

# FE<sup>™</sup> MINIATURE SELF-CLINCHING FASTENERS



# PEM<sup>®</sup> brand miniature fasteners fit into a minimal space and provide strong, reusable threads.

PEM miniature fasteners provide visual indication when proper installation has been accomplished.

A strong, knurled collar, which is embedded in the sheet, guarantees against rotation of the fastener in the sheet. The torque-out resistance of the knurl greatly exceeds the torque that can be exerted by the self-locking feature.

When this collar is embedded in the sheet, the undercut cavity beneath the collar is filled with displaced sheet material thereby developing pushout resistance.

FE<sup>™</sup>/FEO<sup>™</sup>/UL<sup>™</sup> prevailing torque locknuts provide ideal solutions to prevent mating hardware from loosening in service due to vibration or other application-related factors. A design feature of the lock nut produces friction between threads of mated components thereby increasing the force needed to tighten as well as loosen the nut. Prevailing torque locknuts provide essentially the same torque value regardless of the amount of axial load applied. Their use can save time and money compared with alternative chemical locking methods or patches.

A dry-film lubricant applied to locking FE<sup>™</sup>/FEO<sup>™</sup>/UL<sup>™</sup> nuts provides the smooth, non-galling prevailing torque performance necessary for reliable locking and for reusability.(1) Screws for use with PEM self-clinching locking fasteners should be Class 3A/4h fit or no smaller than Class 2A/6g.

Fastener drawings and models are available at <u>www.pemnet.com.</u> Custom sizes are available on special order. <u>Contact us</u> for more information.

FE<sup>™</sup>/FEO<sup>™</sup>/UL<sup>™</sup> elliptically squeezed nuts are self-locking. FE/FEO nut thread locking torque performance is equivalent to applicable NASM25027 specifications. UL self-locking nuts meet locking torque requirements specified herein. Some sizes of FE/FEO/UL nuts can be ordered to NASM45938/7 specifications (2). For more information on NASM25027 as applied to PEM self-clinching, self-locking nuts, check our web site for tech sheet PEM<sup>®</sup> - Ref/NASM25027.

**FEX™/FEOX™/U™** non-locking nuts have class 2B/6H strong reusable threads. These fasteners can be installed into thinner sheets and closer to the edge of a sheet than standard self-clinching nuts. Some sizes of FEX/FEOX/U nuts can be ordered to NASM45938/7 specifications (2).

(1) Consult Bulletin LN for complete line of self-clinching, locking fasteners.

(2) To meet national aerospace standards and to obtain testing documentation, product must be ordered using appropriate NASM45938/7 part number. Check our website for a complete Military Specification and National Aerospace Standards Reference Guide (Bulletin NASM).







## **Specifications**







Tops Of UL<sup>™</sup>/FE<sup>™</sup>/ **FEO<sup>™</sup> Nuts Have Elliptically Squeezed** Locking Feature



All dimensions are in inches.

		Тур	e		Ohank		Ohaat	Hole Size	_			-	Min. Dist.	Max. Hole
	Thread Size	Non- locking(1)	Self- locking	Thread Code	Code (2)	A (Shank) Max.	Sneet Thickness (3)	in Sneet +.003 000	L +.000 005	D Max.	E ±.005	+.015 000	to Edge (5)	Attached Parts
	.060-80 (#0-80)	U	UL	080	0	.020	.019022	.110	.1095	.076	.125	.050	.09	.080
	.073-64 (#1-64)	U	UL	164	0	.020	.019022	.110	.1095	.090	.125	.050	.09	.093
	.086-56			25.6	0	.020	.019022	144	1425	106	160	065	11	106
ed	(#2-56)	U	UL	200	1	.031	.030036	.144	.1455	.100	.100	.005	.11	.100
ìifi	.112-40	FEOX	FE0	110		.040	.039045	170	171	145	10.2	0.05	14	100
Ur	(#4-40)	FEX	FE	440		.060	.059070	.1/2	.171	.140	.192	.000	.14	.132
	.138-32	FEOX	FE0	633		.040 .039	.039045	010	010	100	044	075	17	150
	(#6-32)	FEX	FE	032		.060	.059070	.213	.212	.180	.244	.075	.17	.158
	.164-32	FEOX	FE0			.040	.039045	200	200	015	222	000		10.4
	(#8-32)	FEX	FE	832		.060	.059070	.290	.289	.215	.322	.090	.20	.184
	.190-32	FEOX	FE0			.040	.039045	000	000	045	000	110	00	010
	(#10-32)	FEX	FE	032		.060	.059070	.290	.289	.245	.322	.110	.20	.210
	1/4-20	FEV	FE	0420		060	050-070	244	242	210	204	120	20	270
	1/4-28	FEX.	I C	0428		.000	.033070	.344	.545	.310	.304	.120	.20	.270

All dimensions are in millimeters.

