

Hardness Conversion Table

(SAE J 417) [for steel]

Yamamoto Scientific Tool Laboratory

| Rockwell | Vickers | Brinell | | Rockwell | | | Rockwell Superficial | | | Shore ⁽²⁾ | Leeb ⁽³⁾ | | Tensile Strength (Approx.) Mpa | Rockwell |
|----------------|---------|------------|--------------|---------------|-------------------|----------------|----------------------|-------|-------|----------------------|---------------------|---------|--------------------------------|----------------|
| | | HB 10/3000 | | HRA | HRB | HRD | HR15N | HR30N | HR45N | | HS | HLD | | |
| Diamond 150kgf | | Steel ball | Carbide ball | Diamond 60kgf | 1/16" ball 100kgf | Diamond 100kgf | Diamond | | | | Carbide | Diamond | | Diamond 150kgf |
| | | | | | | | 15kgf | 30kgf | 45kgf | | | | | |
| 68 | 940 | - | - | 85.6 | - | 76.9 | 93.2 | 84.4 | 75.4 | 98.0 | 878 | 846 | - | 68 |
| 67 | 900 | - | - | 85.0 | - | 76.1 | 92.9 | 83.6 | 74.2 | 95.6 | 869 | 836 | - | 67 |
| 66 | 865 | - | - | 84.5 | - | 75.4 | 92.5 | 82.8 | 73.3 | 93.4 | 860 | 826 | - | 66 |
| 65 | 832 | - | (739) | 83.9 | - | 74.5 | 92.2 | 81.9 | 72.0 | 91.2 | 850 | 817 | - | 65 |
| 64 | 800 | - | (722) | 83.4 | - | 73.8 | 91.8 | 81.1 | 71.0 | 89.0 | 840 | 806 | - | 64 |
| 63 | 772 | - | (705) | 82.8 | - | 73.0 | 91.4 | 80.1 | 69.9 | 87.1 | 830 | 796 | - | 63 |
| 62 | 746 | - | (688) | 82.3 | - | 72.2 | 91.1 | 79.3 | 68.8 | 85.2 | 820 | 786 | - | 62 |
| 61 | 720 | - | (670) | 81.8 | - | 71.5 | 90.7 | 78.4 | 67.7 | 83.3 | 810 | 776 | - | 61 |
| 60 | 697 | - | (654) | 81.2 | - | 70.7 | 90.2 | 77.5 | 66.6 | 81.5 | 800 | 766 | - | 60 |
| 59 | 674 | - | (634) | 80.7 | - | 69.9 | 89.8 | 76.6 | 65.5 | 79.7 | 790 | 755 | - | 59 |
| 58 | 653 | - | 615 | 80.1 | - | 69.2 | 89.3 | 75.7 | 64.3 | 78.1 | 781 | 746 | - | 58 |
| 57 | 633 | - | 595 | 79.6 | - | 68.5 | 88.9 | 74.8 | 63.2 | 76.4 | 771 | 736 | - | 57 |
| 56 | 613 | - | 577 | 79.0 | - | 67.7 | 88.3 | 73.9 | 62.0 | 74.8 | 762 | 726 | - | 56 |
| 55 | 595 | - | 560 | 78.5 | - | 66.9 | 87.9 | 73.0 | 60.9 | 73.2 | 753 | 717 | 2075 | 55 |
| 54 | 577 | - | 543 | 78.0 | - | 66.1 | 87.4 | 72.0 | 59.8 | 71.7 | 744 | 708 | 2015 | 54 |
| 53 | 560 | - | 525 | 77.4 | - | 65.4 | 86.9 | 71.2 | 58.6 | 70.2 | 735 | 699 | 1950 | 53 |
| 52 | 544 | (500) | 512 | 76.8 | - | 64.6 | 86.4 | 70.2 | 57.4 | 68.8 | 727 | 691 | 1880 | 52 |
