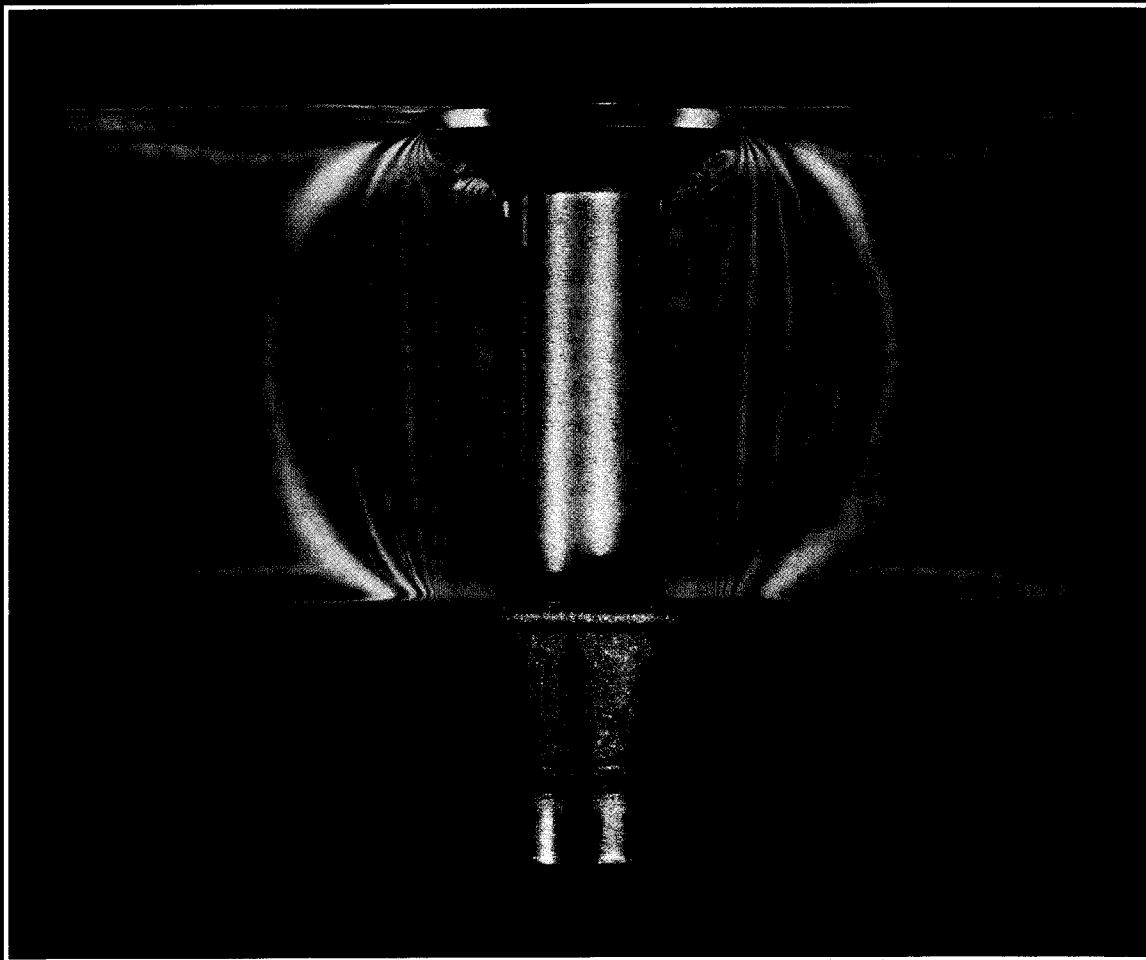


RADIAL-LOK[®]