		Туре	9										Min. Dist.	Max. Hole
	Thread Size x Pitch	Non- locking(4)	Self- locking	Thread Code	Code (2)	A (Shank) Max.	Sheet Thickness (3)	Hole Size In Sheet +0.08	C -0.13	D Max.	E ±0.13	T +0.4	Hole C/L to Edge (5)	In Attached Parts
	M2 x 0.4	U	UL	M2	1	0.79	0.76-0.91	3.61	3.6	2.5	4.07	1.65	2.8	2.5
<u>.</u>	M3 x 0 5	FEOX	FE0	M2		1.02	0.99-1.14	4.20	4.27	2.06	4 00	10	26	25
etr	INIO X 0.0	FEX	FE	WI3		1.53	1.5-1.78	-100	4.3/	3.90	4.00	1.9	3.0	5.5
ž	M4×07	FEOX	FE0	14		1.02	0.99-1.14	730	737	5.23	817	2 55	5.0	4.5
	IM4 X U.7	FEX	FE	W14		1.53	1.5-1.78	1.33	1.31	5.25	0.17	2.55	5.2	4.5
	MEYOO	FEOX	FE0	МЕ		1.02	0.99-1.14	730	737	6.48	817	3.05	5.0	
	WIJ X U.8	FEX	FE	CIVI		1.53	1.5-1.78	1.55	1.57	0.40	0.1/	5.00	5.2	0.0
	M6 x 1	FEX	FE	M6		1.53	1.5-1.78	8.74	8.72	7.72	9.74	3.3	7.1	6.5

(1) 2B Go Gauge may stop at barrel end but class 3A screw will pass thru with finger torque.

(2) Shank code applicable only to U and UL fasteners.

(3) In applications between the sheet thicknesses for your thread size, see last paragraph of installation data on page 4. Knurled collar may fracture if fastener is used in

(4) 6H Go Gauge may stop at barrel end but class 4h screw will pass thru with finger torque.
(5) For more information on proximity to bends and distance to other clinch hardware, see <u>PEM® Tech Sheet C/L To Edge</u>.

## **Material And Finish Specifications**

		Threads	Fastener Material	S	tandard Finishe	es	For Use In Sheet Hardness <sup>(1)</sup>			
Туре	Internal, ASME B1.1, 2B / ASME B1.13M, 6H	Internal, UNJ Class 3B per ASME B1.15 / MJ Class 4H6H per ASME B1.21M (M6 thread 4H5H)	300 Series Stainless Steel	Passivated and/or Tested Per ASTM A380	Passivated Plus Clear Dry-film Lubricant	Black Dry-film Lubricant	HRB 70 / HB 125 or Less	Locking Temperature Limit	Self-locking	Covered by M45938/7 <sup>(2)</sup>
U	•		•	•			•			•
UL		•	•		-		•	400°F/204°C	-	•
FE		•	•	•		•	•	400°F/204°C	-	•
FEX	•		•	•			•			•
FE0		•	•	•		•	•	400°F/204°C	•	•
FE0X	•		•	•			•			•
Part number of	codes for finishes	·		None	CW <sup>(3)</sup>	MD <sup>(4)</sup>				

(1) HRB - Hardness Rockwell "B" Scale. HB - Hardness Brinell.

(2) To meet national aerospace standards and to obtain testing documentation, product must be ordered using appropriate NASM45938 part number.

Check our web site for a complete Military Specification and National Aerospace Standards Reference Guide (Bulletin NASM).

(3) See PEM Technical Support section of our web site for related plating standards and specifications.

(4) MD finish on stainless steel provides a minimum of 100 hours of salt spray resistance.

#### Installation

- 1. Prepare properly sized mounting hole in sheet. Do not perform any secondary operations such as deburring.
- 2. Insert fastener into the anvil hole and place the mounting hole (preferably the punch side) over the shank of the fastener.
- 3. With installation punch and anvil surfaces parallel, apply squeezing force to the knurled collar until knurled collar is flush with top of the sheet for sheets .060"/1.5mm thick and up, or until shank is flush with the bottom of the sheet for sheets .040"/1mm to .060"/1.5mm thick for FE/FEO nuts.

