

Designation: A 752 – 93 (Reapproved 2003)

Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel¹

This standard is issued under the fixed designation A 752; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers general requirements for alloy steel rods and uncoated coarse round alloy wire in coils that are not required to meet hardenability band limits.

1.2 In case of conflict, the requirements in the purchase order, on the drawing, in the individual specification, and in this general specification shall prevail in the sequence named.

1.3 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:

- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products²
- A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment³
- A 919 Terminology Relating to Heat Treatment of Metals⁴

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications⁵

E 30 Test Methods for Chemical Analysis of Steel, Cast Iron, Open-Hearth Iron, and Wrought Iron⁶ ASTM A7

E 112 Test Methods for Determining Average Grain Size⁷ 2.2 *AIAG Standard:*

AIAGB-5 02.00 Primary Metals Identification Tag Application Standard⁸

3. Terminology

3.1 Description of Terms Specific to This Standard:

3.1.1 *alloy steel*— 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 0.60 %, copper 0.60 %; 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 elements added to obtain a desired alloying effect. Note that aluminum, columbium, and vanadium may also be used for grain refinement purposes.

3.1.1.1 Boron treatment of alloy steels, which are fine grain, may be specified to improve hardenability.

3.1.1.2 Other elements, such as lead, selenium, tellurium, or bismuth, may be specified to improve machinability.

3.1.2 coarse round wire—from 0.035 to 0.999 in. (0.89 to 25.4 mm) in diameter, inclusive, wire produced from hot-rolled wire rods or hot-rolled coiled bars by one or more cold reductions primarily for the purpose of obtaining a desired size with dimensional accuracy, surface finish, and mechanical properties. By varying the amount of cold reduction and other wire mill practices, including thermal treatment, a wide diversity of mechanical properties and finishes are made available.

3.1.2.1 Coarse round wire is designated by common fractions or decimal parts of an inch, or millimetres.

3.1.3 *wire rods*—rods that are hot rolled from billets into an approximate round cross section and into coils of one continuous length. Rods are not comparable to hot-rolled bars in accuracy of cross section or surface finish and as a semi-finished product are primarily for the manufacture of wire.

3.1.3.1 Rod sizes from $\frac{7}{32}$ to $\frac{47}{64}$ in. (5.6 to 18.7 mm) in diameter, inclusive, are designated by fractions or decimal parts of an inch as shown in Table 1.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys, and is the direct responsibility of Subcommittee A01.03 on Steel Rod and Wire.

Current edition approved April 10, 2003. Published June 2003. Originally approved in 1977. Last previous edition approved in 1998 as A 752 – 93 (1998).

² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 01.05.

⁴ Discontinued; see *1998 Annual Book of ASTM Standards*, Vol 01.01. Replaced by A 941.

⁵ Annual Book of ASTM Standards, Vol 14.02.

⁶ Discontinued; see 1994 Annual Book of ASTM Standards, Vol 03.05.

⁷ Annual Book of ASTM Standards, Vol 03.01.

 $^{^{\}rm 8}$ Available from the Automotive Industry Action Group, 26200 Lahser, Suite 200, Southfield, MI 48034.

🕼 A 752 – 93 (2003)

TABLE 1 Sizes of Alloy Steel Wire Rods

Inch Fraction	Decimal Equivalent, in.	Metric Equivalent, mm	Inch Fraction	Decimal Equivalent, in.	Metric Equivalent mm
7/32	0.219	5.6	31/64	0.484	12.3
15/64	0.234	6.0	1/2	0.500	12.7
1/4	0.250	6.4	33/64	0.516	13.1
17/64	0.266	6.7	17/32	0.531	13.5
9/32	0.281	7.1	35/64	0.547	13.9
19/64	0.297	7.5	9⁄16	0.562	14.3
5/16	0.312	7.9	37/64	0.578	14.7
²¹ / ₆₄	0.328	8.3	19/32	0.594	15.1
11/32	0.344	8.7	39/64	0.609	15.5
23/64	0.359	9.1	5/8	0.625	15.9
3/8	0.375	9.5	41/64	0.641	16.3
²⁵ / ₆₄	0.391	9.9	21/32	0.656	16.7
13/ ₃₂	0.406	10.3	43/64	0.672	17.1
27/64	0.422	10.7	11/16	0.688	17.5
7/16	0.438	11.1	45/64	0.703	17.9
29/64	0.453	11.5	23/32	0.719	18.3
15/32	0.469	11.9	47/64	0.734	18.7

4. Ordering Information

4.1 Orders for hot-rolled wire rods under this specification should include the following information:

- 4.1.1 Quantity (pounds or kilograms),
- 4.1.2 Name of material (wire rods),
- 4.1.3 Diameter (Table 1),
- 4.1.4 Chemical composition grade number (Table 2),
- 4.1.5 Thermal treatment, if required,
- 4.1.6 Packaging, and
- 4.1.7 ASTM designation and date of issue.

NOTE 1—A typical ordering description is as follows: 80 000 lb Hot-Rolled Alloy Steel Wire Rods, ¹/₄ in., Grade 4135 in 2 000-lb maximum coils to ASTM A 752-XX. 4.2 Orders for coarse round wire under this specification shall include the following information:

- 4.2.1 Quantity (pounds or kilograms),
- 4.2.2 Name of material (alloy steel wire),
- 4.2.3 Diameter (see 3.1.3.1),
- 4.2.4 Chemical composition (Table 2 or Table 3),
- 4.2.5 Thermal treatment, if required,
- 4.2.6 Packaging,
- 4.2.7 ASTM designation A 752 and date of issue, and
- 4.2.8 Special requirements, if any.

NOTE 2—A typical ordering description is as follows: 40 000 lb, Alloy Steel Wire, 0.312 in. diameter, Grade 8620, annealed at finish size, in 500-lb Catch Weight Coils on Tubular Carriers to ASTM A 752-XX.

<u>ASTM A752-93(2003)</u>

https://standards.itel. TABLE 2 Chemical Composition Ranges and Limits for Cast or Heat Analysis d/astm-a752-932003

NOTE 1—Grades shown in this table with prefix letter E are normally only made by the basic electric furnace process. All others are normally manufactured by the basic open hearth or basic oxygen processes but may be manufactured by a basic electric furnace process. If the electric furnace process is specified or required for grades other than those designated above, the limits for phosphorus and sulfur are respectively 0.025 % max.

