



Establishing Setpoints on Overpressure Protection Devices

**Summary** This work procedure covers requirements for determining the setpoints of overpressure protection (OPP) devices protecting PG&E's gas transmission and distribution (GT&D) pipelines that operate in excess of 60 pounds per square inch gauge (psig).

Typical OPP devices include monitor valves, relief valves, and automatic shutoff valves.

This procedure does not apply to overpressure protection of auxiliary systems (for example, lube oil, air, and hydraulic systems, natural gas-operated control systems, etc.), or to gas field collection relief valves that act as the primary automatic pressure control into a gathering/transmission line, or to district regulator stations.

Level of Use: Information Use

**Target Audience** Station and pipeline engineers and maintenance and operations employees.

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

**Before You Start** Employees must know the gas systems involved in the setpoint revisions, the gas system operations, and the federal codes governing maximum allowable operating pressures (MAOP) and overpressure protection (OPP) requirements.

**Employee qualifications:** Employees performing inspections or maintenance in accordance with this procedure must first receive proper training and qualification under the applicable operator qualification (OQ) tasks:

- 14-02.00 "Inspect/Test Pressure Regulation and Limiting Devices."
- 16-01.00 "Test/Maintain Relief Devices."

**Tools, materials, and equipment:** Use only Company-approved tools and equipment. "Equipment" includes, but is not limited to, calibrated test gauges, calibrated pressure recorders, air monitoring instruments, and leak test soap solution. Refer to manufacturer's instructions for specialized tools required for the maintenance of unique equipment.

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**Procedure Steps**
**1 General Requirements**

- 1.1 The OPP device prevents the pipeline from being over-pressured if the regulator(s) or compressor(s) supplying the pipeline fails. In addition to properly designing, sizing, and maintaining the OPP device, correctly establishing the device setpoint is crucial to ensuring that the OPP device operates properly and provides the necessary protection to the pipeline.
- 1.2 The OPP setpoint evaluation must account for the potential pressure buildup beyond the setpoint, which could exceed the code-allowable overpressure. An OPP device does not prevent pressure from increasing above its setpoint under all conditions. This is especially true for conventional relief valves, since their wide-open relief capacity may not trigger until the pressure increases to 110% of setpoint.
- 1.3 If the OPP setpoint is adjusted too closely to the supply device setpoint, the OPP could interfere with the operation of the pressure regulator or compressor. Therefore, all of the following below in this procedure must be considered:





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## 2 Upper Setpoint Limitation

- 2.1 Based on Code of Federal Regulations (CFR) Title 49, § 192.201(a), the overpressure protection device must be set to ensure the pressure in a transmission or distribution feeder main (DFM) system does not exceed the lower of the following pressure settings:
1. The maximum allowable operating pressure plus 10%.
  2. The pressure that produces a hoop stress of 75% of specified minimum yield stress (SMYS).
- 2.2 For this document, the lower of the pressures listed above must be considered the maximum overpressure (MOvP).
- 2.3 For the GT&D transmission system, determine the setpoint of the OPP device based on the line's maximum operating pressure (MOP), not the maximum allowable operating pressure (MAOP). Generally, whenever the line's MOP is less than its MAOP, another transmission line with a lower MAOP is tied directly to it. This requires the first line's MOP to be lower. The OPP device must be set to protect the transmission line with the lower MAOP.

## 3 Hydraulic Head Effect

- 3.1 If there is a substantial drop in pipeline elevation downstream of the regulator station, the low point of the pipeline sees an increase in pressure due to the hydraulic head pressure effect. The low point of the pipeline requires the setpoints of both the supply and OPP devices to be reduced corresponding to the pressure increase due to the elevation change.
- 3.2 The pressure increase at the low point of the pipeline occurs due to the hydraulic head effect (weight) of the natural gas. However, hydraulic head effects are not considered relevant unless the elevation of the low point of the pipeline (downstream of the regulator station) is 400 feet or more below the regulating station. In these situations, contact the responsible GT&D station or pipeline engineer to calculate this effect. TD-4125P-07, Attachment 1, "Computing Pressure Increase Due to Hydraulic Head Effect," provides an equation for computing the pressure increase due to the hydraulic head effect.

