

# **RITZ** Quality Product with Reasonable Price



Designer's Manual for Precision High Tensile  
Hexagon Head Bolts, Screws, and Nuts  
Socket Head Bolts, Screws, and Nuts

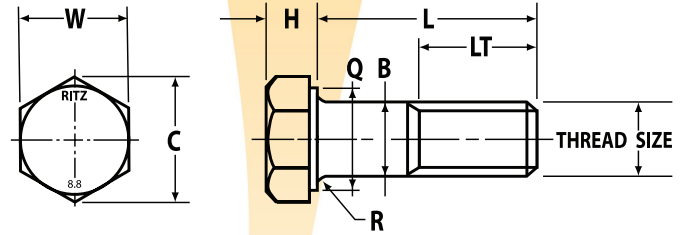
# Hexagon Head Bolts/Screws



## Metric Series - Dimensions

### Note:

1. The bolts and screws will generally conform to IS:1364, ISO 4014, ISO 4017 and DIN 931/933.
2. Threads will conform to class 6g of IS:4218, Coarse Series.
3. Material: RITZ High grade carbon/alloy steel
4. Heat Treatment: Property Class 10.9 or 8.8 of IS:1367-III.
5. Thread Length LT:  
LT1 for  $L \leq 125$   
LT2 for  $L > 125$  to 200  
LT3 for  $L > 200$
6. Screw Lengths equal to or shorter than those listed in row 'LFT' will be threaded to head.
7. Sizes in brackets are non-preferred standards
8. All dimensions are in millimeters.



| Thread Size | Pitch | W Max. |      | C Min. |       | B Max. | H Nom | R Min. | Q Min. | Length of Thread |     |     |     | LENGTH RANGE L |
|-------------|-------|--------|------|--------|-------|--------|-------|--------|--------|------------------|-----|-----|-----|----------------|
|             |       |        |      |        |       |        |       |        |        | LT1              | LT2 | LT3 | LFT |                |
| M4          | 0.7   | 7.0    |      | 7.66   |       | 4.0    | 2.8   | 0.2    | 5.9    | 14               | -   | -   | 20  | 10-40          |
| M5          | 0.8   | 8.0    |      | 8.79   |       | 5.0    | 3.5   | 0.2    | 6.9    | 16               | -   | -   | 20  | 10-50          |
| M6          | 1.0   | 10.0   |      | 11.05  |       | 6.0    | 4.0   | 0.25   | 8.9    | 18               | -   | -   | 25  | 10-50          |
| M8          | 1.25  | 13.0   |      | 14.38  |       | 8.0    | 5.3   | 0.4    | 11.6   | 22               | 28  | -   | 30  | 12-90          |
| M10         | 1.5   | 17.0   | 16.0 | 18.90  | 17.80 | 10.0   | 6.4   | 0.4    | 15.6   | 26               | 32  | 45  | 35  | 16-90          |
| M12         | 1.75  | 19.0   | 18.0 | 21.10  | 20.03 | 12.0   | 7.5   | 0.6    | 17.4   | 30               | 36  | 49  | 40  | 20-280         |
| (M14)       | 2.0   | 22.0   | 21.0 | 24.49  | 23.35 | 14.0   | 8.8   | 0.6    | 20.5   | 34               | 40  | 53  | 45  | 25-200         |
| M16         | 2.0   | 24.0   |      | 26.75  |       | 16.0   | 10.0  | 0.6    | 22.5   | 38               | 44  | 57  | 50  | 25-280         |
| (M18)       | 2.5   | 27.0   |      | 30.14  |       | 18.0   | 11.5  | 0.6    | 25.3   | 42               | 48  | 61  | 60  | 40-200         |
| M20         | 2.5   | 30.0   |      | 33.53  |       | 20.0   | 12.5  | 0.8    | 28.2   | 46               | 52  | 65  | 60  | 40-280         |
| (M22)       | 2.5   | 32.0   | 34.0 | 35.72  | 37.72 | 22.0   | 14.0  | 0.8    | 30.0   | 50               | 56  | 69  | 65  | 50-280         |
| M24         | 3.0   | 36.0   |      | 39.98  |       | 24.0   | 15.0  | 0.8    | 33.6   | 54               | 60  | 73  | 75  | 50-280         |
| (M27)       | 3.0   | 41.0   |      | 45.20  |       | 27.0   | 17.0  | 1.0    | 38.0   | 60               | 66  | 79  | 85  | 70-300         |
| M30         | 3.5   | 46.0   |      | 50.85  |       | 30.0   | 18.7  | 1.0    | 42.7   | 66               | 72  | 85  | 85  | 75-300         |
| (M330)      | 3.5   | 50.0   |      | 55.55  |       | 33.0   | 21.0  | 1.0    | 46.6   | 72               | 78  | 91  | 95  | 75-300         |
| M36         | 4.0   | 55.0   |      | 60.79  |       | 36.0   | 22.5  | 1.0    | 51.1   | 78               | 84  | 97  | 100 | 80-300         |
| (M39)       | 4.0   | 60.0   |      | 66.44  |       | 39.0   | 25.0  | 1.0    | 55.9   | 84               | 90  | 103 | 110 | 90-300         |
| M42         | 4.5   | 65.0   |      | 72.02  |       | 42.0   | 26.0  | 1.2    | 60.6   | 90               | 96  | 109 | 120 | 90-300         |

Dimensions in accordance with revised standards  
- in the process of being implemented

