

OPERATION AND MAINTENANCE PLAN

Facility Name: _____

Address: _____

SCOPE

This operation and maintenance plan was developed to assist _____ by providing specific instructions for conducting and documenting (See Section 5, Maintenance Records) operations and maintenance activities on the gas pipeline system.

The personnel responsible for the operations and maintenance of the gas system (responsible facility representative(s) and/or contractor) must be trained in the use of the procedures contained within this Operations and Maintenance Plan, and they must be qualified to conduct operations and maintenance activities (refer to the Operator Qualification Plan for more information).

This Operations and Maintenance plan shall be reviewed at intervals not to exceed 15 months, but at least once each calendar year, by all personnel who have responsibilities for the operations and maintenance of the gas system. A record of each review conducted shall be maintained (record annual O&M plan reviews on the last page of this plan).

This operations and maintenance plan, the emergency plan (Section 3), all system maps and records shall be kept in a location where they are made easily available to all appropriate responsible facility representative and/or contractor personnel and any representative of the Arizona Corporation Commission's Office of Pipeline Safety (AZOPS). The location where the plans, maps and all operation, maintenance, repair, new construction, and any other documentation that is relevant to the system is located at: _____.

PROCEDURE EVALUATION

At least once every 2 years, but more often as needed, normal operations and maintenance work done by responsible facility representative(s) and/or contractor personnel shall be observed and reviewed by the responsible facility representative(s). This observation is NOT conducted to review the person(s) who are conducting the operations and maintenance activities, but the review is done to evaluate the procedures that are being used to conduct the normal operations and maintenance activities.

If the review determines that the operations and maintenance procedures are not effective or if the procedures direct the work to be conducted in an unsafe manner, then the procedure(s) shall be revised as needed to ensure that activities are being conducted in a safe manner.

A written record shall be made and kept of each work review that is conducted. This record shall identify the person who is conducting the observation, the date that the observation was conducted, the person(s) who are conducting the specific operations and maintenance activity, the procedure(s) that are used to conduct such activities, and whether the procedure is satisfactory or unsatisfactory (See Section 5, Record No. 11).

If a procedure must be revised as a result of the work review, then a written record shall also be made and kept, to document the procedure revision showing the date the revision was made, the person who made the revision, and the reason for the procedure revision.

DISTRIBUTION SYSTEM

The distribution system consists of the following:

DIAMETER OF PIPE	TYPE MATERIAL	FT ABOVE GROUND	FT BELOW GROUND	TOTAL FEET	DATE INSTALLED
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

SYSTEM OPERATING PRESSURE

At the time of the very first inspection of the system, the maximum allowable operating pressure (MAOP) shall not exceed the pressure that is being provided by the gas supplier.

The MAOP of the pipeline system shall be determined by **lowest** value of the following:

1. The documented working pressure ratings of all piping and components. Steel mains and services shall use the design formula as listed in Title 49 CFR Part 192.105. Plastic mains and services shall use the design formula as listed in in Title 49 CFR Part 192.121. All components shall have a working pressure rating either marked on the component or have a written record that includes the pressure rating.
2. Pressure testing of the system. Refer to the pressure test section of this plan for more information. If test records are available, then the MAOP shall be determined by dividing the test pressure by 1.5.
3. If the system was constructed between 1965 and 1970, and there are records available to document the operating pressure between January 1, 1965 to December 31, 1970, then the MAOP shall be that operating pressure.
4. All new or replaced piping that is installed in the system shall be pressure tested to establish the MAOP that is the same as the current system pressure. The new or replaced segment may be pre-tested prior to installation. Refer to the pressure testing section of this plan for more information. A written record of each pressure test conducted on the system shall be made and kept for the life of the pipeline facility.
5. In the absence of any documentation that is listed in items 1-4 listed above, the MAOP shall not exceed the operating pressure provided by the gas supplier.

The MAOP of the system is _____ psi. This pressure was determined by item ____ (identify by the numbered item listed above)

CONTINUING SURVEILLANCE

The system shall be monitored on a continuous basis. This is accomplished by observing the physical condition of the system while conducting normal operations and maintenance activities on the system and observing system conditions at all other times. Appropriate corrective action shall be taken when any of the following conditions are observed, which shall include, but are not limited to, the following:

- Any failures of pipe or components which would require repair or replacements.
- Any increase in leaks, or changes in leak history.
- Any indications of corrosion if the underground piping is steel.
- Any changes in requirements for adequate cathodic protection if the underground piping is steel.
- Any other operating or maintenance condition that is determined to be unusual.

If any of the conditions listed above are observed, then action taken shall be towards minimizing hazards to life and property. Refer to the remedial measures section of the integrity management plan for more information about corrective action to be taken, based on the observed condition.

If any segment of main or service is found to be in unsafe condition, then steps shall be taken immediately to either repair the segment, replace the segment, take the segment out of service, or reduce the operating pressure. Any segments of mains and/or service lines that are determined to be prone to leakage must be replaced as soon as possible in accordance with the DIMP plan (PIPES Act 2020, Section 114).

All leaks discovered are to be considered hazardous and shall be responded to and repaired immediately.

SYSTEM STARTUP / SHUTDOWN

When occasions require that the system must be shutdown for maintenance, repairs, or for an emergency event, the system valves shall be used. Individual buildings may be isolated by using valves located on the inlet riser. If the entire system must be isolated, use the main valve located on the downstream side of the master meter set if available. The inlet valve to the master meter set may also be used, but that valve is the property of the gas supplier and only the gas supplier may re-open the valve.

