Attachment 4

Asset Type:	**Gas Distribution and Transmission**	Date Issued/Updated:	**March 2009**
Function:	**Maintenance and Operation**	Page:	**1** of **23**

Title: Gas Valve Maintenance Requirements and Procedures

Overview

This work procedure provides maintenance requirements and procedures for plug, ball, and gate valves (referred to as "valves") installed in and necessary for the safe or emergency operation of Pacific Gas and Electric Company's (the Company's) gas systems and facilities.

Governing Document

S4430, "Gas Facilities Requirements,"– *Expected publication 2009*

Safety

Failure to perform required maintenance could pose a risk to public safety in the event of equipment or pipeline failure.

Perform work safely and in accordance with all applicable safety rules, the *Code of Safe Practices*, and Utility Standard Practice (USP) 22, "Safety and Health Program."

Compliance

The manager of Gas Transmission and Distribution (GT&D) Pipeline Engineering and the manager of Gas System Integrity are responsible for establishing and maintaining procedures to comply with this work procedure.

Division and district Maintenance and Construction (M&C) superintendents are responsible for implementing this work procedure within their respective organizations.

Division and district M&C superintendents must ensure that their valve maintenance supervisors are aware of and follow the requirements in this work procedure. Periodic audits by Company personnel may be conducted to ensure compliance with these requirements.

Responsible superintendents and supervisors must measure the implementation and effectiveness of this work procedure through the record reviews described in Attachment 1, "Valve Maintenance Record," and regular field verifications. The California Public Utilities Commission (CPUC) also conducts compliance audits on the requirements set forth in this work procedure.

Gas Valve Maintenance Requirements

1. Purpose

The purpose of this work procedure is to provide procedural details for inspecting, lubricating, servicing, and operating gas valves.

2. Code Requirements

A. 49 CFR Paragraph 192.745, "Valve maintenance: Transmission lines" requires that:
"Each transmission line valve that might be required during any emergency must be inspected and partially operated at intervals not exceeding 15 months, but at least once each calendar year," and that

"Each operator must take prompt remedial action to correct any valve found inoperable, unless the operator designates an alternative valve."

B. 49 CFR Paragraph 192.747, "Valve maintenance: Distribution systems" requires that:
"Each valve, the use of which may be necessary for the safe operation of a distribution system, must be checked and serviced at intervals not exceeding 15 months, but at least once each calendar year," and that

"Each operator must take prompt remedial action to correct any valve found inoperable, unless the operator designates an alternative valve."

C. G.O. 112E Section 143.2, "Valve Maintenance" requires that:
"Each valve, the use of which may be necessary for the safe operation of a distribution system, must be inspected, serviced, lubricated (where required) and partially operated at intervals not exceeding 15 months, but at least once each calendar year."

D. 49 CFR 192 Subpart N – Qualification of Pipeline Personnel requires that:
All employees performing valve maintenance tasks need to be fully qualified to perform those tasks per the company's Operator Qualification Plan. Refer to the Utility Task and Subtask list in the Operator Qualification Plan.

3. Valve Maintenance Schedule

The responsible operating department must establish a schedule for valve inspection and maintenance. Mandatory work requirements, frequencies, and guidelines for additional recommended inspections and maintenance are as follows:

A. New Valves

All valves must be inspected and operated before installation. When operating a valve, verify that the ball, plug, or gate actually moves.

1) If a ball valve is to be buried, inspect the valve to ensure that any lubrication (or backup lubrication) and body cavity drain fitting(s) are extended upward to a serviceable location per Numbered Document F-21.1, "Material Specification for Carbon Steel Ball Valves."

   Use the body cavity drain fitting to remove debris and liquids from the valve body and to test the seat integrity. Inspect the ball valve to ensure that all body relief valves are removed and plugged. Valve body relief valves are only necessary for valves in liquid service. Replace the relief valves with steel plugs with a pressure rating at least equal to that of the valve.

   Also, inspect the valve to ensure that all shipping tabs are removed, unless they are two-bolt and on buried valves. Remove single-bolt lifting eyes before shipping, unless they are welded to the valve closure. For 14-inch and larger buried valves, two-bolt lifting eyes are required and can remain on the valve. Two-bolt lifting eyes are acceptable on valves smaller than 14 inches. Valves with feet that are single-bolted to the closure must be removed or welded to the closure before shipment. Company employees must never weld lifting eyes or feet to valves.

2) Before installing any lubricated-type plug valve, lubricate the valve. This ensures the proper flow and distribution of lubricant throughout the valve body (and lubricant extension pipe, if used). Construction employees must inspect and lubricate the plug valves in cooperation with the operating personnel responsible for the station maintenance after construction. If a valve is operating improperly, and the report needs to be made in the field, print out and submit a Material Problem Report (Company Form 62-0113). To submit the report on-line, go to "Material Problem Reporting Online" at http://mpr/mpr/mpr.do.

   Lubricate other valves that require lubrication before installation. (After lubrication, but before installation, internally inspect the valves to ensure that the lubricant is properly distributed.)

   Note: Some valves are designed to be operated without lubrication, but are supplied with backup lubrication systems to provide a good seal if the valve is worn. Do not lubricate these valves unless it is determined in the field that lubrication is necessary for proper operation. Once these valves are lubricated, they **may** require subsequent lubrication to achieve bubble-tight shutoff.

3) Maintenance personnel must prepare a Valve Maintenance Record for each new valve and verify that the proposed (prior to construction) and final (after construction) Operating Diagram and Operating Map, or Division Station Sketch, have been issued and are accurate. Valve position for valves that are normally open or normally closed must be clearly shown on these documents. Automatically controlled valves must be so indicated.

B. Manually Operated Valves

Gas transmission valves classified as "emergency," gas distribution "critical" main valves, and district regulator station valves, including upstream and downstream fire valves, must be inspected, serviced/lubricated (where required, see the paragraph above), and operated (see Paragraph 3.A., "New Valves") at intervals not exceeding 15 months to the date, but at least once each calendar year. If a valve requiring lubrication (all plug valves and ball valves if a positive shutoff cannot otherwise be obtained. Gate valves do not require lubrication.) is not lubricated regularly, it may become inoperable, not shut off adequately when necessary, or develop external valve stem leakage. Each responsible operating department must identify all gas transmission "emergency" valves, gas distribution "critical" main valves, and district regulator station valves and ensure that these valves are properly maintained. For gas distribution "critical" main valves, see Attachment 2, "Gas Distribution Critical Main Valves," and for district regulator station valves, see Work Procedure WP4430-03, "District Regulator Station Maintenance."

1) Gas transmission valves classified as "Operational" and "Maintenance" must be inspected, lubricated, and operated annually.

2) Use Selig Grand Slam grease to re-lubricate *manual* gearboxes. See www.seligind.com for more information. The product comes in 14 ounce (oz.) tubes for handguns (24 tubes to the case) and in 7 pound (lb.) pails (about the size of a 2 lb. coffee can). This product is not considered a hazardous waste. The grease is good up to 550° Fahrenheit (F). It should never "separate" in the valve gearboxes and is good for extreme contact pressure between mating gear teeth. If grease separation does occur, remove the old grease and replace with new Selig Grand Slam grease.

C. Power-Actuated Valves

All power-actuated valves installed in Company gas systems must be maintained in accordance with the maintenance requirements listed below. The Company specifies more stringent maintenance schedules for these valves because of the following:

- Power-actuated valves have added complexity because of valve actuation and control.
- Power-actuated valves are commonly used in throttling applications.
- Power-actuated valves are typically more critical to system operation.

Power-actuated isolation and block valves must be inspected, serviced, lubricated, and operated twice each calendar year (at approximate 6-month intervals). Power-actuated regulating valves on standby (not required to regulate during normal operations) and power-actuated valves used for overpressure protection (monitors) must be partially operated and inspected once a month and serviced and lubricated (unless exempted by Paragraph 3.A., "New Valves") twice each calendar year (at approximate 6-month intervals). Power-actuated ball and plug valve regulators used frequently during normal operations must be lubricated and inspected at least once every 2 weeks. During the first days of operation or after a significant operating change, closely observe power-actuated valves used as regulators. If a valve is operating often, lubrication may be

needed as frequently as every other day.

D. Modifying the Valve Maintenance Schedule

Modify the valve maintenance frequencies specified in Paragraphs 3.B., "Manually Operated Valves," and 3.C., "Power-Actuated Valves," to provide additional inspecting, servicing, and lubricating, when necessary. This is especially important when valves are operated more frequently or when there are special operating conditions. Reducing any of the specified maintenance frequencies to make them less stringent is not allowed.

4. Inspection Procedures

A. Before lifting the lid and entering any pit or vault, observe the necessary precautions regarding barricading, identifying sources of ignition, and checking for combustible gases in accordance with Utility Standard S4414, "CGT Confined Space Entry Program," Work Procedure WP4414-01, "Work Procedures in Confined Spaces," and the *Code of Safe Practices*.

B. If a valve is located in a valve box or a vault, follow these steps:

1) Ensure that the valve box or vault is cleared of any debris that would interfere with or delay the operation of the valve.

2) Ensure that there is adequate access to the valve (the vault cover opens, etc.), the valve is adequately protected (the vault and vault cover have integrity), and the vault is safe for the employee to enter.

C. Inspect the valve for the following problems:

1) Missing valve number tag.

2) Broken or missing valve components (e.g., lubrication fitting, handwheel, padlock).

3) Any gas or oil leaking on the valve body, high-head extension, or valve operator.

