

Mailing Address  
Alabama Power Company  
600 North 18th Street  
Post Office Box 2641  
Birmingham, Alabama 35291  
Telephone 205 783-6090

R. P. McDonald  
Senior Vice President  
Flintridge Building

July 10, 1985



Docket Nos. 50-348  
50-364

Director, Nuclear Reactor Regulation  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Attention: Mr. S. A. Varga

Joseph M. Farley Nuclear Plant - Units 1 and 2  
Containment Tendon Anchorhead Failure Reports - Unit 2

Gentlemen:

During meetings held on February 7 and March 1, 1985 to discuss tendon anchorhead failures at the Joseph M. Farley Nuclear Plant - Unit 2, Alabama Power Company provided the NRC with its preliminary findings and with a commitment to update these findings after Inryco investigation reports were available. Attachment 1 provides the results of the Inryco investigation which concludes that the tendon anchorheads failed as a result of hydrogen stress cracking caused by moisture in the environment of the tendon anchorheads. Enclosed with Attachment 1 is the Inland Steel Metallurgical Laboratory Report, the Battelle Report and a summary of the load tests and magnetic particle test results as well as the results of the Suburban Laboratories grease sample analyses. Attachment 2 provides a list of minor corrections to the two reports enclosed as part of Attachment 1.

The tendon anchorage inspection and replacement programs have been completed for Units 1 and 2. Laboratory analysis of additional anchors is in progress. Details of the inspection and replacement program and results of additional anchorage analyses will be provided in a supplemental LER.

If there are any questions, please advise.

Yours truly,

*W. B. Harston*  
R. P. McDonald

8507170400 850710  
PDR ADOCK 05000348  
S PDR

RPM/JAR:bdv-D28

Attachments

cc: Mr. L. B. Long  
Dr. J. N. Grace  
Mr. E. A. Reeves  
Mr. W. H. Bradford

*Just per fm*  
*2222*  
*1/12 See attached*

INRYCO, Inc.  
Concrete Systems Division  
7200 S. Narragansett Avenue  
Bedford Park  
Chicago, Illinois 60638-6067

312 585 7300 Chicago  
312 594 7300 Suburban

TLX-72-1497 BDPK  
FAX: Ext. 202



**Inryco**

JUN 1985  
RECEIVED  
NEIS

June 3, 1985

Alabama Power Co.  
P.O. Box 2641  
Birmingham, AL 35291

Attention: Mr. W. G. Hairston III

✓	WGH		DMV
	JEG		COL
	DEM		
	MDR		JWM
	WCC		HOT
			RPM
DOC. CONTROL:			


SUBJECT:

Joseph M. Farley Nuclear Plant - Unit 2  
Failure Investigation

Dear Mr. Hairston:

The reports of the anchorhead failures contain minor errors.  
They are hereby corrected with the enclosed addenda.

Very truly yours,

  
Jack Heise  
Manager, Contract Management

JWH:lgw

Enc.

W. G. Hairston  
Alabama Power Co.  
June 3, 1985

ADDENDUM 1 TO METALLURGICAL LABORATORY INVESTIGATION NO. 19975 - FINAL REPORT

INRYCO POST TENSIONING DIVISION  
JOSEPH M. FARLEY NUCLEAR PLANT, UNIT 2  
ANCHORHEAD INVESTIGATION

Page 1, Line 3 - Correct "Dolton" to read "Dothan".

Page 2, Item 2, line 3 - Correct "nacent" to read "nascent".

Page 1, Introduction, line 1 - Correct "Dolton" to read "Dothan".

Page 1, Investigation No. 19975, line 11 - Correct "three anchorages" to read "two anchorages".

Page 2, Investigation No. 19975, lines 13 and 14 - Correct "...January 25, 1985. During a 30 day refueling shutdown...." to read "...January 27, 1985. During a refueling shutdown...".

Page 16, Investigation No. 19975, line 26 and 27 - Revise to read "In addition a water sample obtained from the cover on V-21 was sent to Suburban Laboratory for analysis. The test result was subsequently sent in an Inryco transmittal dated 4-16-85."

Page 17, Investigation No. 19975, line 19 - Correct "nacent" to read "nascent".

W. G. Hairston  
Alabama Power Co.  
June 3, 1985

ADDENDUM 1 TO BATTELLE FINAL REPORT DATED APRIL 9, 1985 ON

INVESTIGATION OF FAILED FIELD ANCHOR HEADS  
HVO16 AND HVO38 FROM THE J. M. FARLEY  
NUCLEAR POWER PLANT, UNIT 2 CONTAINMENT

Page 21, last line, last word - Delete "tt".

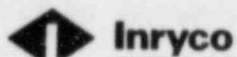
Page 27, second to last line - Correct "failed" to read "failure".

Page 32, line 19 - Correct "A3222" to read "A322".

INRYCO, Inc.  
Concrete Systems Division  
7200 S. Narragansett Avenue  
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Chicago, Illinois 60638-6087

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312 594 7300 Suburban

TLX-72-1497 BDPK  
FAX: Ext. 202



**Inryco**

April 16, 1985

Alabama Power Company  
P.O. Box 2641  
Birmingham, Alabama 35219

Attention: Mr. W. G. Hairston III

SUBJECT: Joseph M. Farley Nuclear Power Plant  
Containment Building 2  
Failure Investigation of Post Tensioned  
Field Anchorheads HV016 and HV038

Dear Mr. Hairston:

We are enclosing reports entitled "Joseph M. Farley Nuclear Plant, Unit No. 2, Anchorhead Investigation: Metallurgical Laboratory Investigation No. 19975 - Final Report" dated March 27, 1985, from Inland Steel Co. and Final Report dated April 9, 1985 from Battelle Columbus Laboratories. Inryco generated these reports as part of the subject failure investigation at your request: Your P.O. #40578 Dated 1/29/85, as Amended.

These investigations concluded that the anchorheads failed as a result of hydrogen stress cracking caused by the moisture in the environment of the anchorhead. Intergranular Separation (IGS) was found on the fracture faces supporting the embrittlement conclusion. The labs also found evidence of water, both in the grease can that surrounds the anchorage, as well as grease on the anchorhead of HV038.

As stated in meetings with the NRC, the source of water might be from rain, water present during installation or from ground water. The environment of the anchorhead must be free of water to preclude further anchorhead problems.

Mr. W. G. Hairston III  
Alabama Power Co.  
Page Two  
April 16, 1985

The presence of water in contact with high strength steel (the anchorhead), stressed to a high value, and also in contact with Zinc constituted a galvanic corrosion cell. The corrosion reaction released nascent hydrogen at the steel surface and oxidized the zinc. The hydrogen thus released entered the atomic lattice of the steel and caused cracking of the highly stressed steel. The cracks continued to grow as long as the galvanic action continued to produce nascent hydrogen, until it reached critical dimensions, at which point complete failure of the remainder of the anchorhead occurred. These final crack paths were transgranular (cleavage) and even ductile.

The origin of the cracks was typically in the perforated region, on the shim surface; in the center of the anchorhead. Once they were initiated the cracks propagated radially from ligament to ligament, as well as upward in the direction of the anchorhead depth. Final failure occurred when the crack entered the unperforated portion of the anchorhead and propagated radially outward and upward through the last piece of resistance.

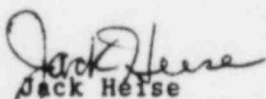
There are several other failure mechanisms that result in intergranular cracking. They were ruled out on the basis of our testing as outlined in the reports. Temper-Embrittlement was an early candidate that we subsequently eliminated based on the fact that the unfractured portions of the steel had high strength and ductility characteristics. This was also coupled with the fact that temper-embrittlement is not time - dependent. Certain anchors were re-tempered and showed no significant differences in properties from the other anchorheads. In general, the anchorhead steel unaffected by Hydrogen had good to excellent tensile properties, and would not have failed in a neutral environment.



Mr. W. G. Hairston III  
Alabama Power Co.  
Page Three  
April 15, 1985

Inland Steel Co., Operating Technology Department and Battelle Columbus Laboratories performed all metallurgical evaluation. Inland Steel also performed the grease analyses. Additional grease analyses were done at Suburban Laboratories, Hinsdale, Illinois. The structural laboratory at the University of Illinois, Champaign-Urbana, performed the load test. Magnetic Particle tests were conducted at our own facilities. Copies of these have been previously submitted and are submitted for completeness.