TRUE HOLE FILLING BLIND FASTENER

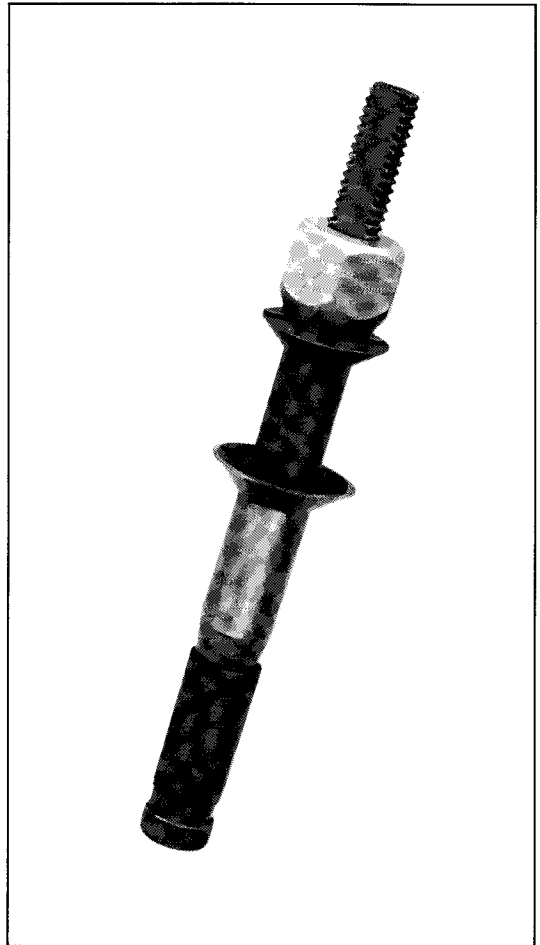


MONOGRAM AEROSPACE FASTENERS

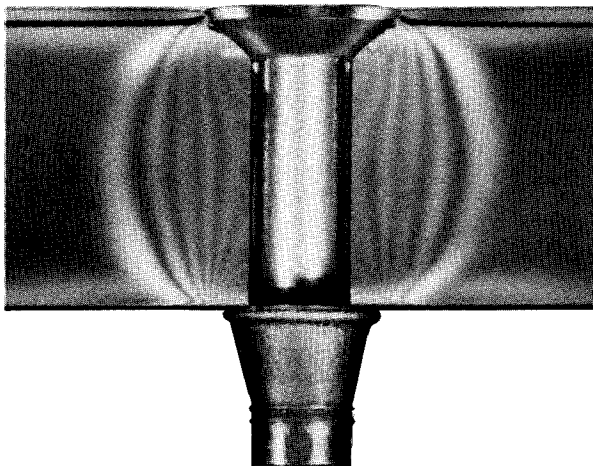


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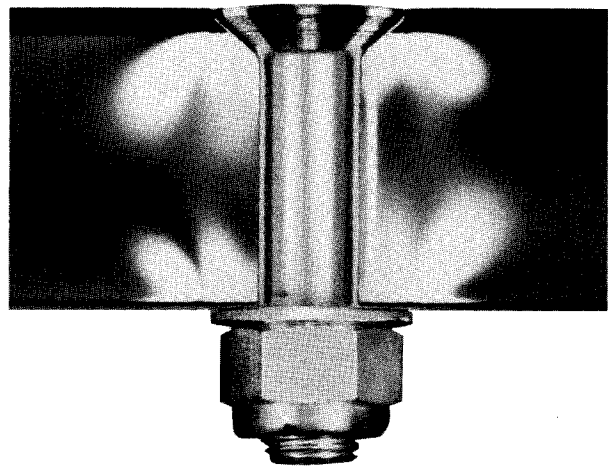
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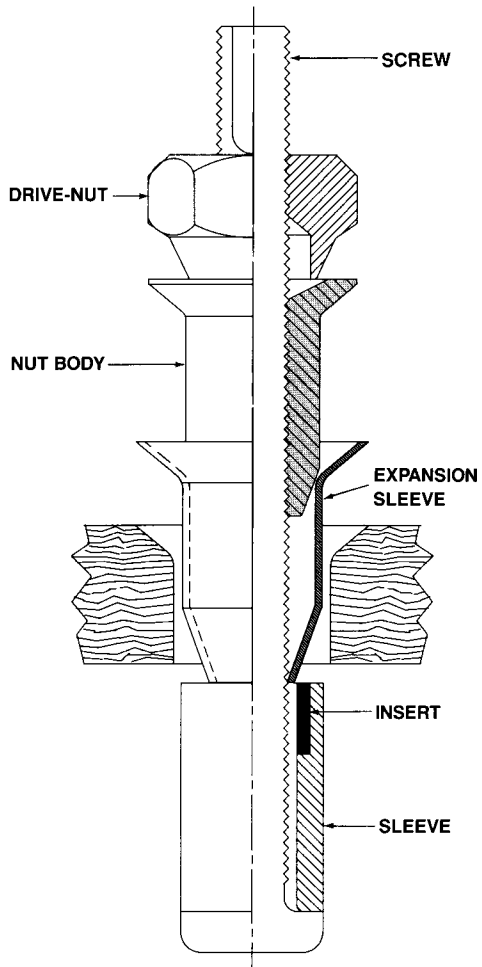
RADIAL-LOK Fastener



Conventional Fastener



Comparative photos show benefits of Radial-Lok's unique hole filling properties as compared to a conventional fastener. Bands shown are made visible by viewing a bi-refrigent plastic through polarizing filters.



FEATURES

- Uniform radial expansion throughout the length of the clearance fit hole.
 - Ideal for aluminum and composite applications.*
 - Tighter joints.
 - Enhanced fatigue life.
 - Better lightning strike protection.
 - Clearance fit before installation.
 - High clamp-up.
 - Eliminates costly hole preparation.
 - Easy one sided installation.
 - Large blind side upset.
 - .100" grip accommodation.
 - Interference fits to .006".
 - Available in 3/16" through 3/8" diameters including oversized.
 - 7 degree blind slope capability.
- * Contact Monogram Aerospace Fasteners for applications in higher modulus metallic material.

DESCRIPTION

With rapid advancement in aircraft technology and the need for repair of aluminum or composite aircraft structures, the use of interference fit fasteners in areas of high fatigue is often desired. Monogram's Radial-Lok blind fastener will answer these needs and is the only fastener of its kind that will achieve full radial expansion in a clearance fit hole.

The ability of the Radial-Lok to expand (.002" to .006") uniformly throughout the entire length of the hole greatly increases the fatigue life of the fastener and assures structural integrity under severe cyclic loading conditions in both aluminum and composite structures. With Radial-Lok's .003" hole tolerance, these benefits are achieved without the costly preparation of close tolerance or tapered holes required by some fasteners.

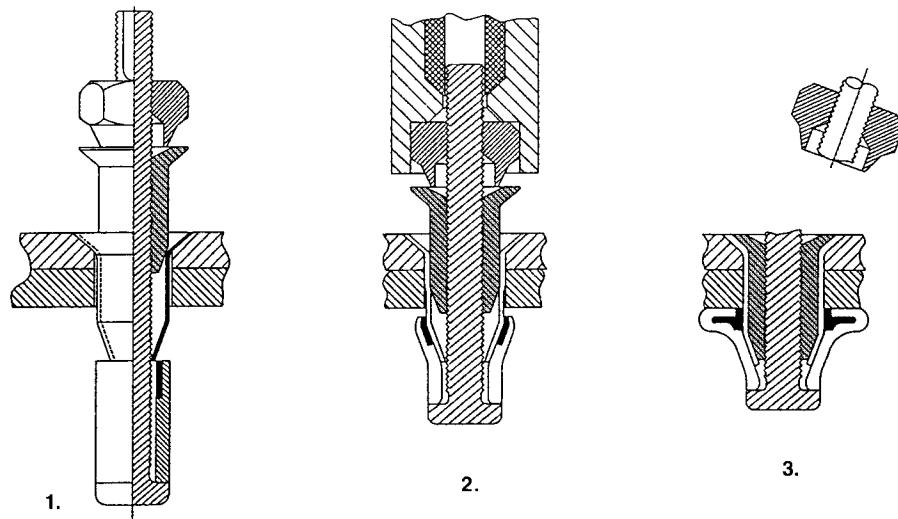
Because of the Radial-Lok's hole filling capability, it is ideal for lightning strike applications in composite materials. Additionally, high clamp up loads are achieved without damage to composite materials by the formation of a large blind side upset, which distributes the loading over a large bearing area.

An added benefit is its .100" grip accommodation, permitting installation in a wider range of composite or aluminum material stack-ups, while maintaining designated strength requirements.

These unique characteristics make the Radial-Lok the most versatile blind fastener for a variety of applications in both composite and aluminum structures. It is completely compatible with graphite and is not subject to galvanic corrosion. In addition, Monogram's proven Drive Nut system greatly simplifies the installation of Radial-Loks.

