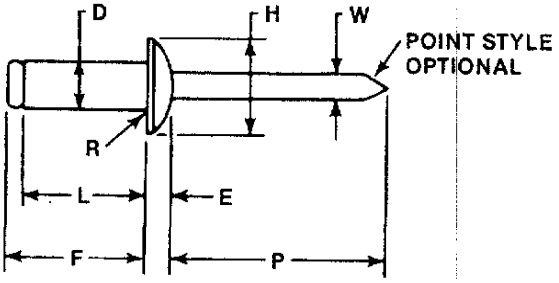
BLIND RIVETS

BREAK MANDREL BLIND RIVETS

IFI 114 1986

1. Scope.

1.1 Scope. This standard establishes the dimensional, mechanical, and performance requirements of break mandrel 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, 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 setting to join the component parts of an assembly.

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

1.2.3 Definitions of other terms used in this standard are given in IFI-110, "Glossary of Terms Relating to Blind Rivets," page K-40.

Table 1 Dimensions of Regular and Large Protruding Head Style Break Mandrel Blind Rivets

Rivet Series No.	Nom Rivet Size	D		H		E	H		E	R	W	P	F	L
		Body Dia		Style 1 - Regular Head			Style 2 - Large Head			Radius of Fillet	Mandrel Dia	Mandrel Protrusion	Blind Side Protrusion	Rivet Body Length
				Head Dia		Head Height	Head Dia		Head Height					
		Max	Min	Max	Min	Max	Max	Min	Max	Max	Nom	Min	Max	Max
3	3/32 0.0938	0.096	0.090	0.198	0.178	0.032	0.293	0.269	0.040	0.015	0.057	1.00	L+.100	See Table 2
4	1/8 0.1250	0.128	0.122	0.262	0.238	0.040	0.390	0.360	0.065	0.020	0.076	1.00	L+.120	
5	5/32 0.1562	0.159	0.153	0.328	0.296	0.050	0.488	0.448	0.075	0.020	0.095	1.00	L+.140	
6	3/16 0.1875	0.191	0.183	0.394	0.356	0.060	0.650	0.600	0.092	0.025	0.114	1.00	L+.160	
8	1/4 0.2500	0.255	0.246	0.525	0.475	0.080	0.780	0.720	0.107	0.030	0.151	1.00	L+.180	
See Notes 3										4			5	

NOTES:

1. All dimensions are in inches.
2. For application data see Table 2.
3. Rivet series numbers represent the nominal sizes of rivets in 1/32 in.
4. The junction of head and shank shall have a fillet with a max radius as shown. For Grades 40, 50 and 51 rivets, the max fillet radius for 3/16 in. rivets shall be 0.035 in., and for 1/4 in. rivets shall be 0.060 in.
5. When computing the blind side protrusion (F), the max length of rivet body (L) as given in Table 2 for the applicable grip shall be used. Minimum blind side clearance may be calculated by subtracting the actual grip (G), (i.e., total thickness of the material to be joined), from the specified blind side protrusion (F). (Example: To join two plates, each .100 in. thick, with a 5/32 in. rivet, a No. 54 rivet would be used. Minimum blind side clearance necessary to permit proper rivet setting would be L + .140 - G, which is .425 + .140 - .200, and equals .365 in.).

BREAK MANDREL BLIND RIVETS

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

Rivet Series No.	Nom Rivet Size	Recommended Drill Size	Recommended Hole Size		Rivet No.	Grip Range	Rivet Body Length L
			Max	Min			Max
3	3/32 0.0938	#41	0.100	0.097	32 34 36	.020 - .125 .126 - .250 .251 - .375	.250 .375 .500
4	1/8 0.1250	#30	0.133	0.129	41 42 43	.020 - .062 .063 - .125 .126 - .187	.212 .275 .337
					44 45 46 48 410	.188 - .250 .251 - .312 .313 - .375 .376 - .500 .501 - .625	.400 .462 .525 .650 .775
5	5/32 0.1562	#20	0.164	0.160	52 53 54	.020 - .125 .126 - .187 .188 - .250	.300 .362 .425
					56 58 510	.251 - .375 .376 - .500 .501 - .625	.550 .675 .800
6	3/16 0.1875	#11	0.196	0.192	62 63 64	.020 - .125 .126 - .187 .188 - .250	.325 .387 .450
					66 68 610 612	.251 - .375 .376 - .500 .501 - .625 .626 - .750	.575 .700 .825 .950
					614 616 618	.751 - .875 .876 - 1.000 1.001 - 1.125	1.075 1.200 1.325
8	1/4 0.250	F	0.261	0.257	82 84 86	.020 - .125 .126 - .250 .251 - .375	.375 .500 .625
					88 810 812 814	.376 - .500 .501 - .625 .626 - .750 .751 - .875	.750 .875 1.000 1.125
					816 818 820	.876 - 1.000 1.001 - 1.125 1.126 - 1.250	1.250 1.375 1.500
See Notes		3			2		

NOTES:

1. All dimensions are in inches.
2. The first numeral in the rivet number designates the rivet series number, the last one or two numerals give the maximum grip in 1/16 in. which the rivet is capable of joining.
3. Recommended drill sizes are those which normally produce holes within the specified hole size limits.