Very truly yours,

  
Jack Heise

Manager, Contract Management

JH:lgw

Enclosures

cc: Mr. D. Mansfield, Alabama Power Co.  
Mr. R. Lawler  
Mr. H. Hendrickson  
Mr. D. Waitkus  
Mr. H. Presswalla

FARLEY NUCLEAR POWER PLANT - 41T-2400  
ANCHORHEAD TESTING SUMMARY FORM FNP-ATP-8

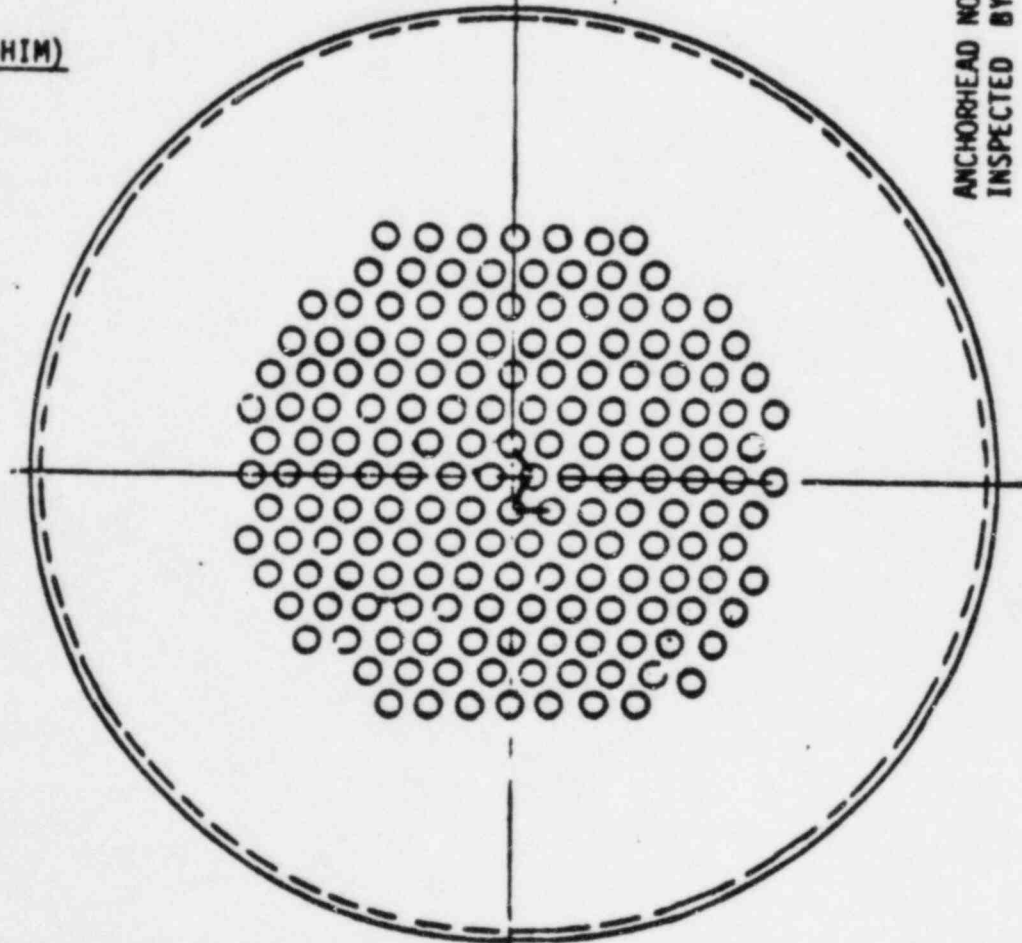
ANCHOR HEAD I.D.	No. OF CRACKS (MPT)				LOAD TEST		COMPOSITION 4140/42 ?	MECHANICAL TESTING (transverse)						METALLOGRAPHY		FRACTOGRAPHY (REMARKS)
	TOP		BOT		PULT MODE	TS (ksi)		YS (ksi)		RA (%)		GRAIN SIZE	INCLUSION RATING			
	PRE	POST	PRE	POST		Low		High	Low	High	Low			High		
HV016 <sup>1</sup>	--	--	--	--	--	flex failure	YES	199	201	164	168	13.9	18.6	8 or finer	A3-4H B2H temp M	IGS and Cleavage
HV038 <sup>1</sup>	--	--	--	--	--	flex failure	YES	193	202	161	161	11.1	13.4		A3-4H temp M	
HV039	0	0	3	12	137	flex crack	YES	200	207	170	184	15.9	15.9		A3-4H B2H temp M	IGS on pre cracks only
HV028	0	0	0	0	140	none	YES	192	203	159	173	10.7	14.5		A3-4H B3H temp M	No IGS
HV027 <sup>2</sup>	0	0	0	13	115	flex crack	YES	183	191	157	168	5.5	14.1		A3-4H B2H temp M	No IGS
HV049 <sup>2</sup>	0	0	0	11	120	flex crack	YES	188	196	156	175	9.3	17.4		A3-4H B2H temp M	No IGS

NOTE: 1) Field Failure of Anchorhead  
2) Retempered @ 850°F. for 4 hrs. before load test



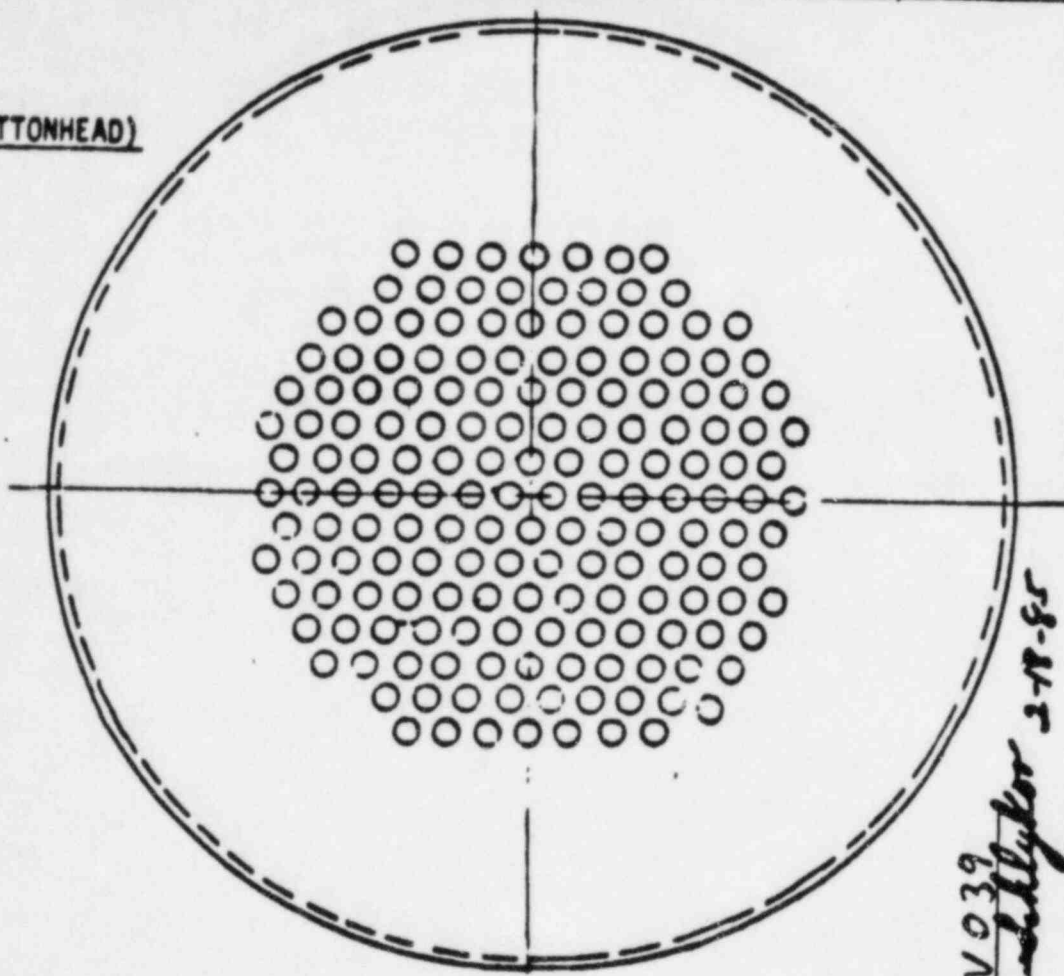
Pre-Load Test MPT.  
Head from London V-64

BOTTOM (SHIM)  
FACE



3 - CRACKS

TOP (BUTTONHEAD)  
FACE



ANCHORHEAD NO. HV 039  
INSPECTED BY *W. J. Hylker* 2-18-85

NO INCRUSTATION

MAGNETIC PARTICLE TEST RESULTS

This drawing has not been published. It is the sole property of BERTCO, Inc. It is loaned to the recipient for his confidential use only, and upon the conditions and agreements following. In consideration of the loan of this drawing, the recipient promises and agrees to return it upon request, and that it shall not be reproduced, copied, loaned or otherwise disposed of directly or indirectly without BERTCO, Inc. written consent, nor be used in any way detrimental to the interests of BERTCO, Inc.

