

Standard Specification
for

Aluminum Alloy Sheet for Corrugated Aluminum Pipe¹

AASHTO DESIGNATION: M 197/M 197M-88¹
(ASTM DESIGNATION: B 744/B 744M-85)

1. SCOPE

1.1 This specification covers aluminum alloy sheets used in the fabrication of corrugated aluminum pipe intended for use for storm water drainage, underdrains, culverts, and similar uses. The material is furnished corrugated in cut lengths, and uncorrugated in coils and cut lengths.

1.2 This specification is applicable to orders in either inch-pound units (as M 197) or SI units (as M 197M). Inch-pound units and SI units are not necessarily equivalent. SI units are shown in parentheses in the text; they are the applicable values when the material is ordered to M 197M.

2. REFERENCED DOCUMENTS

- 2.1 *ASTM Standards:*
 B 209 Specification for Aluminum-Alloy Sheet and Plate
 B 209M Specification for Aluminum-Alloy Sheet and Plate [Metric]
 B 666 Practice for Identification Marking of Aluminum Products
 B 666 Practice for Identification Marking of Aluminum Products [Metric]
- 2.2 *American National Standards:*
 H35.2 Dimensional Tolerances for Aluminum Mill Products
 H35.2M Dimensional Tolerances for Aluminum Mill Products [Metric]

¹ This specification is identical to ASTM B 744/B 744M-85 except for including requirements from ASTM B 209 and B 209M on cladding thickness, chemical composition, and mechanical requirements.

3. DESCRIPTIONS OF TERMS SPECIFIC TO THIS STANDARD

- 3.1 *Fabricator*—the producer of the pipe.
 3.2 *Manufacturer*—the producer of the sheet.
 3.3 *Purchaser*—the purchaser of the finished pipe.

4. ORDERING INFORMATION

4.1 Sheet covered by this specification shall be ordered only to the specified thicknesses listed in Table 1.

4.2 Orders for material to this specification shall include the following information, as necessary, to adequately describe the desired product.

- 4.2.1 Name of material (aluminum alloy sheet for corrugated aluminum pipe),
 4.2.2 AASHTO designation number and year of issue, as M 197-_____ for inch-pound units or M 197M-_____ for SI units,
 4.2.3 Corrugation size, if corrugated (see Section 8.4),
 4.2.4 Dimensions (thickness; width, either flat or overall corrugated; and length, if cut length),
 4.2.5 Coil size requirements (specify maximum outside diameter (OD), acceptable inside diameter (ID), and maximum weight),
 4.2.6 Certification, if required (see Section 11.1), and
 4.2.7 Special requirements.

NOTE 1—Typical ordering descriptions are as follows: (1) Aluminum alloy sheet for corrugated aluminum pipe conforming to AASHTO M 197-_____ 2²/₃ by 1/2 in. corrugations, 0.060 by 25 1/2 by 60 in. (2) Aluminum alloy sheet for corrugated aluminum

TABLE 1 Sheet Thickness^A

Specified Thickness		Minimum Thickness	
in.	mm	in.	mm
0.036	0.91	0.034	0.84
0.048	1.22	0.045	1.14
0.060	1.52	0.057	1.44
0.075	1.91	0.072	1.82
0.105	2.67	0.101	2.55
0.135	3.43	0.130	3.29
0.164	4.17	0.158	3.99

^A Thickness is measured at any point on the sheet not less than 3/4 in. or 10 mm from an edge, and if corrugated, on the tangents of corrugations.

pipe conforming to AASHTO M 197M-_____ 2.67 by 760 mm by coil, 1,200 mm OD max. 600 mm ID min. 5,000 kg max, certified with test report.

5. GENERAL REQUIREMENTS

5.1 Aluminum alloy sheets or coils supplied under this specification shall conform to the applicable requirements of ASTM B 209 or B 209M (as appropriate) for alclad alloy 3004-H34.

6. CHEMICAL COMPOSITION

6.1 The sheet material shall conform to the chemical composition limits in ASTM B 209 or B 209M, as shown in Table 2.

7. MECHANICAL REQUIREMENTS

7.1 The sheet material shall conform to the requirements for mechanical properties specified in ASTM B 209 or

TABLE 2 Chemical Composition^a

Alloy	Sheet Core	Sheet Cladding ^b
	(Percent)	(Percent)
	3,004	7,072
Silicon	0.30	(Si + Fe) = 0.7
Iron	0.7	
Copper	0.25	0.10
Manganese	1.0-1.5	0.10
Magnesium	0.8-1.3	0.10
Zinc	0.25	0.8-1.3
Other Each	0.05	0.05
Total	0.15	0.15
Aluminum	Remainder	Remainder

^a Composition in mass percent maximum unless shown as range.

^b Composition of cladding alloy as applied during the course of manufacture. Samples from finished sheet or plate shall not be required to conform to these limits.

B 209M, as shown in Table 3 when tested prior to corrugating or other fabrication.

NOTE 2—Sheet material tested after corrugating and other fabricating should conform to the special tensile and yield strength requirements, but due to cold working, conformance to the elongation requirements may not be obtained.

8. DIMENSIONS AND TOLERANCES

8.1 Sheet thickness shall conform to dimensions prescribed in Table 1.

8.2 The nominal cladding thickness on each side shall be 5 percent of the total composite thickness. The average cladding thickness, determined according to Section 9.4, shall not be less than 4 percent of the total composite thickness.

8.3 Permissible variations in flat width, length and squareness shall be in accordance with ANSI H35.2 or H35.2M.

8.4 Corrugations shall form smooth continuous curves and tangents. The dimensions of the corrugations shall be in accordance with Table 4.

