PROCUREMENT SPECIFICATION
CHERRYMAX® PLUS
RIVET, BLIND, ALUMINUM SLEEVE, MECHANICALLY LOCKED SPINDLE, BULBED

Authorizing Signature is on FILE

APPROVED: _____
DIRECTOR OF PRODUCT ENGINEERING

TABLE OF CONTENTS

1.0 SCOPE

1.1. Scope - The specification establishes the requirements for procurement of self-plugging blind rivets with a visual mechanically locked spindle. These blind rivets are intended for use in aircraft structural or similar applications in both thick and thin sheets. The bulbed blind head configuration makes these blind rivets especially well suited for thin sheet or double dimple applications.

1.2. Styles, Classes and Codes - Rivets are furnished in the following styles, classes and codes.

Style 'A' Nominal Shank Diameter

Class 1 - Protruding Head Rivets (MS20470)
Code B - 5056 Aluminum Alloy Sleeve - Alloy Steel Stem
Code E - 5056 Aluminum Alloy Sleeve - CRES Stem

Class 2 - 100° Flush Head (MS20426)
Code B - 5056 Aluminum Alloy Sleeve - Alloy Steel Stem
Code E - 5056 Aluminum Alloy Sleeve - CRES Stem

Class 3 - 100° Flush Shear Head (NAS1097)
Code B - 5056 Aluminum Alloy Sleeve - Alloy Steel Stem
Code E - 5056 Aluminum Alloy Sleeve - CRES Stem

Style 'B' 1/64" Oversize Shank Diameter

Class 1 Protruding Head Rivets (MS20470)
Code B - 5056 Aluminum Alloy Sleeve - Alloy Steel Stem
Code E - 5056 Aluminum Alloy Sleeve - CRES Stem

Class 2 - 100° Flush Head (MS20426)
Code B - 5056 Aluminum Alloy Sleeve - Alloy Steel Stem
Code E - 5056 Aluminum Alloy Sleeve - CRES Stem

Class 4 Flanged Dome Head
Code B - 5056 Aluminum Alloy Sleeve - Alloy Steel Stem
Code E - 5056 Aluminum Alloy Sleeve - CRES Stem

2.0 APPLICABLE DOCUMENTS

2.1. Publications - The following publications of the issue in effect on date of invitation for bids shall form a part of this specification to the extent specified herein.

2.1.1. Federal Specifications

QQ-P-416 Plating, Cadmium (Electro-Deposited)

(Copies of Federal Specifications and the Federal Specifications Index may be obtained upon application, accompanied by money order, coupon or cash, to the Superintendent of Documents, Government printing office, Washington, DC. 20402. The price of Federal Specifications may be obtained from the Federal Specification Index of the Superintendent of Documents.)

2.1.2. Military Specifications

AMS-H-6088	Heat treatment of aluminum alloys, process for
MIL-R-85188	Riveter, power, pneumatic-hydraulic
AMS-H-6875	Heat treatment of steels, process for

(Copies of Military Specifications may be obtained upon application to the Commander, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; or to the Commanding Officer, U.S. Naval Air Development Station, Johnsville, Pennsylvania. The price may be obtained from the Index of Military Aeronautical (AN or MIL) Standards or upon applications to either of the above agencies and payments shall be made by check or money order, payable to the Superintendent of Documents or to the Treasurer of the United States.)

2.1.3. Standards

Federal

MS33522	Federal Test Method Standard # 151

Military

ANSI/ASQC Z1.4	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
NASM1312	Fastener Test Methods

3.0 REQUIREMENTS

3.1. Qualification - The rivet furnished under this specification shall be a product, which has been tested and has passed the qualification tests specified herein. The rivet manufacturer is responsible for conducting the tests of this specification. Results of these tests shall be submitted upon application for qualification.

3.2. Materials - The materials used in the manufacture of the blind rivets shall be as specified on the applicable product standards pages.

3.3. Design and construction

3.3.1. Construction - The blind rivet is of multiple piece construction, must be an integral assembly and shall include a means, other than friction or the use of adhesives, of mechanically locking the spindle to the blind rivet sleeve. The blind rivet assembly shall consist principally of a blind rivet sleeve and spindle plus any other elements required with a visible metallic locking element to lock the spindle to the blind rivet sleeve and a disposable driving anvil.

This metallic locking element must be visibly dimensionally inspectable for flushness after installation (See 3.3.6). The 1/8, 5/32 and 3/16 diameter blind rivets produced to this specification must be capable of being installed using tooling manufactured to the requirements of MIL-R-85188.

3.3.2. Installation - Installation tests shall be conducted as specified in Paragraph 4.4.6. Installation is to be accomplished with a tool conforming to MIL-R-85188. The installation tool shall be capable of installing the blind rivet and mechanically locking the spindle to the blind rivet sleeve. The excess portion of the blind rivet spindle shall be separated during the installation operation.

3.3.3. Spindle retention - When tested as specified in Paragraph 4.4.7, the installed blind rivet spindle shall withstand the axial pushout load values specified in Table IX. The spindle of an uninstalled blind rivet shall be capable of withstanding the axial pushout loads specified in Table X.

3.3.4. Dimensions - Blind rivets shall conform dimensionally to the applicable product standards pages.

3.3.5. Eccentricity of heads - The periphery of the blind rivet manufactured head shall measure within the limits specified in Table V when tested as specified in Paragraph 4.4.2.

3.3.6. Installed Flushness - The installed spindle and locking element shall be flush within the limits shown in Figure 1. This means of visual inspection is provided to show that the rivet is properly installed.

3.3.7. Finish - The blind rivet shall be finished in accordance with the applicable product standards pages.

3.3.8. Heat Treatment - Heat treatment of 5056 aluminum components shall be as required to meet the performance requirements of this specification. Heat treatment of 8740 alloy steel components shall be per AMS-H-6875.

3.3.9. Shear strength - The single shear strength of the blind rivet shall be not less than the value specified in Table VI when tested in accordance with Paragraph 4.4.3.

3.3.10. Tensile strength - The tensile strength of the driven blind rivet shall be not less than the value listed in Table VII when tested in accordance with Paragraph 4.4.4.

