EARLE M. JORGENSEN COMPANY

REFERENCE BOOK

ALLOY • ALUMINUM • BRASS • BRONZE
CARBON • CAST IRON • CHROME • NICKEL
STAINLESS • SUPER ALLOY • TITANIUM
BAR • PIPE • PLATE • SHEET • TUBE

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SECTION P

CHEMICAL ANALYSES OF STANDARD SIZES

STANDARD METALS AND DESIGNATION SYSTEMS

UNS

Studies have been made in the metals industry for the purpose of establishing certain “standard” metals and eliminating as much as possible the manufacture of other metals which vary only slightly in composition from the standard metals. These standard metals are selected on the basis of serving the significant metallurgical and engineering needs of fabricators and users of metal products.

UNIFIED NUMBERING SYSTEM: UNS is a system of designations established in accordance with ASTM E 527 and SAE J1086, Recommended Practice for Numbering Metals and Alloys. Its purpose is to provide a means of correlating systems in use by such organizations as American Iron and Steel Institute (AISI), American Society for Testing Materials (ASTM), and Society of Automotive Engineers (SAE), as well as individual users and producers. UNS designation assignments are processed by the SAE, the ASTM, or other relevant trade associations. Each of these assignors has the responsibility for administering a specific UNS series of designations. Each considers requests for the assignment of new UNS designations, and informs the applicants of the action taken. UNS designation assignors report immediately to the office of the Unified Numbering System for Metals and Alloys the details of each new assignment for inclusion into the system.

The UNS number is not in itself a specification, but an identification symbol to provide for efficient indexing, record keeping, data storage and retrieval, cross referencing, and avoidance of the same number being used for entirely different alloys. Specifications may alter composition requirements.

Composition of the various grades shown herein correspond to the respective AISI specifications.

The UNS designations for metals and alloys are as follows:

UNS Descriptor	Metals and Alloys
AXXXXX	Aluminum
CXXXXX	Copper and copper alloys
DXXXXX	Specified mechanical properties steels
FXXXXX	Cast irons
GXXXXX	AISI and SAE carbon and alloy steels (except tool steels)
HXXXXX	AISI and SAE H-steels
JXXXXX	Cast steels
KXXXXX	Miscellaneous steels and ferrous alloys
RXXXXX	Reactive and refractive alloys
SXXXXX	Heat and corrosion resistant (stainless) steels
TXXXXX	Tool steels

EFFECTS OF COMMON ALLOYING ELEMENTS IN STEEL

By definition, steel is a combination of iron and carbon. Steel is alloyed with various elements to improve physical properties and to produce special properties, such as resistance to corrosion or heat. Specific effects of the addition of such elements are outlined below:

ALUMINUM (Al) is a deoxidizer and degasifier. It retards grain growth and is used to control austenitic grain size. In nitriding steels it aids in producing a uniformly hard and strong nitrided case when used in amounts of 1.00%-1.25%.

BISMUTH (Bi) is an element added to improve machinability in a variety of alloys.

CALCIUM (Ca) is used in certain steel to control the shape, size and distribution of oxide and/or sulfide inclusions. Benefits may include improved ductility, impact strength and machinability.

CARBON (C), although not usually considered as an alloying element, is the most important constituent of steel. It raises tensile strength, hardness, and resistance to wear and abrasion. It lowers ductility, toughness, and machinability.

CHROMIUM (Cr) increases tensile strength, hardness, hardenability, toughness, resistance to wear and abrasion, resistance to corrosion, and scaling at elevated temperatures.

COBALT (Co) increases strength and hardness and permits higher quenching temperatures. It also intensifies the individual effects of other major elements in more complex steels.

LEAD (Pb), while not strictly an alloying element, is added to improve machining characteristics. It is almost completely insoluble in steel, and minute lead particles, well dispersed, reduce friction where the cutting edge contacts the work. Addition of lead also improves chip-breaking formations.

MANGANESE (Mn) is a deoxidizer and degasifier and reacts with sulfur to improve forgeability. It increases tensile strength, hardness, hardenability, and resistance to wear. It decreases tendency toward scaling and distortion. It increases the rate of carbon penetration in carburizing.

MOLYBDENUM (Mo) increases strength, hardness, hardenability, and toughness, as well as creep resistance and strength at elevated temperatures. It improves machinability and resistance to corrosion and it intensifies the effects of other alloying elements. In hot-work steels, it increases red-hardness properties.

EFFECTS OF COMMON ALLOYING ELEMENTS IN STEEL (cont.)

NICKEL (Ni) increases strength and hardness without sacrificing ductility and toughness. It also increases resistance to corrosion and scaling at elevated temperatures when introduced in suitable quantities in high-chromium (stainless) steels.

PHOSPHORUS (P) increases strength and hardness and improves machinability. However, it adds marked brittleness and cold-shortness of steel.

SILICON (Si) is a deoxidizer and degasifier. It increases tensile and yield strength, hardness, forgeability, and magnetic permeability.

SULPHUR (S) improves machinability in free-cutting steels, but without sufficient manganese it produces brittleness at red heat. It decreases weldability, impact toughness, and ductility.

TITANIUM (Ti), COLUMBIUM (Cb), and TANTALUM (Ta) are used as stabilitizing elements in stainless steels. Each has a high affinity for carbon and forms carbides, which are uniformly dispersed throughout the steel. Thus localized depletion of carbon at grain boundaries is prevented.

TUNGSTEN (W) increases strength, hardness, and toughness. Tungsten steels have superior hot-working and greater cutting efficiency at elevated temperatures.

VANADIUM (V) increases strength, hardness, and resistance to shock impact. It retards grain growth, permitting higher quenching temperatures. It also enhances the red-hardness properties of high-speed metal cutting tools and intensifies the individual effects of other major elements.

DESIGNATION OF CARBON STEELS

AISI/SAE

DEFINITION: Steel is considered to be carbon steel when no minimum content is specified or required for aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, or zirconium, or any other element added to obtain a desired alloying effect; when the specified minimum for copper does not exceed .40%; or when the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicone .60, cooper .60.