8.5 Covering width of corrugated sheet shall be in accordance with Table 5. Covering width is the distance between the crests of the extreme corrugations. There is no established tolerance for overall width since the covering width and lip dimensions are the governing factors for the formed product. The

lip dimension of corrugated sheet shall be in accordance with Table 6. This dimension is measured along the radial curvature from the crest of the corrugation to the edge of the sheet.

9. SAMPLING AND TESTING

9.1 Sampling and testing shall be according to ASTM B 209 or B 209M. The manufacturer shall make adequate tests and measurements to ensure that the material produced complies with this specification.

9.1.1 Test results including chemical composition, mechanical properties, and cladding thickness shall be maintained by the sheet manufacturer for 7 years and shall be made available to the fabricator and purchaser upon request, for examination at the manufacturer's facility unless otherwise agreed upon.

9.2 The fabricator or the purchaser may make such tests as are necessary to

determine the acceptability of the material or to verify the correctness of a certification.

9.3 Mechanical properties shall be determined on sheet prior to corrugating or other fabricating, except tests may be made after fabrication by the purchaser for tensile and yield strengths.

9.4 When the thickness of the cladding is to be determined on finished material, not less than three transverse samples approximately $\frac{3}{4}$ in. (19 mm) in length shall be mounted to expose a transverse cross section and polished for examination with a metallurgical microscope. Using a 100x magnification, the maximum and minimum cladding thickness shall be measured in each of five fields approximately 0.1 in. (2.5 mm) apart along both sides of the cross section. The average of ten thickness measurements on each side is the average cladding thickness.

NOTE 3—If necessary to better define the interface between core and cladding, the pol-

TABLE 3 Mechanical Requirements, Alclad Alloy 3004-H34

Specified Thickness	Tensile Strength		Yield Strength	Elongation in
	min	max	(0.2 percent offset)	2 in. or 50 mm
			Min	Min
	<i>M 197</i>			
in.	ksi	ksi	ksi	Percent
0.036, 0.048	31.0	37.0	24.0	3
0.060 thru 0.105	31.0	37.0	24.0	4
0.135, 0.164	31.0	37.0	24.0	5
	<i>M 197M</i>			
mm	MPa	MPa	MPa	Percent
0.91, 1.22	215	260	165	3
1.52 thru 4.17	215	260	165	4

TABLE 4 Corrugation Requirements

Nominal Size	Maximum Pitch ^a	Minimum Depth ^b	Inside Radius	
			Nominal	Minimum
<i>M 197</i> —All values in in.				
2 $\frac{2}{3}$ by $\frac{1}{2}$	2 $\frac{7}{8}$	0.48	$\frac{1}{16}$	0.5
3 by 1	3 $\frac{1}{4}$	0.95	$\frac{9}{16}$	0.5
6 by 1	6 $\frac{1}{4}$	0.95	2.2	2.0
<i>M 197M</i> —All values in mm				
68 by 13	73	12	17	12
75 by 25	83	24	14	12
150 by 25	160	24	56	51

^a Pitch is measured from crest to crest of corrugations, at 90° to the direction of the corrugations.

^b Depth is measured as the vertical distance from a straightedge resting on the corrugation crests to the bottom of the intervening valley.

TABLE 5 Covering Width Tolerance for Corrugated Sheet

Covering Width, in. (mm)	Tolerance Over and Under in. (mm)
To 24 (610), inclusive	$\frac{1}{4}$ (6.5)
Over 24 (610) to 36 (915), inclusive	$\frac{3}{8}$ (9.5)
Over 36 (915) to 48 (1,220), inclusive	$\frac{1}{2}$ (13)

TABLE 6 Corrugated Sheet Lip Dimensions

Nominal Corrugation Size	Lip Dimension	
	Minimum	Maximum
$2\frac{2}{3}$ by $\frac{1}{2}$ 68 by 13	$\frac{3}{4}$ 19	$\frac{15}{16}$ 24
3 by 1 75 by 25	$\frac{7}{8}$ 22	$1\frac{1}{8}$ 28
6 by 1 150 by 25	$\frac{7}{8}$ 22	$1\frac{1}{2}$ 38

ished surface may be etched with Keller's etch or equivalent. Keller's etch contains: 1 part HF conc., 1.5 parts HCl conc., 2.5 parts HNO₃ conc., and 95 parts water.

10. REJECTION

10.1 Material tested by the purchaser and found not conforming to this specification may be rejected.

11. CERTIFICATION

11.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser of the sheet (fabricator) or to the purchaser of the finished pipe stating that samples representing each lot have been tested and inspected in accordance with this specification and the requirements have been met. When specified in the purchase order or contract, a report of the mechanical test results and the chemical composition limits shall be furnished.

NOTE 4—As the identity of the sheet is not maintained from the original ingot production, if numerical results are required by the purchaser, tests should be performed on the finished sheet.

12. PRODUCT MARKING

12.1 Each corrugated sheet furnished for use in annular corrugated pipe shall be identified by the sheet manufacturer showing the following:

12.1.1 Name or trademark of sheet manufacturer,

12.1.2 Alloy and temper,

12.1.3 Specified thickness,

12.1.4 Date of corrugating by a six-digit number indicating in order the year, month, and day of the month, and

12.1.5 AASHTO designation number.

12.2 Coils and cut-length flat sheets shall be similarly marked by the manufacturer (except Section 12.1.4) at 2- to 5-ft (0.6 to 1.5 m) intervals, or the information shall be included on a tag so that the fabricator can mark the sheet at the time of fabrication.

12.3 The marking shall be applied to the sheet by a permanent method such as coining in accordance with ASTM B 666 or B 666M.