



**CHERRY**® **AEROSPACE**  
SPS Fastener Division, a PCC Company

PROCUREMENT SPECIFICATION NUMBER

**PS-CMR-3000**

Rev. U

Date: 14 Sep 21

DCR# 21-0265

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## PROCUREMENT SPECIFICATION

### CHERRYMAX® FASTENING SYSTEM

Self-Plugging, Flush Fracturing  
Mechanically Locked Spindle, Bulbed Rivet  
Nominal and 1/64" Oversize Series

APPROVED: \_\_\_\_\_  
*Authorizing Signature is on FILE*  
DIRECTOR OF PRODUCT ENGINEERING



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CHERRYMAX<sup>®</sup> FASTENING SYSTEM

**1.0 SCOPE**

**1.1 Purpose**

This specification establishes the requirements for procurement of CherryMax<sup>®</sup>, self-plugging, mechanically locked spindle fasteners of the bulbed configuration capable of being installed with CherryMax<sup>®</sup> tooling or other power or hand riveters with sufficient force and suitable pulling heads. These rivets are intended for use in aircraft structure or similar applications, in thin and double dimpled as well as thick sheets. The rivets can be installed in assemblies where access to only one side of the work is available and also may be installed in non-blind applications to achieve installation cost savings and eliminate noise due to solid rivet bucking. The rivets, once installed, have a visible mechanical locking device, measurable for acceptance.



1.2 Styles, Classes and Types. Rivets shall be furnished in the following styles, classes, and types.

**Style 'A' Nominal Shank Diameter**

Class 1 - Protruding Head Rivets (MS20470)

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type E - 5056 Aluminum Alloy Sleeve-CRES Stem

Type M - Monel Sleeve-CRES Stem

**Cherry  
Part No.**

CR3213

CR3223

CR3523

Class 2 - 100° Flush Head (MS20426)

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type E - 5056 Aluminum Alloy Sleeve-CRES Stem

Type M - Monel Sleeve-CRES Stem

CR3212

CR3222

CR3522

Class 3 - 100° Reduced Flush Head (NAS1097)

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type E - 5056 Aluminum Alloy Sleeve-CRES Stem

Type M - Monel Sleeve-CRES Stem

CR3214

CR3224

CR3524

**Style 'B' 1/64" Oversize Shank Diameter**

Class 1 - Protruding Head Rivets (MS20470)

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type E - 5056 Aluminum Alloy Sleeve-CRES Stem

Type M - Monel Sleeve - CRES Stem

Type C - Inconel 600 Sleeve - Inconel X-750 Stem

**Cherry  
Part No.**

CR3243

CR3253

CR3553

CR3853

Class 2 - 100° Flush Head (MS20426)

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type E - 5056 Aluminum Alloy Sleeve-CRES Stem

Type M - Monel Sleeve - CRES Stem

Type C - Inconel 600 Sleeve - Inconel X-750 Stem

CR3242

CR3252

CR3552

CR3852

Class 4 - Unisink Head

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type E - 5056 Aluminum Alloy Sleeve - CRES Stem

Type M - Monel Sleeve-CRES Stem

CR3245

CR3255

CR3555

Class 5 - 120° Flush Head

Type B - 5056 Aluminum Alloy Sleeve-Alloy Steel Stem

Type M - Monel Sleeve-CRES Stem

CR3246

CR3556



## 2.0 APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

### 2.1.1 Military Standards and Specifications

|              |   |
|--------------|---|
| MIL-STD-105  | Sampling Procedures and Tables for Inspection by Attributes                 |
| MIL-STD-129  | Marking for Shipment and Storage  |
| MIL-STD-1312 | Fastener, Test Methods  |
| MIL-C-5541   | Chemical Films and Chemical Film Materials for Aluminum and Aluminum Alloys |
| MIL-H-6088   | Heat Treatment of Aluminum Alloys   |
| MIL-H-6875   | Heat Treatment of Steels (Aircraft Practice, Process for)                   |
| MIL-A-8625   | Anodic Coatings, for Aluminum and Aluminum Alloy                            |
| MIL-R-7885   | Rivets; Blind, Structural, Pull-Stem  |
| MIL-C-83488  | I.V.D. Aluminum Coating for Fasteners                                       |
| MIL-R-85188  | Riveters, Power, Pneumatic-Hydraulic  |
| MIL-P-3982   | Packing and Packing for Shipment and Storage of Hardware                    |
| MIL-P-3803   | Plastic, Polyethylene, Molded and Extruded Shapes, Sheets and Tubing        |
| MIL-L-10547  | Liners: Case, Waterproof  |

### 2.1.2 Federal Standards and Specifications

|          |   |
|----------|---|
| No. 151  | Federal Test Method   |
| QQ-A-430 | Aluminum Alloy Rod and Wire; For Rivets and Cold Heading  |
| QQ-N-281 | Nickel Copper Alloy (Monel and R-Monel) Bars, Plates, Rods, Sheets, Strips, Wire, Forgings and Structural and Special Shaped Sections |
| QQ-P-416 | Plating, Cadmium (Electro-Deposited)  |

### 2.1.3 Industry Specifications

|          |  |
|----------|--|
| AMS 5665 | Alloy Bars, Forgings and Rings, Corrosion and Heat Resistant         |
| AMS 5731 | Steel Bars, Forgings, Corrosion and Heat Resistant (A-286 CRES)      |
| AMS 5657 | Alloy Wire, Corrosion and Heat Resistant (15-7 PH CRES)              |
| AMS 5732 | Steel Bars, Forgings, Tubing and Rings, Corrosion and Heat Resistant |
| AMS 5737 | Steel Bars, Forgings and Tubing, Corrosion and Heat Resistant        |
| AMS 5698 | Alloy Wire, Corrosion and Heat Resistant (INCO X750 CRES)            |
| AMS 4911 | Ti-6-4 Annealed Sheet  |
| AMS 5687 | Alloy Wire, Corrosion and Heat Resistant (INCO 600 CRES)             |
| AMS 6322 | Steel Bars, Forgings and Rings (8740 Alloy Steel)                    |
| ASTM E3  | Standard Methods of Preparation of Metallographic Specimens          |



2.1.4 NAS Standards

NAS4006 Coating, Aluminum Pigmented, organically bonded

2.1.5 MS

MS33522 Rivets for blind attachment, limitations for design usage

3.0 REQUIREMENTS

3.1 Fasteners shall meet all engineering requirements of TABLE I.

3.2 Specification sheets and product drawings. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets and product drawings. In the event of any conflict between requirements of this specifications and the applicable product drawing (or standards), the latter shall govern.

3.3 Design and Construction

3.3.1 Construction. The fasteners shall be a four-component assembly consisting of a tubular rivet sleeve, a spindle (stem) with an integral shear ring which forms the blind side head, a separate locking collar pre-locked into a locking groove on the stem and a disposable driving anvil to form the locking collar into the dimpled recess in the rivet sleeve during the installation cycle and to be visible dimensionally inspectable after installation.

3.3.2 Installation. The rivet shall be installed by mechanical means. Installation is to be accomplished by pulling the spindle into the rivet shank thereby forming the blind head and subsequently locking the spindle to the sleeve by deformation of the separate locking collar against the disposable driving anvil. The pulling portion of the spindle and the driving anvil shall be discarded after the installation operation.