INSTALLATION SEQUENCE

1. The Radial-Lok fastener is first inserted into the prepared clearance fit hole. The installation tool is placed over the screw, simultaneously engaging the wrench flats and the DRIVE NUT.
2. Torque is applied to the screw, while the DRIVE NUT is held stationary. The screw continues to advance through the center of the fastener, forcing the nut body into the expansion sleeve, causing uniform radial expansion throughout the length of the prepared hole.
3. Once the nut body is fully seated in the expansion sleeve, initial blind head formation is started. Continued tightening removes sheet gap, clamps the sheets tightly together, and forms the large blind head required for composite materials. When the blind side sleeve forms tight against the structure, the screw will fracture at the break groove. The tool is pulled away and the pintail DRIVE NUT assembly is discarded.





LOW PROFILE PROTRUDING HEAD SERIES MRL 3210

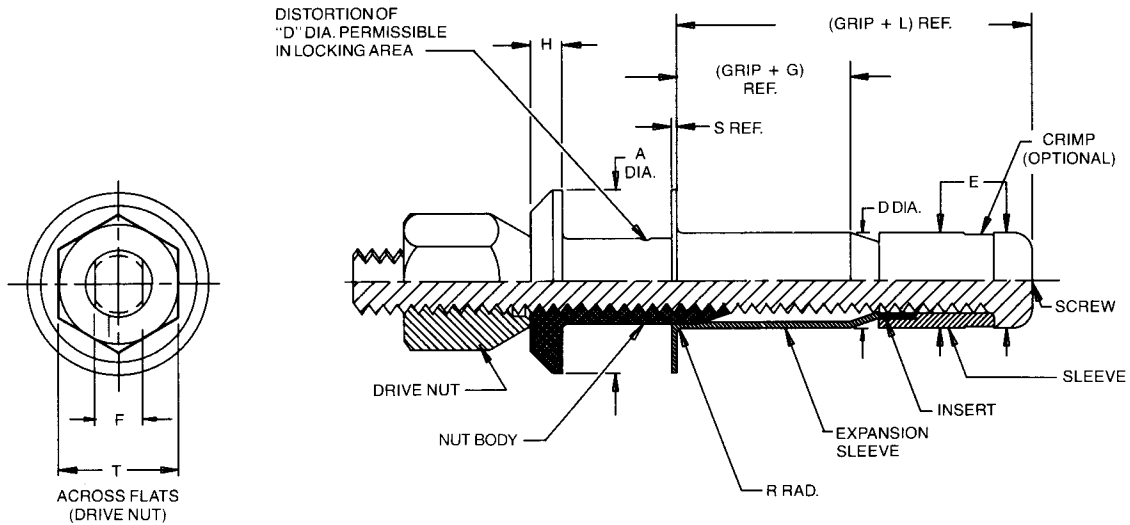


TABLE 1

BASIC DIA DASH NO.	A DIA REF.	D DIA REF.	E DIA MAX.	F WRENCH FLATS	G REF.	H	L REF.	R RADIUS MAX.	S REF.	T ACROSS FLATS	MIN AVAIL. GRIP	MAX AVAIL. GRIP
-6	406	197	1985	.113 .108	.075	.070 .063	.650	.040	.011	.375	-100	-500
-7	406	.226	2275	.121 .116	.075	.070 .063	.650	.040	.011	.375	-100	-500
-8	531	258	2595	.135 .130	.075	.085 .078	.700	.045	.014	.375	-200	-1000
-9	531	.288	2895	.152 .147	.075	.085 .078	.750	.045	.014	.500	-200	-1000
-10	625	310	3110	.152 .147	.090	.105 .098	.800	.050	.017	.500	-200	-1000
-11	625	.342	3433	.185 .180	.090	.105 .098	.850	.050	.017	.500	-200	-1000
-12	750	373	3740	.185 .180	.100	.125 .118	1.000	.050	.017	.500	-200	-1000

TABLE 2

2ND (GRIP) DASH NO.	GRIP RANGE	
	MIN. GRIP	MAX. GRIP
-100	.050	.125
-200	.126	.225
-300	.226	.325
-400	.326	.425
-500	.426	.525
-600	.526	.625
-700	.626	.725
-800	.726	.825
-900	.826	.925
-1000	.926	1.025

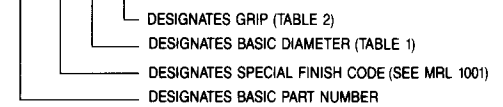
TABLE 3

BASIC PART NO.	COMPONENT	MATERIAL	HEAT TREAT	FINISH	LUBRICATION
MRL 3210	NUT	6-AL-4V TITANIUM PER MIL-T-9047 STA OR AMS 4928 OR AMS 4967.	PER MIL-H-81200 TO 95 KSI SHEAR STRENGTH MIN. MAX. HYDROGEN 125 PPM.	KALGARD CONVERSION COATING ANN-RO 1012.	DRY FILM LUBE PER THE CHEMICAL REQUIREMENTS OF MIL-L-46101, TYPE I. PARAFFIN WAX, AND/OR CETYL ALCOHOL USED AS REQUIRED FOR PERFORMANCE.
	SCREW	A-286 PER AMS 5732. AMS 5731 OR AMS 5737.	TO 175 KSI TENSILE MIN.	PASSIVATE PER 00-P-35. KALGARD CONVERSION COATING ANN-RO 1013 (OPTIONAL).	
	SLEEVE	304 STAINLESS STEEL PER AMS 5639 FULLY ANNEALED.	AS REQUIRED	NONE.	
	EXPANSION SLEEVE	A-286 PER AMS 5732. AMS 5731 OR AMS 5737.	FOR PERFORMANCE	COLOR GREY.	
	INSERT	ACETAL PER FEDERAL SPECIFICATION ASTM D4181.			
	DRIVE NUT	MILD STEEL.			

NOTES:

1. PROCUREMENT SPECIFICATION: MRL 1000
2. EXAMPLE OF PART NUMBER:

MRL 3210 () - 6 - 200



3. LOCKING FEATURE CONSISTS OF THREE (3) INDENTATIONS LOCATED 120° APART ON THE PERIPHERY OF THE NUT COMPONENT.
4. SEE MRL 1003 FOR INSTALLATION AND INSPECTION INFORMATION.
5. CONCENTRICITY OF NUT HEAD TO "D" DIAMETER SHALL BE WITHIN .010 T.I.R.

