

1. SCOPE

- 1.1 These procedures cover the purging of air or natural gas from transmission and distribution facilities. They describe the manner in which the facilities are to be purged, how to determine when the purge is completed, and items to be considered prior to and during purging.
- 1.2 Procedures and examples of various purging applications are found in the Appendix.

2. GENERAL

2.1 Purging is required when:

- (a) New or existing facilities are brought into service.
- (b) Existing facilities are temporarily taken out of service and the removal of natural gas is necessary.
- (c) Lines that are abandoned. Section 192.727 of General Order 112 states that abandoned facilities do not have to be purged when the volume of gas is so small that there is no potential for hazard. Company policy requires that all sections of abandoned main be purged. (For abandonment procedures, refer to Standard Practice 463-2).

2.2 Except for simple single line piping systems, a written plan for purging should be prepared prior to the work and reviewed with the Company personnel involved. The following items should be discussed:

- (a) The extent of the facility to be purged and points of isolation.
- (b) The purging medium to be used.
- (c) The sequence of operation and assignment of personnel.
- (d) Safe working practices (especially around plastic pipe).
- (e) Means of communication during purge.
- (f) Means of determining end of purge at vent points.
- (g) Procedures for handling emergencies, such as gas ignition.



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LCN	PAL	2	1-5-83	Added Note IIIC				KAFL	PAL	PAL
LWH	PEL	1	1-20-78	Changed Gas Std. Ref. on Pg. 5 from M-15				RTA	PAL	PAL
JAF	WJH	0	1-20-77	Issued for Use				LWH	PAL	PAL
PEH	CJT	REV.	DATE	DESCRIPTION	GM	DWN.	CHKD.	SUPV.	APVD.	
GM	PIPING - DATA SHEET PROCEDURE FOR PURGING GAS TRANSMISSION & DISTRIBUTION FACILITIES GAS STANDARD PACIFIC GAS AND ELECTRIC COMPANY SAN FRANCISCO, CALIFORNIA								B/M	
SUPV.									DWG. LIST	
DSGN.									SUPSDS	
DWN.									SUPSD BY	
CHKD.									SHEET NO. 10 of 15	SHEETS
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- (h) Notification of governmental authorities if required (police, fire, air pollution, noise abatement).
- (i) Back up provision, in case of unanticipated occurrences (i.e. compressor failure, insufficient supply of purging gas, etc.)

2.3 When purging, the air or gas to be removed must be removed from all sections of the piping system. Branches and services must be individually purged. The straight through section should be purged first, then each lateral.

2.4 Injection Rate

2.4.1 Injection of purging medium must be done at a high enough velocity to create a minimum lineal flow of 100 feet/minute within the pipeline. This flow rate will maintain a turbulent interface between the natural gas and air. It will also minimize:

- (a) Mixing of air and gas in the pipeline to limit the extent of the combustible mixture, and
- (b) The duration of the purge.

2.4.2 For purging air in other than low pressure systems, a cracked main line valve will create a minimum lineal velocity of 100 feet/minute within the pipeline. When purging low pressure systems, the available injection pressure and the physical characteristics must be examined to determine if the 100 feet/minute velocity can be achieved.

2.5 It is essential that vented natural gas and air/gas mixtures be diffused into the air without hazard to Company personnel, the general public or property. Valved vertical vent stacks should be used to keep the natural gas out of the work area and to blow it in a safe direction. Buildings, overhead lines, aircraft landing patterns and other obstructions or sources of ignition should be considered when determining the location for venting the gas. (See Section 20 of the Accident Prevention Rule Book.)

2.6 Consideration must be given to public relations with regard noise and odor as well as to any applicable state and local noise and pollution abatement requirements. Such considerations may include the notification of residents in close proximity to the blowdown operations, the use of noise suppressors, reduction of line pressure, reduced rate of venting, etc.

