



Designation: **A955/A955M – 18b** A955/A955M – 19

Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement¹

This standard is issued under the fixed designation A955/A955M; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This specification covers deformed and plain stainless steel bars for concrete reinforcement in cut lengths and coils used in applications requiring resistance to corrosion or controlled magnetic permeability. The standard sizes and dimensions of deformed bars and their numerical designation shall be those listed in [Table 1](#). ~~The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.~~

~~1.1.1 Supplementary A supplementary requirement (S1) of an optional nature is provided. It shall apply only when specified by the purchaser. In order to obtain is provided for use where a controlled magnetic permeability product, steel conforming to Supplementary Requirement S1 should be ordered. product is required by the purchaser. Supplementary requirement (S1) applies only when specified in the purchase order.~~

1.2 The chemical composition of the stainless steel alloy shall be selected for suitability to the application involved by agreement between the manufacturer and the purchaser. This is an important consideration in achieving the desired corrosion resistance or controlled magnetic permeability, or both, because these properties are not provided by all stainless steels.

~~NOTE 1—The austenitic and austenitic-ferritic (duplex) alloys shown in [Table 2](#) are known to be sold by producers to the requirements of this specification. It provides guidance and is not a mandatory chemical composition table. Other alloys may also provide desired properties; consult with the manufacturer for stainless steel alloy properties and availability. After adoption of [Annex A5](#), a mandatory chemical composition requirements table will be balloted in accordance with its requirements. This note and references to Specification [A276/A276M](#) will be simultaneously removed.~~

~~1.3 Corrosion Resistance requirements are contained in Section [11](#) and [Annex A1](#) and the test procedures options are [Annex A2](#) (Rapid Macrocell Test) or [Annex A3](#) (Cracked Beam Test).~~

1.4 The requirements for introduction of new alloys into a mandatory chemical composition requirements table in this specification are given in [Annex A5](#).

1.5 Requirements for the relative deformation area of three-sided deformed bars are contained in [Annex A4](#).

1.6 Bars are of three minimum yield strength levels, namely, 60 000 psi [420 MPa], 75 000 psi [520 MPa], and 80 000 psi [550 MPa], designated as Grade 60 [420], Grade 75 [520], or Grade 80 [550], respectively.

1.7 Plain bars in sizes up to and including 2 in. [50.8 mm] in diameter in coils or cut lengths are furnished in accordance with this specification in Grade 60 [420], Grade 75 [520], and Grade 80 [550], respectively. Mechanical testing, when required, shall be to the nearest nominal deformed bar size. Requirements providing for deformations and marking shall not be applicable to plain bars.

1.8 When stainless steel is to be welded, use a procedure suitable for the chemical composition and intended use or service.

~~NOTE 1—Welding of stainless steel reinforcement would occur after shipment from the ~~producer~~ manufacturer. Structural welding should be performed in accordance with the latest edition of AWS D1.6/D1.6M, any other internationally accepted stainless steel welding code, or a procedure suggested by the material ~~producer~~ manufacturer. AWS D1.6/D1.6M describes the proper selection of the filler metals, temperature control, as well as, performance, procedure qualification and inspection requirements.~~

1.9 This specification is applicable for orders in either inch-pound units (as Specification A955) or in SI units (as Specification A955M).

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 [A01.05](#) on Steel Reinforcement.

Current edition approved Nov. 15, 2018 May 15, 2019. Published December 2018 May 2019. Originally approved in 1996. Last previous edition approved in 2018 as [A955/A955M – 18a](#); [A955/A955M – 18b](#). DOI: [10.1520/A0955_A0955M-18B](#); [10.1520/A0955_A0955M-19](#).

