Designation: A 358/A 358M – 08 Designation: A 358/A 358M – 08a

Used in USDOE-NE Standards

Standard Specification for Electric-Fusion-Welded Austenitic Chromium-Nickel Stainless Steel Pipe for High-Temperature Service and General Applications¹

This standard is issued under the fixed designation A 358/A 358M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ɛ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification² covers electric-fusion-welded austenitic chromium-nickel stainless steel pipe suitable for corrosive or high-temperature service, or both, or for general applications.

Note 1—The dimensionless designator NPS (nominal pipe size) has been substituted in this standard for such traditional terms as "nominal diameter," "size," and "nominal size."

- 1.2 This specification covers the grades of alloy and stainless steel listed in Table 1. The selection of the proper grade and requirements for heat treatment shall be at the discretion of the purchaser, dependent on the service conditions to be encountered.
 - 1.3 Five classes of pipe are covered as follows:
- 1.3.1 *Class 1*—Pipe shall be double welded by processes employing filler metal in all passes and shall be completely radiographed.
 - 1.3.2 Class 2—Pipe shall be double welded by processes employing filler metal in all passes. No radiography is required.
- 1.3.3 Class 3—Pipe shall be single welded by processes employing filler metal in all passes and shall be completely radiographed.
- 1.3.4 Class 4—Same as Class 3 except that the weld pass exposed to the inside pipe surface may be made without the addition of filler metal (see 6.2.2.1 and 6.2.2.2).
 - 1.3.5 Class 5—Pipe shall be double welded by processes employing filler metal in all passes and shall be spot radiographed.
- 1.4 Supplementary requirements covering provisions ranging from additional testing to formalized procedures for manufacturing practice are provided. Supplementary Requirements S1 through S6 are included as options to be specified when desired.
- 1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system <u>aremay</u> not <u>be</u> exact equivalents; therefore, each system <u>mustshall</u> be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

2. Referenced Documents

2.1 ASTM Standards:3

A 240/A 240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A 999/A 999M Specification for General Requirements for Alloy and Stainless Steel Pipe

E 527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 ASME Boiler and Pressure Vessel Code:⁴

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.10 on Stainless and Alloy Steel Tubular Products.

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² For ASME Boiler and Pressure Vessel Code applications see related Specifications SA-358 in Section II of that Code.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

⁴ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, http://www.asme.org.

	30	SNN	:	÷	S30880	S30883	S30880	S30883	S30880	<u> </u> :	:	<u> </u> :	:	:	:	<u> </u> :	:	S31680	S31683	S31680	S31683	S31680	÷	:	:	:	S34780
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	A5.22	SNO	:	:	W30831	W30835	W30831	W30835	W30831	:	:	:	:	:	:	:	:	W31631	W31635	W31631	W31635	W31631	W31735	W31735	:	:	W34733
ication	A5	Class.	:	:	E308T	E308LT	E308T	W308LT	E308T	:	:	:	:	: :	:	:	:	E316T	E316LT	E316T	E316LT	E316T	E317LT	E317LT	:	:	E347T
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ASTM Plate	Specification No.	and Grade	A 240 Type 201	A 240 Type 201LN	A 240 Type 304	A 240 Type 304	A 240 Type 304N	A 240 Type 304LN	A 240 Type 304H	A 240, Type 309Cb	A 240 Type 309Cb	A 240, Type 309S	A 240 Type 309S	A 240, Type 310Cb	A 240 Type 310Cb	A 240, Type 310S	A 240 Type 310S	A 240 Type 316	A 240 Type 316L	A 240 Type 316N	A 240 Type 316LN	A 240 Type 316H	A 240 Type 317	A 240 Type 317L	A 240 S31727	A 240 S32053	A 240 Type 321
Material,		2	201	201LN	304	304L	304N	304LN	304H	309Cb	309Cb	-8608	309S	310Cb	310Cb	310S -	310S	316	316L	316N	316LN	316H	317	317L	:	:	321
or Z	Desig-	nation	S20100	S20153	S30400	S30403	S30451	S30453	S30409	S30940	S30940	80608	830908	S31040	S31040	831008	S31008	S31600	S31603	S31651	S31653	S31609	831700	S31703	S31727	S32053	832100
	Grade		201	201LN	304	304L	304N	304LN	304H	-9260E	309Cb	\$608	3098	310Cb	310Cb	310S	310S	316	316L	316N	316LN	316H	317	317L	:	:	321