100° FLUSH TENSION HEAD SERIES MRL 3212

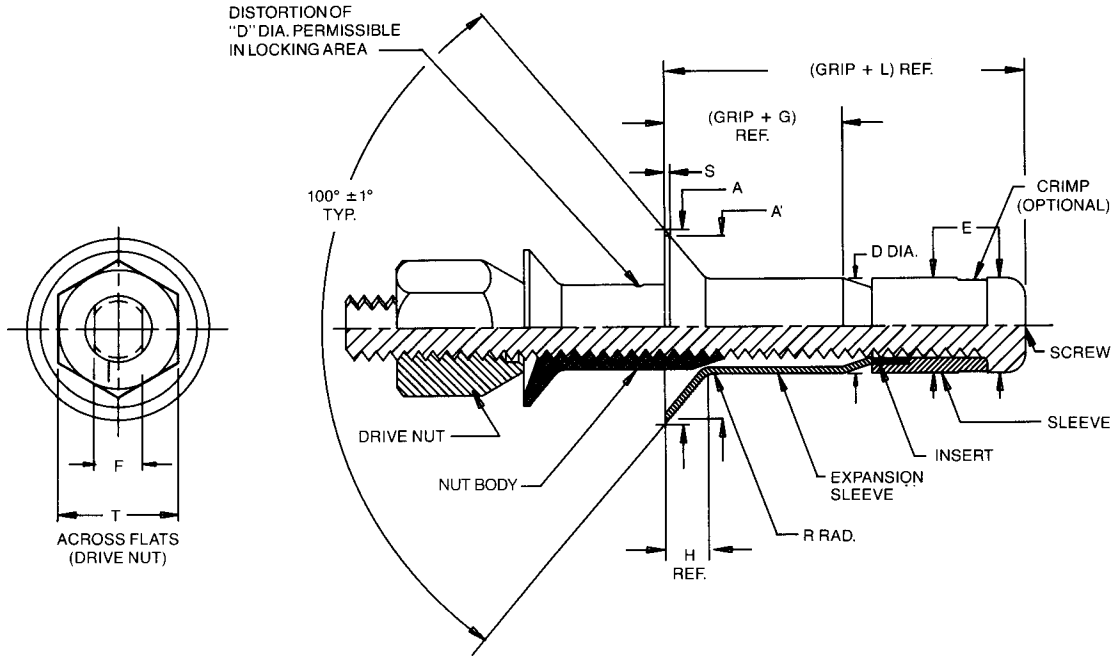


TABLE 1

TABLE 2

BASIC DIA DASH NO.	A DIA	A' DIA MIN.	D DIA REF.	E DIA MAX.	F WRENCH FLATS	G REF.	H REF.	L REF.	R RADIUS	S REF.	T ACROSS FLATS	MIN AVAIL. GRIP	MAX AVAIL. GRIP
-6	.385 .378	.342	.197	.1985	.113 .108	.075	.077	.650	.030	.010	.375	-200	-500
-7	.416 .409	.373	.226	.2275	.121 .116	.075	.077	.650	.030	.015	.375	-200	-500
-8	.507 .499	.463	.258	.2595	.135 .130	.075	.104	.700	.030	.015	.375	-200	-1000
-9	.538 .530	.494	.288	.2895	.152 .147	.075	.104	.750	.030	.015	.500	-200	-1000
-10	.635 .626	.577	.310	.3110	.152 .147	.090	.136	.800	.040	.015	.500	-300	-1000
-11	.666 .657	.608	.342	.3433	.185 .180	.090	.136	.850	.040	.015	.500	-300	-1000
-12	.762 .752	.696	.373	.3740	.185 .180	.100	.162	1.000	.040	.015	.500	-300	-1000

2ND (GRIP) DASH NO.	GRIP RANGE	
	MIN. GRIP	MAX. GRIP
-200	.126	.225
-300	.226	.325
-400	.326	.425
-500	.426	.525
-600	.526	.625
-700	.626	.725
-800	.726	.825
-900	.826	.925
-1000	.926	1.025

TABLE 3

BASIC PART NO.	COMPONENT	MATERIAL	HEAT TREAT	FINISH	LUBRICATION
MRL 3212	NUT	6-AL-4V TITANIUM PER MIL-T-9047 STA OR AMS 4928 OR AMS 4967.	PER MIL-H-81200 TO 95 KSI SHEAR STRENGTH MIN. MAX. HYDROGEN 125 PPM.	KALGARD CONVERSION COATING ANN-RO 1012.	DRY FILM LUBE PER THE CHEMICAL REQUIREMENTS OF MIL-L-46010, TYPE I, PARAFFIN WAX, AND/OR CETYL ALCOHOL USED AS REQUIRED FOR PERFORMANCE.
	SCREW	A-286 PER AMS 5732, AMS 5731 OR AMS 5737.	TO 175 KSI TENSILE MIN.	PASSIVATE PER 00-P-35, KALGARD CONVERSION COATING ANN-RO 1013 (OPTIONAL).	
	SLEEVE	304 STAINLESS STEEL PER AMS 5638 FULLY ANNEALED.	AS	NONE.	
	EXPANSION SLEEVE	A-286 PER AMS 5732, AMS 5731 OR AMS 5737.	REQUIRED	COLOR GREY.	
	INSERT	ACETAL PER FEDERAL SPECIFICATION ASTM D4181.	FOR PERFORMANCE		
	DRIVE NUT	MILD STEEL.			

NOTES:

- PROCUREMENT SPECIFICATIONS: MRL 1000
- EXAMPLE OF PART NUMBER:
MRL 3212 () - 6 - 200
 - () DESIGNATES GRIP (TABLE 2)
 - 6 DESIGNATES BASIC DIAMETER (TABLE 1)
 - 200 DESIGNATES SPECIAL FINISH CODE (SEE MRL 1001)
 - 3212 DESIGNATES BASIC PART NUMBER
- LOCKING FEATURE CONSISTS OF THREE (3) INDENTATIONS LOCATED 120° APART ON THE PERIPHERY OF THE NUT COMPONENT.
- SEE MRL 1003 FOR INSTALLATION AND INSPECTION INFORMATION.
- CONCENTRICITY OF NUT HEAD TO "D" DIAMETER SHALL BE WITHIN .010 T.I.R.



INSTALLATION TOOLING

This section describes the installation tooling and accessories required to properly install Radial-Lok blind bolts and ensure proper performance.

The Radial-Lok blind fastener uses standard NAS1675 tooling at standard air pressure levels. No secondary hydraulic units are required. Limited access tooling is available (contact MAF).