## 4 Lower Setpoint Limitation

- 4.1 Set the relief valve or monitor valve controls just sufficiently above the MOP of the system being protected to permit the system to operate at the MOP without causing the relief valve to weep (vent gas), or the monitor valve to interact negatively with the regulator. Determine this pressure setpoint by considering the operating characteristics and operating tolerances of the valve being used. It must not be any higher than necessary, and must never be set to exceed the MOvP.





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- 4.2 In some cases, it may be necessary to reduce the setpoint of the main supply device to below the pipeline MOP to prevent the supply device(s) and overpressure protection device(s) from interacting negatively with each other.
- 4.3 Another option is to replace the OPP device with another more responsive device (for example, replace the conventional relief with either a quick-opening relief valve or a monitor valve).

### 5 Types of OPP Devices and Their Operating Characteristics

- 5.1 **Monitor Valves** are essentially backup pressure regulators set to operate above the pipeline MOP. These monitor valves operate if the primary supply device fails to maintain pressure below its setpoint. The monitor valves may be controller or pilot-operated. Although monitor valves are designed to control pressure, several factors (controller responsiveness, monitor versus regulator actuator speed, etc.) can contribute to an outlet pressure initially exceeding the monitor valve setpoint.
- 5.2 **Pressure Relief Valves** for transmission lines fall into three categories:
- Conventional (direct spring or conventional pilot-operated).
  - Quick-opening, pilot-operated.
  - Controller-operated.
1. Conventional relief valves require up to 10% over the setpoint to obtain full open flow capacity. This factor may require the setpoints of some valves to be set at 10% below the MOvP. These valves also characteristically weep small amounts of gas when the pressure approaches the setpoint.
  2. Quick-opening relief valves (for example, Anderson-Greenwood type valves with pilots) achieve full open flow very near their setpoint. This type of relief valve also can operate near its setpoint without valve leakage.
  3. The controller-operated relief valve may require several pounds per square inch (psi) over its setpoint to obtain full open capacity. These relief valves generally use a pneumatic-powered plug valve with a pneumatic controller.

### 6 Variables Affecting the Operating Characteristics of OPP Device

Several factors may affect the responsiveness of the OPP device to minimize any pressure increase above the OPP setpoint. These factors include:

- Proper tuning and calibration of the controller.
- Pilot and/or OPP device.
- Speed of operation of the regulator.



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6 (continued)

- Internal volume of downstream piping.
- Design of the OPP system.
- Maintenance of the device.

**7 Guideline for OPP Device Setpoints**

7.1 Due to the difficulty in computing the maximum setpoint of OPP devices that ensure downstream pressure never exceeds limitations allowed in the code, Table 1, "Guidelines for Maximum Setpoint of OPP Device," below establishes the following guidelines based on minimal interference experienced in present and past applications:

**Table 1. Guidelines for Maximum Setpoint of OPP Device**

MOP	< 250 psig	≥ 250 psig
Monitor:	5 psig over MOP	10 psig over MOP
Relief (conventional):	5 psig over MOP	10 psig over MOP
Relief (with quick-opening pilots):	5 psig under MOvP	5 psig under MOvP

- 7.2 Note that the setpoint of any OPP device must always be set lower than the MOvP. (In other words, never set the monitor or relief valve at MOP plus 10% or at a pressure that produces a hoop stress of 75% SMYS.)
- 7.3 If there is a substantial length of piping between the relief valve and the piping it is protecting, and that relief valve is not directly sensing the pipe it is protecting, subtract the anticipated pressure drop between the main piping and the relief valve from the setpoint recommended above in Table 1.
- 7.4 Following these guidelines ensures that the pressures under emergency conditions do not exceed the allowable values.
- 7.5 Due to operational problems, certain OPP installations may require the setpoint increased above these guidelines. Contact the appropriate facilities or pipeline engineer for agreement to increase the setpoint above these guidelines. The engineer alone computes the expected pressure increase to determine whether it complies with code.



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7.6 Table 2 below provides examples of typical setpoints of overpressure devices for various operating pressures.

