

|                                 |              | Similar Grades                             |   |                            |   | Grades for Potential Substitution          |   |                   |
|---------------------------------|--------------|--|---|----------------------------|---|--|---|-------------------|
| Stocked Product                 | BS 970: 1955 | British Standards                          | European  | Werkstoff                  | SAE/AISI  | Lesser                                     | Greater   | Supply Size Range |
| 230M07 (230)                    | EN1A         |  | <b>11SMn30</b>  | 1.0715                     | 1113 / 1213                                     |  | 070M20 (070)  | 10mm-80mm Dia     |
| 230M07Pb (23P)                  | EN1A Leaded  |  | <b>11SMnPb30</b>  | 1.0718                     |   |  |   | 10mm-80mm Dia     |
| 070M20 (070)                    | EN3A<br>EN32 | 080A15                                     | C15<br>C20<br><b>ST52-3 (ST5)</b><br><b>S235 (S23)</b><br><b>S275 (S27 &amp; S28)</b> | 1.0402<br>1.0401<br>1.1151 | 1020<br>1023                                    |  | LF2 (LF2)   | 10mm - 860mm Dia  |
| 080M40 (080)                    | EN8<br>EN8D  | <b>080A42 (08A)</b>                        | C40   | 1.0511                     | 1040  |  | <b>C45E (08B)</b><br><b>070M55 (07A)</b>  | 10mm - 860mm Dia  |
| <b>C45E (08B)</b>               |              | <b>080M46 (08E)</b><br><b>080M50 (08I)</b> |   |                            | <b>1050 (10M)</b>                               | <b>080M40 (080)</b>                        | <b>070M55 (07A)</b>   | 32mm - 860mm Dia  |
| <b>070M55 (07A)</b>             | EN9          | <b>080M50 (08I)</b>                        | C55<br><b>C60 (C60)</b>   | 1.0535                     | <b>1050 (10M)</b><br>1055                       | <b>C45E (08B)</b>                          |   | 32mm - 860mm Dia  |
| <b>150M19 (150)</b>             | EN14         |  | <b>ST52-3 (ST5)</b><br><b>S275 (S27 &amp; S28)</b><br><b>S355 (S36 &amp; S38)</b>     | 1.1170                     | 1320<br>1024                                    | <b>LF2 (LF2)</b>                           |   | 32mm - 860mm Dia  |
| <b>605M36 (605)</b>             | EN16         |  |   |                            |   |  | <b>38MB5 (035)</b><br><b>4130 (41C)</b><br><b>945M38 (945)</b>                              | 32mm - 240mm Dia  |
| <b>709M40 (709)</b>             | EN19         | <b>708M40 (708)</b>                        | <b>42CrMo4 (C44)</b>  | 1.7225                     | <b>4140 (41F &amp; 41G)</b><br>4142<br>B7<br>L7 | <b>945M38 (945)</b><br><b>41CrS4 (C41)</b> | <b>4145 (411)</b><br><b>4340 (43B)</b><br><b>817M40 (817)</b><br><b>826M40 (826)</b>        | 32mm - 860mm Dia  |
