



# SURFACE VEHICLE INFORMATION REPORT

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## Estimated Mechanical Properties and Machinability of Steel Bars

### RATIONALE

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**Foreword**—This Document has also changed to comply with the new SAE Technical Standards Board format.

**1. Scope**—This SAE Information Report is intended to provide a guide to mechanical and machinability characteristics of some SAE steel grades. The ratings and properties shown are provided as general information and not as requirements for specifications unless each instance is approved by the source of supply. The data are based on resources which may no longer be totally accurate. However, this report is retained as a service in lieu of current data.

## **2. References**

**2.1 Applicable Publication**—The following publication forms a part of this specification to the extent specified herein.

U. S. Air Force Machinability Report, Volume 2, 1951, published by Curtiss-Wright Corporation

**2.2 Related Publications**—The following publications are provided for information purposes only and are not a required part of this document.

Metals Handbook, 8th ed., Volume 3, Machining, American Society for Metals, Metals Park, OH 44073.

Machining Data Handbook, Volumes 1 and 2.

Machinability Data Center, Metcut Research Associates, 3980 Rosslyn Drive, Cincinnati, OH 45209.

**3. Carbon Steel**—Mechanical properties and machinability ratings for carbon steel grades 10xx, 11xx, 12xx, and 15xx are listed in Tables 1, 2, and 3. These properties can generally be expected from bars ranging in size from 20 to 30 mm (3/4 to 1-1/4 in) based on the standard round tensile test specimen with 50 mm (2 in) gage length.

Sizes under 20 mm (3/4 in) will show a strength which is slightly higher than those shown in the Tables. The mass effect of larger sections has a direct influence on mechanical properties and results in slightly lower values as the section size increases.

Properties of turned and polished or turned and ground types of cold finished material will correspond to the hot rolled values.

The cold drawn properties are based on conventional production from hot rolled bars.

Cold drawn carbon steel bars in grades 1042 and higher are frequently thermally treated prior to cold drawing to enhance machinability.

**4. Alloy Steel**—Hardness and machinability ratings for cold drawn alloy steel bars are listed in Table 4 with the appropriate microstructure. The microstructure listed for alloy steels in Table 4 is identified as follows:

- a. Type A—Predominantly lamellar pearlite and ferrite.
- b. Type B—Predominantly spheroidized.
- c. Type C—This is a hot rolled structure which depends upon grade, size, and rolling conditions of the producing mill. The structure may be coarse or fine pearlite or bainite. The pearlite at low magnification may be blocky or acicular. For descriptive information, see U. S. Air Force Machinability Report, Volume 2, 1951, published by Curtiss-Wright Corporation.
- d. Type D—This is a structure resulting from a subcritical anneal or temper anneal. It is usually a granular or spheroidized carbide condition confined to the hot rolled grain pattern, which may be blocky or acicular.

**5. Machinability**—While it is recognized that the views regarding alloy steel machinability vary considerably, it is believed that the ratings contained in this report reflect current industry experience. The data on which the ratings were based were obtained by a detailed survey of both producers and users. The data summarize the combined experience of both groups. Various factors influence machinability and, therefore, results shown in Table 1 are average and may be affected to some degree by the amount of cold reduction, mechanical properties, grain size, microstructure, type of tooling, and machining operation(s) performed.

The machinability ratings listed are based on a value of 100% for SAE 1212 cold drawn steel. This value involves turning at a cutting speed of 55 m (180 surface feet) per minute for feeds up to 0.18 mm (0.007 in) per revolution and depths of cut up to 6.4 mm (0.250 in), using appropriate cutting fluids with high speed steel tools, SAE Grade T-1 (18-4-1) hardened to 63-65 HRC (SAE J437, J438).

Most low carbon alloy steels are machined in the as-rolled or as-rolled and cold drawn or cold finished condition. Higher carbon alloy steels and high hardenability low carbon steels, such as SAE 9310, may be conditioned for machining by a variety of heat treatments. Thermal treatments used to condition these steels for machining include subcritical annealing, annealing for softening to no specified structure, annealing to a specified structure such as lamellar pearlite or a percentage of lamellar pearlite and spheroidization, or to a fully spheroidized condition.