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an Inland Steel company

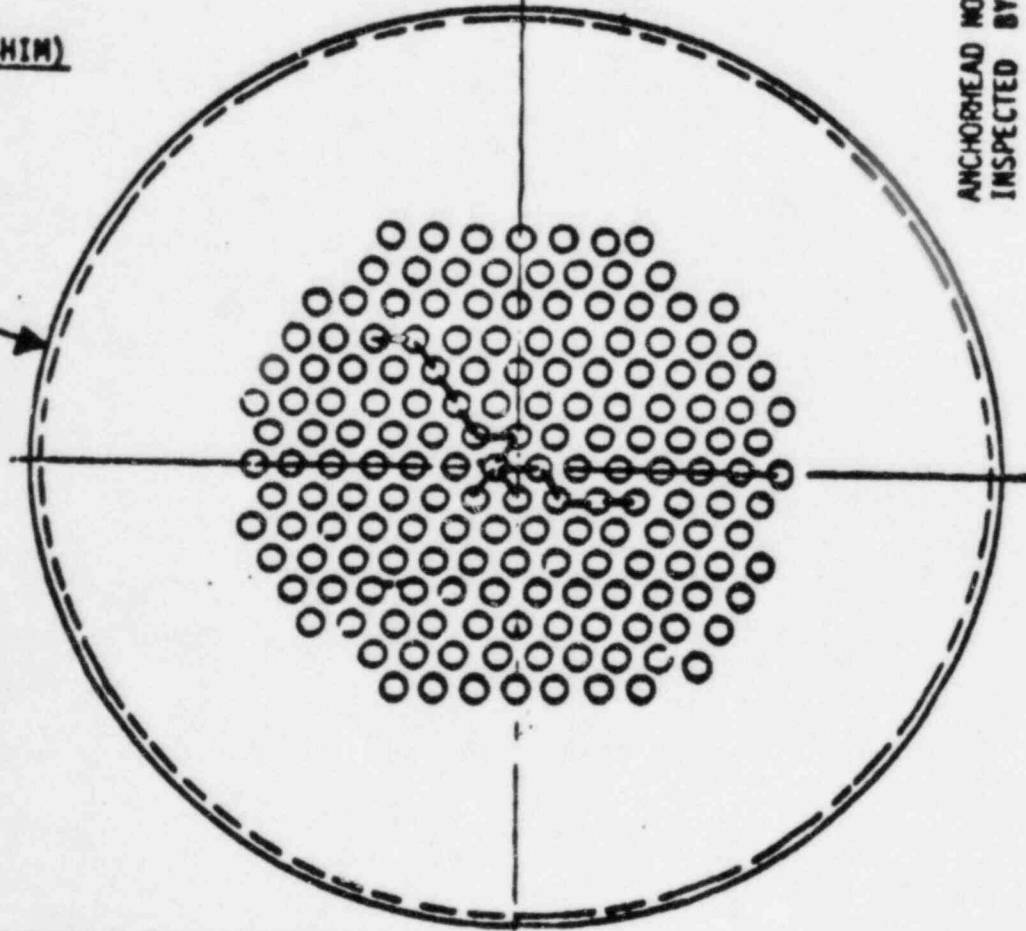
Concrete Systems Division

Reviewed By	Checked By	Date
<i>W. J. Hylker</i>	<i>W. J. Hylker</i>	14 FEB 1985
<i>W. J. Hylker</i>	<i>W. J. Hylker</i>	14 FEB 1985

