

**DIMENSIONAL REQUIREMENTS OF HEXAGON BOLTS, FLANGED HEXAGON BOLTS AND HEXAGON BOLT&WASHER ASSEMBLIES****1. SCOPE**

This standard gives dimensional requirements for hexagon bolts, flanged hexagon bolts and bolt & washer assemblies with ISO metric thread diameters M4 to M24 inclusive for hexagon bolts and M5 to M16 inclusive for flanged hexagon bolts.

**2. REFERENCES**

|            |                                                                                                                                                                                                    |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 261    | General purpose metric screw threads - General plan.                                                                                                                                               |
| ISO 965    | General purpose metric screw threads - Tolerances.                                                                                                                                                 |
| ISO 1502   | General purpose metric screw threads - Gauging.                                                                                                                                                    |
| ISO 4014   | Product grade A for the head of hexagon headed products.                                                                                                                                           |
| ISO 4017   | Product grade A for the fully threaded shank portion of hexagon and hexagon flange headed bolts.                                                                                                   |
| ISO 4753   | Fasteners - Ends of parts with external Metric ISO thread.                                                                                                                                         |
| ISO 6157-3 | Fasteners – Surface discontinuities.                                                                                                                                                               |
| ISO 15071  | Hexagon bolts with flange – Small series – Product grade A.                                                                                                                                        |
| WA 950     | Material Requirements & Mechanical Properties of Bolts, Studs, and Bolt & Washer Assemblies.                                                                                                       |
| WA 990     | Surface Discontinuities of Bolts and Screws.                                                                                                                                                       |
| WF 900     | Dimensional, Material, Heat Treatment, Hardness and Performance Requirements for Flat, Toothed, Conical, Bowed and Wavy Washers for general use and for use in Screw or Nut and Washer Assemblies. |

**3. GENERAL REQUIREMENTS****3.1 DIMENSIONS AND TOLERANCES**

The basic dimensions are shown in the individual product standards or 'Utility Part' drawings. Unspecified dimensions and tolerances shall be in accordance with:

ISO 15071 for hexagon flange headed bolts.  
ISO 15071 for the shank portion of hexagon headed bolts.  
ISO 4017 Product grade A for the fully threaded shank portion of hexagon and hexagon flange headed bolts.  
ISO 4014 Product grade A for the head of hexagon headed products.

**3.2 GAUGING REQUIREMENTS**

The gauging requirements shall be in accordance with the following standards:

ISO 15071 for hexagon flange headed bolts.  
ISO 15071 for the shank portion of hexagon headed bolts.  
ISO 4017 Product grade A for the fully threaded shank portion of hexagon and hexagon flange headed bolts.  
ISO 4014 Product grade A for the head of hexagon headed products.

**3.3 PROTECTIVE FINISH**

All dimensions and tolerances defined in this specification apply prior to the application of the protective finish except where otherwise specified.

Note: For dimensions and tolerances of plated bolt threads see Clause 8.

**4. LENGTH****4.1 BOLT & WASHER ASSEMBLIES**

Bolt & washer assemblies must be threaded to permit a ring gauge to be screwed to within a distance from the bearing face of the head not exceeding the free height of the assembled washer plus 2.5 x the thread pitch for lengths up to and including 2.5 x nominal size of the bolt thread, and 3 x the thread pitch for lengths greater than 2.5 x nominal size of the bolt thread.

**5. DIAMETER OF SHANK (unthreaded portion).****5.1 BOLTS**

Reduced shank is the only shank design permitted unless otherwise specified on a Utility drawing (no full shank constructions, see Foreword February 2003).

**5.2 BOLT & WASHER ASSEMBLIES**

The diameter of the unthreaded portion of bolt & washer assemblies must be less than the major diameter of the bolt thread by an amount sufficient to permit free rotation of the washer, while disassembly from the bolt is prevented. The fillet type use for bolt and washer assemblies shall be at the discretion of the manufacturer provided all other requirements of the standard are met.

**6. WASHERS**

The dimensions and tolerances of the washer component of bolt & washer assemblies must conform to the data specified in the related Ford Standard or Utility Part drawing and WF 900.

**7. UPPER SURFACE AND BEARING SURFACE OF HEADS**

The upper surfaces of heads may be flat or indented at the option of the manufacturer and shall be either chamfered or rounded. The diameter of the top circle must not be greater than the maximum width across flats and not less than 85% of the minimum width across flats.

