



# Lawrence Berkeley Laboratory

UNIVERSITY OF CALIFORNIA

## Engineering & Technical Services Division

RECEIVED  
LAWRENCE  
BERKELEY LABORATORY

DEC 4 1980

LIBRARY AND  
DOCUMENTS SECTION

**For Reference**

Not to be taken from this room



LBID-281 c.1

## **DISCLAIMER**

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

LAWRENCE BERKELEY LABORATORY - UNIVERSITY OF CALIFORNIA		CODE	SERIAL	PAGE
<b>ENGINEERING NOTE</b>		D32250	M5320	1 of 3
AUTHOR	DEPARTMENT	LOCATION	DATE	
R. DeWITT	MECHANICAL ENGINEERING - DIII	Berkeley	March 30, 1979	
PROGRAM - PROJECT - JOB				
DOUBLET III - NEUTRAL BEAM INJECTOR SYSTEM (NBIS)				
TITLE				
THREADING AL-4750 SHIELDING				

Threading bolts into soft materials can result in stripped threads. The Allegheny-Ludlum alloy AL-4750 is such a material. The ultimate yield strength is 61,000 lbs/in<sup>2</sup>.

However, the elastic limit is reached on magnetically annealed parts at 20,000 lbs/in<sup>2</sup>. The material arrived at LBL as .45 inch thick plate. After machining, it may be as thin as .40 inches thick. Will the material allow bolts to be torqued to standard specifications, or not?

Refer to pages 1168 and 1169 of the 20th Edition of "Machinery's Handbook". These equations use the data found on pages 1282, 1298 and 1299 of the same volume:

Page 1168-1169

$$n = 16 \text{ for } 3/8" = 16 \text{ UNC}$$

Page 1298

$$K_n = .3210$$

$$E_s = .3266$$

$$D_s = .3595$$

$$E_n = .3429$$

Page 1282

$$A_t = .0775$$

LAWRENCE BERKELEY LABORATORY - UNIVERSITY OF CALIFORNIA		CODE	SERIAL	PAGE
<b>ENGINEERING NOTE</b>		D32250	M5320	2 OF 3
AUTHOR	DEPARTMENT	LOCATION	DATE	
R. DeWITT	MECHANICAL ENGINEERING - DIII	Berkeley	March 30, 1979	

$$L_e = \frac{2/\pi \times A_t}{K_n (1/2 + (E_s - K_n) .57735)} = .3054$$

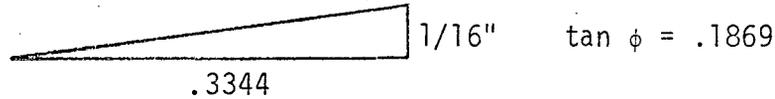
$$J = \frac{A_s}{A_n} \cdot \frac{T_e}{T_i} = \frac{K_n}{D_s} \times \frac{(1/2n + .57735 [E_s - K_n])}{[1/2n + .57735 (D_s - E_n)]} \cdot \frac{T_e}{T_i}$$

$$= (.7540) \frac{T_e}{T_i} = (.754) \frac{40,000}{20,000} = 1.508$$

Mild std. yield pt.  
4750 yield pt.

$$Q = L_e J = (.3054) (1.508) = .461" \text{ for zero S.F.}$$

$$P = SA_t = (20,000) (.0775) = 1,550 \text{ lbs.}$$



$$M = \text{ctn } \phi \cdot \frac{12}{.3344} = \text{ctn } \phi \frac{6}{.3344} = 96$$

$$T = \frac{1550}{96} = 16 \text{ ft-lbs for S.F.} = \phi$$

$$= 8 \text{ ft-lbs for S.F.} = 100\%$$

TOO SMALL! USE PERMANENT SEATING BACK-UP NUTS.

**ENGINEERING NOTE**

D32255

M5320

3 OF 3

AUTHOR

DEPARTMENT

LOCATION

DATE

R. DeWITT

MECHANICAL ENGINEERING - DIII

Berkeley

March 30, 1979

$n = 13$  for  $1/2'' - 13$  UNC bolt

Page 1282

$A_t = .1419$

Page 1299

$K_n = .434$

$D_s = .4876$

$E_s = .4435$

$E_n = .4564$

$D = .5000$

$E = .450$

$$L_e = K_n \frac{2/\pi \cdot A_t}{(1/2 + [E_s - K_n] \cdot .57735)}$$

$$A_s = \pi n L_e K_n \left[ \frac{1}{2n} + .57735 (E_s - K_n) \right]$$

$$A_n = \pi n L_e D_s \left[ \frac{1}{2n} + .57735 (D_s - E_n) \right]$$

$$A_t = \frac{\pi}{4} (D = \frac{.9743}{n})^2$$

$$J = \frac{A_s}{A_n} \left( \frac{T_h}{T_l} \right)$$

$$Q = J L_e$$

$$P = S A_t$$

$L_e = .4118$

$$J = (.7645) \left( \frac{40,000}{20,000} \right) = 1.53$$

$$Q = (.4118) (1.53) = .6297 \approx .63$$

$$P = (20,000) (.1419) = 2838$$

$$M = \left( \frac{E}{n} \right) \left( \frac{6}{E} \right) = 6.13 = 78$$

$$T = \frac{2838}{78} = 36 \text{ ft-lbs, S.F.} = 0$$

$$18 \text{ ft-lbs, S.F.} = 100\%$$

STILL RISKY, BETTER USE BACK-UP NUTS!!

This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

Reference to a company or product name does not imply approval or recommendation of the product by the University of California or the U.S. Department of Energy to the exclusion of others that may be suitable.

TECHNICAL INFORMATION DEPARTMENT  
LAWRENCE BERKELEY LABORATORY  
UNIVERSITY OF CALIFORNIA  
BERKELEY, CALIFORNIA 94720