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NSIC

September 14, 1979
Fort St. Vrain
Unit 1
P-79209

Mr. Karl V. Seyfrit
Director, NRC
Region IV
611 Ryan Drive, Suite 1000
Arlington, TX 76011

Subject: I & E Bulletin 79-02,
Base Plate Design Using
Concrete Expansion Anchor
Bolts

Reference: P-79143

Dear Mr. Seyfrit:

The following letter is in response to additional information requested by Mr. Sutton of your staff concerning our response to IE Bulletin 79-02. The following questions from Mr. Sutton were submitted by telephone to PSC.

Question 1 How many of the base plates audited were considered flexible and how many rigid?

Answer: Based on the flexibility criteria set forth in IE Bulletin 79-02, and our sample size of 90 baseplates, 54 baseplates were considered flexible and 36 baseplates were considered rigid.

Question 2 Please supply information on the model used to analytically calculate the anchor bolt loads.

Answer: A typical model used to calculate the anchor bolt loads is outlined in Attachment 1.

Question 3 Please provide a description of the Audit Program PSC performed on the sample of Class I Base Plates.

Answer: DESCRIPTION OF TESTING PROGRAM

The Bolt Torque Testing Program was performed by two people using a calibrated torque wrench, tape measure, detailed hanger drawings, data sheets, and a socket wrench with various size sockets. The following data was obtained and recorded:

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- a. The number of hanger base plates required as per the hanger drawing & actual number field installed.
- b. The number of bolts in each base plate, required and actual number installed.
- c. The Torque of one bolt randomly selected in each base plate was determined.
- d. For the bolt in Item C, its required diameter from the hanger drawing and the actual diameter bolt installed was measured.
- e. For the bolt in Item C, the length of thread engaged in the concrete anchor was determined.
- f. For the bolt in Item C, determine if the top of the concrete anchor was below the bottom of the base plate and the concrete surface.
- g. Determine the center line distances between bolts on the base plate.
- h. Determine the minimum edge distance between the center of the bolt and the edge of the base plate.

Question 4 Were all base plate configurations considered in your 10% sample?

Answer: It is felt that all base plate configurations for pipe hangers were considered in our sample audit. This is based on a review of all drawings in which the hangers were attached to concrete.

Question 5 For the one bolt that didn't have a 4 to 1 factor of safety, what was done to bring it back into compliance?

Answer: No type of craft action work was performed against any of the hangers. PSC is currently under going an audit of its Class I Piping Systems and hangers, and an evaluation of those hangers which have discrepancies will be performed. At that time craft action work will be initiated against all hangers which require modifications to bring them into compliance. The bolt in question, which did not have the 4 to 1 factor of safety, will be properly modified at that time. The factor of safety on the existing bolt is 2.8 to 1.

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Question 6 How many bolts were not torqued to their proper value?

Answer: Approximately 29 bolts of the sample of 90 were not torqued to their proper value.

Question 7 What is the time schedule for the completion of the Bolt Torquing Program?

Answer: We intend to complete the bolt torquing on those systems required for reactor depressurization and cooling by November 15, 1979. The remainder of the Class I Systems shall be completed by February 24, 1980.

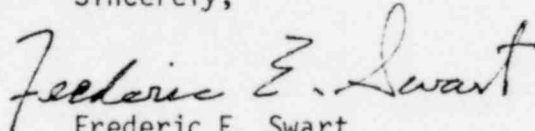
Question 8 Does Q.C. Documentation exist for the installation of the existing bolts?

Answer: We have Q.C. Documentation on the bolt sizes and spacing, however, no. Q.C. Documentation for the installation of the concrete anchors has been found.

Question 9 Describe the proposed Torque Program for the bolts.

Answer: The proposed torque program consists of properly torquing each bolt in each base plate of all Class I hangers anchored to concrete. A team of two people shall be given a copy of the hanger drawing or data sheet. They will locate the hanger in the field, and using a calibrated torque wrench, properly torque the bolts to the manufacture's recommended value in order to properly preload the bolt. The values to which the bolts are torqued, along with the date and names of the people performing the work shall be recorded for documentation purposes. It is PSC's intent upon completion of the bolt torquing program to reaudit and analyze a portion of the bolts to insure that the required factor of safety is achieved.