Supplier identification and property class marking embossed or indented on the upper surface must comply with WA 950, unless otherwise specified on a Utility drawing.

**8. BOLT THREAD CONFORMANCE**

**8.1** Bolt threads must conform to the dimensions and tolerances specified in ISO 261 and ISO 965, tolerance class 6g, unless otherwise specified on the part drawing. Acceptability of bolt thread gauging shall be determined according to ISO 1502. Acceptability of thread damage due to nicks and gouges shall be determined according to WA 990.

**8.2** Bolt threads with a protective finish may require additional allowance to accommodate thicker plating and/or coating. The additional allowances are specified in the WX 100 Finish Specification.

**9. ENDS OF HEXAGON AND FLANGED HEXAGON BOLTS**

Unless otherwise specified, the ends of hexagon and flanged hexagon bolts shall be the 'Chamfered End' design only.

**10. PILOT POINT DIMENSIONS****10.1 LENGTH AND DIAMETER**

The length and diameter of pilot points shall be as specified in Table 1.

**10.2 ENDS OF PILOT POINTS**

Ends of pilot points shall be flat or slightly indented to permit normal material flow as illustrated in Figure 1. All other requirements shall conform to ISO 4753.

Table 1

| Size           |     | M3   | M4   | M5   | M6   | M8   | M10  | M12  | M14  | M16  | M20  | M24  |
|----------------|-----|------|------|------|------|------|------|------|------|------|------|------|
| Length $L_p$   | nom | 1.5  | 2.0  | 2.5  | 3.0  | 4.0  | 5.0  | 6.0  | 7.0  | 8.0  | 10.0 | 12.0 |
|                | +/- | 0.25 | 0.25 | 0.25 | 0.25 | 0.3  | 0.3  | 0.3  | 0.4  | 0.4  | 0.4  | 0.4  |
| Diameter $d_p$ | max | 2.0  | 2.9  | 3.75 | 4.5  | 6.1  | 7.8  | 9.3  | 11.1 | 13.2 | 16.3 | 19.6 |
|                | min | 1.7  | 2.70 | 3.55 | 4.30 | 5.90 | 7.60 | 9.00 | 10.8 | 12.9 | 15.9 | 19.2 |

