



Pressure Reductions, Blowdowns, and Purging Pipeline Facilities

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STANDARD OPERATING PROCEDURE

1. PURPOSE

- 1.1 This Standard Operating Procedure (SOP) is to be used when performing a pipeline pressure reduction, blowdown, and/or purge.
 - 1.1.1 The purpose of purging is to provide and maintain a safe atmosphere inside pipeline facilities being placed in service or taken out of service when it is necessary to replace the air content with combustible gas or to replace combustible gases with air, other gases or other approved methods.

2. SCOPE

- 2.1 This procedure shall be used by all individuals who are required to perform the following:
 - 2.1.1 A pipeline Pressure Reduction;
 - 2.1.2 A pipeline Blowdown,
 - 2.1.3 A pipeline Purge IN to service, or
 - 2.1.4 A pipeline Purge OUT of service.
- 2.2 This procedure applies to distribution, transmission, storage and gathering pipeline facilities.
- 2.3 This procedure is specific to the following mediums: natural gas, air, and inert gases.
- 2.4 This procedure does not apply to hazardous liquids that may be found within gas gathering processing facilities, compressor stations, and the related.

3. REGULATORY REFERENCES AND COMMITMENTS

- 3.1 Pipeline Safety Code Requirements
 - 3.1.1 Department of Transportation - Title 49 - Codes of Federal Regulation:
 - a. 192.629 – Purging of Pipelines
 - b. 192.751 – Prevention of Accidental Ignition

4. DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

4.1 General

- 4.1.1 Common definitions defined within the pipeline safety regulations are found in the document AG-OM-A-030-001, Code Definitions, on the TEIC SharePoint site.

4.2 Definitions

- 4.2.1 **Air Inerting:** A method of *Purging Out* (see term below), where there is a use of pneumatic air for purging natural gas from a pipeline or pipeline facility. A sufficient amount of air is introduced into the pipe to displace natural gas to a safe level below its lower explosive level (LEL).
- 4.2.2 **Air Mover:** An air driven cone shaped Venturi device that pulls a low vacuum powered by compressed air (e.g. siphons, jets)
- 4.2.3 **Blowdown:** Process of relieving pressure in a pipeline by controlled release to open atmosphere until zero pressure is achieved.
- 4.2.4 **Inert Gas:** A noncombustible gas incapable of supporting combustion, which contains less than two percent oxygen and combustible constituents of less than 50 percent of the lower explosive limit of the combustible being purged.
- 4.2.5 **Pneumatic Jet Fan:** A device driven by compressed air to push high volumes of air at low pressure into a pipe to evacuate natural gas.
- 4.2.6 **Pressure Reduction:** Process of relieving pressure, typically a temporary reduction in pressure, in a pipeline or pipeline facility by either a controlled release to open atmosphere, or other controlled means through Gas Control, until a reduced pressure above zero is achieved.
- 4.2.7 **Purging:** The act of displacing air or gas in a pipeline by direct replacement so rapidly that a minimum of mixing between the two gases occurs.
- a. **Purging IN:** Replacement of air in a closed system by natural gas. The replacement may, or may not, include the use of Inert Gas for separation of the air and gas.
- Purging OUT:** Removal of natural gas from a closed system. The removal may, or may not, include the use of Inert Gas for separation of air and gas.
- 4.2.8 **Segment or Affected Segment:** Section of pipeline or pipeline system that will be isolated upstream and downstream, depressurized and natural gas evacuated to perform cutting and welding operations. The Segment or Affected Segment will encompass the Work Zone.
- 4.2.9 **Work Zone:** An area or location, in which a pipeline Segment or pipeline facility Segment will be cut, separated and welded.

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5. RESPONSIBILITIES, TRAINING AND QUALIFICATIONS**5.1 Responsibilities**

- 5.1.1 The procedure user shall use and adhere to this SOP as required by Dominion Energy's Procedure Use and Adherence Policy.
- 5.1.2 Procedure users, including employees and contractors, are responsible for confirming each day before using this procedure that it is the current and effective version for the Business Unit that the work is being performed.
- 5.1.3 Any person who uses this procedure is responsible for following the content within.
- 5.1.4 Company, and/or Third-Party, Inspectors are expected to ensure the steps of this procedure are followed.

5.2 Qualifications

- 5.2.1 For performing covered task(s) outlined herein, personnel shall be qualified, or shall be directed and observed by someone who is qualified, as outlined in the Company DOT Operator Qualification (OQ) Program.
 - a. At a minimum, the following OQ Tasks are applicable:
 - 1. OQ Task L02.1651: Purge – Flammable or Inert Gas

6. PRECAUTIONS AND LIMITATIONS**6.1 General**

- 6.1.1 Any blowdown/purging condition where the potential for gas and air to mix exists is susceptible to accidental ignition. Safety precautions shall be taken during blowdown/purging operations to prevent accidental ignition of natural gas. These precautions are intended to protect employees, contractors and the public and are referenced in each Business Unit's Safety SOPs/Manuals below:
 - a. DEO/DEWV - [360-20 / Prevention of Accidental Ignition of Natural Gas](#)
 - b. DENC/DESC - [O&M Manual - Chapter 12-I Prevention of Accidental Ignition](#)
 - c. DEUWI - Contractor shall comply with the latest version of Company's Contractor Safety Manual (Safety Manual). The Safety Manual is accessible through Contractor's ISNetWorld page on the ISNetWorld Contractor Bulletin Board.
- 6.1.2 It is extremely important to eliminate all potential sources of ignition where gas is being vented to the atmosphere. Sources of Ignition may include, but are not limited to:
 - a. standing pilots;
 - b. open flames;
 - c. cigarettes;
 - d. non-intrinsically safe electrical equipment (e.g. cell phone, laptops, flashlights, etc.);
 - e. electric light switches and appliances;
 - f. motorized equipment and vehicles;

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- g. For steel lines, cathodic protection current (contact system integrity, support, and/or corrosion department); and
- h. Anything else that may cause a spark.

6.1.3 An approved fire extinguisher must be readily available at the purging site, placed upwind where practical.

6.2 Personal Protective Equipment

6.2.1 Always use appropriate personal protective equipment (PPE) for when conducting purging operations.

6.3 Prior to Blowdowns/Purges

6.3.1 Identify all shutoff valves in the vicinity of the purge to operate in the event of an emergency.

6.3.2 Eliminate hazardous conditions/potential ignition sources (as listed above in Section 6.1.2)

CAUTION: To reduce the potential for ignition, locate air compressors and vehicles upwind and as far from the purge vent as practical.

6.3.3 Ensure workers, not necessary to the operation, and all other observers are out of the work area where gas is being vented, relieved, or purged.

6.3.4 When blowing down a compressor station, meter station, regulator station or yard piping, ensure blow-off is of an adequate size and is positioned in a safe location.

6.3.5 If necessary, plan an escape route for each worker to use in the event of an emergency such as a fire or uncontrolled blowing gas.

6.3.6 Personnel shall not allow limbs or any other body part to be over a relief device e.g. vent stack, blow down stack, gas valve, relief valve, gas pipe, test head etc. during testing or while in an otherwise energized state.

6.3.7 Ensure any gas will be directed into the atmosphere away from buildings, pits, vaults, personnel, equipment, overhead A.C. power lines, aircraft landing patterns or other potential ignition sources. If it is not possible to safely blowdown, consult with Engineering to determine best alternative site.

6.3.8 Special precautions should be taken where hydrocarbon liquids are present or may have been introduced into the pipeline Segment or pipeline facility Segment to be blown down/ purged. Ensure liquids are removed from the pipeline or pipeline facility prior to blowdown and natural gas evacuation operations. See Company specific procedures for managing these liquids.

6.3.9 Metallic Pipeline Components:

- a. If installed on the purge outlet, metallic components shall be in contact with the soil or otherwise electrically grounded.

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6.3.10 Plastic Pipeline Components:

- a. Plastic pipe shall not be used to vent gas during purging operations.
- b. When purging plastic mains and services, follow the mandatory precautions specified in each Business Units Safety SOPs for Controlling of Static Electricity.
- c. Prior to and during purging operations, ensure pipeline is adequately grounded or static electricity on plastic pipe is dissipated.
 1. Refer to Company specific SOP for grounding plastic pipelines/components, if applicable.
 2. Ensure plastic pipe is purged/blown down through a properly grounded steel valve.

6.3.11 Air Movers:

- a. Do not blowdown through an Air Mover.
- b. Prior to natural gas evacuation with an Air Mover, ensure Air Mover has been properly grounded.

7. PRELIMINARY ACTIONS**7.1 Initial Conditions**

- 7.1.1 If applicable, procedure user shall ensure an adequate pressure test was completed per Company Pressure Testing procedures prior to performing a purge/blowdown.
- 7.1.2 Procedure user shall ensure all training and qualifications are current, and up to date, prior to performing the procedure.

7.2 Planning and Coordination

- 7.2.1 The following aspects should be taken into consideration when planning a purging operation:
 - a. The type of equipment necessary to perform the purge, such as valves, vent stacks, blind plates, stoppers, bags and other fittings.
 - b. Where to introduce the purge (gas/air) and where to vent.
 - c. The length, size and MAOP of the pipeline.
 - d. Valve sequencing, purge pressure and purge time.
 - e. Proximity to overhead electric lines, sources of ignition, building openings, and mechanical air intakes.
 - f. Flow requirements, meter capacities and odorization equipment throughput capacities.
 - g. Shut down of customer meters, M&R stations, and producer taps should be considered as part of the pipeline isolation and purging activities.
- 7.2.2 The purging operation should be reviewed with involved personnel prior to commencement of purging activities as required.
- 7.2.3 Service interruptions may require customer notification and regulatory reporting.
- 7.2.4 Specific scenarios may require a **written plan** for the pressure reduction, blowdown and/or purge. If a plan is developed it shall be followed.

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- 7.3.1 Accurately calibrated devices used for detecting combustible gas (e.g. CGI) shall be used for Blowdowns and Purges.
- 7.3.2 Accurately calibrated gauges, when determined to be needed by this procedure.

7.4 Field Preparations

NOTE: In an emergency situation where purging is required, it may not be possible to make all of the notifications specified herein.

7.4.1 General

- a. Complete pre-job safety briefs, Job Safety Analysis (“JSA”), or equivalent, as required by the Company Business Unit.
- b. Ensure procedures are followed when mechanical equipment must be locked out and tagged during testing operations. See Company specific SOP for lock out and tag out, if applicable.
- c. Ensure personnel responsible for performing purging operation understand which facilities are to be purged.
- d. Prior to purging, assure that reliable communications have been established between the valve site, vent site and any other control points in between, as necessary.
- e. Ensure a pressure gauge is on the pipeline Segment to be purged on all pipelines, as shown in the Figures with Typical Arrangements under Appendix B.
- f. Connect the pipeline to the source of natural gas, air or Inert Gas. If Inert Gas is to be used, follow procedures outlined within this SOP whether.
- g. When applicable, reference Company’s Odorization procedures to ensure gas odorization levels.

7.4.2 Preparing for Blowdown and Pressure Reduction

- a. Ensure all approvals and notifications have been obtained, when needed, as identified within Section 7.5 of this SOP.
- b. Ensure all valves closed for isolation purpose are locked and tagged when performing hot tie ins, removing blind flanges downstream of an isolation valve or other work on an open-ended pipe (see Company specific SOP on Lockout/Tagout).
- c. Ensure blow off piping is secured to withstand the thrust created during the Blowdown. Secure piping against vertical, horizontal and/or turning movement.

WARNING: Do not use threaded fittings for change of direction on high pressure pipelines.

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- d. Before steel lines are blown down, temporarily shut down the cathodic protection rectifier system in the immediate area and ensure that the pipe in the work area is grounded. Contact appropriate personnel to coordinate shut down of cathodic protection.

CAUTION: Blow down of plastic pipe must be controlled with the use of a grounded steel valve to prevent static electric discharge and possible ignition of natural gas.

- e. Ensure blow down process is completed through a grounded steel valve such as a service valve, a riser or a valve welded to the end of a transition fitting.

7.4.3 De-Pressuring Valve Cavities

WARNING: If a ball or gate valve assembly has been arranged in a manner to allow depressurization without excavation, ensure valve cavities are depressurized to prevent sudden release of gas pressure which may cause serious injury or death to personnel performing hot work downstream of valve.

