

TECHNICAL SPECIFICATION

No. TS220™

TECHNICAL SPECIFICATION FOR
UNION NUTS, SELF-LOCKING (UNIFIED THREADS)

HIGH TEMPERATURE NICKEL ALLOY INCONEL 718
CLASSIFICATION $R_m \geq 1270 \text{ MPa}$ (185000 lbf/in²) @ $T_A / +705^\circ\text{C}$



RATIONALE

Second Issue of this Technical Specification.
Material hardness value has been amended in line with industry expectation for Inconel 718.
For full details of changes, refer to supplementary SAE ITC Amendment Record document TS220-AR.

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**SAE INDUSTRY TECHNOLOGIES CONSORTIA
AEROSPACE STANDARDS AND PART QUALIFICATION PROGRAM**

FOREWORD

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1. SCOPE

- 1.1 This specification establishes the requirements and the appropriate performance, inspection and production acceptance tests which apply to self-locking Union Nuts. The Union Nuts shall be manufactured with unified threads to ISO 3161 (BS A 346) made of corrosion and heat resistant nickel alloy which develops a minimum tensile strength of 1270 MPa at ambient room temperature.

This specification covers the procedures to be followed by a manufacturer to become qualified to supply self-locking Union Nuts to this specification.

1.2 Construction

- 1.2.1 The nut element shall be a self-contained 'all metal' unit including the self-locking device. The locking element shall not operate either by means of a separate movement from the installation nor depend upon pressure on the bearing surfaces for locking action.
- 1.2.2 Tool marks resulting from producing the self-locking feature shall blend smoothly without abrupt change and shall not affect the performance or identification of the part.

2. REQUIREMENTS

- 2.1 SAE ITC Standards have been issued to provide dimensional control.
- 2.2 The heat treatment requirement for the product standards controlled by this specification is given in clause 7.3.2.

3. NORMATIVE REFERENCES

- 3.1 The following documents, in whole or in part, are normatively referenced in this specification. For dated / revision listed references, only the issue stated applies. For undated / revision listed references, the latest issue of the referenced document (including any amendments) applies. The documents shown in brackets [] are USA alternatives to the British documents wherever the latter are called out in this specification, however they may be subject to change and their inclusion as such is no guarantee of latest issue and that the specifications still coincide.

(a) SAE Industry Technologies Consortia (ITC)

RS726	Removal of Incomplete Threads
TS46	Assembly of Union Nuts, Thrust Wires and Union Ferrules
TS200	Qualified Manufacturers for SAE ITC Aerospace Industry Standard Parts
TS201	Method Change Approval for Qualified parts Listed in TS200
TS202	Qualification Test Requirements & Procedures for Aerospace Industry Standard Parts

(b) ASD-STAN

(pr)EN2952	Aerospace Series - Heat Resisting Alloy NI-PH2601 - Solution Treated and Cold Worked - Bar for Forged Fasteners - $D \leq 50$ mm - $1270 \text{ MPa} \leq R_m \leq 1550 \text{ MPa}$
(pr)EN2961	Aerospace Series - Heat Resisting Alloy NI-PH2601 - Solution Treated Bar for Machined Fasteners - $D \leq 50$ mm - $R_m \geq 1270 \text{ MPa}$
(pr)EN3219	Aerospace Series - Heat Resisting Nickel Base Alloy (Ni-P101HT) - Cold Worked and Softened Bar and Wire for Continuous Forging or Extrusion for Fasteners - $3 \leq D \leq 30$ mm
(pr)EN4376	Aerospace Series - Heat Resisting Alloy NI-PH2601 (NiCr19Fe19Nb5Mo3) - Solution Treated and Precipitation Treated - Bar and Section - $D \leq 200$ mm

(c) **ASTM International (ASTM)**

ASTM E112	Standard Test Methods for Determining Average Grain Size
ASTM A276	Standard Specification for Stainless Steel Bars and Shapes

(d) **British Standards Institution (BSi)**

BS S 80	High Chromium-Nickel Corrosion Resisting Steel Forging Stock, Bars, Forgings and Parts (880 to 1 080 MPa: Limiting Ruling Section 100 mm).
BS S 130	Specification for 18/9 chromium-nickel corrosion-resisting steel (niobium stabilized) billets, bars, forgings and parts - (540 MPa: limiting ruling section 150 mm).
BS 1134 [ASME B46.1]	Assessment of surface texture - Guidance and general information
BS 1580-1	Unified screw threads Part 1: Screw threads with diameters 1/4 in and larger - Requirements

(e) **International Standards Organisation (ISO)**

ISO 2859-1:1999 (BS 6001-1)	Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection
ISO 3161 (BS A 346) [SAE AS8879]	UNJ Threads - General Requirements and Limit Dimensions
ISO 3452-1	Non-destructive testing - Penetrant testing - Part 1: General principles
ISO 6506-1	Metallic materials - Brinell hardness test - Part 1: Test method
ISO 6507-1	Metallic materials - Vickers hardness test - Part 1: Test method
ISO 6508-1 [ASTM E18]	Metallic materials - Rockwell hardness test - Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)
ISO 9001	Quality Management Systems – Requirements

