



AEROSPACE STANDARD	AS3506	REV. B
	Issued	1995-12
	Revised	2014-02
Superseding AS3506A		
(R) Insert - Screw Thread, Thin Wall, Self-Locking, UNS N07718, Silver Plated, Class: 185 ksi/1025 °F, Procurement Specification FSC 5340		

RATIONALE

This revision corrects an error in the paragraph title for the 'as-received' self-locking torque test, Section 4 (Quality Assurance Provisions) has been substantially revised (including removal of AQLs, Table 6 completely revised, and Table 8 deleted), revise 1st cycle requirements for max locking torque for reuse testing, references have been updated including thread specification to AS8879 and others.

1. SCOPE

1.1 Scope

This SAE Aerospace Standard (AS) establishes the requirements for AS3504 and AS3505 thin wall self-locking inserts made from a corrosion and heat resistant, age hardenable nickel base alloy of the type identified under the Unified Numbering System as UNS N07718.

1.1.1 Classification

Tensile strength at room temperature 185 ksi minimum. Maximum test temperature of parts is 1025 °F.

1.1.2 The method of locking the insert into parent material to resist rotation to be by means of swaging the insert knurled collar into a hole prepared in per AS3508.

1.2 Application

Primarily for use in aircraft engines application up to approximately 1025 °F where an insert with a self-locking feature is required at elevated temperature, having excellent tensile strength and resistance to relaxation.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

SAE Technical Standards Board Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2014 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

SAE values your input. To provide feedback on this Technical Report, please visit
<http://www.sae.org/technical/standards/AS3506B>

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AMS2411	Plating, Silver for High Temperature Applications
AMS5662	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 Heat Treated, Precipitation-Hardenable
AS1310	Faster Torque for Threaded Applications, Definitions Of
AS3504	Insert - Thin Wall, Short, Self-Locking, 1025 °F, Silver Plated on Internal Surfaces Only, UNS N07718, UNJ Thread
AS3505	Insert - Thin Wall, Long, Self-Locking, 1025 °F, Silver Plated on Internal Surfaces Only, UNS N07718, UNJ Thread
AS3507	Insert -Thin Wall, Self-Locking, Short and Long Length, Installation and Removal of
AS3508	Insert - Thin Wall, Short and Long, Hole Preparation for
AS8879	Screw Threads - UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter

2.1.2 ASME Publications

Available from ASME, P.O. Box 2900, 22 Law Drive, Fairfield, NJ 07007-2900, Tel: 800-843-2763 (U.S./Canada), 001-800-843-2763 (Mexico), 973-882-1170 (outside North America), www.asme.org.

ANSI Y14.5M-1982	Dimensioning and Tolerancing (ASME Publication)
ASME B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)
ASME Y14.36M	Surface Texture Symbols

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM E112	Test Methods for Determining the Average Grain Size
ASTM E1417/E1417M	Standard Practice for Liquid Penetrant Testing
ASTM D3951	Practice for Commercial Packaging

2.1.4 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ISO 2859	Sampling Procedure and Tables for Inspection by Attributes
----------	--

2.1.5 NAS Publications

Available from Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3928, Tel: 703-358-1000, www.aia-aerospace.org.

NASM1312-6 Fastener Test Methods, Method 6, Hardness

2.1.6 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

MIL-PRF-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base

2.2 Definitions

The following terms used in this document are defined as follows:

2.2.1 PRODUCTION INSPECTION LOT

Shall be all finished parts of the same part number, made from a single heat of alloy, heat treated at the same time to the same specified condition, produced as one continuous run, and submitted for supplier's inspection at the same time.

2.2.2 DISCONTINUITY

An interruption in the normal physical structure or surface configuration of the part such as a crack, seam, lap, or inclusions.

2.2.2.1 Crack

A clean crystalline fracture passing through or across grain boundaries without inclusion of foreign elements. Cracks are normally caused by overstressing the metal during forging or forming, or during heat treatment.

2.2.2.2 Seam

Open surface imperfection that is narrow and continuous, usually straight, running generally parallel to the insert axis. Seams are generally inherent in the bar from which the insert is made.

2.2.2.3 Lap

A surface imperfection appearing as a seam or crack, caused by folding of material during such operations as forming, rolling, or drawing.

