



Designation: A959 – 19

# Standard Guide for Specifying Harmonized Standard Grade Compositions for Wrought Stainless Steels<sup>1</sup>

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## 1. Scope\*

1.1 This guide provides a guide to ASTM Subcommittees A01.06, A01.10, A01.17, A01.22, and A01.28 for specifying chemical composition limits of wrought stainless steels. It is intended that these recommended grade composition limits be suitable for adoption by other standardization bodies that prepare standards for stainless steel products.

1.2 Included in this guide are the recommendations for determining the number of significant figures for specifying chemical composition from Test Methods, Practices, and Terminology [A751](#).

1.3 All stainless steel UNS numbers and the stainless steel grades in all standards overseen by the aforementioned ASTM subcommittees have been included, except those grades applicable to restricted special end uses and alloys containing less than 10.5 % minimum chromium.

1.4 Not addressed are minor composition modifications which a specific product subcommittee may find necessary to accommodate effects of normal processing or to enhance fabricability by the producer or user, or both.

1.5 Also not generally addressed (except when established by ASTM product subcommittees) is a complete rationalization of all limits, especially when such would conflict with long-standing practices and is not justified by special technical effect.

1.6 Excluded from this guide are cast material and welding filler metal.

1.7 *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.*

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee [A01](#) on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee [A01.17](#) on Flat-Rolled and Wrought Stainless Steel.

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## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

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

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

### 2.2 SAE Standards:<sup>3</sup>

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

[HS-1086](#) Metals and Alloys in the Unified Numbering System

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *austenitic grade, n*—metallurgical term meaning that the material is usually predominantly face-centered cubic in structure and hardenable only by cold working.

3.1.2 *austenitic-ferritic (duplex) grade, n*—metallurgical term meaning that the material is a mixture of austenitic and ferritic structures, with at least one-fourth of the lesser phase, and hardenable only by cold working.

3.1.3 *ferritic grade, n*—metallurgical term meaning that the material is body-centered cubic in structure (with little, if any, tempered martensite) and hardenable only slightly by cold working (responding little or only slightly to conventional heat treatment by quenching and tempering).

3.1.4 *martensitic grade, n*—metallurgical term meaning that the material is capable of being produced in a distorted body-centered cubic structure by conventional heat treating and quenching, and that the quenched structure is capable of conventional tempering. Martensitic grades are delivered in the annealed (ferritic) condition or the hardened and tempered (martensitic) condition.

3.1.5 *precipitation hardening grade, n*—metallurgical term meaning that the material may be basically austenitic or

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

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

martensitic in structure and hardenable by precipitation hardening (sometimes called age hardening).

3.1.6 *standard stainless steel grade, n*—listed chemical composition associated with a stainless steel grade identified by a particular UNS number appearing in SAE publication HS-1086, except as modified by an ASTM subcommittee having oversight of a wrought stainless steel product where such a modification is justified by a specific technical effect.

#### 4. Significance and Use

4.1 It is anticipated that the ASTM Subcommittees A01.06, A01.10, A01.17, A01.22, and A01.28 will use the standard composition limits listed in this guide for the grades identified by the corresponding UNS designation in the product specification unless there is a specific technical justification for doing otherwise. The compositions in this guide shall not be considered as chemical requirements for any particular product until adopted by the subcommittee overseeing that product.

4.2 Assuming that uniform compositions among the many product standards for stainless steel are desirable, the composition limits provided in this standard are to be used as guides in determining limits for each of the elements included in the total composition of each grade. The composition limits have been established with the intent that each product subcommittee will find it necessary to require only a minimum number of changes to reflect specific technical effects. Section 5 lists the general guidelines followed for determining the limits for each element; the limits established in this guide are based on these guidelines.

4.3 Not included in this standard stainless steel grade harmonization effort is an attempt to unify stainless steel compositions in ASTM product standards by any means other than recognizing current industry practices.

#### 5. General Guidelines Used for Determining Composition Limits

5.1 *Carbon*—It is recommended that limits be to only two decimal places for levels of 0.04 % and higher because it is not necessary to control to such precision at levels above 0.04 %. (It should be recognized that limits such as 0.045 % maximum may also be simply stated as 0.04 % maximum.) It is also recommended that three decimal places be used at levels of 0.030 % and lower, unless, for example, it is clearly recognized that 0.03 % maximum means that 0.035 % is satisfactory.