| <b>817M40 (817)</b>             | EN24         |  | <b>34CrNiMo6 (C36)</b><br>40CrNiMo6   | 1.6565<br>1.6582           | <b>4340 (43B)</b>                               |  | <b>4145 (411)</b><br><b>4340 (43B)</b><br><b>826M40 (826)</b><br><b>4330V (43V)</b>         | 32mm - 860mm Dia  |
| <b>826M40 (826)</b>             | EN26         |  | 40NiMoCr10-5  | 1.6745                     |   | <b>4340 (43B)</b>                          | <b>4330V (43V)</b>  | 45mm - 405mm Dia  |
| <b>835M30 (83A)</b>             | EN30B        |  | 30NiCrMo16-6  | 1.6747                     |   | <b>1.2767</b>                              | <b>4330V (43V)</b>  | 30mm - 400mm Dia  |
| <b>722M24 (722)</b>             | EN40B        |  | 32CrMo12  | 1.7361                     |   |  |   | 32mm - 860mm Dia  |
| <b>535A99 (535)</b>             | EN31         |  | <b>100Cr6 (CC1)</b>   | 1.3505                     | 52100   |  | <b>100CrMo7-3 (CC3)</b>   | 38mm - 235mm Dia  |
| <b>665M17 (665)</b>             | EN34         |  |   |                            | 4615<br>4617                                    |  | <b>655M13 (655)</b>   | 60mm - 250mm Dia  |
| <b>655M13 (655)</b>             | EN36         | <b>832M13 (832)</b>                        | <b>14NiCr4</b>  | 1.5752                     | 3415<br>3310                                    | <b>18CrNiMo7-6 (C18)</b>                   | <b>835M15 (835)</b>   | 32mm - 860mm Dia  |
| <b>835M15 (835)</b>             | EN39         |  | 15NiCrMo16-5  | 1.6723                     |   |  |   | 38mm - 210mm Dia  |
| <b>8620 (86B)</b>               |              | <b>635M15 (635)</b><br>805M20              | 21NiCrMo2-2   | 1.6543                     | 8617  | <b>16MnCr5 (M15)</b>                       | <b>8630 (86D)</b><br><b>655M13 (655)</b><br><b>18CrNiMo7-6 (C18)</b>                        | 45mm - 280mm Dia  |
| <b>16MnCr5 (M15)</b>            |              | 590M17                                     | <b>20MnCr5 (M25)</b>  | 1.7131                     | 5115<br>5117                                    |  | <b>8620 (86B)</b><br><b>635M15 (635)</b><br><b>655M13 (655)</b><br><b>18CrNiMo7-6 (C18)</b> | 95mm - 250mm Dia  |
| <b>4140 mod (41F &amp; 41G)</b> | EN19         | <b>708M40 (708)</b><br><b>709M40 (709)</b> | <b>42CrMo4 (C44)</b>  | 1.7225                     | 4142<br><b>B7 (B7A)</b><br>L7                   |  | <b>4340 (43B)</b>   | 32mm - 860mm Dia  |
| <b>4145 mod (411)</b>           |              |  |   |                            |   | <b>817M40 (817)</b>                        | <b>4340 (43B)</b>   | 32mm - 760mm Dia  |
| <b>4330V (43V)</b>              |              |  |   |                            |   | <b>826M40 (826)</b>                        | <b>835M30 (83A)</b>   | 120mm - 368mm Dia |
| <b>17-4 (Y17)</b>               |              |  |   | 1.4542                     | Grade 630<br>S17400 (UNS)                       |  |   | 36mm - 305mm Dia  |

