbl (0.8 m^3) resulting from a pipeline maintenance activity if the release is:

   1) not otherwise reportable under this section,

   2) not one described in 49 *CFR* § 195.52(a)(4),

   3) confined to company property or pipeline right-of-way, and

   4) cleaned up promptly.

c) Death of any person.

d) Personal injury necessitating hospitalization.

e) Estimated property damage, including cost of clean-up and recovery, value of lost product, and damage to the property of the operator or others, or both, exceeding $50,000.

NOTE As defined in 49 *CFR* § 195.50.

3.1.3
complexity
An analysis type that includes a review of the knowledge and skill components of a task.

NOTE Factors that may be used to determine complexity minimally include:

— level of knowledge required,

— amount of independent judgment required,

— advanced skills that are necessary,

— technical training or certifications that are required,

— required training or certification needed by regulation.

3.1.4
covered task
Defined as follows:

— is a discrete activity performed by an individual or group of individuals,

— has a beginning and an ending point,

— has two or more steps,

— can be observed and measured,

— is identified by the company,

— meets all four of the conditions of the “Four-part Test.”

NOTE As defined in 49 CFR 195.501 and 49 CFR § 192.801.

3.1.5
criticality
An analysis type that includes a review of the potential adverse impacts that could result from improper performance of a task.

NOTE 1 Criticality can be determined as a factor of the likelihood and consequences of improper performance.

NOTE 2 Consequences that may be used to determine criticality minimally include:

— exceeding design limits,

— personal injury,

— release of a product,

— ignition source.

3.1.6
evaluation
A process, established and documented by the operator, to determine an individual’s ability to perform a covered task by any of the following:

a) written examination;

b) oral examination;

c) work performance history review (WPHR);

d) observation during:

1) performance on the job,

2) on-the-job training (OJT), or

3) simulations;

e) other forms of assessment.

NOTE As defined in 49 *CFR* § 195.503 and 49 *CFR* § 192.803.

3.1.7
incident
Any of the following events.

1) An event that involves a release of gas from a pipeline, gas from an underground natural gas storage facility, liquefied natural gas (LNG), liquefied petroleum gas, refrigerant gas, or gas from an LNG facility and that results in one or more of the following consequences:

   i) a death or personal injury necessitating in-patient hospitalization;

   ii) estimated property damage of $50,000 or more, including loss to the operator and others, or both, but excluding cost of gas lost; or

   iii) unintentional estimated gas loss of 3 MMcf or more.

2) An event that results in an emergency shutdown of an LNG facility or an underground natural gas storage facility. Activation of an emergency shutdown system for reasons other than an actual emergency does not constitute an incident.

3) An event that is significant in the judgment of the operator, even though it did not meet the criteria of Item 1) or Item 2) of this definition.

NOTE As defined in 49 *CFR* § 191.3 Definitions.

3.1.8
operator qualification program
OQ program
Operators of natural gas and hazardous liquid pipelines to develop a program to ensure that personnel who are performing the operations and maintenance tasks on a pipeline are qualified to do so.

3.1.9
practicality
An analysis type that includes a review of typical situational factors inherent in the performance of a task.

NOTE Factors that may be used to determine practicality may include:

— number of individuals required to perform a task,

— number of individuals that can reasonably fit in a job performance area,

— number of individuals that can be directly observed at one time,

— location where the task is performed,

— coordination with other individuals or groups.

3.1.10
qualification
The result of a process determined by the operator that includes successful completion of task-specific evaluation(s) with the associated abnormal operating conditions (AOCs), documentation, and any other requirements as documented in the OQ program.

3.1.11
qualified
An individual who has been evaluated and can:

a) perform assigned covered tasks, and

b) recognize and react to AOCs associated with those tasks.

3.1.12
remote evaluation
An evaluation that is conducted and controlled by an evaluator where the evaluator is not physically present.

3.1.13
span of control
The ratio of nonqualified to qualified individuals where the nonqualified individual may be directed and observed by a qualified individual when performing a covered task, with the consideration to complexity of the covered task and the operational conditions when performing the covered task.

3.1.14
training
Act of facilitating the learning, development, and improvement of new and existing knowledge and skills and not the evaluation or qualification of those knowledge and skills.

3.2 Acronyms and Abbreviations

AC	alternating current
AO	abnormal operation
AOC	abnormal operating condition
CP	cathodic protection
CPM	computational pipeline monitoring
DC	direct current
DCF	density correction factor
DRA	drag reducing agent
HMI	human machine interface
HQ	headquarters
HVL	highly volatile liquid
HVLP	high-volume low-pressure
I/O	input/output
KCl	potassium chloride
KS	knowledge and skills
LNG	liquefied natural gas
MIL	$^{1}/_{1000}$ in.
MOP	maximum operating pressure (liquid)
NDT	nondestructive testing
OJT	on-the-job training
O&M	operations and maintenance

OPD	overfill protective device
OPID	operator identification number
OPS	Office of Pipeline Safety
OQ	operator qualification
PCR	polarization cell replacement
PHMSA	Pipeline and Hazardous Materials Safety Administration
PLC	programmable logic controller
PV	pressure/vacuum
RMU	remote monitoring unit
RTD	resistance thermal device
SCADA	Supervisory Control and Data Acquisition
SRC	safety-related condition
SSD	solid state decoupling
VOM	volt-ohm meter
WPHR	work performance history review

4 Guidance for Developing an OQ Program

4.1 Roles and Responsibilities

Operators should define roles and responsibilities for the administration, management, and consistent implementation of the OQ program. Clear responsibilities for implementing the elements of the OQ program should be established and communicated to affected individuals. Responsibilities associated with the OQ program may include but are not limited to the following:

— central management and oversight of the OQ program;

— training, as appropriate;

— conducting and administering evaluations;

— recordkeeping;

— assigning covered tasks to individuals;

— verifying individuals' qualifications;

— managing contractors and other entities.

4.2 Participation in an Industry Group

The operator may consider participating in an industry OQ group. These groups develop and update OQ guidance materials, share best practices, and interact with regulatory agencies.

4.3 Language

The operator's OQ program should include a policy on language to ensure effective communication when non-English-speaking individuals perform covered tasks. Options may include but are not limited to the following:

— maintain a single-language policy, whereby all individuals performing covered tasks speak the same language (i.e. English);

— utilize bilingual individuals to interpret for non-English-speaking individuals performing covered tasks;

— ensure availability of acceptable qualification methods in applicable language(s).

4.4 Program Improvement

4.4.1 General

While not specifically required by the regulation, an operator may consider developing processes for periodic review of the OQ program and auditing program implementation. Operators should determine the process for incorporating program improvements based on the findings.

4.4.2 OQ Program Review

The purpose of periodically reviewing the OQ program is to ensure that it meets current regulatory compliance and any additional needs of the operator. The operator has the flexibility to structure the review as formally or informally as deemed necessary and should document the results and identify any modifications to the OQ program.

NOTE Refer to Annex E for further information.

4.4.3 Internal Audit

The purpose of an internal audit is to assure that the OQ program is being implemented as written. The operator has the flexibility to structure the audit as formally or informally as deemed necessary and should document the results of the audit and identify any modifications to the OQ program.

NOTE Refer to Annex E for further information.

5 Element 1: Identify Covered Tasks

5.1 General

The program shall identify and document covered tasks. A covered task is an activity identified by the operator that:

— is performed on a pipeline facility, and

— is an operations or maintenance task, and

— is performed as a requirement of 49 *CFR* Part 192 and/or Part 195, and

— affects the operations or integrity of the pipeline.

The four criteria listed above are referred to hereafter as the Four-part Test.

5.2 Guidance on Identifying Covered Tasks

5.2.1 General

In developing the covered task list, the operator shall consider tasks performed on the pipeline facility, regardless of who performs them (employees, contractors, subcontractors, or other entities such as other pipeline operators or those with access to the operator's equipment). For example, if an operator contracts out pipeline repair activities, those activities shall be considered in the identification of covered tasks.

The operator has flexibility to determine how to accomplish covered task identification. The operator should document the method and justification for selecting covered tasks. Options for establishing a covered task list may include but are not limited to the following two methods.

5.2.2 Adoption of an Industry-developed Covered Task List

Industry and technical associations, qualification product providers, and others have developed covered task lists through subject matter expert consensus. The Covered Task List developed by API (in conjunction with the Operator Qualification Workgroup under the Pipeline Committee) is attached to this document as Annex A. The operator should take additional steps if adopting such a list and at a minimum should compare the covered task list to its operations and maintenance activities to ensure completeness. The operator has the flexibility to combine or separate covered tasks as suitable to its operations and if gaps are identified should apply the Four-part Test to add or delete covered tasks as applicable.

5.2.3 Analysis of Operations and Maintenance Activities

An analysis of operations and maintenance activities may be used in the process of determining which activities should be included in an operator's covered task list. Items to be considered when conducting activity identification and analysis may include but are not limited to the following:

— 49 *CFR* Part 192 and/or Part 195;

— state or local requirements;

— operations, maintenance, and safety procedures;

— industry-developed covered task list(s);

— applicable Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletins.

It may be helpful to record each applicable activity on a master list and document the answers to the Four-part Test questions, adding justification notes as needed. This method of documentation produces a list of covered and noncovered tasks and may assist in regulatory and internal reviews. Subject matter experts, regulatory compliance personnel, and others may be enlisted to assist in the identification and analysis of activities. Operators have the flexibility to include additional tasks that do not meet the Four-part Test.

5.3 Guidance on Interpreting the Four-part Test

5.3.1 Part 1—Is the Task Performed on a Pipeline Facility?

Operators should review the regulatory definitions of pipeline and pipeline facility. Components, piping, and equipment that are physically connected to the pipeline or pipeline system (i.e. by wires, tubing, pipe, or by the pipeline right-of-way) or that are connected by signals through the air are considered part of the pipeline facility.

A component, piping, or equipment disconnected and physically removed from the pipeline or pipeline system is not considered part of the pipeline facility. A component that is disconnected, but not physically removed from the pipeline facility, would meet the Part 1 requirement of the Four-part Test.

5.3.2 Part 2—Is the Task an Operations or Maintenance Task?

Operations tasks may be defined as those activities associated with monitoring and controlling the transportation of hazardous materials within a pipeline system. Maintenance tasks may be defined as those activities performed to maintain, restore, replace, or relocate existing pipeline facilities.

5.3.3 Part 3—Is the Task Performed as a Requirement of 49 *CFR* Part 192 and/or Part 195?

The operator should review all subparts of 49 *CFR* Part 192 and/or Part 195, including documents incorporated by reference, and state and local requirements to ensure completeness of all tasks. Operations and maintenance tasks are not limited to those tasks addressed in 49 *CFR* Part 192, Subparts L and M and/or 49 *CFR* Part 195, Subpart F.

5.3.4 Part 4—Does the Task Affect the Operation or Integrity of the Pipeline?

Tasks that, if performed incorrectly, could adversely affect the operations or integrity of the pipeline during or after the performance of the task would meet the Part 4 requirement of the Four-part Test.

6 Element 2: Ensure, Through Evaluation, That Individuals Performing Covered Tasks Are Qualified

6.1 General

Operators shall have a documented process to ensure individuals performing a covered task are qualified through an evaluation process.

6.2 Guidance on Establishing Criteria for Qualification Through Evaluation

6.2.1 General

The terms qualification and evaluation are frequently used interchangeably throughout the industry; however, they are two distinct terms.

Qualification is the result of a process determined by the operator that includes successful completion of task-specific evaluation(s) with the associated AOCs, documentation, and any other requirements as documented in the OQ program. An evaluation is a step in the qualification process that determines an individual's knowledge, skill, and ability.

6.2.2 Qualification

6.2.2.1 General

The operator encounters several decision points when developing a qualification process. At a minimum, consideration should be given to the covered task, the individual or groups of individuals to be qualified, and the type of qualification. The resulting qualification process(es) should be documented.

6.2.2.2 Covered Task

The operator should review the covered tasks to determine the appropriate evaluation method(s) and other qualification requirements. Items to be considered may include but are not limited to the following:

— scope and complexity of the covered task,

— level of knowledge and/or skill needed to perform the covered task,

— any other factors as determined by the operator.

6.2.2.3 Individuals or Groups of Individuals

The operator has flexibility to determine the evaluation methods and other qualification requirements for all individuals who perform covered tasks and may utilize the same evaluation methods and other qualification requirements for all groups of individuals (employees, contractors, subcontractors, or other entities such as other pipeline operators or those with access to the operator's equipment) or may establish different requirements for different groups. The operator may establish provisions in its OQ program to accept qualifications from other entities' internal OQ programs.

6.2.2.4 Type of Qualification

Types of qualification should be considered when determining evaluation methods and other qualification requirements. Requirements may differ by type of qualification (e.g. initial qualifications, current qualifications prior to an expiration date, qualifications that have exceeded an expiration date, or qualifications that may require additional actions as described in Element 4 and Element 5).

6.2.3 Evaluations

As stated in the regulation, evaluation is the process, established and documented by the operator, to determine an individual's ability to perform a covered task through application of any of the following:

— written examination;

— oral examination;

— WPHR;

— observation during:

  — performance on the job,

  — OJT,

  — simulation;

— other forms of evaluation.

Neither WPHR nor observation of performance on the job can be used as the sole evaluation method for determining qualification. These methods shall be used in conjunction with other allowable methods of evaluation.

6.2.4 Evaluation Methods

Written and oral examinations consist of standard, predetermined questions and shall contain enough questions to adequately measure the knowledge required to perform a covered task. A written examination is a knowledge test on paper or electronic format, whereas oral examination is a verbal knowledge test. Consideration should be made for the role of a proctor and/or evaluator to ensure tests are administered in a secure and controlled setting.

WPHR is a structured, documented review of an individual's task-related performance records. WPHR was originally established to aid operators in transitioning their employees past work experience to meet regulatory requirements. If an operator chooses to use WPHR as an evaluation method, the following steps should be completed and documented at a minimum:

— a search of existing records for documentation of an individual's past satisfactory performance of a covered task(s);

— verification that the individual's work performance history contains no indications of substandard work or involvement in an accident caused by an error in performing a covered task; and

— verification that the individual has successfully performed the covered task on a regular basis.

Observation during performance on the job is a casual, unstructured observation.

Observation during OJT is a performance evaluation conducted at the conclusion of training on a covered task. (See other forms of evaluation.)

Observation during simulation can be any of several evaluation methods described as follows:

— simulated scenario of a closed pipeline system such as those used in control centers,

— off the right-of-way using a mock-up scenario to perform various covered tasks,

— demonstrating and communicating the intended performance of the covered task without physically touching the equipment.

Other forms of evaluation are as follows.

— Performance evaluations are formal, structured observations to measure skills and knowledge. An individual independently performs a covered task in a real-time or simulated environment while an evaluator assesses his/her skills based on a set of predetermined and documented criteria (such as a checklist).

— Professional certifications [e.g. National Association of Corrosion Engineers (NACE), American Society for Nondestructive Testing, (ASNT), API, American National Standards Institute (ANSI)] that include evaluation.

6.2.5 Evaluation Material

Evaluations should assess an individual's knowledge and skills necessary to perform a task. An operator has the option to develop internal evaluation materials or utilize material developed by third-party organizations.

If developing internal evaluation material, the operator may base evaluations on operations and maintenance procedures. If using third-party vendors, the operator is responsible for assessing the vendors' processes and materials to ensure that all requirements are met.

The operator should consider periodically reviewing and updating evaluations to ensure they meet requirements.

6.2.6 Evaluation Process

6.2.6.1 General

The evaluation process is established and documented by the operator to determine an individual's ability to perform a covered task. This evaluation establishes that an individual is qualified to perform covered tasks.

Qualified means that an individual has been evaluated and can:

a) perform assigned covered tasks and

b) recognize and react to AOCs.

Operators should develop the acceptance criteria for evaluations.

Operators should track and maintain an individual's qualification records, including the methods used to verify an individual's knowledge, skills, and ability to perform a task.

The evaluation process should include, at a minimum, the following.

- Grading system:
  - identify grading system(s); examples of grading systems include, but are not limited to:
    - pass/fail—no number or alphabetic grade given,
    - criterion-based scale—graded on a scale, for example, an 80 % score;
  - operators should be prepared to provide justification for the grading method(s) applied.
- Number of allowable attempts.
- Consequences of failure.
- Process for communicating evaluation results.
- Minimum requirements for testing:
  - ensure that environment is conducive for testing,
  - ensure all operator testing requirements are met,
  - maintain control of test materials,
  - establish requirements for proctors,
  - establish requirements for evaluators.
- Rules to ensure test integrity:
  - fair and consistent administration,
  - security of test questions and answer banks.
- Rules for ensuring the integrity of evaluations performed remotely

Evaluators should have the technical knowledge and skills for the task they are evaluating and the ability to recognize and respond to AOCs.

Evaluators should have training to ensure that they understand the evaluation process and their role in the process.

The operator may also consider if the evaluator needs to maintain the qualification for each task that they are able to evaluate. This is especially important if the evaluation is performed on an active system and there are no other qualified individuals available to direct and observe task performance.

6.2.6.2 Evaluation Qualification Documentation

Qualification records shall include:

- identification of qualified individual(s);

— identification of the covered tasks the individual is qualified to perform;

— date(s) of current qualification; and

— qualification method(s).

Records supporting an individual's current qualification shall be maintained while the individual is performing the covered task. Records of prior qualification and records of individuals no longer performing covered tasks shall be retained for a period of 5 years.

NOTE Documentation requirements for OQ are found under *CFR* § 192.807 and *CFR* § 195.507.

6.2.6.3 Alternative Methods of Evaluation

6.2.6.3.1 General

Individuals may be qualified using alternative methods. Examples of these alternative methods would include the use of remote software applications when performing performance verifications. There are many applications that are currently available to perform alternative methods of evaluation. Some examples of these types of tools include video conferencing platforms and communication equipment used by diving personnel, as well as computer-generated simulated environments such as augmented reality and virtual reality.

Qualification records should identify if a qualification was performed using an alternative method. Alternative methods should have well-defined processes and be properly documented.

As defined in 3.1.6, the term “evaluation” identifies other forms of assessment [Item e)] as a qualification option. Section 6.2.3 describes evaluations as formal, structured observations to measure knowledge, skills, and ability.

6.2.6.3.2 Remote Evaluation Considerations

Evaluations should be performed in real-time or in a simulated environment while an evaluator assesses the individual’s skills based on a set of predetermined and documented criteria. These criteria should not vary whether the evaluation takes place remotely or with an evaluator physically present, but there are some important considerations when an operator determines if a covered task can be remotely evaluated.

— *Active System vs Simulation*—A remote evaluation presumes the evaluator is not physically in control of the performance evaluation. If an evaluation is taking place on an active system, and the candidate is not currently qualified for the task being evaluated, the span of control oversight rule applies, and the task performance shall be directly observed by a qualified individual. Tasks that have been identified by the operator as more critical or more complex may not be suitable for remote evaluations.

— *Initial vs Subsequent Qualification*—Initial qualification presumes the individual has not yet been evaluated on the covered task. When performing an initial qualification, it should be recognized that there is an additional layer of novice risk associated with the evaluation. Tasks that have been identified by the operator as more critical or more complex may not be suitable for initial remote evaluations.

— *Covered Task Considerations*—The operator should assess and determine which evaluations of tasks on their covered task lists are eligible to be performed remotely. Tasks that have been identified by the operator as more critical or more complex may not be suitable for remote evaluations.

— *Remote Evaluation Limitations*—Remote evaluations require the evaluator to have a video and audio connection to the evaluated individual. The operator should assess if a particular facility has sufficient communications access to permit effective remote evaluations.

6.2.6.3.3 Alternative Evaluation Considerations

When qualifying using an alternative method the following should be taken into consideration.

1) Before performing the evaluation, the evaluator should verify all equipment being used to perform the evaluation is working properly. Evaluations through a conversation on a phone will not be allowed unless using some form of a video-capable app. Before performing a remote evaluation, the evaluator should verify that all audio and visual equipment is working properly.

2) If necessary, the evaluator shall ensure that there is a designated observer on premises to verify the individual and the environment is safe. The designated observer shall remain at the evaluation until it is complete.

3) The evaluator shall verify that the individual being evaluated is the person to be qualified. This should be done through the verification of an individual's picture identification (such as company ID, government-issued ID, etc.).

4) The evaluator shall verify that no other person is assisting the individual during the evaluation. The onsite designated observer or any other person that is needed to assist with holding the phone, camera, microphone, etc., cannot provide direction to the individual being evaluated.

5) The evaluator and individual performing the qualification should be in an area that limits distractions.

6) Unless used as part of the evaluation, phones or other communication devices should be turned off/silenced before beginning the evaluation.

7) The individual being evaluated and the evaluator shall remain at the evaluation until it is complete. If an individual leaves for any reason, the evaluation should be discontinued and restarted when he/she is available.

8) The name of any additional person(s) in the room shall be documented. This includes the onsite designated observer and others that might be required to assist.

9) The task steps shall be completed in a manner that the evaluator can easily determine that the individual qualifying has the proper knowledge, skills, and ability to perform the task both safely and correctly.

6.2.7 AOCs

As stated in the regulation, qualification shall include an evaluation of the individual's ability to recognize and react to AOCs associated with covered tasks.

The operator has the flexibility to determine method(s) for ensuring that individuals can recognize and react to AOCs. These methods may include but are not limited to the following:

— develop a standalone AOC evaluation,

— incorporate AOCs into task evaluation,

— review AOCs in pre-job meetings and document review,

— review AOCs in periodic meetings and document review,

— any combination of the above.

Identifying AOCs for covered tasks includes but is not limited to analyzing the covered task procedures to identify any steps that, if performed incorrectly, could lead to a release, overpressure, or other potentially hazardous condition. Upon identification of these steps, determine and document the AOC and the

recognition and appropriate corrective response. Further guidance on identifying AOCs is provided in Annex G.

6.3 Other Circumstances That Require Qualification Considerations

6.3.1 New Construction

The operator's OQ program should address how OQ regulation applies to new construction. As defined by PHMSA, new construction is the act of building a pipeline facility or expanding an existing pipeline facility (as in looping a pipeline segment, which may also be construction to meet increased load requirements or to enhance reliability of the system) to provide new service to a customer(s) or in order to meet increased demand. New construction ends when the pipeline facility is being commissioned or during the act of connecting to an active pipeline (the tie-in).

6.3.2 Mergers and Acquisitions

An operator's OQ program should include provisions for mergers and acquisitions of assets subject to 49 *CFR* Part 192 and/or Part 195 to ensure that qualified individuals perform covered tasks. It is important to note that the availability and timing of receipt of the information to the operator may vary for each merger or acquisition. Upon transfer of ownership of the newly acquired asset, steps should be taken to ensure that OQ covered tasks are being performed by qualified personnel.

When acquiring a new asset, the operator has several options, which may include but are not limited to the following:

— accept all or part of the acquired asset's program (conduct review),

— temporarily accept all or part of the acquired asset's program during the transition period (conduct review),

— incorporate any new personnel/contractors from the acquired company into the operator's program.

A review of the asset's OQ program should be conducted if the asset's qualifications and/or any part of their program is to be used. The purpose of the review is to identify compatibility with the operator's program and any improved processes that may need to be addressed. Additional review items to be considered may include but are not limited to:

— covered tasks;

— span of control;

— reevaluation intervals;

— evaluation methods;

— contractor qualifications;

— AOC modifications may be necessary due to differences in product transported, technology, or equipment, among other factors.

At the review's conclusion, a plan may be established to transition the personnel and contractors under the acquired asset's program to the operator's program. Consideration may be given for incorporating any improved processes identified during the review.

If the operator incorporates the new personnel/contractors into their own OQ program, an asset review for product transported, technology, or equipment should be reviewed and incorporated into program as applicable.

The operator should document the process and OQ program actions taken during the merger or acquisition. An example of an OQ program merger and acquisition review guidance document that may be utilized during a merger or acquisition is included in Annex E.

6.3.3 Comingling of Operations

Comingling of operations is operational responsibilities by more than one operator of a pipeline system [i.e. cathodic protection (CP), valve operations, relief tank]. Operators should determine demarcation line of responsibility.

The agreed operations between the companies should be documented and on file with both parties. When operators have comingling of operations, each operator should establish a mechanism for ensuring qualifications. This may include providing OQ records when requested or be present when covered tasks are being performed.

7 Element 3: Allow Individuals That Are Not Qualified Pursuant to the Regulation to Perform a Covered Task if Directed and Observed by an Individual That Is Qualified

7.1 General

Operators may consider a mechanism to observe and direct performance of a covered task by nonqualified personnel.

7.2 Span of Control

An operator's program may allow nonqualified individuals to perform some covered tasks, providing they are directed and observed by a qualified individual. For a qualified individual to direct and observe a nonqualified individual, the qualified individual shall be in close proximity and within line of sight to the nonqualified individual so that the qualified individual may intervene if needed, assume control if the task is being performed incorrectly, and respond to an AOC if one should arise.

Operators that choose to use span of control shall determine the span of control for each task. The number of nonqualified individuals that may perform a task under the direction of a qualified individual (span of control) should be determined based on criteria. The following criteria may be considered: task's practicality, complexity, and criticality. Typical industry spans of control range from 1:0 through 1:5 (ratio is qualified:nonqualified). It is recommended operators not exceed spans above 1:5.

— An operator may consider temporarily reducing span of control for a specific task when actual jobsite conditions (i.e. language barriers, weather conditions, excessive distraction) limit the qualified individual's ability to direct and observe nonqualified individuals.

— If an operator sets the span of control for tasks at 1:0, then the operator may consider including a provision in its program to allow a nonqualified individual to perform covered tasks during OJT providing that a qualified individual is present for the training and is in close proximity and within line of sight in order to intervene, assume control, or respond to an AOC.

— Span of control only applies to individuals who are physically performing steps of a covered task. Span of control does not apply to individuals who are only performing ancillary functions (such as a welder's helper) in support of the completion of a covered task.

— A qualified individual can only direct and observe nonqualified individuals performing a single task at any given time.

In addition, the program should state that the qualified individual shall be in close proximity and within line of sight to the nonqualified individual so that he/she can intervene or assume control if the task is being performed incorrectly and can respond to an AOC if one should arise.

7.3 Guidance on Emergency Response

An emergency is considered a fire, explosion, or release of hazardous liquid/gas occurring near or directly involving a pipeline facility caused by accidental failure and/or natural disasters. The emergency phase extends until the source has been secured, the threat of harm to the environment and/or public has been removed, and the safety of all responders is achieved. Once the emergency phase ends, OQs shall thereafter be required for all individuals performing covered tasks.

8 Element 4: Evaluate an Individual if the Operator Has Reason to Believe That the Individual's Performance of a Covered Task Contributed to an Accident/Incident as Defined in the Regulation

8.1 General

Operators may temporarily suspend and review an individual's qualification upon determination that the individual's performance of a covered task(s) may have contributed to an accident or incident.

8.2 Guidance on Determination of Appropriate Action Following Individual's Involvement in an Accident or Incident

If the operator has determined that a covered task was being performed by an individual at the time the accident/incident occurred, the operator shall investigate to determine if the improper performance of a covered task was a causal factor to the incident/accident. When making this determination, an operator's consideration may include:

— an individual's lack of knowledge on how to perform a covered task,

— a change in an individual's skills or ability required to perform a covered task,

— deficiency in the performance of a procedure,

— unsatisfactory or unsafe performance of a covered task,

— nonqualified individual.

The operator shall determine and execute appropriate action(s) to review qualification and effectiveness. Appropriate actions to be taken may include:

— suspend individual's performance of covered task,

— provide training for individual,

— conduct procedure review with individual,

— evaluate and/or requalify individual,

— revise the procedure(s),

— revise the OQ program,

— other actions as warranted.

Operators should document the results of the review, evidence of requalification, disqualification, or suspension.

9 Element 5: Evaluate an Individual if the Operator Has Reason to Believe That the Individual Is No Longer Qualified to Perform a Covered Task

9.1 General

Operators shall review an individual's performance of covered tasks if there is reason to believe the individual should no longer be qualified.

9.2 Guidance on Determining if an Individual Should No Longer Be Qualified

Operators should develop a process to determine if and when an individual is no longer qualified to perform a covered task. Reasons an individual may no longer be qualified, other than an accident or incident as defined by 49 *CFR* Part 192 and/or Part 195, may include:

— failure to properly perform a covered task;

— failure to recognize or react to an AOC;

— extended leave;

— prolonged period of nonperformance of a covered task;

— loss of motor skills, vision, or impairments.

The operator has the flexibility to establish a policy that applies to all affected individuals or may choose to determine qualification on an individual basis, or a combination of both. It may be helpful to consider the following.

— If covered tasks were performed improperly, does the individual lack knowledge, skill, or ability?

— If extended leave was involved, consider the following.

  — Did the reason for leave effect the individual's ability to perform covered tasks?

  — Have procedures changed during a leave of absence?

  — Have qualifications expired during a leave of absence?

— How much experience does the individual have at performing the covered tasks?

— How much time elapsed since the last performance of the covered tasks?

— Are there other contributing factors to consider?

If the individual is no longer qualified, the operator may consider additional actions, which may include:

— restrict performance of covered task (such as performing task under span of control),

— training,

— reevaluation,

— procedure review,

— no action required.

9.3 Suspension Process

If an individual fails to demonstrate proficiency, the operator has reason to believe an individual is no longer able to satisfactorily perform a covered task, or the individual's actions may have contributed to an incident or accident (see 8.2), then upon knowledge of inadequate performance, the operator shall immediately suspend the individual's qualification for the specific covered task.

The suspension of an individual's qualifications shall at a minimum apply to the specific covered task(s). Suspension of such qualifications may not affect the individual's ability to perform other covered task(s).

The suspension shall be documented and continue until the operator has determined the successful completion of the necessary retraining and/or evaluation process or it was determined that the individual's actions did not contribute to an incident or accident.

An operator may have a separate suspension process for contractors.

10 Element 6: Identify Those Covered Tasks and the Intervals at Which Evaluation of the Individual's Qualifications Is Needed

10.1 General

Operators shall establish reevaluation intervals for each covered task.

10.2 Guidance on Developing Reevaluation Intervals

When developing reevaluation intervals, the operator has the option of utilizing industry associations' (or other entities) recommended intervals or developing operator-specific intervals. A reevaluation interval of 36 months is the recognized industry standard for most covered tasks. If an operator chooses to adopt an industry-developed interval, the operator should review the interval to ensure that the operator's OQ program's requirements are met. Some covered tasks, such as welding or nondestructive testing (NDT), have regulatory requirements that may affect reevaluation intervals.

When developing intervals internally or revising intervals, the operator should document the rationale used to determine the intervals and may consider the following:

— complexity of the task (difficulty of the knowledge and skill components of a task),

— criticality of the task (the potential adverse impacts that could result from improper performance of a task),

— frequency of performance of the task (how often the task is performed).

The operator may establish a method of notification prior to the expiration of the qualification(s).

11 Element 7: Communicate Changes That Affect Covered Tasks to Individuals Performing Those Covered Tasks

11.1 General

The operator shall have a mechanism for communicating changes that affect covered tasks.

11.2 Guidance on Developing Processes to Communicate Changes That Affect Covered Tasks

The operator should have processes in place for communicating the change to the affected individuals.

Examples of changes that affect covered tasks may include the following:

— task addition or deletion;

— revisions or additions to identified AOCs;

— policies, procedures, and standards;

— tools, equipment, or technology;

— evaluation methods, materials, and criteria;

— suspension and disqualification processes;

— reevaluation intervals;

— span of control.

Significant changes to covered tasks may necessitate additional evaluation to maintain qualification.

12 Element 8: Provide Training, as Appropriate, to Ensure That Individuals Performing Covered Tasks Have the Necessary Knowledge and Skills to Perform the Tasks in a Manner That Ensures the Safe Operation of Pipeline Facilities

12.1 General

The operator should address the role of training in the qualification of individuals.

12.2 Guidance on Providing Training, as Appropriate

There may be circumstances that require training to ensure that individuals have the knowledge and skills required for qualification. Operators may provide training on specific covered tasks and/or based on the individual's need for training.

Examples of when training may be appropriate include:

— initial qualification;

— suspension;

— per incident investigation;

— addition of a covered task;

— revisions to policies and procedures;

— changes to tools, equipment, or technology;

— failed evaluation.

Training delivery methods may include:

— OJT,

— instructor-led training,

— computer-based training,

— certification programs,

— table-top/simulation,

— self-study.

13 Element 9: Notify the Administrator or a State Agency if the Operator Significantly Modifies the Program After the Administrator or State Agency Has Verified That It Complies with Regulation

13.1 General

Operators are required to identify significant modifications that would require notification and submission to PHMSA and appropriate state regulatory agencies.

13.2 Guidance on Determining a Significant Change

Operators should determine what changes would be considered significant to the OQ program. Examples of changes that may be considered significant include:

— modifications to covered task list;

— modifications to evaluation process;

— modifications to qualification process;

— revisions to span of control;

— wholesale changes made to the operator's OQ program (e.g. consolidation of programs following a merger, acquisition, or divestiture; changes to roles and responsibilities; or other changes the operator deems significant).

13.3 Guidance on Transmitting OQ Program Revisions

Notifications to PHMSA may be submitted by electronic mail to InformationResourcesManager@dot.gov, or by mail to ATTN: Information Resources Manager DOT/PHMSA/OPS, East Building, 2nd Floor, E22-321, New Jersey Avenue SE, Washington, DC 20590. The operator should submit the complete OQ program accompanied by a revision/change log and the effective date of change(s). The OQ program should be written such that changed areas of the program can be readily identified. Employee-specific information (i.e. social security numbers) and testing material do not need to be sent.

Each notification to PHMSA should include the following:

— operator identification number(s) [OPID(s)], operator name(s), headquarters (HQ) address;

— name of individual submitting notification;

— data/email/phone number;

— commodity (gas/liquid/both);

— PHMSA region(s) where pipeline(s) operates;

— names of respective facilities or pipeline systems where changes apply.

NOTE Operators subject to pipeline safety regulations by state agencies are required to send OQ notifications directly to each affected state agency.