5.2 *Manganese*—Except for the Cr-Ni-Mn grades (S2XXXX), it is recommended that limits of 2 % maximum and 1 % maximum be used for the austenitic and other grades respectively, except for the free machining grades with high sulfur or selenium, or when necessary to promote nitrogen solubility.

5.3 *Phosphorus*—It is recommended that 0.045 % maximum be applied to austenitic grades, and 0.040 % maximum to other grades unless the sponsoring producer recommends a

lower limit for specific technical effect. *Exception*—some of the Cr-Ni-Mn austenitic grades have always been produced to 0.060 % maximum.

5.4 *Sulfur*—It is recommended that 0.030 % maximum be applied to all grades except the free-machining grades unless lower limits have been required for specific technical effects.

5.5 *Silicon*—Past practice has been to establish 0.75 % maximum for tubular related products such as flat rolled and tubulars, and 1.00 % maximum for long products and forgings. For grades produced both as long and flat-rolled products, 1 % maximum was chosen since it will also include products melted to lower limits. Use of lower or higher limits should be based on specific technical effect.

5.6 *Chromium*—A composition spread of 2 % is recommended; existing broader limits were not reduced to less than a 3 % spread.

5.7 *Nickel*—It is recommended that the composition spread not exceed 3 % unless a broader (generally higher) spread is justified by specific technical effect.

5.8 *Molybdenum*—It is recommended that the composition spread not exceed 1 %, unless a broader range is justified by specific technical effect. Molybdenum limits having only a maximum limit but no minimum should not be used unless justified by specific technical effect.

5.9 *Nitrogen*—It is recommended that nitrogen limits having only a maximum limit but no minimum should not be used unless justified by specific technical effect.

5.10 *Copper*—It is recommended that copper limits having only a maximum limit but no minimum should not be used unless justified by specific technical effect.

5.11 *Columbium and Tantalum*—Except for special applications requiring positive identification of tantalum, it is recommended that prior listings of these two elements together be limited to listing only columbium. The words “columbium” and “niobium” refer to the same element.

#### 6. Harmonized Standard Grade Stainless Steel Compositions

6.1 The harmonized composition limits are shown in Table 1, grouped by metallurgical classification, that is, austenitic, austenitic-ferritic, and so forth. Within those groups, grades are listed by UNS designation, in numerical order.

6.2 Unless adopted by the appropriate product subcommittee in a product standard, the compositions described in this guide shall not be used for specifying an ASTM product.

#### 7. Keywords

7.1 austenitic stainless steels; austenitic-ferritic or ferritic-austenitic stainless steels; duplex stainless steels; ferritic stainless steels; harmonized stainless steel compositions; martensitic stainless steels; precipitation hardening stainless steels; standard stainless steel grade compositions