4) Signs of external corrosion and/or degradation of coating. For buried valves with high-head extensions, inspect the air-to-soil transitions for signs of corrosion or disbondment of the wrap.

5) Valve not locked in the appropriate position.

6) Identify any issues on the "Valve Maintenance Record" (Attachment 1) and schedule for repair, if appropriate.

5. Operating Valves During Maintenance

A. When servicing a valve as required in Section 3, "Valve Maintenance Schedule," the valve must be **operated** (or "stroked") through its complete range when operating conditions permit. When operating conditions do not permit full operation of the valve (such as the downstream piping would be over pressured or the flow through the valve would be adversely affected), stroke through the maximum range that is practicable. For normally closed valves, never stroke the valve less than the amount required to establish flow through the valve. Listed below are recommendations for partially operating various types of valves.

- **Plug valves with gearing:** For a normally open valve, take the "slop" out of the gearing and then turn the valve handle three complete turns. For a normally closed valve, just barely initiate flow or until the operator indicates approximately 25% of travel (22.5° open position).

  Note: Plug valves do not start to flow until 20-23° open.

- **Plug valves without gearing:** For a normally open valve, take the "slop" out of the keyway, then move through approximately 25% of travel (67.5° open position). For a normally closed valve, just barely initiate flow or until the valve wrench indicates approximately 25% of travel (22.5° open position).

- **Ball valves with gearing:** For a normally open valve, take the "slop" out of the gearing and then turn the valve handle three complete turns. For a normally closed valve, just barely initiate flow.

  Note: Ball valves do not start to flow until 6-8° open position.

- **Ball valves without gearing:** For a normally open valve, take the "slop" out of the keyway, then move through approximately 25% of travel (67.5° open position). For a normally closed valve, just barely initiate flow.

- **Gate valves:** For a normally open valve, take the "slop" out of the gearing, and then turn the valve handle one complete additional turn. For a normally closed valve, just barely initiate flow.

B. Verify the number on the valve tag against the Operating Map, Operating Diagram, Division Station Sketch, or Division Plat Sheet and on the Valve Maintenance Record.

   i.) If they do not match, notify the maintenance supervisor immediately.

   ii.) For any changes required on an Operating Diagram or Operating Map, submit revisions to the GT&D Principal Mapper, per the requirements of S4460, Attachment 1.

C. After operating a valve, return it to the "as found" position. Log the "as found" and "as left" positions on the Valve Maintenance Record.

   i.) If a valve is found in the wrong position according to a diagram or maintenance record, investigate the system operation to determine in which position the valve should be left. Notify the appropriate personnel (supervisor, GSO, planning engineer) to validate any valve position change prior to correcting valve position.

   ii.) Log that change on the Valve Maintenance Record along with the reason for the change. Redline local diagrams, or submit changes per section 5-B-ii above.

D. To report problems encountered when operating any valve, either during scheduled maintenance or at any other time, either print out and submit a Material Problem Report (Company Form 62-0113), or, to submit the report on-line, go to "Material Problem Reporting Online" at http://mpr/mpr/mpr.do. Complete a PLM Work Request or a Corrective Notification, which ever is appropriate, to correct any problem on a valve.

E. If a valve is inoperable, immediately notify the maintenance supervisor so that prompt action is

initiated to remedy the problem. Also, note the inoperability on the "Valve Maintenance Record" (Attachment 1) and either print out and submit a Material Problem Report (Company Form 62-0113), or, to submit the report on-line, go to "Material Problem Reporting Online" at http://mpr/mpr/mpr.do. For inoperable valves that are not under CPUC jurisdiction, the supervisor determines what action to take. At a minimum, identify non-jurisdictional valves left inoperable on the appropriate Operating Diagram, Operating Map, or Division Wall Map.

6. Lubrication Procedures

A. General

Periodic lubrication ensures that valves operate with minimal effort and seal properly to provide shut-off. In addition, lubrication can prevent external stem leaks in plug valves.

All equipment, such as valve lubrication guns, hypreguns, and pumps must be appropriate for the particular valve being maintained. Equipment must be kept in good condition and operated by qualified employees.

1) All lubricants must be clean. Only use specific lubricants recommended by the valve manufacturer. Refer to Section 7, "Approved Valve Lubricants." on Page 16. Using lubricants that are not recommended by the appropriate valve manufacturers voids the warranties and leaves the Company vulnerable in any potential lawsuit involving third-party damages that are considered caused by valve leakage. Refer to the manufacturer's lubrication instructions for the proper use of lubricants.
2) When lubricating valves equipped with buttonhead lubricating fittings, use a high-pressure grease gun that includes the appropriate pressure gauge. For valves equipped with lubricant screws, use stick-type lubricants.
3) **[Optional]** Attach a tag to the valve to indicate if lubrication is required. The tag must state the type of lubricant to use.
4) When double block-and-bleed type valves are exposed to water, condensate, or other foreign matter, drain/blow the valve body to prevent damage to the valve. Always drain/blow the valve body after hydrotests.
5) If a valve is difficult to operate or leaks from upstream to downstream, it may be necessary to flush out the old lubricant. See Section 8, "Valve Flushing Procedures," on Page 18.
6) If a valve will not seal off completely after performing the manufacturer's recommended procedures to stop leakage, inject the valve with limited amounts of Sealweld 5050 (10-oz. cartridge, Code M500042, 10-lb. pail, Code M500041). At the first occurrence that any valve needs Sealweld 5050 to operate properly, bring that valve to the attention of the M&C supervisor and Engineering. The valve may need to be replaced as soon as economically feasible. Note the use of Sealweld 5050 on the "Valve Maintenance Record" (Attachment 1).

B. Plug Valves

1) Always lubricate plug valves in the fully-open (preferred) or fully-closed position. In either of these positions, all grease grooves in the body connect with the circular grooves at the top

and bottom of the plug, and the grease grooves in the plug mate to the grease grooves in the body. This ensures a full and even spread of the lubricant over all surfaces. The lubricant then acts as a bearing interface as well as a sealant. (Multi-port valves have special lubrication systems and must only be lubricated in one of the 90° positions.) After lubrication, turn the valve through its complete range or through the maximum range practicable, as described in Section 5, "Operating Valves During Maintenance."

Lubricate plug valves used as regulators that are backed up by monitor valves in the fully open position. This permits the monitor valve to take over the control function. Lubricate plug valve monitors in their normal fully-open position.

2) For valves using a lubrication screw to inject stick sealant, do not leave the lubrication screw in the plug stem beyond complete engagement of the threads. (If the screw is left in this position, a pocket is created where water, dirt, or corrosion products could collect and make the lubricant screw difficult to remove.) Insert another stick of the sealant into the valve to allow the lubricant screw to back out.

3) When lubricating valves, the grease gun's pressure gauge should indicate steadily increasing pressure with each stroke until the pressure gauge reading no longer rises but begins to drop and the pumping effort decreases. At this point, the valve is sufficiently lubricated. Stop injecting the lubricant.

Estimate the quantity of plug valve sealant required using the following table:

Table 1. Plug Valve Sealant Quantity

Plug Valve Size	Amount of Sealant (for periodic lubrication)[1]
12" and smaller	0.5 oz./inch of valve size
14" through 18"	0.75 oz./inch of valve size
20" and larger	1.00 oz./inch of valve size

[1]For new valves or a valve with sealant flushed out, use four times the amount stated in Table 1.

Note: If the sealant in the riser pipe must be purged with new sealant, estimate additional sealant to be used based on the following: For ½-inch and ¾-inch riser pipe, inject an additional 2.0 oz. and 4.0 oz. respectively, per foot of riser pipe.

CAUTION: All regulator/meter station plug valves and all gas distribution low pressure system main plug valves must be lubricated as follows:
Inject the minimum amount of sealant to maintain operability (the valve operates with a reasonable amount of effort and it seals off the gas flow when closed). Do not to exceed one half of the amount shown in Table 1 above.

4) The lubricant pressure on the grease gun gauge must read a minimum of 2,000 lbs. per square inch gauge (psig) for any plug valve. The lubricant pressures must not exceed 5,000 psig when lubricating semi-steel valves, and 12,000 lbs. per square inch (psi) when lubricating steel valves. Very low pressure or no static pressure on the gauge during injection indicates one of the following problems:

   a) The gun is empty.

   b) The valve plug is loose. See Paragraphs (6) and (9) below.

c) The gun is malfunctioning and must be checked.

Make no repairs to the hydraulic system. If the gun is broken, recondition it. If excessive clearance exists between the plug and the body, either because the adjustment gland or the adjustment screw is backed off too far, the lubricant migrates into the pipeline and the lubricant pressure will not build up properly. If the lubricant pressure immediately becomes high, it may indicate a defective lubricant fitting which could prevent lubricant from entering the valve.

Caution: Do not attach or detach couplers while guns are under pressure. Relieve gun pressure by opening the gun by-pass valve.

5) If a valve plug is difficult to operate or is stuck, inject it with Rockwell No. 1033 sealant to free it. After lubrication, operate the valve until it turns freely. If lubricating the valve fails to loosen it, flush the valve as specified in Section 8, "Valve Flushing Procedures."

6) The practice of loosening plug adjustment screws to obtain a temporarily free turning plug invariably results in undesirable secondary effects. The following are secondary effects of improper plug adjustment:

   - Valve leakage. The lubricant may be ineffective since too much clearance does not allow the lubricant to distribute properly within the valve.
   - Excessive clearance, which allows foreign or abrasive materials to be trapped between the plug and seat can result in damaged sealing surfaces.
   - Higher torque characteristics as damage occurs.
   - Possible gear and operator damage as the torque becomes excessive.
   - An ultimate need to replace the valve.