Part - Ford T-25 MPT  
Used from Tendon V-64

BOTTOM (SHIM)  
FACE

SHIM  
MARK

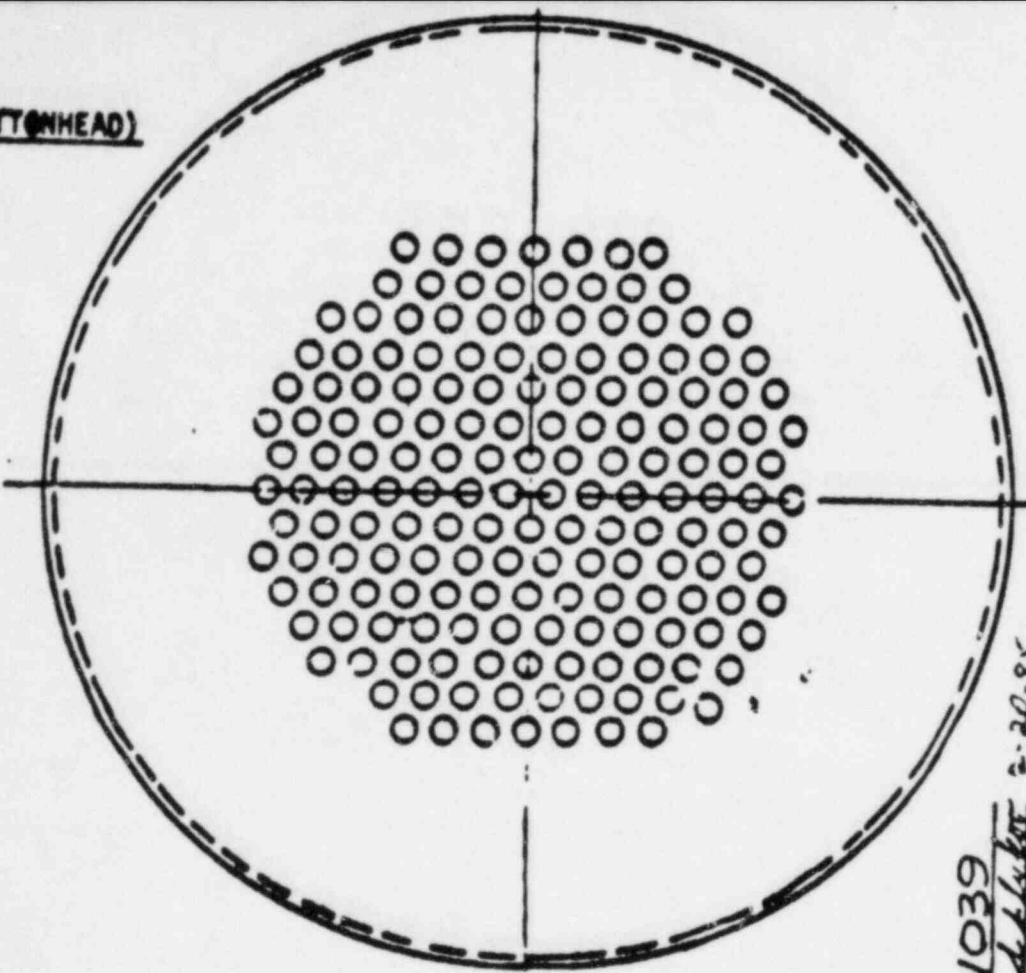


12 - CRACKS

ANCHORHEAD NO. HVO39  
INSPECTED BY W. A. Lyke 2-20-85

NO INDICATION

TOP (BUTTONHEAD)  
FACE



# MAGNETIC PARTICLE TEST RESULTS

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an Inland Steel company

Concrete Systems Division

Inspected by

Date

W. A. Lyke

Date

14 FEB 1985

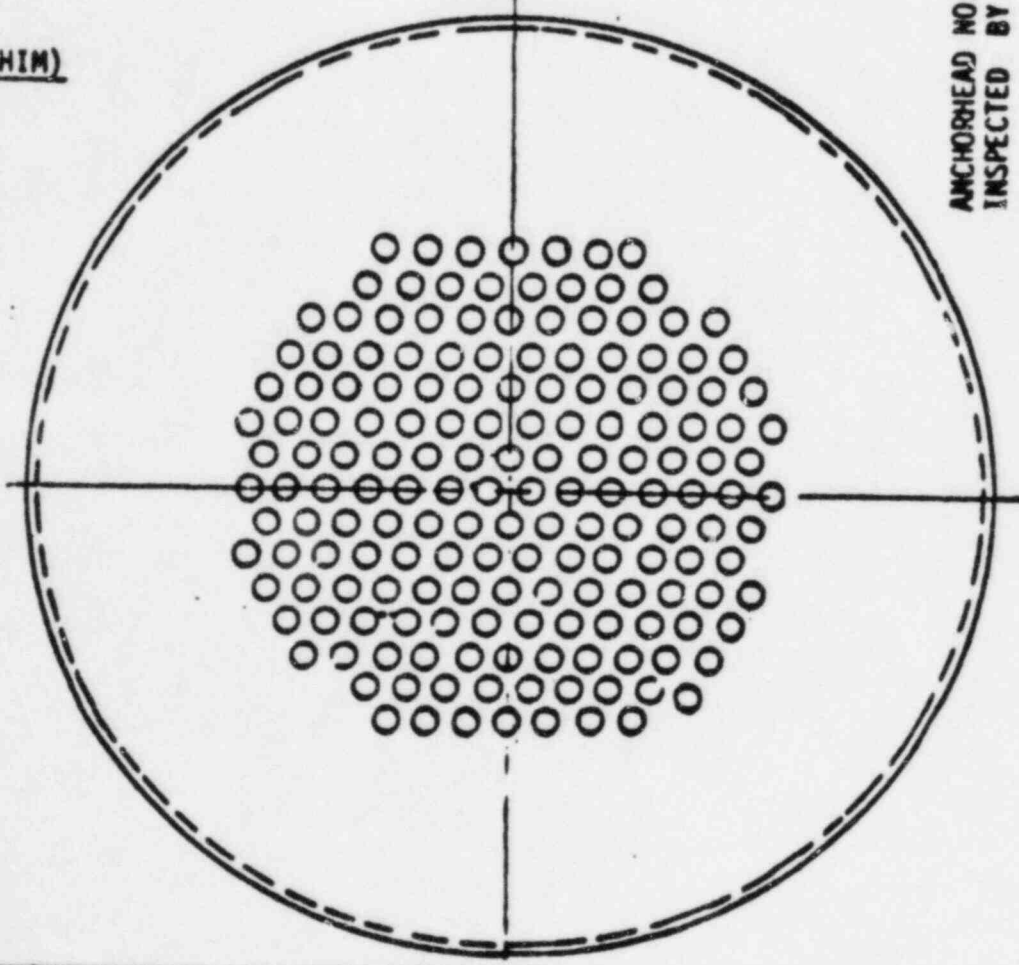
Inspected by

Date

14 FEB 1985

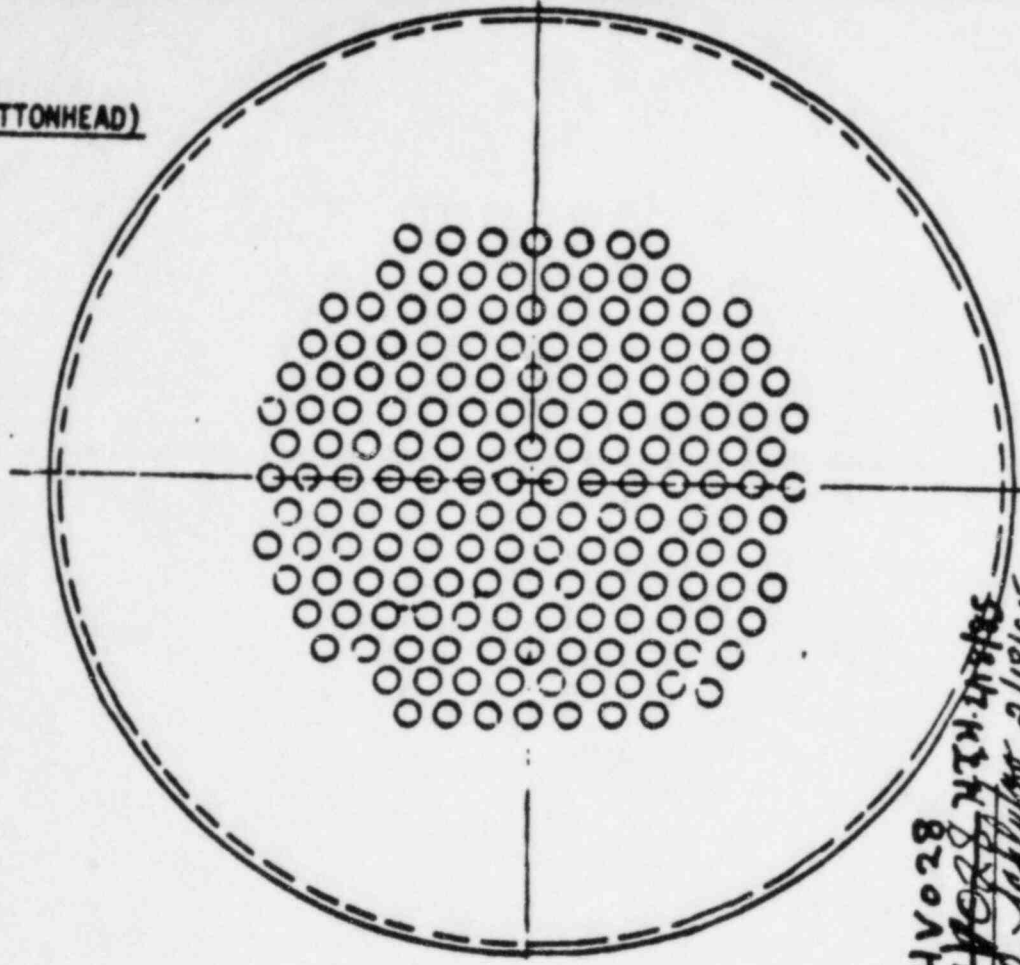
Pre-Load Test MPT  
 Hand from Tendon 18-DE

BOTTOM (SHIM)  
FACE



No INDICATION

TOP (BUTTONHEAD)  
FACE



No INDICATION

HV028  
 ANCHORHEAD NO. ~~HV028~~ 474-4745  
 INSPECTED BY ~~D. Schuyler~~ 2/18/85

MAGNETIC PARTICLE TEST RESULTS

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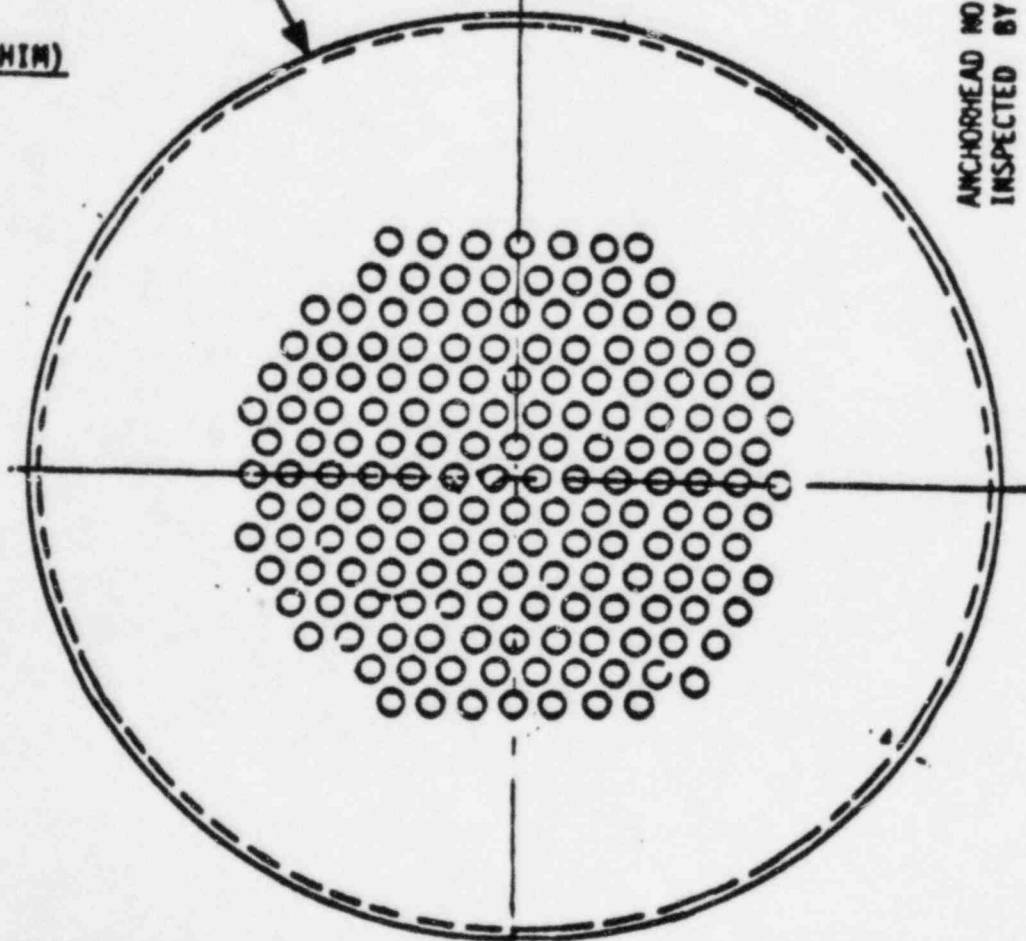
**Inryco**  
 an Inland Steel company  
 Concrete Systems Division

Specified By	Drawn By	Date
	<i>[Signature]</i>	14 FEB 1985
Specified By	Drawn By	Date
	<i>[Signature]</i>	14 FEB 1985