Gas service shall be started up and/or restored by conducting the following steps listed below:

- Install pressure gages at various locations on the system to monitor the system pressure.
- Open the valve(s) slowly to avoid damage to regulators and any other equipment.
- Observe the pressure gages during the startup to ensure that the system pressure does not exceed the system maximum allowable operating pressure.

Following system startup, all service regulators shall be tested for proper operation. Refer to the service regulators section of this plan for more information.

CUSTOMER NOTIFICATION

If the system is located within a mobile home park, and features sub-meters for each mobile home unit, where the tenant is responsible for ownership and maintenance of the piping from the sub-meter to the mobile home unit, then the tenant shall be notified of their responsibility to maintain the gas piping that is not maintained by the mobile home park. The Customer Notification handout is located in Section 5, Record No. 12.

The tenant shall receive the customer notification handout no later than 90 days after service to the tenant has commenced.

The information may be given to the tenant directly by either mail, e-mail, or hand delivery. If this option is used, then a written record shall be made that documents the identified tenant and the date that the handout was delivered to the tenant. This record shall be kept on file for a minimum of 5 years.

As an alternative to delivering the information to the tenants individually, a copy of the customer notification handout shall be posted at all times on the property at a location that is accessible to the public/tenants.

PUBLIC EDUCATION / AWARENESS

The public awareness notice is located in Section 5, Records No. 8. It is the responsibility of the facility to fill in the blanks on the handout to make it site-specific to the facility. The notice shall be made available to the tenants of the property by using one of the following methods:

- The public awareness notice shall be delivered to each individual tenant at least twice each calendar year by either hand delivery, mail, e-mail, etc. If this option is chosen, then a written record shall be made that identifies each tenant that the handout was delivered to and the date of delivery. This record shall be kept on file for at least 5 years.
- As an alternative to individual hand delivery, a current copy of the public awareness notice shall be posted at all times at a location on the property that is accessible to the public. A record shall be made and kept that documents the posting of the notice along with the date and location of the posting. This record shall be kept on file for at least 5 years.

In addition to delivering the notice to tenants, a copy of the notice shall be given to any excavator that makes a request to locate the pipeline system on the property prior to excavation activities (refer to the damage prevention section of this plan for more information). A written record shall be made that identifies the excavator and documents the date that the notice was given. This record shall be kept on file for at least 5 years.

DAMAGE PREVENTION

No person or company shall begin any excavation on the property where the pipeline system is located without first notifying the responsible facility representative(s).

If a request for a locate is received, Arizona state law requires a positive response to the locate request. The locate request shall be reviewed to determine if any mains and/or services are within the proposed excavation area. This review shall be conducted within 10 working days after the request has been received. Refer to Section 8 of this manual for more information about the responsibilities of the facility owner as stated in the Arizona Underground Facilities Law.

If the property is an apartment complex or mobile home park, Arizona state law requires these facilities to register with the Arizona 811 Center as a landlord. Contact the Arizona 811 Center for more information about the registration process.

A copy of the public awareness handout notice (Section 5, Record No. 8) shall be given to the excavator that makes a request for a locate. A written record shall be made that identifies the excavator, and the date the handout was given.

If the pipeline facility needs to be located and marked, it shall be conducted in accordance with the following:

- If the facility was installed after 1988, then Arizona state law requires that maps and/or installation records be consulted to verify location of the affected facility in addition with the physical locating method. For facilities installed before 1988, maps and installation records may be used, but are not required.
- The equipment used to locate the underground facility shall be operated in accordance with the manufacturer's instructions. It is recommended to use a conductive locate, where the locating transmitter is connected directly to the piping system through a locate wire (for plastic facilities), risers, and/or test station wires (for steel facilities).
- Markings shall be spaced close enough to allow the excavator to reasonably determine the location of the affected pipeline facilities. Markings must be placed at service tees and locations where the pipeline changes direction in addition to all mains and services within the excavating area. All marks for gas pipeline facilities shall be yellow in color, and are made using paint, stakechasers, or flags.
- If there are no facilities within the area to be excavated, then the excavator shall be notified by either placing no conflict markings at the excavation site, or sending a message to the excavator using telephone, e-mail, etc. A written record shall be made and kept of each no-conflict notification.

If there is any reason to believe that excavation activities might result in possible damage to the piping facilities, then an inspection shall be conducted during and after the excavation activities to check for damage. This shall include a leak survey if the excavation involves blasting (refer to the leak survey and leak investigation sections of this plan). If any damages were the result of boring excavations, then the inspection shall include a leak investigation.

A written record shall be made of each locate request received, and each time that locating and marking activities are completed (See Section 5, Record 14).

INVESTIGATIONS OF FAILURES

Any event that is a result of failure of pipe or components, the cause of the failure shall be investigated by the responsible facility representative(s). This investigation is conducted to determine the cause of the failure and to determine what corrective action must be taken to prevent a recurrence.

If the cause of failure cannot be determined during the initial investigation, then the failed pipe or component must be removed from the system for analysis by an outside laboratory. The AZOPS shall be contacted (602-262-5601) prior to removal, then the failed sample must be dealt with in accordance with Arizona Administrative Code R14-5-207(P) (See Section 9 of this manual for more information).

