

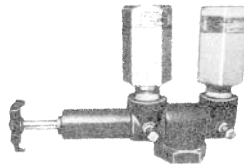
ANHYDROUS AMMONIA

Manifold & Pressure Relief Valve (PRV) Requirements

This fact sheet was prepared by the Minnesota Department of Agriculture to provide information on some of the state requirements for facilities which store, handle, and use of Anhydrous Ammonia on their premises. This guidance is intended to supplement--not replace--the Minnesota Anhydrous Ammonia Rules.

INTRODUCTION

Anhydrous ammonia tanks must be provided with adequate pressure or cubic feet per minute flow (cfm) relief by means of 250 psi-rated spring-loaded pressure relief valves [PRV(s)] rated for anhydrous ammonia use. For storage tanks, PRV(s) are required to be installed in a manifold. The manifold allows the replacement of PRV(s) while the tank remains pressurized.



DETERMINING THE PRESSURE RELIEF REQUIREMENTS

The pressure/cfm relief required for a tank is determined by two factors:

1. The square-foot area of the tank, and
2. The **lowest** cfm flow rating stamped on or listed for either:
 - A. The PRV, or
 - B. The manifold, in the case of storage tanks. The square-foot area of an applicator, nurse, or storage tank can be found on the nameplate of the tank. Once the square-foot area of the tank is noted, use the minimum required flow rate chart (Table 1) to find the "Flow Rate CFM Air" that coincides with the square-foot area of the tank. If the nameplate is illegible or missing, measure the total length (including doomed heads) and circumference of the tank, and use the following equation to determine the square-foot area of the tank:

$$\ast \text{ AREA OF TANK} = \frac{\text{CIRCUMFERENCE} \times \text{LENGTH}}{(\text{SQUARE FEET}) \quad (\text{FEET}) \quad (\text{FEET})}$$

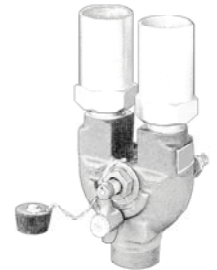
Determine the number of PRV(s) or manifolds that will be required by dividing the flow rating of the PRV or manifold used into the "Flow Rate CFM Air".

$$\ast \text{ "FLOW RATE CFM AIR" } \div \text{ FLOW RATING OF PRV OR MANIFOLD} = \text{ \# OF PRVS OR MANIFOLDS}$$

Generally, nurse tanks up to 1,450 gallons will require one 3/4-inch male-normal pipe thread (M.NPT) PRV with a UL cfm rating of 1,865 or greater. Two or more PRV(s) will generally be required for nurse tanks larger than 1,450 gallons.

For storage tanks, one dual port manifold and two 1 1/4-inch M.NPT PRV(s) will meet the pressure relief requirement for a tank 4,500 gallons or less (590 sq. ft. surface area = 4,150 cfm required). Tanks 4,501 gallons (591 sq. ft. surface area) to approximately 20,000 gallons (1,378 sq. ft. surface area = 8,300 cfm required) require two dual port manifolds and four PRV(s).

Three dual port manifolds with six PRV(s) will provide sufficient pressure relief for a tank with a capacity of approximately 36,200 gallons (2,260 sq. ft. surface area = 12,450 cfm relief required). These figures are based on a manifold with a cfm/air rating of 4,150. Check with suppliers and manufacturers to obtain the cfm/air rating of the manifold to be purchased/used.



In summary, the key in determining the actual number of manifolds and PRV(s) needed to provide sufficient pressure relief is to match up the square-foot area of the tank with (1) Table 1, "Flow Rate CFM Air" required, and (2) the **lowest** UL cfm rating stamped on or listed for either the manifold OR PRV(s).

VENTING AND CONDITION

Discharge from PRV(s) and manifolds must be vented away from the container, upward and unobstructed to the atmosphere. For storage tank manifold/PRV(s), noncorrosive vent pipes may be utilized provided that the cross-sectional area of the vent piping is at least equal to the sum of the cross-sectional area of the PRV(s).

PRV(s) may **NOT** be painted or contain other foreign substances. Rain caps must be installed on the PRV(s) discharge opening to allow free discharge of the vapor, while preventing the entrance of water and other foreign substances. Provisions must be made for draining condensate which may accumulate.