3.3.3 Lubrication. Lubrication as necessary to assure proper function of the rivet is permissible. The lubricant used shall pass the lubricant tests as specified in Para. 4.5.8. Lubricants used shall be stable and not subject to deterioration under recommended handling and storage conditions.

3.3.4 Workmanship. Rivets shall be of uniform quality and shall be finished 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 II provided they do not affect other requirements of this specification.

3.3.5 Dimensions. Blind rivets shall conform dimensionally to the applicable drawings.

3.3.6 Concentricity of Heads. The blind rivet manufactured head shall be concentric with the shank within the limits specified in TABLE III when tested as specified in para. 4.4.

3.3.7 Protective Treatment. Protective treatment shall be as specified on the applicable drawings.

3.3.7.1 Cadmium Plating. Stems requiring cadmium plate shall be plated to the requirements of QQ-P-416 with the following exceptions:

3.3.7.1.1 8740 Alloy Steel and 15-7 CRES stems shall be baked at 375° ±25°F (191° C ±14°C) for a minimum of four (4) hours, starting within three (3) hours after plating.

3.3.7.1.2 Stress durability testing will not be required.

3.3.8 Lubricant. A lubricant may be used on any component to improve installation, provided the lubricant is not detrimental to the corrosion resisting properties of the rivet. The lubricant used shall be subjected to and pass the lubricant test (see 4.5.8). Lubricants used shall be stable and shall not deteriorate under recommended handling and storage conditions.



- 3.3.9 Heat Treatment. Heat treatment of all aluminum alloys shall be in accordance with MIL-H-6088. Monel and CRES materials shall be in accordance with MIL-H-6875. Deviations that are necessary to manufacture rivets shall be noted in detail and shall accompany the rivets for qualification inspection.
- 3.3.10 Installation Flushness. The installed spindle (see Figure 1) shall be flush with the top surface of the rivet head and within the limits "A" and "B" shown in TABLE VIII when tested as specified in 4.5.7. The locking feature (see Figure 1) shall not protrude above the "A" limit of TABLE VIII.
- 3.3.11 Acceptable Blind Head Formations. The installed blind rivet may show formations as shown in Figure 2.
- 3.3.12 Identification of Product. The rivets shall have the driving anvils identified by color code, to distinguish between Style A and Style B, in accordance with the applicable drawings. Appropriate head markings pertaining to Style, Type and Class shall be per TABLE XII.

#### 3.4 Mechanical Properties

- 3.4.1 Shear Strength. The ultimate single shear strength of the rivets shall be not less than the value specified in TABLE IV, when tested as specified in 4.5.1.
- 3.4.2 Tensile Strength. The ultimate tensile strength of the rivet shall be not less than the value specified in TABLE V, when tested as specified in 4.5.2.
- 3.4.3 Tensile Strength in Thin Sheet. The rivet shall meet the minimum pull through strength specified in TABLE VI, when tested as specified in 4.5.3. This requirement is not applicable to rivets shorter than -4 grip.
- 3.4.4 Spindle Retention. The rivet spindle shall withstand the steadily applied axial minimum push-out load specified in TABLE VII, when tested as specified in 4.5.5.
- 3.4.5 Shank Expansion. The rivet shall be capable of passing the expansion test specified in 4.5.6.
- 3.4.6 Fatigue Strength. The rivet shall be capable of passing the fatigue test specified in 4.5.4.
- 3.4.7 Installation. Installed rivets in minimum and maximum grip test plates (see Figure 9) shall be in accordance with 4.5.7.

#### 4.0 QUALITY ASSURANCE PROVISION

- 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 Testing

4.2.1 Sampling Instructions. Qualification test samples shall be selected in accordance with TABLE X. Qualification test samples shall be accompanied by the manufacturer's test results, or the results of tests conducted by an approved independent test laboratory, of the tests listed herein. Samples shall be identified as required and forwarded to the activity responsible for qualification. Samples shall be packaged in accordance with the requirements of Section 5.0 and plainly identified by securely attached labels or tags marked with the following information:

Sample for Qualification Test

Rivets, Blind, Self-Plugging, Mechanically Locked Spindle Bulbed

Type: (Material)

Class: (Flush or protruding head)

Grip Length:

Diameter:

Manufactured by: (Name and symbol)

Submitted by: (Name)

Lubricant Coating: (Manufacturer's Designation)

4.2.2 Tests. The qualification tests of blind rivets shall consist of all the tests of this specification as specified in TABLE X. After each significant manufacturing design or process change, qualification tests shall be performed upon authorization of the activity responsible for qualification, on materials previously found satisfactory and at other times as may be specified. Requalification tests may be waived on minor design or process changes, provided substantiating test data is submitted indicating no change in performance characteristics and upon acceptance of such test data by the qualification activity. Qualification testing of one class of rivets shall not qualify the other class of rivets, except for thin sheet pull-thru.

4.3 Acceptance Tests. Lot acceptance tests consist of all tests specified in TABLE I other than those specified as qualification only. Rivet manufacturer shall use sufficient in-process controls and/or inspection of product to assure conformance to all requirements of this specification. Rivet manufacturer shall retain MRB authority for minor defects (do not affect fit, form or function) for parts procured under this specification.

4.3.1 Lot. A lot shall consist of finished blind rivets which are of the same type, 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.

4.3.1.1 A lot of component members of blind rivets (such as sleeves or stems) shall consist of those components which are of the same type, class, grip and diameter, fabricated by the same processes, heat treated in the same manner and produced as one continuous run or order or part thereof. Dimensional inspection already performed on component members need not be repeated after assembly of finished blind rivets submitted as an inspection lot.

4.3.2 Responsibility of Tests. Cherry Aerospace LLC shall be responsible for accomplishing the required tests. Cherry Aerospace LLC shall maintain a record available to the inspector or customer of the quantitative results of all tests required by the specification.

4.3.3 Examination. Each of the sample rivets selected at random in accordance with TABLE XI shall be examined for conformance to the requirements for dimensions, locking feature integrity, protective treatment and marking. These examinations shall be accomplished visually. Optical aids and special gages are permissible to ensure compliance with this specification.



#### 4.4 Concentricity of Head

- 4.4.1 Class 1 and Class 4 Protruding Head Rivets. Concentricity of protruding head blind rivets shall be determined by observing the total variation of a dial indicator in contact with the periphery of the head as the rivet is rotated along the axis of the shank. (See TABLE III)
- 4.4.2 Class 2, Class 3 and Class 5 Flush Head Rivets. Concentricity of flush head rivets shall be determined by observing the total variation of a dial indicator testing the conical surface of the head (adjacent to the top of the rivet), as the rivet is rotated along the axis of the shank (See TABLE III).

