Attachment 1

Consolidated Edison Company of New York

Indian Point Nuclear Generating Facility - Unit No. 2

Interim Report

Concrete Expansion Anchor Verification Program

July 1979

INTERIM REPORT

Concrete Expansion Anchor Verification Program

Introduction

U.S. Nuclear Regulatory Commission I.E. Bulletin 79-02 requires a review of the design and installation of Seismic Category I piping system supports utilizing concrete expansion anchors to verify that these systems will remain functional during and after a seismic event. The Consolidated Edison Company of New York (Con Ed) with the assistance of an Architect-Engineering Firm, Ebasco Services Incorporated, is presently performing a thorough review of our Indian Point Unit No. 2 nuclear generating facility aimed at satisfying the intent of the IE Bulletin. The unit is presently in a refueling outage and is scheduled to return to service on September 1979. The following discussions represent an interim report covering pertinent details of the ongoing verification program. Some early results of the verification work are discussed along with a schedule for completion of our program and submission of a Final Report to the NRC.

Program Description

Our program includes both design office review work and field inspection and testing.

In the design office the following sequence of activities has taken place:

a. Seismic Category I pipe lines and systems were identified using the FSAR, nuclear line lists and other pertinent information for the Unit. A list of the major seismic Category I systems is included on Table 1.

b. For each seismic Category I pipe line, the applicable pipe support detail drawings were reviewed to identify those supports using concrete expansion anchors. A breakdown by plant area showing anticipated numbers of support plates using expansion anchors found in this review is included on Table 2.

c. Individual expansion anchor pipe support plates were grouped considering plate dimensions, thickness and number of bolts, type of attaching member, and type and magnitude of applied load,

d. A computer analysis was performed for each group to establish bolt design loads considering base plate flexibility and edge distance. The TELEDYNE pre and post processor program for ANSYS were used for the analysis considering the highest loadings occurring within the group. In instances where the analysis showed bolt design loads in excess of the allowable load or plate bending stresses to be excessive, further runs were made using progressively lower loading occurring within the group to define a break point between acceptable and unacceptable supports therein. In general, only a few cases have been found where bolt design loads or support plate stresses have exceeded allowable values.

Presently, we estimate that 4700 concrete expansion anchors were used in seismic Category I pipe line supports. Of this number, roughly 87% are Phillips self-drilling anchors (Red Heads). The remainder are wedge anchors, sleeve anchors and the like. 3000, 4000 and 5000 psi (nominal 28 day strength) concrete were used in the construction of Indian Point Unit No. 2. The bolt allowable loads being used in our review work are the ultimate values recommended by the anchor vendors for 3000 psi concrete, with an adjustment for the age of the concrete, divided by a safety factor of four (4) or five (5) depending on the type of anchor. The ultimate values are being verified at the site by pulling test anchors installed in 3000 psi job concrete to failure.

In applying the TELEDYNE pre and post processor program, representative bolt and concrete spring constants are being used. Parametric studies indicate that for the magnitudes of loads being checked, variations in spring constant do not significantly affect bolt design loads. In general, we have found that 50% of the support plates falling under our review program have bolt design load under 500 pounds. While a few conditions have been identified, where bolt design load equals or exceed allowable load, the majority of the remaining 50% of the supports have bolt design loads in the range of 50% to 75% of allowable load.

Our field verification program is aimed at checking the installation of support plates and expansion anchors. Part of this field verification program includes a line tracing aimed at locating seismic Category I pipe supports using concrete expansion anchors which may not show up on our piping arrangement drawings or, locating any major deviations from the piping arrangement drawings.

Procedures for line tracing and for the actual field inspection and testing work are included as Appendixes 1 and 2.

The field inspection and testing work includes the aspects listed below. We are employing option A in Appendix A of Revision 1 of IE Bulletin 79-02 at present in our work.

a. Verify that correct bolt and correct plate sizes were used.
b. Verify that expansion anchors were properly installed to correct depths and properly set. Verify that adequate thread engagements exist. Verify that there is no excessive angularity to the anchor or its nut or bolt.
c. Tension test each anchor to its appropriate allowable load. Hold allowable load for minimum of 30 seconds after reaching load. Check for any movement of anchor during tension test.

Any visual inspection or tension test failure found will be corrected such that all installations will be correct installations and all seismic Category 1 supports will be capable of carrying the required loads. Data sheets used for the field inspection work and schematics of the hydraulic cylinder test set-ups used for actual tension testing of anchors are included as part of the field inspection procedure included in Appendix 1.

As of the week of June 25, we had experienced no tension test failures of concrete expansion anchors. Our present schedule calls for the completion of all supports in the containment as well as all supports on critical systems outside of the containment by the time this present outage is completed. The remainder of the work will be completed by October 1, 1979. By completion of the work, is meant completion of inspection and testing and completion of any necessary modifications or repairs stemming from our inspection program.

TABLE - 1

Seismic Category I Piping Systems

Expansion Anchors and support plates on Seismic Category I sections of the following piping systems are included in our verification program. At present, we are concentrating on lines 2-1/2 inches in diameter and larger along with any lines under 2-1/2 inches for which analyses are available. Final report will address the subject of field run lines under 2-1/2 inches.

a. Auxiliary Coolant System
b. Reactor Coolant System
c. Service Water System
d. Safety Injection System
e. Chemical & Volume Control System
f. Primary Make-Up Water System
g. Waste Disposal System
h. Residual Heat Removal System
i. Component Cooling Water System
j. Charging System
k. Main Steam
l. Boiler Feedwater
m. Auxiliary Feedwater System
n. Air Cooling System for Hot Penetrations
o. Diesel Generator Building Piping
p. Containment Spray System

TABLE - 2

Estimated Numbers of Seismic Category I Pipe Support Plates Using Concrete Expansion Anchors

	Estimated Number
Vapor Containment Building	700
Primary Auxiliary Building	475
Pipe Trenches	235
Auxiliary Feed Pump Building	135
Yard Areas	65
Diesel Generator Building	45
River Intake Structure	55
Nuclear Tank Farm	45
Miscellaneous Areas	50
TOTAL	1,815±