The structures imparted to the bars are evaluated in the machining operation by the tooling setup and the type of tool used. It is possible to use widely diverging hardnesses and structures with different tooling setups and obtain satisfactory results both as to finish and parts per hour.

**TABLE 1—ESTIMATED MECHANICAL PROPERTIES AND MACHINABILITY RATINGS  
OF NONRESULFURIZED CARBON STEEL BARS, MANGANESE 1.00% MAXIMUM**

| UNS No. | SAE and/or AISI No. | Type of Processing | Tensile Strength MPa | Tensile Strength psi | Estimated Minimum Values Yield Strength MPa | Estimated Minimum Values Yield Strength psi | Estimated Minimum Values Elongation in 2 in, % | Reduction in Area % | Brinell Hardness | Average Machinability Rating (Cold Drawn) 1212=100% |
|---------|---------------------|--------------------|----------------------|----------------------|---------------------------------------------|---------------------------------------------|------------------------------------------------|---------------------|------------------|-----------------------------------------------------|
| G10060  | 1006                | Hot Rolled         | 300                  | 43 000               | 170                                         | 24 000                                      | 30                                             | 55                  | 86               | 50                                                  |
|         |                     | Cold Drawn         | 330                  | 48 000               | 280                                         | 41 000                                      | 20                                             | 45                  | 95               |                                                     |
| G10080  | 1008                | Hot Rolled         | 303                  | 44 000               | 170                                         | 24 500                                      | 30                                             | 55                  | 86               | 55                                                  |
|         |                     | Cold Drawn         | 340                  | 49 000               | 290                                         | 41 500                                      | 20                                             | 45                  | 95               |                                                     |
| G10100  | 1010                | Hot Rolled         | 320                  | 47 000               | 180                                         | 26 000                                      | 28                                             | 50                  | 95               | 55                                                  |
|         |                     | Cold Drawn         | 370                  | 53 000               | 300                                         | 44 000                                      | 20                                             | 40                  | 105              |                                                     |
| G10120  | 1012                | Hot Rolled         | 330                  | 48 000               | 180                                         | 26 500                                      | 28                                             | 50                  | 95               | 55                                                  |
|         |                     | Cold Drawn         | 370                  | 54 000               | 310                                         | 45 000                                      | 19                                             | 40                  | 105              |                                                     |
| G10150  | 1015                | Hot Rolled         | 340                  | 50 000               | 190                                         | 27 500                                      | 28                                             | 50                  | 101              | 60                                                  |
|         |                     | Cold Drawn         | 390                  | 56 000               | 320                                         | 47 000                                      | 18                                             | 40                  | 111              |                                                     |
| G10160  | 1016                | Hot Rolled         | 380                  | 55 000               | 210                                         | 30 000                                      | 25                                             | 50                  | 111              | 70                                                  |
|         |                     | Cold Drawn         | 420                  | 61 000               | 350                                         | 51 000                                      | 18                                             | 40                  | 121              |                                                     |
| G10170  | 1017                | Hot Rolled         | 370                  | 53 000               | 200                                         | 29 000                                      | 26                                             | 50                  | 105              | 65                                                  |
|         |                     | Cold Drawn         | 410                  | 59 000               | 340                                         | 49 000                                      | 18                                             | 40                  | 116              |                                                     |
| G10180  | 1018                | Hot Rolled         | 400                  | 58 000               | 220                                         | 32 000                                      | 25                                             | 50                  | 116              | 70                                                  |
|         |                     | Cold Drawn         | 440                  | 64 000               | 370                                         | 54 000                                      | 15                                             | 40                  | 126              |                                                     |
| G10190  | 1019                | Hot Rolled         | 410                  | 59 000               | 220                                         | 32 500                                      | 25                                             | 50                  | 116              | 70                                                  |
|         |                     | Cold Drawn         | 460                  | 66 000               | 380                                         | 55 000                                      | 15                                             | 40                  | 131              |                                                     |
| G10200  | 1020                | Hot Rolled         | 380                  | 55 000               | 210                                         | 30 000                                      | 25                                             | 50                  | 111              | 65                                                  |
|         |                     | Cold Drawn         | 420                  | 61 000               | 350                                         | 51 000                                      | 15                                             | 40                  | 121              |                                                     |
| G10210  | 1021                | Hot Rolled         | 420                  | 61 000               | 230                                         | 33 000                                      | 24                                             | 48                  | 116              | 70                                                  |
|         |                     | Cold Drawn         | 470                  | 68 000               | 390                                         | 57 000                                      | 15                                             | 40                  | 131              |                                                     |
| G10220  | 1022                | Hot Rolled         | 430                  | 62 000               | 230                                         | 34 000                                      | 23                                             | 47                  | 121              | 70                                                  |
|         |                     | Cold Drawn         | 480                  | 69 000               | 400                                         | 58 000                                      | 15                                             | 40                  | 137              |                                                     |
| G10230  | 1023                | Hot Rolled         | 370                  | 56 000               | 210                                         | 31 000                                      | 25                                             | 50                  | 111              | 65                                                  |
|         |                     | Cold Drawn         | 430                  | 62 000               | 360                                         | 52 500                                      | 15                                             | 40                  | 121              |                                                     |
| G10250  | 1025                | Hot Rolled         | 400                  | 58 000               | 220                                         | 32 000                                      | 25                                             | 50                  | 116              | 65                                                  |
|         |                     | Cold Drawn         | 440                  | 64 000               | 370                                         | 54 000                                      | 15                                             | 40                  | 126              |                                                     |
| G10260  | 1026                | Hot Rolled         | 440                  | 64 000               | 240                                         | 35 000                                      | 24                                             | 49                  | 126              | 75                                                  |
|         |                     | Cold Drawn         | 490                  | 71 000               | 410                                         | 60 000                                      | 15                                             | 40                  | 143              |                                                     |

