Common Covered Task 601OP
Start-up/Shut-down of Pipeline to Assure Operation within MAOP/MOP

Directions

This training guide is to be used by a Veriforce Authorized Evaluator/Trainer and Trainee during on-the-job training (OJT) or prior to an evaluation as a resource. (S) Indicates a demonstration or skill task; (K) indicates a knowledge task.

OJT Reminder

OJT is an active hands-on process. Practice should be as similar to the actual job task as possible. However, if the training is being provided on an actual job site while a covered task is actually being performed, the Evaluator either needs to be qualified on that covered task or be assisted by someone who is qualified on the covered task. The Evaluator should closely monitor the Trainee's practices to ensure safe and correct task performance. At no time should a non-qualified individual perform, or train for, a covered task unless directed and observed by a qualified individual. However, if the "span of control" for that particular covered task is "1:0" (requiring only qualified individuals to perform the covered task), the training must be simulated. Training is simulated by "walking through" the task and simulating all actual manipulations (valves, switches, tools, etc.) an individual would use during the performance of a covered task. Simulating includes the use of safety and administrative requirements as if the task were being performed live. Refer to the Veriforce Evaluator Training Program for more on how to conduct formal OJT.

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Common Covered Task 6010P
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Recommended Student Training or Resources:
- DOT 49 CFR 192.605(b)(5)
- DOT 49 CFR 192.751
- DOT 49 CFR 195.402
- DOT 49 CFR 195.406

Knowledge: Explain what is required prior to performing this task.

Pipeline Operator-Approved Procedures and Appropriate Equipment/Material

Prior to performing this task, you will need to have the pipeline operator-approved procedures as well as the appropriate equipment and materials. The procedures will outline requirements for performing this task that are specific to the pipeline operator. Operators may also have specific requirements regarding the type of equipment that can be used to perform this task.

Therefore, it’s important to follow the specific requirements of the procedures and only use operator-approved equipment. Doing so can ensure the task is performed correctly and according to the pipeline operator’s standards.

Knowledge: Identify the key components of a pipeline shutdown and startup procedure.

The purpose of planning for a controlled startup or shutdown is to identify key components to ensure a smooth transition when it comes time to implement the startup or shutdown. This will assist in controlling the pressure in the pipe and keep it from rising above the MAOP or MOP. The plan will also keep you on task and help you communicate with others involved in the startup or shutdown.

Note: Communication being essential to any plan, determine which methods will be used to maintain communication. These may include face to face conversation, calls to and from gas control, and using communication devices like radios.

You can ensure clear communications by using back briefings (i.e., I understand you want me to open valve 50? Is this correct?). Also, use the phonetic alphabet when identifying segments or devices (a as in alpha, b as in bravo, c as in Charlie, etc.).

Proper shutdown and startup procedures can be thought of in a three phase format. The first phase is the identification and planning phase. Phase 2 includes startup and shutdown considerations. And phase 3 is the actual process of shutdown or startup.

Identification and planning

Proper identification and planning requires:
- identification of the pipeline segment to be shutdown
- identification of components and valves required for isolation to include lockout tagout
- and notifications to employees working on the isolated segment, pipeline control, and other agencies and companies

Identification of pipeline segment to be shutdown

Using pipeline schematics, drawings, as-builds, and historical records, identify all valves and components that will require operation to isolate the segment of pipeline to be shutdown
Identification of components and valves required for isolation to include lockout tagout

Identified components may be compressors, pumps, and/or any other parts of the pipeline that affect pressure or transmission. Component operation (whether it is on or off, or at what level of operation) should be determined and personnel responsible for the identified component’s operation should also be outlined in the plan.

As an add on to your plan, you should include MAOP/MOP limits and designate operating pressures for each segment at each stage of shutdown and startup.

Using the shutdown plan and your lockout/ tag out procedures, prepare for isolation by ensuring adequate locks, tags, and any other necessary equipment are available to complete the lockout and tag out when you execute the isolation. This activity should be included in the shutdown plan.

Notification requirements such as Pipeline control center or outside agencies

Once the shutdown plan is approved, notify gas control and others that will be affected by the shutdown. Notifications should include any outside companies that have interconnecting points with the affected segment.

This should be any affected companies, not just those who have gas interconnections. For example, if you will be shutting down an electric compressor, notify the electric company that you will be dumping power back on their grid; conversely, if you will be starting up, let the electric utility know that you will be turning on a compressor and will need additional wattage.

Note: Controllers will make the plans for rerouting gas/product.