13.4 Recordkeeping

In addition to Elements 1 through 9, 49 *CFR* § 192.807 and 49 *CFR* § 195.507 require that the operator maintain the following records for all individuals performing covered tasks:

— identification of qualified individual(s),

— identification of the covered task(s) the individual is qualified to perform,

— qualification date,

— qualification method(s).

Records supporting an individual's current qualification shall be maintained while the individual is performing the covered task(s). Records of prior qualification and records of individuals no longer performing covered task(s) shall be retained for a period of 5 years. It is important to note that this 5-year period begins on the last date the qualification was valid.

13.5 Guidance on Developing Recordkeeping Criteria

Operators may consider developing and documenting a process that ensures that individuals performing covered tasks have valid qualifications. Examples of validation methods may include but are not limited to:

— hard copy records,

— electronic records,

— ID cards.

Qualification records may be maintained by the operator or a third party. It is important to note that different methods may be used to validate qualification for employees, contractors, subcontractors, or other entities.

The operator may consider maintaining additional records to demonstrate compliance with the program. While this list of records is not required by regulation, many are integral to the OQ program:

— documented history of OQ program and all program revisions, including covered task changes;

— communication of the OQ program;

— management of change, including the notification of applicable contractors;

— evaluation criteria;

— span of control;

— applicable training;

— reevaluation records for cause;

— feedback from field personnel, accident and incident investigations, near miss programs, or other sources that could enhance the OQ program, such as AOCs, evaluations, and training;

— results of program review and/or auditing;

— history file of checklist used for performance verifications and written/oral exams;

— justification for selection of evaluators;

— revision log.

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 5.2 of this document.

Task No.	Covered Task Name
1.1	Measure 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	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	Adjust 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	Perform 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

Task No.	Covered Task Name
10.1	Insert and Remove Coupons
10.2	Monitor Probes (Online)
11	Monitor and Control the Injection Rate of the Corrosion Inhibitor
12	Perform Visual Inspection of 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	Perform Visual Inspection of Surface Conditions of Right-of-way
16.1	Inspect Navigable Waterway Crossing
19.1	Perform Valve Body Winterization or Corrosion Inhibition
19.2	Perform Valve Lubrication
19.3	Perform Valve Seat Sealing
19.4	Perform Valve Stem Packing Maintenance
19.5	Adjust Actuator/Operator, Electric
19.6	Adjust Actuator/Operator, Pneumatic
19.7	Adjust Actuator/Operator, Hydraulic
20	Inspect Mainline Valves
21.1	Repair Valve Actuator/Operator, Pneumatic
21.2	Disassemble/Reassemble Valves
21.3	Perform Internal Inspection of Valves
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	Inspect, Test, and Calibrate Relief Valves
24.1	Maintain/Repair Pressure-limiting Devices
24.2	Inspect, Test, and Calibrate Pressure-limiting Devices
25.1	Inspect, Test, and Calibrate Pressure Switches
25.2	Inspect, Test, and Calibrate Pressure Transmitters
27.1	Perform Routine Inspection of Breakout Tanks (API 653 Monthly or DOT Annual)
27.2	Perform API 653 Inspection of In-service Breakout Tanks
27.3	Perform API 510 Inspection of In-service Breakout Tanks
30	Test Overfill Protective Devices
31	Inspect and Calibrate Overfill Protective Devices
32	Observe Excavation Activities
38.1	Perform Visual Inspection of Pipe and Pipe Components Prior to Installation
38.3	Perform Visual Inspection of Welds

Task No.	Covered Task Name
38.4	Perform NDT—Radiographic Testing
38.5	Perform NDT—Liquid Penetrant Testing
38.6	Perform NDT—Magnetic Particle Testing
38.7	Perform NDT—Ultrasonic Testing
39	Perform Backfilling
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 Coupling
40.6	Install and Remove Plugging Machine
40.7	Install a Tap 2 in. and Under on a Pipeline System
40.8	Install a Tap Larger than 2 in. on a Pipeline System
40.9	Install and Remove Completion Plug on Pipelines Larger than 2 in.
41	Conduct Pressure Test
42.7	Perform Welding
43.1	Perform Start-up of a Liquid Pipeline (Control Center)
43.2	Perform 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	Operate Valves Remotely on a Liquid Pipeline System
44.3	Inspect, Test, and Maintain a Flow Computer for Hazardous Liquid Leak Detection
44.4	Inspect, Test, and Perform Corrective and Preventative Maintenance of Tank Gauging for Hazardous Liquid 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 for Hazardous Liquid Leak Detection
63.1	Perform Start-up of a Liquid Pipeline (Field)
63.2	Perform 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	Operate Valves Locally on a Liquid Pipeline System

Annex B
(normative)

Covered Task Standards

Annex B includes task standards for each task identified in Annex A (Covered Task List). All task standards follow a standardized format that includes the following sections: task description; knowledge component (including AOCs specifically associated with the performance of the task); and a skill component.

Task 1.1—Measure Structure-to-Soil Potentials

1.0 Task Description

This task consists of taking a structure-to-soil reading with a half cell during an annual survey or CP analysis.

The task begins with equipment selection. This task ends with documenting the readings as required by the operator's procedure.

2.0 Knowledge Component

The purpose of the task is to verify electrical continuity between structures and soil.

An individual performing this task must have knowledge of:

- CP systems;
- types of reference cells to use in combination with a high-impedance volt-ohm meter (VOM):
  - copper/copper sulfate half cells,
  - saturated potassium chloride (KCl) calomel reference electrodes,
  - saturated silver/silver oxide half cells;
- minimum requirements for negative voltage;
- considerations that must be made to account for IR drop. Voltage drops other than those across the structure-to-electrolyte boundary must be considered.

AOCs associated with the performance of this task include the following.

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

3.0 Skill Component

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

Step	Action	Explanation
1	Select the instrumentation (test leads, voltmeter, and reference electrode) to be used.	Incorrect or faulty equipment will not provide accurate results.
2	Identify the correct test point locations where measurements will be taken.	The reference electrode must be correctly located to obtain accurate results. A structure may have several locations for taking measurements.
3	Connect the test leads to the voltage meter and reference cell.	Damaged equipment or improper connection of equipment 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 and check polarity to ensure that they are within the desired range of readings.	Readings should be reviewed as they are taken to ensure that measurements fall within the desired range with the correct polarity. This is not meant to be an engineering analysis or to account for IR drop considerations. This may include a comparison to historical data at that location. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
6	Document the readings as required by operator's procedure.	Documentation is critical to future analysis and identification of problem areas.

Task 1.2—Conduct Close Interval Survey

1.0 Task Description

This task consists of using equipment to obtain and record structure-to-soil potential readings at specific intervals along the length of a located pipeline.

The task begins with identifying the test point locations where connections will be made. The task ends when the readings are documented as required by the operator's procedures.

Data analysis is not part of this covered task.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Locate Line (reference Task 14.1).

— Measure Structure-to-Soil Potentials (reference Task 1.1).

2.0 Knowledge Component

The purpose of this task is to verify electrical continuity between structures and soil along the length of a pipeline.

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

— Types of close interval surveys, which may include but are not limited to, the following:

  — "ON" survey,

  — interrupted survey,

  — depolarized survey.

— CP systems and components comparable to NACE Certification Level CP 2. This knowledge includes, 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.

Terms applicable to this task are as follows.

current interrupter
A device that stops/interrupts the transfer of an electric charge used to cycle rectifiers, anodes, bonds, etc., on and off.

data logger
A digital device used to record multiple structure-to-soil potentials.

depolarized (off) survey
Measures the potential difference between the structure and the ground surface after the CP current has been switched off long enough for the structure-to-soil to stabilize.

“instant off” potential
The polarized half-cell potential of an electrode taken immediately after the CP current is stopped. This process closely approximates the potential without IR drop.

interrupted (on/off) survey
Measures the potential difference between the structure and the ground surface as the CP current is switched on and off.

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.

“ON” survey
Measures the potential difference between the structure and the ground surface as the CP current is applied.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Missing or broken test points, leads, and/or stations.	Repair the test leads or equipment as needed.
Reverse polarity of readings.	Document and notify the appropriate operator personnel immediately.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

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

Step	Action	Explanation
1	Identify the test point locations where connections will be made.	To confirm that potentials taken are on the intended pipeline and are the most accurate readings.
2	Connect the test leads, the voltage meter or data logger, and reference cell.	Damaged equipment or 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. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator’s procedures.
8	Verify data is recorded.	Readings should be continuous; 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.

Task 1.3—Test to Detect Interference

1.0 Task Description

This task consists of testing a cathodically protected structure for interference from other sources.

This task begins with testing for direct current (DC) or alternating current (AC) interference. The task ends when the readings are documented as required by the operator's procedures.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Structure-to-Soil Potentials (reference Task 1.1).

— Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance (reference Task 3).

2.0 Knowledge Component

The purpose of this task is to assess structures in proximity to each other and their respective CP systems.

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

— CP 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 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 CP 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 CP systems.

  — Documenting the readings and recommendations for future reference.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Missing or broken test points, leads, and/or stations.	Repair the test leads or equipment as needed.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

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

Step	Action	Explanation
1	Select instrumentation, test leads, and reference electrodes.	Incorrect equipment and/or improper usage will not provide accurate results.
2	Assess the area for other CP 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. If readings are outside the desired range check for possible causes such as reversed polarity, open bonds, shorted diodes, or changes in cathodic system. Take appropriate action per operator's procedures.
5	Interrupt rectifiers to determine if interference exists.	Interrupting one of the structure's CP 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.

Task 1.4—Inspect and Perform Electrical Test of Bonds

1.0 Task Description

This task consists of the visual and electrical inspection of connections related to the electrical connection (bond) of two or more structures.

This task begins with identifying the location of the bond(s). The task ends with the collection of data.

2.0 Knowledge Component

The purpose of this task is to test for electrical continuity and the direction and magnitude of current flow between two or more structures.

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 that may include critical and noncritical interference bonds (other bonds that may be inspected include continuity bonds).

— Voltmeters or multimeters.

— Shunts [bond currents are measured by taking a millivolt reading across a shunt that has a defined resistance; the current passing through the shunt (bond) is calculated by dividing the voltage reading by the shunt's resistance].

Terms applicable to this task are as follows.

continuity bond
A connection, usually metallic, that provides electrical continuity between structures that can conduct electricity.

critical bonds
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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Broken bond connection.	Repair or request a repair and document.

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 confirm that potentials and current measurements are taken at the correct location.
2	Conduct a visual inspection of the bond test station for physical damage to the bond station, a burned or damaged shunt, loose connections, disconnected wires, arcing across terminal, etc.	Faulty equipment can cause inaccurate results. If the shunt is burned or damaged, measure the current to ensure that it is not underrated.
3	Select the instrumentation, including VOM, 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 that is improperly connected or scaled may yield faulty data. Repair/replace any damaged tests leads or equipment.
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 confirm that they are within a desired range of readings, including a check of the polarity.	Readings should be reviewed as they are taken to verify that measurements fall within the 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. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
9	Document readings as required by operator's procedures.	Documentation is critical to future analysis and identification of problem areas.

Task 1.5—Inspect and Test Electrical Isolation

1.0 Task Description

This task consists of the inspection and testing of electrical isolation.

The task begins with identification of the isolation device. The task ends when measurements have been taken and recorded.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Structure-to-Soil Potentials (reference Task 1.1).

2.0 Knowledge Component

The purpose of this task is to assure that electrical isolation is adequate.

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

— Isolation devices (which may include insulated flanges, couplings, unions, monolithic insulating pipe joints, and nonmetallic pipe and structural members).

— Casings (which need to be electrically isolated from the carrier pipe so as not to shield the carrier pipe from CP).

— 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 (which 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 isolation joints other than flanges).

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
No AOCs identified.	

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 confirm 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 burned or damaged shunt, loose connections, disconnected wires, arcing across a terminal, etc.	This step verifies that there is no visual damage. Implement mitigation measures per operator's procedures.
3	Select the instrumentation, including voltmeter, isolation (flange) tester, test leads, or reference cell.	Incorrect equipment will not provide accurate results.
4	Make connections with the test equipment to take and record readings.	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 to help determine if structures are isolated. If the difference in potential is approximately 100 mV or greater, the isolation is effective. If the reading is less than 100 mV, further testing may be necessary. If readings are outside desired range or are erratic or floating, implement mitigation measures per operator's procedures.
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.

Task 2.1—Verify Test Lead Continuity

1.0 Task Description

This task consists of the electrical inspection of test leads connected to a structure.

This task begins with identification of the test lead wire. The task ends when a determination is made about whether valid data may be obtained using the test lead wire.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Repair Damaged Test Lead (reference Task 2.2).

— Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).

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

— Measure Structure-to-Soil Potentials (reference Task 1.1).

2.0 Knowledge Component

The purpose of this task is to test for electrical continuity between a structure and test station.

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

— Interpretation of structure-to-soil potential measurements taken at a test station [which may not meet expected results (lower than anticipated, unstable, or erratic) and may be indicative of a broken test lead].

— Multimeters (which are used to measure resistance between a structure and a test lead wire to determine if continuity exists).

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Improper or loose wire connection.	Implement mitigation measures per operator’s procedures.
Damaged or malfunctioning reference electrode.	Replace reference electrode.

3.0 Skill Component

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

Step	Action	Explanation
1	Identify the test lead to be tested.	This step is to confirm that measurements are taken on the intended test lead.
2	Select the proper instrumentation (multimeter, reference electrodes, etc.) to be used and verify the proper operation.	Incorrect or faulty equipment will not provide accurate results.
3	Connect the multimeter 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 to determine continuity. If test lead wire, test points, and/or test stations are damaged, missing, or loose, implement mitigation measures per operator's procedures.
5	Record all required information per operator's procedures.	Up-to-date records are essential for maintaining a corrosion control system.

Task 2.2—Repair Damaged Test Lead

1.0 Task Description

This task consists of the repair or replacement of test leads connected to a structure.

The task begins when test lead damage has been identified. The task ends when repair or replacement has been completed.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Structure-to-Soil Potentials (reference Task 1.1).

— Verify Test Lead Continuity (reference Task 2.1).

— Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).

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

2.0 Knowledge Component

The purpose of this task is to repair or replace leads that do not exhibit continuity.

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.

Terms applicable to this task are as follows.

test lead
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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

3.0 Skill Component

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

Step	Action		Explanation
1	Identify test lead damage. Perform a visual inspection of the aboveground wire and components. If the test station is intact, continuity must be verified.		The test lead connection may be loose, corroded, or disconnected; the wire may be broken; or the test station may be damaged or moved.
2	Can the test lead damage be repaired?		Repair that can be made in the test station or in the immediate area may not require excavation of the pipeline.
	Yes—Continue with Step 3.	No—Continue with Step 4.	
3	Repair the test lead damage. This repair may require reconnecting the lead to the test station or faceplate by stripping the insulation and reconnecting.		This step corrects the damage if it can be repaired above ground or in the immediate area of test station.
4	Replace the test lead by connecting a new lead to the structure by exothermic weld or non-exothermic connection.		If a structure appurtenance is not available, excavation is necessary to expose the pipe. The lead should be routed loosely to relieve soil stress during backfill and then connected to the test station or termination point.
5	Verify that the test leads function properly and are no longer damaged.		Checking the test lead repair is done by taking a structure-to-soil potential and/or by verifying continuity.
6	Document actions and readings according to operator's procedures.		Proper documentation is critical to future analysis and identification of problem areas.

Task 2.3—Install Test Leads by Non-exothermic Welding Methods

1.0 Task Description

This task consists of making an electrical connection by mechanical means that may include magnetic coupling, conductive epoxy, clamp, and/or split bolt connectors.

The task begins after the test point is properly located. The task ends when the installation is documented.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Verify Test Lead Continuity (reference Task 2.1).

— Prepare Surface for Coating Using Hand and Power Tools (reference Task 7.2).

— Apply Coating Using Hand Application Methods (reference Task 7.5).

2.0 Knowledge Component

The purpose of this task is to install test leads on a structure by methods other than exothermic welding.

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.

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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 confirms 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.
4	Prepare the pipe surface for wire installation according to manufacturer or operator's specifications.	If foreign materials are not removed, they could cause a failure to bond reducing or eliminating electrical continuity.
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.	

Task 2.4—Install Test Leads by Exothermic Welding Methods

1.0 Task Description

This task consists of installation of test leads on a structure by exothermic weld.

The task begins after the test point is properly located. The task ends when documentation of the connection is complete.

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 or electronic device, melts, and drops down, welding the wire to the structure.

Pin brazing is a means of thermite welding that involves using electrical current to melt solder to provide a connection.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Prepare Surface for Coating Using Hand and Power Tools (reference Task 7.2).

— Apply Coating Using Hand Application Methods (reference Task 7.5).

— Measure Wall Thickness with Ultrasonic Meter (reference Task 8.2).

2.0 Knowledge Component

The purpose of this task is to install test leads by exothermic welding methods such as thermite welding and pin brazing.

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

— The proper size mold and charge for different sizes of wires and structures.

— Different alloy charges (which are used for steel and cast/ductile iron structures).

— Hazards associated with melting materials and using extreme heat.

  — 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 °F, and all safety concerns must be addressed.

— Manufacturer's specifications for the pin brazing method [this includes the use of equipment that uses lower temperatures (approximately 600 °F)].

Terms applicable to this task include the following.

alloy charges
A charge is the mixture of a copper alloy and magnesium starting powder.

AOCs associated with the performance of this task include the following.

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 confirms 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.	Verify that the surface profile meets manufacturer or operator specifications. If foreign materials are not removed, they could cause the exothermic weld to fail.
5	Remove sufficient insulation from the 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. 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. 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. 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. NOTE Charges may be ignited electronically or with a sparking device. 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.	Verify the integrity of the weld and prepare the surface to be coated.
10	Document installation according to operator's procedures.	

Task 3—Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance

1.0 Task Description

This task consists of measuring and documenting the electrical output of a rectifier.

The task begins with the identification of the rectifier. The task ends with the measurement of a rectifier output and documentation of data.

This task does not include data analysis.

2.0 Knowledge Component

The purpose of this task is to verify the proper performance of a rectifier.

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

— CP systems and components comparable to NACE Certification Level CP 1.

— Voltmeters

— 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].

— Validation of display meters with observed readings and with remote read devices, if applicable.

— Proper rectifier output polarity.

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

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. — Connect the positive lead to the rectifier positive terminal. — Connect the negative lead to the rectifier negative terminal.	Obtaining accurate voltage and polarity are essential to maintaining CP.
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 CP 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	Document 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 nonexistent or reversed in polarity.

Task 4.1—Troubleshoot Rectifier

1.0 Task Description

This task consists of checking rectifier components.

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

This task does not include but may lead to the performance of other covered tasks such as the following.

— Repair or Replace Defective Rectifier Components (reference Task 4.2).

— Adjust Rectifier (reference Task 4.3).

2.0 Knowledge Component

The purpose of this task is to identify faulty rectifier components.

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

— Troubleshooting a rectifier and components comparable to NACE Certification Level CP 2.

— Basic electricity, electrical circuits, and electrical schematics.

— The operation of rectifiers and the principles of converting AC to DC.

— 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 (RMUs), and surge protection.

Terms applicable to this task are as follows.

This section left intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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. Consult or refer to 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 according to operator's procedures.	

Task 4.2—Repair or Replace Defective Rectifier Components

1.0 Task Description

This task consists of repairing or replacing defective rectifier components.

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

This task does not include but may lead to the performance of other covered tasks such as the following.

— Troubleshoot Rectifier (reference Task 4.1).

2.0 Knowledge Component

The purpose of this task is to repair defective rectifiers and return them to operational service.

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

— Rectifier components such as AC supply, circuit breakers, transformers, rectifier elements (stack), shunts, display meters, adjustment links, DC output terminals, RMUs, and surge protection.

— Rectifier operation and the principles of converting AC to DC.

Terms applicable to this task are as follows.

rectifier elements or stacks
Devices designed to allow current flow in one direction only. These stacks are used to convert AC to DC.

remote monitoring unit
RMU
A device that transmits rectifier readings to a remote site via wireless media.

shunts
Calibrated resistor links that allow current measurement in a rectifier.

transformer
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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	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. — Disconnect wires from the supply to the breaker. — Disconnect wires from the breaker to the rectifier. — Replace the defective breaker with a new breaker, if necessary. — Connect wires from the breaker to the rectifier. — 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.
2b	If AC fuses are faulty, complete the following on the primary AC fuses. — Remove the fuse or fuses. — 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. — Disconnect wires from the rectifier AC breaker to the transformer. — Disconnect wires from the transformer to the coarse and fine tap panels. — Replace the defective transformer with a new transformer. — Connect wires from the transformer to the coarse and fine tap panel. — 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). — Disconnect wires from the fine and coarse tap panel to the stack. — Disconnect wires from the rectifier element to the positive and negative DC output terminals. — If the stack is selenium, remove the stack and replace it with a new stack. — If the stack is silicon, remove the defective diodes and replace with new diodes. — Connect wires from the stack to the positive and negative DC output terminals. — Connect wires from the fine and coarse tap panel to the stack.	Rectifier stacks are required to change AC to DC.
2e	If the DC fuses are faulty, complete the following on DC fuses. — Remove the fuse or fuses. — 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 according to operator's procedures.	Up-to-date records are essential to maintaining a corrosion control system.

Task 4.3—Adjust Rectifier

1.0 Task Description

This task consists of making rectifier adjustments.

This task begins with the identification of the rectifier in need of adjustment. The task ends with proper adjustment of the rectifier and completion of documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Structure-to-Soil Potentials (reference Task 1.1).

— Obtain a Voltage and Current Output Reading from a Rectifier to Verify Proper Performance (reference Task 3).

2.0 Knowledge Component

The purpose of this task is to adjust the rectifier to maintain the CP system.

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

— CP systems and components comparable to NACE Certification Level CP 2.

— Basic electricity, electrical circuits, and electrical schematics.

— 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) (Task 1.1). These measurements are used to determine CP and necessary current adjustments to the rectifier.

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Inability to achieve target output.	Notify appropriate personnel for 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.
3	Increase/decrease the fine tap setting in progressive steps until the desired settings have been achieved. NOTE Power should be off before making these adjustments. 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. NOTE Power should be off before making these adjustments. 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.

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 Tasks 7.1 to 7.7).

2.0 Knowledge Component

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

This section intentionally left blank.

Terms 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.

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

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

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

scratch
A thin, shallow cut or mark on the surface.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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. 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	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. 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.

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).

Coating tasks are separate covered tasks (reference Tasks 7.1 to 7.7).

2.0 Knowledge Component

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

This section intentionally left blank.

Terms 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 that have the potential to cause rapid wall loss.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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. 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	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. 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.

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.

This section intentionally left blank.

Terms 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 that is derived either by mining (e.g. gilsonite) or 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.[4]

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 that 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.[4]

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.

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

[4] Munger, C.G. and L.D. Vincent, *Corrosion Prevention by Protective Coatings*, National Association of Corrosion Engineers, 1984.

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.[5]

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 naphthene 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

biological
Bacteria and fungi are the primary microorganisms that can act on coatings. There are two types of action. One type 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.[4]

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 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).[4]

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.

Coating Methods

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

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[5] 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*.

coating overlap
The amount one wrap of coating overlaps the adjacent wrap of coating.

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.

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 precoated condition with the ends of the pipe prepared to facilitate welding and joining procedures.

spiral wrap
A method used to apply coating in a continuous fashion around the circumference of the pipeline.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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. 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. 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.

Task 7.1—Perform Visual Inspection of Atmospheric Coatings

1.0 Task Description

This task consists of the visual inspection of aboveground pipeline components normally exposed to atmospheric conditions. This task begins with the identification of the component to be inspected and ends when the component has been visually inspected and all required information is documented per company procedure.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Perform Coating Inspection (reference Task 7.7).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Measure Pit Depth with Pit Gauge (reference Task 8.1).

— Measure Wall Thickness with Ultrasonic Meter (reference Task 8.2).

— Measure Corroded Area (reference Task 8.3).

2.0 Knowledge Component

The purpose of this task is to visually inspect exposed pipeline components to identify signs of atmospheric corrosion.

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

Terms applicable to this task are as follows.

alligatoring
Pronounced wide cracking over the surface of a coating, which has the appearance of alligator hide.

atmospheric corrosion
Types of rust (spotting, pin point, pitting, perforation, etc.).

blistering
A dome-shaped projection on the surface of a coating resulting from the local loss of adhesion and lifting of the film from an underlying coat or from the base substrate.

blushing
Whitening and loss of gloss of a coating, usually organic, caused by moisture.

chalking
The development of loose, removable powder (pigment) at the surface of an organic coating, usually caused by weathering.

checking
The development of slight breaks in a coating that do not penetrate to the underlying surface.

cracking
Fracture of a material along a path that produces a linear discontinuity (without complete separation).

disbondment
The loss of adhesion between a coating and the substrate.

mechanical/physical damage
Damage resulting from abrasion or impacts to the surface of the coated surface.

orange peel
The dimpled appearance of a dried coating resembling the surface of a navel orange.

peeling
Detachment or partial detachment of a coating from the substrate or undercoat.

pinhole
A minute hole through a coat or coats that exposes an underlying coat or the substrate.

sags
Nonuniform downward flow of a wet-applied coating under the force of gravity that results in an uneven coating having a thick lower edge.

soil stress
Typically created by gravel/backfill pressure as it settles around a transitional zone (air-to-soil); the result is often a “bag and sag” in the coating.

wrinkling
Formation of a surface appearance in a coating resembling the skin of a dried prune, usually caused by application shortcomings.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	Confirm the correct location for inspection.	Ensure that the correct pipeline component is being inspected.
2	Identify and confirm type of surface to be evaluated (coating/paint/bare).	This will help determine the equipment and methods to be used for the evaluation.
3	Perform visual inspection of coating.	Critical areas of inspection would be: — at soil-to-air interfaces, — under thermal insulation, — under disbonded coatings, — at pipe supports, — in splash zones, — at deck penetrations, — in spans over water.
4	Inspect pipeline components for any atmospheric corrosion.	Identify any areas of rust, spotting, pin point, pitting, or perforation.
5	Determine overall pipeline component condition and complete documentation.	
6	Record all required information per company procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 7.2—Prepare Surface for Coating Using Hand and Power Tools

1.0 Task Description

This task consists of preparing surface for coating using hand and power tools.

The task begins with visually inspecting the surface area to be prepared in order to determine the proper method to use. This task ends when the surface is ready for coating application and all required information is recorded per company procedure.

2.0 Knowledge Component

The purpose of this task is to prepare surface for coating.

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

— Surface conditions and which type of tool is needed for surface preparation.

Terms applicable to this task are as follows.

hand power tool cleaning
The removal of any loose rust, loose mill scale and loose paint to a degree specified by using a chipping power tool, a power sander, or a wire wheel, etc.

hand tool cleaning
The removal of any loose mill scale, loose rust, and loose paint to a degree specified by hand chipping, scraping, or sanding. Hand cleaning tools include wire brushes, files, scrapers, knives, chisels, chipping hammers, rags, etc.

hand wash
The removal of oil, dirt, soil, grease, and other contaminants by hand with solvent and detergents, etc.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Presence of atmospheric/surface corrosion, pitting, etc. when preparing the surface.	Document as required. Notify appropriate personnel.
Unexpected hazardous liquid or carbon dioxide encountered when preparing surfaces for coating.	Eliminate ignition source and notify appropriate personnel.
Pipeline damages such as dents, gouges, scrapes, etc. are identified.	Notify appropriate personnel.

3.0 Skill Component

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

Step	Action	Explanation
1	Visually inspect the surface area to be prepared to determine the proper method to use.	This is necessary to determine if hand tool cleaning, power tool cleaning, and/or hand washing is required.
2	Determine the proper steps and tools for cleaning and surface preparation.	
3	Remove contaminants from specified area, if present.	This is necessary to avoid grease or oil causing contamination of tools and surface. NOTE Utilize appropriate personal protective equipment to protect from contact or injuries from solvents/detergents, dust, projectiles, and hand/power tools.
4	Remove existing coating if present.	Address hazardous coatings (e.g. containing asbestos or lead) in accordance with regulatory requirements and company procedures. NOTE If coating to be applied meets existing coating the transition may be made by feathering the existing coating at the interface.
5	Ensure that surface preparation meets company standards or specifications.	
6	Record all required information per company procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 7.3—Prepare Surface for Coating by Abrasive Water Blasting

1.0 Task Description

This task consists of preparing the surface by different types of abrasive water blasting.

The task begins with identification of the area to be blasted. The task ends when all required information has been recorded per company procedure.

2.0 Knowledge Component

The purpose of this task is to prepare surface for coating.

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

— Equipment setup logistics, and possible environmental concerns.

— Coating removal, cleaning, and preparation of pipe to accept coating repair.

— Caution in operation due to hazards related to high-pressure discharge.

— Coating manufacturer's specifications for application or repairs to the coating and in accordance to company safety and environmental guidelines.

Three types of abrasive water blasting, including the following.

— Grit blast with shroud—grit is emitted in center of a water shroud.

— Sand injected water blast—sand or other medium is blended in water stream at nozzle.

— Slurry blast—water and grit mixed together in constantly agitated reservoir.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Presence of atmospheric/surface corrosion, pitting, etc. when preparing the surface.	Document as required. Notify appropriate personnel.
Unexpected hazardous liquid or carbon dioxide encountered when preparing surfaces for coating.	Eliminate ignition source and notify appropriate personnel.
Pipeline damages such as dents, gouges, scrapes, etc. are identified.	Notify appropriate personnel.

3.0 Skill Component

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

Step	Action	Explanation
1	Identify area to be abrasive water blasted.	This is necessary to determine where to set up equipment.
2	Set up equipment logistics per job requirements.	Ensures safe and efficient operations.
3	Visually inspect the surface area for contaminants prior to blasting.	
4	Remove contaminants from specified area if present.	This is necessary to avoid grease or oil causing contamination of tools and surface. NOTE Utilize appropriate personal protective equipment to protect from contact or injuries from solvents/detergents, dust, projectiles, and hand/power tools.
5	Remove existing coating or mill scale, rust, or weld slag, etc. to achieve profile.	Address hazardous coatings (e.g. containing asbestos or lead) in accordance with regulatory requirements and company procedures. NOTE If coating to be applied meets existing coating the transition may be made by feathering the existing coating at the interface
6	Ensure that surface preparation meets company standards or specifications.	
7	Record all required information per company procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 7.4—Prepare Surface for Coating by Abrasive Blasting Methods Other Than Water

1.0 Task Description

This task consists of preparing the surface by abrasive blasting other than water.

The task begins with the identification of the area to be prepared and with equipment setup. The task ends when all required information has been recorded per the operator's procedure.

2.0 Knowledge Component

The purpose of this task is to prepare surface for coating.

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

- Equipment setup logistics and possible environmental concerns associated with the handling and disposal of spent blast media and coating material.
- Coating removal, cleaning, and preparation of pipe to accept the coating application.
- Hazards related to high-pressure discharge.
- Coating manufacturer’s specifications for application or repairs.
- Operator's safety and environmental procedures associated with the handling and disposal of spent blast media and coating material.
- Surface preparation standards for abrasive blast cleaning.
- Types of abrasive blasting including, but not limited to, the following:
  - grit/shot blast,
  - walnut shell,
  - aluminum oxide,
  - crushed slag,
  - glass bead,
  - soda blast.

Terms applicable to this task include the following.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Presence of atmospheric/surface corrosion, pitting, etc. when preparing the surface.	Document as required. Notify appropriate personnel.
Unexpected hazardous liquid or carbon dioxide encountered when preparing surfaces for coating.	Eliminate ignition source and notify appropriate personnel.
Pipeline damages such as dents, gouges, scrapes, etc. are identified.	Notify appropriate personnel.

3.0 Skill Component

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

Step	Action	Explanation
1	Identify the area to be abrasive blasted.	This step is necessary to determine where to setup equipment.
2	Setup equipment logistics per job requirements.	This step ensures safe and efficient operations.
3	Visually inspect the surface area for contaminants prior to blasting.	
4	Remove contaminants from specified area, if present.	This step is necessary to avoid grease or oil causing contamination of the tools and surface. NOTE Appropriate personal protective equipment should be utilized to provide protection from contact or injuries from solvents/detergents, dust, projectiles, and hand/power tools.
5	To achieve specified or required profile, remove existing coating, mill scale, rust, or weld slag, etc.	This step addresses hazardous coatings (e.g. containing asbestos or lead) in accordance with regulatory requirements and the operator's procedures. NOTE If coating to be applied meets existing coating, the transition may be made by feathering the existing coating at the interface.
6	Ensure that surface preparation meets the operator's standards or specifications.	
7	Record all required documentation per the operator’s procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 7.5—Apply Coating Using Hand Application Methods

1.0 Task Description

This task consists of application of coating to a pipeline component by hand.

This task begins with determining the type of coating to be used and ends after all required information is recorded per company procedure.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Prepare Surface for Coating Using Hand and Power Tools (reference Task 7.2).

— Prepare Surface for Coating by Abrasive Water Blasting (reference Task 7.3).

— Prepare Surface for Coating by Abrasive Blasting Methods Other than Water (reference Task 7.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Coating Inspection (reference Task 7.7).

2.0 Knowledge Component

The purpose of this task is to apply protective coating to pipeline components.

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

— Methods for applying coating by hand, including:

  — roller,

  — brush,

  — wrap,

  — melting—hot sticks.

Terms applicable to this task are as follows.

sags
Nonuniform downward flow of a wet-applied coating under the force of gravity that results in an uneven coating having a thick lower edge.

wrinkling
Formation of a surface appearance in a coating resembling the skin of a dried prune, usually caused by application shortcomings.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	Determine what type of coating is applicable to the specified pipeline component.	Check that coating applied has adequate coverage and thickness, if required.
2	Assemble the tools and equipment necessary for application as required by coating specification.	
3	Follow applicable coating specification.	Coating procedures are dictated by the scope of work for the particular job. This should include type of coating, surface cleanliness, thickness of coating application, and applicable atmospheric conditions. NOTE Utilize appropriate personal protective equipment to protect from contact with coating materials as applicable depending on coating system used.
4	Prepare coating for application.	If applicable, mix coating according to manufacturer's coating specification. Ensure that coating has not exceeded shelf life.
5	Ensure that weather conditions are suitable for coating operations.	Temperature of pipeline component and dew point are critical to ensure proper adhesion.
6	Apply per coating specification.	Apply at the proper wet film thickness.
7	Record all required information per company procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 7.6—Apply Coating Using Spray Applications

1.0 Task Description

This task consists of applying coating to a pipeline component by spray method.