2.7 Purging once started, must be continued until completed.

3. PURGING AIR OUT OF FACILITIES TO BE PLACED IN SERVICE

3.1 Refer to Appendix A for procedures and examples of purging air from services and mains.

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3 2 Purging Services

Service installations may be purged by opening the riser valve after the service tee has been tapped. Care must be taken to blow gas away from structures by connecting a meter bend or street ell to the riser valve and pointing stream of gas in a safe direction. The valve should be opened slowly to the full open position. No person or object should be in the exhaust stream area. The operator shall hold the wrench and keep it in contact with the valve stem at all times. Care must also be taken that no source of ignition is present in the area. A sufficient amount of gas should be blown to atmosphere to insure that all air is removed from the line. Service lines should be purged immediately after the service tee has been tapped and gas is in the service line (refer to Appendix A 1 for example)

3 3 Purging of Pipelines (10' Diameter and Smaller)

3 3 1 Small diameter mains should be purged of air by injecting gas at high enough velocities to create a minimum lineal flow of 100 feet/minute within the pipeline (refer to Appendix A 2 for example of calculations). If this velocity cannot be met a slug of nitrogen between the air and gas is required (refer to Section 5)

3 3 2 The following methods can be used to determine the absence of air

- a) A portable combustible gas indicator (Gas Standard M-53) set on percent gas scale. The reading must indicate 100% gas
- b) A small amount of the vented gas can be blown into a bucket of soapy water with a hose. Move the bucket to a safe location stand up wind, and ignite the gas contained in the bubbles. If the gas burns with an orange or yellow flame the purge is complete. If the gas burns with a blue flame then there is air present and further purging is necessary

3 4 Purging Pipelines (Larger than 10' Diameter)

3 4 1 For mains greater than 10 inches diameter it is desirable to separate the air from the natural gas with a slug of nitrogen. This technique minimizes mixing which otherwise would be accelerated due to the greater cross-sectional area of the large diameter pipe and reduces required purge time (refer to Appendix A 3, for example of calculations). Section 5 of these instructions describes purging with a slug of nitrogen

3 4 2 When the use of nitrogen is impractical pipelines with a diameter greater than 10" are purged of air by injecting natural gas into the line at high velocities (refer to Appendix A 4, for example of calculations)

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4 PURGING NATURAL GAS OUT OF EXISTING FACILITIES

4 1 Refer to Appendix B for additional information on purging natural gas from pipelines using air with and without a nitrogen slug

4 2 Purging of Pipelines (10' Diameter and Less)

4 2 1 Lines 10 inches in diameter and smaller are purged of natural gas using a Lamb air mover (see Gas Std A 38 1) or injecting a supply of air *

4 2 2 The disposal of large volumes of natural gas into the atmosphere should be minimized as far as practical by transferring as much as possible to adjacent systems

4 2 3 The following methods can be used to determine the absence of natural gas

- (a) Use of a combustible gas indicator
- (b) Blowing a small portion of the vented gases through soapy water and attempting to ignite the gas entrapped in the bubbles at a safe location. If the gas ignites continue the purge

4 3 Purging Pipelines (Larger than 10' Diameter)

4 3 1 For mains greater than 10 inches diameter it is desirable to separate the natural gas from the air with a slug of nitrogen (refer to Appendix B 2 for example of calculations). This technique prevents mixing which otherwise would be accelerated due to the greater cross-sectional area of the large diameter pipe. Section 5 of these instructions describes purging with a slug of nitrogen

4 3 2 When it is impractical to use nitrogen pipelines with a diameter greater than 10 inches can be purged of natural gas with air. The purging air can be supplied by a compressor* (or bank of compressors) (refer to Appendix B 1 for example of calculations) or a Lamb Air Mover. Gas Standard A-38 1 describes the use of the Lamb Air Mover

4 3 3 The following methods can be used to determine the absence of natural gas

- (a) Use of a combustible gas indicator

*A standard PGandE compressor is rated for 150 CFM. It will provide the minimum flow rate for pipelines up to 16 inches in diameter. Air compressors with 250 CFM and 650 CFM capacities can also be obtained. Appendix C gives the flow-pressure drop relationships for air through flexible hose and orifices

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- (b) Blowing a small portion of the vented gases through soapy water and attempting to ignite the gas entrapped in the bubbles at a safe location. If the gas does not ignite then the purge is completed.