# Hexagon Head Bolts/Screws



## Metric Series - Physical Properties - Tightening Torques

### Physical Properties:

| PROPERTY CLASS                                       |          |     | 8.8               |                     |                   |                     | 10.9              |                     |
|------------------------------------------------------|----------|-----|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|
| Diameter                                             |          |     | ≤ M16             |                     | > M16             |                     | all diameters     |                     |
| Unit                                                 |          |     | N/mm <sup>2</sup> | Kgf/mm <sup>2</sup> | N/mm <sup>2</sup> | Kgf/mm <sup>2</sup> | N/mm <sup>2</sup> | Kgf/mm <sup>2</sup> |
| Tensile Strength, Min.                               |          |     | 800               | 81.5                | 830               | 84.6                | 1040              | 106.0               |
| Yield Strength, 0.2% offset Min.                     |          |     | 64                | 65.2                | 660               | 67.3                | 940               | 95.8                |
| Proof Load Stress                                    |          |     | 580               | 59.1                | 600               | 61.2                | 830               | 84.6                |
| Shear Strength, Min.                                 |          |     | 480               | 48.9                | 498               | 50.8                | 624               | 63.6                |
| Hardness                                             | Brinell  | HB  | 219-285           |                     | 242-319           |                     | 295-362           |                     |
|                                                      | Rockwell | HRC | 20-30             |                     | 23-34             |                     | 31-39             |                     |
| Elogation % on GL = 5.65A.<br>A=Cross Sectional Area |          |     | 12% Min.          |                     |                   |                     | 9% Min.           |                     |

### Recommended Tightening Torques and Induced Loads:

| Thread Sizes | Stress Area<br>mm <sup>2</sup> | Property Class 8.8 |        |              |       | Property Class 10.9 |        |              |       |
|--------------|--------------------------------|--------------------|--------|--------------|-------|---------------------|--------|--------------|-------|
|              |                                | Torque             |        | Induced Load |       | Torque              |        | Induced Load |       |
|              |                                | Nm                 | Kgm.   | N            | Kgs.  | Nm                  | Kgm.   | N            | Kgs.  |
| M4           | 8.78                           | 3.0                | 0.30   | 3877         | 395   | 4.3                 | 0.44   | 5695         | 580   |
| M5           | 14.2                           | 6.0                | 0.62   | 6361         | 648   | 8.9                 | 0.91   | 9344         | 952   |
| M6           | 20.1                           | 10.3               | 1.05   | 9005         | 918   | 15.1                | 1.54   | 13230        | 1348  |
| M8           | 36.6                           | 25.0               | 2.54   | 16400        | 1671  | 37.0                | 3.73   | 24080        | 2455  |
| M10          | 58.0                           | 50.0               | 5.11   | 26360        | 2686  | 74.0                | 7.50   | 38700        | 3946  |
| M12          | 84.3                           | 87.0               | 8.90   | 38300        | 3905  | 128.0               | 13.08  | 56300        | 5735  |
| (M14)        | 115.0                          | 139.0              | 14.17  | 52300        | 5327  | 205.0               | 20.82  | 76800        | 7824  |
| M16          | 157.0                          | 214.0              | 21.82  | 72300        | 7375  | 315.0               | 32.06  | 106300       | 10832 |
| (M18)        | 192.0                          | 304.0              | 30.97  | 91200        | 9300  | 435.0               | 44.10  | 129900       | 13246 |
| M20          | 245.0                          | 431.0              | 43.91  | 116400       | 11868 | 615.0               | 62.54  | 165800       | 16903 |
| (M22)        | 303.0                          | 586.0              | 59.74  | 144000       | 14677 | 835.0               | 85.08  | 205100       | 20904 |
| M24          | 353.0                          | 745.0              | 75.94  | 167700       | 17100 | 1060.0              | 108.00 | 238700       | 24333 |
| (M27)        | 459.0                          | 1090.0             | 111.00 | 218100       | 22234 | 1550.0              | 158.00 | 310400       | 31640 |
| M30          | 561.0                          | 1480.0             | 150.00 | 266600       | 27175 | 2105.0              | 214.60 | 379400       | 38671 |
| (M33)        | 694.0                          | 2013.0             | 205.20 | 329800       | 33618 | 2865.0              | 292.00 | 469300       | 47839 |
| M36          | 817.0                          | 2586.0             | 263.60 | 388200       | 39576 | 3680.0              | 375.00 | 552500       | 56318 |
| (M39)        | 976.0                          | 3346.0             | 341.10 | 463800       | 47278 | 4760.0              | 485.40 | 660000       | 67278 |
| M42          | 1120.0                         | 4135.0             | 421.50 | 532200       | 54253 | 5880.0              | 599.80 | 757400       | 77205 |

#### Note:

The tightening torques calculated to induce approximate stresses as under in screw threads:  
 448 N/mm<sup>2</sup> for  
 Property Class 8.8 dia ≤ M16  
 462 N/mm<sup>2</sup> for  
 Property Class 8.8 dia > M16  
 658 N/mm<sup>2</sup> for Property Class 10.9

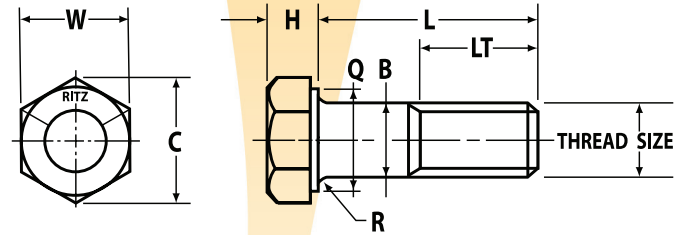
# Hexagon Head Bolts/Screws



## Inch Series, UNC/UNF - Dimensions

### Note:

1. The bolts and screws will generally conform to BS: 1768. (Bolts/Screws made to BS:1768 will also generally conform to American Standard ANSI B.18.2.1)
2. Threads will conform to Class 2A of BS:1580 for Unified threads (Coarse/Fine).
3. Material: RITZ High grade carbon/alloy steel
4. Heat Treatment: As per Grade 'S' or 'V' (Bolts/Screws made to Grades 'S' and 'V' as per BS:1768 will also generally conform to requirements of SAE Grade '5' and '8' respectively)
5. Thread Length LT:  
LT1 for  $L \leq 6$   
LT2 for  $L > 6$
6. Screw lengths equal to or shorter than those listed in row 'LFT' will be threaded to head.
7. All dimensions are in inches.



