

**Table 7-9**

Descriptions of Preferred Fits Using the Basic Hole System

Source: *Preferred Metric Limits and Fits*, ANSI B4.2-1978. See also BS 4500.

| Type of Fit  | Description  | Symbol  |
|--------------|--|---------|
| Clearance    | <i>Loose running fit</i> : for wide commercial tolerances or allowances on external members  | H11/c11 |
|              | <i>Free running fit</i> : not for use where accuracy is essential, but good for large temperature variations, high running speeds, or heavy journal pressures  | H9/d9   |
|              | <i>Close running fit</i> : for running on accurate machines and for accurate location at moderate speeds and journal pressures                                 | H8/f7   |
|              | <i>Sliding fit</i> : where parts are not intended to run freely, but must move and turn freely and locate accurately   | H7/g6   |
| Transition   | <i>Locational clearance fit</i> : provides snug fit for location of stationary parts, but can be freely assembled and disassembled                             | H7/h6   |
|              | <i>Locational transition fit</i> for accurate location, a compromise between clearance and interference  | H7/k6   |
|              | <i>Locational transition fit</i> for more accurate location where greater interference is permissible  | H7/n6   |
| Interference | <i>Locational interference fit</i> : for parts requiring rigidity and alignment with prime accuracy of location but without special bore pressure requirements | H7/p6   |
|              | <i>Medium drive fit</i> : for ordinary steel parts or shrink fits on light sections, the tightest fit usable with cast iron                                    | H7/s6   |
|              | <i>Force fit</i> : suitable for parts that can be highly stressed or for shrink fits where the heavy pressing forces required are impractical                  | H7/u6   |

**Table A-10**

Cumulative Distribution Function of Normal (Gaussian) Distribution (Continued)

| $Z_{\alpha}$    | 0.0                  | 0.1                  | 0.2                  | 0.3                  | 0.4                   | 0.5                   | 0.6                   | 0.7                   | 0.8                   | 0.9                   |
|-----------------|----------------------|----------------------|----------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 3               | 0.00135              | 0.0 <sup>3</sup> 968 | 0.0 <sup>3</sup> 687 | 0.0 <sup>3</sup> 483 | 0.0 <sup>3</sup> 337  | 0.0 <sup>3</sup> 233  | 0.0 <sup>3</sup> 159  | 0.0 <sup>3</sup> 108  | 0.0 <sup>4</sup> 723  | 0.0 <sup>4</sup> 481  |
| 4               | 0.0 <sup>4</sup> 317 | 0.0 <sup>4</sup> 207 | 0.0 <sup>4</sup> 133 | 0.0 <sup>5</sup> 854 | 0.0 <sup>5</sup> 541  | 0.0 <sup>5</sup> 340  | 0.0 <sup>5</sup> 211  | 0.0 <sup>5</sup> 130  | 0.0 <sup>6</sup> 793  | 0.0 <sup>6</sup> 479  |
| 5               | 0.0 <sup>6</sup> 287 | 0.0 <sup>6</sup> 170 | 0.0 <sup>7</sup> 996 | 0.0 <sup>7</sup> 579 | 0.0 <sup>7</sup> 333  | 0.0 <sup>7</sup> 190  | 0.0 <sup>7</sup> 107  | 0.0 <sup>8</sup> 599  | 0.0 <sup>8</sup> 332  | 0.0 <sup>8</sup> 182  |
| 6               | 0.0 <sup>9</sup> 987 | 0.0 <sup>9</sup> 530 | 0.0 <sup>9</sup> 282 | 0.0 <sup>9</sup> 149 | 0.0 <sup>10</sup> 777 | 0.0 <sup>10</sup> 402 | 0.0 <sup>10</sup> 206 | 0.0 <sup>10</sup> 104 | 0.0 <sup>11</sup> 523 | 0.0 <sup>11</sup> 260 |
| $z_{\alpha}$    | -1.282               | -1.643               | -1.960               | -2.326               | -2.576                | -3.090                | -3.291                | -3.891                | -4.417                |                       |
| $F(z_{\alpha})$ | 0.10                 | 0.05                 | 0.025                | 0.010                | 0.005                 | 0.001                 | 0.0005                | 0.0001                | 0.000005              |                       |
| $R(z_{\alpha})$ | 0.90                 | 0.95                 | 0.975                | 0.990                | 0.995                 | 0.999                 | 0.9995                | 0.9999                | 0.999995              |                       |

**Table A-11**

A Selection of International Tolerance Grades—Metric Series (Size Ranges Are for Over the Lower Limit and Including the Upper Limit. All Values Are in Millimeters)

