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Specification No.: 342
Issue Date: 4-17-70
Revision Date: (AG) 7-1-03

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PRODUCT SPECIFICATION
HI-LOK®/HI-TIGUE® AND HI-LOK® FASTENING SYSTEM
HI-LOK®/HI-TIGUE® AND HI-LOK® PIN

LIST OF CONTENTS

REVISION (AG)

Page 3	Para 3	Deleted MIL-S-8879
Page 5	Para 3	Added AS8879
Page 7	Table I	Threads: replaced MIL-S-8879 with AS8879
Page 20	Table V	Thread Pitch Diameter and Function: replaced MIL-S-8879 with AS8879
Page 20	Table V	Added note for head protrusion
Page 26	Table VI	Added exclusion for fillet radius and transition in note (d)
Page 34	Table IX	Corrected lot size value (was 3,500; now 35,000)

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1.0 SCOPE AND APPLICATION

1.1 Scope

This specification defines the engineering design and inspection requirements for the Hi-Lok pin with the Hi-Tigue feature and the Hi-Lok pin without the Hi-Tigue feature procured under part numbers listed on Hi-Shear drawings that refer to this specification. Receiving contractors may reject any lot that does not conform. Recommendations for improvement or corrections to this specification should be directed to the Chief Engineer of Hi-Shear Corporation.

1.2 Description (Hi-Lok/Hi-Tigue and Hi-Lok Pin)

Shear Pin	Threaded; hex socket; Crown, flush and protruding heads
Tension	Threaded; hex socket; Crown, flush and protruding heads

2.0 FUNCTIONAL REQUIREMENTS

The Hi-Lok/Hi-Tigue pin and Hi-Lok pin shall be inserted from one side of the assembly with the collar threaded into place from the other. Utilizing an installation tool whose hex wrench engages the hex socket of the pin completes the assembly of the fastener, thereby holding the pin stationary while applying torsional force to the Hi-Lok/Hi-Tigue collar or the Hi-Lok collar. At a predetermined torque, the driving portion of the collar shears off thus completing the installation of the fastener.

3.0 APPLICATION DOCUMENTS

Specifications listed herein of the issue in effect on date of price inquiry are a part of this specification to the extent indicated. In case of conflict, the requirements herein take precedence.

Specifications

Federal

PPP-B-566	Boxes, Paperboard, Folding
PPP-B-665	Boxes, Paperboard, Metal-Stayed
QQ-A-430	Aluminum Alloy Rod and Wire

Military

MIL-H-81200	Heat Treatment of Titanium and Titanium Alloy
MIL-S-18732	Steel Bars, Wire, Forging Stock, Forgings, Tubing (431), Special Quality

Standards

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-171	Finishing of Metal and Wood Surfaces
MIL-STD-1537	Electrical Conductivity Test

Other Publications

National Institute of Standards

Handbook H28	Screw Threads Standard for Federal Services

Aerospace Materials Specifications

AMS2772	Heat Treatment of Aluminum Alloys
AMS4928	Titanium Alloy Bars, Wire, Forgings, and Rings 6Al 4V Annealed (6Al-4V titanium)
AMS4967	Titanium Alloy Bars, Wire, Forgings, and Rings 6.0Al 4.0V Annealed, Heat Treatable (6Al-4V titanium)
AMS4971	Titanium Alloy, Bars, Wire, Forgings, and Rings 6Al 6V 2Sn, Annealed, Heat Treatable
AMS5628	Steel, Corrosion Resistant, Bars, Wire, Forgings, and Tubing 16Cr – 2.5Ni (431)

AMS5629	Steel, Corrosion Resistant, Bars, Forgings, Rings, and Extrusions, 13Cr 8.0Ni 2.2Mo 1.1Al Vacuum Induction Plus Consumable Electrode Melted Solution Heat Treated, Precipitation Hardenable (PH13-8Mo)
AMS5662	Nickel Alloy, Corrosion and Heat Resistant, Bars, Forgings, and Rings 52.5Ni 19Cr 3.0 Mo 5.1 Cb .90 Ti 0.50 Al 18Fe, Consumable Electrode or Vacuum Induction Melted 1775ºF (968ºC) Solution Heat Treated, Precipitation Hardenable (Inconel 718)
AMS5708	Nickel Alloy, Corrosion and Heat Resistant, Bars, Forgings, and Rings 58Ni 19.5Cr 13.5Co 4.3Mo 3.0 Ti 1.4Al Consumable Electrode or Vacuum Induction Melted 1975ºF (1079ºC) Solution Heat Treated (Waspaloy)
AMS5731	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Tubing, and Rings 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1800ºF (982ºC) Solution Heat Treated (A-286)
AMS5737	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings and Tubing 15Cr 25.5Ni 1.2Mo 2.1Ti 0.006B 0.30V, Consumable Electrode Melted, 1650ºF (899ºC), Solution and Precipitation Heat Treated (A-286)
AMS5758	Alloy Bars, Corrosion-Resistant, 20Cr-35Ni-35Co-10Mo, Vacuum Induction Plus Consumable Electrode Vacuum Melted, Solution Heat Treated for Work Strengthening (MP35N)
AMS5844	Alloy Bars, Corrosion Resistant, Bars 20Cr-3.5 Ni-35Co-10Mo, Vacuum Induction Plus Vacuum Consumable Electrode Melted, Solution Heat Treated and Work Strengthened (MP35N)
AMS5962	Nickel Alloy, Corrosion and Heat Resistant, Bars and Wire 52.5Ni 19Cr 3.0Mo 5.1Cb 0.90Ti 0.50Al 19Fe Consumable Electrode or Vacuum Induction Melted 1775ºF (968ºC) Solution Treated and Cold Worked Precipitation Hardenable (Inconel 718)

AMS6349	Steel Bars, 0.95 Cr 0.2 Mo (0.38-0.43C) Normalized (4140)
AMS6415	Steel Bars, Forgings, Tubing, 0.80Cr 1.8Ni 0.25Mo (0.38-0.43C) (4340)
AMS6487	Steel, Bars and Forgings 50Cr – 1.3Mo – 0.50V (0.38 – 0.43C) Consumable Vacuum Melted (H-11)
AMS-H-6875	Heat Treatment of Steel Raw Materials
AMS-QQ-A-225	Aluminum Alloy Bar, Rod, Wire
AMS-QQ-S-763	Steel Bars, Wire, Corrosion-Resisting
AMS-S-6049	Steel, Chrome-Nickel-Molybdenum (8740) Bars and Reforging Stock (Aircraft Quality)

National Aerospace Standard

NASM1312	Fasteners, Test Methods
NASM8907	Bolts, Alloy Steel, Shear and Tensile (156 KSI Min Fsu and 260 KSI Min Ftu), 450ºF, External Wrenching, Flanged Head

Aerospace Standard

AS8879	Screw Threads – UNJ Profile, Inch, Controlled Radius Root with Increased Minor Diameter

American National Standards Institute

ANSI B46.1	Surface Texture
ANSI/ASQC Z1.4	Sampling Procedures and Table for Inspection by Attributes

ASTM Specification

E29	Using Significant Digits in Test Data to Determine Conformance with Specifications
E1444	Standard Practice for Magnetic Particle Inspection
E1417	Standard Practice for Liquid Penetrant Inspection
G110	Standard Practice for Evaluating Intergranular Corrosion Resistance of Heat Treatable Aluminum Alloys by Immersion in NaCl + H_2O_2 Solution

British Standard

2TA 28	Forging Stock and Wire of Titanium-Aluminum-Vanadium Alloy (6A1-4V Ti)

Hi-Shear Corporation Specifications

No. 20	Inspection of the Hi-Tigue Element and Grip of Hi-Lok/Hi-Tigue Pins
No. 23	Inspection of Grip and Runout for Special Hi-Tigue Pins
No. 24	Inspection of Hi-Tigue Feature and Grip
No. 26	Inspection of Grip and Runout for Hi-Lok Feature Beyond Grip
No. 363	Manufacturer's Identification
No. 384	Thread Rework Limitations for Externally Threaded Fasteners
No. 400	Flush Head Protrusion Gaging System
No. 2-1599147	Hi-Lite®/Hi-Lok®/Hi-Tigue® Installation Tooling Catalog

4.0 GENERAL REQUIREMENTS

Hi-Lok and Hi-Lok/Hi-Tigue pins shall conform to the requirements of Table I.

TABLE I. GENERAL REQUIREMENTS

Engineering Characteristics	Engineering Requirements	Inspections Requirements
Material	The material shall be the same for both shear and tension applications. The pin shall be manufactured to strength levels specified on the applicable drawing.	Table II
Dimensional Control	Configuration and geometry shall conform to applicable Hi-Lok/Hi-Tigue or Hi-Lok drawings (see Note 1).	Table V
Heads	Heads shall be formed by a forging method. The bearing surface of protruding head pins shall be perpendicular to the shank within plus or minus one degree.	Table V
Hi-Tigue Feature	The Hi-Tigue feature on Hi-Lok/Hi-Tigue pins shall be made to the dimensional requirements of the applicable drawing and shall be inspected according to requirements specified herein.	Table V
Threads	Threads shall conform to Handbook H28 and AS8879. Threads on the following pins shall be fully formed by a single rolling process after heat treat unless otherwise specified: Titanium, shear and tension. Alloy Steel, tension except 8-32 and smaller. H-11, tension except 8-32 and smaller. PH13-8Mo, tension except 8-32 and smaller. Inco 718, 108 ksi shear, 125 ksi shear. Threads on the following pins shall be fully formed by a single rolling process either before or after heat treat unless otherwise specified on applicable drawing: Alloy Steel, shear. H-11, shear. PH13-8Mo, shear. 431 Steel, shear and tension. A-286, shear and tension. MP35N, shear and tension. Waspaloy, shear and tension.	Table V

TABLE I. GENERAL REQUIREMENTS (Continued)