Extreme care must be taken to prevent injury when removing plugs which have been installed to replace leaking valve cavity bleed.

- a. Open bleed (if equipped) and blow down valve cavity to prevent accidental discharge of pressure.
- b. If applicable, the tagout should indicate the bleed valve for the valve body cavity is open and should be closed before operating the tagged-out valve.

7.4.4 Pipeline Isolation

- a. There are several methods which may be used to segregate or isolate a section of pipeline. These methods include but are not limited to the following:
 - 1. Actual detachment by removal of the fitting or segments of pipe and capping, blanking or plugging the open ends.
 - 2. Insertion of blanks or check valves which block flow.
 - 3. Closing of pipeline valves adjacent to the section to be purged.
 - 4. Installation of bags.
 - 5. Installation of stoppers.
 - 6. The use of squeeze jacks on plastic pipe.
- b. The type of valve, location and operating condition should be determined prior to its use in a purging operation.
- c. If a valve to be used to isolate a section of pipeline cannot be closed gas-tight, another method of isolation or combination of methods should be used at that location. Other methods include:
 - 1. If the system is plastic, perform a squeeze off upstream of the valve.

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2. Installing a metal plate between flanges, blind plate at the valve flange or fully restrained cap or plug assembly.
3. Installing one or more *Air Movers* and/or *Pneumatic Jet Fans* on the isolated section of pipeline (e.g. either downstream of the control point or upstream of the purge point), about two pipe diameters from the valve to pick up and discharge the leakage.
4. Installing and/or using another valve upstream of that location.
5. Installing a bag downstream from the valve, venting the leakage to a safe place.
 - (a) The setting or installation of bags in connection with purging isolation should be performed by qualified personnel.
 - (b) The use of bags requires drilling holes in the main. These holes should be tapped and plugged or mechanically clamped after purging. If bags are used as secondary isolation for venting gas which is leaking past a valve or stopper on medium-, intermediate or high-pressure mains, the remaining bag hole should be covered with an approved mechanical or weld fitting.
 - (c) When bagging low-pressure (less than 1 psig) distribution mains isolation should be achieved using two (2) bags or one bag and one stopper, if at all practical. The second bag acts as a backup for safety purposes.
6. Installing a stopper downstream from the valve, venting the leakage to a safe place.
 - (a) The setting or installation of stoppers in connection with purging isolation should be performed by qualified personnel.
 - (b) Welded stopper fittings should have a design pressure rating equal to or greater than the MAOP of the line to be isolated.
 - (c) All welded stopper fittings should be blanked or capped and leak-tested.

7.4.5 Purge Stacks

- a. Ensure the blowdown stack is installed as close as practical to one end of the pipeline to be purged and on the end of the pipeline opposite the natural gas or air injection point. For illustrations showing installed blowdown stack configurations, see the Figures with Typical Arrangements under Appendix B.
- b. Purge stacks should be located to enable gas to dissipate into the atmosphere without hazard to the workers, public or property.
- c. Purge stacks shall be metallic (i.e. steel, stainless steel, etc.) and must be a smaller diameter than the pipeline being purged.
- d. When venting plastic or metallic pipelines (upstream of the metallic purge stack), the metallic vent pipe shall be grounded by connecting a jumper cable from the vent pipe to the ground rod.
- e. Support purge stacks as necessary.
- f. Purge stack shall extend higher than the heads of operating personnel. Observers shall remain at least 10 feet from the purge point.

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- g. The point of purging shall be controlled with a shutoff valve and gauges to ensure the MAOP of the pipeline is not exceeded.
- h. During the purging, the open point of discharge shall be continuously attended and monitored with a combustible gas indicator to ensure that the line has been thoroughly purged.
- i. Where the purge stack and means of controlling gas flow are not in near proximity, ensure that a means of adequate communication is available and established so that the flow can be controlled or stopped in the event of an emergency.
- j. Additional requirements may be necessary, based on the weather or conditions at the purging site, including but not limited to: the use of silencers to minimize noise; using a deodorizing filter or other means (masking agents) to control the spread of Mercaptan odor when purging in populated areas and/or when purging on windy or overcast days; taller or remote purge stacks, to control the hazards associated with the purging of gas; use of flaring procedures to eliminate raw gas discharge (by approval only).

7.5 Approvals and Notifications**7.5.1 Dominion Departments:**

- a. The appropriate Dominion departments (i.e., Dispatch, Call Center, Gas Control) should be notified of all purging/blowdown operations that may affect any monitored pressure or flow signals.

7.5.2 Public Officials and Emergency Responders:

- a. Appropriate public officials should be notified prior to a purge or blowdown in those situations when the normal flow of traffic through the area might be disturbed or where calls from the public regarding the purge/blowdown are anticipated.
- b. When determined necessary, notify local authorities such as police, highway patrol, county sheriff and fire officials before releasing gas.

7.5.3 Public:

- a. The public in the vicinity of the gas discharge should be notified prior to a purge or blowdown if it is anticipated that the process might affect the public. The primary considerations for determining the need for notification are odor, noise, and the possibility of accidental ignition (e.g. Arrange for courtesy notification of residents, schools, and businesses in the immediate vicinity of the blowdown/purge to minimize noise and odor related concerns).

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WARNING: Personnel shall not allow limbs or any other body part to be over relief device e.g. vent stack, blow down stack, gas valve, relief valve, gas pipe, test head etc. during testing or while in an otherwise energized state. Ensure stacks meet section 8.3.1.b of this SOP. Do not allow non-essential personnel to be in dangerous proximity of venting, relieving, or purging gas.

8.1 Pressure Reductions

8.1.1 To reduce gas pressure, the procedure user shall use one of the following methods:

a. **Method 1** - Deplete by normal gas consumption.

1. Install a pressure gauge on the line segment in which the gas pressure will be reduced.
2. Isolate the section of pipe in which the pressure will be reduced.
3. When the pressure in the line reaches the desired level, stop the gas flow out of the line.

b. **Method 2** - Flowing into another gas line.

NOTE: This method may or may not include the use of a portable compressor.

1. Determine which line(s) will receive the gas from the line segment where pressure will be reduced.

CAUTION: Confirm MAOP and ensure pipeline segment which will receive gas has adequate over-pressure protection.

2. Ensure MAOP will not be exceeded.
3. Determine whether a compressor will be required for the injection and ensure appropriate compressor selection and performance characteristics.
 - (a) If compression evacuation (e.g. a ZEVAC unit) is used, see SOP GD-OM-L-030-001 ZEVAC Unit Operating Procedure.
4. Install a pressure gauge on the line segment in which the gas pressure will be reduced.
5. Connect the line in which the pressure will be reduced to the line which will receive the gas.
6. Flow gas into the line which will receive the gas. Use a compressor, if necessary.
7. When the desired gas pressure reduction is attained, stop the gas flow and disconnect the lines.

c. **Method 3** - Vent directly to the atmosphere.

1. Determine the desired pressure level. If the desired pressure level is or nearly atmospheric pressure, follow procedures outlined in this SOP for Blowdown, see Section 8.2.
2. Install a pressure gauge on the line segment in which the gas pressure will be reduced.
3. Isolate the section of pipe in which the pressure will be reduced.
4. Open the valve on the vent and allow the pressure to decrease to the desired level. When the pressure has decreased to the desired level, close the valve.

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8.2 Blowdowns

- 8.2.1 When operational conditions allow, one or more of the following methods to reduce the amount of gas released to open atmosphere from a Blowdown should be considered by the procedure user. Once the procedure user has considered the use of one or more of the following methods, the Blowdown may be performed.

Methods include the following:

- a. Consumption of the gas / diverting gas to another pipeline. (*see the section on Pressure Reductions for additional information*);
 - b. Use stopper fittings to minimize pipe segment that need to be isolated and blowdown;
 - c. Use of an emission control device (e.g. ZEVAC); and/or
 - d. Flare the gas
 1. When flaring is the determined option, the procedure user should coordinate with an experienced contractor.
- 8.2.2 Once the procedure user has considered the use of one or more of the above methods, the Blowdown may be performed. The following steps are for performing the Blowdown and shall be followed by the procedure user:
- a. Ensure procedures outlined in **Section 7.4.2** of this SOP have been completed.
 - b. Isolate segment of pipeline, see **Section 7.4.4**, where pressure is to be reduced.
 - c. Open the blowoff valve and allow the gas within the pipe to exit.
 - d. Ensure that no air flows back into the pipe.

NOTE: Consider opening multiple blowoffs to decrease the time required for Blowdown.

CAUTION: If multiple blowoffs are used to initially reduce pressure, the desired pressure should be reached using only one blowoff to avoid air flow into pipeline.
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8.3 Purging IN Gas

- 8.3.1 To Purge IN gas, the procedure user shall use one of the following methods:

Method 1 – Purge Out Air Directly with Natural Gas (<i>most common and preferred</i>)
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Method 2 – Introduce a Slug of Inert Gas between the Air and Natural Gas for Purge IN
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Method 3 – Use of Vacuum Pump Equipment
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- 8.3.2 General Requirements Applicable to all Purging IN Gas Methods:

- a. When purging a pipeline facility of air by the use of natural gas, the natural gas shall be released into one end of the pipeline in a moderately rapid and continuous flow.
 1. If natural gas cannot be supplied in sufficient quantity to prevent formation of a hazardous mixture of natural gas and air, a slug of inert gas shall be released into the line before the natural gas. See **Method 2** below on “Inert Gas” use.
- b. Verbal, or radio, contact shall be maintained with an operator at the purge exit.

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1. A minimum of two OQ qualified individuals are required when the control point and purge point are out of sight from one another.
 - c. Accurately calibrated gauges shall be installed.
 - d. Regulate the purging pressure and flow rate at the purge inlet.
 - e. **Once the purging operation has started, it must continue uninterrupted until two consecutive gas readings of at least 95.0% Natural Gas is reached.**
 1. End point samples should be taken with an accurately calibrated combustible gas indicator (CGI), natural gas detecting instrument, gravity measuring instrument, oxygen indicator, or other approved device to ensure the completeness of the purge.
- NOTE:** When purging air from distribution lines less than 200 feet in length and less than four (4) inches in diameter, the use of a CGI or other device is optional, as determined by the qualified supervisor or technician.
- f. Ensure all branch pipelines from the main and all points that might contain sufficient gas or air to create a hazardous mixture of gas and air have been purged.
- g. When the purge is complete, ensure no air will flow back into the pipeline after the natural gas flow is terminated by closing off the pipeline to prevent the formation of a hazardous mixture of air and gas.

8.3.3 Method 1 - Purge Out Air Directly with Natural Gas (see Figure 2 in Appendix B).**a. Purging IN Transmission/Storage/Regulated Gathering Lines:**

1. In addition to the general requirements above, the procedure user shall ensure the following:

NOTE: If a written plan has been developed for the Purge, the plan shall include these requirements and the procedure user shall follow the plan.

- (a) An accurately calibrated pressure gauge is installed on the upstream pressure tap (i.e. control point).
- (b) The downstream blow off (i.e. purge point) shall be opened to the outside atmosphere.
- (c) An inlet pressure shall be established as determined by **Table 7 – Inlet Pressure Chart** of this SOP.
- (d) The pipeline shall be purged until two consecutive gas readings of at least 95.0% Natural Gas is reached.
 - i. As a guide, to obtain the desired 95.0% Natural Gas reading for purging in, the purge time should be equal to a minimum of two minutes per mile (2 min/mile) for the pipeline section. It is recommended to begin taking gas readings prior

to the estimated purge time duration of 2 min/mile for the pipeline facility being purged.

- (e) Once two readings of 95.0% Natural Gas is reached, the inlet gas flow should be shut off and then the downstream blow off should be closed.

b. Purging IN Gas for Mains and Services 2 inch in Diameter and Greater:

1. In addition to the general requirements above, the procedure user shall ensure the following:

NOTE: If a written plan has been developed for the Purge, the plan shall include these requirements and the procedure user shall follow the plan.