2.2.2.4 Inclusion

Nonmetallic particles inherent in the material when it was made. These particles may be isolated or distributed in the form of longitudinal stringers.

2.2.3 TEST TEMPERATURE

Ambient temperature, unless otherwise specified.

2.2.4 FINISHED INSERTS

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

2.2.5 STANDARD PARTS DRAWING

Document specifying all the requirements for insert; i.e., metallurgical, geometrical and dimensional, functional (strength and temperature class).

2.2.6 Refer to AS1310 for definitions related to fastener torque.

3. TECHNICAL REQUIREMENTS

3.1 Qualification

The insert furnished under this document shall be a product which has been subjected to and successfully passed the qualification tests specified in Section 4 of this document.

3.2 Material

Shall be Nickel Alloy 718 (UNS N07718) Corrosion and Heat Resistant Nickel Alloy per AMS5662.

3.3 Design

Finished insert shall conform to the following requirements:

3.3.1 Dimensions

The dimensions of finished inserts, after all processing including plating, shall conform to the standard part drawing.

3.3.2 Surface Texture

Surface texture of finished inserts, prior to plating, shall conform to the requirements as specified on the standard part drawing, determined in accordance with ASME B46.1.

3.3.3 Threads

Screw thread UNJ profile and dimensions as specified in AS8879 prior to the thread deformation for the self-locking feature, unless otherwise specified on the standard part drawing.

3.3.3.1 Incomplete Threads

Incomplete threads are permissible at the chamfered end of the inserts.

3.3.3.2 Chamfer

The entering point of the thread shall be chamfered as specified on the standard part drawing.

3.3.4 Geometric Tolerances

Insert feature shall be within the geometric tolerances specified on the standard part drawing.

3.4 Fabrication

Inserts may be manufactured by machining or forming.

3.4.1 Heat Treatment

The heat treatment medium or atmosphere shall not cause any surface contamination. Any scale which will not be removed by subsequent machining shall be removed by abrasive blasting. After final heat treatment, the hardness shall be as specified on AS3504 and AS3505.

3.4.2 Solution and Precipitation Heat Treatment

The semi-finished blanks shall be solution treated at a temperature of $1775\text{ }^{\circ}\text{F} \pm 75\text{ }^{\circ}\text{F}$, holding at the selected temperature within $\pm 25\text{ }^{\circ}\text{F}$ for at least 1 hour, then air cooling. The solution treated blanks shall be precipitation heat treated at a temperature of $1325\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$, holding at heat for 8 hours, then furnace cooling down to $1150\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$ with a rate of $100\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$ per hour, holding at the $1150\text{ }^{\circ}\text{F}$ for 8 hours followed by air cooling. Instead of the $100\text{ }^{\circ}\text{F} \pm 10\text{ }^{\circ}\text{F}$ per hour cooling rate to $1150\text{ }^{\circ}\text{F}$, inserts may be furnace cooled at any rate provided the time at $1150\text{ }^{\circ}\text{F}$ is adjusted to give a total precipitation time of 18 hours \pm 30 minutes.

3.4.3 Threads Forming

Threads may be produced either by machining, grinding, or fully formed by single rolling process. Threads in locking area may be displaced in any manner which enables the insert to meet the requirements of this document.

3.4.4 Surface Plating

All inserts shall be silver plated per AMS2411, 0.0002 thickness minimum, or as specified on AS3504 and AS3505.

3.4.5 Surface Discontinuities

Prior to surface plating, insert shall be subjected to penetrant inspection per ASTM E1417/E1417M, Type I, Sensitivity Level 2. Insert showing discontinuities equal to or exceeding the limitations of Table 1 shall be rejected.

3.5 Performance:

The insert shall be capable of the performance requirements specified as follows:

3.5.1 Rotational Resistance

Insert shall be installed into test block shown in Figure 1 by the method given in AS3507.

The test block shall be tested with a counterclockwise rotational direction of the torque wrench as shown in Figure 2. The rotational resistance torque values shall not be less than those in Table 2.

3.5.2 Installation Torque

Sample inserts shall be screwed into Nickel Alloy 718 Test blocks as shown in Figure 3 and the figure recorded. The torque required to install inserts to the required depth shall not exceed 4.5 lbf.in.