4.4 Working On Existing Pipelines Which Have Been Purged

- 4.4.1 When it is necessary to perform work on an existing pipeline which has been purged in accordance with 4.2 or 4.3 of this section, precautions shall be taken to verify that a combustible mixture has not developed inside the pipeline due to leakage from a segment of pipeline remaining in service, or from the release of gas from residual liquids in the pipeline. Special care must be taken when performing cutting or welding on such a line. The degree of isolation should be determined by observing any pressure increases within the purged space with all vents closed and by monitoring for the presence of natural gas using the method outlined in Section 4.2.3.

5 PURGING WITH NITROGEN

5.1 Purging with a Slug of Nitrogen

- 5.1.1 In order to prevent explosive mixtures when purging long large diameter lines a slug of nitrogen can be injected into line prior to the purging medium. The nitrogen will mix with the air and the gas, but as long as sufficient nitrogen is injected an explosive mixture will not occur. Refer to Appendix B.2, for purging procedures using a slug of nitrogen.

- 5.1.2 Following are additional facts regarding inert slug purging which have been determined experimentally:

- (a) Purge velocity is extremely important. Avoid a slow purge. Velocities less than 100 feet per minute in large diameter pipe allow stratification between heavier and lighter gases.
- (b) The amount of nitrogen necessary to purge short lengths (500 feet or less) of large-diameter pipe satisfactorily at practical purge velocities exceeds the volume of the line.
- (c) Changes in horizontal or vertical direction because of elbows or return bends do not destroy the nitrogen slug.
- (d) A temperature variation in the order of 20°F has no effect on mixing of the nitrogen slug with combustible gas or air.
- (e) The same amount of inert gas as a slug, may be used if either combustible gas or air is being purged from a line.
- (f) Turbulence even if it causes mixing is much less the cause of deterioration of the slug than is stratification.

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(g) A delay of approximately three minutes between the addition of the inert gas and the injection of air or combustible gas will destroy the slug

5 2 Purging with 100/ Nitrogen

5 2 1 When it is suspected that hydrate formations are in the pipeline, natural gas must be purged with 100% nitrogen. After the natural gas has been purged, the nitrogen should be left in the line until all of the hydrates have sublimated. Hydrates sublimation can be accelerated by the injection of methanol.

5 2 2 When it is suspected that natural gas may be entrained in liquids in the pipeline, 100% nitrogen should also be considered. The exclusion of air in the purging medium prevents the formation of an explosive mixture subsequent to the passage of the purge gas through the pipeline.

5 2 3 Consideration should also be given to pigging a line to remove entrained liquids if they are known to be present.