Engineering Characteristics	Engineering Requirements	Inspection Requirements
Threads (Continued)	Threads on aluminum pins shall be fully formed by a single rolling process before solution treat. Threads fully formed by a single rolling process and damaged during subsequent manufacturing processes may be reworked within the limits of Hi-Shear Specification 384.	Table V
Hex Socket	The hex socket shall conform to the requirements on the applicable drawing. Solid film lube and aluminum coatings are not required in the hex socket. A slight overcut on each is caused by the drill diameter being slightly larger than the hex broach (across flats). If overcut exceeds 20% of any one hex flat, a functional torsional test per Table XV will be used to determine fastener acceptance.	Table V
Fillet Radius (Head-to-Shank)	The fillet radius shall conform to applicable Hi-Lok/Hi-Tigue or Hi-Lok drawings. Distortions shall not exceed the limits given in Figure 1 (See Grain Flow below).	Table V
Heat Treatment	Heat Treatment shall be as defined herein and on drawing. H-11 steel alloy shall be heat treated using triple tempering sequence. Heat treatment of steel shall be per AMS-H-6875, aluminum shall be per AMS2772 and titanium shall be per MIL-H-81200.	Table III And Table IV
Stress Relief	H-11 steel alloy shall be stress relieved after head forming and before final heat treatment. All H-11 steel alloy ground after heat treatment shall be stress relieved after grinding and before plating. Stress relief shall be at 925°F ± 25°F for 2 hours minimum.	Test of mechanical and metallurgical properties verifies stress relief.
Finish	As specified on applicable drawing.	Visual
Lubrication	As specified on applicable drawing.	Visual

TABLE I. GENERAL REQUIREMENTS (Continued)

Engineering Characteristics	Engineering Requirements	Inspection Requirements
Embrittlement	Electro-cadmium plated alloy steel, 431 steel, and H-11 steel pins shall be baked for a minimum of 23 hours at 375° ± 25°F within 4 hours after plating, and shall not exhibit embrittlement characteristics. Alloy steel pins at 180-200 ksi tension strength or 108 ksi minimum shear strength shall not be subjected to acid cleaning baths.	Table III and Table IV
Mechanical Performance	Mechanical performance of the Hi-Lok/Hi-Tigue or Hi-Lok fasteners shall meet the engineering requirements and Qualifications and Production Lot test requirements as designated herein (see Note 2).	Table III and Table IV
Metallurgical	Pins shall be examined for metallurgical characteristics as defined herein.	Table III and Table IV
Discontinuities General	Pins having discontinuities equal to or exceeding the following limitations shall be rejected (see Note 3). Care must be exercised to avoid confusing cracks with other discontinuities (see Table I, Non-rateable Discontinuities). Cracks. Pins shall be free from cracks in any direction or location. A crack is defined as a clear crystalline break passing through grain or grain boundary without inclusion of foreign elements. Laps and Seams. Pins may not possess laps and/or seams, except in locations specified. Inclusions. Pins shall show no evidence of surface or sub-surface inclusions at the thread root or head-to-shank fillet. Small inclusions in other parts of the pin not indicative of unsatisfactory quality shall not be cause for rejection.	Table III and Table IV
Head Discontinuities	The non-bearing surfaces of Hi-Lok/Hi-Tigue or Hi-Lok pin heads shall not have more than three discontinuities (see Table I, Non-rateable Discontinuities).	Table III and Table IV

TABLE I. GENERAL REQUIREMENTS (Continued)

Engineering Characteristic	Engineering Requirements	Inspection Requirements
Thread Discontinuities	Surface irregularities on the crest of the threads are permissible provided the total depth of the irregularity does not exceed the limits defined herein (see Figure 4 and Table I, Non-rateable Discontinuities.)	Table III and Table IV
Non-Rateable Discontinuities	Any discontinuity that is not a crack, regardless of location, with a depth of 0.0005 inch or less, is considered a non-rateable discontinuity and shall not be cause for rejection.	Table III and Table IV
Surface Contamination	Surface contamination and examination of specimens shall be as defined herein.	Table III and Table IV
Microstructure	No crack or internal burst shall be permitted. Microstructure shall be free from bursts, voids, gross alloy segregation or intergranular carbide precipitation. Microstructure shall also be free from overheating.	Table III and Table IV
Decarburization	Decarburization shall not exceed the limits specified herein (See Table VIII).	Table III and Table IV
Grain Flow	Heads. A longitudinal section of the forged head shall show no detrimental defects. The grain flow lines may be slightly broken by the finish machining or grinding. Cold Worked Fillet Radius (Head to Shank). The fillet radius on pins that have tension-tension fatigue requirements shall be cold worked (See Table XII). Cold work shall be accomplished after heat treatment of the pin. Threads. Grain flow in the threads shall be continuous and shall follow the general thread contour with the maximum density at the bottom of the root radius.	Table III and Table IV

TABLE I. GENERAL REQUIREMENTS (Continued)

Engineering Characteristics	Engineering Requirements	Inspection Requirements
Hydrogen Content (Titanium)	Finished fasteners shall not have hydrogen content exceeding the limits defined herein.	Table III And Table IV
Packaging	Fasteners shall be packaged in such a manner as to assure that they will not be damaged or exposed to undue weathering or harmful material. A unit package may include fasteners of only one type, size, part number and lot number. Boxes shall conform to specifications of either PPP-B-566, Style II or PPP-B-665, Style C. Unit packages of fasteners may be consolidated into larger packages for shipment. Packages for shipment must allow for economical transportation and conform to consolidated freight classification rules.	Visual
Marking	Each unit container shall be durably and legibly marked, to give the following information: brief descriptive title, complete part number, manufacturer's name or trademark, inspection lot number, purchase order number, quantity in container and patent number, per MIL-STD-129.	Visual
Installation Tools	The fasteners covered by this specification shall be installed with tools recommended by Hi-Shear Corporation and in accordance with Hi-Shear Instruction Manual, 2-1599147 Hi-Lite/Hi-Lok/Hi-Tigue Installation Tool Catalog.	-----

Notes

1. For purposes of determining conformance with this specification, all dimensional values shall be rounded to the nearest unit in the last right-hand digit used in expressing the drawing limit in accordance with the rounding method of ASTM E29.

2. For purposes of determining conformance with this specification, all specified mechanical property limits are absolute limits in accordance with ASTM E29.

3. For purposes of determining conformance with this specification, all specified limits per Table VIII are absolute limits in accordance with ASTM E29.

5.0 QUALITY ASSURANCE REQUIREMENTS

5.1 Qualification Requirements

Qualification shall constitute tests to determine the qualifications of the manufacturer to meet the requirements of this specification and maintain the facilities and the quality control organization to ensure production of satisfactory fasteners.

5.2 Qualification Tests

Qualification tests shall consist of all test characteristics specified in Table III.

5.2.1 Qualification Samples

Test samples for qualification shall consist of each type and diameter in sampling quantities as specified in Table III.

5.2.2 Certified Test Report

The qualification tests shall be supported by a certified test report with the actual data for the tests specified in Table III and drawings including the following details: dimensions, tolerances, composition of material, coating or plating applied and heat treatment.

5.3 Quality Conformance Inspection

Quality conformance inspection pertains specifically to production lots, and shall be accomplished on every production lot of the Hi-Lok/Hi-Tigue or Hi-Lok fasteners represented in a shipment. The inspection shall consist of the examinations and tests specified in Table IV or Paragraph 5.3.4.

5.3.1 Inspection Lot

An inspection lot is a production lot which is a defined quantity of finished fasteners or components of identical configurations fabricated from one mill heat or melt of material, produced as one continuous run or order or part thereof, and presented for inspection at the same time.

5.3.2 Sample

A sample consists of one or more units of product drawn from an inspection lot, the units of the sample being selected at random without regard to their quality. The number of units in the sample is the sample size. Selection of the sample pieces for inspection shall be in accordance with ANSI/ASQC Z1.4.

5.3.3 Responsibility for Inspection

The manufacturer is responsible for the performance of all inspection requirements specified herein. Inspection records of the examination and tests shall be maintained and be available to the customer on request, for a minimum of seven years from shipment of parts.

5.3.4 Alternative Lot Acceptance Inspection

Lot conformance test requirements and sample sizes may be other than indicated, per Table IV, if all these conditions are met:

1. A written agreement exists between the Buyer and licensed manufacturer that encompasses complete qualification, per Table III, of the parts involved; and
2. Process controls are defined by sealed routers or process control documents; and
3. Hi-Shear Corporation is notified, in writing, of the modified test requirements or sample sizes before implementation; and
4. If the modifications are acceptable to Hi-Shear Corporation, the Chief Engineer of Hi-Shear Corporation will issue a letter of acceptance stating concurrence of the modified test requirements or sample sizes.

5.4 Test Methods

Test methods for quality assurance designated in the "Inspection Requirements" column of Table I.

5.5 Screening

Screening (100% inspection accompanied by rejection of defective parts) may be applied at the inspector's discretion to any lot that is not acceptable by sampling plans described herein. Screening may be applied only to characteristics inspected by non-destructive tests. For characteristics inspected by destructive tests, the entire lot shall be accepted or rejected according to test results of prescribed sample.

5.6 Production Lot Inspection Report

Each production lot of fasteners shall have an authorized inspection report on file. This report shall state that the fasteners are from a production lot that was manufactured, inspected and accepted in accordance with requirements of this specification. The report shall identify the part number and the production lot number and include all actual test results on the certification of conformance as required by the applicable test method on all production lots represented in the shipment.