3.3.11. Thin sheet pull-through - The blind rivet shall exhibit not less than the minimum pull-through strength value specified in Table VIII when tested as specified in Paragraph 4.4.5

3.3.12. Sheet take-up - The blind rivet shall be capable of closing the respective gap indicated in Table XI when the total stack of thickness (not including gap) is equal to the prescribed maximum grip for the blind rivet tested. The force resisting closure of the gap shall not be less than that specified in Table XI, when tested per Paragraph 4.4.8.

3.3.13. Lubrication - Lubrication as necessary to assure proper function of the blind rivet is permissible. The lubricant used shall pass the lubricant tests as specified in Paragraph 4.4.9 (qualification only). Cadmium shall not be used for a lubricant unless specified as a finish on the applicable standards pages. Lubricants used shall be stable and not subject to deterioration under normal handling and storage conditions not to exceed 150°F.

3.3.14. Workmanship - The blind rivet shall be of uniform quality and shall be finished in a workmanlike manner in accordance with high-grade aircraft manufacturing practice. Discontinuities such as seams and clinch or die marks are permitted within the limits specified in Table IV provided they do not affect other requirements of this specification. Rivets shall be free from fins and other defects, which could cause an injury to the operator.

3.3.15. Head marking - The rivet shall be marked in accordance with the applicable standards pages.

3.3.16. Shank Expansion. The rivet shall be capable of passing the expansion test specified in 4.4.10

3.3.17. Fatigue Strength. The rivet shall be capable of passing the fatigue test specified in 4.4.11.

4.0 QUALITY ASSURANCE PROVISIONS

4.1. Classification of tests - The inspection and testing of blind rivets shall be classified as follows:

(A) Qualification Tests (See 4.2)
(B) Acceptance Tests (See 4.3)

4.2. Qualification tests - Qualification tests are those tests performed on samples submitted for qualification. These samples must be manufactured on production equipment using the same methods as intended for production. Qualification of any one head style constitutes qualification of the remaining head styles except that shear and tension testing is required for all head styles.

4.2.1. Sampling instructions - Qualification test samples shall be selected in accordance with Table I and Ia. Samples shall be packaged in accordance with the requirements of Section 5 and plainly identified by securely attached labels or tags marked with the following information:

Rivet part number
Sample for qualification test
Rivets, blind, self-pligging, mechanically locked solid spindle, bulbed
Specification: PS-CMR-3003
Code: (Material)
Class: (Flush or protruding head)
Grip Length:
Diameter:
Manufactured by: (Name and symbol)
Submitted by: (Name)

4.2.2. Tests - The qualification tests of blind rivets shall consist of all the tests of this specification as described under "Test Methods" (See 4.4) and as specified in Table I.

4.3. Acceptance tests - Acceptance tests consist of all tests specified in Table III that must be applied to all lots by the manufacturer.

4.3.1. Sampling instructions - Acceptance tests shall consist of Sampling Plan A, Sampling Plan B, Sampling Plan C and Sampling Plan D tests. Reduced Sampling Plan may be installed after ten (10) consecutive lots of the same part number have passed the acceptance criteria in accordance with ANSI/ASQC Z1.4.

4.3.2. Lot - A lot shall consist of finished blind rivets which are of the same code, class, grip and diameter, fabricated by the same process, heat treated in the same manner and produced as one continuous run or order, or part thereof. No one lot of assemblies shall be comprised of more than one lot each of stems, sleeves, lockrings, driving anvils or shear rings.

4.3.2.1. A lot of component members of blind rivets (such as sleeves or spindles) shall consist of those components which are of the same code, class, grip and diameter, fabricated by the same processes, heat treated in the same manner and produced as one continuous run, or order, from the same heat of raw material or part thereof. Dimensional inspection already performed on component members need not be repeated after assembly of finished blind rivets submitted as inspection lot. Lot control is required for all components, excluding driving anvils.

4.3.3. Sampling Plan A Tests - Samples shall be selected at random in accordance with ANSI/ASQC Z1.4, Level S-3, and shall be subjected to the following tests described under "Test Methods" (see 4.4):

(A) Visual and Dimensional Inspection (4.4.1)
(B) Eccentricity of Head (4.4.2) (AQL 6.5)

4.3.4. Sampling Plan B Tests - Samples shall be selected at random in accordance with ANSI/ASQC Z1.4, Level S-3, and shall be subjected to the following tests described under "Test Methods" (see 4.4):

(A) Shear Strength	(4.4.3)	(AQL=0)
(B) Tensile Strength	(4.4.4)	(AQL=0)
(C) Spindle Retention	(4.4.7)	(AQL=0)

The number of tests to be made shall be the smallest number shown under the multiple sampling plan.

4.3.5. Sampling Plan C Tests - Samples shall be selected at random in accordance with ANSI/ASQC Z1.4, Level S-3, and shall be subjected to the following test described under "Test Methods" (see 4.4):

(A) Installation (4.4.6) (AQL 2.5)

4.3.6. Sampling Plan D Tests - One sample each shall be selected at random and shall be subjected to the following test described under "Test Methods" (see 4.4):

(A) Thin Sheet Pull Thru (4.4.5)
(B) Sheet Take-up (4.4.8)

4.3.6.1. Retest - In the event of failure, test three more samples. All three samples in the retest must pass in order for the lot to be accepted.

4.3.7. Resubmitted inspection lots - ANSI/ASQC Z1.4 shall apply.

4.4. Test Methods

4.4.1. Visual and Dimensional Examination

4.4.1.1. Sampling per 4.3.3.

4.4.1.2. Procedure - Dimensional examinations may be accomplished visually. Optical aids or special gages may be used whenever appropriate to insure compliance with this specification.

4.4.1.3. Classification of defects - All dimensional characteristics are considered defective when out of tolerance.

Major		
101	Shank diameter	4.0 AQL
102	Identification	1.0 AQL
103	Gage Protrusion (Flush Heads)	4.0 AQL
104	Presence of lock ring	4.0 AQL
105	Presence of driving anvil	4.0 AQL
Minor		
201	Land Thickness (Flush Head)	4.0 AQL
202	Head Angle (Flush Head)	4.0 AQL
203	Fillet Radius (Flush Head)	4.0 AQL

4.4.2. Eccentricity of Head

4.4.2.1. Eccentricity of heads shall be determined by observing the total variation of a dial indicator testing the periphery of the head (both flush and protruding styles) as the blind rivet is rotated with its shank as an axis. (See Table IV).