This task begins with determination of the type of coating to be used and ends when all required information is recorded per company procedure.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Prepare Surface for Coating Using Hand and Power Tools (reference Task 7.2).

— Prepare Surface for Coating by Abrasive Water Blasting (reference Task 7.3).

— Prepare Surface for Coating by Abrasive Blasting Methods Other than Water (reference Task 7.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Coating Inspection (reference Task 7.7).

2.0 Knowledge Component

The purpose of this task is to apply protective coating to pipeline components.

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

— Methods of applying coating by spraying including:

  — high-volume low-pressure (HVLP),

  — airless spray.

Terms applicable to this task are as follows.

orange peel
The dimpled appearance of a dried coating resembling the surface of a navel orange.

over spray
Dry, flat, pebbly surface resulting from paint particles falling outside spray pattern.

sags
Nonuniform downward flow of a wet-applied coating under the force of gravity that results in an uneven coating having a thick lower edge.

wrinkling
Formation of a surface appearance in a coating resembling the skin of a dried prune, usually caused by application shortcomings.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	Determine what type of coating is applicable to the specified pipeline component.	Check that coating applied has adequate coverage and MIL thickness, if required.
2	Assemble the tools and equipment necessary for application as required by coating specification.	Ensure that the proper type of spray nozzle is selected and that the orifice corresponds to requirements for the particular coating.
3	Follow applicable coating specification.	Coating procedures are dictated by the scope of work for the particular job. This should include type of coating, surface cleanliness, MIL thickness of coating application, and applicable atmospheric conditions. NOTE Utilize appropriate personal protective equipment in accordance with regulatory requirements and company procedures.
4	Prepare coating for application.	If applicable, mix coating according to coating specification. Ensure that coating has not exceeded shelf life.
5	Ensure that weather conditions are suitable for coating operations.	Temperature of pipeline component and dew point are critical to ensure proper adhesion.
6	Apply per coating specification.	Apply at the proper wet film thickness.
7	Record all required information per company procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 7.7—Perform Coating Inspection

1.0 Task Description

This task consists of inspecting the coating and measuring coating thickness after application.

This task begins when surface preparation is complete and ends when inspection of applied coating is completed and required information is recorded per company procedure.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Apply Coating Using Hand Application Methods (reference Task 7.5).

— Apply Coating Using Spray Applications (reference Task 7.6).

2.0 Knowledge Component

The purpose of this task is to validate that coating has been properly applied to pipeline components.

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

Terms applicable to this task are as follows.

Barcol hardness test
A hardness value obtained by measuring the resistance of rubbers, plastics, or coatings to indentation by a steel impresser under spring load.

dry film thickness
DFT
The thickness of a coating after it has completely dried or cured, usually measured in mils (1 mil = 0.001 in.).

holiday test
Testing of a coating system for holidays (a discontinuity in a coating that exposes unprotected surface) using an instrument that applies a voltage between the external surface of the coating and a conductive substrate.

orange peel
The dimpled appearance of a dried coating resembling the surface of a navel orange.

over spray
Dry, flat, pebbly surface resulting from paint particles falling outside spray pattern.

sags
Nonuniform downward flow of a wet-applied coating under the force of gravity that results in an uneven coating having a thick lower edge.

surface profile
The irregular peak and valley profile on a bare surface that can result from operations such as abrasive blast cleaning or power tool cleaning.

Tooke gauge
A precision tool for inspection and thickness measurement of single or multiple coats on any substrate and for microscopic observation and measurement of substrate and film defects.

wet film thickness
WFT
The thickness of the coating measured immediately after application before any appreciable solvent has evaporated or drying has taken place. This is usually measured in mils (1 mil = 0.001 in.).

wrinkling
Formation of a surface appearance in a coating resembling the skin of a dried prune, usually caused by application shortcomings.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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	Complete weather and surface temperature testing.	This includes use of a sling psychrometer, surface temperature indicator, and ambient temperature gauge.
2	Verify the surface profile is met pursuant to the coating specification.	This ensures that there is a sufficient anchor pattern for the coating to adhere to.
3	After coating is applied, perform wet film test, if applicable.	Determine that coating meets specifications.
4	Perform dry film test in accordance with coating specification, if applicable.	Determine that the final coating thickness meets specifications.
5	Conduct pinhole/holiday test, if applicable.	This is used to determine whether coating anomalies exist.
6	Conduct adhesion test, if applicable.	
7	Conduct Tooke test, if applicable.	This is used to ensure that layers of coating applied meet coating specifications.
8	Conduct Barcol hardness test, if applicable.	Determines hardness of coating by measuring its resistance.
9	Record all required information per company procedure.	Up-to-date records are essential to maintaining corrosion control data.

Task 8.1—Measure Pit Depth with Pit Gauge

1.0 Task Description

This task consists of measuring 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. The task ends when measurements are documented and proper notifications are made.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Measure Corroded Area (reference Task 8.3).

2.0 Knowledge Component

The purpose of this task is to measure and document pipe wall loss.

An individual performing this task must have knowledge of:

— pit gauges.

Terms applicable to this task are as follows.

wall loss
Removal of metal caused by either mechanical damage (e.g. gouge or groove) or corrosion (e.g. general or pitting).

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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. If the observation identifies integrity issues that are not safe, discontinue the task, and make immediate notifications.	Confirms 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 accurate readings.
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 and ensuring that the pit gauge is supported on noncorroded surfaces. 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.
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 per operator's procedures.	Follow operator's policies/procedures for appropriate documentation, notification protocol, and actions required.

Task 8.2—Measure Wall Thickness with Ultrasonic Meter

1.0 Task Description

This task consists of the use of an ultrasonic thickness meter to measure wall thickness.

This task begins when a steel pipe surface is exposed and prepared for inspection. The task ends when measurements are documented and proper notifications are made.

2.0 Knowledge Component

The purpose of this task is to accurately collect and record a wall thickness reading on the pipeline or related appurtenance.

An individual performing this task must have knowledge of:

— ultrasonic thickness meters.

Terms 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.

nominal thickness
The expected wall thickness determined by alignment sheets or other records.

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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. If the observation identifies integrity issues that are not safe, discontinue the task, and make immediate notifications.	Confirms that the pipeline is safe for operation and continued task performance.
2	Assemble, check, and calibrate ultrasonic thickness 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 needs 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.
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.	Confirm 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 per operator's procedures.	Follow operator's policies/procedures for appropriate documentation, notification protocol, and actions required.

Task 8.3—Measure Corroded Area

1.0 Task Description

This task consists of measuring corroded areas.

This task begins when the steel pipe surface has been exposed and prepared for inspection. The task ends when measurements are documented and proper notifications are made.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Pit Depth with Pit Gauge (reference Task 8.1).

— Measure Wall Thickness with Ultrasonic Meter (reference Task 8.2).

2.0 Knowledge Component

The purpose of this task is to obtain measurements to verify pipeline integrity.

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

— Methods for creating a visual representation of the pipeline segment after the corrosion has been identified that includes all areas of localized corrosion.

Terms 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 that have the potential to cause rapid wall loss.

interaction
If two or more locations of localized corrosion are 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”).

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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. 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	Obtain proper tools for the work assignment.	Necessary equipment and tools required to complete task; tools may include a tape measure, pit gauge, ultrasonic gauge, metallic ruler, bridging bar, or other measuring devices to take accurate measurements.
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 documented. 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.	The profile measurements can be represented as the remaining wall thickness or actual pit/general corrosion depth.
10	Obtain and determine nominal wall thickness.	
11	Identify areas of greatest wall loss within each area of localized corrosion and obtain pit depth measurements.	
12	Document the findings and make notifications per operator's procedures. 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.

Task 9.1—Install Bonds

1.0 Task Description

This task consists of installing a CP bond.

This task begins with identifying the structures to be connected. This task ends with validating the effectiveness of the bond and documenting the readings.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Test to Detect Interference (reference Task 1.3).

— Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).

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

2.0 Knowledge Component

The purpose of this task is to electrically connect two or more structures to improve CP systems and prevent possible structure damage caused by interference.

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

— CP systems and components comparable to NACE Certification Level CP 2.

— Types of bonds, including critical and noncritical (critical bonds are determined by an operator's procedures and are defined as bonds that, if disconnected, may be detrimental to one or more structures).

— Installing interference bond facilities at the location of current discharge, if possible.

— Shunts (commonly used between the structures to determine the current amplitude and polarity between the structures).

— Blocking diodes (may be necessary to prevent current flow in the opposite direction, such as when bonding to DC traction systems).

Terms applicable to this task are as follows.

bonds
Electrical 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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.
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.

Task 9.2—Install Galvanic Anodes

1.0 Task Description

This task consists of installing galvanic anodes that provide CP for buried or submerged metallic structures.

This task begins with determining the most suitable locations for the galvanic anodes within design considerations. The task ends when installation documentation is complete.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).

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

2.0 Knowledge Component

The purpose of this task is to provide a galvanic anode to operate with a CP system.

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

— CP systems and components comparable to NACE Certification Level CP 2.

— 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).

— Galvanic anodes and their applications (galvanic anodes may be used for direct CP, 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).

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Indications of a leak (soil discoloration, smell, dead vegetation) when installing the anode bed.	Stop all activity related to this task and 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	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.
3	Install the anode by placing in an augered hole or horizontal excavation. 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.

Task 9.3—Install Rectifiers

1.0 Task Description

This task consists of installation of impressed current CP rectifiers.

This task begins with verifying the rectifier is appropriate for the location and service. This task ends with documentation of the installation.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Adjust Rectifier (reference Task 4.3).

— Install Test Leads by Non-exothermic Welding Methods (reference Task 2.3).

— Install Impressed Current Groundbeds (reference Task 9.4).

2.0 Knowledge Component

This purpose of this task is install CP rectifiers to protect facilities against external corrosion.

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

— CP systems and components comparable to NACE Certification Level CP 2.

— Basic electricity and electrical circuits.

— Rectifier types, including: air cooled, oil cooled, explosion proof, solar powered, etc.

— Mounting requirements (pole mount and rack mount).

— Terminal termination requirements.

Terms applicable to this task are as follows.

This section left intentionally blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the rectifier is appropriate for the location and service.	Rectifiers are available for nonhazardous 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. NOTE Installation must meet all applicable building and electrical codes.
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). 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. 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.

Task 9.4—Install Impressed Current Groundbeds

1.0 Task Description

This task consists of installing impressed current groundbeds.

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 documentation has been completed as required.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Adjust Rectifier (reference Task 4.3).

— Install Rectifiers (reference Task 9.3).

2.0 Knowledge Component

The purpose of this task is to provide CP for buried or submerged metallic structures.

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

— CP systems and components comparable to NACE Certification Level CP 2.

— 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 (which are installed in special backfill, such as coke breeze or other fill material).

— Header cables (which is a cable or wire to which the anode lead wires are connected).

— Splice connections (which 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 protect the connection from oxidation).

— Rectifier adjustment (which is performed after the anode system is energized to set CP levels).

Terms applicable to this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

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 a right-of-way that is separated from the pipeline. Locations are selected using criteria such as soil resistivity, topography, proximity to other structures, and geography.
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): installed vertically or horizontally as designed for the location and typically more than a hundred feet away from pipeline. Distributed: located in close proximity to the structure and typically installed a minimum of 10 ft from the structure.
3	Excavate a vertical hole or horizontal ditch for anode installation. 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. Anodes are also installed as a replacement for expended anodes. 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. Confirm that anodes are placed flat in horizontal installation or centered in the bore for vertical installation. NOTE Do not lift or lower the anode by its lead wire to prevent damage to the anode.	Anodes should 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 result in 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 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.

Task 9.5—Repair Shorted Casings

1.0 Task Description

This task consists of electrically isolating the pipe and pipe casing after a short is detected. An electrical short between the casing and 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. The task ends when the pipeline casing is tested for isolation and proper documentation is completed per the operator's procedure.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Structure-to-Soil Potentials (reference Task 1.1).

— Inspect the Condition of External Coating on Buried or Submerged Pipe (reference Task 5.3).

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

— Locate Line (reference Task 14.1).

— Observe Excavation Activities (reference Task 32).

— Perform Backfilling (reference Task 39).

2.0 Knowledge Component

The purpose of this task is to provide CP for the pipe.

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

— Casing systems (which includes 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 nonmetallic material.

— Metallic shorts (which are caused by metal-to-metal contact between the pipe and casing).

— Electrolytic shorts (which are caused by material in casing that provides a current path between the pipe and casing such as water or soil).

Terms associated with this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexplained hydrocarbon encountered.	Stop all activity related to this task and notify operator personnel, as required.
Pipeline damage discovered while repairing shorted casings.	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 the location of metal contact, which may be near the end seal or at another location in the casing.
4	If pipe has settled, then center the carrier pipe within the casing if possible. NOTE Pipeline/casing support must be performed in accordance with engineering procedures or work plans to prevent damage to pipeline.	This is to confirm that there is no contact between the carrier pipe and casing. If the pipe has to be lifted, then follow procedures for moving in-service pipe. On long casings, cutting off excess casing may eliminate the casing short.
5	If the pipeline is coated, confirm that the coating is bonded to carrier pipe.	Coating is necessary for good CP 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.	Test leads on both the carrier pipe and casing may be required for testing casing isolation. 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.	Up-to-date records are essential to maintaining corrosion control data.

Task 9.6—Install Electrical Insulating Device

1.0 Task Description

This task consists of installing electrical insulating devices.

Specific applications addressed include the following:

— flange or dielectric union isolation/insulation,

— isolation joints,

— lightning and ground fault protection,

— electrical isolation from electrical grounding,

— aboveground piping isolation from other buried structures,

— casing isolation/insulation.

The task begins when the need for the electrical insulating device is determined. The task ends when isolation has been verified and the required information has been documented per the operator's procedure.

2.0 Knowledge Component

The purpose of this task is to isolate pipeline segments and equipment to ensure proper functioning of CP, lightning protection, and ground fault protection.

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

— CP systems.

— Electrical isolation.

— Grounding systems.

— Various electrical isolation devices, including the following:

  — flange isolation,

  — dielectric union,

  — monolithic,

  — casing isolators/spacers.

Terms associated with this task are as follows.

This section intentionally left blank.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Presence of corrosion, pitting, etc.	Document as required and notify appropriate personnel.
Unexpected hazardous liquid or carbon dioxide encountered: inspection of flange alignment.	Stop all activity related to this task and notify operator personnel, as required, and eliminate ignition source.
Pipeline damage: dents, gouges, scrapes, etc.	Notify appropriate personnel.

3.0 Skill Component

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

Flange or Dielectric Union Isolation/Insulation

Step	Action	Explanation
1	Verify the location where the isolation device is needed.	This step verifies that the installation will be appropriately mounted, enclosed, and compatible with the location of the installation.
2	Verify appropriate kit materials such as insulating sleeves on the studs or bolts and insulating washers under the nuts and/or the heads of the bolts; mild steel washers are placed over top of the insulating washers to prevent damage when tightened.	
3	Verify proper flange alignment prior to installation of insulation kit.	When installing insulating kits, the individual should use alignment pins in the flange. The usage of alignment pins in the flange will prevent damage or destruction of the isolating sleeves that can result from misalignment of the flange faces.
4	Install flange kit and/or dielectric unions according to the manufacturer's specifications.	This step emphasizes precautions to prevent any moisture, soil, or other foreign matter from contacting any portion of the insulating joint prior to its being sealed. NOTE If moisture, soil, or other foreign matter contacts any portion of the insulating joint, the entire joint shall be disassembled, cleaned with a suitable solvent, and dried prior to re-assembly.
5	Verify isolation with the appropriate insulation tester.	The use of a digital multimeter can give a false indication of isolation.
6	Record all required documentation per the operator's procedures.	Up-to-date records are essential.

Isolation Joints

Step	Action	Explanation
1	Verify the location where the isolation device is needed.	This step verifies that the installation will be appropriately mounted, enclosed, and compatible with the location of the installation.
2	Verify the type of isolation device required, such as monolithic-style insulating fittings that are typically welded in place. NOTE Assembling isolating joints and testing them both hydrostatically and electrically before installation in the pipeline is preferred.	This step requires certain types of isolation devices where the isolation point location must be buried or the fluid inside the pipe is electrically conductive such as produced water. Isolating joints for pipelines must be adequate for the maximum pressure and temperature conditions encountered on the particular installation.
3	Install bond wires/cables on both sides of the encapsulated insulating device.	This step will mitigate interference or enable electrical continuity when necessary.
4	Terminate wires in a common terminal box at the approved location.	
5	Verify isolation with the appropriate insulation tester.	The use of a digital multimeter can give a false indication of isolation.
6	Record all required documentation per the operator's procedures.	Up-to-date records are essential.

Lightning and Ground Fault Protection

Step	Action	Explanation
1	Verify the location where the isolation device is needed.	This step verifies that the installation will be appropriately mounted, enclosed, and compatible with the location of the installation.
2	Install all insulating devices with the appropriate fault and lightning protection in accordance to the manufacturer's design practice.	The equipment typically will consist of either a polarization cell replacement (PCR) or a solid state decoupling (SSD) device that is bonded sufficiently and oppositely on both sides of the insulating flange.
3	Verify isolation with the appropriate insulation tester.	
4	Record all required documentation per the operator's procedures.	Up-to-date records are essential.

Electrical Isolation from Electrical Grounding

Step	Action	Explanation
1	Verify the location where the isolation device is needed.	This step verifies that the installation will be appropriately mounted, enclosed, and compatible with the location of the installation. NOTE Facility grounding cables and electrical AC neutrals offer low-resistance pathways that can bypass or short insulating devices.
2	Install the SSD or PCR to isolate the pipeline from electrical grounding systems.	Provision for electrical isolation through an approved electrical device (PCR or SSD) that is rated for the service must be made at main line valves, densitometers, flow-meters, pressure transmitters, and other sites where such structures will be in bare metal contact to the soil.
3	Conduct testing on all utility (electrical, telephone, etc.) supply or feeder cables to identify DC flow to the foreign structures.	
4	Verify isolation with the appropriate insulation tester.	
5	Record all required documentation per the operator's procedures.	Up-to-date records are essential.

Aboveground Piping Isolation from Other Buried Structures

Step	Action	Explanation
1	Verify the location where the isolation device is needed.	This step verifies that the installation will be appropriately mounted, enclosed, and compatible with the location of the installation.
2	Install the piping system so that it is not in physical contact with any foreign electrically conductive or metallic structure such as casings, valve culverts, concrete caisson steel, cable trays, supporting pipe stanchions, bridge structures, pilings, or reinforcing steel in concrete.	The CP design must include and account for such structures if electrical isolation is impracticable to achieve. This step ensures that cathodically protected pipelines installed aboveground and supported with steel supports are electrically insulated from the supports.
3	Align the predetermined-sized electrical isolation device between metallic piping and metal pipe supports through the use of nonmetallic spacers or shields.	The proper installation of these materials ensures crevice corrosion does not result from ingress of dust and moisture between the insulation material/pipe interfaces.
4	Install the nonmetallic spacers between the insulation material and the pipe interface.	This step ensures the material is compression/abrasion resistant in conjunction with having effective dielectric properties.
5	Verify isolation with the appropriate insulation tester.	
6	Record all required documentation per the operator's procedures.	Up-to-date records are essential.

Casing Isolation/Insulation

Step	Action	Explanation
1	Verify the location where the isolation device is needed.	When metallic casings are used as part of the underground piping system (such as at roadways, railway crossings, watercourse crossings, etc.), the electrical isolation of the carrier pipeline from such casings is accomplished by the use of adequate and approved insulating spacing capable of high compressive strength and end-seal materials.
2	Ensure the annular space is cleared of any debris and contaminants.	This step emphasizes the use of precaution to ensure the removal of all organic materials or electrolytes from the annular space between the casing and the carrier pipe and to ensure that it is completely free of contaminants prior to installation of the insulating spacers.
3	Install the nonmetallic spacers or shields and seal the ends per the operator's procedure and the manufacturer's specification.	The careful selection of casing isolating spacers ensures they have the mechanical strength required.
4	Verify that the annular space is cleared of any debris and contaminants and verify spacers are secured.	
5	Install the end seals. NOTE Install the casing end seals according to the manufacturer’s instructions and in the quantity recommended by the manufacturer or design engineer.	The correct installation of end seals ensures that water/debris penetration is effectively prevented.
6	Verify isolation with the appropriate insulation tester.	
7	Record all required documentation per the operator's procedures.	Up-to-date records are essential.

Task 10.1—Insert and Remove Coupons

1.0 Task Description

This task consists of the removal of corrosion coupons to submit for testing.

The task begins with the verification that the isolation valve has been closed. The task ends when the coupon has been submitted for testing and required information is recorded per company procedure.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

The purpose of this task is to monitor internal corrosion.

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

Terms applicable to this task are as follows.

corrosion
The chemical or electrochemical reaction between a material (usually a metal) and its environment that produces a deterioration of the material and its properties.

coupon
A sample of clean and pre-weighed metal of a known surface area inserted into a pipeline system to monitor corrosion rate and inhibitor effectiveness (coupons come in a variety of metals and configurations such as flush, flat, and rod).

coupon holder assembly
A device utilized to hold and isolate coupon from surrounding metals.

isolation or service valve
A device utilized to isolate the coupon and plug assembly from pipeline contents.

localized corrosion
Types of corrosion in which there is an intense attack at localized sites on the surface of a component. The most common type of localized corrosion is pitting. Other types of corrosion that may cause localized corrosion include crevice corrosion, cavitation, and impingement.

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

retrieval tool/extractor tool
A device used to remove and replace coupons.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Damage or malfunction to coupon holder assembly causing leak or prevention of coupon insertion or retraction.	Stop process and make notification.
Malfunction of isolation/service valve.	Stop process and make notification.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the isolation valve is closed and secure.	This isolates coupon and plug assembly from pipeline contents.
2	Remove fitting cap slowly, if equipped.	This provides access to coupon. Fitting caps are typically installed at locations where portable retrievers or direct access procedures are used.
3	Remove coupon and coupon holder assembly according to manufacturer's and company procedures. NOTE Do not touch the coupon with bare hands or allow it to come in contact with external contaminants.	Coupon holders and retrieval tools vary with manufacturer. External contaminants such as acid present on human hands can affect weight loss of the coupon.
4	Remove coupon from coupon holder and conduct visual inspection of coupon. If obvious corrosion is present in the visual inspection (pitting or localized corrosion), make notifications per company procedures. NOTE Do not touch the coupon with bare hands or allow it to come in contact with external contaminants.	External contaminants such as acid present on human hands can affect weight loss of the coupon.
5	Place coupon directly in original protective packaging, and document visual characteristics of coupon, removal date, and remover's name. NOTE Do not touch the coupon with bare hands or allow it to come in contact with external contaminants.	External contaminants such as acid present on human hands can affect weight loss of the coupon.
6	Properly document the new coupon's serial number or identification, its associated protective packaging, date of installation, location of installation, installer's name.	Each coupon comes with its own protective package. It must be returned with its package and the required documentation to ensure accurate results.
7	Clean and prepare coupon holder and ancillary equipment for coupon installation. Follow manufacturer's or company procedures to prevent contamination of the coupon.	Proper preparation is essential to accurately measure future corrosion.
8	Install coupon into coupon holder. Follow manufacturer's or company procedures to prevent contamination of the coupon.	Proper installation of coupon secures it in place and electrically isolates it from coupon holder.
9	Install coupon holder and coupon according to manufacturer and company procedures. Perform this function slowly to prevent damage to the coupon and plug assembly. NOTE Coupon holders and retrieval tools vary with manufacturer. Consult manufacturer and company installation procedures.	New coupon is placed to continue measuring future corrosion.
10	Replace fitting cap according to manufacturer and company procedures.	Fitting caps are typically installed at locations where portable retrievers or direct access procedures are used.
11	Notify an individual who is qualified to open the isolation valve.	Exposes new coupon to pipeline contents.
12	Check for signs of leakage.	When the coupon installation is complete and the isolation valve is opened, monitor the site for any possible leaks.
13	Submit removed coupon and properly store new coupon protective packaging according to company procedures.	Packaging for new coupon must be stored properly so it can be used when the coupon is removed.
14	Record all required documentation per company procedures.	Up-to-date records are essential to maintaining a corrosion control system.

Task 10.2—Monitor Probes (Online)

1.0 Task Description

This task consists of connecting a data logger and recording readings from monitor probes.

The task begins when the secondary containment cover is opened. The task ends when the reading has been obtained, verified, and documented.

2.0 Knowledge Component

The purpose of this task is to monitor for metal loss.

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

Terms applicable to this task are as follows.

bio probes
Bio probes are used to monitor sample elements for sessile bacteria growth.

electrical resistance probe
ER probe
ER probes determine metal loss over time by measuring the increase of the electronic resistance of an electrode as its cross-sectional area is reduced by corrosion.

galvanic probe
GP probe
Galvanic probes measures the change in current generated between brass and steel electrodes. When the two electrodes are immersed in electrolyte, a current is generated. Changes in the electrolyte or other variables such as temperature, velocity, pH, oxygen, or inhibitor characteristics are reflected by changes in the current output of the probes and recorded by a data acquisition system.

hydrogen probe
HP probe
Hydrogen probes monitor hydrogen permeation in steels.

linear polarization resistance probe
LPR probe
LPR probes work on the principle of voltage change over time. One element is polarized positively and the time it takes to return to its normal state is measured with reference to the second element. The element is then polarized negatively and the time it takes to return to its normal state is measured. Two curves are generated, one for the positive polarization and one for the negative polarization. The curves are plotted and the point at which they cross is defined as “the imbalance,” which is subsequently interpreted as the tendency to pit.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	Locate probe site and remove any secondary containment covers to gain access to the probe.	Secondary containment covers are often used to protect against a release.
2	Confirm the probe terminals are acceptable for use.	Verify that probes are not damaged or corroded, which may result in inaccurate monitoring results.
3	Connect the data cords from the data logger to the appropriate terminal of the probe. Turn the data logger on and obtain the reading. NOTE Data recorders and monitor probes vary by manufacturer. Follow manufacturer's operating procedures.	Necessary for accurate corrosion measurement.
4	Document the reading.	Documentation of measurements is necessary for corrosion monitoring and mitigation.
5	Disconnect the data logger leads from the probe.	
6	Dress secondary container cover with anti-seize compound and place cap back on probe adapter.	
7	Confirm data logger readings are appropriate.	If the data logger readings are not consistent with the probe manufacturer's readings, and all external components are in good working order, confirm the data logger is functioning properly. Otherwise, there may be a problem with the probe itself.
8	Record all required documentation per company’s procedures.	Up-to-date records are essential to maintaining a corrosion control system.

Task 11—Monitor and Control the Injection Rate of the Corrosion Inhibitor

1.0 Task Description

The tasks consist of monitoring and controlling the injection rate of corrosion inhibitor.

When corrosion inhibitors are used to mitigate internal corrosion, the operator must inject the inhibitor in sufficient quantities to ensure design coverage of the inhibitor.

This task begins with a visual observation of the injection system. The task ends when proper documentation and notification is completed.

2.0 Knowledge Component

The purpose of this task is to monitor corrosion inhibitor injection rates and adjust these rates to ensure the proper amount of inhibitor is being injected.

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

Terms applicable to this task are as follows.

corrosion
The chemical or electrochemical reaction between a material, usually a metal, and its environment that produces a deterioration of the material and its properties.

inhibitor
A chemical substance or combination of substances that, when in proper concentrations, forms an environment that prevents or reduces corrosion.

mils per year
MPY
The rate of corrosion measured in 1/1000 of an inch/year.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Damage or malfunction to injection system causing leak.	Stop process and make notification.

3.0 Skill Component

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

Step	Action	Explanation
1	Visually inspect tank and injection system to verify the injection system is operating and inspect for signs of leakage.	Verifies operation and integrity of the system.
2	Verify the volume of inhibitor is sufficient to last until the next inspection.	
3	Monitor inhibitor injection rate to determine if the inhibitor rate meets the requirements based on the pipeline flow rate. This may include measuring changes in the volume of inhibitor using a sight glass.	Follow operator's policies and procedures to determine the flow of the inhibitor.
4	Adjust injection rate as necessary to meet established pipeline flow rate.	Follow operator's policies and procedures when adjusting the injection rate of the inhibitor.
5	Document measurements and/or changes and make proper notification per operator's procedures.	Follow operator's policies and procedures for proper documentation and notification.

Task 12—Perform Visual Inspection of Internal Pipe Surface

1.0 Task Description

This task consists of visually inspecting the internal pipe surface.

This task begins after the pipe has been opened and prepared for inspection. The task ends with proper documentation of observations.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Measure Pit Depth with Pit Gauge (reference Task 8.1).

— Measure Wall Thickness with Ultrasonic Meter (reference Task 8.2).

2.0 Knowledge Component

The purpose of this task is to identify evidence of corrosion whenever the pipe has been opened to the atmosphere.

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

Terms 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.

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

> **buckle**
> A bend, bulge, or kink that can cause flattening or changes in the curvature of the pipe.
>
> **dent**
> A depression in the surface that has been created by external forces on the pipeline with no visual evidence of metal loss.
>
> **gouge**
> A groove in which metal has been removed from the surface.
>
> **scratch**
> A thin, shallow cut or mark on the surface.

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

scale
Deposit of a solid on the pipe wall.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	

3.0 Skill Component

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

Step	Action	Explanation
1	Confirm that pipe is in a condition to allow an internal inspection. If pipe is removed, pipe orientation must be properly marked. Removed and upstream/ downstream pipe should be marked according to operator's procedures.	Correctly orienting the pipe will provide key information to corrosion patterns observed on the internal diameter of the pipe. Hydrocarbon must be removed to accurately view the internal surface of the pipe.
2	Visually inspect all internal pipe surfaces for which visual inspection is possible, including the removed component section, and observable portions of pipe upstream and downstream of the removed component or access point.	
3	Record all required documentation per operator's procedures.	Up-to-date records are essential to maintaining a corrosion control system. Special care should be taken in recording the patterns and location of general corrosion, pitting, mechanical damage, and/or scale buildup.

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, mapping software, 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. This task ends when the correct line segment has been located.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Observe Excavation Activities (reference Task 32).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Examine for Mechanical Damage on Buried or Submerged Pipe (reference Task 5.1).

— Examine for External Corrosion on Buried or Submerged Pipe (reference Task 5.2).

— Inspect the Condition of External Coating on Buried or Submerged Pipe (reference Task 5.3).

— Install, Inspect, and Maintain Permanent Marker (reference Task 14.2).

— Install, Inspect, and Maintain Temporary Marker (reference Task 14.5).

2.0 Knowledge Component

This task is performed to verify location of pipeline.

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

— Pipeline maps, mapping software, drawings, blueprints, and GPS.

— Methods used to locate pipe (e.g. potholing, daylighting, probing, electronic line locating, hand digging).

— Signal interference or unexpected changes in frequency and/or depth readings.

— One-Call notification system and One-Call laws (may vary from state to state).

Terms applicable to this task are as follows.

electronic line locator
A device designed and used to locate metal pipelines and/or plastic pipelines installed with a metal (tracer) wire, below the earth’s surface.

Electronic line locator readings may be impacted by pipeline depth, other underground utilities, adjacent structures, CP systems, type of soil, soil density, and overhead power lines.

When using handheld electronic line locators, interference or unexpected changes in frequency and/or depth readings may be encountered.

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
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.

potholing or daylighting
The practice of uncovering a pipeline to verify its location.

probing
The practice of contacting the pipeline with a bar or rod to verify the presence or absence of a pipeline or underground structure. When probing, care must be taken to avoid damaging pipeline coating.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Discovery of unintentionally exposed pipeline.	Notify appropriate pipeline personnel.
Pipeline location does not match pipeline maps.	Notify map owner and/or follow company procedure to update map.

3.0 Skill Component

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

Step	Action	Explanation
1	Obtain/verify necessary permits, waivers, access requirements, and/or One-Call Ticket, as applicable.	Refer to operator, state, and local requirements.
2	Determine the approximate location of the pipeline section, by using the most current drawings, maps, and/or GPS.	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. If equipment is not working properly, stop task activities, determine cause of malfunction, and remediate per manufacturer's recommendations.
4	Conduct a visual assessment to determine site conditions that could affect task performance.	Some rights-of-way or site conditions may impede task completion. Examples may include physical obstructions, traffic, soil conditions, hazards, standing water, trenches, etc.
5	Use appropriate line locating equipment and/or methods to determine the location of the line.	Determine pipeline location by appropriate locating method according to operator procedures. NOTE Exposed pipe must be inspected by following Tasks 5.1, 5.2, or 5.3. Take appropriate action per operator's procedures.

Task 14.2—Install, Inspect, and Maintain Permanent Marker

1.0 Task Description

This task consists of installing, inspecting, and maintaining permanent pipeline markers in required locations.

The task begins with verification that the line has been located. The task ends when the pipeline route is accurately marked with permanent marker(s).

The performance of this covered task may require the performance of other covered tasks such as the following.

— Locate Line (reference Task 14.1).

2.0 Knowledge Component

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

— Permanent markers visually communicate the approximate location of the pipeline. Line markers must meet the specifications outlined in applicable regulations.

— Location requirements for marker installation.

— Information and design requirements for markers.

— One-Call notification system and One-Call laws (may vary from state to state).

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Discovery of unintentionally exposed pipeline.	Notify appropriate pipeline personnel.

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 helps prevent damage to the pipeline.
3	Verify the appropriate marker for the location and product.	Confirm information on the marker is correct and in good condition. Markers need to have the correct product identification and information required by the regulation.
4	Securely install the mounting apparatus and marker, per manufacturer's specifications.	Ensure markers have a good solid foundation. **Caution—When applicable, probe or pothole prior to installing a post to help ensure that the pipeline is not damaged.**
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.

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.

