ASTM A358/A358M 316L (S31603) Engineering Datasheet

Prepared from ASTM A358/A358M-15

1. Basic designation

Standard	Grade	UNS	Material type	Plate material basis
ASTM A358/A358M-15	316L	S31603	316L	A240/A240M Type 316L

2. Plate and filler metal specification table (ASTM A358 Table 1)

Plate spec / grade	A5.4/A5.4M	A5.9/A5.9M	A5.11/A5.11M	A5.14/A5.14M	A5.22/A5.22M	A5.30/A5.30M	Notes
A240/A240M Type 316L	E316L / W31613	ER316L / S31683	—	—	E316LT / W31635	IN316L / S31683	—

3. Chemical composition requirements

Item	Requirement
Plate chemistry basis	The steel plate material shall conform to the chemistry requirements of A240/A240M Type 316L (ASTM A240/A240M).
Welding filler chemistry	Except for Grade S34751, welding filler metal shall conform to the applicable AWS specification shown in Table 1, or to the chemistry of the plate in A240/A240M, or, subject to purchaser approval, to a filler metal more highly alloyed than the base metal when needed for corrosion resistance or other properties.
Product analysis	For each lot of 500 ft [150 m] of pipe or fraction thereof, product analyses of both plate and weld deposit are required from the finished pipe.
Tolerance basis	Product analysis acceptance is subject to the product analysis tolerances of Table 1 in ASTM A480/A480M.

4. Annealing / heat treatment requirements (ASTM A358 Table 2)

Grade / UNS	Heat treating temperature	Cooling / testing requirement
316L / S31603	1900 °F [1040 °C]	Code C: Quenched in water or rapidly cooled by other means at a rate sufficient to prevent reprecipitation of carbides; capability of passing ASTM A262 Practice E when specified.

Purchaser may specify: HT (final heat treatment under 1900 °F [1040 °C]), HT-O (no final heat treatment because plate was already solution heat treated), or HT-SO (no final heat treatment because plate was not solution heat treated).

5. Pipe class and weld construction requirements

Class	Requirement
Class 1	Double welded; filler metal in all passes; completely radiographed
Class 2	Double welded; filler metal in all passes; no radiography required
Class 3	Single welded; filler metal in all passes; completely radiographed
Class 4	Same as Class 3 except inside weld pass may be made without filler metal as permitted by 6.2.2.1 and 6.2.2.2
Class 5	Double welded; filler metal in all passes; spot radiographed

Welds shall be full-penetration single- or double-welded butt joints. Backing rings or strips, if used during welding, shall be removed before required radiography. Backing strips or rings remaining in place are prohibited.

6. Mechanical test requirements

Requirement	Details
Plate tensile properties	Plate material shall meet the tensile requirements of the applicable A240/A240M grade listed in Table 1.
Transverse tension test across welded joint	Tensile strength shall be not less than the specified minimum tensile strength of the plate.
Guided-bend weld tests	Two transverse bend specimens per pipe lot; one face bend and one root bend unless side bends are allowed by thickness.
Wall thickness > 3/8 in. to < 3/4 in.	Side-bend tests may be used instead of face and root bend tests.
Wall thickness ≥ 3/4 in.	Both specimens shall be side-bend tests.
Acceptance of bend test	No cracks or defects exceeding 1/8 in. [3 mm] in any direction in the weld or between weld and base metal after bending; edge cracks < 1/4 in. [6.5 mm] not measured during testing are disregarded.

7. Inspection and examination requirements

Requirement	Details
Product analysis	For each lot of 500 ft [150 m] of pipe or fraction thereof, analysis shall be made from finished pipe of plate and weld deposit; results shall conform to Section 7 subject to product analysis tolerances of A480/A480M Table 1.
Hydrostatic test	Each length of pipe shall be hydrostatically tested in accordance with A999/A999M unless exempted by system pressure test provision.
System pressure test option	By agreement, purchaser may use system pressure test; pipe shall be marked NH if manufacturer hydro was not completed.
Radiography Classes 1, 3, 4	All welded joints completely examined by radiography per ASME BPVC Section VIII Paragraph UW-51.
Radiography Class 5	Spot radiography at not less than 12 in. [300 mm] of radiograph per 50 ft [15 m] of weld per ASME BPVC Section VIII Div.1 Paragraph UW-52.
Radiography before heat treatment	Permitted.

8. Permitted variations in dimensions

Characteristic	Basis	Requirement
Outside diameter	Based on circumferential measurement	±0.5% of specified outside diameter
Out-of-roundness	Difference between major and minor OD	1%
Alignment	Using a 10 ft [3 m] straightedge with both ends in contact	1/8 in. [3 mm] max deviation from contact with pipe
Thickness	Minimum wall thickness at any point	Not more than 0.01 in. [0.3 mm] under nominal thickness

9. Supplementary requirements

Supplementary requirement	Summary
S1 Product analysis	Product analysis shall be made on each length of pipe; nonconforming lengths rejected.
S2 Tension and bend tests	Tension and bend tests shall be made on specimens to represent each length of pipe.
S3 Penetrant oil and powder examination	All welded joints shall be examined; acceptance by agreement.
S4 Ferrite control in weld deposits	Ferrite content, test equipment, method, location, and limits by agreement.
S5 Stabilizing heat treatment	Grades 321, 321H, 347, 347H, and 348 receive stabilizing heat treatment when specified.
S6 Intergranular corrosion test	Per ASTM A262 Practice E when specified; S5 may be needed for titanium / columbium grades.
S7 In-process heat treatments	For H grades, separate solution treatments are required; in-process heat treatments are not a substitute.
S8 ASME Section III or Section VIII, Division 1 construction	Additional ASME authorization, lot definition, documentation, and double-welded requirements as specified.

10. Purchase order description example

Example wording
ASTM A358/A358M, Grade 316L (S31603), Class 1 (or 2 / 3 / 4 / 5), electric-fusion-welded pipe, plate material A240/A240M Type 316L, OD 610 mm × WT 12.7 mm, fixed length 6000 mm, heat treated per Table 2, hydrostatic test, radiography as required by class, certification per A999/A999M, supplementary requirements as specified.

11. Notes

• This specification directly governs electric-fusion-welded pipe construction, weld class, heat treatment, dimensional tolerances, weld tests, hydrostatic test, and radiography requirements.

• Numerical plate chemistry and plate tensile values are not listed directly in ASTM A358; they are governed by the referenced ASTM A240/A240M plate grade shown in Table 1.

• Where purchaser approval is required for alternative filler metals, plate repair by welding, system pressure test substitution, or circumferential welds, such approval should be stated in the PO.