Planning considerations

With components identified, develop a shutdown plan that includes the necessary valves for isolation, what position the valves must be in for isolation, and who will be responsible for operating the valves. Also, list the order in which each valve, compressor, and pump should be operated.

With your initial plan for segment isolation complete, you may want to include the considerations in the plan before submitting for approval, this is phase 2.

Now that you have identified the segment of pipeline to be isolated and made the proper notifications, there are some procedures to consider before you isolate the identified segment for the following:

- line cleaning
- leakage survey
- and valve maintenance

Line cleaning

If line cleaning is scheduled for the shutdown period, make arrangements for the cleaning method. Also, make arrangements to handle any liquids or residue from cleaning that may be swept from the line. Incorporate what valves are required to do the cleaning into your plan.

Leakage survey, as applicable

Leakage surveys can be conducted prior to isolating a segment. Remember to document the survey in startup and shutdown procedures. This may lead to repairs, if necessary, to reduce the need for repetitive shutdowns and startups.

Valve maintenance
Properly working valves are essential to isolation. Consider performing valve maintenance, such as greasing lubrication points, checking fluid levels on hydraulically operated and gas over hydraulic type valves, and testing sensors and motors on remotely operated valves.

Remember to record all valve maintenance activity according to your company’s method.

**Plan execution**

Once Phase 1 and Phase 2 are complete get it approved by the operator. When the operator is ready execute your approved plan by:

- isolating the segment of pipe
- using pull-down and/or blow-down procedures to reduce pressure
- Ensure MAOP/MOP limitations of the pipeline segment(s)
- purging the line
- packing the line to raise pressure if starting up
- and returning the line to service if starting up

**Isolation**

Following the plan developed for shutdown, isolate the segment of pipe from its source. Follow up on any planned maintenance, leakage survey, and/or any other planned procedure as described in the plan to take place prior to the time of shutdown.

Remember to follow your lockout/ tag out procedures when operating valves and other tag-able components.

**Pull-down/blow-down**

The isolated segment of pipeline will still have pressure and gas in it. Once the segment of pipe is isolated and secured, a pressure reduction plan can be put into place. The pressure reduction can be accomplished by using tie-over valves to move the gas from the isolated segment to another line. If this is not available, a temporary compressor can be used to move gas from one segment to another, if cost effective.

For those times when transferring pressure from the isolated segment to another can not be accomplished, pull-down/ blow-down is an acceptable means of reducing pressure in an isolated line.

**MAOP/MOP limitations of the pipeline segment(s)**

Always make sure that the pressure does not exceed MAOP/ MOP.

**Purging**

Purging is required if you must remove air or gas from a line. Determine which method that you will use to purge the isolated segment. Make note that the plan requires purging if there is air in a line that is about to be put into service or remaining gas in a line about to be opened to the atmosphere.

**Line packing**

Packing is accomplished by opening up the upstream source of gas or transferring gas into the isolated segment of pipe. With either method, the purpose of line packing is to equalize pressures between pipe segments. Monitoring of pressures is required to ensure no segment of the pipe exceeds its particular MAOP/MOP.

**Return to service**

Once the segment is packed and pressure is equalized with adjoining segments, the line is ready to be put back into service. Using the pipeline schematics and startup plan, operate the required valves, reverse the lockout and tag out procedure, and return the line to service.

To prevent over pressure and feedback of a line, remember to notify company management, gas control, and all other agencies or companies affected by the shutdown to inform them that the segment of pipe will be returned to service. This will ensure that all parties affected by the shutdown will be ready for the startup. Complete all documentation of the activities.
Knowledge: Describe the steps required for isolation of segment.

Now that you have identified isolating the segment as part of your startup and/or shutdown plan, let’s take a deeper look into isolating that segment of pipe. Any time you are isolating a segment of pipe, you must:

- Operate valves in proper sequence, including all receipt and delivery points
- Lockout/tag out valves
- Monitor pressures in adjacent sections to ensure MAOP/MOP is not exceeded, as applicable

Operate valves in proper sequence including all receipt and delivery points

Following your isolation plan in conjunction with necessary schematics and drawings, operate all required valves in order to shutdown or startup the line. The plan should outline the sequence in which the valves should be operated.

In reviewing the schematics, identify all receipts and delivery points along the isolated line, and make arrangements for these points to be shut in. If possible, make arrangements to receive or deliver gas from other points not in the isolated segment. Ensure all management and gas control personnel are notified of the isolation plan to include re-routed lines.

Lockout/tag out of valves

Using the above plan, lock and tag all valves identified in accordance with the companies lockout and tag out procedures.