TABLE II. MATERIAL REQUIREMENTS [2] [4]

ROOM TEMPERATURE				MATERIAL	
Tensile Strength psi	Shear Strength psi	Rockwell C		Alloy	Specification
		Max.	Min.		
160,000 to 180,000	95,000 Min.	40	36	4140 Steel 8740 Steel 4340 Steel	AMS6349 AMS-S-6049 AMS6415
180,000 to 200,000	108,000 Min.	44	40	4140 Steel 8740 Steel 4340 Steel	AMS6349 AMS-S-6049 AMS6415
210,000 Min. 220,000 to 240,000 260,000 to 290,000	125,000 Min. 132,000 Min. 156,000 Min.	48 49 55	45 46 50	H-11 Steel	Vacuum Melt per AMS6487
160,000 Min.	95,000 Min.			6A1-4V Titanium	AMS4928 AMS4967 2TA 28
150,000 Min.	90,000 Min.				
180,000 Min.	108,000 Min.			6Al-6V-2Sn Titanium	AMS4971
160,000 Min. 180,000 Min.	95,000 to 115,000 110,000 to 130,000			A-286 High Temperature Alloy	AMS5731 AMS5737
210,000 Min.	125,000 Min.	48		PH13-8Mo	AMS5629
	115,000 Min . [1]			PH13-8Mo	AMS5629
201,000 to 233,000 [3]	117,000 to 133,000 [3]			PH13-8Mo	AMS5629
210,000 Min.	125,000 Min.		42	431 Steel	AMS5628 MIL-S-18732 (Nickel content may be 1.5% min.)
	125,000 Min.			Inco 718	AMS5662 AMS5962 Cold Reduced
	108,000 Min.			Inco 718	AMS5662 AMS5962
70,000 to 90,000	45,000 Min.			305 Cres	AMS-QQ-S-763
120,000 to 140,000	72,000 Min.			305 Cres	AMS-QQ-S-763
75,000 Min.	45,000 Min.			7075 Aluminum T6 Condition Per AMS2772	AMS-QQ-A-225/9 QQ-A-430
66,000 Min.	40,000 Min.			7075 Aluminum T73 Condition Per AMS2772	AMS-QQ-A-225/9 QQ-A-430

TABLE II. MATERIAL REQUIREMENTS (Continued) 2 4

ROOM TEMPERATURE				MATERIAL	
Tensile Strength psi	Shear Strength psi	Rockwell C		Alloy	Specification
		Max.	Min.		
220,000 Min. 260,000 Min.	132,000 Min. 145,000 Min.			MP35N	AMS5758 AMS5844
160,000 Min.	95,000 Min.			Waspaloy	AMS5708

1. Material shall be precipitation (age) hardened at the highest temperature possible to meet the strength requirements. Age temperature shall not be less than 1000°F.
2. Refer to applicable drawing for material strength that may be size dependent.
3. Material shall be precipitation (age) hardened at the highest temperature possible to meet the strength requirements. Age temperature shall not be less than 990°F.
4. All raw material shall have alloy verification performed either by manufacturer or independent laboratory. Fasteners produced to the requirements of this specification with a date of manufacture on or before January 1, 2001 do not require alloy verification.

TABLE III. QUALIFICATION TESTS WITH SAMPLING

Test	Applicable Alloy Head Configuration	Test Method and Acceptance	Grip Condition	Sample Size	Number of Defectives Allowed
Material – Receiving Inspection	All	See Note 1	-----	-----	-----
Heat Treatment	All				
Dimensional Examination	All	Table V	-----	*	0
Threads			-----	7	0
Surface Texture			-----	7	0
Performance					
Double Shear Strength	All	Table VI	-----	7 (a)	0
Tensile Strength	All		Max.	7	0
Tension-Tension Fatigue	See Table XII		Max.	7	0
Hardness	H-11 Steel, Alloy Steel, PH13-8Mo, 431 Steel		-----	2	0
Metallurgical Examination		Table VII			
Discontinuities	All		-----	5	0
Microstructure	All		-----	5	0
Grain Flow	All		-----	5	0
Cold Worked Fillet	Titanium MP35N H-11 Steel 431 Steel PH13-8Mo Inco 718 180 ksi Tension Alloy Steel		-----	5	0
Debarburization & Carburization	H-11 Steel, 431 Steel, Alloy Steel		-----	5	0

* All qualification samples tested must be dimensionally inspected.

(a) Flush and Protruding Heads

Qualification for double shear strength of flush head shall constitute qualification for double shear strength of the corresponding protruding head.

TABLE III. QUALIFICATION TEST WITH SAMPLINGS (Continued)

Test	Applicable Alloy Head Configuration	Test Method And Acceptance	Grip Condition	Sample Size	Numbers of Defective Allowed
Surface Contamination	Titanium	Table VII	-----	5	0
Hydrogen Content	Titanium	Table VII	-----	1	0
Embrittlement	Electro-cadmium plated pins from the following materials: 180 ksi Tension Alloy Steel, 431 Steel, 108 ksi Shear Alloy Steel, H-11 Steel	NASM1312 Test 5 See Note 2	-----	4	0
Head Ductility	Inco 718 (125 ksi Shear), 431 Steel (Not required on ½" dia. and larger)	Table VI	-----	4	0
Grinding Burns	All	Table VII	-----	5	0
Intergranular Corrosion	Aluminum	Table VII	-----	5	0

1. The pins shall be manufactured in strength ranges specified in Table II.

   Heat treatment shall develop tensile, shear, fatigue and ductility properties as defined herein and on applicable drawings without adverse effect on required metallurgical properties defined herein.

   Test of mechanical and metallurgical properties verifies heat treatment.

2. Parts shall pass a 72-hour stress durability test per NASM1312 Test 5 with the load equal to 85% of the rated ultimate tensile strength of the pin.

TABLE IV. LOT ACCEPTANCE INSPECTION

Test	Applicable Alloy and Head Configuration	Test Method and Acceptance	Sampling
Material-Receiving Inspection	All	See Note 3	
Heat Treatment	All	See Note 1	
Dimension Examination	All	Table V	Table V
Performance			
Double Shear Strength	All	Table VI	Table XI
Tensile Strength	All		
Tension-Tension Fatigue	See Table XII		
Hardness	H-11 Steel, Alloy Steel, PH13-8Mo, 431 Steel		Table IX
Metallurgical Examination			
Discontinuities	All	Table VII	Table VII
Microstructure	All		
Grain Flow	All		
Cold Worked Fillet	Titanium 180 ksi Tension Alloy Steel MP35N, Inco 718 431 Steel, H-11 Steel PH13-8Mo		
Carburization & Decarburization	H-11, Alloy Steel, 431 Steel		
Surface Contamination	Titanium		
Hydrogen Content	Titanium		
Embrittlement	Electro-cadmium plated pins from the following materials: 180 ksi Tension Alloy Steel 108 ksi Shear Alloy Steel 431 Steel H-11 Steel	NASM1312 Test 5 See Note 2	4 per Lot
Head Ductility	Inco 718 (125 ksi Shear), 431 Steel (Not required on ½" dia. and larger)	Table VI	4 per Lot
Grinding Burns	All	Table VII	Table XI

Notes:

1. The pins shall be manufactured in strength ranges specified in Table II.

   Heat treatment shall develop tensile, shear, fatigue and ductility properties as defined herein and on applicable drawings without adverse effect on required metallurgical properties defined herein.

2. Test of mechanical and metallurgical properties verifies heat treatment. Parts shall pass a 72-hour stress durability test per NASM1312 Test 5 with the load equal to 85% of the rated ultimate tensile strength of the pin.