| Thread Size | T.P.I |     | W Max. | C Max. | B Max. | H Nom. | R Min. | Q Min. | Length of Thread |       |       | Length Range L |
|-------------|-------|-----|--------|--------|--------|--------|--------|--------|------------------|-------|-------|----------------|
|             | UNC   | UNF |        |        |        |        |        |        | LT1              | LT2   | LFT   |                |
| 1/4"        | 20    | 28  | 0.438  | 0.505  | 0.250  | 0.158  | 0.015  | 0.411  | 3/4              | -     | 1     | 1/2-2-1/4      |
| 5/16"       | 18    | 24  | 0.500  | 0.577  | 0.313  | 0.206  | 0.015  | 0.473  | 7/8              | -     | 1-1/8 | 1/2-4          |
| 3/8"        | 16    | 24  | 0.563  | 0.650  | 0.375  | 0.238  | 0.015  | 0.535  | 1                | -     | 1-1/4 | 1/2-4          |
| 7/16"       | 14    | 20  | 0.625  | 0.722  | 0.438  | 0.286  | 0.015  | 0.595  | 1-1/8            | -     | 1-3/8 | 3/4-3-1/2      |
| 1/2"        | 13    | 20  | 0.750  | 0.866  | 0.500  | 0.318  | 0.015  | 0.720  | 1-1/4            | 1-1/2 | 1-1/2 | 3/4-3-1/2      |
| 5/8"        | 11    | 18  | 0.938  | 1.083  | 0.625  | 0.398  | 0.020  | 0.908  | 1-1/2            | 1-3/4 | 1-7/8 | 1-8            |
| 3/4"        | 10    | 16  | 1.125  | 1.300  | 0.750  | 0.473  | 0.020  | 1.090  | 1-3/4            | 2     | 2-1/8 | 1-1/2-8        |
| 7/8"        | 9     | 14  | 1.313  | 1.515  | 0.875  | 0.553  | 0.040  | 1.275  | 2                | 2-1/4 | 2-3/8 | 1-1/2-8        |
| 1"          | 8     | 12  | 1.500  | 1.732  | 1.000  | 0.617  | 0.060  | 1.463  | 2-1/4            | 2-1/2 | 2-5/8 | 1-1/2-8        |

# Hexagon Head Bolts/Screws



## Inch Series, UNC/UNF - Physical Properties - Tightening Torques

| Grade                         | Grade S                  | Grade V                   |
|-------------------------------|--------------------------|---------------------------|
| Tensile Strength (Min.)       | 50 tonf/in <sup>2</sup>  | 65 tonf/in <sup>2</sup>   |
|                               | 78.9 Kgf/mm <sup>2</sup> | 102.6 Kgf/mm <sup>2</sup> |
| Proof Load Stress             | 38 tonf/in <sup>2</sup>  | 49.5 tonf/in <sup>2</sup> |
|                               | 59.9 Kgf/mm <sup>2</sup> | 78.0 Kgf/mm <sup>2</sup>  |
| Elongation % on GL = 4A       | 18%                      | 14%                       |
| Brinell Hardness (HB 10/3000) | 223-310                  | 293-370                   |

Recommended  
Tightening Torques  
and Induced Loads  
UNC Threads:

| Thread Size | Stress Area     | Grade S |              | Grade V |              |
|-------------|-----------------|---------|--------------|---------|--------------|
|             |                 | Torque  | Induced Load | Torque  | Induced Load |
| UNF         | In <sup>2</sup> | lb.in.  | lbf          | lb.in.  | lbf          |
| 1/4"        | 0.037           | 104.1   | 2192         | 150.8   | 3174         |
| 5/16"       | 0.059           | 207.7   | 3498         | 300.6   | 5062         |
| 3/8"        | 0.089           | 381.5   | 5354         | 552.1   | 7749         |
| 7/16"       | 0.120           | 601.8   | 7240         | 871.0   | 10478        |
| 1/2"        | 0.161           | 925.5   | 9742         | 1358.3  | 14298        |
| 5/8"        | 0.258           | 1828.3  | 15812        | 2646.0  | 22884        |
| 3/4"        | 0.375           | 3189.0  | 22982        | 4615.0  | 33262        |
| 7/8"        | 0.513           | 5089.0  | 31440        | 7366.0  | 45503        |
| 1"          | 0.6120          | 6939.0  | 37507        | 10043.0 | 54287        |

Recommended  
Tightening Torques  
and Induced Loads  
UNF Threads:

| Thread Size | Stress Area     | Grade S |              | Grade V |              |
|-------------|-----------------|---------|--------------|---------|--------------|
|             |                 | Torque  | Induced Load | Torque  | Induced Load |
| UNF         | In <sup>2</sup> | lb.in.  | lbf          | lb.in.  | lbf          |
| 1/4"        | 0.037           | 104.1   | 2192         | 150.8   | 3174         |
| 5/16"       | 0.059           | 207.7   | 3498         | 300.6   | 5062         |
| 3/8"        | 0.089           | 381.5   | 5354         | 552.1   | 7749         |
| 7/16"       | 0.120           | 601.8   | 7240         | 871.0   | 10478        |
| 1/2"        | 0.161           | 925.5   | 9742         | 1358.3  | 14298        |
| 5/8"        | 0.258           | 1828.3  | 15812        | 2646.0  | 22884        |
| 3/4"        | 0.375           | 3189.0  | 22982        | 4615.0  | 33262        |
| 7/8"        | 0.513           | 5089.0  | 31440        | 7366.0  | 45503        |
| 1"          | 0.667           | 7562.0  | 40878        | 10945.0 | 59163        |

