

# Bolt Torque Chart

Torque range and target preload matrix by property class × friction state, Nm ↔ ft-lb toggle, printable.

M6–M36 · 6 property classes · 5 friction states · N·m (typ / min–max) · coarse + fine thread

M6

N·m · As 20.1 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 4.8                 | 6<br>5–6                         | 5<br>4–6                         | 6<br>5–7                           | 4<br>3–4                   | 3<br>2–3                                     |
| 8.8   | 640         | 9                   | 11<br>10–12                      | 9<br>8–11                        | 12<br>10–14                        | 7<br>6–8                   | 5<br>4–6                                     |
| 10.9  | 940         | 13.2                | 16<br>14–17                      | 13<br>12–16                      | 17<br>14–20                        | 10<br>10–12                | 8<br>6–10                                    |
| 12.9  | 1100        | 15.5                | 19<br>17–20                      | 16<br>14–19                      | 20<br>17–23                        | 12<br>11–14                | 9<br>7–11                                    |
| A2-70 | 450         | 6.3                 | 8<br>7–8                         | 6<br>6–8                         | 8<br>7–9                           | 5<br>5–6                   | 4<br>3–5                                     |
| A4-80 | 600         | 8.4                 | 10<br>9–11                       | 9<br>8–10                        | 11<br>9–13                         | 7<br>6–8                   | 5<br>4–6                                     |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M6 As = 20.1 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

### Fine-Thread Torque Matrix

M6 is not covered by the fine-thread stress area table of ISO 898-1:2013 (Table 6 starts at M8×1); the fine-thread values shown on this page equal the coarse chart.  
Cell shows the typical value; the small line below is the range (min–max).

M8

N·m · As 36.6 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 8.7                 | 14<br>13–15                      | 12<br>10–14                      | 15<br>13–17                        | 9<br>8–10                  | 7<br>6–8                                     |
| 8.8   | 640         | 16.4                | 26<br>24–29                      | 22<br>20–26                      | 29<br>24–33                        | 17<br>16–20                | 13<br>10–16                                  |
| 10.9  | 940         | 24.1                | 39<br>35–42                      | 33<br>29–39                      | 42<br>35–48                        | 25<br>23–29                | 19<br>15–23                                  |
| 12.9  | 1100        | 28.2                | 45<br>41–50                      | 38<br>34–45                      | 50<br>41–56                        | 29<br>27–34                | 23<br>18–27                                  |
| A2-70 | 450         | 11.5                | 18<br>17–20                      | 16<br>14–18                      | 20<br>17–23                        | 12<br>11–14                | 9<br>7–11                                    |
| A4-80 | 600         | 15.4                | 25<br>22–27                      | 21<br>18–25                      | 27<br>22–31                        | 16<br>15–18                | 12<br>10–15                                  |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M8 As = 36.6 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

### Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 9.3                 | 15<br>13–16                      | 13<br>11–15                      | 16<br>13–19                        | 10<br>9–11                 | 7<br>6–9                                     |
| 8.8   | 640         | 17.6                | 28<br>25–31                      | 24<br>21–28                      | 31<br>25–35                        | 18<br>17–21                | 14<br>11–17                                  |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 10.9  | 940         | 25.8                | 41<br>37–45                      | 35<br>31–41                      | 45<br>37–52                        | 27<br>25–31                | 21<br>17–25                                  |
| 12.9  | 1100        | 30.2                | 48<br>43–53                      | 41<br>36–48                      | 53<br>43–60                        | 31<br>29–36                | 24<br>19–29                                  |
| A2-70 | 450         | 12.3                | 20<br>18–22                      | 17<br>15–20                      | 22<br>18–25                        | 13<br>12–15                | 10<br>8–12                                   |
| A4-80 | 600         | 16.5                | 26<br>24–29                      | 22<br>20–26                      | 29<br>24–33                        | 17<br>16–20                | 13<br>11–16                                  |

Cell shows the typical value; the small line below is the range (min–max).