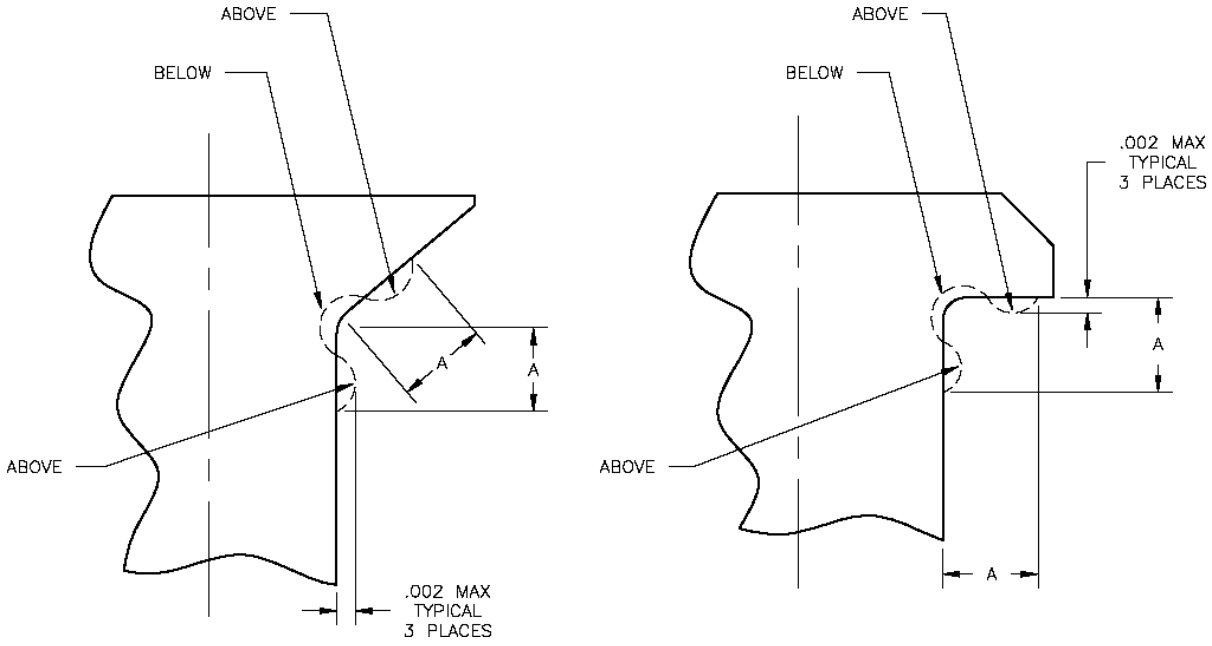
TABLE V. CLASSIFICATION OF DIMENSIONAL DEFECTS

Sampling and acceptance at Random per ANSI/ASQC Z1.4, Level II

DIMENSIONAL CHARACTERISTICS	PROCEDURE	CRITERIA
Identification	Visual; See Figure 6	Table XVII
Head Angle (Flush Heads)	Comparator Measurement	Table XVII
Bearing Surface of Head (Protruding Heads)	Comparator Measurement	Table XVII
Thread Major Diameter	Dimensional Measurement	1.5% AQL
Thread Pitch Diameter and Function	Gaging per AS8879, Handbook H28, and Figure 2	.65% AQL
Incomplete Threads & Minor Diameter	Comparator Measurement	Table XVI
Shank Diameter	Dimensional Measurement	1.5% AQL
Grip Length	Comparator Measurement	Table XVII
Hi-Tigue Feature	Comparator Measurement; Bead-type Transition Requires Dimensional Measurement	Table XVII or 1.5% AQL for Bead-type
Head-to-Shank Fillet	Comparator Measurement; See Figure 1	Table XVII
Head Concentricity	Dimensional Measurement	1.5% AQL
Straightness of Shank	Dimensional measurement per Table X	1.5% AQL
Surface Texture	ASNI B46.1	1.5% AQL
Burrs and Tool Marks	Visual	Table XVII
Overall Length	Dimensional Measurement	2.5% AQL
Head Diameter and Height (Protruding Heads)	Dimensional Measurement	2.5% AQL
Hex Socket and Associated Recess Requirements (except Hex Countersink)	Dimensional Measurement; Gage per Figure 9 and Table XV (see note 1)	2.5% AQL
Hex Countersink	Dimensional Measurement	4.0% AQL
Head Protrusion (Flush Heads)	Dimensional Measurement Using HS400 for Hi-Lok/Hi-Tigue and Hi-Lok head Styles (see note 2)	.65% AQL or 50 piece Lot Plot with Cpk ≥ 1.0
All Other Dimensions	Dimensional Measurement or Comparator Measurement, as applicable	4.0% AQL or Table XVII, as applicable

Notes:

1. The socket shall be such as to allow the go member of gage per Figure 9 to enter freely to the minimum depth requirement of the socket. The no-go member of the gage should not enter. If the no-go member enters any one of the three across flat dimensions (maximum one entry per part), the torsional functional test per Table XV shall be run for acceptability. Parts meeting the torsional requirements are acceptable. Sample size per Table XI.
2. Head protrusion may be used to determine “A” and “H” theoretical dimensions per the applicable standard per the procedure and criteria stated above.



A Max

Nominal Size	5/32, 3/16,1/4	5/16	3/8	7/16	1/2, 9/16, 5/8	¾ & Larger
Tension Heads	.062	.094	.094	.125	.125	.156
Flush Shear Heads	.030	.030	.030	.035	.035	.040
Protruding Shear Heads	.035	.035	.040	.040	.040	.050

Cold working of head-to-shank fillet may cause distortion of fillet area. Distortion shall not exceed .002 above or below contour shown on fastener drawing. Distorted area shall not extend beyond (A) as illustrated above.

FIGURE 1. FILLET ROLLING PERMISSIBLE DISTORTION

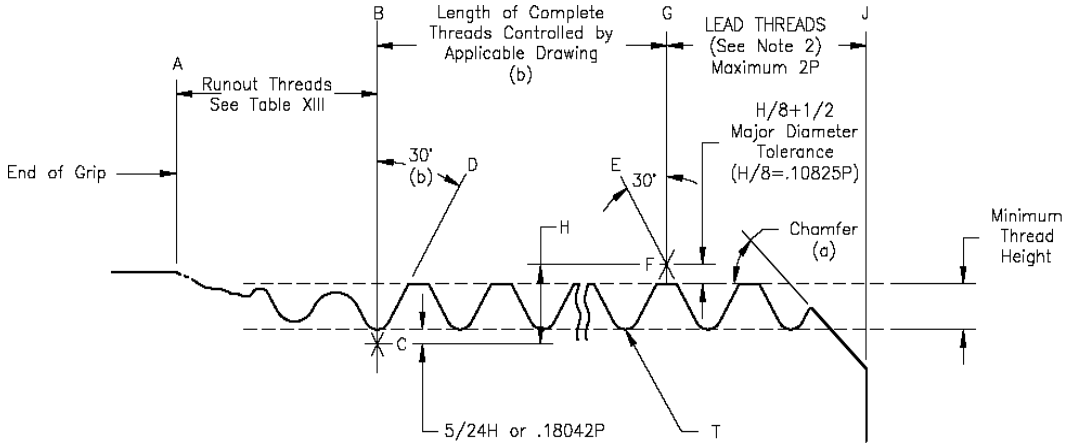


Figure 2. INCOMPLETE THREADS, RUNOUT RADIUS, AND ROOT RADIUS

DETERMINATION OF INCOMPLETE THREADS BY COMPARATOR METHOD
(Referee Method Applicable to Pins with Class 3A Threads)

(a) Point to be flat and chamfered, chamfer to be approximately 1.25 pitch. Threads adjacent to chamfer and adjacent to grip may be incomplete. Incomplete threads may be out of tolerance at major, pitch or minor diameter but shall not exceed 2 pitch in length when measured as shown in the figure. Transition from complete thread to no thread shall be smooth and gradual. Angle of chamfer shall be as specified on applicable drawing.

(b) Acceptability of dimensions for root radius incomplete thread, lead error and angle error shall be based on comparator measurement. Acceptability of other thread dimensions at maximum metal condition shall be based on virtual (or effective) diameter gaging with gage dimensions per applicable thread specification. Acceptability of other thread dimensions at minimum metal conditions shall be based on actual (or single element) measurement. Acceptability of grain flow or discontinuities shall be based on metallurgical examination.

(c) The requirements described are the essentials details needed for measurement of incomplete threads. They may be combined with others for checking additional thread characteristics and sizes. “H” in figure is the height of a theoretical sharp V thread.

1. Runout Thread Requirements

Horizontal parallel lines to define minimum thread height that is one-half the difference between minimum major diameter minus maximum minor diameter. See Table XIII for distance between vertical lines A and B.

1.1 Procedure

Rotate fastener to find first complete thread nearest to grip. At this point, thread height equals minimum height as indicated in Figure 2, then move shadow longitudinally until left flank of first complete tread profile coincides with Line D. Runout threads shall then fall between Lines A and B to be acceptable.

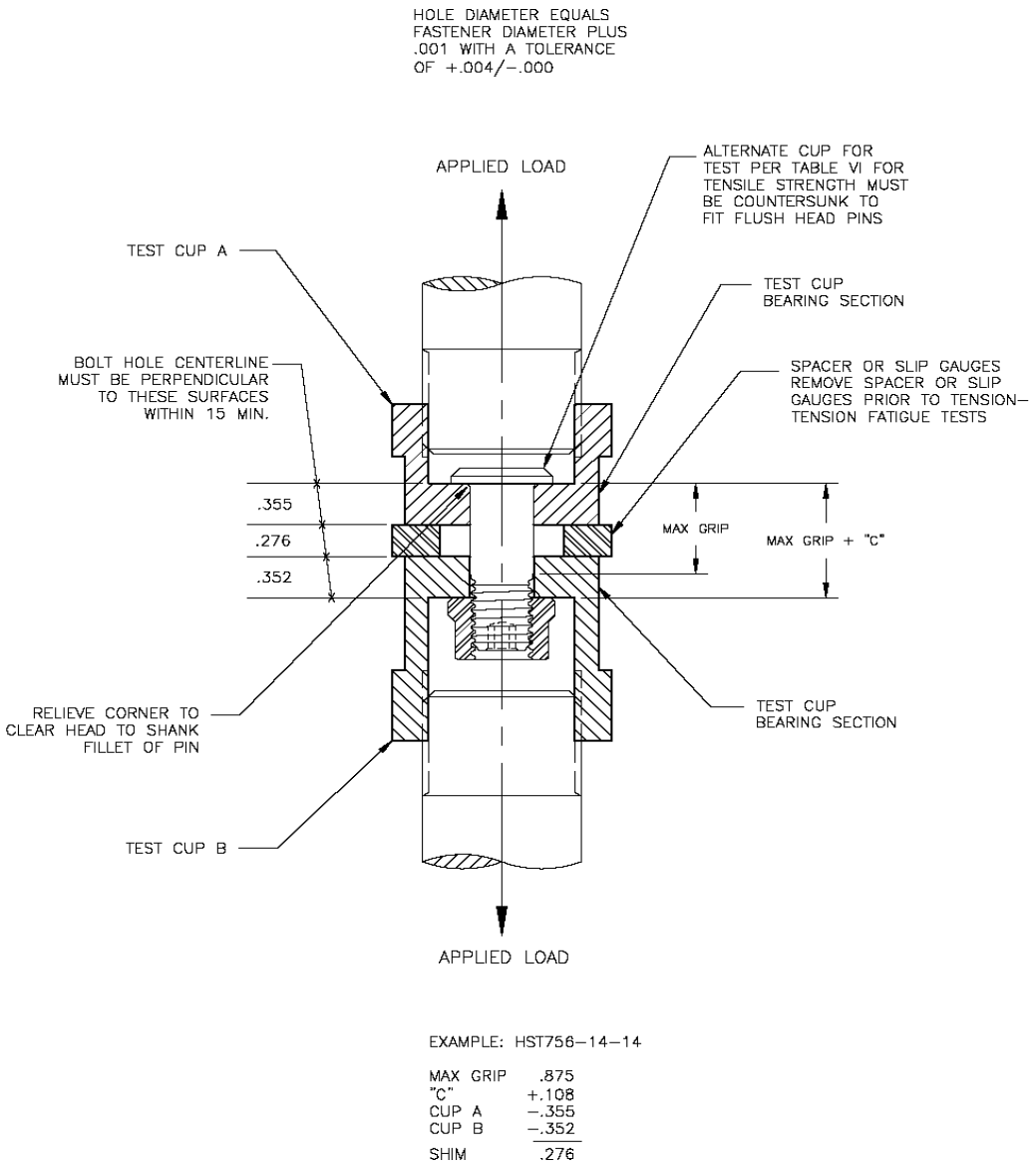
2. Lead Thread Requirements

Horizontal lines as described above. Vertical Line G intersecting 30° flank angle Line E at Point F. Vertical Line J located 2 pitch distance to right of G.