3.5.3 Reusability

3.5.3.1 Test bolt shall be of Nickel Alloy 718 (UNS N07718) per AMS5662, 180 ksi UTS minimum, lubricated with engine oil per MIL-PRF-7808 at each cycle. Test bolt threads shall be UNJ profile per AS8879 with maximum pitch diameter .0004 above the standard minimum pitch diameter.

3.5.3.2 Spacer shall be of Nickel Alloy 718 (UNS N07718) per AMS5662, 180 ksi UTS minimum, uncoated.

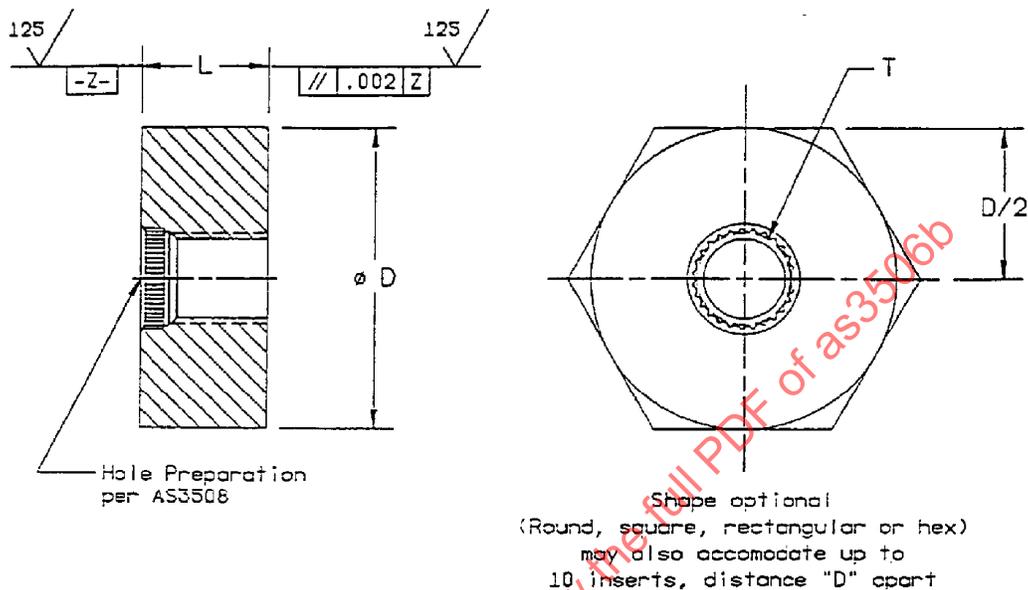
3.5.3.3 After testing, insert threads shall not show any indications of distortion, galling, or scratches of such depth as to prevent reassembly of the insert freely with the fingers up to the self-locking device.

3.5.3.4 Self-Locking Torque (15 Cycles) as Received:

a. Insert shall be installed into test block shown in Figure 1 by the method given in AS3507.

b. Bolt shall be seated on spacer located on top of the test block and tightened to the seating torque in Table 3, Column 5. The bolt shall be of sufficient length to extend beyond the locking feature a minimum of 2 pitches.

- c. The self-locking torque shall be measured and recorded and shall not be less than the values specified in Table 3, Column 1 (cycles 1 to 15) or greater than the values specified in Table 3, Column 3. On the 1st cycle only, 20% of parts tested may exceed the maximum locking torque (Table 3, Column 3) by 10% of the stated value for the insert size being tested.
- d. The breakaway torque shall be measured and recorded for each cycle on removal of the bolt and shall not be less than the values specified in Table 3, Column 1.



NOTES:

1. Material: Nickel Alloy 718 (UNS N07718) per AMS5662, 180 ksi UTS min.
2. Dimensions:
T = Nominal diameter of insert external thread
D = 4 x T
L = Insert length
3. Dimensioning and Tolerancing ANSI Y14.5M-1982 (ASME Publication)
4. Surface Texture: Symbols per ASME Y14.36M; requirements per ASME B46.1. Unless otherwise specified, surfaces to be 125 microinches Ra.