- (a) A purge point shall be established by installing a vent valve (valve means any type of valve or squeeze tool and should meet the MAOP requirements) near the outlet of the pipe to be purged. A typical vent stack for purging a main is shown in the **Figures of Appendix B**.
- (b) An inlet valve shall be installed at the inlet of the pipeline to be purged to control the gas flow rate during purging.
- (c) Assure the vent valve is in the fully open position before starting the purge.
- (d) Allow the purge to continue. Measure the percent of gas at the vent stack outlet using an approved combustible gas detector.
 - i. Purging shall continue until two consecutive gas readings of 95.0% Natural Gas is reached.
- (e) Close the vent valve and return the pipeline to service.

c. Purging IN Gas for Services less than 2 inch in Diameter:

1. In addition to the general requirements above, the procedure user shall ensure the following:
 - (a) A second lock-wing/meter stop may be temporarily installed when purging at a riser. The first lockwing/meter stop should be fully open and the second lockwing/meter stop should be used to throttle the flow rate during purging.
 - (b) When purging individual services, a purge stack should be attached to the outlet of the temporary lockwing/meter stop. The purge stack is not required to extend above workers heads due the controlled nature of a service line purge and the relatively small volume of gas to be released. This stack shall be constructed to meet the requirements in Section 7 of this SOP.
 - (c) From experience, most service lines can be purged in less than 10 seconds through a slightly opened valve. Thus, when Purging IN gas services, the use of a gas detector is not required to confirm the presence of natural gas unless:

- i. The gas volume being purged is great enough to pose a potential problem, or
- ii. A readily detectable gas odor is not present within the time believed to be sufficient to have achieved a complete purge.

d. **Purging IN ½ inch and ¾ inch Service Lines with an EFV Installed**

NOTE: Procedure user should select one of the following Options.

- 1. Option 1 (cap or plug – **DENC/DESC only***)
 - (a) Purge the service line through the meter cock plus a second valve temporarily installed downstream of the meter cock with a 3" nipple and a cap.
 - (b) Drill an orifice in the cap using a 7/64" bit size.
 - (c) Purge an EFV-equipped service line by using the second valve/nipple/cap (with 7/64" orifice) installed on the stopcock on the riser.

****See Figure 11 of Appendix B (Comes from DENC Construction Standards CS-825)***

- 2. Option 2 (cap or plug method – **All Gas Companies**):
 - (a) Install a cap or plug with a 0.042 inch diameter hole drilled in the center into the service valve;
 - (b) Ground the service valve;
 - (c) Open the service valve fully and allow air to be purged from the service line; and
 - (d) Close service valve when air is purged from the service line.
- 3. Option 3 (¼ turn method – **All Gas Companies**):
 - (a) Ground the service valve;
 - (b) Open the service valve ¼ turn (approximately 22½° turn – **see Figure 12 in Appendix B**). Allow air to be purged from the service line; and
 - (c) c. Close service valve.

e. **Purging IN 1 ¼ inch and greater Service Lines with an EFV Installed**

- 1. The procedure user shall:
 - (a) Install a nipple and reducer assembly reducing the outlet size to ¾ inch.
 - (b) Ground the service valve;
 - (c) Open the service valve slowly to the fully open position and allow air to be purged from the service line; and
 - (d) Close service valve when air is purged from the service line.

8.3.4 **Method 2 - Using Inert Gas Slug in Between Air and Natural Gas for a Purge IN. (see Figures 3 and 4 in Appendix B)**

- a. Before using Inert Gas to purge, consider using a vacuum pump, **Method 3** below, to purge the air from the pipeline.
- b. The following considerations should be used when determining if a Pipeline segment should be purged with the use of an inert gas slug:
 1. If the Pipeline is 10 miles or more in length; or
 2. If the Pipeline is 12" in diameter or greater; or
 3. The act of Welding and/or Cutting on a Pipeline Facility has an increased risk as an ignition source; or
 4. At the determination of a Company Representative.
- c. In such cases above, contact the Engineering Department to have a job-specific **purge routine/plan** developed.
- d. Using a slug of inert gas (i.e; Nitrogen) to separate air and gas is a method of purging with inert gas. Such a slug must be long enough to prevent the air and gas from coming together and mixing during the purge. A delay of approximately three (3) minutes between addition of the inert gas and the following of air or gas may destroy the slug.
- e. The length of an inert slug for various sizes of pipe from 4-inches to 30-inches in diameter and up to 80,000 feet in length are provided in the chart. The volume of an inert slug required for these sizes and lengths of pipe are provided in the Length of Slug of Nitrogen Required for Purging chart. The volume of an inert slug required for these sizes and lengths of pipe are provided in the chart. The volume of an inert slug required for these sizes and lengths of pipe are provided in the Volume of Slug of Nitrogen Required for Purging chart.
- f. Obtain the length and volume of the slug to be used from **Table 1** and **Table 2**. Ensure there is sufficient Inert Gas to satisfy the purge.

NOTE: Any additional increase in the amount of Inert Gas used is not necessary because the **Tables 1 and 2** include an adequate factor of safety.

- g. Connect the pipeline to the Inert Gas source as shown in **Figures 3 through Figure 5 of Appendix B**.
- h. Allow the Inert Gas to enter the pipeline at a moderately continuous flow until no natural gas is detected at end of pipeline using CGI. When necessary, contact Engineering for the inlet pressure and flow rate required.
- i. After the required amount of Inert Gas has been injected, shut off and disconnect inert source. Do not allow more than three minutes to elapse before gas or air is introduced behind the Inert Gas slug or the slug of Inert Gas may become mixed with the natural gas and/or air in the pipeline in front of the slug.

8.3.5 Method 3 - Use of Vacuum Pump Equipment

- a. Set the equipment up as shown in **Figure 6 of Appendix B**. Perform the vacuum operation as instructed in this section.
- b. Ensure qualified personnel are responsible for operating the vacuum pump producing the pipeline vacuum.
- c. When work installing or repairing the pipeline has been completed, connect vacuum pump equipment to the pipeline as shown in **Figure 6 of Appendix B**. Ensure valve controlling natural gas is in the closed position (**see Figure 6, Item 3**).
- d. Determine highest level of vacuum that vacuum pump can produce at job site conditions by following steps 5 through 8 below.

NOTE: Company no longer uses mercury manometers. Manometers have been replaced by vacuum pressure gauges that read in pounds per square inch gauge (psig) and inches of mercury (In. Hg.).

- e. Determine job site atmospheric pressure (psig or In. Hg.) and/or elevation using one of the following methods:
 - (a) The actual atmospheric pressure (In. Hg.) at the job site using a barometer. Ensure all instruments are calibrated to the existing site and are in working order; or
 - (b) The job site elevation using maps or other sources. Find the elevation in **Table 3** that most closely matches the job site elevation and use corresponding (In. Hg.) as job site atmospheric pressure.
- f. To establish the vacuum pump's maximum vacuum limit that can be obtained at existing job site conditions, isolate and seal the vacuum pump hose from the pipeline by closing the valve shown in **Figure 6, Item 1**.
- g. Attach a vacuum pressure gauge and operate the vacuum pump according to the manufacturer's requirements. Record data for use during the vacuum pumping process.
- h. Compare the reading obtained on the vacuum pressure gauge in step 7 above with the reading obtained in step 5 above, to determine proper vacuum pump operation.

NOTE: Depending on conditions, the job site vacuum pressure gauge reading will be less than the reading obtained in step 5 above by one to two tenths (0.1 to 0.2) of an equivalent inch of mercury.

- i. Connect a vacuum pressure gauge to the pump end of the pipeline (**see Figure 6, Item 2**).
- j. Start the vacuum pump equipment according to the manufacturer's requirements.
- k. Slowly open the valve as shown in **Figure 6, Item 1**.

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- i. Pump the pipeline to a vacuum level that as much as practicable approximates that determined in step 7 above and isolate the vacuum pump from the pipeline. Let the system stabilize while observing the gauge on the vacuum side of the pipeline to determine if any leaks are evident. If leaks are detected, release the vacuum, repair the leaks and again bring the pipeline to the highest vacuum level that is practicable.

CAUTION: Failure to remove or isolate the vacuum gauge from the pipeline will allow gas pressure to damage vacuum gauge.

- m. Isolate or remove vacuum gauge shown in **Figure 6, Item 2** from the pipeline.
- n. Isolate vacuum pump from pipeline by closing the valve shown in **Figure 6, Item 1** and slowly opening the valve controlling the natural gas allowing the natural gas, in a controlled low, to enter and pressurize the pipeline (**see Figure 6, Item 3**). Check pipeline pressure gauges for proper pressure (**see Figure 6, Item 4**).
- o. Check points such as meter risers along the pipeline with a CGI to determine if 95.0% natural gas exists in the pipeline. Open valve slightly and hold detection equipment probe in controlled natural gas flow from the valve. If at least 95.0% reading is not obtained, allow controlled flow to continue for a short time until two consecutive 95.0% natural gas readings are obtained.
- p. Close valve(s) used for detection and place pipeline into service.

8.4 PURGING OUT GAS

8.4.1 To Purge OUT gas, the procedure user shall use one of the following methods:

Method 1 – Purge Out Natural Gas Directly with Air or Inert Gas (<i>most common and preferred</i>)
Method 2 – Introduce a Slug of Inert Gas between the Air and Natural Gas for Purge OUT
Method 3 – Air Inerting of Natural Gas

8.4.2 General Requirements Applicable to all Purging OUT Gas Methods:

- a. When purging a pipeline facility of natural gas by the use of air or inert gas, the air or inert gas shall be released into one end of the pipeline in a moderately rapid and continuous flow.
 1. If air or inert gas cannot be supplied in sufficient quantity to prevent formation of a hazardous mixture of natural gas and air, a slug of inert gas shall be released into the line. See **Method 2** below on “Inert Gas” use.
- b. Verbal, or radio, contact shall be maintained with an operator at the purge exit.
 1. A minimum of two OQ qualified individuals are required when the control point and purge point are out of sight from one another.
- c. Accurately calibrated gauges shall be installed.
- d. Regulate the purging pressure and flow rate at the purge inlet.
- e. **Once the purging operation has started, it must continue uninterrupted until two consecutive gas readings of 1.0% Natural Gas, or less, is reached.**
 1. End point samples should be taken with an accurately calibrated combustible gas indicator (CGI), natural gas detecting instrument, gravity measuring instrument, oxygen indicator, or other approved device to ensure the completeness of the purge.
- f. Ensure all branch pipelines from the main and all points that might contain sufficient gas or air to create a hazardous mixture of gas and air have been purged.
- g. When the purge is complete, ensure no air will flow back into the pipeline after the natural gas flow is terminated by closing off the pipeline to prevent the formation of a hazardous mixture of air and gas.

NOTE: When purging air from distribution lines less than 200 feet in length and less than four (4) inches in diameter, the use of a CGI or other device is optional, as determined by the qualified supervisor or technician.

8.4.3 **Method 1 - Purge Out Natural Gas Directly with Air or Inert Gas (see Figure 1 of Appendix B).**

- a. **Purging OUT Gas for Mains and Services 2 inch in Diameter and Greater:**

NOTE: If a written plan has been developed for the Purge, the plan shall include these requirements and the procedure user shall follow the plan.

1. In addition to the general requirements above, the procedure user shall ensure the following:
 - (a) A purge point shall be established by installing a vent valve (valve means any type of valve or squeeze tool and should meet the MAOP requirements) near the outlet of the pipe to be purged. A typical vent stack for purging a main is shown in the **Figures of Appendix B**.
 - (b) An inlet valve shall be installed at the inlet of the pipeline to be purged to control the gas flow rate during purging.
 - (c) Assure the vent valve is in the fully open position before starting the purge.
 - (d) Allow the purge to continue. Measure the percent of gas at the vent stack outlet using an approved combustible gas detector.
 - i. Purging shall continue until two consecutive gas readings of 1.0% Natural Gas, or less, is reached.
 - (e) Close the vent valve and return the pipeline to service.

b. Purging OUT Gas for Services 2 inch in Diameter and Less:

1. In addition to the general requirements above, the procedure user shall ensure the following:
 - (a) When purging individual services, a purge stack should be installed. The purge stack is not required to extend above workers heads due the controlled nature of a service line purge and the relatively small volume of gas to be released. This stack shall be constructed to meet the requirements in Section 7 of this SOP.
 - (b) From experience, most service lines can be purged in less than 10 seconds through a slightly opened valve. Thus, when Purging OUT gas services, the use of a gas detector is not required to confirm the presence of natural gas unless:
 - i. The gas volume being purged is great enough to pose a potential problem, or
 - ii. A readily detectable gas odor is not present within the time believed to be sufficient to have achieved a complete purge.

