BLIND RIVETS

METRIC STRUCTURAL FLUSH BREAK PULL MANDREL SELF-PLUGGING BLIND RIVETS

IFI-551
1999

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. This is the first metric edition of this standard.*

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

1. Scope

1.1 Scope. This standard establishes the dimensional, mechanical and performance requirements of metric structural flush break pull mandrel self-plugging 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.

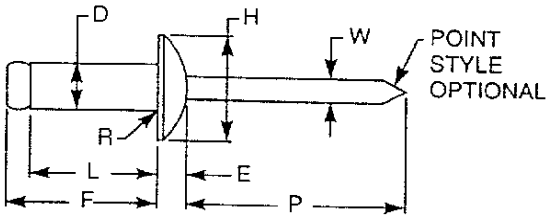

Table 1 Dimensions of Metric Regular and Large Protruding Head Style Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

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
4	3.2	3.25	3.10	6.25	6.05	1.02	9.91	9.14	1.65	0.5	1.93	19	L + 4.75	See Table 2
5	4.0	4.04	3.89	8.33	7.52	1.27	12.40	11.38	1.90	0.5	2.41	19	L + 5.15	
6	4.8	4.85	4.65	10.01	9.04	1.52	16.51	15.24	2.34	0.7	2.90	19	L + 5.53	
8	6.3	6.47	6.25	13.33	12.07	2.03	19.81	18.29	2.72	0.8	3.84	19	L + 6.34	
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. For Grades 40, 50, 51 and 52 rivets, the max fillet radius for 4.8 mm rivets shall be 0.9 mm, and for 6.3 mm rivets shall be 1.52 mm.
4. 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 2.54 mm thick, with a No. 5 rivet, a No. 53 rivet would be used. Minimum blind side clearance necessary to permit proper rivet setting would be L + 5.15 mm – G which is 9.19 + 5.15 – 5.08, and equals 9.26 mm.).

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1.2.2 Metric structural flush break pull mandrel self-plugging 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 a point within or above the rivet head. Flush break means that the break plane of the mandrel occurs above the junction of rivet shank and head, thus the shear plane(s) of the joints will occur through rivet shank and mandrel.

1.2.3 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 metric structural flush break pull mandrel self-plugging 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 structural flush break pull mandrel self-plugging 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 structural flush break pull mandrel self-plugging blind rivets shall be in accordance with the practice of the manufacturer.

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 0.0038 mm. Rivet bodies of all other grades are furnished plain (bare metal) unless otherwise specified. Grade 30 mandrels may be either zinc or cadmium plated or 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 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 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 shear strengths specified for the applicable size and grade given in Table 6 when tested in accordance with 2.1 of IFI-522, "Mechanical Testing of Metric Blind Rivets."

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-522.

3.3.3 Protruding head rivets with specified maximum grip lengths shorter than 1.0 times the

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Table 2 Application Data for Metric Protruding Head Style Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

Rivet Series No.	Nom Rivet Size	Recommended Metric Drill Size	Recommended Hole Size		Rivet No.	Grip Range		Rivet Body Length L
			Max	Min		Min	Max	Max
4	3.2	3.3	3.38	3.28	41 41.5 42 42.5	1.19 1.98 2.77 3.58	1.98 2.77 3.58 4.37	5.38 6.98 6.98 8.55
					43 43.5 44 44.5	4.37 5.15 5.94 6.75	5.15 5.94 6.75 7.54	8.55 10.15 10.15 11.72
					45 45.5 46	7.54 8.32 9.11	8.32 9.11 9.92	11.72 13.32 13.32
					46.5 47 47.5 48	9.92 10.71 11.50 12.28	10.71 11.50 12.28 13.07	14.90 14.90 16.50 16.50
					48.5 49 49.5 410	13.07 13.36 14.67 15.46	13.86 14.67 15.46 16.24	18.07 18.07 19.67 19.67
5	4.0	4.1	4.16	4.06	52 52.5 53 53.5	2.77 3.58 4.37 5.15	3.58 4.37 5.15 5.94	7.61 9.19 9.19 10.79
					54 54.5 55 55.5	5.94 6.75 7.54 8.32	6.75 7.54 8.32 9.11	10.79 12.36 12.36 13.96
					56 56.5 57 57.5	9.11 9.92 10.71 11.50	9.92 10.71 11.50 12.28	13.96 15.56 15.56 17.13
					58 58.5 59 59.5 510	12.28 13.07 13.86 14.67 15.46	13.07 13.86 14.67 15.46 16.24	17.13 18.70 18.70 20.30 20.30