M10

N·m · As 58 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 13.8                | 28<br>25–30                      | 23<br>21–28                      | 30<br>25–35                        | 18<br>17–21                | 14<br>11–17                                  |
| 8.8   | 640         | 26                  | 52<br>47–57                      | 44<br>39–52                      | 57<br>47–65                        | 34<br>31–39                | 26<br>21–31                                  |
| 10.9  | 940         | 38.2                | 76<br>69–84                      | 65<br>57–76                      | 84<br>69–95                        | 50<br>46–57                | 38<br>31–46                                  |
| 12.9  | 1100        | 44.7                | 89<br>80–98                      | 76<br>67–89                      | 98<br>80–112                       | 58<br>54–67                | 45<br>36–54                                  |
| A2-70 | 450         | 18.3                | 37<br>33–40                      | 31<br>27–37                      | 40<br>33–46                        | 24<br>22–27                | 18<br>15–22                                  |
| A4-80 | 600         | 24.4                | 49<br>44–54                      | 41<br>37–49                      | 54<br>44–61                        | 32<br>29–37                | 24<br>19–29                                  |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ ; D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M10 As = 58 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 15.4                | 31<br>28–34                      | 26<br>23–31                      | 34<br>28–38                        | 20<br>18–23                | 15<br>12–18                                  |
| 8.8   | 640         | 28.9                | 58<br>52–64                      | 49<br>43–58                      | 64<br>52–72                        | 38<br>35–43                | 29<br>23–35                                  |
| 10.9  | 940         | 42.4                | 85<br>76–93                      | 72<br>64–85                      | 93<br>76–106                       | 55<br>51–64                | 42<br>34–51                                  |
| 12.9  | 1100        | 49.7                | 99<br>89–109                     | 84<br>74–99                      | 109<br>89–124                      | 65<br>60–74                | 50<br>40–60                                  |
| A2-70 | 450         | 20.3                | 41<br>37–45                      | 35<br>30–41                      | 45<br>37–51                        | 26<br>24–30                | 20<br>16–24                                  |
| A4-80 | 600         | 27.1                | 54<br>49–60                      | 46<br>41–54                      | 60<br>49–68                        | 35<br>33–41                | 27<br>22–33                                  |

Cell shows the typical value; the small line below is the range (min–max).

M12

N·m · As 84.3 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 20.1                | 48<br>43–53                      | 41<br>36–48                      | 53<br>43–60                        | 31<br>29–36                | 24<br>19–29                                  |
| 8.8   | 640         | 37.8                | 91<br>82–100                     | 77<br>68–91                      | 100<br>82–113                      | 59<br>54–68                | 45<br>36–54                                  |
| 10.9  | 940         | 55.5                | 133<br>120–146                   | 113<br>100–133                   | 146<br>120–166                     | 87<br>80–100               | 67<br>53–80                                  |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 12.9  | 1100        | 64.9                | 156<br>140–171                   | 132<br>117–156                   | 171<br>140–195                     | 101<br>93–117              | 78<br>62–93                                  |
| A2-70 | 450         | 26.6                | 64<br>57–70                      | 54<br>48–64                      | 70<br>57–80                        | 41<br>38–48                | 32<br>25–38                                  |
| A4-80 | 600         | 35.4                | 85<br>76–93                      | 72<br>64–85                      | 93<br>76–106                       | 55<br>51–64                | 42<br>34–51                                  |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M12 As = 84.3 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 21                  | 50<br>45–55                      | 43<br>38–50                      | 55<br>45–63                        | 33<br>30–38                | 25<br>20–30                                  |
| 8.8   | 640         | 39.5                | 95<br>85–104                     | 81<br>71–95                      | 104<br>85–118                      | 62<br>57–71                | 47<br>38–57                                  |
| 10.9  | 940         | 58                  | 139<br>125–153                   | 118<br>104–139                   | 153<br>125–174                     | 90<br>83–104               | 70<br>56–83                                  |
| 12.9  | 1100        | 67.8                | 163<br>147–179                   | 138<br>122–163                   | 179<br>147–204                     | 106<br>98–122              | 81<br>65–98                                  |
| A2-70 | 450         | 27.8                | 67<br>60–73                      | 57<br>50–67                      | 73<br>60–83                        | 43<br>40–50                | 33<br>27–40                                  |
| A4-80 | 600         | 37                  | 89<br>80–98                      | 75<br>67–89                      | 98<br>80–111                       | 58<br>53–67                | 44<br>36–53                                  |

Cell shows the typical value; the small line below is the range (min–max).