The tooling, when used in conjunction with the proper "Nose Adapters" and "Wrench Adapters", will satisfactorily install all basic Radial-Lok fastener configurations in the 3/16" thru 3/8" body diameters.

The basic configurations of installation tools and their accessories are described below:

1. THE DRIVER - Pneumatic power motor.

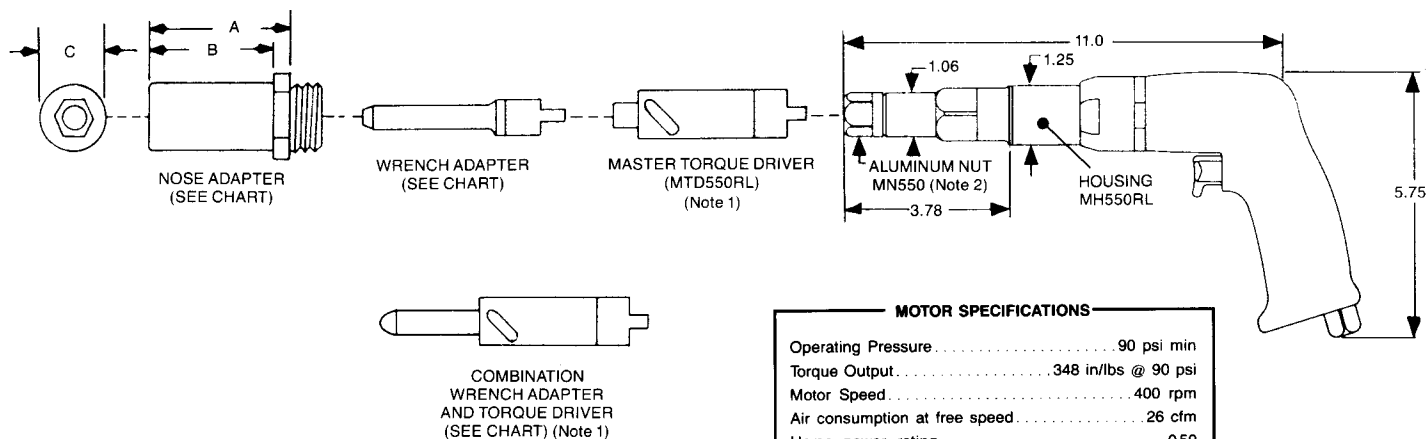
2. THE NOSE ADAPTER - The nose adapter connects to the power motor housing. Its function is to engage the DRIVE NUT and prevent rotation of the fastener body.

3. THE WRENCH ADAPTER - The wrench adapter is enclosed by the nose adapter and connects directly to the power source. Its function is to apply driving force to the fastener wrenching end and eject it after break-off.

Recommended tool source:

Monogram Aerospace Fasteners

PNEUMATIC PISTOL



MOTOR SPECIFICATIONS	
Operating Pressure	90 psi min
Torque Output	.348 in/lbs @ 90 psi
Motor Speed	400 rpm
Air consumption at free speed	.26 cfm
Horse power rating	0.50
Weight	3.50 lbs
Work space needed	Portable

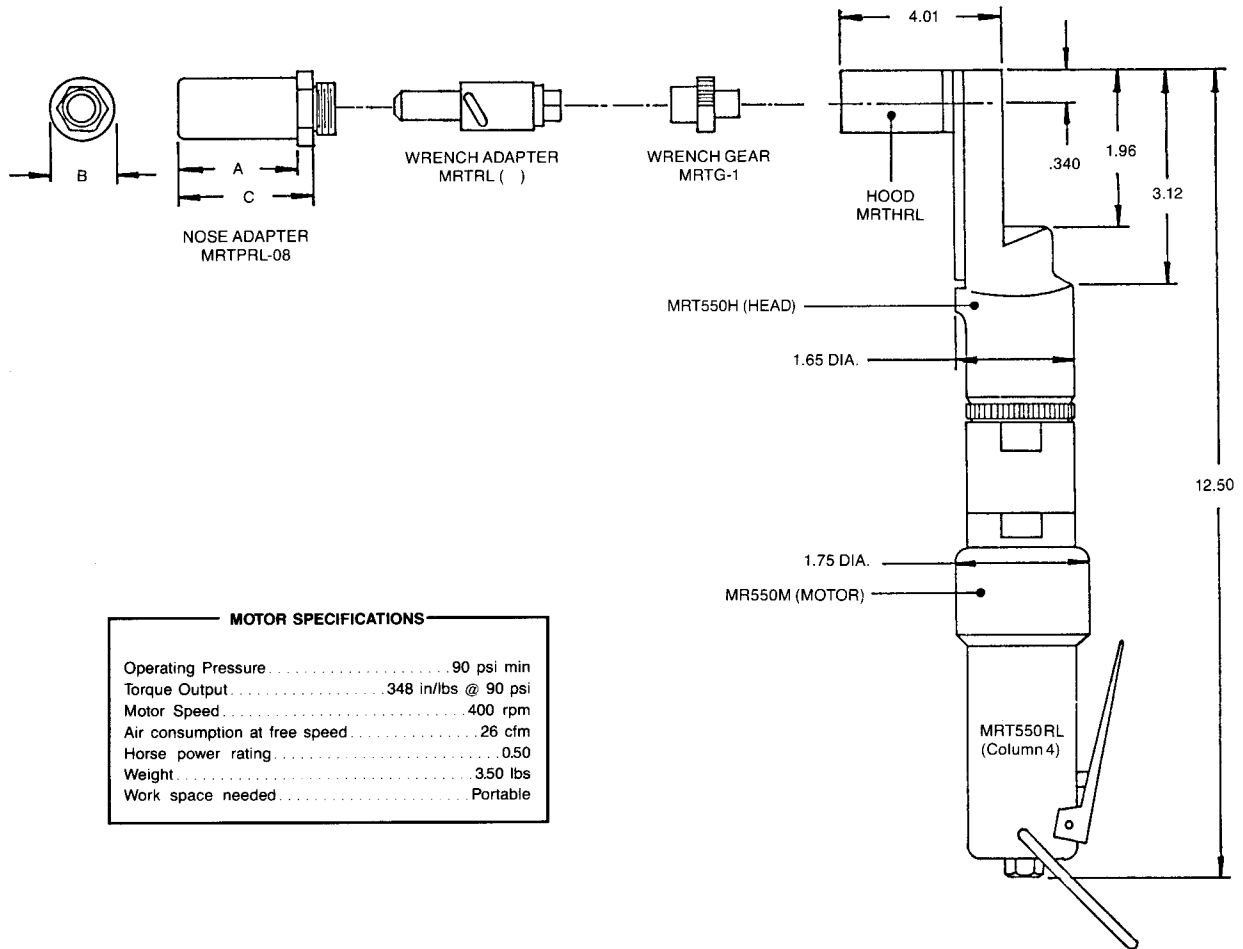
1	2	3	4	5	6	7	8	9
BASIC DIA.	TYPICAL RADIAL-LOK FASTENER PART NUMBERS	COMPLETE MOTOR ASSEMBLY	PNEUMATIC MOTOR	NOSE ADAPTER (HOLDS NUT)	WRENCH ADAPTER (TURNS SCREW)	A REF.	B REF.	C REF.
3/16	MRL3210	MP55ORL-6AA	MP55ORL	MPPBF-08	MPBF-06	1.80	1.70	.56
7/32		MP55ORL-7AA			MPBF-07			
1/4		MP55ORL-8AA			MPBF-08			
9/32	MRL3212	MP55ORL-10AA		MPP-12 (See Note 2)	MPTRL-10 (See Note 1)	1.48	1.36	.75
5/16					MP55ORL-12AA			
11/32								
3/8								

