IFI-509
1999

# METRIC BREAK MANDREL CLOSED END BLIND RIVETS

BLIND RIVETS

*IFI NOTES:*

1. ***This specification is under the jurisdiction of the IFI Standards and Technical Practices Committee and directly under the Technical Committee of IFI's Division I. First published in 1982 it has been revised and reissued in 1999. Sizes in this document are based on a soft conversion from inch practice and reflect the needs of major users.***

2. ***There are no national consensus standards or ISO standards for this product at this time.***

## 1. Scope

**1.1 Scope.** This standard establishes the dimensional, mechanical, and performance requirements of metric break mandrel closed end blind rivets suitable for use in joining the component parts of an assembly.

## 1.2 Definitions

**1.2.1 Blind Rivet.** A blind rivet is a blind fastener which has a self-contained mechanical, chemical or other feature which permits the formation of an upset on the blind end of the rivet and expansion of the rivet shank during rivet

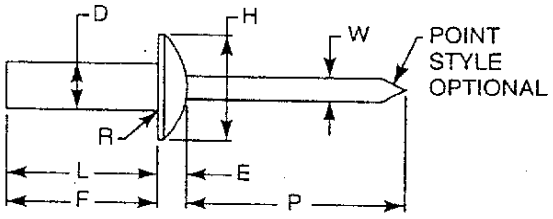


**Table 1 Dimensions of Protruding Head Style Break Mandrel Closed End Blind Rivets**

| Rivet Series No. | Nom Rivet Size | D | | H | | E | R | W | P | F |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Body Dia | | Style 1 – Regular Head | | | Radius of Fillet | Mandrel Dia | Mandrel Protrusion | Blind Side Protrusion |
| | | | | Head Dia | | Head Height | | | | |
| | | Max | Min | Max | Min | Max | Max | Max | Min | Max |
| 4 | 3.2 | 3.25 | 3.10 | 6.40 | 5.69 | 1.27 | 0.7 | 1.85 | 25 | Equal to "L" Rivet Length |
| 5 | 4.0 | 4.04 | 3.89 | 8.33 | 7.52 | 1.65 | 0.7 | 2.31 | 27 | |
| 6 | 4.8 | 4.85 | 4.65 | 10.01 | 9.04 | 2.03 | 0.7 | 2.77 | 27 | |
| 8 | 6.3 | 6.48 | 6.25 | 13.33 | 12.07 | 2.54 | 0.7 | 3.71 | 27 | |
| See Notes | | | | | | | 3 | | | 4 |

NOTES:
1. All dimensions are in millimeters.
2. For application data see Table 2.
3. The junction of head and shank shall have a fillet with a max radius as shown.
4. The blind side protrusion (F) equals the max length of rivet (L) as given in Table 2 for the applicable grip. Minimum blind side clearance may be calculated by subtracting the actual grip (G), (i.e., the total thickness of the material to be joined), from the blind side protrusion (F). (Example: To join two plates each 2.5 mm thick with a No. 5 rivet, a No. 54 rivet would be used. Minimum blind side clearance necessary to permit proper rivet setting would be L – G, which is 12.7 – 5.0, and equals 7.7 mm).

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**Table 2 Application Data for Protruding Head Style Break Mandrel Closed End Blind Rivets**