#### 4.5 Mechanical Testing

- 4.5.1 Shear Strength. Test rivets shall be installed in a fixture as shown in Figure 3. Specimens shall be tested at the maximum grip of the particular rivet under test. The actual tests of the specimens shall be in accordance with the methods specified in MIL-STD-1312-4. The tests need not be carried to destruction if the test specimens meet the rated strengths specified in TABLE IV without failure. MIL-STD-1312-20 can be used as an alternate test method with blade thickness equivalent to 1/2 the maximum grip of the rivet being tested. Test speed (load rate) per NAS 1740 is acceptable as an option.
- 4.5.2 Tensile Strength. Tensile strength of riveted specimens shall be tested in the rivets maximum grip in a fixture as shown in Figure 4. Rivet grip lengths that will not accommodate the minimum sheet thickness specified in the table of Figure 4 need not be tested. Tests shall be in accordance with methods specified in MIL-STD-1312-8. Test speed (load rate) per NAS 1740 is acceptable as an option.
- 4.5.3 Thin Sheet Pull-Thru (Qualification Only). The resistance to pull-thru of the blind side head shall be determined using the specimen shown in Figure 5. Test method procedure shall be per MIL-STD-1312-8. Unless otherwise specified, tests shall be conducted such that the blind head bears against the thin sheet. Rivets shall meet the appropriate requirement in pounds of TABLE IV prior to pull-thru of the blind head or rivet failure. Fasteners to be tested in prescribed maximum grip.
- 4.5.4 Fatigue Strength (Qualification Only). Fatigue strength shall be determined by the full load transfer method per MIL-STD-1312-21. Minimum load shall be 10% of maximum load as indicated in TABLE IX. Minimum life requirement at the loads listed in TABLE IX shall be  $3 \times 10^6$  cycles. If no failure after  $3 \times 10^6$  cycles, tests may be discontinued.
- 4.5.5 Spindle Retention Test. A full sample of the rivet test specimens shall be tested in a minimum specified grip thickness (except that rivets with minimum grip length equal to or less than their diameters shall be installed in a test plate of maximum specified 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 7 shall be used. The load shall be applied at a maximum rate of .05 inch per minute to the spindle from the manufactured head of the rivet. The loads required to push out the spindles of the installed rivets shall be equal to or greater than those in TABLE VII, Column A. Also, the loads required to push out the spindles of the uninstalled rivets shall be equal to or greater than those in TABLE VII, Column B. 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.



4.5.6 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 8. 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. Rivets with grip lengths greater than their diameter are not required to meet the shank expansion requirements.

4.5.7 Installation. Test rivets shall be installed in test plates as shown in Figure 9. Holes shall be in accordance with Figure 9. One half of the rivets shall be tested at minimum grip and other half at the rivet's maximum grip. After installation, the fastener shall be inspected for defects such as deformed heads, split sleeves, locking feature protrusion or spindle flushness outside the limits of Figure 1, TABLE VIII.

4.5.8 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 shall exceed six square inches. These specimens shall be subjected to a 96-hour salt spray test in accordance with Method 811 of Federal Test Method Standard 151. After exposure, no significant increase in corrosions shall be found when a comparison is made between lubricated and unlubricated panels.

## 5.0 PREPARATION FOR DELIVERY

5.1 Inspection of Preparation for Delivery. Preparation, packing and marking shall be inspected to determine conformance to Section 5.

5.2 Packaging.

5.2.1 Preservation. Preservation shall be level A or C as specified in the contract or order.

5.2.1.1 Level A. The rivets shall be preserved and packaged in accordance with the applicable level A requirement of PPP-H-1581.

5.2.1.2 Level C. The rivets shall be preserved and packaged in accordance with the supplier's standard practice.

5.2.2 Packing. Packing shall be Level A or Level C as specified in the contract or order.

5.2.2.1 Level A. The rivets shall be packed in accordance with the applicable level A requirements of PPP-H-1581.

5.2.2.2 Level C. The rivets shall be packed in a manner which will ensure arrival at destination in satisfactory condition and be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules, or with National Motor Freight Classification rules.



5.2.3 Marking. In addition to any special marking specified in the contract or order, marking shall be in accordance with MIL-STD-129.



**TABLE I**

| CHARACTERISTICS            | ENGINEERING REQUIREMENTS  | INSPECTION REQUIREMENTS  |  |
|----------------------------|---|--|--|
|                            |   | TEST METHOD  | SAMPLING                                     |
| IDENTIFICATION             | Per applicable rivet drawing and <b>TABLE XII</b> for appropriate head markings.  | Visual examination and depth or height measurement. Depth of marking to be measured from undisturbed surface | MIL-STD-105<br>Level S-3<br>AQL 1.0          |
| MATERIALS                  | Per applicable product drawing  | Per material specification   |  |
| DIMENSIONS                 | Per applicable product drawing.   | Conventional measuring methods.  | MIL-STD-105<br>Level S-3<br>AQL 4.0          |
| DISCONTINUITIES            | Rivets shall meet the dimension requirements of <b>TABLE II</b> .   | Microscopic examination per ASTM E3  | MIL-STD-105<br>Level S-1<br>Zero (Defective) |
| CONCENTRICITY              | Rivet head shall be concentric with the shank within the limits specified in <b>TABLE III</b> .   | Test per Paragraph 4.4   | MIL-STD-105<br>Level S-1<br>AQL 4.0          |
| SHEAR STRENGTH             | Rivets shall meet minimum single shear strengths per <b>TABLE IV</b> .  | Test per Paragraph 4.5.1   | MIL-STD-105<br>Level S-1<br>Zero (Defective) |
| TENSION STRENGTH           | Rivets shall meet minimum tensile strength in steel coupons per <b>TABLE V</b> .  | Test per Paragraph 4.5.2   | MIL-STD-105<br>Level S-1<br>Zero (Defective) |
| THIN SHEET PULL-THRU       | Rivets shall meet minimum pull-thru values of <b>TABLE VI</b> .   | Test per Paragraph 4.5.3   | Per <b>TABLE XI</b><br>Qualification Only    |
| FATIGUE                    | Rivets shall withstand a minimum of 3x10 <sup>6</sup> cycles when tested per Paragraph 4.5.4 and <b>TABLE X</b> .                           | Joint Shear fatigue test. Method per MIL-STD-1312-21. Per Paragraph 4.5.4                                    | Per <b>TABLE X</b> Qualification Only        |
| SPINDLE RETENTION          | Rivets shall develop minimum loads of <b>TABLE VII</b> .  | Test per Paragraph 4.5.5.  | MIL-STD-105<br>Level S-1<br>Zero (Defective) |
| SPINDLE & COLLAR FLUSHNESS | Installed rivets shall meet the spindle and collar flushness limits specified in Paragraph 3.3.10 and <b>TABLE VIII</b> .                   | Conventional measuring methods.  | MIL-STD-105<br>Level S-3<br>AQL 2.5          |
| SHANK EXPANSION            | Installed rivets shall exhibit shank expansion characteristics required per Paragraph 4.5.6   | Test per paragraph 4.5.6   | Per <b>TABLE XI</b><br>Qualification Only    |
| INSTALLATION               | Installed rivets in the min. and max. grip test plates shall not have splits in excess of 5% of the total number tested.                    | Test per Paragraph 4.5.7   | MIL-STD-105<br>Level S-3<br>AQL 2.5          |
| HEAT TREATMENT             | 15-7PH CRES per MIL-H-6875<br>Aluminum Alloy per MIL-H-6088<br>Inconel per MIL-H-6875<br>Monel per MIL-H-6875<br>Alloy steel per MIL-H-6875 | Tests of Mechanical properties to verify heat treatment.   | As Required.                                 |
| PACKAGING                  | Unit packages to be sealed in plastic bags to protect against lubricant degradation.  | Visual examination.  | MIL-STD-105<br>Level S-3<br>AQL 1.0          |
| MARKING                    | Unit packages to be labeled with part number, grip range, hole size, lot number and manufacturer's identification                           | Visual examination.  | MIL-STD-105<br>Level S-3<br>AQL 1.0          |



