SAE International™

SURFACE VEHICLE STANDARD

SAE J402

REV. JUL2005

Issued 1912-01
Revised 2005-07

Superseding J402 MAY1997

(R) New Steel Designation System for Wrought or Rolled Steel

1. Scope

This SAE Standard describes a new alphanumeric designation system for wrought steel used to designate wrought ferrous materials, identify chemical composition, and any other requirements listed in SAE Standards and Recommended Practices.

The previous SAE steel designation coding system consisted of four or five numbers used to designate standard carbon and alloy steels specified to chemical composition ranges. Using SAE 1035 as an example, the 35 represents the nominal weight % carbon content for the grade. Using SAE 52100 as an example, the 100 represents the nominal weight % carbon content. The first two numbers of this four or five number series are used to designate the steel grade carbon or alloy system with variations in elements other than carbon. These are described in Table 1. In addition to the standard four or five number steel designation above, a letter was sometimes added to the grade code to denote a non-standard specific element being added to the standard grade. For example, with SAE 10B21, B designates a boron addition; with SAE 12L14, L designates a lead addition; and with SAE 10V45, V designates a vanadium addition.

For many years, the SAE four or five character steel designation system has provided a simple way to identify and label steel grades. However, it is not comprehensive enough to allow for the accurate coding of popular new or non-standard chemistry grades, different chemistries for the same grade that traditionally have been associated with a specific product form, eg. SAE 1006 and SAE 1008, steel grades with dual chemistry and mechanical property requirements, microalloyed grades, and grades with both chemistry and hardenability requirements. As a result, these grades could not be properly recorded within the constraints of the previous steel designation system and were not included in the SAE steel grade Tables in SAE J403/J404 and other SAE documents. The new steel designation system is meant to ensure that the original or old SAE steel grades are still usable and both old and new SAE grades can be referenced uniformly between Standards organizations. Since the UNS numbering system for metals provides the basis for the recording of steel grades between North American and International Standards organizations, UNS was used as the framework of the new coding system. However, in order for the traditional five number UNS code to be used, it had to be expanded and modified to allow for an increase in the number of grades that would need to be classified in the future and to provide proper coding of new or non-standard element modifications, corresponding element ranges and dual hardenability, mechanical property or special processing requirements.

These new steel designations are the same in both the UNS and SAE systems, as described in this standard (J402) and the joint SAE J1086/ASTM E527 UNS Publication. An alphanumeric code has been developed to identify the composition of SAE steel grades.

1.1 Rationale

The name of J402 has been changed to reflect the "New SAE Steel Designation System for Wrought or Rolled Steel". SAE J402 has been completely rewritten to describe a new SAE/UNS steel designation system which will be used to identify current and new steel grades. This system will replace the old UNS designations used to identify modified SAE steel grades.

2. References

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

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

SAE J403—Chemical Compositions of SAE Carbon Steels
SAE J404—Chemical Compositions of SAE Alloy Steels
SAE J1086—Numbering Metals and Alloys
SAE J1249—Former SAE Standard and Former SAE Ex-Steels
SAE J1268—Hardenability Bands for Carbon and Alloy H Steels
SAE J1868—Restricted Hardenability Bands for Selected Alloy Steels
SAE HS-1086—Metals and Alloys in the Unified Numbering System

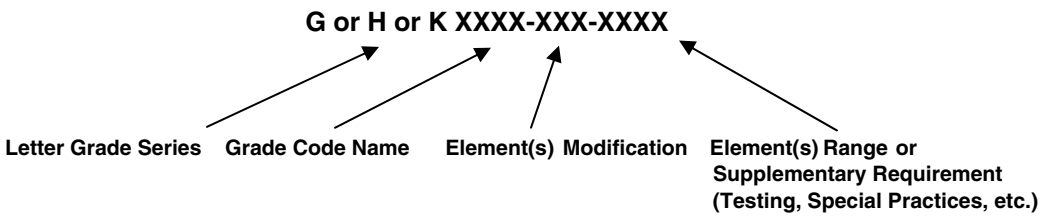
2.1.2 ASTM PUBLICATIONS

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM E 527—Practice for Numbering Metals and Alloys (UNS)
ASTM DS 56H—Metals and Alloys in the Unified Numbering System (UNS)

3. New SAE Steel Designation

The new SAE steel designation is a five character alphanumeric code consisting of a letter prefix "G", "H", or "K", and the conventional four number steel grade code. The first two numbers identify the characteristic carbon or alloy system and the last two numbers designate the nominal weight % carbon content. The four numeric descriptors will follow the current SAE steel specifications to enable continuity between this revised standard and prior standards. This five character code is followed by a three digit element modification code (reference Table 2) indicating the specific element(s) being modified, changed or added. The three digit code is then followed by a four digit code (reference Table 3) describing the modification in the chemical ranges and the Supplementary Requirements for Testing and Special Practices. The following illustrates the coding series for the new SAE grade designation.