| 51 | 528 | (487) | 496 | 76.3 | - | 63.8 | 85.9 | 69.4 | 56.1 | 67.3 | 719 | 683 | 1820 | 51 |
| 50 | 513 | (475) | 481 | 75.9 | - | 63.1 | 85.5 | 68.5 | 55.0 | 65.9 | 711 | 675 | 1760 | 50 |
| 49 | 498 | (464) | 469 | 75.2 | - | 62.1 | 85.0 | 67.6 | 53.8 | 64.5 | 703 | 667 | 1695 | 49 |
| 48 | 484 | 451 | 455 | 74.7 | - | 61.4 | 84.5 | 66.7 | 52.5 | 63.1 | 695 | 659 | 1635 | 48 |
| 47 | 471 | 442 | 443 | 74.1 | - | 60.8 | 83.9 | 65.8 | 51.4 | 61.9 | 688 | 652 | 1580 | 47 |
| 46 | 458 | 432 | 432 | 73.6 | - | 60.0 | 83.5 | 64.8 | 50.3 | 60.6 | 681 | 645 | 1530 | 46 |
| 45 | 446 | 421 | 421 | 73.1 | - | 59.2 | 83.0 | 64.0 | 49.0 | 59.4 | 674 | 639 | 1480 | 45 |
| 44 | 434 | 409 | 409 | 72.5 | - | 58.5 | 82.5 | 63.1 | 47.8 | 58.2 | 668 | 632 | 1435 | 44 |
| 43 | 423 | 400 | 400 | 72.0 | - | 57.7 | 82.0 | 62.2 | 46.7 | 57.1 | 661 | 626 | 1385 | 43 |
| 42 | 412 | 390 | 390 | 71.5 | - | 56.9 | 81.5 | 61.3 | 45.5 | 55.9 | 655 | 620 | 1340 | 42 |
| 41 | 402 | 381 | 381 | 70.9 | - | 56.2 | 80.9 | 60.4 | 44.3 | 54.9 | 649 | 614 | 1295 | 41 |
| 40 | 392 | 371 | 371 | 70.4 | - | 55.4 | 80.4 | 59.5 | 43.1 | 53.8 | 643 | 608 | 1250 | 40 |
| 39 | 382 | 362 | 362 | 69.9 | - | 54.6 | 79.9 | 58.6 | 41.9 | 52.7 | 636 | 602 | 1215 | 39 |
| 38 | 372 | 353 | 353 | 69.4 | - | 53.8 | 79.4 | 57.7 | 40.8 | 51.6 | 630 | 596 | 1180 | 38 |
| 37 | 363 | 344 | 344 | 68.9 | - | 53.1 | 78.8 | 56.8 | 39.6 | 50.6 | 624 | 591 | 1160 | 37 |
| 36 | 354 | 336 | 336 | 68.4 | (109.0) | 52.3 | 78.3 | 55.9 | 38.4 | 49.6 | 618 | 585 | 1115 | 36 |
| 35 | 345 | 327 | 327 | 67.9 | (108.5) | 51.5 | 77.7 | 55.0 | 37.2 | 48.6 | 612 | 579 | 1080 | 35 |
| 34 | 336 | 319 | 319 | 67.4 | (108.0) | 50.8 | 77.2 | 54.2 | 36.1 | 47.6 | 605 | 573 | 1055 | 34 |
| 33 | 327 | 311 | 311 | 66.8 | (107.5) | 50.0 | 76.6 | 53.3 | 34.9 | 46.6 | 599 | 567 | 1025 | 33 |
| 32 | 318 | 301 | 301 | 66.3 | (107.0) | 49.2 | 76.1 | 52.1 | 33.7 | 45.5 | 592 | 561 | 1000 | 32 |
| 31 | 310 | 294 | 294 | 65.8 | (106.0) | 48.4 | 75.6 | 51.3 | 32.5 | 44.6 | 586 | 555 | 980 | 31 |
| 30 | 302 | 286 | 286 | 65.3 | (105.5) | 47.7 | 75.0 | 50.4 | 31.3 | 43.6 | 579 | 549 | 950 | 30 |
| 29 | 294 | 279 | 279 | 64.7 | (104.5) | 47.0 | 74.5 | 49.5 | 30.1 | 42.7 | 572 | 543 | 930 | 29 |
| 28 | 286 | 271 | 271 | 64.3 | (104.0) | 46.1 | 73.9 | 48.6 | 28.9 | 41.7 | 566 | 537 | 910 | 28 |
| 27 | 279 | 264 | 264 | 63.8 | (103.0) | 45.2 | 73.3 | 47.7 | 27.8 | 40.9 | 559 | 531 | 880 | 27 |