TABLE 1 Chemical Composition Limits, %<sup>A</sup>

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Other Elements
Austenitic Grades												
S16800	16-8-2H <sup>D</sup>	0.05–0.10	2.00	0.045	0.030	1.00	14.5–16.5	7.5–9.5	1.50–2.00	...	...	...
S20100	201	0.15	5.5–7.5	0.060	0.030	1.00	16.0–18.0	3.5–5.5	...	...	...	...
S20103	201L	0.03	5.5–7.5	0.045	0.030	1.00	16.0–18.0	3.5–5.5	...	...	...	...
S20153	201LN <sup>D</sup>	0.03	6.4–7.5	0.045	0.015	1.00	16.0–17.5	4.0	...	...	...	...
S20161	...	0.15	4.0–6.0	0.045	0.030	3.0–4.0	15.0–18.0	4.0	...	...	...	...
S20162	...	0.15	4.0–8.0	0.040	0.040	2.5–4.5	16.5–21.0	...	...	...	...	...
S20200	202	0.15	7.5–10.0	0.060	0.030	1.00	17.0–19.0	...	...	...	...	...
S20300	XM-1 <sup>E</sup>	0.08	5.0–6.5	0.045	0.18–0.35	1.00	16.0–18.0	...	...	...	...	...
S20400	...	0.030	7.0–9.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S20430	...	0.15	6.5–9.0	0.060	0.030	1.00	16.0–18.0	...	...	...	...	...
S20431	...	0.12	5.0–7.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S20432	...	0.08	3.0–5.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S20433	...	0.08	5.5–7.5	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S20500	205	0.12–0.25	14.0–15.0	0.060	0.030	1.00	16.0–18.0	...	...	...	...	...
S20910	XM-19 <sup>E</sup>	0.06	4.0–6.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S21400	XM-31 <sup>E</sup>	0.12	14.0–16.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S21460	XM-14 <sup>E</sup>	0.12	14.0–16.0	0.060	0.030	1.00	16.0–18.0	...	...	...	...	...
S21500	...	0.06–0.15	5.5–7.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S21600	XM-17 <sup>E</sup>	0.08	7.5–9.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S21603	XM-18 <sup>E</sup>	0.03	7.5–9.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S21640	...	0.08	3.5–6.5	0.060	0.030	1.00	16.0–18.0	...	...	...	...	...
S21800	...	0.10	7.0–9.0	0.060	0.030	1.00	16.0–18.0	...	...	...	...	...
S21900	XM-10 <sup>E</sup>	0.08	8.0–10.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S21904	XM-11 <sup>E</sup>	0.04	8.0–10.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S24000	XM-29 <sup>E</sup>	0.08	11.5–14.5	0.060	0.030	1.00	16.0–18.0	...	...	...	...	...
S24100	XM-28 <sup>E</sup>	0.15	11.0–14.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S28200	...	0.15	17.0–19.0	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30100	301	0.15	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30103	301L <sup>D</sup>	0.030	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30116	301Si	0.15	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30153	301LN <sup>D</sup>	0.030	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30200	302	0.15	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30215	302B	0.15	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30300	303	0.15	2.00	0.20	0.15 min	1.00	16.0–18.0	...	...	...	...	...
S30310	XM-15 <sup>E</sup>	0.15	2.5–4.5	0.20	0.25 min	1.00–2.00	16.0–18.0	...	...	...	...	...
S30323	303Se	0.15	2.00	0.20	0.06	1.00	16.0–18.0	...	...	...	...	...
S30345	XM-2 <sup>E</sup>	0.15	2.00	0.05	0.11–0.16	0.30	16.0–18.0	...	...	...	...	...
S30400	304	0.07	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30403	304L	0.030	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30409	304H	0.04–0.10	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30415	...	0.04–0.06	0.80	0.045	0.030	1.00–2.00	16.0–18.0	...	...	...	...	...
S30430	...	0.03	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30432	...	0.07–0.13	0.50	0.045	0.030	0.30	16.0–18.0	...	...	...	...	...
S30434	...	0.07–0.14	2.00	0.040	0.010	1.00	17.5–19.5	8.0–11.0	...	...	...	...
S30435	...	0.08	2.00	0.045	0.030	1.00	16.0–18.0	...	...	...	...	...
S30441	...	0.08	2.00	0.045	0.030	1.0–2.0	17.5–19.5	8.0–11.0	...	...	...	...
S30451	304N	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–11.0	...	...	...	...
S30452	XM-21 <sup>E</sup>	0.08	2.00	0.045	0.030	1.00	18.0–20.0	8.0–10.0	...	...	...	...