4.4.3. Shear strength - Blind rivets shall be tested at the maximum grip of the particular blind rivet under test. The actual tests of the specimens shall be in accordance with the methods specified in NASM1312-20 or equivalent. Test fixture holes shall be in accordance with Table XIII. The tests need not be carried to destruction if the test specimens meet the rated strengths specified in Table VI without failure. Failure is defined as the highest load obtained during the test. Load deflection curves are not required.

4.4.4. Tensile strength - Tensile strength of blind riveted specimens shall be tested, in the rivet's maximum grip condition, in a fixture as shown in Figure 2. Blind rivet grip lengths that will not accommodate the minimum sheet thickness specified in the Figure 2 table need not be tested. Failure is defined as the highest load obtained during the test.

4.4.5. Thin sheet pull-thru - The resistance to pull-thru of the blind side head shall be determined using the specimen shown in Figure 3. Test method procedure shall be per NASM1312-8. Tests shall be conducted such that the blind head bears against the thin sheet. Blind rivets shall meet the appropriate requirement in pounds of Table VIII. Hole sizes per Table XIII. Fasteners to be tested in minimum grip only.

4.4.6. Installation - The blind rivet shall be installed in sheet specimens equivalent to minimum grip and maximum grip for the particular blind rivet under test in accordance with Figure 6. The blind rivets shall be installed in accordance with the manufacturer's instructions. Superficial surface cracking in the rivet blind head as the result of installation is not cause for rejection. Splits, failure to expand, improper locking element position or stem position as the result of driving are considered defective. Superficial surface cracks are those cracks whose length is less than one third of the height of the blind head after upset.

4.4.7. Spindle retention - A full sample of the rivet test specimens shall be tested in a minimum specified grip thickness (except that rivets with minimum grip thickness). The installed specimens shall be completely and properly locked. An additional full sample shall be in the uninstalled condition.

In determining the spindle retention loads, a test device similar to that shown in Figure 4 shall be used. The load shall be applied at maximum rate of .05 inch per minute to the spindle from the manufactured head or the rivet. The loads required to push out the spindles of the installed rivets shall be equal to or greater than those in Table IX. Also, the loads required to push out the spindles of the uninstalled rivets shall be equal to or greater than those in Table X. A means for accurately determining the force applied to the rivet spindle shall be provided. The push out load shall be applied directly in line with the axis of the rivet spindle.

4.4.8. Sheet take-up - The sheet material and hole sizes shall be as shown in Figure 5. One test shall be made and the rivet shall remove the entire gap. Gap removal shall be measured with the use of a 0.0015" thick gage. The gage shall not be able to penetrate the faying surface to touch the rivet shank. The force resisting the closing of the gap and the gap to be closed shall not be less than the value shown in Table XI.

4.4.9. Suitability of lubricant coatings - Lubricant coated and unlubricated "scratch specimens" made of the same materials as the finished rivet sleeves and having the same protective or other surface finish (if any) shall be scratched through to the basic metal. Specimens may be of any convenient size and shape, but the total surface area of each should exceed 6 square inches. These specimens shall be subjected to a 96-hour salt spray test in accordance with Method 811 of the Federal Test Method Standard #151. After exposure, no significant increase in corrosion shall be found when a comparison is made between lubricated and unlubricated panels.

4.4.10. Shank Expansion (Qualification Only). The test rivet shall be installed in 7075-T6 (UNS A90705) coupon and steel split plate fixture in total grips equal to the nominal diameter of the rivet being tested. Headside coupon thickness and hole size, and split plate thickness and hole size shall be as shown in Figure 7. Insert the rivet into the headside coupon. The shank diameter shall be measured at the faying surface and recorded, Install the rivet as previously described. After installation, the plates shall be separated from one another and from the rivet leaving the rivet and headside coupon together. The shank diameter of the installed rivet shall be measured at the faying surface of the split plate and the solid head side aluminum coupon.

The difference between the two recorded measurements shall be a minimum of .002 inch.

4.4.11. Fatigue Strength (Qualification Only). Fatigue strength shall be determined by the full load transfer method per NASM1312-21. Minimum load shall be 10% of maximum load as indicated in Table XII. Minimum life requirement at the loads listed in Table XII shall be $3X10^6$ cycles. If no failure after $3X10^6$ cycles, test may be discontinued.

5.0 PREPARATION FOR DELIVERY

5.1. Packaging - To the requirements of MIL-STD-129 unless otherwise specified.

6.0 NOTES

6.1. Intended use - This specification is intended to establish and control the quality of blind rivets for use in structural applications on items and components of military and commercial equipment.

6.2. Design information - Design and construction requirements information concerning the use of rivets for blind attachment is contained in Standard MS33522.

6.3. Installation tools - For government use only, procurement of blind rivets may be limited to those acceptable rivets, which may be driven, by installation tools already in the service stock system and in compliance with MIL-R-85188.

6.4. Ordering data - Procurement documents should specify the following:

(A) Type and class of rivets by part number. (See 1.2)
(B) Quantity
(C) Selection of applicable levels of packaging and packing. (See Section 5)

6.5. Cadmium plating - Plating, when required, shall be to the requirements of QQ-P-416 with the following exceptions:

1. The restriction on "Steel Fasteners RC 43 or higher shall not be plated" is waived.
2. Alloy steel stems shall be baked at 375°F ± 25°F (191°C ± 14°C) for a minimum of four (4) hours within (4) hours after plating.
3. Hydrogen Embrittlement relief testing will not be required.
4. The maximum plating thickness requirement is waived.