Sincerely,

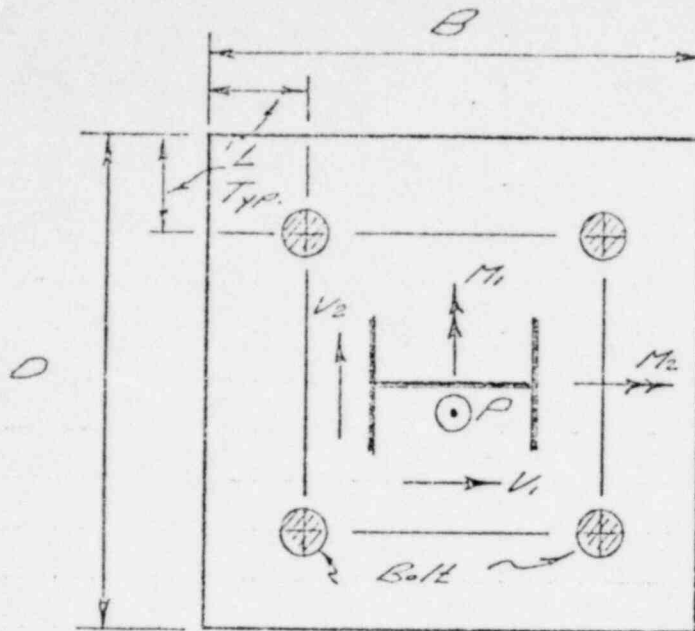


Frederic E. Swart
Nuclear Project Manager

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TYPICAL ANALYTICAL MODEL USED TO ANALYZE A FOUR HOLE
BASE PLATE FOR EXPANSION ANCHOR BOLT LOADS



BASIC EQUATIONS:

$$M_1 = 2T_1 \frac{2}{3}A$$

$$M_1 = \frac{4T_1(B-L)}{3}$$

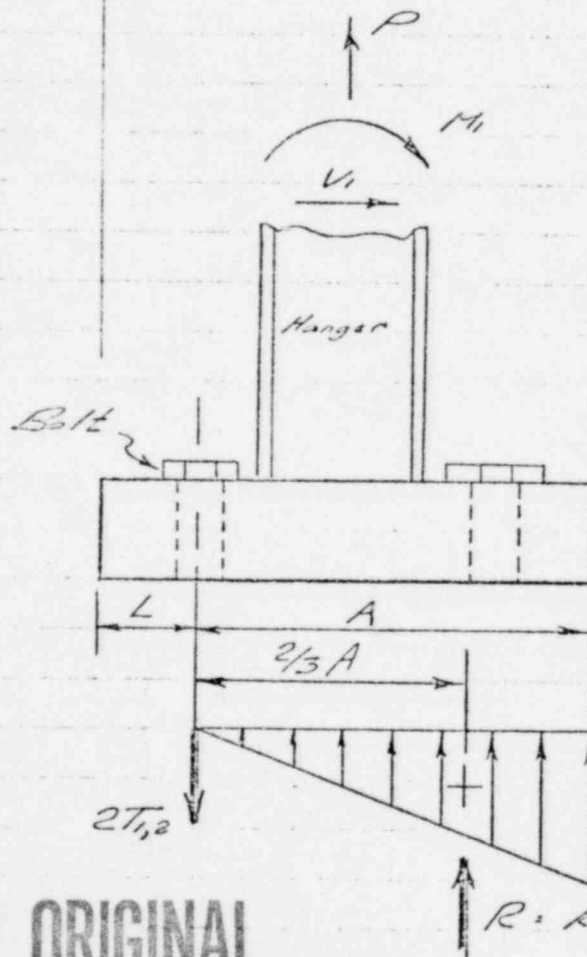
$$T_1 = \frac{3M_1}{4(B-L)} = \text{Tension/Bolt Due To } M_1$$

$$T_2 = \frac{3M_2}{4(D-L)} = \text{Tension/Bolt Due To } M_2$$

$$T_3 = \frac{P}{4} = \text{Tension/Bolt Due To } P$$

$$V = \frac{[V_1^2 + V_2^2]^{1/2}}{4} = \text{Shear/Bolt Due To } V_1 \text{ \& } V_2$$

BASE PLATE PLAN
 M_1, M_2 = Bending Moments
 V_1, V_2 = Base Shears
 P = Axial Force



USE INTERACTION FORMULA:

$$\frac{T_{actual}}{T_{allow}} + \frac{V_{actual}}{V_{allow}} \leq 1.0$$

where: $T_{actual} = T_1 + T_2 + T_3$

T_{allow} = Manufacturer's Re.

$V_{actual} = V$

V_{allow} = Manufacturer's Re.

* Note, Proper Factor of Safety
 Must Be Used with
 Manufacturer's Recommendation.

POOR ORIGINAL

BASE PLATE ELEVATION