

Eric

## Technical Memorandum

**To:** Duane Miller  
Birns, Inc.

**Date:** 28 April 1992

**From:** Amir Dejbakhsh AD  
Wyle Laboratories

**Ref.** Wyle Job. No. 57772

**Subject:** Stress Analysis Results of Birns' Emergency Lighting Fixture Hardware

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Dynamic seismic spectra analysis and static dead weight analysis were performed to evaluate maximum plate stress and bolt loads and moments for the Birns' Emergency Lighting Fixture.

The fixtures are to be installed in various locations at the Yongwang Nuclear Power Plant Units 3 & 4. The fixture enclosure is built from .048" thick type 304 stainless steel with a minimum yield strength of 39,000 psi. The bolts are assumed to be 5/16" steel concrete expansion anchor bolts with a minimum yield strength of 60,000 psi. The subject fixture is described on Birns' Drawing Number 4701-1015C. The finite element method was used for this analysis. The fixture attachment was analyzed for the auxiliary turbine building (node 306), fuel building (node 2) and the containment building (node 30).

The following seismic spectra for the Yongwang Nuclear Power Plant were enveloped resulting in six worst case spectra; three (x, y, z) OBE and three (x,y,z) DBE; spectra nos. 306-EW-OBE, 602-EW-OBE, 230-EW-OBE, 306-NS-OBE, 602-NS-OBE, 230-NS-OBE, 306-VW-OBE, 230-V-OBE, 602-VW-OBE, 306-NS-SSE, 230-NS-SSE, 602-NS-SSE, 306-VW-SSE, 230-V-SSE, 602-VW-SSE, 306-EW-SSE, 230-EW-SSE, 602-EW-SSE.

The stress and loading analysis was performed under normal operating, upset and emergency conditions. The stress analysis results are presented below and the foundation load summary is attached (Attachment A).

Maximum plate stress at the bolt interface with the fixture = 12040 psi  
(SSE condition)

Maximum plate stress at the bolt interface with the fixture = 10610 psi  
(OBE condition)

$$\text{Worst case safety factor on yield} = \frac{39000 \text{ psi}}{12040 \text{ psi}} = 3.24$$

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$$\text{Max bolt tensile stress} = \frac{19.9}{.0522} = 381 \text{ psi}$$

- $\text{Max bolt shear stress} = \frac{17.6}{.0522} = 337 \text{ psi}$
- Bolt safety margins =  $\frac{60000}{381} = \text{Large}$  and  $\frac{60000}{337} = \text{Large}$

The loads and moments for the three support bolts are combined and presented on the foundation load summary sheet.

It is concluded that the areas of interest as mentioned above under the said load conditions are structurally adequate and have sufficient factors of safety.

Encl.: Attachment A, Foundation Load Summary

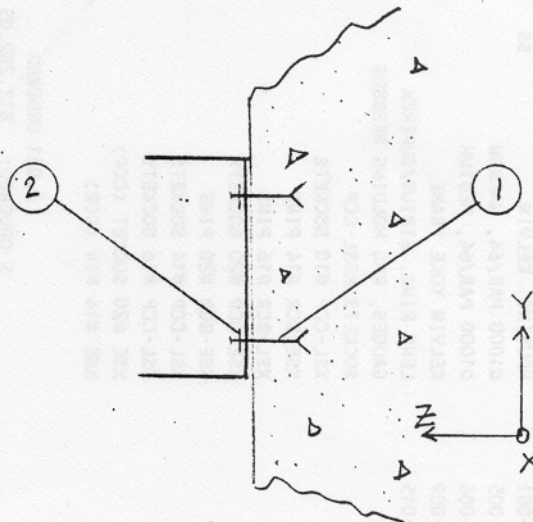
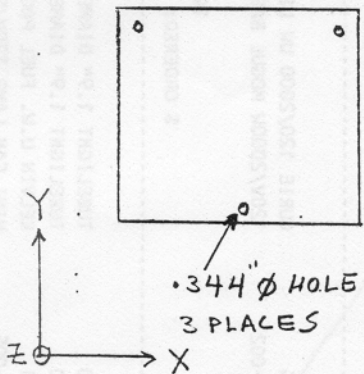
cc: H. P. Bausch, Wyle *HPS*  
B. Marriott, Wyle

FOUNDATION LOAD SUMMARY

Equip. Name <b>EMERGENCY LIGHTING FIXTURE</b>	<input type="checkbox"/> Category I Foundation
Location <b>AUX. BLDG (MAX. G AREA)</b>	<input type="checkbox"/> Non-Category I Foundation
Elevation <b>182'-0"</b>   Item No.	<input type="checkbox"/> Safety-Related Equipment
Drawing Number	<input type="checkbox"/> Non-Safety-Related Equipment

Foundation Loads *		Forces (KIPS)			Moments (FT-KIPS)			
		F <sub>x</sub>	F <sub>y</sub>	F <sub>z</sub>	M <sub>x</sub>	M <sub>y</sub>	M <sub>z</sub>	
Type of Loads								
Dead Weight Loads		0	-0.046	0	0.001	0	0	
Operating Loads		0	-0.046	0	0.001	0	0	
Nozzle Loads	Service Level B (Upset)	N/A						
	Service Level C (Emergency)							
	Normal (Note 1)							
Dynamic Loads	Service Level B (Upset) (Note 2)	-0.0095	-0.0065	-0.0355	-0.026	-0.0067	0	
	Level C (Emergency) (Note 3)	-0.0107	-0.0073	-0.04	-0.030	-0.0075	0	
	UBC (Note 1)	-	-	-	-	-	-	

Foundation Sketch



- ① 5/16" CONCRETE EXPANSION BOLT
- ② 5/16" STUD WASHER  
·328" ID, ·562" OD, ·063" THICK

\* NOTE: TOTAL LOADS & MOMENTS FOR ALL THREE BOLTS SHOWN.

Note 1. For Non-Category I Foundation Design and/or Non-Safety-Related Equipment Anchorage Design.  
 Note 2. SSE Plus Other Dynamic Loads (As Applicable).  
 Note 3. SSE Plus Other Dynamic Loads (As Applicable).