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DIVISION OR DEPARTMENT GAS SYSTEM DESIGN

FILE NO ~~52~~ 463 X 028.6

RE LETTER OF

SUBJECT Sizing and Setting of Relief Valves

January 17, 1975

DIVISION GAS SUPERINTENDENTS:
MANAGER, PIPE LINE OPERATIONS:
MANAGER, CIVIL-HYDRO AND GAS CONSTRUCTION:

Par. 192.201 of CPUC General Order 112-C states the requirements for providing overpressure protection for pipeline facilities. The attached material has been prepared to provide guidance when designing, setting, or reviewing overpressure protection facilities to meet these requirements.

It is suggested that copies of this guide material be supplied to personnel involved with the design, installation setting, and review of overpressure protection facilities. Additional copies may be obtained from the Gas System Design Department.

Please call [redacted], if there are questions concerning this material.

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Attachment

Gas System Design Department
January 17, 1975 F 028.C

# GUIDELINES FOR SIZING AND SETTING RELIEF VALVES TO PROVIDE OVERPRESSURE PROTECTION

The requirements for overpressure protection of pipeline facilities are stated in Par. 192.201 of G.O. 112-C. They are as follows:

§192.201 Required Capacity of Pressure Relieving and Limiting Stations

(a) Each pressure-relief station or pressure-limiting station or group of those stations installed to protect a pipeline must have enough capacity, and must be set to operate, to insure the following:

(1) In a low pressure distribution system, the pressure may not cause the unsafe operation of any connected and properly adjusted gas utilization equipment.

(2) In pipelines other than a low pressure distribution system -

(i) 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;

(ii) 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

(iii) If the maximum allowable operating pressure is less than 12 psig, the pressure may not exceed the maximum allowable operating pressure plus 50 percent.

(b) When more than one pressure-regulating or compressor station feeds into a pipeline, relief valves or other protective devices must be installed at each station to ensure that the complete failure of the largest capacity regulator or compressor, or any single run of lesser capacity regulators or compressors in that station, will not impose pressures on any part of the pipeline or distribution system in excess of those for which it was designed, or against which it was protected, whichever is lower.

(c) Relief valves or other pressure-limiting devices must be installed at or near each regulator station in a low-pressure distribution system, with a capacity to limit the maximum pressure in the main to a pressure that will not exceed the safe operating pressure for any connected and properly adjusted gas utilization equipment.

## A. Setting of Relief Valves

1. Par. 192.201(a) specifies the maximum permissible pressure to which a system can be legally subjected under any condition. These are:

| | *MAOP OR MOP | MAXIMUM PERMISSIBLE PRESSURE |
|---|---|---|
| (a) | Low Pressure | - A pressure which will not cause the unsafe operation of any connected and properly adjusted gas utilization equipment. |
| (b) | Above LP, less than 12 psig | - The MAOP x 1.5. |
| (c) | 12 psig to less than 60 psig | - The MAOP + 6 psig. |
| (d) | 60 psig and up | - The MAOP x 1.1 or 75% of SMYS, whichever gives the lowest pressure. |

*Refer to S.P. 463-8 for the definition of MAOP and MOP. In this guide material, reference is made to the MAOP. However, if the MOP of a system is less than the MAOP of some of the segments, then the relief valve must be set to limit the pressure to the MOP of the system.

2. The actual set pressure will depend on the capacity of the relief valve, its operating characteristics, the pressure at which the system is to be operated under normal conditions, and the maximum permissible pressure as outlined in

#1. Within these parameters, the relief valve may be set sufficiently above the normal operating pressure of the system (MAOP) to prevent any venting or leaking of gas during normal operation.

3. The relief valve or other overpressure protection may be set at a pressure above the MAOP of the system being protected, to permit operation up to the MAOP without causing the relief valve to leak or vent gas; provided the relief valve is sized and has operating characteristics which will prevent the pressure in the system from exceeding the limits stated in #1, above, under any conditions.