TABLE 1 Continued

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Grade	Desig-	Type	Specification No.	A5.4	4.	sta	A5.9	A5.11		A5.14		A5	A5.22	A5.30	30
	nation	;	and Grade	Class.	SNO	Class.	NNS	Class.	SNN	Class.	SNN	Class.	SNO	Class.	NNS
321H ^C	S32109 ^C	321H ^C	A 240 Type 321H ^C	E321H	W34710	ER321	S32180 W32140 S34780 W34740					E347T	W34731	IN348	S34780
347	S34700	347	A 240 Tvpe 347	E347	W34710	ER347	S34780 W34740	:	:	:	:	E347T	W34733	IN348	S34780
347H ^C	S34709 ^C	347H ^C	$^{ m A}$ 240 $^{ m Type}$ 347H c	E347H	E347H	W34710	ER347	S34780 W34740				E347T	W34731	IN348	S34780
348	S34800	348	, A 240 Tvpe 348	E347	W34710	ER347	S34780 W34740	:	:	:	:	E347T	W34733	IN348	S34780
XM-19	S22100	XM-19	A 240 Type XM-19	E209	W32210	ER209	S20980 W32240	:	:	:	:	:	:	:	:
XM-29	S28300	XM-29	A 240 Type XM-29	E240	W32410	ER240	S23980 W32440	:	:	:	:	:	:	÷	:
:	S31254	÷	A 240 S31254	:	:	ls/si	0:0	ENICrMo-3	W86112	ERNICrMo-3	N06625	:	:	:	:
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:	S31725	:	A 240 S31725	:	:	TM)9e	n N	ENICrMo-3	W86112	ERNICrMo-3	N06625	:	:	:	:
:	S31726	:	A 240 S31726	÷	:	<u>A3</u> 9dc	ai le	ENICrMo-3	W86112	ERNICrMo-3	N06625	:	:	:	:
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:	S30415	:	A 240 S30415	:	:	<u>8M-</u> .424	Pr	da	:	:	:	:	:	:	:
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:	S32050	:	A 240 S32050	:	:	313	1. 3	:	:	:	:	:	:	:	:
:	N08367	:	A 240 N08367	:	:	a69	41 ,	ENICrMo-3	W86112	ERNICrMo-3	N06625	:	:	:	:
:	N08904	÷	A 240 N08904	:	:	25c	:	:	:	:	:	:	:	:	:
:	N08926	:	A 240 N08926	:	:	9/as	:	ENICrMo-3	W86112	ERNICrMo-3	N06625	:	:	:	:
:	N08800	:	A 240 N08800	:	:	stm-	:	:	:	:	:	:	:	:	:
:	N08810	÷	A 240 N08810	:	:	a35	:	:	:	:	:	:	:	:	:
:	N08020	:	A 240 N08020	÷	:	8-a	:	:	:	:	:	:	:	:	:
:	S20400	÷	A 240 S20400	E 209	W32210	ER209	S20980 W32240	:	:	:	:	:	:	:	:
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^A New designation established in accordance with Practice E 527and SAE J1086. For the Meding Society specification depends on the welding process used. Coming Median content of the filler metal shall be 0.040 mass %.

