1.0 Purpose and Scope

1.1 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.

2.0 Design Requirements

2.1 Relief valves should not be used unless it has been determined that monitor valves are impractical.

2.2 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.

2.2.1 In a low pressure distribution system, the pressure may not exceed 14" w.c.

2.2.2 In pipelines other than a low pressure distribution system:

2.2.2.1 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;

2.2.2.2 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

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

2.3 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 2.2 of this standard, taking into account the pressure build up required for the valve to reach full capacity.

2.4 The relief valve or other overpressure protection should be set just sufficiently above the 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 2.2 of this standard.

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 2.2.

2.5.1 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.

2.5.2 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.

2.5.2.1 If the capacity of the supply devices has changed, the pressure relief devices shall have sufficient capacity to meet the requirements of Paragraph 2.5.1.

2.5.2.2 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 2.5.1 should be considered when relief devices with increased capacity can be installed with only minor piping changes.

2.6 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.

3.0 Sizing of Relief Valves

3.1 The relief valve must have adequate capacity, and must have operating characteristics, to prevent the pressure from exceeding the limits specified in Paragraph 2.2 (above), taking into account the set pressure, the operating tolerance of the valve, and the pressure buildup required to achieve full capacity.

3.2 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 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.

3.3 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.

3.4 The manufacturer's capacity rating may be used to determine the adequacy of the relief valve (subject to precautions outlined in Section 3.6). 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.

3.5 When selecting and sizing a relief valve, consideration must be given to the following characteristics:

3.5.1 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 2.2.

3.5.2 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.

3.5.3 The pressure to which the system must drop before the relief valve will close after it operates.

3.5.4 The potential hammering or excessive vibration effects. The relief valve should be sized small enough to prevent hammering or excessive vibration.

3.6 The regulator capacity against which the relief valve must protect is the <u>failed wide open</u> 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 <u>wide open</u> capacity.

3.7 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.

3.8 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.

3.9 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.

4.0 Inspection and Testing of Pressure Relief Devices

4.1 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.

4.2 The relief devices shall be **inspected** and **tested** to determine that they are:

4.2.1 In good operating condition;

4.2.2 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

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

4.3 Verify that the relief valve has sufficient **capacity** to limit pressure to the level required by Paragraph 2.2 by the following:

4.3.1 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

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

4.4 The capacity shall be considered satisfactory if the maximum downstream system pressure will not exceed the maximum pressure specified in Paragraph 2.2. If the capacity at the maximum system pressure is not adequate, immediate steps shall be taken to provide adequate capacity.

4.5 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.

4.6 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.

5.0 Responsibility

5.1 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.

6.0 References

Sections 192.199, 192.201, 192.731, 192.739, and 192.743 of the latest edition of DOT 49 CFR Part 192, *Pipeline Safety Regulations, Natural Gas.*

CGT Standard S-4433, *Gas Pressure Relief Devices - Responsibility for Capacity Verification*

CES Standard C-T&CS-S031, *District Regulator Station Maintenance*

DCS/CGT Standard D-S0430/S4125, *Standard, Maximum Allowable Operating Pressures, Requirements for Transmission Lines and Distribution Mains & Services.*

Subchapter 1. Unfired Pressure Vessel Safety Orders
Article 6. Anhydrous Ammonia

New query

§511. Safety Relief Valves.

(a) Every vessel used in anhydrous ammonia service shall be fitted with 1 or more safety relief valves in direct communication with the vapor space. These safety relief valves shall be of the spring-loaded type suitable for anhydrous ammonia service. The discharge from safety relief valves shall be full size and be directed away from the vessel, and shall discharge upward and unobstructed to the open air.

All relief-valve discharge openings shall have suitable loose-fitting rain caps that will allow free discharge of the vapor and prevent entrance of water. Provision shall be made for draining condensate which may accumulate in the discharge pipe.

