remotely controlled valve must be located as close to the tank as practicable.

(1) On a cargo tank with a capacity in excess of 3,500 gallons of water, each remotely controlled shut-off valve must be provided with remote means of automatic closure, both mechanical and thermal, installed at the ends of the cargo tank in at least two diagonally opposite locations. The thermal means shall consist of fusible elements actuated at a temperature not exceeding 250 °F., or equivalent devices. One means may be used to close more than one remotely controlled valve.

(2) On a cargo tank with a capacity of 3,500 gallons of water or less, each remotely controlled shut-off valve must be provided with at least one remote control station on the end of the cargo tank opposite the main control station. The remote control station must contain a manual means of closure. In addition, it may contain fusible elements actuated at a temperature not exceeding 250 °F., or equivalent devices. One means may be used to close more than one remotely controlled valve.

[Amdt. 178–77, 48 FR 27705, June 16, 1983, as amended by Amdt. 178–105, 59 FR 55173, Nov. 3, 1994; 60 FR 17402, Apr. 5, 1995]

§ 178.338–12 Shear section.

Unless the valve is located in a rear cabinet forward of and protected by the bumper (see § 178.338–10(c)), the design and installation of each valve, damage to which could result in loss of liquid or vapor, must incorporate a shear section or breakage groove adjacent to, and outboard of, the valve. The shear section or breakage groove must yield or break under strain without damage to the valve that would allow the loss of liquid or vapor. The protection specified in § 178.338–10 is not a substitute for a shear section or breakage groove.

[Amdt. 178–77, 49 FR 24316, June 12, 1984]

§ 178.338–13 Supports and anchoring.

(a) All attachments of supports and bumpers to tanks and to load-bearing jackets must be made by means of pads of material similar to that of the tank or jacket, by load rings, or by bosses designed or gusseted to distribute the load. The pad must be at least ¼-inch thick, or as thick as the tank or jacket material, if less, but shall in no case be thicker than the tank or jacket material. Each pad must extend at least four times its thickness, in each direction, beyond the weld attaching the support or bumper. Each pad must be preformed to an inside radius no greater than the outside radius of the tank or jacket at the place of attachment. Each pad corner must be rounded to a radius at least one-fourth the width of the pad and no greater than one-half the width of the pad. If weep holes or telltale holes are used, they must be drilled or punched before the pads are attached. Each pad must be attached to the tank or jacket by continuous fillet welding using filler material having properties conforming to the recommendations of the manufacturer of the tank or jacket material. Any fillet weld discontinuity may only be for the purpose of preventing an intersection between the fillet weld and a tank or jacket seam weld.

(b) A tank motor vehicle constructed so that the cargo tank constitutes in whole or in part the structural member used in place of a motor vehicle frame must have the tank or the jacket supported by external cradles or by load rings. A cargo tank mounted on a motor vehicle frame must have the tank or jacket supported by external cradles, load rings, or longitudinal members. If cradles are used, they must subtend at least 120 degrees of the cargo tank circumference. The design calculations for the supports and load bearing tank or jacket, and the support attachments must include beam stress, shear stress, torsion stress, bending moment, and acceleration stress for the loaded vehicle as a unit, using a safety factor of four, based on the tensile strength of the material, and static loadings that take into consideration the weight of the cargo tank and its attachments when filled to the design weight of the lading (see appendix G of the ASME Code). The effects of fatigue must also be considered in the calculations. Minimum static loadings must be as follows:

(1) For a vacuum-insulated cargo tank—

(i) Vertically downward of 2;

(ii) Vertically upward of 2;

(iii) Longitudinally of 2; and
(iv) Laterally of 2.
(2) For a nonvacuum-insulated cargo tank—
(i) Vertically downward of 3;
(ii) Vertically upward of 2;
(iii) Longitudinally of 2; and
(iv) Laterally of 2.
(c) When a loaded tank is supported within the vacuum jacket by structural members, the design calculations for the tank and its structural members must be based on a safety factor of four and the tensile strength of the material at ambient temperature. The enhanced tensile strength of the material at actual operating temperature may be substituted for the tensile strength at ambient temperature to the extent recognized in the ASME Code for static loadings. Static loadings must take into consideration the weight of the tank and the structural members when the tank is filled to the design weight of lading (see appendix G of the ASME Code). When load rings in the jacket are used for supporting the tank, they must be designed to carry the fully loaded tank at the specified static loadings, plus external pressure. Minimum static loadings must be as follows:
(1) Vertically downward of 2;
(2) Vertically upward of 1½;
(3) Longitudinally of 1½; and,
(4) Laterally of 1½.

[Amdt. 178–77, 48 FR 27705, June 16, 1983, as amended at 49 FR 24317, June 12, 1984]

§ 178.338–14 Gauging devices.

(a) *Liquid level gauging devices.*
(1) Unless a cargo tank is intended to be filled by weight, it must be equipped with one or more gauging devices, which accurately indicate the maximum permitted liquid level at the loading pressure, in order to provide a minimum of two percent outage below the inlet of the pressure control valve or pressure relief valve at the condition of incipient opening of that valve. A fixed-length dip tube, a fixed trycock line, or a differential pressure liquid level gauge must be used as the primary control for filling. Other gauging devices, except gauge glasses, may be used, but not as the primary control for filling.
(2) The design pressure of each liquid level gauging device must be at least that of the tank.
(3) If a fixed length dip tube or trycock line gauging device is used, it must consist of a pipe or tube of small diameter equipped with a valve at or near the jacket and extending into the cargo tank to a specified filling height. The fixed height at which the tube ends in the cargo tank must be such that the device will function when the liquid reaches the maximum level permitted in loading.
(4) The liquid level gauging device used as a primary control for filling must be designed and installed to accurately indicate the maximum filling level at the point midway of the tank both longitudinally and laterally.
(b) *Pressure gauges.* Each cargo tank must be provided with a suitable pressure gauge indicating the lading pressure and located on the front of the jacket so it can be read by the driver in the rear view mirror. Each gauge must have a reference mark at the cargo tank design pressure or the set pressure of the pressure relief valve or pressure control valve, whichever is lowest.
(c) *Orifices.* All openings for dip tube gauging devices and pressure gauges in flammable cryogenic liquid service must be restricted at or inside the jacket by orifices no larger than 0.060-inch diameter. Trycock lines, if provided, may not be greater than ½-inch nominal pipe size.

[Amdt. 178–77, 48 FR 27706, June 16, 1983, as amended at 49 FR 24317, June 12, 1984]

§ 178.338–15 Cleanliness.

A cargo tank constructed for oxygen service must be thoroughly cleaned to remove all foreign material in accordance with CGA Pamphlet G–4.1. All loose particles from fabrication, such as weld beads, dirt, grinding wheel debris, and other loose materials, must be removed prior to the final closure of the manhole of the tank. Chemical or solvent cleaning with a material compatible with the intending lading must be performed to remove any contaminants likely to react with the lading.

[Amdt. 178–77, 48 FR 27706, June 16, 1983]