

**WAC 296-307-41025 Safety devices.** (1) Every container except those constructed according to DOT specifications and every vaporizer (except motor fuel vaporizers and vaporizers described in WAC 296-307-41029(3) and 296-307-42007 (6) (a) whether heated by artificial means or not, must have one or more safety-relief valves of spring-loaded or equivalent type. These valves must be arranged to afford free vent to the outer air with discharge not less than five feet horizontally away from any opening into the building that is below such discharge. The rate of discharge must be according to the requirements of subsection (2) or (4) of this section.

(2) Minimum required rate of discharge in cubic feet per minute of air at one hundred twenty percent of the maximum permitted start to discharge pressure for safety-relief valves to be used on containers other than those constructed according to DOT specification must be as follows:

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	626	170	3,620	550	9,470
25	751	175	3,700	600	10,170
30	872	180	3,790	650	10,860
35	990	185	3,880	700	11,550
40	1,100	190	3,960	750	12,220
45	1,220	195	4,050	800	13,540
50	1,330	200	4,130	850	14,190
55	1,430	210	4,300	900	14,830
60	1,540	220	4,470	950	15,470
65	1,640	230	4,630	1,000	16,100
70	1,750	240	4,800	1,050	16,720
75	1,850	250	4,960	1,100	17,350
80	1,950	260	5,130	1,150	17,960
85	2,050	270	5,290	1,200	18,570
90	2,150	280	5,450	1,250	19,180
95	2,240	290	5,610	1,300	19,780
100	2,340	300	5,760	1,350	20,380
105	2,440	310	5,920	1,400	20,980
110	2,530	320	6,080	1,450	21,570
115	2,630	330	6,230	1,500	22,160
120	2,720	340	6,390	1,550	22,740
125	2,810	350	6,540	1,600	23,320
130	2,900	360	6,690	1,650	23,900
135	2,990	370	6,840	1,700	24,470
140	3,080	380	7,000	1,750	25,050
145	3,170	390	7,150	1,800	25,620
150	3,260	400	7,300	1,850	26,180
155	3,350	410	7,450	1,900	26,750
160	3,440	420	7,600	1,950	27,310
165	3,530				

Surface area = total outside surface area of container in square feet.

(3) When the surface area is not stamped on the name plate or when the marking is not legible, calculate the area with one of the following formulas:

(a) Hemispherical heads: Area = (equals) (overall length) X (outside diameter) X 3.1416.

(b) Other than hemispherical heads: Area = (equals) (overall length) + 0.3 (outside diameter) X (outside diameter) X 3.1416.

**Note:** This formula is not exact, but will give results within the limits of practical accuracy for the sole purpose of sizing relief valves.

(c) Spherical container: Area = (equals) (outside diameter)<sup>2</sup> X 3.1416.

(d) Flow rate: CFM air = (equals) required flow capacity in cubic feet per minute of air at standard conditions, 60°F and atmospheric pressure (14.7 psia).

For containers with total outside surface area greater than 2,000 sq. ft., the formula is: Flow rate CFM air = (equals) 53.632 A<sup>0.82</sup> where A = (equals) outside surface area of the container in square feet.

Valves not marked "air" have flow rate marking in cubic feet per minute of LP-gas. These can be converted to ratings in cubic feet per minute of air by multiplying the LP-gas ratings by factors listed below. Air flow ratings can be converted to ratings in cubic feet per minute of LP-gas by dividing the air ratings by the factors listed below.

**AIR CONVERSION FACTORS**

Container type	100	125	150	175	200
Air conversion factor	1.162	1.142	1.113	1.078	1.010

(4) The minimum required rate of discharge for safety-relief valves for LP-gas vaporizers (steam heated, water heated, and direct fired) must be determined as follows:

(a) Obtain the total surface area by adding the surface area of vaporizer shell in square feet directly in contact with LP-gas and the heat exchanged surface area in square feet directly in contact with LP-gas.

(b) Obtain the minimum required rate of discharge in cubic feet of air per minute, at 60°F and 14.7 psia from subsection (2) of this section, for this total surface area.

(5) Container and vaporizer safety-relief valves must be set to start to discharge, with relation to the design pressure of the container, according to the following:

Containers	Minimum (percent)	Maximum (percent)
ASME Code; Par. U-68, U-69—1949 and earlier editions	110	*125
ASME Code; Par. U-200, U-201—1949 edition	88	*100
ASME Code—1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division I) editions	88	*100
API—ASME Code—all editions	88	*100
DOT	As prescribed in 49 C.F.R. Chapter I	

\*Manufacturers of safety-relief valves are allowed a plus tolerance not exceeding 10% of the set pressure marked on the valve.

(6) Safety-relief devices used with systems employing non-DOT containers must be constructed to discharge at not less than the rates shown in subsection (2) of this section, before the pressure is in excess of 120% of the maximum (not including the 10% referred to in subsection (5) of this section) permitted start-to-discharge pressure setting of the device.

(7) In high temperature areas, the employer must use a lower vapor pressure product or a higher designed pressure vessel to prevent the safety valves from opening. The tanks may be protected by cooling devices such as spraying, shading, or other means.

(8) Safety-relief valves must be arranged to minimize tampering. For external pressure setting or adjustment, the relief valves must have an approved sealable adjustment.

(9) Shut-off valves are prohibited between safety-relief devices and the container, equipment, or piping.

**Exception:** A shut-off valve may be used where the arrangement of the valve allows the required capacity flow through the safety-relief device.

(10) Safety-relief valves must have direct communication with the vapor space of the container.

(11) Each safety-relief valve must be plainly and permanently marked with the following:

(a) Container type of the pressure vessel on which the valve is designed to be installed;

(b) The pressure in psig at which the valve is set to discharge;

(c) The actual rate of discharge of the valve in cubic feet per minute of air at 60°F and 14.7 psia; and

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

For example: T200-250-4050 AIR: Indicates that the valve is suitable for use on a Type 200 container, that it is set to start to discharge at 250 psig; and that its rate of discharge is 4,050 cubic feet per minute of air.

(12) Safety-relief valve assemblies and their connections must be large enough to provide the required rate of flow for the container on which they are installed.

(13) A hydrostatic relief valve must be installed between each pair of shut-off valves on LP-gas liquid piping. The start-to-discharge pressure setting of such relief valves must be a maximum of 500 psig. The minimum setting on relief valves installed in piping connected to non-DOT containers must be 140% of the container relief valve setting. For piping connected to DOT containers, the minimum must be 400 psig. The relief valve should not be installed in the pump discharge piping if the same protection can be provided by installing the relief valve in the suction piping. The start-to-discharge pressure setting of such a relief valve, if installed on the discharge side of a pump, must exceed the maximum pressure permitted by the recirculation device in the system.

(14) The discharge from any safety-relief device must not terminate in or beneath any building.

**Exception:** This requirement does not apply to relief devices covered by WAC 296-307-41017(1), 296-307-41507(1), or 296-307-41509.

(15) Container safety-relief devices and regulator relief vents must be located at least five feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, and 49.17.060. WSR 20-21-091, § 296-307-41025, filed 10/20/20, effective 11/20/20. Statutory Authority: RCW 49.17.040. WSR 98-24-096, § 296-307-41025, filed 12/1/98, effective 3/1/99. WSR 97-09-013, recodified as § 296-307-41025, filed 4/7/97, effective 4/7/97. Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. WSR 96-22-048, § 296-306A-41025, filed 10/31/96, effective 12/1/96.]