NUMBERING SYSTEM: A four-numeral series is used to designate graduations of chemical composition of carbon steel. The first two digits indicate the grade of carbon steel. The last two numbers are intended to indicate the approximate middle of the carbon range of .32% - .38%.

It is necessary, however, to deviate from this system and to interpolate numbers in the case of some carbon ranges and for variations in manganese, phosphorus or sulfur with the same carbon range.

Within the numerical designation system the special-purpose elements lead and boron are commonly designated by inserting the letter "L" or "B" respectively between the second and third numerals of the AISI number, e.g., 10L45 and 10B46.

The prefix "M" indicates "merchant quality". The "M" grades are produced to wider carbon and manganese ranges than the corresponding standard grades which are not so prefixed.

Grade	Description
10XX	Non-resulfurized Carbon Steels, Manganese 1.00% maximum
11XX	Resulfurized Carbon Steels
12XX	Rephosphorized and Resulfurized Carbon Steels
15XX	Non-resulfurized Carbon Steels, Manganese max. over 1.00%

First two digits indicate grade of carbon steel.
Last two digits represent middle of carbon range.

The standard carbon steels and their compositions are shown on the following pages.

STANDARD CARBON STEELS
Chemical Analysis

	AISI/SAE number	UNS number	C	Mn	P (Max.)	S (Max.)	Si	Cu, Pb
Non-resulfurized	1008	G10080	0.10 Max.	0.30/0.50	0.040	0.050	When silicon is required, the following ranges and limits are commonly specified: 0.10 max or 0.10-0.20 or 0.15-0.30 or 0.20-0.40	When required, copper is specified as 0.20% minimum. When lead is required as an added element to a standard steel, a range of 0.15%-0.35%, inclusive, is generally used. Such a steel is identified by inserting the letter "L" between the second and third numeral of the AISI number. A heat analysis for lead is not determinable, since lead is added to the ladle stream while each ingot is poured.
	1010	G10100	0.08/0.13	0.30/0.60	0.040	0.050		
	1012	G10120	0.10/0.15	0.30/0.60	0.040	0.050		
	1015	G10150	0.13/0.18	0.30/0.60	0.040	0.050		
	1016	G10160	0.13/0.18	0.60/0.90	0.040	0.050		
	1017	G10170	0.15/0.20	0.30/0.60	0.040	0.050		
	1018	G10180	0.15/0.20	0.60/0.90	0.040	0.050		
	1019	G10190	0.15/0.20	0.70/1.00	0.040	0.050		
	1020	G10200	0.18/0.23	0.30/0.60	0.040	0.050		
	1021	G10210	0.18/0.23	0.60/0.90	0.040	0.050		
	1022	G10220	0.18/0.23	0.70/1.00	0.040	0.050		
	1023	G10230	0.20/0.25	0.30/0.60	0.040	0.050		
	1025	G10250	0.22/0.28	0.30/0.60	0.040	0.050		
	1026	G10260	0.22/0.28	0.60/0.90	0.040	0.050		
	1029	G10290	0.25/0.30	0.60/0.90	0.040	0.050		
	1030	G10300	0.28/0.34	0.60/0.90	0.040	0.050		
	1035	G10350	0.32/0.38	0.60/0.90	0.040	0.050		
	1037	G10370	0.32/0.38	0.70/1.00	0.040	0.050		
	1038	G10380	0.35/0.42	0.60/0.90	0.040	0.050		
	1039	G10390	0.37/0.42	0.70/1.00	0.040	0.050		
	1040	G10400	0.37/0.42	0.60/0.90	0.040	0.050		
	1042	G10420	0.40/0.47	0.60/0.90	0.040	0.050		
	1043	G10430	0.40/0.47	0.70/1.00	0.040	0.050		
	1044	G10440	0.43/0.50	0.30/0.60	0.040	0.050		
	1045	G10450	0.43/0.50	0.60/0.90	0.040	0.050		
	1046	G10460	0.43/0.50	0.70/1.00	0.040	0.050		
	1049	G10490	0.46/0.53	0.60/0.90	0.040	0.050		
	1050	G10500	0.48/0.55	0.60/0.90	0.040	0.050		
	1053	G10530	0.48/0.55	0.70/1.00	0.040	0.050		
	1055	G10550	0.50/0.60	0.60/0.90	0.040	0.050		
	1060	G10600	0.55/0.65	0.60/0.90	0.040	0.050		
	1070	G10700	0.65/0.75	0.60/0.90	0.040	0.050		
	1078	G10780	0.72/0.85	0.30/0.60	0.040	0.050		
	1080	G10800	0.75/0.88	0.60/0.90	0.040	0.050		
	1084	G10840	0.80/0.93	0.60/0.90	0.040	0.050		
	1090	G10900	0.85/0.98	0.60/0.90	0.040	0.050		
	1095	G10950	0.90/01.03	0.30/0.50	0.040	0.050		
	1513	G15130	0.10/0.16	1.00/1.40	0.040	0.050		
	1522	G15220	0.18/0.24	1.00/1.40	0.040	0.050		
	1524	G15240	0.19/0.25	1.35/1.65	0.040	0.050		
	1526	G15260	0.22/0.29	1.10/1.40	0.040	0.050		
	1527	G15270	0.22/0.29	1.20/1.50	0.040	0.050		
	1541	G15410	0.36/0.44	1.35/1.65	0.040	0.050		
	1548	G15480	0.44/0.52	1.10/1.40	0.040	0.050		
	1551	G15510	0.45/0.56	0.85/1.15	0.040	0.050		
	1552	G15520	0.47/0.55	1.20/1.50	0.040	0.050		
	1561	G15610	0.55/0.65	0.75/1.05	0.040	0.050		
	1566	G15660	0.60/0.71	0.85/1.15	0.040	0.050		