**Note:**  
The Tightening torques calculated  
to induce stress equal to approxi-  
mately 70% of Yield Stress

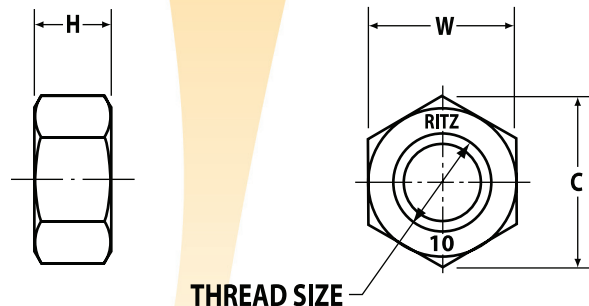
# Hexagon Nuts



## Metric Series - Dimensions - Physical Properties

### Note:

1. The nuts will generally conform to IS: 1364, ISO 4032, DIN 934.
2. Threads will conform to Class 6H of IS:4218 for Coarse Series.
3. Material & Heat Treatment:  
To achieve mechanical properties of Property Class 8 or 10 of IS:1367-VI.
4. Nuts of Property Class 8 are used with bolts of Property Class 8.8.  
Nuts of Property Class 10 are used with bolts of Property Class 10.9  
(In general, nut of a higher property class can replace nuts of a lower property class in a joint).
5. In Bolt/Nut assembly, tightening should be done by rotation of nut.  
Torque values as recommended in tables for bolts (p:5).
6. Sizes in brackets are non-preferred standards.
7. All dimensions are in millimeters.



### Dimensions:

| Thread size | Pitch | W Max. |      | C Min. |       | H Max. |       |
|-------------|-------|--------|------|--------|-------|--------|-------|
| M4          | 0.7   | 7.0    |      | 7.66   |       | 3.20   |       |
| M5          | 0.8   | 8.0    |      | 8.79   |       | 4.00   | 4.70  |
| M6          | 1.0   | 10.0   |      | 11.05  |       | 5.00   | 5.20  |
| M8          | 1.25  | 13.0   |      | 14.38  |       | 6.50   | 6.80  |
| M10         | 1.5   | 17.0   | 16.0 | 18.90  | 17.80 | 8.00   | 8.40  |
| M12         | 1.75  | 19.0   | 18.0 | 21.10  | 20.03 | 10.00  | 10.80 |
| (M14)       | 2.0   | 22.0   | 21.0 | 24.49  | 23.35 | 11.00  | 12.80 |
| M16         | 2.0   | 24.0   |      | 26.75  |       | 13.00  | 14.80 |
| (M18)       | 2.5   | 27.0   |      | 30.14  |       | 15.00  | 15.80 |
| M20         | 2.5   | 30.0   |      | 33.53  |       | 16.00  | 18.00 |
| (M22)       | 2.5   | 32.0   | 34.0 | 35.72  | 37.72 | 18.00  | 19.40 |
| M24         | 3.0   | 36.0   |      | 39.98  |       | 19.00  | 21.50 |
| (M27)       | 3.0   | 41.0   |      | 45.20  |       | 22.00  | 23.80 |
| M30         | 3.5   | 46.0   |      | 50.85  |       | 24.00  | 25.60 |
| (M33)       | 3.5   | 50.0   |      | 55.55  |       | 26.00  | 28.70 |
| M36         | 4.0   | 55.0   |      | 60.79  |       | 29.00  | 31.00 |
| (M39)       | 4.0   | 60.0   |      | 66.44  |       | 31.00  | 33.40 |
| M42         | 4.5   | 65.0   |      | 72.02  |       | 34.00  |       |



Dimensions in accordance with revised standards - in the process of being implemented

### Physical Properties:

| Nut Size |     | Property Class8   |             |      |             |        | Property Class 10 |             |      |              |      |
|----------|-----|-------------------|-------------|------|-------------|--------|-------------------|-------------|------|--------------|------|
|          |     | Proof Load Stress | Hardness HV |      | Hardness HR |        | Proof Load Stress | Hardness HV |      | Hardness HRC |      |
| Over     | To  | N/mm²             | Min.        | Max. | Min.        | Max.   | N/mm²             | Min.        | Max. | Min.         | Max. |
|          | M4  | 800               | 170         | 302  | HRB 87      | HRC 30 | 1040              | 272         | 353  | 26           | 36   |
| M4       | M7  | 810               | 188         |      | HRB 90      |        | 1040              |             |      |              |      |
| M7       | M10 | 830               |             |      |             |        | 1040              |             |      |              |      |
| M10      | M16 | 840               |             |      |             |        | 1050              |             |      |              |      |
| M16      | M42 | 920               | 233         | 353  | HRC 19      | HRC 36 | 1060              |             |      |              |      |