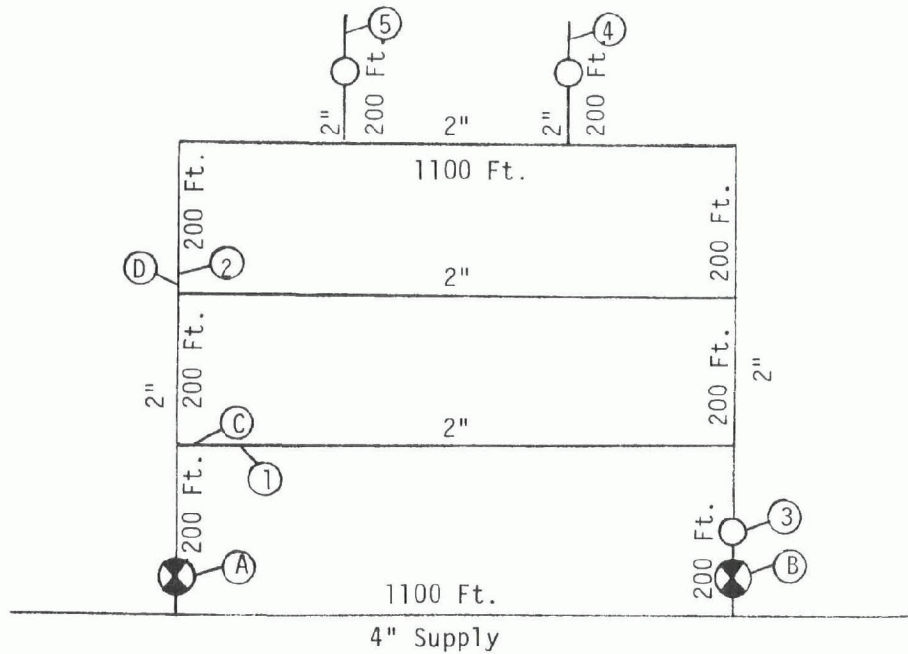
NOTE One cylinder of nitrogen at 2200 psig contains 220 cubic feet of gas at atmospheric pressure. Table 4 in Appendix C, shows how much nitrogen remains in a partially used cylinder.

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APPENDIX A

PURGING OF AIR FROM SERVICES AND PIPELINES

1. PROCEDURE FOR PURGING AIR FROM SERVICES USING NATURAL GAS



Distribution Main System for New Subdivision

Example:

Replace air with natural gas in newly installed services.

Procedure:

- (1) Close off 2" lines a C and D, isolating by pinch, fitting, valve or other means.
- (2) Open vent at 1.
- (3) Open valve A. Leave valve B closed.
- (4) Close vent at 1 when 100% natural gas is detected.
- (5) Open vent at 2. Close when 100% natural gas is detected.
- (6) Open vent at 3. Close when 100% natural gas is detected.
- (7) Open vent at 4. Close when 100% natural gas is detected.
- (8) Open vent at 5. Close when 100% natural gas is detected.
- (9) Open isolation points C and D.
- (10) Open valve B.
- (11) Purge all service lines installed. Stub services do not have to be purged.

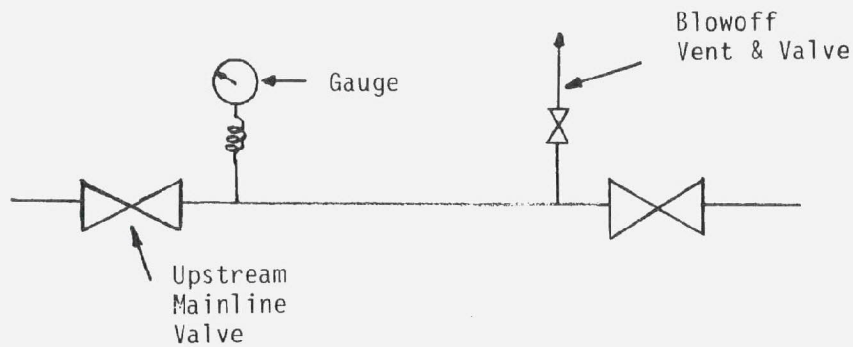
¹"Purging Principles and Practices", American Gas Association, Cat. No. XK0775, 1975

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2. PROCEDURE FOR PURGING AIR FROM PIPELINES 10" IN DIAMETER AND LESS USING NATURAL GAS

When purging with combustible gas into a pipeline containing air, a minimum flow velocity of 100 linear feet per minute or greater is required. The combustible gas flow should be continued without interruption until the vented combustible gas is free from air.



Example:

Replace air with natural gas in a 6,000 foot segment of 6" pipe. Nitrogen purge not required. Blowoff size is 2."