Source: Preferred Metric Limits and Fits, ANSI B4.2-1978. See also BSI 4500.

| Basic Sizes | Tolerance Grades |       |       |       |       |       |
|-------------|------------------|-------|-------|-------|-------|-------|
|             | IT6              | IT7   | IT8   | IT9   | IT10  | IT11  |
| 0-3         | 0.006            | 0.010 | 0.014 | 0.025 | 0.040 | 0.060 |
| 3-6         | 0.008            | 0.012 | 0.018 | 0.030 | 0.048 | 0.075 |
| 6-10        | 0.009            | 0.015 | 0.022 | 0.036 | 0.058 | 0.090 |
| 10-18       | 0.011            | 0.018 | 0.027 | 0.043 | 0.070 | 0.110 |
| 18-30       | 0.013            | 0.021 | 0.033 | 0.052 | 0.084 | 0.130 |
| 30-50       | 0.016            | 0.025 | 0.039 | 0.062 | 0.100 | 0.160 |
| 50-80       | 0.019            | 0.030 | 0.046 | 0.074 | 0.120 | 0.190 |
| 80-120      | 0.022            | 0.035 | 0.054 | 0.087 | 0.140 | 0.220 |
| 120-180     | 0.025            | 0.040 | 0.063 | 0.100 | 0.160 | 0.250 |
| 180-250     | 0.029            | 0.046 | 0.072 | 0.115 | 0.185 | 0.290 |
| 250-315     | 0.032            | 0.052 | 0.081 | 0.130 | 0.210 | 0.320 |
| 315-400     | 0.036            | 0.057 | 0.089 | 0.140 | 0.230 | 0.360 |

**Table A-12**

Fundamental Deviations for Shafts—Metric Series

(Size Ranges Are for Over the Lower Limit and Including the Upper Limit. All Values Are in Millimeters)

Source: Preferred Metric Limits and Fits, ANSI B4.2-1978. See also BSI 4500.

| Basic<br>Sizes | Upper-Deviation Letter |        |        |        |   | Lower-Deviation Letter |        |        |        |        |
|----------------|------------------------|--------|--------|--------|---|------------------------|--------|--------|--------|--------|
|                | c                      | d      | f      | g      | h | k                      | n      | p      | s      | u      |
| 0-3            | -0.060                 | -0.020 | -0.006 | -0.002 | 0 | 0                      | +0.004 | +0.006 | +0.014 | +0.018 |
| 3-6            | -0.070                 | -0.030 | -0.010 | -0.004 | 0 | +0.001                 | +0.008 | +0.012 | +0.019 | +0.023 |
| 6-10           | -0.080                 | -0.040 | -0.013 | -0.005 | 0 | +0.001                 | +0.010 | +0.015 | +0.023 | +0.028 |
| 10-14          | -0.095                 | -0.050 | -0.016 | -0.006 | 0 | +0.001                 | +0.012 | +0.018 | +0.028 | +0.033 |
| 14-18          | -0.095                 | -0.050 | -0.016 | -0.006 | 0 | +0.001                 | +0.012 | +0.018 | +0.028 | +0.033 |
| 18-24          | -0.110                 | -0.065 | -0.020 | -0.007 | 0 | +0.002                 | +0.015 | +0.022 | +0.035 | +0.041 |
| 24-30          | -0.110                 | -0.065 | -0.020 | -0.007 | 0 | +0.002                 | +0.015 | +0.022 | +0.035 | +0.048 |
| 30-40          | -0.120                 | -0.080 | -0.025 | -0.009 | 0 | +0.002                 | +0.017 | +0.026 | +0.043 | +0.060 |
| 40-50          | -0.130                 | -0.080 | -0.025 | -0.009 | 0 | +0.002                 | +0.017 | +0.026 | +0.043 | +0.070 |
| 50-65          | -0.140                 | -0.100 | -0.030 | -0.010 | 0 | +0.002                 | +0.020 | +0.032 | +0.053 | +0.087 |
| 65-80          | -0.150                 | -0.100 | -0.030 | -0.010 | 0 | +0.002                 | +0.020 | +0.032 | +0.059 | +0.102 |
| 80-100         | -0.170                 | -0.120 | -0.036 | -0.012 | 0 | +0.003                 | +0.023 | +0.037 | +0.071 | +0.124 |
| 100-120        | -0.180                 | -0.120 | -0.036 | -0.012 | 0 | +0.003                 | +0.023 | +0.037 | +0.079 | +0.144 |
| 120-140        | -0.200                 | -0.145 | -0.043 | -0.014 | 0 | +0.003                 | +0.027 | +0.043 | +0.092 | +0.170 |
| 140-160        | -0.210                 | -0.145 | -0.043 | -0.014 | 0 | +0.003                 | +0.027 | +0.043 | +0.100 | +0.190 |
| 160-180        | -0.230                 | -0.145 | -0.043 | -0.014 | 0 | +0.003                 | +0.027 | +0.043 | +0.108 | +0.210 |
| 180-200        | -0.240                 | -0.170 | -0.050 | -0.015 | 0 | +0.004                 | +0.031 | +0.050 | +0.122 | +0.236 |
| 200-225        | -0.260                 | -0.170 | -0.050 | -0.015 | 0 | +0.004                 | +0.031 | +0.050 | +0.130 | +0.258 |
| 225-250        | -0.280                 | -0.170 | -0.050 | -0.015 | 0 | +0.004                 | +0.031 | +0.050 | +0.140 | +0.284 |
| 250-280        | -0.300                 | -0.190 | -0.056 | -0.017 | 0 | +0.004                 | +0.034 | +0.056 | +0.158 | +0.315 |
| 280-315        | -0.330                 | -0.190 | -0.056 | -0.017 | 0 | +0.004                 | +0.034 | +0.056 | +0.170 | +0.350 |
| 315-355        | -0.360                 | -0.210 | -0.062 | -0.018 | 0 | +0.004                 | +0.037 | +0.062 | +0.190 | +0.390 |
| 355-400        | -0.400                 | -0.210 | -0.062 | -0.018 | 0 | +0.004                 | +0.037 | +0.062 | +0.208 | +0.435 |

