

TECHNICAL SPECIFICATION

No. TS138™

MANUFACTURING SPECIFICATION FOR INSERTS, IMPERIAL, THINWALL, SCREW LOCKING, (INCONEL® 718) SILVER COATED



Aerospace Standards Part Qualification Program

A Program of SAE ITC

RATIONALE

Ninth issue of this Technical Specification.

Precipitation heat treatment temperature and tolerance clarified. Tensile and stress rupture test requirements clarified. Test blocks and test block materials clarified.

For full details of changes, refer to supplementary SAE ITC Amendment Record document TS138AR-9.

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

FOREWORD

On the 1st January 2015 the SAE Industry Technologies Consortia (SAE ITC) acquired the ADS Aerospace Standards, previously known as the Society of British Aerospace Companies (SBAC) Aerospace Standards. The SAE ITC established in 2003 operates as a trade association as part of the SAE International Enterprise, providing a unique framework serving the automotive, aerospace and commercial vehicle sectors. Clients include private companies, government agencies, individuals and trade associations. Building consensus and breakthrough barriers to achieve solutions, and the ways by which those solutions take shape are tailored to each client's individual needs.

The legal obligations and copyright authority of all Aerospace Standards that were issued by the ADS Group Limited are therefore assigned / transferred to the SAE ITC.

These Standards are produced by the SAE ITC with the assistance of, and for the benefit of the Aerospace Industry, as part of a continuous programme of Standardisation for Aerospace application under the control of the Technical Standards Committee (TSC) of the SAE ITC.

SAE ITC Standards are published as part of the series of SAE ITC Aerospace Industry Standards, and where appropriate, additional manufacturing and inspection requirements are issued as Reference Sheets (RS) or Technical Specifications (TS). It is the responsibility of those using or specifying a Standard to ensure the product, process, or manufacturer so used or specified, is appropriate for the task or role in question. The SAE ITC wishes to draw special attention to the fact Technical Specifications (TS) include testing and procedures by which a user or Design Authority can establish whether a particular manufacturer, *prima facie*, has the capability to produce hardware in accordance with the appropriate standards and related specifications.

The SAE ITC, its servants, or representatives accept no responsibility for the continued quality of hardware items produced against the relevant drawings and specifications; this responsibility remains with the user.

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It is recommended that Technical Specification TS260, Metallic Materials List of Alternative Material Specifications and Standards Only Authorised for Use on SAE ITC Standard Parts, be consulted prior to manufacture of SAE ITC products. Selection of a material identified in TS260 as an alternative to those specified in the product standards requires Manufacturing Change Request (MCR) approval from the EATSC QMB.

Each Standard is a facsimile or electronic reproduction of a master drawing, and therefore, any outline view scales stated are not necessarily reproduced accurately. A Master Index of all SAE ITC Aerospace Standards is published separately on the SAE ITC website.

All references to Standards include reference to RS and TS publications.

Details of this and any further information can be obtained from the SAE ITC.

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1. SCOPE

This specification covers the requirements for thinwall self-locking inserts in material DTD5638, AMS5662 NI-P100-HT (INCONEL® 718) of tensile strength class 1275 MPa at room temperature, maximum test temperature of parts 550°C. Primarily for aerospace applications, it is applicable to such thinwall self-locking inserts when referenced on the product standard or definition document.

2. NORMATIVE REFERENCES

2.1 The following documents, in whole or in part, are normatively referenced in this Technical Specification & are indispensable for its application. For dated / revision listed references, only the issue cited applies. For undated / revision listed references, the latest issue of the referenced document (including any amendments) applies.

2.1.1 SAE Industry Technologies Consortia (ITC)

RS746	Tapped Hole and Counterbore Details for Thinwall Inch Threaded Inserts – Long and Short Series.
TS152	Installation and Removal of Inch Threaded Thinwall Inserts, Long and Short Series.
TS200	Database of 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.

2.1.2 British Standards Institution (bsi.)

BS1134	Assessment of Surface Texture. Guidance and General Information.
BS M39	Method of Penetrant Inspection of Aerospace Materials and Components.

2.1.3 European Standards (CEN)

EN 2786	Electrolytic Silver Plating of Fasteners.
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2.1.4 SAE International Standards

AMS2411	Plating, Silver for High Temperature Applications.
AMS2750	Pyrometry
AMS4117	Aluminium Alloy, Rolled or Cold Finished Bars, Rods and Wire and Flash Welded Rings (6061; -T6, -T651).
AMS5662	Nickel Alloy, Corrosion and Heat-Resistant, Bars, Forgings, and Rings 52.5N-19Cr - 3.0Mo - 5.1Cb (Nb) - 0.90Ti - 0.50Al - 18Fe Consumable Electrode or Vacuum Induction Melted 1775 °F (968 °C) Solution Heat Treated, Precipitation-Hardenable - UNS N07718.
AS8879	Screw Threads – UNJ Profile, Inch Controlled, Radius Root with Increased Minor Diameter.

AS9100 QMS for Quality Assurance in Design, Development, Production, Installation and Servicing.

AS9138 Quality Management Systems Statistical Product Acceptance Requirements.

2.1.5 **UK Ministry of Defence Standards**

DEF STAN 91-98 Lubricating Oil, Gas Turbine Engine, Synthetic Grade 7.5 cSt
NATO Code: O-149 Joint Service Designation: OX-38.