The above represents an example of products available. Others grades are available on request.  
Also, we can offer a bespoke product design service to create the most cost effective raw material solution for your application.

**Similar Grades** – Grades of similar (not identical) chemistry. Please note the similar grades are based on chemistry only, and may not meet the necessary mechanical properties (in the standard 'as stocked' state).

**Grades for Potential Substitution** – Grades capable of achieving similar mechanical properties (material may need further treatment to achieve the desired properties). The potential substitution grades are based on mechanical properties, not necessarily the chemical analysis.

**Notes:**

1) Items in **bold** denote stocked item

2) Where queries exist regarding offering similar or substituted grades, please refer to the Sales Team.

**For full details on grades, service and technical data please call 0114 2331133**



### Hardness Conversions

| VPN       | Rockwell Scales |    | Brinell    | U.T.S. |      |
|-----------|-----------------|----|------------|--------|------|
|           | B               | C  |            | Kpsi   | Mps  |
| DPH HV/10 |                 |    | BHN 3000KG |        |      |
| 746       |                 | 62 | 688        |        |      |
| 720       |                 | 61 | 670        |        |      |
| 697       |                 | 60 | 654        | 320    | 2206 |
| 674       |                 | 59 | 634        | 310    | 2137 |
| 653       |                 | 58 | 615        | 300    | 2069 |
| 633       |                 | 57 | 595        | 290    | 2000 |
| 613       |                 | 56 | 577        | 282    | 1944 |
| 595       | 120             | 55 | 560        | 274    | 1889 |
| 577       | 120             | 54 | 543        | 266    | 1834 |
| 560       | 119             | 53 | 523        | 257    | 1772 |
| 544       | 119             | 52 | 512        | 245    | 1689 |
| 528       | 118             | 51 | 496        | 239    | 1648 |
| 513       | 117             | 50 | 481        | 233    | 1607 |
| 498       | 117             | 49 | 469        | 227    | 1565 |
| 484       | 116             | 48 | 455        | 221    | 1524 |
| 471       | 116             | 47 | 443        | 217    | 1496 |
| 458       | 115             | 46 | 432        | 212    | 1462 |
| 446       | 115             | 45 | 421        | 206    | 1420 |
| 434       | 114             | 44 | 409        | 200    | 1379 |
| 423       | 113             | 43 | 400        | 196    | 1351 |
| 412       | 113             | 42 | 390        | 191    | 1317 |
| 402       | 112             | 41 | 381        | 187    | 1289 |
| 392       | 112             | 40 | 371        | 182    | 1255 |
| 382       | 111             | 39 | 362        | 177    | 1220 |
| 372       | 110             | 38 | 353        | 173    | 1193 |
| 363       | 110             | 37 | 344        | 169    | 1165 |
| 354       | 109             | 36 | 336        | 165    | 1138 |
| 345       | 109             | 35 | 327        | 160    | 1103 |
| 336       | 108             | 34 | 319        | 156    | 1076 |
| 327       | 108             | 33 | 311        | 152    | 1048 |
| 318       | 107             | 32 | 301        | 147    | 1014 |
| 310       | 106             | 31 | 294        | 144    | 993  |
| 302       | 105             | 30 | 286        | 140    | 965  |
| 294       | 104             | 29 | 279        | 137    | 945  |
| 286       | 104             | 28 | 271        | 133    | 917  |
| 279       | 103             | 27 | 264        | 129    | 889  |
| 272       | 103             | 26 | 258        | 126    | 869  |

| VPN       | Rockwell Scales |    | Brinell    | U.T.S. |     |
|-----------|-----------------|----|------------|--------|-----|
|           | B               | C  |            | Kpsi   | Mps |
| DPH HV/10 |                 |    | BHN 3000KG |        |     |
| 266       | 102             | 25 | 253        | 124    | 855 |
| 260       | 101             | 24 | 247        | 121    | 834 |
| 254       | 100             | 23 | 240        | 118    | 814 |
| 248       | 99              | 22 | 234        | 115    | 793 |
| 243       | 98              | 21 | 228        | 112    | 772 |
| 238       | 97              | 20 | 222        | 109    | 752 |
| 234       | 97              | 19 | 218        | 107    | 738 |
| 230       | 96              | 18 | 214        | 106    | 731 |
| 226       | 96              | 17 | 210        | 104    | 717 |
| 222       | 95              | 16 | 208        | 102    | 703 |
| 217       | 95              | 15 | 205        | 100    | 690 |
| 213       | 94              | 14 | 203        | 99     | 683 |
| 208       | 93              | 13 | 200        | 98     | 676 |
| 204       | 92              | 12 | 195        | 96     | 662 |
| 200       | 92              | 11 | 193        | 95     | 655 |
| 196       | 91              | 10 | 190        | 93     | 641 |
| 192       | 90              | 9  | 185        | 91     | 627 |
| 188       | 89              | 8  | 180        | 88     | 607 |
| 184       | 88              | 7  | 176        | 86     | 593 |
| 180       | 87              | 6  | 172        | 84     | 579 |
| 176       | 86              | 5  | 169        | 83     | 572 |
| 172       | 85              | 4  | 165        | 81     | 558 |
| 168       | 84              | 3  | 162        | 79     | 545 |
| 164       | 83              | 2  | 159        | 78     | 538 |
| 160       | 82              | 1  | 156        | 76     | 524 |
| 156       | 81              | 0  | 153        | 75     | 517 |
| 152       | 80              |    | 150        | 73     | 503 |
| 148       | 79              |    | 147        |        |     |
| 144       | 78              |    | 144        |        |     |
| 141       | 77              |    | 141        |        |     |
| 139       | 76              |    | 139        |        |     |
| 137       | 75              |    | 137        |        |     |
| 135       | 74              |    | 135        |        |     |
| 132       | 73              |    | 132        |        |     |
| 130       | 72              |    | 130        |        |     |
| 127       | 71              |    | 127        |        |     |
| 125       | 70              |    | 125        |        |     |