Post-Load Test MPT.  
 Hand from Tachan 18-DE

BOTTOM (SHIM)  
FACE

SHIM  
MARK

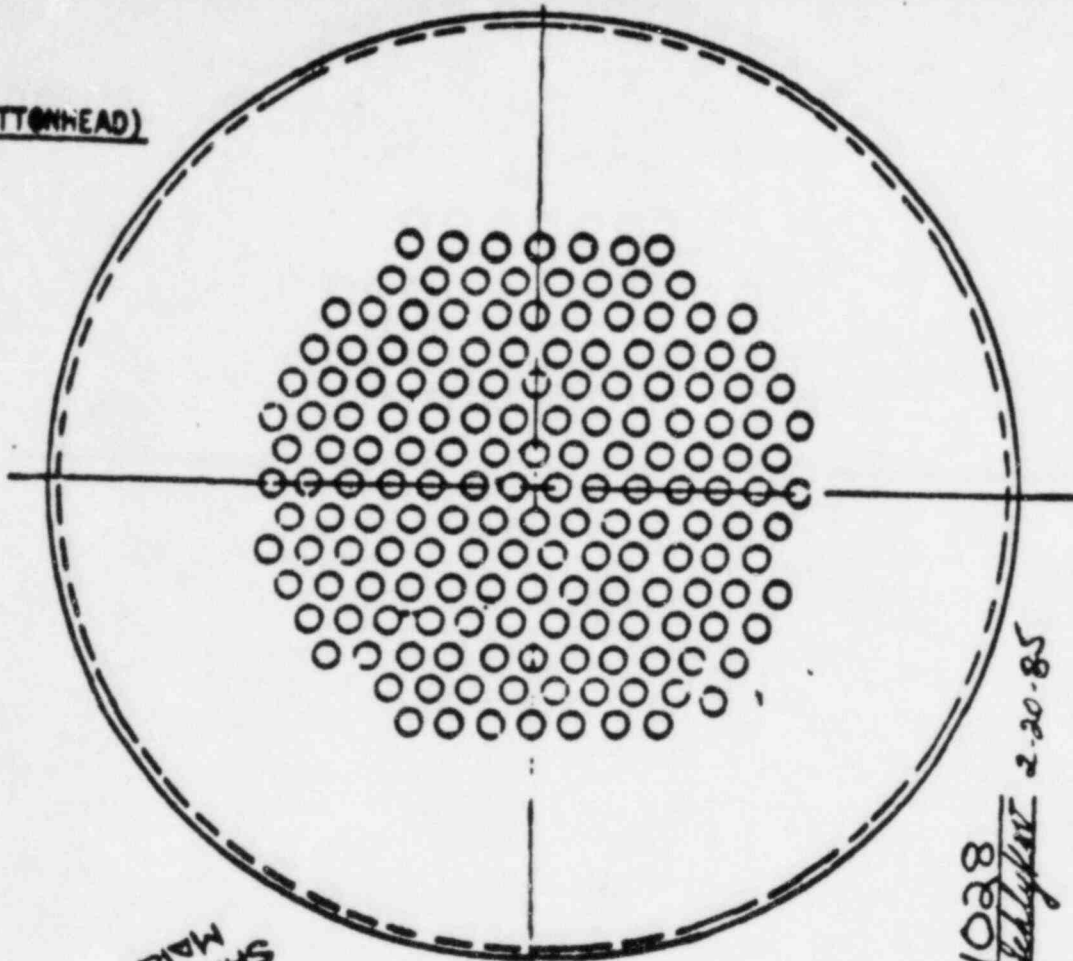


No INDICATION

ANCHORHEAD NO. HVO28  
 INSPECTED BY R. Kelly 2-20-85

No INDICATION

TOP (BUTTONHEAD)  
FACE



# MAGNETIC PARTICLE TEST RESULTS

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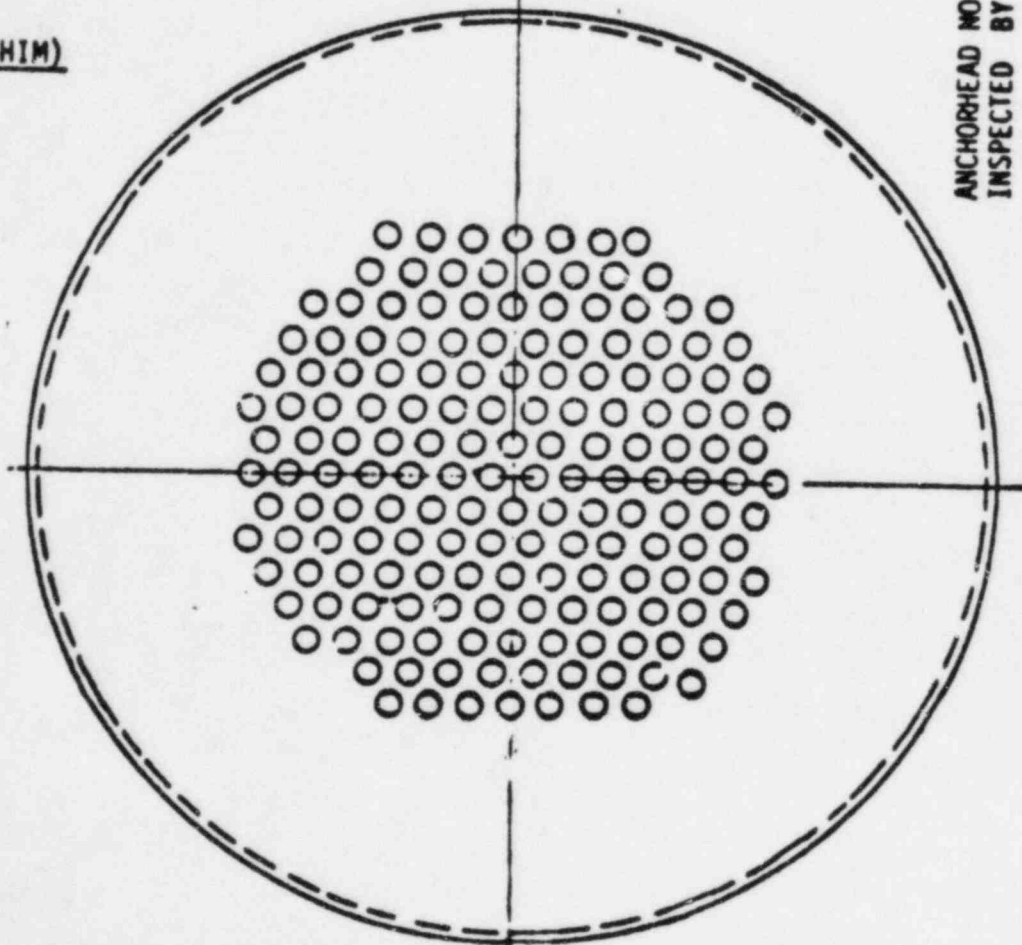
Concrete Systems Division

Revised By	Drawn By	Check By	Date
	<u>R. Kelly</u>	<u>R. Kelly</u>	14 FEB 1985
	<u>R. Kelly</u>	<u>R. Kelly</u>	14 FEB 1985



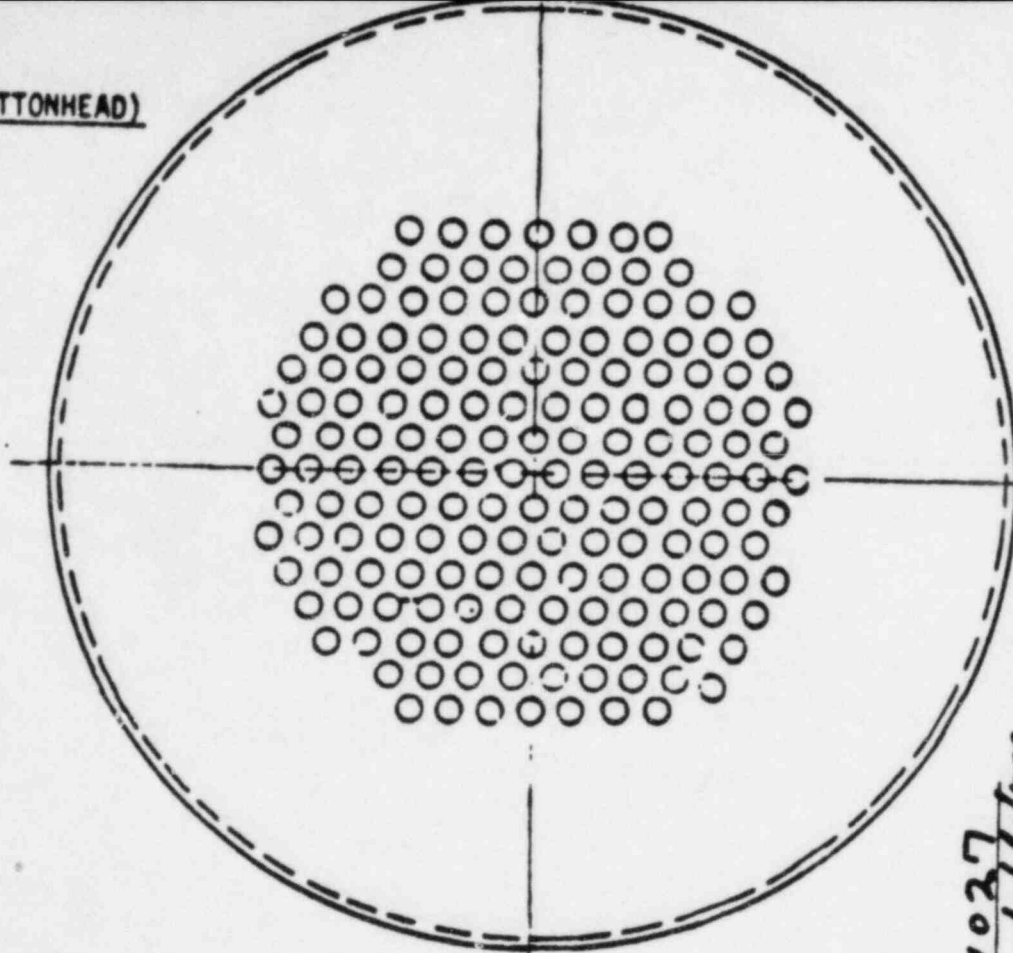
*Per - Fred Test MPT  
Head from Tendon Y-65*

