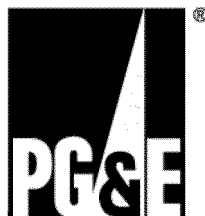


Proceeding: R.11-02-019
Exhibit No.: _____
Date: _____

PACIFIC GAS AND ELECTRIC COMPANY

**Determination of Maximum Allowable Operating Pressure in Natural
Gas Pipelines – PHMSA Instructions**

([http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/
maop_determination.pdf](http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/maop_determination.pdf))



DETERMINATION OF MAXIMUM ALLOWABLE OPERATING PRESSURE IN NATURAL GAS
PIPELINES

INSTRUCTIONS

The minimum federal pipeline safety standards of 49 CFR Part 192 require that each section of pipeline or each segment of a distribution system have a maximum allowable operating pressure (MAOP) established. A separate MAOP must be established for each distinct segment of a gas pipeline system. The transmission line transporting gas to the town border station, the feeder line supplying district regulator stations, and each separately operated portion of a distribution system, must each have a designated MAOP. The federal standards of Part 192.619, Part 192.621, and Part 192.623 list the factors to review in determining the MAOP, and the lowest pressure thus determined is the MAOP. Records must be available to substantiate any value determined.

The attached form can be used to determine MAOP. It should be kept on permanent file, along with any support documents or records, and periodically reviewed to determine if anything has occurred which would change the MAOP.

The form can be used for both transmission pipelines and distribution systems. Part 192.619 applies to both transmission lines and distribution systems, but only for steel and plastic pipe; this regulation does not apply to other types of pipe, such as cast iron. Part 192.621 applies to high pressure distribution systems but not to transmission lines. Part 192.623 covers low pressure distribution systems.

A. Part 192.619: Transmission Lines and High Pressure Distribution Systems, and Part 192.621: High Pressure Distribution Systems.

Part 192.619(a)(1), Part 192.621(a)(1) Design Pressure.

The design pressure for steel pipe can be determined from Part 192.105, and for plastic pipe from Part 192.121. The design pressure for other pipeline system components will presumably come from the manufacturer's literature. Copies of this literature should be retained for every type of component installed.

Special attention should be paid to pressure regulators. The body pressure rating is not the value to use, but rather the inlet pressure rating which will vary with orifice size. For example, one common service regulator has a body pressure rating of 125 psig, but with a large orifice an inlet pressure rating of only 5 psig. Also, some district regulators may have outlet pressure ratings as low as 5 psig above set point.

If the design pressure rating for system components cannot be determined due to lack of information, setting the MAOP based on Part 192.619(a)(4) or Part 192.621(a)(5) may be considered. This decision should be cleared through the appropriate regulatory authority. It is suggested that any approval received from an appropriate regulatory authority be obtained in writing to confirm action in the future.

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For transmission pipelines, under certain circumstances a design pressure limit (or lack of information on which to set a design pressure limit) may be overridden by Part 192.619(c). This regulation allows systems components installed prior to July 1, 1970, to remain in service at the same pressure they were subjected to between July 1, 1965, and June 30, 1970, even if that pressure exceeds the pressure rating for the component. If that is the case, the historic operating pressure may be used to set the MAOP in lieu of the design pressure. Note that if the component is replaced, it must meet current design pressure requirements.

Part 192.619(a)(2): Pressure Test.

A pressure test means raising the pressure in the pipeline (using water, gas, or air) to a level well in excess of the intended operating pressure to check pipeline tightness and integrity. Leak tests conducted at or near operating pressure are not pressure tests within the context of this regulation.

This regulation applies not only to tests made after initial construction of the pipeline or system, but also to tests of pipe used for extensions, laterals, or services connected to the original pipe, and to any replacement pipe. Any single piece of pipe tested to a lower pressure than the rest of the system will set the MAOP for the entire system.

Note that the regulation makes no provision for using a pressure test to set the MAOP for steel pipe operating at less than 100 psig.

If more than one pressure test has been conducted, the most recent test controls.

A record of the pressure test, or for distribution systems the test procedure in use at the time, must be available.

Part 192.619(a)(3): Historic Operating Pressure.

For onshore pipelines, review records for the highest operating pressure between July 1, 1965, and July 1, 1970, such as pressure charts, regulator station inspection reports showing inlet or outlet pressures, etc. (If no records are available, a notarized statement by a person in charge of pipeline operations during that time period, attesting to the operating pressure during that period, may be acceptable at the discretion of regulatory agencies).

The historic operating pressure limit can be overridden in two ways: by a pressure test under Part 192.619(a)(2) conducted after July 1, 1965, or by an uprating in compliance with Part 192, Subpart K. The most recent test or uprating would control.

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B. Part 192.621: High Pressure Distribution Systems.

Part 192.621(a)(2): The federal standards limit distribution system MAOP to 60 psig **unless** overpressure protection in accordance with Part 192.197(c) is provided at the point of delivery to customers.

If, as permitted by Part 192.197(c)(3), service regulators with internal relief are selected to permit operation at over 60 psig, the inlet pressure rating for adequate relief capacity must be carefully checked. The amount of inlet pressure the internal relief can safely vent depends on the size of the regulator orifice, with the relievable inlet pressure rating decreasing as orifice size increases.