8.4.4 Method 2 - Using Inert Gas Slug in Between Air and Natural Gas for a Purge OUT. (see Figure 3 and 4 of Appendix B)

- a. Before using Inert Gas to purge, consider using **Method 3** below.
- b. The following considerations should be used when determining if a Pipeline segment should be purged with the use of an inert gas slug:
 1. If the Pipeline is 10 miles or more in length; or
 2. If the Pipeline is 12" in diameter or greater; or

3. The act of Welding and/or Cutting on a Pipeline Facility has an increased risk as an ignition source; or
 4. At the determination of a Company Representative.
- c. In such cases above, contact the Engineering Department to have a job-specific **purge routine/plan** developed.
 - d. Using a slug of inert gas (i.e; Nitrogen) to separate air and gas is a method of purging with inert gas. Such a slug must be long enough to prevent the air and gas from coming together and mixing during the purge. A delay of approximately three (3) minutes between addition of the inert gas and the following of air or gas may destroy the slug.
 - e. The length of an inert slug for various sizes of pipe from 4-inches to 30-inches in diameter and up to 80,000 feet in length are provided in the chart. The volume of an inert slug required for these sizes and lengths of pipe are provided in the Length of Slug of Nitrogen Required for Purging chart. The volume of an inert slug required for these sizes and lengths of pipe are provided in the chart. The volume of an inert slug required for these sizes and lengths of pipe are provided in the Volume of Slug of Nitrogen Required for Purging chart.
 - f. Obtain the length and volume of the slug to be used from **Table 1** and **Table 2**. Ensure there is sufficient Inert Gas to satisfy the purge.

NOTE: Any additional increase in the amount of Inert Gas used is not necessary because **Tables 1 and 2** include an adequate factor of safety.

- g. Connect the pipeline to the Inert Gas source as shown in **Figures 3 through Figure 5 of Appendix B**.
- h. Allow the Inert Gas to enter the pipeline at a moderately continuous flow until no natural gas is detected at end of pipeline using CGI. When necessary, contact Engineering for the inlet pressure and flow rate required.
- i. After the required amount of Inert Gas has been injected, shut off and disconnect inert source. Do not allow more than three minutes to elapse before gas or air is introduced behind the Inert Gas slug or the slug of Inert Gas may become mixed with the natural gas and/or air in the pipeline in front of the slug.

8.4.5 Method 3 – Air Inerting of Natural Gas

- a. Pipeline Natural Gas Evacuation
 1. Blowdown the pipeline Segment by following this procedure. The qualified person shall write and submit a procedure to Gas Control for isolating and blowing down the affected pipeline Segment to atmospheric pressure.
 2. Consider location of available blow-offs and thread-o-lets in relation to Work Zone and placement of Air Movers. A Pneumatic Jet Fan should be used to evacuate the affected pipeline Segment unless it is not practical to use it. Short Segments of feeder line, yard piping, or cut and cap jobs may not require the use of a Pneumatic Jet Fan.
 3. When selecting an Air Mover for a purging operation:

- (a) Work with Air Mover manufacturer to ensure the selected equipment has the capacity to provide sufficient flow to ensure the pipeline velocity is above the Stratification velocity.
 - (b) Specific attention to limitations of flow resulting from attachment of the unit to the pipe and associated opening is essential to ensure actual flow conditions are achieved as specified in the manufacturer's instructions.
 - (c) Units may need to be de-rated if inlet and outlet openings are not sized properly. Specific de-rating recommendations are provided by the manufacturer based on connection configurations.
4. Calculate the estimated time to evacuate the natural gas using the following equations and **Table 4**, **Table 5**, and **Table 6**.
- (a) Calculate the volume of the pipeline Segment by multiplying the length of the isolated Segment by the value found in **Table 4**.
 - (b) Calculate the air flow in cubic feet per minute (cfm) from the Pneumatic Jet Fan using the manufacturer's performance specs. When a Pneumatic Jet Fan is not being used, calculate the air flow of the Air Mover. If a Pneumatic Jet Fan different than the TX-JF12 Pneumatic Jet Fan and/or 9518-09 Venturi Air Mover will be used, consult with supervision, and obtain the Jet Fan and/or Air Mover Manufacturer Specifications. **Table 5** and **Table 6** give the performance specifications for the TX-JF12 Pneumatic Jet Fan and 9518-09 Venturi Air Mover.
 - (c) Calculate the minutes to evacuate the pipeline Segment by dividing the calculated gas volume in cubic feet (cf) that is in the pipeline Segment by the calculated air flow in cfm from the Air Mover.

EXAMPLE: A 2.5 mile Segment of pipeline with 20 inch diameter has been blown down to atmosphere (0 psig). From **Table 4**, the volume of the pipeline Segment 11,500 cf. $11,500 \text{ cf} \times 2.5 \text{ miles} = 28,750 \text{ cf}$.

A TX-JF12 will be supplied 100 psi air to push air to evacuate the Segment. From **Table 5**, the induced air flow is 2,866 cfm.

The estimated time to evacuate the pipeline is $28,750 \text{ cf} / 2,866 \text{ cfm} = 10.0 \text{ minutes}$.

5. Install Air Mover and Pneumatic Jet Fan (as required) on pipeline upstream and downstream blow-offs (**see Figure 7 – Typical Arrangement at Start of Air Inerting Process**).
- (a) Ensure each unit is fully grounded by either a ground cable connected to the blow-off or to a ground rod.
 - (b) An air compressor is required at each end.
 - (c) Ensure each air compressor is full of fuel at the start of work.
 - (d) Ensure a $\frac{3}{4}$ inch ball valve or equivalent has been installed in each Air Mover.
 - (e) A vacuum gauge may be installed at the Air Mover.

CAUTION: If the air compressor runs low on fuel or has a mechanical failure, immediately notify personnel within the Work Zone and stop work.

6. Establish communication between personnel located at upstream blow-off, downstream blow-off, Work Zone and Gas Control.
7. Blow-off with Air Mover.
 - (a) Securely attach surveyors ribbon(s) near top of Air Mover to confirm air flow.
 - (b) Ensure Air Mover is free of obstruction and pipeline blow-off valve is open.
 - (c) Open $\frac{3}{4}$ inch valve installed in Air Mover.
 - (d) Turn on air compressor.
 - (e) Completely open discharge air valves at compressor and Air Mover.
 - (f) Ribbon(s) should blow above the Air Mover and vacuum gauge (as required) should show a vacuum is being pulled.

8. Blow-off with Pneumatic Jet Fan:

- (a) Ensure that Pneumatic Jet Fan discharge is directed into the blow-off.
 - (b) Turn on air compressor.
 - (c) Ensure there is suction at the inlet of the Pneumatic Jet Fan.

NOTE: Draw air through Pneumatic Jet Fan and into pipeline. Ensure adequate air flow rate through the pipeline by observing the ribbons and vacuum gauge (as required) on the Air Mover (see Figure 9).

9. Draw air through the affected pipeline Segment for the duration calculated in section 8.4.1.c.1.e at a minimum.

NOTE: The duration calculated in section 8.4.1.c.1.e and used in section 8.4.1.c.1.j is only an estimate. A gas monitor shall be used to monitor gas content and identify when natural gas has evacuated the affected pipeline Segment.

10. Calculate the vacuum ratio that should be achieved in order to help balance flows in the affected pipeline Segment using the following method. The vacuum ratio will be used in section 8.4.1.c.1.l.vi (under "Work Zone")
 - (a) Determine approximate lengths of pipe between the Work Zone and the two blow-off sites.
 - (b) Divide the larger length by the shorter length to determine the vacuum ratio.

EXAMPLE: A 2.5 mile Segment has been isolated. There is approximately 0.75 miles of pipe between the nearest blow-off site and the Work Zone. There is approximately 1.75 miles of pipe between the nearest blow-off site and the Work Zone.

Dividing 1.75 miles by 0.75 miles ($1.75 \text{ miles} \div 0.75$) gives a vacuum ratio of 2.33.

11. Work Zone

- (a) Ensure all cathodic protection facilities have been turned off to the Affected Segment(s). If the affected pipeline Segment has been mitigated for induced AC,

contact Corrosion Engineering to determine if any actions need to be taken to ensure that the mitigation remains intact and effective.

- (b) Install a 2 inch Thread O Ring (TOR), or equivalent, at the location of the work for gas sampling during this operation to ensure an acceptable level of less than 10% of LEL prior to performing cutting or welding. The 2 inch TOR should be installed on Segment of pipeline being removed. If a blow-off is located at the Work Zone, the blow-off may be used as a substitute to a 2 inch TOR for sampling.
- (c) Test for presence of flammable atmosphere at the Work Zone until natural gas evacuation provides a safe condition for cutting and welding operations. If unable to obtain less than 1.0% LEL, consider changing direction of air flow in pipeline and/or check for leaking valves on the isolated section. If unable to find source of flammable atmosphere (could be from natural gas, methane or hydrocarbon liquid), consult with supervision before proceeding.
- (d) If liquids are found at the bottom of the pipe at the Work Zone, stop work and contact the Safety Department before proceeding.

NOTE: The discharge from the Air Mover can be checked for the presence of gas and percent LEL. If the LEL has significantly changed at the sampling locations or there are other indicators that the pipeline status has changed, contact supervision.

- (e) Instruct personnel to remove the Pneumatic Jet Fan and install and operate an Air Mover following sections 8.4.1.c.1.f and 8.4.1.c.1.h (see **Figure 8 – Typical Arrangement for Air Mover Flow Away from Work Zone**).
- (f) Contact personnel at both blow-off sites to evaluate operating conditions. The vacuum gauge at each site should show a vacuum is being pulled by the Air Movers. Coordinate with personnel at both blow-off sites to adjust the supply of compressed air at each site to help balance the amount of vacuum being pulled. This can be done by multiplying the reading at the nearest blow-off site by the vacuum ratio calculated in section 8.4.1.c.1.k. This calculated value should be close to the reading at the furthest blow-off site.

EXAMPLE: The vacuum gauge reading at an Air Mover installed closest to the Work Zone shows a vacuum is being pulled measuring -1 psig. Using a calculated vacuum ratio of 2.33, the Air Mover installed furthest from the Work Zone should be adjusted until its vacuum gauge reads approximately -2.33 psig.

NOTE: There may be a delay in the response of the vacuum gauge at either end after adjusting the supplied air to either Air Mover.

- (g) With both Air Movers in service and air moving from the Work Zone to upstream and downstream blow-off Air Movers, pipe can be cut once the LEL at Work Zone is verified to be less than 10% of LEL.
- (h) Upon completion of separating pipeline, continue to evacuate natural gas pipeline using both Air Movers (see **Figure 9 – Typical Arrangement for Air Mover Flow When Pipe Section Has Been Removed**).

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- (i) Upstream and downstream blow-off Air Movers should continue to show that a vacuum is being pulled at each blow-off site.
- (j) Continue to monitor the atmosphere at the pipe ends in the Work Zone (see section 8.4.1.c.1.e.i.iii under "Work Zone").
- (k) Complete pipeline work and prepare to weld root bead.
- (l) Adjust and monitor Air Movers to ensure the welding bead is not drawn into the pipe during tie-in. Pinch (close) back upstream and downstream blow-off Air Mover valves as needed to avoid sucking in root bead.
- (m) If installing a valve with blow-offs, an option is to close the valve and open both blow-off valves. Maintain air flow through blow-off valves to help reduce pulling air past the Work Zone.
- (n) If installing a valve without blow-offs, open the valve. Maintain air flow through valve.

NOTE: In some cases, it may be necessary to shut off both Air Movers to complete the root pass.

- (o) At completion of root pass welding, return the Air Movers to the operational levels established in section 8.4.1.c.1.i.vi (under "Work Zone")
 - (p) Maintain the operation of the Air Movers at both blow-off sites until welds have successfully been completed.
12. If weld is found to be unacceptable, establish a new sampling location by drilling a ½ inch hole near the weld to be removed. See section 8.4.1.c.1.i.vi (under "Work Zone") to re-purge pipeline and make repair.

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9. ACCEPTANCE CRITERIA**9.1 System Restoration Parameters**

- 9.1.1 If applicable, the procedure user shall notify Gas Control when restoring the system back to in-service status.
- 9.1.2 The procedure user shall ensure all permits, if applicable to the pressure reduction, blowdown and/or purge, have been closed at the completion of the procedure (note that other tasks may still have to be performed before permits can be closed).

9.2 Testing Criteria

- 9.2.1 If the pipeline system operability was affected while performing the procedure, the operability should be verified before returning the system back to service. This includes the need to perform the following, as needed:
 - a. Leak investigation if the presence of odor does not dissipate after a reasonable amount of time.