Procedure:

- (1) Determine blowoff size from Table 1, using pipeline size and length of section to be purged (2" blowoff, 6" pipeline, 6000' section).
- (2) Determine minimum inlet control pressure from Table 1. Verify that upstream pressure is equal to or greater than the inlet control pressure. If not, contact Gas System Design Department to determine if 100 ft./min. velocity can be reached. (Inlet control pressure, 22.4 psig).
- (3) Install on the section to be purged and near the upstream mainline valve, a pressure gauge which is accurate and readable within 1 psi, so that inlet pressure can be observed. (The gauge should be connected through several feet of flexible tubing to eliminate excessive vibration.)
- (4) Open the blowoff valve at the downstream end of the section to be purged. Downstream blowoff valves should always be in the fully open position.
- (5) Begin purging by cracking upstream main line valve until minimum inlet control pressure is reached.

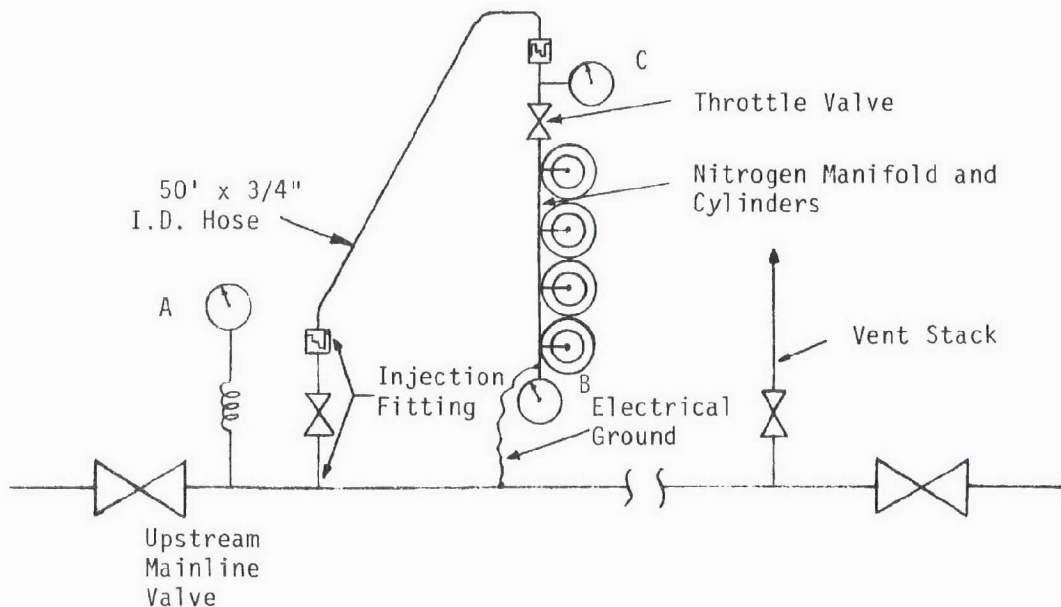
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(6) Monitor blowoff gas until combustible gas indicator reads essentially 100 percent natural gas. Stop injection. The use of a combustible gas indicator provides a means of analyzing the gas air mixture throughout the purging operation.

(7) Close blowoff value and return pipe to service.

3. PROCEDURE FOR PURGING AIR FROM PIPELINES GREATER THAN 10" IN DIAMETER USING A NITROGEN SLUG



Example:

Replace air with natural gas in a newly installed segment of 5,000 feet of 16" pipe utilizing an inert gas slug purge to prevent formation of a flammable mixture.

Procedure:

- (1) Determine blowoff size from Table 1 using pipeline size and length of section to be purged (6" blowoff and vent pipe diameter).
- (2) Determine minimum inlet control from Table 1 (11 psig inlet control pressure). Verify that upstream pressure is equal to or greater than the inlet control pressure. If not, contact System Design Department to determine if minimum slug velocity for pipeline size can be reached.
- (3) From Table 2, select a slug velocity (100 ft./min., for example) and determine the volume of nitrogen required to maintain that velocity. (790 cubic feet or four cylinders of nitrogen will be required.)

