PennEngineering®

MINIATURE SELF-CLINCHING FASTENERS

BULLETIN **FE**

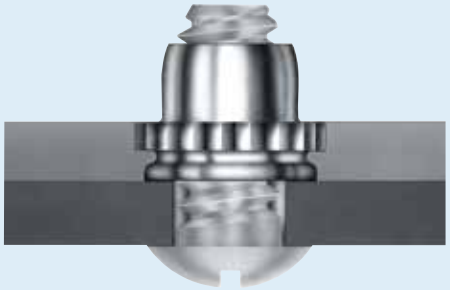
PEM®

MINIATURE SELF-CLINCHING FASTENERS

PEM® brand miniature fasteners fit into a minimal space and provide strong, reusable threads.

PEM miniature fasteners provide immediate 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.

A dry-film lubricant applied to these fasteners provides the smooth, non-galling prevailing torque performance necessary for reliable locking and for reusability.

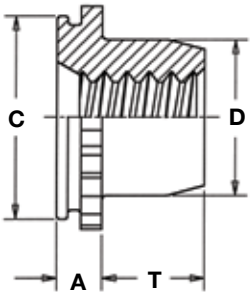
Types FE/FEO/UL elliptically squeezed nuts are **self-locking**. Types FE/FEO thread locking torque performance is equivalent to applicable NASM25027 specifications. Type UL self-locking nuts meet locking torque requirements specified herein. Some sizes of FE/FEO/UL can be ordered to NASM45938/7 specifications.*	
Types FEX/FEOX/U have **free-running** class 2B/6H threads. For more information on NASM25027 as applied to PEM self-clinching, self-locking nuts, check our web site for tech sheet PEM® - Ref/NASM25027.	

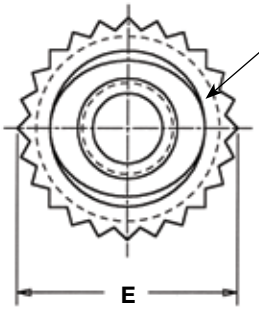
**To meet national aerospace standards and to obtain testing documentation, product must be ordered using appropriate NASM45938/7 part number. Check our web site for a complete Military Specification and National Aerospace Standards Reference Guide (Bulletin NASM).*

PART NUMBER DESIGNATION

U	–	080	–	0	
UL	–	080	–	0	CW
FE	–	440	–		MD
FEX	–	440			
FEO	–	440	–		MD
FEOX	–	440			
↓ Type		↓ Thread Code		↓ Shank Code	↓ Finish Code

SPECIFICATIONS





TYPES U/FEX/FEOX ROUND

TYPES FE/FEO/UL TOPS HAVE ELLIPTICALLY SQUEEZED LOCKING FEATURE

All dimensions are in inches.

	Thread Size	Type: Non-locking(1)	Type: Self-locking	Thread Code	Shank Code (2)	A (Shank) Max.	Sheet Thickness (3)	Hole Size In Sheet +.003 −.000	C +.000 −.005	D Max.	E ±.005	T +.015 −.000	Min. Dist. Hole ℄ To Edge	Max. Hole In Attached Parts
UNIFIED	.060-80 (#0-80)	U	UL	080	0	.020	.019-.022	.110	.1095	.076	.125	.050	.09	.080
	.073-64 (#1-64)	U	UL	164	0	.020	.019-.022	.110	.1095	.090	.125	.050	.09	.093
	.086-56 (#2-56)	U	UL	256	0	.020	.019-.022	.144	.1435	.106	.160	.065	.11	.106
					1	.031	.030-.036							
	.112-40 (#4-40)	FEOX	FEO	440		.040	.039-.045	.172	.171	.145	.192	.065	.14	.132
		FEX	FE			.060	.059-.070							
	.138-32 (#6-32)	FEOX	FEO	632		.040	.039-.045	.213	.212	.180	.244	.075	.17	.158
		FEX	FE			.060	.059-.070							
	.164-32 (#8-32)	FEOX	FEO	832		.040	.039-.045	.290	.289	.215	.322	.090	.20	.184
		FEX	FE			.060	.059-.070							
	.190-32 (#10-32)	FEOX	FEO	032		.040	.039-.045	.290	.289	.245	.322	.110	.20	.210
		FEX	FE			.060	.059-.070							
	1/4-20	FEX	FE	0420		.060	.059-.070	.344	.343	.318	.384	.120	.28	.270
	1/4-28			0428										

All dimensions are in millimeters.