| Rivet Series No. | Nom Rivet Size | Recommended Metric Drill Size | Recommended Hole Size | | Rivet No. | Grip Range | Rivet Length L |
|---|---|---|---|---|---|---|---|
| | | | Max | Min | | | Max |
| 4 | 3.2 | 3.3 | 3.38 | 3.28 | 41<br>42<br>43 | 0.5 to 1.6<br>1.7 to 3.2<br>3.3 to 4.8 | 7.5<br>9.1<br>10.7 |
| | | | | | 44<br>45<br>46<br>48 | 4.9 to 6.4<br>6.5 to 7.9<br>8.0 to 9.5<br>9.6 to 12.7 | 12.3<br>13.9<br>15.5<br>18.7 |
| 5 | 4.0 | 4.1 | 4.16 | 4.06 | 52<br>53<br>54 | 0.5 to 3.2<br>3.3 to 4.8<br>4.9 to 6.4 | 9.5<br>11.1<br>12.7 |
| | | | | | 55<br>56<br>58 | 6.5 to 7.9<br>8.0 to 9.5<br>9.6 to 12.7 | 14.3<br>15.9<br>19.1 |
| 6 | 4.8 | 4.9 | 4.98 | 4.88 | 62<br>63<br>64 | 0.5 to 3.2<br>3.3 to 4.8<br>4.9 to 6.4 | 10.3<br>11.9<br>13.5 |
| | | | | | 66<br>68<br>610<br>612 | 6.5 to 9.5<br>9.6 to 12.7<br>12.8 to 15.9<br>16.0 to 19.1 | 16.7<br>19.8<br>23.0<br>26.1 |
| 8 | 6.3 | 6.5 | 6.63 | 6.53 | 82<br>84<br>86 | 0.5 to 3.2<br>3.3 to 6.4<br>6.5 to 9.5 | 11.3<br>14.5<br>17.7 |
| | | | | | 88<br>810 | 9.6 to 12.7<br>12.8 to 15.9 | 20.8<br>24.0 |
| | | | | | 812<br>814<br>816 | 16.0 to 19.1<br>19.2 to 22.2<br>22.3 to 25.4 | 27.2<br>30.4<br>33.5 |
| See Notes | | 2 | | | | | |

**NOTES:**
1. All dimensions are in millimeters.
2. Recommended drill sizes are those which normally produce holes within the specified hole size limits.

setting to join the component parts of an assembly.

**1.2.2** Break mandrel closed end blind rivets are pull mandrel type blind rivets where during the setting operation the mandrel is pulled within the rivet body and breaks at or near the junction of the mandrel shank and its upset end.

**1.2.3 Closed End.** The end of the rivet, as manufactured, is solid and remains closed on the blind side after setting.

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**1.2.4** Definitions of other terms used in this standard are given in IFI-110/550, "Glossary of Terms Relating to Blind Rivets," page I–3.

## 2. Designations

**2.1 Styles.** The two basic styles of break mandrel closed end blind rivets are designated as protruding head and flush head. Flush head rivets are available only in the 120 deg countersunk head style.

**2.2 Grades.** The material combinations of break mandrel closed end blind rivets are designated as grades, with each material combination representing a different combination of rivet body material and mandrel material as given in Table 5.

**2.3 Design.** The design of break mandrel closed end blind rivets shall be in accordance with the practice of the manufacturer.

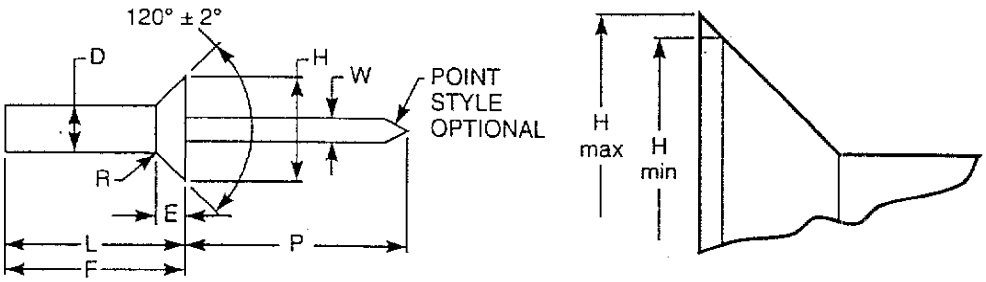


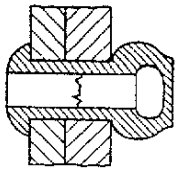

**Table 3 Dimensions of 120 Deg Flush Head Style Break Mandrel Closed End Blind Rivets**

| Rivet Series No. | Nom Rivet Size | D | | H | | E | R | W | P | F |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Body Dia | | Style 4 – 120 Deg Head | | | Radius of Fillet | Mandrel Dia | Mandrel Protrusion | Blind Side Protrusion |
| | | | | Head Dia | | Head Height | | | | |
| | | Max | Min | Max | Min | Ref | Max | Max | Min | Max |
| 4 | 3.2 | 3.25 | 3.10 | 6.22 | 5.61 | 1.07 | 0.7 | 1.85 | 25 | Equal to "L" Rivet Length |
| 5 | 4.0 | 4.04 | 3.89 | 8.33 | 7.52 | 1.30 | 0.7 | 2.31 | 27 | |
| 6 | 4.8 | 4.85 | 4.65 | 10.01 | 9.04 | 1.52 | 0.7 | 2.77 | 27 | |
| 8 | 6.3 | 6.48 | 6.25 | 13.33 | 12.07 | 2.03 | 0.7 | 3.71 | 27 | |
| See Notes | | | | 3 | | 4 | | | | 5 |

