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.**

Types FE, FEO and UL are self-locking. Types FE and 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, and UL can be ordered to NASM45938/7 specifications.* Types FEX, FEOX and 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.

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.

**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

| | | | | | | |
|---|---|---|---|---|---|---|
| FE | – | 632 | – | | MD |
| UL | – | 256 | – | 1 | CW |

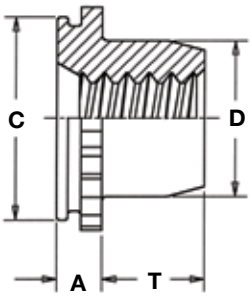
Type:
U = Non-locking
UL = Locking
FEOX = Non-locking, short shank
FEX = Non-locking, long shank
FEO = Self-locking, short shank
FE = Self-locking, long shank

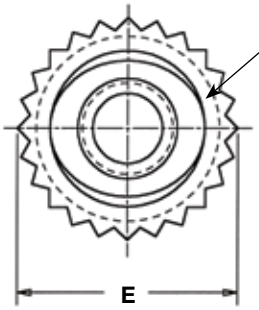
Thread Size Code

Shank Code

Finish Code:
CW or MD on self-locking
None on non-locking

## SPECIFICATIONS




**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 FE-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 AND UL(3)

| | Type | Thread Code | Shank Code | Max. Rec. Tightening Torque (in. lbs.) (4) | Type UL Locking Torque (in. oz.) (5) | 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) (4) | Type UL Locking Torque (N•m) (5) | 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 |

***(3) The values above are representative of pushout and torque-out resistance between the shank of the fastener and the sheet. The installation, pushout and torque-out 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.***

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

*(5) 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, AND 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 installation, pushout and torque-out 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.***

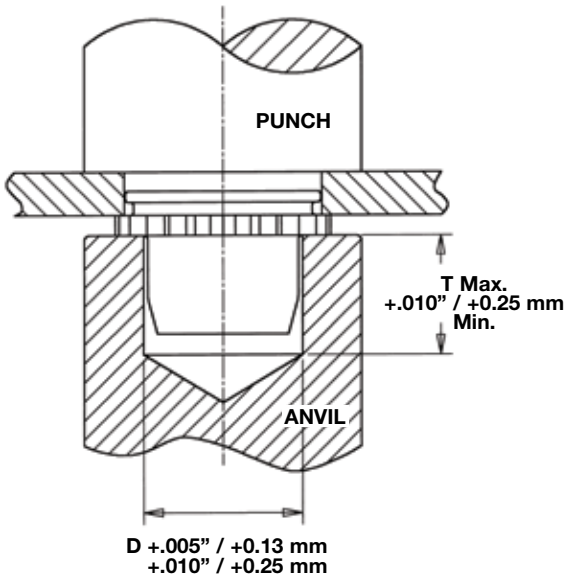
*(2) For Types FE and FEO fasteners, thread locking performance is equivalent to applicable NASM25027 specifications. Consult technical sheet PEM-REF/NASM25027 on our web site for details.*

*(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" / 1.78 mm or when type FEO/FEOX is installed in sheets thicker than .045" / 1.14 mm, 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 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" / 1.5 mm thick and up, or until shank is flush with the bottom of the sheet for sheets .040" / 1 mm to .060" / 1.5 mm 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 FE-3.*




## INSTALLATION RECOMMENDATION

*In applications for sheet thicknesses between the two ranges (see "Sheet Thickness" on page FE-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 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.*

**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.

*RoHS compliance information can be found on our website.*


*Specifications subject to change without notice.*
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