**TABLE 1—ESTIMATED MECHANICAL PROPERTIES AND MACHINABILITY RATINGS  
OF NONRESULFURIZED CARBON STEEL BARS, MANGANESE 1.00% MAXIMUM (CONTINUED)**

| UNS<br>No. | SAE<br>and/or<br>AISI No. | Type of<br>Processing | Tensile<br>Strength<br>MPa | Tensile<br>Strength<br>psi | Estimated<br>Minimum<br>Values<br>Yield<br>Strength<br>MPa | Estimated<br>Minimum<br>Values<br>Yield<br>Strength<br>psi | Estimated<br>Minimum<br>Values<br>Elongation<br>in<br>2 in, % | Reduction<br>in<br>Area % | Brinell<br>Hardness | Average<br>Machinability<br>Rating<br>(Cold Drawn)<br>1212=100% |
|------------|---------------------------|-----------------------|----------------------------|----------------------------|------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|---------------------------|---------------------|-----------------------------------------------------------------|
| G10300     | 1030                      | Hot Rolled            | 470                        | 68 000                     | 260                                                        | 37 500                                                     | 20                                                            | 42                        | 137                 | 70                                                              |
|            |                           | Cold Drawn            | 520                        | 76 000                     | 440                                                        | 64 000                                                     | 12                                                            | 35                        | 149                 |                                                                 |
| G10350     | 1035                      | Hot Rolled            | 500                        | 72 000                     | 270                                                        | 39 500                                                     | 18                                                            | 40                        | 143                 | 65                                                              |
|            |                           | Cold Drawn            | 550                        | 80 000                     | 460                                                        | 67 000                                                     | 12                                                            | 35                        | 163                 |                                                                 |
| G10370     | 1037                      | Hot Rolled            | 510                        | 74 000                     | 280                                                        | 40 500                                                     | 18                                                            | 40                        | 143                 | 65                                                              |
|            |                           | Cold Drawn            | 570                        | 82 000                     | 480                                                        | 69 000                                                     | 12                                                            | 35                        | 167                 |                                                                 |
| G10380     | 1038                      | Hot Rolled            | 520                        | 75 000                     | 280                                                        | 41 000                                                     | 18                                                            | 40                        | 149                 | 65                                                              |
|            |                           | Cold Drawn            | 570                        | 83 000                     | 480                                                        | 70 000                                                     | 12                                                            | 35                        | 163                 |                                                                 |
| G10390     | 1039                      | Hot Rolled            | 540                        | 79 000                     | 300                                                        | 43 500                                                     | 16                                                            | 40                        | 156                 | 60                                                              |
|            |                           | Cold Drawn            | 610                        | 88 000                     | 510                                                        | 74 000                                                     | 12                                                            | 35                        | 179                 |                                                                 |
| G10400     | 1040                      | Hot Rolled            | 520                        | 76 000                     | 290                                                        | 42 000                                                     | 18                                                            | 40                        | 149                 | 60                                                              |
|            |                           | Cold Drawn            | 590                        | 85 000                     | 490                                                        | 71 000                                                     | 12                                                            | 35                        | 170                 |                                                                 |
| G10420     | 1042                      | Hot Rolled            | 550                        | 80 000                     | 300                                                        | 44 000                                                     | 16                                                            | 40                        | 163                 | 60                                                              |
|            |                           | Cold Drawn            | 610                        | 89 000                     | 520                                                        | 75 000                                                     | 12                                                            | 35                        | 179                 |                                                                 |
