	PRESSURE RELIEF DEVICES	H-70

Department:	Gas System Technical Support	**Section:**	Gas Systems Standards Management
Approved by:	D. W. Anderson	**Approved by:**	S. Y. Chwistek **Date:** 06-04-98

Rev. #00: This document replaces PG&E Drawing 088036. For a description of the changes, see Page 3.

Purpose and Scope:

This standard provides basic design requirements, and sets inspection and testing requirements for gas pressure relief devices used for natural gas service at compressor, pressure limiting, and regulator stations. This standard does not cover rupture disks.

Design Requirements

1. Relief valves should not be used unless it has been determined that monitor valves are impractical.
2. A pressure relief device shall have the capacity, and shall be set, to limit the pressure in a system to the appropriate maximum pressure shown below, under any possible operating conditions.
   A. In a low pressure distribution system, the pressure may not exceed 14" water column (WC).
   B. In pipelines other than a low pressure distribution system:
      1. If the maximum allowable operating pressure is 60 psig or more, the pressure may not exceed the maximum allowable operating pressure plus 10 percent, or the pressure that produces a hoop stress of 75 percent of SMYS, whichever is lower;
      2. If the maximum allowable operating pressure is 12 psig or more, but less than 60 psig, the pressure may not exceed the maximum allowable operating pressure plus 6 psig; or
      3. If the maximum allowable operating pressure is less than 12 psig, the pressure may not exceed the maximum allowable operating pressure plus 50 percent.
3. The pressure at which the relief valve is set to open will depend on its operating characteristics, including the pressure build up above the set pressure necessary to achieve full capacity, and the pressure at which the system is to be operated under normal conditions. However, the setting shall **not** be higher than a level which would permit the pressure to reach or exceed the pressures specified in Paragraph 2., taking into account the pressure build up required for the valve to reach full capacity.
4. The relief valve or other overpressure protection should be set just sufficiently above the maximum operating pressure (MOP) of the system being protected to permit the system to be operated at the MOP without causing the relief valve to leak or vent gas. This pressure shall be determined considering the operating characteristics and operating tolerances of the valve being used. It shall **not** be any higher than necessary to accomplish this, and **under no condition** shall it be set so high that it will permit the pressure in the piping to exceed that specified in Paragraph 2.
5. When more than one pressure regulating or compressor station feeds into a pipeline, relief valves or other protective devices shall be installed at each station to ensure that a failure of the supply devices will not impose pressure on any part of the downstream pipeline system in excess of the pressure permitted by Paragraph 2.
   A. At stations built or rebuilt after July 3, 1972, pressure relief devices shall have sufficient capacity to relieve a failure of all parallel supply devices in the final stage of pressure regulation. That capacity is **not** to be based on the simultaneous failure of all supply devices in all stages of regulation.
   B. At stations built before July 3, 1972 and not rebuilt since then, pressure relief devices shall comply with the minimum requirement of the latest edition of 49CFR 192; the relief devices shall have sufficient capacity to relieve a failure of the supply device with the largest capacity.
      1. If the capacity of the supply devices has changed, the pressure relief devices shall have sufficient capacity to meet the requirements of Paragraph 5.A.

Pressure Relief Devices

2. If the pressure relief devices are being replaced due to wear, the capacity of pressure relief devices being replaced may remain unchanged. However, increasing the capacity of the relief devices to comply with Paragraph 5.A. should be considered when relief devices with increased capacity can be installed with only minor piping changes.

6. The discharge piping of pressure relief valves shall be designed to prevent an accumulation of water, ice, or snow and to discharge gas to non-hazardous locations. To prevent injury to personnel, the vent exhaust shall be located at or above 8 feet from ground level.

