

*Standard Specification
for*

Cast Aluminum Alloy Railing Posts

AASHTO DESIGNATION: M 193-80¹

1. SCOPE

1.1 This specification covers permanent mold cast aluminum alloy for bridge railing posts as designated in the material section of this specification. Finishing is not covered by this document and must be specified separately by the purchaser.

1.2 The values stated in SI units are to be regarded as the standard.

2. CHEMICAL COMPOSITION

2.1 The chemical composition of the castings shall conform to the limits listed in Table 1.

3. MECHANICAL PROPERTIES

3.1 Minimum mechanical properties of test bars machined either vertically or horizontally from the highly stressed area of the post tension flange 360 mm (14 in.), but not at the junction of the rib and tension flange), as designated on the part drawing, shall be as shown in Table 2.

4. LOT

4.1 A lot of castings, for the purpose of this specification, shall consist of not more than 450 kg (1000 lb) of trimmed castings when produced from batch type furnaces, or 900 kg (2000 lb) of trimmed castings when produced from a continuous furnace during a period not exceeding 8 consecutive hours.

¹ Aluminum Association Alloy Number A 444.0-T4.

TABLE 1 Composition Limits

<i>Cu</i>	<i>Fe</i>	<i>Si</i>	<i>Mn</i>	<i>Mg</i>	<i>Zn</i>	<i>Ti</i>	Other (Each)	Other (Total)
0.10	0.20	6.5-7.5	0.10	0.05	0.10	0.20	0.05	0.15

* All values maximum unless shown as a range.

**TABLE 2 Mechanical Properties of
Casting Tension Flange**

Ultimate tensile strength, min, 140 (20000) MPa (psi)	
Elongation, in 50 mm (2 in.) or 4D, min percent	20

mit the extraction of at least 6 mm (¹/₄ in.) diameter specimen.

6.3 All testing shall be performed in accordance with the requirements of T 68, and shall be certified by an approved laboratory or witnessed by a representative of the procuring agency.

5. SAMPLING FOR CHEMICAL ANALYSIS

5.1 A minimum of one sample representative of each lot of castings shall be analyzed to determine conformance with the requirements of Table 1.

6. SAMPLING FOR MECHANICAL PROPERTY TESTS

6.1 One tensile specimen shall be machined from the designated area of the tension flange (see Section 3) of one casting from each lot of castings, and shall be tested to determine conformance with requirements of Table 2.

6.2 Specimens machined from the castings shall be as shown in Figure 6 or 7 (or other sheet type specimen acceptable to the procuring agency) of AASHTO T 68. The largest possible round specimen shall be used, and flat (sheet type) specimens shall be used only when the casting thickness will not per-

7. RETESTS

7.1 If any test specimen fails to meet the requirements shown in Table 2, two additional specimens shall be selected to replace each specimen which failed. The average values for the three specimens must meet the requirements shown in Table 2 or the lot of castings which they represent shall be rejected.

8. QUALITY REQUIREMENTS

8.1 Castings shall be uniform quality and condition, free of cracks, shrinks, porosity blowholes or other defects which, due to their nature or extent, will detrimentally affect the suitability of the castings for their intended use. Castings shall be smooth and well cleaned before inspection.

8.2 Castings shall be produced under radiographic control, which control shall consist of the following: Castings shall be X-ray inspected until a foundry technique has been established for each mold which will assure production of castings

TABLE 3 Radiographic Acceptance Standards

Type of Defect	Reference Radiograph	Thickness	
		6 mm ($1/4$ in.)	6 mm ($1/4$ in.)
Gas holes	1.1	2	3
Gas porosity (round)	1.21	3	2
Gas porosity (elongated)	1.22	2	2
Shrinkage cavity	2.1	2	—
Shrinkage-sponge	2.2	2	2
Foreign material (less dense)	3.11	3	3
Foreign material (more dense)	3.12	2	1

NOTE—(1) Presence of one or more defects greater than indicated by the above acceptance standards shall be cause for rejection of the casting.

(2) Presence of defects equal to but not greater than shown in the acceptance standards shall be limited to a total of two each of all types, or three of any one type.

which are commercially free from harmful defects. When an acceptable foundry technique has been established, the bottom 360 mm (14 in.) of tension and compression flanges, and the casting base of each production lot of castings shall be X-ray inspected.

NOTE—One X-ray exposure which will cover these three areas shall be considered sufficient.

8.3 Radiographic acceptance levels for critical areas shall be based on ASTM E 155, Reference Radiographs for In-

spection of Aluminum and Magnesium Castings (Series II), as shown in Table 3 of this specification. Non-critical areas do not require production X-ray inspection.

9. INSPECTION

9.1 Inspection shall normally be done at the manufacturer's works or at an inspection laboratory chosen by the manufacturer. Inspection may be performed at the point where the castings are received if so specified by the purchaser.

9.2 Each casting shall be visually

inspected to determine compliance with the general requirements under "Quality Requirements" and to determine conformance with such visual standards as may have been established. Inspection shall also be performed as required to determine conformance with dimensional requirements as provided by applicable part drawings.

10. REPORTS

10.1 A report certifying compliance with all requirements of this specification shall be furnished with each shipment of castings.

11. NOTE

11.1 Achievement of the high level of ductility required by this specification may require effective modification of the silicon constituent. This may be achieved by the addition of a controlled amount of sodium or by some other means that may be practical.