#### Approx. Weight Calculations Formulae

|                             |                             |               |
|-----------------------------|-----------------------------|---------------|
| Rounds (inches)             | $\text{Dia}^2 \times 1.211$ | kgs per foot  |
| Rounds (inches)             | $\text{Dia}^2 \times 3.973$ | kgs per metre |
| Rounds (millimetres)        | $\text{Dia}^2 \div 533$     | kgs per foot  |
| Rounds (millimetres)        | $\text{Dia}^2 \div 162$     | kgs per metre |
| Hexagons (inches)           | $A/F^2 \times 1.337$        | kgs per foot  |
| Hexagons (inches)           | $A/F^2 \times 4.387$        | kgs per metre |
| Hexagons (millimetres)      | $A/F^2 \div 482.6$          | kgs per foot  |
| Hexagons (millimetres)      | $A/F^2 \div 147.1$          | kgs per metre |
| Squares/Flats (inches)      | $W \times T \times 1.542$   | kgs per foot  |
| Squares/Flats (inches)      | $W \times T \times 5.059$   | kgs per metre |
| Squares/Flats (millimetres) | $W \times T \div 418$       | kgs per foot  |
| Squares/Flats (millimetres) | $W \times T \div 127$       | kgs per metre |

## Maximum recommended finished machined sizes for hot rolled bars according to BS 970: Part 1: 1996

| Hot Rolled Dia mm | Rec. Fin. Size Dia mm | Hot Rolled Dia mm | Rec. Fin. Size Dia mm | Hot Rolled Dia mm | Rec. Fin. Size Dia mm |
|-------------------|-----------------------|-------------------|-----------------------|-------------------|-----------------------|
| 20                | 18.912                | 53                | 50.304                | 125               | 118.080               |
| 21                | 19.872                | 54                | 51.246                | 130               | 122.880               |
| 22                | 20.832                | 55                | 52.224                | 135               | 127.680               |
| 23                | 21.792                | 56                | 53.184                | 140               | 132.480               |
| 24                | 22.752                | 57                | 54.144                | 145               | 137.280               |
| 25                | 23.712                | 58                | 55.104                | 150               | 142.080               |
| 26                | 24.672                | 59                | 56.064                | 155               | 146.880               |
| 27                | 25.536                | 60                | 57.024                | 160               | 151.680               |
| 28                | 26.496                | 61                | 57.984                | 165               | 156.000               |
| 29                | 27.456                | 62                | 58.944                | 170               | 160.800               |
| 30                | 28.416                | 63                | 59.904                | 175               | 165.600               |
| 31                | 29.376                | 64                | 60.864                | 180               | 170.400               |
| 32                | 30.336                | 65                | 61.728                | 185               | 175.200               |
| 33                | 31.296                | 66                | 62.688                | 190               | 180.000               |
| 34                | 32.356                | 67                | 63.648                | 195               | 184.800               |
| 35                | 33.216                | 68                | 64.608                | 200               | 189.600               |
| 36                | 34.176                | 69                | 65.568                | 205               | 193.920               |
| 37                | 35.136                | 70                | 66.528                | 210               | 198.720               |
| 38                | 36.096                | 71                | 67.488                | 215               | 203.520               |
| 39                | 36.960                | 72                | 68.448                | 220               | 208.320               |
| 40                | 37.920                | 73                | 69.408                | 230               | 217.920               |
| 41                | 38.880                | 74                | 70.368                | 240               | 227.520               |
| 42                | 39.840                | 75                | 71.328                | 250               | 237.120               |
| 43                | 40.800                | 76                | 71.712                | 255               | 241.920               |
| 44                | 41.760                | 80                | 75.552                | 260               | 246.720               |
| 45                | 42.720                | 85                | 80.352                | 270               | 256.320               |
| 46                | 43.680                | 90                | 85.512                | 280               | 265.920               |
| 47                | 44.640                | 95                | 89.760                | 290               | 275.520               |
| 48                | 45.600                | 100               | 94.560                | 300               | 285.120               |
| 49                | 46.560                | 105               | 99.360                | 305               | 289.920               |
| 50                | 47.520                | 110               | 104.160               | 320               | 304.320               |
| 51                | 48.480                | 115               | 108.960               | 330               | 313.920               |
| 52                | 49.344                | 120               | 113.760               | 350               | 333.120               |