The safety relief valves for anhydrous ammonia service shall be set to start to discharge with relation to the allowable working pressure of the vessel as follows:

Pressure vessels constructed in accordance with:	*Minimum*	*Maximum*
Code paragraphs U-68 and U-69	110%	125%
Code paragraphs U-200, through 1974 edition	100%	110%
API-ASME Code	100%	110%
DOT Cylinders	As required by DOT Regulations	

(b) Except for code paragraphs U-68 and U-69 tanks, the discharge capacity of safety relief valves for anhydrous ammonia tanks shall be sufficient to prevent pressure in the tank from exceeding 120 percent of the allowable working pressure of the tank. ASME code paragraphs U-68 and U-69 tanks shall have safety valve capacity sufficient to prevent pressure in the tank from exceeding 135 percent of the allowable working pressure of the tank. All safety relief valves required by this Order shall be ASME rated and stamped. The minimum required rate of discharge of safety relief valves for anhydrous ammonia tanks shall be in accordance with the following table:

Surface area sq. ft	*Flow rate CFM air*	*Surface area sq. ft*	*Flow rate CFM air*	*Surface area sq. ft*	*Flow rate CFM air*
20 or less	258	185	1,600	900	5,850
25	310	190	1,640	950	6,120
30	360	195	1,670	1,000	6,380
35	408	200	1,710	1,050	6,640
40	455	210	1,780	1,100	6,900
45	501	220	1,850	1,150	7,160
50	547	230	1,920	1,200	7,410

55	591	240	1,980	1,250	7,660
60	635	250	2,050	1,300	7,910
65	678	260	2,120	1,350	8,160
70	720	270	2,180	1,400	8,410
75	762	280	2,250	1,450	8,650
80	804	290	2,320	1,500	8,900
85	845	300	2,380	1,550	9,140
90	885	310	2,450	1,600	9,380
95	925	320	2,510	1,650	9,620
100	965	330	2,570	1,700	9,860
105	1,010	340	2,640	1,750	10,090
110	1,050	350	2,700	1,800	10,330
115	1,090	360	2,760	1,850	10,560
120	1,120	370	2,830	1,900	10,800
125	1,160	380	2,890	1,950	11,030
130	1,200	390	2,950	2,000	11,260
135	1,240	400	3,010	2,050	11,490
140	1,280	450	3,320	2,100	11,720
145	1,310	500	3,620	2,150	11,950
150	1,350	550	3,910	2,200	12,180
155	1,390	600	4,200	2,250	12,400
160	1,420	650	4,480	2,300	12,630
165	1,460	700	4,760	2,350	12,850
170	1,500	750	5,040	2,400	13,080
175	1,530	800	5,300	2,450	13,300
180	1,570	850	5,590	2,500	13,520

Surface area = total outside surface area of container in square feet. When the surface area is not stamped on the nameplate or when the marking is not legible, the area can be calculated by using one of the following formulas:

(1) Cylindrical container with hemispherical heads.

Area = overall length in feet times outside diameter

in feet times 3.1416

(2) Cylindrical containers with other than hemispherical

heads.

Area = (overall length in feet plus 0.3 outside

diameter in feet) time outside diameter in feet times

3.1416

(3) Spherical container.

Area = outside diameter in feet squared times 3.1416

Flow rate -- CFM Air = cubic feet per minute of air required at standard conditions, 60 degrees Fahrenheit and atmospheric pressure (14.7 psia).

The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than 2,500 square feet, the required flow rate can be calculated using the formula: Flow Rate CFM Air = 22.11A[0.82], where A = outside surface area of the container in square feet.

The minimum required rate of discharge of safety relief valves for anhydrous ammonia DOT cylinders shall be in accordance with the regulations of the Bureau of Explosives.

(c) Safety relief valves shall be so designed and installed that the possibility of tampering will be minimized. If the pressure setting is external, the relief valves shall be provided with acceptable means for sealing the adjustment.

(d) Shutoff valves shall not be installed between the safety relief valve and tank, except that a shutoff valve may be used where the arrangement of this valve is such as always to provide full required capacity flow through sufficient relief valves to properly protect the tank. [This exception is intended to permit 3-way valves, mechanically interconnected valves, etc., to be installed between the tank and safety valve where the installation and arrangement will always permit the required number of valves to be in communication with the tank to provide the relief capacity required by (b) above.]

The flow capacity of the relief valve shall not be restricted by any connection to it on either the upstream or downstream side.

(e) Each safety relief valve used on anhydrous ammonia tanks shall be plainly marked with the following information:

(1) With the letters "AA".

(2) The pressure in pounds per square inch gage (psig) at which the valve is set to start to discharge.

(3) The rate of discharge of the valve at its full open position in cubic feet per minute (cfm) of air.

(4) The manufacturer's name and catalog number.

(5) The symbol of the ASME Code.

HISTORY:

1. Amendment filed 12-8-72 as procedural and organizational; effective upon filing (Register 72, No. 50).

2. Amendment of subsections (a) and (d) filed 3-28-75; effective thirtieth day thereafter (Register 75, No. 13).

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