The task begins when a One-Call ticket is received. The task ends when the line is accurately marked.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Locate Line (reference Task 14.1).

2.0 Knowledge Component

Operators must provide temporary marking of buried pipelines in the area of excavation activity before, as far as practical, the activity begins. Temporary markers visually communicate the location of the pipeline on the surface of the right-of-way.

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

— Types of temporary markers.

— Temporary marker locations.

— ANSI uniform color code.

— One-Call notification system and One-Call laws (may vary from state to state).

Terms 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Discovery of unintentionally exposed pipeline.	Notify appropriate pipeline personnel.

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: — the date the locate must be completed by, — the area to be marked.
2	Verify that the line has been located within the proposed excavation area.	Ensures accurate placement of the marker. 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.

Task 15.1—Perform Visual Inspection of Surface Conditions of Right-of-way

1.0 Task Description

This task consists of performing an inspection of surface conditions on, or adjacent to, the pipeline right-of-way. Methods of inspection may include walking, driving, flying, or other appropriate means of traversing the right-of-way.

The task begins with accurately identifying the right-of-way to be inspected. The task ends with completion of the required documentation.

2.0 Knowledge Component

The purpose of the inspection is to identify and observe for indications of leaks, construction activity, and other factors affecting safety and operation.

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

— Immediate threat to persons, property, or the environment.

— 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.).

— Exposure that could immediately damage or affect the stability of a pipeline.

— Fire or explosion near the right-of-way.

Conditions that could impact the safety or integrity of the pipeline 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, sinkhole, subsidence, or settling;

— 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.

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);

— damage to coatings or insulation on aboveground pipe or components.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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.	Make proper notification of any abnormal conditions.
3	Report right-of-way inspection results.	Follow company procedures.
4	Complete required documentation.	Follow company procedures.

Task 16.1—Inspect Navigable Waterway Crossing

1.0 Task Description

This task includes the locating and inspection of the below surface pipeline crossings of navigable waterways. Activities would include determining the pipeline depth of cover within the navigable waterway and/or denoting any other conditions that may result in damages to the pipeline. The activities of this task apply only to the area of the pipeline that is below the water surface.

This task begins after locating the pipeline at water edge of each bank or shoreline and ends when the inspection of conditions and determination of depth of cover of the pipeline that is within the navigable waterway is documented.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Locate Line (reference Task 14.1).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Visual Inspection of Surface Conditions of Right-of-way (reference Task 15.1).

2.0 Knowledge Component

The purpose of this task is to determine pipeline depth of cover, potential pipe exposures, and any other conditions that may result in damage to the pipe within the navigable waterway.

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

— Specialized locating equipment to determine depth of cover.

Conditions that could impact the safety or integrity of the pipeline include the following:

— vessel anchored over the pipeline,

— visible sheen or other indications of product release,

— waterway bank erosion,

— debris lodged against pipeline,

— pipe movement or suspended pipeline.

Terms applicable to this task are as follows.

depth of cover
The vertical distance from the top of pipe to the soil or water sediment interface.

navigable waterway
A waterway where substantial likelihood of commercial navigation exists.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Response
This section intentionally left blank.	*This section intentionally left blank.*

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 waterway crossing.	Establishes a reference point.
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 per operator's procedures.	Location of exposed or unsupported pipe. Depth of cover.

Task 19.1—Perform 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 verification of the valve number/nameplate and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task prepares valves to continue functioning properly in freezing conditions and/or corrosive environments.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

body bleed (depressurization)
The action of 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.

body or body cavity
The principle pressure-containing part of a valve where the closure element and seals are located.

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the valve identifier.	Ensure that the proper valve is located.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed.
3	Verify proper isolation of the valve.	
4	Position the valve to isolate the valve body from the line pressure.	The individual must follow the manufacturer's recommendations and/or the operator's procedures.
5	Depressurize the valve body; drain nonpetroleum material (such as water or sediment) from the valve body.	Flush until clean product is observed. NOTE Ensure drain valve is closed prior to restarting.
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. NOTE If that the valve fails to seal, proper notification must be communicated as per the operator's procedure.
7	Connect the injection equipment.	
8	Operate the injection equipment and inject appropriate antifreeze and/or corrosion inhibitor.	The individual must follow the manufacturer's recommendations and/or the operator's procedures.
9	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the valve can be put back into service.
10	Document task results as per the operator's procedures.	This step documents the results per the operator's procedures.

Task 19.2—Perform Valve Lubrication

1.0 Task Description

This task involves the activities required to lubricate the components of a valve.

This task begins with the verification of the valve number/nameplate and ends with the completion of the required documentation.

2.0 Knowledge Component

This preventative maintenance task lubricates the components of a valve to provide reliable operation.

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

- How to determine valve types. Common types of valves include:
  - ball,
  - gate,
  - butterfly,
  - plug,
  - globe.
- How to determine valve actuator/operator types. Common types of valve actuators/operators include:
  - mechanical/hand,
  - hydraulic,
  - electronic,
  - pneumatic.
- How to properly lubricate valves.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the valve identifier.	Ensure that the proper valve is located. If the valve identifier is missing, replace per operator's specifications.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the repair has been scheduled and communicated and that the operational status has been confirmed.
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. If unable to lubricate one or more components, follow the manufacturer's recommendations and/or the operator's procedures.
4	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the valve can be put back into service.
5	Document task results as per the operator's procedures.	This step documents the results per the operator's procedures.

Task 19.3—Perform Valve Seat Sealing

1.0 Task Description

This task involves verification of valve sealing and the injection of seat sealing products into a valve.

This task begins with the identification of the valve and concludes upon notification of appropriate personnel of task completion.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

Valve seat sealing is performed to complete a positive seal and prevent leak-by and leak-through conditions.

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

— How to determine valve types. Common types of valves include:

  — ball,

  — gate,

  — butterfly,

  — plug,

  — globe.

— How to determine valve actuator/operator types. Common types of valve actuators/operators include:

  — mechanical/hand,

  — hydraulic,

  — electronic,

  — pneumatic.

— How to properly seal valves.

Terms applicable to this task are as follows.

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.

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

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the valve identifier.	Ensure that the proper valve is located. If the valve identifier is missing, replace per operator's specifications.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the valve is closed according to the manufacturer's instructions.	This step ensures that the valve is in the proper position to accept the sealant. Manual control of the valve must be established to prevent inadvertent actuation of the valve during the performance of this task.
4	Position the valve to isolate the valve body from the line pressure.	The individual must follow the manufacturer's recommendations and/or the operator's procedures.
5	Depressurize the valve body.	The individual must follow the manufacturer's recommendations and/or the operator's procedures.
6	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.
7	Inject appropriate sealant into seats.	This step ensures that the sealant is compatible with the valve.
8	Check for leak-by and leak-through sealing of valve.	The individual must follow the manufacturer's recommendations and/or the operator's procedures. In the event the valve fails to seal, proper notification must be communicated as per the operator's procedure.
9	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.
10	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the valve sealing is complete.

Task 19.4—Perform 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.

This task begins with verification of the valve identifier and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

Valve stem packing maintenance is performed to prevent leak-out and maintain proper valve function and integrity.

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

— How to determine valve types. Common types of valves include:

  — ball,

  — gate,

  — butterfly,

  — plug,

  — globe.

— How to determine valve actuator/operator types. Common types of valve actuators/operators include:

  — mechanical/hand,

  — hydraulic,

  — electronic,

  — pneumatic.

— How to properly insert packing.

Terms applicable to this task are as follows.

energized
The act of maintaining the pressure of the injectable packing material.

injectable packing
Bulk material injected into the stem seal gland to provide a temporary or permanent seal.

stem seal
Seal surrounding the valve stem that prevents leakage.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the valve identifier.	Ensure that the proper valve is located. If the valve identifier is missing, replace per operator's specifications.
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	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed.
5	Insert the appropriate amount of injectable packing into valve stem packing gland.	Ensure that the insertion pressure does not exceed the manufacturer's instructions.
6	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.
7	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the maintenance is complete.
8	Document task results as per the operator's procedures.	This step documents the results per the operator's procedures.

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 verification of the valve identifier and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task is performed to set the actuator limits and torque switch values to define the open and closed limits for the valve.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

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.

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.

AOCs associated with the performance of this task include the following.

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.
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the valve identifier.	Ensure that the proper valve is located. If the valve identifier is missing, replace per operator's specifications.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the proper isolation of the valve and actuator prior to performing an adjustment.	Operation of the valve must not adversely affect operations. The valve actuator should be placed in local control.
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.
6	Properly set the torque switches.	The individual must follow the manufacturer's recommendations and/or the operator's procedures.
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. If the valve is not in proper working order, investigate cause and rectify or notify the appropriate personnel to take actions as required.
8	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the valve sealing is complete.
9	Document inspection results as per the operator's procedures.	This step documents the results per the operator's procedures.

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 verification of the valve identifier and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task is performed to properly set the adjustment mechanisms for full open and closed positions.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

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.

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).

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.
Unexpected valve movement	Return the valve to the proper position, 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 identifier.	Ensure that the proper valve is located. If the valve identifier is missing, replace per operator's specifications.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the proper isolation of the valve and actuator prior to performing adjustment.	Operation of the valve must not adversely affect operations. The valve actuator should be placed in local control.
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. If unable to achieve full open or full closed, investigate cause and rectify or notify the appropriate personnel to take actions as required.
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.
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.
8	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the valve sealing is complete.
9	Document inspection results as per the operator's procedures.	This step documents the results per the operator's procedures.

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 verification of the valve identifier and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task is performed to properly set the adjustment mechanisms for full open and closed positions.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

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.

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 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions as required.
Unexpected valve movement.	Return the valve to the proper position, 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 identifier.	Ensure that the proper valve is located. If the valve identifier is missing, replace per operator's specifications.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	This step ensures that the task has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the proper isolation of the valve and actuator prior to performing an adjustment.	Operation of the valve must not adversely affect operations. The valve actuator should be placed in local control.
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. If unable to achieve full open or full closed, investigate cause and rectify or notify the appropriate personnel to take actions as required.
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.
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. NOTE This is a separate covered task.
8	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the valve sealing is complete.
9	Document inspection results as per the operator's procedures.	This step documents the results per the operator's procedures.

Task 20—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 that the proper security controls are in place.

This task begins with identification of the valve to be inspected and ends with completion of required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task will confirm that valves will operate as intended for system operations.

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

— How to determine valve types. Common types of valves include:

  — ball,

  — gate,

  — butterfly,

  — plug,

  — globe.

— How to determine valve actuator/operator types. Common types of valve actuators/operators include:

  — mechanical/hand,

  — hydraulic,

  — electronic,

  — pneumatic.

— DOT regulatory and operator valve inspection requirements.

Terms applicable to this task are as follows.

functionality test
This test consists of a partial or full opening or closing of the valve within operational parameters, either locally and/or remotely as applicable.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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 inspected and confirm that the valve is correctly labeled.	This step confirms that the valve is identified and labeled consistent with the operator's documentation.
2	Make proper notifications.	This step confirms that the inspection has been scheduled and communicated and that the operational status has been confirmed.
3	Inspect the valve security and access control.	This step verifies 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 confirms that there are no visible leaks, damage, or corrosion of the valve, components, or flanges.
5	Inspect the valve position indicator.	This step confirms that the position indicator is intact, operational, and correctly identifies valve position.
6	Perform functional testing to check all modes of operation of the valve as per applicable procedures, including remote operation if capable.	This step confirms that the valve is in proper working order. NOTE Performance of this step requires a person to be qualified to operate the valve.
7	Reestablish proper valve status.	This step confirms that the valve is in the proper operating position.
8	Reestablish proper security and access controls.	This step confirms that the valve and/or valve site are secured against unauthorized access and operation.
9	Perform the necessary notifications upon completion of the inspection.	
10	Document the inspection results as per the operator's procedures.	

Task 21.1—Repair Valve Actuator/Operator, Pneumatic

1.0 Task Description

This task involves disassembly, diagnosis of component failure, repair or replacement, and reassembly of a pneumatic valve actuator.

This task begins with the identification of the valve actuator to be repaired and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Adjust Actuator/Operator, Pneumatic (reference Task 19.6).

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task addresses the repair of a pneumatic actuator according to the applicable procedures and is conducted to maintain the integrity and function of the valve actuator.

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

— Applicable manufacturer and/or operator procedures for the equipment being repaired.

Terms applicable to this task are as follows.

functionality test
A test to ensure the actuator operates properly and does not leak after reassembly.

AOCs associated with the performance of this task include the following.

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.
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions 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 valve actuator to be repaired.	This step confirms that the valve actuator is identified.
2	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test if required by the operator's procedures.	This step confirms that the repair has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the proper isolation of the valve and actuator prior to repair or disassembly.	
4	Diagnose and disassemble the actuator following applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
5	Repair or replace worn or damaged parts.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
6	Reassemble the actuator per applicable procedures.	The individual must follow the manufacturer's instructions for the applicable valve.
7	Perform a functionality test to ensure proper actuator operation and integrity.	This step ensures that the pneumatic source does not leak and the actuator operates properly.
8	Adjust actuator/operator.	NOTE Performance of this step requires a person to be qualified to adjust the actuator.
9	Reestablish the proper actuator status.	This step confirms that the actuator performs in all modes of operation.
10	Reestablish proper security and access controls.	This step confirms that the valve and/or valve site are secured against unauthorized access and operation.
11	Perform the necessary notifications upon completion of the repair.	
12	Document the repair results per the operator's procedures.	

Task 21.2—Disassemble/Reassemble Valves

1.0 Task Description

This task involves the disassembly and reassembly of valves, diagnosis of valve component failure, and repair or replacement of parts.

This task begins with the identification of the valve to be disassembled and reassembled and ends with the completion of required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Conduct Pressure Test (reference Task 41).

2.0 Knowledge Component

This task addresses the assembly/disassembly of a valve according to the applicable procedures and is conducted to maintain the integrity and function of the valve.

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

— How to determine valve types. Common types of valves include:

  — ball,

  — gate,

  — butterfly,

  — plug,

  — globe.

— Applicable manufacturer and/or operator procedures for the equipment being repaired.

Terms applicable to this task are as follows.

functionality test
A test to ensure the valve operates properly and does not leak after reassembly.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions 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 valve to be disassembled and reassembled and confirm that it is correctly labeled.	This step confirms that the valve is identified and labeled consistent with the operator's documentation.
2	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test if required by the operator's procedures.	This step confirms that the repair has been scheduled and communicated and that the operational status has been confirmed.
3	Verify that the valve has been isolated according to applicable procedures.	This step prevents release of hazardous energy and ensures worker safety.
4	Disassemble the valve following applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
5	Diagnose and repair or replace worn or damaged parts per the applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
6	Reassemble the valve per applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
7	Perform a functionality test to ensure proper valve operation and integrity.	This step ensures that the valve operates properly and does not leak after reassembly. The individual must follow applicable manufacturer and/or operator procedures for the valve.
8	Perform the necessary notifications upon completion of the valve repair.	

Task 21.3—Perform Internal Inspection of Valves

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 identifier and ends with completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Disassemble/Reassemble Valves (reference Task 21.2).

2.0 Knowledge Component

The purpose of this task is to inspect the valve and associated internal components to identify operational issues and make arrangements for necessary repairs.

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

— Applicable manufacturer and/or operator procedures for the equipment being assembled or disassembled.

Terms applicable to this task are as follows.

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

drain and vent plug
A mechanical device used to vent or bleed off internal valve body pressure.

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).

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the valve identifier.	This step confirms that the valve is identified and labeled consistent with the operator's documentation.
2	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test if required by the operator's procedures.	This step confirms that the repair has been scheduled and communicated and that the operational status has been confirmed.
3	Verify that the valve has been isolated according to applicable procedures.	This step prevents release of hazardous energy and ensures worker safety.
4	Inspect the valve and components.	The individual must follow the manufacturer's recommendations and/or the operator's procedures. Inspection can include: — components for condition and acceptable tolerances; — condition of seals/elastomers; — proper installation of seat/stem seals; — valve stem and nut/seats and seat pockets/seals for the extent of wear; — condition of closure device (gate, ball, plug, etc.); — fasteners (torqued to specified limits); — condition of valve body and coatings.
5	Perform the necessary notifications of results of the inspection and items for repair upon completion.	NOTE Arrange for repairs and functionality tests according to covered task for Disassemble/Reassemble Valves (reference Task 21.2).
6	Document the inspection results per operator's procedures.	

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 reassembly of a hydraulic valve actuator.

This task begins with the identification of the valve actuator to be repaired and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Adjust Actuator/Operator, Hydraulic (reference Task 19.7).

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task addresses the repair of a hydraulic actuator according to the applicable procedures and is conducted to maintain the integrity and function of the valve actuator.

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

— Applicable manufacturer and/or operator procedures for the equipment being repaired.

Terms applicable to this task are as follows.

functionality test
A test to ensure the actuator operates properly and does not leak after reassembly.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected valve movement.	Return the valve to the proper position, if safe to do so. Immediately notify the control room or appropriate operations personnel and execute applicable emergency procedures.
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions 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 valve actuator to be repaired.	This step confirms that the valve actuator is identified.
2	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test if required by the operator's procedures.	This step confirms that the repair has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the proper isolation of the valve and actuator prior to repair or disassembly.	
4	Diagnose and disassemble the actuator following applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
5	Repair or replace worn or damaged parts.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
6	Reassemble the actuator per applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures for the valve.
7	Perform a functionality test to validate actuator operation and integrity.	Validates that the hydraulic source does not leak and that the actuator operates properly.
8	Adjust actuator/operator.	NOTE Performance of this step requires a person to be qualified to adjust the actuator.
9	Reestablish the proper actuator status.	This step confirms that the actuator performs in all modes of operation.
10	Reestablish proper security and access controls.	This step confirms that the valve and/or valve site are secured against unauthorized access and operation.
11	Perform the necessary notifications upon completion of the repair.	
12	Document the repair results per the operator's procedures.	

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 reassembly of an electric valve actuator.

This task begins with the identification of the valve actuator to be repaired and ends with the completion of the required documentation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Adjust Actuator/Operator, Electric (reference Task 19.5).

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

This task addresses the repair of an electric actuator according to the applicable procedures and is conducted to maintain the integrity and function of the valve actuator.

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

— Applicable manufacturer and/or operator procedures for the equipment being repaired.

Terms applicable to this task are as follows.

functionality test
A test to ensure the actuator operates properly and does not leak after reassembly.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected valve movement.	Return the valve to the proper position, if safe to do so. Immediately notify the control room or appropriate operations personnel and execute the applicable emergency procedures.
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Damage to valve or valve component.	Notify the appropriate personnel to take actions 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 valve actuator to be repaired.	This step confirms that the valve actuator is identified.
2	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test if required by the operator's procedures.	This step confirms that the repair has been scheduled and communicated and that the operational status has been confirmed.
3	Verify the proper isolation of the valve and actuator prior to repair or disassembly.	
4	Diagnose and disassemble the actuator following applicable procedures.	The individual must follow applicable manufacturer and/or operator procedures.
5	Repair or replace worn or damaged parts.	The individual must follow applicable manufacturer and/or operator procedures.
6	Reassemble the actuator.	The individual must follow applicable manufacturer and/or operator procedures.
7	Perform a functionality test to ensure proper actuator operation and integrity.	This step ensures that the electric source does not leak and the actuator operates properly.
8	Adjust actuator/operator.	NOTE Performance of this step requires a person to be qualified to adjust the actuator.
9	Reestablish the proper actuator status.	This step confirms that the actuator performs in all modes of operation.
10	Reestablish proper security and access controls.	This step confirms that the valve and/or valve site are secured against unauthorized access and operation.
11	Perform the necessary notifications upon completion of the repair.	
12	Document the repair results per the operator's procedures.	

Task 22.1—Inspect Tank Pressure/Vacuum Breakers

1.0 Task Description

This task involves activities performed on an atmospheric tank pressure/vacuum (PV) breaker vent to verify that it is functioning properly, is in good mechanical condition, and is adequate for its intended purpose.

This task begins with notification to control center and or local operations (if applicable) that the tank will be isolated for the inspection and ends with appropriate notifications that the PV breaker has returned to a normal operating condition.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

A tank PV vent device is typically a weight-loaded, pilot-operated, or spring-loaded valve, used to relieve excess pressure or vacuum in a tank in order to prevent damage to the tank. Overpressure or vacuum in a tank can be caused by liquid movement into or out of the tank, tank breathing due to weather changes, and other typical or atypical operating conditions.

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

— Pallet weight.

— Tank PV breaker/vent principles of operation.

— Calibration equipment and tools, including digital scales and calipers.

— Tank/vessel construction types—cone roof, internal floating, external floating roofs.

— Device set point.

— Bolting sequences.

Test equipment must have a valid certification of calibration and must be appropriate for the intended calibration range per manufacturer specifications.

Terms applicable to this task are as follows.

body or body cavity
The principal pressure-containing part of a PV vent device where the closure element and seals are located.

diaphragm
A round, thin, flexible sealing device that is secured and sealed around its outer edge—and sometimes around a central hole in the diaphragm—with its unsupported area free to move by flexing.

pressure pallet
A moving, flat, circular plate (or pallet) that provides relief of internal tank pressure when the pressure exceeds design specifications.

vacuum pallet
A moving, flat, circular plate (or pallet) that provides relief of internal tank vacuum when the vacuum exceeds the design amount.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Observe structural damage to tank or roof components.	Stop the task, notify/inform appropriate company personnel of the condition.
Debris or freestanding product exists on the roof.	Stop the task, notify/inform appropriate company personnel of the condition.

3.0 Skill Component

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

Step	Action	Explanation
1	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test if required by the operator's procedures.	This step confirms that the inspection has been scheduled and communicated and that the operational status has been confirmed.
2	Isolate the tank from the process system, if required.	
3	Verify the device identifier.	This step confirms that the correct component is identified.
4	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
5	Visually inspect the device and its associated equipment to determine: — appropriateness for intended service, — physical/mechanical condition, — presence of corrosion, — presence of leakage, — condition of the nozzle to gasket seal and its integrity.	Confirms the condition of the device.
6	Remove the device cover and examine PV vent for signs of sticking, blockage, hydrocarbon, or corrosion fouling.	Sticking, blockage, hydrocarbon, or corrosion fouling can prevent the device from functioning properly. If maintenance, repair, or replacement is required, make appropriate notifications or repairs per operator and manufacturer procedures.
7	Validate pallet weights.	Confirms that the correct pallet weights are installed per manufacturer specifications and operator's design criteria.
8	Move the pressure pallet and vacuum pallet, if applicable. Examine the pressure pallet and vacuum pallet seat for signs of hydrocarbon fouling, cracking, diaphragm damage, or other mechanical damage.	Confirms that the pressure pallet and vacuum pallet move freely, and the seat creates a tight seal.
9	Examine the outlet of the PV device for blockage or fouling.	The amount of hydrocarbon vented and the amount of air drawn in during a vacuum cycle is decreased by blockage or fouling of the outlet of the device.
10	Reassemble the PV device per manufacturer's specifications.	
11	Apply a security seal to the PV device, if required by operator's procedure.	Security seal can include inspection information and results.
12	Document inspection results per operator's procedures.	
13	Notify control center, local operations (if applicable), and any affected personnel per the operator's procedures.	Provides notice that the device is operable and that the system is ready or has returned to normal operation.

Task 22.2—Inspect, Test, and Calibrate HVL Tank Pressure-relief Valves

1.0 Task Description

This task involves inspection, testing, and calibration activities performed on a highly volatile liquid (HVL) tank pressure-relief valve to verify that the device is functioning properly, is in good mechanical condition, and is adequate for its intended purpose.

This task begins with notification to control center and local operations that work will begin on the tank relief valve and ends with notification that the relief valve has returned to a normal operating condition.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Maintain/Repair Relief Valves (reference Task 23.1).

2.0 Knowledge Component

Pressure-relief valves installed on HVL tanks protect the tank and personnel by opening at predetermined pressures and preventing excessive pressure in the tank. The valve is also designed to reclose after opening when normal pressure is restored, thereby preventing further flow of fluid or vapor.

This task is performed in order to ensure that the valve will function properly if the pressure in the HVL tank reaches the specified set pressure.

Work platforms, walkways, ladders, and other safety equipment may be needed for safe access to and egress from the pressure-relief valve. Calibrated pressure gauges and atmospheric monitoring equipment are typically needed for performance of this task.

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

— Types of tank pressure-relief valves and the corresponding principles of operation, including:

  — spring loaded,

  — snap-acting pilot,

  — modulating pilot.

— Calibration equipment and tools used in HVL pressure-relief valve inspection, including:

  — analog pressure gauges,

  — digital pressure gauges,

  — calipers,

  — micrometers.

— Device set point, including the ability to understand manufacturer's specifications and operator's design criteria:

  — manufacturer-specified reseating adjustments (spring-loaded valves),

  — manufacturer-specified lift setting adjustments (pilot-operated valves).

— Operator procedures for inspection, testing, and calibration of pressure-relieving devices and pressure-relief valves.

Terms applicable to this task are as follows.

backpressure
The pressure that exists at the outlet of a pressure-relief device as a result of the pressure in the discharge system. Backpressure is the sum of the superimposed and built-up backpressures.

blowdown
The difference between the set pressure and the closing pressure of a pressure-relief valve, expressed as a percentage of the set pressure or in pressure units.

closing pressure
The value of decreasing inlet static pressure at which the valve disc reestablishes contact with the seat or at which lift becomes zero, as determined by seeing, feeling, or hearing.

opening pressure
The value of increasing inlet static pressure whereby there is a measurable lift of the disk or at which discharge of the fluid or vapor becomes continuous, as determined by seeing, feeling, or hearing.

set pressure
The inlet gauge pressure at which a pressure-relief valve is set to open under service conditions.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown, etc.) that results in a loss of control or overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify control room or local operations monitoring the facility.

3.0 Skill Component

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

Step	Action	Explanation
1	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test per operator's procedures.	The control center and local operations (if applicable) must be notified that work is to be performed on the relief valve.
2	Verify the device identifier.	This step confirms that the correct component is identified.
3	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
4	Visually inspect the device and its associated equipment to determine: — appropriateness for intended service, — physical/mechanical condition, — presence of corrosion, — presence of erosion, — presence of leakage, — inlet and outlet (if applicable) flange connections, — integrity of the device and its associated piping support, — correct position and function of isolation valve.	Confirms the condition and functionality of the device. If maintenance, repair, or replacement is required, make appropriate notifications, or repairs, per operator and manufacturer procedures.
5	Verify that test equipment has been calibrated prior to performing any calibrations.	This includes equipment such as pressure gauges, calipers, or micrometers that are used during the inspection, testing, and calibration of a pressure-relief valve. Test equipment must have a valid certification of calibration and be appropriate for the intended calibration range.
6	Isolate the device from the process system.	Isolate the device from the process system and relieve trapped process pressure. This will allow the correct test pressure and medium to be applied during calibration and prevent a loss of containment. Stop task if the isolation valve does not function correctly and make appropriate notifications.
7	Connect test equipment and inspect all connections for leakage.	Loss of test pressure will result in inaccurate test results or calibration of the device.
8	Apply test medium pressure and determine the device set point or range and opening pressure "as found."	Using the "as found" value of a device set point and opening pressure prior to calibration helps determine the proper functionality and repeatability. This may need to be repeated multiple times per operator's procedures. If the device is found to have an improper set point or opening pressure, it may have a problem maintaining its calibration within acceptable limits and tolerance, or a set point may have incorrectly been applied by a previous calibration. This step provides a historical record, verifies current device settings, and determines if a calibration is required.

Step	Action	Explanation
9	Document “as found” results.	Document “as found” results per operator’s procedures. This documentation provides historical data that may indicate if the device fails to maintain calibration and may need to be replaced.
10	If device calibration is required, reapply the test medium (Step 8) to the desired set point or range and adjust it according to the device manufacturer’s specifications and applicable operator procedures. Repeat the test procedure to achieve calibration.	Establish repeatability to the desired set point and opening pressure.
11	Document the final set point value “as left” results.	Document “as left” results per operator’s procedures. Documentation of the final calibration will provide an opportunity for a review to ensure that the correct set point(s) were established, and it will provide historical data for future testing of the device.
12	Remove test equipment, return the device to normal operating condition, and verify the integrity of the system per operator’s procedures.	
13	Apply a security seal to valve, if required by operator’s procedure.	Security seal can include inspection information and results. Utilize company procedures.
14	Notify control center, local operations (if applicable), and any affected personnel, per the operator’s procedures.	Provides notice that the device is operable and that the system is ready or has returned to normal operation.

Task 23.1—Maintain/Repair Relief Valves

1.0 Task Description

This task involves disassembling and reassembling a relief valve, diagnosing a relief valve component failure, and repairing or replacing parts as necessary. This task addresses repairing a relief valve according to the applicable procedures and is conducted to maintain the valve's integrity and to verify that the valve's performance meets all the necessary functions.

This task begins with verification of the device number and identifier and ends with notification to appropriate personnel that the maintenance and repairs are complete.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Inspect, Test, and Calibrate Relief Valves (reference Task 23.2).

2.0 Knowledge Component

This task is performed in order to diagnose, clean, lubricate, and repair or replace the worn or damaged parts.

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

— Types of relief valves may include but are not limited to the following:
  — spring loaded,
  — snap-acting pilot,
  — modulating pilot,
  — nitrogen loaded.
— Manufacturer's specifications for device set point.
— Manufacturer-specified reseating adjustments (spring-loaded valves).
— Manufacturer-specified lift setting adjustments (pilot-operated valves).

Terms applicable to this task are as follows.

actuator
A mechanism or device to automatically or remotely control a valve from outside the body.

adjusting screw
A screw used to manipulate the opening and/or closing pressure of the disc or piston.

body
The outer casing around most or all of the valve that contains the internal parts or trim.

bonnet
A cover attached to the valve body that is commonly screwed or bolted to the valve body to hold the internal parts in place.

disc
A movable obstruction or piston inside the valve body that restricts flow through a port(s).

gaskets
The mechanical, resilient seals used to prevent the leakage of fluids or gases between two or more parts.

O-rings
A mechanical gasket with a round cross-section designed to be seated in a groove and compressed during assembly of two or more parts to create a seal.

ports
Passages that allow fluid to pass through the valve.

seat
The interior surface of the valve body against which a disc or piston contacts to form a leak-tight seal.

spindle
Valve part that transmits motion from the spring or actuator.

spring
Coiled steel valve part usually used to keep a disc shut against the seat.

trim
The internal parts of a valve, including the stem or spindle, seating surfaces, guides, and other elements.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown, etc.) that results in a loss of control or overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify the control center or local operations.
Improper position of a device isolation valve found when attempting to isolate.	Make the appropriate operator notifications and verify the proper valve position.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device identifier.	This step confirms that the correct component is identified.
2	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
3	Notify the control center, local operations (if applicable), and any affected personnel, prior to performing any maintenance per the operator's procedures.	This step confirms that the inspection has been scheduled and communicated and that the operational status has been confirmed.
4	Isolate the relief valve from the process system.	This step provides the ability to relieve trapped process pressure.
5	Relieve trapped process pressure.	This step allows the valve to be disassembled.
6	Disassemble the relief valve following applicable manufacturer's procedures.	
7	Diagnose, clean, lubricate, and repair or replace the worn or damaged parts.	Follow the manufacturer's instructions and specifications for the applicable relief valve in order to properly inspect, diagnose, and repair the valve.
8	Assemble the relief valve per manufacturer's procedures.	Assemble following the manufacturer's instructions and specifications for the applicable relief valve.
9	Document repairs as required by operator's procedures.	
10	Notify control center and/or local operations (if applicable) and any affected personnel that maintenance and repairs are complete.	Inspection, testing, and calibrating the relief valve must be completed prior to returning the relief valve to service.

Task 23.2—Inspect, Test, and Calibrate Relief Valves

1.0 Task Description

This task involves the inspection, testing, and calibration activities performed on a pressure-relief valve in order to verify that a device is functioning properly, is in good mechanical condition, and is adequate for the application.

This task begins with verification of the device number and identifier and ends with notification to appropriate personnel that the maintenance and repairs are complete.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Maintain/Repair Relief Valves (reference Task 23.1).

2.0 Knowledge Component

This task is performed to ensure that the valve will function properly if the pressure in the pipeline reaches the specified set pressure.

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

— Types of tank pressure-relief valves and the corresponding principles of operation, including:
  — spring loaded,
  — snap-acting pilot,
  — modulating pilot.
— Calibration equipment and tools used include:
  — analog pressure gauges,
  — digital pressure gauges.
— Device set point, including the ability to understand manufacturer’s specifications and operator’s design criteria:
  — manufacturer-specified reseating adjustments (spring-loaded valves),
  — manufacturer-specified lift setting adjustments (pilot-operated valves).
— Operator procedures for inspection, testing, and calibration of pressure-relieving devices and pressure-relief valves.
— Operator procedures for device set point:
  — manufacturer-specified reseating adjustments (spring-loaded valves),
  — manufacturer-specified lift setting adjustments (pilot-operated valves).

Terms applicable to this task are as follows.

backpressure
The pressure that exists at the outlet of a pressure-relief device because of the pressure in the discharge system. Backpressure is the sum of the superimposed and built-up backpressures.

blowdown
The difference between the set pressure and the closing pressure of a pressure-relief valve, expressed as a percentage of the set pressure or in pressure units.

closing pressure
The value of decreasing inlet static pressure at which the valve disc reestablishes contact with the seat or at which lift becomes zero, as determined by seeing, feeling, or hearing.

opening pressure
The value of increasing inlet static pressure whereby there is a measurable lift of the disk or at which discharge of the fluid or vapor becomes continuous, as determined by seeing, feeling, or hearing.

set pressure
The inlet gauge pressure at which a pressure-relief valve is set to open under service conditions.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown, etc.) that results in a loss of control or overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify controller or local operations monitoring the facility.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device identifier.	This step confirms that the correct component is identified.
2	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
3	Verify that test equipment has been calibrated prior to performing any calibrations.	This includes equipment such as pressure gauges that are used during the inspection, testing, and calibration of a pressure-relief valve. Test equipment must have a valid certification of calibration and be appropriate for the intended calibration range.
4	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test per operator's procedures.	The control center and local operations (if applicable) must be notified that work is to be performed on the relief valve.