**Table A-13**

A Selection of International Tolerance Grades—Inch Series (Size Ranges Are for Over the Lower Limit and *Including* the Upper Limit. All Values Are in Inches, Converted from Table A-11)

| Basic Sizes | Tolerance Grades |        |        |        |        |        |
|-------------|------------------|--------|--------|--------|--------|--------|
|             | IT6              | IT7    | IT8    | IT9    | IT10   | IT11   |
| 0–0.12      | 0.0002           | 0.0004 | 0.0006 | 0.0010 | 0.0016 | 0.0024 |
| 0.12–0.24   | 0.0003           | 0.0005 | 0.0007 | 0.0012 | 0.0019 | 0.0030 |
| 0.24–0.40   | 0.0004           | 0.0006 | 0.0009 | 0.0014 | 0.0023 | 0.0035 |
| 0.40–0.72   | 0.0004           | 0.0007 | 0.0011 | 0.0017 | 0.0028 | 0.0043 |
| 0.72–1.20   | 0.0005           | 0.0008 | 0.0013 | 0.0020 | 0.0033 | 0.0051 |
| 1.20–2.00   | 0.0006           | 0.0010 | 0.0015 | 0.0024 | 0.0039 | 0.0063 |
| 2.00–3.20   | 0.0007           | 0.0012 | 0.0018 | 0.0029 | 0.0047 | 0.0075 |
| 3.20–4.80   | 0.0009           | 0.0014 | 0.0021 | 0.0034 | 0.0055 | 0.0087 |
| 4.80–7.20   | 0.0010           | 0.0016 | 0.0025 | 0.0039 | 0.0063 | 0.0098 |
| 7.20–10.00  | 0.0011           | 0.0018 | 0.0028 | 0.0045 | 0.0073 | 0.0114 |
| 10.00–12.60 | 0.0013           | 0.0020 | 0.0032 | 0.0051 | 0.0083 | 0.0126 |
| 12.60–16.00 | 0.0014           | 0.0022 | 0.0035 | 0.0055 | 0.0091 | 0.0142 |

**Table A-14**

Fundamental Deviations for Shafts—Inch Series (Size Ranges Are for Over the Lower Limit and Including the Upper Limit. All Values Are in Inches, Converted from Table A-12)

