SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
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SURFACE VEHICLE STANDARD

SAE J404 | REV. FEB91

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Submitted for recognition as an American National Standard

Superseding J404 JAN89

(R) CHEMICAL COMPOSITIONS OF SAE ALLOY STEELS

1. Scope —In 1941, the SAE Iron and Steel Division in collaboration with the American Iron and Steel Institute made a major change in the method of expressing composition ranges for the SAE steels. The plan, as now applied, is based in general on narrower ladle analysis ranges plus certain product (check) analysis allowances on individual samples, in place of the fixed ranges and limits without tolerances formerly provided for carbon and other elements in SAE steels (reference J408). To avoid the possibility of confusion and conflict between SAE and AISI steel designations, all proposed changes in compositions, additions, or deletions of numbers will be coordinated between the two organizations.

The compositions in this SAE Standard may apply to open hearth and basic oxygen, or electric furnace steels. Grades shown in Tables 1A and 1B with prefix letter E are normally made by the electric furnace process with maximum limits of 0.035% phosphorus and 0.040% sulfur. The nominal chemical limits or ranges in the compositions given in Table 1A are subject to standard variations in check analysis given in SAE J409.

Table 1A is applicable to billets, blooms, slabs, and hot-rolled and cold-finished bars. This table is applicable also to wire rods, but there are additional grades in J1249 Table 1 (refer to footnote c) which also are standard for wire rods.

J404 is not applicable to the following product forms:

a. Structural shapes: Not normally furnished to alloy chemistries.
b. Sheet and strip, hot rolled and cold rolled: Refer to ASTM A 506 and A 507.
c. Seamless and welded mechanical tubing: Refer to ASTM A 513 and A 519.

2. References

2.1 Applicable Documents—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J408—Methods of Sampling Steel for Chemical Analysis

SAE J409—Product Analysis—Permissible Variations from Specified Chemical Analysis of a Heat or Cast of Steel

SAE J1249—Former SAE Standard and Former SAE Ex-Steels

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM A 506—Specification for Steel Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Regular Quality

ASTM A 507—Specification for Steel Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, Drawing Quality

ASTM A 513—Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

ASTM A 519—Specification for Seamless Carbon and Alloy Steel Mechanical Tubing

3. Cross Index to Equivalent Grades and Government Specifications—Attention is called to the SAE Aerospace Material Specifications (AMS) Index which is published twice a year. This index gives a cross reference to AMS grades, SAE grades, AISI grades, and Government Specifications (MIL, QQS, and so on) for metals, alloys, and nonmetallic materials.

4. Notes

4.1 Marginal Indicia—The (R) is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

PREPARED BY THE SAE IRON AND STEEL TECHNICAL COMMITTEE—
DIVISION 1—CARBON AND ALLOY STEELS

TABLE 1A—ALLOY STEEL COMPOSITIONS[1]