Sizing of Relief Valves

7. The relief valve must have adequate capacity, and must have operating characteristics, to prevent the pressure from exceeding the limits specified in Paragraph 2. (above), taking into account the set pressure, the operating tolerance of the valve, and the pressure buildup required to achieve full capacity.
8. The capacity of the relief valve should be based on the highest anticipated supply pressure in the line feeding the regulator. This may be the MOP rather than the maximum allowable operating pressure (MAOP) of the line. However, there must be adequate assurance that the supply pressure will not increase above that for which the relief valve is sized. If it is necessary to increase the MOP of the system supplying the regulator(s), the capacity of all relief valves protecting it must first be checked to verify that there is adequate relief capacity for the new conditions. Where the relief capacity is not adequate, additional capacity must be provided before the MOP is increased.
9. The minimum demand on a system may be considered when sizing the relief valve, provided there is assurance that this minimum demand will always be present.
10. The manufacturer's capacity rating may be used to determine the adequacy of the relief valve (subject to precautions outlined in Paragraph 12.). Before using the manufacturer's capacity rating, verify with System Standards Management of GSTS or Engineering & Planning of DCS that the latest available information is being used.
11. When selecting and sizing a relief valve, consideration must be given to the following characteristics:
    A. The pressure buildup above the point the valve first opens which is necessary to obtain full capacity. This must be compared to the maximum pressure permitted by Paragraph 2.
    B. The repeatability of operation. How closely the relief valve can be set to the MOP of the downstream piping system without operating or leaking gas unintentionally.
    C. The pressure to which the system must drop before the relief valve will close after it operates.
    D. The potential hammering or excessive vibration effects. The relief valve should be sized small enough to prevent hammering or excessive vibration.
12. The regulator capacity against which the relief valve must protect is the **failed wide open** capacity. This can be calculated using the valve coefficient (Cv) for a wide open valve. The tabulated capacity for the regulator shown in the Gas Standards and Specifications or the manufacturer's literature should not be used unless it is known to be the **wide open** capacity.
13. Piping between the system being protected and the relief valve must be sized so that it will not restrict the capacity of the relief valve.
14. Any valve between the system being protected and the relief valve must be locked open to prevent any unauthorized operation that would isolate the relief valve from the piping being protected.
15. The vent stack represents a restriction against which the relief valve must discharge. The pressure drop in the vent stack must be considered when sizing the relief valve and the vent stack piping.

Inspection and Testing of Pressure Relief Devices

16. All pressure relief devices shall be inspected, tested, and the capacity reviewed at intervals not exceeding 15 months, but at least once each calendar year as required by DOT 49 CFR Part192, Paragraphs 192.739 and 192.743.
17. The relief devices shall be **inspected** and **tested** to determine that they are:
    A. In good operating condition;
    B. Set to function at the correct pressure (Note: the setpoint must be verified by physically testing that the relief valve begins to operate at the proper pressure setting); and

C. Properly installed and protected from dirt, liquids, and other conditions that might prevent proper operations.

18. Verify that the relief valve has sufficient **capacity** to limit pressure to the level required by Paragraph 2. by the following:

    A. Making an office review and calculation, to verify that under operating conditions the relief valve has the proper setting and capacity to limit pressure to the required level; or

    B. Physically testing relief valve(s) in place to verify that the relief valve(s) has sufficient capacity to limit pressure to the required level.

19. The capacity shall be considered satisfactory if the maximum downstream system pressure will not exceed the maximum pressure specified in Paragraph 2. If the capacity at the maximum system pressure is not adequate, immediate steps shall be taken to provide adequate capacity.

20. The capacity of the relief devices at **pressure limiting and regulating stations** shall be recorded using the form, "Capacity Review of Relief Devices at Pressure Limiting & Regulator Stations", Exhibit 1. The capacity of the relief devices protecting against overpressure due to **gas compression** shall be recorded using the form, "Capacity Review of Relief Devices at Compressor Stations", Exhibit 2. Both forms are available from the System Standards Management Section of Gas System Technical Support.

21. In addition to annual capacity testing, the capacity of relief devices shall be verified immediately when changes are made which could affect the ability of the relief valve to protect the system.