Step	Action	Explanation
5	Visually inspect the device and its associated equipment to determine: — appropriateness for intended service, — physical/mechanical condition, — presence of corrosion, — presence of erosion, — presence of leakage, — inlet and outlet (if applicable) flange connections, — integrity of the device and its associated piping support, — correct position and function of isolation valve.	Confirms the condition and functionality of the device.
6	Isolate the device from the process system.	This will allow the correct test pressure and medium to be applied during calibration and prevent a loss of containment. If the isolation valve is not in the correct position, make the appropriate operator notifications.
7	Connect test equipment and inspect all connections for leakage.	Loss of test pressure will result in inaccurate test results or calibration of the device.
8	Apply test medium pressure and determine the device set point or range and opening pressure "as found."	Using the "as found" value of a device set point and opening pressure prior to calibration helps determine the proper functionality and repeatability. This may need to be repeated multiple times per operator's procedures. If the device is found to have an improper set point or opening pressure, it may have a problem maintaining its calibration within acceptable limits and tolerance, or a set point may have incorrectly been applied by a previous calibration.
9	Document "as found" results per operator's procedure.	This documentation provides historical data that may indicate if the device fails to maintain calibration and may need to be replaced.
10	If device calibration is required, reapply the test medium (Step 8) to the desired set point or range and adjust it according to the device manufacturer's specifications. Repeat the test procedure to achieve calibration.	Establish repeatability to the desired set point and opening pressure.
11	Document the final set point value "as left" results per operator's procedure.	Documentation of the final calibration will provide an opportunity for a review to ensure that the correct set point(s) were established, and it will provide historical data for future testing of the device.
12	Remove test equipment, return the device to normal operating condition, and verify the integrity of the system per operator's procedures.	
13	Apply a security seal to device, if required by operator's procedure.	Security seal can include inspection information and results. Utilize company procedures.
14	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication notifies the appropriate personnel that the device is ready for normal operation.

Task 24.1—Maintain/Repair Pressure-limiting Devices

1.0 Task Description

This task is performed to diagnose, clean, lubricate, and repair or replace worn or damaged of pressure-limiting devices. Performance of this task can include the disassembly and reassembly of the device according to the applicable procedures and is conducted to maintain or repair the device's integrity and to verify that its performance meets all necessary functions.

This task begins with verification of the device number/identifier and ends with the notification to the appropriate personnel that the device is operable and that the system has returned to normal operation.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Inspect, Test, and Calibrate Pressure-limiting Devices (reference Task 24.2).

2.0 Knowledge Component

This task is performed to ensure that the valve will function properly if the pressure in the pipeline reaches a specified control pressure.

Local operator procedures including any alternate means of overpressure protection should be considered prior to maintenance or repair activities. Performance of this task may require disabling certain output signals to related equipment during maintenance or repair.

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

— How to disassemble and/or reassemble a valve and related devices for internal inspection, cleaning, and to replace components for repair, maintenance, and adjustments.

— Types of sliding-stem-style pressure-limiting devices and principles of operation, including the following:

  — globe control valve and its associated components,

  — cage control valve and its associated components.

— Types of rotary-style pressure-limiting devices and principles of operation, including the following:

  — butterfly-style control valve its and associated components,

  — ball valves,

  — V-notch valves.

— Associated equipment of pressure-limiting devices and principles of operation, including the following:

  — controllers,

  — positioners,

  — solenoid valves,

  - limit switches,
  - regulators,
  - transducers.
- Operation and safe handling of test media, such as:
  - pressure regulators,
  - nitrogen sources,
  - process connections.
- Calibration equipment and tools, including the following:
  - analog pressure gauges,
  - digital pressure gauges,
  - calipers,
  - micrometers,
  - VOM multimeters,
  - manufacturer-specific multifunction calibrators,
  - torque wrench,
  - lifting equipment suitable for the weight of the valve and/or valve controller, if repair requires removal from the facility.
- Operation and safe handling of electrical systems, such as:
  - voltages applied to the device,
  - electrical requirements,
  - connections of test equipment to the device.

Terms applicable to this task are as follows.

actuator
A mechanism or device to automatically or remotely control a valve from outside the body.

adjusting screw
A screw used to manipulate the opening and/or closing pressure of the disc or piston.

body
The outer casing around most or all of the valve that contains the internal parts or trim.

bonnet
A cover attached to the valve body that is commonly screwed or bolted to the valve body to hold the internal parts in place.

cage
A perforated or slotted valve part that allows restricted flow through a port(s).

disc
A movable obstruction or piston inside the valve body that restricts flow through a port(s).

gaskets
The mechanical, resilient seals used to prevent the leakage of fluids or gases between two or more parts.

O-rings
A mechanical gasket with a round cross-section designed to be seated in a groove and compressed during assembly of two or more parts to create a seal.

plug
A movable piston inside the valve body that restricts flow through a port(s) or cage.

ports
Passages that allow fluid to pass through the valve.

seat
The interior surface of the valve body against which a disc or piston contacts to form a leak-tight seal.

spring
Coiled steel valve part usually used to keep a disc shut against the seat.

stem
Valve part and/or actuator part that transmits motion from the spring or actuator to the plug.

trim
The internal parts of a valve, including the cage, stem or spindle, seating surfaces, guides, and other elements.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
The unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown) that results in a loss of control or an overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify the control center or local operations.
The improper position of a device isolation valve.	Make the appropriate operator notifications and verify the proper valve position.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the control valve number and location.	This step confirms that the correct component is identified.
2	Verify the control valve and associated components type and manufacturer identifier.	This step confirms the appropriate inspection/repair procedures to be followed.
3	Notify the control room, local operations (if applicable), and any affected personnel prior to performing any test per the operator's procedures.	The control room and local operations (if applicable) must be notified that work is to be performed on a control valve.
4	Isolate the control valve from the process system.	This step allows the ability to relieve trapped process pressure.
5	Disassemble the control valve following the applicable manufacturer's procedures.	
6	Diagnose, clean, lubricate, and repair or replace the worn or damaged parts.	Follow the manufacturer's instructions and specifications for the applicable control valve in order to properly inspect, diagnose, and repair the valve.
7	Assemble the control valve per the manufacturer's procedures.	
8	Inspect, test, and calibrate the control valve and associated components.	Inspection, testing, and calibrating the control valve must be completed prior to returning the control valve to service. NOTE Inspect, Test, and Calibrate Pressure-limiting Devices (reference Task 24.2) is a separate covered task.
9	Return the control valve to normal operating condition and verify the integrity of the system per the manufacturer's specifications and the operator's procedures.	This step verifies that the control valve operates properly and is maintaining its integrity.
10	Document repairs as required by operator's procedures.	
11	Notify the control room, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notice that the control valve is operable and that the system is ready or has returned to normal operation.

Task 24.2—Inspect, Test, and Calibrate Pressure-limiting Devices

1.0 Task Description

This task involves the inspection, testing, and calibration activities performed on a pressure-limiting devices to verify that it is functioning properly, is in good operating condition, and is performing adequately for its intended purpose.

This task begins with verification of the device number/identifier and ends with notification that the pressure-limiting device is ready to be returned to a normal operating condition.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Maintain/Repair Pressure-limiting Devices (reference Task 24.1).

2.0 Knowledge Component

Pressure-limiting devices installed on pipelines protect the pipeline from exceeding specified pressure limits by controlling the pressure in adjacent sections of the pipeline. This task is performed in order to ensure that the valve will function properly if the pressure in the pipeline reaches the specified control pressure.

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

— Methods of inspecting, testing, and calibrating pressure-limiting devices.

— Types of sliding-stem-style pressure-limiting devices and the principles of operation, including the following:

  — globe control valve and its associated components,

  — cage control valve and its associated components.

— Types of rotary-style pressure-limiting devices and the principles of operation, including:

  — butterfly-style control valve its and associated components,

  — ball valves,

  — V-notch valves.

— Associated equipment of pressure-limiting devices and their principles of operation, including:

  — controllers,

  — positioners,

  — solenoid valves,

  — limit switches,

  - regulators,
  - transducers.
- Calibration equipment and tools, including:
  - analog pressure gauges,
  - digital pressure gauges,
  - calipers,
  - micrometers,
  - VOM multimeters,
  - manufacturer-specific multifunction calibrators.
- Operation and safe handling of test media, including:
  - pressure regulators,
  - nitrogen sources,
  - process connections.
- Operation and safe handling of electrical systems, such as:
  - voltages applied to the device,
  - electrical requirements,
  - connections of test equipment to the device.

Terms applicable to this task are as follows.

actuator
A mechanism or device to automatically or remotely control a valve from outside the body.

calibration
The process of testing and adjusting, if needed, a device to ensure that it can be relied on to deliver predictable, accurate results that meet quality/tolerance standards.

set pressure
The inlet or outlet gauge pressure at which a pressure-limiting device is set to move open or move closed under service conditions.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.
Leaking from the pressure-limiting device or leaking past the seating surfaces of the valve.	Make appropriate operator notifications to repair or replace.
The unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown) that results in a loss of control or an overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify the control center or local operations.
The improper position of a device isolation valve.	Make the appropriate operator notifications and verify the proper valve position.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device number and location.	This step confirms that the correct component is identified.
2	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
3	Verify that test equipment has been calibrated prior to performing any calibrations.	This includes equipment such as pressure gauges that are used during the inspection, testing, and calibration of a pressure-relief valve. Test equipment must have a valid certification of calibration and be appropriate for the intended calibration range.
4	Notify control center and/or local operations (if applicable), and any affected personnel, prior to performing any test per operator's procedures.	The control center and local operations (if applicable) must be notified that work is to be performed on a device.
5	Visually inspect the device and its associated equipment to determine: — appropriateness for intended service, — physical/mechanical condition, — presence of corrosion, — presence of erosion, — presence of leakage, — inlet and outlet (if applicable) flange connections, — integrity of the device and its associated equipment.	This inspection confirms the condition and functionality of the device. If maintenance, repair, or replacement is required, make the appropriate notifications or repairs per the operator's and manufacturer's procedures.
6	For static (out-of-service) testing and calibration, isolate the pressure-limiting device from the process system.	Isolation of the device and associated equipment from the process system provides for the correct test pressure and medium to be applied during calibration. If the isolation valve is not in the correct position, make the appropriate operator notifications.

Step	Action	Explanation
7	For dynamic (in-service) testing and calibration, use the operator's procedures and notification protocols.	Dynamic testing yields the most accurate results and must be performed in coordination with operations to establish operational testing limits and to avoid operational upsets. If the isolation valve is not in the correct position, make the appropriate operator notifications.
8	Connect the test equipment and inspect all connections for leakage.	The loss of test pressure results in inaccurate test results or calibration of the device.
9	Apply the test medium pressure and determine the device upper and lower operating limits and range.	If the device is improperly adjusted, it may have a problem maintaining its calibration within acceptable limits and tolerance. This step verifies the current settings for the device and its associated components and determines if a calibration and adjustment are required.
10	If calibration or adjustment of the device and/or its associated components is required, reapply the test medium (Step 9) to the required values and range. Adjust the device and its associated components per the manufacturer's and the operator's specifications. Repeat the test procedure to achieve calibration and establish repeatability to the desired upper and lower operating limits and range.	
11	Document the inspection and calibration results per the operator's procedures.	
12	Remove the test equipment, return the device and its associated equipment to normal operating condition, and verify the integrity of the system per the operator's procedures.	
13	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notice that the device is operable and that the system is ready or has returned to normal operation.

Task 25.1—Inspect, Test, and Calibrate Pressure Switches

1.0 Task Description

This task consists of the inspection, testing, and calibration activities performed on a pressure switch to verify that the equipment and associated output signals are functioning properly.

This task begins with identifying and verifying the pressure switch to be inspected, tested, and/or calibrated, and ends with notification that the pressure switch is ready to be returned to a normal operating condition.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

The primary purpose of this task is to ensure that the pressure switch operates correctly to detect a possible overpressure of the pipeline system.

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

— Types of test equipment, including:
  — multimeters,
  — multifunction calibrators,
  — analog or digital pressure gauges,
  — digital pressure modules,
  — equipment process connections,
  — pressure regulators,
  — hand pumps.
— Types of test media and equipment, including:
  — air,
  — nitrogen,
  — glycol.
— The principles of operation of pressure switches.

Terms applicable to this task are as follows.

alarm
A visible and/or audible means of indicating to the controller an equipment malfunction, an analog or accumulation process deviation, or other condition requiring a controller’s response.

calibration
The process of testing and adjusting, if needed, a device to ensure that it can be relied on to deliver predictable, accurate results that meet quality/tolerance standards.

pressure switch deadband
The difference between the set point pressure (e.g. set to detect increasing pressure) and the pressure value (e.g. decreasing when system pressure subsides) required to reset a pressure switch after it has been actuated.

pressure switch range
Adjustable span of pressure switch.

pressure switch set point
Trip threshold at which switch activates.

shutdown device
A device that must operate to provide protection for a pipeline.

EXAMPLE A pressure switch activates and through the control sequence prevents the pipeline from exceeding pressure limits.

test equipment calibration
Able to determine that the test equipment is within its calibration period and accuracy.

test equipment operation
Operation and proper use of test equipment to be used to perform the functions required in this task [i.e. multimeters, multifunction calibrators, gauges (analog, digital, and digital pressure modules)].

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown, etc.) that results in a loss of control or overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify control center or local operations.
The improper position of a device isolation valve.	Make the appropriate operator notifications and verify the proper valve position.
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device identifier.	This step confirms that the correct component is identified.
2	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
3	Verify that test equipment has been calibrated prior to performing calibrations.	Test equipment (i.e. multimeters, multifunction calibrators, analog or digital pressure gauges, and digital pressure modules) that is used to calibrate pressure switches that are providing overpressure protection must have valid certification of calibration and be appropriate for the intended calibration range.
4	Verify device set point for switches prior to performing calibration.	Set points of pressure switches that provide overpressure or other protection to a process system are established by design criteria through engineering. Consult company documentation to determine proper set point value. Designated set points must be strictly adhered to.

Step	Action	Explanation
5	Determine correct test medium to be used for testing.	The use of an incorrect test medium can result in inaccurate calibration of a device and cause possible damage to the device. Consult company documentation to determine proper test medium.
6	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test per company procedures.	The control center and local operations (if applicable) must be notified that the pressure switch will be tested and that an alarm tag may be activated. The control center may be required to validate: — receipt/initiation of the alarm, — proper pressure switch device number to alarm tag. Notification is crucial to avoid a “false alarm” that could affect the operation of the pipeline.
7	Visually inspect pressure switch (per company procedure) and its associated equipment.	To look for: — physical/mechanical condition, — corrosion, — leakage, — electrical connections (if applicable).
8	Isolate the pressure switch from the process system per company procedure.	This will allow correct test pressure and medium to be applied during calibration and to also prevent loss of containment.
9	Connect test equipment and inspect all connections for leakage.	Loss of test pressure will result in inaccurate test results or calibration of the device.
10	Apply test medium pressure and determine device set point(s), deadband, and/or differential range “as found.”	The “as found” value of a device set point and other values prior to calibration helps determine the proper functionality and repeatability. This may need to be repeated multiple times per company procedure. If the device is found to have an improper set point, the device may have a problem maintaining its calibration within acceptable limits or a set point was incorrectly applied by a previous calibration. This step provides a historical record, verifies current device setting, and determines if a calibration is required.
11	Document “as found” results.	Document “as found” results per company procedure. This documentation provides historical data that may indicate the device fails to maintain calibration and may need to be replaced.
12	If device calibration is required, reapply test medium to desired set point or range and adjust according to device manufacturer’s specifications. Repeat test procedure to achieve calibration and establish repeatability to desired set point.	Calibration according to device manufacturer’s instructions will assure proper calibration is achieved.
13	Document final set point(s), deadband, and/or differential range values “as left” results.	Document “as left” results per company procedure.
14	Remove test equipment, return device to normal operating condition, and verify integrity of system as per company procedure.	
15	Notify control center, local operations (if applicable), and any affected personnel, per the operator’s procedures.	To notify appropriate personnel that the device is ready for normal operation.

Task 25.2—Inspect, Test, and Calibrate Pressure Transmitters

1.0 Task Description

This task involves the inspection, testing, and calibration activities performed on a pressure transmitter in order to verify that the equipment and associated output signals are functioning properly.

This task begins with identifying and verifying the pressure transmitter to be inspected, tested, and/or calibrated and ends with notification that the pressure transmitter is ready to be returned to a normal operating condition.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

2.0 Knowledge Component

The primary purpose of this task is to ensure that the pressure transmitter operates correctly to relay the detection of a possible overpressure of the pipeline system.

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

— Types of test equipment may include but are not limited to the following:
  — multimeters,
  — multifunction calibrators,
  — analog or digital pressure gauges,
  — digital pressure modules,
  — equipment process connections,
  — pressure regulators,
  — hand pumps.
— Types of test media and equipment may include but are not limited to the following:
  — air,
  — nitrogen,
  — glycol.
— The principles of operation of pressure transmitters/transducers.

Terms applicable to this task are as follows.

alarm
A visible and/or audible means of indicating to the controller an equipment malfunction, an analog or accumulation process deviation, or other condition requiring a controller’s response.

calibration
The process of testing and adjusting, if needed, a device to ensure that it can be relied on to deliver predictable, accurate results that meet quality/tolerance standards.

pressure transmitter range
Device output signal that can be adjusted by the operator to a different span of pressure.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unintentional activation of a safety/control device (e.g. abnormal shutdown, unintentional valve movement, high-pressure shutdown, etc.) that results in a loss of control or overpressure condition of the pipeline.	Take appropriate action to mitigate the situation and to return the pipeline to normal condition. Notify controller or local operations monitoring the facility.
The improper position of a device isolation valve.	Make the appropriate operator notifications and verify the proper valve position.
Unexpected release or discharge of product related to task performance.	Notify the appropriate personnel to take actions as required.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device identifier.	This step confirms that the correct component is identified.
2	Verify the device type and manufacturer.	This step confirms the appropriate inspection/repair procedures to be followed.
3	Verify that test equipment has been calibrated prior to performing calibrations.	Test equipment (i.e. multimeters, multifunction calibrators, analog or digital pressure gauges, and digital pressure modules) that is used to calibrate pressure transmitters that are providing overpressure protection must have valid certification of calibration and be appropriate for the intended calibration range.
4	Verify the required device input and output range values for the transmitter prior to performing testing or calibration.	The input and output range values of a pressure transmitter are established by design criteria through engineering analysis. Consult operator documentation to determine proper device range.
5	Determine correct test medium to be used for testing.	The use of an incorrect test medium can result in inaccurate calibration of a device and possibly cause damage to the device. Consult operator documentation to determine proper test medium.

Step	Action	Explanation
6	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any test per company procedures.	The control center and local operations (if applicable) must be notified that the pressure transmitter will be tested. The control center may be required to validate: — receipt/initiation of an alarm, — Supervisory Control and Data Acquisition (SCADA)/human machine interface (HMI) display values, — transmitter device number corresponds to SCADA/HMI display ID. Notification is crucial to avoid a “false alarm” that could affect the operation of the pipeline.
7	Visually inspect pressure transmitter per company procedure and its associated equipment.	To look for: — physical/mechanical condition, — corrosion, — leakage, — electrical connections (if applicable).
8	Isolate the pressure transmitter from the process system per company procedure.	This will allow correct test pressure and medium to be applied during calibration and to also prevent loss of containment.
9	Connect test equipment and inspect all connections for leakage.	Leakage of test pressure will result in inaccurate test results or calibration of the device.
10	Apply test medium pressure through the desired test range. Determine the output values “as found.”	This test determines proper functionality and repeatability and shall be repeated multiple times per company procedure. Determines if a calibration is required.
11	Document “as found” results.	Document “as found” results per company procedure. This documentation provides historical data that may indicate the device fails to maintain calibration and may need to be replaced.
12	If device calibration is required, reapply test medium pressure through the desired test range and adjust device settings using manufacturer’s procedures. Repeat test procedure to verify proper calibration and establish repeatability.	The device range output values shall be set to the company required values.
13	Document “as left” results.	Document “as left” results per company procedure.
14	Remove test equipment, return device to normal operating condition, and verify integrity of system as per company procedure.	
15	Notify control center, local operations (if applicable), and any affected personnel, per the operator’s procedures.	To notify appropriate personnel that the device is ready for normal operation.

Task 27.1—Perform 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-adopted edition of API 653. Individuals performing routine inspections do not need to be an authorized inspector as defined in API 653 or API 510.

This task begins with the visual inspection of the tank. The task ends when the documentation is complete.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Perform API 653 Inspection of In-service Breakout Tanks (reference Task 27.2).

— Perform API 510 Inspection of In-service Breakout Tanks (reference Task 27.3).

2.0 Knowledge Component

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.

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

— The three primary types of atmospheric steel aboveground breakout tanks.

1) External/Open Top 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 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.

Terms applicable to this task are as follows.

bottom projection plate (chime ring)
The outside edge of the tank bottom that extends past the weld of the tank shell.

reinforcing plate/pad/repad
Steel reinforcement plates installed around appurtenances to provide added strength to the structure.

roof
The top external surface of the tank.

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.

shell
The vertical, cylindrical walls of a tank.

shell appurtenances
Manways, reinforcement plates, nozzles, sampling ports, temperature probes, mixers, and auto-gauge systems.

tank foundation/ring wall
Provides support for the tank. The foundation/ring wall may be made from concrete, earth, or other supportive materials.

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

3.0 Skill Component

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

Step	Action	Explanation
1	Visually inspect for settlement around the perimeter of the tank and the condition of the foundation: — check that rainwater runoff from the shell drains away from tank, — inspect for broken concrete and cracks, — inspect for cavities under the foundation and vegetation against the bottom of the tank, — sheen on water in containment area.	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.
2	Visually inspect the following items for evidence of leaks, corrosion, pitting, and distortion, as applicable: — mixer seals, — flanges, — manways/nozzles, — bottom projection plate, — welds/rivets, — telltales/weep holes on reinforcing pads, — reinforcement plate/padding around appurtenances, — inspect for shell distortions—look for deflection or deformation of the shell, — insulation condition.	Visual inspection of the shell is performed to identify coating condition, areas of pitting, or corrosion and distortions. Leaks indicate an integrity issue, and immediate response according to operator's policies is required. Response actions may include stopping operation and securing equipment, if safe to do so, immediately notifying the operator, and executing applicable emergency procedures.
3	— 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. Dikes compromised by erosion, excavations, or excessive vegetation need to be addressed per operator's procedures.
4	Visually inspect the tank roof for the following, if applicable: — coating condition, holes, pitting, and corrosion; — standing or pooling water or product; — floating roof out of level; — roof supports.	Large standing water areas on a floating roof indicate inadequate drainage design. Nonlevel roof indicates 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.
5	Document the findings of the inspection.	Submit a completed inspection form according to operator's procedures.

Task 27.2—Perform API 653 Inspection of In-service Breakout Tanks

1.0 Task Description

This task involves performing a detailed 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* only, as defined by API 653.

This task begins with the inspection of the tank. The task ends when the documentation is complete.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Perform Routine Inspection of Breakout Tanks (API 653 Monthly or DOT Annual) (reference Task 27.1).

2.0 Knowledge Component

The purpose of this task is to complete a comprehensive inspection of an in-service breakout tank by an authorized inspector. An individual performing this task must provide documentation of the API Authorized Inspector Certification for API 653 (atmospheric and low-pressure steel aboveground tanks).

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

— The requirements detailed in the DOT-approved edition of API 653.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

3.0 Skill Component

The certificate demonstrates task performance proficiency.

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.
2	Document the findings of the inspection.	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.

Task 27.3—Perform API 510 Inspection of In-service Breakout Tanks

1.0 Task Description

This task involves performing a detailed 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* only, as defined by API 510.

This task begins with the inspection of the tank. The task ends when the documentation is complete.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Perform routine Inspection of Breakout Tanks (API 653 Monthly or DOT Annual) (reference Task 27.1).

2.0 Knowledge Component

The purpose of this task is to complete a comprehensive inspection of an in-service breakout tank by an authorized inspector. An individual performing this task must provide documentation of the API Authorized Inspector Certification for API 510 (LPG installations built to API 2510).

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

— The requirements detailed in the DOT-approved edition of API 510.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

3.0 Skill Component

The certificate demonstrates task performance proficiency.

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.
2	Document the findings of the inspection.	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.

Task 30—Test Overfill Protective Devices

1.0 Task Description

This task consists of the testing activities performed on an overfill protective device (OPD) installed on a tank or sump to ensure that the equipment and associated control center alarms are functioning properly and are adequate for the intended purpose.

This task begins with notification to the control center, local operations (if applicable), and/or affected personnel that OPD testing activities are to commence. The task ends with the completion of the appropriate documentation per operator's procedure.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Inspect and Calibrate Overfill Protective Devices (reference Task 31).

2.0 Knowledge Component

The primary purpose of this task is to verify that an OPD operates correctly in order to prevent or detect a possible overfill of a pipeline breakout tank. The OPD's purpose is to signal the controller or other individual monitoring the tank filling operation prior to the loss of containment of hazardous liquids due to the overfilling of a breakout storage tank or other containment vessel. The OPD typically initiates a high-priority level alarm to the control center. After receipt of the alarm, the control center takes appropriate and immediate actions to prevent an actual overfill beyond operational limits.

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

— The various types of overfill protection devices, systems, and associated equipment and their principles of operation.

— Methods of testing OPDs.

— Tank/vessel construction types:

  — fixed roof,

  — internal floating,

  — external floating,

  — underground.

— Tank/vessel fill/drain operations.

— Alarms:

  — location,

  — activation,

  — shutdown sequence of activated alarms.

Terms applicable to this task are as follows.

alarm
A visible and/or audible means of indicating to the controller an equipment malfunction, an analog or accumulation process deviation, or other condition requiring a controller's response.

set point
Liquid level at which switch and/or signal activates an alarm, notification, and/or automated action.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Liquid level is found to be at an unexpected high or low level.	Notify control center or appropriate personnel of level status.
Corrosion pitting or residue that interferes with the operation of the device or associated equipment.	Notify/inform appropriate personnel of the condition of the OPD.
Damage or deformation of housing, fitting, or support structure related to OPD.	Notify/inform appropriate personnel of the condition of the OPD.

3.0 Skill Component

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

Step	Action	Explanation
1	Notify control center or local operations (if applicable), and affected personnel, prior to performing this test per operator's procedures.	The control center and local operations (if applicable) must be notified that the OPD will be tested and that an alarm tag will be activated. The control center and/or local operations will be required to validate: — receipt/initiation of the alarm, — proper OPD device number to alarm tag. If the OPD is part of an automated shutdown or flow relief system, the control center, or local operations, may be required to set the alarm to a "Test Mode" status per operator procedure. An OPD alarm could initiate response activities. Notification is crucial to avoid a "false alarm" that could affect the operation of the pipeline.
2	Verify the device identifier.	Ensure that the proper device is located. If the identifier is missing, replace per operator's specifications.
3	Review the operation of the overfill protection control scheme (if applicable).	Identify any devices, such as valves, that may operate as part of a designed shutdown or relief flow system.
4	Manually activate the OPD.	This step confirms the operability of the OPD.
5	Verify the alarm has been received by the control center and/or local operations.	This step confirms the correct alarm tag is received.
6	Verify the operation of any devices such as valves that might operate as part of a shutdown or relief flow system per operator procedure (if applicable).	This step confirms the operation of the overfill protection control scheme. If the OPD is part of an automated shutdown or flow relief system, notify the control center and/or local operations of any unexpected changes in operation. (i.e. valve movements, pump run status, etc.).
7	Reset and confirm that OPD has returned to a normal operating condition.	This step verifies that any alarms have cleared appropriately.
8	Verify all devices such as valves that might have operated as part of a shutdown or relief flow system have returned to normal operating condition (if applicable).	This step verifies the system has returned to normal operation.
9	Notify control center, local operations, and any affected personnel the test has ended.	
10	Document test results as required by operator's procedures.	Documentation of OPD test.

Task 31—Inspect and Calibrate Overfill Protective Devices

1.0 Task Description

This task consists of the inspection and calibration activities performed on an OPD installed on a tank or sump to ensure that the equipment is functioning properly and is adequate for the intended purpose.

This task begins with notification to the control center, local operations (if applicable), and/or affected personnel that OPD inspection and calibration activities are to commence. This task ends with the completion of the appropriate documentation per operator's procedure.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Test Overfill Protective Devices (reference Task 30).

2.0 Knowledge Component

The primary purpose of this task is to verify that an OPD is maintained and operates correctly and at the desired level in order to prevent the loss of containment of hazardous liquids due to the overfilling of a breakout storage tank or other containment vessel. The OPD initiates a high-priority level alarm to the control center. After receipt of the alarm, the control center takes appropriate and immediate actions to prevent an actual overfill beyond operational limits.

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

— The various types of overfill protection devices, systems, and associated equipment and their principles of operation.

— Methods of inspection and calibration of OPDs.

— Calibration equipment and tools:

  — multimeter,

  — measurement equipment,

  — displacement test mediums.

— Tank/vessel construction types:

  — fixed roof,

  — internal floating,

  — external floating,

  — underground.

— Alarms:

  — location,

  — activation,

  — shutdown sequence of activated alarms.

— Device set point:

  — threshold at which switch activates.

Terms applicable to this task are as follows.

calibration
The process of testing and adjusting, if needed, a device to ensure that it can be relied on to deliver predictable, accurate results that meet quality/tolerance standards.

set point
Liquid level at which switch and/or signal activates an alarm, notification, and/or automated action.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Liquid level is found to be at an unexpected high or low level.	Notify control center or appropriate personnel of level status.
Unintentional activation or shutdown of system devices.	Take appropriate action such as disabling OPD output signals to mitigate the situation. Notify control center or appropriate personnel that are monitoring the facility.
Observed structural damage to tank, tank roof, and/or other components.	Notify/inform appropriate company personnel of the condition.
Debris or freestanding product on roof.	Notify/inform appropriate company personnel of the condition.

3.0 Skill Component

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

Step	Action	Explanation
1	Notify control center, local operations (if applicable), and any affected personnel, prior to performing any inspection or calibration activity, per operator's procedures.	The control center and local operations (if applicable) must be notified that inspection or calibration activities will be performed on the OPD and to communicate the device status.
2	Obtain OPD set point value.	Refer to operator's documentation to determine proper set point value.
3	Determine required calibration equipment.	Consult device manufacturer manual and company procedures to determine type of calibration equipment needed.
4	Verify the device identifier.	Ensure that the proper device is located. If the identifier is missing, replace per operator's specifications.
5	Inspect internal and external components of the OPD and associated equipment per manufacturer recommendations and operator-specific procedures: — physical/mechanical condition, — corrosion, — electrical connections.	Confirms condition and functionality. If maintenance, repair, or replacement is required, make appropriate notifications per operator's procedure.
6	Verify device set point.	The set point is the point that an alarm will be activated based on the liquid level in the tank.
7	Adjust device, if required, according to manufacturer's recommendations. Repeat procedure to achieve calibration and establish repeatability.	Refer to operator's documentation to determine proper set point value and calibration procedures.
8	Test OPD to verify the alarm is received by the control center and/or local operations.	Confirms operability of OPD and that the correct alarm tag is received. NOTE This is a separate OQ task. Refer to Task 30—Test Overfill Protective Devices.
9	Reset and confirm that OPD has returned to a normal operating condition.	Verify the alarms have been cleared appropriately.
10	Verify all devices such as valves that might have operated as part of a shutdown or relief flow system have returned to normal operating condition. (If applicable.)	This step verifies the system has returned to normal operation.
11	Notify control center, local operations, and any affected personnel that the inspection/calibration is complete and has ended.	
12	Document inspection and calibration results as required by operator's procedures.	Documentation of OPD test.

Task 32—Observe Excavation Activities

1.0 Task Description

This task is intended for the individual that is responsible for the observation of and taking action to prevent excavation activities from damaging buried pipeline facility. This task does not apply to horizontal/directional drilling but does apply to all vertical drilling (e.g. soil sampling) when pipelines are known to be in the area of the excavation activity.

This task begins with verifying that the pipeline(s) has been properly located and marked and ends with the completion of the required documentation after all intended earth removal has been accomplished.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Locate Line (reference Task 14.1).

— Install, Inspect, and Maintain Temporary Marker (reference Task 14.5).

2.0 Knowledge Component

This activity is performed to prevent damage to submerged or buried pipelines during excavation activities.

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

— Operator Damage Prevention Program, including the requirement for compliance with the One-Call system and the required on-site temporary markings of facilities within the area of excavation.

— Allowable positioning of equipment, materials, and/or supplies at the excavation site as not to produce unacceptable stress loads on buried structures or excavations.

— Operator procedures, specifications, or methodology for excavation criteria or process, which may include but is not limited to:

  — tolerance zones,

  — hand excavations requirements,

  — pothole requirements for facility identification,

  — soft excavation requirements (e.g. vacuum or water jet excavation).

— Damage and injury prevention requirements for an unattended excavation site.

— Types of equipment and/or tools that are appropriate for the excavation, which may include but is not limited to:

  — heavy excavation equipment,

  — jackhammer,

  — vacuum excavator,

  — shovels and hand tools.

Terms applicable to this task are as follows.

excavation
Any operation using nonmechanical or mechanized equipment, demolition, or explosives in the movement of earth, rock, or other material below existing grade.

tolerance zone
The space in which a line or facility is located and in which special care is to be given.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Pipeline is hit during the excavation.	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.
Unplanned or preexisting release of hazardous liquid or gas.	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.
Discovery of damage to an underground pipeline facility, including but not limited to: — coating, — casing, — conduits, — any communication or protection device.	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.
Discovery of an unexpected foreign structure in the area of excavation.	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.
Insufficient support for the pipeline during excavation.	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify that the pipeline has been located and marked.	
2	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.
3	Identify an appropriate location for excavated material (soil) to ensure that it is not placed in a location that could affect the integrity of the pipeline.	Provide adequate distance from the excavation to ensure the integrity of the excavation, prevent excessive stress on the pipeline, and prevent pipeline damage because of collapse.
4	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.
5	Determine and communicate to excavator the required tolerance zone and any site-specific operator requirements.	Adherence to tolerance zones reduces the probability that the pipeline will be hit. Site-specific operator requirements may include, but are not limited to, the use of a flat bar, spotter, and/or equipment preparation.
6	Ensure that the tolerance zone is maintained during excavation. Require hand digging or other noninvasive excavation methods of the remaining soil within the tolerance zone.	Use of hand tools, vacuum excavation, or other noninvasive methods minimizes the probability of 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: — date; — location (line segment, mile post, etc.); — name of excavator; — purpose of excavation; — scope of excavation (size, extent, etc.); — One-Call information, if required; — depth of cover.

