



Standard Guide for Specifying Harmonized Standard Grade Compositions for Wrought Carbon, Low-Alloy, and Alloy Steels¹

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^{ε1} NOTE—Units statement was inserted in 1.8 editorially in September 2015.

1. Scope*

1.1 This guide covers ASTM Subcommittees A01.02, A01.03, A01.06, A01.09, A01.11, A01.15, A01.19, A01.22, and A01.28 for specifying chemical composition limits of wrought carbon, low-alloy, and alloy steels. It is intended that these recommended grade composition limits be suitable for adoption by other standardization bodies that prepare standards for carbon, low-alloy, and alloy steel products, including discontinued steels.

1.2 Included in this guide are the recommendations for determining the number of significant figures for specifying chemical composition.

1.3 The carbon and alloy steel grades in all standards overseen by the aforementioned ASTM subcommittees have been included, except those grades applicable to restricted special end uses.

1.4 Not addressed are minor composition modifications that a specific ASTM 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 where established by ASTM subcommittees) is a complete rationalization of all limits, especially where such would conflict with long-standing practices and is not justified by special technical effect.

1.6 This guide does not address discontinued or formerly standard steel grades. A listing of such steel grades can be found in SAE J1249. Also excluded from this guide are cast materials and welding filler metals.

1.7 In 1995, the AISI made the decision to transfer the responsibility of maintaining its numbering system to the Society of Automotive Engineers (SAE) for carbon and alloy steels (SAE J403 and SAE J404) and to ASTM International

for stainless steels (Guide A959 and others). To inform users of this important event, historical information is included in the appendix of this standard.

1.8 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 ASTM Standards:²

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

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

[A959 Guide for Specifying Harmonized Standard Grade Compositions for Wrought Stainless Steels](#)

2.2 SAE Standards:³

[SAE J403 Chemical Compositions of SAE Carbon Steels](#)

[SAE J404 Chemical Compositions of SAE Alloy Steels](#)

[SAE J1013 Measurement of Whole Body Vibration of the Seated Operator of Off-Highway Work Machines](#)

[SAE J1249 Former SAE Standard and Former SAE EX-Steels](#)

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *long product, n*—generic term describing wrought bars, rod, wire, rail, tubing (welded and seamless), plate, and pipe.

3.1.1.1 *Discussion*—Product forms such as “C” shapes, “HP” shapes, “L” shapes, “M” shapes, “MC” shapes, “S” shapes, “W” shapes, and sheet piling are considered long products. Such product forms are produced to mechanical

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

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

properties and are not normally produced to the chemical compositions listed in this guide.

3.1.2 *flat product, n*—generic term describing wrought sheet and strip.

3.2 Refer to Terminology **A941** for additional definitions of terms used in this guide.

4. Significance and Use

4.1 It is anticipated that the ASTM Subcommittees A01.02, A01.03, A01.06, A01.09, A01.11, A01.15, A01.19, A01.22, and A01.28 will use the standard composition limits listed in this guide for the grades identified in their product specifications unless there is a specific technical justification for doing otherwise.

4.2 The composition limits given in this guide 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 ASTM 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 upon these guidelines.

5. General Guidelines Used for Determining Composition Limits

5.1 **Table 1** gives typical chemical composition limits for respective elements.

6. Harmonized Standard Grade Wrought Carbon, Low-Alloy, and Alloy Steel Compositions

6.1 The harmonized composition limits are given in **Tables 2-17**, grouped by metallurgical classification. Within all tables, grades are listed in numerical order.

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

6.3 Criteria for the addition of grades to the grade lists in this guide are as follows: (1) New grades will be considered based upon the grade meeting a standard grade designation and chemistry; (2) New grades shall have an annual production or consumption of 250 tons (225 Mg); (3) New grades shall have the sponsorship of at least two individual users or producers.

7. Keywords

7.1 alloy steels; carbon steels; harmonized carbon, low-alloy, and alloy steel compositions; low-alloy steels

TABLE 1 Expression of Chemical Composition Limits

Chemical Element	Chemical Composition Limit
C, Cr, Cu, Mn, Mo, Ni, Pb, Si	Two decimal places (0.xx %) or (1.xx %)
Al, Ca, N, Nb (Cb), P, S, Sn, Ti, V	Three decimal places (0.xxx %)
B	Four decimal places (0.xxxx %)