Please note that forged bars are produced to a different tolerance. Information available on request.

| General Conversions | Multiply By | Inversion |
|---------------------|-------------|-----------|
| <b>Length</b>       |             |           |
| cm to inch          | 0.3937      | 2.540     |
| m to ft             | 3.281       | 0.304     |
| mm to inch          | 0.0394      | 25.380    |

|               |       |       |
|---------------|-------|-------|
| <b>Energy</b> |       |       |
| ft/lb to J    | 1.356 | 0.737 |

|   |         |       |
|---|---------|-------|
| <b>Pressure</b>                           |         |       |
| N/mm <sup>2</sup> to P.S.I.               | 144.99  | 0.006 |
| K.S.I. to P.S.I.                          | 1000    | 0.001 |
| K.S.I. to N/mm <sup>2</sup>               | 6.89476 | 0.145 |
| Tons/in <sup>2</sup> to N/mm <sup>2</sup> | 15.4442 | 0.064 |

Every care has been taken in the preparation of this technical data, however no liability can be accepted for any errors nor the consequences arising from such errors.

| Tolerances for hot rolled round and square bar and rough turned rounds as per BS 970 : Part 1 : 1996 |                               |                |                           |                |
|--|-------------------------------|----------------|---------------------------|----------------|
| Size   | Permitted Variation           |                |                           |                |
|  | General Applications          |                |                           |                |
|  | Primary rolled round material |                | Re-rolled material        |                |
|  | Dia                           | Out of section | Dia or width across flats | Out of section |
| mm   | mm                            | mm             | mm                        | mm             |
| ≤ 16   | -                             | -              | 0.2                       | 0.3            |
| > 16 ≤ 26  | -                             | -              | 0.3                       | 0.5            |
| > 26 ≤ 38  | -                             | -              | 0.4                       | 0.6            |
| > 38 ≤ 51  | -                             | -              | 0.5                       | 0.8            |
| > 51 ≤ 64  | -                             | -              | 0.6                       | 0.9            |
| > 64 ≤ 76  | -                             | -              | 0.7                       | 1.1            |
| > 76 ≤ 90  | 1.3                           | 2.0            | 0.7                       | 1.1            |
| > 90 ≤ 120   | 1.5                           | 2.3            | 0.8                       | 1.2            |
| > 120 ≤ 160  | 2.0                           | 3.0            |                           |                |
| > 160 ≤ 200  | 2.5                           | 3.8            |                           |                |
| > 200  | 3.0                           | 4.5            |                           |                |