Task 38.1—Perform Visual Inspection of Pipe and Pipe Components Prior to Installation

1.0 Task Description

This task involves the visual inspection of pipe and components at the site of, and just prior to installation on, the pipeline system. 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.

This task begins with visually inspecting pipe and components. This task ends with communicating the results.

2.0 Knowledge Component

The purpose of the inspection is to ensure that the pipe and components are not visibly 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.

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

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

- Each length of pipe with a nominal outside diameter of $4^1/_2$ 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:
  - manufacturer’s name or trademark;
  - class designation or the maximum working pressure to which the valve may be subjected;
  - body material designation (the end connection material, if more than one type is used);
  - nominal valve size;
  - monogram license.

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

Terms applicable to this task are as follows.

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.

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

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

crack
A surface flaw or defect characterized by a break without complete separation.

dent
A depression in the surface that has been created by external forces on the pipe or component with no visual evidence of metal loss.

gouge
A surface flaw characterized by the removal of steel from the pipe or component.

maximum operating pressure
MOP
The maximum pressure at which a pipeline or segment of a pipeline or a component may be normally operated.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

3.0 Skill Component

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

Step	Action	Explanation
1	Visually inspect pipe and components for: — corrosion; — defects such as cracks, grooves, gouges, dents, or out-of-round pipe; — coating damage; — buckles and/or wrinkles in bends.	This inspection occurs at the installation location just prior to installation. NOTE This inspection does not include an assessment of damage and a determination of the measures necessary to mitigate the damage.
2	Ensure component is rated for intended service.	Confirm that the markings on the pipe and components are compatible with the MOP for the system.
3	Communicate the inspection results.	A satisfactory outcome of the inspection must be achieved. If not, the condition must be noted and resolved.

Task 38.3—Perform Visual Inspection of Welds

1.0 Task Description

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

This task begins with identifying any conditions that do not meet the qualified welding procedure or the DOT-approved edition of API 1104. This task ends with communicating the results.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform NDT—Radiographic Testing (reference Task 38.4).

— Perform NDT—Liquid Penetrant Testing (reference Task 38.5).

— Perform NDT—Magnetic Particle Testing (reference Task 38.6).

— Perform NDT—Ultrasonic Testing (reference Task 38.7).

2.0 Knowledge Component

The purpose of the inspection is to ensure that the welds were produced with the correct welding procedure and to identify any defects that may affect the integrity of a pipeline tie-in or component replacement.

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

— The inspection of welds and identification of conditions as defined by the DOT-approved edition of API 1104 and the operator's applicable written welding procedure(s) are limited to conditions that can be identified visually and include the following terms.

Terms applicable to this task are as follows.

arc burns
Occur on the internal or external surface of the pipe as a result of inadvertent arc strikes or improper grounding. They generally appear as a pit or cavity visible to the eye. The cavity may be surrounded by a hard heat-affected zone that may be of lower toughness than the base material or the weld deposit.

crack
A surface flaw or defect characterized by a break without complete separation.

external undercut
EU
A groove melted into the parent material adjacent to the toe or root of the weld and left unfilled by weld metal.

individual or scattered porosity
Gas trapped by solidifying weld metal before the gas has a chance to rise to the surface of the molten puddle and escape. Porosity is generally spherical but may be elongated or irregular in shape, such as piping (wormhole) porosity.

qualified welding procedure
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.

slag inclusions
A nonmetallic solid entrapped in the weld metal or between the weld metal and the parent material. Elongated slag inclusions (ESIs)—e.g. continuous or broken slag lines or wagon tracks—are usually found at the fusion zone. Isolated slag inclusions (ISIs) are irregularly shaped and may be located anywhere in the weld.

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

3.0 Skill Component

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

Step	Action	Explanation
1	Identify any conditions that do not meet the qualified welding procedure or the DOT-approved edition of API 1104. Conditions may include the following: — arc burn, — cracks, — external undercut (EU), — pinhole/porosity, — slag, — weld (cap) height—inadequate or excessive.	— Arc burns and cracks are not acceptable and must be repaired. — Surface pinholes are an indication of porosity. — Slag and weld splatter can mask surface imperfections. — 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 a satisfactory outcome is not achieved, make appropriate notifications per the operator's procedures.

Task 38.4—Perform NDT—Radiographic Testing

1.0 Task Description

This task involves verifying that welds meet the specifications of the latest DOT-approved edition of API 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.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Visual Inspection of Welds (reference Task 38.3).

2.0 Knowledge Component

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

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

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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 ASNT Recommended Practice No. SNT-TC-1A, ACCP for radiography, or any other recognized national certification program that shall be acceptable to the operator for the test method used.

Task 38.5—Perform 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 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.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Visual Inspection of Welds (reference Task 38.3).

2.0 Knowledge Component

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

— An individual performing this task must provide documentation of certification through ASNT Recommended Practice No. SNT-TC-1A, ACCP certification for liquid penetrant testing, or any other recognized national certification program that shall be acceptable to the operators for the test method used.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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 ASNT Recommended Practice No. SNT-TC-1A, ACCP for liquid penetrant testing, or any other recognized national certification program that shall be acceptable to the operators for the test method used.

Task 38.6—Perform 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 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.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Visual Inspection of Welds (reference Task 38.3).

2.0 Knowledge Component

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

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

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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 ASNT Recommended Practice No. SNT-TC-1A, ACCP for magnetic particle testing, or any other recognized national certification program that shall be acceptable to the operator for the test method used.

Task 38.7—Perform NDT—Ultrasonic Testing

1.0 Task Description

This task involves verifying that welds meet the specifications of the latest DOT-approved edition of API 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.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Visual Inspection of Welds (reference Task 38.3).

2.0 Knowledge Component

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

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

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
This section intentionally left blank.	*This section intentionally left blank.*

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 ASNT Recommended Practice No. SNT-TC-1A, ACCP for ultrasonic testing, or any other recognized national certification program that shall be acceptable to the operator for the test method used.

Task 39—Perform Backfilling

1.0 Task Description

This task applies to the process and material to backfill or cover a buried pipeline that has been excavated or otherwise exposed. Backfilling shall be done in a manner that provides firm support to the pipe while preventing damage to the pipe and/or coating from equipment or the material that is used for backfilling.

This task begins with the visual inspection of the excavation and backfilling material and ends with the documentation after the pipe is sufficiently covered such that further backfilling would not cause damage to the pipe and/or coating. Continuous monitoring must be performed throughout the backfilling process.

2.0 Knowledge Component

The purpose of this task is to prevent damage from occurring to the pipe or its coating when backfilling an exposed pipeline.

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

- Pipe support procedures and methods.
- Items that would determine the excavation or backfill material as unacceptable would include but not be limited to:
  - items that could affect compaction such as roots, stones, cans, packing boxes, brush, broken skids, broken tools, refuse, etc.;
  - items that could affect CP 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.

Terms applicable to this task are as follows.

crowning
The act of applying backfill material over an excavation site to an elevation that is greater than the adjacent ground level for the purpose of compensating for future settling (natural occurring compaction) of the material used to backfill the excavation.

rock shield
Operator-approved material that is applied around a pipe prior to backfilling for the purpose of preventing backfill material from becoming embedded into or otherwise damaging the coating of the pipe during the backfilling process.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Response
Coating damage from coarse materials.	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.
Pipeline mechanical damage (e.g. dent, gouge, scrape, etc.).	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.
Pipeline stress resulting from pipe movement (e.g. pipe sag).	Stop task activities, move to a safe distance, and notify appropriate pipeline personnel.

3.0 Skill Component

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

Step	Action	Explanation
1	Inspect excavation 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 excavation.
2	Perform a visual inspection of backfill material. Identify and remove foreign objects that could cause damage to the pipeline system.	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. Noncoarse material must be used near the coating. If excavated material is not suitable to refill the excavation, 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 an excavation, continue to observe material.	Ensure there are no voids located near the pipeline.
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 appropriate equipment/methods.	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.	

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 confirming the preparation of the carrier pipe, and this task ends with confirmation that the sleeves are correctly installed and the proper welding gap has been established.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform NDT—Ultrasonic Testing (reference Task 38.7).

— Perform Welding (reference Task 42.7).

2.0 Knowledge Component

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

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

— 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. Type A sleeve installation parameters are dictated by the welding procedure used.

Terms 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Anomaly or other defect on carrier pipe outside the area of application.	Notify the operator or appropriate individual.

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 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 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. Type A sleeves are installed to reinforce the carrier pipe. 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. Wall thickness measurement is performed under 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 preheating 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. Improper use of the lifting device could result in damage to the carrier pipe.

Task 40.3—Apply Composite Sleeve

1.0 Task Description

Application of composite material repairs corrosion and mechanical damage defects for an in-service pipeline.

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

The application of composite material in the form of multiple layers of woven fiber wrap or rigid fiber sleeves is an acceptable alternative to steel split sleeves for 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.

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

— A 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.

Terms applicable to this task are 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Anomaly or other defect on carrier pipe outside the area of application.	Notify the operator of suspected defect.

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.

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 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 preparation of the carrier pipe pursuant to the device manufacturer's procedures, and the task ends when the bolts are tightened using the proper sequence and torque per the manufacturer's specifications.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Measure Wall Thickness with Ultrasonic Meter (reference Task 8.2).

2.0 Knowledge Component

The mechanical bolt-on device is a type of pipeline repair used for covering anomalies with a full encirclement component secured onto the pipeline.

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.

Terms applicable to this task are 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Anomaly or other defect on carrier pipe outside the area of installation.	Notify the operator of the suspected defect.
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. 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.

Task 40.5—Install Weldable Compression Coupling

1.0 Task Description

This task involves the installation of a weldable compression coupling. A weldable compression coupling is a bolt-on repair device used to mechanically connect pipeline segments, and it is installed by being clamped to the surface of a pipeline. Once attached, longitudinal bolts apply pressure to a steel ring and neoprene seal. The neoprene seal expands and provides a compressive seal between the coupling and exterior surface of the pipe.

This task begins with preparation of the carrier pipe pursuant to the device manufacturer's procedures, and the task ends when the bolts are tightened using the proper sequence and torque per the manufacturer's specifications.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Measure Wall Thickness with Ultrasonic Meter (reference Task 8.2).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform NDT—Ultrasonic Testing (reference Task 38.7).

— Perform Welding (reference Task 42.7).

2.0 Knowledge Component

A weldable compression coupling is a bolt-on repair device mechanically connected to the pipeline to provide a compressive seal between the coupling and exterior surface of the pipe as a temporary or permanent repair.

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

— Appropriate application of a weldable compression coupling device. A weldable compression coupling device is designed for application on a pipeline or flanged assembly. A device may be used as a temporary or permanent repair.

— Torque procedures.

— Compatibility of weldable compression coupling device with existing pipeline.

Terms applicable to this task are as follows.

weldable compression coupling
A device that uses radial bolts to attach a compression coupling to the surface of a pipeline. Once attached, longitudinal bolts apply pressure to a steel ring and neoprene seal that expand providing a compressive seal between the weldable compression coupling and exterior surface of the pipe. This type of device is available in various designs, lengths, and diameters, and it may be welded to the pipeline for permanent installation.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Anomaly or other defect on a carrier pipe inside the area of installation.	Notify the operator of the suspected defect.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the compatibility of the weldable compression coupling device with pipeline and the shelf life of the seal.	
2	Prepare the carrier pipe for proper fit of the sealing elements according to the manufacturer's instructions.	This step ensures the sealing integrity of the device.
3	Prior to installing the device on the carrier pipe, confirm that the acceptable wall thickness has been measured in the seal welding zones if the installation will be permanent.	Confirmation of the wall thickness ensures that a qualified person has measured the wall thickness of the carrier pipe. This step also ensures the integrity of the carrier pipe in anticipation of welding, if necessary.
4	Install the repair device, and tighten the bolts using the proper sequence and torque per the manufacturer's specifications.	The bolts used to secure a coupling must be tightened in the proper torque sequence and value in order to properly establish a satisfactory seal. This step ensures the proper location and sealing integrity of the repair device.

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

The installation or removal of the plugging machine allows for isolation of a pipeline segment or the diversion the flow on an active pipeline.

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

— 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.

Terms 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 installed 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.

tapping valve
The component installed on the fitting to control product flow while inserting the boring bar and operating the cutter on the pipeline or breakout tank and during removal of the tapping machine.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Malfunction of or damage to tapping machine, tapping valve, or other related equipment that has the potential for loss of product.	Stop operation and secure the equipment, if safe to do so. Inspect the equipment and readjust or reset, as necessary.
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.
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.
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	Prior to opening the valve, equalize the pressure on each side of the valve if possible.	Equalized pressure facilitates operation of tapping machine.
4	Slowly open the valve fully on the fitting.	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 tapping valve and relieve the pressure from the plugging machine.	The plugging machine is isolated from the product flow. Ensures that the tapping valve is fully closed.
11	Drain the plugging machine before removal.	
12	Remove the plugging machine from the tapping valve.	Install the cap, blind flange, piping, instrumentation, or other component onto the fitting or valve per operator's procedures.

Task 40.7—Install a Tap 2 in. and Under on a Pipeline System

1.0 Task Description

This task provides the means for safely hot tapping into an operating pipeline or breakout tank. This task may or may not require the removal of a coupon.

This task starts with the installation of the tapping machine onto the tapping valve and ends with the removal of the tapping machine from the tapping valve and retrieval of the coupon, if applicable.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Install and Remove Completion Plug on Pipelines Larger than 2 in. (reference Task 40.9).

2.0 Knowledge Component

Hot tapping is performed on an in-service pipeline or breakout tank to make connections without having to shut down.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

bleeder valve
A valve that allows the controlled relief of pressure.

boring bar
The main shaft of a tapping machine that turns the cutter.

coupon
The piece of wall cut from a pipeline or breakout tank with a cutter.

cutter
The cutter is the tool used to drill or cut a hole through the wall of a pipeline or breakout tank. The cutter may or may not produce a coupon.

fitting
A component welded or clamped to the pipeline upon which a tapping valve is installed to allow tapping and plugging.

hot tap
The process of safely cutting or boring a hole into an in-service pipeline or breakout tank.

tapping or drilling machine
A machine installed onto the appropriate tapping valve for the purpose of boring a hole into a pipeline or breakout tank.

tapping valve
The component installed on the fitting to control product flow while inserting the boring bar and operating the cutter on the pipeline or breakout tank and during removal of the tapping machine.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Malfunction of or damage to tapping machine, tapping valve, or other related equipment that has the potential for loss of product.	Stop operation and secure equipment, if safe to do so. Inspect equipment and readjust or reset, as necessary.
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.
Lost coupon may damage downstream equipment.	Immediately notify the operator.
Pressure trapped between the tapping valve and the hot tap machine.	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	Verify the proper tapping valve and fitting were installed according to applicable procedure.	This will ensure tapping valve and fitting will maintain integrity and prevent leakage during the hot tapping task.
2	Confirm proper operation of the tapping valve.	This allows insertion of the boring bar and cutter through the tapping valve bore.
3	Confirm the tapping machine rating and cutter size.	Verifies the proper machine rating on specific size pipelines.
4	Assemble the tapping machine per the manufacturer’s procedures.	Assembles the tapping machine to bore the proper sized hole.
5	Prior to connecting the tapping machine to the tapping valve, make necessary measurements to determine the depth of cut.	Accurate measurement is important to ensure the tap is performed correctly.
6	Verify the operating conditions meet company procedures and requirements.	Ensure that pressures, level, product, or other operational parameters are as specified by the company.
7	Install the tapping machine on the tapping valve and ensure the cutter can pass through the open tapping valve and the tapping valve can be fully closed when the cutter is retracted.	Performing this step assures tapping valve operation and isolation can occur before and after the tap is made.
8	Conduct leak test.	Verify no leaks occur, per operating procedure.
9	Lower the boring bar to verify proper alignment and initial depth measurements.	Accurate measurement is important to ensure the tap is performed correctly.
10	Operate tapping machine and perform hot tap according to manufacturer’s instructions.	
11	Raise the boring bar and close the tapping valve.	Prevent release of product when tapping machine is removed by ensuring the tapping valve is fully closed.
12	Depressurize and drain the product trapped between the tapping valve and the hot tap machine.	Prepare for removal of the tapping machine.
13	Remove the tapping machine.	
14	Confirm retrieval of coupon, if applicable.	Provide to appropriate personnel for evaluation.

Task 40.8—Install a Tap Larger than 2 in. on a Pipeline System

1.0 Task Description

This task provides the means for safely cutting a hole 2 in. and larger in an operating pipeline or breakout tank. This task will require the removal of a coupon.

This task begins with the installation of the valve on the fitting and ends with the removal of the tapping machine from the valve and retrieval of the coupon.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Install and Remove Completion Plug on Pipelines Larger than 2 in. (reference Task 40.9).

2.0 Knowledge Component

Hot tapping is performed on an in-service pipeline or breakout tank to make connections without having to shut down.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

bleeder valve
A valve that allows the controlled relief of pressure.

boring bar
The main shaft of a tapping machine that turns the cutter.

coupon
The piece of wall cut from a pipeline or breakout tank with a cutter.

cutter
The bit that cuts a coupon from the wall of a pipeline or breakout tank. The cutter is equipped with a pilot bit to bore a hole that will center the cutter.

fitting
A component welded or clamped to the pipeline upon which a tapping valve is installed to allow tapping and plugging.

hot tap
The process of safely cutting or boring a hole into an in-service pipeline or breakout tank.

tapping or drilling machine
A machine installed onto the appropriate tapping valve for the purpose of boring a hole into a pipeline or breakout tank.

tapping valve
The component installed on the fitting to control product flow while inserting the boring bar and operating the cutter on the pipeline or breakout tank and during removal of the tapping machine.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Malfunction of or damage to tapping machine, tapping valve, or other related equipment that has the potential for loss of product.	Stop operation and secure equipment, if safe to do so. Inspect equipment and readjust or reset, as necessary.
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.
Lost coupon may damage downstream equipment.	Immediately notify the operator.
Pressure trapped between the tapping valve and the hot tap machine.	Stop operation and secure equipment, if safe to do so. Immediately notify the operator and execute applicable emergency procedures.
Loss of product by boring hole through opposite wall of pipeline.	Stop operation and secure equipment, if safe to do so. Immediately notify the operator and execute applicable emergency procedures.
Improper alignment may result in damage to tapping valve or tapping machine.	Stop operation and secure equipment, if safe to do so. Inspect equipment and readjust or reset, as necessary.
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	Verify the proper tapping valve and fitting were installed according to applicable procedure.	This will ensure tapping valve and fitting will maintain integrity and prevent leakage during the hot tapping task.
2	Confirm proper operation of the tapping valve and that it is in the open position.	This allows insertion of the boring bar and cutter through the tapping valve bore.
3	Confirm the tapping machine rating and cutter size.	Verifies the proper machine rating on specific size pipelines.
4	Assemble the tapping machine per the manufacturer's procedures.	Assembles the tapping machine to bore the proper sized hole.
5	Prior to connecting the tapping machine to the tapping valve, make necessary measurements to determine the depth of cut.	Accurate measurement is important to ensure the tap is performed correctly.
6	Verify the operating conditions meet company procedures and requirements.	Ensure that pressures, level, product, or other operational parameters are as specified by the company.
7	Install the tapping machine on the tapping valve and ensure the cutter can pass through the open tapping valve and the tapping valve can be fully closed when the cutter is retracted.	Performing this step assures tapping valve operation and that isolation can occur before and after the tap is made.
8	Conduct leak test.	Verify no leaks occur, per operating procedure.
9	Lower the boring bar to verify proper alignment and initial depth measurements.	Accurate measurement is important to ensure the tap is performed correctly.
10	Operate tapping machine to complete hot tap and verify depth measurements of cutter assembly.	Ensures prevention of drilling through the opposite pipe wall.
11	Raise the boring bar, cutter, and pilot bit and verify depth measurements to ensure valve clearance and allow closure.	Valve closure is necessary to prevent product release.
12	Close the tapping valve.	Prevent release of product when tapping machine is removed by ensuring the tapping valve is fully closed.
13	Depressurize and drain the product trapped between the tapping valve and the hot tap machine.	Prepare for removal of the tapping machine.
14	Remove the tapping machine.	
15	Confirm retrieval of coupon	Provide to appropriate personnel for evaluation.

Task 40.9—Install and Remove Completion Plug on Pipelines Larger than 2 in.

1.0 Task Description

This task addresses the installation of a completion plug to tightly seal the fitting and allow installation and removal of the valve used in conjunction with a tapping machine or plugging machine. The fitting referenced in this task has been installed by a person qualified to perform the respective task, prior to installing the completion plug.

This task begins with the installation of the tapping machine on the tapping valve and ends with the installation of a cap, blind flange, piping, instrumentation, or other component onto the fitting.

2.0 Knowledge Component

A completion plug is used to seal the fitting to allow removal of the valve after completion of a hot tap.

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

— The completion plug prevents the release of product while a blind flange, piping, valve, or other component is being attached to the fitting. The completion plug can be subsequently removed from the fitting to install a plugging machine.

Terms 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 installed 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.

tapping machine
A machine installed onto the appropriate valve for the purpose of cutting a hole into a pipeline or breakout tank and installing and removing completion plugs.

tapping valve
The component installed on the fitting to control product flow while inserting the boring bar and operating the cutter on the pipeline or breakout tank and during removal of the tapping machine.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Malfunction of completion plug or tapping machine affects integrity of fitting or pipeline.	Stop operation and secure equipment, if safe to do so. Inspect equipment and readjust or reset, as necessary.
Unexpected release of hazardous liquid or gas from pipeline or completion plug.	Stop operation and secure equipment, if safe to do so. Immediately notify the operator or responsible person and initiate applicable emergency procedures. Remove completion plug or leaking component, inspect or replace components, and reinstall the plug in the fitting.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps for installation.

Step	Action	Explanation
1	Assemble plug and plug holder to the boring bar.	Proper assembly of compatible components ensures the plug correctly fits the void and remains in place once installed, as well as ensuring correct retrieval and removal of the plug.
2	Inspect and assemble tapping machine and plug holder components.	Ensures components are in good condition.
3	Take necessary measurements prior to installing the tapping machine on the valve.	Ensures proper seating location.
4	Install tapping machine onto the valve with the plug holder fully retracted.	Prevents damage to tapping machine.
5	Prior to opening the valve, equalize the pressure on each side of the valve if possible.	Equalized pressure facilitates operation of tapping machine.
6	Slowly open the valve fully on the fitting.	Ensure valve is fully opened to allow insertion of the completion plug.
7	Lower the completion plug into the fitting with the boring bar. Verify proper alignment and initial depth measurements.	
8	Confirm plug is properly set.	Ensures plug is mechanically positioned correctly.
9	Safely relieve pressure.	Ensures proper depressurization and containment of product.
10	Confirm plug is properly sealed.	Allows removal of the tapping machine, valve and installation of the cap, blind flange, etc.
11	Remove the tapping machine from the valve.	Install the cap, blind flange, piping, instrumentation, or other component onto the fitting or valve per operator’s procedures.

To demonstrate proficiency of this task, an individual must perform the following steps for removal.

Step	Action	Explanation
1	Visually inspect that the completion plug is seated in the fitting.	Proper alignment also ensures correct retrieval and removal of the completion plug.
2	Verify the proper tapping valve is installed according to applicable procedure.	This will ensure tapping valve will maintain integrity and prevent leakage during the hot tapping task.
3	Open the tapping valve fully on the fitting.	Ensure tapping valve is fully opened to allow removal of the completion plug.
4	Verify clear accessibility to the completion plug.	Verify correct retrieval and removal of the completion plug.
5	Inspect and assemble tapping machine and plug holder components.	Ensures components are in good condition.
6	Take necessary measurements prior to installing the tapping machine on the tapping valve.	Ensures proper fit.
7	Install tapping machine onto the valve with the boring bar fully retracted.	Prevents damage to tapping machine.
8	Lower the boring bar to the plug.	
9	Verify proper alignment and initial depth measurements.	
10	Connect to the completion plug.	
11	Equalize the pressure on each side of the plug if possible, prior to removing the plug.	
12	Release plug from fitting.	
13	Retract the boring bar, plug holder, and plug from the fitting and tapping valve.	
14	After fully retracting the boring bar, plug holder, and completion plug, close the valve and relieve pressure above the tapping valve and from the tapping machine per operator procedures.	Relieve pressure and drain.
15	Remove the tapping machine from the tapping valve.	Once machine is removed, assembly is now ready for further operational tasks.

Task 40.10—Install and Remove Completion Plug on a Pipeline 2 in. and Under

1.0 Task Description

This task addresses the installation of a completion plug to tightly seal the fitting and allow installation and removal of the valve used in conjunction with a tapping machine or plugging machine. The fitting referenced in this task has been installed by a person qualified to perform the respective task, prior to installing the completion plug.

This task begins with the installation of the tapping machine on the tapping valve and ends with the installation of a cap, blind flange, piping, instrumentation, or other component onto the fitting.

2.0 Knowledge Component

A completion plug is used to seal the fitting to allow removal of the valve after completion of a hot tap. The completion plug prevents the release of product while a blind flange, piping, valve, or other component is being attached to the fitting. The completion plug can be subsequently removed from the fitting to install a plugging machine.

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

Terms applicable to this task are as follows.

completion plug
A plug designed to seal the opening created by a hot tap and allow installation and removal of the valve.

fitting
A component welded or clamped to the pipeline upon which a valve is installed 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.

tapping machine
A machine installed onto the appropriate valve for the purpose of cutting a hole into a pipeline or breakout tank and installing and removing completion plugs.

tapping valve
The component installed on the fitting to control product flow while inserting the boring bar and operating the cutter on the pipeline or breakout tank and during removal of the tapping machine.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Malfunction of completion plug or tapping machine affects integrity of fitting or pipeline.	Stop operation and secure equipment, if safe to do so. Inspect equipment and readjust or reset, as necessary.
Unexpected release of hazardous liquid or gas from pipeline or completion plug.	Stop operation and secure equipment, if safe to do so. Immediately notify the operator or responsible person and initiate applicable emergency procedures. Remove completion plug or leaking component, inspect or replace components, and reinstall the plug in the fitting.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps for installation.

Step	Action	Explanation
1	Assemble plug and plug holder to the boring bar.	Proper assembly of compatible components ensures the plug correctly fits the void and remains in place once installed, as well as allowing for correct retrieval and removal of the plug.
2	Inspect and assemble tapping machine and plug holder components.	Verifies components are in good condition.
3	Take necessary measurements prior to installing the tapping machine on the valve.	Confirms proper seating location.
4	Install tapping machine onto the valve with the plug holder fully retracted.	Prevents damage to tapping machine.
5	Prior to opening the valve, equalize the pressure on each side of the valve if possible.	Equalized pressure facilitates operation of the valve.
6	Slowly open the valve fully on the fitting.	Fully opening valve allows for insertion of the completion plug.
7	Lower the completion plug into the fitting with the boring bar. Verify proper alignment and initial depth measurements.	
8	Confirm plug is properly set.	
9	Safely relieve pressure.	Proper depressurization reduces the likelihood of unexpected product release.
10	Confirm plug is properly sealed.	Allows removal of the tapping machine, valve and installation of the cap, blind flange, etc.
11	Remove the tapping machine from the valve.	Install the cap, blind flange, piping, instrumentation, or other component onto the fitting or valve per operator's procedures.

To demonstrate proficiency of this task, an individual must perform the following steps for removal.

Step	Action	Explanation
1	Visually inspect that the completion plug is seated in the fitting	Proper alignment enables correct retrieval and removal of the completion plug.
2	Verify the proper tapping valve is installed according to applicable procedure.	This will ensure tapping valve will maintain integrity and prevent leakage during completion plug removal.
3	Open the tapping valve fully on the fitting.	Ensure tapping valve is fully opened to allow removal of the completion plug.
4	Verify clear accessibility to the completion plug.	Verify correct retrieval and removal of the completion plug.
5	Inspect and assemble tapping machine and plug holder components.	Validates components are in good condition.
6	Take necessary measurements prior to installing the tapping machine on the tapping valve.	Confirms proper fit.
7	Install tapping machine onto the valve with the boring bar fully retracted.	Prevents damage to tapping machine.
8	Lower the boring bar to the plug.	
9	Verify proper alignment and initial depth measurements.	
10	Connect to the completion plug.	
11	Equalize pressure on each side of the plug prior to removing the plug (if required).	
12	Release plug from fitting.	
13	Retract the boring bar, plug holder, and plug from the fitting and tapping valve.	
14	After fully retracting the boring bar, plug holder, and completion plug, close the valve and relieve pressure above the tapping valve and from the tapping machine per operator’s procedures.	Relieve pressure and drain.
15	Remove the tapping machine from the tapping valve.	Once machine is removed, assembly is now ready for further operational tasks.

Task 40.11—Install and Remove Completion Plug on a Pipeline 2 in. and Under

1.0 Task Description

This task addresses the installation of a completion plug to tightly seal the fitting and allow installation and removal of the valve used in conjunction with a tapping machine or plugging machine. The fitting referenced in this task has been installed by a person qualified to perform the respective task, prior to installing the completion plug.

This task begins with the installation of the tapping machine on the tapping valve and ends with the installation of a cap, blind flange, piping, instrumentation, or other component onto the fitting.

2.0 Knowledge Component

A completion plug is used to seal the fitting to allow removal of the valve after completion of a hot tap. The completion plug prevents the release of product while a blind flange, piping, valve, or other component is being attached to the fitting. The completion plug can be subsequently removed from the fitting to install a plugging machine.

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

Terms applicable to this task are as follows.

completion plug
A plug designed to seal the opening created by a hot tap and allow installation and removal of the valve.

fitting
A component welded or clamped to the pipeline upon which a valve is installed 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.

tapping machine
A machine installed onto the appropriate valve for the purpose of cutting a hole into a pipeline or breakout tank and installing and removing completion plugs.

tapping valve
The component installed on the fitting to control product flow while inserting the boring bar and operating the cutter on the pipeline or breakout tank and during removal of the tapping machine.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Unexpected release of hazardous liquid or gas from pipeline or completion plug.	Stop operation and secure equipment, if safe to do so. Immediately notify the operator or responsible person and initiate applicable emergency procedures. Remove completion plug or leaking component, inspect or replace components, and reinstall the plug in the fitting.
Unexpected release of pressure or product while removing cap or blind flange.	Stop operation and secure equipment, if safe to do so. Immediately notify the operator or responsible person and initiate applicable emergency procedures. Allow pressure to dissipate before completing removal of cap or flange bolts. If release continues, retighten cap or flange bolts, if safe to do so.

3.0 Skill Component

To demonstrate proficiency of this task, an individual must perform the following steps for installation.

Step	Action	Explanation
1	Assemble plug and plug holder to the boring bar.	Proper assembly of compatible components ensures the plug correctly fits the void and remains in place once installed, as well as allowing for correct retrieval and removal of the plug.
2	Inspect and assemble tapping machine and plug holder components.	Verifies components are in good condition.
3	Take necessary measurements prior to installing the tapping machine on the valve.	Confirms proper seating location.
4	Install tapping machine onto the valve with the plug holder fully retracted.	Prevents damage to tapping machine.
5	Prior to opening the valve, equalize the pressure on each side of the valve if possible.	Equalized pressure facilitates operation of the valve. Follow manufacturer instructions and operator procedures as appropriate.
6	Slowly open the valve fully on the fitting.	Fully opening valve allows for insertion of the completion plug. Follow manufacturer instructions and operator procedures as appropriate.
7	Lower the completion plug into the fitting with the boring bar. Verify proper alignment and depth measurements.	Follow manufacturer instructions and operator procedures as appropriate.
8	Confirm plug is properly set.	Improper plug placement could result in a leak and/or damage to the integrity of the pipeline. Stop operation and secure equipment, if safe to do so.
9	Safely relieve pressure.	Proper depressurization reduces the likelihood of unexpected product release.
10	Confirm plug is properly sealed.	Allows removal of the tapping machine, valve and installation of the cap, blind flange, etc.
11	Remove the tapping machine from the valve.	Install the cap, blind flange, piping, instrumentation, or other component onto the fitting or valve. Follow manufacturer instructions and operator procedures as appropriate.

To demonstrate proficiency of this task, an individual must perform the following steps for removal.

Step	Action	Explanation
1	Visually inspect that the completion plug is seated in the fitting.	Proper alignment enables correct retrieval and removal of the completion plug.
2	Verify the proper tapping valve is installed according to applicable procedure.	This will ensure tapping valve will maintain integrity and prevent leakage during completion plug removal.
3	Open the tapping valve fully on the fitting.	Ensure tapping valve is fully opened to allow removal of the completion plug.
4	Verify clear accessibility to the completion plug.	Verify correct retrieval and removal of the completion plug.
5	Inspect and assemble tapping machine and plug holder components.	Validates components are in good condition.
6	Take necessary measurements prior to installing the tapping machine on the tapping valve.	Confirms proper fit.
7	Install tapping machine onto the valve with the boring bar fully retracted.	Prevents damage to tapping machine.
8	Lower the boring bar to the plug.	
9	Verify proper alignment and initial depth measurements.	
10	Connect to the completion plug.	
11	Equalize pressure on each side of the plug prior to removing the plug (if required).	
12	Remove plug from fitting.	
13	Retract the boring bar, plug holder, and plug from the fitting and tapping valve.	
14	After fully retracting the boring bar, plug holder, and completion plug, close the valve and relieve pressure above the tapping valve and from the tapping machine.	Relieve pressure and drain. Follow manufacturer instructions and operator procedures as appropriate.
15	Remove the tapping machine from the tapping valve.	Once machine is removed, assembly is now ready for further operational tasks.