Project Identification

No. COED 2990-01

EBASCO SERVICES INCORPORATED

PROCEDURE NO. 01

INSPECTION AND TESTING OF EXISTING CONCRETE EXPANSION ANCHOR BOLTS

PURCHASER: _____

OWNER: CONSOLIDATED EDISON COMPANY

OPERATING COMPANY: _____

PROJECT: INDIAN POINT NUCLEAR GENERATING FACILITY - UNIT #2

UNIT NO.: 2 NOMINAL MW 873 MW(e)

LOCATION: BUCHANAN, NEW YORK

SELLER: _____

PROCEDURE STATUS	DATE	PREPARED BY	REVIEWED BY	PAGES AFFECTED
Original	6/11/79	K B Kim	J H Barnes JHB	ALL
R1	7/05/79	K B Kim	J H Barnes JHB	ALL
R2				
R3				
R4				

TABLE OF CONTENTS

RI

Ebasco Procedure 01
Inspection and Testing of
Existing Concrete Expansion
Anchor Bolts

1.0 SCOPE

The following procedure shall be used for the inspection and testing of existing concrete expansion anchor bolts used in Seismic Category I pipe support base plates in order to insure that they meet or exceed their required design strength.

.01 Expansion anchor bolts that shall be inspected and tested are the self-drilling shell type anchor and wedge type anchor.

.02 The inspection and testing shall cover expansion anchor bolts for pipe supports for lines 2 1/2 inch and larger and any smaller size line whose supports have been engineered and for which support design drawings exist.

2.0 EXPANSION ANCHOR BOLT DATA

.01 Ultimate load capacity and safe working loads for the various size and type expansion anchor bolts are shown in Table No. 1 and Table No. 2. The safe working loads are based on a factor of safety of four (4) for the wedge type anchors and a factor of safety of five (5) for the self-drilling shell type anchors.

.02 Dimensional characteristics of properly installed expansion anchor bolts are shown in Table No. 3 and Table No. 4.

3.0 INSPECTION PROCEDURE

.01 One (1) accessible expansion anchor bolt per support plate shall be inspected for proper installation using the following procedure. Bolt that is visually suspect shall be inspected first. If more than one type of expansion anchor is located on the same support plate, one (1) of each type shall be inspected. All measurements where called for shall be made using a metal or wood ruler graduated in sixteenths (1/16) of an inch. R1

a - Examine the structure configuration to determine if temporary piping supports are required. If required in the judgement of the Ebasco Inspection Team Leader, temporary supports shall be erected prior to inspection.

b - Determine the angularity of the bolt by measuring with feeler gage the maximum gap between the support plate and any point on the bolt head or nut.

c - For self-drilling anchors, verify that the conical plug is in-place by removing the bolt from the anchor sleeve and visually inspecting the sleeve.

d - Do not remove more than one bolt or nut at a time. No inspection shall be done on adjacent supports, on the same piping system, at the same time. Bolts which cannot be removed shall be noted on the appropriate data sheet.

3.0 INSPECTION PROCEDURE (Cont'd)

.01 (Cont'd)

e - Determine the diameter of the installed expansion bolt or stud. | R1

f - For self-drilling anchors, verify that the expansion anchor sleeve is fully expanded by determining the depth to the conical plug from the top of sleeve. Note if any excessive depth (or projection) exists from concrete surface to top of sleeve.

g - For self-drilling anchors, determine the bolt thread engagement by measuring the visible thread length when the bolt is engaged approximately one turn.

h - Wedge anchors shall be tested in accordance with Paragraph 4.01i prior to removing nut for further inspection. | R1

i - For wedge type anchors, determine the stud thread engagement by measuring the visible thread length above the nut and measuring the visible thread length from support plate or washer with the nut removed. | R1

j - For wedge type anchors, verify that the threaded end has not been shortened by cutting or burning. | R1

k - For wedge type anchors, determine the length of stud from the concrete surface (visible length plus support plate thickness plus distance between plate and face of concrete). Determine the minimum embedment in concrete based on the minimum overall length of the applicable size wedge anchor.

l - For supports without existing design calculation or sketches, determine the center-to-center distance (and concrete edge distance, if applicable) between adjacent expansion anchor bolts in all directions, if less than ten (10) bolt diameters.

m - Reinstall bolt and tighten snugly with wrench. Wedge anchors shall be torqued to the specified values with a calibrated manually operated torque wrench. (See Table No. 4.)

n - All required data shall be recorded on Data Sheet No. 1 or Data Sheet No. 2, as applicable, and signed by the Ebasco Inspection Team Leader and the Quality Control Inspector. All data shall be complete and clearly legible. Rough sketches of support plates shall be included in remarks columns of the Data Sheets showing bolt numbering in accordance with the provisions of Section 3.7 of Procedure 2990-02. Bolts visually inspected and tested shall be identified by their assigned number. | R1

.02 A self-drilling expansion anchor bolt shall be considered to be installed properly using the following acceptance criteria:

a - The expansion anchor bolt and associated sleeve is of the diameter (or larger) specified on the design drawing; the conical plug is in place; and the expansion anchor sleeve is fully expanded by measuring the depth from the top of the sleeve to the top of plug with a +1/8 inch tolerance. | R1

3.0 INSPECTION PROCEDURE (Cont'd)

.02 (Cont'd)

b - The bolt engagement meets the minimum criteria as determined by the shear strength of the threads. (See Table No. 3.)

c - The angularity of the bolt is acceptable provided the gap between the support plate and any point on the bolt head does not exceed 1/16 inch for 1/2 inch bolts or smaller and 1/8 inch for bolts greater than 1/2 inch. The bolt head (or washer) must be in contact with the support plate at one (1) location when tightened snugly.

d - The center-to-center distance between adjacent expansion anchor bolts and edge distance is greater than the minimum required for 100 percent design capacity. (See Table No. 3.)

e - The sleeve is not in contact with the back of base plate. R1

.03 A wedge type expansion anchor bolt shall be considered to be installed properly using the following acceptance criteria:

a - The expansion anchor bolt is of the diameter (or larger) specified on the design drawings or pipe support detail sheets. R1

b - The stud engagement meets the minimum criteria as determined by the shear strength of the threads. (See Table No. 4.)

c - The angularity of the bolt is acceptable provided the gap between the support plate and any point on the nut does not exceed 1/16 inch for 1/2 inch bolts or smaller and 1/8 inch for bolts greater than 1/2 inch. The nut (or washer) must be in contact with the support plate at one (1) location when tightened snugly.

d - The threaded end has not been shortened.

e - The anchor embedment in concrete is equal to or greater than the minimum required.

f - The center-to-center distance between adjacent expansion anchor bolts and edge distance is greater than the minimum required for 100 percent design capacity. (See Table No. 4.)