NOTE 2—Small quantities of certain elements, which are not specified or required, are present in alloy steels. 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 %.

NOTE 3—Where minimum and maximum sulfur content is shown it is indicative of resulfurized steel.

NOTE 4—The chemical ranges and limits shown in Table 2 are produced to check, product, or verification analysis tolerances shown in Table 4. NOTE 5—Standard alloy steels can be produced with a lead range of 0.15 to 0.35 %. Such steels are identified by inserting the letter "L" between the second and third numerals of the Grade number, for example, 41L40. Lead is reported only as a range of 0.15 to 0.35 % since it is added to the mold as the steel is poured.

				Che	mical Compositi	on, Ranges and Lir	nits, %		
UNS Desig- nation	Grade No.	Carbon	Manganese	Phos- phorus, max	Sulfur, max	Silicon	Nickel	Chromium	Molyb- denum
				STANDA	RD ALLOY STE	ELS			
G13300 G13350 G13400 G13450 G40120 G40230 G40240	1330 1335 1340 1345 4012 4023 4024	0.28 to 0.33 0.33 to 0.38 0.38 to 0.43 0.43 to 0.48 0.09 to 0.14 0.20 to 0.25 0.20 to 0.25	1.60 to 1.90 1.60 to 1.90 1.60 to 1.90 1.60 to 1.90 0.75 to 1.00 0.75 to 1.00 0.70 to 0.90	0.035 0.035 0.035 0.035 0.035 0.035 0.035	0.040 0.040 0.040 0.040 0.040 0.040 0.040	0.15 to 0.30 0.15 to 0.30	···· ···· ···· ···	···· ··· ···	0.15 to 0.25 0.20 to 0.30 0.20 to 0.30
G40240 G40270 G40280	4024 4027 4028	0.25 to 0.30 0.25 to 0.30	0.70 to 0.90 0.70 to 0.90 0.70 to 0.90	0.035 0.035 0.035	0.035 to 0.040 0.035 to 0.050	0.15 to 0.30 0.15 to 0.30 0.15 to 0.30		···· ···	0.20 to 0.30 0.20 to 0.30 0.20 to 0.30

A 752 – 93 (2003)