TAPPING PIPELINES UNDER PRESSURE

If tapping mains under pressure is performed, the operation shall be conducted in accordance with a detailed written procedure. Many mechanical and fusion tees for plastic lines will have a factory procedure to complete the tap. If this is the case, the factory procedure shall be followed. If contractor personnel use their own detailed procedures for conducting tapping, then reviews shall be conducted to ensure that the written procedures are being followed.

It is mandatory that all personnel (both responsible facility representative(s) and/or contractor) shall be properly trained and qualified on all tapping procedures that are being used (Refer to Section 1, Operator Qualification Plan for more information).

PURGING GAS LINES

Purging of air and/or gas from mains and services shall be conducted in accordance with a detailed written procedure. The Purging Guidelines are located in Section 15 of this manual must be followed to ensure the purging is conducted in a safe manner. If another purging procedure is used, it shall contain the following:

- The air or gas must be released into the pipeline in a rapid and continuous flow.
- A combustible gas indicator (CGI) shall be used to verify readings of 0% gas (if purging with air), or 100% gas (if purging with gas).
- If air or gas cannot be supplied in enough amounts to ensure that no hazardous gas/air mixture is created inside the main or service, then a slug of inert gas (Nitrogen, etc.) must be used before introducing gas or air into the facility.
- The purge stack shall extend far enough above grade (minimum of 6 feet) to safely vent the gas or air away from the purging area. In addition, the stack shall be properly grounded to prevent the buildup of static electricity using grounding rods and clamps, and the purge stack shall not be directed towards persons or buildings.
- Every effort shall be made to minimize the amount of gas being purged into the atmosphere by either ensuring that the gas is consumed within the pipeline segment to be purged prior to conducting the purging, or by making the segment to be purged as small as possible. The use of flaring to burn off the gas as it is being expelled from the pipeline is prohibited (PIPES Act 2020, Section 114).

It is mandatory that all personnel (both responsible facility representative(s) and/or contractor(s)) shall be properly trained and qualified on all purging procedures that are being used (Refer to Section 1, Operator Qualification Plan for more information).

ODORIZATION

To ensure that the gas is properly odorized, a sniff test shall be conducted at least 4 times each calendar year with intervals not to exceed 4 months.

The sniff test is conducted by releasing a small amount of gas into the atmosphere while making an attempt to detect the distinctive odor with a sense of smell. The use of 2 persons to conduct this test is recommended. In addition to the sniff test, documentation may also be obtained from the gas supplier that verifies that the gas supplied to the system is adequately odorized.

The safest locations to conduct the sniff test are at gas grills or gas stoves, since gas can be released into the atmosphere without having to disconnect any piping or fittings. Do not disconnect any pipe or fittings inside buildings or near ignition sources to conduct the test. If there are no places inside buildings to safely conduct the test without having to disconnect the pipe or fittings, then conduct the test outdoors at risers or at the master meter set.

It is recommended to conduct the test at the far ends of the system to ensure that odorant is reaching all parts of the system.

If odorant is not detected, the gas supplier shall be notified immediately for action to be taken to odorize the system. The AZOPS shall be notified when odorant is not detected at (602) 252-4449.

A written record shall be made and kept of each sniff test that is conducted (See Section 5, Record No. 1).

PATROLLING

Patrols are visual inspections of mains that are in locations where anticipated physical movement of the facility may result in damage or leakage. These inspections are done to watch for, and correct, any conditions that may result in failures/leaks and include, but are not limited to, the following:

- Movement of aboveground piping on wall or roof supports.
- Application of roofing foam on rooftop piping.
- Risers and other aboveground piping in locations that may be subject to damage from motor vehicle traffic.
- Encroachments of buildings over underground mains and/or services.

Mains at priority 1 facilities (schools, churches, hospitals, day care centers, adult care centers, prisons, etc.) where outside forces may result in damages or leaks, shall be patrolled at intervals not exceeding 4 ½ months, but at least 4 times each calendar year.

Mains at priority 2 facilities (apartments, mobile home parks, campgrounds, industrial plants, etc.) where outside forces may result in damages or leaks, shall be patrolled at intervals not exceeding 7 ½ months, but at least 2 times each calendar year.

If there are any conditions observed during patrols that are identified as being in an unsatisfactory condition, then corrective action to minimize the hazard shall be conducted within 30 days of the discovery. Refer to the preventative measures section of the written integrity management plan for more information about corrective action.

A written record shall be made and kept of each patrol that is conducted (See Section 5, Record No. 10).

LEAKAGE SURVEYS AND INVESTIGATION

Leak detection surveys are conducted using specialized equipment that is capable of detecting both underground and aboveground leaks. Leak surveys shall be conducted using the types of equipment that is listed in TABLE 2 of GPTC G-192-11 (2022 edition).

Leak survey equipment shall be tested and calibrated before each use in accordance with manufacturer's instructions and sections 4.6 and 4.7 of GPTC G-192-11 (2022 edition).

Both surface and sub-surface leak surveys shall be conducted in a manner that is in accordance with sections 4.4(a) and 4.4(b) of GPTC G-192-11 (2022 edition). An entire system pressure test may be used as an alternative to an instrument leak survey (refer to the pressure test section of this plan for more information).

Leak surveys shall be conducted at intervals not to exceed 15 months, but at least once each calendar year.

