(1) The steels from which they are fabricated do not specifically require thermal stress relief in UCS–56 of the ASME Code and have a ratio of yield to ultimate tensile strength not greater than 0.8. For example: A–537 steels could be mechanically stress relieved.

(2) Pressure difference across the shell is not greater than 100 pounds per square inch, thickness of shell is not greater than 1 inch, and the design temperature is not greater than 115 °F.

(3) It will carry liquids of specific gravity no greater than 1.05.

(4) Design details are sufficient to eliminate stress concentrators: Mechanical stress relief is not acceptable in designs involving the following types of welded connections shown in UW–16.1 of the ASME Code:

(i) Types l, m, n, and p because of nonintegral reinforcement. Type o will be acceptable provided the plate, nozzle, and reinforcement assembly are furnace stress relieved and the reinforcement is at least 6 inches or 10t, whichever is larger, from the plate head.

(ii) Types d, e, and f because expansion and contraction stresses are concentrated at the junction points.

(5) That no slip-on flanges in sizes greater than 2 inches are used.

(6) The categories A and B joints are type one as described in Table UW–12 of the ASME Code and all categories C and D joints are full penetration welds. See UW–3 of the ASME Code for definition of categories.

(b) When a pressure vessel is to be mechanically stress relieved in accordance with § 54.30–10(a)(1), its maximum allowable working pressure will be 40 percent of the value which would otherwise be determined. However, an increase of this 40 percent factor may be permitted if the stress relief is carried out at a pressure higher than that required by § 54.30–10(a)(1) and an experimental strain analysis is carried out during stress relief. This evaluation should provide information as to the strains at the saddles, welded seams and nozzles as well as the body of the vessel. The hydrostatic pressure applied during stress relief should be such that, except in the case of welds, the stresses in the vessel shall closely approach but not exceed 90 percent of the yield stress of the material at the test temperature. The proposed experimental program should be submitted to the Commandant for approval prior to its use. Photo-elastic coating, strain gaging, or a brittle coating technique is suggested for the experimental analysis.

### § 54.30–10 Method of performing mechanical stress relief.

(a) The mechanical stress relief shall be carried out in accordance with the following stipulations using water as the pressurizing medium:

(1) At a hydrostatic pressure (measured at the tank top) of 1½ times the design pressure. (See UA–60(e) of the ASME Code.)

(2) At a temperature of 70 °F. or the service temperature plus 50 °F., whichever is higher. Where the ambient temperature is below 70 °F., and use of water at that temperature is not practical, the minimum temperature for mechanical stress relief may be below 70 °F. but shall not be less than 50 °F. above service temperature.

(3) The stress relief shall be at the required temperature and pressure and held for a period not less than 2 hours per inch of metal thickness, but in no case less than 2 hours.

(b) It is considered preferable that mechanical stress relief be accomplished with the tanks in place on their saddles or supporting structure in the barge or ship in which they will be utilized. In any case, it is considered mandatory that the tank be supported only by its regular saddles or supporting structure, without any auxiliary or temporary supports.

### § 54.30–15 Requirement for analysis and computation.

(a) A stress analysis shall be performed to determine if the tank may be exposed to excessive loadings during the mechanical stress relief process. This analysis should include consideration of the local stresses in way of saddles or other supporting structure and additional bending stresses due to the weight of the pressurizing liquid particularly in areas of high stress concentration. While it is necessary that the general stress level during the process be in excess of the normal

working level, the calculated maximum stress during test shall not exceed 90 percent of the yield strength of the material at test temperature. The supporting structure shall be analyzed to verify its adequacy.

(b) In all cases where the tanks are mechanically stress relieved in place in the ship or barge and the tanks are designed to carry cargoes with a specific gravity less than 1.05, the ship or barge shall be shown to have adequate stability and buoyancy, as well as strength to carry the excess weight of the tank during the stress relief procedure.

# PART 56—PIPING SYSTEMS AND APPURTENANCES

## Subpart 56.01—General

Sec.



## Subpart 56.04—Piping Classification



## Subpart 56.07—Design



## Subpart 56.10—Components



## Subpart 56.15—Fittings



## Subpart 56.20—Valves



## Subpart 56.25—Pipe Flanges, Blanks, Flange Facings, Gaskets, and Bolting



## Subpart 56.30—Selection and Limitations of Piping Joints



## Subpart 56.35—Expansion, Flexibility and Supports



## Subpart 56.50—Design Requirements Pertaining to Specific Systems