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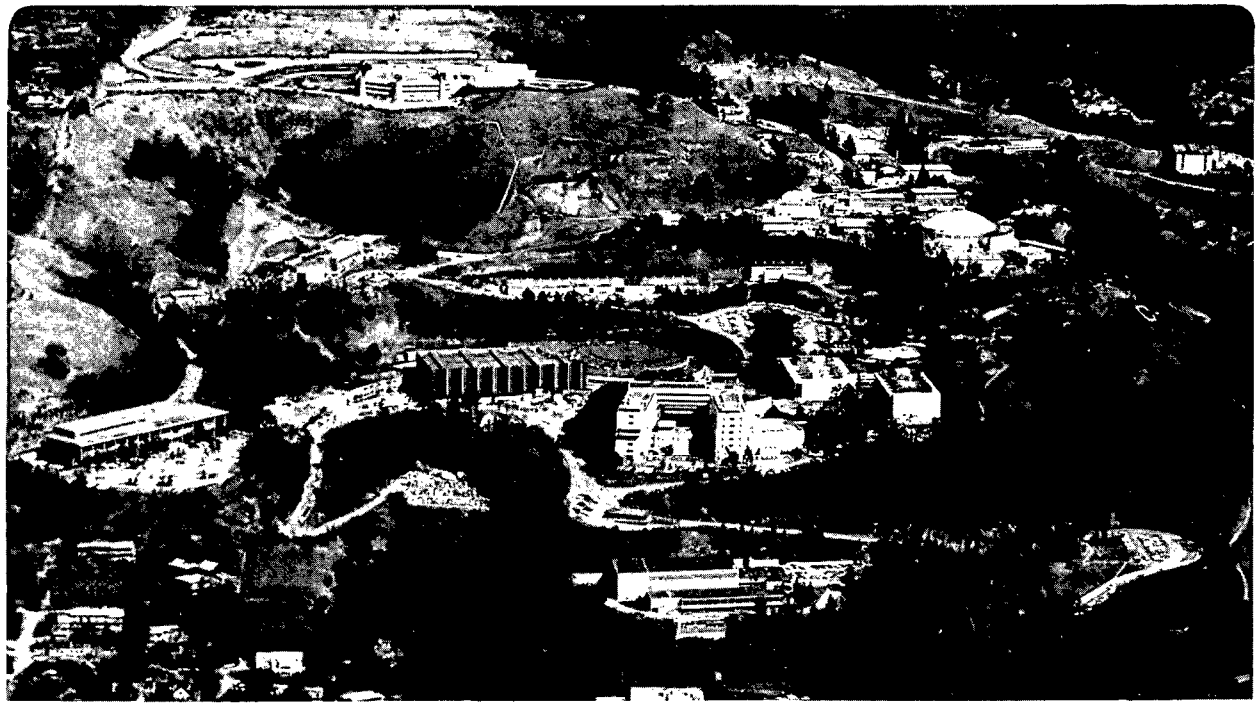

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ENGINEERING NOTE

CODE	SERIAL	PAGE
D32250	M5320	1 OF 3

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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^2.

However, the elastic limit is reached on magnetically annealed parts at 20,000 lbs/in^2. 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

$n = 16$ for 3/8" = 16 UNC

Page 1298

$K_n = .3210$

$E_s = .3266$

$D_s = .3595$

$E_n = .3429$

Page 1282

$A_t = .0775$

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

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

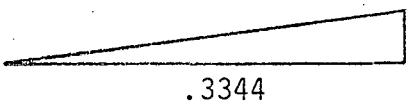
$$= (.7540)\,\frac{T_e}{T_i} = (.754)\,\frac{40{,}000}{20{,}000} = 1.508$$

Mild std. yield pt.

4750 yield pt.

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

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



$\tan \phi = .1869$

$$M = \text{ctn}\,\phi \cdot \frac{\frac{12}{.3344}}{2} = \text{ctn}\,\phi\,\frac{6}{.3344} = 96$$

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

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

TOO SMALL! USE PERMANENT SEATING BACK-UP NUTS.

n = 13 for 1/2" - 13 UNC bolt

Page 1282

$A_t = .1419$

Page 1299

$K_n = .434$

$D_s = .4876$

$E_s = .4435$

$E_n = .4564$

$D = .5000$

$E = .450$

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

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

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

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

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

$$Q = J\ L_e$$

$$P = S\ A_t$$

$L_e = .4118$

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

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

$P = (20{,}000)\ (.1419) = 2838$

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

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

18 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.

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