M14

N·m · As 115 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 27.4                | 77<br>69–84                      | 65<br>57–77                      | 84<br>69–96                        | 50<br>46–57                | 38<br>31–46                                  |
| 8.8   | 640         | 51.5                | 144<br>130–159                   | 123<br>108–144                   | 159<br>130–180                     | 94<br>87–108               | 72<br>58–87                                  |
| 10.9  | 940         | 75.7                | 212<br>191–233                   | 180<br>159–212                   | 233<br>191–265                     | 138<br>127–159             | 106<br>85–127                                |
| 12.9  | 1100        | 88.6                | 248<br>223–273                   | 211<br>186–248                   | 273<br>223–310                     | 161<br>149–186             | 124<br>99–149                                |
| A2-70 | 450         | 36.2                | 101<br>91–112                    | 86<br>76–101                     | 112<br>91–127                      | 66<br>61–76                | 51<br>41–61                                  |
| A4-80 | 600         | 48.3                | 135<br>122–149                   | 115<br>101–135                   | 149<br>122–169                     | 88<br>81–101               | 68<br>54–81                                  |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M14 As = 115 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 29.7                | 83<br>75–92                      | 71<br>62–83                      | 92<br>75–104                       | 54<br>50–62                | 42<br>33–50                                  |
| 8.8   | 640         | 56                  | 157<br>141–172                   | 133<br>118–157                   | 172<br>141–196                     | 102<br>94–118              | 78<br>63–94                                  |
| 10.9  | 940         | 82.3                | 230<br>207–253                   | 196<br>173–230                   | 253<br>207–288                     | 150<br>138–173             | 115<br>92–138                                |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 12.9  | 1100        | 96.3                | 270<br>243–296                   | 229<br>202–270                   | 296<br>243–337                     | 175<br>162–202             | 135<br>108–162                               |
| A2-70 | 450         | 39.4                | 110<br>99–121                    | 94<br>83–110                     | 121<br>99–138                      | 72<br>66–83                | 55<br>44–66                                  |
| A4-80 | 600         | 52.5                | 147<br>132–162                   | 125<br>110–147                   | 162<br>132–184                     | 96<br>88–110               | 74<br>59–88                                  |

Cell shows the typical value; the small line below is the range (min–max).

M16

N·m · As 157 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 37.4                | 120<br>108–132                   | 102<br>90–120                    | 132<br>108–149                     | 78<br>72–90                | 60<br>48–72                                  |
| 8.8   | 640         | 70.3                | 225<br>203–248                   | 191<br>169–225                   | 248<br>203–281                     | 146<br>135–169             | 113<br>90–135                                |
| 10.9  | 940         | 103.3               | 331<br>298–364                   | 281<br>248–331                   | 364<br>298–413                     | 215<br>198–248             | 165<br>132–198                               |
| 12.9  | 1100        | 120.9               | 387<br>348–426                   | 329<br>290–387                   | 426<br>348–484                     | 251<br>232–290             | 193<br>155–232                               |
| A2-70 | 450         | 49.5                | 158<br>142–174                   | 135<br>119–158                   | 174<br>142–198                     | 103<br>95–119              | 79<br>63–95                                  |
| A4-80 | 600         | 65.9                | 211<br>190–232                   | 179<br>158–211                   | 232<br>190–264                     | 137<br>127–158             | 106<br>84–127                                |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M16 As = 157 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 39.7                | 127<br>114–140                   | 108<br>95–127                    | 140<br>114–159                     | 83<br>76–95                | 64<br>51–76                                  |
| 8.8   | 640         | 74.8                | 239<br>215–263                   | 203<br>180–239                   | 263<br>215–299                     | 156<br>144–180             | 120<br>96–144                                |
| 10.9  | 940         | 109.9               | 352<br>316–387                   | 299<br>264–352                   | 387<br>316–440                     | 229<br>211–264             | 176<br>141–211                               |
| 12.9  | 1100        | 128.6               | 411<br>370–453                   | 350<br>309–411                   | 453<br>370–514                     | 267<br>247–309             | 206<br>165–247                               |
| A2-70 | 450         | 52.6                | 168<br>152–185                   | 143<br>126–168                   | 185<br>152–210                     | 109<br>101–126             | 84<br>67–101                                 |
| A4-80 | 600         | 70.1                | 224<br>202–247                   | 191<br>168–224                   | 247<br>202–281                     | 146<br>135–168             | 112<br>90–135                                |

Cell shows the typical value; the small line below is the range (min–max).