|            |                           | NCD <sup>(1)</sup>    | 590                        | 85 000                     | 500                                                        | 73 000                                                     | 12                                                            | 45                        | 179                 |                                                                 |
| G10430     | 1043                      | Hot Rolled            | 570                        | 82 000                     | 310                                                        | 45 000                                                     | 16                                                            | 40                        | 163                 | 60                                                              |
|            |                           | Cold Drawn            | 630                        | 91 000                     | 530                                                        | 77 000                                                     | 12                                                            | 35                        | 179                 |                                                                 |
|            |                           | NCD <sup>(1)</sup>    | 600                        | 87 000                     | 520                                                        | 75 000                                                     | 12                                                            | 45                        | 179                 |                                                                 |
| G10440     | 1044                      | Hot Rolled            | 550                        | 80 000                     | 300                                                        | 44 000                                                     | 16                                                            | 40                        | 163                 |                                                                 |
| G10450     | 1045                      | Hot Rolled            | 570                        | 82 000                     | 310                                                        | 45 000                                                     | 16                                                            | 40                        | 163                 | 55                                                              |
|            |                           | Cold Drawn            | 630                        | 91 000                     | 530                                                        | 77 000                                                     | 12                                                            | 35                        | 179                 |                                                                 |
|            |                           | ACD <sup>(2)</sup>    | 590                        | 85 000                     | 500                                                        | 73 000                                                     | 12                                                            | 45                        | 170                 |                                                                 |
| G10460     | 1046                      | Hot Rolled            | 590                        | 85 000                     | 320                                                        | 47 000                                                     | 15                                                            | 40                        | 170                 | 55                                                              |
|            |                           | Cold Drawn            | 650                        | 94 000                     | 540                                                        | 79 000                                                     | 12                                                            | 35                        | 187                 |                                                                 |
|            |                           | ACD <sup>(2)</sup>    | 620                        | 90 000                     | 520                                                        | 75 000                                                     | 12                                                            | 45                        | 179                 |                                                                 |
| G10490     | 1049                      | Hot Rolled            | 600                        | 87 000                     | 330                                                        | 48 000                                                     | 15                                                            | 35                        | 179                 | 45                                                              |
|            |                           | Cold Drawn            | 670                        | 97 000                     | 560                                                        | 81 500                                                     | 10                                                            | 30                        | 197                 |                                                                 |
|            |                           | ACD <sup>(2)</sup>    | 630                        | 92 000                     | 530                                                        | 77 000                                                     | 10                                                            | 40                        | 187                 |                                                                 |
| G10500     | 1050                      | Hot Rolled            | 620                        | 90 000                     | 340                                                        | 49 500                                                     | 15                                                            | 35                        | 179                 | 45                                                              |
|            |                           | Cold Drawn            | 690                        | 100 000                    | 580                                                        | 84 000                                                     | 10                                                            | 30                        | 197                 |                                                                 |
|            |                           | ACD <sup>(2)</sup>    | 660                        | 95 000                     | 550                                                        | 80 000                                                     | 10                                                            | 40                        | 189                 |                                                                 |