.04 If evidence indicated that an expansion anchor bolt was not installed properly, the following action shall be taken. In all cases, actual implementation of the repair work is by Consolidated Edison in accordance with Ebasco Services' written or drawn instructions. R1

a - If the diameter of the expansion anchor bolt and associated sleeve (if applicable) is less than that specified on the design drawing, an analysis shall be made to determine the adequacy of the "as-built" expansion anchor installation to carry the support loading with a minimum factor of safety of four (4) for wedge anchors or five (5) for shell type anchors. R1

3.0 INSPECTION PROCEDURE (Cont'd)

.04 (Cont'd)

b - For self-drilling anchors, if the conical plug is not in place (or a determination cannot be made) or the sleeve is not fully expanded, an analysis shall be made to determine the adequacy of the anchorage system with the discrepant bolt missing. In lieu of analysis, the sleeve strength may be verified by a tension test in accordance with Paragraph 4.01g. | R1

c - For self-drilling anchors, if the bolt thread engagement is found to be less than the minimum required, or the bolt is damaged, the bolt shall be replaced with one of sufficient length to insure that the minimum engagement required is provided in the sleeve when the bolt is snug against the support plate.

d - For wedge type anchors, if the stud engagement is found to be less than the minimum required, the anchor shall be replaced.

e - If the angularity of the bolt produces a gap between the support plate and any point on the bolt head or nut in excess of 1/16 inch for 1/2 inch bolts or smaller and 1/8 inch for bolts larger than 1/2 inch, the anchor shall be replaced or the anchor strength shall be verified by a tension test in accordance with Paragraph 4.01g. | R1

f - For wedge type anchors, if the threaded end has been shortened the anchor shall be replaced or the anchor strength shall be verified by a tension test in accordance with Paragraph 4.01g. | R1

g - For wedge type anchors, if the embedment in concrete is less than the minimum required, the anchor shall be replaced, or an analysis shall be made to determine the adequacy of the anchorage system with the discrepant bolt missing.

.05 If the inspected expansion anchor bolt does not meet the acceptance criteria of Paragraph 3.02 or 3.03, as applicable, all the remaining expansion anchors on the same support plate shall be inspected.

.06 All replaced expansion bolts shall be located a minimum of (10) diameters from the nearest bolt in tension or two (2) diameters from the existing anchor bolt and shall be of the wedge type with a minimum diameter of 1/2 inch. Installation shall be in strict accordance with manufacturer's instructions and shall be torqued to the manufacturer's specified values. (See Table No. 4.) | R1

.07 Inaccessible supports shall be noted on the applicable data sheet. Inaccessible supports include supports located so that one or more of the following conditions exist:

a - Location in a high radiation area.

b - Parallel sets of pipe lines obstruct access to the anchor bolts.

3.0 INSPECTION PROCEDURE (Cont'd)

.07 (Cont'd)

c - Clearance at the bolt is less than the height of hydraulic test jack.

4.0 TEST PROCEDURE

.01 On accessible supports, one (1) bolt per support plate shall be tension tested as follows:

a - Bolt to be tested (self-drilling or wedge type) shall be randomly selected by the Ebasco Inspection Team Leader and the Quality Control Inspector. Only one (1) bolt (or nut) per support plate shall be removed during testing. Temporary support shall be erected prior to testing, as required.

b - The tensioner shall be a hydraulic pulling device bearing on the support plate (see Detail A and Detail B). For the self-drilling anchors, it shall be assured that greater than 1/16 inch clearance exists between the back of the support plate and the sleeve prior to testing. If clearance greater than 1/16 inch between support plate and the sleeve cannot be confirmed, shims shall be placed between back of plate and concrete in an approved manner to provide at least 1/16 inch clearance from concrete support. Integrity of the support and plate must be ensured during shim placement and removal. Shims shall be placed so that they are clear of insert and provide equalized support for plate during testing. RI

c - For the self-drilling anchors, the threaded stud of the tensioner device shall be inserted into the expansion anchor sleeve to the maximum depth possible (minimum 1/2 inch).

d - For self-drilling and wedge anchors which pass the visual test (see Section 3.0), the applied tensile test load shall be equal the safe working load. For applicable safe working tensile test loads and pressures, see Table No. 5 or Table No. 6. Test load shall be held for a minimum of 30 seconds after reaching test pressure. RI

e - For the self-drilling anchors, the bolt location, bolt diameter, depth of sleeve behind the back of the support plate before and after testing, test rig number, test pressure and anchor disposition shall be recorded on Data Sheet No. 3 and signed by the Ebasco Inspection Team Leader and the Quality Control Inspector. Bolt tested shall be identified by its assigned number on the support as shown on a rough sketch in the Remarks Column of the Data Sheet. (See Procedure 2990-02, Sect. 3.7). RI

f - For the wedge anchors, the bolt location, bolt diameter, length of stud from the concrete surface (visible length plus support plate thickness plus distance between plate and face of concrete) before and after testing, test rig number, test pressure and anchor disposition shall be recorded on Data Sheet No. 4 and signed by the Ebasco Inspection Team Leader and the Quality Control Inspector. Bolt tested shall be identified by its assigned number on the support as shown on a rough sketch in the Remarks Column of the Data Sheet. (See Procedure 2990-02, Sect. 3.7). RI