M18

N·m · As 192 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 45.7                | 165<br>148–181                   | 140<br>123–165                   | 181<br>148–206                     | 107<br>99–123              | 82<br>66–99                                  |
| 8.8   | 640         | 86                  | 310<br>279–341                   | 263<br>232–310                   | 341<br>279–387                     | 201<br>186–232             | 155<br>124–186                               |
| 10.9  | 940         | 126.3               | 455<br>409–500                   | 387<br>341–455                   | 500<br>409–569                     | 296<br>273–341             | 227<br>182–273                               |
| 12.9  | 1100        | 147.8               | 532<br>479–585                   | 452<br>399–532                   | 585<br>479–665                     | 346<br>319–399             | 266<br>213–319                               |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| A2-70 | 450         | 60.5                | 218<br>196–240                   | 185<br>163–218                   | 240<br>196–272                     | 142<br>131–163             | 109<br>87–131                                |
| A4-80 | 600         | 80.6                | 290<br>261–319                   | 247<br>218–290                   | 319<br>261–363                     | 189<br>174–218             | 145<br>116–174                               |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M18 As = 192 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 51.4                | 185<br>167–204                   | 157<br>139–185                   | 204<br>167–231                     | 120<br>111–139             | 93<br>74–111                                 |
| 8.8   | 640         | 96.8                | 348<br>314–383                   | 296<br>261–348                   | 383<br>314–435                     | 226<br>209–261             | 174<br>139–209                               |
| 10.9  | 940         | 142.1               | 512<br>460–563                   | 435<br>384–512                   | 563<br>460–640                     | 333<br>307–384             | 256<br>205–307                               |
| 12.9  | 1100        | 166.3               | 599<br>539–659                   | 509<br>449–599                   | 659<br>539–748                     | 389<br>359–449             | 299<br>240–359                               |
| A2-70 | 450         | 68                  | 245<br>220–269                   | 208<br>184–245                   | 269<br>220–306                     | 159<br>147–184             | 122<br>98–147                                |
| A4-80 | 600         | 90.7                | 327<br>294–359                   | 278<br>245–327                   | 359<br>294–408                     | 212<br>196–245             | 163<br>131–196                               |

Cell shows the typical value; the small line below is the range (min–max).

M20

N·m · As 245 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 58.3                | 233<br>210–257                   | 198<br>175–233                   | 257<br>210–292                     | 152<br>140–175             | 117<br>93–140                                |
| 8.8   | 640         | 109.8               | 439<br>395–483                   | 373<br>329–439                   | 483<br>395–549                     | 285<br>263–329             | 220<br>176–263                               |
| 10.9  | 940         | 161.2               | 645<br>580–709                   | 548<br>484–645                   | 709<br>580–806                     | 419<br>387–484             | 322<br>258–387                               |
| 12.9  | 1100        | 188.7               | 755<br>679–830                   | 641<br>566–755                   | 830<br>679–943                     | 490<br>453–566             | 377<br>302–453                               |
| A2-70 | 450         | 77.2                | 309<br>278–340                   | 262<br>232–309                   | 340<br>278–386                     | 201<br>185–232             | 154<br>123–185                               |
| A4-80 | 600         | 102.9               | 412<br>370–453                   | 350<br>309–412                   | 453<br>370–515                     | 268<br>247–309             | 206<br>165–247                               |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M20 As = 245 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 64.7                | 259<br>233–285                   | 220<br>194–259                   | 285<br>233–324                     | 168<br>155–194             | 129<br>104–155                               |
| 8.8   | 640         | 121.9               | 487<br>439–536                   | 414<br>366–487                   | 536<br>439–609                     | 317<br>292–366             | 244<br>195–292                               |
| 10.9  | 940         | 179                 | 716<br>644–787                   | 609<br>537–716                   | 787<br>644–895                     | 465<br>430–537             | 358<br>286–430                               |
| 12.9  | 1100        | 209.4               | 838<br>754–922                   | 712<br>628–838                   | 922<br>754–1047                    | 545<br>503–628             | 419<br>335–503                               |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| A2-70 | 450         | 85.7                | 343<br>308–377                   | 291<br>257–343                   | 377<br>308–428                     | 223<br>206–257             | 171<br>137–206                               |
| A4-80 | 600         | 114.2               | 457<br>411–503                   | 388<br>343–457                   | 503<br>411–571                     | 297<br>274–343             | 228<br>183–274                               |

Cell shows the typical value; the small line below is the range (min–max).