| 26 | 272 | 258 | 258 | 63.3 | (102.5) | 44.6 | 72.8 | 46.8 | 26.7 | 40.0 | 553 | 525 | 860 | 26 |
| 25 | 266 | 253 | 253 | 62.8 | (101.5) | 43.8 | 72.2 | 45.9 | 25.5 | 39.3 | 548 | 520 | 840 | 25 |
| 24 | 260 | 247 | 247 | 62.4 | (101.0) | 43.1 | 71.6 | 45.0 | 24.3 | 38.5 | 542 | 515 | 825 | 24 |
| 23 | 254 | 243 | 243 | 62.0 | 100.0 | 42.1 | 71.0 | 44.0 | 23.1 | 37.7 | 536 | 509 | 805 | 23 |
| 22 | 248 | 237 | 237 | 61.5 | 99.0 | 41.6 | 70.5 | 43.2 | 22.0 | 37.0 | 530 | 504 | 785 | 22 |
| 21 | 243 | 231 | 231 | 61.0 | 98.5 | 40.9 | 69.9 | 42.3 | 20.7 | 36.4 | 525 | 499 | 770 | 21 |
| 20 | 238 | 226 | 226 | 60.5 | 97.8 | 40.1 | 69.4 | 41.5 | 19.6 | 35.7 | 519 | 494 | 760 | 20 |
| (18) | 230 | 219 | 219 | - | 96.7 | - | - | - | - | 34.7 | 510 | 486 | 730 | (18) |
| (16) | 222 | 212 | 212 | - | 95.5 | - | - | - | - | 33.6 | 501 | 478 | 705 | (16) |
| (14) | 213 | 203 | 203 | - | 93.9 | - | - | - | - | 32.4 | 490 | 468 | 675 | (14) |
| (12) | 204 | 194 | 194 | - | 92.3 | - | - | - | - | 31.2 | 479 | 458 | 650 | (12) |
| (10) | 196 | 187 | 187 | - | 90.7 | - | - | - | - | 30.2 | 469 | 448 | 620 | (10) |
| (8) | 188 | 179 | 179 | - | 89.5 | - | - | - | - | - | - | - | 600 | (8) |
| (6) | 180 | 171 | 171 | - | 87.1 | - | - | - | - | - | - | - | 580 | (6) |
| (4) | 173 | 165 | 165 | - | 85.5 | - | - | - | - | - | - | - | 550 | (4) |
| (2) | 166 | 158 | 158 | - | 83.5 | - | - | - | - | - | - | - | 530 | (2) |
| (0) | 160 | 152 | 152 | - | 81.7 | - | - | - | - | - | - | - | 515 | (0) |

(1) This table is edited fundamentally based on ASTM E 140. Number in the parenthesis is the Value of the range that it isn't usually used.

(2) Shore hardness is based on JIS B 7731-1993(HV-HS Conversion).

(3) HLD and HLE values are based on the 5th degree equation of 2015 revised edition Roll Hardness Committee of MTRAJ (SK5 φ115x133 block, HV-HL conversion)

(4) Approx. tensile strength is referred to the tables of JIS Z 8413 and Z 8438. (These standards were abolished in 1993.)

(5)but a conversion table just indicates approximate values for convenient use, therefore judging product quality by conversion value should be forbidden. The important values such like that should be taken from the test by the test machine of the purpose itself. (Takeo Yoshizawa, "Hardness Test and Applications" p.291, SHOKA-BO)