STANDARD CARBON STEELS

AISI/SAE Number	UNS Number	C	Mn	P (Max.)	S (Max.)	Si	Cu, Pb
Resulfurized							
1110	G11100	0.08/0.13	0.30/0.60	0.040	0.08/0.13	When silicone is required, the following ranges and limits are commonly specified: 0.10 Max. or 0.10-0.20 or 0.15-0.30 or 0.20-0.40	When required, copper is specified as 0.20% minimum. When lead is required as an added element to a standard steel, a range of 0.15%-0.35%, inclusive, is generally used. Such a steel is identified by inserting the letter "L" between the second and third numberal of the AISI number. A heat analysis for lead is not determinable, since lead is added to the ladle stream while each ingot is poured.
1117	G11170	0.14/0.20	1.00/1.30	0.040	0.08/0.13		
1118	G11180	0.14/0.20	1.30/1.60	0.040	0.08/0.13		
1137	G11370	0.32/0.39	1.35/1.65	0.040	0.08/0.13		
1139	G11390	0.35/0.43	1.35/1.65	0.040	0.13/0.20		
1140	G11400	0.37/0.44	0.70/1.00	0.040	0.08/0.13		
1141	G11410	0.37/0.45	1.35/1.65	0.040	0.08/0.13		
1144	G11440	0.40/0.48	1.35/1.65	0.040	0.24/0.33		
1146	G11460	0.42/0.49	0.70/1.00	0.040	0.08/.013		
1151	G11510	0.48/0.55	0.70/1.00	0.040	0.08/0.13		
Resulfurized and Rephosphorized							
1211	G12110	0.13 Max.	0.60/0.90	0.07/0.12	0.10/0.15	It is not common practice to produce these steels to specified limits for silicon because of its adverse effect on machinability.	
1212	G12120	0.13 Max.	0.70/1.00	0.07/0.12	0.16/0.23		
1213	G12130	0.13 Max.	0.70/1.00	0.07/0.12	0.24/0.33		
1215	G12150	0.09 Max.	0.75/1.05	0.04/0.09	0.26/0.35		
12L14	G12144	0.15 Max.	0.85/1.15	0.04/0.09	0.26/0.35		Pb .15-.35
Resulfurized and Rephosphorized							
M1008	N/A	0.10 Max.	0.25/0.60	0.040	0.050	Merchant quality steels are not produced to any specified silicon content.	
M1010	N/A	0.07/0.14	0.25/0.60	0.040	0.050		
M1012	N/A	0.09/.016	0.25/0.60	0.040	0.050		
M1015	N/A	0.12/0.19	0.25/0.60	0.040	0.050		
M1017	N/A	0.14/0.21	0.25/0.60	0.040	0.050		
M1020	N/A	0.17/0.24	0.25/0.60	0.040	0.050		
M1023	N/A	0.19/0.27	0.25/0.60	0.040	0.050		
M1025	N/A	0.20/0.30	0.25/0.60	0.040	0.050		
M1031	N/A	0.26/.036	0.25/0.60	0.040	0.050		
M1044	N/A	0.40/0.50	0.25/0.60	0.040	0.050		

DESIGNATION OF ALLOY STEELS

DEFINITION: Steel is considered to be alloy steel when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: manganese, 1.65%; silicon, .60%, copper, .60%; or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99%, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying element added to obtain a desired alloying effect.

NUMBERING SYSTEM: The compositions listed here may apply to open hearth, basic oxygen, or electric furnace steels. Where they apply to electric furnace steels, the maximum phosphorus and sulfur shall be .025 each.

The first two digits of the four-numeral series indicate the grade of alloy. The last two digits are intended to indicate the approximate middle of the carbon range. For example, in the grade designation 4142,42 represents a carbon range of 0.40% to 0.45%. (Where a five-numeral series occurs, the last digits indicate the approximate mean of the carbon range.) It is necessary, however, to deviate from this rule and to interpolate numbers in the case of some carbon range, and for variations in manganese, sulfur, chromium, or other elements.

Grade	Principal alloying elements	% Content
13XX	Manganese	1.75
23XX	Nickel	3.50
25XX	Nickel	5.00
31XX	Nickel	1.25
	Chromium	0.65
E33XX	Nickel	3.50
	Chromium	1.55
	Electric Furnace	
40XX	Molybdenum	0.25
41XX	Chromium	0.50 or 0.95
	Molybdenum	0.12 or 0.20
43XX	Nickel	1.80
	Chromium	0.50 or 0.80
	Molybdenum	0.25
E43XX	Same as above, produced in Basic Electric Furnace	
44XX	Manganese	0.80
	Molybdenum	0.40
45XX	Manganese	0.55
	Molybdenum	0.50
46XX	Nickel	1.85
	Molybdenum	0.25
47XX	Nickel	1.05
	Chromium	0.45
	Molybdenum	0.20 or 0.35
50XX	Chromium	0.28 or 0.40
51XX	Chromium	0.80,0.88,0.93,0.95, or 1.00
E5XXXX	High Carbon	
	High Chromium	
	Electric Furnace Bearing Steel	
E50100	Carbon	1.00
	Chromium	0.50
E51100	Carbon	1.00
	Chromium	1.00
E52100	Carbon	1.00
	Chromium	1.45
61XX	Chromium	0.60,0.80, or 0.95
	Vanadium	0.12, 0.10 min or 0.15 min
7140	Carbon	0.40
	Chromium	1.60
	Molybdenum	0.35
	Aluminum	1.15
81XX	Nickel	0.30
	Chromium	0.40
	Molybdenum	0.12

Grade	Principal alloying elements	% content
86XX	Nickel	0.55
	Chromium	0.50
	Molybdenum	0.20
87XX	Nickel	0.55
	Chromium	0.50
	Molybdenum	0.25
88XX	Nickel	0.55
	Chromium	0.50
	Molybdenum	0.35
92XX	Manganese	0.85
	Silicon	2.00
9262	*Chromium*	*0.25-0.40*
93XX	Nickel	3.25
	Chromium	1.20
	Molybdenum	0.12
98XX	Nickel	1.00
	Chromium	0.80
	Molybdenum	0.25
14BXX	Boron	*
50BXX	Chromium	0.50 or 0.18
	Boron	*
51BXX	Chromium	0.80
	Boron	*
81BXX	Nickel	0.33
	Chromium	0.45
	Molybdenum	0.12
	Boron	*
86BXX	Nickel	0.55
	Chromium	0.50
	Molybdenum	0.20
	Boron	*
84BXX	Nickel	0.45
	Chromium	0.40
	Molybdenum	0.12
	Boron	*

First two digits indicate grade of alloy steel.
Last two digits represent middle of carbon range.
If carbon over 1.00%, a third digit is added.

