**Section 178.326 Specification MC 305; Cargo Tanks Constructed of Aluminum Alloys for High-Strength Welded Construction, Primarily For the Transportation of Flammable Liquids, or Poisonous Liquids, Class B**

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.1 [178.326-1] General Requirements**

a) Spec. MC 305 cargo tanks constructed on or before September 1, 1967 for the bulk transportation of hazardous materials must meet all the requirements contained in this section.

b) Every cargo tank shall be designed and constructed in accordance with the best known and available practices in addition to the other applicable cargo tank specification requirements.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.2 [178.326-2] Material**

All sheets for shell, heads, bulkheads, and baffles of such cargo tanks shall be of aluminum alloys GR20A (5052 commercial designation), GR40A (5154 commercial designation), GM40A (5086 commercial designation), or GM31A (5454 commercial designation) conforming to American Society for Testing Materials Specification B209-57T (as revised to include 5454).

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.3 [178.326-3] Thickness of Sheets**

The minimum thicknesses of tank sheets shall be limited by the volume capacity of the tank, expressed in terms of gallons per inch of length; by the distance between successive bulkheads in the case of bulkhead sheets; and by the distance between bulkheads, baffles, or other shell stiffeners as well as by the radius of shell curvature in the case of shell sheets, as follows:

Table I – Minimum Thickness of Head, Bulkhead,

Baffle Sheets and Ring Stiffeners1

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Distance between bulkhead attachments to shell in inches |  |  |  |  |  |  |  |  |  |  |
|  |  |  | Volume capacity of tank in gallons per inch of length | | | | | |  |  |
|  | 6 or less | | Over 6 to 10 | | Over 10 to 14 | | Over 14 to 18 | | Over 18 | |
|  | Bulkhead and baffle (dished, corrugated, or reinforced) sheet and ring stiffener thickness in United States gauge numbers and inches depending upon distances between attachments thereof to shell | | | | | | | | | |
|  | Gauge No. | In. appr. | Gauge No. | In. appr. | Gauge No. | In. appr. | Gauge No. | In. appr. | Gauge No. | In. appr. |
| 30 inches or less | 17 | 0.056 | 16 | 0.062 | 15 | 0.070 | 14 | 0.078 | 13 | 0.094 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 30 inches | 16 | .062 | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 |

AGENCY NOTE: Flat heads without reinforcement no longer permitted.

Table II – Thickness of Shell Sheets

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Distance between bulkhead attachments to shell in inches |  |  |  |  |  |  |  |  |  |  |
|  |  |  | Volume capacity of tank in gallons per inch of length | | | | | |  |  |
|  | 6 or less | | Over 6 to 10 | | Over 10 to 14 | | Over 14 to 18 | | Over 18 | |
|  | Shell-sheet thickness in United States gauge and number of inches for that portion of the shell rolled to a radius of less than 70 inches, depending on spacing of shell stiffeners | | | | | | | | | |
|  | Gauge No. | In. appr. | Gauge No. | In. appr. | Gauge No. | In. appr. | Gauge No. | In. appr. | Gauge No. | In. appr. |
| 20 inches or less | 19 | 0.044 | 18 | 0.050 | 17 | 0.056 | 16 | 0.062 | 15 | 0.070 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 20 inches to 36 inches | 18 | .050 | 17 | .056 | 16 | .062 | 15 | .070 | 14 | .078 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 36 inches to 56 inches | 17 | .056 | 16 | .062 | 15 | .070 | 14 | .078 | 13 | .094 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 56 inches | 16 | .062 | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 |
|  | Shell-sheet thicknesses in United States gauge and number of inches for that portion of the shell rolled to a radius of 70 inches or more but less than 90 inches, depending on spacing of shell stiffeners | | | | | | | | | |
| 20 inches or less | 18 | 0.050 | 17 | 0.056 | 16 | 0.062 | 15 | 0.070 | 14 | 0.078 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 20 inches to 36 inches | 17 | .056 | 16 | .062 | 15 | .070 | 14 | .078 | 13 | .094 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 36 inches to 56 inches | 16 | .062 | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 56 inches | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 | 11 | .125 |
|  | Shell-sheet thicknesses in United States gauge and number of inches for that portion of the shell rolled to a radius of 90 inches or more but less than 125 inches, depending on spacing of shell stiffeners | | | | | | | | | |
| 20 inches or less | 17 | 0.056 | 16 | 0.062 | 15 | 0.070 | 14 | 0.078 | 13 | 0.094 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 20 inches to 36 inches | 16 | .062 | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 36 inches to 56 inches | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 | 11 | .125 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 56 inches | 14 | .078 | 13 | .094 | 12 | .109 | 11 | .125 | 10 | .141 |
|  | Shell-sheet thicknesses in United States gauge and number of inches for that portion of the shell rolled to a radius of 125 inches or more depending upon spacing of shell stiffeners | | | | | | | | | |
| 20 inches or less | 16 | 0.062 | 15 | 0.070 | 14 | 0.078 | 13 | 0.094 | 12 | 0.109 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 20 inches to36 inches | 15 | .070 | 14 | .078 | 13 | .094 | 12 | .109 | 11 | .125 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 36 inches to 56 inches | 14 | .078 | 13 | .094 | 12 | .109 | 11 | .125 | 10 | .141 |
|  |  |  |  |  |  |  |  |  |  |  |
| Over 56 inches | 13 | .094 | 12 | .109 | 11 | .125 | 10 | .141 | 9 | .156 |