TABLE 2 Continued

UNS Depic Outcome Process max Silicon max Nicket Chromium Magen dawn G44270 G44270 4037 0.35 to 0.40 0.70 to 0.00 0.035 0.040 0.15 to 0.30 0.30 to 0.30 G44270 4047 0.45 to 1.80 0.70 to 0.00 0.035 0.040 0.15 to 0.30 0.20 to 0.30 0.040 0.15 to 0.30 0.20 to 0.30 0.040 0.15 to 0.30 0.20 to 1.00 0.20 to 0.30 0.040 0.15 to 0.30 0.20 to 1.10 1.15 to 0.25 0.140 0.15 to 0.25 0.040 0.15 to 0.30 0.20 to 1.10 1.15 to 0.25 G414200 4147 4147 0.45 to 0.50 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.20 to 1.00 1.05 to 0.25 G414201 4146 0.45 to 0.30 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.75 to 1.00 0.25 to 0.35 0.5 to 0.35 0.75 to 1.00 0.25 to 0.35 0.5 to 0.30 0.75 to 1.00 0.25 to 0.35 0.5 to 0.35 </th <th></th> <th></th> <th colspan="6">Chemical Composition, Ranges and Limits, %</th> <th></th> <th></th>			Chemical Composition, Ranges and Limits, %							
GALATO 64 Jar 0.45 to .50 0.70 to .00 0.035 0.040 0.15 to .0.30 0.040 to .00 0.08 to 1.10 0.08 to 1.03 0.040 to .00 0.08 to 1.10 0.08 to 1.03 0.040 to .00 0.08 to 1.10 0.08 to 1.10 0.15 to .23 0.040 to .00 0.08 to 1.10 0.15 to .23 0.040 to .00 0.08 to 1.10 0.15 to .23 0.040 to .00 0.08 to 1.10 0.15 to .23 0.040 to .00 0.08 to 1.10 0.15 to .23 0.040 to .00 0.08 to 1.10 0.15 to .23 0.040 to .015 to .03 0.050 to .	•	Grade No.	Carbon	Manganese	phorus,		Silicon	Nickel	Chromium	
G41180 4118 L1 8b 0.23 0.27 to 10.50 0.045 0.046 0.15 to 0.33 0.40 to 0.65 0.08 to 0.15 G41300 4137 0.38 to 0.40 0.70 to 1.00 0.035 0.040 0.15 to 0.33 0.40 to 0.65 0.80 to 1.10 0.15 to 0.23 G41450 4147 0.40 to 0.66 0.75 to 1.00 0.035 0.040 0.15 to 0.23 0.40 to 0.66 0.80 to 1.10 0.15 to 0.23 G41460 4147 4147 0.45 to 0.33 0.75 to 1.00 0.035 0.040 0.15 to 0.23 0.400 to 1.10 0.15 to 0.23 G41460 41450 0.48 to 0.33 0.75 to 1.00 0.035 0.040 0.15 to 0.33 0.000 to 1.10 0.15 to 0.23 G41480 4145 0.48 to 0.34 0.050 to 0.35 0.040 0.15 to 0.31 1.65 to 2.20 0.70 to 0.30 0.20 to 0.30 0.21 to 0.30 0.22 to 0.33 0.24 to 0			0.35 to 0.40				0.15 to 0.30			
CH1300 H130 L28 b 0.33 L0 H0 to 0.60 D.035 D.040 L15 to 0.23 D.80 to 1.10 D.15 to 0.25 CH1400 H140 D.38 to 0.43 D.75 to 1.00 D.035 D.040 D.15 to 0.23 D.80 to 1.10 D.15 to 0.25 CH1400 H140 D.38 to 0.43 D.75 to 1.00 D.035 D.040 D.15 to 0.23 D.040 to 1.15 to 0.23 D.80 to 1.10 D.15 to 0.25 CH1500 H160 D.45 to 0.25 D.75 to 1.00 D.035 D.040 D.15 to 0.23 D.80 to 1.10 D.15 to 0.25 CH1500 H160 H161 D.45 to 0.33 D.040 D.15 to 0.33 D.070 to 0.90 D.25 to 0.33 D.44 to 0.45 to 0.45 D.25 to 0.33 D.44 to 0.45 to 0.45 to 0.45 D.25 to 0.30 D.44 to 0.45 to 0.45 to 0.45 D.25 to 0.30 D.44 to 0.45 to 0.30 D.70 to 0.90 D.20 to 0.30 D.44 to 0.45 to 0.30 D.70 to 0.90 D.25 to 0.30 D.44 to 0.45 to 0.30										
G41370 4137 0.35 b 0.40 0.70 b 0.30 0.035 0.040 0.15 b 0.33 0.88 b 1.10 0.15 b 0.25 G41404 4442 0.40 b 0.45 0.75 b 1.00 0.033 0.040 0.15 b 0.33 0.88 b 1.10 0.15 b 0.25 G41407 4442 0.44 b 0.45 0.75 b 1.00 0.033 0.040 0.15 b 0.33 0.88 b 1.10 0.15 b 0.25 G41500 4447 4.44 b 0.45 0.75 b 1.00 0.035 0.040 0.15 b 0.33 0.88 b 1.10 0.15 b 0.25 G41300 443 0.48 b 0.65 0.035 0.040 0.15 b 0.33 1.65 b 2.00 0.70 b 0.80 0.22 b 0.30 G44300 4441 0.13 b 0.22 0.45 b 0.55 0.035 0.040 0.15 b 0.33 1.65 b 2.00 0.20 b 0.30 0.20 b 0.35 0.040 0.15 b 0.33 1.65 b 2.00 0.20 b 0.30 0.20 b 0.3										1
G41400 4140 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41420 4142 0.40 to .64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41400 4142 0.40 to .64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41400 4142 0.41 to .64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41400 4140 0.55 to 0.43 0.75 to 1.03 0.76 to 0.30 1.65 to 2.00 0.70 to 0.80 0.20 to 0.30 G41400 416 to 0.21 0.45 to 0.86 0.035 0.040 0.15 to 0.30 1.65 to 2.00 7.00 to 0.00 0.20 to 0.30 G41401 416 to 2.21 0.45 to 0.85 0.035 0.040 0.15 to 0.30 1.65 to 2.00 7.00 to 0.00 0.20 to 0.30 G41401 416 to 2.21 0.71 to 0.80 0.035 0.040 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td>										1
G41420 4142 0.41 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41450 4147 0.45 to 0.50 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41400 4147 0.45 to 0.50 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G41500 4147 0.45 to 0.50 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G43200 4320 0.45 to 0.65 0.035 0.040 0.15 to 0.30 0.80 to 1.00 0.020 to 0.30 G43406 4415 0.18 to 0.25 0.025 0.025 0.025 0.025 0.020 0.030 0.70 to 0.30 0.7										1
CH1460 CH1460 CH1470 CH14700 CH14700 CH14700 CH14										1
G41470 G4147 G45 to 0.50 O.75 to 1.00 O.335 O.440 O.15 to 0.30 O.80 to 1.10 O.15 to 0.25 G4150 4161 G46 to 0.84 O.75 to 1.00 O.335 O.440 O.15 to 0.30 O.80 to 1.10 O.15 to 0.25 G41200 42300 G45 to 0.81 O.75 to 1.00 O.335 O.440 O.15 to 0.30 I.65 to 2.00 O.70 to 0.80 O.25 to 0.30 G43200 42300 H110 O.15 to 0.25 O.15 to 0.30 I.65 to 2.00 O.70 to 0.80 O.21 to 0.30 G44370 44150 O.13 to 0.15 O.45 to 0.65 O.335 O.440 O.15 to 0.30 I.65 to 2.00 O.21 to 0.30 G44570 4615 O.13 to 0.15 O.466 O.335 O.440 O.15 to 0.30 I.65 to 2.00 O.21 to 0.30 G44270 4415 O.18 to 0.22 O.50 to 0.70 O.35 to 0.440 O.15 to 0.30 I.55 to 2.00 O.21 to 0.30 G44570 4817 O.16 to 0.20 O.50 to 0.70										1
G41500 4150 0.48 to 0.53 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.71 to 0.80 0.75 to 0.30 G43200 4320 0.17 to 0.22 0.45 to 6.56 0.035 0.040 0.15 to 0.30 0.71 to 0.80 0.25 to 0.35 G44300 4330 0.38 to 0.43 0.64 to 6.56 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.71 to 0.80 0.25 to 0.35 G44150 4615 0.13 to 0.23 0.64 to 6.56 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.71 to 0.80 0.25 to 0.35 G44500 4450 0.17 to 0.22 0.45 to 6.56 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G44500 4450 0.17 to 0.22 0.45 to 6.56 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G44500 4450 0.21 to 0.23 0.035 0.040 0.15 to 0.33 3.25 to 3.75 0.20 to 0.30 G44170 417 to 15 to 0.23 0.										