9.3 Inspection Criteria

- 9.3.1 The procedure user shall ensure all gas measurements taken by a gas measurement device (e.g. CGI) meet the requirements of this procedure when either Purging IN or Purging OUT of service.
- 9.3.2 The procedure user shall ensure all records/forms have been completed, as applicable.

10. RECORDS AND RECORDS RETENTION

- 10.1 Purges should be recorded on the appropriate form by the procedure user, if applicable.
 - 10.1.1 Purging records should be retained for a minimum of five (5) years.

11. ADDITIONAL PROCEDURE REFERENCES**11.1 Procedure Exceptions**

- 11.1.1 Not applicable.

11.2 Work Procedures

- 11.2.1 Not applicable.

11.3 Safety and Environmental

- 11.3.1 [AG-SF-A-130-001 Stop Work Authority](#)
- 11.3.2 DEO/DEWV – [360-20 / Prevention of Accidental Ignition of Natural Gas](#)
- 11.3.3 DENC/DESC – [O&M Manual - Chapter 12-I Prevention of Accidental Ignition](#)

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11.3.4 DEUWI - Contractor shall comply with the latest version of Company's Contractor Safety Manual (Safety Manual). The Safety Manual is accessible through Contractor's ISNetWorld page on the ISNetWorld Contractor Bulletin Board.

11.4 Charts, Graphs, Drawings and Lists

11.4.1 See Appendix A – TABLES

11.4.2 See Appendix B – FIGURES

11.5 Software Applications

11.5.1 Not Applicable.

11.6 Forms

11.6.1 System specific forms should be used, when applicable.

12. REVISION HISTORY

Revision History

Revision # 0 (December 16, 2021)

New TEIC SOP for Pressure Reductions, Blowdowns, and Purges created. This SOP consolidates the following:

DEO

- **SOP 330-01 Purging Pipeline Facilities** (Revision Date: 11/21/2013)

DENC/DESC

- **Chapter 11 Operations – 11-H Purging** (SOP version 2021.2 - Dated March 15, 2021)

DEUWI:

- **SP 2-17-01 Blowdown Procedures and Temporary Pressure Reduction** (Revision # 03C - Effective Date 2/28/2019)
- **SP 2-17-03 Purging Pipelines** (Revision # 02A - Effective Date 8/3/2020)
- **SP 2-17-04 Air Inerting of Natural Gas Pipelines or Pipeline Facilities** (Revision # 00 - Effective Date 11/6/2015)

Revision # (Mmm-DD-YYYY)

For Future Use - Revision summary text. Adds Section x.x. Deletes Section x.x. Edits Section x.x.

APPENDIX A – TABLES

1. **Table 1 – Length of Nitrogen Slug Required**
2. **Table 2 – Volume of Nitrogen Slug Required**
3. **Table 3 – Elevation and Atmospheric Pressure**
4. **Table 4 – Volume Content**
5. **Table 5 – TX-JF 12 Pneumatic Jet Fan Performance Specs**
6. **Table 6 – 9518-06 Venturi Air Mover**
7. **Table 7 – Inlet Pressure Chart**

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Table 1 – Length of Nitrogen Slug Required

Pipe Length (in 1000 ft)		Pipe Diameter Nominal (inches)																	
Over	Up to	3/4	1¼	2	3	4	6	8	10	12	14	16	18	20	22	24	26	30	36
0	1	7	12	20	29	39	59	78	98	117	137	156	176	195	215	234	253	294	351
1	2	9	14	23	34	45	69	91	115	137	160	182	205	228	250	273	295	344	410
2	4	11	19	30	45	60	90	120	150	180	210	240	270	300	329	360	390	452	540
4	6	14	23	37	55	73	109	146	183	220	256	292	329	365	402	432	475	551	657
6	8	16	27	44	65	87	131	174	218	262	305	348	392	435	478	522	565	656	783
8	10	19	32	51	76	101	151	202	252	304	353	404	455	505	556	606	656	762	909
10	15	26	43	68	102	136	204	272	340	408	476	544	612	680	748	816	885	1026	1224
15	20	32	53	86	128	171	256	342	428	514	598	684	770	855	940	1026	1110	1291	1539
20	25	39	64	103	155	206	309	412	515	617	720	824	928	1030	1131	1236	1340	1555	1854
25	30	45	75	121	181	241	361	482	605	722	845	964	1085	1210	1325	1446	15870	1820	2169
30	40	58	97	156	233	311	467	622	778	935	1090	1244	1400	1555	1710	1866	2021	2350	2799
40	50	71	119	191	286	381	571	762	953	1150	1340	1524	1710	1880	2100	2286	2480	2880	3429
50	60	85	141	226	338	451	676	902	1130	1360	1580	1804	2030	2260	2480	2706	2930	3410	4059
60	70	98	163	261	391	521	784	1042	1320	1570	1830	2084	2350	2610	2870	3126	3400	3930	4689
70	80	111	185	296	443	591	889	1182	1480	1780	2070	2364	2670	2980	3250	3546	3860	4460	5319
		* Same length for carbon dioxide																	
		Reference: Gas Engineers Handbook, First Edition, Table 14-8																	

Table 2 – Volume of Nitrogen Slug Required

Pipe Length (in 1000 ft)		Pipe Diameter Nominal (inches)																	
Over	Up to	3/4	1¼	2	3	4	6	8	10	12	14	16	18	20	22	24	26	30	36
0	1	7	12	20	29	7	24	54	107	184	274	430	588	806	1070	1390	1768	2722	4962
1	2	9	14	23	34	8	28	73	126	216	320	4840	686	940	1250	1624	2060	3190	5789
2	4	11	19	30	45	11	36	83	165	282	420	632	902	1240	1640	2142	2720	4180	7634
4	6	14	23	37	55	13	44	103	200	348	512	784	1118	1540	2000	2580	3300	5100	9288
6	8	16	27	44	65	15	52	123	236	418	610	936	1334	1840	2380	3120	3930	6080	11069
8	10	19	32	51	76	18	60	143	270	484	706	1088	1550	2040	2790	3620	4580	7060	12851
10	15	26	43	68	102	24	82	168	372	640	952	1430	2046	2800	3720	4860	6160	9520	17304
15	20	32	53	86	128	30	102	238	468	808	1196	1800	2580	3540	4680	6120	7720	12000	21757
20	25	39	64	103	155	36	124	288	528	976	1440	2170	3014	4380	5640	7400	9320	14400	26210
25	30	45	75	121	181	42	146	338	588	1144	1690	2540	3448	5020	6600	8620	10960	16900	30664
30	40	58	97	156	233	55	186	432	1042	1470	2180	3280	4680	6420	8520	11120	14100	21800	39570
40	50	71	119	191	286	67	228	530	1234	1820	2680	4000	5720	7960	10440	13680	17300	26800	48476
50	60	85	141	226	338	80	270	630	1426	2170	3160	4720	6760	9500	12320	16200	20500	31700	57383
60	70	98	163	261	391	92	312	730	1618	2520	3660	5440	7900	11040	14300	18700	23620	36500	66289
70	80	111	185	296	443	101	354	830	1812	2870	4140	6160	8940	12580	16200	21220	27000	41400	75196
		* Same volumes for carbon dioxide																	
		† Calculated from Table 1: length of slug X cubic feet of pipe volume per linear foot X 100% factor of safety.																	
		‡ Number of large cylinders of nitrogen required can be obtained by dividing the volume required by 200.																	
		Reference: Gas Engineers Handbook, First Edition, Table 14-9																	

STANDARD OPERATING PROCEDURE
Table 3 – Elevation and Atmospheric Pressure

Altitude (in feet)	Pressure (in inches of mercury (In. Hg))
0	29.92
250	29.65
500	29.38
750	29.12
1000	28.86
1250	28.60
1500	28.33
1750	28.08
2000	27.82
2250	27.51
2500	27.31
2750	27.06
3000	26.81
3250	26.57
3500	26.32
3750	26.08
4000	25.84
4250	25.60
4500	25.36
4750	25.13
5000	24.89
5250	24.66
5500	24.43
5750	24.21
6000	23.98
6250	23.76
6500	23.53
6750	23.31
7000	23.09
7250	22.87
7500	22.65
7750	22.44
8000	22.22
8250	22.01
8500	21.80
8750	21.59
9000	21.38
9250	21.18
9500	20.98
9750	20.78
10000	20.58

Table 4 – Volume Content

Diameter (in)	Volume per mile (cubic feet)	Volume per mile (MCF)
2	120	0.12
4	460	0.46
6	1,040	1.04
8	1,840	1.84
10	2,880	2.88
12	4,150	4.15
14	5,640	5.64
16	7,370	7.37
18	9,330	9.33
20	11,520	11.52
24	16,590	16.59
26	19,470	19.47
30	25,920	25.92

STANDARD OPERATING PROCEDURE

Table 5 – TX-JF 12 Pneumatic Jet Fan Performance Specs

Power Pressure (psig)	Induced Air Flow (CFM)
40	1,684
60	2,161
80	2,550
100	2,866
120	3,120

Table 6 – 9518-06 Venturi Air Mover

Power Pressure (psig)	Induced Air Flow (CFM)
40	2,385
60	2,885
80	3,347
100	3,834*
120	4,315*

*Values were interpolated

STANDARD OPERATING PROCEDURE

Table 7 – Inlet Pressure Chart*

Pipeline Length (Miles):	2" Blow-off Valve		4" Blow-off Valve				6" Blow-off Valve						8" Blow-off Valve			10" Blow-off Valve			12" Blow-off Valve			
	Pipe Size:		Pipe Size:				Pipe Size:						Pipe Size:			Pipe Size:			Pipe Size:			
	04"	06"	06"	08"	10"	12"	12"	16"	18"	20"	22"	24"	20"	22"	24"	24"	26"	30"	34"	36"	42"	48"
	Inlet Pressure (psig):		Inlet Pressure (psig):				Inlet Pressure (psig):						Inlet Pressure (psig):			Inlet Pressure (psig):			Inlet Pressure (psig):			
1	6	9	3	3	3	5	2	3	4	5	8	12	2	3	3	2	2	3	2	3	6	10
2	12	13	7	5	5	7	3	4	5	6	8	12	3	3	4	2	3	3	3	3	6	11
3	18	17	10	7	7	8	5	5	5	7	9	13	3	4	5	3	3	4	3	4	6	11
4	24	21	13	10	9	10	6	6	6	8	10	14	4	5	5	3	4	5	4	4	6	11
5	32	25	16	12	11	11	7	7	7	8	11	15	5	5	6	4	4	5	4	4	7	12
6	40	30	20	14	12	13	9	8	8	9	12	15	6	6	6	5	5	5	4	5	7	12
7	49	35	24	17	14	14	10	9	9	10	12	16	7	7	7	5	5	6	5	5	7	12
8	59	41	28	20	16	16	11	10	10	11	13	17	7	7	8	6	6	6	5	6	8	12
9	71	46	33	22	18	18	13	11	11	12	14	18	8	8	8	6	6	7	6	6	8	13
10	83	52	38	25	20	19	14	12	12	13	15	19	9	9	9	7	7	7	6	6	8	13
11	97	59	43	28	22	21	16	13	13	14	16	20	10	9	10	8	7	8	6	7	9	13
12	-	66	48	31	25	23	17	14	14	15	17	20	10	10	10	8	8	8	7	7	9	14
13	-	73	54	35	27	25	19	15	15	15	17	21	11	11	11	9	9	9	7	7	9	14
14	-	81	60	38	29	27	21	16	16	16	18	22	12	12	12	9	9	9	8	8	10	14
15	-	90	67	42	32	29	22	18	17	17	19	23	13	12	12	10	10	10	8	8	10	15

Pipeline Length (Miles):	2" Blow-off Valve		4" Blow-off Valve				6" Blow-off Valve						8" Blow-off Valve			10" Blow-off Valve			12" Blow-off Valve			
	Pipe Size:		Pipe Size:				Pipe Size:						Pipe Size:			Pipe Size:			Pipe Size:			
	04"	06"	06"	08"	10"	12"	12"	16"	18"	20"	22"	24"	20"	22"	24"	24"	26"	30"	34"	36"	42"	48"
	Inlet Pressure (psig):		Inlet Pressure (psig):				Inlet Pressure (psig):						Inlet Pressure (psig):			Inlet Pressure (psig):			Inlet Pressure (psig):			
20	-	-	-	63	45	40	31	24	22	22	24	28	17	16	16	13	13	12	10	10	12	16
25	-	-	-	90	62	52	42	31	28	28	29	33	22	20	19	17	16	15	12	12	14	18
30	-	-	-	-	81	66	54	39	35	33	34	38	27	24	23	20	19	17	14	14	15	20
35	-	-	-	-	-	82	68	47	42	40	40	44	32	29	27	24	22	20	17	16	17	22
40	-	-	-	-	-	-	84	57	50	46	46	50	38	34	32	28	26	23	19	18	19	24
45	-	-	-	-	-	-	-	67	58	54	53	56	44	39	36	32	29	26	21	21	21	25
50	-	-	-	-	-	-	-	79	67	61	60	63	51	45	41	37	33	29	24	23	23	27

***Notes:**

1. Table is from *AGA Purging Principles & Practice*.
2. Purge pressures that exceed 100psig are not shown in this table. Possible detonation of flammable gasses could create unsafe pipeline pressures. Longer purge times (greater than 2 min/mile) and lower purge pressures should be used.
3. For 3" blow-off valves, add 10psig to 4" blow-off pressure.
4. Time for all: Use 2 minutes per mile (2 min/mile).