**Table 2. Examples of Overpressure Protection Device Setpoints**

		Monitor	Relief (Conventional)	Relief (Quick Opening)
MOP	MOvP	MOP +5 or 10 psi	MOP + 5 or10 psi	MOvP - 5 psi
100	110	105	105	105
200	220	205	205	215
300	330	310	310	325
400	440	410	410	435
500	550	510	510	545
600	660	610	610	655
700	770	710	710	765
800	880	810	810	875
900	990	910	910	985
1000	1100	1010	1010	1095

**NOTE:** Table 2 is based on limitation of MAOP plus 10%. 75% SMYS limitation and/or hydraulic head effect must be considered where applicable. 5 or 10 psig is based on Table 1 criteria.

**8 Records**

- 8.1 Document maximum setpoints of OPP devices on PG&E Drawing No. 183018, "Overpressure Protection Device Maximum Settings." The latest revision of Drawing No. 183018 must remain on file in the Electronic Library System (ELS).
- 8.2 The manager of station engineering of GT&D approves the annual updates to PG&E Drawing No. 183018.
- 8.3 The manager of station engineering also issues or otherwise distributes PG&E Drawing No. 183018 annually on or before March 15th to reflect setpoint changes or additions submitted for posting.

**END of Instructions**





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**Definitions**

**Maximum overpressure (MOvP):** The level of maximum permissible overpressure by code under any possible operating condition in the event of a failure of the pressure regulating device. This maximum overpressure is based on the limitations identified in section 2. For cases where hydraulic head is a factor, the maximum pressure pertains to the pressure at the station supplying the particular pipeline section.

**Over pressure protection (OPP):** A pressure-relieving or pressure-limiting apparatus installed to protect a pipeline from exceeding its maximum code-allowable overpressure, as described in CFR Title 49, Part 192, Subpart D, "Design of Pipeline Components," in the event of a pressure control failure.

Types of OPP devices include the following valves:

- Relief valves
- Monitor valves
- Security valves

**Implementation Responsibilities**

District or division maintenance or operating supervisors ensure the setpoints of the OPP devices in facilities located within their assigned areas do not exceed the maximum settings shown on PG&E Drawing No. 183018.

**Governing Document**

Utility Standard TD-4125S, "Maximum Allowable Operating Pressure Requirements for Gas Distribution Systems and Transmission and Gathering Lines."

**Compliance Requirement/Regulatory Commitment**

This procedure enforces federal code CFR 49, § 192.195, "Protection against accidental overpressuring," which states that each pipeline connected to a gas source, so that the maximum allowable operating pressure could be exceeded as the result of pressure control failure or of some other type of failure, must have pressure relieving or pressure limiting devices that meet the requirements of § 192.199, "Requirements for design of pressure relief and limiting devices," and § 192.201, "Required capacity of pressure relieving and limiting stations."



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**Reference Documents****Developmental References:**

CFR Title 49, § 192.195 "Protection against accidental overpressuring."

CFR Title 49, § 192.199 "Requirements for design of pressure relief and limiting devices."

CFR Title 49, § 192.201 "Required capacity of pressure relieving and limiting stations."

Code of Safe Practices

PG&E Drawing No. 183018, "Overpressure Protection Device Maximum Settings."

Utility Standard Practice (USP) 22, "Safety and Health Program."

**Supplemental References:**

Numbered Document H-70, "Pressure Relief Devices."

Utility Procedure TD-4430P-02, "Gas Transmission Stations Inspection, Testing, and Maintenance Procedures."

Utility Procedure TD-4125P-06, "Revising Setpoints on Overpressure Protection Devices."

Utility Standard TD-4125S, "Maximum Allowable Operating Pressure Requirements for Gas Distribution Systems and Transmission and Gathering Lines."

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**Appendices**

NA

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**Attachments**

TD-4125P-07, Attachment 1, "Computing Pressure Increase Due to Hydraulic Head Effect."

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**Document Revision**

This procedure supersedes CGT Standard 4125.2, Revision 1.1, "Establishing Setpoints on Overpressure Protection Devices" dated October 1, 1999.







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Revision Notes

Where?	What Changed?
NA	This is a document.