4.0 TEST PROCEDURE (Cont'd)

.01 (Cont'd)

g - Where a self-drilling or wedge type anchor fails in one or more aspects of a complete visual test, and tension testing is selected to demonstrate the anchors capacity, the applied tensile load shall be equal to five times the calculated design load for a self-drilling anchor or four times the calculated design load for a wedge type anchor. Test load shall be held for a minimum of 30 seconds after reaching test pressure. All applicable provisions of Sections a through f above shall apply to this testing. The calculation of the appropriate test pressure (4 or 5 times the design load divided by the effective cylinder area of the hydraulic cylinder used) shall be shown in the Remarks Column of Data Sheet No. 3 or No. 4 as appropriate for the type of anchor involved. R1

h - Support plates resting on grout pads anchored by threaded rod with leveling nuts set in self-drilling anchors may be encountered. Where the threaded rod cannot be removed to complete a visual inspection without damage, a tension test shall be performed as follows. The leveling nut shall be backed-off or the plate shall be shimmed and uniformly supported to provide a minimum of 1/16 inch clearance between the bottom of the plate and the grout pad and/or leveling nut. A coupling shall be attached to the top of the threaded rod and a tension test performed in accordance with the requirements of Section 4.01g above. R1

i - In addition to visual inspection and tension testing, wedge type anchors shall be checked for preload by torque wrench. The torque required to initially remove the nut shall be determined and bolt preload established through torque-load curves provided by anchor vendors and verified in a load-torque test program. R1

.02 Expansion anchor bolts that are tension tested shall be considered acceptable if, at the tensile test load, no concrete failure occurs, the anchor sleeve or stud (wedge type) does not rupture, distort or deform, the anchor does not slip excessively or become loose, and the anchor does not pull out.

a - The term "slip excessively" shall mean that the anchor sleeve or stud has been displaced a distance greater than 1/16 inch.

.03 If the test expansion anchor bolt does not meet the acceptance criteria of Paragraph 4.02, all the remaining expansion anchor bolts in that support plate shall be tension tested.

.04 Wedge type anchors which have been tension tested and "slip excessively" shall be retorqued to the specified values with a calibrated, manually operated torque wrench and retested (after removing nut). Torque values shall be in accordance with Table No. 4.

.05 Self-drilling anchors and wedge anchors which have been tension tested and do not meet the acceptance criteria shall be replaced, torqued and accepted one bolt at a time for same support plate.

4.0 TEST PROCEDURE (Cont'd)

.06 All replaced expansion bolts shall be relocated a minimum of ten (10) anchor diameters away from the existing bolt location and shall be of the wedge type with a minimum diameter of 1/2 inch. Installation (by Con Ed) shall be in strict accordance with manufacturer's instructions and shall be torqued to the manufacturer's specified values. (See Table No. 4.) R1

.07 Supports which are inaccessible, as defined in Paragraph 3.07, and are within the scope of this specification shall be identified as inaccessible on the applicable data sheet.

5.0 DEVIATIONS/DISCREPANCIES

In the event that deviations/discrepancies are noted during the inspection and/or testing of the expansion anchor bolts, the Ebasco Site Engineer shall advise Consolidated Edison representative immediately.

6.0 DOCUMENTATION

All expansion anchor bolts which are inspected and tested shall be documented and their disposition noted (acceptable or unacceptable). Unacceptable anchor bolts shall be replaced by Consolidated Edison and reinspected by Ebasco for acceptability.

.01 Documentation shall be in the form of a final report issued to Consolidated Edison Company at the conclusion of the inspection/testing program.

.02 Pressure gages used with the hydraulic pulling devices shall be calibrated before and after all testing is completed and periodically at least once a week. Gage calibration traceable to the National Bureau of Standards shall be to (-)10 and (+)20 psi of the applied test pressure. R1

.03 Torque wrenches shall be calibrated before and after all testing is completed and periodically at least once a week. Calibration shall be to (±)5% of the applied test torque. R1

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PROCEDURE FOR INSPECTION AND TESTING OF EXISTING
CONCRETE EXPANSION ANCHOR BOLTS

TABLE NO. 1

PHILLIPS RED HEAD SELF-DRILLING SNAP OFF ANCHORS

LOAD CAPACITY OF ANCHORS (1)

CAT. NO.	BOLT SIZE (INCHES)	ULTIMATE LOAD CAPACITY* TENSION (LBS.)	ULTIMATE LOAD CAPACITY* SHEAR (LBS.)	SAFE WORKING LOAD** TENSION (LBS.)	SAFE WORKING LOAD** SHEAR (LBS.)
S-14	1/4	3,853	1,522	770	305
S-16	5/16	4,263	2,314	853	463
S-38	3/8	5,953	3,842	1,190	768
S-12	1/2	8,925	7,661	1,785	1,532
S-58	5/8	12,285	13,566	2,457	2,713
S-34	3/4	17,010	18,468	3,402	3,694
S-78	7/8	18,742	21,033	3,748	4,207

* Based on Phillips data contained in Catalog F-1000 reduced for 3000 PSI concrete and adjusted for age of concrete using Red Head Engineering Bulletin No. 102, Page 1 and 2, dated May 1, 1973: R1

Ultimate Anchor Capacity (Tension) in 3000 PSI Concrete = 0.875 x Ultimate Anchor Capacity (Tension) in 3500 PSI Concrete x 1.2 (Effect of Concrete Age).

Ultimate Anchor Capacity (Shear) in 3000 PSI Concrete = 0.95 x Ultimate Anchor Capacity (Shear) in 3500 PSI Concrete x 1.2 (Effect of Concrete Age).

**Based on a factor of safety of five (5).

(1) Note: Anchors will be tension tested to failure in job concrete during initial phase of the inspection program. If warranted, ultimate tension capacities and safe tension working loads may be adjusted after this site testing.