Responsibility

22. The DCS Area Managers, the Manager of Gas System Maintenance, or their designated representatives are responsible for performing the inspection, testing, operation and maintenance of the subject facilities, within their assigned areas of responsibility.

References:	**Document**
49 CFR Part 192, Pipeline Safety Regulations, Natural Gas.	Section 192.199
49 CFR Part 192, Pipeline Safety Regulations, Natural Gas.	Section 192.201
49 CFR Part 192, Pipeline Safety Regulations, Natural Gas.	Section 192.731
49 CFR Part 192, Pipeline Safety Regulations, Natural Gas.	Section 192.739
49 CFR Part 192, Pipeline Safety Regulations, Natural Gas.	Section 192.743
CGT Standard, *Gas Pressure Relief Devices – Responsibility for Capacity Verification*	S-4433
DCS Standard, *District Regulator Station Maintenance*	D-S031
DCS/CGT Standard, *Standard, Maximum Allowable Operating Pressures, Requirements for Transmission Lines and Distribution Mains & Services.*	D-S0430/S4125

Revision Notes:

Revision 00 has the following changes:

1. To make the forms user friendly, the capacity review forms have been divided into two forms. One form is for "Pressure Limiting and Regulator Stations" and other form is for "Gas Compression."
2. Converted PG&E Drawing 088036 to Interleaf Gas Standard H-70.
3. Rearranged contents; completely revised text, table and graphics numbering streams.
4. Reset Revision number stream to zero.
5. This document is part of Change 43.

CAPACITY REVIEW OF RELIEF DEVICES AT PRESSURE LIMITING AND REGULATING STATIONS AS REQUIRED BY PARAGRAPHS 192.739 (B) AND 192.743 OF 49CFR192 (REFER TO GAS STANDARD H–70)

Station Name: Area: District:

Line or system supplied by facility (see Note #1 below) Anniversary month (see Note #2 below)

PART I — To Be Completed Annually

This capacity check is for the Year												
#1 Was capacity reviewed for previous year?	YES											
If NO, complete Part II of Annual Capacity Review for PLS & Reg stations.	NO											
#2 Did previous review show that relief valve(s) had adequate capacity?	YES											
If NO, complete Part II of Annual Capacity Review for PLS & Reg stations.	NO											
#3 Have there been any changes to the equipment at this station, pressure conditions (either inlet or outlet), load conditions, or supply conditions which could affect the ability of the relief valve(s) to limit the pressure to the maximum permitted by paragraphs 192.169 and 192.201 of 49CFR192?	YES											
	NO											
*If the answer is YES, complete Part II of Annual Capacity Review for PLS & Reg Stns. **If answers to Item #1 and #2 were YES and Item #3 was NO, check YES on Item #4.												
#4 Relief valve(s) at this station have adequate capacity. If NO, complete Part III of Annual Capacity Review for PLS & Reg stations.	YES											
	NO											
VERIFIED BY (Place initials in the appropriate box)												
DATE (Put date verified in the appropriate box)												
APPROVED BY (Place initials in the appropriate box)												
DATE (Put date approved in the appropriate box)												

NOTES:

1. If there are regulating and overpressure facilities at the station supplying more than one line or system, a separate review must be performed for the overpressure protection devices for each line or system.
2. All pressure relief devices shall be inspected, tested, and the capacity reviewed at intervals not exceeding 15 months, but at least once each calendar year. Furthermore, in addition to the annual capacity testing, the capacity of the relief devices shall be verified immediately when changes are made which could affect the ability of the relief device to protect the connected systems.
3. The **Verified By** box is usually initialed by a Technician or an M&C mechanic. The **Approved By** box is usually initialed by a Foreman or Operating Supervisor.

RETAIN THIS DOCUMENT AS A PERMANENT RECORD FOR THE LIFE OF THE FACILITY.