**Content may vary.*

NOTES PERTAINING TO STANDARD ALLOY STEELS: Most grades are normally manufactured as electric furnace quality with adjustments in phosphorus and sulfur and shown as prefix letter E.

The phosphorus and sulfur limitations for each process are as follows:

	Max %	
	P	S
Electric furnace quality	0.025	0.025
Regular quality	0.035	0.040

Small quantities of certain elements are present in alloy steels which are not specified or required. These elements are considered as incidental and may be present to the following maximum amounts: copper, 0.35%; nickel, 0.25%; chromium, 0.20%; molybdenum, 0.06%.

Standard alloy steels can be produced with a lead range of 0.15% - 0.35%. Such steels are identified by inserting the letter “L” between the second and third numerals of the AISI number, e.g., 41L40. Lead is reported only as a range of 0.15% - 0.35% since it is added to the ladle stream as the steel is being poured. The letter “B” within the AISI number indicates boron steel.

STANDARD ALLOY STEELS
CHEMICAL ANALYSIS

Chemical composition limits (%)

AISI number	UNS number	C	Mn	P (Max.)	S (Max.)	Si	Ni	Cr	Mo	V
1330	G13300	0.28/0.33	1.60/1.90	0.035	0.040	0.15/0.35	—	—	—	—
1335	G13350	0.33/0.38	1.60/1.90	0.035	0.040	0.15/0.35	—	—	—	—
1340	G13400	0.38/0.43	1.60/1.90	0.035	0.040	0.15/0.35	—	—	—	—
1345	G13450	0.43/0.48	1.60/1.90	0.035	0.040	0.15/0.35	—	—	—	—
4023	G40230	0.20/0.25	0.70/0.90	0.035	0.040	0.15/0.35	—	—	0.20/0.30	—
4024	G40240	0.20/0.25	0.70/0.90	0.035	0.035/0.050	0.15/0.35	—	—	0.20/0.30	—
4027	G40270	0.25/0.30	0.70/0.90	0.035	0.040	0.15/0.35	—	—	0.20/0.30	—
4028	G40280	0.25/0.30	0.70/0.90	0.035	0.035/0.050	0.15/0.35	—	—	0.20/0.30	—
4037	G40370	0.35/0.40	0.70/0.90	0.035	0.040	0.15/0.35	—	—	0.20/0.30	—
4047	G40470	0.45/0.50	0.70/0.90	0.035	0.040	0.15/0.35	—	—	0.20/0.30	—
4118	G41180	0.18/0.23	0.70/0.90	0.035	0.040	0.15/0.35	—	0.40/0.60	0.08/0.15	—
4130	G41300	0.28/0.33	0.40/0.60	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4137	G41370	0.35/0.40	0.70/0.90	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4140	G41400	0.38/0.43	0.75/1.00	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4142	G41420	0.40/0.45	0.75/1.00	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4145	G41450	0.43/0.48	0.75/1.00	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4147	G41470	0.45/0.50	0.75/1.00	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4150	G41500	0.48/0.53	0.75/1.00	0.035	0.040	0.15/0.35	—	0.80/1.10	0.15/0.25	—
4161	G41610	0.56/0.64	0.75/1.00	0.035	0.040	0.15/0.35	—	0.70/0.90	0.25/0.35	—
4320	G43200	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	—
4340	G43400	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	—
E4340	G43406	0.38/0.43	0.60/0.80	0.025	0.025	0.15/0.35	1.65/2.00	0.70/0.90	0.20/0.30	—
4615	G46150	0.13/0.18	0.45/0.65	0.035	0.040	0.15/0.35	1.65/2.00	—	0.20/0.30	—
4620	G46200	0.17/0.22	0.45/0.65	0.035	0.040	0.15/0.35	1.65/2.00	—	0.20/0.30	—

STANDARD ALLOY STEELS
CHEMICAL ANALYSIS (continued)

Chemical composition limits (%)

AISI number	UNS number	C	Mn	P (Max.)	S (Max.)	Si	Ni	Cr	Mo	V
4626	G46260	0.24/0.29	0.45/0.65	0.035	0.040	0.15/0.35	0.70/1.00		0.15/0.25	—
4720	G47200	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	—
4815	G48150	0.13/018	0.40/0.60	0.035	0.040	0.15/0.35	3.25/3.75	—	0.20/0.30	—
4817	G48170	0.15/0.20	0.40/0.60	0.035	0.040	0.15/0.35	3.25/3.75	—	0.20/0.30	—
4820	G48200	0.18/0.23	0.50/0.70	0.035	0.040	0.15/0.35	3.25/3.75	—	0.20/0.30	—
5117	G51170	0.15/0.20	0.70/0.90	0.035	0.040	0.15/0.35	—	0.70/0.90	—	—
5120	G51200	0.17/0.22	0.70/0.90	0.035	0.040	0.15/0.35	—	0.70/0.90	—	—
5130	G51300	0.28/0.33	0.70/0.90	0.035	0.040	0.15/0.35	—	0.80/1.10	—	—
5132	G51320	0.30/0.35	0.60/0.80	0.035	0.040	0.15/0.35	—	0.75/1.00	—	—
5135	G51350	0.33/0.38	0.60/0.80	0.035	0.040	0.15/0.35	—	0.80/1.05	—	—
5140	G51400	0.38/0.43	0.70/0.90	0.035	0.040	0.15/0.35	—	0.70/0.90	—	—
5150	G51500	0.48/0.53	0.70/0.90	0.035	0.040	0.15/0.35	—	0.70/0.90	—	—
5155	G51550	0.51/0.59	0.70/0.90	0.035	0.040	0.15/0.35	—	0.70/0.90	—	—
5160	G51600	0.56/0.64	0.75/1.00	0.035	0.040	0.15/0.35	—	0.70/0.90	—	—
E51100	G51986	0.98/01.10	0.25/0.45	0.035	0.040	0.15/0.35	—	0.90/1.15	—	—
E52100	G52986	0.98/01.10	0.25/0.45	0.035	0.040	0.15/0.35	—	1.30/1.60	—	—
6118	G61180	0.16/0.21	0.50/0.70	0.035	0.040	0.15/0.35	—	0.50/0.70	—	0.10/0.15
6150	G61500	0.48/0.53	0.70/0.90	0.035	0.040	0.15/0.35	—	0.80/1.10	—	0.15 Min.
8615	G86150	0.13/0.18	0.70/0.90	0.035	0.040	0.15/0.35	0.40/.70	0.40/0.60	0.15/0.25	—
8617	G86170	0.15/0.20	0.70/0.90	0.035	0.040	0.15/0.35	0.40/.70	0.40/0.60	0.15/0.25	—
8620	G86200	0.18/0.23	0.70/0.90	0.035	0.040	0.15/0.35	0.40/.70	0.40/0.60	0.15/0.25	—
8622	G86220	0.20/0.25	0.70/0.90	0.035	0.040	0.15/0.35	0.40/.70	0.40/0.60	0.15/0.25	—
8625	G86250	0.23/0.28	0.70/0.90	0.035	0.040	0.15/0.35	0.40/.70	0.40/0.60	0.15/0.25	—
8627	G86270	0.25/0.30	0.70/0.90	0.035	0.040	0.15/0.35	0.40/.70	0.40/0.60	0.15/0.25	—

