

§ 54.30-1

apply to welded pressure vessels and non-pressure vessel type tanks of quenched and tempered steels other than 9-percent nickel.

(b) [Reserved]

[CGFR 68-82, 33 FR 18828, Dec. 18, 1968, as amended by USCG-2003-16630, 73 FR 65171, Oct. 31, 2008]

Subpart 54.30—Mechanical Stress Relief

§ 54.30-1 Scope.

(a) Certain pressure vessels may be mechanically stress relieved in accordance with the requirements in this subpart.

(b) [Reserved]

§ 54.30-3 Introduction.

(a) Large conventional pressure vessels used to transport liquefied petroleum and natural gases, at “low temperatures” may often be difficult to thermally stress relieve. Where no other problem, such as corrosion exists, mechanical stress relief will be permitted for Class II-L pressure vessels.

(b) Mechanical stress relief serves to cause small flaws, particularly in the weld zone, to yield plastically at the flaw tip resulting in a local relief of stress and a blunting of the crack tip. To achieve the maximum benefit from mechanical stress relief, it is necessary that the stresses so imposed be more severe than those expected in normal service life. At the same time, it is necessary that the stresses which are imposed are not so high as to result in appreciable deformation or general yielding.

(c) The weld joint efficiencies as listed in Table UW-12 of section VIII of the ASME Boiler and Pressure Vessel Code (incorporated by reference; see 46 CFR 54.01-1) shall apply except that a minimum of spot radiography will be required. UW-12(c) of section VIII of the ASME Boiler and Pressure Vessel Code that permits omitting all radiography does not apply. Spot examination shall follow UW-52 of section VIII of the ASME Boiler and Pressure Vessel Code and, in addition, these vessels will be required to have radiographic examination of intersecting circumferential

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and longitudinal joints for a distance of at least 20 times the plate thickness from the junction. See 46 CFR 54.25-8 on spot radiography.

(d) Severe cold forming will not be permitted unless thermal stress relief is used. For example, parts of the vessels which are individually cold formed, such as heads, must be thermally stress relieved, where the extreme fiber strain measured at the surface exceeds 5 percent as determined by:

$$\text{Percent strain} = (65t/R_f)[1 - (R_f/R_o)]$$

where:

t=Plate thickness.

R_f=Final radius.

R_o=Original radius (equals infinity for flat plate).

[CGFR 68-82, 33 FR 18828, Dec. 18, 1968, as amended by USCG-2000-7790, 65 FR 58460, Sept. 29, 2000; USCG-2003-16630, 73 FR 65171, Oct. 31, 2008]

§ 54.30-5 Limitations and requirements.

(a) Class II-L pressure vessels which require stress relief (see Table 54.01-5(b)) may be mechanically stress relieved provided:

(1) The steels from which they are fabricated do not specifically require thermal stress relief in UCS-56 of section VIII of the ASME Boiler and Pressure Vessel Code (incorporated by reference; see 46 CFR 54.01-1) 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 section VIII of the ASME Boiler and Pressure Vessel 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