FIGURE 1 - TEST BLOCK

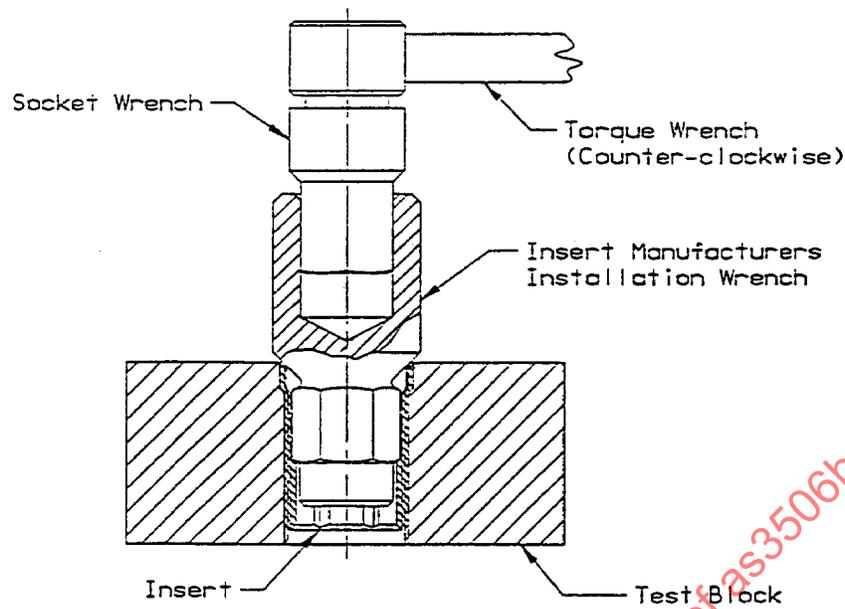


FIGURE 2 - ROTATIONAL RESISTANCE TEST FIXTURE

Installation torque test block requirements

1. Dimensions

T = Nominal diameter of insert external thread

$D = 2 \times T$

L = Insert length

Pitch Diameter of tapping to be in lower 25% of AS8879 Tolerance range

2. Material

INCO718 material to AMS 5662

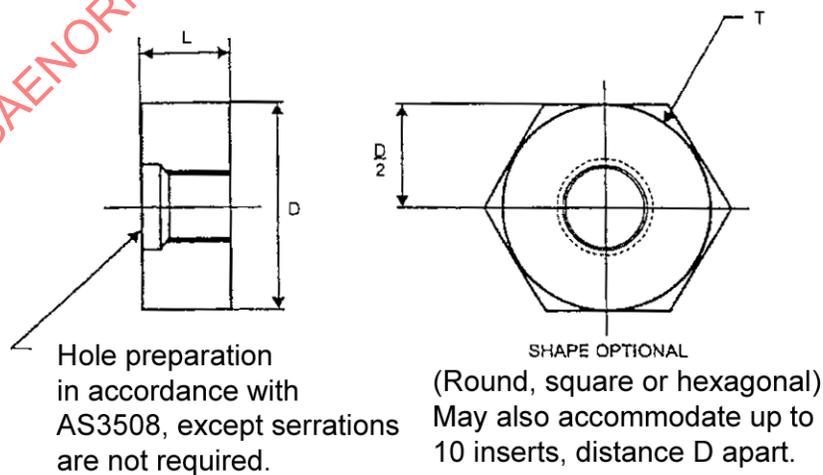


FIGURE 3 - INSTALLATION TORQUE TEST BLOCK

TABLE 1 - MAXIMUM DEPTH OF PERMISSIBLE DISCONTINUITIES

Insert-Short Identification Number	Insert-Long Identification Number	Insert Internal Thread, Ref	Depth inch
AS3504-01	AS3505-01	0.1900-32	0.0047
AS3504-02	AS3505-02	0.2500-28	0.0051
AS3504-03	AS3505-03	0.3125-24	0.0051
AS3504-04	AS3505-04	0.3750-24	0.0059
AS3504-05	AS3505-05	0.4375-20	0.0059
AS3504-06	AS3505-06	0.5000-20	0.0059