STANDARD ALLOY STEELS
CHEMICAL ANALYSIS (continued)

Chemical composition limits (%)

AISI number	UNS number	C	Mn	P (Max.)	S (Max.)	Si	Ni	Cr	Mo	V
8630	G86300	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	—
8637	G86370	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	—
8640	G86400	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	—
8642	G86420	0.40/0.45	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	G86450	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	—
8655	G86550	0.51/0.59	0.75/1.00	0.035	0.040	0.15/0.35	0.40/0.70	0.40/0.60	0.15/0.25	—
8720	G87200	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	—
8740	G87400	0.38/0.43	0.75/1.00	0.035	0.040	0.15/0.35	0.40/0.70	0.40/0.60	0.20/0.30	—
8822	G88220	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	—
9260	G92600	0.56/0.64	0.75/1.00	0.035	0.040	1.80/2.20	—	—	—	—
Standard boron steels*										
50B44	G50441	0.43/0.48	0.75/1.00	0.035	0.040	0.15/0.35	—	0.40/0.60	—	—
50B46	G50461	0.44/0.49	0.75/1.00	0.035	0.040	0.15/0.35	—	0.20/0.35	—	—
50B50	G50501	0.48/0.53	0.75/1.00	0.035	0.040	0.15/0.35	—	0.40/0.60	—	—
50B60	G50601	0.56/0.64	0.75/1.00	0.035	0.040	0.15/0.35	—	0.40/0.60	—	—
51B60	G51601	0.56/0.64	0.75/1.00	0.035	0.040	0.15/0.35		0.70/0.90		—
81B45	G81451	0.43/0.48	0.75/1.00	0.035	0.040	0.15/0.35	0.20/0.40	0.35/0.55	0.08/0.15	—
94B17	G94171	0.15/0.20	0.75/1.00	0.035	0.040	0.15/0.35	0.30/0.60	0.30/0.50	0.08/0.15	—
94B30	G94301	0.28/0.33	0.75/1.00	0.035	0.040	0.15/0.35	0.30/0.60	0.30/0.50	0.08/0.15	—

• These steels can be expected to have 0.005% minimum boron content.

STAINLESS AND HEAT-RESISTING STEELS GRADE

Stainless Steels possess unusual ability to resist attack by corrosive media at atmospheric and elevated temperatures. These properties are due principally to the addition of relatively large amounts of chromium, and also nickel and/or manganese in certain grades. Stainless Steels are melted exclusively by the electric furnace process.

The analyses shown below have been adopted as standard in the steel industry, and the American Iron & Steel Institute has assigned the "type" numbers indicated. The various types fall into four classes, according to analysis:

2XX	chromium-nickel-manganese types
3XX	chromium-nickel types
4XX	straight chromium types
5XX	low chromium types

Note: Specifications may slightly alter chemical requirements.

STAINLESS AND HEAT-RESISTING STEELS STANDARD GRADES

Chemical composition limits (%) Maximum unless otherwse shown

AISI number	UNS number	C	Mn	P	S	Si	Cr	Ni	Other Elements
201	S20100	0.15	5.50/7.50	0.060	0.030	1.00	16.00/18.00	3.50/5.50	N 0.25
202	S20200	0.15	7.50/10.00	0.060	0.030	1.00	17.00/19.00	4.00/6.00	N 0 .25
205	S20500	0.12/0.25	14.00/15.50	0.060	0.030	1.00	16.50/18.00	1.00/1.75	N 0.32/0.40
301	S30100	0.15	2.00	0.045	0.030	1.00	16.00/18.00	6.00/8.00	
302	S30200	0.15	2.00	0.045	0.030	1.00	17.00/19.00	8.00/10.00	
302B	S30215	0.15	2.00	0.045	0.030	2.00/3.00	17.00/19.00	8.00/10.00	
303	S30300	0.15	2.00	0.200	0.150 Min.	1.00	17.00/19.00	8.00/10.00	Mo 0.60 (optional)
303Se	S30323	0.15	2.00	0.200	0.060	1.00	17.00/19.00	8.00/10.00	Se 0.15 Min.
304	S30400	0.08	2.00	0.045	0.030	1.00	18.00/20.00	8.00/10.50	N 0.10 Max.
304L	S30403	0.03	2.00	0.045	0.030	1.00	18.00/20.00	8.00/12.00	N 0.10 Max.
—	S30430	0.08	2.00	0.045	0.030	1.00	17.00/19.00	8.00/10.00	Cu 3.00/4.00
304N	S30451	0.08	2.00	0.045	0.030	1.00	18.00/20.00	8.00/10.50	N 0.10/0.16
305	S30500	0.12	2.00	0.045	0.030	1.00	17.00/19.00	10.50/13.00	
308	S30800	0.08	2.00	0.045	0.030	1.00	19.00/21.00	10.00/12.00	
309	S30900	0.20	2.00	0.045	0.030	1.00	22.00/24.00	12.00/15.00	
309S	S30908	0.08	2.00	0.045	0.030	1.00	22.00/24.00	12.00/15.00	
310	S31000	0.25	2.00	0.045	0.030	1.50	24.00/26.00	19.00/22.00	
310S	S31008	0.08	2.00	0.045	0.030	1.50	24.00/26.00	19.00/22.00	
314	S31400	0.25	2.00	0.045	0.030	1.50/3.00	23.00/26.00	19.00/22.00	
316	S31600	0.08	2.00	0.045	0.030	1.00	16.00/18.00	10.00/14.00	Mo 2.00/3.00; N 0.10 Max.