B. Sizing of Relief Valves

1. The relief valve must have adequate capacity, and must have operating characteristics, which will prevent the pressure from exceeding the limits specified in Par. 192.201(a), under any of the conditions prescribed by Par. 192.201(b) or (c).

2. The capacity of the relief valve may be based on the [illegible] highest anticipated supply pressure in the line feeding the regulator. * This may be the MOP rather than the 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.

3. 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.

4. Where there is more than one regulator at a station, the relief capacity for the station shall be based on the assumption that all regulators have failed open simultaneously unless the flow is limited by other factors such as the ability of the system to supply the regulators.

5. Consideration should also be given to the capacity of the line or system supplying the regulator(s). If it is not capable of supplying the wide open capacity of the regulator(s), the relief valve(s) may be sized on the basis of the maximum capacity of the line or system supplying the regulator(s).

6. The manufacturer's capacity rating may be used to determine the adequacy of the relief valve (subject to precautions outlined in item #7). Before using the manufacturer's capacity rating, verify with Gas Operations that the latest available information is being used.

7. 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 Par. 192.201(a).

    (b) The repeatability of operation. How closely can the relief valve be set to the MAOP of the 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) Whether the relief valve will start to weep, or pass a small amount of gas, before it reaches the set pressure, and where this cracking (weeping) starts with respect to the MAOP of the system being protected.

8. 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 Book of Standards or the manufacturer's literature should not be used unless it is known to be the wide open capacity.

9. The pressure drop through the relief valve vent stack represents a back pressure against which the relief valve must discharge. If the pressure drop is significant, it must be considered when sizing the relief valve.

10. 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.

### C. Changing Conditions

1. When changes are made to a system which could have an effect on the ability of the relief valve to protect the system as required by Par. 192.201(a), the adequacy of the relief valve must be checked. Changes which require a review of the relief valve capacity include but are not limited to the following:

(a) Any change in the size or capacity of the regulator(s) supplying the system.

(b) Any change in the size or capacity of the relief valve(s) which protect the system.

(c) Any increase in the supply pressure or capacity of the system supplying the regulator.

(d) Any change in the piping configuration of the system being protected which could increase the supply to the relief valve.

(e) Any change in the MOP or MAOP of the system being protected.

(f) Any change in the minimum demand on the system, if the minimum demand was used when the relief valve was originally sized.

(g) Any other change in the operation of the system being protected, or the system supplying the regulator(s), which could affect the ability of the relief valve(s) to control the pressure to the required level.

2. If the review indicates that a relief valve is not adequate to protect the system with the new conditions, it must be replaced with overpressure protection that will limit the pressure as required by Par. 192.201(a).

D. Annual Capacity Check

Par. 192.739 covers the requirement for inspection and testing of overpressure protection. It states that:

> §192.739 Pressure Limiting and Regulating Stations: Inspection and Testing
>
> Each pressure limiting station, relief device (except rupture discs), and pressure regulating station and its equipment must be subjected, at intervals not exceeding one year, to inspections and tests to determine that it is -
>
> (a) In good mechanical condition;
>
> (b) Adequate from the standpoint of capacity and reliability of operation for the service in which it is employed;