Monitor pressures in adjacent sections to ensure MAOP/MOP is not exceeded, as applicable

During and after isolation, monitor the pressure in isolated and adjacent segments. A bad valve seal or other valve malfunction could cause pressure to leak into the isolated line. If this should occur, the seal must be re-established, or alternative means to seal the segment must be used.

Continue to monitor the pressure to ensure that it does not rise above the isolation plan’s pressures for maintenance or other pipeline activities. You will also need to continue monitoring pressures in adjoining sections. Pressure should never exceed the MAOP/MOP.

Knowledge: Identify the steps required for pulldown/blowdown of isolated section.

Now that you have identified pulldown/ blowdown as part of your startup and/or shutdown plan, let’s take a deeper look into the steps required for pull-down/ blow-down, which consist of the following:

- Perform pull-down to reduce pressure and minimize gas loss
- Identify and remove potential ignition sources
- Perform blowdown according to procedure
- Keep air out of depressurized section

Perform pull-down to reduce pressure and minimize gas loss

Pulldown allows the gas in the isolated line to pass downstream, thus releasing pressure without wasting gas. Once the segment of pipe is isolated and properly locked and tagged, a pulldown plan can be utilized. Using pipeline schematics, all valves should be identified that will be used to perform the pulldown. Pulldown will be performed before blow-down as you want to reduce pressure before blow-down and minimize waste as much as possible.

Pull-downs can be performed by either transferring the gas from the higher pressure, isolated segment to a lower pressure segment or by using a temporary compressor to move the gas.
With either method, the gas loss can be minimized.

*Identify and remove potential ignition sources*

Perform a safety analysis to ensure ignition sources are identified and removed or made safe. Review safety issues with all personnel involved.

*Perform blowdown according to procedure*

Once the pressure has been reduced to the lowest possible pressure, the remaining gas can be blown down, or flared, according to approved procedures.

Blow-down is done after pulldown by isolating the line from both its downstream system and its upstream system and opening a vent or valve for a controlled release of gas and pressure. Once the pulldown and blow-down are completed, calculate the actual gas loss and report it on the proper forms. Pulldown/blowdown maybe the most cost and time effective method of pressure reduction.

**Note:** Remember to notify the appropriate agencies before conducting a blow-down (i.e. schools, local authorities, hospitals, airports, etc.).

*Keep air out of depressurized section*

Check for downdraft at the blow-off valve at completion of the blow-down. Monitor blow-off valves by using a piece of tape or cloth to detect the direction of movement through the blow-off. Ensure no air enters the pipe to eliminate the need for a full purge before returning to service.

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### Knowledge: Identify the steps required for purging with air or inert gas.

Purging a line with air or an inert gas is sometimes conducted after shutting down a line. This will remove any remaining gas left over from pull-down/blow-down. You want to remove all gas from a line that will be exposed to oxygen in the atmosphere to avoid a combustible mix; this is accomplished by purging the gas in a controlled manner.

Purging a line out of service is an activity that you must plan for in any shutdown procedure. Incorporate the following steps for purging into your shutdown procedure:

- Review purge procedure
- Ensure adequate supply of air or inert gas.
- Perform purge according to procedure

#### Review purge procedures

Your purge plan should be reviewed and approved by management. There are many items to consider when developing a purge plan. These include:

- Develop a purging plan
- Weather and ignition sources
- Liquids in the line
- Electrical Bonding
- Communications
- Equipment
- time and pressure for purge

#### Develop a purging plan

Determine what method of purging you will use (inert gas or air) and develop a purging plan. Hold a review meeting with all involved personnel to review the plan. Use schematic drawings to explain the process to include where personnel will be located, direction of flow, and pressures and times to be monitored and
recorded. Confirm that all personnel involved have the proper safety equipment and are knowledgeable with its use.

Weather and ignition sources

Remove or make safe any possible ignition sources as you will be using air or an inert gas to purge any remaining gas from the isolated line. Check the weather forecast and monitor the weather conditions to ensure a safe purge.

Consideration for liquids in the line

There may be condensates left in the line, and you must have a plan developed in case liquids are encountered in the line. Have adequate and proper equipment available to handle these liquids if necessary.

Bonding

Bonding is the intentional electrical connection of all exposed metallic items to ensure that no electrical difference in potential that could cause a static discharge exists between metallic items. Electrically bond the segment of pipe to be purged to prevent a static discharge, which is a source of ignition, while purging out gas with either air or inert gas.

Communications

Communications being key to any plan or procedure, establish communications with all personnel involved in the purge. Review the purge plan to verify all valves are in their proper position and all personnel are in place for purging.