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- (4) Determine the injection rate from Table 2 (130 cu ft /min)
 - (5) Determine the nitrogen injection pressure from Table 3 using the injection rate and size and length of hose (49 psig)
 - (6) Install on section to be purged and near the upstream mainline valve, a pressure gauge which is accurate and readable within 1 psi, so that inlet pressure can be observed (The gauge should be connected through several feet of flexible tubing to eliminate excessive vibration)
 - (7) Install nitrogen injection fitting near upstream mainline valve
 - (8) Install nitrogen injection fixture as shown above Close all fixture valves
 - (9) Install vent stack and blowoff valve near the downstream mainline valve Leave blowdown valve open
 - (10) Blow down line to atmospheric pressure and leave vent stack open
 - (11) Open cylinder valves and pressurize manifold
 - (12) Open injection fitting valve
 - (13) Crack throttling valve till gauge C reads the required nitrogen injection pressure as a minimum
 - (14) When the required volume of nitrogen is injection and injection pressure cannot be maintained close throttling valve then injection fitting valve
 - (15) Immediately crack upstream mainline valve till gauge A reads desired inlet control pressure
 - (16) Monitor blowoff gas until combustible gas indicator reads essentially 100 percent natural gas Stop injection The use of a combustible gas indicator provides a means of analyzing the gas air mixture throughout the purging operation
 - (17) Close blowoff valve and return pipe to service
- 4 PROCEDURE FOR PURGING AIR FROM PIPELINE GREATER THAN 10" IN DIAMETER USING NATURAL GAS WITHOUT NITROGEN SLUG

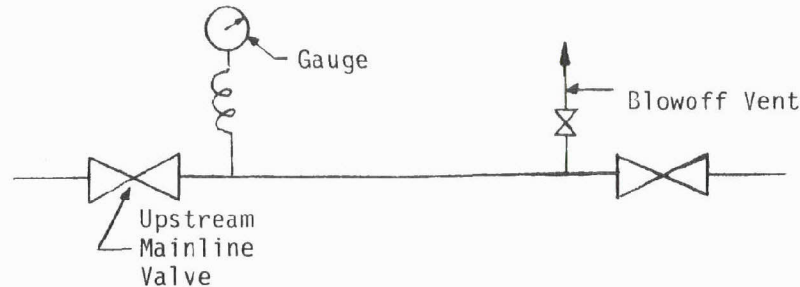
This procedure should only be used when lamb air movers are not available or purging with a nitrogen slug is impractical

As pipe diameter increases, the length of flammable mixture increases, and it becomes a more important consideration during purging operations

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Purging procedures for large diameter lines to provide means of removing all of the air by direct displacement with a combustible gas and displacement of a combustible gas with air follows.



Example:

Replace air with natural gas in a 10,000 foot section of 16" pipe. Nitrogen slug will not be used.

Procedure:

The following procedure, often called the Inlet Control Procedure, should be used for purging pipe of known size and length, which is dry and has connection for a pressure gauge at the inlet end of the section to be purged:

- (1) Determine the blowoff size from Table 1, using pipeline size, and the length of section to be purged (6" blowoff, 16" pipeline, 10,000 foot section).
- (2) Obtain the minimum inlet control pressure from Table 1 (12 psig).
- (3) Install on the section to be purged and near upstream mainline valve a pressure gauge, which is accurate and readable to within 1 psi, so that the inlet pressure can be observed. (Note: The gauge should be connected through several feet of flexible tubing to eliminate excessive vibration).
- (4) Open the blowoff valve at the downstream end of the section to be purged. Downstream blowoff valves should always be in the fully open position.
- (5) Start purging by bringing the inlet pressure quickly to the determined pressure and maintain the pressure for a period of time equal to two minutes for each mile of pipe in the section to be purged. (Maintain 12 psig inlet pressure for approximately four minutes).
- (6) At the end of the determined time (two minutes per mile), the inlet gas flow is shut off. However, the venting downstream blowoff should remain open for an additional one minute per mile of pipe being purged. (Keep downstream vent open for an additional two minutes.)