(f) **SAE International Group**

AMS5663	Nickel Alloy, Corrosion and Heat-Resistant, Bars, Forgings, and Rings 52.5Ni - 19Cr - 3.0Mo - 5.1Cb (Nb) - 0.90Ti - 0.50Al - 18Fe Consumable Electrode or Vacuum Induction Melted 1775°F (968°C) Solution and Precipitation Heat Treated - UNS N07718
AMS5628	Steel, Corrosion-Resistant, Bars, Wire, Forgings, and Tubing 16Cr - 2.5Ni (SAE 51431) - UNS S43100

(g) **UK Defence Standardisation (DSTAN)**

Def Stan 91-098	Lubricating Oil, Gas Turbine Engine, Synthetic Grade 7.5 cSt, NATO Code: 0-149; Joint Service Designation: OX-38
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4. DEFINITIONS

4.1 Authorities

4.1.1 Design Authority

The Design Authority is the SAE ITC Technical Standards Committee (TSC).

4.1.2 Qualification Testing Authority

In accordance with SAE ITC TS202, the qualification testing authority shall be the SAE ITC TSC or other body nominated by the TSC to carry out the testing.

4.2 Production Batch

Quantity of finished Union Nuts fabricated by the same process from a single material cast (single heat of alloy), having the same basic part number and diameter, heat treated together to the same specified condition and produced as one continuous run.

4.3 Inspection Lot

Consists of Union Nuts from a single production batch of the same part number which completely defines the Union Nuts.

4.4 Discontinuities

4.4.1 Crack : Rupture in the material which may extend in any direction and which may be intercrystalline or transcrystalline in character.

4.4.2 Seam : Longitudinal surface defect in the form of an unwelded open fold in the material.

4.4.3 Lap : Surface defect caused by folding over metal fins or sharp corners and then rolling or forging them into the surface.

4.4.4 Inclusion : Non-metallic particles originating from the material making process. They may exist as discrete particles or strings of particles extending longitudinally.

4.4.5 Burr : A rough edge or ridge left on the metal due to a cutting, grinding, piercing or blanking operation.

4.5 Test Temperature

Ambient room temperature, unless otherwise specified.

4.6 Simple Random Sampling

The taking of n items from a population of N items in such a way that all possible combinations of n items have the same probability of being chosen.

4.7 Critical Defect

A defect that according to judgement and experience is likely to result in hazardous or unsafe conditions for individuals using, maintaining, or depending upon the considered product, or that is likely to prevent performance or the function of major end item.

4.8 Major Defect

A defect other than critical, that is likely to result in a failure or to reduce materially the usability of the considered product for its intended purpose.

4.9 Minor Defect

A defect that is not likely to reduce materially the usability of the considered product for its intended purpose, or is a departure from established specification, having little bearing on the effective use of operation of this product.

4.10 **Sampling Plan**

A plan according to which, one or more samples being taken in order to obtain information and possibly to reach a decision.

4.11 **Limiting Quality Lq10**

In a sampling plan, a quality level which corresponds to a specified and relatively low probability of acceptance - in this case 10% probability of acceptance.

4.12 **Acceptable Quality Level (AQL)**

A quality level, which in a sampling plan corresponds to a specified but relatively high probability of acceptance.

It is the maximum per cent defective (or the maximum number of defects per hundred units), that for purposes of sampling inspection, can be considered satisfactory as a process average.

4.13 **Finished Union Nut**

A Union Nut ready for use, inclusive of any possible treatments and/or surface coatings, as specified in the product standard or definition document.

4.14 **Definition Document**

The document specifying all the requirements for the finished Union Nuts, e.g.

- metallurgical
- geometrical and dimensional
- functional (strength and temperature classes)

4.15 **Self-Locking Torque**

The torque applied to the Union Nut to maintain movement of rotation in relation to the threaded male connection (e.g. Union Adapter), the assembly being under no axial load and the Union Nut locking system being completely engaged with the male threaded connection (e.g. Union Adaptor).

4.16 **Seating Torque**

The tightening torque applied to the Union Nut to introduce or to increase the axial load in the assembly.

4.17 **Unseating Torque**

The untightening torque applied to the Union Nut to reduce or remove the axial load in the assembly.

4.18 **Breakaway Torque (Starting Torque)**

The torque required to start an installed Union Nut unscrewing off its threaded male connection (e.g. Union Adapter). The Union Nut locking device having been fully engaged onto the threaded male connection (e.g. Union Adapter), but with no axial load applied.

4.19 **Crimp**

A controlled squeeze using suitable hardened jaws (a sudden impact movement is not acceptable).