(b) Safety valves for use on pressure vessels in which steam or pressure is generated shall comply with the requirements of §54.15–10. Rupture discs used in lieu of these safety valves, as provided for in paragraph (a) of this section, shall comply with the requirements of §54.15–13.

(c) The relieving capacity of evaporator safety valves required by paragraph (a) of this section shall be at least equal to the capacity of the orifice fitted in the steam supply to the evaporator. The orifice capacity shall be determined in accordance with the formula in paragraph (c) (1) or (2) of this section as appropriate:

(1) Where the set pressure of the evaporator shell safety valve is 58 percent or less than the setting of the safety valve in the steam supply:

\[ W = 51.45AP \]

(2) Where the set pressure of the evaporator shell safety valve exceeds 58 percent of the setting of the safety valve on the steam supply:

\[ W = 105.3A \sqrt{P_1 - P_2} \]

where:

- \( W \) = The required orifice capacity, in pounds per hour.
- \( A \) = Cross-sectional area of rounded entrance orifice, in square inches. The orifice shall be installed near the steam inlet or the coils or tubes and where no orifice is employed the area used in the formula shall be that of the inlet connection or manifold.
- \( P \) = Set pressure of steam supply safety valve, in pounds per square inch, absolute.
- \( P_1 \) = Set pressure of evaporator shell safety valve, in pounds per square inch, absolute.
- \( P_2 \) = Pressure in the tube or coils, in pounds per square inch.
- \( D \) = Internal diameter of the largest tube or coil, in inches.
- \( K \) = Coefficient of discharge = 0.62.


§54.15–25 Minimum relief capacities for cargo tanks containing compressed or liquefied gas.

(a) Each tank shall be fitted with one or more safety relief valves designed, constructed, and flow tested in accordance with subpart 162.017 or 162.018 in subchapter Q (Specifications) of this chapter. Valves conforming to specification subpart 162.017 shall be limited to use on tanks whose maximum allowable working pressure is not in excess of 10 pounds per square inch. With specific approval of the Commandant, such valves may be connected to the vessel in lieu of being directly fitted to the tanks.

(b) The discharge pressure and the maximum overpressure permitted shall be in accordance with §54.15–5.

(c) The rate of discharge for heat input of fire must meet the following formula:
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Q = FGA^0.82

where:

Q = minimum required rate of discharge in cubic meters (cubic feet) per minute of air at standard conditions 15 °C and 103 kPa (60 °F and 14.7 psia).

F = fire exposure factor for the following tank types:

F = 1.0 for tanks without insulation located on the open deck.
F = 0.5 for tanks on the open deck having insulation that has approved fire proofing.
F = 0.5 for tanks without insulation located on the open deck.
F = 0.5 for tanks on the open deck having insulation that has approved fire proofing.
F = 0.1 for membrane and semi-membrane tanks.

G = gas factor of:

"G = [(177/LC)(\sqrt{ZT/M})] \quad \text{SI units}\)

"G = [(633,000/LC)(\sqrt{ZT/M})] \quad \text{English units}\)

where:

L = latent heat of the material being vaporized at the relieving conditions, in Kcal/kg (Btu per pound).
C = constant based on relation of specific heats (K), Table § 54.15–25(c) (if K is not known, C = 0.606(315)).
Z = compressibility factor of the gas at the relieving conditions (if not known, Z = 1.0).
T = temperature in degrees K = (273 + degrees C) (R = (460 + degrees F)) at the relieving conditions (120% of the pressure at which the pressure relief valve is set).
M = molecular weight of the product.
A = external surface area of the tank in m^2 (sq. ft.) for the following tank types:

For a tank of a body of revolution shape:
A = external surface area.
For a tank other than a body of revolution shape:
A = external surface area less the projected bottom surface area.
For a grouping of pressure vessel tanks having insulation on the vessel’s structure:
A = external surface area of the hold without the projected bottom area.
For a grouping of pressure tanks having insulation on the tank:
A = external surface area of the pressure tanks excluding insulation, and without the projected bottom area. \(^1\)

\(^1\)Figure 54.15–25(c) shows a method of determining the side external surface area of a grouping of vertical pressure tanks.

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For an independent tank that has a portion of the tank protruding above the open deck, the fire exposure factor must be calculated for the surface area above the deck and the surface area below the deck, and this calculation must be specially approved by the U.S. Coast Guard, Office of Design and Engineering Standards (CG-ENG).

(d) In determining the total safety valve relieving capacity, the arrangement and location of the valves on the tank will be evaluated. The valves shall be placed so that a number of valves sufficient to provide the required relieving capacity shall always be in communication with the cargo vapor phase. The possible motions which the tank may see in its intended service and attendant changes in cargo liquid level will be considered. Shut off
§ 54.20–1 Scope (modifies UW–1 through UW–65).

(a) Pressure vessels and vessel parts that are fabricated by welding shall be as required by paragraphs UW–1 through UW–65 of section VIII of the ASME Boiler and Pressure Vessel Code (incorporated by reference; see 46 CFR 54.01–1) except as noted otherwise in this subchapter.

(b) [Reserved]

§ 54.20–2 Fabrication for hazardous materials (replaces UW–2(a)).

(a) Pressure vessels containing hazardous materials as defined in § 150.115 of this chapter must be of the class and construction required by subchapter D, I, O, or, when not specified, of a class determined by the Commandant.

(b) Class III pressure vessels must not be used for the storage or stowage of hazardous materials unless there is specific authorization in subchapters D, I, or O.


§ 54.20–3 Design (modifies UW–9, UW–11(a), UW–13, and UW–16).

(a) Fabrication by welding shall be in accordance with the provisions of this part and with part 57 of this subchapter.

(b) Welding subject to UW–11(a) of section VIII of the ASME Boiler and Pressure Vessel Code (incorporated by reference; see 46 CFR 54.01–1) shall be modified as described in § 54.25–8 for radiographic examination.

(c) A butt welded joint with one plate edge offset, as shown in Figure UW–13.1(k) of section VIII of the ASME Boiler and Pressure Vessel Code, may only be used for circumferential joints of Class II and Class III pressure vessels.

(d) Attachment welds for nozzles and other connections shall be in accordance with UW–16 of section VIII of the ASME Boiler and Pressure Vessel Code. When nozzles or connections are made to pressure vessels, as shown in Figure UW–16.1(a) and (c) of the ASME Code, and are welded from one side only, backing strips shall be used unless it can be determined visually that a full penetration weld has been achieved.

(e) When fabricating by welding the minimum joint requirements shall be as specified under the column headed “minimum joint requirements” in Table 54.01–5(b) for various classes of pressure vessels.

(f) Joints in Class II or III pressure vessel cargo tanks must meet the following:

(1) Category A and B joints must be type (1) or (2).

(2) Category C and D joints must have full penetration welds extending through the entire thickness of the vessel wall or nozzle wall.