NOTES: 1. Combination Wrench Adapter & Torque Driver - requires removal of Master Torque Driver (MTD550RL) supplied with the tool.
 2. Larger male thread on Nose Adapters - requires removal of Aluminum Nut (MN550) supplied with tool

INSTALLATION TOOLING



PNEUMATIC RIGHT ANGLE MOTOR



MOTOR SPECIFICATIONS	
Operating Pressure	.90 psi min
Torque Output	.348 in/lbs @ 90 psi
Motor Speed	400 rpm
Air consumption at free speed	.26 cfm
Horse power rating	.050
Weight	3.50 lbs
Work space needed	Portable

1	2	3	4	5	6	7	8	9
BASIC DIA	TYPICAL RADIAL-LOK FASTENER PART NUMBERS	COMPLETE MOTOR ASSEMBLY	PNEUMATIC MOTOR ASSEMBLY	NOSE ADAPTER (HOLDS NUT)	WRENCH ADAPTER (TURNS SCREW)	A REF.	B REF.	C REF.
3/16	MRL3210	MRT55ORL-6AA	MRT550RL	MRTPL-08	MRTRL-06	.90	.77	.56
7/32		MRT55ORL-7AA			MRTRL-07			
1/4		MRT55ORL-8AA			MRTRL-08			
9/32 5/16 11/32 3/8	MRL3212	FOR INSTALLATION INFORMATION, CONTACT MONOGRAM.						



STRENGTHS & WEIGHTS

TENSILE & DOUBLE SHEAR

MRL 3210 MRL 3212		TENSILE STRENGTH (LBS. MIN.)	DOUBLE SHEAR STRENGTH (LBS. MIN.)	LOCKING TORQUE (IN.-LBS. MIN.)	PRE-LOAD (LBS. MIN.)
DIA.	DASH				
3/16	—6	1600	4800	1.5	700
7/32*	—7	1700	6000	2.0	700
1/4	—8	2300	8000	2.5	1000
9/32*	—9	2400	10,000	3.0	1000
5/16	—10	3600	12,000	3.5	1500
11/32*	—11	3700	14,000	4.0	1500
3/8	—12	5000	17,000	4.0	2000

NOTE: VALUES SHOWN ARE FASTENER CAPABILITIES ONLY. LAP SHEAR & TENSILE STRENGTH IN SPECIFIC COMPOSITE MATERIALS TESTED UPON REQUEST.

*OVERSIZE FASTENERS INTENDED FOR REPAIR ONLY.

INSTALLED WEIGHT (Pounds Per Thousand)

MAT'L	HEAD STYLE	DIA. DASH NO.	GRIP DASH NO.									
			—100	—200	—300	—400	—500	—600	—700	—800	—900	ADDER*
T I T A N I U M	100° FLUSH TENSION	— 6		5.73	6.48	7.23	7.98	8.73	9.48	10.23	10.98	.75
		— 8		11.48	12.77	14.06	15.35	16.64	17.93	19.22	20.51	1.29
		—10			19.96	21.77	23.58	25.39	27.20	29.01	30.82	1.31
		—12			31.80	34.35	36.90	39.45	42.00	44.55	47.10	2.55
	LOW PROFILE PROT.	— 6	5.65	6.40	7.15	7.90	8.65	9.40	10.15	10.90	11.65	.75
		— 8		12.90	14.19	15.48	16.77	18.06	19.35	20.64	21.93	1.29
		—10		21.80	23.11	24.42	25.73	27.04	28.35	29.66	30.97	1.31
		—12		33.06	35.61	38.16	40.71	43.26	45.81	48.36	50.91	2.55

*ADDER FOR ADDITIONAL GRIP INCREMENTS.



Radial-Lok Fasteners

INSTALLED WEIGHT

(Pounds per Thousands)

MATL	HEAD STYLE	DIA. DASH NO.	GRIP DASH NUMBER									
			-100	-200	-300	-400	-500	-600	-700	-800	-900	ADDER *
T i t a n i u m	100 FLUSH TENSION	-6	-	4.71	5.17	5.64	6.10	6.57	7.04	7.50	7.97	.44
		-8	-	8.03	8.82	9.61	10.40	11.19	11.98	12.77	13.56	.75
		-10	-	-	15.21	16.32	17.44	18.56	19.67	20.79	21.91	1.09
		-12	-	-	25.25	26.81	28.37	29.93	31.48	33.04	34.60	1.62
	LOW PROFILE PROT.	-6	5.52	5.98	6.45	6.91	7.38	7.84	8.31	8.77	9.24	.44
		-8	-	10.72	11.51	12.30	13.09	13.88	14.67	15.46	16.25	.75
		-10	-	18.18	19.29	20.41	21.53	22.65	23.76	24.88	26.00	1.08
		-12	-	29.62	31.18	32.74	34.29	35.85	37.41	38.97	40.52	1.62

