§ 178.348-4 Pressure relief.

(a) Each cargo tank must be equipped with a pressure and vacuum relief system in accordance with §178.345–10 and this section.

(b) *Type and construction.* Vacuum relief devices are not required for cargo tanks designed to be loaded by vacuum or built to withstand full vacuum.

(c) *Pressure settings of relief valves.* The setting of the pressure relief devices must be in accordance with §178.345–10(d), except as provided in paragraph (d)(3) of this section.

(d) *Venting capacities.* (1) The vacuum relief system must limit the vacuum to less than 80 percent of the design vacuum capability of the cargo tank.

(2) If pressure loading or unloading devices are provided, the pressure relief system must have adequate vapor and liquid capacity to limit tank pressure to the cargo tank test pressure at the maximum loading or unloading rate. The maximum loading and unloading rates must be included on the metal specification plate.

(3) Cargo tanks used in dedicated service for materials classed as corrosive material, with no secondary hazard, may have a total venting capacity which is less than required by §178.345–10(e). The minimum total venting capacity for these cargo tanks must be determined in accordance with the following formula (use of approximate values given for the formula is acceptable):

Formula in Nonmetric Units

$$Q = 37{,}980{,}000\ A^{0.82}(ZT)^{0.5}/\ (LC)(M^{0.5})$$

Where:

Q = The total required venting capacity, in cubic meters of air per hour at standard conditions of 15.6 °C and 1 atm (cubic feet of air per hour at standard conditions of 60 °F and 14.7 psia);

T = The absolute temperature of the vapor at the venting conditions—degrees Kelvin (°C+273) [degrees Rankine (°F +460)];

A = The exposed surface area of tank shell—square meters (square feet);

L = The latent heat of vaporization of the lading—calories per gram (BTU/lb);

Z = The compressibility factor for the vapor (if this factor is unknown, let Z equal 1.0);

M = The molecular weight of vapor;

C = A constant derived from (K), the ratio of specific heats of the vapor. If (K) is unknown, let C = 315.

$$C = 520[K(2/(K+1))[(K+1)/(K-1)]]^{0.5}$$

Where:

$$K = C_p/\ C_v$$

C_p= The specific heat at constant pressure, in -calories per gram degree centigrade (BTU/lb °F.); and

C_V= The specific heat at constant volume, in -calories per gram degree centigrade (BTU/lb °F.).

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