2.1 Procedure

Rotate fastener to find first complete thread nearest to end. At this point, complete thread height equals minimum height as indicated on chart. Then move shadow longitudinally until right flank of first complete thread profile coincides with Line E. Lead threads shall then fall between Lines G and J to be acceptable.

Hi-Lok & Hi-Lok/Hi-Tigue Dash No.	Thread Size	Threads per MIL-S-88779 And Handbook H28	P Thread Pitch	T Root Radius	
				Min.	Max.
-4	6-40	.1380-40 UNJF-3A	.02500	.0038	.0045
-4	6-32	.1380-32 UNJC-3A	.03125	.0047	.0056
-5	8-32	.1640-32 UNJC-3A	.03125	.0047	.0056
-5	8-36	.1640-36 UNJF-3A	.02778	.0042	.0050
-6	10-32	.1900-32 UNJF-3A	.03125	.0047	.0056
-7	12-32	.2160-28 UNJF-3A	.03571	.0054	.0064
-8	1/4-28	.2500-28 UNJF-3A	.03571	.0054	.0064
-10	5/16-24	.3125-24 UNJF-3A	.04167	.0063	.0075
-12	3/8-24	.3750-24 UNJF-3A	.04167	.0063	.0075
-14	7/16-20	.4375-20 UNJF-3A	.05000	.0075	.0090
-16	11/2-20	.5000-20 UNJF-3A	.05000	.0075	.0090
-18	9/16-18	.5625-18 UNJF-3A	.05556	.0083	.0100
-20	5/8-18	.6250-18 UNJF-3A	.05556	.0083	.0100
-24	3/4-16	.7500-16 UNJF-3A	.06250	.0094	.0113
-28	7/8-14	.8750-14 UNJF-3A	.07143	.0107	.0129
-32	1-12	1.0000-12 UNJF-3A	.08333	.0125	.0150



EXAMPLE: HST756–14–14

MAX GRIP	.875
"C"	+.108
CUP A	−.355
CUP B	−.352
SHIM	.276

FIGURE 3. TENSION AND TENSION-TENSION FATIGUE FIXTURE

TABLE VI. TEST METHODS

For Both Qualification Requirements and Production Lot Inspection
Sampling for Qualification Tests, See Table III
Sampling for Production Lot Inspection, See Table IV

Type	Procedure	Qualification Acceptance	Inspection Lot Acceptance
Tensile Strength	Notes (a) (c)	Note (e)	Per Table XI where the test value must equal or exceed the values of applicable drawing. Note (e)
Shear Strength	Note (d)	Note (e)	
Tension-Tension Fatigue Strength	Note (b) (c)	Note (f)	Note (f)
Hardness	Note (g)	Table II	Table II
Head Ductility	Note (h)	Note (h)	Note (h)

Notes:

(a) Tension test shall be performed per NASM1312-8 except as noted.

Pins subjected to tensile test shall be installed and fully assembled in tension fixtures meeting the requirements of Figure 3. When testing countersunk head pins, an alternate tension cup must be used which provides a countersunk seat for the pin head. Loading rates shall not exceed 100,000 lbs. per minute. This test is not applicable on production lots of pins having a grip less than two times the nominal diameter.

The inspection record shall contain the actual values for the tensile tests and shall record the location on the fasteners where the break occurred for each test specimen.

(b) Fatigue tests shall be performed per NASM1312-11 except as noted.

Fasteners subjected to fatigue test shall be installed in a test fixture meeting the requirements of Figure 3. The test loads shall be applied at 500 to 18,000 cycles per minute at room temperature. This test is not applicable to pins having a grip less than two diameters.

High load and low load (in pounds) shall be per Table XII, or as specified on applicable drawing.

(c) Tension and tension-tension fatigue test methods.

To ensure that Hi-Lok/Hi-Tigue and Hi-Lok pins are in maximum grip for the static axial tension and tension-tension fatigue tests, one of the following methods of assembly shall be used.

All tension head pins shall be tested using Method “A” and all shear head pins shall be tested using either Method “A” or Method “B”.

If anything other than head failure occurs when testing shear head pins via Method "B", in either the static axial tension or tension-tension fatigue test, then all tests shall be deemed invalid and rerun using Method "A".

Method "A" is the more precise method and shall be the referee method in the event of any dispute.

Method "A"

Firstly determine the distance to the first loaded thread by adding the maximum grip length of the pin, which is given in sixteenths of an inch, to an allowance "C" which represents the counterbore depth of a mating nut or collar. Table XVI gives the allowance "C" for each pin diameter.

The cup separation required shall then be determined by deducting the bearing section thickness of both test cups from the distance to the first loaded thread. This calculated separation shall then be set to a tolerance of +.000" to -.004" with slip gauges or precision ground spacers to ensure the correct position of the first loaded thread is achieved. The pin shall be assembled in the cups using an internally threaded fixture or non-counterbored free running nut.

An illustration of this test configuration is given in Figure 3.

Method "B"

The pin shall be assembled in the test cups using an internally threaded fixture or a non-counterbored free running nut. The fixture or nut shall be threaded onto the pin and rotated until it touches the Hi-Lok/Hi-Tigue or Hi-Lok transition area. No torque greater than that necessary to overcome frictional resistance shall be applied to the internally threaded fixture or free running nut during assembly. The fixture or nut shall then be turned counterclockwise 720° ± 20° to achieve the correct position of the first loaded thread prior to testing.

(d) Shear tests shall be performed per NASM1312-13 except as noted.

Pins subjected to shear test may be installed in a double shear test fixture meeting the requirements of NASM1312-13 with sharp blades. When testing pins having other than a protruding head configuration, the bearing surface of the head shall not contact the shear fixture. Loading rates shall not exceed 100,000 lbs. per minute. This test is not applicable on production lots of flush head pins having a grip less than two and one-half times the nominal diameter and on production lots of protruding head pins having a grip less than two times the nominal diameter excluding the fillet radius and shank-to-thread transition area.

(e) Acceptance

1) Qualification for both tensile and shear shall require that $\overline{X}$-1.45 (S) $\geq$ M.

Definition of Terms:

M	Minimum tensile or shear value per drawing
X	Individual value in sample
$\overline{X}$	Average of X values
$\sum X^2$	Sum of squares of X values
$(\sum X)^2$	Square of sum of X values
N	Number of parts in sample (7 for qualification)
S	Best estimate of standard deviation = $\sqrt{\frac{N\sum X^2-(\sum X)^2}{N(N-1)}}$
1.45	K factor for qualification sample size of seven (7) specimens
$\geq$	is equal to or greater than
$\sqrt{}$	Square root of

2) Production Lot: When no maximum load is specified, test may be discontinued at five (5) percent over specified minimum load.

If any one sample exhibits an ultimate load less than five (5) percent over specified minimum, then all pins in the sample shall be tested to ultimate.

If all samples meet the five (5) percent over specified minimum requirement, report lot acceptance shear and tensile test as “proof load” and specify the proof load value.

(f) The fatigue life shall exceed the number of cycles indicated.

Material	Average All Samples	Minimum Individual Sample	Continue Test to Not Over	Calculate Average on Failure or
Alloy Steel, PH13-8Mo, MP35N, H-11, Inco 718	65,000	45,000	130,000	130,000 Max
Titanium, 431Steel	30,000	15,000	60,000	60,000 Max.

(g) The pins shall be tested for Rockwell hardness on a smooth, flat, prepared surface. The tests shall be performed after heat treatment but prior to plating. For pins with threads rolled after heat treatment, the hardness shall be performed prior to thread rolling.

(h) Ductility in the head of pin shall be determined as follows (not required on ½ diameter and larger:)

Flush Heads

Flush head pins shall be installed in fixtures capable of supporting compression loads (see Figure 7). The upper surface of the fixture shall be of satisfactory contour to allow complete seating of the pin head. Shank clearance shall be 0.001" to 0.003". The fixture shall be of such a design as to insure the shank/threaded portion of the pins shall not contact any surface that can react to compression loads applied to it. The load stud contacting the pin head shall be flat. The stud diameter shall approximate but not exceed the diameter of the pins being tested. Apply a compressive load to the pin head until failure occurs. When testing the dome configuration, the dome may be removed prior to testing.

Head Ductility: Disks formed by pin heads axially sheared shall exhibit the following characteristics:

- The peripheral shape of the head shall remain essentially unchanged with slight deformation of the outer edge being permissible.

- The void created by the axial shearing shall exhibit a basically concentric internal diameter approximately the same size as the fastener shank. One fracture surface extending from the inside diameter to the outside diameter is permissible.

The following characteristic is not considered permissible:

- Failure of the sheared disk in a manner that results in a multi-piece fracture.

Protruding Heads

Protruding head pins shall be installed in fixtures capable of supporting compression loads (see Figure 8). The bore of the fixture shall provide 0.001" to 0.003" clearance for the shank of the pin and be relieved to clear the fillet radius of the pin. The surface contacting the bearing surface of the head of the pin shall have a 3° slope. The pin shall be inserted in the sloped surface fixture and a compressive force equal to two times the minimum rated tensile strength of the fastener shall be applied to the head of the pin. The compressive force shall be released and the pin removed from the fixture. Any plating or coating shall be removed prior to examination.

Tested pins shall show no evidence of cracks when examined at a magnification of 10X.