Equipment

Verify that all test equipment is installed and properly calibrated to measure and record pressures, times, and concentrations of gas, air, and/or inert gas.

Define time and pressure for purge

Using the purge plan as the guideline, begin the purge using the defined time and pressure for each segment of the line.

Ensure adequate supply of air or inert gas

With either method, make sure that you will have enough air or inert gas readily available to perform the purge.

Perform purge according to procedure

When performing the purge take note of the following planning considerations:

- Purge
- Documentation
- Process review

Purge and notifications

Complete the purge as described in the plan. Secure the purged segment, then notify gas control and appropriate management of the completion. If public safety personnel were notified before, update them as well.

Documentation

Complete the required purging forms to document all activities. Record and disseminate post-purge reports to required personnel.

Process review

Hold a post-purge meeting with those involved with the purge to review the process, and record any information required for reports.
**Knowledge:** Identify the steps required for purging with gas.

The reason to purge a line prior to bringing the segment into service is to remove all air, more specifically oxygen, from the line that will transport gas. Oxygen and gas make for a very combustible mix, which is unwanted in a gas transmission line. This is accomplished by purging the air out of the line in a controlled manner.

*Note:* Remember to make the proper notifications before conducting a purge

Purging a line is an activity that you must plan for in any startup procedure. Many of the steps that you take for purging a segment will be the same as purging with air or inert gas; in addition to those, incorporate the following steps into your purge plan:

**Review purge procedure**
- Ensure adequate supply of gas
- Notify pipeline control center and/or other appropriate personnel
- Perform purge according to procedure

**Review purge procedure**

Purging with gas follows similar review considerations as purging with inert gas or air, but with more emphasis on safety and approval. The following must be incorporated into your in-service purge with gas.

- Review safety plan
- Plan ahead for purge completion

**Review safety plan**

There are extra safety considerations to take in the case of purging with gas. Develop and review your safety plan for issues involved with purging and handling gas. Outline requirements for personal safety equipment in your safety plan, and inform all personnel to be involved with the purging process about the added safety considerations.

**Plan ahead for purge completion**

Prepare for the completion of the purge by planning to shut off the purge vent and isolate the section. Additional plans may be necessary to return the line to service or keep the segment isolated in a locked and tagged condition.

**Ensure adequate supply of gas**

Just like when purging with an inert gas, calculate the required volume of gas along with the pressures and time to complete the purge.

**Notify pipeline control center and/or other appropriate personnel**

Notifications must be made to gas control and all personnel involved in the purge. The following considerations must also be made prior to purging with gas.

- Obtain approval of your purge plan from company management and gas control.
- After approvals are received, schedule the time and date of the purge and notify all involved personnel.
- Notify outside agencies that may be affected by the purge, such as the local fire dept., state police, local emergency mgmt., and if in an air flight corridor, the FAA.

**Perform purge according to procedure**

Follow your operators purge policy and/or procedure and conduct the purge. When purging, always remember to complete the purge as described in the plan. Include the following in your planning:
• secure valves and close off the purged segment
• notify gas control and appropriate management of the completion
• update public safety personnel that your purge is complete.

Knowledge: Identify the steps required for re-pressurizing pipeline.

A segment of pipeline that has been out of service must be re-pressurized up to the pressure of its interconnecting system before it can be returned to service. This is referred to as line packing and can be accomplished by opening the upstream source of gas or transferring gas into the isolated segment.

Re-pressurizing the line must be done to return a line to service. The following steps should be taken to re-pressurize the line:

• Develop re-pressurizing plan and notify gas control
• Control flow
• Ensure pressure does not exceed MAOP / MOP
• Return line to normal service
• Notify management when complete

Develop re-pressurizing plan and notify gas control

Following your start-up plan in conjunction with necessary schematics and drawings, identify all valves required to re-pressurize the line. The plan should outline the sequence in which the valves should be operated, at what rate the pressure will be increased, and what the final pressure is to be.

Make arrangements to monitor the re-pressurization and have the plan approved by management and gas control. Review all safety issues and ensure all personnel have proper safety equipment available. Notify gas control when ready to execute your re-pressurization plan.

Control flow

As pressure is introduced into the segment, control flow rates according to your re-pressurization plan. Continuously monitor the pressure in the segment of pipe and its interconnections. Annotate time and pressure at predetermined intervals during the re-pressurization process.

Ensure pressure does not exceed MAOP / MOP

When executing a re-pressurization plan in your startup procedure, ensure pressure does not exceed MAOP/MOP. The MAOP/MOP must be known to all participants (including gas control), and all precautions must be taken to ensure this pressure is not exceeded.

