

TABLE A-20

Mechanical Properties of Some Hot-Rolled (HR) and Cold-Drawn (CD) Steels  
 [The Strengths Listed Are Estimated ASTM Minimum Values in the Size Range 18 to 32 mm ( $\frac{3}{4}$  to  $1\frac{1}{4}$  in). These Strengths Are Suitable for Use With the Design Factor Defined in Sec. 1-9, Provided the Materials Conform to ASTM A6 or A568 Requirements or Are Required in the Purchase Specifications. It is Well to Remember that a Numbering System Is Not a Specification. See Table 1-1 for Certain ASTM Steels]

| 1       | 2                   | 3          | 4                            | 5                          | 6                     | 7                    | 8                |
|---------|---------------------|------------|------------------------------|----------------------------|-----------------------|----------------------|------------------|
| UNS NO. | SAE AND/OR AISI NO. | PROCESSING | TENSILE STRENGTH, MPa (kpsi) | YIELD STRENGTH, MPa (kpsi) | ELONGATION IN 2 in, % | REDUCTION IN AREA, % | BRINELL HARDNESS |
| G10060  | 1006                | HR         | 300 (43)                     | 170 (24)                   | 30                    | 55                   | 86               |
|         |                     | CD         | 330 (48)                     | 280 (41)                   | 20                    | 45                   | 95               |
| G10100  | 1010                | HR         | 320 (47)                     | 180 (26)                   | 28                    | 50                   | 95               |
|         |                     | CD         | 370 (53)                     | 300 (44)                   | 20                    | 40                   | 105              |
| G10150  | 1015                | HR         | 340 (50)                     | 190 (27.5)                 | 28                    | 50                   | 101              |
|         |                     | CD         | 390 (56)                     | 320 (47)                   | 18                    | 40                   | 111              |
| G10180  | 1018                | HR         | 400 (58)                     | 220 (32)                   | 25                    | 50                   | 116              |
|         |                     | CD         | 440 (64)                     | 370 (54)                   | 15                    | 40                   | 126              |
| G10200  | 1020                | HR         | 380 (55)                     | 210 (30)                   | 25                    | 50                   | 111              |
|         |                     | CD         | 470 (68)                     | 390 (57)                   | 15                    | 40                   | 131              |
| G10300  | 1030                | HR         | 470 (68)                     | 260 (37.5)                 | 20                    | 42                   | 137              |
|         |                     | CD         | 520 (76)                     | 440 (64)                   | 12                    | 35                   | 149              |
| G10350  | 1035                | HR         | 500 (72)                     | 270 (39.5)                 | 18                    | 40                   | 143              |
|         |                     | CD         | 550 (80)                     | 460 (67)                   | 12                    | 35                   | 163              |
| G10400  | 1040                | HR         | 520 (76)                     | 290 (42)                   | 18                    | 40                   | 149              |
|         |                     | CD         | 590 (85)                     | 490 (71)                   | 12                    | 35                   | 170              |
| G10450  | 1045                | HR         | 570 (82)                     | 310 (45)                   | 16                    | 40                   | 163              |
|         |                     | CD         | 630 (91)                     | 530 (77)                   | 12                    | 35                   | 179              |
| G10500  | 1050                | HR         | 620 (90)                     | 340 (49.5)                 | 15                    | 35                   | 179              |
|         |                     | CD         | 690 (100)                    | 580 (84)                   | 10                    | 30                   | 197              |
| G10600  | 1060                | HR         | 680 (98)                     | 370 (54)                   | 12                    | 30                   | 201              |
| G10800  | 1080                | HR         | 770 (112)                    | 420 (61.5)                 | 10                    | 25                   | 229              |
| G10950  | 1095                | HR         | 830 (120)                    | 460 (66)                   | 10                    | 25                   | 248              |

Source: 1986 SAE Handbook, p. 2.15.

TABLE A-21

Mechanical Properties of Some Heat-Treated Steels

[These Are Typical Properties for Materials Normalized and Annealed. The Properties for Quenched and Tempered (Q&T) Steels Are from a Single Heat. Because of the Many Variables, the Properties Listed Might Be Considered Attainable but Should Not Be Treated as Average or as Minimum. In All Cases, Data Were Obtained from Specimens of Diameter 0.505 in, Machined from 1-in Rounds, and of Gauge Length 2 in. Unless Noted, All Specimens Were Oil-Quenched]