M22

N·m · As 303 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 72.1                | 317<br>286–349                   | 270<br>238–317                   | 349<br>286–397                     | 206<br>190–238             | 159<br>127–190                               |
| 8.8   | 640         | 135.7               | 597<br>538–657                   | 508<br>448–597                   | 657<br>538–747                     | 388<br>358–448             | 299<br>239–358                               |
| 10.9  | 940         | 199.4               | 877<br>790–965                   | 746<br>658–877                   | 965<br>790–1097                    | 570<br>526–658             | 439<br>351–526                               |
| 12.9  | 1100        | 233.3               | 1027<br>924–1129                 | 873<br>770–1027                  | 1129<br>924–1283                   | 667<br>616–770             | 513<br>411–616                               |
| A2-70 | 450         | 95.4                | 420<br>378–462                   | 357<br>315–420                   | 462<br>378–525                     | 273<br>252–315             | 210<br>168–252                               |
| A4-80 | 600         | 127.3               | 560<br>504–616                   | 476<br>420–560                   | 616<br>504–700                     | 364<br>336–420             | 280<br>224–336                               |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M22 As = 303 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS₂ band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 79.3                | 349<br>314–384                   | 296<br>262–349                   | 384<br>314–436                     | 227<br>209–262             | 174<br>139–209                               |
| 8.8   | 640         | 149.2               | 656<br>591–722                   | 558<br>492–656                   | 722<br>591–821                     | 427<br>394–492             | 328<br>263–394                               |
| 10.9  | 940         | 219.1               | 964<br>868–1061                  | 819<br>723–964                   | 1061<br>868–1205                   | 627<br>578–723             | 482<br>386–578                               |
| 12.9  | 1100        | 256.4               | 1128<br>1015–1241                | 959<br>846–1128                  | 1241<br>1015–1410                  | 733<br>677–846             | 564<br>451–677                               |
| A2-70 | 450         | 104.9               | 462<br>415–508                   | 392<br>346–462                   | 508<br>415–577                     | 300<br>277–346             | 231<br>185–277                               |
| A4-80 | 600         | 139.9               | 615<br>554–677                   | 523<br>462–615                   | 677<br>554–769                     | 400<br>369–462             | 308<br>246–369                               |

Cell shows the typical value; the small line below is the range (min–max).

M24

N·m · As 353 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 84                  | 403<br>363–444                   | 343<br>302–403                   | 444<br>363–504                     | 262<br>242–302             | 202<br>161–242                               |
| 8.8   | 640         | 158.1               | 759<br>683–835                   | 645<br>569–759                   | 835<br>683–949                     | 493<br>455–569             | 380<br>304–455                               |
| 10.9  | 940         | 232.3               | 1115<br>1003–1226                | 948<br>836–1115                  | 1226<br>1003–1394                  | 725<br>669–836             | 557<br>446–669                               |
| 12.9  | 1100        | 271.8               | 1305<br>1174–1435                | 1109<br>979–1305                 | 1435<br>1174–1631                  | 848<br>783–979             | 652<br>522–783                               |
| A2-70 | 450         | 111.2               | 534<br>480–587                   | 454<br>400–534                   | 587<br>480–667                     | 347<br>320–400             | 267<br>213–320                               |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| A4-80 | 600         | 148.3               | 712<br>640–783                   | 605<br>534–712                   | 783<br>640–890                     | 463<br>427–534             | 356<br>285–427                               |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M24 As = 353 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 91.4                | 439<br>395–483                   | 373<br>329–439                   | 483<br>395–548                     | 285<br>263–329             | 219<br>175–263                               |
| 8.8   | 640         | 172                 | 826<br>743–908                   | 702<br>619–826                   | 908<br>743–1032                    | 537<br>495–619             | 413<br>330–495                               |
| 10.9  | 940         | 252.7               | 1213<br>1092–1334                | 1031<br>910–1213                 | 1334<br>1092–1516                  | 788<br>728–910             | 606<br>485–728                               |
| 12.9  | 1100        | 295.7               | 1419<br>1277–1561                | 1206<br>1064–1419                | 1561<br>1277–1774                  | 923<br>852–1064            | 710<br>568–852                               |
| A2-70 | 450         | 121                 | 581<br>523–639                   | 494<br>435–581                   | 639<br>523–726                     | 377<br>348–435             | 290<br>232–348                               |
| A4-80 | 600         | 161.3               | 774<br>697–852                   | 658<br>581–774                   | 852<br>697–968                     | 503<br>464–581             | 387<br>310–464                               |

Cell shows the typical value; the small line below is the range (min–max).

