

## 1. Scope and Field of Application

**1.1** This standard covers the mechanical and performance requirements for five classes of prevailing-torque type steel metric hex and hex flange nuts,

- With hex nut nominal thread diameters M3 thru M36;
- With hex flange nut nominal thread diameters M6 thru M20;
- With specific strength requirements;
- For application within the following temperature ranges:
  - all-metal, plain – minus 50°C to plus 300°C
  - all-metal, plated – minus 50°C to plus 230°C
  - nonmetallic insert – minus 50°C to plus 120°C.

**1.2** This standard does not apply to nuts requiring special properties such as:

- weldability;
- corrosion resistance;
- ability to perform at temperatures outside the ranges specified in 1.1.

**1.3** Unless otherwise noted, all references to nuts in this standard mean prevailing-torque hex nuts and hex flange nuts.

## 2. Referenced Documents

### 2.1 ASTM Standards

ASTM standards are available from The American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

**ASTM F1940** *Standard Test Method for Process Control Verification to Prevent Hydrogen Embrittlement in Plated or Coated Fasteners*

**ASTM F1941M** *Standard Specification for Electrodeposited Coatings on Threaded Fasteners [Metric]*

**ASTM F568M** *Carbon and Alloy Steel Externally Threaded Metric Fasteners*

**ASTM F606M** *Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers and Rivets*

### 2.2 ASME Standards

ASME standards are available from the American Society of Mechanical Engineers; Three Park Avenue; New York, NY 10016-5990.

**ASME B1.13M** *Metric Screw Threads—M Profile*

**ASME B18.2.3.1M** *Metric Hex Cap Screws*

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| IFI<br>STANDARD ®                                                                    | <b>MECHANICAL AND PERFORMANCE<br/>REQUIREMENTS FOR PREVAILING-TORQUE TYPE<br/>STEEL METRIC HEX NUTS AND FLANGE NUTS</b> | <b>IFI-545</b><br>Page 1 of 8     |
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**ANSI B18.16.2M**      *Torque Tension Test Requirements for Prevailing-Torque Type Steel Metric Hex Nuts and Hex Flange Nuts*

**2.3 IFI Standards**

IFI standards are available from the Industrial Fasteners Institute, 6363 Oak Tree Boulevard, Independence, OH 44131-2500.

**IFI-142** *Hydrogen Embrittlement Risk Management*

**3. Definitions**

**3.1 Prevailing-Torque Type Nut.** A nut which is frictionally resistant to rotation due to a self-contained prevailing-torque feature, and not because of a compressive load developed against the bearing surface of the nut.

**3.2 Prevailing-Torque Developed by a Nut.** The torque necessary to rotate the nut on its mating externally threaded component, with the torque being measured while the nut is in motion, and with no axial load in the mating component.

**4. Designations**

**4.1** The property classes of nuts are designated by the numbers 5, 9, 10 and 12 as shown in Table 1.

**4.2** The designation number is approximately one-hundredth of the specified proof load stress in megapascals. The proof load stress of each class of nut is equal to or greater than the specified minimum tensile strength of the property class of bolt or screw with which the class of nut is suitable for assembly. This ensures a loading capacity of the bolted connection up to the specified minimum tensile strength of the bolt or screw. The property classes of bolts and screws, as given in ASTM F568M with which each property class of nut is suitable for use are shown in Table 2.

**5. Mechanical and Performance Requirements**

**5.1 Materials and Processes**

**5.1.1 Material.** Nuts shall be made of steel conforming to the requirements of IFI-140. Selection of a given IFI steel grade shall be based on compliance with the chemical composition limits specified in Table 3. The prevailing-torque element of insert design nuts may be made of a material other than steel.

**5.1.2 Heat Treatment.** Class 5 nuts need not be heat treated. Class 9 nuts may be heat treated at the option of the manufacturer. Class 10 nuts and Class 12 nuts shall be heat treated to meet the mechanical and performance requirements of this standard. Case hardening is not allowed for any property class.

**5.1.3 Finish.** Nuts may be furnished plain (bare metal) or with a protective coating (electrodeposited plating and/or chemical conversion coating) as specified by the user. Electroplating shall be in accordance with ASTM F1941M.

All nuts shall be provided with a supplementary lubricant if necessary to meet the stated performance requirements without galling. The lubricant shall be clean and dry to the touch, shall not be irritating to normal skin, nor emit an unpleasant odor during nut assembly.

The performance of nuts which are furnished with a protective coating shall not deteriorate when the nuts are stored indoors for a period of six months.

In cases where nuts are given a protective coating or are cleaned following delivery to the purchaser, the nut producer shall not be held responsible for failure of the nut to meet dimensional, mechanical, or performance requirements traceable to plating, coating or cleaning practice.

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**Table 1 Mechanical Requirements for Nuts**

| Property Class | Nominal Nut Dia |     | Proof Load Stress | Nut Hardness |     |          |     |
|----------------|-----------------|-----|-------------------|--------------|-----|----------|-----|
|                |                 |     |                   | Vickers      |     | Rockwell |     |
|                | Over            | To  | MPa               | Min          | Max | Min      | Max |
| 5              | —               | M4  | 520               | 130          | 302 | B70      | C30 |
|                | M4              | M7  | 580               |              |     |          |     |
|                | M7              | M10 | 590               |              |     |          |     |
|                | M10             | M16 | 610               |              |     |          |     |
|                | M16             | M39 | 630               | 146          |     | B78      |     |
| 9              | —               | M4  | 900               | 170          | 302 | B85      | C30 |
|                | M4              | M7  | 915               | 188          |     | B89      |     |
|                | M7              | M10 | 940               |              |     |          |     |
|                | M10             | M16 | 950               |              |     |          |     |
|                | M16             | M39 | 920               |              |     |          |     |
| 10             | —               | M4  | 1040              | 272          | 353 | C26      | C36 |
|                | M4              | M7  |                   |              |     |          |     |
|                | M7              | M10 |                   |              |     |          |     |
|                | M10             | M16 | 1050              |              |     |          |     |
|                | M16             | M39 | 1060              |              |     |          |     |
| 12             | —               | M4  | 1150              | 272          | 353 | C26      | C36 |
|                | M4              | M7  |                   |              |     |          |     |
|                | M7              | M10 | 1160              |              |     |          |     |
|                | M10             | M16 | 1190              |              |     |          |     |
|                | M16             | M39 | 1200              |              |     |          |     |

**5.1.4 Hydrogen Embrittlement.** Nuts shall not be embrittled. The requirements of IFI-142 shall apply. When heat treated nuts are electroplated or phosphate coated, appropriate plating or coating processes shall be employed to avoid hydrogen embrittlement. If necessary, the product shall be suitably treated as soon as practicable after plating or coating to preclude detrimental hydrogen embrittlement. The provisions of ASTM F1940 may be employed to eliminate further treatment.

## 5.2 Mechanical Requirements

**5.2.1 Proof Load.** Nuts shall withstand the proof loads specified in Table 4 for the applicable class when tested as specified in 6.1.

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