

THE **BOEING** COMPANY  
AERO-SPACE DIVISION  
LAUNCH SYSTEMS BRANCH

DOCUMENT NO. T5-6539-84

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TITLE TEST OF BACNLOEL NUTPLATE

MODEL NO. Saturn V/S-IC CONTRACT NO. NAS8-5608

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**CHANGE RECORD**

REV. SYM.	SECT.	PAGES			REV. SYM.	SECT.	PAGES		
		REVISED	ADDED	DELETED			REVISED	ADDED	DELETED

REV. SYM. \_\_\_\_\_

3

REVISIONS			
REV. SYM.	DESCRIPTION	DATE	APPROVED

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4

ABSTRACT

This report contains test data designed to determine the compliance of the physical part to the BAC standard page and the procurement specification MIL-N-25027, "Nut, Self-Locking, 250°F, 450°F, and 800°F, 125 KSI FTU, 60 KSI FTU, and 30 KSI FTU".

KEY WORDS

Nutplate

TABLE OF CONTENTS

	<u>Page</u>
Distribution	ii
Change Record	iii
Revision	iv
Abstract	v
Table of Contents	vi
1.0 OBJECT	1
2.0 BACKGROUND	1
3.0 CONCLUSIONS	1
4.0 RECOMMENDATIONS	1
5.0 PROCEDURES & RESULTS	1 & 2

## 1.0 OBJECT

The object of this test was to compare the properties of the physical part to the requirements of the BAC standard page and the procurement specifications MIL-N-25027. This was done as back up data for inclusion in the preferred parts list of D5-11228-2.

## 2.0 BACKGROUND

Qualification test data on BACN10EL was needed as this part is used on the Saturn S-IC. A search was made for the necessary data but nothing satisfactory was located. Because of this testing was conducted to provide the needed information.

## 3.0 CONCLUSIONS

It is concluded from the results of this test that this standard is acceptable for use on the Saturn S-IC.

## 4.0 RECOMMENDATIONS

It is recommended that more stringent control of parts in stores and/or supplied from stores be enforced. In this manner errors in parts supplied from stores, such as the one encountered in this test, could be avoided.

## 5.0 PROCEDURES AND RESULTS

Procedure: Five samples of BACN10EL3H nutplates were drawn from stock and five samples of BACN10EL nutplates were obtained from Wichita because there were more in supply at Michoud. The five parts selected for test were checked for dimensional compliance with the BAC standard page. The threads were checked with a go-not go thread gage. The locking and breakaway torque were checked by running the nutplates on a 160 KSI cadmium plated bolt for one installation and removal. The torque out was then checked by bottoming a short thread bolt in the installed nutplate and torquing the bolt to the minimum torque specified in MIL-N-25027. After this the push out was checked by pushing on a bolt in the installed nutplate with the minimum force specified in MIL-N-25027. The axial tensile strength was checked using 220 KSI alloy steel bolts, and the nutplates were tested to destruction.

Results: Testing of BACN10EL-3H was not conducted as it was discovered that the parts on hand did not correspond to the BAC standard page. The part received by the test technician was a capped, two lug nutplate, but was not a floating type, nor was it cadmium plated with type II cadmium plating as specified by BACN10EL.

In testing BACN10EL-4 there was a dimensional discontinuity discovered in the M dimensions. This M dimension controls the thickness of the nut base. The parts tested were as much as .007 in. above the maximum specified. The effect of this out of tolerance condition was

5.0 PROCEDURES AND RESULTS (Continued)

analyzed and determined to be non-harmful.

The only other discrepancy countered during this test in the failure of the number 3 sample during the test for torque out. The nut failed as the bolt was bottomed on the nut. This failure was caused by hoop stresses induced in the nut as it was torqued onto the chamfer of the bolt between the threads and bolt shank. This failure did not cause the nut to torque out but it did prevent additional testing.

It is felt that failure of this nut was the result of test procedure rather than non-compliance with the applicable standards.