TABLE VII. METALLURGICAL TESTS

Metallurgical Characteristics	Procedure		Sampling Criteria
	Inco 718, Titanium, A-286, PH13-8Mo, Aluminum, MP35N, Waspaloy	**Alloy Steel, 431 Steel, H-11 Steel**	
Discontinuities	Fluorescent penetrant inspect per ASTM E 1417, Type I, Method B or D, with sensitivity level 2 or greater. Marking of individual Parts is not required. Micro examination of 50X to 100X	Magnetic Inspection per ASTM E1444. Marking of individual parts is not required. Micro examination at 50X to 100X.	As specified per ANSI/ASQC. Z1.4, 0.040 AQL Indications shall be evaluated by metallurgical examination. Accept per Table VIII. As specified by Table XI and its notes.
Microstructure	Micro examination at 100X	Micro examination at 100X	Sampling per Table XI. Acceptance per Table VIII. Microstructure shall be free from alloy segregation, which adversely affects the mechanical or physical properties of the part. Bursts and voids are unacceptable. Titanium microstructure shall be uniform and representative of Alph-Beta processed material consisting essentially of equiaxed primary Alpha grains in a matrix essentially of transformed Beta. A 100% transformed Beta microstructure as evidenced by outlines of equiaxed prior all-Beta grains with no primary Alpha is considered overheated and is unacceptable. Slight overheating on the non-bearing surface of the head is permissible provided the depth does not exceed .003 inch.

TABLE VII. METALLURGICAL TEST (Continued)

Metallurgical Characteristics	Procedure		Sampling Criteria
	Inco 718, Titanium, A-286, PH13-8Mo, Aluminum, MP35N, Waspaloy	**Alloy Steel, 431 Steel, H-11 Steel**	
Grain Flow – Head	Macro examination at 10X.	Macro examination at 10X.	Sampling per Table XI. Grain flow lines may be broken by finish machining or grinding. Metallurgical Examination: Any metallurgical condition which adversely affects mechanical properties of the part is unacceptable.
Grain Flow – Thread	Micro examination at 50X	Micro examination at 50X	Sampling per Table XI. Threads shall be continuous and shall follow the general thread contour with the maximum density at the bottom of the root radius.
Decarburization and Carburization	Not Applicable	Micro examination along longitudinal section per Figure 5, at 100X. A micro hardness traverse shall be taken on all questionable samples. Readings at .003 inch shall convert to the same Rockwell "C" range as that of the core within limits of Table II.	Sampling per Table XI. Acceptance per Table VIII and Table II.
Cold Worked Fillet	Micro examination at 50X on short pins. Tension-tension fatigue test on long pins (not aluminum)	Micro examination at 50X on short pins. Tension-tension fatigue test on long pins.	Sampling per Table XI. Fillet shall show evidence of cold work.
Surface Contamination	Micro examination at 250X to 500X	Not Applicable	Sampling per Table XI. Acceptable per Table VIII.

TABLE VII. METALLURGICAL TESTS (CONTINUED)

Metallurgical Characteristics	Procedure		Sampling Criteria
	Inco 718, Titanium, A-286, PH13-8Mo, Aluminum, MP35N, Waspaloy	**Alloy Steel, 431 Steel, H-11 Steel**	
Hydrogen Content	Remove material from head-to-shank fillet area (titanium only).	Not Applicable	Sampling: One part per inspection lot. Acceptance per specification in Table II.
Embrittlement	Not Applicable	Electro-cadmium plated 180 ksi tension alloy steel, 108 ksi shear alloy steel, 431 Steel, H-11 Steel. NASM1312 Test 5. See Note 1.	Sampling per Table III or Table IV. Acceptance per NASM1312, Test 5, and Note 1.
Grinding Burns	All Materials, H-11 per NASM8907		Sampling per Table XI. Acceptance: H-11: No indication of grind burns per NASM8907. Other Materials: Grinding burns are not permitted on shank, head-to-shank fillet or the bearing surface of the head, except titanium fasteners may have partial plus full microstructure change to a depth not to exceed .003 on bearing surface of head only, exclusive of fillet.
Intergranular Corrosion	Aluminum only: Per ASTM G110	Not Applicable	Sampling per Table XI. Local intergranular corrosion shall not exceed .012 inch depth, and general intergranular corrosion shall not exceed .008 inch depth.

Note 1. Parts shall pass a 72-hour stress durability test per NASM1312, Test 5, with the load 85% of the rated ultimate tensile strength of the pin. The method shall maintain the required load for the 72-hour test.

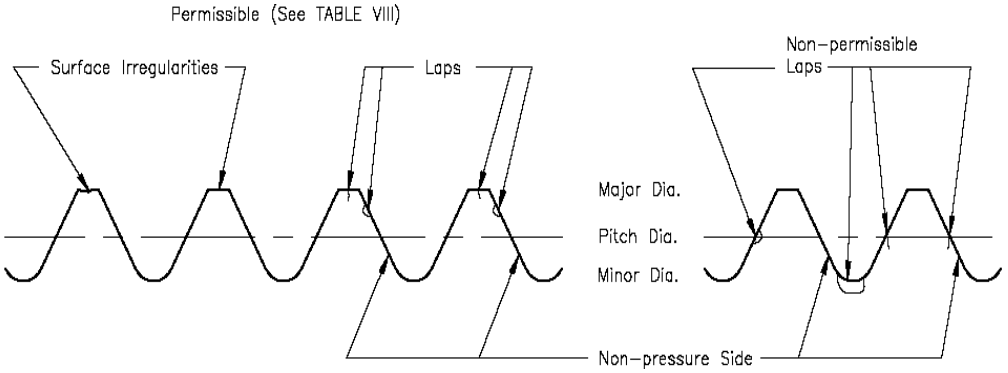
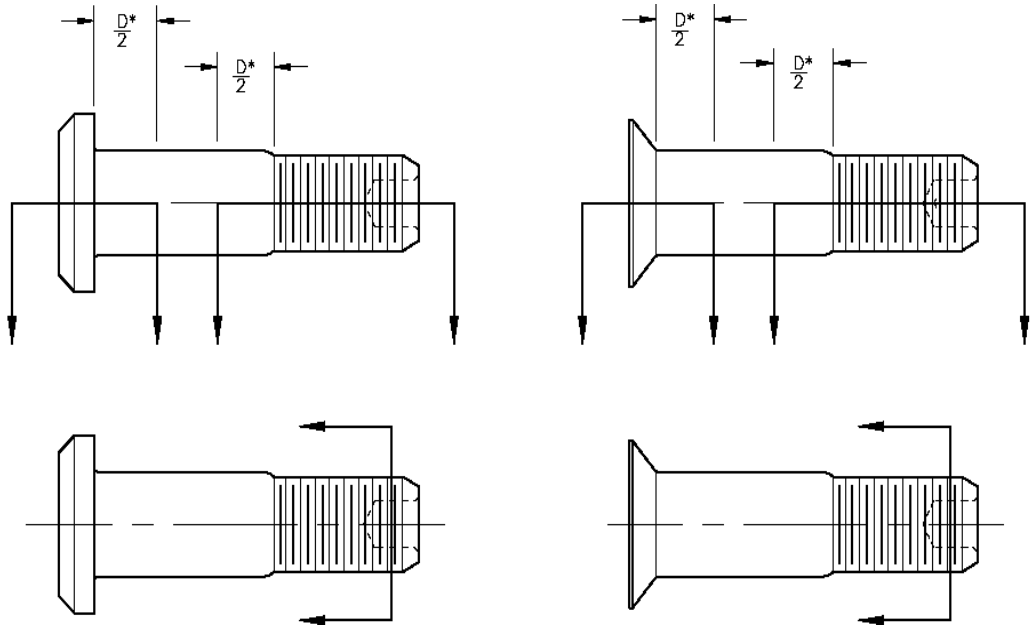


FIGURE 4. LAPS AND SURFACE IRREGULARITIES IN FULL FORM THREADS



*Minimum Dimension

Pins shall be sectioned as shown by section arrows and subjected to micro and macro examination. Micro or macro examination shall be at magnification as specified in Table VII. Section at hex-broach shall be at 90º as indicated to detect the presence of cracks at the hex corners. Pins shall be examined for internal and surface defects to the limits of Table VIII.

FIGURE 5. METALLURGICAL SPECIMENS

TABLE VIII. DISCONTINUITIES (a) – DECARBURIZATION – SURFACE CONTAMINATION

Location	Permissible Conditions	Maximum Depth Normal to Surface (Inches) Nominal Size or Diameter of Fastener						Surface Contamination All Sizes
		5/32, 3/16	1/4	5/16	3/8	7/16	1/2 & Over	
Head-to-Shank Fillet Root of Bolt Threads	No Rateable Discontinuities	.0005						None
Pin Thread Locations per Figure 4	Laps and Surface Defects	.005	.005	.005	.005	.007	.008	None
Transition from Thread Runout to Hi-Tigue Feature	Laps and Foldbacks	.005						None
Hi-Tigue Feature	No Rateable Discontinuities	.0005						None
Grip or Shank Diameter	Seams-Not Extending into Head-to-Shank Fillet or Threads	.005	.005	.005	.006	.007	.008	None
Non-Bearing Surfaces of Head	Laps, Seams, Nicks or Gouges	.010	.010	.010	.012	.014	.016	.003
Any Location Except Head-to-Shank Fillet or Root of the Threads	Inclusions Not Indicative of Unsatisfactory Quality	Not Applicable						Not Applicable
Hex Socket	No Cracks	None						Not Applicable
Decarburization	Complete Plus Partial Decarburization	.003						Not Applicable

Note: (a) See Table I – Non-Rateable Discontinuities

TABLE IX. SAMPLE FOR HARDNESS TESTING

Lot Size	Sample Size			Acceptance No.	Rejection No.
	Normal	Tightened	Reduced		
150 & Under	5	8	2	0	1
151 to 500	8	13	3	0	1
501 to 3,200	13	20	5	0	1
3,201 to 35,000	20	32	8	0	1
35,001 & Over	32	50	13	0	1

TABLE X. STRAIGHTNESS OF SHANK

First Dash No.	Nominal Diameter	Within Values FIR per Inch of
-5	5/32	.0040
-6	3/16	.0040
-8	1/4	.0030
-10	5/6	.0030
-12	3/8	.0025
-14	7/16	.0025
-16 & Over	1/2 & Over	.0020

TABLE XI. SAMPLING FOR DESTRUCTIVE, TENSILE, SHEAR, FATIGUE, METALLURGICAL PROPERTIES, AND HEX SOCKET DISCONTINUITIES (a)

Lot Size	Sample Size For Each Test	Acceptance No.	Rejection No.
Under 500	2	0	1
500 – 2,499	4	0	1
2,500 to 9,999	5	0	1
10,000 to 49,999	10	0	1
50,000 to 99,999	15	0	1
100,000 & Over	27	1	2

(a) Hex socket discontinuities are examined by radial section per Figure 6.