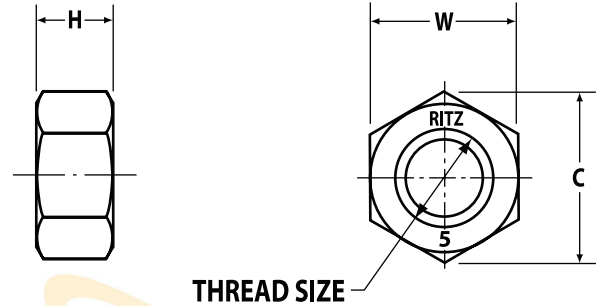
# Hexagon Nuts



## Inch Series, UNC/UNF - Dimensions - Physical Properties

### Note:

1. The nuts will generally conform to BS:1768. (Nuts made as per BS:1768 will also generally conform to American Standard ANSI B:18.2.2)
2. Threads will conform to Class 2B of BS:1580 for Unifined threads, (Coarse/Fine).
3. Material and Heat Treatment:  
To achieve mechanical properties of Grade '1' or '5' of BS:1768. (Nuts made to Grade '1' and '5' as per BS:1768 will also generally conform to requirements of SAE Grade '5' and '8'; respectively).
4. In Bolt/Nut assembly, tightening should be done by rotation of nut. Torque values as recommended in tables for bolts (p.7)
5. All dimensions are in inches.



### Dimensions:

| Thread Size | T.P.I |     | W Max. | C Max. | H Nom. |
|-------------|-------|-----|--------|--------|--------|
|             | UNC   | UNF |        |        |        |
| 1/4"        | 20    | 28  | 0.438  | 0.505  | 0.219  |
| 5/16"       | 18    | 24  | 0.500  | 0.577  | 0.266  |
| 3/8"        | 16    | 24  | 0.563  | 0.650  | 0.328  |
| 7/16"       | 14    | 20  | 0.625  | 0.722  | 0.375  |
| 1/2"        | 13    | 20  | 0.750  | 0.866  | 0.437  |
| 5/8"        | 11    | 18  | 0.938  | 1.083  | 0.547  |
| 3/4"        | 10    | 16  | 1.125  | 1.300  | 0.647  |
| 7/8"        | 9     | 14  | 1.313  | 1.515  | 0.750  |
| 1"          | 8     | 12  | 1.500  | 1.732  | 0.859  |

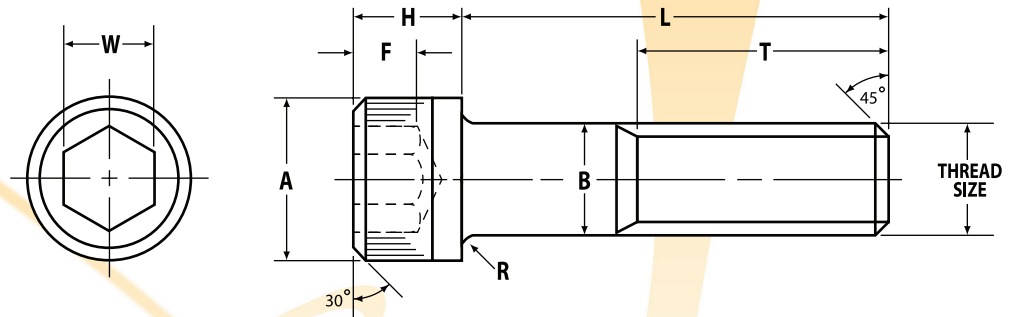
### Physical Properties:

| Grade | For use with Bolts of Grade | Proof Load Stress | Brinell Hard-ness HB | Rockwell Hard-ness |
|-------|-----------------------------|-------------------|----------------------|--------------------|
| 1     | 5                           | 50 tonf/in2       | 180-240              | RB 89 - RC 23      |
|       |                             | 78.9 kgf/mm2      |                      |                    |
| 5     | 8                           | 65 tonf/in2       | 270-335              | RC 28 - 36         |
|       |                             | 102.6 kgf/mm2     |                      |                    |

# Socket Head Cap Screws



ISO Metric Series



Dimensions:

| Thread Size | Pitch | A    | B    | H    | W    | F    | T     | R    | Shank Area (mm <sup>2</sup> ) | Stress Area (mm <sup>2</sup> ) |
|-------------|-------|------|------|------|------|------|-------|------|-------------------------------|--------------------------------|
|             |       | max. | max. | max. | nom. | min. | Basic | max. |                               |                                |
| M1.6        | 0.35  | 3.0  | 1.6  | 1.6  | 1.5  | 0.8  | 15    | 0.2  | 2.01                          | 1.27                           |
| M2          | 0.40  | 3.8  | 2.0  | 2.0  | 1.5  | 1.0  | 16    | 0.3  | 3.14                          | 2.07                           |
| M2.5        | 0.45  | 4.5  | 2.5  | 2.5  | 2.0  | 1.25 | 17    | 0.3  | 4.91                          | 3.39                           |
| M3          | 0.50  | 5.5  | 3.0  | 3.0  | 2.5  | 1.5  | 18    | 0.3  | 7.07                          | 5.03                           |
| M4          | 0.70  | 7.0  | 4.0  | 4.0  | 3.0  | 2.0  | 20    | 0.35 | 12.6                          | 8.78                           |
| M5          | 0.80  | 8.5  | 5.0  | 5.0  | 4.0  | 2.5  | 22    | 0.35 | 19.6                          | 14.2                           |
| M6          | 1.00  | 10.0 | 6.0  | 6.0  | 5.0  | 3.0  | 24    | 0.4  | 28.3                          | 20.1                           |
| M8          | 1.25  | 13.0 | 8.0  | 8.0  | 6.0  | 4.0  | 28    | 0.6  | 50.3                          | 36.6                           |
| M10         | 1.50  | 16.0 | 10.0 | 10.0 | 8.0  | 5.0  | 32    | 0.6  | 78.5                          | 58.0                           |
| M12         | 1.75  | 18.0 | 12.0 | 12.0 | 10.0 | 6.0  | 36    | 1.0  | 113.0                         | 84.3                           |
| M14         | 2.00  | 21.0 | 14.0 | 14.0 | 12.0 | 7.0  | 40    | 1.0  | 154.0                         | 115.0                          |
| M16         | 2.00  | 24.0 | 16.0 | 16.0 | 14.0 | 8.0  | 44    | 1.0  | 201.0                         | 157.0                          |
| M20         | 2.50  | 30.0 | 20.0 | 20.0 | 17.0 | 10.0 | 52    | 1.2  | 314.0                         | 245.0                          |
| M24         | 3.00  | 36.0 | 24.0 | 24.0 | 19.0 | 12.0 | 60    | 1.2  | 452.0                         | 353.0                          |
| M30         | 3.50  | 45.0 | 30.0 | 30.0 | 22.0 | 15.0 | 72    | 1.5  | 707.0                         | 561.0                          |
| M36         | 4.00  | 54.0 | 36.0 | 36.0 | 27.0 | 18.0 | 84    | 1.5  | 1018.0                        | 817.0                          |
| M42         | 4.50  | 63.0 | 42.0 | 42.0 | 32.0 | 21.0 | 96    | 1.6  | 1385.0                        | 1120.0                         |