BOTTOM (SHIM)  
FACE



*No INDICATION*

TOP (BUTTONHEAD)  
FACE

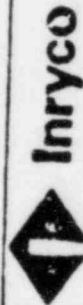


*No INDICATION*

ANCHORHEAD NO. *HV037*  
INSPECTED BY *W. Schlyker* *2/19/85*

**MAGNETIC PARTICLE TEST RESULTS**

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**an Inland Steel company**

Concrete Systems, Inc.

Reviewed By

Date

Reviewed By

Date

14 FEB 1985

Reviewed By

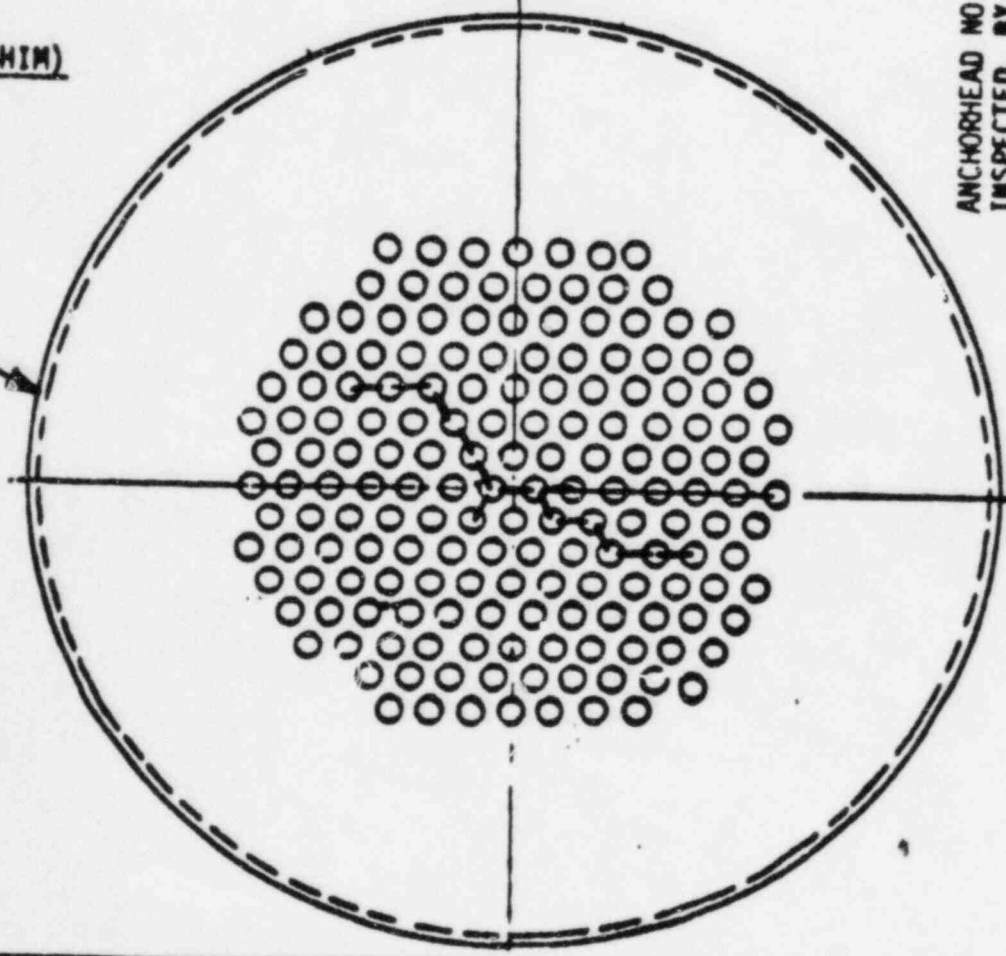
Date

14 FEB 1985

Post-Inst Test MPI  
Head from Tester V-65

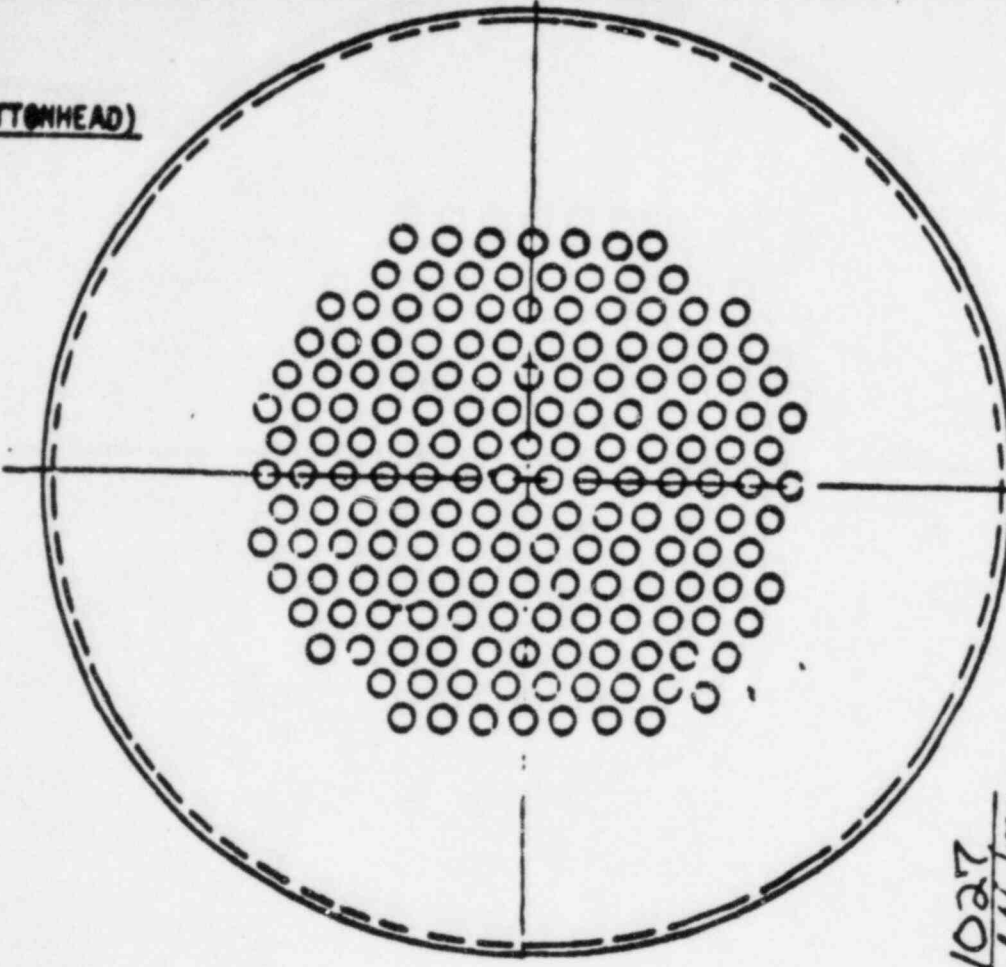
SHIM MARK

BOTTOM (SHIM)  
FACE



13 CRACKS

TOP (BUTTONHEAD)  
FACE

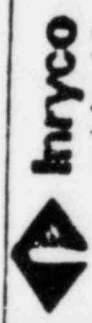


NO INDICATION

ANCHORHEAD NO. HVO27  
INSPECTED BY W. Hyatt 2-20-85

MAGNETIC PARTICLE TEST RESULTS

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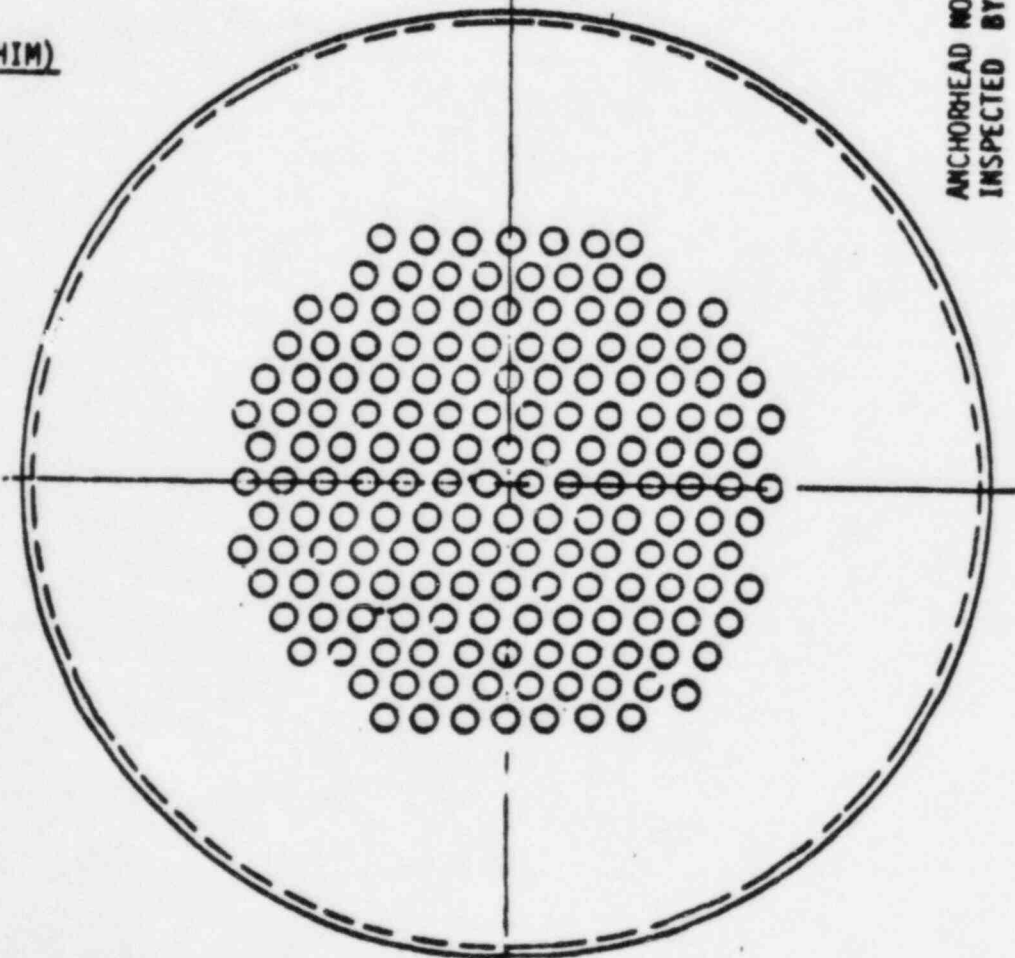
**BIRYCO**  
an Inland Steel company  
Concrete Systems Division

Reviewed By	Drawn	Date
W. Hyatt	W. Hyatt	14 FEB 1985
Checked By	Drawn	Date
W. Hyatt	W. Hyatt	14 FEB 1985



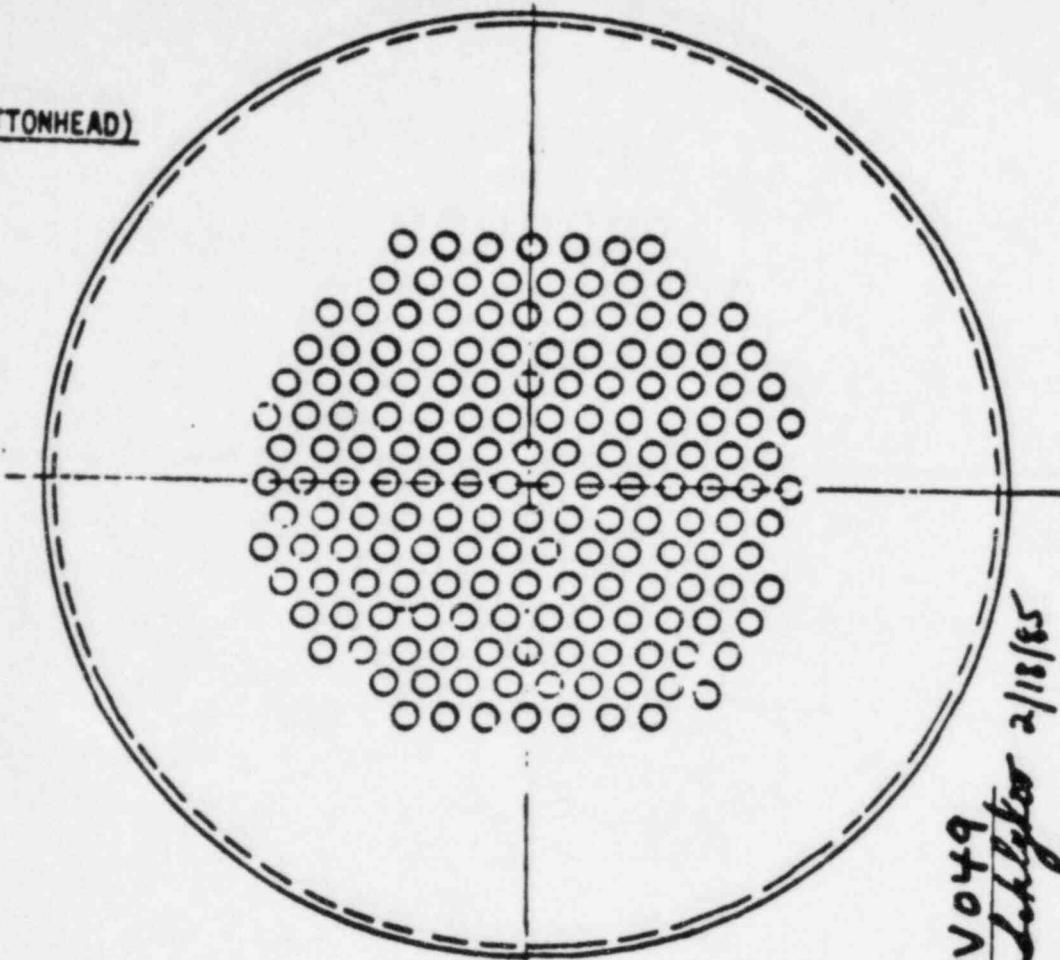
Pre-Test TMT  
 Used from Tendon B-DE

BOTTOM (SHIM)  
 FACE



No INDICATION

TOP (BUTTONHEAD)  
 FACE

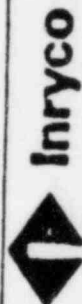


No INDICATION