CAPACITY REVIEW OF RELIEF DEVICES AT **PRESSURE LIMITING AND REGULATING STATIONS** AS REQUIRED BY PARAGRAPHS 192.739 (B) AND 192.743 OF 49CFR192 (REFER TO GAS STANDARD H–70)

PART II — To be completed only if Part I indicates that a complete review is required.

Station Name: _____ Date: _____

Division _____ District _____

Line or System Supplied by Facility (see note #1 below) _____

This Capacity Review is for the Year _____

1. **Complete capacity review was required because:**
   - a. _____ Capacity review was not performed in previous year.
   - b. _____ The previous capacity review showed that relief device capacity was inadequate.
   - c. _____ Changes have been made to the equipment at the station, pressure conditions, load conditions, or supply conditions which could affect the ability of the relief valves to limit the pressure to the maximum permitted by 49CFR192.

2. **Station Pressure Conditions**
   - P1 – Maximum upstream pressure (MAOP, or MOP if lower). _____ psig
   - P2 – MAOP or MOP downstream of station. _____ psig
   - P3 – Maximum permissible downstream pressure (see Par. 192.201). _____ psig

3. **Regulator(s) Supplying Line or System Described Above**

Regulating Valve					Wide Open Capacity	Indicate Catalog Reference or Gas Standard for Capacity (Attach calculation sheet)
No.	Size	Model	Inner Valve Size	Field Verified	(P1 in , P2 out)	

Regulator(s) installed in series _____; parallel _____

4. **Maximum Supply Capability**
   - a. Total Capacity of all regulators if installed in parallel. _____ scfh

     Total capacity of series regulator installation with pressure drops adjusted to give maximum flow. _____ scfh
   - b. Maximum capacity through station if limited by conditions other than regulators. _____ scfh

     State limiting conditions: _____

Note 1 If there are regulating and overpressure protection facilities at the station supplying more than one line or system, a separate review must be performed for the overpressure protection device for each line or system.

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CAPACITY REVIEW OF RELIEF DEVICES AT **PRESSURE LIMITING AND REGULATING STATIONS** AS REQUIRED BY PARAGRAPHS 192.739 (B) AND 192.743 OF 49CFR192 (REFER TO GAS STANDARD H–70)

PART II, (continued)

Station Name: _____ Date: _____

5. **Minimum Downstream Load**

The minimum load supplied from the line or system being reviewed **under any operating condition or situation**. _____ scfh

Note: Unless it can be established that this minimum load will be present under any operating condition, this load should be considered as zero.

Describe load if present:

6. **Relief Capacity Required**

Enter either #4a or #4b above, whichever is lower _____ scfh

Less #5 above (if any) _____ scfh

Minimum Relief Capacity Required _____ scfh

7. **Relief Device(s) Protecting Line or System Described above**

a.

Relief Valve						Maximum Capacity @ P3 (See note 2)	Capacity Reference
No.	Size	Model	Inner Valve Size	Field Verified	Pressure Setting		

b. Total capacity restrictions from valves, piping, silencers, etc. _____ scfh

Describe: _____

c. Relief capacity available. Total of 7(a), less total of 7(b) _____ scfh

8. **Adequacy of Relief Capacity**

a. Capacity shown in 7(c) is equal to or greater than relief capacity required (Item #6). Capacity Adequate. See #9. _____

b. Capacity shown in 7(c) is less than the relief capacity required (Item # 6). Capacity not adequate. See Part III. _____

9. **The relief device(s) described above have adequate capacity.** (See note 3)

Verified by: _____	Approved by: _____
Date:	Date:

Note 2 Refer to Section 3.0 of Gas Standard H–70.

Note 3 The **Verified By** box is usually initialed by a GSM or DCS Area Engineer. The **Approved By** box is usually approved by the Engineering Supervisor.