All dimensions in millimeters

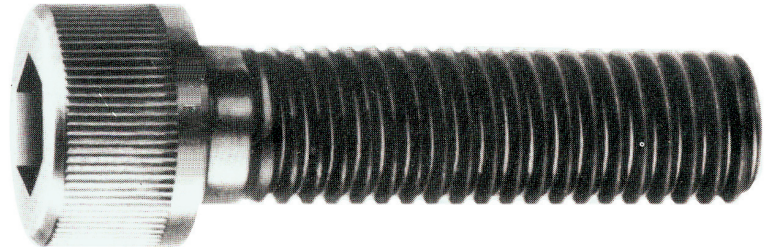
# Socket Head Cap Screws



## ISO Metc Series

### Note:

1. Material - High Grade Alloy Steel
2. Hardness - Rc 38-45 (alloy steel)
3. Tensile Stress - (alloy steel)  
1300 MPa up to M10      1250 MPa over M10
4. Shear Stress - (alloy steel)  
780 MPa up to M10      750 MPa over M10
5. 0.2% Yield Stress - (alloy steel)  
1170 MPa up to M10      1125 MPa over M10



| APPLICATION DATA |                       |         |                     |      |                            |                            |          |                      |            |              |
|------------------|-----------------------|---------|---------------------|------|----------------------------|----------------------------|----------|----------------------|------------|--------------|
| Thread Size      | Tensile Strength min. |         | Yield Strength min. |      | Body Double Shear Strength | Recommended Seating Torque |          | Hole Dimensions (mm) |            |              |
|                  | MPa                   | KN      | Mpa                 | KN   | KN                         | N-m                        | Inch-lbf | Tap drill            | body drill | c/bore drill |
| *M1.6            | 1300                  | 1.65    | 1170                | 1.49 | 3.14                       | 0.29                       | 2.5      | 1.25                 | 1.9        | 3.3          |
| *M2              | 1300                  | 2.69    | 1170                | 2.42 | 4.90                       | 0.60                       | 5.3      | 1.6                  | 2.4        | 4.4          |
| *M2.5            | 1300                  | 4.41    | 1170                | 3.97 | 7.66                       | 1.21                       | 11       | 2.05                 | 2.9        | 5.4          |
| M3               | 1300                  | 6.54    | 1170                | 5.89 | 11.00                      | 2.10                       | 19       | 2.5                  | 3.4        | 6.5          |
| M4               | 1300                  | 11.40   | 1170                | 10.3 | 19.70                      | 4.60                       | 41       | 3.3                  | 4.5        | 8.25         |
| M5               | 1300                  | 18.50   | 1170                | 16.6 | 30.60                      | 9.50                       | 85       | 4.20                 | 5.6        | 9.75         |
| M6               | 1300                  | 26.10   | 1170                | 23.5 | 44.10                      | 16.00                      | 140      | 5.0                  | 6.8        | 11.25        |
| M8               | 1300                  | 47.60   | 1170                | 42.8 | 78.40                      | 39.00                      | 350      | 6.75                 | 8.8        | 14.25        |
| M10              | 1300                  | 75.40   | 1170                | 67.9 | 122.00                     | 77.00                      | 680      | 8.5                  | 10.8       | 17.25        |
| M12              | 1250                  | 105.00  | 1125                | 95   | 170.00                     | 135.00                     | 1200     | 10.25                | 12.8       | 19.25        |
| M14              | 1250                  | 144.00  | 1125                | 129  | 231.00                     | 215.00                     | 1900     | 12.0                 | 15         | 22.25        |
| M16              | 1250                  | 196.00  | 1125                | 177  | 300.00                     | 330.00                     | 2900     | 14.0                 | 17         | 25.5         |
| M20              | 1250                  | 306.00  | 1125                | 276  | 470.00                     | 650.00                     | 5750     | 17.5                 | 21         | 31.5         |
| M24              | 1250                  | 441.00  | 1125                | 397  | 680.00                     | 1109.00                    | 9700     | 21.0                 | 25         | 37.5         |
| M30              | 1250                  | 701.00  | 1125                | 631  | 1060.00                    | 2250.00                    | 19900    | 28.5                 | 31.5       | 47.5         |
| M36              | 1250                  | 1021.00 | 1125                | 919  | 1530.00                    | 3850.00                    | 34100    | 32.0                 | 37.5       | 56.5         |
| M42              | 1250                  | 1400.00 | 1125                | 1260 | 2080.00                    | 6270.00                    | 55580    | 37.5                 | 44         | 66.0         |

\*Micro-Sizes

### Note:

1KN = approx. 102 kgf (or 225 lbf) 1MPa = 1 N/mm<sup>2</sup> or approx. 145 psi  
 Tap drill sizes based on approx. 70% thread height.  
 Seating torques based on 800 Mpa induced stress in screw threads.