Return line to normal service

When pressure is equalized, ensure all valves are returned to designated operating position as described in the plan.

Notify management when complete

Notify management and gas control when the re-pressurization is completed and the segment of pipe is ready to be returned to service. Ensure the valves are in the proper position and the reversal of the lockout/ tag out procedure is complete. Complete required company forms for return to service.
Knowledge: Using facility drawings as necessary identify the steps required for pipeline startup.

Just like shutting down a line, starting up a line requires a planned out procedure. Remember to make any considerations like you would for shutdown. The following steps are required for pipeline start-up:

- Get operator's approval
- Identify section to startup
- Identify valves and components
- Pack pipeline
- Monitor pressure to ensure MAOP / MOP is not exceeded
- Review interconnecting points

Get operator's approval

Startup procedure must be verified and approved by the Operator's representative prior to beginning startup. This is to ensure that the operator is aware and prepared for the segment of pipe to go into service.

Identify section to startup

Using pipeline schematics and historical records, identify the section of pipeline that is to be started up. Identify interconnecting points and plan their reconnection to the line about to be brought into service.

Identify valves and components

Identify all valves, the correct position of all valves, and the order in which they will be operated. Designate any components, such as compressors and pumps, that will require operation to startup the segment of pipeline.

Pack pipeline

Operate valves as designated in your start up plan to pack the line and equalize pressure with interconnecting points or to operator specified levels.

Monitor pressure to ensure MAOP / MOP is not exceeded

As you are packing the line with gas, consistently monitor the pressure and control the flow to avoid increasing the pressure in the line above the MAOP/MOP.

Review interconnecting points

Review the receipt/delivery points into the pipeline and verify with the Pipeline control center that all interconnections are ready for the segment to startup and reconnect.

Abnormal Operating Conditions (AOCs)

Candidates are required to possess the ability to RECOGNIZE and REACT to the listed AOCs for each task. Be prepared to answer questions concerning additional AOCs that may be relevant. Evaluators may ask questions about AOCs throughout the evaluation.

An AOC is defined in 49 CFR §§ 192.803 and 195.503 as:

A condition identified by the pipeline 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.
Recognize: Unintentional releases, vapors, or hazardous atmosphere could be signs that an abnormal operating condition has occurred. Some examples could include, but are not limited to:

- Blowing gas
- Puddles
- Dead vegetation

React/Respond: Proper reactions/responses to take in the event of an unintentional release, vapors, or hazardous atmosphere include the following:

- Eliminate potential ignition sources.
- Move to a safe location.
- Notify emergency response personnel, as appropriate.
- Limit access to location, as necessary.
- Follow appropriate procedures for notification, documentation, and remedial action.

Recognize: An unintended fire and/or explosion on or near the pipeline, is an abnormal operating condition.

React/Respond: Proper reactions/responses to take in the event of an unintended fire and/or explosion on or near the pipeline include the following:

- Move to a safe location.
- Notify emergency response personnel, as appropriate.
- Limit access to location, as necessary.
- Follow appropriate procedures for notification, documentation, and remedial action.

Recognize: Failure or malfunction of pipeline component(s) is an abnormal operating condition. Examples could include, but not limited to:

- Gasket failure
- Improper valve alignment/position.

React/Respond: Proper reactions/responses to take in the event of a failure or malfunction of pipeline component(s) include the following:

- Determine extent, cause, and potential hazard(s) of failure and/or malfunction.
- Follow appropriate procedures for notification, documentation, and remedial action.

Recognize: Unexplained pressure and/or flow rate deviation exceeding design limits are abnormal operating conditions. Some examples could include, but not limited to:

- High, low, or no pressure/flow
- Unplanned shutoff of service to a customer
- Activation of a safety device

React/Respond: Proper reactions/responses to take in the event of an unexplained pressure and/or flow rate deviation exceeding design limits of pipeline include the following:

- Follow appropriate procedures for notification, documentation, and remedial action.

Recognize: Loss of communication is an abnormal operating condition. Some examples could include, but not limited to:

- Interruption or intermittent loss of electrical power
- Loss of part of the SCADA system or station control systems critical for startup / shutdown of any part of the pipeline
- Failure to communicate with a remote control valve

**React/Respond:** Proper reactions/responses to take in the event of loss of communication on the pipeline include the following:

- Find alternate means of communication, if not possible, suspend activities and follow appropriate procedures for notification, documentation, and remedial action.

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**Glossary**

**AOC**
abnormal operating condition

**CCT**
common covered task

**CFR**
Code of Federal Regulations