PERIODIC INSPECTIONS

Periodic inspection (suggested at least annually) by facility personnel to determine that:

1. PRV(s) and manifolds are free of tampering, damage, corrosion, paint, or foreign matter that might prevent proper operation;
2. PRV(s) and manifolds are free of leakage when subject to pressures below the minimum allowable start-to-discharge setting;
3. PRV(s) are provided with properly secure rain caps or other device to avoid entry of moisture or other matter in the relief valve outlet; and
4. PRV(s) have open weep holes to permit moisture to escape.
5. Manifold closes off completely when shut off to replace PRV(s).

REPLACEMENT REQUIREMENT

No nonrefrigerated container PRVs may be used over five years after the date of installation. Accurate records must be maintained which identify each tank and indicate the date of installation for each tank PRV(s).

Table 1

Minimum Required Flow Rate of Pressure Relief Valves and Manifolds							
Surface Area Sq. Ft.	Flow Rate CFM Air	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	258	145	1,310	340	2,640	1,350	8,160
25	310	150	1,350	350	2,700	1,400	8,410
30	360	155	1,390	360	2,760	1,450	8,650
35	408	160	1,420	370	2,830	1,500	8,900
40	455	165	1,460	380	2,890	1,550	9,140
45	501	170	1,500	390	2,950	1,600	9,380
50	547	175	1,530	400	3,010	1,650	9,620
55	591	180	1,570	450	3,320	1,700	9,860
60	635	185	1,600	500	3,620	1,750	10,090
65	678	190	1,640	550	3,910	1,800	10,330
70	720	195	1,670	600	4,200	1,850	10,560
75	762	200	1,710	650	4,480	1,900	10,800
80	804	210	1,780	700	4,760	1,950	11,030
85	845	220	1,850	750	5,040	2,000	11,260
90	885	230	1,920	800	5,300	2,050	11,490
95	925	240	1,980	850	5,590	2,100	11,720
100	965	250	2,050	900	5,850	2,150	11,950
105	1,010	260	2,120	950	6,120	2,200	12,180
110	1,050	270	2,180	1,000	6,380	2,250	12,400
115	1,090	280	2,250	1,050	6,640	2,300	12,630
120	1,120	290	2,320	1,100	6,900	2,350	12,850
125	1,160	300	2,380	1,150	7,160	2,400	13,080
130	1,200	310	2,450	1,200	7,410	2,450	13,300
135	1,240	320	2,510	1,250	7,660	2,500	13,520
140	1,280	330	2,570	1,300	7,910		

Table 2: Pressure Relief Ratings in Cubic Feet per Minute (CFM) of Manifold and Pressure Relief Valve Combinations for Storage Tanks

Pressure Relief Valves (PRV)		Manifold Brand/Model & CFM Ratings			
PRV Brand	PRV Model	Continental NH3 A-462 2 ports - 1 counted	RegO DuoPort AA8542UA250 2 ports -1 counted	RegO Multiport AA8563/64G 4 ports - 3 counted	Squibb Taylor A1415 & A1416 2 ports - 1 counted
Continental NH3	AA-417-Ab	5637	6093	17874 (5958/port)	6432
RegO (1¼ inch)	AA3135MUA250	5337	5865	17100 (5700/port)	6109
RegO (2½ inch)	A3149MG	N/A	N/A	27750 (9250/port)	N/A
Squibb Taylor	A1310	5011	5433	15936 (5312/port)	5759

Disclaimer: The rating combinations listed in this table are based on respective manifold and pressure relief valve CFM ratings, not necessarily published in manufacturer's literature.

Other equations for finding out square foot of ammonia tank:

1. Circumference (feet) divided by 3.1416 (pie) = diameter (feet); and
2. Diameter x length (feet) x 3.1416 = square feet area

Use **Table 1** to determine the CFM required based on the square feet area of a tank.

Use **Table 2** to determine the number of manifolds and pressure relief valves required to satisfy the CFM requirement for the tank.

FOR MORE INFORMATION

Contact the Minnesota Department of Agriculture at **651/201-6275** (telephone) or **651/201-6117** (fax).