TABLE II

| Discontinuity Limits |                                       |
|----------------------|---------------------------------------|
| Location             | Maximum Depth of Discontinuity (Inch) |
| Shank                | 0.005                                 |
| Periphery of Head    | 0.020                                 |
| Other Surfaces       | 0.010                                 |

TABLE III

| Tolerances on Concentricity of Head |   |                        |
|-------------------------------------|---|------------------------|
| Rivet Diameter                      | Total Variation in Indicator Reading on Rivet Head (Max.) |                        |
|                                     | Flush Head (Inch)   | Protruding Head (Inch) |
| 1/8 (-4)                            | 0.010   | 0.010                  |
| 5/32 (-5)                           | 0.010   | 0.015                  |
| 3/16 (-6)                           | 0.010   | 0.015                  |
| 1/4 (-8)                            | 0.010   | 0.020                  |



**TABLE IV**

| Rivet Diameter                 | Grip (1) | Single Shear Strength / Minimum Shear Strength (lbs.) |                  |                            |                                      |                  |        |                  |                  |        |        |
|--------------------------------|----------|---|------------------|----------------------------|--------------------------------------|------------------|--------|------------------|------------------|--------|--------|
|                                |          | CR3212<br>CR3222<br>CR3214<br>CR3224                  | CR3213<br>CR3223 | CR3242<br>CR3252<br>CR3246 | CR3243<br>CR3253<br>CR3245<br>CR3255 | CR3522<br>CR3524 | CR3523 | CR3552<br>CR3556 | CR3553<br>CR3555 | CR3852 | CR3853 |
| 1/8 (-4)                       | -2       | 411   | 505              | 480                        | 592                                  | 486              | 651    | 574              | 751              | 816    | 921    |
|                                | -3       | 531   | 584              | 614                        | 692                                  | 660              | 846    | 784              | 968              | 1010   | 1115   |
|                                | -4       | 651   | 655              | 741                        | 771                                  | 836              | 995    | 994              | 1185             | 1160   | 1220   |
|                                | -5       | 664   | 664              | 814                        | 814                                  | 995              | 995    | 1205             | 1220             | 1220   | 1220   |
|                                | -6       | 664   | 664              | 814                        | 814                                  | 995              | 995    | 1220             | 1220             | 1220   | 1220   |
| 5/32 (-5)                      | -2       | (2)   | 699              | (2)                        | 805                                  | (2)              | 888    | (2)              | 1020             | (2)    | 1285   |
|                                | -3       | 714   | 840              | 815                        | 982                                  | 863              | 1130   | 1010             | 1285             | 1375   | 1545   |
|                                | -4       | 862   | 929              | 977                        | 1080                                 | 1080             | 1375   | 1270             | 1555             | 1605   | 1745   |
|                                | -5       | 1010  | 1020             | 1135                       | 1175                                 | 1300             | 1545   | 1530             | 1820             | 1775   | 1865   |
|                                | -6       | 1030  | 1030             | 1245                       | 1245                                 | 1525             | 1545   | 1800             | 1865             | 1865   | 1865   |
| 3/16 (-6)                      | -2       | (2)   | 920              | (2)                        | 1015                                 | (2)              | 1145   | (2)              | 1255             | (2)    | 1625   |
|                                | -3       | 918   | 1130             | 1005                       | 1240                                 | 1030             | 1450   | 1220             | 1585             | 1720   | 1945   |
|                                | -4       | 1095  | 1250             | 1200                       | 1385                                 | 1290             | 1740   | 1520             | 1900             | 1990   | 2250   |
|                                | -5       | 1310  | 1355             | 1390                       | 1505                                 | 1550             | 2030   | 1825             | 2210             | 2260   | 2420   |
|                                | -6       | 1455  | 1460             | 1580                       | 1615                                 | 1820             | 2215   | 2135             | 2525             | 2435   | 2525   |
| 1/4 (-8)                       | -7       | 1480  | 1480             | 1685                       | 1685                                 | 2080             | 2215   | 2440             | 2525             | 2525   | 2525   |
|                                | -8       | 1480  | 1480             | 1685                       | 1685                                 | 2215             | 2215   | 2525             | 2525             | 2525   | 2525   |
|                                | -3       | (2)   | 1725             | (2)                        | 1880                                 | (2)              | 2170   | (2)              | 2360             | (2)    | 2985   |
|                                | -4       | 1620  | 2000             | 1775                       | 2175                                 | 1820             | 2560   | 2135             | 2770             | 2995   | 3390   |
|                                | -5       | 1860  | 2165             | 2020                       | 2365                                 | 2165             | 2950   | 2530             | 3180             | 3360   | 3795   |
|                                | -6       | 2100  | 2305             | 2270                       | 2520                                 | 2525             | 3350   | 2945             | 3610             | 3735   | 4085   |
|                                | -7       | 2340  | 2450             | 2520                       | 2675                                 | 2870             | 3740   | 3340             | 4015             | 4055   | 4300   |
| -8                             | 2615     | 2615  | 2765             | 2825                       | 3215                                 | 3920             | 3745   | 4390             | 4390             | 4390   |        |
| -9                             | 2615     | 2615  | 2925             | 2925                       | 3565                                 | 3920             | 4140   | 4390             | 4390             | 4390   |        |
| -10                            | 2615     | 2615  | 2925             | 2925                       | 3920                                 | 3920             | 4390   | 4390             | 4390             | 4390   |        |
| Reference Shear Strength Level | -----    | 50 KSI  | 50 KSI           | 50 KSI                     | 50 KSI                               | 75 KSI           | 75 KSI | 75 KSI           | 75 KSI           | 75 KSI | 75 KSI |

- (1) For rivet grips greater than those listed, use highest value shown for the diameter, class and type.
- (2) Parts too short to be tested.



**TABLE V**

| MINIMUM TENSILE STRENGTH VALUES (LBS) |                  |                                      |  |                  |                                      |                  |        |
|---------------------------------------|------------------|--------------------------------------|--|------------------|--------------------------------------|------------------|--------|
| Rivet Diameter                        | CR3214<br>CR3224 | CR3212<br>CR3213<br>CR3222<br>CR3223 | CR3242<br>CR3243<br>CR3245<br>CR3246<br>CR3252<br>CR3253<br>CR3255 | CR3522<br>CR3523 | CR3552<br>CR3553<br>CR3555<br>CR3556 | CR3852<br>CR3853 | CR3524 |
| 1/8 (-4)                              | 250              | 285                                  | 345  | 400              | 490                                  | 570              | 360    |
| 5/32 (-5)                             | 390              | 445                                  | 530  | 635              | 740                                  | 860              | 555    |
| 3/16 (-6)                             | 560              | 635                                  | 710  | 890              | 1000                                 | 1160             | 800    |
| 1/4 (-8)                              | 1000             | 1125                                 | 1260   | 1570             | 1755                                 | 2030             | 1410   |

NOTE: 4-1, 5-1, 5-2, 6-1 AND 6-2 rivets are too short to test.