2. Designations.

2.1 Styles. The two basic styles of break mandrel blind rivets are designated as protruding head and flush head. Protruding head rivets are available in two styles designated as regular head and large head. Flush head rivets are available in two styles designated

as 100 deg countersunk head and 120 deg countersunk head.

2.2 Grades. The material combinations of break mandrel 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 blind rivets shall be in accordance with the practice of the manufacturer.

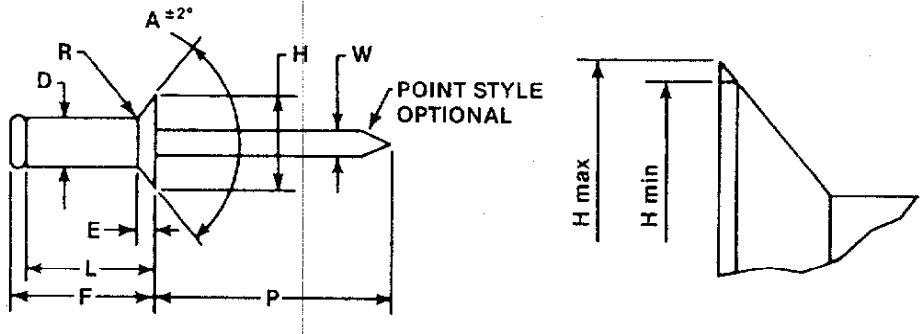


Table 3 Dimensions of 100 Deg and 120 Deg Flush Head Style Break Mandrel Blind Rivets

Rivet Series No.	Nom Rivet Size	D		A	H		E	A	H		E	R	W	P	F	L
		Body Dia		Style 3 - 100 Deg Head				Style 4 - 120 Deg Head				Radius of Fillet	Mandrel Dia	Mandrel Protrusion	Blind Side Protrusion	Rivet Body Length
				Head Angle	Head Dia		Head Height	Head Angle	Head Dia		Head Height					
		Max	Min	Deg Nom	Max	Min	Ref	Deg Nom	Max	Min	Ref	Max	Nom	Min	Max	Max
3	3/32 0.0938	0.096	0.090	100	0.187	0.161	0.039	120	0.187	0.161	0.027	0.020	0.057	1.00	L + .100	See Table 4
4	1/8 0.1250	0.128	0.122	100	0.233	0.207	0.045	120	0.233	0.207	0.031	0.025	0.076	1.00	L + .120	
5	5/32 0.1562	0.159	0.153	100	0.294	0.268	0.058	120	0.294	0.268	0.040	0.030	0.095	1.00	L + .140	
6	3/16 0.1875	0.191	0.183	100	0.361	0.335	0.073	120	0.361	0.335	0.050	0.035	0.114	1.00	L + .160	
See Notes 3					4		5		4		5				6	

NOTES:

1. All dimensions are in inches.
2. For application data see Table 4.
3. Rivet series numbers represent the nominal sizes of rivets in 1/32 in.
4. Max head diameter is calculated on nominal rivet diameter and nominal head angle extended to sharp corner. Min head diameter is absolute.
5. 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.
6. When computing the blind side protrusion (F), the max length of rivet body (L) as given in Table 4 for the applicable grip shall be used. Minimum blind side clearance may be calculated by subtracting the actual grip (G), (i.e., total thickness of the material to be joined), from the specified blind side protrusion (F). (Example: To join two plates, each .187 in. thick, with a 3/16 in. rivet, a No. 66 rivet would be used. Minimum blind side clearance necessary to permit proper rivet setting would be L + .160 - G, which is .575 + .160 - .374, which equals .361 in.).

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

Rivet Series No.	Nom Rivet Size	Recommended Drill Size	Recommended Hole Size		Rivet No.	Grip Range	Rivet Body Length L
			Max	Min			Max
3	3/32 0.0938	#41	0.100	0.097	32 34	.079 - .125 .126 - .250	.250 .375
4	1/8 0.1250	#30	0.133	0.129	42 43 44	.092 - .125 .126 - .187 .188 - .250	.275 .337 .400
					45 46 48	.251 - .312 .313 - .375 .376 - .500	.462 .525 .650
5	5/32 0.1562	#20	0.164	0.160	53 54 56 58	.120 - .187 .188 - .250 .251 - .375 .376 - .500	.362 .425 .550 .675
6	3/16 0.1875	#11	0.196	0.192	63 64 66 68 610	.151 - .187 .188 - .250 .251 - .375 .376 - .500 .501 - .625	.387 .450 .575 .700 .825
See Notes		3			2		