PROCEDURE FOR INSPECTION AND TESTING OF EXISTING
CONCRETE EXPANSION ANCHOR BOLTS

TABLE NO. 2

PHILLIPS WEDGE ANCHORS

LOAD CAPACITY OF ANCHORS(1)

ANCHOR BOLT SIZE (INCHES)	ULTIMATE LOAD CAPACITY* TENSION (LBS.)	ULTIMATE LOAD CAPACITY* SHEAR (LBS.)	SAFE WORKING LOAD** TENSION (LBS.)	SAFE WORKING LOAD** SHEAR (LBS.)
1/4	2,520	2,650	630	662
3/8	4,305	5,700	1,076	1,425
1/2	6,195	9,576	1,549	2,394
5/8	8,216	13,680	2,054	3,420
3/4	12,075	19,380	3,019	4,845
7/8	12,442	28,386	3,110	7,096
1	17,115	40,356	4,279	10,089
1¼	42,630	55,404	10,657	13,851

* Based on Phillips data contained in Catalog F-1000 reduced for 3000 PSI concrete and adjusted for age of concrete using Red Head Engineering Bulletin No. 102, Page 1 and 2, dated May 1, 1973: RI

Ultimate Anchor Capacity (Tension) in 3000 PSI Concrete = 0.875 x Ultimate Anchor Capacity (Tension) in 3500 PSI Concrete x 1.2 (Effect of Concrete Age).

Ultimate Anchor Capacity (Shear) in 3000 PSI Concrete = 0.95 x Ultimate Anchor Capacity (Shear) in 3500 PSI Concrete x 1.2 (Effect of Concrete Age).

**Based on a factor of safety of four (4).

(1) Note: Anchors will be tension tested to failure in job concrete during initial phase of the inspection program. If warranted, ultimate tension capacities and safe tension working loads may be adjusted after this site testing.

PROCEDURE FOR INSPECTION AND TESTING OF EXISTING
CONCRETE EXPANSION ANCHOR BOLTS

TABLE NO. 3

PHILLIPS RED HEAD SELF-DRILLING SNAP OFF ANCHORS

DIMENSIONAL CHARACTERISTICS OF PROPERLY INSTALLED ANCHORS

(1)	(2)	(3)	(4)	(5)	(6)		(7)	
Cat. No. (Bolt Size)	Depth of Sleeve In Concrete (Inches)	Plug Length (Inches)	Depth from Top of Sleeve to Top of Plug (Inches)	Min. Bolt Thread Engagement (Inches)	Min. C-To-C Spacing* (Inches) 100% Load Capacity	Min. C-To-C Spacing* (Inches) 80% Load Capacity	Min. Edge Distance* (Inches) 100% Load Capacity	Min. Edge Distance* (Inches) 50% Load Capacity
S-14 (1/4")	1-3/16	9/16	9/16	3/16	3	1-1/2	1-1/2	3/4
S-16 (5/16")	1-3/8	5/8	11/16	1/4	3-1/4	1-5/8	1-7/8	1
S-38 (3/8")	1-5/8	3/4	3/4	1/4	4	2	2-1/4	1-1/8
S-12 (1/2")	2-1/8	7/8	1-1/8	3/8	5	2-1/2	3	1-1/2
S-58 (5/8")	2-9/16	1-1/16	1-3/8	3/8	6	3	3-3/4	1-7/8
S-34 (3/4")	3-5/16	1-1/4	1-15/16	1/2	7	3-1/2	4-1/2	2-1/4
S-78 (7/8")	3-3/4	1-7/16	2-1/4	5/8	8	4	5-1/4	2-5/8

*Linear interpolation may be used for intermediate spacings and edge distances. Edge distance is distance from center of bolt to edge of concrete.

NOTE: Values in Columns 2,3, & 4 are rounded to nearest 1/16" where necessary. Values based upon Phillips Self-Drilling Anchor Data Sheet Dated 2/17/70.

PROCEDURE FOR INSPECTION AND TESTING OF EXISTING
CONCRETE EXPANSION ANCHOR BOLTS

TABLE NO. 4

PHILLIPS WEDGE ANCHORS

DIMENSIONAL CHARACTERISTICS OF PROPERLY INSTALLED ANCHORS

Anchor Bolt Drill Size (Inches)	Min. Embedment In Concrete (Inches)	Thread Length (Inches)	Min. Stud Thread Engagement (Inches)	Min. C-To-C Spacing* (Inches)		Min. Edge Distance* (Inches)		Installation Torque** (Ft-Lbs)
				100% Load Capacity	80% Load Capacity	100% Load Capacity	50% Load Capacity	
1/4	1-3/8	3/4	3/16	1-3/4	7/8	1-1/2	3/4	8
3/8	1-3/4	1-1/8	1/4	2-5/8	1-3/8	2-1/4	1-1/8	20-25
1/2	2-1/8	1-1/4	3/8	3-1/2	1-3/4	3	1-1/2	40-55
5/8	2-5/8	1-1/2	3/8	4-3/8	2-1/4	3-3/4	1-7/8	80-90
3/4	3-1/4	1-1/2	1/2	5-1/4	2-5/8	4-1/2	2-1/4	125-175
7/8	3-3/4	2-1/4	5/8	6-1/8	3	5-1/4	2-5/8	200-250
1	4-1/2	2-1/4	5/8	7	3-1/2	6	3	250-300
1-1/4	5-1/2	3-1/4	3/4	8-3/4	4-3/8	7-1/2	3-3/4	400-500

*Linear interpolation may be used for intermediate spacings and edge distances. Edge distance is distance from center of bolt to edge of concrete.