Examples using the new coding system are presented in the footnotes at the end of Tables 3 and 4.

4. Grade Series

4.1 G Series Grades

The standard SAE "G" series will have "chemistry only" requirements. Standard SAE steel grades are listed in SAE J403 and J404 with their specified chemistry ranges. Since there are no element modifications for these steels, their three digit element modification codes and the four digit element modification range codes are all zeros, indicating that there are no modifications.

The new SAE steel designation provides for the coding of new, non-standard or modified steel grades by the use of a three number digit modification code followed by a four digit modified element range code. Both the standard and the modified steels will share the same initial five character identification code to indicate which standard grade forms the basis for the modified grade.

4.2 H Series Grades

The SAE "H" series will have a dual chemistry and hardenability requirement. The chemistry ranges and the hardenability requirements for standard SAE H and RH grades are listed in SAE J1268 and SAE J1868, respectively. Non-standard or modified grades will be coded with a three digit element modification code and a four digit element modification range code.

The hardenability requirement may be a Jominy hardenability band requirement, specific J position(s) hardenability specification, a DI hardenability range or other condition. New grades will be listed in SAE J1268 and SAE J1868 and/or the appropriate ASTM standard along with their chemistry and hardenability requirement.

The specific hardenability requirement along with the chemistry is described in the UNS Publication – "Metals and Alloys in the Unified Numbering System published jointly as SAE HS-1086 and ASTM DS-56H.

4.3 K Series Grades

The SAE "K" series steels have dual chemistry and supplementary mechanical property or special processing requirements. The chemistry and supplementary requirements for a specific grade/product is listed in the appropriate SAE/ASTM steel product standard. The grade along with the chemistry and the standard where details on the supplementary requirements can be found will be documented in the UNS Publication "Metals and Alloys in the Unified Numbering System" published jointly as SAE HS-1086 and ASTM DS-56H.

5. Grade Code

The four digit grade code conforms to the generic grade designations in Table 1. This four number series will denote the generic grade as described in the Scope and in Section 2 of the "New SAE Steel Designation" above.

6. Element Modification Code

The three digit modification code will be assigned in the order indicated in Table 2. New grade modification codes will be assigned sequentially as new grades are added.

A modification to SAE grade chemistry will in general consist of one or two elements being outside the specified chemistry limits cited in SAE J403, J404, J1268, and J1868. Restrictive chemical ranges within the SAE range for a grade will not normally be considered as a modified grade unless there is consensus that this serves a useful purpose, for example, a restrictive sulfur level for SAE 1006 or SAE 1008 flat rolled steel.

The two element modification code will be reported in alphabetical order based on using the full name of the element, rather than its chemical symbol, as the basis for ranking, for example, **NIC**kel (Ni) would precede **NIO**bium (Nb).

The three digit element modification will allow up to two elements to be modified on a standard grade. If three or more element modifications are involved with a standard grade, a new generic grade name should be considered as per Table 1.

7. Element Modification Code Details or Supplementary Requirements

7.1 Element Modification Range Code

The four digit element modification range code will be indicated as in Table 3. The table will be expanded as necessary and new code numbers will be assigned sequentially as new steel grades are added. Modifications or restrictions may be represented as minimum element concentration values, maximum element concentration values or as an allowable element concentration range and will be assigned alphabetically as described in Section 5.

The first two digits of the four digit modifier code will describe the first element addition or modification while the second two digits will describe the second element modification, if applicable. To facilitate recognition of whether the modification or limitation is a minimum, maximum or range, the following system will be employed to describe the chemistry limitation:

Digits 00 No deviation from parent grade
Digits 01-24 Minimum value
Digits 25-49 Maximum value
Digits 50-99 Range

7.2 Supplementary Requirement Code

The four digit supplementary requirement code is an alphanumeric system describing the test, mechanical properties or special processing condition(s).

This information is indicated in Table 4, which will act as a reference table in SAE J402. It is suggested the user reference the actual standards.

8. Additions and Deletions of Steel Grades

8.1 Additions

New additions to the SAE standard “G”, “H” and ”K” series steels, as listed in SAE J403/J404 and/or SAE J1268/J1868, will be based upon the results of the five-year SAE Steel Grade Usage Survey indicating that the new grade meets minimum tonnage requirements, is supported by two or more users/producers, and is in compliance with standard SAE grade chemistry ranges. These same rules apply to new modified steel grades, except that there must be general consensus agreement between users and producers on the ranges of the modified elements. With respect to the “H” series and the “K” series grades, there must be general agreement between users and producers on the hardenability requirement or supplementary requirements respectively.