**TABLE VI**

| MINIMUM THIN SHEET PULL THRU LOADS (lbs.) |                                      |      |     |                              |      |      |
|---|--------------------------------------|------|-----|------------------------------|------|------|
| Rivet Diameter                            | 2024-T3 Aluminum Sheet<br>Types B, E |      |     | 6Al-4V Ti Sheet<br>Type M, C |      |      |
|   | Thickness                            | Load |     | Thickness                    | Load |      |
|   |                                      | NOM  | OS  |                              | NOM  | OS   |
| 1/8 (-4)                                  | .025                                 | 160  | 180 | .020                         | 250  | 280  |
| 5/32(-5)                                  | .032                                 | 220  | 260 | .025                         | 360  | 430  |
| 3/16(-6)                                  | .040                                 | 315  | 375 | .032                         | 570  | 680  |
| 1/4(-8)                                   | .050                                 | 400  | 480 | .040                         | 1000 | 1060 |

**TABLE VII**

| SPINDLE RETENTION LOAD |  |             |  |
|------------------------|--|-------------|--|
| Rivet Diameter         | Column A   |             | Column B   |
|                        | Minimum Axial Push-Out (lbs.)<br>Installed Condition |             | Minimum Axial Push-Out (lbs.)<br>Uninstalled Condition |
|                        | Types B & E  | Types M & C | All Types  |
| 1/8 (-4)               | 125  | 150         | 10   |
| 5/32 (-5)              | 200  | 250         | 10   |
| 3/16 (-6)              | 290  | 450         | 10   |
| 1/4 (-8)               | 380  | 750         | 10   |



**TABLE VIII**

| Spindle Flushness Limits (Inch)<br>All Types, Styles & Classes |                |                |
|--|----------------|----------------|
| Rivet Diameter   | A Max. (Above) | B Max. (Below) |
| 1/8 (-4)   | 0.010          | 0.015          |
| 5/32 (-5)  | 0.010          | 0.020          |
| 3/16 (-6)  | 0.010          | 0.020          |
| 1/4 (-8)   | 0.015          | 0.025          |

NOTE: 1) Collar (locking element) to be flush with top surface of rivet head within  $\pm 0.05$ . Slight collar flash permissible .010 Max. from top of rivet head, provided the flash is not so sharp and/or rigid as to be a safety concern.

**TABLE IX**

| FATIGUE TEST LOAD (lbs.) |                     |                   |                   |                              |                                  |       |
|--------------------------|---------------------|-------------------|-------------------|------------------------------|----------------------------------|-------|
| Rivet Diameter           | Rivet Grip Dash No. | Style A Hole Size | Style B Hole Size | Sheet Thickness "T" (Inches) | Maximum Load Per Specimen (lbs.) |       |
|                          |                     | $\pm .0005$       | $\pm .0005$       | $\pm .002$                   | B, & E                           | M & C |
| 1/8 (-4)                 | -2                  | .130              | .144              | .063                         | 440                              | 610   |
| 5/32 (-5)                | -3                  | .162              | .178              | .080                         | 700                              | 970   |
| 3/16 (-6)                | -3                  | .194              | .207              | .090                         | 945                              | 1310  |
| 1/4 (-8)                 | -4                  | .259              | .273              | .125                         | 1190                             | 1650  |

**TABLE X**

**QUALIFICATION TESTS**

| TEST                           | REQUIREMENT PARAGRAPH             | METHOD PARAGRAPH    | NUMBER OF SAMPLES                                 | NUMBER OF DEFECTS ALLOWED |
|--------------------------------|-----------------------------------|---------------------|---|---------------------------|
| Examination                    | 3.3.1, 3.3.2, 3.3.5, 3.3.6, 3.3.7 | 4.3.3, 4.4.1, 4.4.2 | All Qualification Samples                         | 0                         |
| Shear Strength                 | 3.4.1                             | 4.5.1               | 5 pieces each lot submitted                       | 0                         |
| Tensile Strength               | 3.4.2                             | 4.5.2               | 5 pieces each dia. and class submitted            | 0                         |
| Tensile Strength in Thin Sheet | 3.4.3                             | 4.5.3               | 3 pieces each lot submitted                       | 0                         |
| Spindle Retention              | 3.4.4                             | 4.5.5               | 6 pieces each lot submitted                       | 0                         |
| Fatigue Strength               | 3.4.6                             | 4.5.4               | 3 Fatigue Specimens each dia. and class submitted | 0                         |
| Installation                   | 3.4.7                             | 4.5.7               | 20 pieces each lot submitted                      | 1/Lot ②                   |
| Shank Expansion                | 3.4.5                             | 4.5.6               | 3 Class 1 pieces each lot submitted               | 0                         |

NOTES:



- 1) Grip lengths and diameters to be tested will be specified by the activity requesting qualification. Unless otherwise specified, number of grip lengths to be tested shall be three (3) of one diameter and two (2) of each additional diameter.
  - ② Failure rate (unacceptable spindle flushness) greater than 5%, or any splits shall be cause for rejection during qualification testing.

**TABLE XI**

**QUALITY CONFORMANCE TESTS**

| TEST   | REQUIREMENT PARAGRAPH             | METHOD PARAGRAPH | SAMPLE (MIL-STD-105) | ACCEPTANCE LIMITS (%AQL) |
|--|-----------------------------------|------------------|----------------------|--------------------------|
| Examination  | 3.3.1, 3.3.4, 3.3.5, 3.3.6, 3.3.7 | 4.3.3            | S-3                  | 4.0                      |
| Installation<br>a) Split Sleeve<br>b) Spindle Protrusion | 3.3.2, 3.3.10                     | 4.5.7            | S-3                  | 4.0                      |
| Shear Strength   | 3.4.1                             | 4.5.1            | S-1                  | 0 defective              |
| Tensile Strength   | 3.4.2                             | 4.5.2            | S-1                  | 0 defective              |
| Spindle Retention  | 3.4.4                             | 4.5.5            | S-1                  | 0 defective              |

**Sampling:**

Samples shall be selected at random, in accordance with MIL-STD-105, Inspection Level and Acceptance Quality Level (AQL), as specified in TABLE I and TABLE XI. Identical sample items may be used for any of the tests, provided selection of random samples is maintained and known characteristics of the samples are not used to influence the integrity of the test results.