TABLE I

QUALIFICATION SAMPLING AND TEST PROCEDURE

Qualification Tests	Requirement Paragraph	Method Paragraph Table, and/or Figure	Each Diameter of Each Class Style Code (1)	Acceptance Limits
Examination	3.3.1 3.3.4 3.3.5 3.3.7 3.3.15	4.4.1, 4.4.2, Tables III & IV	For each test: Test ten fasteners for each grip length submitted	1 Defect per part number submitted
Installation Installed Flushness (2)	3.3.2 3.3.6	4.4.6, Figure 6 Figure 1	For each test: Test ten fasteners for each grip length submitted.	1/20 Total over-all defectives per part number.
Shear strength Tensile strength Spindle retention	3.3.9 3.3.10 3.3.3	4.4.3, Table VI, 4.4.4, Table VII, Fig. 2 4.4.7, Table IX & X, Figure 4	For each test: Test three fasteners for each of the three grip lengths submitted.	0 Defective
Thin Sheet Pull-Through	3.3.11	4.4.5, Table VIII Figure 3	For each test: Test three fasteners for each of the three grip lengths.	0 Defective
Sheet take-up	3.3.12	4.4.8, Table XI, Figure 5	Test three fasten-ers of each grip length submitted.	0 Defective
Shank Expansion	3.3.16	4.4.10 Figure 7	Test three fasten-ers of the appropriate grip length	0 Defective
Fatigue Strength	3.3.17	4.4.11, Table XII	Test three fasten-ers of the appropriate grip length	0 Defective

(1) The grip lengths submitted for qualification shall be as specified by the qualifying activity and shall be selected from Table II. Generally, 9 lots of hardware are required to qualify a given head style for a particular material combination (-4, -5 and -6 diameters).

(2) Full sample shall be tested in both minimum and maximum grip conditions (total 20 fasteners)

TABLE II

QUALIFICATION RIVET SELECTION

Rivet Diameter	Range of Grip Lengths for Qualification
-4	-2 thru -8
-5	-3 thru -10
-6	-3 thru -10

TABLE III

ACCEPTANCE TESTS (SUMMARY)

TEST	REQUIREMENT PARAGRAPH	METHOD PARAGRAPH	SAMPLE SIZE (ANSI/ASQC Z1.4)		ACCEPTANCE LIMITS (% AQL)
			NORMAL	REDUCED	
EXAMINATION	3.3.1, 3.3.4, 3.3.5, 3.3.7 3.3.15	4.4.1, 4.4.2	See Para. 4.4.1		
INSTALLATION	3.3.2 3.3.6	4.4.6	S-3	N/A	4.0
SHEAR STRENGTH	3.3.9	4.4.3	S-3	S-1	0 DEFECTIVE
TENSILE STRENGTH	3.3.10	4.4.4	S-3	S-1	0 DEFECTIVE
SPINDLE RETENTION	3.3.3	4.4.7	S-3	S-1	2.5
THIN SHEET PULL THRU	3.3.11	4.4.5	1 * PIECE	N/A	* 0 DEFECTIVE
SHEET TAKE-UP	3.3.12	4.4.8	1 * PIECE	N/A	* 0 DEFECTIVE

* Sample size for retest = 3 pieces. Acceptance limits on retest = 0 Defective

TABLE IV

DISCONTINUITY LIMITS

LOCATION	MAXIMUM DEPTH OF DISCONTINUITY (INCH)
SHANKS OF SLEEVES	.005
PERIPHERY OF MANUFACTURED HEADS OF SLEEVES	.020
OTHER SURFACES ON SLEEVE AND STEM	.010

TABLE V

TOLERANCES ON ECCENTRICITY OF HEAD

RIVET DIAMETER	TOTAL VARIATION IN INDICATOR READING (INCH)	
	CLASS 2,3,4	CLASS 1
-4	0.010	0.010
-5	0.010	0.015
-6	0.010	0.015

TABLE VI

SINGLE SHEAR STRENGTH

RIVET DIAMETER & GRIP (1) DASH NUMBER		MINIMUM SHEAR STRENGTH (POUNDS)			
		STYLE A		STYLE B	
		CLASS 1 CODE B&E	CLASS 2, 3 CODE B & E	CLASS 1,4 CODE B&E	CLASS 2 CODE B&E
	-1	(2)	(2)	(2)	(2)
	-2	505	411	592	480
	-3	584	531	692	614
-4	-4	655	651	771	741
	-5	664	664	814	814
	-2	699	(2)	805	(2)
	-3	840	714	982	815
-5	-4	929	862	1080	977
	-5	1020	1010	1175	1135
	-6	1030	1030	1245	1245
	-2	920	(2)	1015	(2)
	-3	1130	918	1240	1005
-6	-4	1250	1095	1385	1200
	-5	1355	1310	1505	1390
	-6	1460	1455	1615	1580
	-7	1480	1480	1685	1685
Reference Shear Strength Level		50 KSI	50 KSI	50 KSI	50 KSI

Notes: (1) For rivet grips greater than listed use highest value shown for the diameter, code, class and style.

(2) Parts too short to be tested.

TABLE VII

TENSILE STRENGTH

RIVET DIAMETER	MINIMUM TENSILE STRENGTH VALUES (POUNDS)		
	STYLE A		STYLE B
	CLASS 1,2 CODE B&E	CLASS 3 CODE B&E	CLASS 1,2,4 CODE B&E
-4	285	250	345
-5	445	390	530
-6	635	560	710

Note: 4-1, 5-1, 5-2, 6-1 & 6-2 rivets are too short to be tested in tensile.

TABLE VIII

THIN SHEET PULL THRU

Rivet Diameter	Thin Sheet Thickness "T" ±.001	Minimum Thin Sheet Pull-Thru Loads (Pounds)	
		Style A	Style B
-4	.025	160	180
-5	.032	220	260
-6	.040	315	375

TABLE IX
SPINDLE RETENTION LOAD

Style A		Style B	
RIVET DIA	MINIMUM AXIAL PUSH-OUT (LBS.) INSTALLED CONDITION	RIVET DIA	MINIMUM AXIAL PUSH-OUT (LBS.) INSTALLED CONDITION
-4	125	-4	150
-5	200	-5	250
-6	290	-6	450

TABLE X
SPINDLE RETENTION LOAD

RIVET DIA	MINIMUM AXIAL PUSH-OUT (LBS) UNINSTALLED CONDITION
-4	10
-5	10
-6	10

TABLE XI

SHEET TAKE-UP

GRIP LENGTHS FOR WHICH THIS TEST IS APPLICABLE		RIVET DIA.	STYLE A		STYLE B	
			GAP G (INCH)	FORCE RESISTING CLOSURE (POUNDS)	GAP G (INCH)	FORCE RESISTING CLOSURE (POUNDS)
CLASS 1, 3 & 4	**CLASS 2**					
-2 AND LONGER	-2 AND LONGER	-4	.031	10	.031	15
-2 AND LONGER	-2 AND LONGER	-5	.031	25	.031	30
-2 AND LONGER	-2 AND LONGER	-6	.031	40	.031	50

Note: The -2 & -3 grip parts may not consistently close the gap in the minimum grip condition because of hole filling. The -4 grip and longer are expected to close the gap regardless of whether they are installed in minimum or maximum grip condition. Acceptance testing is performed in maximum grip only.