ANCHORHEAD NO. HV049  
 INSPECTED BY W. Schlyker 2/18/85

MAGNETIC PARTICLE TEST RESULTS

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**Inryco**  
 an Inland Steel company

Concrete Systems Division

Reviewed By	Checked By	Date
	W. Schlyker	14 FEB 1985
	W. Schlyker	14 FEB 1985

1. NAME : \_\_\_\_\_

3rd

<b>STRUCTURAL TESTING ANCHORHEADS    PROCEDURE QC</b>	 <b>Inryco</b> an Inland Steel company
<b>TESTING DOCUMENTATION FORM FNP-LT DF</b>	

Hold Load Minutes	LOAD IN KIPS Target    Actual	NOISE KIPS Actual	FAILURE MODE & TIME	LOAD IN % OF TENDON CUTS Target    Actual	REMARKS Describe fracture or other events.
1.0	500    500				
1.0	1000    1000				
1.0	1500    1500				
1.0	1800    1800	2735-1			
1.0	2000    2000	2765-1			
1.0	2200    2200	2795-2			
1.0	2400    2400	2800-2	40 seconds		
1.0	2600    2600	2800-1	1:10		
1.0	2800    2800	2800-1	1:14		
Fracture Load or					
2.0	2800    2800				

Pre NPT CRACKS 2/18/85    Post NPT \_\_\_\_\_
 Anchorhead Heat Code HV039

Retained Distortion at 2800 Kips NONE
Bushing Heat Code N/A

Visible Cracks YES (CENTER WIRE HOLDS SHIN SURFACE)    Accept YES    Reject \_\_\_\_\_

Each time noise is emitted during testing, that value in Kips will be documented.