M27

N·m · As 459 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 109.2               | 590<br>531–649                   | 501<br>442–590                   | 649<br>531–737                     | 383<br>354–442             | 295<br>236–354                               |
| 8.8   | 640         | 205.6               | 1110<br>999–1221                 | 944<br>833–1110                  | 1221<br>999–1388                   | 722<br>666–833             | 555<br>444–666                               |
| 10.9  | 940         | 302                 | 1631<br>1468–1794                | 1386<br>1223–1631                | 1794<br>1468–2039                  | 1060<br>979–1223           | 815<br>652–979                               |
| 12.9  | 1100        | 353.4               | 1909<br>1718–2099                | 1622<br>1431–1909                | 2099<br>1718–2386                  | 1241<br>1145–1431          | 954<br>763–1145                              |
| A2-70 | 450         | 144.6               | 781<br>703–859                   | 664<br>586–781                   | 859<br>703–976                     | 507<br>468–586             | 390<br>312–468                               |
| A4-80 | 600         | 192.8               | 1041<br>937–1145                 | 885<br>781–1041                  | 1145<br>937–1301                   | 677<br>625–781             | 521<br>416–625                               |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M27 As = 459 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 118                 | 637<br>574–701                   | 542<br>478–637                   | 701<br>574–797                     | 414<br>382–478             | 319<br>255–382                               |
| 8.8   | 640         | 222.2               | 1200<br>1080–1320                | 1020<br>900–1200                 | 1320<br>1080–1500                  | 780<br>720–900             | 600<br>480–720                               |
| 10.9  | 940         | 326.4               | 1762<br>1586–1939                | 1498<br>1322–1762                | 1939<br>1586–2203                  | 1146<br>1057–1322          | 881<br>705–1057                              |
| 12.9  | 1100        | 381.9               | 2062<br>1856–2269                | 1753<br>1547–2062                | 2269<br>1856–2578                  | 1341<br>1237–1547          | 1031<br>825–1237                             |
| A2-70 | 450         | 156.2               | 844<br>759–928                   | 717<br>633–844                   | 928<br>759–1055                    | 548<br>506–633             | 422<br>337–506                               |

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| A4-80 | 600         | 208.3               | 1125<br>1012–1237                | 956<br>844–1125                  | 1237<br>1012–1406                  | 731<br>675–844             | 562<br>450–675                               |

Cell shows the typical value; the small line below is the range (min–max).

M30

N·m · As 561 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 133.5               | 801<br>721–881                   | 681<br>601–801                   | 881<br>721–1001                    | 521<br>481–601             | 401<br>320–481                               |
| 8.8   | 640         | 251.3               | 1508<br>1357–1659                | 1282<br>1131–1508                | 1659<br>1357–1885                  | 980<br>905–1131            | 754<br>603–905                               |
| 10.9  | 940         | 369.1               | 2215<br>1993–2436                | 1883<br>1661–2215                | 2436<br>1993–2769                  | 1440<br>1329–1661          | 1107<br>886–1329                             |
| 12.9  | 1100        | 432                 | 2592<br>2333–2851                | 2203<br>1944–2592                | 2851<br>2333–3240                  | 1685<br>1555–1944          | 1296<br>1037–1555                            |
| A2-70 | 450         | 176.7               | 1060<br>954–1166                 | 901<br>795–1060                  | 1166<br>954–1325                   | 689<br>636–795             | 530<br>424–636                               |
| A4-80 | 600         | 235.6               | 1414<br>1272–1555                | 1202<br>1060–1414                | 1555<br>1272–1767                  | 919<br>848–1060            | 707<br>565–848                               |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M30 As = 561 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS₂ band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 147.8               | 887<br>798–975                   | 754<br>665–887                   | 975<br>798–1108                    | 576<br>532–665             | 443<br>355–532                               |
| 8.8   | 640         | 278.2               | 1669<br>1502–1836                | 1419<br>1252–1669                | 1836<br>1502–2087                  | 1085<br>1002–1252          | 835<br>668–1002                              |
| 10.9  | 940         | 408.6               | 2452<br>2207–2697                | 2084<br>1839–2452                | 2697<br>2207–3065                  | 1594<br>1471–1839          | 1226<br>981–1471                             |
| 12.9  | 1100        | 478.2               | 2869<br>2582–3156                | 2439<br>2152–2869                | 3156<br>2582–3586                  | 1865<br>1721–2152          | 1435<br>1148–1721                            |
| A2-70 | 450         | 195.6               | 1174<br>1056–1291                | 998<br>880–1174                  | 1291<br>1056–1467                  | 763<br>704–880             | 587<br>469–704                               |
| A4-80 | 600         | 260.8               | 1565<br>1408–1721                | 1330<br>1174–1565                | 1721<br>1408–1956                  | 1017<br>939–1174           | 782<br>626–939                               |

Cell shows the typical value; the small line below is the range (min–max).