7) Adjusting the packing gland on fixed-adjustment gland valves is generally not necessary. Do not adjust the gland except as specified by the manufacturer.

8) When the valve plug is not properly seated or when lubrication is not effective in loosening a difficult-to-operate (malfunctioning) valve and an approved valve flush is used, tighten the gland adjustment nuts. Tightening the nuts seals off lubricant leaks and helps to develop the proper hydraulic pressure during lubrication. Do not attempt to tighten the gland adjustment nuts without consulting the valve manufacturer, unless the operator is experienced with the particular adjustment of the specific valve type.

   Note: Never loosen the packing gland before lubrication!

9) Rockwell Hypreseal-type valves have an adjustment screw in the bottom cover. This screw is adjusted at the factory to strict specifications. To prevent tampering, a cover is tack welded over this screw. Do not adjust the screw position in the field unless trained personnel are on site.

10) When specified adjustments to adjustable valves are unsuccessful and the valves cannot be properly lubricated or when an inoperable plug valve requires adjustment, either print out and submit a Material Problem Report (Company Form 62-0113), or, to submit the report on-line, go to "Material Problem Reporting Online" at http://mpr/mpr/mpr.do.

C. Ball Valves

1) Rockwell Hypresphere Ball Valves (old floating ball model, manufacture ended in 1973)

   a) Lubricate the Hypresphere valve when the valve is fully open or fully closed. Some sizes have three lubricant fittings, one for each seat and one for the stem. The stem must only be lubricated if stem leakage occurs. Keep all valves lubricated for satisfactory operation. Thoroughly lubricate the seat on the low-pressure side of the valve, especially if the valve is difficult to operate.

      Note: When a valve is closed and the line is blown down on what is normally the upstream side of the valve, seat reversal occurs. Before the line is pressurized and returned to service, lubricate **both** valve seats.

   b) Rockwell's specified lubricant for Hypresphere valves is Rockwell No. 1033. Do not use any other lubricant in Rockwell valves (see Table 4 on Page 17).

2) Rockwell TM Hypresphere Ball Valves (trunnion mounted ball, manufactured since 1972)

   a) The Rockwell TM Hypresphere ball valve needs no lubrication for a tight shutoff. However, as noted below, perform periodic maintenance according to a schedule designed to keep the valve in good working order. Obtain a longer seat life and easier operation by periodically injecting the valve with lubricant.

   b) The valve has a lubricant injection system to provide a backup seat seal if the seats become damaged and tight shutoff is not possible. Both valve seats have lubricant injection fittings on the sides of the valve body. In addition, there is a lubricant injection fitting at the base of the valve stem to provide a secondary stem seal. The stem must only be lubricated if stem leakage occurs. Valve sizes 20 inches and larger have five lubricant injection fittings.

   c) Although lubricant injection is not necessary for shutoff, Rockwell states that "periodic lubricant injection with approved Rockwell lubricants helps maintain good operating conditions and minimizes wear and abrasion on the seats and ball." Depending on the severity of the service environment, inject lubricant at least annually.

   d) Lubricate Rockwell TM Hypresphere ball valves before installation. Construction employees, in cooperation with operating employees responsible for the station after construction, lubricate the ball valves. Visually check the valves for lubricant excretion around the ball port and valve body to verify proper flow and distribution of lubricant throughout the valve body (and lubricant extension pipe, if used). Lubricate as often as necessary to ensure smooth operation while the valve is being throttled. Lubricate the valves in the closed position, if possible. To report any problems with the operation of these valves, either during scheduled maintenance or at any other time, either print out and submit a Material Problem Report (Company Form 62-0113), or, to submit the report on-line, go to "Material Problem Reporting Online" at http://mpr/mpr/mpr.do.

   e) Rockwell's specified lubricant for Hypresphere valves is Rockwell No. 1033. Do not use any other lubricant in Rockwell valves (see Table 4 on Page 17).

3) Grove Ball Valves

a) Grove Model B-4, B-5, B-6, and B-8 ball valves normally need no lubrication for bubble-tight shutoff. Lubricate the valves not used as monitors or standby regulators (using the fittings provided) only if a positive shutoff cannot otherwise be obtained. Inspect valves that do not provide positive shutoff for possible valve seat or ball damage. Once the valve is lubricated, it may need lubrication in the future to achieve bubble-tight shutoff.

b) The manufacturer's specified lubricant for shutoff on Grove Model B-4, B-5, B-6, and B-8 ball valves, and for Grove BVR-4 and BVR-5, and Becker ball valve regulators is Sealweld 911 (see Table 5 on Page 17). Do not use any other lubricants in Grove or Becker ball valve regulators.

c) Lubricate Grove Model BVR-4 and BVR-5 ball valve regulators (and Becker ball valve regulators) before installation. Construction employees, in cooperation with operating employees responsible for the station after construction, lubricate the ball valve regulators. Visually inspect the valves for lubricant excretion around the ball port and valve body to verify the proper flow and distribution of lubricant throughout the valve body (and lubricant extension pipe, if used).

Note: After release to operations, lubricate the valves as often as necessary to ensure smooth operation when the valves are throttling. Lubricate the valves in the closed position, if possible.

d) Do not lubricate Grove regulating valves with retractable seats (commonly known as the Arcron Model). This destroys the retractable seat feature. The valve has no lubrication fittings to lubricate the valve seats. It does, however, have Zerk fittings under the Arcron cover for lubricating the operator. Use Sealweld No. 911 lubricant to grease these fittings.

4) TK and KF (Series P3) Ball Valves

a) TK and KF (Series P3) ball valves normally do not need lubrication for bubble-tight shutoff. Lubricate the valves not used as monitors or standby regulators (using the fittings provided) only if a positive shutoff cannot otherwise be obtained. Inspect valves that do not provide positive shutoff for possible valve seat or ball damage. Once the valve is lubricated, lubricate it in the future to achieve bubble-tight shutoff, as necessary.

b) The manufacturer's specified lubricant for shutoff on TK and KF (Series P3) ball valves is Sealweld 911 (see Table 5 on Page 17). Do not use any other lubricants in these ball valves.

5) PBV-USA Ball Valve

a) PBV-USA Series 6700 trunnion mounted ball valves do not require periodic lubrication since they are manufactured with permanently lubricated seals and bearings. These valves are also equipped with seat seals that are designed not to require sealants.

b) Although lubricant injection is not normally necessary, periodic injection of Sealweld 911 helps maintain the valve in good operating condition by minimizing wear on the ball and seats. This operation purges old grease and residual buildup, which contribute to seat

leakage and excessive valve operating torque.

c) In the presence of excessive line contaminants, the possibility of leakage due to erosion is greater when throttling the valve than when the valve is used for normal on/off service. If the primary seal and the secondary metal-to-metal seal are damaged, obtain an emergency shutoff with a sealant injected through buttonhead grease fittings located in the end closures. First, purge the sealant passages by injecting Sealweld Valve Cleaner (see Table 6 on Page 18). Then, with the valve in the fully closed position, slowly inject Sealweld 5050 ball valve sealant through the large buttonhead fitting provided on the upstream end closure. If possible, move the ball slightly during injection to ensure that the sealant is evenly distributed over the seating surfaces of the seat ring and ball.

6) WKM Dynaseal Ball Valves

a) WKM Dynaseal ball valves normally do not require lubrication for bubble-tight shutoff. However, it may be necessary to inject lubricant (emergency seat renewal) if the seats become damaged. The recommended lubricant for shutoff is WKM Lubricant No. 103 or an approved equivalent, such as Rockwell No. 1033. Close the valve and inject lubricant at both seats under block-and-bleed conditions.

b) If a leak develops around the stem, it can be stopped under pressure by injecting WKM plastic stem packing No. 107 or Sealweld Slick Stick.

7) Cameron Ball Valves

a) Cameron all-welded ball valves do not normally require lubrication. The valve is sealed for life. Seals and stem bearings are self-lubricating and designed for the life of the valve. Although lubricant injection normally is not necessary, periodic injection of Sealweld 911 helps maintain the valve in good operating condition by minimizing wear on the seats and ball and ensuring free movement of the valve seats.

b) The valve has lubricant-injection ports with check valves to provide a backup seat seal if the sealing surfaces become damaged and bubble-tight shutoff cannot be obtained.

Note: 2-inch through 4-inch valves have a smaller buttonhead fitting, requiring a 5/8--inch coupling on the handgun.

c) Use the injection system for flushing the seat ring area, when necessary.

d) If the primary seats become damaged, it may be necessary to inject lubricant through the lubricant injection fittings. The recommended lubricant for Cameron ball valves is Sealweld 911.

e) For Cameron valves 14 inches and larger, the rotating seat design creates an increased torque for the last 15° when the valve is being closed. Although lubricant injection is not normally necessary, periodic injection of Sealweld 911 helps ensure easy rotation of the valve seats, which minimizes operating torque. Use the valve position indicator to determine when the valve is fully closed. Some early-version Cameron valves have excessive stem wind-up, which must be accounted for when determining the position (open, closed, etc.) of the valve.

8) Broen Ballomax and Kerotest Weldball Valves

a) Broen Ballomax and Kerotest Weldball valves do not require lubrication or any maintenance. These valves are sealed for life. Seals and stem bearings are self-lubricating and designed for the life of the valve.

b) Refer to the following Numbered Documents for any restrictions on the use of these valves:

- Numbered Document F-22, "Kerotest Weldball Valve"
- Numbered Document F-24, "Broen Ballomax Floating Ball Valves"

9) VSI Cam Valve (considered a ball valve by the Company)

a) The VSI Model 111 valve does not require lubrication or any maintenance. The valves are sealed for life. Seals and stem bearings are self-lubricating and designed for the life of the valve.

b) The opening torque for a VSI valve may be higher than normal if there is a high differential pressure across the valve.