Task 41—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.

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

2.0 Knowledge Component

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

— 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:

  — MOP certification or integrity management;

  — testing for certification;

  — testing of replacement pipe for sections being relocated, replaced, or otherwise changed;

  — conversion of service.

— 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 ft of test section are unoccupied when test pressure is greater than a pressure that 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.

— If elevation differences in the test segment exceed 100 ft, 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.

Terms 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 predetermined 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.

AOCs associated with the performance of this task include the following.

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. 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.

Task 42.7—Perform Welding

1.0 Task Description

This task validates that welders can perform welds on pipelines and breakout storage tanks according to the operator's applicable welding procedures.

This task pertains to numerous welding types, including but not limited to installing components such as flanges, reinforcing saddles, and nozzles; joining steel pipe; or welding a door sheet on a breakout tank. Each individual welding type must have a qualified welding procedure, and the individual must satisfactorily complete the weld according to that procedure.

This task begins with the first step identified in the operator's applicable welding procedure. The task ends once the weld has been completed.

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Visual Inspection of Welds (reference Task 38.3).

— Perform NDT—Radiographic Testing (reference Task 38.4).

— Perform NDT—Liquid Penetrant Testing (reference Task 38.5).

— Perform NDT—Magnetic Particle Testing (reference Task 38.6).

— Perform NDT—Ultrasonic Testing (reference Task 38.7).

2.0 Knowledge Component

This task validates that qualified welders can effectively follow operator established welding procedures.

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

— Operator-approved welding procedures applicable to the welds to be performed.

Welders shall be qualified in accordance with the latest DOT-approved edition of API 1104 or Section IX of the ASME *Boiler and Pressure Vessel Code* before they can be qualified to perform this covered task.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Burn-through during the performance of a butt weld.	Stop task activities and notify local operations personnel.
Arc burns outside the weld area.	Stop task activities and notify local operations personnel.

3.0 Skill Component

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

Step	Action	Explanation
1	Complete the qualifying weld(s) according to the operator's welding procedures.	Welding procedures are developed to meet standards applicable to the type of weld being performed. Successful completion of the qualifying weld(s) is determined either through destructive or nondestructive testing, and results shall be interpreted by a qualified person.

Task 43.1—Perform 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.

Perform 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).

Operate Valves Remotely 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.

This section intentionally left blank.

Terms 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 are 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.

maximum operating pressure
MOP
MOP 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 (DRAs);

— 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Activation of a Safety Device—Pressure-relief, emergency/abnormal shutdown, high-pressure shutdown, case pressure/temperature shutdown, etc. 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. 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. 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 backup systems are activated. Follow troubleshooting procedures and take appropriate action to mitigate the situation. 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. 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. 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. 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. 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.	

Task 43.2—Perform 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 shut down. 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).

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

Operate Valves Locally 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.

This section left intentionally blank.

Terms 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—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 are 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.

maximum operating pressure
MOP
MOP 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 DRAs;

— 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Activation of a Safety Device—Pressure-relief, emergency/abnormal shutdown, high-pressure shutdown, case pressure/temperature shutdown, etc. 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. 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. 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 backup systems are activated. Follow troubleshooting procedures and take appropriate action to mitigate the situation. 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. 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. 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. 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 nonautomated 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.	

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.

Perform Start-up of a Liquid Pipeline (Control Center) is a separate covered task (reference Task 43.1).

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

Operate Valves Remotely 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.

This section intentionally left blank.

Terms 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—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 are 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.

maximum operating pressure
MOP
MOP 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 DRAs;

— 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.

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Activation of a Safety Device—Pressure-relief, emergency/abnormal shutdown, high-pressure shutdown, case pressure/temperature shutdown, etc. 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. 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. 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 backup systems are activated. Follow troubleshooting procedures and do what is necessary to mitigate the situation. 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. 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. 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. 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. 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, 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.

Task 43.4—Operate Valves Remotely 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.

Operate Valves Locally 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.

- How valve indication is identified by some type of SCADA, 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.

AOCs associated with the performance of this task include the following.

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. Reactions could include: — shutting down the system (if qualified), — returning the valve to its original position, — operating an appropriate valve, — isolating damaged equipment, — 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. Reactions could include the following: — shutting down the system (if qualified), — returning the valve to its original position, — operating an appropriate valve, — isolating damaged equipment, — making appropriate notifications.
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. 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.

Task 44.3—Inspect, Test, and Maintain a Flow Computer for Hazardous Liquid Leak

1.0 Task Description

This task consists of the inspection, testing, and maintenance activities performed on a flow computer that is associated with a hazardous liquid leak detection system. This task ensures that the computer and its associated input/output (I/O) signals are functioning properly and are adequate for their intended purpose.

This task begins with verification of the flow computer number/nameplate and ends with notification to appropriate personnel that the flow computer is ready for normal operation.

Inspect, Test, and Calibrate Pressure Transmitters is a separate covered task (reference Task 25.2).

Prove Flow Meters for Hazardous Liquid Leak Detection is a separate covered task (reference Task 44.5).

Inspect, Test, and Maintain Gravitometers/Densitometers for Hazardous Liquid Leak Detection is a separate covered task (reference Task 44.7).

Inspect, Test, and Maintain Temperature Transmitters for Hazardous Liquid Leak Detection is a separate covered task (reference Task 44.8).

2.0 Knowledge Component

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

This section intentionally left blank.

Terms applicable to this task are as follows.

flow computer
A flow computer is a microprocessor-based computational device that implements the required algorithms using the analog and digital signals received from flow meters and temperature, pressure, and density devices to calculate volumetric or mass flow.

A flow computer also audits changes that have been made to any of the parameters required to turn the raw flow meter data into standard volumes. It records events and alarms related to the flow measurement system.

A flow computer keeps a running tally of the volume for each flow meter it monitors and creates a record of this volume on an hourly, daily, batch, monthly, or continuous basis.

Flow data is made available externally through an electronic interface [i.e. programmable logic controller (PLC), HMI, SCADA, or leak detection systems and processes].

Topics including the following:

— flow computer configuration programming;

— analog/digital I/O;

— communications;

— operation and safe handling of electrical systems (i.e. voltage applied to the device, electrical requirements, and connection of test equipment to the device to be tested);

— knowledge of the control instrumentation for the process system (i.e. knowing the alarm, control, indication, and recording functions of the device in the process system);

— differential pressure;

— ethernet;

— serial;

— analog;

— digital;

— end device that receives and processes data from field equipment. Some examples of end devices include PLC, HMI, SCADA, and flow computers.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
A flow computer is found in an inoperable condition or does not communicate to HMI/SCADA.	Notify the control center or appropriate personnel to take actions as specified by the 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 flow computer number/nameplate data.	This step uses the appropriate operator's documentation to verify the correct flow computer to be maintained.
2	Identify all associated devices that interface with the flow computer.	Associated equipment inputs may include the following: — flow meters, — temperature/pressure transmitters, — gravitometers/densitometers, — valve status devices, — prover detector switches, — strainer differential pressure devices, — HMI/SCADA, — fluid interface detection, — sampling systems. Associated equipment outputs can include the following: — sampling systems, — prover controls, — HMI/SCADA communication, — PLC/analog/digital.
3	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance.	The control center and local operations (if applicable) must be notified that work is to be performed on the flow computer. The control center may be required to validate the following: — receipt/initiation of an alarm, — SCADA/HMI display values, — flow computer data corresponds to SCADA/HMI display ID. This step includes consulting the operator's procedures.

Step	Action	Explanation
4	Inspect and maintain the flow computer hardware.	A visual inspection of the device and its associated equipment includes the following: — physical/mechanical condition, — corrosion, — electrical connections, — electronic components. Components are repaired or replaced as needed according to the manufacturer's specifications and to the operator's procedure.
5	Verify that the I/O parameters for each identified device are correct, the displayed values are accurate, and that no unwanted override parameters exist.	Parameter values of a flow computer are established by the operating conditions and calibration results of associated equipment. This step includes consulting the appropriate operator's documentation of associated equipment such as the following: — proving reports, — pycnometer reports, — transmitter calibration reports.
6	Verify that the configuration for the flow computer is correct.	Engineering design of system criteria establishes configuration parameters. The correct flow computer configuration is determined by referencing the operator's documentation and/or consulting with a measurement specialist.
7	Confirm that the communication link to HMI/SCADA is functional.	This step confirms that the relayed information is accurate. Common communication links can include the following: — ethernet, — serial, — analog/digital. The step includes consulting the operator's procedures.
8	Correct any errors and/or implement required changes noted in Steps 5 to 7.	This step follows the manufacturer's specifications and the operator's procedures.
9	Validate the changes made in the flow computer.	A review of Steps 5 to 7 confirms the changes.
10	Document any corrections or changes to the flow computer I/O parameters and configuration.	This step creates a backup of the flow computer configuration. Notification and data retention should follow the operator's procedures.
11	Notify the control center, local operations (if applicable), and any affected personnel.	This communication notifies the appropriate personnel that the flow computer is ready for normal operation and that the task is complete.

Task 44.4—Inspect, Test, and Perform Corrective and Preventative Maintenance of Tank Gauging for Hazardous Liquid Leak Detection

1.0 Task Description

This task involves the inspection, testing, and maintenance activities performed on tank gauging equipment that is associated with a hazardous liquid leak detection system, including calibration. This task ensures that the equipment and its associated output signals are functioning properly and are adequate for their intended purpose.

This task begins with identifying and verifying the tank gauging equipment to inspect, test, and/or maintain and ends with appropriate notifications that the tank gauging equipment is returned.

Test Overfill Protective Devices is a separate covered task (reference Task 30).

Inspect and Calibrate Overfill Protective Devices is a separate covered task (reference Task 31).

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

NOTE 49 *CFR* § 195.428(c) gives direction on overfill protection devices and requires API 2350 be followed. If the level device is also used for overfill protection, then testing and calibration are separate covered tasks (see Tasks 30 and 31 above).

2.0 Knowledge Component

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

— Tank gauge systems. The primary purpose of a tank gauge system is to accurately determine the liquid volume within a breakout storage tank or other containment vessel. The tank gauge device output values are utilized to display and manage the flow into and out of a tank and can be an input into an operator's hazardous liquid leak detection system or process.

  In some instances, when designed to do so by an operator, the tank gauge device can be part of an automated overfill protection control scheme.

— Gauging equipment to maintain, which may include the following:

  — sonar,

  — radar,

  — mechanical (tape with displacer).

— Operation and safe handling of electrical systems (i.e. voltage applied to the device, electrical requirements, and connection of test equipment to the device to be tested).

— Control instrumentation for the process system (i.e. knowing the alarm, control, indication, and recording functions of the device in the process system).

— Tank/vessel construction types.

— Tank/vessel fill/drain operations.

— Control center communication methods.

— Operator’s testing and operating procedures related to the testing of tank gauges.

— Alarms indicating that an operating parameter has been exceeded.

— Test measurement equipment required.

— Test equipment certification.

— Test equipment operation.

— Documentation/recordkeeping.

— End device that receives and processes data from field equipment; some examples of end devices include PLC, HMI, and SCADA.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
The liquid level is at an unexpected high or low level.	Notify the control center or the appropriate personnel of the level status.
The tank gauge equipment and/or system is in an inoperable condition.	Notify/inform the appropriate operator personnel of the condition.
Roof components contain structural damage.	Notify/inform the appropriate operator personnel of the condition.
A floating roof contains debris, water, or freestanding product.	Notify/inform the appropriate operator personnel of the condition.
A tank in static condition experiences an unexplained level movement.	Notify/inform the appropriate operator personnel of the condition.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device number/nameplate data.	This step uses the appropriate operator's drawings to verify the correct device.
2	Verify the calibration point values for the gauging device.	Engineering analysis of design criteria establishes the calibration point values of a tank gauge device. This step includes consulting the operator's documentation to determine the proper device range.
3	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any inspection, testing, and/or maintenance activities.	The control center and local operations (if applicable) must be notified that work is to be performed on the tank gauging device. The control center may be required to validate the following: — receipt/initiation of an alarm, — SCADA/HMI display values, — gauge device number corresponds to SCADA/HMI display ID. If the tank gauging device is part of an automated shutdown or flow relief system, the control center or local operations may be required to override automation to prevent unintended operations.
4	Inspect/maintain the tank gauging device and system.	Inspection of the tank gauging device and the associated equipment includes the following: — physical/mechanical condition, — corrosion, — leakage, — electrical connections (if applicable), — high/low level triggers. All moving parts should move smoothly and freely. The cable and/or tape should move smoothly over the rollers (if applicable). Components are repaired or replaced as needed according to the manufacturer's specifications and the operator's procedures.
5	Confirm that the tank is in a static condition per the operator's procedures.	The tank level must be in a static condition with no movements in or out and with all mixers turned off.
6	Verify that the test equipment has been certified prior to performing verification.	The test equipment must have a valid certification of calibration including the date and appropriateness for the intended range per the operator's policy/API standard.
7	Perform a test to determine the proper gauge equipment functionality and to determine if calibration is required per the manufacturer's specifications and the operator's procedures.	Local procedures specify how to obtain an accurate value for the tank level (test value). Typically, this step is accomplished by use of a certified gauge tape (hand line). This step compares the test value with local and remote gauge displays (includes control center HMI/SCADA values). The manufacturer's procedures should be followed when using alternate electronic test equipment in order to obtain a test value (i.e. radar, sonar, or laser).
8	Document the "as found" results of the performance of this task.	The step documents the results per the operator's procedures.

Step	Action	Explanation
9	If calibration of the gauging device is required, adjust the device settings using the manufacturer's specifications and the operator's procedures.	The device output value should be set to the correct test value. The field device must be calibrated and verified to the "end" device. This step incorporates validating the accurate local and remote display values (including control center HMI/SCADA values).
10	Document the "as left" results of the performance of this task.	This step documents the results per the operator's procedures.
11	Return the device to normal operating condition and verify the integrity of the system as per the operator's procedures.	
12	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication notifies appropriate personnel that the device is ready for normal operation and that the task is complete.

Task 44.5—Prove Flow Meters for Hazardous Liquid Leak Detection

1.0 Task Description

This task involves proving a flow meter to obtain an accurate meter factor and proving report.

This task begins with identifying and verifying the meter to prove. The task ends with a control center notification that the meter has returned to a normal operating condition.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Inspect, Test, and Calibrate Pressure Transmitters (reference Task 25.2).

— Inspect, Test, and Maintain a Flow Computer for Hazardous Liquid Leak Detection (reference Task 44.3).

— Inspect, Test, and Maintain Temperature Transmitters for Hazardous Liquid Leak Detection (reference Task 44.8).

— Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Field) (reference Task 63.3).

2.0 Knowledge Component

This task establishes accurate flow measurements for leak detection.

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

— Prover types, including the following:

  — master meter,

  — bidirectional,

  — unidirectional,

  — compact.

— Input information used to calculate a meter factor, including the following:

  — product tables,

  — material selection,

  — temperature coefficients,

  — pressure coefficients,

  — base prover volume,

- meter orientation (prover upstream or downstream of the meter),
- meter ID,
- K factor,
- meter counts,
- acceptable deviation between prover runs (repeatability),
- previous meter factor.

Terms applicable to this task are as follows.

end device
A device that receives and processes data from field equipment. Some examples of end devices include PLC, HMI, SCADA, and flow computers.

flow computer
A microprocessor-based computational device that implements the required algorithms using the analog and digital signals received from flow meters and temperature, pressure, and density devices to calculate volumetric or mass flow.

A flow computer also audits changes that have been made to any of the parameters required to turn the raw flow meter data into standard volumes. It records events and alarms related to the flow measurement system. It will keep a running tally of the volume for each flow meter it monitors and will create a record of this volume on an hourly, daily, batch, monthly, or continuous basis.

The flow data is made available externally through an electronic interface (i.e. PLC, HMI, SCADA, or leak detection systems and processes).

K factor
The nominal number of pulses per unit volume generated by a meter.

meter factor
A ratio of the corrected prover volume to the corrected meter volume. For subsequent metering operations, the actual throughput is determined by multiplying the indicated volume registered at the meter by the meter factor.

meter proving
The procedure required to determine the relationship between the actual measured volume of liquid through a meter and the indicated meter volume.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
A meter is found in an inoperable condition or does not communicate to the end device.	Notify the control center or the appropriate personnel to take appropriate action.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the meter number/nameplate data.	This step uses the appropriate operator's documentation to verify the correct meter to prove.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any meter proving.	This step makes all of the required notifications prior to the performance of this procedure per the operator's procedures.
3	Verify the flow rate range values for the meter from the manufacturer's specifications.	To obtain an accurate meter factor, the meter must be proven at the actual operating flow rate and within a determined flow rate range established by a meter manufacturer's design criteria and specifications.
4	For a portable prover, verify that the pipeline pressure is within the portable prover equipment design specifications.	The portable prover equipment should meet or exceed the pipeline pressure specifications.
5	For a portable prover, make the connections to appropriate meter equipment.	The prover equipment must connect to the meter to be proven. Connections include the following: — prover piping, — meter pulse wiring, — AC power—if applicable, — grounding lead. This step follows the manufacturer's and the operator's procedures.
6	Line up the appropriate valves to fill and pressurize the portable prover equipment.	This step follows the manufacturer's and operator's procedures to fill the prover and purge all air out of the prover equipment.
7	Perform an equipment integrity assessment.	This step ensures connections and prover equipment are operating as intended.
8	For stationary and portable prover equipment, line up valves for meter proving.	The prover loop equipment diverts all meter flow.
9	Check the double block and bleed valves.	This step checks all double block and bleed valves on an associated prover loop piping for seal integrity. This step follows the valve manufacturer's and operator's procedures.
10	Verify that the prover temperature, pressure, and flow rate is stable with the meter.	This step allows sufficient time for the temperature, pressure, and flow rate of the meter and prover equipment to stabilize. This step follows the operator's procedures.
11	Determine the product gravity/density and stability.	Stable gravity/density is required to obtain an accurate meter factor.

Step	Action	Explanation
12	Initiate the prover run and complete the required number of proving runs.	Initiation of a prover run can be performed manually or automatically based on equipment design and the operator's requirements. This step verifies the integrity (positive seal) of a four-way valve (as applicable). The operator, contract, and/or industry standards determine the number of proving run parameters.
13	Verify all proving input information.	This information is utilized for manual calculations or data points in a flow computer. Input information includes the following: — product tables, — material selection, — temperature coefficients, — pressure coefficients, — base prover volume, — meter orientation (prover upstream or downstream of the meter), — meter ID, — K factor, — meter counts, — acceptable deviation between prover runs (repeatability), — previous meter factor.
14	Calculate the meter factor and produce a proving report.	The calculation can be performed manually or as a function of a flow computer. Completed meter proving will calculate the new meter factor.
15	Verify that the new meter factor is acceptable and implement the new meter factor as applicable.	This step implements the new meter factor by the following methods: — input into the flow computer, — apply to a manual meter ticket.
16	For a portable prover, line up appropriate valves to drain and depressurize portable prover equipment.	This step follows the manufacturer's and the operator's procedures.
17	For a portable prover, disconnect all connections to appropriate meter equipment.	From Step 5, the connections to disconnect include the following: — prover piping, — meter pulse wiring, — AC power—if applicable, — grounding lead. This step follows the manufacturer's and the operator's procedures.
18	Reset all valves to the normal operating position.	This step follows the operator's procedure.
19	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication notifies appropriate personnel that proving activities have concluded and to return to normal operation.

Task 44.6—Maintain Flow Meters for Hazardous Liquid Leak Detection

1.0 Task Description

This task involves activities associated with maintaining a liquid flow meter that is part of a hazardous liquid leak detection system. This task ensures that the equipment and associated output signals are functioning properly and are adequate for their intended purpose. This task begins with identifying and verifying the meter to maintain and ends with the completion of repair documentation per the operator's procedures.

Perform Start-up of a Liquid Pipeline (Control Center) is a separate covered task (reference Task 43.1).

Prove Flow Meters for Hazardous Liquid Leak Detection is a separate covered task (reference Task 44.5).

Perform Start-up of a Liquid Pipeline (Field) is a separate covered task (reference Task 63.1).

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).

Operate Valves Locally 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.

- Primary purpose of a meter. The primary purpose of a meter is to accurately determine the liquid flow volume within an operating pipeline. The meter device output values are utilized to determine the flow rate and are commonly an input into an operator's hazardous liquid leak detection system or process.
- Types of meters to maintain, including the following:
  - turbine meter,
  - positive displacement meter,
  - ultrasonic meter,
  - Coriolis meter,
  - magmeter,
  - differential pressure meter,
  - vortex meter.
- Operation and safe handling of electrical systems (i.e. voltage applied to the device, electrical requirements, and connection of test equipment).
- Control instrumentation for the process system (i.e. knowing the alarm, control, indication, and recording functions of the device in the process system).
- Ancillary equipment, including the following:
  - flow conditioners,
  - strainers,
  - filter.

— Control center communication methods.

— Alarms indicating that an operating parameter has been exceeded.

— Test/diagnostic equipment required.

— Test equipment calibration.

— End device that receives and processes data from field equipment; some examples of end devices include PLC, HMI, SCADA, or a flow computer.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
The meter is found in an inoperable condition or does not communicate to the end device.	Notify the control center or the appropriate personnel to take appropriate action.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the meter number/nameplate data.	This step uses the appropriate operator's documentation to verify the correct meter to maintain.
2	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance per the operator's procedures.	The control center and local operations (if applicable) must receive notification of work to be performed.
3	Perform routine preventive maintenance per the manufacturer's specifications and the operator's procedures.	Preventive maintenance activities are meter-type specific. This step consults the manufacturer's specifications and the operator's procedures.
4	Conduct a visual inspection.	A visual inspection of the meter and its associated equipment includes the following: — physical/mechanical condition, — corrosion, — leakage, — electrical connections, — electronic components, — ancillary equipment.
5	Perform diagnostics to determine if repairs are required per the applicable manufacturer's and operator's procedures.	Diagnostic activities include the following: — meter factor trend analysis, — pulse output diagnostics, — manufacturer software, — vibration, — noise, — electrical power and connections, — electronic components.
6	Determine if removal of the meter is required.	The step determines if meter removal is required and proceeds to Step 9 if it is not required.
7	Isolate, depressurize, drain, and purge the piping.	This step follows the operator's procedures.

Step	Action	Explanation
8	Remove the meter from the pipeline.	This step follows the operator's procedures.
9	Perform the repair as required.	This step performs repairs per the manufacturer's and the operator's procedures.
10	Reinstall the meter in the pipeline and ensure that the orientation is correct for product flow, as applicable.	This step follows the operator's procedures.
11	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification that meter commissioning and start-up activities begin.
12	Remove isolation measures, purge, and fill the piping with product.	This step follows the operator's procedures. This step includes consulting and following the manufacturer's procedure for start-up to ensure that damage does not occur to the meter.
13	Perform a meter loop integrity check.	This step inspects for leaks and verifies that the meter is ready for service.
14	Notify operations that the meter run is ready for start-up.	This step includes consulting and following the manufacturer's procedure for start-up to ensure that damage does not occur to the meter.
15	Notify operations that the meter should be proven.	
16	Document the repair results per the operator's procedures.	This step documents the results per the operator's procedures.

Task 44.7—Inspect, Test, and Maintain Gravitometers/Densitometers for Hazardous Liquid Leak Detection

1.0 Task Description

This task involves the inspection, testing, and calibration activities performed on gravitometers/densitometers to ensure that the equipment and associated output signals are functioning properly and are adequate for their intended purpose. This task begins with identifying and verifying that the gravitometer/densitometer device has been inspected, tested, and/or calibrated. The task ends with documenting repair and/or calibration results.

Perform Start-up of a Liquid Pipeline (Field) is a separate covered task (reference Task 63.1).

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

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).

Operate Valves Locally 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.

— Operation and proper use of test equipment used to perform the functions required in this task (i.e. pycnometer, multimeter, certified thermometer, certified hydrometer, or certified electronic scale).

— Operation and safe handling of electrical systems (i.e. voltage applied to the device, electrical requirements, and connection of test equipment to the device to be tested).

— Control instrumentation for the process system (i.e. knowing the alarm, control, indication, and recording functions of the device in the process system).

— Density.

— Pycnometer.

— Density correction factor (DCF).

— Test equipment certification.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
The device is found in an inoperable condition or does not communicate to the end device.	Notify the control center or the appropriate personnel to take appropriate action.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the densitometer number/nameplate data.	This step uses the appropriate operator's documentation to verify the correct densitometer to maintain.
2	Confirm the test equipment has been certified, calibrated, and verified prior to performing device calibration.	Test equipment (i.e. multimeters, multifunction calibrators, thermometers) must have a valid certification of calibration that is appropriate for the intended calibration range.
3	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any maintenance per the operator's procedures.	The control center and local operations (if applicable) must receive notification of work to be performed.
4	Conduct a visual inspection.	A visual inspection of the densitometer and its associated equipment includes the following: — physical/mechanical condition, — corrosion, — leakage, — electrical connections, — electronic components.
5	Perform a routine pycnometer calibration or hydrometer verification check.	Pycnometer calibration and hydrometer verification checks are dependent on the product type and the operator's procedures. Pycnometer calibration is typically used for pressurized gas products in a liquid state and for refined products. Hydrometer verification checks can be used for refined products and crude oil.
6	Calculate the DCF and produce a pycnometer report.	The report is used for the densitometer calibration correction factor. Performance of this step is per the operator's procedures, contract requirements, and/or industry standards.
7	Verify that the new DCF is acceptable and implement the new DCF as applicable.	This step implements the new DCF by the following methods: — input into the flow computer, — apply to a manual meter ticket. Performance of this step is per the operator's procedures, contract requirements, and/or industry standards.
8	If the DCF is not acceptable or is out of tolerance, perform test diagnostics to determine if a repair or maintenance is required.	Depending on the manufacturer's design and/or product service, test diagnostic activities can include the following: — densitometer factor trend analysis, — signal output diagnostics, — electrical power and connections, — electronic components, — vibration, — coefficient checks.
9	Determine if removal of the densitometer is required.	Inspection of the device for buildup of debris or contaminates may require removal.

Step	Action	Explanation
10	Perform internal device maintenance and override the density value at the end device per the operator's procedure.	This step provides a temporary density value input to the hazardous liquid leak detection system in order to maintain accurate measurement during the maintenance activities. The override value should be the current live process density value unless the operator's procedures dictate otherwise.
11	Isolate, depressurize, and drain the device piping.	This step follows the operator's procedures.
12	Remove the densitometer from the pipeline if necessary.	This step follows the operator's procedures.
13	Perform all inspection, cleaning, and repairs as required.	Repairs are performed per the manufacturer's and the operator's procedures.
14	Reinstall densitometers in the pipeline and ensure that the orientation is correct for product flow, as applicable.	This step follows the operator's procedures.
15	Remove isolation measures, purge the piping, and fill the piping with product.	Following the manufacturer's procedure for start-up ensures that damage does not occur to the densitometers.
16	Perform a densitometer loop integrity check.	This step inspects for leaks and verifies that the densitometer is ready for service.
17	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication provides notification to personnel that the densitometer commissioning and start-up activities begin.
18	Remove the override density value at the end device per the operator's procedure.	A live density value must be observed to perform a pycnometer calibration.
19	Perform a pycnometer calibration (see Steps 4 to 6).	After performing maintenance, this step repeats the pycnometer calibration to generate a new DCF.
20	Document repair results per the operator's procedures.	This step documents the results per the operator's procedures.

Task 44.8—Inspect, Test, and Maintain Temperature Transmitters for Hazardous Liquid Leak Detection

1.0 Task Description

This task involves the inspection, testing, and maintenance activities (including calibration) performed on a temperature transmitter associated with a hazardous liquid leak detection system. This purpose of this task is to ensure that the equipment and associated output signals are functioning properly and are adequate for their intended purpose. This task begins with identifying and verifying the temperature transmitter to be inspected, tested, and/or maintained and ends with appropriate notifications that the temperature transmitter returned to a normal operating condition.

Elements of this task may include the following:

— verify that all calibration equipment certifications are valid and have not expired,

— inspect the physical and mechanical condition and function,

— conduct tests to determine if the output values are within agreed tolerances,

— calibrate a transmitter to the proper input and output range values,

— document all results—input and output range values “as found” and “as left.”

Inspect, Test, and Maintain a Flow Computer for Hazardous Liquid Leak Detection is a separate covered task (reference Task 44.3).

Operate Valves Locally 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.

— Operation and proper use of test equipment used to perform the functions required in this task. Common test equipment can include the following:

  — smart communicators,

  — volt/ohm/amp multimeters,

  — decade box,

  — resistance thermal device (RTD) simulator,

  — certified thermometers (digital and analog),

  — multifunction calibrators.

— Operation and safe handling of electrical systems (i.e. voltage applied to the device, electrical requirements, and connection of test equipment to the device to test).

— Control instrumentation for the process system (i.e. knowing the alarm, control, indication, and recording functions of the device in the process system).

Terms applicable to this task are as follows.

alarm
A SCADA- or HMI-generated visual and/or audible indication that an operating parameter has been exceeded.

end device
A device that receives and processes data from field equipment. Some examples of end devices include PLC, HMI, SCADA, and flow computers.

temperature sensor
An ancillary component of a transmitter that outputs a signal. The temperature transmitter receives and processes this signal to determine an accurate temperature value. Some examples of temperature sensors include the following:

— RTD,

— thermocouple (voltage).

temperature transmitter range and span functions
A device output signal that can be adjusted by the operator to a different span and range of temperature.

test equipment calibration
Process used to determine that test equipment is within its calibration period and accuracy.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
The transmitter is found in an inoperable condition or does not communicate to the end device.	Notify the control center or the appropriate personnel to take appropriate action.

3.0 Skill Component

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

Step	Action	Explanation
1	Verify the device number/nameplate data.	This step uses the appropriate operator's documentation to verify the correct device. This step is crucial in verifying that the temperature transmitter output display and/or the correct alarm tag will be activated.
2	Confirm that test equipment has been certified, calibrated, and verified prior to performing device calibration.	Test equipment (i.e. multimeters, multifunction calibrators, thermometers) must have a valid certification of calibration and be appropriate for the intended calibration range.
3	Verify the required device input and output range values for the transmitter and the end device prior to performing testing or calibration.	Engineering analysis of design criteria establishes the input and output range values of a temperature transmitter. This step includes consulting the operator's documentation to determine the proper device range.
4	Notify the control center, local operations (if applicable), and any affected personnel prior to performing any test per the operator's procedures.	The control center and local operations (if applicable) must be notified that the temperature transmitter is tested or calibrated. The control center may be required to validate the following: — receipt/initiation of an alarm, — SCADA/HMI display value, — transmitter device number corresponds to SCADA/HMI display ID. If the temperature transmitter is part of an automated shutdown or flow relief system, the control center or local operations may be required to override automation to prevent unintended operations.

Step	Action	Explanation
5	Visually inspect the temperature transmitter per the operator's procedure.	Visual inspection of the transmitter and associated equipment includes the following: — physical/mechanical condition, — corrosion, — leakage, — electrical connections (if applicable).
6	To perform a verification test, install a certified thermometer in the test well with product flowing.	This step obtains an accurate reference temperature. Product flow is necessary to ensure that a consistent temperature is obtained between the test well and the transmitter sensor well.
7	Compare the reference temperature to the transmitter output and end device temperature values.	This comparison determines if the output values are within the agreed upon tolerances per the operator's documentation. This comparison also determines if a calibration of the transmitter and/or the end device is required.
8	Document "as found" results.	This step documents the results per the operator's procedures.
9	To perform calibration, override the temperature value at the end device per the operator's procedure.	This step provides a temporary temperature value input to the hazardous liquid leak detection system in order to maintain accurate measurement during the test and calibration activities. The override value should be the current live process temperature value unless the operator's procedures dictate otherwise.
10	Disconnect the sensor input connections.	
11	Connect the test equipment using the manufacturer's and the operator's procedures.	The test equipment is used to simulate sensor input.
12	Confirm the transmitter configuration and range values obtained in Step 3.	
13	Apply the simulated sensor input values through the desired test range and adjust the device settings using the manufacturer's and the operator's procedures.	This step repeats the calibration procedure, as necessary, to verify the proper calibration and to establish repeatability.
14	Remove the test equipment and reconnect the sensor input connections.	
15	Remove the override temperature value at the end device (Step 9) per the operator's procedure.	
16	Perform a verification test (Step 7) and determine if a sensor trim adjustment is required.	The sensor trim adjustment compensates for any slight discrepancies between the sensor actual and sensor nominal values. Perform sensor trim adjustment using the manufacturer's and the operator's procedures.
17	Document "as left" results.	This step documents "as left" results per the operator's procedure.
18	Return the device to normal operating condition per the manufacturer's and the operator's procedures.	
19	Notify the control center, local operations (if applicable), and any affected personnel per the operator's procedures.	This communication notifies the appropriate personnel that the device is ready for normal operation.

Task 63.1—Perform Start-up of a Liquid Pipeline (Field)

1.0 Task Description

The purpose of this task is to safely start up a pipeline and achieve steady state operation.

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.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Shutdown of a Liquid Pipeline (Field) (reference Task 63.2).

— Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Field) (reference Task 63.3).

2.0 Knowledge Component

This task involves the start-up of any pipeline system in a manner designed to assure safe operation.

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

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Terms applicable to this task are as follows.

alarm
SCADA- or HMI-generated visual or audible alert that indicates an operating parameter has been exceeded. An alarm receipt requires 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 accepts and implements control instructions. Typically, information is displayed in a graphic format.