M33

N·m · As 694 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 165.2               | 1090<br>981–1199                 | 927<br>818–1090                  | 1199<br>981–1363                   | 709<br>654–818             | 545<br>436–654                               |
| 8.8   | 640         | 310.9               | 2052<br>1847–2257                | 1744<br>1539–2052                | 2257<br>1847–2565                  | 1334<br>1231–1539          | 1026<br>821–1231                             |
| 10.9  | 940         | 456.7               | 3014<br>2713–3315                | 2562<br>2260–3014                | 3315<br>2713–3767                  | 1959<br>1808–2260          | 1507<br>1206–1808                            |
| 12.9  | 1100        | 534.4               | 3527<br>3174–3880                | 2998<br>2645–3527                | 3880<br>3174–4409                  | 2292<br>2116–2645          | 1763<br>1411–2116                            |
| A2-70 | 450         | 218.6               | 1443<br>1299–1587                | 1226<br>1082–1443                | 1587<br>1299–1804                  | 938<br>866–1082            | 721<br>577–866                               |
| A4-80 | 600         | 291.5               | 1924<br>1731–2116                | 1635<br>1443–1924                | 2116<br>1731–2405                  | 1250<br>1154–1443          | 962<br>770–1154                              |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M33 As = 694 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 181.1               | 1195<br>1076–1315                | 1016<br>897–1195                 | 1315<br>1076–1494                  | 777<br>717–897             | 598<br>478–717                               |
| 8.8   | 640         | 340.9               | 2250<br>2025–2475                | 1913<br>1688–2250                | 2475<br>2025–2813                  | 1463<br>1350–1688          | 1125<br>900–1350                             |
| 10.9  | 940         | 500.7               | 3305<br>2974–3635                | 2809<br>2479–3305                | 3635<br>2974–4131                  | 2148<br>1983–2479          | 1652<br>1322–1983                            |
| 12.9  | 1100        | 586                 | 3867<br>3481–4254                | 3287<br>2901–3867                | 4254<br>3481–4834                  | 2514<br>2320–2901          | 1934<br>1547–2320                            |
| A2-70 | 450         | 239.7               | 1582<br>1424–1740                | 1345<br>1187–1582                | 1740<br>1424–1978                  | 1028<br>949–1187           | 791<br>633–949                               |
| A4-80 | 600         | 319.6               | 2109<br>1899–2320                | 1793<br>1582–2109                | 2320<br>1899–2637                  | 1371<br>1266–1582          | 1055<br>844–1266                             |

Cell shows the typical value; the small line below is the range (min–max).

M36

N·m · As 817 mm²

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 194.4               | 1400<br>1260–1540                | 1190<br>1050–1400                | 1540<br>1260–1750                  | 910<br>840–1050            | 700<br>560–840                               |
| 8.8   | 640         | 366                 | 2635<br>2372–2899                | 2240<br>1976–2635                | 2899<br>2372–3294                  | 1713<br>1581–1976          | 1318<br>1054–1581                            |
| 10.9  | 940         | 537.6               | 3871<br>3484–4258                | 3290<br>2903–3871                | 4258<br>3484–4838                  | 2516<br>2322–2903          | 1935<br>1548–2322                            |
| 12.9  | 1100        | 629.1               | 4529<br>4077–4982                | 3850<br>3397–4529                | 4982<br>4077–5662                  | 2944<br>2718–3397          | 2265<br>1812–2718                            |
| A2-70 | 450         | 257.4               | 1853<br>1668–2038                | 1575<br>1390–1853                | 2038<br>1668–2316                  | 1204<br>1112–1390          | 926<br>741–1112                              |
| A4-80 | 600         | 343.1               | 2471<br>2224–2718                | 2100<br>1853–2471                | 2718<br>2224–3088                  | 1606<br>1482–1853          | 1235<br>988–1482                             |

Torque follows the K-factor (nut factor) method  $T = K \cdot D \cdot F$ : D is the nominal diameter and F the target preload = 70% of  $Rp0.2 \times$  thread stress area (M36 As = 817 mm²). Yield strengths are published values from ISO 898-1 (carbon/alloy steel) and ISO 3506-1 (stainless A2/A4). K follows published empirical ranges per friction condition (Machinery's Handbook; the wax/PTFE/anti-seize band  $K \approx 0.10$  follows Machine Design test data). The grease/MoS<sub>2</sub> band ( $K \approx 0.11$ ) nearly overlaps anti-seize and is available in the calculator instead of a separate column.