CherryMax® Head Markings  
TABLE XII

| Part No.            | Head Style       | Rivet Material | Stem Material | Rivet Diameter | Head Markings |
|---------------------|------------------|----------------|---------------|----------------|---------------|
| CR 3212<br>Nominal  | MS20426<br>CSK.  | 5056           | 8740          | ALL            |               |
| CR 3213<br>Nominal  | MS20470<br>UNIV. | 5056           | 8740          | ALL            |               |
| CR 3222<br>Nominal  | MS20426<br>CSK.  | 5056           | 15-7          | ALL            |               |
| CR 3223<br>Nominal  | MS20470<br>UNIV. | 5056           | 15-7          | ALL            |               |
| CR 3522<br>Nominal  | MS20426<br>CSK.  | MONEL          |               |                |               |
| CR 3523<br>Nominal  | MS20470<br>UNIV. | MONEL          | 15-7          | ALL            |               |
| CR 3242<br>Oversize | MS20426<br>CSK.  | 5056           | 8740          | ALL            |               |
| CR 3243<br>Oversize | MS20470<br>UNIV. | 5056           | 8740          | ALL            |               |
| CR 3252<br>Oversize | MS20426<br>CSK.  | 5056           | 8740          | ALL            |               |
| CR3253<br>Oversize  | MS20470<br>UNIV. | 5056           | 15-7          | ALL            |               |
| CR 3552<br>Oversize | MS20426<br>CSK.  | MONEL          | 15-7          | ALL            |               |
| CR 3553<br>Oversize | MS20470<br>UNIV. | MONEL          | 15-7          | ALL            |               |
| CR 3214<br>Nominal  | NAS1097<br>CSK.  | 5056           | 8740          | -4 & -5        |               |
| CR 3214<br>Nominal  | NAS1097<br>CSK.  | 5056           | 8740          | -6 & -8        |               |
| CR 3224<br>Nominal  | NAS1097<br>CSK.  | 5056           | 15-7          | -4 & -5        |               |
| CR 3224<br>Nominal  | NAS1097<br>CSK.  | 5056           | 15-7          | -6 & -8        |               |
| CR 3524<br>Nominal  | NAS1097<br>CSK.  | MONEL          | 15-7          | -4 & -5        |               |
| CR 3524<br>Nominal  | NAS1097<br>CSK.  | MONEL          | 15-7          | -6 & -8        |               |
| CR 3245<br>Oversize | UNISINK          | 5056           | 8740          | ALL            |               |
| CR 3255<br>Oversize | UNISINK          | 5056           | 15-7          | ALL            |               |
| CR 3555<br>Oversize | UNISINK          | MONEL          | 15-7          | ALL            |               |
| CR 3852<br>Oversize | MS20426<br>CSK.  | INCO           | INCO          | ALL            |               |
| CR 3853<br>Oversize | MS20470<br>UNIV. | INCO           | INCO          | ALL            |               |
| CR 3246<br>Oversize | 120<br>CSK.      | 5056           | 8740          | ALL            |               |
| CR 3556<br>Oversize | 120<br>CSK.      | MONEL          | 15-7          | ALL            |               |

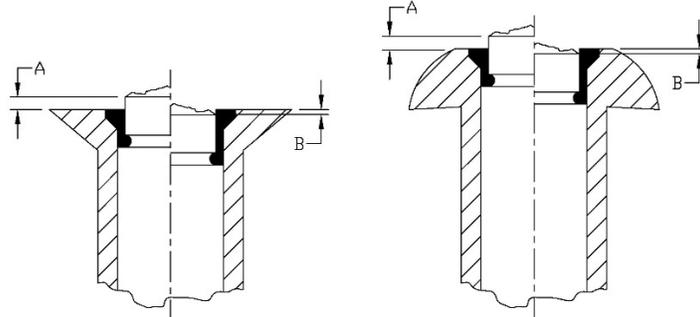


Figure 1

INSTALLED SPINDLE AND COLLAR FLUSHNESS

NOTE: Locking element shall be flush with top surface of rivet head within  $\pm 0.005$ .  
Slight element flash permissible .010 maximum from top of rivet head.

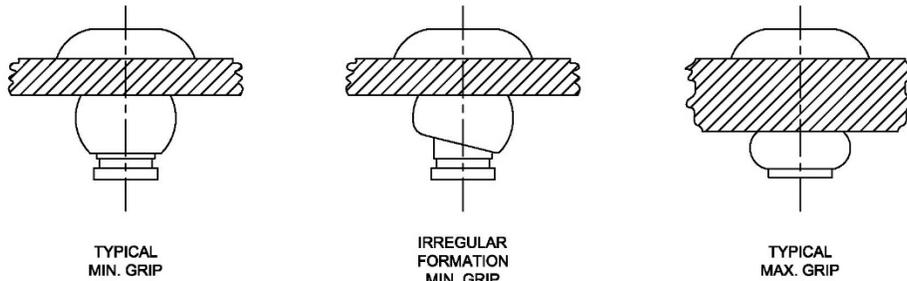


Figure 2

ACCEPTABLE BLIND HEAD FORMATION

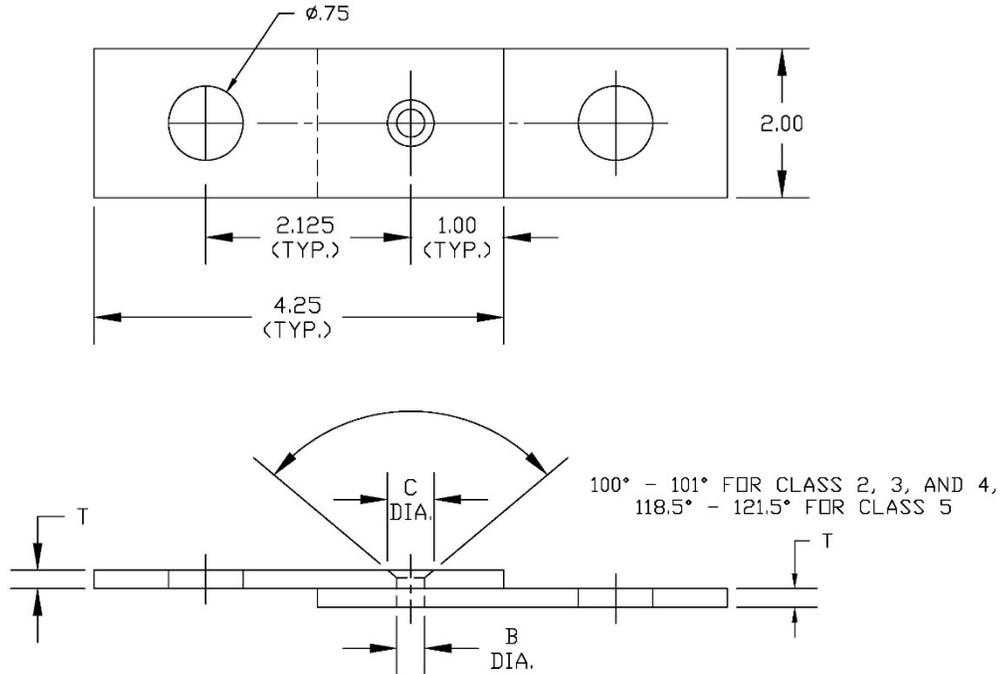


Figure 3

| TYPE   | CLASS   | (-4)<br>1/8" Diameter |       | (-5)<br>5/32 Diameter |       | (-6)<br>3/16" Diameter |       | (-8)<br>1/4" Diameter |       |
|--------|---------|-----------------------|-------|-----------------------|-------|------------------------|-------|-----------------------|-------|
|        |         | B                     | C     | B                     | C     | B                      | C     | B                     | C     |
|        |         | ±0005                 | ±003  | ±0005                 | ±.003 | ±0005                  | ±003  | ±0005                 | ±.003 |
| Type A | Class 1 | 0.130                 | ---   | 0.162                 | ---   | 0.194                  | ---   | 0.258                 | ---   |
|        | Class 2 | 0.130                 | 0.225 | 0.162                 | 0.286 | 0.194                  | 0.353 | 0.258                 | 0.476 |
|        | Class 3 | 0.130                 | 0.192 | 0.162                 | 0.243 | 0.194                  | 0.299 | 0.258                 | 0.392 |
| Type B | Class 1 | 0.144                 | ---   | 0.178                 | ---   | 0.207                  | ---   | 0.273                 | ---   |
|        | Class 2 | 0.144                 | 0.225 | 0.178                 | 0.286 | 0.207                  | 0.353 | 0.273                 | 0.476 |
|        | Class 4 | 0.144                 | 0.170 | 0.178                 | 0.213 | 0.207                  | 0.255 | ---                   | ---   |
|        | Class 5 | 0.144                 | 0.272 | 0.178                 | 0.314 | 0.207                  | 0.350 | ---                   | ---   |

SHEAR STRENGTH TEST SPECIMEN

**NOTES:**

- 1) Holes to be square with both faces.
- 2) Countersink and cylindrical holes to be concentric.
- 3) Material: Alloy Steel Rc46 Min.
- 4) All dimensions in inches.
- 5) "T" Thickness shall be 1/2 the maximum grip of the rivet being tested.
- 6) Coupon dimensions not affecting test results are optional.