TABLE 2 - TORQUE VALUES FOR ROTATIONAL RESISTANCE TEST

Insert-Short Identification Number	Insert-Long Identification Number	Insert Internal Thread, Ref	Rotational Resistance Minimum lbf.in
AS3504-01	AS3505-01	0.1900-32	75
AS3504-02	AS3505-02	0.2500-28	120
AS3504-03	AS3505-03	0.3125-24	200
AS3504-04	AS3505-04	0.3750-24	260
AS3504-05	AS3505-05	0.4375-20	350
AS3504-06	AS3505-06	0.5000-20	450

TABLE 3 - VALUES FOR BREAKAWAY TORQUE, SELF-LOCKING TORQUE, AND SEATING TORQUE

Insert-Short Identification Number	Insert-Long Identification Number	Insert Internal Thread, Ref	Breakaway Torque and Self-Locking Torque Minimum	Self-Locking Torque Maximum	Self-Locking Torque Maximum	Seating Torque			
			lbf.in /1/	lbf.in /2a/	lbf.in /2b/	lbf.in /2c/	lbf.in /3/	lbf.in /4/	lbf.in /5/
AS3504-01	AS3505-01	0.1900-32	2.2	5.0	3.9	2.7	15.0	30.0	55.0
AS3504-02	AS3505-02	0.2500-28	3.5	8.0	6.2	4.4	30.0	60.0	135.0
AS3504-03	AS3505-03	0.3125-24	6.6	15.0	11.5	8.4	60.0	120.0	285.0
AS3504-04	AS3505-04	0.3750-24	9.7	22.0	17.3	11.9	80.0	160.0	495.0
AS3504-05	AS3505-05	0.4375-20	14.2	32.0	24.8	16.8	100.0	200.0	670.0
AS3504-06	AS3505-06	0.5000-20	18.6	40.0	31.0	22.1	150.0	300.0	1070.0

NOTES:

- /1/ Minimum self-locking torque and breakaway torque for 15 cycles /as received/ test and 25 cycles after 1025 °F bake test.
 /2a/ Minimum self-locking torque and breakaway torque for first cycle of 3 cycles test.
 /2b/ Minimum self-locking torque and breakaway torque for second cycle of 3 cycles test.
 /2c/ Minimum self-locking torque and breakaway torque for third cycle of 3 cycles test.
 /3/ Maximum self-locking torque for 15 cycles as received test and cycles 2 and 3 of 3 cycles test.
 /4/ Maximum self-locking torque for 25 cycles after 1025 °F bake test.
 /5/ Seating torque for 15, 25 cycles and 3 cycles tests.

3.5.3.5 Self-Locking Torque (25 Cycles, Loaded, 1025 °F)

- a. Insert shall be installed into test block shown in Figure 1 by the method given in AS3507.
- b. The self-locking torque shall be measured and recorded and shall not be less than values specified in Table 3, Column 1 nor exceed values in Column 4.
- c. Bolt shall be seated on spacer located on top of the test block and tightened to the seating torque specified in Table 3, Column 5.
- d. Heat the assembly in furnace at 1025 °F \pm 10 °F and hold at this temperature for 6 hours \pm 15 minutes.
- e. Remove the assembly from furnace and cool to ambient temperature.
- f. Release load by unscrewing 1/2 turn of bolt.
- g. Then continue to unscrew to measure and record the breakaway torque, which shall not be less than value specified in Table 3, Column 1.
- h. Remove the bolt from the insert.

The above procedure shall be repeated until 25 cycles have been completed.

3.5.3.6 Self-Locking Torque (3 Cycles) as Received

- a. Insert shall be installed into test block shown in Figure 1 by the method given in AS3507.
- b. The self-locking torque shall be measured and recorded and shall not be less than values specified in Table 3, Column 2a, 2b, and 2c (cycles 1 to 3) nor greater than the values specified in Table 3, Column 3. On the 1st cycle only, 20% of parts tested may exceed the maximum locking torque (Table 3, Column 3) by 10% of the stated value for the insert size being tested.
- c. Bolt shall be seated on spacer located on top of the test block and tightened to the seating torque specified in Table 3, Column 5 (cycles 2 and 3).
- d. Unscrew the bolt and measure and record the breakaway torque for each cycle. Torque values shall not be less than those specified in Table 3, Column 2a, 2b, and 2c (cycles 1 to 3).