**TABLE 1—ESTIMATED MECHANICAL PROPERTIES AND MACHINABILITY RATINGS  
OF NONRESULFURIZED CARBON STEEL BARS, MANGANESE 1.00% MAXIMUM (CONTINUED)**

| UNS No. | SAE and/or AISI No. | Type of Processing  | Tensile Strength MPa | Tensile Strength psi | Estimated Minimum Values Yield Strength MPa | Estimated Minimum Values Yield Strength psi | Estimated Minimum Values Elongation in 2 in, % | Reduction in Area % | Brinell Hardness | Average Machinability Rating (Cold Drawn) 1212=100% |
|---------|---------------------|---------------------|----------------------|----------------------|---------------------------------------------|---------------------------------------------|------------------------------------------------|---------------------|------------------|-----------------------------------------------------|
| G10550  | 1055                | Hot Rolled          | 650                  | 94 000               | 360                                         | 51 500                                      | 12                                             | 30                  | 192              |                                                     |
|         |                     | ACD <sup>(2)</sup>  | 660                  | 96 000               | 560                                         | 81 000                                      | 10                                             | 40                  | 197              | 55                                                  |
| G10600  | 1060                | Hot Rolled          | 680                  | 98 000               | 370                                         | 54 000                                      | 12                                             | 30                  | 201              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 620                  | 90 000               | 480                                         | 70 000                                      | 10                                             | 45                  | 183              | 60                                                  |
| G10640  | 1064                | Hot Rolled          | 670                  | 97 000               | 370                                         | 53 500                                      | 12                                             | 30                  | 201              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 610                  | 89 000               | 480                                         | 69 000                                      | 10                                             | 45                  | 183              | 60                                                  |
| G10650  | 1065                | Hot Rolled          | 690                  | 100 000              | 380                                         | 55 000                                      | 12                                             | 30                  | 207              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 630                  | 92 000               | 490                                         | 71 000                                      | 10                                             | 45                  | 187              | 60                                                  |
| G10700  | 1070                | Hot Rolled          | 700                  | 102 000              | 390                                         | 56 000                                      | 12                                             | 30                  | 212              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 640                  | 93 000               | 500                                         | 72 000                                      | 10                                             | 45                  | 192              | 55                                                  |
| G10740  | 1074                | Hot Rolled          | 720                  | 105 000              | 400                                         | 58 000                                      | 12                                             | 30                  | 217              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 650                  | 94 500               | 500                                         | 73 000                                      | 10                                             | 40                  | 192              | 55                                                  |
| G10780  | 1078                | Hot Rolled          | 690                  | 100 000              | 380                                         | 55 000                                      | 12                                             | 30                  | 207              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 650                  | 94 000               | 500                                         | 72 500                                      | 10                                             | 40                  | 192              | 55                                                  |
| G10800  | 1080                | Hot Rolled          | 770                  | 112 000              | 420                                         | 61 500                                      | 10                                             | 25                  | 229              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 680                  | 98 000               | 520                                         | 75 000                                      | 10                                             | 40                  | 192              | 45                                                  |
| G10840  | 1084                | Hot Rolled          | 820                  | 119 000              | 450                                         | 65 500                                      | 10                                             | 25                  | 241              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 690                  | 100 000              | 530                                         | 77 000                                      | 10                                             | 40                  | 192              | 45                                                  |
| G10850  | 1085                | Hot Rolled          | 830                  | 121 000              | 460                                         | 66 500                                      | 10                                             | 25                  | 248              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 690                  | 100 500              | 540                                         | 78 000                                      | 10                                             | 40                  | 192              | 45                                                  |
| G10860  | 1086                | Hot Rolled          | 770                  | 112 000              | 420                                         | 61 500                                      | 10                                             | 25                  | 229              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 670                  | 97 000               | 510                                         | 74 000                                      | 10                                             | 40                  | 192              | 45                                                  |
| G10900  | 1090                | Hot Rolled          | 840                  | 122 000              | 460                                         | 67 000                                      | 10                                             | 25                  | 248              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 700                  | 101 000              | 540                                         | 78 000                                      | 10                                             | 40                  | 197              | 45                                                  |
| G10950  | 1095                | Hot Rolled          | 830                  | 120 000              | 460                                         | 66 000                                      | 10                                             | 25                  | 248              |                                                     |
|         |                     | SACD <sup>(3)</sup> | 680                  | 99 000               | 520                                         | 76 000                                      | 10                                             | 40                  | 197              | 45                                                  |