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CAPACITY REVIEW OF RELIEF DEVICES AT **PRESSURE LIMITING AND REGULATING STATIONS** AS REQUIRED BY PARAGRAPHS 192.739 (B) AND 192.743 OF 49CFR192 (REFER TO GAS STANDARD H–70)

PART III — To be completed only if Part II indicates that relief capacity is inadequate.

Station Name: _____ Date: _____

Division _____ District _____

Line or System Supplied by Facility _____

1. Additional relief capacity required (from Part II #6, less #7(c)). _____ scfh
2. Corrective action to be taken:
   a. Increase relief capacity (see #3, this sheet). _____ scfh
   b. Replace relief equipment with a monitor.
   c. Other. Describe: _____
3. If relief capacity is increased by adding an additional relief device or replacing the existing relief equipment with a relief device of larger capacity, a copy of the design calculations must be attached to this form.
4. Date capacity was found to be inadequate: _____
5. Work to provide adequate overpressure protection completed.
   Job No. _____ Completed on: _____

Verified by: _____	Approved by: _____
Date:	Date:

Note 1 The **Verified By** box is usually initialed by a GSM or DCS Area Engineer. The **Approved By** box is usually approved by the Engineering Supervisor.

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CAPACITY REVIEW OF RELIEF DEVICES AT **COMPRESSOR STATIONS** AS REQUIRED BY PARAGRAPH 192.731 OF 49CFR192 (REFER TO GAS STANDARD H–70)

Station Name: Area: District:

Line or system supplied by facility (see Note #1 below) Anniversary month (see Note #2 below)

PART I — To Be Completed Annually

This capacity check is for the Year												
#1 Was capacity reviewed for previous year?	**YES**											
If NO, complete Part II of Annual Capacity Review for Compressor Stations.	**NO**											
#2 Did previous review show that relief valve(s) had adequate capacity?	**YES**											
If NO, complete Part II of Annual Capacity Review for Compressor Stations.	**NO**											
#3 Have there been any changes to the compressor(s) at this station, pressure conditions (either inlet or outlet), load conditions, or supply conditions which could affect the ability of the relief valve(s) to limit the pressure to the maximum permitted by paragraphs 192.169 and 192.201 of 49CFR192? *If the answer is YES, complete Part II of Annual Capacity Review for Compressor Stns. **If answers to Item #1 and #2 were YES and Item #3 was NO, check YES on Item #4.	**YES**											
	NO											
#4 Relief valve(s) at this station have adequate capacity. If NO, complete Part III of Annual Capacity Review for Compressor stations.	**YES**											
	NO											
VERIFIED BY (Place initials in the appropriate box)												
DATE (Put date verified in the appropriate box)												
APPROVED BY (Place initials in the appropriate box)												
DATE (Put date approved in the appropriate box)												

NOTES:

1. If there are compression facilities at the station supplying more than one line or system, a separate review must be performed for the overpressure protection devices for each line or system.
2. All pressure relief devices shall be inspected, tested, and the capacity reviewed at intervals not exceeding 15 months, but at least once each calendar year. Furthermore, in addition to the annual capacity testing, the capacity of the relief devices shall be verified immediately when changes are made which could affect the ability of the relief device to protect the connected systems.
3. The **Verified By** box is usually initialed by a Technician or an M&C mechanic. The **Approved By** box is usually initialed by a Foreman or Operating Supervisor.

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CAPACITY REVIEW OF RELIEF DEVICES AT **COMPRESSOR STATIONS** AS REQUIRED BY PARAGRAPHS 192.731) OF 49CFR192 (REFER TO GAS STANDARD H–70)

PART II — To be completed only if Part I indicates that a complete review is required.

Station Name: _____ Date: _____

Division _____ District _____

Line or System Supplied by Facility (see note #1 below) _____

_____

This Capacity Review is for the Year _____

1. **Complete capacity review was required because:**
   - a. _____ Capacity review was not performed in previous year.
   - b. _____ The previous capacity review showed that relief device capacity was inadequate.
   - c. _____ Changes have been made to the equipment at the station, pressure conditions, load conditions, or supply conditions which could affect the ability of the relief valves to limit the pressure to the maximum permitted by 49CFR192.