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https://standards.iteh.ai/catalog/standards/sist/409e9dcc_909e_4244_hh89_c93f3a6925c9/astm_a358_a358m_08a

Section II, Materials

Section III, Rules for Construction of Nuclear Facility Components

Section VIII, Pressure Vessels

Section IX, Welding and Brazing Qualifications

- 2.3 AWS Specifications:⁵
- A 5.22 Flux Cored Arc Welding
- A 5.30 Consumable Weld Inserts for Gas Tungsten Arc Welding
- A 5.4 Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes
- A 5.9 Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Rods and Bare Electrodes
- A 5.11 Nickel and Nickel-Alloy Covered Welding Electrodes
- A 5.14 Nickel and Nickel-Alloy Bare Welding Rods and Electrodes
- 2.4 Other Standard:⁶

SAE J1086 Practice for Numbering Metals and Alloys (UNS)

3. Terminology

- 3.1 Definitions:
- 3.1.1 The definitions in Specification A 999/A 999M and Terminology A 941 are applicable to this specification.

4. Ordering Information

- 4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for product under this specification. Such requirements to be considered include, but are not limited to, the following:
 - 4.1.1 Quantity (feet, metres, or number of lengths),
 - 4.1.2 Name of material (electric-fusion-welded pipe),
 - 4.1.3 Grade (Table 1),
 - 4.1.4 Class (see 1.3),
 - 4.1.5 Size (outside diameter and nominal wall thickness),
 - 4.1.6 Length (specific or random),
 - 4.1.7 End finish (Section on Ends of Specification A 999/A 999M),
- 4.1.8 Authorization for repair of plate defects by welding and subsequent heat treatment without prior approval if such is intended (see 9.3).
 - 4.1.9 Specification designation,
 - 4.1.10 Special requirements,
 - 4.1.11 Statement invoking requirements of 16.4 if such is intended.
 - 4.1.12 Circumferential weld permissibility (see Section 16),
 - 4.1.13 Supplementary Requirements (S1 through S6),
 - 4.1.14 Applicable ASME Code if known,
 - 4.1.15 For ASME Code Section III applications, the service classification intended, and
 - 4.1.16 Certification requirements (see Section on Certification of Specification A 999/A 999M).

5. General Requirements

5.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification A 999/A 999M unless otherwise provided herein.

6. Materials and Manufacture

- 6.1 Materials:
- 6.1.1 The steel plate material shall conform to the requirements of one of the grades of Specification A 240/A 240M, listed in Table 1, except as provided in 6.3.2.3.
 - 6.2 Welding:
- 6.2.1 The joints shall be full penetration double-welded or single-welded butt joints employing fusion welding processes as defined under "Definitions," ASME Boiler and Pressure Vessel Code, Section IX. This specification makes no provision for any difference in weld quality requirements regardless of the weld joint type employed (single or double) in making the weld. Where backing rings or strips are employed, the ring or strip material shall be of the same P-Number (Table QW-422 of Section IX) as the plate being joined. Backing rings or strips shall be completely removed after welding, prior to any required radiography, and the exposed weld surface shall be examined visually for conformance to the requirements of 6.2.3. Welds made by procedures

⁵ Available from American Welding Society (AWS), 550 NW LeJeune Rd., Miami, FL 33126, http://www.aws.org.

⁶ Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

employing backing strips or rings that remain in place are prohibited. Welding procedures, and welding operators shall be qualified in accordance with ASME Boiler and Pressure Vessel Code, Section IX.