PEM miniature fasteners must be installed by a force applied through parallel surfaces. Since force must not be applied to the barrel, a cavity must be used in either the punch or anvil so that the installation force is applied to the knurled collar. "D" dimensions for the punch or anvil cavity are given in the tables on page 3.

#### Installation Tooling - U, UL, FE, FEO, FEX and FEOX Nuts

Type	Thread	HAEGER® P	art Number	PEMSERTER®	Part Number
турс	Code	Anvil	Punch	Anvil	Punch
U/UL	080	H-133-0L	H-108-0019L	8008451	975200048
U/UL	164	H-133-1L	H-108-0019L	970200300300	975200048
U/UL	256/M2	H-133-2L	H-108-0019L	975200020	975200048
FE/FE0/FEX/FE0X	440/M3	H-133-4L	H-108-0019L	975200021	975200048
FE/FE0/FEX/FE0X	632	H-133-6L	H-108-0019L	975200022	975200048
FE/FE0/FEX/FE0X	832/M4	H-133-8L	H-108-0019L	975200023	975200048
FE/FE0/FEX/FE0X	032/M5	H-133-10L	H-108-0019L	975200024	975200048
FE/FE0/FEX/FE0X	0420	H-133-04L	H-108-0019L	975200025	975200048
FE/FE0/FEX/FE0X	M6	-	-	8013143	975200048

# PUNCH PUNCH T Max.\* +.010" / +0.25 mm ANVIL \* For "D" and "T", see page 3. D\* +.005" / +0.13 mm +.010" / +0.25 mm

#### **Installation Notes**

- For best results we recommend using a HAEGER<sup>®</sup> or PEMSERTER<sup>®</sup> machine for installation of PEM<sup>®</sup> self-clinching fasteners. See our <u>website</u> for more information.
- Visit the <u>Animation Library</u> on our website to view the installation process.

#### Installation Recommendation

In applications for sheet thicknesses between the two ranges (see "Sheet Thickness" on page 3) use the fastener with the larger "A" dimension. For example, if you want a #4-40 thread and your sheet thickness is between .045"/1.14 mm and .059"/1.49 mm, you should use FE or FEX nuts. This is not recommended installation practice, but in this case if it is necessary, you should install the fastener so that the bottom of the shank is flush with the underside of the sheet (instead of having the top of the knurled collar flush with the top of the sheet). When this method is used, care must be taken to protect the fastener against crushing which would damage the threads. This method will also result in reduced pushout and torque-out values.

# For Additional HAEGER® and PEMSERTER® Tooling Information / Part Numbers



# Performance Data For U<sup>™</sup>/UL<sup>™</sup> Fasteners<sup>(1)</sup>

					Test Sheet Material								
		Thread Code	Shank Code		5052-H34 Aluminum		Cold-rolled Steel						
nified	Туре			Installation (Ibs.)	Pushout (Ibs.)	Torque-out (in. lbs.)	Installation (Ibs.)	Pushout (Ibs.)	Torque-out (in. lbs.)				
	U/UL	080	0	750	20	2	1000	30	2				
Ur		164	0	750	20	3	1000	30	3				
		256	0	1000	20	4	1300	30	4				
		230	256 1	1000	20	7	1500	50	7				

					Test Sheet Material							
ပ					5052-H34 Aluminum		Cold-rolled Steel					
Metri	Туре	Code	Shank Code	Installation (kN)	Pushout (N)	Torque-out (N•m)	Installation (kN)	Pushout (N)	Torque-out (N•m)			
	U/UL	M2	1	4	89	0.45	5.8	133	0.45			

# Performance Data For FE<sup>™</sup>/FEO<sup>™</sup>/FEX<sup>™</sup>/FEOX<sup>™</sup> Fasteners<sup>(1)(2)</sup>

				5052-H34 Aluminum			Cold-rolled Steel	
	Туре	Thread Code	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)
	FE0/FE0X	440	000	88	10	1500	140	10
ğ	FE/FEX	440	900	135	210	IZ		
ifi∈	FE0/FE0X	622	1200	105	20	2100	185	20
Un	FE/FEX	032	1300	1300 175 20	20	2100	255	20
	FE0/FE0X	022	1500	155	40	2500	260	40
	FE/FEX	032	1500	255	40	2300	360	40
	FE0/FE0X	022	1500	155		2500	260	10
	FE/FEX	032	1500	255	40	2300	360	40
	FF/FFX	0420	2100	320	110	3500	420	110
	12,127	0428	2.00	020		0000	120	