STANDARD STAINLESS STEELS
(continued)

Chemical composition limits (%) Maximum unless otherwise shown

	AISI number	UNS number	C	Mn	P	S	Si	Cr	Ni	Other Elements
Stainless and heat-resisting steels	316F	S31620	0.08	2.00	0.200	0.100 Min.	1.00	16.00/18.00	10.00/14.00	Mo 1.75/2.50
	316L	S31603	0.03	2.00	0.045	0.030	1.00	16.00/18.00	10.00/14.00	Mo. 2.00/3.00; N. 0.10 Max.
	316N	S31651	0.08	2.00	0.045	0.030	1.00	16.00/18.00	10.00/14.00	Mo 2.00/3.00; N. 10/16
	317	S31700	0.08	2.00	0.045	0.030	1.00	18.00/20.00	11.00/15.00	Mo 3.00/4.00
	317L	S31703	0.03	2.00	0.045	0.030	1.00	18.00/20.00	11.00/15.00	Mo 3.00/4.00
	321	S32100	0.08	2.00	0.045	0.030	1.00	17.00/19.00	9.00/12.00	Ti 5XC Min.
	329	S32900	0.10	2.00	0.040	0.030	1.00	25.00/30.00	3.00/6.00	Mo 1.00/2.00
	330	N08330	0.08	2.00	0.040	0.030	0.75/1.50	17.00/20.00	34.00/37.00	
	347	S34700	0.08	2.00	0.045	0.030	1.00	17.00/19.00	9.00/13.00	Cb+Ta 10xC Min.
	348	S34800	0.08	2.00	0.045	0.030	1.00	17.00/19.00	9.00/13.00	Cb+Ta 10xC Min.
	—	—	—	—	—	—	—	—	—	Ta 0.10 Max; Co 0.20 Max.
	384	S38400	0.08	2.00	0.045	0.030	1.00	15.00/17.00	17.00/19.00	
	403	S40300	0.15	1.00	0.040	0.030	0.50	11.50/13.00	—	
	405	S40500	0.08	1.00	0.040	0.030	1.00	11.50/14.50	—	Al 0.10/0.30
	409	S40900	0.08	1.00	0.045	0.045	1.00	10.50/11.75	—	Tl 6XC Min./0.75 Max.
	410	S41000	0.15	1.00	0.040	0.030	1.00	11.50/13.50	—	
	414	S41400	0.15	1.00	0.040	0.030	1.00	11.50/13.50	1.25/2.50	
	416	S41600	0.15	1.25	0.060	0.150 Min.	1.00	12.00/14.00	—	Mo 0.60 (optional)
	416Se	S41623	0.15	1.25	0.060	0.060	1.00	12.00/14.00	—	Se 0.15 Min.
	420	S42000	Over 0.15	1.00	0.040	0.030	1.00	12.00/14.00	—	

STANDARD STAINLESS STEELS
(continued)

Chemical composition limits (%) Maximum unless otherwise shown

AISI number	UNS number	C	Mn	P	S	Si	Cr	Ni	Other Elements
420F	S42020	Over 0.15	1.25	0.060	0.150 Min.	1.00	12.00/14.00	—	Mo 0.60 (optional)
422	S42200	0.20/0.25	1.00	0.025	0.025	0.75	11.00/13.00	0.50/1.0	Mo 0.75/1.25; V .015/0.30:
429	S42900	0.12	1.00	0.040	0.030	1.00	14.00/16.00	—	W 0.75/1.25
430	S43000	0.12	1.00	0.040	0.030	1.00	16.00/18.00	—	—
430F	S43020	0.12	1.25	0.060	0.150 Min.	1.00	16.00/18.00	—	Mo 0.60 (optional)
430Se	S43023	0.12	1.25	0.060	0.060	1.00	16.00/18.00	—	Se 0.15 Min.
431	S43100	0.20	1.00	0.040	0.030	1.00	15.00/17.00	1.25/2.50	—
434	S43400	0.12	1.00	0.040	0.030	1.00	16.00/18.00	—	Mo 0.75/1.25
436	S43600	0.12	1.00	0.040	0.030	1.00	16.00/18.00	—	Mo 0.75/1.25; Cb+Ta 5xC/0.70 Max.
440A	S44002	0.60/0.75	1.00	0.040	0.030	1.00	16.00/18.00	—	Mo 0.75
440B	S44003	0.75/0.90	1.00	0.040	0.030	1.00	16.00/18.00	—	Mo 0.75
440C	S44004	0.95/1.20	1.00	0.040	0.030	1.00	16.00/18.00	—	Mo 0.75
442	S44200	0.20	1.00	0.040	0.030	1.00	18.00/23.00	—	—
446	S44600	0.20	1.50	0.040	0.030	1.00	23.00/27.00	—	N 0.25
501	S50100	Over 0.10	1.00	0.040	0.030	1.00	4.00/6.00	—	Mo 0.40/0.65
502	S50200	0.10	1.00	0.040	0.030	1.00	4.00/6.00	—	Mo 0.40/0.65
—	S13800	0.05	0.10	0.010	0.008	0.10	12.25/13.25	7.50/8.50	Mo 2.00/2.50; Al 0.90/1.35; N 0.010
—	S15500	0.07	1.00	0.040	0.030	1.00	14.00/15.50	3.50/5.50	Cu 2.50/4.50; Cb+Ta 0.15/0.45
—	S17400	0.07	1.00	0.040	0.030	1.00	15.50/17.50	3.00/5.00	Cu 3.00/5.00; Cb+Ta 0.15/0.45
—	S17700	0.09	1.00	0.040	0.040	1.00	16.00/18.00	6.50/7.75	Al 0.75/1.50