- 6.2.2 Except as provided in 6.2.2.1 and 6.2.2.2, welds shall be made in their entirety by processes involving the deposition of filler metal.
 - 6.2.2.1 For Class 4 pipe employing multiple passes, the root-pass may be without the addition of filler metal.
- 6.2.2.2 For Class 4 pipe, the weld surface exposed inside the pipe may result from a single pass made from the inside of the pipe without the addition of filler metal.
 - 6.2.2.3 All single-welded pipe shall be completely radiographed.
- 6.2.3 The weld surface on either side of the weld is permitted to be flush with the base plate or to have a reasonably uniform crown, not to exceed ½ in. [3 mm]. It is permitted at the option of the manufacturer or by agreement between the manufacturer and purchaser to remove any weld reinforcement. The contour of the reinforcement should be reasonably smooth and free from irregularities. The deposited metal shall be fused uniformly into the plate surface. No concavity of contour is permitted unless the resulting thickness of weld metal is equal to or greater than the minimum thickness of the adjacent base metal.
- 6.2.4 Weld defects shall be repaired by removal to sound metal and rewelding. Subsequent heat treatment and examination (that is, visual, radiographic, and dye penetrant) shall be as required on the original welds.
 - 6.3 Heat Treatment:
- 6.3.1 Unless otherwise stated in the order, all pipe shall be furnished in the heat-treated condition in accordance with the requirements of Table 2.
- 6.3.2 The purchase order shall specify one of the following conditions if the heat-treated condition specified in 6.3.1 is not desired by the purchaser:
- 6.3.2.1 A final heat-treatment temperature under 1900 °F [1040 °C]—Each pipe supplied under this requirement shall be stenciled with the final heat-treatment temperature in degrees Fahrenheit or degrees Celsius after the suffix "HT". Controlled structural or special service characteristics may be specified as a guide for the most suitable heat treatment.
- 6.3.2.2 No final heat treatment of pipe fabricated of plate that has been solution heat treated at temperatures required by this specification—Each pipe supplied under this requirement shall be stenciled with the suffix "HT-O".
- 6.3.2.3 No final heat treatment of pipe fabricated of plate that has not been solution heat treated—Each pipe supplied under this requirement shall be stenciled with the suffix "HT-SO".
- 6.4 A solution annealing temperature above 1950 °F [1065 °C] may impair the resistance to intergranular corrosion after subsequent exposure to sensitizing conditions in Grades 321, 321H, 347, 347H, and 348. When specified by the purchaser, a lower temperature stabilization or re-solution anneal shall be used subsequent to the initial high temperature solution anneal (see Supplementary Requirement S5).

7. Chemical Composition

7.1 The chemical composition of the plate shall conform to the requirements of the applicable specification and grade listed in Specification A 240/A 240M.

TABLE 2 Annealing Requirements

	<u> </u>	
Grade or UNS Designation ^A	Heat Treating Temperature ^B	Cooling/Testing Requirements
All grades not individually listed below:	1900 °F [1040 °C]	С
304H, 309S, 309Cb, 310S, 310Cb, 321H, 347H, S22100, S28300,	1900 °F [1040 °C]	D
N08020	1800-1850 °F [980-1010 °C]	D
N08367	2025 °F [1110 °C]	D
N08810	2050 °F [1120 °C]	D
N08904	2000 °F [1095 °C]	D
N08926	2010 °F [1100 °C]	D
S30600	2100 °F [1150 °C]	D
S30815	1920 °F [1050 °C]	D
S31254	2100 °F [1150 °C]	D
S31266	2100 °F [1150 °C]	D
S31727	1975–2175 °F [1080 to 1180 °C]	D
S32050	2100 °F [1150 °C]	\overline{D}
S32053	1975–2175 °F [1080 to 1180 °C]	\overline{D}
S32654	2100 °F [1150 °C]	D
S34565	2050 °F [1120 °C]	D

^A New designation established in accordance with Practice E 527 and SAE J1086.

^B Minimum, unless otherwise stated.

^C Quenched in water or rapidly cooled by other means, at a rate sufficient to prevent reprecipitation of carbides, as demonstrable by the capability of passing Practices A 262, Practice E. The manufacturer is not required to run the test unless it is specified on the purchase order (see Supplementary Requirement S7). Note that Practices A 262 requires the test to be performed on sensitized specimens in the low-carbon and stabilized types and on specimens representative of the as-shipped condition for other types. In the case of low-carbon types containing 3 % or more molybdenum, the applicability of the sensitizing treatment prior to testing shall be a matter for negotiation between the seller and the purchaser.

 $^{^{\}check{D}}$ Quenched in water or rapidly cooled by other means.