| Basic Sizes | Upper Deviation Letter |         |         |         |   |         |         |         |         |         | Lower Deviation Letter |  |  |  |  |
|-------------|------------------------|---------|---------|---------|---|---------|---------|---------|---------|---------|------------------------|--|--|--|--|
|             | c                      | d       | f       | g       | h | k       | n       | p       | s       | u       |                        |  |  |  |  |
| 0-0.12      | -0.0024                | -0.0008 | -0.0002 | -0.0001 | 0 | 0       | +0.0002 | +0.0002 | +0.0006 | +0.0007 |                        |  |  |  |  |
| 0.12-0.24   | -0.0028                | -0.0012 | -0.0004 | -0.0002 | 0 | 0       | +0.0003 | +0.0005 | +0.0007 | +0.0009 |                        |  |  |  |  |
| 0.24-0.40   | -0.0031                | -0.0016 | -0.0005 | -0.0002 | 0 | 0       | +0.0004 | +0.0006 | +0.0009 | +0.0011 |                        |  |  |  |  |
| 0.40-0.72   | -0.0037                | -0.0020 | -0.0006 | -0.0002 | 0 | 0       | +0.0005 | +0.0007 | +0.0011 | +0.0013 |                        |  |  |  |  |
| 0.72-0.96   | -0.0043                | -0.0026 | -0.0008 | -0.0003 | 0 | +0.0001 | +0.0006 | +0.0009 | +0.0014 | +0.0016 |                        |  |  |  |  |
| 0.96-1.20   | -0.0043                | -0.0026 | -0.0008 | -0.0003 | 0 | +0.0001 | +0.0006 | +0.0009 | +0.0014 | +0.0019 |                        |  |  |  |  |
| 1.20-1.60   | -0.0047                | -0.0031 | -0.0010 | -0.0004 | 0 | +0.0001 | +0.0007 | +0.0010 | +0.0017 | +0.0024 |                        |  |  |  |  |
| 1.60-2.00   | -0.0051                | -0.0031 | -0.0010 | -0.0004 | 0 | +0.0001 | +0.0007 | +0.0010 | +0.0017 | +0.0028 |                        |  |  |  |  |
| 2.00-2.60   | -0.0055                | -0.0039 | -0.0012 | -0.0004 | 0 | +0.0001 | +0.0008 | +0.0013 | +0.0021 | +0.0034 |                        |  |  |  |  |
| 2.60-3.20   | -0.0059                | -0.0039 | -0.0012 | -0.0004 | 0 | +0.0001 | +0.0008 | +0.0013 | +0.0023 | +0.0040 |                        |  |  |  |  |
| 3.20-4.00   | -0.0067                | -0.0047 | -0.0014 | -0.0005 | 0 | +0.0001 | +0.0009 | +0.0015 | +0.0028 | +0.0049 |                        |  |  |  |  |
| 4.00-4.80   | -0.0071                | -0.0047 | -0.0014 | -0.0005 | 0 | +0.0001 | +0.0009 | +0.0015 | +0.0031 | +0.0057 |                        |  |  |  |  |
| 4.80-5.60   | -0.0079                | -0.0057 | -0.0017 | -0.0006 | 0 | +0.0001 | +0.0011 | +0.0017 | +0.0036 | +0.0067 |                        |  |  |  |  |
| 5.60-6.40   | -0.0083                | -0.0057 | -0.0017 | -0.0006 | 0 | +0.0001 | +0.0011 | +0.0017 | +0.0039 | +0.0075 |                        |  |  |  |  |
| 6.40-7.20   | -0.0091                | -0.0057 | -0.0017 | -0.0006 | 0 | +0.0001 | +0.0011 | +0.0017 | +0.0043 | +0.0083 |                        |  |  |  |  |
| 7.20-8.00   | -0.0094                | -0.0067 | -0.0020 | -0.0006 | 0 | +0.0002 | +0.0012 | +0.0020 | +0.0048 | +0.0093 |                        |  |  |  |  |
| 8.00-9.00   | -0.0102                | -0.0067 | -0.0020 | -0.0006 | 0 | +0.0002 | +0.0012 | +0.0020 | +0.0051 | +0.0102 |                        |  |  |  |  |
| 9.00-10.00  | -0.0110                | -0.0067 | -0.0020 | -0.0006 | 0 | +0.0002 | +0.0012 | +0.0020 | +0.0055 | +0.0112 |                        |  |  |  |  |
| 10.00-11.20 | -0.0118                | -0.0075 | -0.0022 | -0.0007 | 0 | +0.0002 | +0.0013 | +0.0022 | +0.0062 | +0.0124 |                        |  |  |  |  |
| 11.20-12.60 | -0.0130                | -0.0075 | -0.0022 | -0.0007 | 0 | +0.0002 | +0.0013 | +0.0022 | +0.0067 | +0.0130 |                        |  |  |  |  |
| 12.60-14.20 | -0.0142                | -0.0083 | -0.0024 | -0.0007 | 0 | +0.0002 | +0.0015 | +0.0024 | +0.0075 | +0.0154 |                        |  |  |  |  |
| 14.20-16.00 | -0.0157                | -0.0083 | -0.0024 | -0.0007 | 0 | +0.0002 | +0.0015 | +0.0024 | +0.0082 | +0.0171 |                        |  |  |  |  |