**Normally requires 3 - 5 turns.

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PROCEDURE FOR INSPECTION AND TESTING OF EXISTING
CONCRETE EXPANSION ANCHOR BOLTS

TABLE NO. 5

PHILLIPS RED HEAD SELF-DRILLING SNAP OFF ANCHORS

TENSION TEST LOADS AND CORRESPONDING PRESSURES

Cat. No. (Bolt Size)	Safe Working Load (LBS)	Tension Test Pressure* (PSI) (Rounded off to Nearest 25 PSI)	
		12 Ton Jack	20 Ton Jack
S-14 (1/4")	770	300	175
S-16 (5/16") R1	853	350	200
S-38 (3/8")	1,190	475	275
S-12 (1/2")	1,785	725	425
S-58 (5/8")	2,457	1,000	575
S-34 (3/4")	3,402	1,350	800
S-78 (7/8")	3,748	1,500	875

R1

*TENSION TEST PRESSURE = $\frac{\text{SAFE WORKING LOAD X 1.10}}{\text{TEST MACHINE CYLINDER AREA}}$ R1

TEST MACHINE DATA: ENERPAC 12 TON MODEL - JSM 121 HOLL-O-CYLINDER
CYLINDER AREA = 2.761 in^2
ENERPAC 20 TON MODEL - JSM 202 HOLL-O-CYLINDER
CYLINDER AREA = 4.725 in^2

PROCEDURE FOR INSPECTION AND TESTING OF EXISTING
CONCRETE EXPANSION ANCHOR BOLTS

TABLE NO. 6

PHILLIPS WEDGE ANCHORS

TENSION TEST LOADS AND CORRESPONDING PRESSURES

Anchor Bolt Size (Inches)	Safe Working Load (LBS)	Tension Test Pressure* (PSI) (Rounded off to Nearest 25 PSI)	
		12 Ton Jack	20 Ton Jack
1/4	630	250	150
3/8	1,076	425	250
1/2	1,549	625	350
5/8	2,054	825	475
3/4	3,019	1,200	700
7/8	3,110	1,240	725
1	4,279	1,700	1,000
1-1/4	10,657	4,250	2,475

R1

*TENSION TEST PRESSURE = $\frac{\text{SAFE WORKING LOAD X 1.10}}{\text{TEST MACHINE CYLINDER AREA}}$

R1

TEST MACHINE DATA: ENERPAC 12 TON MODEL - JSM 121 HOLL-O-CYLINDER
CYLINDER AREA = 2.761 in^2
ENERPAC 20 TON MODEL - JSM 202 HOLL-O-CYLINDER
CYLINDER AREA = 4.725 in^2

DATA SHEET NO. 1

INSPECTION REPORT - PHILLIPS RED HEAD SELF-DRILLING SNAP OFF ANCHORS

PIPING SYSTEM: _____

DATE OF INSPECTION: _____

*RECORD DATA IF DESIGN SKETCHES DO NOT EXIST AND/OR DISTANCE IS LESS THAN TEN (10) BOLT DIAMETERS.

SHEET _____ OF _____

EBASCO SITE ENGINEER REVIEW

_____ DATE _____

HGR/RESTRAINT MARK NO. AND EBASCO SKETCH NO.	BOLT DIAMETER (INCHES)	MAX. GAP BETWEEN BOLT HEAD AND PLATE (INCHES)	CONICAL PLUG IN PLACE (YES OR NO)	DEPTH FROM TOP FACE OF SUPPORT PLATE TO PLUG (D) (INCHES)	SUPPORT PLATE THICKNESS (T) (INCHES)	DEPTH FROM TOP FACE OF SUPPORT PLATE TO TOP OF SLEEVE (S) (INCHES)	CLEARANCE-BOT. OF PLATE TO TOP OF SLEEVE (S-T) (INCHES)	DEPTH FROM TOP OF SLEEVE TO PLUG (D-S) (INCHES)	BOLT THREAD ENGAGEMENT (INCHES)	C-TO-C DISTANCE BETWEEN ADJACENT BOLTS AND/OR CONCRETE EDGE DIST.* (SKETCH)	REINSTALL BOLT AND TIGHTEN SNUGLY	REMARKS (SKETCH, ETC.)	SIGNATURE	
													EBASCO ENGINEER	Q/C INSPECTOR

DATA SHEET NO. 2

INSPECTION REPORT - PHILLIPS WEDGE ANCHORS

PIPING SYSTEM: _____

DATE OF INSPECTION: _____

*RECORD DATA IF DESIGN SKETCHES DO NOT EXIST AND/OR DISTANCE IS LESS THAN TEN (10) BOLT DIAMETERS.

SHEET _____ OF _____

EBASCO SITE ENGINEER REVIEW

_____ DATE _____

HGR/RESTRAINT MARK NO. AND EBASCO SKETCH NO.	STUD DIAMETER (INCHES)	MAX. GAP BETWEEN NUT AND PLATE (INCHES)	THREADED END SHORTENED (YES OR NO)	STUD THREAD ENGAGEMENT (INCHES)	LENGTH OF STUD FROM CONCRETE SURFACE (INCHES)	C-TO-C DISTANCE BETWEEN ADJACENT BOLTS AND/OR CONCRETE EDGE DIST.* (SKETCH)	REINSTALL NUT AND TORQUE (FT-LBS)	REMARKS (SKETCH, ETC.)	SIGNATURE	
									EBASCO ENGINEER	Q/C INSPECTOR

DATA SHEET NO. 3

TENSION TEST REPORT - PHILLIPS RED HEAD SELF-DRILLING SNAP OFF ANCHORS

PIPING SYSTEM: _____

HANGER/RESTRAINT
MARK NO. AND EBASCO SKETCH NO.: _____

DATE OF TEST: _____

EBASCO SITE ENGINEER REVIEW

_____ DATE _____

A = ACCEPTABLE

R = REJECT

BOLT TESTED (SKETCH)	BOLT DIA. (INCHES)	TEST RIG NUMBER	TEST PRESS (PSI)	DEPTH OF SLV. BEHIND SUPPORT PLATE BEFORE TEST (INCHES)	DEPTH OF SLV. BEHIND SUPPORT PLATE AFTER TEST (INCHES)	ANCHOR DISPOSITION (A OR R)	REMARKS	SIGNATURE	
								EBASCO ENG.	Q/C INSPECTOR