TABLE XII

FATIGUE TEST LEAD (lbs.)

Rivet Diameter	Rivet Grip Dash No.	Style A Hole Size	Style B Hole Size	Sheet Thickness "T" (Inches)	Maximum Load Per Specimen (lbs.)
		±.0005	±.0005	±.002	B, & E
1/8 (-4)	-2	.130	.144	.063	440
5/32 (-5)	-3	.162	.178	.080	700
3/16 (-8)	-3	.194	.207	.090	945

TABLE XIII

HOLE SIZES FOR DEFINED TESTS

STYLE AND CLASS		-4 DIAMETER		-5 DIAMETER		-6 DIAMETER	
		HOLE DIA. ±.0005	COUNTERSINK DIA. ±.003	HOLE DIA. ±.0005	COUNTERSINK DIA. ±.003	HOLE DIA. ±.0005	COUNTERSINK DIA. ±.003
STYLE A	CLASS 1	0.130	- - -	0.162	- - -	0.194	- - -
	CLASS 2	0.130	0.225	0.162	0.286	0.194	0.353
	CLASS 3	0.130	0.192	0.162	0.243	0.194	0.299
STYLE B	CLASS 1	0.144	- - -	0.178	- - -	0.207	- - -
	CLASS 2	0.144	0.225	0.178	0.286	0.207	0.353
	CLASS 4	0.144	0.170	0.178	0.213	0.207	0.255

Notes:
1) Holes to be square with both faces within 1°.
2) Countersink and cylindrical holes to be concentric within .002 FIM.
3) Countersink diameters only apply to class 2,3 and 4 rivets, and the angle shall be 100°-101°.
4) Material: Alloy Steel Rc46 min.
5) All dimensions in inches.
6) Alternate coupon configurations (e.g. stepped to allow testing of multiple grips) may be used.

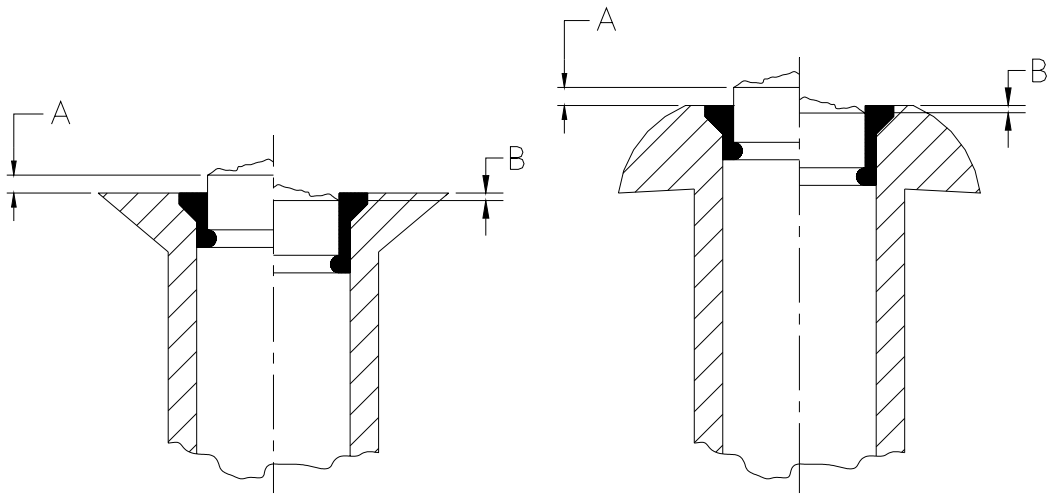


FIGURE 1 - INSTALLED RIVET

LOCKING ELEMENT AND SPINDLE FLUSHNESS LIMITS

SPINDLE FLUSHNESS LIMITS (INCH) ALL TYPES AND STYLES		
RIVET DIAMETER	**A MAX. (ABOVE)**	**B MAX. (BELOW)**
-4	0.010	0.015
-5	0.010	0.020
-6	0.010	0.020

Note: 1) Locking element shall be flush with top surface of rivet head within ±.005. Slight element flash permissible .010 max. from top of rivet head.