NOTES:
1. All dimensions are in millimeters.
2. For application data see Table 4.
3. Max head diameter is calculated on nominal rivet diameter and nominal head angle extended to sharp corner. Min head diameter is absolute.
4. Head height is given for reference purposes only. Variations in this dimension are controlled by the diameters (H) and (D) and the included angle of the head.
5. The blind side protrusion (F) equals the max length of rivet (L) as given in Table 4 for the applicable grip. Minimum blind side clearance may be calculated by subtracting the actual grip (G), (i.e., the total thickness of the material to be joined) from the blind side protrusion (F). (Example: To join two plates each 2.5 mm thick with a No. 5 rivet, a No. 54 rivet would be used. Minimum blind side clearance necessary to permit proper rivet setting would be L – G which is 14.0 – 5.0 and equals 9.0 mm).

# METRIC BREAK MANDREL CLOSED END BLIND RIVETS





Set Closed End Blind Rivet

Table 4 Application Data for Flush Head Style Break Mandrel Closed End Blind Rivets

| Rivet Series No. | Nom Rivet Size | Recommended Metric Drill Size | Recommended Hole Size | | Rivet No. | Grip Range | Rivet Length L |
|---|---|---|---|---|---|---|---|
| | | | Max | Min | | | Max |
| 4 | 3.2 | 3.3 | 3.38 | 3.28 | 41<br>42 | 0.9 to 1.6<br>1.7 to 3.2 | 8.4<br>10.0 |
| | | | | | 43<br>44<br>45 | 3.3 to 4.8<br>4.9 to 6.4<br>6.5 to 7.9 | 11.6<br>13.2<br>14.8 |
| | | | | | 46<br>48 | 8.0 to 9.5<br>9.6 to 12.7 | 16.4<br>19.6 |
| 5 | 4.0 | 4.1 | 4.16 | 4.06 | 52<br>53<br>54 | 1.7 to 3.2<br>3.3 to 4.8<br>4.9 to 6.4 | 10.8<br>12.4<br>14.0 |
| | | | | | 55<br>56<br>58 | 6.5 to 7.9<br>8.0 to 9.5<br>9.6 to 12.7 | 15.5<br>17.1<br>20.3 |
| 6 | 4.8 | 4.9 | 4.98 | 4.88 | 62<br>63 | 1.6 to 3.2<br>3.3 to 4.8 | 12.0<br>13.7 |
| | | | | | 64<br>66<br>68 | 4.9 to 6.4<br>6.5 to 7.9<br>8.0 to 12.7 | 15.3<br>18.7<br>21.6 |
| | | | | | 610<br>612 | 12.8 to 15.9<br>16.0 to 19.1 | 26.1<br>28.0 |
| See Notes | | 2 | | | | | |

NOTES:
1. All dimensions are in millimeters.
2. Recommended drill sizes are those which normally produce holes within the specified hole size limits.

## 3. Requirements

### 3.1 Materials and Processes

**3.1.1 Material.** Rivet bodies and mandrels shall be made of the material specified for the grade in Table 5. When the specific material analysis is not given, the analysis shall be selected by the manufacturer and shall be such to assure that rivets meet the mechanical and performance requirements specified in 3.3.

**3.1.2 Heat Treatment.** Rivet components may be heat treated as necessary to meet the mechanical and performance requirements specified for the grade. Heat treatment shall be in accordance with good commercial practice.

**3.1.3 Finish.** Rivet bodies and mandrels of all grades may be furnished plain (bare metal) or with a protective coating at the option of the manufacturer.

### 3.2 Dimensional Requirements

**3.2.1 Rivet Dimensions.** Protruding and flush head break mandrel closed end blind rivets shall conform to the dimensions given in Tables 1 and 3, respectively.

**3.2.2 Application Data.** Recommendations on the selection and application of protruding and flush head break mandrel closed end blind rivets are given in Tables 2 and 4, respectively.