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Table 2 (Continued)

Rivet Series No.	Nom Rivet Size	Recommended Metric Drill Size	Recommended Hole Size		Rivet No.	Grip Range		Rivet Body Length L
			Max	Min		Min	Max	Max
6	4.8	4.9	4.98	4.88	61	1.17	1.98	8.25
					62	2.36	3.99	8.25
					63	3.99	5.53	11.42
					64	5.53	7.13	11.42
					65	7.13	8.70	14.59
					66	8.70	10.30	14.59
					67	10.30	11.37	17.77
					68	11.87	13.48	17.77
					69	13.48	15.05	20.94
					610	15.05	16.65	20.94
					611	16.65	18.25	24.11
					612	18.25	19.82	24.11
					613	19.82	21.40	27.28
					614	21.40	22.99	27.28
					615	22.99	24.57	30.46
					616	24.57	26.19	30.46
8	6.3	6.5	6.63	6.53	82	2.36	3.99	9.52
					83	3.99	5.53	12.69
					84	5.53	7.13	12.69
					85	7.13	8.70	15.86
					86	8.70	10.30	15.86
					87	10.30	11.87	19.03
					88	11.87	13.48	19.03
					89	13.48	15.05	22.21
					810	15.05	16.65	22.21
					811	16.65	18.25	25.38
					812	18.25	19.82	25.38
					813	19.82	21.40	28.55
					814	21.40	22.99	28.55
					815	22.99	24.57	31.73
					816	24.57	26.19	31.73
See Notes		3			2	4		

NOTES:

1. All dimensions are in millimeters.
2. The first numeral in the rivet number designates the rivet series number, the last one or two numerals give the nominal grip in 1.57 mm which the rivet is capable of joining.
3. Recommended drill sizes are those which normally produce holes within the specified hole size limits.
4. The mean grip between specified min and max grips will give a mandrel break plane closest to being flush with the top surface of rivet head.

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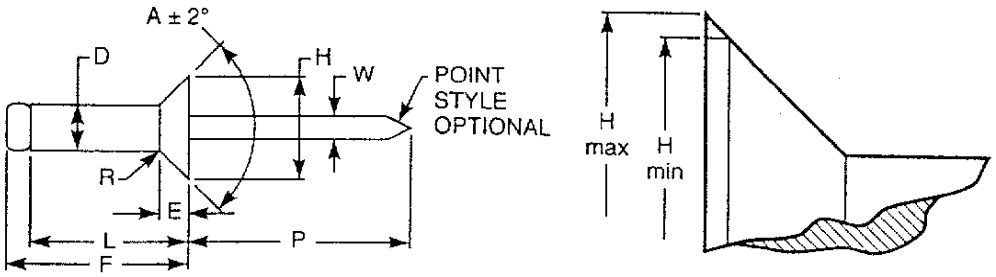

Table 3 Dimensions of 100 and 120 Deg Metric Flush Head Style Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

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 Protru-sion	Blind Side Protru-sion	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
4	3.2	3.25	3.10	100	5.92	5.26	1.14	120	5.92	5.26	0.79	0.7	1.93	25.4	L + 4.8	See Table 4
5	4.0	4.04	3.89	100	7.47	6.81	1.47	120	7.47	6.81	1.02	0.8	2.41	25.4	L + 5.15	
6	4.8	4.85	4.65	100	9.17	8.51	1.85	120	9.17	8.51	1.27	0.9	2.90	25.4	L + 5.53	
See Notes					3		4		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. 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 4.74 mm thick, with a No. 6 rivet, a No. 66 rivet would be used. Minimum blind side clearance necessary to permit proper rivet setting would be L + 5.53 – G, which is 14.59 + 5.53 – 9.48 which equals 10.64 mm.)

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

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Table 4 Application Data for Metric Flush Head Style Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