TABLE XII. TENSION-TENSION FATIGUE LOADING, POUNDS (2)

(High Load is Given, Low Load is 10% of High Load)

Diameter Dash No.	Nominal Diameter	MATERIAL					
		6-4 Titanium		Alloy Steel 180 ksi Tension	Inco 718 125 ksi Shear		431 Steel
		Shear Head	Tension Head	Tension Head	Shear Head	Tension Head	Tension Head
-5	5/32	515	715	800	650	650	880
-6	3/16	800	1,050	1,200	970	1,560	1,300
-8	1/4	1,250	1,950	2,200	1,750	2,800	2,300
-10	5/16	1,920	3,140	3,500	2,750	4,420	3,700
-12	3/8	3,000	4,850	5,400	4,000	6,840	5,700
-14	7/16	4,000	6,540	7,400	5,300	9,270	7,700
-16	1/2	5,450	8,900	10,000	7,000	12,300	10,200
-18	9/16	6,900	11,300	12,400	8,900	15,700	13,000
-20	5/8	8,800	14,400	15,700	11,200	19,600	16,300
-24	3/4	12,800	21,000	22,800	14,900	28,500	23,600
-28	7/8	17,500	28,800	31,600	TBD	TBD	35,000
-32	1	22,800	37,600	41,000	TBD	TBD	42,700

Notes: (1) Flush sealing head pins shall be tested at loads for shear head pins.
(2) Loads shown on applicable drawings supersede values shown.

TABLE XII. TENSION-TENSION FATIGUE LOADING, POUNDS (Continued) (2)

(High Load is Given, Low Load is 10% of High Load)

Diameter Dash No.	Nominal Diameter	MATERIAL							
		PH13-8Mo 115 ksi shear	PH13-8Mo 125 ksi Shear			Inco 718 108 ksi Shear		MP35N	
		Shear Head	Reduced Shear Head	Shear Head	Tension Head	Shear Head	Tension Head	Shear Head	Tension Head
-5	5/32	650	515	650	650	550	800	765	1,560
-6	3/16	890	600	970	1,560	630	1,200	1,150	2,080
-8	1/4	1,610	1,170	1,750	2,800	1,170	2,200	2,000	3,900
-10	5/16	2,530	1,890	2,750	4,420	1,890	3,500	3,150	6,110
-12	3/8	3,680	2,900	4,000	6,840	2,900	5,400	4,050	9,360
-14	7/16	TBD	3,910	5,300	9,270	3,910	7,400	6,300	12,350
-16	1/2	TBD	5,310	7,000	12,300	5,310	10,000	8,100	16,640
-18	9/16	TBD	TBD	8,900	15,700	6,716	TBD	TBD	TBD
-20	5/8	TBD	TBD	10,800	19,600	8,520	TBD	10,800	25,480
-24	3/4	TBD	TBD	14,900	28,500	TBD	TBD	17,775	36,920
-28	7/8	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
-32	1	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Notes: (1) Flush sealing head pins shall be tested at loads for shear head pins.
(2) Loads shown on applicable drawings supersede values shown.

TABLE XII. TENSION-TENSION FATIGUE LOADING, POUNDS (Continued) (2)

(High Load is Given, Low Load is 10% of High Load)

Diameter Dash No.	Nominal Diameter	MATERIAL: H-11 Steel Alloy				6-6-2 Titanium 108 ksi Shear (180 ksi Tension)	
		Shear Head	210 ksi Tension Head	220 ksi Tension Head	260 ksi Tension Head	Shear Head	Tension Head
-5	5/32	435	435	435	--	700	800
-6	3/16	630	1,520	1,590	1,810	1,000	1,200
-8	1/4	1,170	2,810	2,950	3,350	1,400	2,200
-10	5/16	1,890	4,540	4,760	5,410	2,200	3,500
-12	3/8	2,900	6,960	7,300	8,290	3,400	5,400
-14	7/16	3,910	9,390	9,840	11,180	4,500	7,400
-16	1/2	5,310	12,760	13,370	15,190	6,100	10,000
-18	9/16	6,716	16,120	16,890	19,190	TBD	TBD
-20	5/8	8,520	20,450	21,430	24,350	TBD	TBD
-24	3/4	12,480	29,950	31,370	38,650	TBD	TBD
-28	7/8	17,060	40,940	42,890	48,740	TBD	TBD
-32	1	22,160	53,180	55,700	63,310	TBD	TBD

Notes: (1) Flush sealing head pins shall be tested at loads for shear head pins.
(2) Loads shown on applicable drawings supersede values shown.

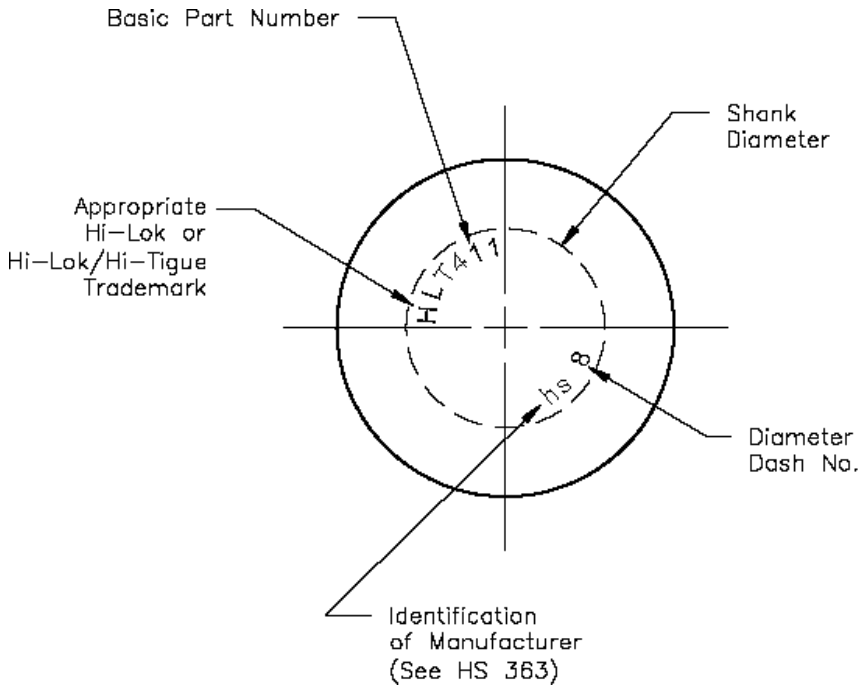


FIGURE 6. PART MARKING

Indented head marking shall be legible at 5X magnification or less and have a maximum depth of .010 inch. The indented marking shall be within the projected area of the shank diameter except for –5 and –6 pins. The indented marking for –5 and –6 may extend beyond the projected area of the shank diameter to a distance half way to the outer diameter of the flat surface of the top of the head.

TABLE XIII. LENGTH OF THREAD RUNOUT

Pin Type	Size		
	Standard	1/64 Oversize	1/32 Oversize
Hi-Lok	2.0 Pitch	2.5 Pitch	3.0 Pitch
Bead Type Hi-Tigue (Spec. 20 or 24)	2.5 Pitch	3.0 Pitch	3.5 Pitch
Special Hi-Tigue (Spec. 23)	2.5 Pitch	3.0 Pitch	3.5 Pitch
Hi-Tigue Feature Beyond Grip (Spec. 26)	2.5 Pitch Plus "K" (Note 1)	2.0 Pitch Plus "K" (Note 1)	3.5 Pitch Plus "K" (Note 1)
Note 1: "K" is a dimensional factor depending on the pin diameter and the Hi-Tigue radius.			