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 are 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.

maximum operating pressure
MOP
MOP 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;

— 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Activation of a Safety Device—Pressure-relief, emergency/abnormal shutdown, high-pressure shutdown, case pressure/temperature shutdown, etc. 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. Make appropriate notifications.
Communications, Control System, or Power Interruption or Failure—Loss of SCADA communication to control room or electrical services.	Ensure that backup systems are activated. Follow troubleshooting procedures and take appropriate action to mitigate the situation. Make appropriate notifications.
Flow Rate Deviation (Unexplained)—High flow, low flow, or no flow. 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. Make appropriate notifications.
Pressure Deviation (Unexplained)—Pressure increase, decrease, or lack of pressure reading. 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. Make appropriate notifications.
Status Change (Unintended)—Changes in unit status or valve position. 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. 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 or appropriate operating personnel to verify that sufficient capacity at the receipt/delivery points exists.	Confirms action with control room or appropriate operations personnel prior to start-up.
2	Verify with the control room or appropriate operating personnel that the intended flow path is configured in accordance with applicable operating procedures.	Verification may include local piping alignment and/or 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 or appropriate operations personnel to verify that it has assumed control of the operation OR continue monitoring system according to company procedures.	

Task 63.2—Perform 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. This task ends when the shutdown is complete, the target static/steady state has been achieved, and the control room or appropriate operating personnel have been notified.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Monitor Pressures, Flows, Communications, and Line Integrity and Maintain Them Within Allowable Limits on a Liquid Pipeline System (Field) (reference Task 63.3).

2.0 Knowledge Component

The purpose of this task is to safely shut down a pipeline.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

alarm
SCADA- or HMI-generated visual or audible alert that indicates an operating parameter has been exceeded. An alarm receipt requires 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 accepts and implements control instructions. Typically, information is displayed in a graphic format.

maximum operating pressure
MOP
MOP 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 may impact shutdown operations. Pipeline hydraulics may be affected by the following:

— elevation profile of the given pipeline;

— operational changes, including start-ups and shutdowns.

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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Activation of a Safety Device—Pressure-relief, emergency/abnormal shutdown, high-pressure shutdown, case pressure/temperature shutdown, etc. 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. Make appropriate notifications.
Communications, Control System, or Power Interruption or Failure—Loss of HMI communication to control room or electrical services.	Ensure that backup systems are activated. Follow troubleshooting procedures and take appropriate action to mitigate the situation. Make appropriate notifications.
Flow Rate Deviation (Unexplained)—High flow, low flow, or no flow. 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. Make appropriate notifications.
Pressure Deviation (Unexplained)—Pressure increase, decrease, or lack of pressure reading. 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. Make appropriate notifications.
Status Change (Unintended)—Changes in unit status or valve position. 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. 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 or the appropriate operating personnel of the impending shutdown.	Allows the control room or appropriate operations personnel to confirm shutdown.
2	Identify which pumping units will be shut down, if any.	
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.	
6	Communicate with the control room or the appropriate operations personnel to confirm that the pipeline shutdown has been completed.	

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 the start-up or shutdown of the pipeline begins.

The performance of this covered task may require the performance of other covered tasks such as the following.

— Operate Valves Remotely on a Liquid Pipeline System (reference Task 43.4).

— Operate Valves Locally on a Liquid Pipeline System (reference Task 63.4).

This task does not include but may lead to the performance of other covered tasks such as the following.

— Perform Start-up of a Liquid Pipeline (Field) (reference Task 63.1).

— Perform Shutdown of a Liquid Pipeline (Field) (reference Task 63.2).

2.0 Knowledge Component

The purpose of this task is to ensure steady state operations are maintained within specified operating limits.

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

This section intentionally left blank.

Terms applicable to this task are as follows.

alarm
SCADA- or HMI-generated visual or audible alert that indicates an operating parameter has been exceeded. An alarm receipt requires 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 accepts and implements control instructions. Typically, information is displayed in a graphic format.

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 are 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.

maximum operating pressure
MOP
MOP 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;

— 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.

AOCs associated with the performance of this task include the following.

AOC Recognition	AOC Reaction
Activation of a Safety Device—Pressure-relief, emergency/abnormal shutdown, high-pressure shutdown, case pressure/temperature shutdown, etc. 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. Make appropriate notifications.
Communications, Control System, or Power Interruption or Failure—Loss of SCADA communication to control room or electrical services.	Ensure that backup systems are activated. Follow troubleshooting procedures and take appropriate action to mitigate the situation. Make appropriate notifications.
Flow Rate Deviation (Unexplained)—High flow, low flow, or no flow. 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. Make appropriate notifications.
Pressure Deviation (Unexplained)—Pressure increase, decrease, or lack of pressure reading. 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. Make appropriate notifications.
Status Change (Unintended)—Changes in unit status or valve position. 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. Make appropriate notifications.

3.0 Skill Component

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

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.	Each pipeline has its own normal operating parameters. If operating limits are not set appropriately, safe operating parameters may be exceeded.
3	Monitor operating information such as alarms, trending, pressure, flow rates, rate of change, 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.	
5	Communicate, as necessary, with field personnel, 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.

Task 63.4—Operate Valves Locally 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.

Operate Valves Remotely 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 overpressured 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.

AOCs associated with the performance of this task include the following.

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. Reactions could include the following: — shutting down the system (if qualified), — returning the valve to its original position, — operating an appropriate valve, — isolating damaged equipment, — making appropriate notifications.
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. Reactions could include the following: — shutting down the system (if qualified), — returning the valve to its original position, — operating an appropriate valve, — isolating damaged equipment, — 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. EXAMPLES — Valve indicator does not show the intended position. — Unexpected pressure and flow outcomes. — Inoperable operator/actuator or hand wheel. 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. Reactions could include the following: — retry operation, — relieve excessive differential pressure, — shut down system (if qualified). 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. 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.

Annex C
(informative)

Evolution of the Covered Tasks

This section left intentionally blank for future use.

Annex D
(informative)

Testing and Evaluation Guidance

D.1 Purpose

The purpose of this annex is to provide guidance for uniform administration of knowledge testing and performance evaluation to support OQ.

D.2 Objective

D.2.1 General

Knowledge testing and performance evaluation methods should be subject to well-documented internal controls and processes to ensure proctor and evaluator personnel are qualified and the programs they deliver are regularly monitored. If training is used as part of the candidate's qualification process, then the scope, objective, and method of training needs to be defined in the provider's program. Audits by third parties may be performed to ensure a check and balance on program conformance.

In this annex, self-audit checklists are outlined and provided for:

— internal controls,

— test administration personnel,

— knowledge and skill measurements,

— security,

— audits.

D.2.2 Internal Controls

The checklist for internal controls is identified in Table D.1.

Table D.1—Internal Controls Checklist

SELF-CHECK √ ❒ Are there documented processes for: o Test administration personnel ▪ Evaluator ▪ Proctor o Knowledge and skill measurements ▪ Knowledge testing ▪ Evaluation process ▪ Training o Security ▪ Test security ▪ Record control o Audit process	❒ If Yes, o What processes are documented? o Who is the custodian? o Where are the documents retained? o How is security/integrity maintained? o What is the review cycle? o Is there version control? ❒ If No, o How are controls over processes maintained?

D.2.3 Test Administration Personnel

D.2.3.1 Evaluator

The checklist for evaluators is identified in Table D.2.

Table D.2—Test Administration Personnel—Evaluator

SELF-CHECK √ ❒ Is there an established requirement for experience?	❒ If Yes, o How is relevant experience validated? ▪ Examples: résumé, references, certification, etc. ❒ If No, o How is experience validated?
❒ Is there an established requirement for knowledge?	❒ If Yes, o What are the requirements? ▪ Examples: trade school diploma, other education, etc. ❒ If No, o How is knowledge validated?
❒ Is there an established process for recertification or refresher training?	❒ If yes, o What is the process? ❒ If No, o How is continued acceptable knowledge ensured?
❒ Are responsibilities of the evaluator clearly established in the policies and procedures documents?	❒ If Yes, o How are they conveyed to the evaluator? ❒ If No, o How are the evaluator's responsibilities established and conveyed?
❒ Are there policies and procedures in place to address evaluator misconduct?	❒ If Yes, o What are the policies/procedures? ❒ If No, o How is misconduct addressed?

D.2.3.2 Proctor

The checklist for proctors is identified in Table D.3.

Table D.3—Test Administration Personnel—Proctor

SELF-CHECK √ ❒ Is there an established requirement for knowledge of the test administration process?	❒ If Yes, o What is the requirement? ▪ Training ▪ Proctor procedures ❒ If No, o How are the requirements and processes validated?
❒ Are responsibilities of the proctor clearly established in the policies and procedures documents?	❒ If Yes, o How are these responsibilities conveyed to the proctor? ❒ If No, o How are the proctor's responsibilities established and conveyed?

D.2.4 Knowledge and Skill Measurements

D.2.4.1 Knowledge Testing

The checklist for knowledge testing is identified in Table D.4.

Table D.4—Knowledge Testing

SELF-CHECK √ ❒ Is there a test development and ongoing validation process?	❒ If Yes, o What is the test development process? ▪ Examples: Industry standards, vetted by subject matter experts, reviewed, ongoing item review, item performance statistics, etc. ❒ If No, o How were the tests developed?
❒ Are there written processes in place for test administration?	❒ If Yes, o What are the methods for delivery? ▪ Examples: computer based, paper based, item randomization, etc. ❒ If No, o What are the processes?
❒ Is there a retesting process?	❒ If Yes, o What is the process? ▪ Example: waiting period for retesting ❒ If No, o How is retesting addressed?
❒ Is there a process in place for candidates to challenge test questions?	❒ If Yes, o What is this process? ❒ If No, o How is fairness to the test candidate and accuracy of the test questions ensured?
❒ Is remediation for testing available?	❒ If Yes, o What is the remediation process? ❒ If No, o How is remediation addressed?

D.2.4.2 Evaluation Process

The checklist for the evaluation process is identified in Table D.5.

Table D.5—Evaluation Process

SELF-CHECK √ ❒ Is there an established evaluation process?	❒ If Yes, o What is the process? ❒ If No, o How are evaluations conducted?
❒ Is there an evaluation development and ongoing validation process?	❒ If Yes, o What is the process? ▪ Industry standard/criteria ▪ Internal/external subject matter expert validation ▪ Manufacturer's guidelines ▪ Operator-specific material ❒ If No, o How are the evaluation materials developed?
❒ Are there criteria for determining successful task performance?	❒ If Yes, o What are these criteria? ❒ If No, o How is successful performance assessed?
❒ Is there a reevaluation process for failed evaluation and/or after period of nonperformance?	❒ If Yes, o What is the process? ❒ If No, o How is reevaluation addressed?
❒ Is there a reevaluation process for significant changes to procedures or specifications that impact the performance of a covered task?	❒ If Yes, o What is the process? ❒ If No, o How is reevaluation addressed?

D.2.4.3 Training for Individuals Performing Covered Tasks

The checklist for training is identified in Table D.6.

Table D.6—Training

SELF-CHECK √ ❒ Is there training available for each covered task?	❒ If Yes, o How are the training materials developed? o How is training conducted? ▪ Examples: instructor led; self-paced (distance/computer); OJT ▪ If instructor led, how are the relevant knowledge, skills and abilities of the instructor determined? ❒ If No, o How does the candidate obtain the necessary knowledge and skills prior to the testing and performance evaluation?
❒ Is there a process to address significant changes that impact the performance of a covered task?	❒ If Yes, o What is the process? o Is a knowledge and/or performance assessment necessary to validate? ❒ If No, o How does the candidate obtain the necessary knowledge and skills?

D.2.5 Security

D.2.5.4 Test Security

The checklist for test security is identified in Table D.7.

Table D.7—Test Security

SELF-CHECK √ ❒ Is there a process in place to protect the security of test items and test material?	❒ If Yes, o What measures are taken to maintain security of testing materials? ❒ If No, o How is the security of testing materials maintained?
❒ Is there a process in place to maintain the security of the test development material?	❒ If Yes, o What measures are taken to maintain security of development materials? ❒ If No, o How is the security of the development materials maintained?

D.2.5.5 Record Control

The checklist for record control is identified in Table D.8.

Table D.8—Record Control

SELF-CHECK √ ❒ Is there a system in place for securing sensitive information?	❒ If Yes, o What measures are used to ensure the security of sensitive information? ❒ If No, o How is security maintained?
❒ Is there a secure records management system in place for qualification records?	❒ If Yes, o Who has access? o What type of recordkeeping system is used? o What is the process for entering records into the recordkeeping system? ❒ If No, o How are qualification records maintained?
❒ Is there a data protection system?	❒ If Yes, o What is the process for data backup? o What is the frequency? ❒ If No, o How is the data protected?

D.2.6 Audit

The checklist for audits is identified in Table D.9.

Table D.9—Audits

SELF-CHECK √ ❒ Is there an audit process in place to ensure processes and/or procedures are followed?	❒ If Yes, o What processes and procedures are audited? o How are objectivity and validity of the audit processes ensured? ❒ If No, o What methods are used to ensure processes and procedures are followed?

Annex E
(informative)

Program Effectiveness Guidance

E.1 Purpose

An OQ program may include methods by which the program is measured for continued effectiveness. The purpose of this annex is to provide guidance in establishing a written process for measuring the OQ program's effectiveness.

Concepts of the "Plan–Do–Check–Act" principles outlined in API 1173 were utilized as a framework for this document.

E.2 Terms and Definitions

E.2.1
program effectiveness
The extent to which planned activities are completed and planned results achieved.

E.3 "Plan–Do–Check–Act" as Applied to Program Effectiveness

E.3.1 Plan

E.3.1.1 General

Establish objectives and processes necessary to measure and deliver results in accordance with the organization's policies and expected goals for its OQ program.

While not specifically required by the regulation, an operator may consider using this annex as a guide when developing processes for periodic review of the written OQ program and auditing program implementation. Operators should determine the process for incorporating program improvements based on the findings.

E.3.1.2 Plan Objectives

Program effectiveness objectives and processes should:

— support execution of the plan;

— address regulatory and legislative requirements;

— ensure that data, results, and findings are shared across relevant employees and contractors; and

— be supported by sufficient resources to design, implement, monitor, and improve the plan.

E.3.1.3 Plan Checklists

E.3.1.3.1 General

An operator may refer to the following checklists when developing program effectiveness processes.

E.3.1.3.2 Records Management Checklist

- ❑ Is the management of your documentation in accordance with your plan?
  - ❑ Do the records conform to the operators' record retention policy?
- ❑ Are the documents complete, accurate, and verified for adherence with your plan?

E.3.1.3.3 Stakeholder Feedback Checklist

- ❑ Do your employees and evaluators have a way for providing feedback?
- ❑ Is feedback received from evaluators, employees, contractors, other affected individuals, and governing agencies reviewed regarding the following?
  - ❑ Training.
  - ❑ Evaluation issues.
  - ❑ Procedural issues.
  - ❑ AOC recognition and reaction.

E.3.1.3.4 On-site/Field Review Checklist

- ❑ Are the responsibilities of individuals under the qualification program clearly and formally defined?
- ❑ Are covered tasks being completed by qualified individuals or by nonqualified individuals being directed and observed by a qualified individual within the qualification program's span of control?
- ❑ Are covered tasks being performed using the appropriate procedures?
- ❑ Are evaluations being performed using approved methods and evaluators?

E.3.1.3.5 OQ Program Review Checklist

- ❑ Are the individuals involved in the qualification program properly trained to perform their duties as stated in the OQ program?
  - ❑ Individuals conducting training and evaluations.
  - ❑ Individuals performing OQ covered tasks.
- ❑ Is the OQ program reviewed periodically and updated using data and information gained from policies and procedures, inspections and testing, integrity-related work, and incident investigations?
- ❑ Are suspended and revoked qualifications being managed as stated in the qualification program?

- ❑ Are changes to the qualification processes being communicated and implemented according to the qualification program?
  - ❑ How are the methods of evaluation deemed effective to measure individual qualifications? (Reference Annex D of this document.)
  - ❑ Have the knowledge and skills (KS) being measured been adequately determined for the specific covered task? (Reference Annex D of this document.)
    - ❑ When changes are made to a covered task, which can include a KS component, are they communicated:
      - ❑ internally?
      - ❑ to contractors?
      - ❑ to third-party service providers?
  - ❑ When changes are made to a covered task or KS, are qualification materials evaluated for changes to the applicable training or evaluation?
  - ❑ Are subsequent qualification intervals evaluated for effectiveness?

E.3.1.3.6 Evaluator Review Checklist

- ❑ Is the evaluator competent in the covered tasks they are evaluating?
- ❑ Is the evaluator trained on evaluation methods, ethics, and documentation responsibilities?
- ❑ Is the evaluator properly conducting evaluations according to the operator's OQ program requirements?

E.3.1.3.7 Inspection Feedback Checklist

- ❑ Is internal inspection feedback evaluated?
- ❑ Is regulatory inspection feedback evaluated?

E.3.1.3.8 Third-party Data Providers Checklist

- ❑ Are third-party certifications (e.g. NACE, ASNT, etc.) evaluated for compliance with the knowledge and skills requirements of corresponding covered task qualifications?
- ❑ Do the evaluation methods of third-party providers conform to the guidance provided in Annex D of API 1161?
- ❑ Do the evaluation methods of third-party providers conform to your plan?

E.3.1.3.9 Incident Review Checklist

- ❑ Are reviews of events or actions involving an OQ covered task that adversely affects the operations or integrity of the pipeline conducted?
- ❑ In the case of an incident investigation, are there policies and procedures in place to impose suspensions and/or revoke qualifications on those who contribute to incidents/accidents?

- ❑ If the incident was related to a qualified individual inadequately directing and observing a nonqualified individual or more than one covered task:
  - ❑ was the responsible person familiar with the span of control requirements?
  - ❑ was the responsible person qualified in those tasks he/she directed and observed under span of control?
- ❑ If the incident was related to span of control not being followed, was the ratio of qualified-to-unqualified individuals communicated?
- ❑ If the incident was related to the qualified individual directing and observing more than one covered task at the same time, was the individual aware of the span of control requirements?
- ❑ If the incident was related to deficiencies in knowledge for the specific covered task, was training provided on that covered task?
- ❑ If the incident was related to an individual improperly or not using appropriate equipment:
  - ❑ Was the equipment specified?
  - ❑ Did the individual receive equipment-specific training?
  - ❑ Was the appropriate equipment used?
- ❑ If the incident was related to the individual failing to recognize or taking appropriate action during an AOC, was the AOC incorporated into the evaluation and training process?
- ❑ If the incident was related to the individual not taking appropriate action following recognition of an AOC, was the AOC incorporated into the evaluation and training process?

E.3.2 Do

Implement program effectiveness plan.

Execute the processes as designed in the planning step above.

E.3.3 Check

Review results compared with established objectives.

Program effectiveness results should provide adequate measures to:

— determine whether the operator's OQ program is meeting its intended goals,

— identify gaps and deviations as compared to established goals and objectives to provide opportunities for improvement.

E.3.4 Act

E.3.4.1 General

Take actions to continually improve process performance, including corrective actions between actual and planned results; analyze the differences to determine their root causes; and determine where to apply changes that will include improvement of the process or product.

E.3.4.2 Actions Checklist

- ❑ How are deficiencies identified in the program communicated to those responsible for managing the program?
- ❑ How are deficiencies validated and tracked for closure?
- ❑ How is performance communicated to management and program administrators?
- ❑ Is there a process in place for improvements to be added and implemented?

Annex F
(informative)

Management of Change Guidance

F.1 Scope

This guidance addresses considerations for:

— how operators manage changes to procedures, tools, standards, and other changes to the OQ program;

— how these changes are incorporated into the qualification and evaluation methods for individuals performing covered tasks;

— the methods employed to communicate changes to the individuals performing covered tasks, whether operator employees or contractors.

F.2 Purpose

The rule [49 *CFR* § 192.805(f)/195.505(f) Qualification Program] requires that the operator communicates changes that affect covered tasks to individuals performing those covered tasks. To perform this effectively, the operator must have a change management methodology so that it knows when changes are occurring, what changes have an impact on covered task performance, the relative significance of the change and how it affects the continued qualification of individuals, and mechanisms to effectively communicate changes to qualified individuals.

The purpose of this annex is to provide guidance for uniform administration of a management of change process for operator qualifications programs. Consideration of the following characteristics is important to determine whether the requirements of the rule have been met.

F.2.1 Identification of the methods used to communicate changes to affected individuals.

F.2.2 Means of ensuring that affected personnel are kept up-to-date on current requirements of the OQ program.

F.2.3 Changes to the OQ plan and revisions to the plan are made and communicated to affected stakeholders

F.3 Management of Change Considerations

Does the operator's OQ program identify how changes to procedures, tools, standards, and other elements used by individuals in performing covered tasks are communicated to the individuals, including contractor individuals, and how these changes are implemented in the evaluation method(s)?

F.3.1 The types of changes that a management of change procedure addresses may include:

— technology,

— equipment,

— procedural, and

— organizational.

Consideration should be made for both permanent or temporary changes. The process should incorporate planning for the effects of the change for each of these situations.

F.3.2 Does the operator's program identify changes that affect covered tasks and how those changes are communicated, when appropriate, to affected individuals?

F.3.3 Does the operator's program identify and incorporate changes that affect covered tasks?

F.3.4 Does the operator's program include provisions for the communication of changes (e.g. who, what, when, where, and why) in the qualification program to the affected individuals?

F.3.5 Does the operator incorporate changes into initial and subsequent evaluations?

F.3.6 Are contractors supplying individuals who perform covered tasks for the operator notified of changes that affect task performance and thereby the qualification of these individuals?

F.3.7 Operators must consider how changes to their O&M procedures, systems, and equipment may affect their OQ program.

F.3.8 The operator should periodically identify changes that need to be communicated to its workers and addressed in its OQ program.

F.3.9 The operator should ensure the person responsible for managing the OQ program is:

— aware of the need and the importance of ensuring qualified personnel are prepared for changed conditions,

— communicating changes affecting covered tasks to the individuals who perform the task,

— fully aware of the written OQ program provisions to address and manage changes to its systems,

— adjusting evaluations for affected tasks if changes have occurred that trigger this provision.

Annex G
(informative)

AOC Guidance

G.1 Purpose

This annex provides guidance to identify AOCs for inclusion in the AOC section of individual covered task standards.

Operators can use all, part, or none of this method to identify AOCs, as alternative and equally valid methods exist.

G.2 Objective

Annex B includes a set of normative covered task standards that may be adopted by the operator as part of their qualification program. Each covered task standard includes a section that documents AOCs specific to the performance of the covered task that should be evaluated when individuals are being qualified to perform the work described in the covered task standard.

Guidance is provided to distinguish AOCs from emergencies, abnormal operations (AOs), and safety-related conditions (SRCs), which are other U.S. regulatory terms that should not be confused with AOCs. Guidance is also provided to eliminate potential AOCs that are listed as a task step, related to improper task performance, or are generic in nature and not directly related to the task being performed.

G.3 Terms and Definitions

For the purposes of this annex, the following definitions apply.

G.3.1
component (gas)
Any part of a pipeline that may be subjected to operating pressure including, but not limited to, pipe, valves, elbows, tees, flanges, and closures.

G.3.2
component (liquids)
Any part of a pipeline that may be subjected to pump pressure including, but not limited to, pipe, valves, elbows, tees, flanges, and closures.

G.3.3
pipeline condition
A circumstance that affects the appearance, quality, or working order of a pipeline, pipeline component, or the pipeline system.

G.3.4
pipeline (gas)
All parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenance attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies.

G.3.5
pipeline or pipeline system (liquids)
All parts of a pipeline facility through which a hazardous liquid or carbon dioxide moves in transportation, including, but not limited to, line pipe, valves, and other appurtenances connected to line pipe, pumping units,

fabricated assemblies associated with pumping units, metering and delivery stations and fabricated assemblies therein, and breakout tanks.

G.4 AOCs

G.4.1 General

An AOC is defined in Section 3 of this document.

G.4.2 Distinguishing Between Emergencies and AOCs

The U.S. regulatory framework requires operators to establish procedures that govern the response to emergencies. Emergencies are defined for liquids pipelines in 49 *CFR* § 195.402(e)(2) and gas pipelines in 49 *CFR* § 192.615(a)(3) and are below.

For liquids pipelines:

— fire or explosion occurring near or directly involving a pipeline facility;

— accidental release of hazardous liquid or carbon dioxide from a pipeline facility;

— operational failure causing a hazardous condition; and

— natural disaster affecting pipeline facilities.

For gas pipelines:

— gas detected inside or near a building;

— fire located near or directly involving a pipeline facility;

— explosion occurring near or directly involving a pipeline facility; and

— natural disaster.

Emergencies are different than AOCs and AOs. Emergencies involve significant consequences that cannot be easily addressed or resolved. Investigation after an AOC or an AO is identified may lead to the discovery of an emergency, but once identified, the response to the emergency must follow an established emergency procedure.

An emergency should not be identified as an AOC.

G.4.3 Distinguishing Between AOs and AOCs

The U.S. regulatory framework distinguishes between an AOC and an abnormal operation (AO). Operators are mandated to have procedures in place by 49 *CFR* § 195.402(d)(1) for liquids pipelines and 49 *CFR* § 192.605(c)(1) for gas pipelines for abnormal operations.

AO procedures describe how an operator will respond to, investigate, and correct the cause of the following events to provide safety when operating design limits have been exceeded:

— unintended closure of valves or shutdowns;

— increase or decrease in pressure or flow rate outside normal operating limits;

— loss of communications;

— operation of any safety device; or

— any other malfunction of a component, deviation from normal operation, or personnel error that could cause a hazard to persons or property.

The key distinction that should be made when interpreting between an AOC and an AO is related to the final bullet point listed above. An AOC is a *condition* that *may indicate* a malfunction of a component or deviation from normal operations, whereas an AO would *require* a malfunction of a component or a deviation from normal operation to have occurred before it can be realized. Put another way, an AOC is an observation that something may be wrong and further investigation is warranted, whereas an AO occurs when something has gone wrong, and an established procedure must be followed to mitigate the consequence and prevent a potential emergency. Investigating an AOC may lead to the discovery of an AO.

Both AOCs and AOs are designed to prepare staff to recognize and react to abnormal situations, but they are distinguished by the degree of evidence that is available to the observer and the level of procedural control each operator must establish to guide the response.

AOs should not be identified as an AOC.

G.4.4 Distinguishing Between SRCs and AOCs

The U.S. regulatory framework has established a series of SRCs that must be reported to the Office of Pipeline Safety (OPS). SRCs are listed in 49 *CFR* § 195.55(a) for liquids pipelines and 49 *CFR* § 191.23 for gas pipelines.

SRCs are related to reporting and overlap exists with AOs and emergencies. However, all SRCs involve the identification of an actual malfunction of a component or an actual deviation from normal operations that preclude them from meeting the definition of an AOC.

SRCs should not be identified as an AOC.

G.4.5 Distinguishing Between Task Steps and AOCs

Conditions observed as a result of performing a task step that specifically instructs an individual to identify the condition should not be identified as an AOC. The task step explanation should be written to provide the individual with sufficient direction to react appropriately.

For example, Task 15.1 (Perform Visual Inspection of Surface Conditions of Right-of-way) includes a task step directing the individual to "*perform the visual inspection/patrol of the right-of-way*." If in the course of doing so, the individual identifies conditions such as stained soil, dead vegetation, or pipeline damage, the task explanation requires them to make proper notification.

When the purpose of the task step is to identify specific conditions, the conditions should not be identified as an AOC.

G.4.6 Distinguishing Between Failure to Correctly Perform Tasks and AOCs

Operators are required to qualify individuals to correctly perform covered tasks. Failure by an individual to properly perform a covered task is a qualification issue.

A potential mode of task performance failure should be addressed as part of the qualification process and should not be identified as an AOC.

G.5 Identifying AOCs

Figure G.1 depicts the recommended process to identify AOCs. Table G.1 provides guidance on the decisions and actions listed in the process as they relate to the regulatory interpretation provided in this annex.

Figure G.1—AOC Identification Process

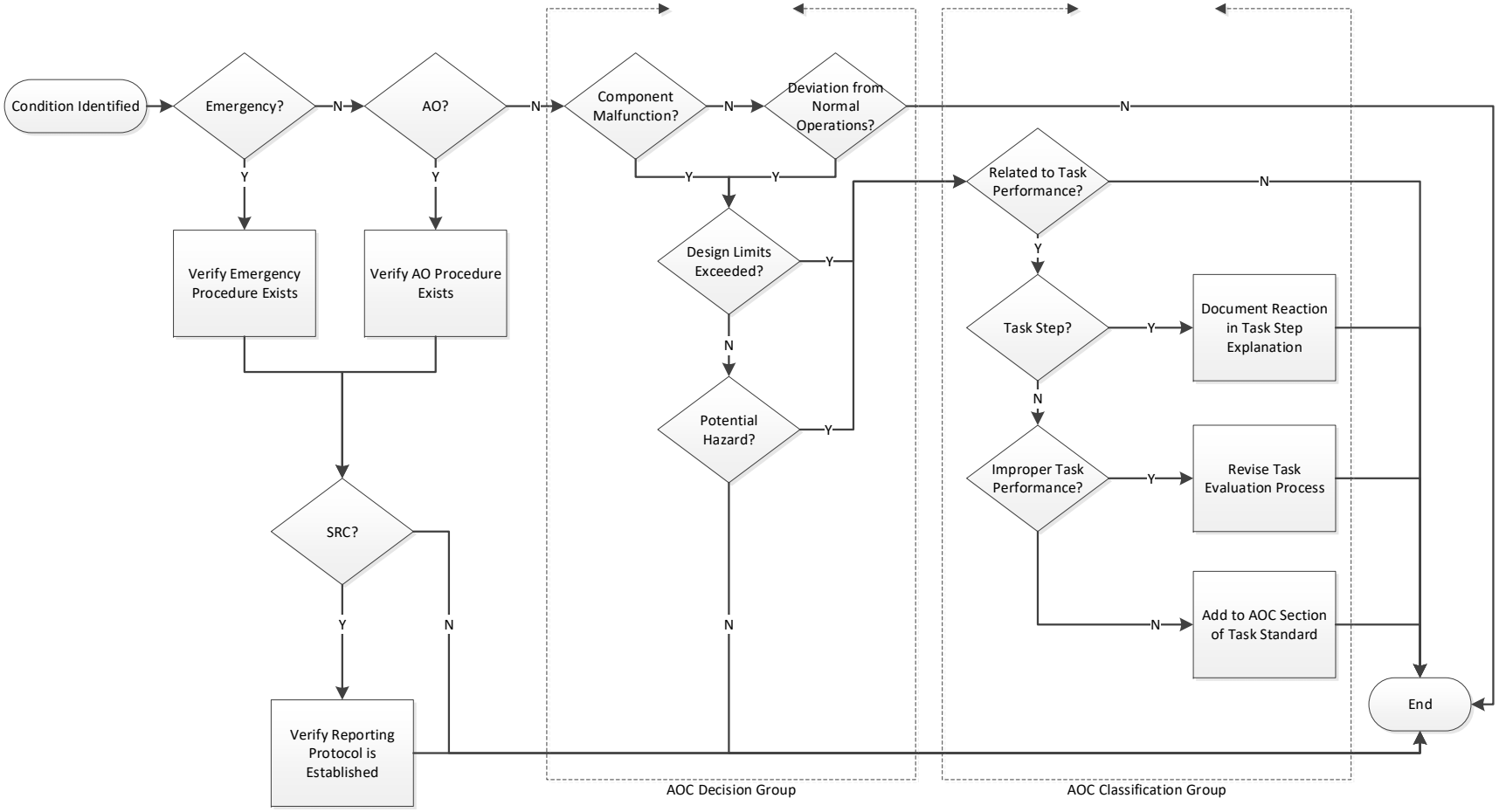

Table G.1—AOC Identification Process Description

	Step	Explanation
	Condition Identified	The process begins with the identification of a "pipeline condition" as defined in G.3.3.
	Emergency Decision — If yes, then "Verify Emergency Procedure Exists" and proceed to SRC decision. — If no, then proceed to AO decision.	If the condition meets the definition of an emergency, then it is not an AO or an AOC. Operators should verify an emergency procedure exists to guide response to the condition.
	AO Decision — If yes, then "Verify AO Procedure Exists" and proceed to SRC decision. — If no, then proceed to AOC Decision Group.	If the condition meets the definition of an AO, then it is not an AOC. Operators should verify an AO procedure exists to guide response to the condition.
	SRC Decision — If yes, then "Verify Reporting Protocol Is Established." — If no, then further action is not required.	SRCs should be reported to the OPS. Operators should verify a process exists to facilitate timely reporting when required.
AOC Decision Group	Component Malfunction or Deviation from Normal Operations Decision — If yes to either question, then proceed to "Design Limits Exceeded" decision. — If no, then further action is not required.	For the condition to be deemed an AOC, it should indicate a malfunction of a component or a deviation from normal operations may have occurred.
	Design Limits Exceeded or Potential Hazard Decision — If yes, then proceed to AOC Classification Group. — If no, then further action is not required.	For the condition to be deemed an AOC, it should also indicate that design limits may have been exceeded or that it may result in a hazard(s) to persons, property, or the environment.
AOC Classification Group	Related to Task Performance Decision — If yes, proceed to "Task Step" decision. — If no, then further action is not required.	AOCs not directly related to work being performed should not be in individual task standards
	Task Step Decision — If yes, then "Document Reaction in Task Step Explanation." — If no, then proceed to "Improper Task Performance" decision.	Conditions observed as a direct result of performing a task step should not be considered an AOC. The task step explanation should document the appropriate reaction.
	Improper Task Performance Decision — If yes, then "Revise Task Evaluation Process." — If no, then "Add to AOC Section of the Task Standard."	Failure to properly perform a covered task is a qualification issue and not an AOC. ***AOCs that remain after this step should be included in the AOC table of the appropriate task standard(s).***
	End	The process concludes after the identified condition has been appropriately classified.

Bibliography

[1] API Recommended Practice 1173, *Pipeline Safety Management Systems*

[2] API Standard 2510, *Design and Construction of LPG Installations*

[3] NACE No. 1/SSPC-SP5 [6], *White Metal Blast Cleaning*

[4] NACE No. 2/SSPC-SP10, *Near-White Metal Blast Cleaning*

[5] NACE No. 3/SSPC-SP6, *Commercial Blast Cleaning*

[6] NACE No. 4/SSPC-SP7, *Brush-Off Blast Cleaning*

[7] NACE No. 8/SSPC-SP14, *Industrial Blast Cleaning*

[6] NACE International, 15835 Park Ten Place, Houston, TX 77084, www.nace.org.

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