* ADDER FOR ADDITIONAL GRIP INCREMENTS

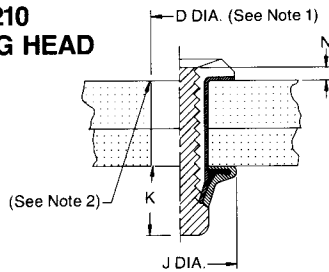
**Radial-Lok
Fasteners**

INSTALLATION INFORMATION

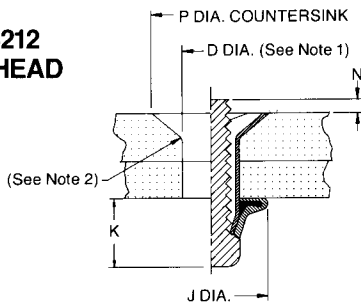


HOLE PREPARATION & INSTALLED DIMENSIONS

MRL 3210 PROTRUDING HEAD



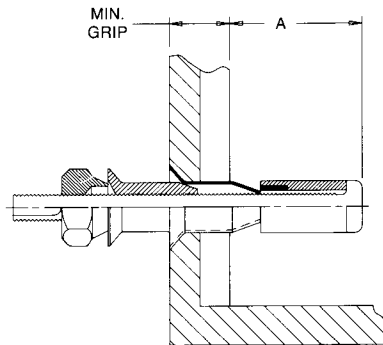
MRL 3212 FLUSH HEAD



DASH DASH NUMBER	D.DIA RECOMMENDED HOLE SIZE	100° CSK P. DIA.	J DIA MIN.	K REF.	N (SEE NOTE 4) SCREW BREAK-OFF LIMITS	
					PROT.	FLUSH
-6	199—202	378—385	290	450	+ 275 + 075	+ 185 - 015
-7	228—231	409—416	340	500	+ 275 + 075	+ 185 - 015
-8	260—263	499—507	400	500	+ 295 + 095	+ 185 - 015
-9	290—293	530—538	430	500	+ 295 + 095	+ 185 - 015
-10	312—315	626—635	460	550	+ 315 + 115	+ 185 - 015
-11	344—347	657—666	490	625	+ 315 + 115	+ 185 - 015
-12	375—378	752—762	520	625	+ 335 + 135	+ 185 - 015

- NOTES: 1. HOLES SHOULD BE STRAIGHT AND PERPENDICULAR TO SURFACE. HOLES SHOULD BE REASONABLY ROUND AND FREE FROM DELAMINATION.
 2. EDGE OF HOLES MUST BE GIVEN A CHAMFER GREATER THAN FASTENER RADIUS.
 3. SHEETS SHOULD BE FIRMLY CLAMPED TOGETHER DURING DRILLING AND GRIP SELECTION.
 4. SCREW BREAK-OFF LIMITS ARE MEASURED FROM SKIN SURFACE ON PROTRUDING HEAD FASTENERS ONLY. FLUSH STYLE FASTENERS ARE MEASURED FROM THE HEAD OF THE FASTENER.

BLIND SIDE PROTRUSION

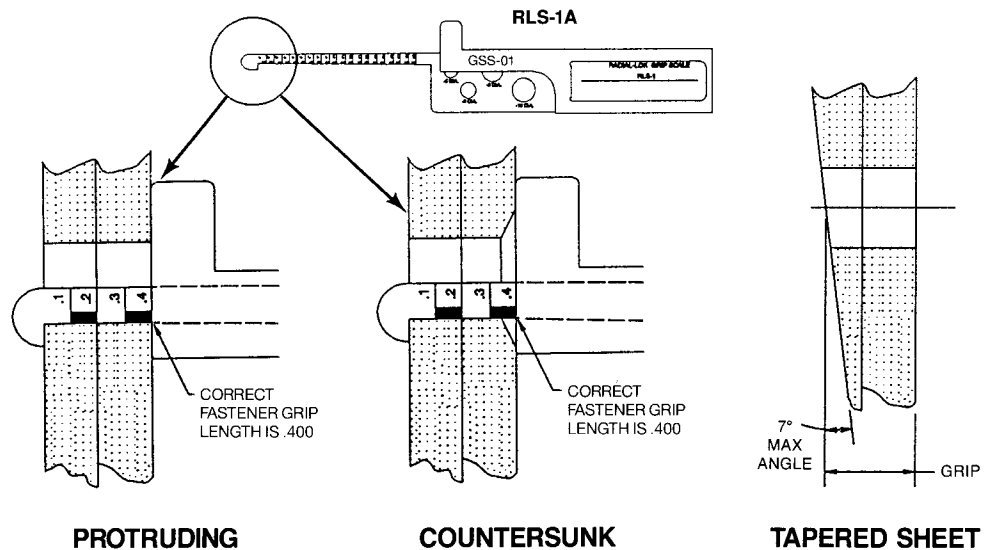


NOMINAL DIAMETER	A BLIND SIDE PROTRUSION IN MIN. GRIP
3/16	.750
7/32	.800
1/4	.800
9/32	.850
5/16	.900
11/32	.950
3/8	1.125

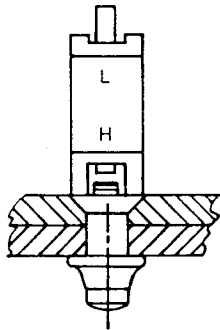
GRIP SECTION

Measure the material thickness with an RLS-1A grip gage as shown. Insert gage into hole, draw gage back until hook contacts the blind sheet. Move the slide (GSS-01) towards the skin surface until it straddles both sides of the prepared hole. This procedure ensures that you're perpendicular to the skin surface, thus producing accurate grip registration on the RLS-1A gage. Once accomplished, remove gage and read where the slide coincides with the numbers on the gage.

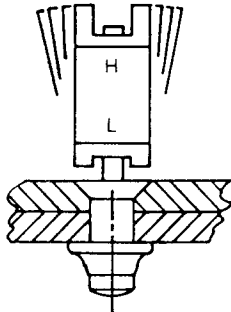
In those applications where a tapered sheet condition exists on the blind side, the grip length must be determined by the depth at the centerline of the hole as illustrated.