UNS No.	SAE No.	Ladle Chemical Composition Limits, % C	Mn	P	S	Si	Ni	Cr	Mo	V	Corresponding AISI No.
G13300	1330	0.28-0.33	1.60-1.90	0.035	0.040	0.15-0.35	—	—	—	—	1330
G13350	1335	0.33-0.38	1.60-1.90	0.035	0.040	0.15-0.35	—	—	—	—	1335
G13400	1340	0.38-0.43	1.60-1.90	0.035	0.040	0.15-0.35	—	—	—	—	1340
G40230	4023	0.20-0.25	0.70-0.90	0.035	0.040	0.15-0.35	—	—	0.20-0.30	—	4023
G40270	4027	0.25-0.30	0.70-0.90	0.035	0.040	0.15-0.35	—	—	0.20-0.30	—	4027
G40280	4028	0.25-0.30	0.70-0.90	0.035	0.035-0.050	0.15-0.35	—	—	0.20-0.30	—	4028
G40370	4037	0.35-0.40	0.70-0.90	0.035	0.040	0.15-0.35	—	—	0.20-0.30	—	4037
G40470	4047	0.45-0.50	0.70-0.90	0.035	0.040	0.15-0.35	—	—	0.20-0.30	—	4047
G41180	4118	0.18-0.23	0.70-0.90	0.035	0.040	0.15-0.35	—	0.40-0.60	0.08-0.15	—	4118
G41200	4120[4]	0.18-0.23	0.90-1.20	0.035	0.040	0.15-0.35	—	0.40-0.60	0.13-0.20	—	4120[4]
G41210	4121[44]	0.18-0.23	0.75-1.00	0.035	0.040	0.15-0.35	—	0.45-0.65	0.20-0.30	—	4121[44]
G41300	4130	0.28-0.33	0.40-0.60	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4130
G41310	4131	0.28-0.33	0.50-0.70	0.035	0.040	0.15-0.35	—	0.90-1.20	0.15-0.25	—	4131
G41370	4137	0.35-0.40	0.70-0.90	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4137
G41400	4140	0.38-0.43	0.75-1.00	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4140
G41420	4142	0.40-0.45	0.75-1.00	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4142
G41450	4145	0.43-0.48	0.75-1.00	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4145
G41470	4147	0.45-0.50	0.75-1.00	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4147
G41500	4150	0.48-0.53	0.75-1.00	0.035	0.040	0.15-0.35	—	0.80-1.10	0.15-0.25	—	4150
G43200	4320	0.17-0.22	0.45-0.65	0.035	0.040	0.15-0.35	1.65-2.00	0.40-0.60	0.20-0.30	—	4320
G43400	4340	0.38-0.43	0.60-0.80	0.035	0.040	0.15-0.35	1.65-2.00	0.70-0.90	0.20-0.30	—	4340
G43406	E4340[2]	0.38-0.43	0.65-0.85	0.025	0.025	0.15-0.35	1.65-2.00	0.70-0.90	0.20-0.30	—	E4340
G46200	4620	0.17-0.22	0.45-0.65	0.035	0.040	0.15-0.35	1.65-2.00	—	0.20-0.30	—	4620
G47150	4715[444]	0.13-0.18	0.70-0.90	0.035	0.040	0.15-0.35	0.70-1.00	0.45-0.65	0.45-0.60	—	4715[444]
G47200	4720	0.17-0.22	0.50-0.70	0.035	0.040	0.15-0.35	0.90-1.20	0.35-0.55	0.15-0.25	—	4720
G48150	4815	0.13-0.18	0.40-0.60	0.035	0.040	0.15-0.35	3.25-3.75	—	0.20-0.30	—	4815
G48200	4820	0.18-0.23	0.50-0.70	0.035	0.040	0.15-0.35	3.25-3.75	—	0.20-0.30	—	4820
G50461	50B46[3]	0.44-0.49	0.75-1.00	0.035	0.040	0.15-0.35	—	0.20-0.35	—	—	50B46
G51200	5120	0.17-0.22	0.70-0.90	0.035	0.040	0.15-0.35	—	0.70-0.90	—	—	5120
G51300	5130	0.28-0.33	0.70-0.90	0.035	0.040	0.15-0.35	—	0.80-1.10	—	—	5130
G51320	5132	0.30-0.35	0.60-0.80	0.035	0.040	0.15-0.35	—	0.75-1.00	—	—	5132
G51400	5140	0.38-0.43	0.70-0.90	0.035	0.040	0.15-0.35	—	0.70-0.90	—	—	5140
G51500	5150	0.48-0.53	0.70-0.90	0.035	0.040	0.15-0.35	—	0.70-0.90	—	—	5150
G51600	5160	0.56-0.64	0.75-1.00	0.035	0.040	0.15-0.35	—	0.70-0.90	—	—	5160
G51601	51B60[3]	0.56-0.64	0.75-1.00	0.035	0.040	0.15-0.35	—	0.70-0.90	—	—	51B60
G51986	E51100[2]	0.98-1.10	0.25-0.45	0.025	0.025	0.15-0.35	—	0.90-1.15	—	—	E51100
G52986	E52100[2]	0.98-1.10	0.25-0.45	0.025	0.025	0.15-0.35	—	1.30-1.60	—	—	E52100
G61500	6150	0.48-0.53	0.70-0.90	0.035	0.040	0.15-0.35	—	0.80-1.10	—	0.15 min	6150
G86150	8615	0.13-0.18	0.70-0.90	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8615
G86170	8617	0.15-0.20	0.70-0.90	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8617
G86200	8620	0.18-0.23	0.70-0.90	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8620
G86220	8622	0.20-0.25	0.70-0.90	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8622
G86300	8630	0.28-0.33	0.70-0.90	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8630
G86370	8637	0.35-0.40	0.75-1.00	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8637
G86400	8640	0.38-0.43	0.75-1.00	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8640

TABLE 1A—ALLOY STEEL COMPOSITIONS[1] (CONTINUED)

UNS No.	SAE No.	Ladle Chemical Composition Limits, %									Corresponding AISI No.
		C	Mn	P	S	Si	Ni	Cr	Mo	V	
G86450	8645	0.43-0.48	0.75-1.00	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.15-0.25	—	8645
G87200	8720	0.18-0.23	0.70-0.90	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.20-0.30	—	8720
G88220	8822	0.20-0.25	0.75-1.00	0.035	0.040	0.15-0.35	0.40-0.70	0.40-0.60	0.30-0.40	—	8822
G92590	9259	0.56-0.64	0.75-1.00	0.035	0.040	0.70-1.10	—	0.45-0.65	—	—	9259
G92600	9260	0.56-0.64	0.75-1.00	0.035	0.040	1.80-2.20	—	—	—	—	9260

[1] For standard variations in composition limits, see Table 4 of SAE J409. Small quantities of certain elements which are not specified or required may be found in alloy steels. These elements are to be considered as incidental and are acceptable to the following maximum amount: copper to 0.35%, nickel to 0.25%, chromium to 0.20%, and molybdenum to 0.06%.