A written record shall be made and kept of each leak survey conducted and all leaks that have been identified and repaired (See Section 5, Record No. 2 and Record No. 2A). These records shall identify the instrument used to conduct the survey, instrument calibration information, and results of the survey. Records also must identify each main and service that has been leak surveyed.

If an initial leak survey indicates the possible presence of an underground leak, then an investigation using a combustible gas indicator (CGI) shall be conducted immediately to pinpoint the location of the leak and determine the spread of underground gas. The CGI shall be operated in accordance with the instructions from the equipment manufacturer.

Samplings shall be taken over the main or service line, and at locations on both sides of the facility. The maximum spacing between initial samples shall not exceed 10 feet.

If there are any indications of underground gas/air mixtures, then additional samples shall be taken at locations that are more closely spaced together. Continue to take additional samples until the highest reading location is identified.

To determine the leak spread over the main or service, take samples moving in both directions over the pipeline away from the positive readings until there are 2 consecutive readings of 0 percent gas to air mixture.

To determine leak spread from the pipeline, take samples while moving away from the pipeline in both directions perpendicular to the main or service. Continue to take samples until there are 2 consecutive readings of 0 percent gas to air mixture.

If there is a building located within 20 feet, then samples shall be taken at the building wall. If there are any indications of gas/air mixtures at the building wall, then the investigation shall continue inside the building. The leak shall be considered as hazardous which means that the emergency plan shall be followed to protect life and property.

NOTE: The only instrument that can be used for safely conducting an indoor leak investigation is a CGI. DO NOT use a flame ionization instrument inside of any building.

A written record shall be made and kept of each leak investigation that is conducted. The record shall identify the locations where samples were taken, the results of each sample, and the date and time that the investigation was conducted.

NOTE: All leaks are to be repaired promptly. AZOPS approval is required before any leaks are graded and classified in accordance with section 5 of GPTC G-192-11 (2022 edition) and shall conform to the repair timelines listed below:

- All grade 1 leaks, which are considered hazardous, must be repaired immediately following discovery.
- All grade 2 leaks shall be identified and repaired within 30 days of discovery.
- All grade 3 leaks shall be identified and repaired within 60 days of discovery.

NOTE: If the facility uses sub-meter sets to provide gas to tenants, the volume of gas billed by the provider through the master meter set is compared to the total volume amount that was measured through all of the sub-meter sets to determine if any lost and/or unaccounted gas is identified. If there is any lost and/or unaccounted gas, then a leak investigation shall be conducted. For non sub-metered facilities, monitor for the total volume of gas billed by the provider to determine if there is any unusually high usage being billed when compared to previous billing statements. If a high bill is noted, the provider shall be contacted as soon as possible to assist in the leak investigation (PIPES Act 2020, Section 114).

VALVE MAINTENANCE ON DISTRIBUTION SYSTEMS

Exterior valves in the distribution system that have been identified as valves that may be used in an emergency event to isolate the entire system, or portions of the system, shall be maintained and tested to ensure proper operation. The valves are inspected by partially operating them by moving the valve operating mechanism enough to partially close the valve, then moving the mechanism back to the open position. If any maintenance is needed to be performed on a valve, the maintenance work shall be conducted in accordance with instructions from the valve manufacturer.

Valves shall be inspected, operated, and serviced (if necessary) at intervals not to exceed 15 months but at least once each calendar year.

If any valve is found to be inoperable during the annual inspection, then corrective action shall be conducted within 30 days. The action shall be to either repair the valve, replace the valve, or to designate another valve.

A written record shall be made and kept of each valve inspection/maintenance that is conducted (See Section 5, Record No. 4).

REGULATOR STATION INSPECTION

If the piping system uses regulator sets and/or relief valves to protect the system from overpressure, then the regulator equipment and/or relief valves shall be inspected and tested for proper operation.

Regulators are tested for proper operation by observing the set-point and lockup pressures by conducting the following:

- Attach a calibrated pressure gage between the regulator(s) and an isolation valve located downstream from the regulator(s).
- Observe the outlet pressure on the regulator. This is the regulator set-point pressure.
- Close the downstream isolation valve to simulate no-load conditions. The pressure reading should go up slightly then stop. The reading where the pressure stops rising is the lockup pressure.

If the station is a worker/monitor design, the worker regulator is tested using the steps listed above then the monitor regulator is also tested the same as the worker regulator. The lockup pressure of the monitor regulator shall not exceed the system MAOP plus allowable buildup pressure.

If the regulator fails to lockup (the pressure continues to rise even with the downstream valve closed), then corrective action must be immediately taken to repair or replace the regulator. The regulator repair shall be conducted in accordance with written maintenance instructions provided by the regulator manufacturer.

Regulator stations shall be inspected and tested for proper operation at intervals not to exceed 15 months, but at least once every calendar year.

If a relief valve is used for overpressure protection, then the capacity must be determined annually using either a full capacity test or calculation reviews. If any equipment is changed, then a new calculation for adequate relief valve capacity must be determined. If a full capacity relief valve test is used, every effort shall be made to minimize the amount of natural gas released by using either compressed air or nitrogen gas (PIPES Act 2020, Section 114).

If any changes are planned to be made to existing regulator stations, then AZOPS shall be contacted to review the proposed changes to ensure compliance with all applicable regulations (PIPES Act 2020, Section 114).

A written record shall be made and kept of each regulator station that is inspected (See Section 5, Record No. 14).

If relief valves are tested or reviewed, a written record shall be made and kept of each test or calculation review that is conducted (See Section 5, Record No. 15).