FLUSH HEAD

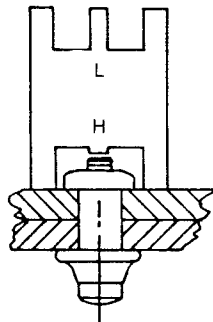


HIGH BREAK-OFF CHECK — GAGE **MUST NOT** ROCK

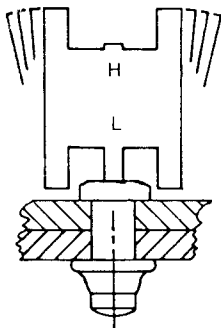


LOW BREAK-OFF CHECK — GAGE **MUST** ROCK

PROTRUDING HEAD



HIGH BREAK-OFF CHECK — GAGE **MUST NOT** ROCK



LOW BREAK-OFF CHECK — GAGE **MUST** ROCK

BLIND BOLT INSPECTION AFTER INSTALLATION

The break-off location of the screw in the head of the nut is a positive indication that the fastener has been properly installed (provided the correct grip length has been used). See Table 1 for break-off gages.

Table 2 indicates the acceptable screw break-off limits for a properly installed fastener. Screw break-offs beyond specification limits are an indication of unsatisfactory installation. To ensure proper performance, it is extremely important to check the grip very carefully before installing the fastener.

TABLE 1
SCREW BREAK-OFF GAGES

FASTENER DIA.	FLUSH HEAD BARREL GAGE	PROTRUDING HEAD LEAF GAGE
— 6	MGFRL— 6	MGPRL— 6
— 7	MGFRL— 7	MGPRL— 7
— 8	MGFRL— 8	MGPRL— 8
— 9	MGFRL— 9	MGPRL— 9
—10	MGFRL—10	MGPRL—10
—11	MGFRL—11	MGPRL—11
—12	MGFRL—12	MGPRL—12

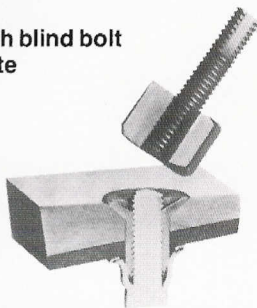
TABLE 2
SCREW BREAK-OFF LIMITS

FASTENER DIA.	PROTRUDING HEAD	FLUSH HEAD
— 6	+ .275 + .075	+ .185 — .015
— 7	+ .275 + .075	+ .185 — .015
— 8	+ .295 + .095	+ .185 — .015
— 9	+ .295 + .095	+ .185 — .015
—10	+ .315 + .115	+ .185 — .015
—11	+ .315 + .115	+ .185 — .015
—12	+ .335 + .135	+ .185 — .015

Strengths and dimensions cited in this catalog are intended for general guidance only. Values given are current at time of printing.

COMPOSI-LOK® II

High strength blind bolt for composite materials

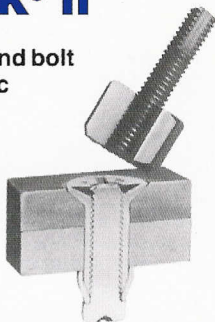


FEATURES

- Large blind side upset
- Light weight
- Visual locking feature
- Controlled clamp-up
- Lower total installed costs
- Simpler long life tooling
- Fuel tight sealing capability

VISU-LOK® II

High strength blind bolt for use in metallic structures

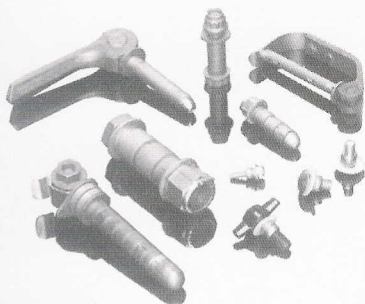


FEATURES

- High clamp-up
- Self locking
- Self inspecting
- Lower total installed costs
- Use of existing tooling
- Wide range of materials, lengths, diameters & head styles

ADJUSTABLE BUSHING

Manually operated radial expansion fasteners



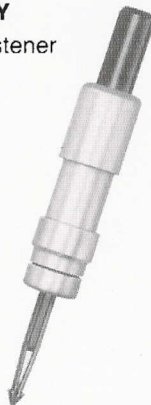
FEATURES

- Ideal for vibration applications
- Removes structural play
- Provides near perfect alignment
- Permits quick-release fastening
- Allows for blind fastening

WEDGELOCK

CYLINDRICAL BODY

A temporary blind fastener for use in composite and metallic structures

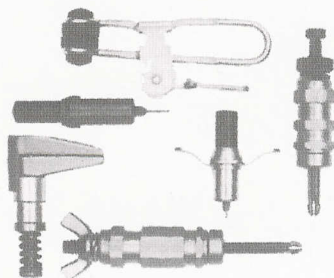


FEATURES

- Easy installation
- 50% time savings in installation and removal efficiency
- Ideal for robotic applications
- Simplified installation tooling

OTHER TEMPORARY FASTENERS

Monogram offers a wide range of lightweight, temporary fastening systems consisting of clamps, template fasteners, drilling aids andplier operated fasteners.



FEATURES

- Wide range of fastening methods
- Inch or metric sizes
- Specials
- Reusable
- Durable
- Simple to use

RADIAL-LOK®

A high strength, hole filling fastener for use in both composite and metallic structures

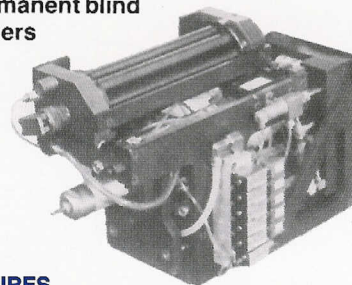


FEATURES

- Radial expansion up to .005"
- Lightning strike protection in composite structures
- High clamp-up
- Ideal in vibration applications
- Available in 3/16" to 3/8" diameters

ROBOTICS

Revolutionary automated fastening system designed to install temporary or permanent blind fasteners



FEATURES

- Fastener and installation tooling designed specifically for automatic and robotic applications
- Light weight
- Robotic end arm and stationary point applications
- Remote center compliance device incorporated into design
- Common cylindrical driving element allows for installation of a wide variety of fasteners with no change of tooling

OSI-BOLT®

High strength fastener for primary structure

FEATURES

- Interference fit capabilities (.006" in aluminum and .003" in steel)
- 95 and 112 KSI shear systems
- Always breaks flush; no corebolt shaving required
- Directly interchangeable with standard & oversize pin & collar systems
- Robotically compatible using Monogram's patented double cylindrical drive system



Maf

Adjustable fastener for soft core and composite materials

FEATURES

- Variety of head style combinations
- Adjustable clamp-up
- Positive mechanical lock
- Choice of three materials
- Available in three sizes plus oversize





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