Figure 1

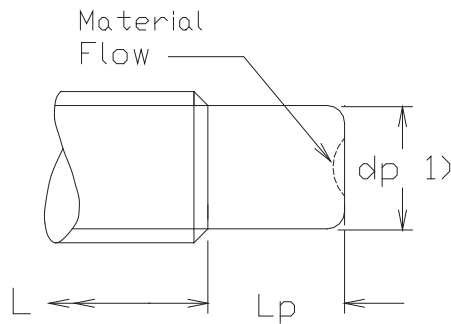


Figure 2 - Thread length and thread end details of bolts

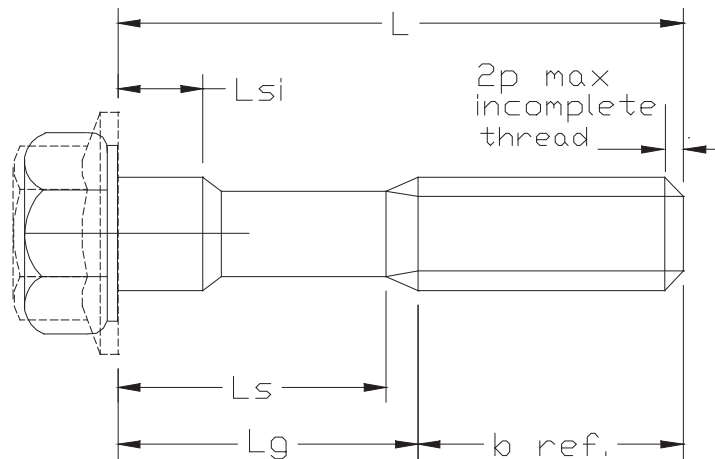




Table 2 - Thread length dimension of bolts

| Size                | M5                    |                       | M6                    |                       | M8                    |                       | M10                   |                       | M12                   |                       | M14                   |                       | M16                   |                       | M20                   |                       | M24                   |                       |
|---------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| B ref <sup>1)</sup> | 16                    |                       | 18                    |                       | 22                    |                       | 26                    |                       | 30                    |                       | 34                    |                       | 38                    |                       | 46                    |                       | 54                    |                       |
| 2)                  |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       | 40                    |                       | 44                    |                       | 52                    |                       | 60                    |                       |
| L                   | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max | L <sub>s</sub><br>min | L <sub>g</sub><br>max |
| 25                  | 5                     | 9                     |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
| 30                  | 10                    | 14                    | 7                     | 12                    |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
| 35                  | 15                    | 19                    | 12                    | 17                    | 6.75                  | 13                    |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
| 40                  | 20                    | 24                    | 17                    | 22                    | 11.75                 | 18                    | 6.5                   | 14                    |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |
| 45                  | 25                    | 29                    | 22                    | 27                    | 16.75                 | 23                    | 11.5                  | 19                    | 6.25                  | 15                    |                       |                       |                       |                       |                       |                       |                       |                       |
| 50                  | 30                    | 34                    | 27                    | 32                    | 21.75                 | 28                    | 16.5                  | 24                    | 11.2                  | 20                    | 6                     | 16                    |                       |                       |                       |                       |                       |                       |
| 55                  |                       |                       | 32                    | 37                    | 26.75                 | 33                    | 21.5                  | 29                    | 16.2                  | 25                    | 11                    | 21                    | 7                     | 17                    |                       |                       |                       |                       |
| 60                  |                       |                       | 37                    | 42                    | 31.75                 | 38                    | 26.5                  | 34                    | 21.2                  | 30                    | 16                    | 26                    | 12                    | 22                    |                       |                       |                       |                       |
| 65                  |                       |                       |                       |                       | 36.75                 | 43                    | 31.5                  | 39                    | 26.2                  | 35                    | 21                    | 31                    | 17                    | 27                    | 6.5                   | 19                    |                       |                       |
| 70                  |                       |                       |                       |                       | 41.75                 | 48                    | 36.5                  | 44                    | 31.2                  | 40                    | 26                    | 36                    | 22                    | 32                    | 11.5                  | 24                    |                       |                       |
| 75                  |                       |                       |                       |                       | 46.75                 | 53                    | 41.5                  | 49                    | 36.2                  | 45                    | 31                    | 41                    | 27                    | 37                    | 16.5                  | 29                    |                       |                       |
| 80                  |                       |                       |                       |                       | 51.75                 | 58                    | 46.5                  | 54                    | 41.2                  | 50                    | 36                    | 46                    | 32                    | 42                    | 21.5                  | 34                    | 11                    | 26                    |
| 85                  |                       |                       |                       |                       |                       |                       | 51.5                  | 59                    | 46.2                  | 55                    | 41                    | 51                    | 37                    | 47                    | 26.5                  | 39                    | 16                    | 31                    |
| 90                  |                       |                       |                       |                       |                       |                       | 56.5                  | 64                    | 51.2                  | 60                    | 46                    | 56                    | 42                    | 52                    | 31.5                  | 44                    | 21                    | 36                    |
| 95                  |                       |                       |                       |                       |                       |                       | 61.5                  | 69                    | 56.2                  | 65                    | 51                    | 61                    | 47                    | 57                    | 36.5                  | 49                    | 26                    | 41                    |
| 100                 |                       |                       |                       |                       |                       |                       | 66.5                  | 74                    | 61.2                  | 70                    | 56                    | 66                    | 52                    | 62                    | 41.5                  | 54                    | 31                    | 46                    |
| 105                 |                       |                       |                       |                       |                       |                       |                       |                       | 66.2                  | 75                    | 61                    | 71                    | 57                    | 67                    | 46.5                  | 59                    | 36                    | 51                    |
| 110                 |                       |                       |                       |                       |                       |                       |                       |                       | 71.2                  | 80                    | 66                    | 76                    | 62                    | 72                    | 51.5                  | 64                    | 41                    | 56                    |
| 120                 |                       |                       |                       |                       |                       |                       |                       |                       | 81.2                  | 90                    | 76                    | 86                    | 72                    | 82                    | 61.5                  | 74                    | 51                    | 66                    |
| 130                 |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       | 80                    | 90                    | 76                    | 86                    | 65.5                  | 78                    | 55                    | 70                    |
| 140                 |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       | 90                    | 100                   | 86                    | 96                    | 75.5                  | 88                    | 65                    | 80                    |
| 150                 |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       |                       | 96                    | 106                   | 85.5                  | 98                    | 75                    | 90                    |

1) For L up to and including 125

2) For L greater than 125

L<sub>si</sub> min = 0.5 d (diameter) see table 5**11. DIAGRAMS AND TABLES TO ASSIST DESIGN ENGINEERING**

The following diagrams and tables have been included to assist Design Engineers.