S = Minimum tensile strength of plate material in p.s.i. as prescribed in AAR Specifications for Tank Cars, appendix M, Table M1;

t = Minimum thickness of plate in inches after forming.

(b) The wall thickness after forming of the inner container heads, if flanged and dished, must be not less than specified in §179.221–1, or not less than that calculated by the following formula:

$$t = \frac{5PL}{6SE}$$

Where:

E = 0.9 welded joint efficiency; except E=1.0 for seamless heads;

L = Main inside radius to which head is dished, measured on concave side in inches;

P = Minimum required bursting pressure in psig;

S = Minimum tensile strength of plate material in psi as prescribed in AAR Specifications for Tank Cars, appendix M, Table M1 (IBR, see §171.7 of this subchapter);

t = Minimum thickness of plate in inches after forming.

(c) The wall thickness after forming of the cylindrical section and heads of the outer shell must be not less than seven-sixteenths of an inch.

(d) See §179.220–9 for plate thickness requirements for inner container when divided into compartments.

[Amdt. 179–9, 36 FR 21340, Nov. 6, 1971, as amended at 66 FR 45390, Aug. 28, 2001; 68 FR 75762, Dec. 31, 2003]

§179.220–7 Materials.

(a) The plate material used to fabricate the inner container and nozzles must meet one of the following specifications and with the indicated minimum tensile strength and elongation in the welded condition.

(b) Carbon steel plate: The maximum allowable carbon content must be 0.31 percent when the individual specification allows carbon content greater than this amount. The plates may be clad with other approved materials.

Specifications	Minimum tensile strength (p.s.i.) welded condition[1]	Minimum elongation in 2 inches (percent) weld metal (longitudinal)
AAR TC 128, Gr. B	81,000	19
ASTM A 516[2], Gr. 70	70,000	20

[1] Maximum stresses to be used in calculations.
[2] This specification is incorporated by reference (IBR, see §171.7 of this subchapter).

(c) *Aluminum alloy plate:* Aluminum alloy plate must be suitable for welding and comply with one of the following specifications (IBR, see §171.7 of this subchapter): * * *

Specifications	Minimum tensile strength (p.s.i.) welded condition[3,4]	Minimum elongation in 2 inches (percent) weld metal (longitudinal)
ASTM B 209, Alloy 5052[1]	25,000	18
ASTM B 209, Alloy 5083[2]	38,000	16
ASTM B 209, Alloy 5086[1]	35,000	14
ASTM B 209, Alloy 5154[1]	30,000	18
ASTM B 209, Alloy 5254[1]	30,000	18
ASTM B 209, Alloy 5454[1]	31,000	18
ASTM B 209, Alloy 5652[1]	25,000	18

[1] For fabrication, the parent plate material may be 0 H112, or H32 temper, but design calculations must be based on the minimum tensile strength shown.
[2] 0 temper only.
[3] Weld filler metal 5556 must not be used.
[4] Maximum stresses to be used in calculations.

(d) High alloy steel plate: High alloy steel plate must comply with one of the following specifications (IBR, see §171.7 of this subchapter):

Specifications	Minimum tensile strength (p.s.i.) welded condition[1]	Minimum elongation in 2 inches (percent) weld metal (longitudinal)
ASTM A 240/A 240M (incorporated by reference; *see* §171.7 of this subchapter), Type 304	75,000	30
ASTM A 240/A 240M (incorporated by reference; *see* §171.7 of this subchapter), Type 304L	70,000	30
ASTM A 240/A 240M (incorporated by reference; *see* §171.7 of this subchapter), Type 316	74,000	30
ASTM A 240/A 240M (incorporated by reference; *see* §171.7 of this subchapter), Type 316L	70,000	30

[1] Maximum stresses to be used in calculations.

(e) Manganese-molybdenum steel plate: Manganese-molybdenum steel

plate must be suitable for fusion welding and must comply with the following specification (IBR, see § 171.7 of this subchapter):

Specifications	Minimum tensile strength (p.s.i.) welded condition [1]	Minimum elongation in 2 inches (percent) weld metal (longitudinal)
ASTM A 302, Gr. B	80,000	20

[1] Maximum stresses to be used in calculations.

(f) Plate materials used to fabricate the outer shell and heads must be those listed in paragraphs (b), (c), (d), or (e) of this section. The maximum allowable carbon content must be 0.31 percent when the individual specification allows carbon content greater than this amount. The plates may be clad with other approved materials.

(g) All appurtenances on the inner container in contact with the lading must be made of approved material compatible with the plate material of the inner container. These appurtenances must not be subject to rapid deterioration by the lading, or must be coated or lined with suitable corrosion resistant material. See AAR Specifications for Tank Cars, appendix M, M4.05 for approved material specifications for castings for fittings.

[Amdt. 179–9, 36 FR 21340, Nov. 6, 1971, as amended by Amdt. 179–28, 46 FR 49906, Oct. 8, 1981; Amdt. 179–40, 52 FR 13048, Apr. 20, 1987; Amdt. 179–52, 61 FR 28681, June 5, 1996; 66 FR 45186, Aug. 28, 2001; 67 FR 51660, Aug. 8, 2002; 68 FR 75762, Dec. 31, 2003]

§ 179.220–8 Tank heads.

(a) Tank heads of the inner container, inner container compartments and outer shell must be of approved contour, and may be flanged and dished or ellipsoidal for pressure on concave side.

(b) Flanged and dished heads must have main inside radius not exceeding 10 feet and inside knuckle radius must be not less than 3¾ inches for steel and alloy steel tanks nor less than 5 inches for aluminum alloy tanks.

(c) Ellipsoidal heads must be an ellipsoid of revolution in which the major axis must equal the diameter of the shell and the minor axis must be one-half the major axis.

[Amdt. 179–9, 36 FR 21341, Nov. 6, 1971]

§ 179.220–9 Compartment tanks.

(a) The inner container may be divided into compartments by inserting interior heads, or by fabricating each compartment as a separate container and joining with a cylinder, or by fabricating each compartment as a separate tank without a joining cylinder. Each compartment must be capable of withstanding, without evidence of yielding or leakage, the required test pressure applied in each compartment separately, or in any combination of compartments.

(b) When the inner container is divided into compartments by fabricating each compartment as a separate container and joining with a cylinder, the cylinder must have a plate thickness not less than that required for the inner container shell and must be applied to the outside surface of the straight flange portion of the container head. The cylinder must fit the straight flange tightly for a distance of at least two times the plate thickness, or 1 inch, whichever is greater and must be joined to the straight flange by a full fillet weld. Distance from fillet weld seam to container head seam must be not less than 1½ inches or three times the plate thickness, whichever is greater.

[Amdt. 179–9, 36 FR 21341, Nov. 6, 1971]

§ 179.220–10 Welding.

(a) All joints must be fusion welded in compliance with AAR Specifications for Tank Cars, appendix W (IBR, see § 171.7 of this subchapter). Welding procedures, welders, and fabricators shall be approved.

(b) Radioscopy of the outer shell is not a specification requirement.

(c) Welding is not permitted on or to ductile iron or malleable iron fittings.

[Amdt. 179–9, 36 FR 21341, Nov. 6, 1971, as amended at 68 FR 75762, Dec. 31, 2003]

§ 179.220–11 Postweld heat treatment.

(a) Postweld heat treatment of the inner container is not a specification requirement.