TABLE 1 Continued

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Other Elements
S30453	304LN	0.030	2.00	0.045	0.030	1.00	18.0–20.0	8.0–13.0	0.010	
S30454	304LHN <sup>D</sup>	0.03	2.00	0.045	0.030	1.00	18.0–20.0	8.0–13.0	0.010	
S30500	305	0.12	2.00	0.045	0.030	1.00	17.0–19.0	8.0–13.0	0.010	
S30530	...	0.08	2.00	0.045	0.030	0.50–2.50	17.0–20.0	8.0–13.0	0.010	
S30600	...	0.018	2.00	0.020	0.020	3.7–4.3	17.0–20.0	8.0–13.0	0.010	
S30601	...	0.015	0.50–0.80	0.030	0.013	5.0–5.6	17.0–20.0	8.0–13.0	0.010	
S30615	...	0.16–0.24	2.00	0.030	0.030	3.2–4.0	17.0–20.0	8.0–13.0	0.010	
S30800	308	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30815	...	0.05–0.10	0.80	0.040	0.030	1.40–2.00	17.0–20.0	8.0–13.0	0.010	
S30900	309	0.20	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30908	309S	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30909	309H <sup>D</sup>	0.04–0.10	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30925	309LMoN <sup>D</sup>	0.025	2.00	0.040	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30940	309Nb <sup>D</sup>	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30941	309HNB <sup>D</sup>	0.04–0.10	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S30942	...	0.03–0.10	2.00	0.040	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31000	310 <sup>D</sup>	0.25	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31002	...	0.015	2.00	0.020	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31008	310S	0.08	2.00	0.045	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31009	310H <sup>D</sup>	0.04–0.10	2.00	0.045	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31025	310MoNbN <sup>D</sup>	0.10	1.50	0.030	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31035	...	0.04–0.10	0.60	0.025	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31040	310Nb <sup>D</sup>	0.08	2.00	0.045	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31041	310HNB <sup>D</sup>	0.04–0.10	2.00	0.045	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31042	310HNB <sup>D</sup>	0.04–0.10	2.00	0.045	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31050	310MoLN <sup>D</sup>	0.030	2.00	0.030	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31060	...	0.05–0.10	1.00	0.040	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31254	...	0.020	1.00	0.030	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31266	...	0.030	2.0–4.0	0.035	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31272	...	0.08–0.12	1.50–2.00	0.030	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31277	...	0.020	3.00	0.030	0.010	1.00	17.0–20.0	8.0–13.0	0.010	
S31400	314 <sup>D</sup>	0.25	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31600	316	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31603	316L	0.030	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31609	316H	0.04–0.10	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31635	316Ti <sup>D</sup>	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31640	316Nb <sup>D</sup>	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31651	316N	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31653	316LN	0.030	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31654	316LHN <sup>D</sup>	0.03	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31700	317	0.08	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31703	317L <sup>D</sup>	0.030	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31725	317LM	0.030	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31726	317LMN	0.030	2.00	0.045	0.030	1.00	17.0–20.0	8.0–13.0	0.010	
S31727	...	0.030	1.00	0.030	0.030	1.00	17.5–19.0	11.0–13.0	0.010	
S31753	317LN <sup>D</sup>	0.030	2.00	0.045	0.030	1.00	18.0–20.0	20.0–23.0	0.010	
S32050	...	0.030	1.50	0.035	0.020	1.00	22.0–24.0	24.0–26.0	0.010	
S32053	...	0.030	1.00	0.030	0.010	1.00	22.0–24.0	24.0–26.0	0.010	
S32100	321	0.08	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0	0.010	0.010 max, 0.70 max



TABLE 1 Continued

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Other Elements
S32109	321H	0.04–0.10	2.00	0.045	0.030	1.00	17.0–19.0	9.0–12.0		
S32615	...	0.07	2.00	0.045	0.030	4.8–6.0	16.5–19.5	19.0–21.0		
S32654	...	0.020	2.0–4.0	0.030	0.005	0.50	24.0–25.0			
S33228	...	0.04–0.08	1.00	0.020	0.015	0.30	26.0–28.0			
S33400	334 <sup>D</sup>	0.08	1.00	0.030	0.015	1.00				
S33425	...	0.08	1.50	0.045	0.020	1.00				
S33550	...	0.04–0.10	1.50	0.040	0.030	1.00				
S34565	...	0.030	5.0–7.0	0.030	0.010					
S34700	347	0.08	2.00	0.045	0.030					
S34705	...	0.05	2.00	0.040	0.030					
S34709	347H	0.04–0.10	2.00	0.045	0.030					
S34710	...	0.06–0.10	2.00	0.045	0.030					
S34751	...	0.015	2.00	0.020	0.03					
S34800	348	0.08	2.00	0.045	0.03					
S34809	348H	0.04–0.10	2.00	0.045	0.03					
S35045	...	0.06–0.10	1.50	0.045	0.03					
S35115	...	0.030	1.00	0.045	0.03					
S35125	...	0.10	1.00–1.50	0.045	0.03					
S35140	...	0.10	1.00–3.00	0.045	0.03					
S35315	...	0.04–0.08	2.00	0.045	0.03					
S38100	XM-15 <sup>E</sup>	0.08	2.00	0.030	0.03					
S38400	...	0.04	2.00	0.045	0.03					
S38815	...	0.030	2.00	0.045	0.020					
S66220	622 <sup>D</sup>	0.08	1.50	0.040	0.030					
S66286	...	0.08	2.00	0.040	0.030					
N08020	...	0.07	2.00	0.045	0.035					
N08367	...	0.030	2.00	0.040	0.030	1.00				
N08700	...	0.04	2.00	0.040	0.030	1.00				
N08800	800 <sup>D</sup>	0.10	1.50	0.045	0.015	1.00				
N08810	800H <sup>D</sup>	0.05–0.10	1.50	0.045	0.015	1.00	19.0–21.0	23.0–28.0	4.0–6.0	0.015
N08811	...	0.06–0.10	1.50	0.040	0.015	1.00	19.0–23.0	24.0–26.0	6.0–7.0	...
N08904	904L <sup>D</sup>	0.020	2.00	0.040	0.030	1.00	19.0–23.0	23.0–28.0	4.0–6.0	0.015
N08926	...	0.020	2.00	0.030	0.010	0.50	19.0–21.0	24.0–26.0	6.0–7.0	...