*A Summary of Changes section appears at the end of this standard

TABLE 1 Deformed Bar Designation Numbers, Nominal Weights [Masses], Nominal Dimensions, and Deformation Requirements

Bar Designation No.	Nominal Weight, lb/ft [Nominal Mass, kg/m] ^A		Nominal Dimensions ^B			Deformation Requirements, in. [mm]			
	400 Series; Duplex Alloys	300 Series	Diameter, in. [mm]	Cross-Sectional Area, in. ² [mm ²]	Perimeter, in. [mm]	Maximum Average Spacing	Minimum Average Height	Maximum Gap per Side ^C	
								Two-Sided Bar	Three-Sided Bar
3 [10]	0.374 [0.556]	0.378 [0.562]	0.375 [9.5]	0.11 [71]	1.178 [29.9]	0.262 [6.7]	0.015 [0.38]	0.143 [3.6]	0.097 [2.5]
4 [13]	0.679 [1.011]	0.686 [1.021]	0.500 [12.7]	0.20 [129]	1.571 [39.9]	0.350 [8.9]	0.020 [0.51]	0.191 [4.9]	0.129 [3.3]
5 [16]	1.048 [1.559]	1.058 [1.575]	0.625 [15.9]	0.31 [199]	1.963 [49.9]	0.437 [11.1]	0.028 [0.71]	0.239 [6.1]	0.162 [4.1]
6 [19]	1.495 [2.225]	1.511 [2.248]	0.750 [19.1]	0.44 [284]	2.356 [59.8]	0.525 [13.3]	0.038 [0.97]	0.286 [7.3]	0.194 [4.9]
7 [22]	2.038 [3.032]	2.059 [3.064]	0.875 [22.2]	0.60 [367]	2.749 [69.8]	0.612 [15.5]	0.044 [1.12]	0.334 [8.5]	0.226 [5.8]
8 [25]	2.685 [3.995]	2.713 [4.037]	1.000 [25.4]	0.79 [510]	3.142 [79.8]	0.700 [17.8]	0.050 [1.27]	0.383 [9.7]	0.259 [6.6]
9 [29]	3.396 [5.053]	3.441 [5.106]	1.128 [28.7]	1.00 [645]	3.544 [90.0]	0.790 [20.1]	0.056 [1.42]	0.431 [10.9]	0.292 [7.4]
10 [32]	4.312 [6.416]	4.358 [6.484]	1.270 [32.3]	1.27 [819]	3.990 [101.3]	0.889 [22.6]	0.064 [1.63]	0.487 [12.4]	0.329 [8.3]
11 [36]	5.296 [7.880]	5.352 [7.964]	1.410 [35.8]	1.56 [1006]	4.430 [112.5]	0.987 [25.1]	0.071 [1.80]	0.540 [13.7]	0.365 [9.3]
14 [43]	7.64 [11.37]	7.72 [11.49]	1.693 [43.0]	2.25 [1452]	5.32 [135.1]	1.185 [30.1]	0.085 [2.16]	0.648 [16.5]	0.438 [11.1]
18 [57]	13.59 [20.22]	13.72 [20.43]	2.257 [57.3]	4.00 [2581]	7.09 [180.1]	1.58 [40.1]	0.102 [2.59]	0.864 [21.9]	0.584 [14.8]

^A The 400 and Duplex-Alloy Series is based on a density of 489.59 lb/ft³ [7833.4 kg/m³]. The 300 Series is based on a density of 494.78 lb/ft³ [7916.5 kg/m³]. Density varies with alloy content which may result in a variation of several percent.

^B The nominal dimensions of a deformed bar are equivalent to those of a round bar having the same weight [mass] per foot [metre] as the deformed bar.

^C The maximum gap (measured as a chord) between the ends of the deformations shall not exceed 25 %/n of the nominal perimeter of the bar, where n is the number of longitudinal gaps or longitudinal ribs around the perimeter of the bar.