Note: VSI valves only operate 87° from fully open to completely closed.

c) Before removing the bonnet from a VSI valve (no pressure in the line), the valve must be in the fully open position. In any other position, the internal parts cannot be removed.

10) Delta Valves

a) Delta (Type 55) ball valves normally need no lubrication for bubble-tight shutoff. Lubricate the valves not used as monitors or standby regulators (using the fittings provided) only if a positive shutoff cannot otherwise be obtained. Inspect valves that do not provide positive shutoff for possible valve seat or ball damage. Once the valve is lubricated, it may need lubrication in the future to achieve bubble-tight shutoff.

b) The manufacturer's specified lubricant for shutoff of Delta (Type 55) ball valves is Sealweld 911 (see Table 5 on Page 17). Do not use any other lubricants in these ball valves.

11) Orbit Valves

After 1970, Orbit valves have been used almost exclusively for blow-down applications. These valves are normally unidirectional and do not have ball lubrication capability.

D. Ball Valve Lubrication

The basic requirement for ball valves is 1 oz. per inch of valve size per seat for flushing and ¼ oz. per inch of valve size per seat for routine maintenance.

Each ball valve has two seats and can have one or two injection fittings per seat.

1) GROVE, TK, KF, PBV, and DELTA (See Table 2 below.)

These ball valves in sizes 2-inch, 3-inch, and 4-inch have only one injection fitting and it is into the body cavity of the valve. **Do not lube these valves unless absolutely necessary, because the body cavity and the valve bore will be filled with lubricant.**

Table 2. Grove, TK, KF, PBV, and Delta Valve Body Capacities

Ball Valve Size	Amount of Lubricant
2"	15 oz.
3"	75 oz.
4"	151 oz.

Note: If the lubricant in the riser pipe must be purged with new lubricant, estimate additional lubricant as follows: For ½-inch and ¾-inch riser pipe, inject an additional 2 oz. and 4 oz., respectively, per foot of riser pipe.

2) CAMERON and ROCKWELL

Cameron valves start at 2 inches and Rockwell valves start at 8 inches in size. These valves have seat lubrication fittings so injection into the body cavity is never required.

E. Gate Valves

1) Kerotest M-1 Gate Valves

a) The Kerotest M-1 gate valve does not normally require lubrication or gland tightening. A stem leak requires replacing the packing seals and gland gasket. Repack the valve and lubricate it as described in Kerotest's procedure for "primary or secondary" repacking. The primary repacking procedures may be performed with the line pressurized. See the *Kerotest M-1 Gate Valve Operations Manual* for more information.

b) If the bonnet gasket leaks, retighten the bonnet screws per torque specifications found in the *Kerotest M-1 Gate Valve Operations Manual*. If leakage persists, remove the valve from service, disassemble it, and inspect it for damage to the gasket or sealing area. Replace the gasket and/or polish the sealing area with a very fine emery cloth. Coat the bonnet gasket with a light film of multipurpose grease and reassemble it.

c) Use caution when the valves are in the open position in a pipeline for a period of time. Sediment or dirt can collect inside the valves and prevent the wedges from fully closing. Close these valves slowly. Do not close the valves completely, but "throttle" them for a short period of time so that the turbulence created flushes away any sediment or dirt that might have settled in the valves. In the event of an emergency, close the valves as quickly as possible.

d) If a valve does not shut off completely, the valve can be reseated using the following procedure:

i) Throttle the valve to flush out loose sediment.

ii) Close the valve using moderate effort. This forces the wedge partially into the seat and loosens accumulated sediment.

iii) Open the valve 1 or 2 turns to retract the wedge from the seat.

iv) Repeat the above procedure, if necessary.

2) Kerotest Model EV-11 "Stirrup" Gate Valve

   a) The EV-11 gate valve does not normally require lubrication for a bubble-tight seal. Lubrication is required only during cleaning and inspection, as specified in Kerotest's maintenance procedures.

   b) If a leak develops in the bonnet, retighten the bonnet screws to Kerotest's torque specifications. If leakage persists, replace the bonnet O-ring. **Do not perform this repair under pressure.**

   c) A stem leak requires replacing the stem seal and gland bushing O-rings. Replacing the stem seal and gland bushings O-rings can be performed under pressure if Kerotest's repair procedure is followed.

   d) If the valve does not shut off completely, it may be necessary to disassemble the valve and clean or replace the gate seal.

   e) For repair procedures and torque requirements, refer to EV-11 gate valve maintenance instructions.

3) RMI Weld Patent Gate Valve (WPV)

   a) The WPV does not require lubrication for a bubble-tight seal.

   b) A stem leak requires replacing the stem O-rings. Replacing the stem O-rings can be performed under pressure if the WPV repair procedure is followed.

   c) The WPV is an all-welded design; therefore, the valve cannot be disassembled to replace the stem, wedge, or seals.

F. Perfection, Kerotest, and Nordstrom Plastic Valves

1) The Perfection, Kerotest, and Nordstrom plastic valves listed in Numbered Document F-90, "Plastic System Valves," do not require lubrication.

2) Ensure that the valve stem is vertical, the valve is not under strain, the top of the valve is exposed, and the valve box does not rest on the plastic pipe or the valve.

7. Approved Valve Lubricants

A. Plug Valve Lubricants

1) Specific general purpose lubricants for plug valves are listed in Table 3 below. Currently, Rockwell No. 1033 Sealant is the only recommended lubricant. Standard sizes and packages of approved lubricants are available by specifying the code number provided.

   Caution: Avoid the **routine** use of lubricants that contain Teflon, such as Sealweld 5050, in plug valves. Teflon particles can clog orifices in the Company's pneumatic-control equipment and customers' appliances, resulting in serious problems. If Sealweld 5050 must be used to stop internal leakage, the valve may need to be scheduled for replacement. See Section 6.A(6), "Lubrication Procedures – General."

Note: A Material Safety Data Sheet (MSDS) must be on file in each operating department for each valve lubricant used.

2) Rockwell No. 1033 sealant is also the recommended lubricant for Resun, Serck Audco, and Walworth plug valves (see Table 3 below). Its use will not void the manufacturer's warranty. Rockwell No. 386 and No. 555 lubricants are not allowed for use on the above-referenced valve brands.

Table 3. Recommended Lubricants for Rockwell, Serck Audco, Resun, and Walworth Plug Valves[1]

Lubricant Fitting Type	Thread Size (Inches)	Lubricant Form Designation (Units per Box)	Codes
			Rockwell No.1033
Threaded	1/2	B (24) stick	Not available
Threaded	3/8	C (24) stick	Not available
	1/2	D (24) stick	Not available
	3/4	G (24) stick	Not available
Buttonhead fitting[2]		K (12) stick	M500007
		J (6) stick	M500003
		GP (6) gun pack[3]	M500029
		Cartridge (4)[4]	M500005
		Bulk (1) 5-quart can[5]	M500014

1. The color of Rockwell No. 1033 lubricant is green.
2. Requires a lubricant handgun.
3. Use with Rockwell No. 400A handgun or Sealweld SuperGun.
4. Use with Rockwell No. 400D handgun.
5. Use with Rockwell Hypregun or Sealweld Activ-8.

B. Ball Valve Lubricants

1) The recommended general purpose lubricants for ball valves are summarized in Table 4 and Table 5 on page 17. Use only the manufacturer's recommended lubricant in these tables for each valve. Standard sizes and packages of approved lubricants are available by specifying the code numbers provided.

Note: A MSDS must be on file in each operating department for each lubricant used.

2) The recommended lubricant for TK, Grove, Cameron, KF, Delta, and PBV-USA ball valves is Sealweld No. 911. Sealweld No. 911 contains micro-fine Teflon particles, which can cause serious problems if used in plug valves and other valves requiring more frequent lubrication or large quantities of lubricant. However, a limited amount of Teflon-bearing lubricant (if used in TK, Grove, Cameron, KF, Delta, and PBV-USA ball valves to obtain a bubble-tight shutoff) should not cause a problem.

Table 4. Recommended Lubricants for WKM Dynaseal and Rockwell Hypresphere Ball Valves[1]

Lubricant Fitting Type	Thread Size (Inches)	Lubricant Form Designation (Units per Box)	Specified Lubricants Codes
			Rockwell No.1033
Threaded	1/2	B (24) stick	Not available
	3/8	C (24) stick	Not available
	1/2	D (24) stick	Not available
	3/4	G (24) stick	Not available
Buttonhead fitting[2]		K (12) stick	M500007
		J (6) stick	M500003
		GP (6) gun pack[3]	M500029
		Cartridge (4)[4]	M500005
		Bulk (1) 5-quart can[5]	M500014

1. The recommended lubricant for Dynaseal and Rockwell valves is Rockwell No. 1033 – green.
2. Requires a lubricant handgun.
3. Use with Rockwell No. 400A handgun or Sealweld SuperGun.
4. Use with Rockwell No. 400D handgun.
5. Use with Rockwell Hypregun.