TABLE 1 Continued

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickle	Molybdenum	Nitrogen	Copper	Other Elements
Austenite-Ferritic (Duplex) Grades												
S31100	XM-26 <sup>E</sup>	0.06	1.00	0.045	0.030	1.00	25.0–27.0	6.0–7.0	...	...	...	Ti 0.25
S31200	...	0.030	2.00	0.045	0.030	1.00	24.0–26.0	5.5–6.5	1.20–2.00	...	...	...
S31260	...	0.030	1.00	0.030	0.030	0.75	24.0–26.0	5.5–7.5	2.50	...	...	...
S31500	...	0.030	1.20–2.00	0.030	0.030	1.40–2.00	18.0–19.0	4.3–5.2	...	...	...	...
S31803	...	0.030	2.00	0.030	0.020	1.00	21.0–23.0	4.5–6.5	...	...	...	...
S32001	...	0.030	4.0–6.0	0.040	0.030	1.00	19.5–21.5	1.00–3.00	...	...	...	...
S32003	...	0.030	2.00	0.030	0.020	1.00	19.5–22.5	3.0–4.0	...	...	...	...
S32101	...	0.040	4.0–6.0	0.040	0.030	1.00	21.0–22.0	1.35–1.60	...	...	...	...
S32202	...	0.030	2.00	0.040	0.010	1.00	21.5–24.0	1.00–1.30	...	...	...	...
S32205	2205 <sup>D</sup>	0.030	2.00	0.030	0.020	1.00	22.0–23.0	1.00–1.30	...	...	...	...
S32304	2304 <sup>D</sup>	0.030	2.50	0.040	0.030	1.00	21.5–24.5	...	...	...	...	...
S32506	...	0.030	1.00	0.040	0.015	0.90	24.0–26.0	...	...	...	...	...
S32520	...	0.030	1.50	0.035	0.020	0.80	24.0–26.0	...	...	...	...	...
S32550	255 <sup>D</sup>	0.04	1.50	0.040	0.030	1.00	24.0–27.0	...	...	...	...	...
S32750	2507 <sup>D</sup>	0.030	1.20	0.035	0.020	0.80	24.0–26.0	...	...	...	...	...
S32760	...	0.030	1.00	0.030	0.010	1.00	24.0–26.0	...	...	...	...	...
S32808	...	0.030	1.10	0.030	0.010	0.50	27.0–27.9	...	...	...	...	...
S32900	329	0.08	1.00	0.040	0.030	0.75	23.0–28.0	...	...	...	...	...
S32906	...	0.030	0.80–1.50	0.030	0.030	0.50	28.0–30.0	...	...	...	...	...
S32950	...	0.030	2.00	0.035	0.010	0.60	26.0–29.0	...	...	...	...	...
S39274	...	0.030	1.00	0.030	0.020	0.80	24.0–26.0	...	...	...	...	...
S39277	...	0.025	0.80	0.025	0.002	0.80	24.0–26.0	6.5–7.0	...	...	...	...
S81921	...	0.030	2.00–4.00	0.040	0.030	1.00	19.0–22.0	2.0–4.0	...	...	...	...
S82011	...	0.030	2.00–3.00	0.040	0.020	1.00	20.5–23.5	1.0–2.0	...	...	...	...
S82012	...	0.05	2.00–4.00	0.040	0.005	0.80	19.0–20.5	0.8–1.5	...	...	...	...
S82031	...	0.05	2.50	0.040	0.005	0.80	19.0–22.0	2.0–4.0	...	...	...	...
S82121	...	0.035	1.00–2.50	0.040	0.010	1.00	21.0–23.0	2.0–4.0	0.30	...	...	...
S82122	...	0.030	2.0–4.0	0.040	0.020	0.75	20.5–21.5	1.5–2.5	0.60	...	...	...
S82441	...	0.030	2.50–4.00	0.035	0.005	0.70	23.0–25.0	3.0–4.5	1.00–2.00	0.20	...	...
Ferritic Grades												
S18200	XM-34 <sup>E</sup>	0.08	2.50	0.040	0.15 min	1.00	17.5–19.5	...	1.50–2.50	...	...	...
S18235	...	0.025	0.50	0.040	0.15–0.35	1.00	17.5–18.5	1.00	2.00–2.50	...	...	0.030–1.00, 0.035 max
S32803	...	0.015	0.50	0.020	0.005	0.55	28.0–29.0	3.0–4.0	1.80	...	...	0.050, 0.030 min
S40500	405	0.08	1.00	0.040	0.030	1.00	11.5–14.5	0.50	...	...	...	...
S40800	...	0.08	1.00	0.045	0.045	1.00	11.5–13.0	0.80	...	...	...	...
S40900	409	0.08	1.00	0.045	0.030	1.00	10.5–11.7	0.50	...	...	...	...
S40910	...	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	...	...	...
S40920	...	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	...	...	...
S40930	...	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	...	...	0.050 max;
S40940	409Nb <sup>D</sup>	0.06	1.00	0.045	0.040	1.00	10.5–11.7	0.50	...	...	...	...
S40945	...	0.030	1.00	0.040	0.030	1.00	10.5–11.7	0.50	...	...	...	...
S40975	...	0.030	1.00	0.040	0.030	1.00	10.5–11.7	0.50–1.00	...	...	...	0.050 max
S40976	...	0.030	1.00	0.040	0.030	1.00	10.5–11.7	0.75–1.00	...	...	...	0.050 min, 0.80 max
S40977	...	0.030	1.50	0.040	0.015	1.00	10.5–12.5	0.30–1.00	...	...	...	...
S41045	...	0.030	1.00	0.040	0.030	1.00	12.0–13.0	0.50	...	...	...	0.050 max(C+N) min, 0.60 max