APPENDIX B – FIGURES

- 1. Figure 1 – Typical Arrangement for Purging Natural Gas Directly from a Pipeline Using Air**
- 2. Figure 2 – Typical Arrangement for Purging Air Directly from a Pipeline Using Natural Gas**
- 3. Figure 3 – Typical Arrangement for Purging Natural Gas Directly from a Pipeline Using Slug**
- 4. Figure 4 – Typical Arrangement for Purging Air Directly from a Pipeline Using Slug**
- 5. Figure 5 – Typical Arrangement for Displacing Air or Natural Gas from a Pipeline Using Inert Gas**
- 6. Figure 6 – Typical Arrangement for Vacuum Pump Equipment Setup**
- 7. Figure 7 – Typical Arrangement at Start of Air Inerting Process**
- 8. Figure 8 – Typical Arrangement for Air Mover Flow Away from Work Zone**
- 9. Figure 9 – Typical Arrangement for Air Mover Flow When Pipe Section Has Been Removed**
- 10. Figure 10 – Typical Arrangement for Vent Stack Construction**
- 11. Figure 11 – Typical Arrangement when Using a Secondary Valve for Service Line Purge Stacks**
- 12. Figure 12 – $\frac{1}{4}$ Turn-On Service Valve**

Figure 1 – Typical Arrangement for Purging Natural Gas Directly from a Pipeline Using Air

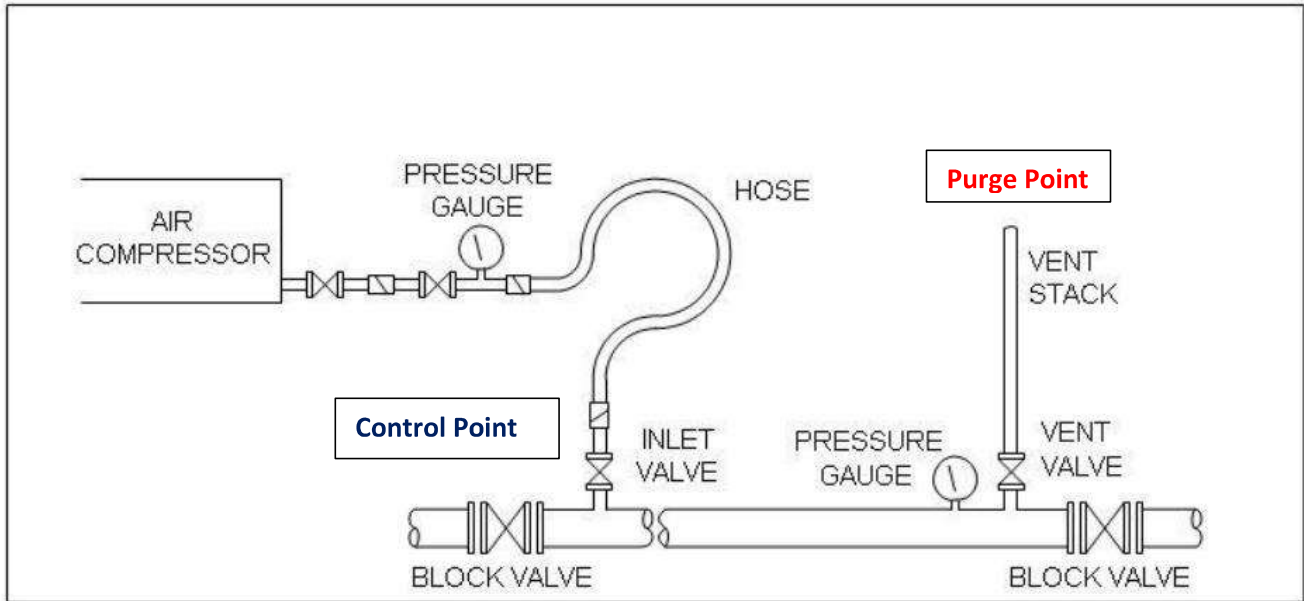


Figure 2 – Typical Arrangement for Purging Air Directly from a Pipeline Using Natural Gas

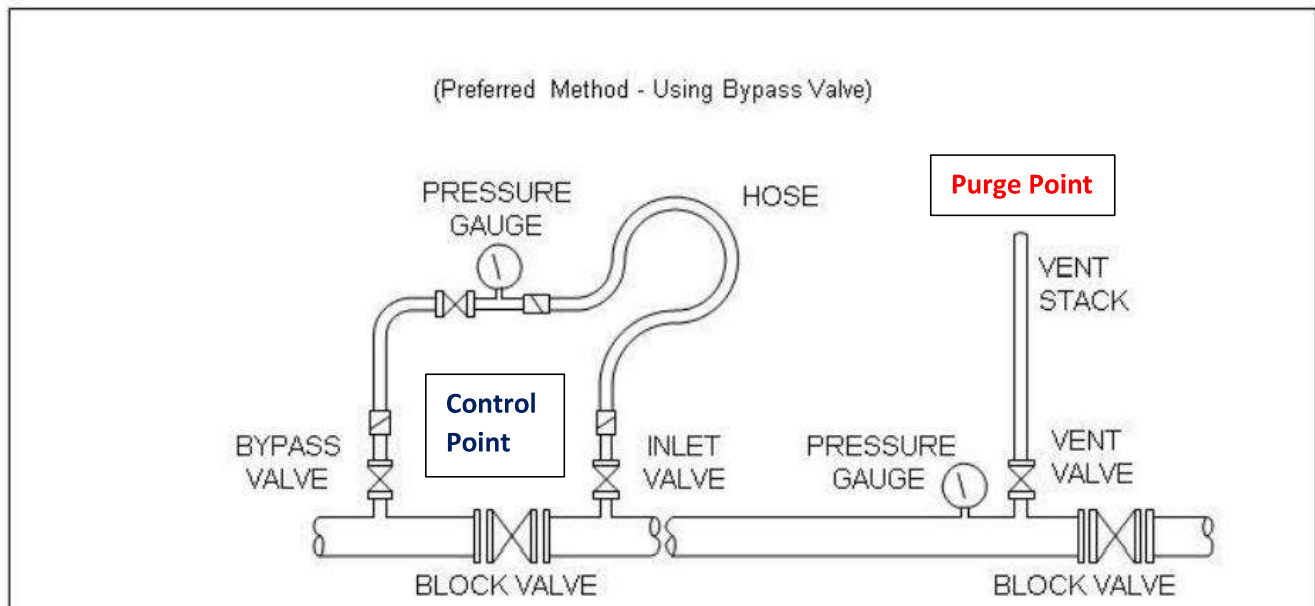


Figure 3 – Typical Arrangement for Purging Natural Gas Directly from a Pipeline Using Slug

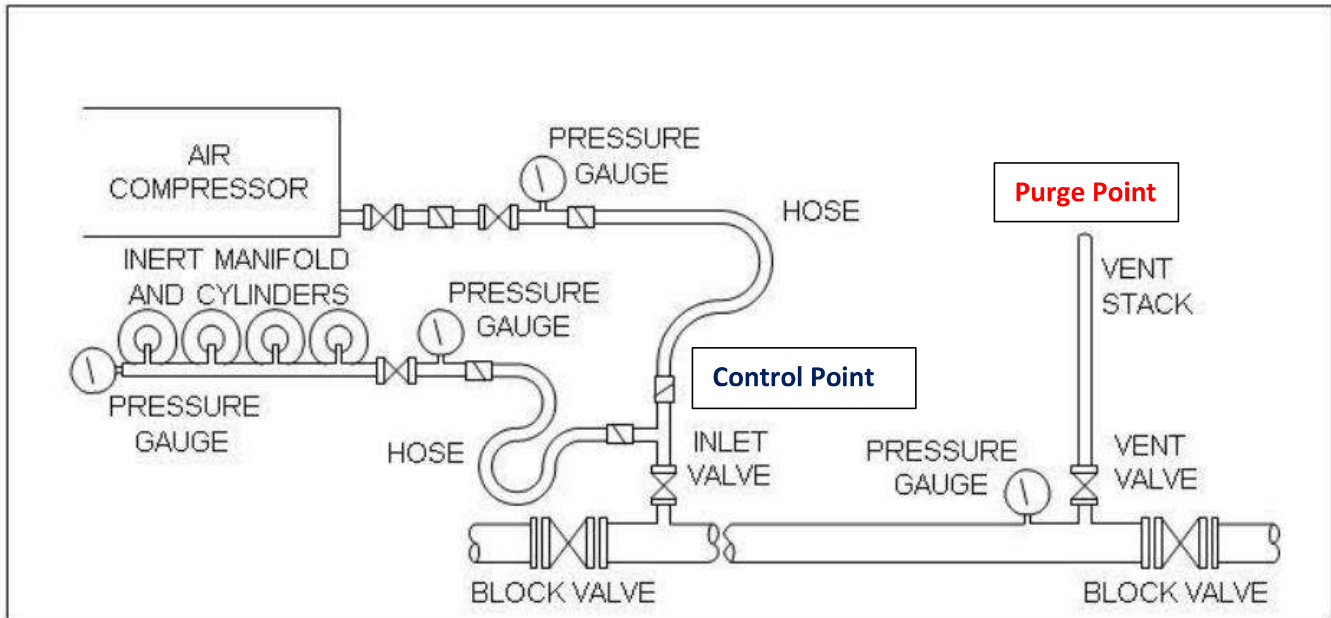


Figure 4 – Typical Arrangement for Purging Air Directly from a Pipeline Using Slug

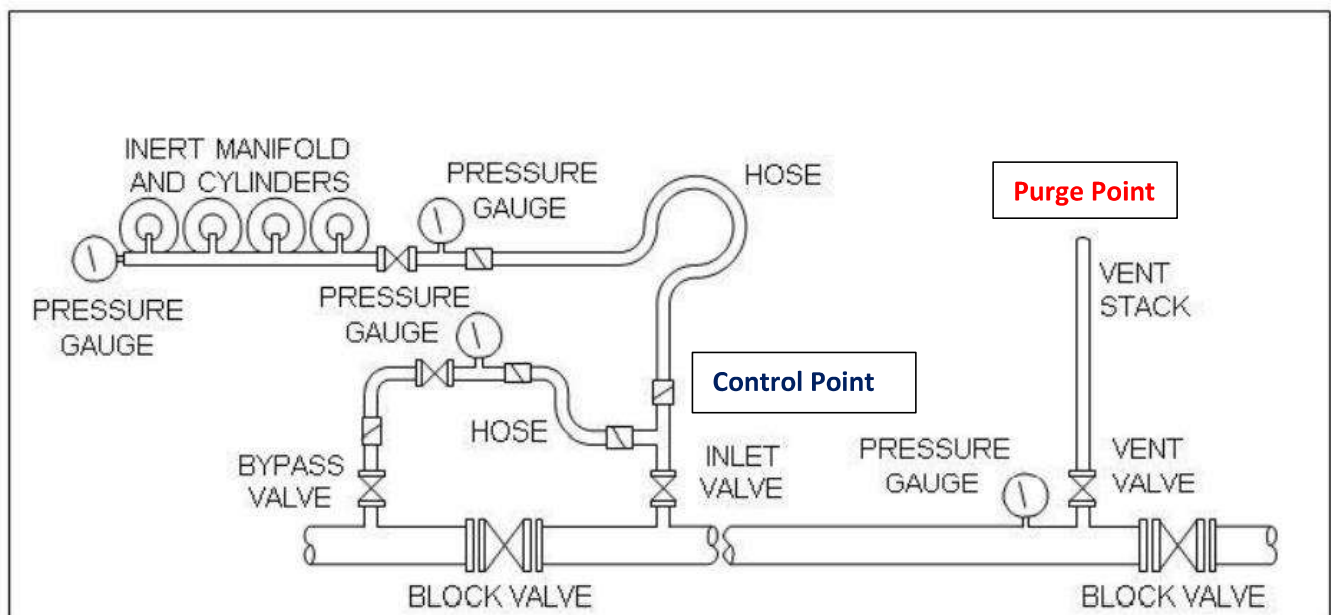


Figure 5 – Typical Arrangement for Displacing Air or Natural Gas from a Pipeline Using Inert Gas