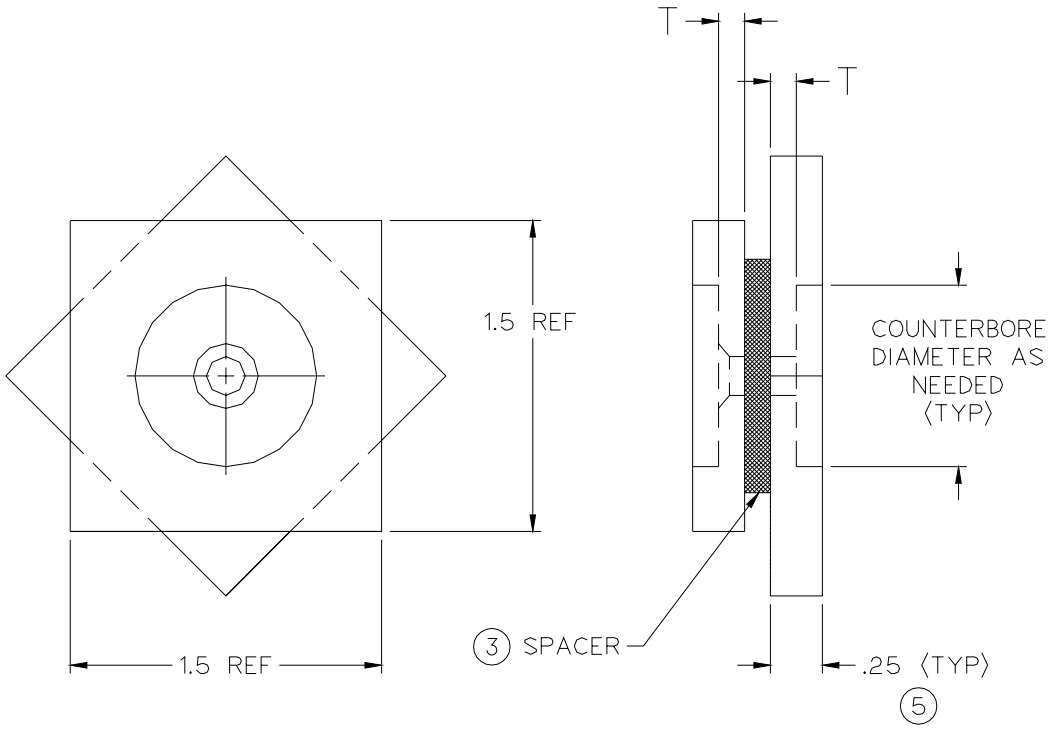


FIGURE 2

TENSION SPECIMEN

RIVET DIAMETER	"T" DIMENSION MINIMUM
-4	.063
-5	.094
-6	.094

Notes:
1) Material: Alloy steel Rc46 Min.
2) Hole preparation per Table XIII.
3) Spacer thickness as necessary to accommodate grip.
4) Dimension in inches.
5) Thickness of coupons may be adjusted to suit manufacturers' fixtures
6) Alternate fixture geometries are permissible provided it is demonstrated that comparable results are achieved.

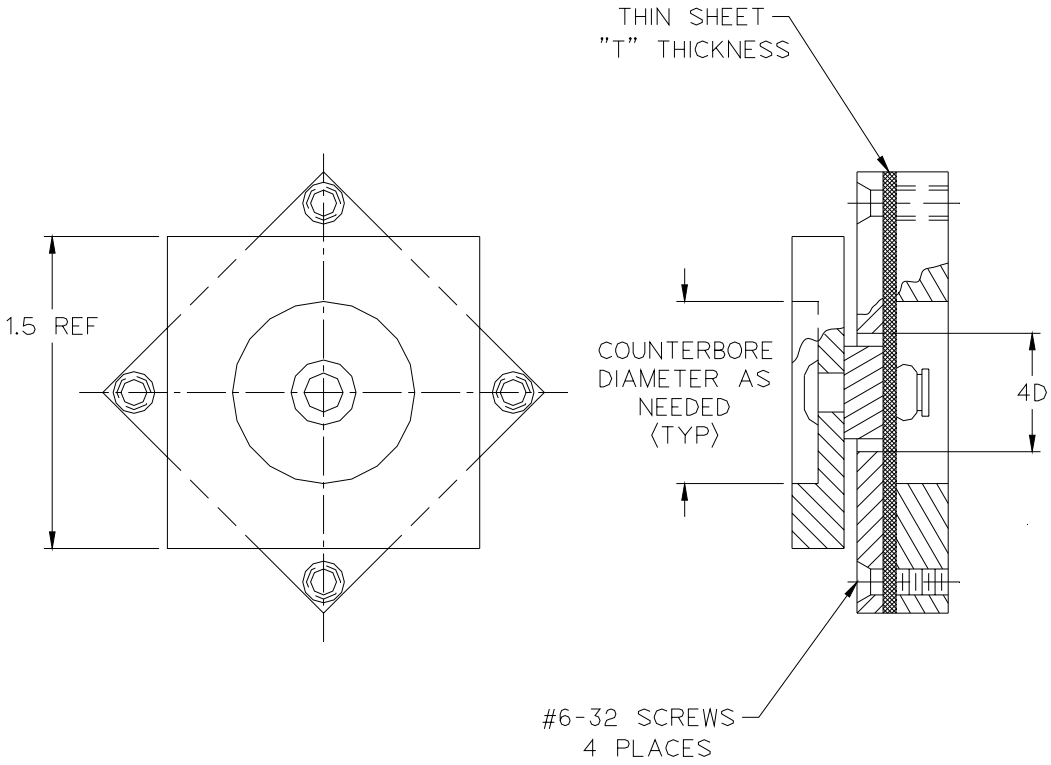


FIGURE 3

THIN SHEET PULL-THRU SPECIMEN

NOTES:

1) Material: Thin Sheet = 2024-T3 Aluminum (bare)
   Fixtures = Alloy Steel (Rc36 Minimum)
2) Hole Preparation - See Table XIII.
3) "T" Thickness (See Table VIII) Selected to produce blind head "Pull Thru".
4) Dimensions in inches.
5) Alternate fixture geometries are permissible if it is demonstrated that comparable results are achieved.
6) Grip lengths -1 and -2 are too short to test.