TABLE 1 Continued

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Other Elements
S41050	...	0.04	1.00	0.045	0.030	1.00	10.5–12.5	0.60–1.10	...	...
S41603	...	0.08	1.25	0.06	0.15 min	1.00	12.0–14.0	...	...	...
S42035	...	0.08	1.00	0.045	0.030	1.00	13.5–15.5	1.00	...	...
S42900	429 <sup>D</sup>	0.12	1.00	0.040	0.030	1.00	14.0–16.0	...	...	...
S43000	430	0.12	1.00	0.040	0.030	1.00	16.0–18.0	...	...	...
S43020	430F	0.12	1.25	0.06	0.15 min	1.00	16.0–18.0	...	...	...
S43023	430FSe <sup>D</sup>	0.12	1.25	0.06	0.06	1.00	16.0–18.0	...	...	...
S43035	439	0.030	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S43036	430Ti <sup>D</sup>	0.10	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S43400	434	0.12	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S43600	436	0.12	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S43932	...	0.030	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S43940	...	0.030	1.00	0.040	0.015	1.00	17.0–19.0	...	...	...
S44100	...	0.030	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44200	442 <sup>D</sup>	0.20	1.00	0.040	0.040	1.00	17.0–19.0	...	...	...
S44300	443 <sup>D</sup>	0.20	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44330	...	0.025	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44400	444	0.025	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44500	...	0.020	1.00	0.040	0.012	1.00	17.0–19.0	...	...	...
S44535	...	0.030	0.30–0.80	0.050	0.020	0.50	17.0–19.0	...	...	...
S44536	...	0.015	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44600	446	0.20	1.50	0.040	0.030	1.00	17.0–19.0	...	...	...
S44626	XM-33 <sup>E</sup>	0.06	0.75	0.040	0.020	0.75	17.0–19.0	...	...	...
S44627	XM-27 <sup>E</sup>	0.010	0.40	0.020	0.020	0.40	17.0–19.0	...	...	...
S44635	25-4-4 <sup>D</sup>	0.025	1.00	0.040	0.030	0.75	17.0–19.0	...	...	...
S44660	26-3-3 <sup>D</sup>	0.030	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44700	29-4 <sup>D</sup>	0.010	0.30	0.025	0.020	0.20	17.0–19.0	...	...	...
S44725	...	0.015	0.40	0.040	0.020	0.040	17.0–19.0	...	...	...
S44735	...	0.030	1.00	0.040	0.030	1.00	17.0–19.0	...	...	...
S44800	29-4-2 <sup>D</sup>	0.010	0.30	0.025	0.020	0.20	17.0–19.0	2.00–2.50	...	...
S46800	...	0.030	1.00	0.040	0.030	1.00	18.0–20.0	0.50	...	...
Martensitic Grades										
S40300	403	0.15	1.00	0.040	0.030	0.50	11.5–13.0	...	...	...
S41000	410	0.15	1.00	0.040	0.030	1.00	11.5–13.5	...	...	...
S41003	...	0.030	1.50	0.040	0.030	1.00	10.5–12.5	1.50	...	...
S41005	...	0.10–0.15	0.25–0.80	0.018	0.015	0.50	11.5–13.0	0.75	0.50	...
S41008	410S	0.08	1.00	0.040	0.030	1.00	11.5–13.5	...	...	...
S41026	...	0.15	1.00	0.02	0.02	1.00	11.5–13.5	1.00–2.00	0.40–0.60	...
S41040	410Nb <sup>D</sup>	0.18	1.00	0.040	0.030	1.00	11.5–13.0	...	...	...
S41041	...	0.13–0.18	0.40–0.60	0.030	0.030	0.50	11.5–13.0	0.50	0.20	...