Rivet Series No.	Nom Rivet Size	Recommended Metric Drill Size	Recommended Hole Size		Rivet No.	Grip Range		Rivet Body Length L
			Max	Min		Min	Max	Max
4	3.2	3.3	3.38	3.28	42 42.5 43	2.77 3.58 4.37	3.58 4.37 5.15	6.98 8.55 8.55
					43.5 44 44.5	5.15 5.94 6.75	5.94 6.75 7.54	10.15 10.15 11.72
					45 45.5 46	7.54 8.32 9.11	8.32 9.11 9.92	11.72 13.32 13.32
					46.5 47 47.5 48	9.92 10.71 11.50 12.28	10.71 11.50 12.28 13.07	14.90 14.90 16.50 16.50
5	4.0	4.1	4.16	4.06	53 53.5 54	4.37 5.15 5.94	5.15 5.94 6.75	9.19 10.79 10.79
					54.5 55 55.5 56	6.75 7.54 8.32 9.11	7.54 8.32 9.11 9.92	12.36 12.36 13.96 13.96
					56.5 57 57.5 58	9.92 10.71 11.50 12.28	10.71 11.50 12.28 13.07	15.56 15.56 17.13 17.13
6	4.8	4.9	4.98	4.88	63 64 65 66	3.99 5.53 7.13 8.70	5.53 7.13 8.70 10.30	11.42 11.42 14.59 14.59
					67 68 69 610	10.30 11.87 13.48 15.05	11.87 13.48 15.05 16.65	17.77 17.77 20.94 20.94
See Notes		3			2	4		

NOTES:

1. All dimensions are in millimeters.
2. The first numeral in the rivet number designates the rivet series number, the last one or two numerals give the nominal grip in 1.57 mm which the rivet is capable of joining.
3. Recommended drill sizes are those which normally produce holes within the specified hole size limits.
4. The mean grip between specified min and max grips will give a mandrel break plane closest to being flush with the top surface of rivet head.

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Table 5 Grades of Metric Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

Grade Designation	Rivet Body Material	Mandrel Material
11	Aluminum Alloy 5052	Aluminum Alloy
12	Aluminum Alloy 5056	Aluminum Alloy
19	Aluminum Alloy 5056	Carbon Steel
30	Low Carbon Steel	Carbon Steel
40	Nickel-Copper Alloy	Carbon Steel
42	Nickel-Copper Alloy	Stainless Steel (300 Series)
50	Stainless Steel (300 Series)	Carbon Steel
51	Stainless Steel (300 Series)	Stainless Steel (300 Series: A286 or equivalent)
52	Stainless Steel (300 Series)	Stainless Steel (400 Series)

Table 6 Ultimate Shear and Tensile Strengths of Metric Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

No.	Ultimate Shear Strength Newtons, min						
	Grade 11	Grade 12	Grade 19	Grade 30	Grade 40	Grade 42	Grades 50, 51, 52
4	980	980	1510	2000	2335	2110	2445
5	1510	1510	2310	2335	3110	2800	3780
6	2135	2135	2890	4000	5335	4800	5890
8	4000	4000	5335	7780	8895	8000	10,005

No.	Ultimate Tensile Strength Newtons, min						
	Grade 11	Grade 12	Grade 19	Grade 30	Grade 40	Grade 42	Grades 50, 51, 52
4	800	800	1220	1555	2000	1775	2355
5	1330	1330	1890	2220	3110	2800	3645
6	1775	1775	2665	3110	4445	4000	5335
8	2890	2890	4445	6225	8895	8000	9340

Table 7 Mandrel Break Loads of Metric Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

Grade		11	12	19	30	40, 42	50	51, 52
Nom Rivet Size mm	Rivet Body Material	Aluminum	Aluminum	Aluminum	Steel	Monel	Stainless Steel	Stainless Steel
	Mandrel Material	Aluminum	Aluminum	Steel	Steel	Steel	Steel	Stainless Steel
3.2	Min	1110	1775	1775	2665	2890	2890	2890
	Max	1775	2665	2665	3560	3780	4230	4230
4.0	Min	1890	2665	2665	3335	4225	5115	5115
	Max	2665	3780	3780	4450	5338	6450	6450
4.8	Min	2780	3335	3335	5115	6445	6225	6225
	Max	3670	4670	4670	6450	7785	8455	8455
6.3	Min	4890	6445	6445	8670	11,120	13,345	13,345
	Max	6230	8230	8230	10,455	12,900	16,015	16,015

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

Table 7, when tested in accordance with 2.3 of IFI-522.

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-522.

3.3.6 *Mandrel Retention.* Mandrels of properly set rivets shall withstand the axial pushout loads specified for the applicable size in Table 8 when tested in accordance with 2.5 of IFI-522, page I–31.

4. Test Methods

Tests shall be conducted in accordance with the test methods specified in IFI-522, page I–27.

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.

Table 8 Mandrel Retention Loads of Metric Structural Flush Break Pull Mandrel Self-Plugging Blind Rivets

Nom Rivet Size, mm	Mandrel Retention Load, Newtons min
3.2	44
4.0	66
4.8	88
6.3	133