NOTES:

1. All dimensions are in inches.
2. The first numeral in the rivet number designates the rivet series number, the last one or two numerals give the maximum grip in 1/16 in. which the rivet is capable of joining.
3. 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 *Finish.* Grade 30 rivet bodies are either zinc or cadmium plated with a minimum plating thickness of 0.00015 in. Rivet bodies of all other grades are furnished plain (bare metal) unless otherwise specified. Because mandrels are discarded following rivet setting, mandrels of all materials may be furnished plain 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 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 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 3.3.3, shall have ultimate shear strengths not less than the minimum ultimate

BREAK MANDREL BLIND RIVETS

Table 5 Grades of Break Mandrel Blind Rivets

Grade Designation	Rivet Body Material	Mandrel Material
10	Aluminum Alloy 5050	Aluminum Alloy
11	Aluminum Alloy 5052	Aluminum Alloy
23	Aluminum Alloy 5754	Aluminum Alloy
16	Aluminum Alloy 5154	Carbon Steel
18	Aluminum Alloy 5052	Carbon Steel
19	Aluminum Alloy 5056	Carbon Steel
24	Aluminum Alloy 5754	Carbon Steel
20	Copper Alloy No. 110	Carbon Steel
26	Aluminum Alloy 5052	Stainless Steel (400 Series)
30	Low Carbon Steel	Carbon Steel
40	Nickel-Copper Alloy (Monel)	Carbon Steel
50	Stainless Steel (300 Series)	Carbon Steel
51	Stainless Steel (300 Series)	Stainless Steel (300 Series, A286 or equivalent)

Table 6 Ultimate Shear and Tensile Strengths of Break Mandrel Blind Rivets

Nom Rivet Size in.	ULTIMATE SHEAR STRENGTH min lbs						ULTIMATE TENSILE STRENGTH min lbs					
	GRADES 10, 11, 18	GRADES 16, 19, 23, 24	GRADE 26	GRADE 30	GRADE 40	GRADES 50, 51	GRADES 10, 11, 18	GRADES 16, 19, 23, 24	GRADE 26	GRADE 30	GRADE 40	GRADES 50, 51
3/32 0.0938	70	90	—	130	200	230	80	120	—	170	250	280
1/8 0.1250	120	170	155	260	350	420	150	220	210	310	450	530
5/32 0.1562	190	260	260	370	550	650	230	350	340	470	700	820
3/16 0.1875	260	380	300	540	800	950	320	500	465	680	1,000	1,200
1/4 0.2500	460	700	—	1,000	1,400	1,700	560	920	—	1,240	1,850	2,100

NOTE: Grade 20 rivets are not subject to shear and tensile testing.

BREAK MANDREL BLIND RIVETS

Table 7 Mandrel Break Loads of Break Mandrel Blind Rivets

GRADE		10, 11, 23	16, 18, 19, 24	20	26	30	40	50	51
Nom Rivet Size in.	Rivet Body Material	Aluminum	Aluminum	Copper	Aluminum	Steel	Monel	Stainless Steel	Stainless Steel
	Mandrel Material	Aluminum	Steel	Steel	Stainless Steel	Steel	Steel	Steel	Stainless Steel
3/32	Min	140	175	175	—	260	300	300	300
	Max	240	275	275	—	360	450	500	500
1/8	Min	250	400	400	510	600	650	650	650
	Max	400	600	600	600	800	850	950	950
5/32	Min	425	600	600	720	750	950	1150	1150
	Max	600	850	850	850	1000	1200	1450	1450
3/16	Min	625	750	750	1040	1150	1450	1400	1400
	Max	825	1050	1050	1210	1450	1750	1900	1900
1/4	Min	1100	1450	1450	—	1950	2500	3000	3000
	Max	1400	1850	1850	—	2350	2900	3600	3600

NOTES:

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

shear strengths specified for the applicable size and grade given in Table 6 when tested in accordance with 2.1 of IFI-135.

3.3.2 *Tensile Strength.* Rivets, except those described in 3.3.3, 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-135.

3.3.3 Grade 20 rivets are not subject to either shear or tensile testing. For all other grades, 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.

3.3.4 *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-135.

3.3.5 *Blind Head Formation.* The axially applied load necessary to upset the end of the rivet body, i.e., form the blind side head, shall not exceed 80 percent of the actual mandrel break load, when tested in accordance with 2.4 of IFI-135.

4. Test Methods.

Tests shall be conducted in accordance with the test methods specified in IFI-135, page K-89.

5. Inspection.

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

In case of dispute following shipment of rivets, acceptability shall be determined in accordance with the procedures given in IFI-137, page K-93.