(c) Set to function at the correct pressure; and

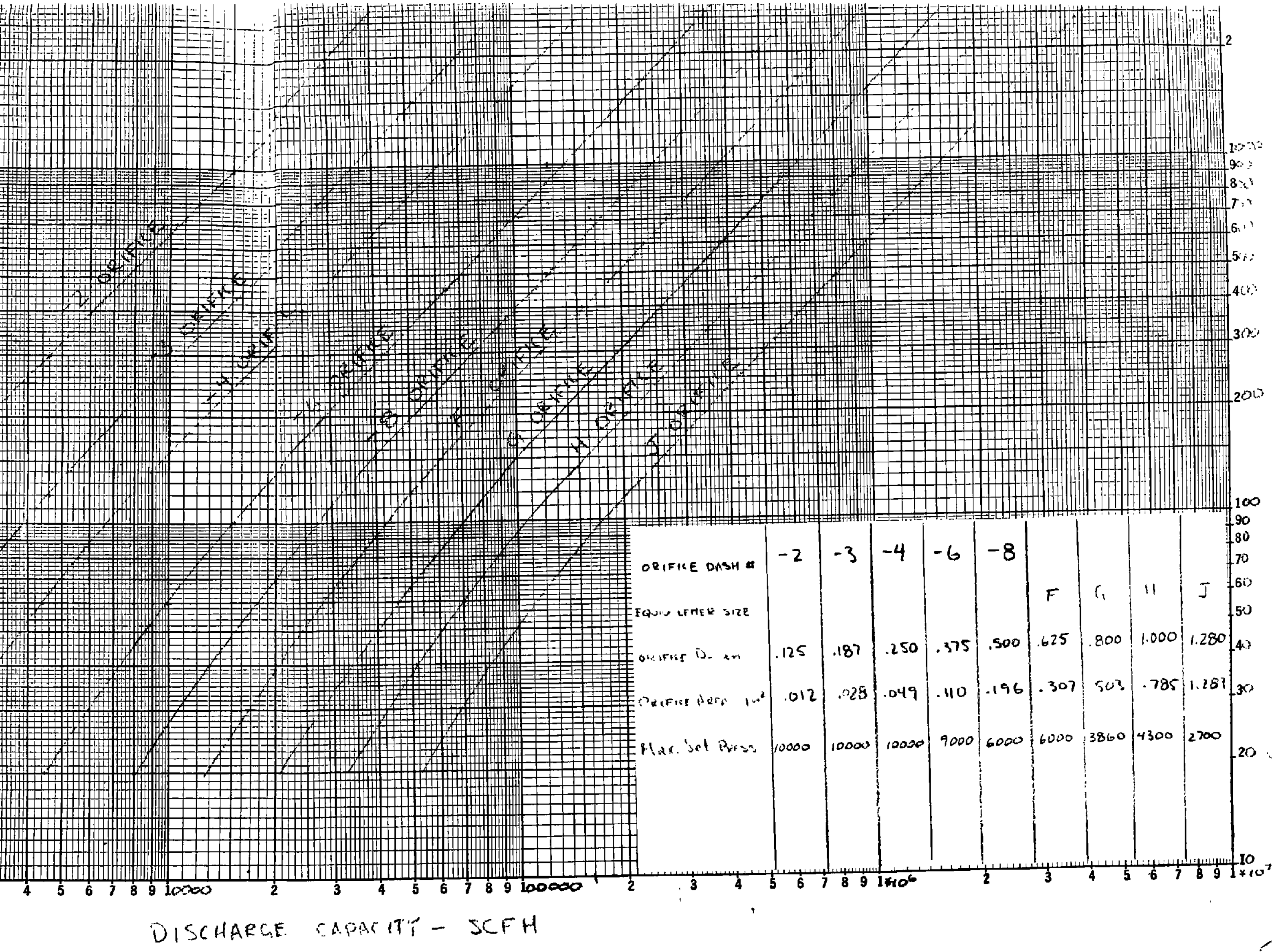
(d) Properly installed and protected from dirt, liquids, or other conditions that might prevent proper operation.

The annual review as required by Par. 192.739(b) need not be an actual test of the capacity of the relief valve. It can be based on calculated capacity. However, the same precautions should be taken as with the original calculations used to establish the size of the relief valve. If the relief valve is found to be inadequate, corrective action must be taken.

The annual review must be adequately documented.

More detailed information on the requirements for the annual inspection may be found in S.P. 464-2.

Questions concerning any of the above material should be directed to [redacted] in Gas System Design Department.



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