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Verify completeness of purge The use of a combustible gas indicator provides a means of analyzing the gas air mixture throughout the purging operating and also of confirming the gas to be free of air

- (7) Close the blowoff valve and return the pipeline to service

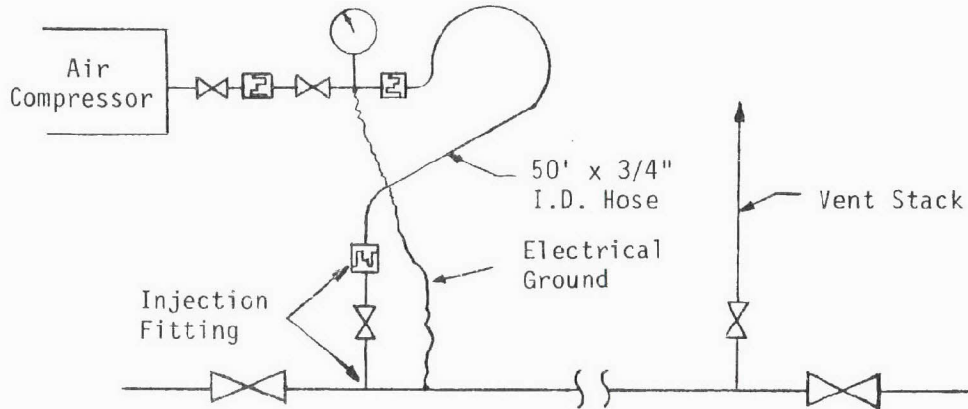
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APPENDIX B

PURGING OF NATURAL GAS FROM PIPELINES

1. PURGING OF NATURAL GAS FROM PIPELINE USING AIR WITHOUT NITROGEN SLUG

This procedure is typically used for purging pipelines 10" in diameter and less. It can be used on pipelines larger than 10" in diameter but only if lamb air movers are not available or a nitrogen slug is impractical.



Example:

Replace the natural gas with air in a section of 16" pipe 5000 feet long.

Procedure:

- (1) Determine blowdown valve size and vent piping diameter from Table 1, Appendix C, (use a 6" valve and vent pipe.)
- (2) Determine injection rate required for a minimum slug velocity of 100 ft./min. for a 16" pipe. Table 2, Appendix C shows an injection rate of 130 CFM is required. If a 150 CFM compressor is used, an injection rate of about 120 ft./min. is selected to make maximum use of the 150 CFM compressor.
- (3) Determine air injection pressure. Table 3, Appendix C shows that air injection pressure for 150 CFM through a 3/4" I.D. 50' hose is 59 PSIG.
- (4) Install vent stack.
- (5) Install connection to inject air.
- (6) Isolate pipe segment to be purged; blow down to atmospheric pressure and leave vent stack open.