	Thread Size x Pitch	Type: Non-locking(4)	Type: Self-locking	Thread Code	Shank 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	Min. Dist. Hole ℄ To Edge	Max. Hole In Attached Parts
METRIC	M2 x 0.4	U	UL	M2	1	0.76	0.76-0.91	3.61	3.6	2.5	4.07	1.65	2.8	2.5
	M3 x 0.5	FEOX	FEO	M3		1.02	0.99-1.14	4.39	4.37	3.96	4.88	1.9	3.6	3.5
		FEX	FE			1.53	1.5-1.78							
	M4 x 0.7	FEOX	FEO	M4		1.02	0.99-1.14	7.39	7.37	5.23	8.17	2.55	5.2	4.5
		FEX	FE			1.53	1.5-1.78							
	M5 x 0.8	FEOX	FEO	M5		1.02	0.99-1.14	7.39	7.37	6.48	8.17	3.05	5.2	5.5
		FEX	FE			1.53	1.5-1.78							
	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 Types U and UL fasteners.
(3) In applications between the sheet thicknesses for your thread size, see last paragraph of installation data on page 6. Knurled collar may fracture if fastener is used in sheets thicker than the specified range and the screw is tightened beyond maximum tightening torque.
(4) 6H Gauge may stop at barrel but 4h screw will pass thru with finger torque.

MATERIAL AND FINISH SPECIFICATIONS

Type	Threads		Fastener Material	Standard Finishes			For Use In Sheet Hardness (1)
	Internal, ASME B1.1, 2B / ASME B1.13M, 6H	Internal, MIL-S-8879, UNJ-3B, ANSI B1.21M, MJ 4H6H 4H5H (M6 thread)	303 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
U	•		•	•			•
UL		•	•		•		•
FE		•	•			•	•
FEX	•		•	•			•
FEO		•	•			•	•
FEOX	•		•	•			•
Part number codes for finishes				None	CW(2)	MD(3)	

(1) HRB - Hardness Rockwell "B" Scale. HB - Hardness Brinell.
(2) Visit our web site for details on CW finish specifications.
(3) Visit our web site for details on MD finish specifications.

PERFORMANCE DATA FOR TYPES U/UL(4)

	Type	Thread Code	Shank Code	Max. Rec. Tightening Torque (in. lbs.) (5)	Type UL Locking Torque (in. oz.) (6)	Test Sheet Material: 5052-H34 Aluminum			Test Sheet Material: Cold-rolled Steel		
						Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)
UNIFIED	U & UL	080	0	1	1 To 12	750	20	2	1000	30	2
		164	0	1.1	2 To 16	750	20	3	1000	30	3
		256	0	1.8	3 To 24	1000	20	4	1300	30	4
			1	3							

	Type	Thread Code	Shank Code	Max. Rec. Tightening Torque (N•m) (5)	Type UL Locking Torque (N•m) (6)	Test Sheet Material: 5052-H34 Aluminum			Test Sheet Material: Cold-rolled Steel		
						Installation (kN)	Pushout (N)	Torque-out (N•m)	Installation (kN)	Pushout (N)	Torque-out (N•m)
METRIC	U & UL	M2	1	0.3	0.02 To 0.2	4	89	0.45	5.8	133	0.45

(4) The values above are representative of pushout and torque-out resistance between the shank of the fastener and the sheet. The values reported are averages when all installation specifications and procedures are followed. Variations in mounting hole size, sheet material and installation procedure will affect results. These torques will ensure that induced preload will not exceed shear strength of knurled collar. Performance testing of this product in your application is recommended. We will be happy to provide samples for this purpose.

(5) These torques consider nut strength only. User must consider screw strength also. When type U/UL is installed in sheets thicker than .025" / 0.64mm, tightening torque must be controlled so that induced preload does not exceed these values.

6) The maximum locking torque and the minimum breakaway will fall within these values for five cycles when tested in accordance with the locking torque test procedure specified in NASM25027.