G41610 4161 0.56 to 0.44 0.75 to 1.00 0.035 0.040 0.15 to 0.32 0.70 to 0.00 0.25 to 0.35 G43200 4330 0.33 to 0.43 0.60 to 0.55 0.036 0.040 0.15 to 0.33 1.65 to 2.00 0.70 to 0.00 0.23 to 0.35 G44410 44419 0.18 to 0.22 0.45 to 0.55 0.035 0.040 0.15 to 0.33 0.45 to 0.30 0.20 to 0.30 G44210 4419 0.18 to 0.22 0.45 to 0.55 0.035 0.040 0.15 to 0.35 0.45 to 0.35 0.040 0.15 to 0.35 0.035 0.040 0.15 to 0.35 0.035 0.040 0.15 to 0.35 0.035 0.040 0.15 to 0.33 0.035 0.040 0.15 to 0.33										1
G43200 6170 0.23 0.45 0.040 0.15 1.65 1.20 0.44 0.46 0.25 0.025 0.040 0.15 0.03 1.65 1.20 0.70 0.80 0.20 0.25 0.025 0.040 0.15 0.03 0.03 0.040 0.15 0.03 0.040 0.15 0.03 0.03 0.03 <										1
G43400 6340 0.38 to 0.43 0.66 to 0.88 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.70 to 0.90 0.20 to 3.0 G43406 E3400 O38 to 0.43 0.65 to 0.65 0.025 0.025 0.035 0.040 0.15 to 0.30 0.70 to 0.90 0.20 to 3.0 G44200 4119 0.18 to 0.45 0.65 to 0.55 0.026 0.035 0.040 0.15 to 0.30 0.70 to 0.90 0.23 to 0.30 G44210 4120 0.17 to 0.23 0.70 to 0.90 0.23 to 0.35 0.040 0.15 to 0.33 0.66 to 0.35 0.040 0.15 to 0.33 0.65 to 0.35 0.30 to 0.35 0.040 0.15 to 0.33 0.05 to 0.35 0.040 0.15 to 0.33 0.35 to 0.55 0.33 to 0.55 0.34 to 0.33 to 0.55 0.35 to 0.35 0.400 0.15 to 0.30 0.35 to 0.35 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td>										1
G43460 E4340 0.38 to 0.43 0.65 to 0.85 0.025 0.025 0.15 to 0.30 1 65 to 2.00 0.70 to 0.50 0.20 to 0.30 G44190 4415 0.13 to 0.23 0.45 to 0.65 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 0.240 to 0.30 G4201 4421 0.18 to 0.23 0.45 to 0.65 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 0.240 to 0.30 0.230 to 0.30 0.240 0.35 to 0.55 0.50 to 0.30 0.240 to 0.30 0.230 to 0.30 0.240 to 0.30 0.230 to 0.30 0.240 to 0.30 0.33 to 0.55 0.50 to 0.50 0.20 to 0.30 0.240 to 0.30 0.33 to 0.55 0.51 to 0.25 0.35 to 0.55 0.50 to 0.30 0.340 to 15 to 0.30 3.25 to 3.75 0.20 to 0.30 0.240 to 1.55 to 0.35 0.400 to 15 to 0.30 0.35 to 0.55 0.51 to 0.35 0.440 to 0.51 to 0.30 0.35 to 0.55 0.51 to 0.30										1
G44190 4419 0.18 to 0.23 0.45 to 0.65 0.035 0.040 0.15 to 0.30 0.45 to 0.60 G44200 4620 0.17 to 0.22 0.45 to 0.65 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G44204 4622 0.74 to 0.22 0.04 to 0.85 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G44210 446 to 0.22 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.25 to 0.35 0.040 0.15 to 0.30 0.25 to 0.35 0.040 0.15 to 0.30 0.25 to 0.55 0.26 to 0.30 0.25 to 0.55 0.26 to 0.30 0.35 to 0.55 0.26 to 0.30 0.36 to 0.56 0.26 to 0.30 0.36 to 0.56 0.26 to 0.30 0.36 to 0.40 0.15 to 0.30 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td>										1
G46200 6420 0.471 b 0.22 0.46 to 0.85 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G46210 6422 0.47 to 0.29 0.45 to 0.85 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G46260 6426 0.24 to 0.29 0.45 to 0.85 0.035 0.040 0.15 to 0.30 0.90 to 1.20 0.35 to 0.55 0.15 to 0.25 G47200 4720 0.17 to 0.22 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.25 to 0.55 0.15 to 0.25 0.35 to 0.55 0.15 to 0.25 0.35 to 0.55 0.15 to 0.25 0.25 to 0.37 0.20 to 0.30 0.24 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.20 to 0.30 0.25 to 3.75 0.										
G46200 6420 0.471 b 0.22 0.43 to 0.65 0.035 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G46210 64221 0.18 to 0.23 0.70 to 0.90 0.355 0.040 0.15 to 0.30 1.65 to 2.00 0.20 to 0.30 G46260 64221 0.18 to 0.21 0.71 to 0.90 0.035 0.040 0.15 to 0.30 0.90 to 1.20 0.35 to 0.55 0.15 to 0.25 0.35 to 0.55 0.15 to 0.30 0.25 to 0.35 0.040 0.15 to 0.30 0.25 to 0.35 0.20 to 0.30 0.25 to 0.35 0.404 0.15 to 0.30 0.25 to 0.35 0.404 0.15 to 0.30 0.25 to 0.35 0.404 0.15 to 0.30 0.20 to 0.30 0.25 to 0.35 0.404										1
G46210 4621 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.23 1.70 to 0.90 0.15 to 0.23 0.70 to 1.00 0.15 to 0.23 0.70 to 1.00 0.55 to 0.25 0.35 to 0.46 0.15 to 0.23 0.26 to 0.35 0.440 0.15 to 0.23 0.25 to 0.25 0.35 to 0.46 0.35 to 0.55 0.30 to 0.40 0.35 to 0.55 0.30 to 0.35 0.440 0.15 to 0.30 0.25 to 0.35 0.26 to 0.30	G46200	4620	0.17 to 0.22	0.45 to 0.65	0.035	0.040				1
G47180 4718 0.76 to 0.21 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.90 to 1.20 0.35 to 0.55 0.30 to 0.25 G44150 4415 0.13 to 0.18 0.40 to 0.60 0.035 0.040 0.15 to 0.30 0.90 to 1.20 0.35 to 0.55 0.31 to 0.25 0.41 to 0.25 0.40 to 0.60 0.035 0.404 0.15 to 0.30 0.25 to 0.375 0.20 to 0.30 G44120 4417 0.15 to 0.27 0.035 0.404 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G44200 4417 0.15 to 0.27 0.70 to 0.90 0.035 0.404 0.15 to 0.30 0.70 to 0.90 0.20 to 0.30 G51300 5130 0.30 to 0.35 0.6040 0.035 0.404 0.15 to 0.30 0.70 to 0.90 0.30 to 0.40 0.15 to 0.30 0.70 to 0.90 0.30 to 0.40 0.15 to 0.30 0.70 to 0.90 0.30 to 0.40 0.15 to 0.30 0.70 to 0.90 0.70 to 0.90	G46210	4621	0.18 to 0.23	0.70 to 0.90	0.035	0.040	0.15 to 0.30			0.20 to 0.30
G47200 4720 0.17 to 0.22 0.50 to 7.0 0.035 0.040 0.15 to 0.30 0.38 to 0.55 0.15 to 0.20 0.35 to 0.55 0.15 to 0.20 0.32 to 0.37 0.20 to 0.30 G44710 4415 0.13 to 0.23 0.040 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G50150 5015 0.12 to 0.17 0.30 to 0.50 0.035 0.040 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G51300 51320 0.71 to 0.22 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 G51300 5132 0.33 to 0.35 0.60 to 0.80 0.035 0.040 0.15 to 0.30 0.70 to 0.90 G51400 5142 0.31 to 0.43 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 G51400 5144 0.43 to 0.43 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 6.5150 0.70 to 0.90	G46260	4626	0.24 to 0.29	0.45 to 0.65	0.035	0.040	0.15 to 0.30	0.70 to 1.00		0.15 to 0.25