| Tolerances for cold drawn bar as per BS 970 : Part 3 : 1991 |                                     |                     |
|---|-------------------------------------|---------------------|
| Section   | Size diameter or width across flats | Permitted variation |
|   | mm                                  | mm                  |
| Round   | ≤ 6 ≤ 18                            | + 0 to - 0.070      |
|   | > 18 ≤ 30                           | + 0 to - 0.085      |
|   | > 30 ≤ 50                           | + 0 to - 0.100      |
|   | > 50 ≤ 80                           | + 0 to - 0.120      |
|   | > 80 ≤ 100                          | + 0 to - 0.140      |
| Square and Hexagon  | > 6 ≤ 18                            | + 0 to - 0.090      |
|   | > 18 ≤ 30                           | + 0 to - 0.110      |
|   | > 30 ≤ 50                           | + 0 to - 0.130      |
|   | > 50 ≤ 80                           | + 0 to - 0.160      |
|   | > 80 ≤ 105                          | + 0 to - 0.250      |
| Flat (width)  | < 18                                | + 0 to - 0.110      |
|   | > 18 ≤ 30                           | + 0 to - 0.130      |
|   | > 30 ≤ 50                           | + 0 to - 0.160      |
|   | > 50 ≤ 80                           | + 0 to - 0.190      |
|   | > 80 ≤ 100                          | + 0 to - 0.220      |
|   | > 100 ≤ 130                         | + 0 to - 0.350      |
|   | > 130 ≤ 160                         | + 0 to - 1.000      |
|   | > 160 ≤ 320                         | + 0 to - 1.000      |
| Flat (thickness)  | < 18                                | + 0 to - 0.110      |
|   | > 18 ≤ 30                           | + 0 to - 0.130      |
|   | > 30 ≤ 50                           | + 0 to - 0.250      |
|   | > 50 ≤ 80                           | + 0 to - 0.350      |

| ISO Tolerances  |     |     |     |    |    |    |
|---|-----|-----|-----|----|----|----|
| h13   | h12 | h11 | h10 | h9 | h8 | h7 |
| Tolerances as per table below. The total tolerance is taken as <b>MINUS</b>                       |     |     |     |    |    |    |
| i.e 45mm dia h9 = -0.062  |     |     |     |    |    |    |
| k13   | k12 | k11 | k10 | k9 | k8 | k7 |
| Tolerances as per table below. The total tolerance is taken as <b>PLUS</b>                        |     |     |     |    |    |    |
| i.e 45mm dia k9 = +0.062  |     |     |     |    |    |    |
| j13   | j12 | j11 | j10 | j9 | j8 | j7 |
| Tolerances as per table below. The total tolerance is taken as <b>DIVIDED OVER PLUS AND MINUS</b> |     |     |     |    |    |    |
| i.e 45mm dia j9 = +/-0.031  |     |     |     |    |    |    |

| Nominal Sizes |       |       |       |       |       |       |       |
|---------------|-------|-------|-------|-------|-------|-------|-------|
| mm            | 13    | 12    | 11    | 10    | 9     | 8     | 7     |
| > 1 to 3      | 0.140 | 0.100 | 0.050 | 0.040 | 0.025 | 0.014 | 0.010 |
| > 3 to 6      | 0.180 | 0.120 | 0.075 | 0.048 | 0.030 | 0.018 | 0.012 |
| > 6 to 10     | 0.220 | 0.150 | 0.090 | 0.058 | 0.036 | 0.022 | 0.015 |
| > 10 to 18    | 0.270 | 0.180 | 0.110 | 0.070 | 0.043 | 0.027 | 0.018 |
| > 18 to 30    | 0.330 | 0.210 | 0.130 | 0.084 | 0.052 | 0.033 | 0.021 |
| > 30 to 50    | 0.390 | 0.250 | 0.150 | 0.100 | 0.062 | 0.039 | 0.025 |
| > 50 to 80    | 0.460 | 0.300 | 0.190 | 0.120 | 0.074 | 0.046 | 0.030 |
| > 80 to 120   | 0.540 | 0.350 | 0.220 | 0.140 | 0.087 | 0.054 | 0.035 |
| > 120 to 180  | 0.630 | 0.400 | 0.250 | 0.160 | 0.100 | 0.063 | 0.040 |

The tolerances shown above are normally applied to metric sizes of drawn, turned and ground finish bright steel bars.

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