CORROSION CONTROL - GENERAL

All underground metallic mains and services shall be maintained and protected against rust (corrosion).

Facility employees and/or contractor personnel who are responsible to carry out the procedures contained in this section shall be trained and qualified in corrosion control methods (Refer to Section 1, Operator Qualification plan for more information).

All new installed steel mains and services that are installed underground shall have both a protective coating and cathodic protection at the time of pipe installation but no later than 45 days following installation. All segments of steel mains and services that are used to replace older piping shall also have a protective coating and be installed with cathodic protection.

All segments of steel mains and services that are used to replace older piping shall also have a protective coating and be installed with cathodic protection.

CORROSION CONTROL – EXTERNAL CORROSION INSPECTION

Whenever a segment of buried steel main or service is exposed for any reason, a visual inspection shall be conducted on the exposed piping to determine the condition of the coating and to look for any evidence of external corrosion.

If external corrosion is observed, then the exposure of the underground main or service shall be extended both longitudinally (in both directions away from the corrosion area) and circumferentially (around the entire outer surface of the facility) until all of the external corrosion area is identified. Once the area of external corrosion is identified, then the corroded area shall be repaired immediately, by cleaning the area, removing the corrosion from the main or service, then applying a new protective coating (Refer to Section 10, Chapter VIII, pages 21-22 of this manual for more information about coating application). If a tape coating is used, make sure you adequately overlap and extend the new wrap to at least 12 inches from the repaired area in both directions.

A written record shall be made and kept for each exposed pipe visual inspection that is conducted, including information on any additional investigations and repairs as necessary. Records for external corrosion visual inspections shall be kept for the life of the pipeline facility.

CORROSION CONTROL – ANNUAL SURVEYS

To determine the effectiveness of the cathodic protection system, an annual pipe-to-soil survey shall be conducted at intervals not to exceed 15 months, but at least once each calendar year.

Equipment used includes a copper/copper sulfate reference cell and a high-impedance voltmeter. Operation and maintenance of the equipment shall be conducted in accordance with the equipment manufacturer's written instructions.

The voltmeter has two test leads which are red and black in color. The red test lead is connected to the positive terminal of the voltmeter (indicated by red) and to the reference cell. The black test lead is connected to the common terminal of the voltmeter (indicated by black) and to the pipe. The voltmeter must be set to read, Direct Current Volts, which will be indicated on the display screen by the symbol VDC.

When taking a voltage reading, place the tip of the reference cell into the soil. If the ground is hard and dry, apply some water to the ground before placing the reference cell (this helps to reduce the electrical resistance). If taking a reading on a riser, make sure there is good metallic contact between the voltmeter lead and the steel riser. For readings at test leads, make sure the wire is cleaned off to ensure metallic contact with the voltmeter lead.

Voltage readings must be taken at a sufficient number of locations and near mid-points between sacrificial anodes to assure that steel piping is being adequately protected.

The reading on the voltmeter shall be at least -0.850 DC volts for adequate cathodic protection. Any readings below -0.850 DC volts shall require corrective action to be taken within **30 days** following discovery. Refer to the remedial action section of this plan for more information.

A written record shall be made and kept for each cathodic protection annual survey that is conducted (See Section 5, Record No. 5). All records of annual pipe-to-soil surveys shall be kept for the life of the pipeline facility.

CORROSION CONTROL – RECTIFIER INSPECTION

If the facility uses rectifiers as the source of protective electrical current, then the rectifiers must be inspected and tested for proper operation at intervals not to exceed 2 ½ months, but at least 6 times each calendar year using the steps listed below:

- Use a high impedance voltmeter to conduct the test.
- Set the voltmeter to read direct current (DC) volts, then connect the red voltmeter lead to the anode or (+) terminal on the rectifier and connect the black voltmeter lead to the pipe or (-) terminal on the rectifier. Read and record the voltage reading.
- If the rectifier has a shunt, then connect the voltmeter leads to each end of the shunt. Read the voltage across the shunt. To determine the DC current, you must divide the voltage reading by the electrical resistance of the shunt (given in Ohms). If there is no shunt on the rectifier, then you must use the voltmeter setting to read current and follow the voltmeter manufacturer's instructions for how to read DC current.

A written record must be made and kept, to document the voltage and current output of the rectifier (See Section 5, Record No. 6) each time a rectifier is inspected and tested.

CORROSION CONTROL – REMEDIAL ACTION

Anytime a reading taken during an annual survey is less than -0.850 DC volts, then corrective action must be conducted immediately. The issue shall be investigated to determine the cause of inadequate cathodic protection, then once the cause is known, then repairs must be conducted to correct the condition. Refer to troubleshooting guidelines listed in Section 10 of this manual for more information. **All corrective action shall be completed within 30 days following discovery.** If the corrective action will take longer than 30 days to complete, then detailed written records shall be made to demonstrate the reason for corrective action that will take longer than 30 days to complete and shall document progress towards completion of the corrective action.

A written record shall be made of each corrective action that is conducted on the system and shall be kept for the life of the pipeline facility.

CORROSION CONTROL – ELECTRICAL ISOLATION

All aboveground pipe shall be electrically isolated from underground pipe by the use of isolating unions or flanges (unions and/or flanges that have a non-conductive electrical gasket separating the two parts). If it is suspected that an isolating fitting has failed, then take pipe-to-soil readings on both sides of the isolating fitting. If the difference between the readings is less than 0.100 DC volts, then the isolating fitting must be replaced within the time period as mentioned above for remedial action.