G46150 4415 0.13 to 0.18 0.40 to 0.60 0.035 0.400 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G46200 4420 0.15 to 0.20 0.36 to 0.70 0.035 0.400 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G61200 5120 0.17 to 0.22 0.70 to 0.90 0.035 0.400 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G613200 5130 0.28 to 0.33 0.70 to 0.90 0.035 0.400 0.15 to 0.30 0.70 to 0.90 G61320 5132 0.33 to 0.33 0.66 to 0.80 0.035 0.4040 0.15 to 0.30 0.70 to 0.90 G614400 5145 0.33 to 0.43 0.70 to 0.90 0.035 0.4040 0.15 to 0.30 0.70 to 0.90 G51500 5155 0.51 to 0.53 0.70 to 0.90 0.035 0.4040 0.15 to 0.30 0.70 to 0.90 Chemical Composition, Ranges and Limits, % Mode <t< td=""><td>G47180</td><td>4718</td><td>0.16 to 0.21</td><td>0.70 to 0.90</td><td>0.035</td><td>0.040</td><td>0.15 to 0.30</td><td>0.90 to 1.20</td><td>0.35 to 0.55</td><td>0.30 to 0.40</td></t<>	G47180	4718	0.16 to 0.21	0.70 to 0.90	0.035	0.040	0.15 to 0.30	0.90 to 1.20	0.35 to 0.55	0.30 to 0.40
G48170 4817 0.15 to 2.30 0.40 to 0.60 0.035 0.040 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G50150 5015 0.12 to 0.17 0.30 to 0.50 0.035 0.040 0.15 to 0.30 3.25 to 3.75 0.30 to 0.50 0.30 to 0.50 0.31 to 0.50 0.32 to 0.33 0.20 to 0.30 0.20 to	G47200	4720	0.17 to 0.22	0.50 to 0.70	0.035	0.040	0.15 to 0.30	0.90 to 1.20	0.35 to 0.55	0.15 to 0.25
G48200 4820 0.16 to 0.23 0.50 to 0.70 0.035 0.040 0.15 to 0.30 3.25 to 3.75 0.20 to 0.30 G51200 5120 0.17 to 0.22 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 0.77 to 0.90 0.75 to 1.00 0.70 to 0.90 0.75 to 0.30 0.70 to	G48150	4815	0.13 to 0.18	0.40 to 0.60	0.035	0.040	0.15 to 0.30	3.25 to 3.75		0.20 to 0.30
650150 5015 0.12 to 0.17 0.30 to 0.50 0.035 0.040 0.15 to 0.30 0.03 to 0.50 0.035 65120 0.71 to 0.22 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 0.71 to 0.20	G48170	4817	0.15 to 0.20	0.40 to 0.60	0.035	0.040	0.15 to 0.30	3.25 to 3.75		0.20 to 0.30
GS1200 5120 0.71 to 0.22 0.70 to 0.90 0.035 0.040 0.75 to 0.30 0.70 to 0.90 GS1300 5132 0.33 to 0.33 0.040 0.05 to 1.03 0.75 to 1.00 GS1320 5132 0.33 to 0.33 0.040 0.05 to 1.03 0.75 to 1.00 GS1440 5144 0.43 to 0.43 0.70 to 0.90 0.70 to 0.90 0.70 to 0.90 GS1470 5144 0.44 to 0.51 0.70 to 0.90 0.70 to 0.90 0.70 to 0.90 GS1500 5150 0.44 to 0.53 0.70 to 0.90 0.75 to 1.30 0.70 to 0.90 GS1600 5150 0.44 to 0.53 0.70 to 0.90 0.75 to 1.30 0.70 to 0.90 GS1600 5150 0.46 to 0.51 0.70 to 0.90 0.75 to 1.30 0.70 to 0.90 GS1600 5150 0.50 to 0.70			0.18 to 0.23	0.50 to 0.70			0.15 to 0.30	3.25 to 3.75		0.20 to 0.30
GS1300 5132 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 GS1320 5132 0.33 to 0.35 0.040 0.035 0.040 0.15 to 0.30 0.80 to 0.80 0.035 0.040 0.15 to 0.30 0.80 to 1.10 GS1430 5142 0.38 to 0.43 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.05 GS1450 5147 0.44 to 0.51 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 GS1500 5150 0.44 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.70 to 0.90 GS1500 5150 0.44 to 0.51 0.70 to 0.90 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.025 0.026 0.025 <										
G61320 (51320) 5132 (5135) 0.30 to 0.33 (0.60 to 0.80) 0.040 (0.035) 0.040 (0.05 to 0.30) 0.75 to 1.00 (0.70 to 0.80) G51450 (51450) 5145 0.43 to 0.43 (0.70 to 0.80) 0.035 (0.040) 0.045 to 0.30 (0.040) 0.75 to 0.30 (0.400) 0.75 to 1.30 (0.70 to 0.80) G51470 (51500) 5145 0.44 to 0.51 (0.70 to 0.80) 0.035 (0.040) 0.045 to 0.30 (0.400) 0.75 to 1.30 (0.400) 0.85 to 1.15 (0.77 to 0.80) G51500 (51500) 5150 0.44 to 0.53 (0.76 to 0.80) 0.035 (0.040) 0.15 to 0.30 (0.15 to 0.30) 0.77 to 0.80 (0.77 to 0.80) G51500 (5150) 0.58 to 1.16 (0.58 to 0.54) 0.77 to 1.0.80 (0.75 to 1.30) 0.77 to 0.30 (0.15 to 0.30) 0.77 to 0.80 (0.75 to 0.30) 0.77 to 0.80 (0.77 to 0.80) E51100 (0.58 to 1.10) 0.25 to 0.45 (0.25 to 0.45) 0.25 to 0.45 (0.25 to 0.15 to 0.30) 0.90 to 1.15 (0.15 to 0.30) 0.90 to 1.1										
GS1350 S135 O.33 D.0.38 D.0.00 D.0.35 D.0.40 D.15 D.0.30 D.80 D.10.5 GS1400 S1447 O.48 D.70 D.0.00 D.0.035 D.0.40 D.15 D.0.30 D.77 D.0.90 GS1470 S147 D.48 D.0.33 D.0.40 D.15 D.0.30 D.77 D.0.90 GS1550 S155 D.51 D.59 D.71 D.0.95 D.0.035 D.0.40 D.15 D.0.30 D.70 D.90 GS1550 S155 D.56 D.56 D.64 D.75 D.00 D.035 D.040 D.15 D.30 D.70 D.90 L CS1600 D.56 D.64 D.75 D.00 D.035 D.040 D.15 D.030 L D.90 L D.90 L D.90 L D.90 L D.90 L D.90 D.90 L D.90 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>										
G51400 (51450) 5145 (51457) 0.38 to 0.43 (70 to 0.90 (70 to 0.90) 0.035 (0.035) 0.040 (0.040) 0.15 to 0.30 (70 to 0.90) 0.70 to 0.90 (70 to 0.90) (70 to 0.90) G51470 5147 0.48 to 0.53 (70 to 0.90) 0.70 to 0.90 (0.035) 0.040 (0.040) 0.15 to 0.30 (70 to 0.90) 0.70 to 0.90 (75 to 0.30) 0.70 to 0.90 (75 to 0.30) 0.70 to 0.90 (75 to 0.30) 0.70 to 0.90 (77 to 0.90) 0.15 (77 to 0.90) 0.71 to 0.90 (77 to 0.90) 0.71 to 0.90 (77 to 0.90) 0.15 to 0.30 0.70 to 0.90 (77 to 0.90) 0.15 to 0										
G51450 G51470 5147 G51500 0.48 to 0.53 G710 0.90 0.035 G710 0.90 0.040 G715 to 0.30 0.44 L, 0.51 to 0.50 G715 to 0.30 0.70 to 0.90 G715 to 0.30 0.45 to 0.51 G715 to 0.30 0.70 to 0.90 G715 to 0.30 0.70 to 0.90 G716 0.90 0.70 to 0.90 G71										
G51470 5147 0.46 to 0.51 0.70 to 0.95 0.035 0.040 0.15 to 0.30 0.71 to 0.90 0.035 G51500 5150 0.55 to 0.64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.70 to 0.90 0.035 G51500 5150 0.55 to 0.64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.70 to 0.90 0.035 E51100 0.98 to 1.10 0.25 to 0.45 0.025 0.040 0.15 to 0.30 0.70 to 0.90 0.035 E52100 0.98 to 1.10 0.25 to 0.45 0.025 0.026 0.15 to 0.30 0.70 to 0.90 0.035 MINS Designation Grade No. Carbon 1.1 Manganese Prosphorus. Sulfur, max Silicol 1 Nickel 1 Chronium Other Elements G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 to 0.25 G661500 6150 0.41 to 0.50 0.70 to 0.90 0.035 0.040 <td></td>										