Table 5. Recommended Lubricant for Grove (BVR-4 and BVR-5) and Becker Ball Valve Regulators and TK, KF, PBV-USA, Grove (Model B-4, B-5, and B-8), Delta, and Cameron Ball Valves[1]

Cartridge Designation (Units per Case)	Codes
#1 Gun cartridge (16) 10 ounce[2]	M500004
5-quart can	M500012

1. The recommended lubricant is **Sealweld 911.**
2. Can be used in a Rockwell 400 handgun.

8. Valve Flushing Procedures

A. Inject an approved cleaning solvent into plug valves that are seized or difficult to turn, or ball valves and gate valves that leak. (This softens old lubricants and purges the grease grooves.) Then lubricate the valves with the manufacturer's recommended lubricant to provide proper lubrication on the mating surfaces when the valves are operated.

B. Follow the valve flushing agent manufacturer's procedures when performing any valve cleaning operation.

C. Table 6 below provides the approved valve flushing agents for use on any brand of valve and with existing valve lubrication equipment.

Table 6. Recommended Valve Flushing Agents

Agent Name	Quantity	Code
Nordstrom VXX Valve Cleaner	Gun Pak (6 per box)	M490778
	Cartridges (4 per box)	M490779
	5-quart can	M490780
Sealweld Equa-Lube Gold Flush	One 32-oz. bottle (4 per box)	M490177
	1-quart bottle (4 per box)	M490781
Val-Tex Valve Flush	5-quart can	M490523
	16-oz. cartridge	M490503
Sealweld Valve Cleaner	10-lb. (5-quart) pail	M490519

Leave the valve-flushing agent in the valve from a minimum of 12 hours to a maximum of 3 days.

Caution: Valve flushing agents can damage elastomers if they are left in contact for extended periods. Minimize contact time with rubber sealant gun components by cleaning valve-flushing agents out of the gun. Do this by pumping sealant through the handgun. When the softening process is complete, always inject fresh lubricant (as recommended by the valve manufacturer) into the valve.

Note: A MSDS must be on file in each operating department for each valve-flushing agent used.

9. Valve Maintenance Records

Record valve maintenance on the appropriate "Valve Maintenance Record." See Attachment 1 for the "Valve Maintenance Record" and instructions for completing a "Valve Maintenance Record." Record the maintenance history of each valve on an individual sheet. The Maintenance department must keep "Valve Maintenance Record" documents for a minimum of the previous 5 years.

10. Miscellaneous Lubricant-Sealant Injection Fittings

A. Rockwell Fittings

Table 7 below lists Rockwell-manufactured combination buttonhead fittings and lubricant screws for use with Rockwell plug valves. These fittings have parallel (straight) pipe threads. Do not use them with the tapered pipe threads of ball valves or screwed pipe fittings.

Table 7. Miscellaneous Rockwell Fittings

Parallel Pipe Threads Size (Inches)	Size of Stick for Valves Using Rockwell Lubricant	Rockwell Part Number	Code
1/4"	B	37415	M208416
3/8"	C	37416	M208417
1/2"	D	37417	M208418
3/4"	G	37418	M201048

B. Sealweld Flow Wolf Fittings (Ball Valves)

Table 8 below lists Sealweld Flow Wolf buttonhead fittings used as the seat lubricant-sealant injection fitting on ball valves. These fittings have low internal flow restriction to minimize plugging the fitting's internal ball check valve when injecting the sealant. These fittings have tapered pipe threads. Never use them on the straight pipe threads found on plug valves.

Table 8. Miscellaneous Sealweld Flow Wolf Fittings

Tapered Pipe Threads Size (Inches)	Sealweld Flow Wolf Part Number	Code
3/8"	F-FW-3/8	M441174
1/2"	F-FW-1/2	M441175

11. Valve Lubrication Equipment ("lubricants" means lubricants and sealants)

Rockwell/Nordstrom

Model #	Injection
400A	1 oz./25 strokes
400D	1 oz./50 strokes
Hypregun	16 oz./9 minutes for light lubricants (estimate) 16 oz./16 minutes for heavy lubricants (estimate)

Note: The Hypregun uses a 10-lb. (160 oz.) pail. Each 1/8-inch drop in the level of the lubricant in the pail is approximately 3 oz.

Sealweld

Model #	Injection
Activ-8	10 lb. pail to 16 oz. loading chamber is 2 oz./stroke. Loading chamber to valve is 16 oz./70 seconds for light lubricants and 16 oz./120 seconds for heavy lubricants.
Uni-Seal	16 oz./70 seconds for light lubricants 16 oz./120 seconds for heavy lubricants
Supergun	1 oz./20 strokes
Hand gun	1 oz./50 strokes

Valtex

Model #	Injection
1000	1 oz./15 strokes
1400	1 oz./24 strokes

Valtex

Model #	Injection
6268	1 oz./44 strokes
QS-2000A	8 oz./30 seconds for light lubricants 8 oz./60 seconds for heavy lubricants
QS-5000	8 oz./30 seconds for light lubricants

8 oz./60 seconds for heavy lubricants

For PG&E: Heavy lubricants are Sealweld 5050 and Sealweld 911. Light lubricants are Rockwell/Nordstrom/FlowServe 1033 and all brands of valve flushing agents.

Note: The Hypregun, Activ-8, and Uni-Seal equipment delivery rates are based on operating these units at their optimum air or gas pressure of 125 psig.

Grease Gun Pressure

The normal pressure range for injecting product into valves is as follows:

Cast iron plug valves	0 to 2,000 psig maximum
Steel plug valves	6,000 to 10,000 psig maximum
Ball valves	2,000 to 6,000 psig maximum

Caution! Never exceed the maximum pressures listed above when injecting product into valves.

12. Approved Grease Guns for Lubricating Gas Valves

Code	Short Description	Long Description
M041013	Grease gun, hydraulic	Grease gun Sealweld # G-S-Gunc Hydraulic super gun with high pressure check valve and 15,000 psi gauge Complete with EZ loader and case WP4430-04
M041014	Grease gun, pneumatic	Grease gun, pneumatic Sealweld # G-A8-Gunc Activ-8 Air operated 15,000 psi gauge 5-quart sealant capacity and 10' hose WP4430-04
M041015	Grease gun, pneumatic	Grease gun, pneumatic Nordstrom # 5Q Hypregun Air operated 15,000 psi gauge 5-quart sealant capacity and 10' hose WP4430-04
M041016	Grease gun, hydraulic	Grease gun Nordstrom # 400D Hydraulic hand gun with internal relief valve and pressure gauge WP4430-04
M041017	Grease gun, spring loaded	Grease gun Nordstrom # 400A Spring loaded hand gun with check valve and bleeder relief valve 15,000 psi gauge and shoulder strap WP4430-04

Definition of Terms

49 CFR: Title 49, "Transportation," of the Code of Federal Regulations.

BTU: British Thermal Unit.

CPUC: California Public Utilities Commission.

DOT: Department of Transportation.

Distribution regulator station valves: Those valves identified in Work Procedure WP4430-03, "District Regulator Station Maintenance."

Emergency: An emergency is defined as: Any unsafe condition that requires the **immediate shutdown and isolation** of an entire station or pipeline section in order to protect employees or the public, and to prevent or minimize equipment damage and property loss.

Emergency valves: Gas transmission valves used to isolate a pipeline facility or pipeline section in an emergency. Valves in this category include transmission mainline valves, cross-tie valves, tap valves, pipeline blowdown valves, station upstream and downstream block valves, line rupture-control valves, and all of the valves controlled by a station emergency shutdown (ESD) system (varies by station and includes uphole safety valves at storage fields).

Note: Classify British Thermal Unit (BTU) Zone isolation valves as "Emergency Valves" because leakage across the valve may create a hazard for customers due to excessive BTU variations.

ESD: Emergency shutdown.

Gas distribution critical main valves: Gas distribution main valves that may be necessary for the safe operation of a distribution system. See Attachment 3, "Buried Valve Identification," for criteria to identify gas distribution's "critical" main valves.

GO 112-E: CPUC General Order 112-E, "State of California Rules Governing Design, Construction, Testing, Operation, and Maintenance of Gas Gathering, Transmission, and Distribution Piping Systems."

Maintenance valves: Gas transmission valves used to isolate equipment to facilitate maintenance or repairs. Valves in this category include, but are not limited to, equipment isolation valves (e.g., separators, filters, coolers), block valves installed on either side of a meter or individual regulator/monitor or load valve/trimmer runs, unit block valves (compressor stations), bypass valves (unless controlled by an ESD system), fuel gas valves (unless controlled by an ESD system), valves on gas well Christmas trees (except uphole safety valves), tap valves for power and control gas, and valves on power gas or instrument supply piping (supply racks). Valves are typically in open/close service and are generally manually operated. A few valves may

be power-actuated.

MAOP: Maximum allowable operating pressure.

MSDS: Material Safety Data Sheet.

Operational valves: Gas transmission valves used to facilitate system operations. Valves in this category include, but are not limited to, maximum allowable operating pressure (MAOP) separation valves and valves used to change routing through a station (primarily terminals and compressor stations). Valves are typically in open/close service and may be manually operated, but are more likely power-actuated.

Recision

This work procedure replaces UO Standard S4220, "Gas Valve Maintenance Requirements," dated May 2003.