8.2 Deletions

Deletions are also based upon the results of the SAE Steel Grade Usage Survey and a consensus that the steel grade is no longer being produced (or production tonnage is well below the minimum). The deleted steel grades will be removed from the standard and transferred to SAE J1249 for permanent storage in the archived grade tables.

9. Reporting of New Steel Designation

9.1 The new steel designation will be listed in the grade tables in SAE J403 and J404 and /or other SAE standards with the generic grade code(name), chemistry ranges, mechanical properties and hardenability requirement. If a Jominy hardenability curve for the grade is specified, the H or RH grade will be listed in SAE J1268 or J1868 respectively.

9.2 The grade series, the grade code, the element modification(s), the element codes and basic information concerning supplementary requirements will be listed in SAE J402. As new codes are assigned, this Standard will be updated based on a five-year review or as needed.

TABLE 1—GRADE CODES OF CARBON AND ALLOY STEELS

SAE Grade	Old UNS Designation	New Steel Designation	Identifying Chemical Characteristics	Reference SAE Std.
		CARBON STEELS		
10XX	G10XX0	G10XX-000-0000	Mn 1% max. - Nonresulphurized Steels	J403 & J1249
11XX	G11XX0	G11XX-000-0000	Resulfurized Steels	J403 & J1249
12XX	G12XX0	G12XX-000-0000	Rephosphorized and Resulfurized Steels	J403 & J1249
15XX	G15XX0	G15XX-000-0000	Mn over 1% -Nonresulfurized Steels	J403 & J1249
		ALLOY STEELS		
13XX	G13XX0	G13XX-000-0000	Manganese Steels	J404 & J1249
23XX	G23XX0	G23XX-000-0000	Nickel Steels	J1249
25XX	G25XX0	G25XX-000-0000	Nickel Steels	J1249
31XX	G31XX0	G31XX-000-0000	Nickel-Chromium Steels	J1249
32XX	G32XX0	G32XX-000-0000	Nickel-Chromium Steels	J1249
33XX	G33XX0	G33XX-000-0000	Nickel-Chromium Steels	J1249
34XX	G34XX0	G34XX-000-0000	Nickel-Chromium Steels	J1249
40XX	G40XX0	G40XX-000-0000	Molybdenum Steels	J404 & J1249
41XX	G41XX0	G41XX-000-0000	Chromium-Molybdenum Steels	J404 & J1249
43XX	G43XX0	G43XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404 & J1249
44XX	G44XX0	G44XX-000-0000	Molybdenum Steels	J404 & J1249
46XX	G46XX0	G46XX-000-0000	Molybdenum-Nickel Steels	J404 & J1249
47XX	G47XX0	G47XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404
48XX	G48XX0	G48XX-000-0000	Molybdenum-Nickel Steel	J404 & J1249
50XX	G50XX0	G50XX-000-0000	Chromium Steels	J404 & J1249
51XX	G51XX0	G51XX-000-0000	Chromium Steels	J404 & J1249
52XX	G52XX0	G52XX-000-0000	Chromium Steels	J404
61XX	G61XX0	G61XX-000-0000	Chromium-Vanadium Steels	J404 & J1249
71XX	G71XX0	G71XX-000-0000	Tungsten-Chromium Steels	J1249
72XX	G72XX0	G72XX-000-0000	Tungsten-Chromium Steels	J1249
81XX	G81XX0	G81XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404
86XX	G86XX0	G86XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404 & J1249
87XX	G87XX0	G87XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404 & J1249
88XX	G88XX0	G88XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404
92XX	G92XX0	G92XX-000-0000	Silicon-Manganese Steel	J404
93XX	G93XX0	G93XX-000-0000	Nickel-Chromium-Molybdenum Steels	J404 & J1249
94XX	G94XX0	G94XX-000-0000	Nickel-Chromium -Molybdenum Steels	J404 & J1249
97XX	G97XX0	G97XX-000-0000	Nickel-Chromium-Molybdenum Steels	J1249
98XX	G98XX0	G98XX-000-0000	Nickel-Chromium-Molybdenum Steels	J1249

NOTE—Grades, from the previous UNS numbering system, consisting of a fifth numeral in the UNS number system to identify Boron Lead, and Vanadium additions, and Electric Furnace steel have been dropped and are replaced with the new steel designation.

9.3 The joint SAE HS-1086/ASTM E DS-56 H Metals and Alloys in the Unified Numbering System (UNS) Publication will record a complete list of steel grades, including the new steel designation code. The chemistry and the associated hardenabilty and physical properties will also be recorded.