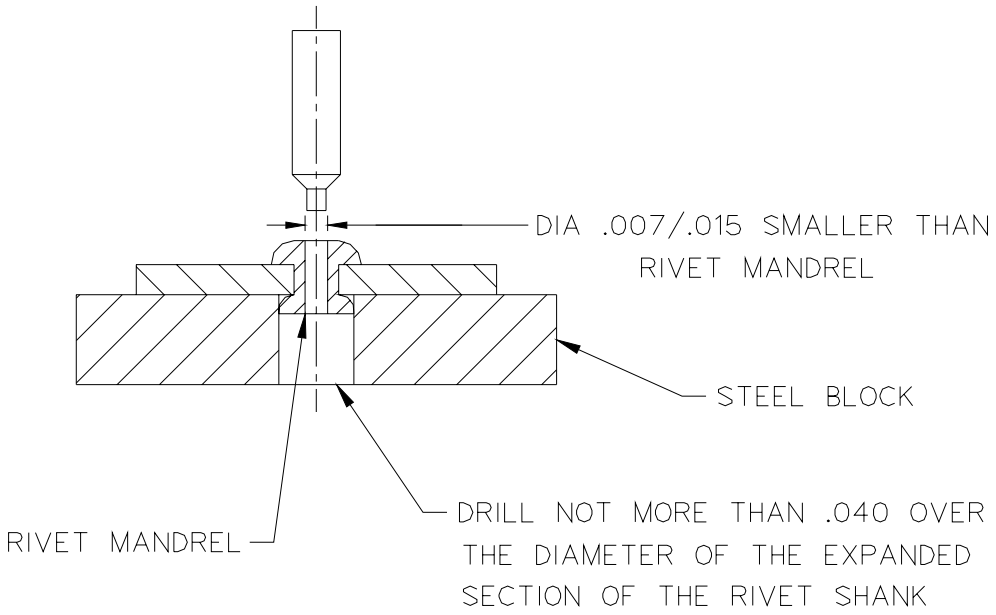


FIGURE 4

SPINDLE RETENTION TEST

Notes:
1) Countersunk dimensions to be same as Table XIII.
2) Material: 2024-T3 Aluminum
3) Except that rivets with a minimum grip length equal to or less than their diameter shall be installed in a test plate representing maximum grip condition and having a hole size equal to that required for the minimum grip test plate of Figure 6.

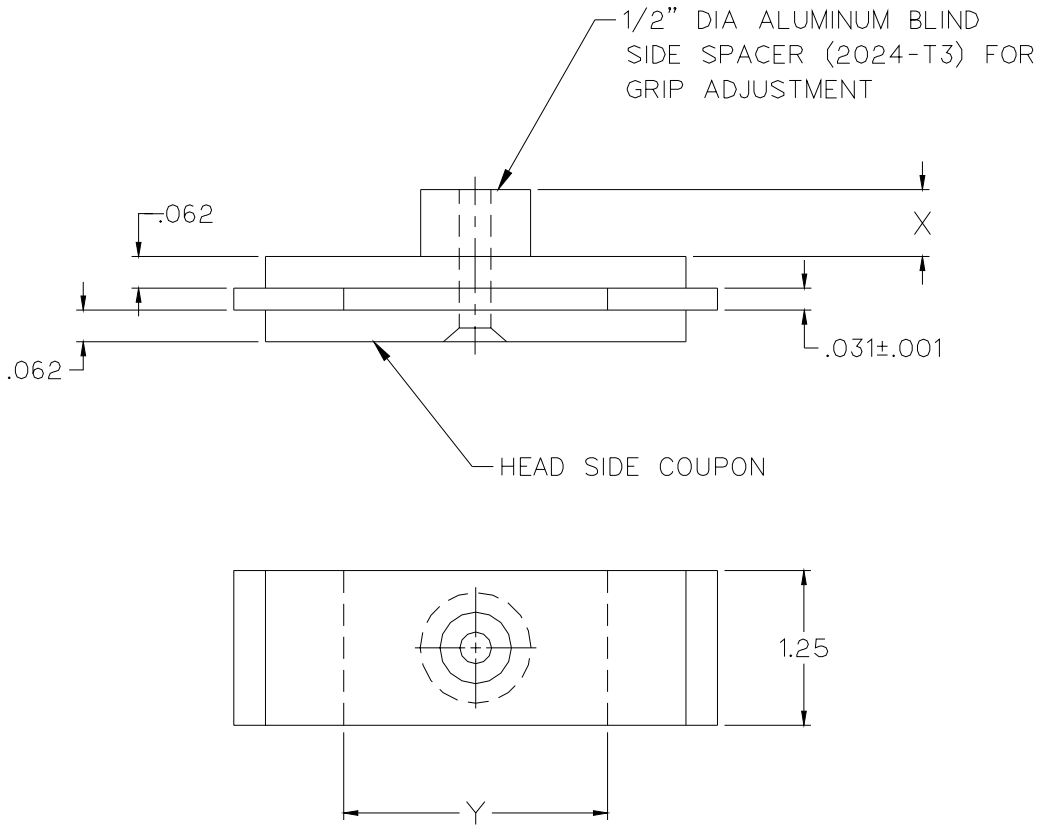
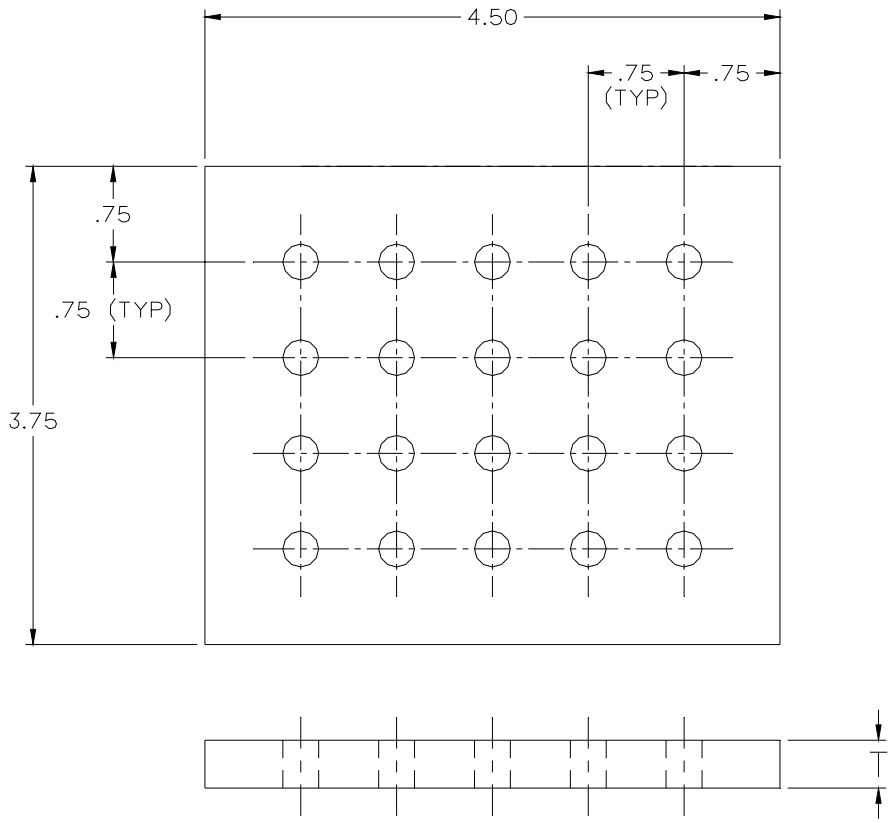