PERFORMANCE DATA FOR TYPES FE/FEO/FEX/FEOX[1][2]

	Type	Thread Code	Max. Rec. Tightening Torque (in. lbs.) (3)	Test Sheet Material					
				5052-H34 Aluminum			Cold-rolled Steel		
				Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)	Installation (lbs.)	Pushout (lbs.)	Torque-out (in. lbs.)
UNIFIED	FEO, FEOX	440	6.3	900	88	12	1500	140	12
	FE, FEX		10		135	12		210	12
	FEO, FEOX	632	10	1200	105	20	2100	185	20
	FE, FEX		15	1300	175			255	
	FEO, FEOX	832	16	1500	155	48	2500	260	48
	FE, FEX		25		255			360	
	FEO, FEOX	032	19	1500	155	48	2500	260	48
	FE, FEX		30		255			360	
	FE, FEX	0420	45	2100	320	110	3500	420	110
		0428							

	Type	Thread Code	Max. Rec. Tightening Torque (N•m) (3)	Test Sheet Material					
				5052-H34 Aluminum			Cold-rolled Steel		
				Installation (kN)	Pushout (N)	Torque-out (N•m)	Installation (kN)	Pushout (N)	Torque-out (N•m)
METRIC	FEO, FEOX	M3	.76	4	391	1.35	6.7	622	1.35
	FE, FEX		1.13		600			934	
	FEO, FEOX	M4	1.8	6.7	689	5.42	11.1	1156	5.42
	FE, FEX		2.8		1134			1601	
	FEO, FEOX	M5	2.2	6.7	689	5.42	11.1	1156	5.42
	FE, FEX		3.5		1134			1601	
	FE, FEX	M6	4.8	9.4	1423	12.43	15.6	1868	12.43

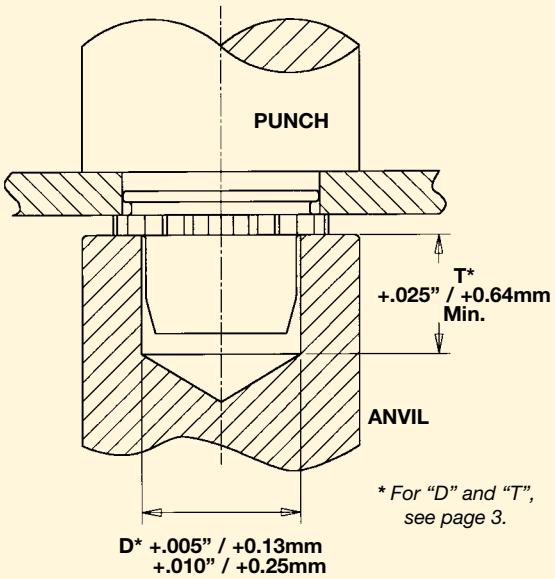
(1) The values above are representative of pushout and torque-out resistance between the shank of the fastener and the sheet. The values reported are averages when all installation specifications and procedures are followed. Variations in mounting hole size, sheet material and installation procedure will affect results. Performance testing of this product in your application is recommended. We will be happy to provide samples for this purpose.

(2) For Types 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.

(3) These torques will ensure that induced preload will not exceed shear strength of knurled collar. These torques consider nut strength only. User must consider screw strength also. When type FE/FEX is installed in sheets thicker than .070" / 1.78mm or when type FEO/FEOX is installed in sheets thicker than .045" / 1.14mm, tightening torque must be controlled so that induced preload does not exceed these values.

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 as shown in the drawing.
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 Type FE/FEO.



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.

PEMSERTER® Installation Tooling

Type	Thread Code	Anvil Part Number	Punch Part Number
U/UL	256/M2	975200020	975200048
FE/FEO/FEX/FEOX	440/M3	975200021	
FE/FEO/FEX/FEOX	632	975200022	
FE/FEO/FEX/FEOX	832/M4	975200023	
FE/FEO/FEX/FEOX	032/M5	975200024	
FE/FEO/FEX/FEOX	0420	975200025	
FE/FEO/FEX/FEOX	M6	8013143	

PEMSERTER® PRESSES

For best results we recommend using a PEMSERTER® press for either manual or automatic installation of PEM Type FE and FEX fasteners. For more information on our line of presses check our web site.

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"/1.14mm and .059"/1.49mm, you should use Type FE or FEX. 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.

Regulatory compliance information is available in Technical Support section of our website.

Specifications subject to change without notice.
Check our website for the most current version of this bulletin.

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