3.6 Marking

Each insert shall be identification marked as specified by the standard part drawing. Unless otherwise specified, the markings may be formed by stamping or machining, raised or depressed 0.015 maximum. The manufacturer's identification mark shall be defined on the manufacturer's drawing.

3.7 Workmanship

Insert shall be uniform in quality and condition, clean, sound, smooth, and free from burrs and foreign materials and from internal and external imperfections detrimental to their performances.

3.7.1 Microscopic Examination

Specimen cut from insert shall be polished and etched in a suitable etchant, and examined at 100X magnification minimum to determine conformance to the following requirements:

3.7.1.1 Microstructure

Insert shall have microstructure of completely recrystallized material prior to thread deformation.

3.7.1.2 Grain Size

Grain size shall be 5 or finer as determined by comparison of the specimen with the chart in ASTM E112. Isolated grains not exceeding a mean diameter or 0.009 are acceptable.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection

The supplier of parts shall provide all samples and shall be responsible for performing all required tests. The purchaser reserves the right to perform such confirmatory testing as deemed necessary to assure that the parts conform to the requirements of this specification.

4.2 Responsibility for Compliance

The manufacturer's system for insert production shall be based on preventing product defects, rather than detecting the defects at final inspection and then requiring corrective action to be invoked. An effective manufacturing in-process control system shall be established, subject to the approval of the purchaser, and used during production of inserts.

4.3 Classification of Tests

The inspection and testing of inserts shall be classified as either qualification tests or acceptance tests.

4.3.1 Qualification Tests

Qualification tests shall be performed on inserts selected from the first lot of each size produced by a manufacturer and shall be repeated whenever a significant change is made in the manufacturing process. The qualification tests shall consist of those tests and inspections defined in Table 4.

4.3.2 Acceptance Tests

Acceptance tests shall be performed on each inspection lot. The acceptance tests shall consist of those tests and inspections defined in Table 4.

4.4 Test Sampling

4.4.1 Material

Raw material chemical analysis certification may be accepted in lieu of test data.

4.4.2 Destructive Tests

A random sample shall be selected from each production inspection lot, the size of the sample shall be as specified in Table 7. The sample inserts may be selected from those that have been subjected to and passed the nondestructive tests.

4.4.3 Nondestructive Tests, Visual and Dimensional

A random sample shall be selected from each inspection lot, the size of the sample to be as specified in Tables 5 and 6. All dimensional characteristics are considered defective when out of tolerance.

TABLE 4 - SUMMARY OF TESTS - QUALIFICATION AND PRODUCTION ACCEPTANCE

Characteristic	Qualification Required Paragraph	Qualification Sample Size	Production Acceptance Required Paragraph	Production Acceptance Sample Size	Test Method
Dimensions, tolerances of form and position, thread gauging and quality	3.3.1	10	3.3.1	Tables 5 and 6	Conventional measuring methods
Surface Texture	3.3.2	3	3.3.2	Tables 5 and 6	ASME B46.1
Surface plating	3.4.4	3	3.4.4	Tables 5 and 6	AMS2411
Rotational resistance	3.5.1	5			3.5.1
Reusability:					
15 cycles "as received"	3.5.3.4	10			3.5.2.4
25 cycles after 1025 °F bake	3.5.3.5	10			3.5.2.5
3 cycles "as received"			3.5.3.6	Table 7 Col B	3.5.2.6
Hardness	3.4.1	5	3.4.1	Table 7 Col A	MIL-STD-1312-6 in accordance with NASM1312-6
Microstructure	3.7.1.1	2	3.7.1.1	Table 7 Col B	Microscopic Examination X100
Grain size	3.7.1.2	2	3.7.1.2	Table 7 Col B	ASTM E112
Surface discontinuities	3.4.5	3	3.4.5	Penetrant Tables 5 and 6	ASTM E1417/E1417M, Type I, Sensitivity Level 2
				Microstructure Table 7 Col B	Microscopic examination X100
Material identification	3.2	33	3.2	100%	3.2
Product identification	5.1	33	5.1	Table 6	Visual examination
Delivery, packaging and labeling			5.1	100%	Visual examination
Installation torque	3.5.2	5		Tables 5 and 6	3.5.2