# Comparison of Different Strength Grades



| SAE     | B.S. | I.S.          | ULTIMATE TENSILE STRENGTH                        |                                                           |                                                          | HARDNESS           |           |                |
|---------|------|---------------|--------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------|--------------------|-----------|----------------|
|         |      | I.S.O.<br>DIN | Tonnes/in <sup>2</sup><br>(Kgf/mm <sup>2</sup> ) | Newtons/mm <sup>2</sup><br>Min.<br>(Kgf/mm <sup>2</sup> ) | Pounds/in <sup>2</sup><br>Min.<br>(Kgf/mm <sup>2</sup> ) | BHN                | HRb       | HRc            |
|         |      | 4.6           |                                                  | 400 (40.8)                                                |                                                          | 114<br>209         | 67<br>95  |                |
| GRADE 1 |      |               |                                                  |                                                           | 60,000<br>(42.3)                                         | (121)<br>(241)     | 70<br>100 |                |
|         |      | 4.8           |                                                  | 420<br>(42.8)                                             |                                                          | 124<br>209         | 71<br>95  |                |
|         |      | 5.6           |                                                  | 500<br>(51.0)                                             |                                                          | 147<br>209         | 79<br>95  |                |
| GRADE 2 |      |               |                                                  |                                                           | 74,000<br>(52.1)                                         | (154)<br>(241)     | 80<br>100 |                |
|         |      | 5.8           |                                                  | 520<br>(53.0)                                             |                                                          | 152<br>209         | 82<br>95  |                |
|         | P    |               | 35/45<br>(55.2/71.0)                             |                                                           |                                                          | 152<br>207         |           |                |
|         |      | 6.8           |                                                  | 600<br>(61.2)                                             |                                                          | 181<br>238         | 89<br>99  |                |
|         | R    |               | 45/55<br>(71.0/86.8)                             |                                                           |                                                          | 201<br>285         |           |                |
|         | S    |               | 50/60<br>(78.9/94.7)                             |                                                           |                                                          | 223<br>310         |           | (20/33)        |
|         |      | 8.8           |                                                  | 800≤M16<br>830>M16<br>(81.6)<br>(84.6)                    |                                                          | 219/285<br>242/319 |           | 20/30<br>23/34 |
| GRADE 5 |      |               |                                                  |                                                           | 120,000<br>(84.6)                                        | (266)<br>(318)     |           | 25/34          |
|         | T    |               | 55/65<br>(86.8/102.6)                            |                                                           |                                                          | 248<br>335         |           | (24/36)        |
|         | U    |               | 60/70<br>(94.7/110.5)                            |                                                           |                                                          | 269<br>331         |           | (28/36)        |
|         | V    |               | 65/75<br>(102.6/118.4)                           |                                                           |                                                          | 293<br>370         |           | (31/40)        |
| GRADE 8 |      |               |                                                  |                                                           | 150,000<br>(105.7)                                       | (311)<br>(362)     |           | 33/39          |
|         |      | 10.9          |                                                  | 1,040<br>(106.0)                                          |                                                          | 295<br>362         |           | 31/39          |
|         | W    |               | 70/80<br>(110.5/126.3)                           |                                                           |                                                          | 311<br>375         |           | (33/41)        |
|         | X    |               | 75/85<br>(118.4/134.2)                           |                                                           |                                                          | 341<br>410         |           | (37/44)        |
|         |      | 12.9          |                                                  | 1,220<br>(124.4)                                          |                                                          | 353<br>412         |           | 38/44          |
|         | Y    |               | 80/90<br>(126.3/142.0)                           |                                                           |                                                          | 363<br>429         |           | (39/46)        |
|         | Z    |               | 100 Min.<br>(157.8)                              |                                                           |                                                          | 444                |           | (47)           |

## Note:

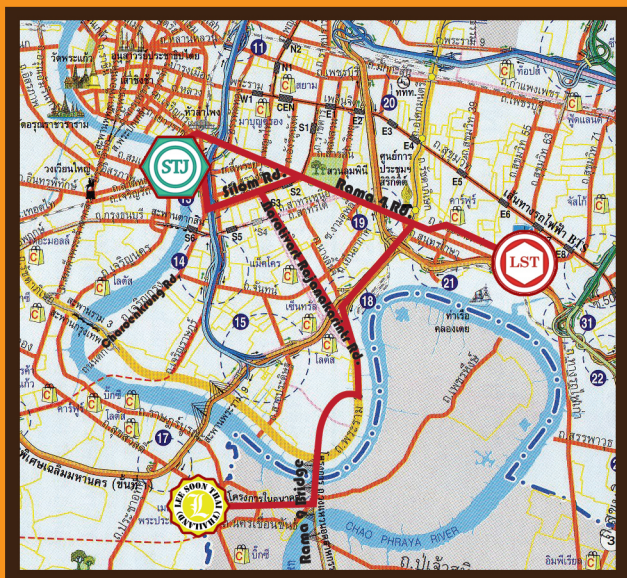
- 1Kgf = 9.81 Newtons 1Kgf/mm<sup>2</sup> = 1421.7 Psi
- Values in brackets are approximate conversions