DTD939 Silver Plating of Heat Resisting Threaded Parts for Anti-seizure Purposes.

DTD5638 Heat Resisting Nickel Base Alloy – Vacuum Melted – Bar and Wire for Fasteners.

2.1.6 **ASTM International Standards**

ASTM E112 Standard Test Methods for Determining Average Grain Size.

ASTM E1417 Standard Practice for Liquid Penetrant Testing.

2.1.7 **International Standards (ISO)**

ISO 3161 UNJ Threads : General Requirements and Limit Dimensions.

ISO 3452 Non-destructive testing – Penetrant testing - Part 1: General principles

ISO 8642 Aerospace - Self-locking nuts with maximum operating temperature greater than 425°C-
Test methods.

2.1.7 **Military Standards**

MIL-PRF-7808 Performance Specification; Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.

3. **DEFINITIONS**

For the purposes of this specification, the following definitions apply : -

3.1 **Authorities**

3.1.1 **Design Authority**

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

3.1.2 **Qualification Testing Authority**

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

3.1.3 **Quality Assurance Authority**

The quality assurance authority will be as agreed by the TSC. Generally, the quality assurance authority will be that of the design authority.

3.2 **Production Batch**

A production batch shall consist of inserts, fabricated by the same process from material of the same 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.

3.3 **Inspection Lot**

An inspection lot consists of inserts from a single production batch of the same part number which completely defines the lot.

3.4 **Discontinuities**

3.4.1 **Crack**

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

3.4.2 **Seam**

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

3.4.3 **Lap**

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

3.4.4 **Inclusion**

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

3.5 **Test Temperature**

Ambient temperature, unless otherwise specified.

3.6 **Finished Insert**

An insert ready for use, inclusive of any possible treatments and/or surface coatings, as specified on the insert standard or definition document.

3.7 **Definition Document**

Document specifying all the requirements for inserts, i.e., metallurgical, geometrical, dimensional and functional (strength and temperature classes).

3.8 **Self-locking Torque**

The torque to be applied to the bolt to maintain movement of rotation in relation to the insert, the assembly being under no axial load and the insert locking system being completely engaged with the bolt thread.

3.9 **Seating Torque**

The tightening torque to be applied to the bolt to introduce or to increase the axial load in the assembly.

3.10 **Unseating Torque**

The untightening torque to be applied to the bolt to reduce or to remove the axial load in the assembly.

3.11 Breakaway Torque

The torque required to start unscrewing the bolt with respect to the insert, with the insert locking device still fully engaged on the bolt, but after the axial load in the assembly has been removed by unscrewing the bolt half a turn followed by a halt in rotational movement.

3.12 Installation Torque

The torque required to screw the insert into the test block, in order to overcome the resistance of the tapped hole to the external thread of the insert.

4. QUALITY REQUIREMENTS

4.1 Qualification

A supplier seeking qualification shall submit to the Qualification Testing Authority a minimum of 40 samples of each diameter of insert for which qualification is required. Inserts shall be selected from a single selection lot by a method defined in AS9138. The number of inserts to be subjected to each test as well as the methods to be used are given in Table 1. These tests are summarised in Table 4. The procedure to be followed is defined in SAE ITC specification TS202. The requirements of sample selection for qualification tests are defined in Table 3.

4.1.1 The test programme may possibly be reduced; this decision will be made by the Design Authority, based on evidence and results of testing carried out on parts of a similar design, size and manufacturing condition.

4.1.2 Re-qualification may be called for from time to time at the discretion of the Design Authority.

If there is any proposed change in manufacturing source or method, the procedures specified in TS201 shall be initiated.

4.2 Acceptance

4.2.1 Purpose

The purpose of the acceptance tests is to check, as simply as possible, by a method representative of actual use conditions, with the uncertainty inherent to statistical sampling, that the inserts constituting the batch satisfy the requirements of this standard.

4.2.2 Conditions

Acceptance tests are summarised in Table 2. They shall be performed on each batch. Table 1 specifies the test methods and sampling tables to be used for each test. Inserts from the batch to be tested shall be selected by a method defined in AS9138.

Each insert may be submitted to several tests.

The inserts subjected to destructive tests may be those on which non-destructive tests have been performed.

4.3 Quality System Certification

4.3.1 Purpose

The purpose of quality system certification is to ensure that the manufacturer has demonstrated the acceptability of their quality system and their ability for continuing production of parts to this standard to the required level of quality.

4.3.2 Conditions

The requirements and procedures for quality systems shall be to the requirements of AS9100 and SAE ITC specification TS202.

4.4 Inspection and Test Report

An inspection and test report showing actual numerical values shall be provided unless otherwise agreed by the Design Authority. Any reason for deviation from these presentation requirements shall be clearly recorded as part of the test report. This shall verify total compliance with product requirements. All deviations shall be considered for effect or applicability and a pass / fail criteria added.

4.5 Qualified Manufacturers of Self-Locking Inserts

A list of insert manufacturers qualified to TS138 is contained in TS200.

<https://ts200.sae-itc.org/>

Note: Qualified manufacturers shall hold a certificate of qualification as evidence of their qualified status for a part.

5. TECHNICAL REQUIREMENTS AND TEST METHODS

See Table 1.