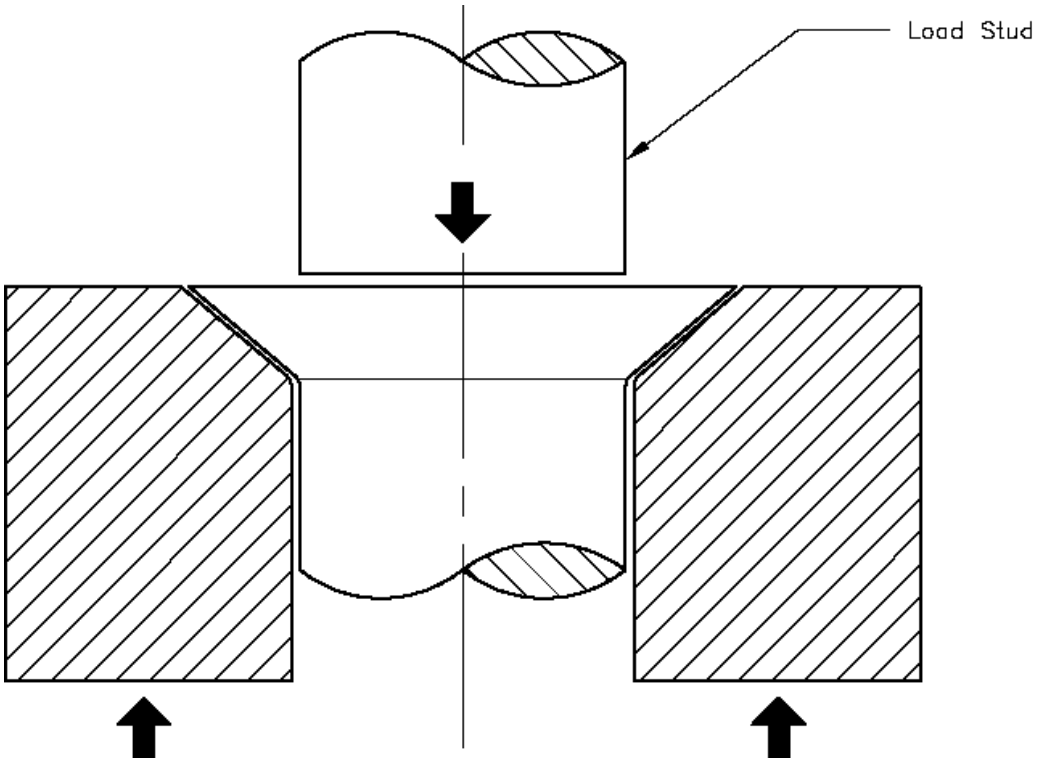


FIGURE 7. FLUSH HEAD DUCTILITY FIXTURE

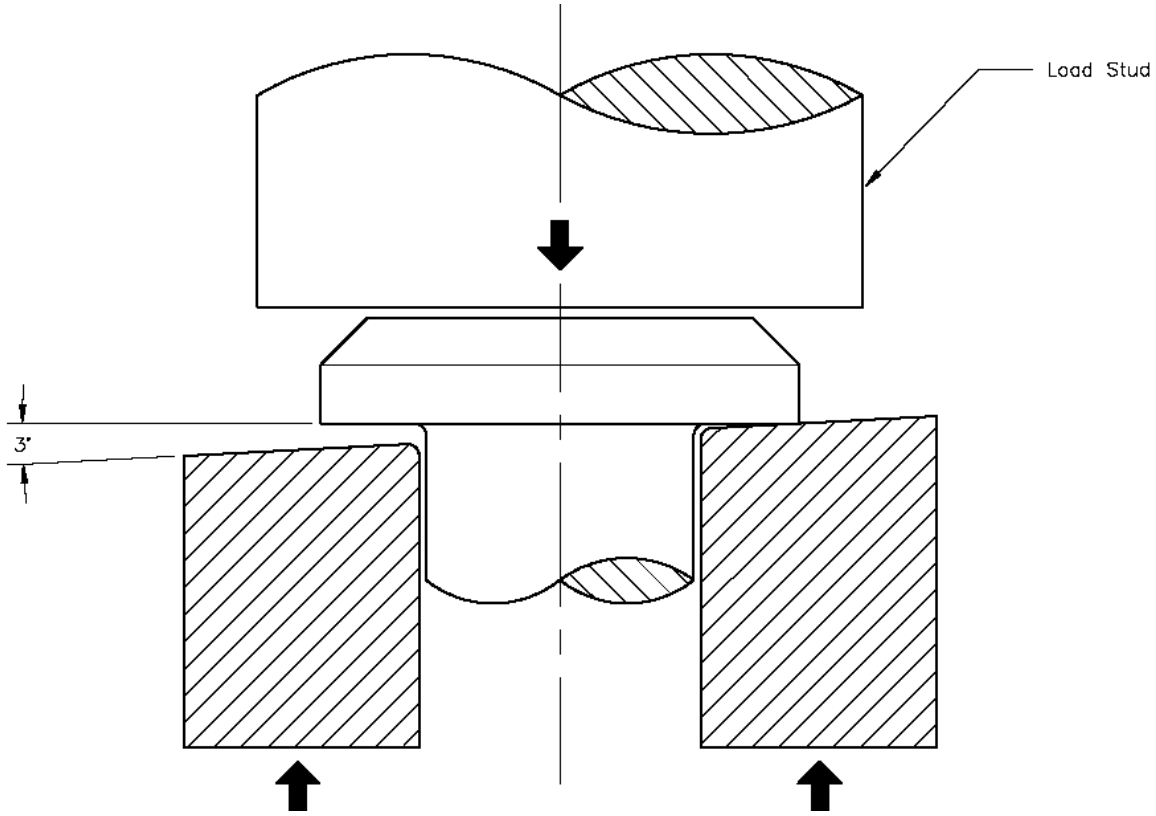


FIGURE 8. PROTRUDING HEAD DUCTILITY FIXTURE

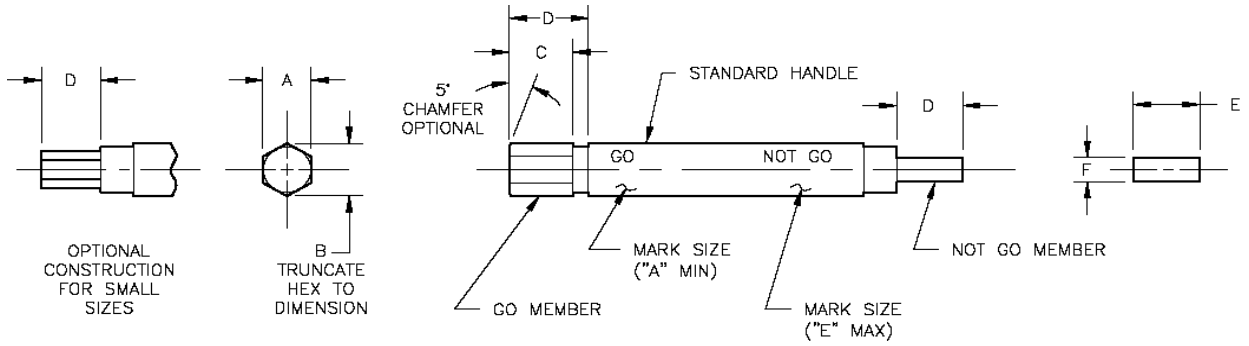


FIGURE 9. HEXAGON SOCKET GAGE DETAILS

Note: Gaging elements to be made from gage steel, hardened and tempered to a hardness of Rockwell C60 minimum. They shall be thermally stabilized and given suitable surface treatment to obtain maximum abrasion resistance. Surface texture of across the flat gaging element Ra 8 maximum per ASNI B46.1.

TABLE XIV. GAGE DIMENSIONS

Size Dash No.	A		B		C	D	E		F	
	Width Across Flats		Width Across Truncated Corners		Go Gage Length	Usable Gage Length	Not-Go Gage Width		Not-Go Gage Thickness	
	Max.	Min.	Max.	Min.	Min.	Min.	Max.	Min.	Max.	Min.
5	.0637	.0635	.0724	.0722	.115	.115	.0646	.0645	.032	.030
5	.0793	.0791	.0905	.0903	.115	.115	.0802	.0801	.041	.039
6	.0793	.0791	.0905	.0903	.115	.115	.0807	.0806	.042	.040
7	.0793	.0791	.0905	.0903	.115	.115	.0807	.0806	.042	.040
8	.0949	.0947	.1085	.1083	.125	.130	.0968	.0967	.050	.048
10	.1272	.1270	.1458	.1456	.126	.150	.1296	.1295	.066	.064
12	.1584	.1582	.1817	.1815	.180	.180	.1618	.1617	.083	.081
14	.1897	.1895	.2178	.2176	.210	.210	.1931	.1930	.099	.097
16	.2209	.2207	.2533	.2531	.240	.240	.2243	.2242	.116	.114
18	.2522	.2520	.2895	.2892	.250	.270	.2556	.2555	.132	.130
20	.2522	.2520	.2895	.2892	.250	.305	.2556	.2555	.132	.130
24	.3152	.3150	.3621	.3618	.250	.365	.3186	.3185	.164	.162
28	.3782	.3780	.4348	.4345	.250	.426	.3821	.3820	.197	.195
32	.5042	.5040	.5802	.5799	.250	.550	.5101	.5100	.263	.261

TABLE XV. KEY DIMENSIONS AND TORSIONAL MOMENTS

Nominal Size Hex Socket	Hex Key, Dimensions Across Flats, Inches		Hex Key, Dimensions Across Corners Inches	Torsional Moment Applied for Test, Inch-Pounds	
	Max	Min	Min	All Materials Except Aluminum	Aluminum Only
.0625	.0625	.0615	.0685	10	7
.0781	.0781	.0771	.0864	18	11
.0937	.0937	.0927	.1045	30	22
.1250	.1250	.1235	.1395	70	45
.1562	.1562	.1547	.1755	80	60
.1875	.1875	.1860	.2115	150	---
.2187	.2187	.2172	.2470	210	---
.2500	.2500	.2485	.2820	275	---
.3125	.3125	.3110	.3545	460	---
.3750	.3750	.3735	.4250	610	---
.5000	.5000	.4975	.5655	760	---
.5625	.5625	.5610	.6377	1,100	---

FUNCTIONAL INSPECTION OF HEX SOCKET

The following inspection methods provide verification of the torsional capability of the hex socket for drivability.

1. The hex shall conform to the dimensional requirements specified in Table XV.

2. The torsional capability of the hex socket is tested by securely holding the pin in a vise or fixture. The hex key is mounted to a calibrated torque wrench. The hex socket shall withstand the torsional moment specified in Table XV without failure. Care should be exercised to ensure that only torsion and no bending is applied to the hex key.

TABLE XVI

TENSION AND TENSION-TENSION FATIGUE COUNTERBORE ALLOWANCE

DASH NO.	PIN NOM DIA.	"C"
-5	5/32	.102
-6	3/16	.102
-8	1/4	.107
-10	5/16	.117
-12	3/8	.117
-14	7/16	.132
-16	1/2	.132
-18	9/16	.140
-20	5/8	.140
-24	3/4	.151
-28	7/8	.164
-32	1	.181

TABLE XVII. ATTRIBUTE SAMPLING FOR VISUAL AND COMPARATOR MEASUREMENTS

Sampling Plan for Visual Examination	Lot Size	Under 91	91-280	281-500	Over 500
	Sample Size	8	32	50	80
	Equal Risk Point (Reference)	8.6 percent	5.0 percent	5.2 percent	4.5 percent
	Acceptance No.	0	1	2	3
Sampling Plan for Comparator Measurement	Lot Size	Under 16	16-1000	1001-3000	Over 3000
	Sample Size	3	5	10	15
	Equal Risk Point (Reference)	24.5 percent	13.0 percent	6.7 percent	4.5 percent
	Acceptance No.	0	0	0	0