1. NCD represents normalized cold drawn.

2. ACD represents annealed cold drawn.

3. SACD represents spheroidized annealed cold drawn.

**TABLE 2—ESTIMATED MECHANICAL PROPERTIES AND MACHINABILITY RATINGS  
OF RESULFURIZED CARBON STEEL BARS<sup>(1)</sup>**

| UNS No. | SAE and/or AISI No. | Type of Processing | Tensile Strength MPa | Tensile Strength psi | Estimated Minimum Values Yield Strength MPa | Estimated Minimum Values Yield Strength psi | Estimated Minimum Values Elongation in 2 in, % | Reduction in Area % | Brinell Hardness | Average Machinability Rating (Cold Drawn) 1212=100% |
|---------|---------------------|--------------------|----------------------|----------------------|---------------------------------------------|---------------------------------------------|------------------------------------------------|---------------------|------------------|-----------------------------------------------------|
| G11080  | 1108                | Hot Rolled         | 340                  | 50 000               | 190                                         | 27 500                                      | 30                                             | 50                  | 101              | 80                                                  |
|         |                     | Cold Drawn         | 390                  | 56 000               | 320                                         | 47 000                                      | 20                                             | 40                  | 121              |                                                     |
| G11170  | 1117                | Hot Rolled         | 430                  | 62 000               | 230                                         | 34 000                                      | 23                                             | 47                  | 121              | 90                                                  |
|         |                     | Cold Drawn         | 480                  | 69 000               | 400                                         | 58 000                                      | 15                                             | 40                  | 137              |                                                     |
| G11320  | 1132                | Hot Rolled         | 570                  | 83 000               | 310                                         | 45 500                                      | 16                                             | 40                  | 167              | 75                                                  |
|         |                     | Cold Drawn         | 630                  | 92 000               | 530                                         | 77 000                                      | 12                                             | 35                  | 183              |                                                     |
| G11370  | 1137                | Hot Rolled         | 610                  | 88 000               | 330                                         | 48 000                                      | 15                                             | 35                  | 179              | 70                                                  |
|         |                     | Cold Drawn         | 680                  | 98 000               | 570                                         | 82 000                                      | 10                                             | 30                  | 197              |                                                     |
| G11400  | 1140                | Hot Rolled         | 540                  | 79 000               | 300                                         | 43 500                                      | 16                                             | 40                  | 156              | 70                                                  |
|         |                     | Cold Drawn         | 610                  | 88 000               | 510                                         | 74 000                                      | 12                                             | 35                  | 170              |                                                     |
| G11410  | 1141                | Hot Rolled         | 650                  | 94 000               | 360                                         | 51 500                                      | 15                                             | 35                  | 187              | 70                                                  |
|         |                     | Cold Drawn         | 720                  | 105 100              | 610                                         | 88 000                                      | 10                                             | 30                  | 212              |                                                     |
| G11440  | 1144                | Hot Rolled         | 670                  | 97 000               | 370                                         | 53 000                                      | 15                                             | 35                  | 197              | 80                                                  |
|         |                     | Cold Drawn         | 740                  | 108 000              | 620                                         | 90 000                                      | 10                                             | 30                  | 217              |                                                     |
| G11460  | 1146                | Hot Rolled         | 590                  | 85 000               | 320                                         | 47 000                                      | 15                                             | 40                  | 170              | 70                                                  |
|         |                     | Cold Drawn         | 650                  | 94 000               | 550                                         | 80 000                                      | 12                                             | 35                  | 187              |                                                     |
| G11510  | 1151                | Hot Rolled         | 630                  | 92 000               | 340                                         | 50 500                                      | 15                                             | 35                  | 187              | 65                                                  |
|         |                     | Cold Drawn         | 700                  | 102 000              | 590                                         | 86 000                                      | 10                                             | 30                  | 207              |                                                     |
| G12110  | 1211                | Hot Rolled         | 380                  | 55 000               | 230                                         | 33 000                                      | 25                                             | 45                  | 121              | 95                                                  |
|         |                     | Cold Drawn         | 520                  | 75 000               | 400                                         | 58 000                                      | 10                                             | 35                  | 163              |                                                     |
| G12120  | 1212                | Hot Rolled         | 390                  | 56 000               | 230                                         | 33 500                                      | 25                                             | 45                  | 121              | 100                                                 |
|         |                     | Cold Drawn         | 540                  | 78 000               | 410                                         | 60 000                                      | 10                                             | 35                  | 167              |                                                     |
| G12130  | 1213                | Hot Rolled         | 390                  | 56 000               | 230                                         | 33 500                                      | 25                                             | 45                  | 121              | 135                                                 |
|         |                     | Cold Drawn         | 540                  | 78 000               | 410                                         | 60 000                                      | 10                                             | 35                  | 167              |                                                     |
| G12144  | 12L14               | Hot Rolled         | 390                  | 57 000               | 230                                         | 34 000                                      | 22                                             | 45                  | 121              | 160                                                 |
|         |                     | Cold Drawn         | 540                  | 78 000               | 410                                         | 60 000                                      | 10                                             | 35                  | 163              |                                                     |