# Thread Size Comparison



| METRIC PRODUCTS |                       |        |          |        |            |       | UNIFIED INCH PRODUCTS |        |     |            | B.S. INCH PRODUCTS |        |     |            |        |            |
|-----------------|-----------------------|--------|----------|--------|------------|-------|-----------------------|--------|-----|------------|--------------------|--------|-----|------------|--------|------------|
| SIZE            | THREAD PITCH & T.P.I. |        |          |        | Major Dia. |       | SIZE                  | T.P.I. |     | Major Dia. | SIZE               | T.P.I. |     | Major Dia. | T.P.I. | Major Dia. |
|                 | COARSE                |        | FINE     |        |            |       |                       | UNC    | UNF |            |                    | BSW    | BSF |            |        |            |
|                 | PTICH mm              | T.P.I. | PTICH mm | T.P.I. | mm         | inch  |                       |        |     | inch       |                    |        |     | inch       | inch   | inch       |
| M3              | 0.5                   | 51.0   | -        | -      | 3.00       | 0.118 | #5                    | 40     | 44  | 0.125      | 1/8                | 40     | -   | 0.125      |        |            |
|                 |                       |        |          |        |            |       |                       |        |     |            | 5BA                |        |     |            | 43.1   | 0.126      |
|                 |                       |        |          |        |            |       | #6                    | 32     | 40  | 0.138      | 4BA                |        |     |            | 38.5   | 0.142      |
| M4              | 0.7                   | 36.0   | -        | -      | 4.00       | 0.157 | #8                    | 32     | 36  | 0.164      | 3BA                |        |     |            | 34.8   | 0.161      |
| M5              | 0.8                   | 32.0   | -        | -      | 5.00       | 0.197 | #10                   | 24     | 32  | 0.190      | 3/16               | 24     | 32  | 0.187      |        |            |
|                 |                       |        |          |        |            |       |                       |        |     |            | 2BA                |        |     |            | 31.3   | 0.185      |
|                 |                       |        |          |        |            |       |                       |        |     |            | 1BA                |        |     |            | 28.2   | 0.209      |
| M6              | 1.0                   | 25.0   | -        | -      | 6.00       | 0.236 | 1/4                   | 20     | 28  | 0.250      | 1/4                | 20     | 26  | 0.250      |        |            |
|                 |                       |        |          |        |            |       |                       |        |     |            | 0BA                |        |     |            | 25.4   | 0.236      |
| M8              | 1.25                  | 20.0   | 1.00     | 25     | 8.00       | 0.315 | 5/16                  | 18     | 24  | 0.313      | 5/16               | 18     | 22  | 0.313      |        |            |
| M10             | 1.5                   | 17.0   | 1.25     | 20     | 10.00      | 0.394 | 3/8                   | 16     | 24  | 0.375      | 3/8                | 16     | 20  | 0.375      |        |            |
|                 |                       |        |          |        |            |       |                       |        |     |            | 7/16               | 14     | 18  | 0.438      |        |            |
| M12             | 1.75                  | 14.5   | 1.25     | 20     | 12.00      | 0.472 | 1/2                   | 13     | 20  | 0.500      | 1/2                | 12     | 16  | 0.500      |        |            |
| (M14)           | 2.0                   | 12.5   | 1.50     | 17     | 14.00      | 0.551 |                       |        |     |            |                    |        |     |            |        |            |
| M16             | 2.0                   | 12.5   | 1.50     | 17     | 16.00      | 0.630 | 5/8                   | 11     | 18  | 0.625      | 5/8                | 11     | 14  | 0.625      |        |            |
| (M18)           | 2.5                   | 10.0   | 1.50     | 17     | 18.00      | 0.709 |                       |        |     |            |                    |        |     |            |        |            |
| M20             | 2.5                   | 10.0   | 1.50     | 17     | 20.00      | 0.787 | 3/4                   | 10     | 16  | 0.750      | 3/4                | 10     | 12  | 0.750      |        |            |
| (M22)           | 2.5                   | 10.0   | 1.50     | 17     | 22.00      | 0.866 | 7/8                   | 9      | 14  | 0.875      | 7/8                | 9      | 11  | 0.875      |        |            |
| M24             | 3.0                   | 8.5    | 2.00     | 13     | 24.00      | 0.945 | 1                     | 8      | 12  | 1.000      | 1                  | 8      | 10  | 1.000      |        |            |
|                 |                       |        |          |        |            |       | 1-1/8                 | 7      | 12  | 1.125      | 1-1/8              | 7      | 9   | 1.125      |        |            |
| (M27)           | 3.0                   | 8.5    | 2.00     | 13     | 27.00      | 1.063 |                       |        |     |            |                    |        |     |            |        |            |
| M30             | 3.5                   | 7.25   | 2.00     | 13     | 30.00      | 1.181 | 1-1/4                 | 7      | 12  | 1.250      | 1-1/4              | 7      | 9   | 1.250      |        |            |
| (M33)           | 3.5                   | 7.25   | 2.00     | 13     | 33.00      | 1.299 |                       |        |     |            |                    |        |     |            |        |            |
| M36             | 4.0                   | 6.4    | 3.00     | 8.5    | 36.00      | 1.417 | 1-1/2                 | 6      | 12  | 1.500      | 1-1/2              | 6      | 8   | 1.500      |        |            |
| (M39)           | 4.0                   | 6.4    | 3.00     | 8.5    | 39.00      | 1.535 |                       |        |     |            |                    |        |     |            |        |            |
| M42             | 4.5                   | 5.6    | 3.00     | 8.5    | 42.00      | 1.653 |                       |        |     |            |                    |        |     |            |        |            |

**Note:** Sizes in bracket are non-preferred standards.



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