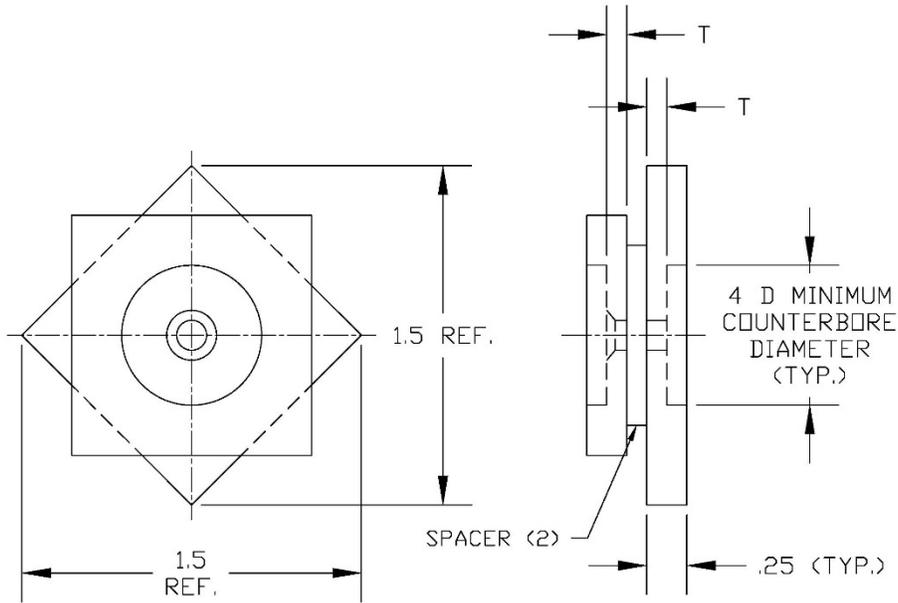


Figure 4

| RIVET DIAMETER | "T" DIMENSION MINIMUM |
|----------------|-----------------------|
| 1/8 (-4)       | .063                  |
| 5/32 (-5)      | .078                  |
| 3/16 (-6)      | .094                  |
| 1/4 (-8)       | .125                  |

TENSION SPECIMEN

**NOTES:**

- 1) Material: Alloy Steel Rc46 Min.
- 2) Hole preparation per Figure 3.
- 3) Spacer thickness as necessary to obtain maximum grip for rivet tested.
- 4) Dimension in inches.
- 5) Coupon dimensions not affecting test results are optional.

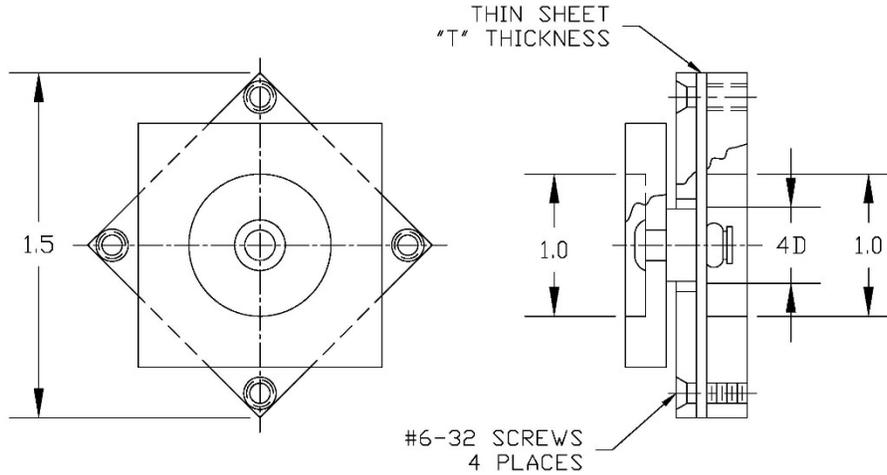


Figure 5

THIN SHEET PULL-THRU SPECIMEN

**NOTES:**

- 1) Material: Type B & E Rivets=2024-T3 Clad Aluminum.  
Type M & C Rivets=6Al-4V Titanium.
- 2) Hole Preparation - See Figure 3.
- 3) "T" Thickness (See TABLE VI) Selected to produce blind head "pull thru".
- 4) Dimensions in Inches.
- 5) Coupon dimensions not affecting test results are optional.

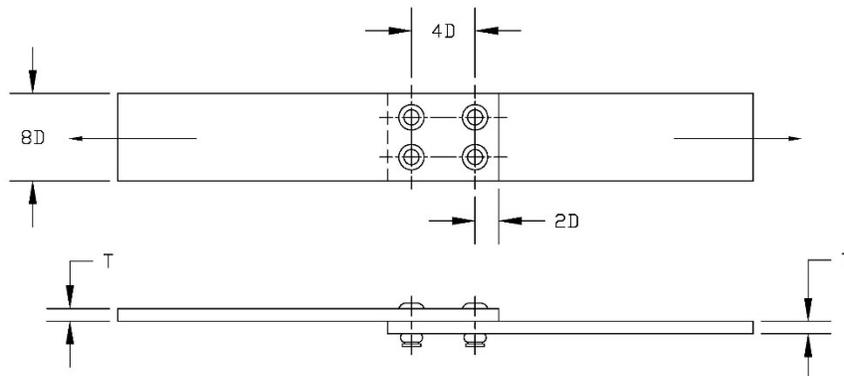


Figure 6

FATIGUE SPECIMEN

**NOTES:**

- 1) Material: Type B, and E Rivets - 2024-T3 Clad Aluminum Alloy Sheet – M&C 6AL-4V
- 2) Hole preparation - See Figure 3
- 3) "T" Thickness to be in accordance with TABLE IX for specific rivet being tested.
- 4) Coupon dimensions not affecting test results are optional.