G61500 G51500 5155 5155 0.48 to 0.53 0.56 to 0.64 0.75 to 1.00 0.28 to 0.45 0.040 0.035 0.040 0.15 to 0.30 0.77 to 0.90 0.77 to 0.90 0.035 0.77 to 0.90 G51500 5155 0.56 to 0.64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.77 to 0.90 0.035 E51100 0.98 to 1.10 0.25 to 0.45 0.025 0.025 0.15 to 0.30 0.70 to 0.90 UNS Designation Grade No. Chemical Composition, Ranges and Limits, % Transition Other Elements G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 1.50 G68150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86150 8615 0.13 to 0.18 0.27 to 0.90 0.03								L.a		
G61550 G51600 5155 5160 0.55 to 0.54 0.55 to 0.45 0.70 to 0.90 0.75 to 1.04 0.035 0.25 0.040 0.15 to 0.30 0.15 to 0.30 0.15 to 0.30 0.70 to 0.90 0.90 to 1.15 0.11 0.25 to 0.45 UNS Desig mation Grade No. to 0.80 to 1.10 0.25 to 0.45 0.025 0.025 0.15 to 0.30 0.000 to 1.15 0.100 to 0.90 0.11 to 0.11 1.30 to 1.60 0.11 to 0.11 1.30 to 1.60 0.11 to 0.11										
G51600 5160 0.56 to 0.64 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.70 to 0.90 UNS Designation Grade No. 0.25 to 0.45 0.025 0.025 0.15 to 0.30 1.30 to 1.60 1.50 to 0.70 0.10 to 0.51 0.30 to 0.70 0.305 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 0.256 0.70 to 0.90 0.35 0.040								7		
E51100 0.98 to 1.10 0.25 to 0.45 0.025 0.025 0.15 to 0.30 0.90 to 1.15 UNS Designation Grade No. Carbon 1ak Maganese Phosphorus. Suffur, max I Silicon 2d Chromium Other Elements Grade No. Carbon 1ak Maganese Phosphorus. Suffur, max I Silicon 2d Chromium Other Elements Grade No. Carbon 1ak Maganese Phosphorus. Suffur, max I Silicon 2d Chromium Other Elements G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G61150 6415 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G86150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G8620 8615 0.13 to 0.28 0.70 to 0.90 0.035 0.040										
E52100 0.98 to 1.10 0.25 to 0.45 0.025 0.15 to 0.30 1.30 to 1.60 UNS Designation Grade No. Carbon 1.4 Manganese Phosphorus, max Sultur, max I Silicon 1.6 Nickel 2.6 Chromium 2.0 Other Elements G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.010 to 0.15 G61500 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G61500 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.70 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86150 8615 0.13 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25	G51600									
Chemical Composition, Ranges and Limits, % Phosphorus, max Sulfur, max It is Silicon of the Nickel 2 differentia (1 for Nickel 2 differentia) Chemical Composition, Ranges and Limits, % Phosphorus, max Sulfur, max It is Silicon of the Nickel 2 differentia Chemical Composition, Ranges and Limits, % Generation Carbon III Manganese Phosphorus, max Sulfur, max It is Silicon of the Nickel 2 differentia Other Elements Generation 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 Generation 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.60 0.15 to 0.25 Generation 8617 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 Generation 8617 0.13 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 Generation 8622 0.28 to 0.28 0.70 to 0.90 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>										
ONS Grade No. mation Carbon Manganese Phosphorus, max Sulfur, max I Silicon Other Elements Other Elements G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G86150 6150 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G86170 8617 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.60 0.15 to 0.25 G86270 8627 0.23 to 0.	···	E92100	0.98 10 1.10	0.25 10 0.45	ASTRA	1752 02/2	002)		1.30 10 1.60	<u> </u>
match Manganeses Since Surue, max Surue, max Fire Sincen 90 Or Nickel 2010, Chromum 50 Other Elements G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G61150 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.15 G86150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86170 8617 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8620 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270 8627 0.28 to 0.70	1	Grade No						11.6 0101		
G61180 6118 0.16 to 0.21 0.50 to 0.70 0.035 0.040 0.15 to 0.30 0.50 to 0.70 0.10 to 0.15 G61500 6150 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.15 G61500 6150 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 to 0.25 G66150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86170 8617 0.15 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.23 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.23 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270	nation	standards	Carbon tal	g/ Manganese S/S		Sulfur, max	418Silicon9d-	d 0 Nickel 200	d/2Chromium	Other Elements
G61500 6150 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 min G61500 66150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86150 8617 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <td></td> <td></td> <td></td> <td></td> <td>I</td> <td></td> <td></td> <td> </td> <td>l</td> <td>Vanadium</td>					I				l	Vanadium
G61500 6150 0.48 to 0.53 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.80 to 1.10 0.15 min G61500 66150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86150 8617 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86260 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <td>G61180</td> <td>6118</td> <td>0.16 to 0.21</td> <td>0.50 to 0.70</td> <td>0.035</td> <td>0.040</td> <td>0.15 to 0.30</td> <td>l</td> <td>0.50 to 0.70</td> <td>0.10 to 0.15</td>	G61180	6118	0.16 to 0.21	0.50 to 0.70	0.035	0.040	0.15 to 0.30	l	0.50 to 0.70	0.10 to 0.15
Gamma Standard Alloy STEELS Gamma Standard Alloy STEELS G86150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86170 8617 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8620 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.60 0.15 to 0.25 G86370 8637 0.25 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8641 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td>										1