CORROSION CONTROL – TEST LEAD AND / OR ANODE INSTALLATION

If the piping system includes large amounts of footage between service risers, then installing a test lead wire must be considered. Test wires are usually attached to the pipe surface by the means of an exothermic weld (often known as a Cadweld). The test wire must be installed in such a manner as to minimize stresses on the wire (Refer to Section 10, Chapter III, page 15 (Figure III-12) of this manual for more information about how a test wire is installed using a Cadweld process).

For installing a galvanic anode, it is recommended to attach a separate test wire to the pipeline, then run the wire up above grade and attach the test wire to the anode lead in an aboveground test station. Connecting the anode in this way allows for easier testing of the anode and for troubleshooting of the cathodic protection system.

If the anode is installed close enough to a service, then the anode lead may be directly attached to the riser using a grounding clamp.

Anytime a Cadweld process is used to install leads on a buried steel main or service, the area of the weld shall be coated in the same manner as a pipeline coating (Refer to Section 10, Chapter III, page 20 of this manual for more information about coating application). If a tape coating is used, make sure you adequately overlap and extend the new wrap to at least 12 inches from the Cadweld area in both directions.

CORROSION CONTROL – INTERNAL CORROSION INSPECTION

Whenever a segment of buried steel main or service line is cut out and removed from the system, the inside surface of the cut-out piping shall be visually inspected for evidence of internal corrosion. If internal corrosion is observed, then an investigation shall be conducted to determine the cause of the internal corrosion, and corrective actions shall be conducted as needed to resolve the issue.

A written record shall be made and kept for each internal corrosion visual inspection that is conducted, including information on any additional investigations and repairs as necessary. Records for internal corrosion visual inspections shall be kept for the life of the pipeline facility.

CORROSION CONTROL – ATMOSPHERIC CORROSION INSPECTION

All aboveground piping shall be protected from atmospheric corrosion by the use of paint or other coatings. This will place a barrier between the pipe and the outside elements. This protection must be suitable to prevent corrosion caused by moisture (rain, fog, sprinklers, coolers, or any other source of water). This protection is vital for locations of the piping at the interface between the soil and the atmosphere.

Aboveground piping shall be visually inspected for evidence of atmospheric corrosion at intervals not to exceed 15 months, but at least once each calendar year. Inspections may be conducted while performing patrols or during the annual leak survey.

If there are any locations of piping that show atmospheric corrosion, then immediate action shall be taken to clean and re-paint the locations. Corrective action shall be completed within 30 days following discovery.

A written record shall be made of each atmospheric corrosion inspection along with any corrective action that was conducted as a result of the inspection. Records of atmospheric corrosion inspections shall be kept for the life of the pipeline facility. Use the Pipeline Patrolling Record (See Section 5, Record No. 10) for atmospheric corrosion inspections and corrective actions taken.

ABANDONMENT OF DISTRIBUTION GAS LINES

If the gas lines are to be abandoned in place, they shall be physically disconnected from the gas system. The open ends of the lines shall be plugged or capped. Purging the abandoned lines to prevent the development of a potentially hazardous condition, will be done by filling the line with water or an inert material. Abandoned gas lines shall be indicated on the system maps. A written record shall be made and kept for each segment of gas line that is abandoned.

All abandoned gas valve boxes shall be filled to grade with sand or a suitable substitute.

DISCONTINUED SERVICE

Whenever gas service to a unit, tenant, or building is discontinued, one of the following steps must be conducted:

- The valve that is closed to prevent the flow of gas into the building must be provided with a locking device or other means designed to prevent the opening of the valve by persons other than those authorized by the facility operator.
- A mechanical device or fitting that will prevent the flow of gas must be installed in the service line riser.
- The building must be physically disconnected from the gas supply and all open pipe ends shall be capped or sealed.

PREVENTION OF ACCIDENTAL IGNITION

Actions shall be taken to minimize and/or eliminate all sources of ignition in all environments where the presence of natural gas or propane vapors may constitute a hazard of fire or explosion.

Procedures shall be developed to address the prevention of accidental ignition covering any task on the pipeline that may result in the release of natural gas or propane, including but not limited to; venting, purging, tapping, cutting, repairing and replacing pipeline, etc. Procedures must include situations where warning signs and fire extinguishers must be provided to minimize hazards.

Do not perform any cutting, welding, or other work that is considered an ignition source on the piping facility that potentially contains a mixture of natural and/or LP gas and air.

ANNUAL REPORT

An annual report shall be filed with the Arizona Corporation Commission's Office of Pipeline Safety by no later than April 15. The report is for the preceding calendar year (January 1 to December 31). See Section 6, Annual Report in this manual for a sample copy of the annual report.

This information shall include the types of material in the system (either steel or plastic) and accurate footages of each material. In addition, if there were any leaks on the system during the previous calendar year, they must be reported with the cause of the leak identified. If there were any leaks that were present at the end of the calendar year that have not yet been repaired, these leaks must be reported, and there must be a documented reason why the leak(s) was not yet repaired.

The mailing address for the annual report is: Arizona Corporation Commission, Office of Pipeline Safety, 1300 West Washington Street, Suite 220, Phoenix, Arizona 85007. Alternatively, the annual report may be e-mailed to safety@azcc.gov.