Reference Documents

Code of Federal Regulations (CFR) 49, Paragraph 192.745, "Valve maintenance: Transmission lines"

CFR 49, Paragraph 192.747, "Valve maintenance: Distribution systems"

CPUC GO 112-E, Section 143.2, "Valve Maintenance"

Kerotest M-1 Gate Valve Operations Manual

Material Problem Report, Company Form 62-0113

Material Problem Reporting Online

Numbered Document F-20, "Standard Ball Valve List: 1/4" Through 2" "

Numbered Document F-21, "Standard Ball Valve List: Carbon Steel 2" Through 24" "

Numbered Document F-21.1, "Material Specification for Carbon Steel Ball Valves"

Numbered Document F-22, "Kerotest Weldball Valve"

Numbered Document F-23, "VSI Cam Valve List 2" - 8" "

Numbered Document F-24, "Broen Ballomax Floating Ball Valves"

Numbered Document F-90, "Plastic System Valves"

Utility Standard 4430, "CGT Gas Facilities Requirements"

Utility Standard 4460, "Gas Transmission Operating Maps and Operating Diagrams"

Work Procedure WP4414-01, "Work Procedures in Confined Spaces" – *Expected publication 2009*

Work Procedure WP4430-03, "District Regulator Station Maintenance" – *Expected publication 2009*

Attachments

Attachment 1, Form F4430-04-1, "Valve Maintenance Record" (instructions and form)

Attachment 2, "Gas Distribution Critical Main Valves (Operating at 60 psig or less)"

Attachment 3, "Buried Valve Identification"

Attachment 4, "Guidelines for Using Hydraulic Wrenches and Other High-Torque Devices on Gas Transmission and Distribution Valves"

Attachment 5, "Estimating Torque When Manually Operating a Valve"

Contact for More Information

Gary Vollbrecht (GMV2)
8-323-1048

Date Issued

February 2009

Approved by

Edward A. Stracke
Manager

Revision History

Chg No.	Date	Description	By (LAN ID)
00	April 2008	Updated per CPUC requirements and current work practices	DLPa
01	Jan/Feb 2009	Revised per SME input	DLPa/YDH1

"Valve Maintenance Record" Instructions

General Information

Ensure that all natural gas block valves (2"and greater for gas transmission district-maintained facilities) requiring maintenance per this work procedure and ball or plug valve regulators have a completed "Valve Maintenance Record" form. For gas transmission district-maintained valves smaller than 2", use the "Technical Maintenance Equipment Card."

Instructions for preparing the "Valve Maintenance Record" Form

1. Copy the Form onto white, 67-pound weight card stock.
2. Copy Page 1 ("General Information") of the "Valve Maintenance Record" Form onto one sheet of paper.
3. Copy Page 2 ("Service History") of the Form onto a separate sheet of paper so that the Service History more than 5 years old can be discarded without losing the general valve information.
4. If a sketch is required, attach it to the Form.
5. Fill out the "Valve Maintenance Record" **in permanent ink**

Explanation of "Valve Maintenance Record" Entries

1. **General Information** (Page 1 of the "Valve Maintenance Record")

   A. **Division/District:** List the name of the division or district that is maintaining the valve.

   B. **Valve No.:** This is the unique number assigned to the valve. This number must be consistent with the Operating Map, Operating Diagram, Division Station Sketch or Division Plat Sheet.

   C. **SAP WM No.:** This is the unique number used by the work-scheduling program to identify the maintenance required on the specified valve.

   D. **Location:** This refers to the physical location of the valve. If a location sketch is necessary, provide a sketch on a separate sheet of paper. For valves not shown on a Station Operating Diagram, Operating Map, Division Station Sketch, or Division Plat Sheet, a location sketch is required. Station valves must always be shown on either an Operating Diagram or a Division Station Sketch.

   E. **Transmission or Distribution:** Insert an "X" in the box to signify whether the valve is a:

      - Gas Transmission 'Emergency Valve' or 'Other Valve'.
      - Gas Distribution 'Station Valve' or 'Critical Main Valve'

   F. Maintenance personnel must prepare a "Valve Maintenance Record" for each new valve and verify that the proposed (prior to construction) and final (after construction) Operating Diagram, Operating Map, Division Station Sketch, or Division Plat Sheet have been issued and are accurate.

2. **Valve Data**

   Fill out the information in the "Valve Data" section. The Serial Number field is optional but should be filled out if the information is available. Plastic valves do not have serial numbers so put "N/A" in the "**SERIAL NO**." space.

Complete the information on the recommended valve lubricant/sealant and the required frequency of lubrication and/or inspection. Manually–operated ball valves do not require lubrication, however; they are required to be operated at least once annually. The following Table 1 summarizes the recommended seat lubricant/sealant and stem packing for the various makes of valves.

Table 1. Recommended Seat Lubricant/Sealant and Stem Packing Summary

Manufacturer	Type	Seat Lubricant/Sealant	Stem Packing
Rockwell/ Nord (not DB)	Plug	Rockwell 1033	Rockwell 909
Rockwell/Nord (DB)	Plug	Rockwell 1033	NA
Walworth	Plug	Rockwell 1033	Walworth 630 (909)
Resun	Plug	Contact GT&D Engineering	Contact GT&D Engineering
Serck Audco	Plug	Rockwell 1033	Rockwell 909
Becker Ball Valve Regulator	Ball	Sealweld 911	See Note 1
Grove	Ball	Sealweld 911	See Note 1
KF	Ball	Sealweld 911	See Note 1
PBV-USA	Ball	Sealweld 911	Sealweld 5050
Delta	Ball	Sealweld 911	Sealweld Equa-Lube 80
Orbit	Ball	NA	Orbit GP-6
Cameron	Ball	Sealweld 911	Sealweld 911
Rockwell (pre 1974)	Ball	Rockwell 1033	Rockwell 950 (5050)
Rockwell (post 1973)	Ball	Sealweld 911	NA
TK	Ball	Sealweld 911	See Note 1
WKM	Ball	Rockwell 1033	WKM 107
Grove	G-4 Gate	Sealweld 911	See Note 1
Grove	G-3, G-9 Gate	NA	See Note 1
Grove	G-5 Gate	NA	NA

Note 1. Use 80/90 weight gear oil for a minor leak. If the leak does not stop and a large buttonhead fitting is furnished for the stem sealant injection, use Sealweld 911. If the leak still does not stop, use Rockwell 950 or Sealweld 5050 as a last option.

If the valve has an enclosed gearbox operator, document whether the gearbox:

- Has a Bettis breather installed on top of the gearbox, and
- Is filled with oil.

Subsequently, if the oil is ever drained, indicate this action on the Form. It is acceptable not to refill the gearbox. See Section 3.B.2 (“Manually Operated Valves”), on page 4 of the main work procedure, for use of Selig grease.

If the valve is buried and has a high–head extension, document whether the extension has a vent installed. The vent can indicate whether or not the entire valve stem seal on a buried valve has failed.

Use the “Comment” section to provide any additional maintenance information or notes. Note if Sealweld 5050 has been used in the valve. Note if a plug adjustment has been made (plug valves only).

Note: If a gearbox or a high-head extension does not have a Bettis breather, put a note on the Form to install a breather.

3. Service History

Use this portion of the "Valve Maintenance Record" to document the maintenance performed on the valve, as well as to document any required repairs and action taken. If a valve is found to be inoperable, notify the maintenance supervisor immediately. Retain the valve maintenance service history for a minimum of 5 years.

Date/Initial/LAN ID: Enter the Date, your Initials and LAN ID after the "DATE" field for each new valve maintenance data entry.

VERIFY VALVE NO: Verify the number on the valve tag against the Operating Map, Operating Diagram, Division Station Sketch, or Division Plat Sheet, and on the Valve Maintenance Record.

i.) If they do not match, notify the maintenance supervisor immediately.

ii.) For any changes required on an Operating Diagram or Operating Map, submit revisions to the GT&D Principal Mapper, per the requirements of S4460, Attachment 1.

INSPECT: See "Inspection Procedures" in Section 4, on Page 5 of the main work procedure.

LUBE: (If required). **Note:** "If required" refers to the need to lubricate all plug valves and all ball valves having power actuation. Gate valves do not require lubrication.

OPERATE: Check the box to show that the valve has been operated. Identify if the valve was partially or fully operated.

VALVE POSITION: Log the "As Found" and "As Left" positions as C (closed), O (open), or T (throttling). After operating a valve, return it to the "As Found" position.

i.) If a valve is found in the wrong position according to a diagram or maintenance record, investigate the system operation to determine in which position the valve should be left. Notify the appropriate personnel (supervisor, GSO, planning engineer) to validate any valve position change prior to correcting valve position.

ii.) Log that change on the Valve Maintenance Record along with the reason for the change. Redline local diagrams as needed.

iii.) For any changes required on an Operating Diagram or Operating Map, submit revisions to the GT&D Principal Mapper, per the requirements of S4460, Attachment 1.

Upon completion of maintenance on a valve, the maintenance supervisor must:

a. Critically review *each* "Valve Maintenance Record" to ensure that it is accurate and complete. Return the "Valve Maintenance Record" to the person that performed the maintenance to correct errors and omissions.

b. During the review required above, check to see if any erasures, obliterations, or other document changes have been made.

- **Write "Valve Maintenance Record" information in permanent black or blue ink** with NO white-outs.
- Review the "Valve Maintenance Record" with the person that performed the maintenance to ensure compliance with these requirements.
- Enter your "LAN ID" and initial and date the "REVIEWED DATE" field for each new valve maintenance entry to indicate that the information has been reviewed and is correct.

Pacific Gas and Electric Company

VALVE MAINTENANCE RECORD FORM

(Make all entries in black or blue permanent ink)

DIVISION _____ DISTRICT _____ **VALVE NO.** _____

LOCATION (SKETCH ON BACK IF REQUIRED) _____ SAP WM NO. _____

LINE/STATION NAME _____ TRANSMISSION: ☐ EMERGENCY ☐ OTHER ☐

OPER. OR WALL MAP _____ OPER. DIAG. OR PLAT _____ BLK. _____ DISTRIBUTION: ☐ STATION ☐ CRITICAL MAIN ☐

VALVE DATA

SIZE _____ MAKE/MODEL _____ TYPE _____ (Ball, Plug, Gate) PRESS RATING _____ (PSIG) SERIAL NO. _____ USE _____ (MLV, BTU, Zone, Station, etc.)