TABLE 1 Continued

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Other Elements
S41400	414	0.15	1.00	0.040	0.030	1.00	11.5–13.5	1.25–2.50		
S41425	...	0.05	0.50–1.00	0.020	0.005	0.50	12.0–15.0	4.0–7.0		
S41428	...	0.10–0.17	0.65–1.05	0.020	0.015	0.10–0.35	11.3–12.7	2.3–3.0		
S41500	...									
S41600	416	0.05	0.50–1.00	0.030	0.030	0.60	11.5–13.5	1.25–2.50		
S41610	XM-6 <sup>E</sup>	0.15	1.25	0.06	0.15 min	1.00	12.0–15.0	4.0–7.0		
S41623	416Se <sup>D</sup>	0.15	1.50–2.50	0.06	0.15 min	1.00	12.0–15.0	4.0–7.0		
S41800	615 <sup>D</sup>	0.15	1.25	0.06	0.06	1.00	12.0–15.0	4.0–7.0		
S42000	420	0.15–0.20	0.50	0.040	0.030	0.50	11.5–13.5	1.25–2.50		
S42010	...	0.15 min	1.00	0.040	0.030	1.00	12.0–15.0	4.0–7.0		
S42010	...	0.15–0.30	1.00	0.040	0.030	1.00	12.0–15.0	4.0–7.0		
S42020	420F	0.30–0.40	1.25	0.06	0.15 min	1.00	12.0–15.0	4.0–7.0		
S42023	420FSe <sup>D</sup>	0.20–0.40	1.25	0.06	0.06	1.00	12.0–15.0	4.0–7.0		
S42200	616 <sup>D</sup>	0.20–0.25	0.50–1.00	0.025	0.025	0.50	12.0–15.0	4.0–7.0		
S42225	...	0.20–0.25	0.50–1.00	0.020	0.010	0.20–0.50	12.0–15.0	4.0–7.0		
S44226	...	0.15–0.20	0.50–0.80	0.020	0.010	0.20–0.60	12.0–15.0	4.0–7.0		
S42300	619 <sup>D</sup>	0.27–0.32	0.95–1.35	0.025	0.025	0.50	11.0–12.5	2.00–3.00		
S43035	439	0.030	1.00	0.040	0.030	1.00	17.0–18.0	0.75–1.50		
S43100	431	0.20	1.00	0.040	0.030	1.00	15.0–17.0	0.40–0.80		
S44002	440A	0.60–0.75	1.00	0.040	0.030	1.00	16.0–18.0	0.40–0.80		
S44003	440B	0.75–0.95	1.00	0.040	0.030	1.00	16.0–18.0	0.40–0.80		
S44004	440C	0.95–1.20	1.00	0.040	0.030	1.00	16.0–18.0	0.40–0.80		
S44020	440F <sup>D</sup>	0.95–1.20	1.25	0.06	0.15 min	1.00	16.0–18.0	0.40–0.80		
S44023	440FSe <sup>D</sup>	0.95–1.20	1.25	0.06	0.06	1.00	16.0–18.0	0.40–0.80		
S44025	...	0.95–1.10	0.30–1.00	0.025	0.025	0.30–1.00	16.0–18.0	0.75–1.50		
S64152	XM-32 <sup>E</sup>	0.08–0.15	0.50–0.90	0.025	0.025	0.35	11.0–12.5	2.00–3.00		
Precipitation Hardening Grades										
S13800	XM-13 <sup>E</sup>	0.05	0.20	0.010	0.008	0.10	12.3–13.2	7.5–8.5	2.00–3.00	Al 0.90–1.35
S15500	XM-12 <sup>E</sup>	0.07	1.00	0.040	0.030	1.00	14.0–15.5	3.5–5.5	...	Nb 0.15–0.45
S15700	632 <sup>D</sup>	0.09	1.00	0.040	0.030	1.00	14.0–16.0	6.5–7.7	2.00–3.00	0.75–1.50
S17400	630 <sup>D</sup>	0.07	1.00	0.040	0.030	1.00	15.0–17.0	3.0–5.0	...	0.15–0.45
S17600	635 <sup>D</sup>	0.08	1.00	0.040	0.030	1.00	16.0–17.5	6.0–7.5	...	0.40, 0.75–1.50
S17700	631 <sup>D</sup>	0.09	1.00	0.040	0.030	1.00	16.0–18.0	6.5–7.7	...	0.120
S35000	633 <sup>D</sup>	0.07–0.11	0.50–1.25	0.040	0.030	0.50	16.0–17.0	4.0–5.0	2.5–3.0	0.150
S35500	634 <sup>D</sup>	0.10–0.15	0.50–1.25	0.040	0.030	0.50	15.0–16.0	4.0–5.0	2.5–3.0	0.150
S36200	XM-9 <sup>E</sup>	0.05	0.50	0.030	0.030	0.30	14.0–14.5	6.5–7.0	0.30–0.50	0.10–0.40
S45000	XM-25 <sup>E</sup>	0.05	1.00	0.040	0.030	1.00	14.0–16.0	5.0–7.0	0.50–1.00	0.90
S45500	XM-16 <sup>E</sup>	0.03	0.50	0.040	0.030	0.50	11.0–12.5	7.5–9.5	0.50	0.10–0.40
S45503	...	0.010	0.50	0.010	0.010	0.20	11.0–12.5	7.5–9.5	0.50	0.10–0.35, 0.100–1.35, Nb 0.10–0.50