PRESSURE TEST REQUIREMENTS

All Installations of new pipe and components, and repairs will be inspected by AZOPS.

Each new, replacement, reinstated or uprated pipe will be subjected to the pressure test required in accordance with Title 49 CFR 192 Subpart J, K prior to being filled with gas and put in service.

Pressure testing medium shall be air, water, or inert gases (such as Nitrogen). Do not use natural gas or LPG as the test medium.

Each pressure test that is conducted shall use a pressure gage that has been calibrated for proper operation, either using a field test with a master gage, or using a newly purchased gage with documentation from the gage manufacturer to demonstrate accuracy and proper operation of the gage. If pressure charts or deadweights are used, these shall also be calibrated to the same standards as for pressure gages.

All pressure tests shall be conducted for a minimum time of one (1) hour.

All pressure tests will be witnessed by AZOPS and an operator representative.

The testing for new pipe (including pre-tested pipe), replaced pipe, or re-located pipe shall be conducted in accordance with the following:

- **All steel piping, regardless of operating pressure:**

The minimum test pressure shall be 90 pounds per square inch (psi), or 1 ½ times the system MAOP, whichever is greater. The pressure gage used for the test shall read in 1 psi increments and shall have a scale that is greater than 90 psi.

- **PE plastic mains and services, regardless of operating pressure:**

The minimum test pressure shall be 60 psi, or 1 ½ times the system MAOP, whichever is greater. The pressure gage used for the test shall read in 1 psi increments and shall have a scale that is greater than 60 psi.

If a new component (valve, regulator) is installed, the component shall have a written record from the component manufacturer that documents the working pressure rating of the component. As an alternative to a written record, the pressure rating must be marked on the component. The tie-in joints for the new component shall be soap-tested at normal operating pressure.

New pipe may be **pre-tested** before installation then soap tested at tie- in joints at normal operating pressure. Pre-tests of new pipe must be documented and witnessed by the operator. A record shall be made of each pre-test that is conducted (See Section 5, Record No. 3) and kept for the life of the pipeline facility.

When new pipe is installed into the system without a pre-test, the part of the system that was taken out of service along with new pipe installed, will be tested as new and the test will be witnessed by AZOPS.

If any local jurisdiction requires testing that exceeds any of the standards listed above, then the pressure test shall be in accordance with the standards that are most restrictive.

RE-ESTABLISHMENT OF SERVICE

All existing pipe and components will be subjected to the following pressure test requirements:

- Regardless of material, the test shall be conducted at either 10 psi or 1 ½ times the system MAOP, whichever is greater. The pressure gage used for the test shall read in 1/10 psi increments and shall have a scale that is greater than 10 psi.
- All existing pipe and components isolated through disconnection will be pressure tested at 10 psi or 1 ½ times the system MAOP, whichever is greater. However, an existing service that is disconnected from the main shall be pressure tested from the point of disconnect to the service valve in the same manner as new pipe testing before reinstatement.
- Any physical damage to the system (ex.: third party damage, vehicle traffic, etc.), the affected main(s) and/or service(s) shall be tested at 10 psi or 1 ½ times the system MAOP, whichever is greater.

Do not conduct a pressure test against a closed valve if there is either natural gas or LPG on the other side of the closed valve. The valve shall be opened and capped for conducting the pressure test.

A written record shall be made for each pressure test that is conducted (See Section 5, Record No. 3). This record shall be kept on file for the life of the pipeline facility.

SHUTOFF BY GAS SUPPLIER

If the system is shut off due to any issues upstream from the master meter on the gas supplier's side, the system will not require a pressure test as described in the pressure test procedure, unless the system fails a pressure drop-test that is performed by the gas supplier. The gas supplier shall notify the AZOPS prior to re-establishing service to the system.

CONSTRUCTION STANDARDS

MATERIALS

All materials that will be installed within the system shall be approved for use with gas service, and they shall be clearly marked to demonstrate to what standard that the material was manufactured to.

Steel pipe shall comply with one of the following standards:

- ASTM A53 (grade B, grade A, grade X42, etc.)
- ASTM A106
- API 5L

All plastic pipe and fittings shall comply with the standard ASTM D2513, and be marked with the lettering CD, CE, CF or CG. This verifies that the pipe material has been rated for elevated temperature service.

All valves, regulators, and other components shall be marked with the manufacturing standard that the component is in compliance with. Valves shall be marked with the working pressure rating of the component (WOG 150, Case 100 psi, etc.).

Flanges shall be marked with the appropriate ANSI class rating.

If no markings are present on the pipe or component, then written documentation shall be available from the component manufacturer that demonstrates the standard that the material was manufactured to. This written documentation shall be kept on file for the life of the facility.

WELDING

All joints in steel mains and services that are made by welding shall be conducted using welding procedures that have been written and qualified in accordance with API 1104 (Welding of Steel Pipelines). The welding procedure must include a record of the destructive test that was done to qualify the procedure. Copies of the welding procedures and qualification test records shall be kept on file for the life of the pipeline facility.

All welders that are engaged in joining together steel mains and services shall be qualified to the welding procedures that are being used prior to conducting the work. Qualification is done by having the welder make a test weld then have the test weld evaluated by either destructive testing or by radiograph (X-ray). If an x-ray test is used, then the weld shall conform to the standards of API 1104 – Section 9 (current referenced edition in state rules). Alternatively, a welder may qualify to weld in accordance with the destructive test that is specified in Title 49 CFR Part 192, Appendix C. A written record shall be made of each welder's qualifying test(s) and kept for the life of the pipeline facility.