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.4 [178.326-4] Joints**

a) Method of joining. All joints in and to tank shells, head and bulkheads shall be welded.

b) Strength of joints. All welded aluminum joints shall be made in accordance with recognized good practice, and the efficiency of a joint shall not be less than 85 percent of the annealed properties of the adjacent material. Aluminum alloys for high-strength welded construction shall be joined by an inert gas arc welding process using filler metals R-GR40A, E-GR40A (5154 alloy) or R-GM50A, E-GM50A (5356 alloy) conforming to American Society of Testing Materials Specification No. B285-54T (American Welding Society Specifications No. A5, 10-54T). Compliance with this requirement shall be determined by preparing from materials representative of those to be used in tanks subject to this specification and by the same technique of fabrication, 2 test specimens conforming to figure as shown in Appendix C and testing them to failure in tension. One pair of test specimens may represent all the tanks to be made of the same combination of materials, by the same technique of fabrication, and in the same shop, within 6 months after the tests on such samples have been completed.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.5 [178.326-5] Bulkheads, Baffles, and Ring Stiffeners**

a) When bulkheads not required. The bulkhead requirements in paragraph (b) of this Section do not apply to any cargo tank, regardless of capacity, which is used in a service in which the entire tank is never loaded less than 80 percent full or in which no compartment of the tank is ever loaded less than 80 percent full, provided that the entire contents of the tank or of one or more compartments of the tank is discharged at each unloading point. Flat bulkheads and baffles without reinforcement are not permitted.

b) When bulkheads required. Except as provided in paragraph (a) of this Section, every cargo tank having a total capacity in excess of 3,000 gallons shall be divided by bulkheads into compartments, none of which shall exceed 2,500 gallons. Each bulkhead required by this paragraph shall be of the same minimum strength as is required elsewhere in this specification for tank heads.

c) Double bulkheads. Tanks with compartments carrying flammable liquids of different shipping names or with compartments containing flammable or poisonous liquids, class B and liquids not so classified by the regulations, shall be provided with an air space between compartments. This air space shall be arranged for venting and be equipped and maintained with drainage facilities operative at all times.

d) Baffles or shell stiffeners. Every cargo tank, and every compartment of a cargo tank over 90 inches in length, shall be provided with baffles or ring stiffeners, the number of which shall be such that the linear distance between any two adjacent baffles or ring stiffeners, or between any tank head or bulkhead and the baffle or ring stiffener nearest it, shall in no case exceed 60 inches. Ring stiffeners shall be continuous around the circumference of the tank shell and shall have at least the section modulus required by the following table:

Minimum Section Modulus Required for Steel Ring Stiffeners

|  |  |
| --- | --- |
| Width of tank | Section modulus |
| 42 inches or less | 0.0180 L1 |
| Over 42 inches to 60 inches | 0.0280 L1 |
| Over 60 inches to 96 inches | 0.0400 L1 |

1 L is the maximum distance from the midpoint of the unsupported shell on one side of the ring stiffener to the midpoint of the unsupported shell on the opposite side of the ring stiffener. See Section 178.326.0.3 for minimum thickness of ring stiffeners.