DATA SHEET NO. 4

TENSION TEST REPORT - PHILLIPS WEDGE ANCHORS

PIPING SYSTEM: _____

HANGER/RESTRAINT
MARK NO. AND EBASCO SKETCH NO.: _____

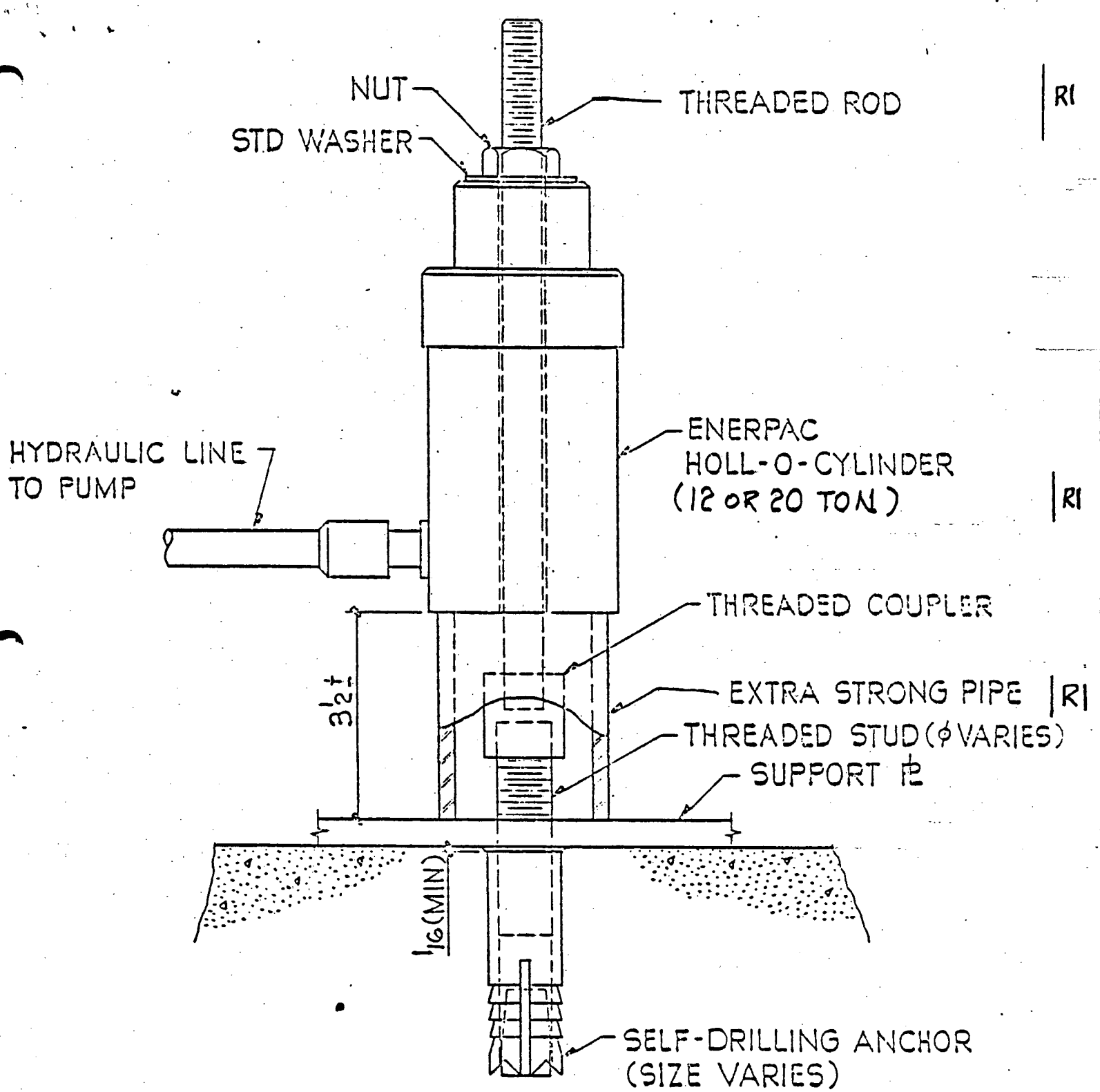
DATE OF TEST: _____

EBASCO SITE ENGINEER REVIEW
_____ DATE _____

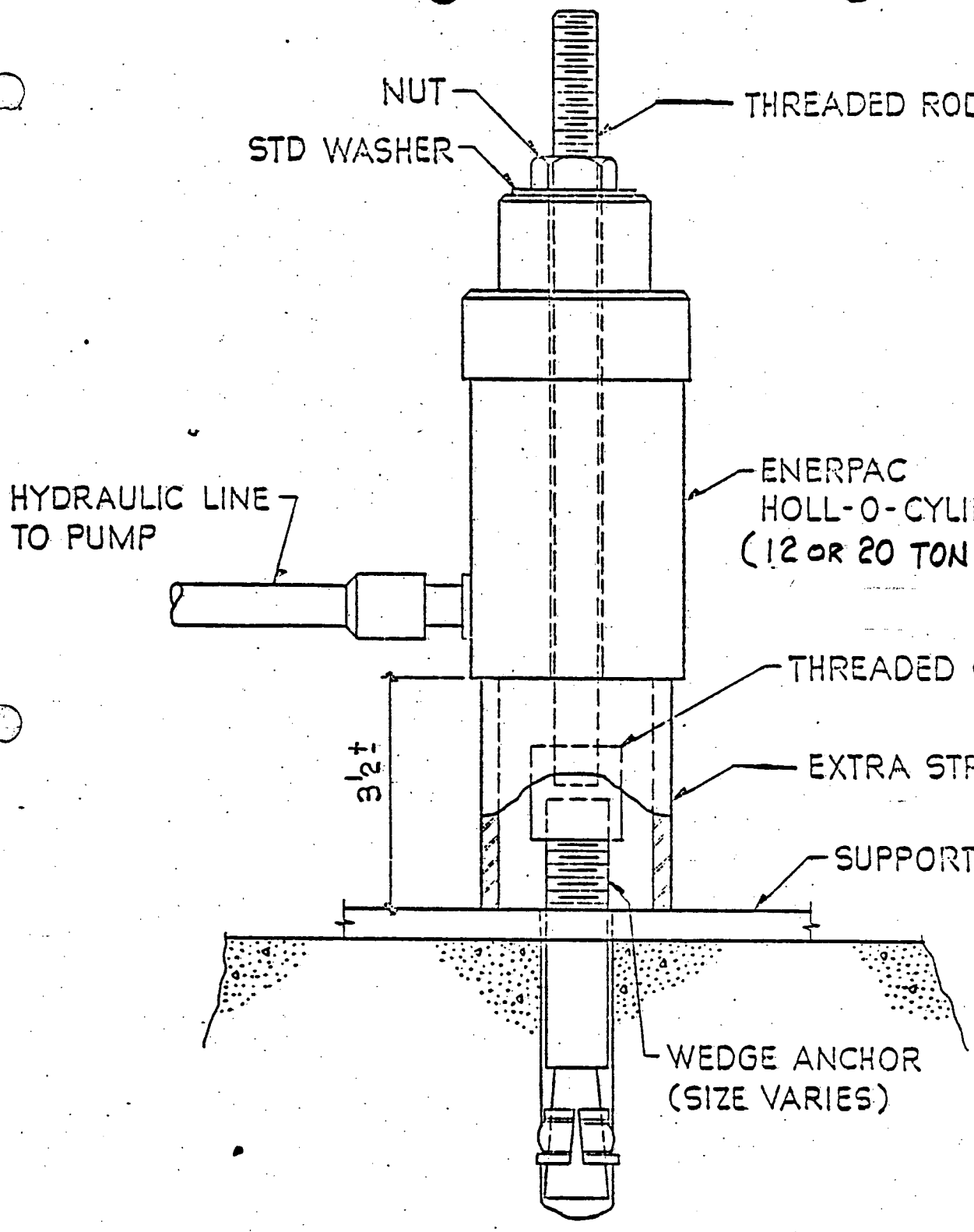
A = ACCEPTABLE

R = REJECT

BOLT TESTED (SKETCH)	STUD DIA. (INCHES)	TEST RIG NUMBER	TEST PRESS (PSI)	LG. OF STUD FROM CONC. FACE BEFORE TEST (INCHES)	LG. OF STUD FROM CONC. FACE AFTER TEST (INCHES)	ANCHOR DISPOSITION (A OR R)	REMARKS	SIGNATURE	
								EBASCO ENGINEER	Q/C INSPECTOR



DETAIL A
TENSION TEST UNIT ASSEMBLY
FOR
SELF-DRILLING TYPE ANCHOR
NTS



DETAIL B
TENSION TEST UNIT ASSEMBLY
FOR
WEDGE TYPE ANCHOR
NTS

Project Identification

No. COED 2990-02

EBASCO SERVICES INCORPORATED

PROCEDURE NO. 02

FIELD TRACING AND MARKING OF SEISMIC CATEGORY I PIPE LINES

PURCHASER: _____

OWNER: CONSOLIDATED EDISON COMPANY

OPERATING COMPANY: _____

PROJECT: INDIAN POINT NUCLEAR GENERATING FACILITY - UNIT #2

UNIT NO.: 2 NOMINAL MW 873 MW(e)

LOCATION: BUCHANAN, NEW YORK

SELLER: _____

PROCEDURE STATUS	DATE	PREPARED BY	REVIEWED BY	PAGES AFFECTED
Original	6/11/79	K B Kim	J H Barnes JHB	ALL
R1	7/05/79	K B Kim	J H Barnes JHB	ALL
R2				
R3				
R4				

Ebasco Procedure 02
Field Tracing and Marking
of Seismic Category-I Pipe Lines

1. SCOPE

This procedure covers the requirements for tracing and marking Seismic Category I pipe support plates anchored to the concrete by expansion bolts at Indian Point Unit No. 2. The work is to be performed in advance of the inspection and testing work to be performed under Ebasco Procedure 01, Inspection and Testing of Existing Concrete Expansion Anchor Base Plates.

2. LINES TO BE TRACED

.1 All Seismic Category-I lines 2½ inches and larger as well as any other lines requested by Con Ed are to be traced and marked as required herein.