Fine-Thread Torque Matrix

| Class | Rp0.2 (MPa) | Target preload (kN) | Dry / Black<br>K 0.18–0.22 · N·m | Electro Zinc<br>K 0.15–0.2 · N·m | Hot-Dip Galv.<br>K 0.18–0.25 · N·m | Oiled<br>K 0.12–0.15 · N·m | Wax / PTFE / Anti-seize<br>K 0.08–0.12 · N·m |
|-------|-------------|---------------------|----------------------------------|----------------------------------|------------------------------------|----------------------------|----------------------------------------------|
| 4.8   | 340         | 205.9               | 1482<br>1334–1630                | 1260<br>1112–1482                | 1630<br>1334–1853                  | 963<br>889–1112            | 741<br>593–889                               |
| 8.8   | 640         | 387.5               | 2790<br>2511–3069                | 2372<br>2093–2790                | 3069<br>2511–3488                  | 1814<br>1674–2093          | 1395<br>1116–1674                            |
| 10.9  | 940         | 569.2               | 4098<br>3688–4508                | 3483<br>3074–4098                | 4508<br>3688–5123                  | 2664<br>2459–3074          | 2049<br>1639–2459                            |
| 12.9  | 1100        | 666.1               | 4796<br>4316–5275                | 4076<br>3597–4796                | 5275<br>4316–5994                  | 3117<br>2877–3597          | 2398<br>1918–2877                            |
| A2-70 | 450         | 272.5               | 1962<br>1766–2158                | 1668<br>1471–1962                | 2158<br>1766–2452                  | 1275<br>1177–1471          | 981<br>785–1177                              |
| A4-80 | 600         | 363.3               | 2616<br>2354–2877                | 2223<br>1962–2616                | 2877<br>2354–3270                  | 1700<br>1569–1962          | 1308<br>1046–1569                            |

Cell shows the typical value; the small line below is the range (min–max).

Basis of Calculation & Sources

Boundary: this chart is a simplified K-factor estimate, not a full VDI 2230 analysis (which accounts for joint resilience, embedment and assembly method). Friction is the dominant variable — no single torque value exists without its friction state. Always follow the design specification or manufacturer torque table.

References

- ISO 898-1:2013 — Mechanical properties of fasteners made of carbon and alloy steel — <https://www.iso.org/standard/60610.html>
- ISO 3506-1:2020 — Mechanical properties of corrosion-resistant stainless steel fasteners (A2/A4) — <https://www.iso.org/standard/70045.html>
- GB/T 3098.1-2010 — Mechanical properties of bolts, screws and studs (CN national standard, official full text) — [https://openstd.samr.gov.cn/bzgk/gb/std?std\\_no=GB%2FT%203098.1-2010](https://openstd.samr.gov.cn/bzgk/gb/std?std_no=GB%2FT%203098.1-2010)
- GB/T 3098.6-2014 — Mechanical properties of stainless steel bolts, screws and studs (CN, official full text) — [https://openstd.samr.gov.cn/bzgk/gb/std?std\\_no=GB%2FT%203098.6-2014](https://openstd.samr.gov.cn/bzgk/gb/std?std_no=GB%2FT%203098.6-2014)
- ISO 16047:2005 — Fasteners: torque/clamp force testing (K-factor measurement method)
- Machinery's Handbook (30th ed.) — empirical K-factor ranges
- Machine Design — anti-seize compound friction test (K=0.10)

Disclaimer: This chart is an engineering estimation for selection and budgeting only. It does not constitute assembly instructions or acceptance criteria.

Bolt Torque Chart — Yaxiio full-range reference PDF, pack v1 · generated 2026-09-10 · data source: yaxiio-customer/utis/fastenerCalc.ts (single source of truth) · methodology matches the online tool pages · <https://www.yaxiio.com/en/tools/bolt-torque-chart/m12>