RECOMMENDED LUBRICANT/SEALANT _____ (Brand/Type or NA) LUBE/INSPECT FREQ. _____ (Annual, Monthly, Other) Gearbox Breather (Bettis) Installed? ☐ YES ☐ NO ☐ NA

RECOMMENDED STEM PACKING MATERIAL _____ (Brand/Type or NA) High-Head Extension Vent Installed? ☐ YES ☐ NO ☐ NA

ACTUATOR TYPE _____
Manual Lever, Exposed Gearing (no gearbox), Enclosed Gearing*, Power Actuated

COMMENTS _____

* Manual gearbox filled with oil? ☐ YES ☐ 90 Wt to 140 Wt Oil ☐ Grand Slam Grease ☐ NO

Drained? ☐ YES ☐ NO

Wrench (Key) Size: ___ Quarter Turn ☐ Multi-Turn (Gate Valve or Plug / Ball Valve w/Gear box) ☐ Number of Turns:

** Enter Service History on next page.

Pacific Gas and Electric Company

VALVE MAINTENANCE RECORD FORM **Line / Station Name:**

(Make all entries in black or blue permanent ink) **Valve Number:**

SERVICE HISTORY (see notes)

DATE MM/DD/YY	INITIAL -------- LAN ID	VERIFY VALVE NUMBER Y/N	INSPECT Y/N	LUBE (If req'd) Y/N or N/A	OPERATE Y/N ---------- F/P	VALVE POSITION As Found / As Left	REPAIRS REQUIRED (If any)	ACTION TAKEN (If required)	REPAIRED DATE MM/DD/YY ---------- INITIAL – LAN ID	REVIEWED DATE MM/DD/YY ---------- INITIAL – LAN ID

NOTES: 1) Use Y/N for yes/no to indicate item performed and completed. 2) "LUBE" pertains to lubrication of the ball or plug. 3) "OPERATE" means to partially operate as a minimum. 4) Use F/P to indicate Full or Partial Operation. 5) Valve positions = C (closed), O (open), T (throttling)

Gas Distribution Critical Main Valves (Operating at 60 psig or Less)

1. General Information

A gas distribution "critical" main valve is one that may be necessary for the safe operation of a distribution system. Maintain any valve that is expected to operate when needed. Number all critical valves and include them in the division valve maintenance program. For all critical valves, maintain, inspect, service, lubricate (where required), and partially operate them at intervals not exceeding 15 months to the date, but at least once each calendar year.

The senior gas operations engineer and the Energy Delivery Maintenance and Construction (ED M&C) distribution supervisor responsible for the gas facilities in a particular division have the responsibility to jointly determine which valves are critical to the gas distribution system(s) in that division. They apply but do not exceed the criteria included in this work procedure. The Gas Transmission and Distribution (GT&D) Gas Engineering section periodically reviews each division's application of these criteria to ensure consistency on a system-wide basis.

2. Criteria for Gas Distribution Critical Main Valves

A. The following valves are considered critical:

1) Gas distribution system emergency shutdown zone valves (identified in Utility Standard S5000, "Gas Distribution Emergency Shutdown Zones").
2) Gas distribution system British thermal unit (BTU) separation valves.
3) Gas distribution system maximum allowable operating pressure (MAOP) separation valves.
4) Gas distribution main valves at shopping centers with distribution systems (three or more customers) on the roof.
5) High and semi-high pressure gas distribution main valves at critical areas where there is an extreme likelihood or history of pipeline failures or a need for accelerated emergency response (due to natural disasters, e.g., liquefaction, fault crossings, erosion, landslides, fire, or storms). Gas Engineering periodically reviews each division's application of this criterion to ensure consistency on a system-wide basis.
6) High pressure (other than low pressure) gas distribution main valves on the following:
    - Large ribs (10-inch and larger), unless other methods of controlling gas are established.
    - 6-inch and 8-inch ribs where excavation for pipe squeezing is not practical (a busy street, etc.), unless other methods of controlling gas are established.

These valves should be spaced as follows:

- At ½-mile intervals in all locations with predominantly four-story or higher buildings and wall-to-wall paving in downtown and business areas.
- At 2½-mile intervals in all other locations.

Give consideration to valve location and the area affected in case of system isolation. Gas Engineering periodically reviews each division's application of these criteria to ensure consistency on a system-wide basis.

B. Gas distribution main valves (tap valves) on laterals, off ribs, as described in Item 2.A.6, where excavation for pipe squeezing is not practical (a busy street, etc.). These valves are critical, unless other methods of controlling gas are established, where the lateral must be maintained to feed an adjacent gas distribution emergency shutdown zone. Exception: Those taps that extend more than one block in an urban area or feed more than 25 customers in a rural area. Gas Engineering periodically reviews each division's application of this criterion to ensure consistency on a system-wide basis.

3. Actions Required for Critical Valves

A. Ensure that valves are properly numbered, tagged, mapped, and included in the valve maintenance program and emergency zone shutdown procedures (zone valves).

B. Perform and document required maintenance, and replace valves when necessary. If a valve is found to be inoperable, notify the maintenance supervisor immediately so that prompt remedial action is initiated. Also, note the inoperability on the "Valve Maintenance Record" (Attachment 1) and submit a Material Problem Report.

C. When replacement is necessary, consider moving the valve to a more advantageous location.

4. Actions Required for Non-Critical Valves (When Converting from Critical to Non-Critical)

A. When removal is required, replace the valve with straight pipe, and install insulating fittings when cathodic protection assessment (CPA) boundaries are involved. Remove or break into valve boxes and fill the hole.

B. If valves are not removed, remove any valve number tags. The senior gas operations engineer or distribution M&C supervisor notifies the Mapping department in writing to remove valve numbers from plats. If a valve will not operate, add a note on the plat sheet that labels it "Non-operational."

C. Remove these valves from the valve maintenance program.

D. Place the "Valve Maintenance Record" document in the inactive file.

Buried Valve Identification

1. General Information

The "Valve Maintenance Record" (see Attachment 1) and proper implementation of this work procedure both require detailed valve data. There are numerous ways to identify buried valves, some of which are listed as follows:

A. Research valve maintenance records.

B. Research valve installation records.

C. Research equipment cards.

D. Examine the exposed parts of the valve in the valve frame and cover.

E. Excavate the valve.

Although excavating a valve is the only positive way to get all the information needed, Methods A through D above may provide the information needed to properly lubricate a valve and safely operate it. Do not use Method E (excavate the valve) unless there are unusual circumstances, such as excavation to repair a leak or to repair the coating on or next to the valve.

2. Proper Valve Identification

A review of the exposed parts and how the valve operates can provide the following vital information:

- Ball and plug valves are quarter-turn. (However, if a buried gearbox on a ball and plug valve exists, the gearbox pinion shaft is extended and multi-turned.) Gate valves are multi-turned.
- Before 1955, virtually all valves installed in Pacific Gas and Electric Company's (the Company's) transmission and distribution systems were plug valves, with the bulk of those manufactured by Rockwell. The year of installation may be available from existing records.
- Old gas standards can shed light on which types and brands of valves were purchased in certain years. This information may be available from the Technical Document Management (TDM) group.
- Plug valves have the grease fitting in the middle of the stem. Ball valves are supposed to have the backup grease feature fittings extended and external to the valve stem. Gate valves have no grease fittings, since they are not designed to be lubricated.

Using the above data, a conservative maximum torque value can be established for each buried valve.

Guidelines for Using Hydraulic Wrenches and Other High-Torque Devices on Gas Transmission and Distribution Valves

1. General Information

Gas transmission and distribution valves must operate properly when a reasonable amount of torque is applied to them. Usually, valves that are difficult to operate are not allowed to remain in that condition. This is true whether the cause of the difficulty is high torque requirements or restricted access. If the difficulty is due to high valve torque requirements, submit a Material Problem Report (MPR) . If the difficulty is due to restricted access, consult the Pacific Gas and Electric Company (Company) engineer responsible for the gas facilities in the division or district to review the situation.

Consider installing a gearbox or a hand-wheel on valves that are currently configured for wrench operation and have a design torque higher than reasonable for proper operation. Some smaller older valves were configured for wrench operation. A particular model valve today may be provided with a gearbox or a hand-wheel, due to revised requirements or policies for lower torque limits. Some valves cannot be converted from wrench to gearbox operation.

2. Valve Maintenance Practices

Always follow the instructions in this work procedure, including those that pertain to difficult-to-operate valves. Inoperable valves require special reporting per the requirements set forth in Section 5, "Operating Valves During Maintenance," in Work Procedure WP4430-04.

3. Employee Qualification

Only employees qualified by training and experience may operate a hydraulic valve wrench.

4. Preparation for Valve Maintenance Using a Hydraulic Torque Wrench

Before using a hydraulic torque wrench on a valve, identify its type, size, manufacturer, and model number. See the revised "Valve Maintenance Record" form (Attachment 1) for a listing of required information.

5. Valve Torque Limits

After a valve is identified, determine the torque limits for that particular valve. Identify the normal torque required to operate a valve that is in good condition and the maximum allowable valve stem torque.

Note: Never exceed valve stem torque limits for a particular valve. This is true whether the valve is operated manually or with the assistance of a hydraulic wrench or other mechanical or pneumatic device.