TABLE 2 Chemical Requirements of Typical Alloys^A

UNS		Composition %								
Designation	Type	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen
S24000	XM-29	0.08	11.50–14.50	0.060	0.030	1.00	17.00–19.00	2.25–3.75	...	0.20–0.40
S24100	XM-28	0.15	11.00–14.00	0.060	0.030	1.00	16.50–19.00	0.50–2.50	...	0.20–0.45
S30400	304	0.08	2.00	0.045	0.030	1.00	18.00–20.00	8.00–10.50	...	0.10
S31603	316L	0.03	2.00	0.045	0.030	1.00	16.00–18.00	10.00–14.00	2.00–3.00	0.10
S31653	316LN	0.03 max	2.00	0.045	0.030	1.00	16.00–18.00	10.00–14.00	2.00–3.00	0.10–0.16
S31803	...	0.03	2.00	0.030	0.020	1.00	21.00–23.00	4.50–6.50	2.50–3.50	0.08–0.20

TABLE 2 Chemical Composition^A

UNS		Composition %									
Designation ^B	Type ^C	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Other Elements
Austenitic Grades											
S24000	XM-29 ^D	0.08	11.5–14.5	0.060	0.030	1.00	17.0–19.0	2.3–3.7	...	0.20–0.40	...
S24100	XM-28 ^D	0.15	11.0–14.0	0.045	0.030	1.00	16.5–19.0	0.50–2.50	...	0.20–0.45	...
S31653	316LN	0.030	2.00	0.045	0.030	1.00	16.0–18.0	10.0–13.0	2.00–3.00	0.10–0.16	...
Austenitic-Ferritic (Duplex) Grades											
S31803	2205 ^E	0.030	2.00	0.030	0.020	1.00	21.0–23.0	4.5–6.5	2.5–3.5	0.08–0.20	...
S32101	...	0.040	4.0–6.0	0.040	0.030	1.00	21.0–22.0	1.35–1.70	0.10–0.80	0.20–0.25	Cu 0.10–0.80
S32205	2205 ^D	0.030	2.00	0.030	0.020	1.00	22.0–23.0	4.5–6.5	3.0–3.5	0.14–0.20	...
S32304	2304 ^D	0.030	2.50	0.040	0.030	1.00	21.5–24.5	3.0–5.5	0.05–0.60	0.05–0.20	Cu 0.05–0.60

^A Maximum, unless otherwise indicated. Where ellipses (...) appear in this table, there is no requirement and the element need not be determined or reported.

^B Unified Numbering System, UNS, is the designation for a metal or alloy described and established by Practice E527 and SAE J 1086.

^C Unless otherwise indicated, a grade designation originally assigned by the American Iron and Steel Institute (AISI).

^D Naming system developed and applied by ASTM.

^E Common name, not a trademark, widely used in the concrete industry, not associated with any one manufacturer.



1.10 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

1.11 The values stated in either inch-pound 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 are not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the ~~standard specification~~.

1.12 *This specification does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this specification to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.13 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[A6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling](#)

~~[A276/A276M Specification for Stainless Steel Bars and Shapes](#)~~

[A342/A342M Test Methods for Permeability of Weakly Magnetic Materials](#)

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A484/A484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings](#)

[A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products](#)

[A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys](#)

[C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory](#)

[E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)

[E290 Test Methods for Bend Testing of Material for Ductility](#)

[E527 Practice for Numbering Metals and Alloys in the Unified Numbering System \(UNS\)](#)

[G3 Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing](#)

2.2 U.S. Military Standard:³

[MIL-STD-129 Marking for Shipment and Storage](#)

2.3 U.S. Federal Standard:³

[Fed. Std. No. 123 Marking for Shipment \(Civil Agencies\)](#)

2.4 AWS Standard:⁴

[AWS D1.6/D1.6M Structural Welding Code – Stainless Steel](#)

2.5 SAE Document:⁵

[SAE J 1086 Recommended Practice for Numbering Metals and Alloys](#)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to 3.2 and Terminology A941.

3.2 *Definitions of Terms Specific to This Specification:*

3.2.1 *deformations, n*—transverse protrusions on a deformed bar.

3.2.2 *deformed bar, n*—steel bar with protrusions; a bar that is intended for use as reinforcement in reinforced concrete construction.

3.2.2.1 *Discussion*—

The surface of the bar is provided with protrusions that inhibit longitudinal movement of the bar relative to the concrete surrounding the bar in such construction. The protrusions conform to the provisions of this specification.