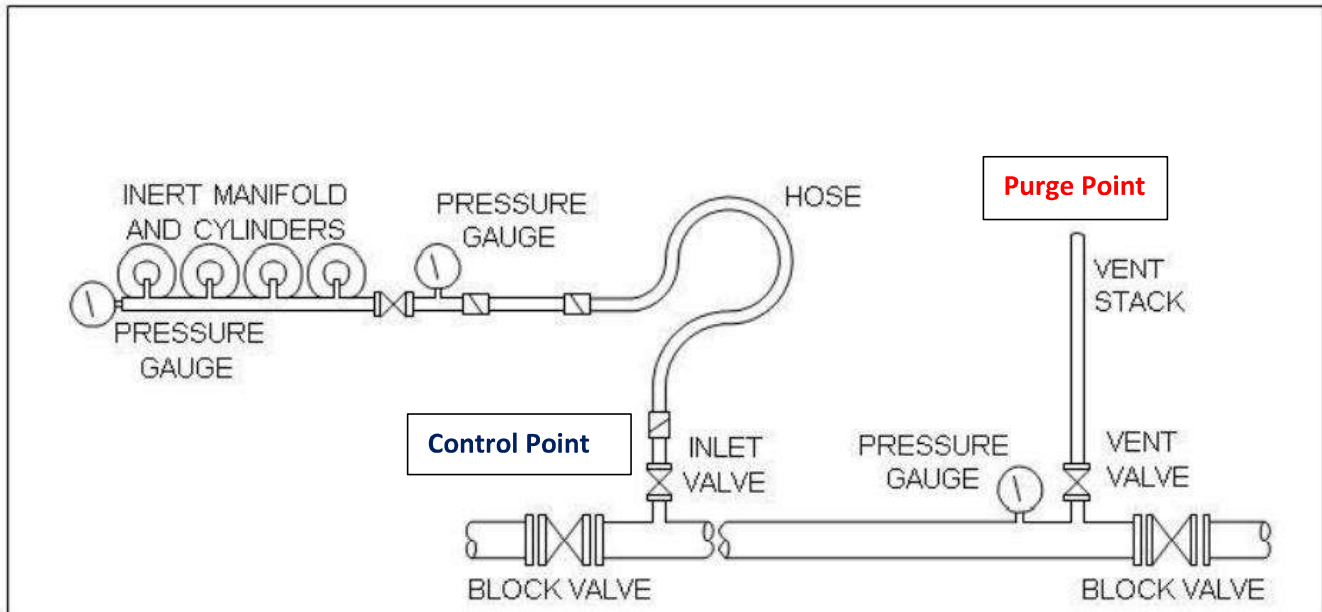


Figure 6 – Typical Arrangement for Vacuum Pump Equipment Setup

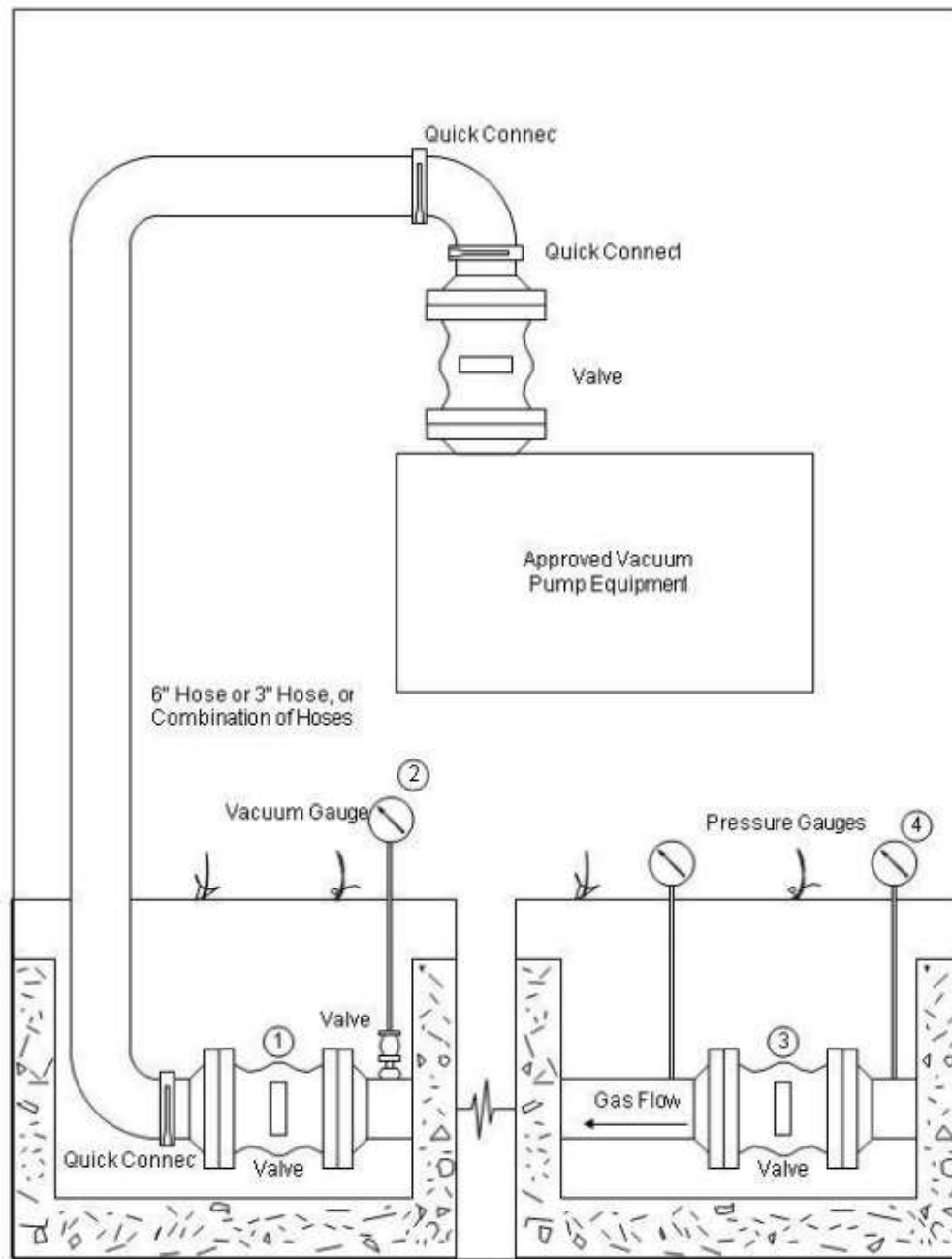


Figure 7 – Typical Arrangement at Start of Air Inerting Process

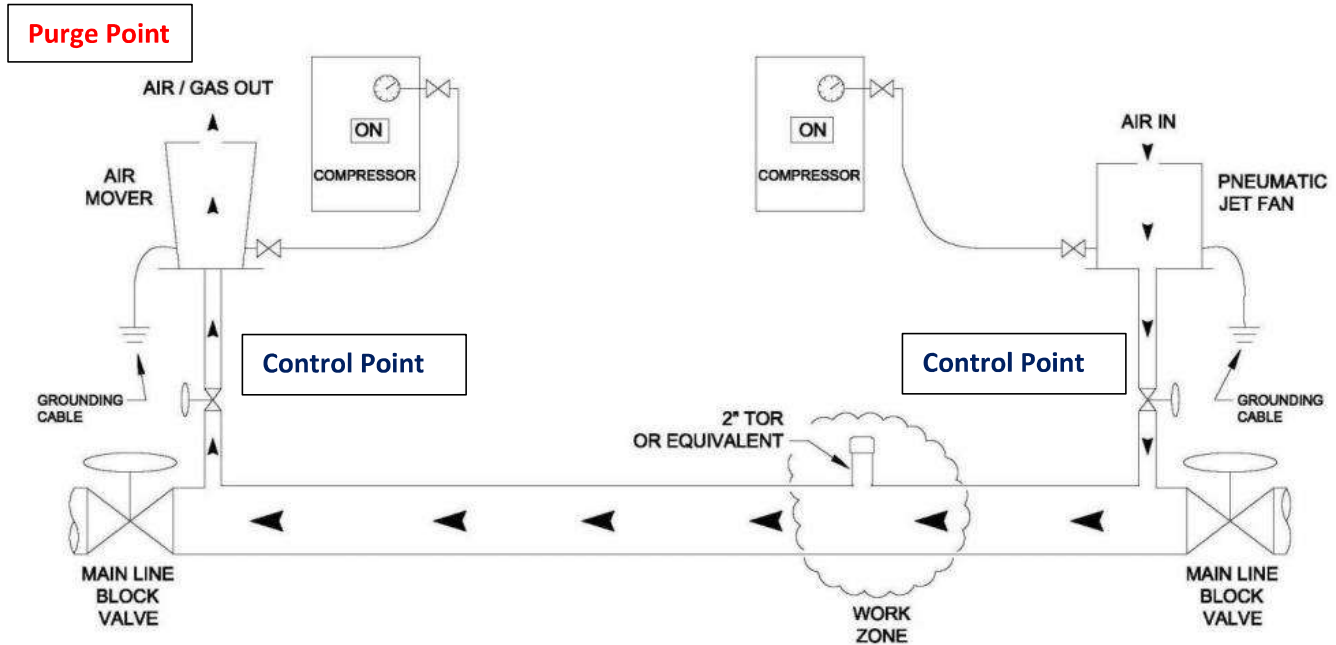


Figure 8 – Typical Arrangement for Air Mover Flow Away from Work Zone

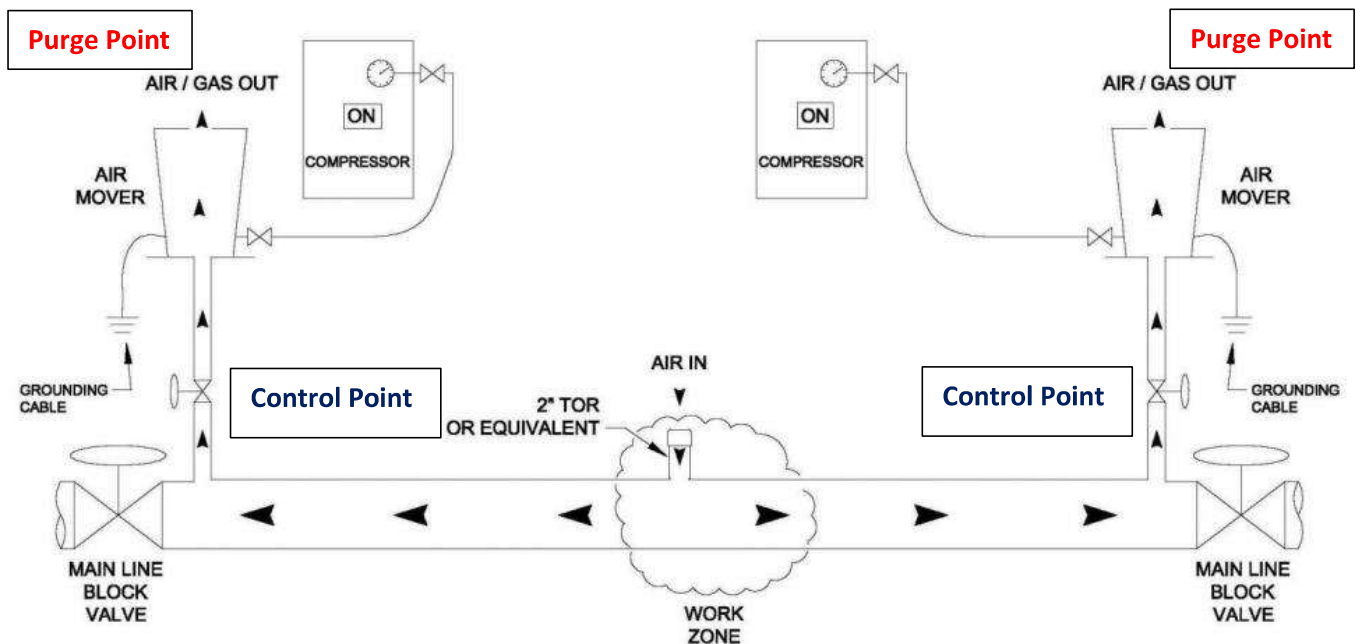


Figure 9 – Typical Arrangement for Air Mover Flow When Pipe Section Has Been Removed