All welds made on steel mains or services shall be inspected to ensure that the welding procedure(s) was followed, and that the weld meets the standards of workmanship that is specified in API 1104 – Section 9. All personnel that conduct inspections of welded joints shall be qualified to inspect by appropriate training and experience to conduct such inspections. Since the piping usually will not operate at the same pressures as a transmission pipeline, and is usually less than 6 inches in diameter, then a visual inspection is all that is required. If non-destructive testing is conducted (x-ray, magnetic particle, liquid penetrant, ultrasonic), then the testing shall be done in accordance with a detailed written procedure and be conducted by persons who are trained and qualified in conducting non-destructive testing. Qualification is usually achieved by the person possessing a level II or level III certification of training from the American Society of Non-Destructive Testing (ASNT). A written record shall be made of each weld that is non-destructively tested and/or visually inspected and kept for the life of the pipeline facility.

Welding operations must be protected from weather and other adverse conditions that may affect the quality of the completed weld by using shelters or waiting for a day when weather conditions are ideal.

No miter weld joints are allowed within the system.

PLASTIC PIPE JOINING

All joints in plastic piping shall be joined by either heat fusion or mechanical joints. Threaded plastic pipe joints for gas services are prohibited.

All fittings (couplings, tees, elbows, etc.) used in making joints shall be marked with the appropriate information as required by ASTM D2513.

Joints made by heat fusion shall be made using a detailed written joining procedure(s). Plastic pipe manufacturer(s) have written/qualified fusion procedures available. If the manufacturer's procedure(s) is used, a copy of the procedure(s) and the destructive test results that qualify the procedure(s) shall be kept on file for the life of the pipeline facility. All equipment used to make fusion joints shall be operated in accordance with the equipment manufacturer's instructions and the written joining procedure(s).

If the system contains PVC pipe, then all solvent/cement used for joints must conform to ASTM D2513-99 and be used in accordance with the written manufacturer's procedure(s). These solvent cement joints shall be limited to installing a PVC cap or a PVC/PE transition fitting that is used for repairs.

All joiners of plastic pipe by heat fusion shall be qualified by the appropriate destructive testing that is specified in Title 49 CFR Part 192.285 and the qualification bulletin(s) supplied by the pipe manufacturer(s). A written record shall be made of each joiner's qualifying test(s) and kept for the life of the pipeline facility.

Joints made by mechanical fittings shall be done in accordance with the detailed written procedure that is provided by the fitting manufacturer. A copy of the procedure(s) that is used shall be kept on file for the life of the pipeline facility. All mechanical fittings shall have a rigid internal stiffener.

All plastic pipe joints shall be visually inspected by personnel who are qualified by appropriate training or experience to conduct joint inspections. All new mechanical fitting locations shall be noted by additions to the system map and/or records (Refer to Section 1, Distribution Integrity Management Plan for more information).

INSTALLATION – GENERAL

Refer to drawing located in Section 14 of this manual and to the following procedures for more information about proper system installation.

NOTE: If a local jurisdiction has standards for gas piping installation that are more restrictive than the requirements of Title 49 CFR Part 192, Arizona Administrative Code, NFPA 58/59 (for LPG systems), then the piping must be installed in accordance with the standards that are the most restrictive.

DEPTH OF COVER

The distance for depth of cover is measured from the top of the pipe up to the elevation of the final finished grade (regardless of material used):

- For buried mains, regardless of location, the minimum amount of cover shall be at least 24 inches.
- For service lines located under areas of vehicle traffic (driveways, parking lots, etc.), the minimum amount of cover shall be at least 18 inches.
- For service lines not located under areas of vehicle traffic, the minimum amount of cover shall be at least 12 inches.

BEDDING AND SHADING

All mains and services shall have at least 6 inches of sandy-type soil installed completely surrounding the pipe. The soil must be able to filter through a Number 4 sieve (about ¼ inch openings). Native soil may be used for bedding and shading material, but it must be free of large rocks and other debris that may damage the plastic pipe wall, or the coating on the steel pipe.

Once the bedding and shading material has been installed, then the backfill on top of the shading may be native material that was originally excavated out of the trench.

TRACER WIRE

All plastic mains and services that are installed underground shall have a tracer wire installed with the new piping to allow for the pipeline to be located in the future as needed. The wire shall have a minimum size of 14 gage (larger gage sizes 12, 10, 8, etc. may be used). In addition, the tracer wire shall have a protective coating and must be electrically conductive to allow for the wire to carry a locate signal. It is recommended to install the tracer wire on top of the shading above the pipe.

Wrapping the tracer wire around the pipe is prohibited.

OTHER INSTALLATION REQUIREMENTS

If the main or service is installed using a trenchless method (i.e. boring), then any new main or service shall be run inside a protective sleeve. Sleeving must be approved sleeving material, yellow in color from the manufacturer or painted yellow. Sleeving must be at least 1 ½ times larger than carrier pipe. Steel carrier pipe may not be inserted into plastic sleeving. The ends of the sleeve must be prepared so that the pipe wall will not be damaged during the installation. For plastic pipe installed in this way, the requirements for tracer wire remain the same as listed above.

Trenchless installation methods shall be limited to installation of plastic mains and services only.