.2 A master set of piping arrangement drawings marked in color to show the pipe systems within the scope of the work will be kept in the Ebasco site office. Team leader will mark-up separate piping arrangement drawings from the master set for the actual field tracing activity. R1

3. PROCEDURES

.1 Lines shall be traced in accordance with a priority list established by Con Ed and/or in accordance with the schedule established by the Site Engineer.

.2 Suitable duct tape enscribed with felt tip marking ~~pens shall be used to mark~~ pipe lines and supports. Marking directly on walls is to be avoided. R1

.3 Pipe lines shall be intermittently marked (on the pipe or insulation covering) to show system and line numbers and where possible, flow directions.

.4 Pipe supports shall be marked to show the designation number appearing on the piping arrangement drawings.

.5 In the event that unknown supports are encountered which do not appear on the piping arrangement drawings, an identifying mark will be assigned consisting of line number, size, tracer's initials and a sequential number. Example: 22-3-CM-05 means line 22, three inches in diameter, traced by a person with the initials CM and the fifth unknown support found by him. This mark shall be used on all documentation pertaining to the support until it can be subsequently identified and given a Bergen-Paterson Number if possible. To aid in identifying the support, the tracer shall record in sketch form its location and details of the support including plate sizes and thickness, number and size of expansion anchors used and their location on the plate, attached members and any other pertinent data. The new mark number will be recorded on the piping arrangement drawings.

.6 Marking shall generally begin at points where the lines can be clearly identified such as at penetrations or at equipment connections.

.7 All bolts to be tested shall be numbered. The top bolt in each plate will be number one (1) and the bottom bolt, number two (2). For multi-bolt plates, the numbering shall begin from the upper right corner (number 1) and follow clockwise direction.