3.2.3 *plain bar, n*—steel bar without protrusions.

3.2.4 *relative deformation area, n*—the ratio of the deformation bearing area (projected deformation area normal to the bar axis) to the shearing area (nominal bar perimeter times the average spacing of the deformations).

3.2.5 *rib, n*—longitudinal protrusion on a deformed bar.

~~3.1.6 *stainless steel, n*—a steel that contains 11 % or more chromium.~~

² 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.

³ Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

⁴ Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

⁵ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, <http://www.sae.org>.

3.2.6 *three-sided bar, n*—deformed steel bar with three rows of transverse deformations.

3.2.7 *two-sided bar, n*—deformed steel bar with two rows of transverse deformations.

4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for material ordered to this specification. Such requirements shall include but are not limited to the following: Orders for stainless steel bars for concrete reinforcement under this specification shall contain the following information

4.1.1 Quantity (weight) [mass],

4.1.2 Name of material (deformed and plain stainless steel bars for concrete reinforcement), Deformed or plain,

4.1.3 Chemical composition (stainless steel alloy), UNS number,

4.1.4 Heat treatment condition, Bar designation number (size) of deformed bars or nominal diameter (size) of plain bars,

4.1.5 Size,

4.1.5 Cut lengths or coils,

4.1.7 Deformed or plain,

4.1.6 Grade (strength level), and

4.1.9 Descaling method and finish,

4.1.10 Requirements for inspection (20.1),

4.1.11 Packaging (see Section 24),

4.1.12 Supplementary requirement (if desired), and

4.1.7 ASTM designation A955 [A955M] and year of issue.

4.2 The purchaser shall have the option to specify additional requirements, including but not limited to the following:

4.2.1 Requirements for inspection (19.1),

4.2.2 Packaging and package marking (Section 22),

4.2.3 Magnetic permeability supplementary requirement (S1) and

4.2.4 Other special requirements, if any.

5. Materials and Manufacture

5.1 The bars shall be rolled/processed from properly identified heats of moldd/mold-cast or strand east steel. strand-cast steel. The steel shall be made by any commercially acceptable process.

5.2 Bars shall be furnished in one of the following heat treatment conditions, as shown in Specification A276/A276M, and as needed to meet the requirements of this specification:

5.2.1 Annealed (A):

5.2.2 Hot rolled (HR):

5.2.3 Strain hardened (B):

NOTE 3—The mechanical properties of the material result from the heat treat condition of the material. Any further heat treatment of the material may alter those properties and affect their ability to meet the specified strength level. No re-treatment should be imposed without retesting to the requirements of this specification.

6. Chemical Composition

6.1 The steel shall conform to the requirements for chemical composition specified in Table 2.

6.2 The chemical analysis of each heat of steel shall be determined in accordance with Test Methods, Practices, and Terminology A751. The manufacturer shall make the analysis on test samples taken preferably during the pouring of the heat.

6.3 The chemical composition agreed to between manufacturer and purchaser steel shall conform to the requirements in Table 1 of Specification A276/A276M and shall conform to all applicable chemical composition requirements in Specification A484/A484M.

7. Requirements for Deformations

7.1 Deformations shall be spaced along the bar at substantially uniform distances. The deformations on all sides of the bar shall be similar in size, shape, and pattern.

7.2 The deformations shall be placed with respect to the axis of the bar so that the included angle is not less than 45°. Where the line of deformations forms an included angle with the axis of the bar of from 45 to 70° inclusive, the deformations on a two-sided bar shall alternately reverse in direction on each side or those on one side shall be reversed in direction from those on the opposite side. The deformations on three-sided bars shall reverse on one of the three sides (see Fig. 1). Where the line of deformation is over 70°, a reversal in direction is not required.

7.3 The average spacing or distance between deformations on each side of the bar shall not exceed seven tenths of the nominal diameter of the bar.