STANDARD ALLOY STEELS G86150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86170 8617 0.15 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70										Molyb-
G86150 8615 0.13 to 0.18 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86170 8617 0.15 to 0.20 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>denum</td></tr<>										denum
G86170 8617 0.15 to 0.20 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86200 8620 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <tr< td=""><td></td><td></td><td></td><td>_</td><td>STANDA</td><td>RD ALLOY STE</td><td>ELS</td><td>-</td><td>-</td><td>-</td></tr<>				_	STANDA	RD ALLOY STE	ELS	-	-	-
G86200 8620 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86220 8622 0.23 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86370 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>										
G86220 8622 0.20 to 0.25 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>										
G86250 8625 0.23 to 0.28 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86270 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86370 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr<>										1
G86270 8627 0.25 to 0.30 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86370 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr<>										1
G86300 8630 0.28 to 0.33 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86370 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86550 8655 0.51 to 0.59 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr<>										1
G86370 8637 0.35 to 0.40 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86550 8655 0.51 to 0.59 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr<>										1
G86400 8640 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86550 8655 0.51 to 0.59 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G87200 8740 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr<>										1
G86420 8642 0.40 to 0.45 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86550 8655 0.51 to 0.59 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G87400 8740 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G88220 8222 0.20 to 0.25 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 <tr< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr<>										
G86450 8645 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G86550 8655 0.51 to 0.59 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G87400 8740 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G88220 8822 0.20 to 0.25 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G92540 9254 0.51 to 0.59 0.60 to 0.80 0.035 0.040 1.20 to 1.60 G92600										1
G86550 8655 0.51 to 0.59 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.15 to 0.25 G87200 8720 0.18 to 0.23 0.70 to 0.90 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 0.20 to 0.30 G87400 8740 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G88220 8822 0.20 to 0.25 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G92540 9254 0.51 to 0.59 0.60 to 0.80 0.035 0.040 1.20 to 1.60 0.60 to 0.80 G92550 9255 0.51 to 0.59 0.70 to 0.95 0.035 0.040 1.80 to 2.20 G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20 G92600 926										1
G87200 G87400 8720 8740 0.18 to 0.23 0.38 to 0.43 0.70 to 0.90 0.75 to 1.00 0.035 0.035 0.040 0.15 to 0.30 0.15 to 0.30 0.40 to 0.70 0.40 to 0.70 0.40 to 0.60 0.40 to 0.70 0.20 to 0.30 0.40 to 0.60 G87200 8740 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G88220 8822 0.20 to 0.25 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G92540 9254 0.51 to 0.59 0.60 to 0.80 0.035 0.040 1.20 to 1.60 0.60 to 0.80 G92550 9255 0.51 to 0.59 0.70 to 0.95 0.035 0.040 1.80 to 2.20 G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20 G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20										1
G87400 8740 0.38 to 0.43 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 G88220 8822 0.20 to 0.25 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.20 to 0.30 0.30 to 0.40 G92540 9254 0.51 to 0.59 0.60 to 0.80 0.035 0.040 1.20 to 1.60 0.60 to 0.80 G92550 9255 0.51 to 0.59 0.70 to 0.95 0.035 0.040 1.80 to 2.20 G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20 STANDARD BORON ALLOY STEELS ^A STANDARD BORON ALLOY STEELS ^A 0.40 to 0.60										1
G88220 G92540 8822 9254 0.20 to 0.25 0.51 to 0.59 0.75 to 1.00 0.60 to 0.80 0.035 0.035 0.040 0.15 to 0.30 0.40 to 0.70 0.40 to 0.60 0.30 to 0.40 G92550 9255 0.51 to 0.59 0.70 to 0.95 0.035 0.040 1.20 to 1.60 0.60 to 0.80 0.60 to 0.80										1
G92540 G92550 9254 9255 0.51 to 0.59 0.51 to 0.59 0.60 to 0.80 0.70 to 0.95 0.035 0.035 0.040 0.40 1.20 to 1.60 1.80 to 2.20 0.60 to 0.80 G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20 G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20 STANDARD BORON ALLOY STEELS ⁴ 50B44 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.60										1
G92550 G92600 9255 9260 0.51 to 0.59 0.56 to 0.64 0.70 to 0.95 0.75 to 1.00 0.035 0.035 0.040 0.040 1.80 to 2.20 1.80 to 2.20 STANDARD BORON ALLOY STEELS ^A G50441 50B44 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.60										
G92600 9260 0.56 to 0.64 0.75 to 1.00 0.035 0.040 1.80 to 2.20 STANDARD BORON ALLOY STEELS ⁴ G50441 50B44 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.60										
STANDARD BORON ALLOY STEELS ^A G50441 50B44 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30										
G50441 50B44 0.43 to 0.48 0.75 to 1.00 0.035 0.040 0.15 to 0.30 0.40 to 0.60	002000	0200	0.00 10 0.04	•	•	•				<u> </u>
	050///	505 / /		-			1	1		
<u> </u>										
	G50461	50B46	0.44 10 0.49	0.75 10 1.00	0.035	0.040	0.15 (0 0.30		0.20 (0 0.35	