Part 192.621(a)(3) The MAOP of a distribution systems containing cast iron pipe with unreinforced bell and spigot joints is limited to 25 psig. Reinforcement can be any of several methods of clamping or encapsulating joints to prevent pullout and/or leakage.

Part 192.621(a)(4) Any pressure limit on joints.

C. Additional Consideration.

If the operator has adequate data to thoroughly check all other MAOP criteria, but believes that a lesser pressure should be specified due to safety considerations not addressed in the other criteria, then the operator can set the MAOP at whatever value is considered the maximum safe pressure. Obviously, this pressure must be less than that determined from Part 192.619(a)(1)-(3) or Part 192.621(a)(1)-(4). Leak histories, corrosion problems, equipment problems, or other safety-related operational problems may require a lower MAOP be specified. However, operation of a system at a pressure below the MAOP for operational, not safety, reasons would not affect the MAOP.

There is also another way these regulations can be used. If pipeline and/or distribution system records are missing or incomplete, it may be impossible to conclusively determine what the MAOP should be under the other criteria. In that case, the operator *must consult with the Regulatory Agency*, and should look at the normal operating pressures over the last 5 years, and select the highest pressure which did not cause unusual safety or operational problems. This pressure must have applied for a long enough period of time for any problems to become evident. The operator could then conclude that this pressure represents the maximum known safe operating pressure, and determine that it should be the MAOP.

Use of these regulations to determine the MAOP would not preclude a future raising of the MAOP through pressure test or uprating, except that any known limits based on other regulations could not be exceeded.

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Use of either of Part 192.619(a)(4) or Part 192.621(a)(5) to establish the MAOP will require that the pipeline or system have overpressure protection to prevent the MAOP from being exceeded should a regulator failure occur. (See Part 192.619(b) and Part 192.621(b).) Any previous "grandfather" exemption from overpressure protection requirements is overruled. The concept is that if higher than normal pressures could cause a safety problem, or if the safety risk of a higher pressure cannot be determined because of lack of information, then measures must be taken to prevent that higher pressure from occurring.

D. Part 192.619(c) The Grandfather Clause.

Onshore transmission pipelines installed prior to March 12, 1971, can have an MAOP established based on the highest actual operating pressure that the pipeline was subjected to during the 5 year period preceding July 1, 1970, even though the design or testing under Part 192.619(a) are not satisfied. However if a segment of pipeline or component is replaced, the replacement is subject to the Part 192.619(a) requirements.

E. Part 192.623: Low Pressure Distribution System.

On distribution systems where the gas is delivered to the customer at system pressure with no service regulator, the MAOP is determined by the operator based on the maximum pressure which can safely be delivered to the customer. There is no universal consensus on what that pressure should be, but it must obviously be compatible with the customer piping and appliances. An MAOP established under this regulation should be periodically reviewed to determine if operating experience, local building code changes, new appliances or appliances regulators, etc., warrant revising the MAOP.

F. Determination of MAOP.

After determining the appropriate pressure limit in each category which applies to the pipeline or pipeline system involved, select the lowest value as the MAOP. Date the document to aid in future decision-making on whether the MAOP should be reevaluated, and attach all support documents. These support documents should be for all categories reviewed, not just the one which controlled. This file should be maintained for the life of the pipeline or system involved.

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Identity of Pipeline/Distribution Area

A. Maximum Allowable Operating Pressure: Steel or Plastic Pipelines (Part 192.619):
and High-Pressure Distribution Systems (Part 192.621).

Part 192.619(a)(1) Design Pressure: Lowest design pressure
Part 192.621(a)(1) for any of the following system elements

Pipe (including service lines)	_____
Valves	_____
Flanges	_____
Fittings	_____
Mechanical Couplings	_____
Leak Clamps	_____
Instruments	_____
Odorizers	_____
Overpressure Protection Devices	_____
Upstream Regulator(s)-Outlet	_____
Pressure Rating	_____
Downstream Regulators-Inlet	_____
Pressure Rating	_____
Other (list) _____	_____

Part 192.619(a)(2) Pressure Test

Plastic Pipe: Test Pressure divided by 1.5

Steel Pipe operated at or over 100 psi: Test Pressure divided by Class
Location Factor _____

Part 192.619(a)(3) Historic Operations

Highest operating pressure between 7/1/65 and 7/1/70 unless the pressure
test in (a)(2) was after 7/1/65 or an uprating in accordance with Subpart K
has been conducted. _____

B. Part 192.621: High Pressure Distribution Systems Only.

Part 192.621(a)(2) 60 psig unless all services have overpressure protection

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Part 192.621(a)(3) 25 psig for any cast iron pipe with unreinforced joints _____

Part 192.621(a)(4) Pressure limit on joints _____

C. Part 192.619(a)(3) and Part 192.621(a)(5): Additional Consideration for Transmission or High Pressure Distribution Lines.

Highest operating pressure considered safe based on operating history _____

D. Part 192.623: Low Pressure Distribution Systems.

Highest delivery pressure which can be safely applied to customer piping and properly adjusted gas appliances. _____

E. Part 192.619(c): Alternate consideration for transmission lines. Highest operating pressure between 7/1/65 and 7/1/70 (7/1/71 and 7/1/76 for offshore gathering lines.)

F. Determination of MAOP.

Either item E, where applicable, or the lowest pressure on any of the above lines is the MAOP.

MAOP _____

By _____

Date _____