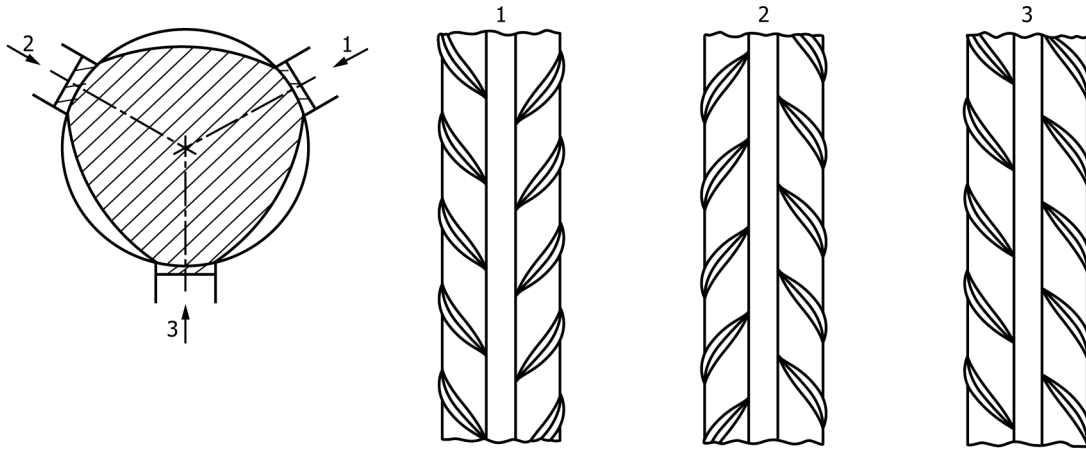


FIG. 1 Typical Three-Sided Deformed Bar

7.4 The overall length of deformations shall be such that the gap (measured as a chord) between the ends of the deformations shall not exceed 25 %/n, where n is the number of longitudinal gaps or longitudinal ribs, of the nominal perimeter of the bar. Where the ends of the deformations terminate in a longitudinal rib, the width of the longitudinal rib shall be considered as the gap between these ends. The summation of the gaps shall not exceed 25 % of the nominal perimeter of the bar. The nominal perimeter of the bar shall be 3.1416 times the nominal diameter.

7.5 The spacing, height, and gap of deformations shall conform to the requirements prescribed in Table 1.

8. Measurement of Deformations

8.1 The average spacing of deformations shall be determined by measuring the length of a minimum of ten spaces and dividing that length by the number of spaces included in the measurement. The measurement shall begin from a point on a deformation at the beginning of the first space to a corresponding point on a deformation after the last included space. Spacing measurements shall not be made over a bar area containing bar marking symbols.

8.2 The average height of deformations shall be determined from measurements made on not less than two typical deformations. Determinations shall be based on three measurements per deformation, one at the center of the overall length and the other two at the quarter points of the overall length.

8.3 For three-sided bars, the relative deformation area, R_d , shall meet the requirements of Annex A4.

8.4 Insufficient height, insufficient circumferential coverage, or excessive spacing of deformations shall not constitute cause for rejection unless it has been clearly established by determinations on each lot (Note 42) tested that typical deformation height, gap, or spacing does not conform to the minimum requirements prescribed in Section 7. No rejection shall be made on the basis of measurements if fewer than ten adjacent deformations on each side of the bar are measured.

TABLE 3 Tensile Requirements^A

	Grade 60 [420]	Grade 75 [520]	Grade 80 [550]
Tensile strength, min, psi [MPa]	90 000 [620]	100 000 [690]	100 000 [690]
Yield strength, min, psi [MPa]	60 000 [420]	75 000 [520]	80 000 [550]
Ratio of actual tensile strength/actual yield strength, min	1.20	1.20	1.20
Ratio of actual tensile strength to actual yield strength, min	1.20	1.20	1.20
Elongation in 8 in. [200 mm], min, %			
Bar designation no.			
3, 4, 5 [10, 13, 16]	20	20	16
6 [19]	20	20	16
7, 8, 9, 10, 11, 14, 18 [22, 25, 29, 32, 36, 43, 57]	20	20	16

^A Consult with the manufacturer for availability of grades and bar sizes.