FIGURE 5

SHEET TAKE-UP SPECIMEN

Notes:

1) Sheet material: Shall be 2024-T3 aluminum alloy per QQ-A-250/4 or QQ-A-250/5 (referee)
2) Y dimension to be adjusted to produce closure-resisting force values shown in Table XI.
3) X dimension +.125 shall be equivalent to maximum and minimum grip of test rivet.
4) Fastener hole in specimen shall not be deburred by chamfering.
5) Fastener holes per Table XIII.
6) During calibration, use a .0015" thick feeler gage at hole. The load required to bring the sheets into contact with the feeler gage is defined as the force resisting closure of the gap. Calibrate with un-installed rivet in plate and apply load between the rivet and 1/2" diameter blind side spacer.
7) Force shall not be measured after the sheets are closed.
8) Alternate fixture geometries are permitted if it is demonstrated that comparable results are achieved.



RIVET DIAMETER	HOLE DIAMETER ± .0005 MINIMUM GRIP		HOLE DIAMETER ± .0005 MAXIMUM GRIP	
	STYLE A	STYLE B	STYLE A	STYLE B
-4	.132	.146	.129	.143
-5	.164	.180	.160	.176
-6	.196	.209	.192	.205

FIGURE 6

SPECIMEN FOR INSTALLATION

Notes:
1) "T" - Sheet thickness. For each specific grip length of appropriate size under evaluation, installation tests shall be conducted at total grip (T) conforming to minimum and maximum grip as indicated in applicable standard. One-half of required tests shall be in min. grip-max. hole and one-half in max. grip-min. hole.
2) Material: Alloy steel or aluminum alloy at manufacturers' option. (Referee material = 2024-T3).
3) Dimensions in inches.
4) See Table XIII for countersink dimensions.
5) This figure presents the recommended test specimen geometry. Specimens with different lengths, widths and hole patterns may be used at the rivet manufacturer's option.

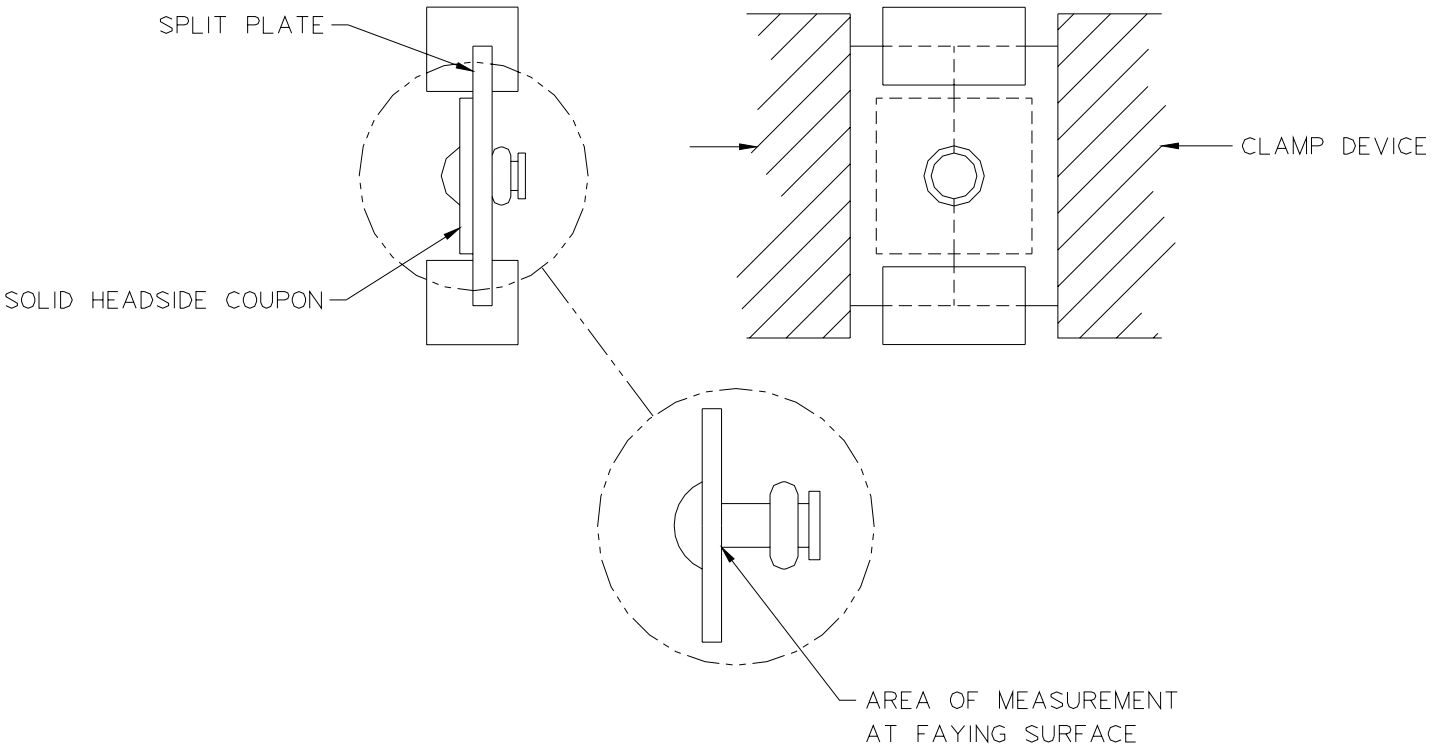


FIGURE 7

SHANK EXPANSION COUPON

Nominal Rivet Diameter	Rivet Grip Dash No.	Headside Coupon			Split Plate			Total Grip
		Thickness ±.002	Hole Size ±.0005		Thickness ±.002	Hole Size ±.001		
			Style A	Style B		Style A	Style B	
1/8 (-4)	-3	.098	.1315	.1460	.062	.132	.146	.160
5/32 (-5)	-4	.127	.1635	.1780	.078	.164	.180	.205
3/16 (-6)	-4	.156	.1955	.2040	.094	.196	.209	.250