6. Safety Issues

If the torque limit for a particular valve is exceeded, the valve stem could fail, which could result in the severed portion of the valve stem being ejected by the pressure in the valve body. The result depends on the type of valve.

For the hydraulic valve wrench to apply torque to a valve stem, it must push against something that can safely handle the same load that is applied to the valve (for every action there is always an equal and opposite reaction). It is critical to position the hydraulic valve wrench so that the force it exerts will not cause an unsafe situation, such as in the following scenarios:

- If the bolts holding the bonnet of the valve in place are used as an anchor for the wrench and are overloaded, the valve bonnet could loosen and leak or completely separate.
- If the wrench is not securely located, it could slip and injure the operator, cause property damage, or not allow the wrench to properly operate the valve.

7. Difficult-to-Turn Valves

Only after all of the procedures relating to difficult-to-operate valves in this work procedure are followed without resolving the difficult-to-operate (or impossible to turn) condition, the hydraulic valve wrench may be used along with proper valve flushing/cleaning/lubrication procedures to restore the operability of difficult-to-operate valves. This may allow the proper flushing/cleaning/lubrication to be effective where it was not possible when attempting to turn the valve manually. A Material Problem Report must be submitted if there is an actual material issue (but not for situations where lubricating, flushing, or cleaning resolve the issue).

If following these procedures does not correct the difficult-to-operate condition (the valve cannot be manually operated within the torque limits and normal operating parameters), repair or replace the valve. Review the need for a particular valve before proceeding with its replacement. Operating parameters (such as configuration of shutdown zones) may have changed since the valve was originally installed.

If a decision is made to repair or replace a valve that is difficult to operate, use the hydraulic valve wrench to operate the valve until the valve can be repaired or replaced.

8. Material Problem Report (MPR)

Report problems with operating any valve, either during scheduled maintenance or at any other time, on a Material Problem Report.

9. Valves Located Where Access Is Restricted

If a valve is difficult to operate because it is in a location where access is restricted (close to vault walls, etc.) and a valve is still required at that location, use the hydraulic valve wrench to operate that valve until the limited access condition can be evaluated and/or corrected. The evaluation is made by the division or district Maintenance and Construction (M&C) supervisor and the engineer responsible for the specific facility. In general, do not leave valves that are difficult to operate in service.

If it is determined that the valve must remain in a restricted access location, note applicable information on the "Valve Maintenance Record" (Attachment 1). This information is beneficial when preparing to operate that valve. The limited access can be accounted for (locate a hydraulic valve wrench, etc.) before arriving at the particular valve for required operation or performing routine maintenance. Use conventional valve wrenches during an emergency because a hydraulic valve wrench may not be available at the time of an emergency.

10. Limitations on the Use of Hydraulic Valve Wrenches

A. Do not use hydraulic valve wrenches when the torque limit of the particular valve is unknown.

B. Do not use hydraulic valve wrenches for routine valve maintenance. Situations are described above where the use of a hydraulic valve wrench is appropriate. Using a hydraulic wrench for routine valve maintenance bypasses a key function of the valve maintenance program, which is to determine the condition of a valve. When the hydraulic wrench is used, it is much more difficult to sense the condition of the valve.

C. Only use hydraulic valve wrenches on valves configured for wrench operation. Hydraulic valve wrenches must **not** be used on valves that are hand-wheel or gearbox operated.

D. When developing plans for emergency operations (dig-in, landslide, earthquake, etc.), using a specialty tool such as a hydraulic valve wrench is not allowed. All emergency valves must be operable manually because specialty tools or the power to operate the specialty tool may not be available to employees responding to a particular valve emergency.

E. Whenever a hydraulic wrench is used to operate a valve, move the valve slowly off the stop. Pause to inspect the condition of valve. Then proceed cautiously, observing the gauge pressure to operate the valve as it is stroked.

F. If the hydraulic wrench is used on a buried valve, it is critical that the valve be adequately identified. Without clear identification, the torque limits for that particular valve cannot be determined. Excavation may be required if there are no other means to adequately identify the valve. In addition, since the condition of a buried valve cannot be observed, take extra caution to ensure that an unsafe condition does not develop while the valve is operated with the hydraulic wrench.

The following table shows all Rockwell (Nordstrom) and Walworth brand valves known to exist in the Company's gas systems, along with their type, model number, size, and torque limits.

Brand	Type	Model/Figure Number	Size (inches)	Torque Limit (foot-lbs.)
Rockwell	Plug	143	2	260
Rockwell	Plug	143	4	910
Rockwell	Plug	143	6	975
Rockwell	Plug	165	4	975
Rockwell	Plug	165	6	2196
Rockwell	Plug	165	8	4191
Rockwell	Plug	1165	6	975
Rockwell	Plug	1943	2	260
Rockwell	Plug	1943	3	570
Rockwell	Plug	1943	4	910
Rockwell	Plug	1945	2	305
Rockwell	Plug	1945	4	798
Rockwell	Plug	1945	6	1,539
Rockwell	Plug	1945	8	2,303
Rockwell	Plug	2024	2	580
Rockwell	Plug	2024	3	1,150
Rockwell	Plug	2045	2	383
Rockwell	Plug	2045	3	819
Rockwell	Plug	2045	4	1,213
Rockwell	Plug	2045	6	2,488
Rockwell	Plug	2245	2	519
Rockwell	Plug	2245	3	1,207
Rockwell	Plug	2245	4	1,938
Rockwell	Plug	2245	6	4,147

Brand	Type	Model/Figure Number	Size (inches)	Torque Limit (foot-lbs.)
Walworth	Plug	1412	3	274
Walworth	Plug	1412	4	372
Walworth	Plug	1412	6	570
Walworth	Plug	1412	8	840
Walworth	Plug	1700	2	57
Walworth	Plug	1718	6	390
Walworth	Plug	1718	8	450
Walworth	Plug	1749	2	180
Walworth	Plug	1749	3	255
Walworth	Plug	1749	4	300
Walworth	Plug	1750	2	122
Walworth	Plug	1750	3	275
Walworth	Plug	1760	2	195
Walworth	Plug	1760	3	277
Walworth	Plug	1760	4	408
Walworth	Plug	1796	2	57
Walworth	Plug	1796	3	129
Walworth	Plug	1796	4	231
Walworth	Plug	1797	2	57
Walworth	Plug	1797	3	129
Walworth	Plug	1797	4	231
Walworth	Plug	1966	2	150
Walworth	Plug	1966	3	195
Walworth	Plug	1966	4	225
Walworth	Plug	2720	2	84
Walworth	Plug	2720	3	163

Brand	Type	Model/Figure Number	Size (inches)	Torque Limit (foot-lbs.)
Walworth	Plug	2720	4	223
Walworth	Plug	3412	2	202
Walworth	Plug	3412	3	342
Walworth	Plug	3412	4	499
Walworth	Plug	3414	2	202
Walworth	Plug	3414	3	342
Walworth	Plug	3414	4	499
Walworth	Plug	3612	6	720
Walworth	Plug	3612	8	840

Estimating Torque when Manually Operating a Valve

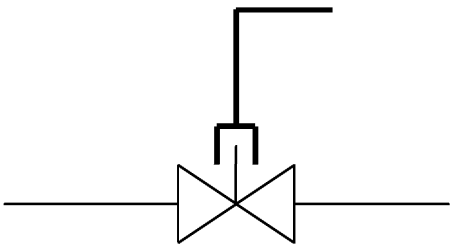
General Information

Torque is the amount of effort exerted in an attempt to rotate something, such as a valve stem. Torque is typically measured in foot-pounds. The amount of torque applied can be determined by multiplying the force being put on a lever arm times the length of that lever arm. Assume that a person can exert about 100 pounds of force on a valve wrench. Here are some examples:

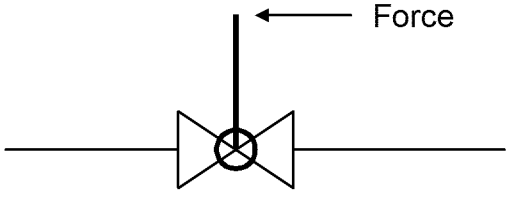
Example 1:

One person operating a valve with a 12-inch long wrench.

Torque = (100 pounds) x (1 foot) x (1 person) = 100 foot-pounds



Side View

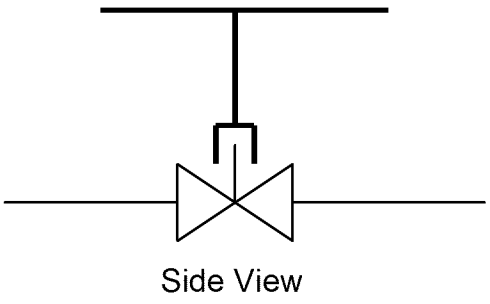


Top View

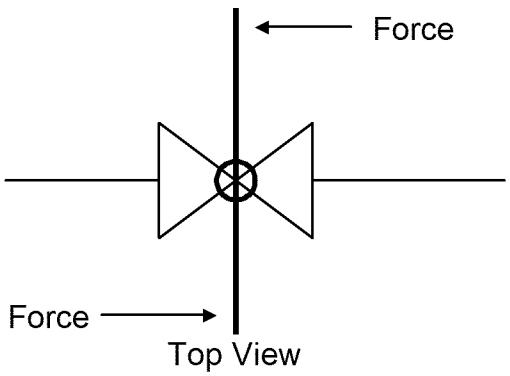
Example 2:

Two people operating a valve with a T-handle wrench that is 48 inches long (24 inches on each side of the shaft).

Torque = (100 pounds) x (2 feet) x (2 people) = 400 foot-pounds



Side View



Top View