					Test S	heet Material			
				5052-H34 Aluminum		Cold-rolled Steel			
	Туре	Thread Code	Installation (kN)	Pushout (N)	Torque-out (N-m)	Installation (kN)	Pushout (N)	Torque-out (N•m)	
<u>.</u>	FE0/FE0X	M2	Λ	391	1.25	67	622	1.25	
letr	FE/FEX	WID	7	600	1.55	0.7	934		
Σ	FE0/FE0X	MA	6.7	689	5.42	111	1156	5.42	
	FE/FEX	1014	0.7	1134	J.4Z	1.1	1601	5.42	
	FE0/FE0X M5	67	689	5.42	11.1	1156	5.40		
	FE/FEX	WD	0.7	1134	J.4Z	1.1	1601	3.42	
	FE/FEX	M6	9.4	1423	12.43	15.6	1868	12.43	

(1) Published installation forces are for general reference. Actual set-up and confirmation of complete installation should be made by observing proper seating of fastener as described in the installation steps. Other performance values reported are averages when all proper installation parameters and procedures are followed. Variations in mounting hole size, sheet material, and installation procedure may affect performance. Performance testing this product in your application is recommended. We will be happy to provide technical assistance and/or samples for this purpose.

(2) For FE and FEO fasteners, thread locking performance is equivalent to applicable NASM25027 specifications. Consult technical sheet PEM-REF/NASM25027 on our web site for details.

# Axial Strength And Tightening Torque Comparison

				Increasing A	xial Strength		ţ	
		U-0/I	JL-0/FEOX/FEO	Nuts	U-1	/UL-1/FEX/FE N	luts	
	Thread Code	Locknut	Mating	Screw	Locknut	Mating	Screw	
		Min. Axial Strength (Ibs.) (1)	Strength Level (ksi) (2)	Tightening Torque (in. lbs.) (3)	Min. Axial Strength (Ibs.) (1)	Strength Level (ksi) (2)	Tightening Torque (in. lbs.) (3)	
р	080	125	69	1.0	-	-	-	
ifie	164	125	49	1.2	-	-	-	
Uni	256	169	46	1.9	316	85	3.5	
	440	465	77	6.8	705	117	10.3	
	632	546	60	9.8	847	93	15.2	
	832	779	56	16.6	1,213	87	25.9	
	032	779	39	19.2	1,213	61	30.0	
	0420	-	-	-	1,412	44	45.9	

	-			Increasing A	xial Strength		ţ	
		U-0,	/UL-0/FEOX/FE	O Nuts	U-1/UL-1/FEX/FE Nuts			
ric	Thread	Locknut	Mating	Screw	Locknut	Mating	Screw	
	coue	Min. Axial Strength (kN) (1)	Strength Level (MPa) (2)	Tightening Torque (N•m) (3)	Min. Axial Strength (kN) (1)	Strength Level (MPa) (2)	Tightening Torque (N•m) (3)	
let	M2	-	-	-	1.39	432	0.36	
Σ	M3	2.08	267	0.81	3.16	405	1.23	
	M4	3.48	255	1.81	5.42	398	2.82	
	M5	3.48	158	2.26	5.42	246	3.52	
	M6	_	_	_	6.28	201	4.9	

(1) Axial strength for nuts is limited by knurled ring strength.

(2) Screw strength level shown is the minimum needed to develop full nut strength, higher strength screws may be used.

(3) Tightening torque shown will induce preload of 65% of locknut minimum axial strength with K or nut factor is equal to 0.20. In some applications tightening torque may need to be adjusted based on the actual K value. If screw strength is less than the value shown, tightening torque should be proportionately reduced by multiplying the torque shown by the actual screw strength over the screw strength shown. If higher strength screws are used, torque is not adjusted upward because assemble strength is still limited by locknut strength.



Drawings and models are available at <u>www.pemnet.com</u>

Custom sizes are available on special order. <u>Contact us</u> for more information.

All PEM<sup>®</sup> products meet our stringent quality standards. If you require additional industry or other specific <u>quality certifications</u>, special procedures and/or part numbers are required. Please contact your local sales office or representative for further information.

Regulatory <u>compliance information</u> is available in Technical Support section of our website. Specifications subject to change without notice. See our website for the most current version of this bulletin.



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