

# TECH SHEET

## PEM® - REF/NASM25027

### NASM25027 As Applied to PEM® Self-Clinching, Self-Locking Nuts

PEM types FE, FEO, LAS, LAC, LA4, LK, LKS, LKA, PL and PLC are produced to meet the locking torque requirements of NASM25027. Specification NASM25027 is a rather lengthy spec which includes many requirements for attributes such as tensile strength and wrenching strength which are not applicable to PEM self-clinching, self-locking nuts. It is difficult for those not familiar with the specification to determine exactly which portions of it apply to the locking torque of PEM self-clinching, self-locking nuts. This matter is further complicated by the fact that many of the requirements in the specification that do apply, apply only to qualification and are not so called "quality conformance inspections" which need to be applied to every lot of product. The fact of the matter is that only one test (room ambient temperature locking torque per the first row of Table IV) needs to be applied on a regular basis of PEM self-clinching, self-locking nuts. This requirement is defined by Table XIV and the permanent set test is not required per footnote 1. The requirements for this test are given in Paragraphs 3.8.2.2.1 and 3.8.2.2.2. The test method is specified in paragraphs 4.5.3.3. and 4.5.3.3.4.1. For convenience of those who do not have access to this specification and/or are not familiar with specification language, these test requirements and test methods are re-stated below in laymen's terms.

The one required test is a 15 cycle reusability test. There are two values of torque which are required by specification. The first is a maximum torque value which dare not be exceeded anytime during the 15 installation and removal cycles. The second is a minimum breakaway torque which must be met during the 15<sup>th</sup> removal cycle. These torque values are shown in Table III of specifications NASM25027. They are also listed below for PEM fastener sizes only and also for metric sizes. The NASM Spec does not address metric thread sizes at all, and the metric values shown below were created by Penn Engineering, and are based on equivalent inch values.

Thread Size	Maximum Locking Torque <u>(Any Cycle)</u>		Minimum 15 <sup>th</sup> Cycle <u>Breakaway Torque</u>	
	in – lb	N.m	in – lb	N.m
#2-56	2.5		0.2	
#4-40	5		0.5	
#6-32	10		1.0	
#8-32	15		1.5	
#10-24	18		2.0	
#10-32	18		2.0	
¼-20	30		4.5	
¼-28	30		3.5	
M2.5	3.8	0.43	0.38	0.043
M3	5	0.56	0.5	0.056
M3.5	10	1.13	1.0	0.113
M4	15	1.7	1.5	0.17
M5	18	2.03	2.0	0.22
M6	28.3	3.2	3.3	0.37

**Details of the test procedure and significant definitions are given on next page.**

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#### **Test Procedure**

A new screw shall be used for every test. A nut shall be assembled onto a screw and that same combination shall be used for all 15 cycles. A complete cycle is defined as moving the screw from the point where it begins to engage the locking element until two threads are extending thru the top of the locking element and back to the point where the screw is once again disengaged from the locking element. PEM practice is to aim for two or more threads extending thru the top of the locking element. During the entire test the maximum torque is monitored to assure that it does not go above the maximum allowable value. During the 15<sup>th</sup> removal cycle the breakaway torque is monitored with between one and two threads extending thru the top of the nut, and is checked for compliance to the minimum breakaway torque requirement.

#### **Torque Measuring Equipment**

Penn Engineering recommends any type of torque measuring equipment which has appropriate accuracy and resolution for the size product being tested.

#### **Test Speed**

The Mil Spec does not specifically address test speed but does state that the test speed must be controlled so that the temperature rise of the parts being tested is no greater than 75 °F (42°C) above room temperature.

#### **Test Screw**

The Mil Spec requires that all test screws be Class 3A thread fit. Although the Mil Spec does not address metric, PEM practice is to use the equivalent class of fit for metric screws which is Class 4h. Material of the test screws is to be the same as the locknuts being tested. That is, stainless steel screws are used when testing stainless steel locknuts, aluminum screws are used when testing aluminum locknuts (applicable only to PEM type LKA) and steel screws are used when testing steel locknuts (applicable only to PEM types PL and LK).

#### **Axial Load**

It should be pointed out that the NASM Spec requirements for locking torque are all based on testing with no axial load applied. Penn Engineering practice is to use screws of sufficient length so that when the screw is fully installed, there is a minimum of two thread pitches between the screw head and the shank of the nut to eliminate the possibility of applying any axial load.

#### **Lubricant**

It is the intention of the Mil Spec that the locknuts be supplied with a lubricant which is adequate to meet the 15 cycle reusability test. Therefore no additional lubricant dare be applied during testing. All test screws are to be in a clean and dry condition. All PEM brand locknuts meeting NASM25027 torque requirements are supplied with a molybdenum disulfide based, heat cured, dry film lubricant applied.

#### **Important Note Regarding Lubricant**

We frequently receive complaints from the field involving poor performance of the locking feature after self-clinching, self-locking nuts have been chemically treated. When using self-clinching, self-locking nuts it is vitally important that they be given no chemical treatment whatsoever. In most cases this means that the nuts must be installed into the panel after all chemical processing of the panel.

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There are some cases in which spray painting of the panel is done after the nuts are installed and the nut ends are masked so that no paint gets into the threads. This practice is acceptable as long as adequate care is taken in the masking to insure that the threads are in fact kept entirely free of paint.

#### MIL Spec Locknuts

Several types of PEM brand self-clinching, self-locking nuts are covered by NASM45938 as follows:

- Types FE, FEO and UL are covered by NASM45938/7 – see cross reference chart
- Type LAC and LAS are covered by NASM45938/12 – see cross reference chart

When ordered as the M45938/X-XX part number, the parts will be fully compliant to the above NASM specs. Note that these locknuts will have the required cadmium plating under the dry film lubricant and will therefore not be RoHS compliant unless European RoHS Directive Annex exemption 8 applies to the device the locknuts will be used in. Parts ordered to the above NASM specs can also be supplied with a Certificate of Compliance.

#### Note on Thread Gaging

Due to the nature of the dry film lubricant and the processes used to apply it, the lubricant frequently prevents parts from accepting a Go threaded plug gage of basic size. Penn Engineering follows the intent of NASM25027 regarding thread acceptability. Paragraph 3.5.2 requires that if a Go threaded plug gage does not enter, locknut threads are acceptable if a Class 3A screw can enter a minimum of  $\frac{3}{4}$  turn. For locknuts with metric threads, the thread is acceptable if a Class 4h screw will enter  $\frac{3}{4}$  of a turn. Locknuts will not accept the 3B/5H NoGo threaded plug gage.