If a ring stiffener is welded to the shell, a portion of the shell may, for purposes of computing the section modulus, be considered as a part of the ring section. If welded at one side of the ring stiffener only, such portion shall not exceed 20 times the shell thickness adjacent to the weld. If welded at both sides of the ring stiffener, such portion shall not exceed 40 times the shell thickness adjacent to the weld, or the width of the ring stiffener between welds plus 20 times the shell thickness adjacent to the welds, whichever is less.

e) Tank supports. The distance from a tank support to the nearest bulkhead, baffle, or other shell stiffener shall not exceed 40 times the thickness of the tank shell at the point of support.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.6 [178.326-6] Closures for Manholes**

No applicable provision.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.7 [178.326-7] Overturn Protection**

All closures for filling openings shall be protected from damage in the event of overturning of the motor vehicle by being enclosed within the body of the tank or dome attached thereto or by the use of suitable metal guards securely attached to the tank or the frame of the motor vehicle. Protection shall also be provided for any protruding or projecting fitting or appurtenance by means of adequate metal guards. The calculated load for the protective devices shall be the weight of the tank-motor vehicle with the tank full of water at one "g" deceleration. If the overturn protection is so constructed as to permit accumulation of liquid on the top of the tank, it shall not be provided with drainage facilities which will permit drainage at or near the front of the tank.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.8 [178.326-8] Tank Outlets**

Outlet fixtures shall be substantially made and attached to the tank in such a manner as to prevent breakage at the outlet point.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.0.9 [178.326-9] Vents, Valves, and Connections**

a) Tank vents. Each cargo tank or tank compartment shall be provided with a vacuum and pressure operated vent with a minimum effective opening of 0.44 square inch, and shall also be provided with an emergency venting facility so constructed as to provide a minimum free-venting opening having a net area in square inches equal to 1.25 plus 0.0025 times the capacity of the tank or compartment in gallons. If the emergency venting facility operates in response to elevated temperatures, the critical temperature for such operation shall not exceed 200°F.

b) Valve and faucet connections. All draw-off valves or faucets of tanks and compartments shall have discharge ends threaded, or be otherwise so designed as to insure in every instance a tight connection with the hose extending to the storage fill pipe.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.0 [178.326-10] Protection of Fittings**

Draw-off valves and faucets projecting beyond the frame, or if the vehicle be frameless, beyond the shell at the rear, shall be adequately protected in the event of collision by steel bumpers or other equally effective devices.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.1 [178.326-11] Emergency Discharge Control**

Each cargo tank or tank compartment of a bottom-discharge tank shall be equipped with a reliable and effective shut-off valve located inside the shell of the tank or tank compartment in the tank or compartment outlet; and the operating mechanism for such valve or valves shall be provided with a secondary closing mechanism remote from tank filling openings and discharge faucets, for operation in the event of fire or other accident. Such control mechanism shall be provided with a fusible section which will cause the valve to close automatically in case of fire, and the critical temperature for the fusing of such section shall not exceed 200°F.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.2 [178.326-12] Shear Section**

There shall be provided between each shut-off valve seat and discharge faucet a shear section which will break under strain, unless the discharge piping is so arranged as to afford equivalent protection, and leave the shut-off valve seat intact in case of accident to the discharge faucet or piping.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.3 [178.326-13] Anchoring of Cargo Tank**

a) Hold-down devices. Adequate hold-down devices shall be provided to anchor each cargo tank in a suitable manner that will not introduce undue concentration of stresses and shall be built to withstand loadings in any direction equal to the weight of the tank and attachments when filled with water. These devices on vehicles with frames shall incorporate turnbuckles or similar positive action devices for drawing the tank down tight on the frame of the motor vehicle.

b) Stops and anchors. Suitable stops and anchors shall be attached to the motor vehicle and the cargo tank to prevent relative movement between them due to starting, stopping and turning. Stops and anchors shall be installed so as to be readily accessible for inspection and maintenance except that insulation is permitted to cover such stops and anchors.