DUPLEX STAINLESS STEELS
CHEMICAL ANALYSIS

	UNS Number	Trade Name	C (Max.)	Cr	Ni	Mn (Max.)	Si (Max.)	Mo	N	Cu	W	P (Max.)	S (Max.)
Duplex	S31803	2205	0.03	21.00/23.00	4.5/6.5	2.00	1.00	2.5/3.5	0.08/0.20	—	—	.030	.020
stainless	S32550	244 Alloy	0.04	24.0/27.00	4.5/6.5	1.50	1.00	2.0/4.0	0.10/0.25	1.5/2.5	—	.040	.030
steels	S39277	918 Alloy	.025	24.0/26.00	6.5/8.0	1.00	0.80	3.0/4.0	0.23/0.22	1.2/2.0	.80/1.20	.025	

PRECIPITATION-HARDENING NICKEL BASE
CHEMICAL ANALYSIS

	UNS Number	Trade Name	C (Max.)	Cr	Ni	Fe	Mn (Max.)	Si (Max.)	Mo
Precipitation-hardening nickel base	N07718	718 Alloy	0.08	17.0/21.0	50.0/55.0	Bal	0.35	0.35	2.8/3.3

NICKEL-COPPER ALLOYS
CHEMICAL ANALYSIS

	UNS Number	Trade Name	C (Max.)	Ni	Cu	Fe	Mn (Max.)	Si (Max.)	Ti	Al	S (Max.)
Nickel-copper alloys	N04400	400 Alloy	0.30	63.0/70.0	Bal	2.50 max	2.00	0.50	—	—	.024
	N05500	K500	0.25	63.0/70.0	Bal	—	2.00	1.50	0.35/0.85	2.30/3.15	.010

HIGH TEMPERATURE HIGH STRENGTH ALLOYS

The alloys listed here are in current use in wrought form. Many of them are proprietary and are commonly referred to by their trade names. As an aid in identifying and describing these materials, the American Iron and Steel Institute has assigned a series of three-digit numbers beginning with 601. The AISI number identifies only the typical chemical composition, as shown below.

			Typical Chemical composition (%)						
	AISI number	Trade name or other designation	C	Mn	Si	Cr	Ni	Mo	W
	602	17-22 AS	0.30	0.55	0.65	1.25	—	0.50	—
	603	17-22 AV	0.27	0.75	0.65	1.25	—	0.50	—
	604	Chromoloy	0.20	0.50	0.75	1.00	—	1.00	—
	610	H-11	0.40	0.30	0.90	5.00	—	1.30	—
	611	M-2	0.84	0.25	0.30	4.20	—	5.00	6.35
	612	M-10	0.87	0.20	0.30	4.00	—	8.25	—
	614	410	0.12	0.42	0.32	12.20	—	—	—
	615	Greek Ascoly	0.17	0.40	0.28	13.00	2.00	0.20	2.95
	616	422	0.23	0.75	0.35	12.00	0.80	1.00	1.00
	617	440C	1.10	0.50	0.40	7.50	—	0.50	—
	619	Lapelloy	0.30	1.10	0.35	11.40	0.30	2.75	—
	630	17-4	0.04	0.28	0.60	16.00	4.25	—	—

DESIGNATION OF ALUMINUM ALLOYS

MAJOR ALLOY GROUPS: Aluminum employs a four-digit system. The first digit indicates the alloy group. The last two digits identify the alloy or, in the instance of the 1000 Series, the purity. The second digit indicates a modification of the alloy. The alloy groups are:

Number		U N S
1XXX	Aluminum — 99% and greater	A91XXX
2XXX	Copper — major alloying element	A92XXX
3XXX	Manganese — major alloying element	A93XXX
4XXX	Silicon — major alloying element	A94XXX
5XXX	Magnesium — major alloying element	A95XXX
6XXX	Magnesium and Silicon — major alloying elements	A96XXX
7XXX	Zinc — major alloying element	A97XXX
8XXX	Other elements	A98XXX
9XXX	Unused to date	A99XXX

STANDARD ALUMINUM ALLOYS
CHEMICAL ANALYSIS

Values are in percent maximum unless shown as a range.

Alloy	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Others each	Total	Al
1100	0.95 Si+Fe	—	0.05/0.20	0.05	—	—	0.10	—	0.05	0.15	99.00 Min.
2024	0.50	0.50	3.8/4.9	0.30/0.90	1.2/1.8	0.10	0.25	0.15	0.05	0.15	Remainder
3003	0.60	0.70	0.05/0.20	1.0/1.5	—	—	0.10	—	0.05	0.15	Remainder
5052	0.25	0.40	0.10	0.10	2.2/2.8	0.15/0.35	0.10	—	0.05	0.15	Remainder
5086	0.40	0.50	0.10	0.20/0.70	3.5/.45	0.05/0.25	0.25	0.15	0.05	0.15	Remainder
6061	0.40/0.80	0.70	0.15/0.40	0.15	0.80/1.2	0.04/0.35	0.25	0.15	0.05	0.15	Remainder
6063	0.20/0.60	0.35	0.10	0.10	0.45/0.90	0.10	0.10	0.10	0.05	0.15	Remainder
7075	0.40	0.50	1.2/2.0	0.30	2.1/2.9	0.18/0.28	5.1/6.1	0.20	0.05	0.15	Remainder

OIL TOOL MATERIALS

BARS

1018 HR

4140 HR Annealed

4140 HR Quench & Tempered 80-100 KSI Yield, 95 KSI Min Tensile, 235 max BHN*

4140 HR Quench & Tempered 110 KSI min Yield, 125 KSI Min Tensile

4130 M7 Quench & Tempered T-95

4130 M7 Quench & Tempered Q-125

4130 HR Normalized, Quench & Tempered, 75 KSI Min Yield, RC 22 Max*

9 Chrome 1 Moly HR RT Quench & Tempered, 80-100 KSI Yield,
95 KSI Min Tensile, 235 Max BHN*

410 HR RT Quench & Double Tempered, 80 KSI Min Yield*

420 (13 Chrome) HR RT Quench & Tempered, 80-100 KSI Yield,
95 KSI Min Tensile, 235 Max BHN