TABLE 2 Chemical Composition for Nonresulfurized Carbon Steels

Grade	Composition ^{A,B,C} %					
	C	Mn	P max	S max	P max	S max
			Long Product		Flat Product	
1001	0.01 max	0.35 max			0.030	0.035
1002	0.02 max	0.35 max			0.030	0.035
1003	0.04 max	0.35 max			0.030	0.035
1004	0.02/0.06	0.35 max			0.030	0.035
1005	0.06 max	0.35 max	0.040	0.050	0.030	0.035
1006 ^B	0.02/0.08	0.45 max			0.030	0.035
1006 ^D	0.08 max	0.25-0.45	0.040	0.050		
1006 ^E	0.08 max	0.45 max			0.030	0.035
1007	0.02/0.10	0.50 max			0.030	0.035
1008 ^D	0.10 max	0.30-0.50	0.040	0.050		
1008 ^E	0.10 max	0.50 max			0.030	0.035
1009	0.15 max	0.60 max			0.030	0.035
1010	0.08-0.13	0.30-0.60	0.040	0.050	0.030	0.035
1011	0.08-0.13	0.60-0.90	0.040	0.050		
1012	0.10-0.15	0.30-0.60	0.040	0.050	0.030	0.035
1013 ^{D, F}	0.11-0.16	0.50-0.80	0.040	0.050		
1013 ^E	0.11-0.16	0.30-0.60			0.030	0.035
1015	0.13-0.18	0.30-0.60	0.040	0.050	0.030	0.035
1016	0.13-0.18	0.60-0.90	0.040	0.050	0.030	0.035
1017	0.15-0.20	0.30-0.60	0.040	0.050	0.030	0.035
1018	0.15-0.20	0.60-0.90	0.040	0.050	0.030	0.035
1019	0.15-0.20	0.70-1.00	0.040	0.050	0.030	0.035
1020	0.18-0.23	0.30-0.60	0.040	0.050	0.030	0.035
1021	0.18-0.23	0.60-0.90	0.040	0.050	0.030	0.035
1022	0.18-0.23	0.70-1.00	0.040	0.050	0.030	0.035
1023	0.20-0.25	0.30-0.60	0.040	0.050	0.030	0.035
1024	0.18-0.25	1.30-1.65	0.035	0.035		
1025	0.22-0.28	0.30-0.60	0.040	0.050	0.030	0.035
1026	0.22-0.28	0.60-0.90	0.040	0.050	0.030	0.035
1027	0.22-0.29	1.20-1.55	0.035	0.035		
1029	0.25-0.31	0.60-0.90	0.040	0.050		
1030	0.28-0.34	0.60-0.90	0.040	0.050	0.030	0.035
1033	0.30-0.36	0.70-1.00	0.040	0.050	0.030	0.035
1034	0.32-0.38	0.50-0.80	0.040	0.050		
1035	0.32-0.38	0.60-0.90	0.040	0.050	0.030	0.035
1037	0.32-0.38	0.70-1.00	0.040	0.050	0.030	0.035
1038	0.35-0.42	0.60-0.90	0.040	0.050	0.030	0.035
1039	0.37-0.44	0.70-1.00	0.040	0.050	0.030	0.035
1040	0.37-0.44	0.60-0.90	0.040	0.050	0.030	0.035
1042	0.40-0.47	0.60-0.90	0.040	0.050	0.030	0.035
1043	0.40-0.47	0.70-1.00	0.040	0.050	0.030	0.035
1044	0.43-0.50	0.30-0.60	0.040	0.050		
1045	0.43-0.50	0.60-0.90	0.040	0.050	0.030	0.035
1046	0.43-0.50	0.70-1.00	0.040	0.050	0.030	0.035
1049	0.46-0.53	0.60-0.90	0.040	0.050	0.030	0.035
1050	0.48-0.55	0.60-0.90	0.040	0.050	0.030	0.035
1053	0.48-0.55	0.70-1.00	0.040	0.050		
1055	0.50-0.60	0.60-0.90	0.040	0.050	0.030	0.035
1059	0.55-0.65	0.50-0.80	0.040	0.050		
1060	0.55-0.65	0.60-0.90	0.040	0.050	0.030	0.035
1064	0.60-0.70	0.50-0.80	0.040	0.050	0.030	0.035
1065	0.60-0.70	0.60-0.90	0.040	0.050	0.030	0.035
1069	0.65-0.75	0.40-0.70	0.040	0.050		
1070	0.65-0.75	0.60-0.90	0.040	0.050	0.030	0.035
1070m ^G	0.65-0.75	0.80-1.10	0.025	0.025		
1071	0.65-0.70	0.75-1.05	0.040	0.050		
1074	0.70-0.80	0.50-0.80	0.040	0.050	0.030	0.035
1075	0.70-0.80	0.40-0.70	0.040	0.050		
1078	0.72-0.85	0.30-0.60	0.040	0.050	0.030	0.035
1080	0.75-0.88	0.60-0.90	0.040	0.050	0.030	0.035
1084	0.80-0.93	0.60-0.90	0.040	0.050	0.030	0.035
1085	0.80-0.93	0.70-1.00	0.040	0.050	0.030	0.035
1086	0.80-0.93	0.30-0.50	0.040	0.050	0.030	0.035