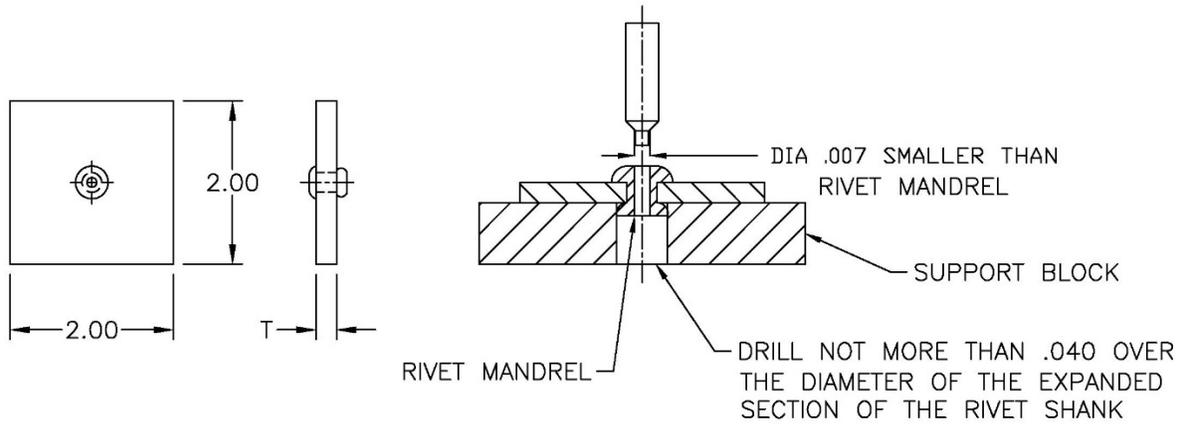


Figure 7

| Nominal Rivet Diameter | Style A Hole Dia. ±.0005 | Style B Hole Dia. ±.0005 |
|------------------------|--------------------------|--------------------------|
| 1/8 (-4)               | .132                     | .146                     |
| 5/32 (-5)              | .164                     | .180                     |
| 3/16 (-6)              | .196                     | .209                     |
| 1/4 (-8)               | .261                     | .275                     |

SPINDLE RETENTION TEST

**NOTES:**

- 1) Dimension in inches.
- 2) Countersunk dimensions to be same as Figure 3.
- 3) "T" to be in accordance with manufacturer's recommended grip length for rivets being tested.
- 4) Coupon dimensions not affecting test results are optional.

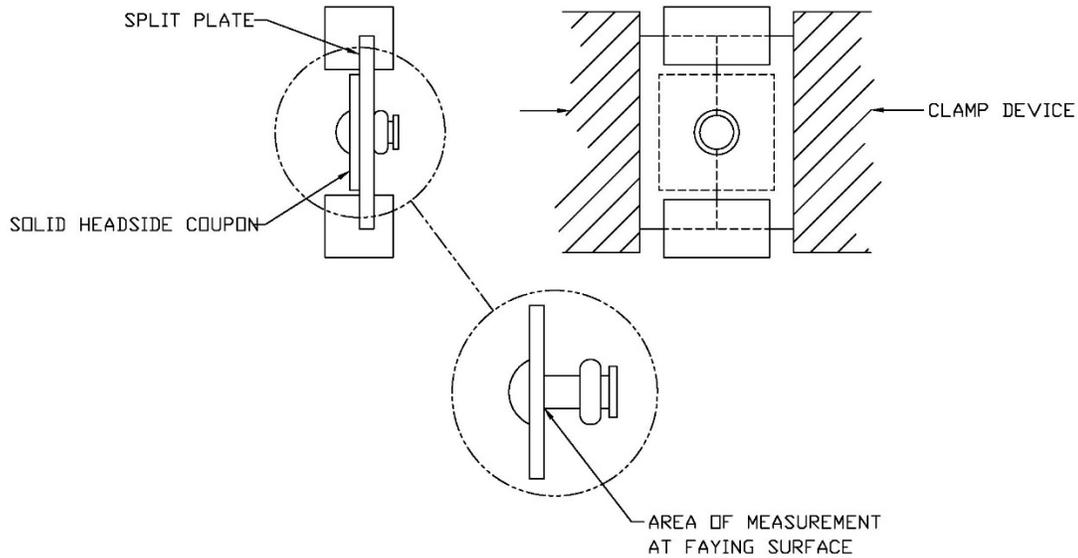


Figure 8

| Nominal Rivet Diameter | Rivet Grip Dash No. | Headside Coupon    |                     |         | Split Plate        |                               |         | Total Grip |
|------------------------|---------------------|--------------------|---------------------|---------|--------------------|-------------------------------|---------|------------|
|                        |                     | Thickness<br>±.002 | Hole Size<br>±.0005 |         | Thickness<br>±.001 | Hole Size<br>+.0005<br>-.0000 |         |            |
|                        |                     |                    | Style A             | Style B |                    | Style A                       | Style B |            |
| 1/8 (-4)               | -2                  | .063               | .1315               | .1455   | .062               | .1325                         | .1465   | .125       |
| 5/32 (-5)              | -3                  | .080               | .1635               | .1795   | .078               | .1645                         | .1805   | .158       |
| 3/16 (-6)              | -3                  | .090               | .1955               | .2085   | .094               | .1965                         | .2095   | .184       |
| 1/4 (-8)               | -4                  | .125               | .2605               | .2745   | .125               | .2615                         | .2755   | .250       |

SHANK EXPANSION COUPON

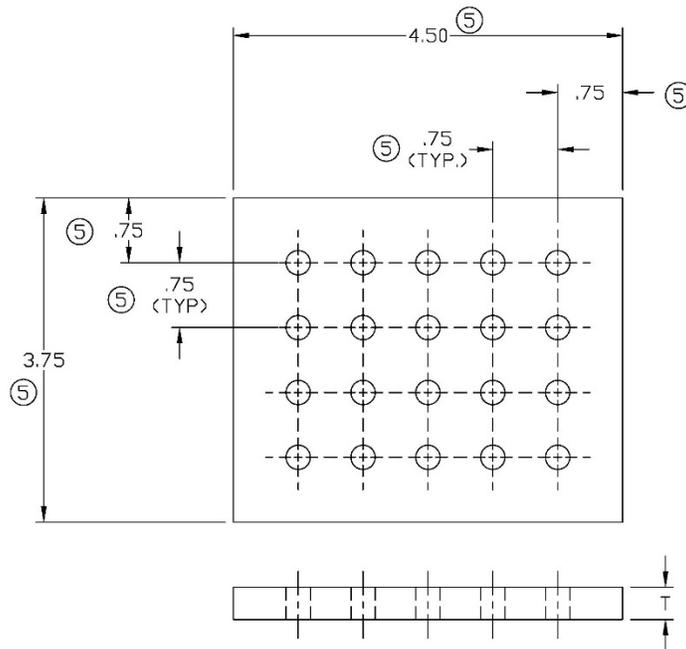


Figure 9

| Rivet Diameter | Hole Diameter<br>±.0005<br>Minimum Grip |         | Hole Diameter<br>±.0005<br>Maximum Grip |         |
|----------------|---|---------|---|---------|
|                | Style A                                 | Style B | Style A                                 | Style B |
| 1/8 (-4)       | .132                                    | .146    | .129                                    | .143    |
| 5/32 (-5)      | .164                                    | .180    | .160                                    | .176    |
| 3/16 (-6)      | .196                                    | .209    | .192                                    | .205    |
| 1/4 (-8)       | .261                                    | .275    | .256                                    | .271    |

SPECIMEN FOR INSTALLATION TEST

**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: Rivet Types B & E = Alloy Steel or 7075-T6 Aluminum Alloy or 2024-T3 Aluminum. Rivet Types M & C = Alloy Steel RC46 Min.
- 3) Dimensions in inches.
- 4) See Figure 3 for countersink dimensions.
- 5) Dimension values are optional.