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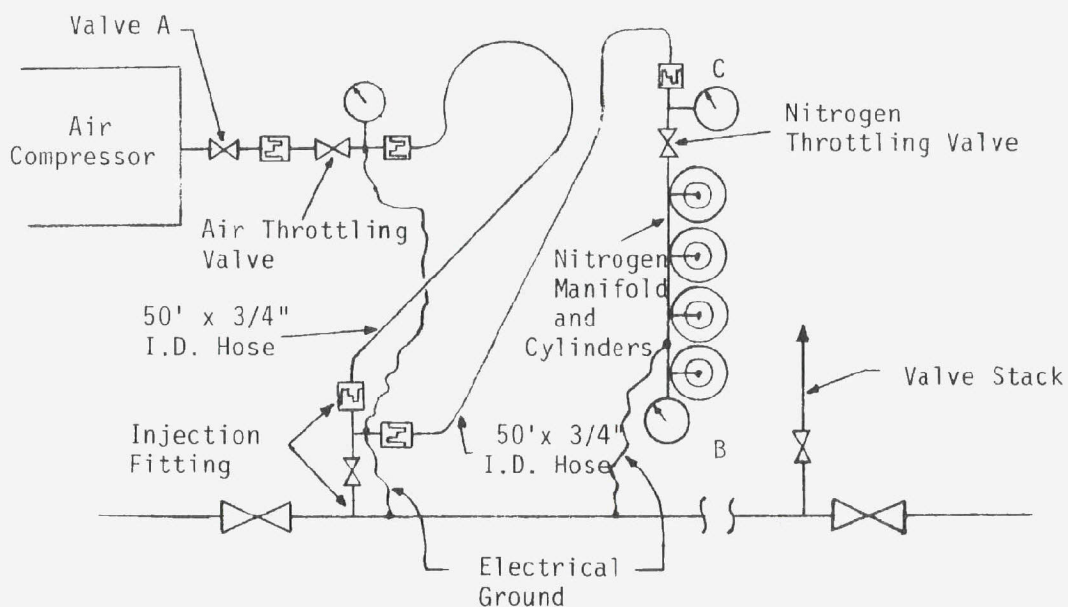
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- (7) Inject air; maintain at least 59 PSIG on the gauge at the inlet to air hose.
- (8) Stop injection of air when no natural gas can be detected. Refer to Section 4.2.3 for methods to determine presence of natural gas.
- (9) Positive steps shall be taken before working on a section of pipeline which has been purged, to isolate the purged section from any source of leakage (refer to Section 4.4). Isolation of the purged section may be accomplished by flooding of the section, insertion of blanks, approved stoppers, or actual detachment. Actual detachment is preferred.

2. PROCEDURE FOR PURGING NATURAL GAS WITH AIR FROM PIPELINES GREATER THAN 10" IN DIAMETER USING AIR WITH A NITROGEN SLUG



Example:

Replace the natural gas with air in a section of 16" pipe 5000 feet long utilizing an inert gas slug purge to prevent formation of a flammable mixture.

Procedure:

- (1) Determine blowoff size from Table 1, Appendix C using pipeline size and length of section to be purged (6" blowoff valve and vent pipe diameter).
- (2) From Table 2, select a slug velocity (100 ft./min., for example) and determine the volume of nitrogen required to maintain that velocity. 790 cubic feet (or four standard cylinders at 2200 PSIG) of nitrogen will be required if a slug velocity of 100 ft./min. is selected. The

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corresponding injection rate of 130 cu ft per minute would required two-105 cfm air compressors. A purge velocity of 150 feet per minute (200 cfm injection rate) is selected in order to make maximum use of the two 105 cfm compressors. Only three cylinders of nitrogen will be needed to provide the 590 cu ft required for the higher purge velocity.

- (3) Determine the nitrogen and air injection pressure from Table 3 Appendix C using the injection rate and size and length of hose (87 psig)
- (4) Install nitrogen and air injection fixtures as shown above. Pressure gauges should be accurate and readable within 1 psi so that inlet pressure can be observed.
- (5) Install vent stack and blowoff valve near the downstream mainline valve. Leave blowdown valve open.
- (6) Blow down line to atmospheric pressure and leave vent stack open.
- (7) Start air compressor and open valve A.
- (8) Open nitrogen cylinder valves and pressurize manifold.
- (9) Open injection fitting valve.
- (10) Crack nitrogen throttling valve till gauge C reads the required injection pressure as a minimum (87 psig).
- (11) When the required volume of nitrogen is injected and injection pressure cannot be maintained, close nitrogen throttling valve.
- (12) Immediately open air throttling valve and maintain minimum injection pressure (87 psig).
- (13) Monitor blowoff gas until purge is complete. Refer to Section 4.3.3. Stop injection of air when no natural gas can be detected.
- (14) Positive steps shall be taken before working on a section of pipeline which has been purged to isolate the purged section from any source of leakage (refer to Section 4.4). Isolation of the purged section may be accomplished by flooding of the section, insertion of blanks, approved stoppers, or actual detachment. Actual detachment is preferred.

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