[2] Electric furnace steel.

[3] Boron content is 0.0005 to 0.003%.

NOTE: Lead—Standard carbon steels can be produced with a range of 0.015 to 0.35% to improve machinability. Such steels are identified by inserting the letter "L" between the second and third numerals of the grade number, for example, 10L45. The UNS designation is also modified by changing the last digit to "4" to indicate lead, for example, G10454. Lead is generally reported as a range of 0.15/0.35%.

*Formerly EX15
**Formerly EX24
***Formerly EX30

TABLE 1B—ALLOY STEEL PLATE COMPOSITIONS[1,2,3] (OPEN HEARTH AND BASIC OXYGEN)

UNS No.	SAE No.	Ladle Chemical Composition Limits, %								
		C	Mn	P max	S max	Si[4]	Ni	Cr	Mo	V
G13300	1330	0.27-0.34	1.50-1.90	0.035	0.040	0.15-0.35	—	—	—	—
G13350	1335	0.32-0.39	1.50-1.90	0.035	0.040	0.15-0.35	—	—	—	—
G13400	1340	0.36-0.44	1.50-1.90	0.035	0.040	0.15-0.35	—	—	—	—
G13450	1345	0.41-0.49	1.50-1.90	0.035	0.040	0.15-0.35	—	—	—	—
G41180	4118	0.17-0.23	0.60-0.90	0.035	0.040	0.15-0.35	—	0.40-0.65	0.08-0.15	—
G41300	4130	0.27-0.34	0.35-0.60	0.035	0.040	0.15-0.35	—	0.80-1.15	0.15-0.25	—
G41350	4135	0.32-0.39	0.65-0.95	0.035	0.040	0.15-0.35	—	0.80-1.15	0.15-0.25	—
G41370	4137	0.33-0.40	0.65-0.95	0.035	0.040	0.15-0.35	—	0.80-1.15	0.15-0.25	—
G41400	4140	0.36-0.44	0.70-1.00	0.035	0.040	0.15-0.35	—	0.80-1.15	0.15-0.25	—
G41420	4142	0.38-0.46	0.70-1.00	0.035	0.040	0.15-0.35	—	0.80-1.15	0.15-0.25	—
G41450	4145	0.41-0.49	0.70-1.00	0.035	0.040	0.15-0.35	—	0.80-1.15	0.15-0.25	—
G43400	4340	0.36-0.44	0.55-0.80	0.035	0.040	0.15-0.35	1.65-2.00	0.60-0.90	0.20-0.30	—
G43406	E4340	0.37-0.44	0.60-0.85	0.025	0.025	0.15-0.35	1.65-2.00	0.65-0.90	0.20-0.30	—
G46150	4615	0.12-0.18	0.40-0.65	0.035	0.040	0.15-0.35	1.65-2.00	—	0.20-0.30	—
G46170	4617	0.15-0.21	0.40-0.65	0.035	0.040	0.15-0.35	1.65-2.00	—	0.20-0.30	—
G46200	4620	0.16-0.22	0.40-0.65	0.035	0.040	0.15-0.35	1.65-2.00	—	0.20-0.30	—
G51600	5160	0.54-0.65	0.70-1.00	0.035	0.040	0.15-0.35	—	0.60-0.90	—	—
G61500	6150	0.46-0.54	0.60-0.90	0.035	0.040	0.15-0.35	—	0.80-1.15	—	0.15 min
G86150	8615	0.12-0.18	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86170	8617	0.15-0.21	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86200	8620	0.17-0.23	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86220	8622	0.19-0.25	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86250	8625	0.22-0.29	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86270	8627	0.24-0.31	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86300	8630	0.27-0.34	0.60-0.90	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86370	8637	0.33-0.40	0.70-1.00	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86400	8640	0.36-0.44	0.70-1.00	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G86550	8655	0.49-0.60	0.70-1.00	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.15-0.25	—
G87420	8742	0.38-0.46	0.70-1.00	0.035	0.040	0.15-0.35	0.40-0.070	0.35-0.60	0.20-0.30	—

[1] Small quantities of certain elements not required may be found. These elements are to be considered as incidental and are acceptable to the following maximum amounts: copper to 0.35%, nickel to 0.25%, chromium to 0.20%, and molybdenum to 0.06%

[2] When electric furnace steel is ordered, the carbon range is restricted 0.01%, manganese 0.05%, chromium 0.05% up to 1.25% incl. and 0.10% over 1.25%. The maximum phosphorus and sulfur is 0.025% each.

[3] Boron or lead may be added to these compositions.

[4] Silicon available in ranges of 0.10 to 0.20%, 0.20 to 0.30%, and 0.35% maximum (when carbon deoxidized) when so specified by the purchaser.