### 3.3 Mechanical and Performance Requirements

**3.3.1 Shear Strength.** Rivets, except those described in 3.3.4, shall have ultimate shear strengths not less than the minimum ultimate shear strengths specified for the applicable size and grade given in Table 6 when tested in accordance with 2.1 of IFI-522, page I–27.

**3.3.2 Tensile Strength.** Rivets, except those described in 3.3.4, shall have ultimate tensile strengths not less than the minimum ultimate tensile strengths specified for the applicable size and grade given in Table 6 when tested in accordance with 2.2 of IFI-522.

**3.3.3 Mandrel Break Load.** While the rivet is being set, the axially applied load necessary to break the mandrel shall be within the limits specified for the applicable rivet size and grade in Table 7, when tested in accordance with 2.3 of IFI-522, page I–31.

**3.3.4** Protruding head rivets with specified maximum grip lengths shorter than 1.0 times the nominal rivet diameter, and flush head rivets with specified maximum grip lengths shorter than 1.5 times the nominal rivet diameter shall not be subject to either shear or tensile testing.

## 4. Marking

Rivets need not be marked to identify either grade or source of manufacture.

## 5. Inspection

Rivets shall be inspected to determine conformance with dimensional, mechanical and performance requirements. Inspection shall be as agreed between manufacturer and purchaser.

# METRIC BREAK MANDREL CLOSED END BLIND RIVETS



## Table 5 Grades of Break Mandrel Closed End Blind Rivets

| Grade Designation | Rivet Body Material | Mandrel Material |
|---|---|---|
| 15 | Aluminum Alloy 1100 | Aluminum Alloy |
| 19 | Aluminum Alloy 5056 | Carbon Steel |
| 20 | Copper Alloy No. 110 | Carbon Steel |
| 26 | Aluminum Alloy | Stainless Steel |
| 30 | Low Carbon Steel | Carbon Steel |
| 50 | Stainless Steel | Carbon Steel |
| 51 | Stainless Steel | Stainless Steel |

## Table 6 Ultimate Shear and Tensile Strength of Break Mandrel Closed End Blind Rivets

| Nom Rivet Size mm | Ultimate Shear Strength Newtons, min | | | | | | | Ultimate Tensile Strength Newtons, min | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Grade 15 | Grade 19 | Grade 20 | Grade 26 | Grade 30 | Grade 50 | Grade 51 | Grade 15 | Grade 19 | Grade 20 | Grade 26 | Grade 30 | Grade 50 | Grade 51 |
| 3.2 | 440 | 1070 | 980 | * | * | * | * | 490 | 1240 | 1330 | * | * | * | * |
| 4.0 | 580 | 1560 | * | * | * | * | * | 710 | 2130 | * | * | * | * | * |
| 4.8 | 930 | 2220 | * | * | * | * | * | 1110 | 3070 | * | * | * | * | * |
| 6.3 | * | 4000 | * | * | * | * | * | * | 4890 | * | * | * | * | * |

* Value as agreed between manufacturer and purchaser.

## Table 7 Mandrel Break Loads of Break Mandrel Closed End Blind Rivets

| Nom Rivet Size mm | Grade | 15 | 19 | 20 | 26 | 30 | 50 | 51 |
|---|---|---|---|---|---|---|---|---|
| | Rivet Body Material | Aluminum | Aluminum | Copper | Aluminum | Steel | Stainless Steel | Stainless Steel |
| | Mandrel Material | Aluminum | Steel | Steel | Stainless Steel | Steel | Steel | Stainless Steel |
| 3.2 | Min | 1110 | 2450 | 2450 | * | * | * | * |
| | Max | 1780 | 3340 | 3340 | * | * | * | * |
| 4.0 | Min | 1890 | 3110 | * | * | * | * | * |
| | Max | 2670 | 4890 | * | * | * | * | * |
| 4.8 | Min | 2670 | 4000 | * | * | * | * | * |
| | Max | 3560 | 6340 | * | * | * | * | * |
| 6.3 | Min | * | 8450 | * | * | * | * | * |
| | Max | * | 10230 | * | * | * | * | * |

* Value as agreed between manufacturer and purchaser.

NOTES:
1. All loads in newtons.
2. Mandrel break load is defined as the load in newtons necessary to break the mandrel when setting the rivet.