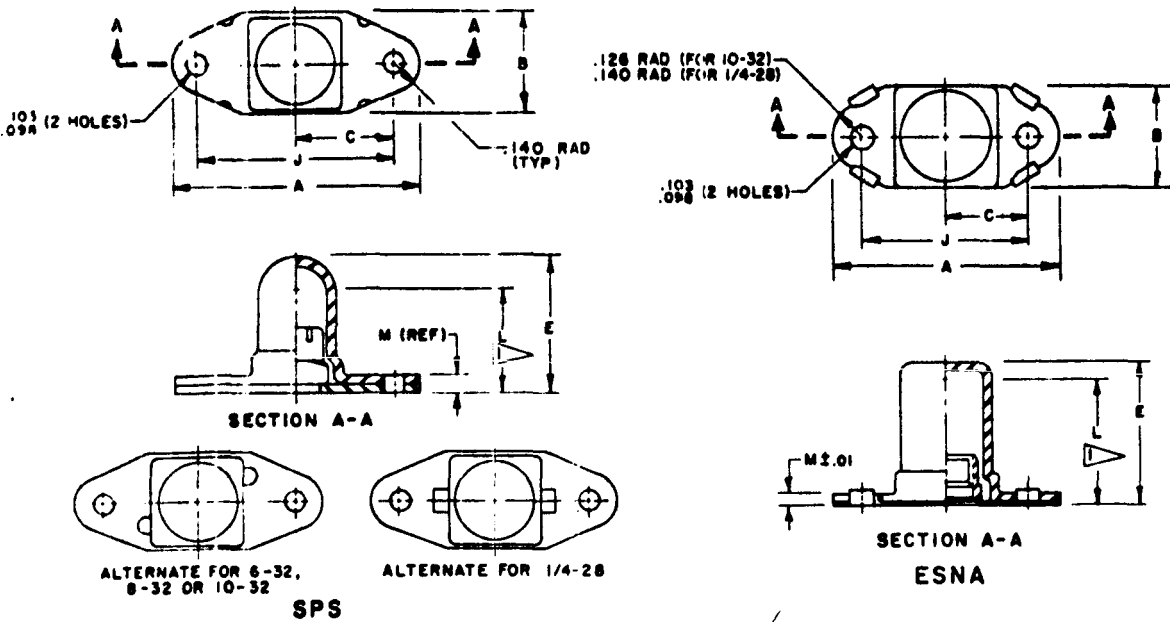


SAMPLE		DIMENSIONS					TEST RESULTS					
		A	B	E	M	GO GAGE	LOCKING TORQUE	BREAKAWAY TORQUE	AXIAL TENSION	TORQUE OUT	PUSH OUT	
		±.015	±.015	MAX.	M	MIN	MAX	MIN.	MIN	MIN	MIN	
BACNIOEL4		1.28	0.50	0.54	0.03	3/4 REV	30	3.5	4580	100	125	
1		1.282	0.501	0.525	0.046	✓	15.0	13.0	6200	✓	✓	
2		1.279	0.501	0.528	0.045	✓	15.5	15.0	5980	✓	✓	
3		1.280	0.503	0.530	0.045	✓	12.0	10.0		*		
4		1.280	0.504	0.531	0.048	✓	15.0	13.0	6480	✓	✓	
5		1.280	0.502	0.527	0.047	✓	6.0	4.5	6140	✓	✓	
*		NUT SPLIT WITH 90 IN. LBS TORQUE										

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QUALIFICATION OF  
BACNIOEL

TEST NO.  
78



PLATING	PART NUMBER	THREAD SIZE	A	B	C	E	J	L		M
								MIN	MAX	
BAC NIOEL	4660-62	6-32 UNC-3B	±.015	±.015	±.005	MAX	±.002			
	4660H-62	6-32 UNC-3B	.97	.39	.344	.47 .66	.688	.23	.39 .58	.03 .04
BAC NIOEL	4660-82	8-32 UNC-3B	±.015	±.015	±.005	MAX	±.002			
	4660H-82	8-32 UNC-3B	.97	.39	.344	.47 .66	.688	.24	.39 .58	.03 .04
BAC NIOEL	4660-02	10-32 UNF-3B	±.015	±.015	±.005	MAX	±.002			
	4660H-02	10-32 UNF-3B	.97	.39	.344	.47 .60	.688	.28	.38 .52	.03 .04 .05
BAC NIOEL	4660-048	1/4-28 UNF-3B	±.015	±.015	±.005	MAX	±.002			
	4660H-048	1/4-28 UNF-3B	1.28	.50	.500	.54 .78	1.000	.36 .29	.44 .69	.03 .04 .05