1. All 1100 and 1200 series steels are rated on the basis of 0.10% maximum silicon or coarse grain melting practice.

**TABLE 3—ESTIMATED MECHANICAL PROPERTIES AND MACHINABILITY RATINGS  
OF NONRESULFURIZED CARBON STEEL BARS, MANGANESE MAXIMUM OVER 1.00%**

| UNS<br>No. | SAE<br>and/or<br>AISI No. | Type of<br>Processing | Tensile<br>Strength<br>MPa | Tensile<br>Strength<br>psi | Estimated<br>Minimum<br>Values<br>Yield<br>Strength<br>MPa | Estimated<br>Minimum<br>Values<br>Yield<br>Strength<br>psi | Estimated<br>Minimum<br>Values<br>Elongation<br>in<br>2 in, % | Reduction<br>in<br>Area % | Brinell<br>Hardness | Average<br>Machinability<br>Rating<br>(Cold Drawn)<br>1212=100% |
|------------|---------------------------|-----------------------|----------------------------|----------------------------|------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|---------------------------|---------------------|-----------------------------------------------------------------|
| G15240     | 1524                      | Hot Rolled            | 510                        | 74 000                     | 280                                                        | 41 000                                                     | 20                                                            | 42                        | 149                 | 60                                                              |
|            |                           | Cold Drawn            | 570                        | 82 000                     | 480                                                        | 69 000                                                     | 12                                                            | 35                        | 163                 |                                                                 |
| G15270     | 1527                      | Hot Rolled            | 520                        | 75 000                     | 280                                                        | 41 000                                                     | 18                                                            | 40                        | 149                 | 65                                                              |
|            |                           | Cold Drawn            | 570                        | 83 000                     | 480                                                        | 70 000                                                     | 12                                                            | 35                        | 163                 |                                                                 |
| G15360     | 1536                      | Hot Rolled            | 570                        | 83 000                     | 310                                                        | 45 500                                                     | 16                                                            | 40                        | 163                 | 55                                                              |
|            |                           | Cold Drawn            | 630                        | 92 000                     | 530                                                        | 77 500                                                     | 12                                                            | 35                        | 187                 |                                                                 |
| G15410     | 1541                      | Hot Rolled            | 630                        | 92 000                     | 350                                                        | 51 000                                                     | 15                                                            | 40                        | 187                 | 45                                                              |
|            |                           | Cold Drawn            | 710                        | 102 500                    | 600                                                        | 87 000                                                     | 10                                                            | 30                        | 207                 |                                                                 |
|            |                           | ACD <sup>(1)</sup>    | 650                        | 94 000                     | 550                                                        | 80 000                                                     | 10                                                            | 45                        | 184                 |                                                                 |
| G15480     | 1548                      | Hot Rolled            | 660                        | 96 000                     | 370                                                        | 53 000                                                     | 14                                                            | 33                        | 197                 | 45                                                              |
|            |                           | Cold Drawn            | 730                        | 106 500                    | 620                                                        | 89 500                                                     | 10                                                            | 28                        | 217                 |                                                                 |
|            |                           | ACD <sup>(1)</sup>    | 640                        | 93 500                     | 540                                                        | 78 500                                                     | 10                                                            | 35                        | 192                 |                                                                 |
| G15520     | 1552                      | Hot Rolled            | 740                        | 108 000                    | 410                                                        | 59 500                                                     | 12                                                            | 30                        | 217                 | 50                                                              |
|            |                           | ACD <sup>(1)</sup>    | 680                        | 98 000                     | 570                                                        | 83 000                                                     | 10                                                            | 40                        | 193                 |                                                                 |

1. ACD represents annealed cold drawn.