| 1        | 2          | 3                    | 4                            | 5                          | 6             | 7                    | 8                |
|----------|------------|----------------------|------------------------------|----------------------------|---------------|----------------------|------------------|
| AISI NO. | TREATMENT  | TEMPERATURE, °C (°F) | TENSILE STRENGTH, MPa (kpsi) | YIELD STRENGTH, MPa (kpsi) | ELONGATION, % | REDUCTION IN AREA, % | BRINELL HARDNESS |
| 1030     | Q&T*       | 205 (400)            | 848 (123)                    | 648 (94)                   | 17            | 47                   | 495              |
|          | Q&T*       | 315 (600)            | 800 (116)                    | 621 (90)                   | 19            | 53                   | 401              |
|          | Q&T*       | 425 (800)            | 731 (106)                    | 579 (84)                   | 23            | 60                   | 302              |
|          | Q&T*       | 540 (1000)           | 669 (97)                     | 517 (75)                   | 28            | 65                   | 255              |
|          | Q&T*       | 650 (1200)           | 586 (85)                     | 441 (64)                   | 32            | 70                   | 207              |
|          | Normalized | 925 (1700)           | 521 (75)                     | 345 (50)                   | 32            | 61                   | 149              |
|          | Annealed   | 870 (1600)           | 430 (62)                     | 317 (46)                   | 35            | 64                   | 137              |
| 1040     | Q&T        | 205 (400)            | 779 (113)                    | 593 (86)                   | 19            | 48                   | 262              |
|          | Q&T        | 425 (800)            | 758 (110)                    | 552 (80)                   | 21            | 54                   | 241              |
|          | Q&T        | 650 (1200)           | 634 (92)                     | 434 (63)                   | 29            | 65                   | 192              |
|          | Normalized | 900 (1650)           | 590 (86)                     | 374 (54)                   | 28            | 55                   | 170              |
|          | Annealed   | 790 (1450)           | 519 (75)                     | 353 (51)                   | 30            | 57                   | 149              |
| 1050     | Q&T*       | 205 (400)            | 1120 (163)                   | 807 (117)                  | 9             | 27                   | 514              |
|          | Q&T*       | 425 (800)            | 1090 (158)                   | 793 (115)                  | 13            | 36                   | 444              |
|          | Q&T*       | 650 (1200)           | 717 (104)                    | 538 (78)                   | 28            | 65                   | 235              |
|          | Normalized | 900 (1650)           | 748 (108)                    | 427 (62)                   | 20            | 39                   | 217              |
|          | Annealed   | 790 (1450)           | 636 (92)                     | 365 (53)                   | 24            | 40                   | 187              |
| 1060     | Q&T        | 425 (800)            | 1080 (156)                   | 765 (111)                  | 14            | 41                   | 311              |
|          | Q&T        | 540 (1000)           | 965 (140)                    | 669 (97)                   | 17            | 45                   | 277              |
|          | Q&T        | 650 (1200)           | 800 (116)                    | 524 (76)                   | 23            | 54                   | 229              |
|          | Normalized | 900 (1650)           | 776 (112)                    | 421 (61)                   | 18            | 37                   | 229              |
|          | Annealed   | 790 (1450)           | 626 (91)                     | 372 (54)                   | 22            | 38                   | 179              |
| 1095     | Q&T        | 315 (600)            | 1260 (183)                   | 813 (118)                  | 10            | 30                   | 375              |
|          | Q&T        | 425 (800)            | 1210 (176)                   | 772 (112)                  | 12            | 32                   | 363              |
|          | Q&T        | 540 (1000)           | 1090 (158)                   | 676 (98)                   | 15            | 37                   | 321              |
|          | Q&T        | 650 (1200)           | 896 (130)                    | 552 (80)                   | 21            | 47                   | 269              |
|          | Normalized | 900 (1650)           | 1010 (147)                   | 500 (72)                   | 9             | 13                   | 293              |
|          | Annealed   | 790 (1450)           | 658 (95)                     | 380 (55)                   | 13            | 21                   | 192              |
| 1141     | Q&T        | 315 (600)            | 1460 (212)                   | 1280 (186)                 | 9             | 32                   | 415              |
|          | Q&T        | 540 (1000)           | 896 (130)                    | 765 (111)                  | 18            | 57                   | 262              |
| 4130     | Q&T*       | 205 (400)            | 1630 (236)                   | 1460 (212)                 | 10            | 41                   | 467              |
|          | Q&T*       | 315 (600)            | 1500 (217)                   | 1380 (200)                 | 11            | 43                   | 435              |
|          | Q&T*       | 425 (800)            | 1280 (186)                   | 1190 (173)                 | 13            | 49                   | 380              |
|          | Q&T*       | 540 (1000)           | 1030 (150)                   | 910 (132)                  | 17            | 57                   | 315              |
|          | Q&T*       | 650 (1200)           | 814 (118)                    | 703 (102)                  | 22            | 64                   | 245              |
|          | Normalized | 870 (1600)           | 670 (97)                     | 436 (63)                   | 25            | 59                   | 197              |
|          | Annealed   | 865 (1585)           | 560 (81)                     | 361 (52)                   | 28            | 56                   | 156              |
| 4140     | Q&T        | 205 (400)            | 1770 (257)                   | 1640 (238)                 | 8             | 38                   | 510              |
|          | Q&T        | 315 (600)            | 1550 (225)                   | 1430 (208)                 | 9             | 43                   | 445              |