c) Anchoring integral cargo tanks. Whenever any cargo tank is so designed and constructed that the cargo tank constitutes, in whole or in part, the stress member used in lieu of a frame, then such cargo tanks shall be designed so as to successfully and adequately withstand the stresses thereby imposed in addition to those otherwise imposed on the cargo tank.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.4 [178.326-14] Gauging Devices**

No applicable provision.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.5 [178.326-15] Pumps**

Liquid pumps, whenever used, must be of suitable design, adequately protected against breakage by collisions. Unless they are of the centrifugal type, they shall be equipped with suitable pressure actuated bypass valves permitting flow from discharge to suction or to the tank.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.6 [178.326-16] Testing Requirements**

a) Test for leaks. Before being certified in accordance with Section 178.326.1.8, every cargo tank shall be tested by a minimum air or hydrostatic pressure of 3 psig. applied to the whole tank and dome if it be noncompartmented. If compartmented, each individual compartment shall be similarly tested with adjacent compartments empty and at atmospheric pressure. Air pressure, if used, shall be maintained for a period of at least five minutes during which the entire surface of all joints under pressure shall be coated with a solution of soap and water, heavy oil, or other material suitable for the purpose, foaming or bubbling of which indicates the presence of leaks. Hydrostatic pressure, if used, shall be done by using water or other liquid having a similar viscosity, the temperature of which shall not exceed 100F. during the test, and applying pressure as prescribed above, gauged at the top of the tank, at which time all joints under pressure shall be inspected for the issuance of liquid to indicate leaks. All closures shall be in place while test by either method is made. During these tests, operative relief devices shall be clamped, plugged, or otherwise rendered inoperative; such clamps, plugs, and similar devices shall be removed immediately after the test is finished. Any leakage discovered by either of the methods above described, or by any other method, shall be deemed evidence of failure to meet the requirements of this specification. Tanks failing to pass this test shall be suitably repaired, and the above described tests shall be continued until no leaks are discovered, before any cargo tank is put into service.

b) Test for distortion or failure. Before being certified in accordance with Section 178.326.1.8, every cargo tank to which this specification applies shall be tested by pressures prescribed in paragraph (a) of this Section and shall withstand such pressure without undue distortion, evidence of impending failure, or failure. Failure to meet this requirement shall be deemed as sufficient cause for rejection under this specification. If there is undue distortion, or if failure impends or occurs, the cargo tank shall not be returned to service unless a suitable repair is made. The suitability of the repair shall be determined by the same method of test.

c) Retest requirements. Every cargo tank shall be retested in accordance with 92 Ill. Adm. Code 177.824.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.7 [178.326-17] Marking of Cargo Tanks**

a) Metal identification plate. There shall be on every cargo tank a metal plate located on the right side, near the front, in a place readily accessible for inspection. This plate shall be permanently affixed to the tank by means of soldering, brazing, welding, or other equally suitable means; and upon it shall be marked by stamping, embossing, or other means of forming letters into or on the metal of the plate itself, in the manner illustrated below, at least the information indicated below. The plate shall not be so painted as to obscure the markings thereon.

Carrier's Serial Number1

Manufacturer's Name2

Date of Manufacture2

ICC MC 305

Nominal Tank Capacity ............................................................. U.S. Gallons

1 Carriers are not required to number their cargo tanks serially; any designation regularly used by the carrier to identify the tank may be put in this space.

2 In the event the identity of the tank manufacturer or the date of manufacture is not known and cannot be ascertained, the spaces indicated shall be marked "MAKE UNKNOWN" and/or "DATE OF MANUFACTURE UNKNOWN."

b) Test date markings. Every cargo tank constructed in accordance with this specification shall be marked with the test date as prescribed in 92 Ill. Adm. Code 177.824(h).

c) Additional markings. In addition to the above markings, cargo tanks must be marked as required by 92 Ill. Adm. Code 177.823.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)

**Section 178.326.1.8 [178.326-18] Certification**

A certificate from the manufacturer of the cargo tank, or from a competent testing agency, certifying that each such cargo tank is designed and constructed in accordance with the requirements of the specification shall be procured, and such certificate shall be retained in the files of the carrier during the time that such cargo tank is employed by him. In lieu of this certificate, if the motor carrier himself elects to ascertain if any such tank fulfills the requirements of the specification by his own test, he shall similarly retain the test data.

(Source: Added at 5 Ill. Reg. 1715, effective February 9, 1981)