- 1 - PENETRATION OF BOLT INTO PLATE NUT.
- 4660-2 SERIES INACTIVE FOR DESIGN AND PROCUREMENT AFTER 15 FEBRUARY 1954. 4660 SERIES SUPERSEDES AND IS INTERCHANGEABLE WITH 4600-2 SERIES.
- DIMPLED HOLES FOR CSK RIVET HEAD INDICATED BY ADDING BC AS SUFFIX TO END OF COMPLETE VENDOR PART NUMBER AND C TO END OF BOEING NUMBER. EXAMPLE - 4660H-02BC OR 12LHA401K4-02BC. BOEING NUMBER IS BACN10EL3HC.
- ESNA NUMBERS WITH PREFIX "F" SUPERSEDE ESNA NUMBERS WITHOUT PREFIX "F". PREFIX "F" INDICATES TYPE II PLATING.

**MATERIAL:**

SHELL	STEEL PER SAE 1050	ALCLAD 7075-T6
NUT	STEEL PER SAE C1118	ALLOY STEEL
SHIM	STEEL PER SAE 1010	CARBON STEEL

**THREADS:** PER MIL-S-7742 BEFORE LUBRICATION. MINIMUM GO GAGE PENETRATION SHALL BE 1/4 OF ONE REVOLUTION.

**FINISH:** CADMIUM PLATE, SPEC. QQ-P-416, TYPE I OR II, CLASS 3 EXCEPT SHELL FOR ESNA (ALODINE PER MIL-C-5541). TYPE I PLATING INACTIVE FOR PROCUREMENT AFTER 1 JUNE 1964. PARTS ON HAND WITH TYPE I PLATING MAY BE USED UNTIL 1 JUN 65.

**PROCUREMENT SPECIFICATION:** MIL-N-25027 FOR REGULAR NUTS, EXCEPT AS NOTED.

**ELASTIC STOP NUT CORPORATION OF AMERICA (ESNA),** 2330 VAUXHALL ROAD, UNION, NEW JERSEY. CODE IDENT. NO. 72962  
**STANDARD PRESSED STEEL CO., (SPS) WESTERN PLANT,** 2701 SOUTH HARBOR BOULEVARD, SANTA ANA, CALIFORNIA. CODE IDENT. NO. 07170

THE SUPPLIERS LISTED AND THEIR AUTHORIZED DISTRIBUTORS ARE THE ONLY APPROVED SOURCES FOR THE ABOVE QUALIFIED PRODUCTS. CHANGES IN PRODUCT DESIGN OR QUALITY WITHOUT PRIOR BOEING APPROVAL MAY RESULT IN SUPPLIER DISQUALIFICATION. SUPPLIERS OF COMPETITIVE PRODUCTS MAY APPLY TO A MATERIAL DEPARTMENT OF THE BOEING COMPANY FOR QUALIFICATION.

**USAGE AND APPLICATION INFORMATION**

THESE FLOATING TYPE CAP NUTS ARE INTENDED FOR USE IN AREAS WHERE A SEAL IS REQUIRED TO PREVENT LEAKAGE OF LIQUID OR FUMES AT BOLTED CONNECTIONS. SEALING COMPOUND IS REQUIRED AROUND THE EDGES OF THE BASE AND OVER THE ENDS OF THE CUP. BECAUSE OF THEIR RADIAL FLOAT THROUGH USE IS DESIRABLE IN INSTALLATIONS OF DOORS WHERE INTERCHANGEABILITY IS REQUIRED. THESE CAP NUTS MAY ALSO BE USED WHERE THREAD ENDS OF BOLTS MUST BE COVERED TO PREVENT INJURY TO PERSONNEL, DAMAGE TO EQUIPMENT, OR TO IMPROVE APPEARANCE.

SEE IACH10EN (PAGE 80.62.6.51) FOR SELF-SEALING CAPPED PLATE NUTS.

SEE PREFACE FOR GENERAL USAGE NOTES.

CODE IDENT. NO. 81205

**BAC NIOEL**

**NUT, PLATE, SELF-LOCKING  
CAPPED, TWO LUG, FLOATING, 450°F**

**BAC NIOEL**

**BOEING STANDARD**

10