Super 13 Chrome HR RT Quench & Tempered, 80-100 KSI Yield,
95 KSI Min Tensile, 235 Max BHN

4340 HR Normalzed & Tempered

4340 HR Quench & Tempered, 130 KSI Min

K 500 Nickel Based Alloy Aged Hardened*

718 Nickel Based Alloy Age Hardened*

17-4 PH HR RT DBL H 1150

2205 Duplex Alloy (UNS S31803) HR RT, 65 KSI Min Yield,
90 KSI Min Tensile, 25% Min Elongation.

MECHANICAL TUBING

1018 HR Smls

1018 CD Smls

4130, 4140 HR Annealed

4130, 4140 HR Smls Quench & Tempered 80-100 KSI Yield,
95 KSI Min Tensile, 235 max BHN*

4130, 4140 HR Smls Quench & Tempered 110 KSI Yield, 125 KSI Min Tensile

4130, 4140 CD Smls Stress Relief Annealed

4130, 4140 CD Smls Quench & Tempered 80-100 KSI Yield,
95 KSI Min Tensile, 235 max BHN*

4130, 4140 CD Smls Quench & Tempered 110 KSI Yield, 125 KSI Min Tensile

4130 M7 HR Smls Quench & Tempered T-95

4130 M7 HR Smls Quench & Tempered Q-125

9 Chrome 1 Moly CF Smls Quench & Tempered 80-100 KSI Yield,
95 KSI Min Tensile, 235 max BHN*

420 (13 Chrome) HR Smls RT Quench & Tempered 80-100 KSI Yield,
95 KSI Min Tensile, 235 max BHN*

* Properties Per NACE MRO-1-75

Legend: HR = Hot Rolled, BHN = Brinell Hardness Number, RT = Rough Turned,
DBL H = Double Aged, CD = Cold Drawn, CF = Cold Finished,
M7 = Molybdenum .070 nominal

API SPECIFICATION REQUIREMENTS

API 5CT GRADE	Chemistry													Mechanical Properties				HEAT TREATMENT
	CARBON		MANGANESE		MOLYBDENUM		CHROMIUM		NICKEL	COPPER	PHOSPHOROUS	SULPHUR	SILICON	YIELD	YIELD	TENSILE	HARDNESS	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MAX	MAX	MAX	MAX	MAX	MIN	MAX	MIN	MAX	
H-40	-	-	-	-	-	-	-	-	-	-	0.03	0.03	-	40,000	80,000	60,000	-	NO
J-55	-	-	-	-	-	-	-	-	-	-	0.03	0.03	-	55,000	80,000	75,000	-	NO
K-55	-	-	-	-	-	-	-	-	-	-	0.03	0.03	-	55,000	80,000	95,000	-	NO
C-75 1	-	0.50	-	1.90	0.15	0.40	-	-	-	-	0.04	0.06	0.45	75,000	90,000	95,000	-	N&T
C-75 2	-	0.43	-	1.50	-	-	-	-	-	-	0.04	0.06	0.45	75,000	90,000	95,000	-	Q&T
C-75 3	.038	0.48	.075	1.00	.015	.025	.080	1.10	-	-	0.04	0.06	-	75,000	90,000	95,000	-	N&T
N-80	-	-	-	-	-	-	-	-	-	-	0.03	0.03	-	80,000	110,000	100,000	-	N or Q&T
L-80 1	-	0.43	-	1.90	-	-	-	-	0.25	0.35	0.03	0.03	0.45	80,000	95,000	95,000	23	Q&T
L-80 9CR	-	0.15	0.30	0.60	0.90	1.10	8.00	10.00	0.50	0.25	0.02	0.01	1.00	80,000	95,000	95,000	23	Q&T
L-80 13CR	0.15	0.22	0.25	1.00	-	-	12.00	14.00	0.50	0.25	0.02	0.01	1.00	80,000	95,000	95,000	23	Q&T
C-90 1	-	0.35	-	1.00	0.250	0.75	-	1.20	0.99	-	0.02	0.01	-	90,000	105,000	100,000	25.4	Q&T
C-90 2	-	0.50	-	1.90	-	-	-	-	0.99	-	0.03	0.01	-	90,000	105,000	100,000	25.4	Q&T
C-95	-	0.45	-	1.90	-	-	-	-	-	-	0.03	0.03	0.45	95,000	110,000	105,000	-	Q&T
T-95 1	-	0.35	-	1.20	0.250	0.85	0.40	1.50	0.99	-	0.02	0.01	-	95,000	110,000	105,000	25.4	Q&T
T-95 2	-	0.50	-	1.90	-	-	-	-	0.99	-	0.03	0.01	-	95,000	110,000	105,000	25.4	Q&T
P-105	-	-	-	-	-	-	-	-	-	-	0.04	0.06	-	105,000	135,000	120,000	-	N&T
P-110	-	-	-	-	-	-	-	-	-	-	0.03	0.03	-	110,000	140,000	125,000	-	Q&T
Q-125 1	-	0.35	-	1.00	-	0.75	-	1.20	0.99	-	0.02	0.01	-	125,000	150,000	135,000	-	Q&T
Q-125 2	-	0.35	-	1.00	-	-	-	-	0.99	-	0.02	0.02	-	125,000	150,000	135,000	-	Q&T
Q-125 3	-	0.50	-	1.90	-	-	-	-	0.99	-	0.03	0.01	-	125,000	150,000	135,000	-	Q&T
Q-125 4 1	0.50	0.50	-	1.90	-	-	-	-	0.99	-	0.03	0.02	-	125,000	150,000	135,000	-	Q&T

API mechanical properties may not be available in all wall thicknesses and bar sizes
NACE MR0175 may require lower hrdness values
Legend: N = Normalized, N&T = Normalized & Tempered, Q&T = Quench & Tempered

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