斯学 A 752 – 93 (2003)

 TABLE 2
 Continued

UNS Desig- nation Grade No		Chemical Composition, Ranges and Limits, %									
	Grade No.	Carbon	Manganese	Phos- phorus, max	Sulfur, max	Silicon	Nickel	Chromium	Molyb- denum		
G50501	50B50	0.48 to 0.53	0.75 to 1.00	0.035	0.040	0.15 to 0.30		0.40 to 0.60			
G50601	50B60	0.56 to 0.64	0.75 to 1.00	0.035	0.040	0.15 to 0.30		0.40 to 0.60			
G51601	51B60	0.56 to 0.64	0.75 to 1.00	0.035	0.040	0.15 to 0.30		0.70 to 0.90			
G81451	81B45	0.43 to 0.48	0.75 to 1.00	0.035	0.040	0.15 to 0.30	0.20 to 0.40	0.35 to 0.55	0.08 to 0.15		
G94171	94B17	0.15 to 0.20	0.75 to 1.00	0.035	0.040	0.15 to 0.30	0.30 to 0.60	0.30 to 0.50	0.08 to 0.15		
G94301	94B30	0.28 to 0.33	0.75 to 1.00	0.035	0.040	0.15 to 0.30	0.30 to 0.60	0.30 to 0.50	0.08 to 0.15		

^A These steels can be expected to a minimum boron content of 0.0005 %.

5. Manufacture

5.1 The product of the steel making processes is either cast into ingots that are hot rolled to blooms or billets, or strand cast directly into blooms or billets for subsequent processing into rods.

6. Chemical Composition

6.1 The chemical composition for alloy steel under this specification shall conform to the requirements set forth in the purchase order. The grades commonly specified for alloy steel wire rods and alloy steel wire are shown in Table 2. For specified compositions not contained in Table 2 the ranges and limits expressed in Table 3 shall apply unless other such ranges and limits shall have been agreed upon between the purchaser and the manufacturer.

6.2 *Cast or Heat Analysis*—An analysis of each cast or heat shall be made by the producer to determine the percentage of the elements specified. The analysis shall be made from a test sample preferably taken during the pouring of the cast or heat. The chemical composition thus determined shall be reported, if required, to the purchaser or his representative.

to confirm a previous result. The purpose of the product analysis is to verify that the chemical composition is within specified limits for each element, including applicable permissible variations in product analysis. The results of analyses taken from different pieces of a heat may differ within permissible limits from each other and from the heat analysis. Table 4 shows the permissible variations for product analysis of alloy steel. The results of the product analysis, except lead, shall not vary both above and below the specified ranges.

6.3.1 The location from which chips for product analysis are obtained is important because of normal segregation. For rods and wire, chips must be taken by milling or machining the full cross section of the sample.

6.3.1.1 Steel subjected to certain thermal treatments by the purchaser may not give chemical analysis results that properly represent its original composition. Therefore, purchasers should analyze chips taken from the steel in the condition in which it is received from the producer.

6.3.1.2 When samples are returned to the producer for product analysis, the samples should consist of pieces of the full cross section.

6.3 *Product Analysis*—A product analysis may be made by 70–7–6.3.2 For referee purposes, Test Methods E 30 shall be used. the purchaser. The analysis is not used for a duplicate analysis

TABLE 3 Alloy Steels—Chemical Composition Ranges and Limits for Cast or Heat Analysis

Note 1-Boron steels can be expected to have a 0.0005 % minimum boron content.

NOTE 2—Alloy steels can be produced with a lead range of 0.15 to 0.35 %. Lead is reported only as a range of 0.15 to 0.35 % since it is added to the mold as the steel is poured.

Note 3-The chemical ranges and limits of alloy steels are produced to the check, product, or verification analysis tolerances shown in Table 4.

		Rang		
Element	When Maximum of Specified Element is, %	Open- Hearth or Basic Oxygen Steel	Electric Furnace Steel	- Maximum Limit, % ^A
Carbon	To 0.55, incl	0.05	0.05	
	Over 0.55 to 0.70, incl	0.08	0.07	
	Over 0.70 to 0.80, incl	0.10	0.09	
	Over 0.80 to 0.95, incl	0.12	0.11	
	Over 0.95 to 1.35, incl	0.13	0.12	
Manganese	To 0.60, incl	0.20	0.15	
-	Over 0.60 to 0.90, incl	0.20	0.20	
	Over 0.90 to 1.05, incl	0.25	0.25	
	Over 1.05 to 1.90, incl	0.30	0.30	
	Over 1.90 to 2.10, incl	0.40	0.35	