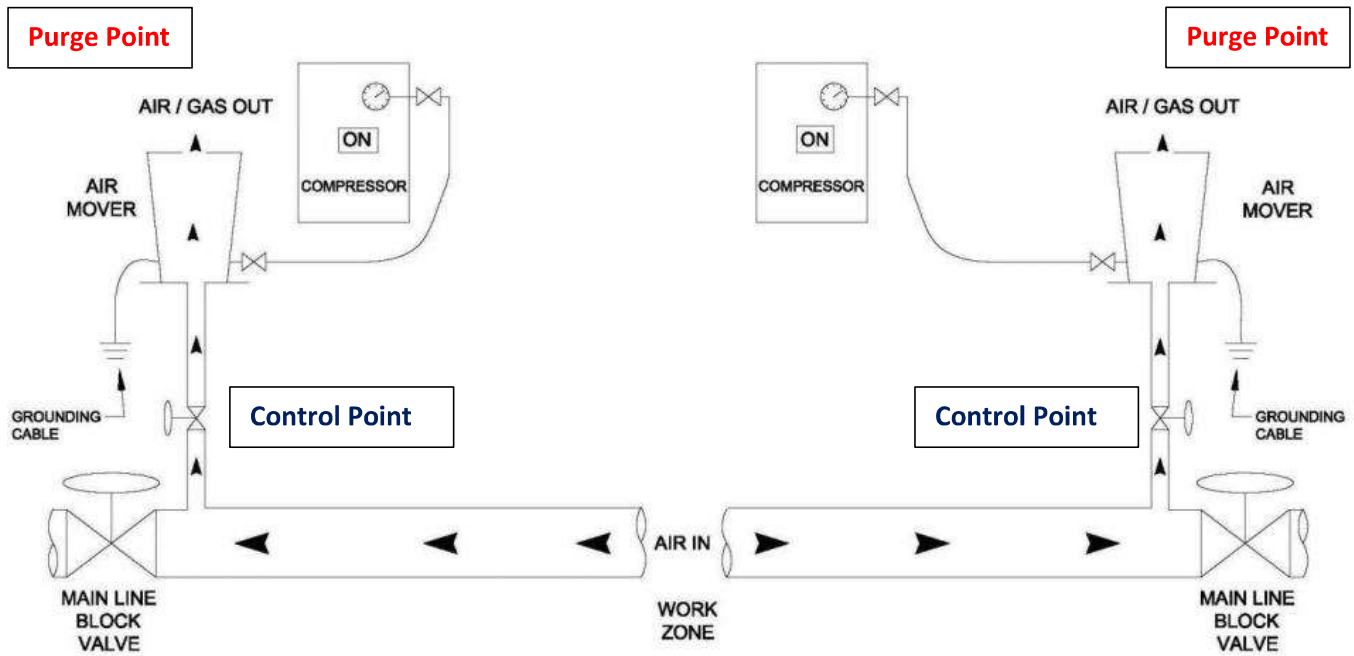


Figure 10 – Typical Arrangement for Vent Stack Construction

[Note: Steel components MUST be touching ground or grounded using a metallic wire]

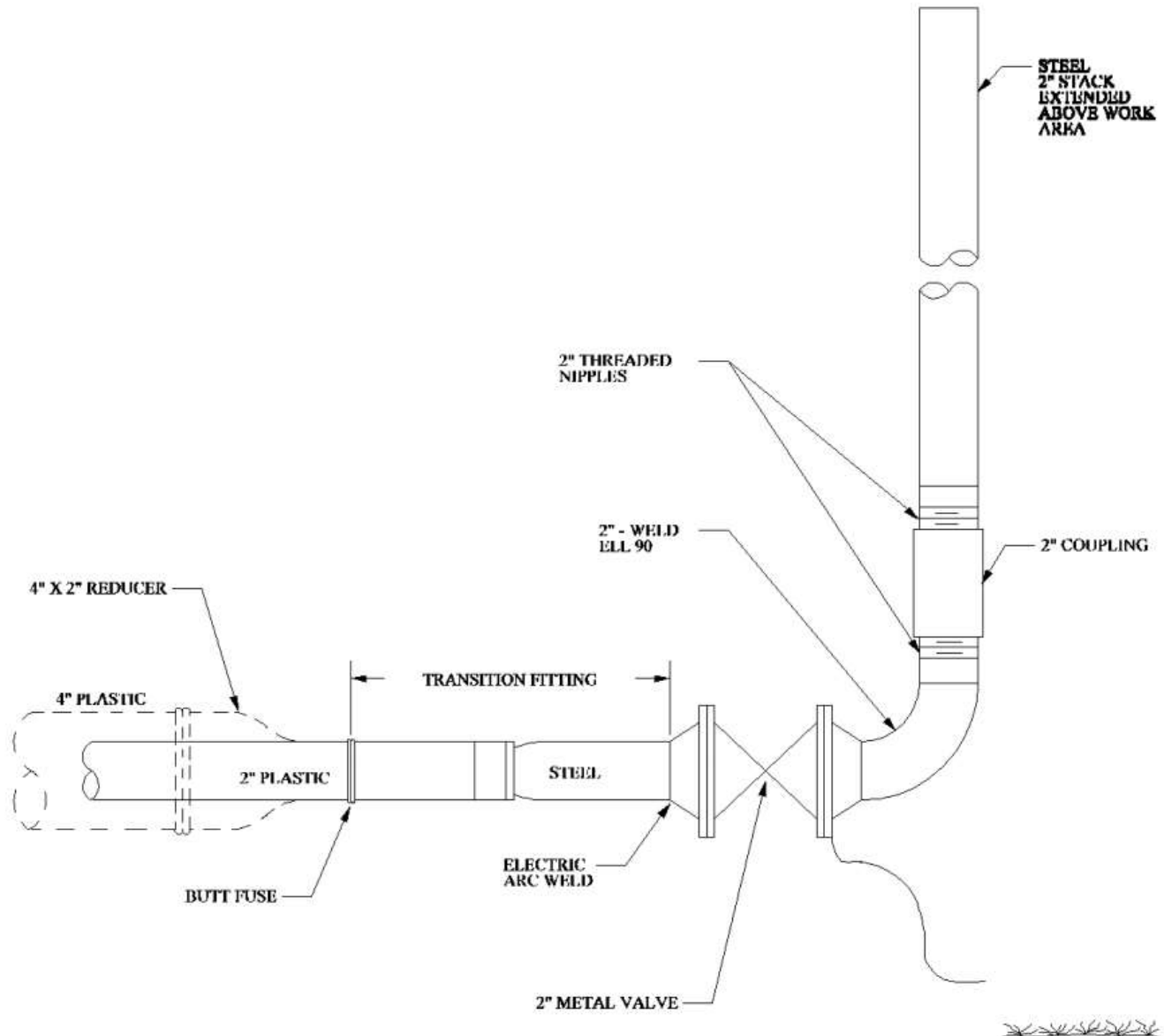
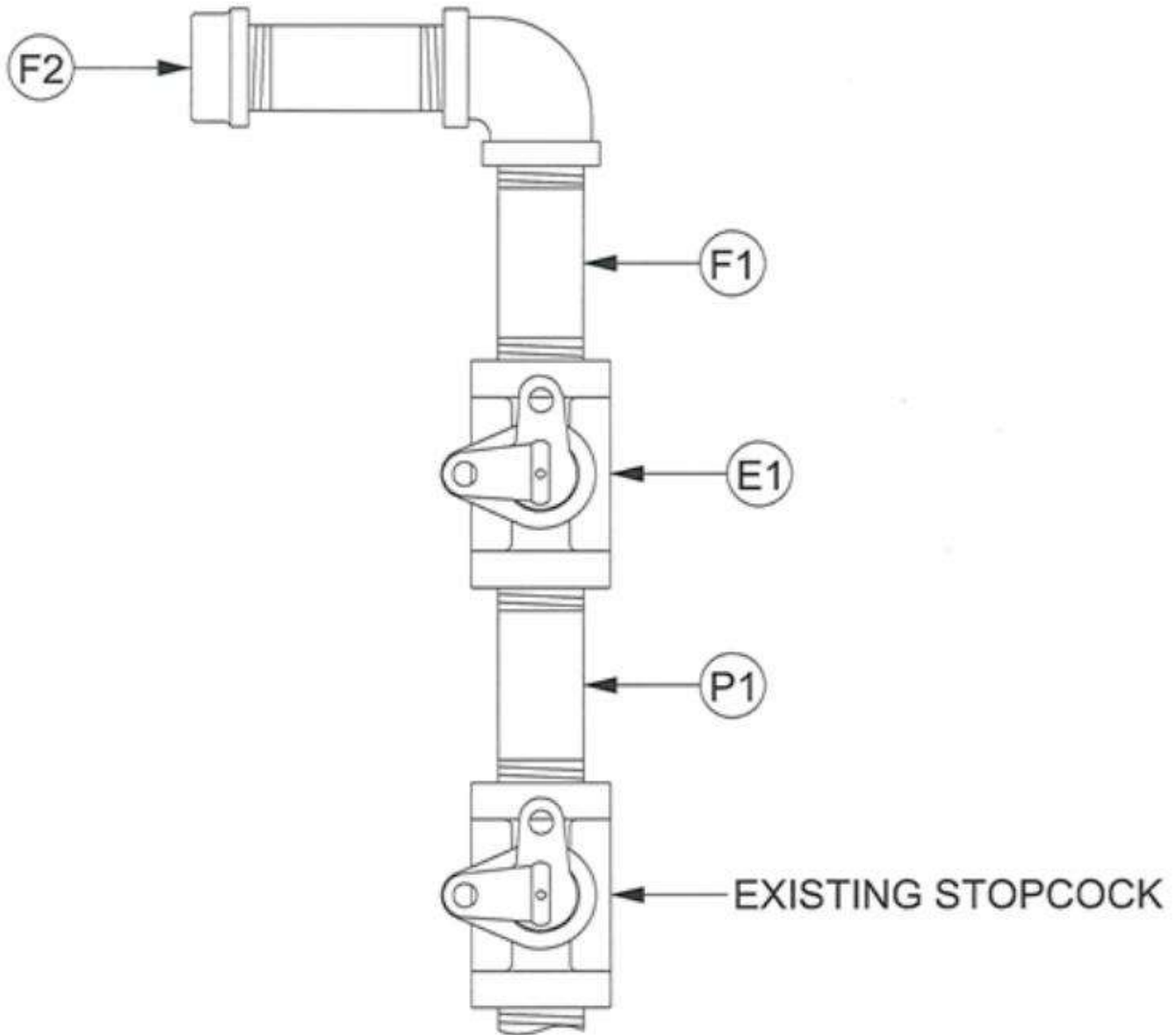


Figure 11 – Typical Arrangement when Using a Secondary Valve for Service Line Purge Stacks



NOTE:

1. Outlet should be pointed away from ignition sources, structures, people, etc.
2. P1 is a nipple section and should be a 3", minimum, in length.
3. E1 is shown as a Stopcock, however any suitable valve is acceptable for this application, including ball valves and other styles.
4. F1 is recommended to be a 90 degree elbow with an P1 nipple section installed upstream and downstream.
5. F2 is a standard cap (NOTE: Ensure Section 8.3.1.a.5 and/or 8.3.1.a.6 of this SOP is followed when determining cap drill hole size).

Figure 12 – ¼ Turn-On Service Valve