2. **Station Pressure Conditions**
   - P1 – Maximum suction pressure (MAOP, or MOP if lower). _____ psig
   - P2 – Maximum normal suction pressure. _____ psig
   - P3 – MAOP or MOP downstream of station. _____ psig
   - P4 – Maximum permissible downstream pressure (see Par. 192.169 and Par. 192.201). _____ psig

4. **Compressor(s) Supplying Line or System Described Above**

Compressor		Max Capacity	Indicate Reference Source
Operating Diagram Designation	Model	(P1 or P2 in, P4 out)	for Capacity ***(Attach calculation sheet)***

4. **Maximum Supply Capability**
   - a. Total Capacity of all compressors if installed in parallel. _____ scfh
     Total capacity of series compressor installation with pressure drops adjusted to give maximum flow. _____ scfh
   - b. Maximum capacity through station if limited by conditions other than compressor(s). _____ scfh
     State limiting conditions: _____
     _____
     _____

Note #1 If there are compressor facilities at the station supplying more than one line or system, a separate review must be performed for the overpressure protection device for each line or system.

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4/15/98

CAPACITY REVIEW OF RELIEF DEVICES AT **COMPRESSOR STATIONS** AS REQUIRED BY PARAGRAPHS 192.731) OF 49CFR192 (REFER TO GAS STANDARD H–70)

PART II, (continued)

Station Name: _____ Date: _____

5. **Relief Capacity Required**

Enter either #4a or #4b above, whichever is lower. _____ scfh

7. **Relief Device(s) Protecting Line or System Described above**

a.

Relief Valve					Maximum Capacity @ P4 (See note 2)	Capacity Reference
Size	Model	Serial No.	Orifice Sq. In.	Set Pressure PSIG		

b. Total capacity restrictions from valves, piping, silencers, etc. _____ scfh

Describe: _____

_____

_____

c. Relief capacity available. Total of 6(a), less total of 6(b) _____ scfh

7. **Adequacy of Relief Capacity**

a. Capacity shown in 6(c) is equal to or greater than relief capacity required (Item #5). Capacity Adequate. Complete #8 below and answer question #4 in Part I. _____

b. Capacity shown in 6(c) is less than the relief capacity required (Item # 5). Capacity not adequate. See Part III. _____

8. **The relief device(s) described above have adequate capacity.** (See note 3)

Verified by: _____	Approved by: _____
Date:	Date:

Note 2 Refer to Section 3.0 of Gas Standard H–70.

Note 3 The **Verified By** box is usually initialed by a GSM or DCS Area Engineer. The **Approved By** box is usually approved by the Engineering Supervisor.

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CAPACITY REVIEW OF RELIEF DEVICES AT **COMPRESSOR STATIONS** AS REQUIRED BY PARAGRAPHS 192.731) OF 49CFR192 (REFER TO GAS STANDARD H–70)

PART III — To be completed only if Part II indicates that relief capacity is inadequate.

Station Name: _____ Date: _____

Area _____ District _____

Line or System Supplied by Facility (see note #1 below) _____

1. Additional relief capacity required (from Part II #5, less #6(c)). _____ Scfh
2. Corrective action to be taken:
   a. Increase relief capacity (see #3, this sheet). _____
   b. Other. Describe: _____
3. If relief capacity is increased by adding an additional relief device or replacing the existing relief equipment with a relief device of larger capacity, a copy of the design calculations must be attached to this form.
4. Date capacity was found to be inadequate: _____
5. Work to provide adequate overpressure protection completed.
   Job No. _____ Completed on: _____

Verified by:	Approved by:
Date:	Date:

Note 1 The **Verified By** box is usually initialed by a GSM or DCS Area Engineer. The **Approved By** box is usually approved by the Engineering Supervisor.

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