TABLE 1 Continued

UNS Designation <sup>B</sup>	Type <sup>C</sup>	Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Other Elements
S46500	...	0.020	0.25	0.015	0.010	0.25	11.0–12.5	10.7–11.3	0.75–1.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03
S46910	...	0.030	1.00	0.030	0.015	0.70	11.0–13.0	8.0–10.0	3.5–4.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03
S63198	651 <sup>D</sup>	0.28–0.35	0.75–1.50	0.040	0.030	0.30–0.80	18.0–21.0	8.0–11.0	1.25–2.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03
S66220	662 <sup>D</sup>	0.08	0.40–1.00	0.040	0.030	0.40–1.00	12.0–15.0	24.0–28.0	1.25–2.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03
S66285	668 <sup>D</sup>	0.08	2.00	0.040	0.030	1.00	13.5–16.0	17.5–21.5	1.25–2.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03
S66286	660 <sup>D</sup>	0.08	2.00	0.040	0.030	1.00	13.5–16.0	24.0–27.0	1.25–2.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03
S66545	665 <sup>D</sup>	0.08	1.25–2.00	0.040	0.030	0.10–0.80	12.0–15.0	24.0–28.0	1.25–2.0	Al 0.01–0.03, B 0.01–0.03, C 0.02–0.03, Cu 0.01–0.03, N 0.005–0.010, P 0.010–0.015, S 0.005–0.010, Ti 0.01–0.03, V 0.01–0.03

<sup>A</sup> Maximum, unless range or minimum is indicated. When two limits are indicated for the same element in a single grade, the more stringent requirement shall apply.

<sup>B</sup> Designation established in accordance with Practice E527 and SAE J 1086.

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

<sup>D</sup> Common type number, not a trademark, widely used; not associated with any one product.

<sup>E</sup> Numbering system developed and applied by ASTM.

<sup>F</sup> Iron shall be determined arithmetically by difference of 100 minus the sum of the other specified elements.

<sup>G</sup> Grade S30434 shall have (Ti + 1/2 Nb) of not less than two times and not more than four times the carbon content.

<sup>H</sup> The terms Columbium (Cb) and Niobium (Nb) both refer to the same element.

## SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A959 – 16) that may impact the use of this standard. (Approved Nov. 15, 2019.)

(1) Modified Table 1 “Other Elements” for UNS S32760.

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