Data Recorded by:

Signed Harry F. Hendrickson    Head for Tendon V-64  
 Title Project Manager  
 Agency Int'l S. Inc.  
 Date 2-19-85

**Witness:**

Signed DR Schmidt  
 Title metallurgy lab manager  
 Agency Bechtel  
 Date 2/20/85

2nd

STRUCTURAL TESTING ANCHORHEADS PROCEDURE QC

TESTING DOCUMENTATION FORM FWP-LT DV



**Inryco**

an Inland Steel company

Hold Load Minutes	LOAD IN KIPS		NOISE KIPS Actual	FAILURE MODE & TIME	LOAD IN % OF TENDON CUTS		REMARKS Describe fracture or other events.
	Target	Actual			Target	Actual	
1.0	300	500					
1.0	1000	1000					
1.0	1500	1500					
1.0	1800	1800					
1.0	2000	2000					
1.0	2200	2200					
1.0	2400	2400					
1.0	2600	2600					
	Fracture Load or						
2.0	2800	2800					

Pre MPT OK 2/18/85 Post MPT \_\_\_\_\_

Anchorhead Heat Code HV028

Retained Distortion at 2800 Kips NONE

Bushing Heat Code N/A

Visible Cracks NONE Accept YES Reject \_\_\_\_\_

Each time noise is emitted during testing, that value in Kips will be documented.

Data Recorded by:

*Head from Tendon 18-DE*

Signed Harry B. Handrickson

*no noise during test*

Title Project Manager

Agency Inryco, Inc.

Date 2-19-85

**Witness:**

Signed GR Schmidt

Title Metallurgy Lab. Manager

Agency Bechtel

Date 2/19/85



## STRUCTURAL TESTING ANCHORHEADS PROCEDURE QC

TESTING DOCUMENTATION FORM FNP-LT DF

**Inryco**

an Inland Steel company

Hold Load Minutes	LOAD IN KIPS Target	Actual	NOISE KIPS Actual	FAILURE MODE & TIME	LOAD IN % OF TENDON CUTS Target	Actual	REMARKS Describe fracture or other events.
1.0	500	500					
1.0	1000	1000					
1.0	1500	1500					
1.0	1800	1800					
1.0	2000	2000					
1.0	2200	2200	2305				
1.0	2400	2400	2440				
1.0	2600	2600	2578				
	Fracture Load or		2555				
			2590				
			2600	3645 seconds.			
			2730				
2.0	2800	2800	2770				
			2800	22 seconds			
			2800	24 seconds			

Pre NPT OK 2/18/85 Post NPT \_\_\_\_\_Anchorhead Heat Code HV027Retained Distortion at 2800 Kips NONEBushing Heat Code N/AVisible Cracks NONE Accept YES Reject \_\_\_\_\_

Each time noise is emitted during testing, that value in Kips will be documented.

Data Recorded by:

Signed Harry F. HendricksonTitle Project ManagerAgency Ingers, Inc.Date 2-19-85Retempered @ 850°F for 4 hrs on 2/15/85  
Head from tendon V-65

Witness:

Signed GR SchmidtTitle metallurgy and lab. mgr. managerAgency BectelDate 2/20/85Effective  
Date:

2-18-85

Previous  
Revision:


Revision:



Page

1 of 1

472

<b>STRUCTURAL TESTING ANCHORHEADS      PROCEDURE QC</b>	 <b>Inryco</b> an Inland Steel company
<b>TESTING DOCUMENTATION FORM    FNP-LT 05</b>	

Hold Load Minutes	LOAD IN KIPS Target    Actual	NOISE KIPS Actual	FAILURE MODE & TIME	LOAD IN % OF TENDON CUTS Target    Actual	REMARKS Describe fracture or other events.
1.0	300    500				
1.0	1000    1000				
1.0	1300    1500				
1.0	1800    1800				
1.0	2000    2000				
1.0	2200    2200				
1.0	2400    2400				
1.0	2600    2600				

*noise*  
*after 12 sec*  
2400-1  
2670-1  
2790-1  
2800-1 14 sec  
2800-1 33 sec  
2900-1 1:04  
2860-1  
2905-1

Fracture Load or

2.0      2800    2800  
1.0      2900    2905

Pre NPT OK 2/18/85      Post NPT \_\_\_\_\_

Anchorhead Heat Code HV049

Retained Distortion at 2800 Kips NONE

Bushing Heat Code N/A

Visible Cracks YES-CENTER HOLES  
SHIM SURFACE      Accept YES      Reject \_\_\_\_\_

Each time noise is emitted during testing, that value in Kips will be documented.

Data Recorded by:

*Re-tempered @ 850°F for 4 hrs on 2/15-16/85*  
*Head from tendon 8-DE*

Signed Harry F. Hendrickson  
Title Project Manager  
Agency Inryco, Inc.  
Date 2-19-85

**Witness:**

Signed GR Schmidt  
Title metallurgy Lab. manager  
Agency Bechtel  
Date 2/20/85



## SUBURBAN LABORATORIES, Inc.

4140 LITT DRIVE

HILLSDALE, ILLINOIS 60162 - 1183

EARL I. ROSENBERG  
PresidentH.R. THOMAS, JR.  
Director

February 21, 1985

Inryco, Inc.  
Concrete Systems Division  
7200 South Narragansett Avenue  
Bedford Park  
Chicago, Illinois 60638Re: P. O. #41T2400-8

Attention: Mr. Harry Handrickson

<u>Samples Received:</u> 2/14/85	<u>Chlorides</u>	<u>Nitrates</u>	<u>Sulfides</u>	<u>Water Content</u>	<u>Neutralization No</u>
	(ppm)	(ppm)	(ppm)	%	Total Base No. (mg KOH/g)
S/L #1537 - Sample A, Uncontrolled Button Head Surface Field End, HV038V21 w/tape	4.30	0.113	0.002	3.21 <sup>8</sup>	46.97
S/L #1538 - Sample B, Uncontrolled around Threads Field End HV038 V21	0.70	0.113	0.007	1.02	47.86
S/L #1539 - Sample #1, V64 Uncontrolled	1.40	0.113	0.007	0.18	51.35
S/L #1540 - Grease Can, V102 Top	0.40	0.075	0.012	0.19	49.48
S/L #1541 - Heated Pumped Out V21, Top	0.70	0.075	0.007	0.17	50.57
S/L #1542 - #840069 Tendon V-17 Top #1	1.40	0.325	0.007	0.27	50.88
S/L #1543 - #840070 Tendon V-17 Top #2	2.90	0.150	0.002	0.18	48.50
S/L #1544 - #840071 V-17, Bottom Grease from Lowest Point #3	2.00	0.180	0.012	1.52	48.18
S/L #1545 - #840072 Tendon V-17, Bottom 1st from Can #4	1.40	0.300	0.012	88	50.02
S/L #1546 - #840073 V-17, Bottom Upper Portion #5	1.40	0.230	0.012	1.34	45.84

(Continued)

<u>Samples Received:</u> 2/14/85						<u>Neutralization No.</u>
	<u>Chlorides</u> (ppm)	<u>Nitrates</u> (ppm)	<u>Sulfides</u> (ppm)	<u>Water Content</u> %	<u>Total Base No.</u> (mg KOH/g)	
<u>Field Anchor Cap / V-21</u>						
S/L #1547 - Grease wrapped in Plastic	1.40	0.250	0.012	1.11		48.36
S/L #1548 - Layer #1, Top Edge	0.40	0.280	0.016	0.54		46.33
S/L #1549 - Layer #1, Top Center	0.70	0.280	0.002	0.77		44.37
S/L #1550 - Layer #3, Edge	0.70	0.280	0.016	0.27		46.95
S/L #1551 - Layer #3, Center	0.70	0.300	0.020	0.44		45.46
S/L #1552 - Layer #4, Edge	2.00	0.300	0.012	0.38		45.74
S/L #1553 - Layer #4, Center	0.70	0.300	0.012	0.54		47.67
S/L #1554 - Layer #6, Bottom Edge	0.70	0.325	0.016	0.70		45.37
S/L #1555 - Layer #6, Bottom Center	2.00	0.325	0.012	1.42		46.55
<u>Interior Anchor Head</u>						
S/L #1556 - Field End / V-17	0.70	0.280	0.012	..		..

Dates Tested: 2/19/85 & 2/20/85 2/20/85 2/20/85 2/19/85

ANALYSIS CERTIFIED BY: [Signature], Director (HRT:lh)

Chlorides (Sect. 5.1)

Method: ASTM D-512

Nitrates "

Method: ASTM D-992

Sulfides "

Method: APHA 427-C

Water Content (Sect. 5.2)

Method: ASTM 4-95

Neutralization Number (Sect. 5.3)

Method: ASTM D-974 (Modified)

\* Black color appears in the water layer

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Insufficient sample

Members of American Chemical Society • American Society for Microbiology  
Water Pollution Control Federation • Institute of Food Technology

Certifications: U.S.D.A. #1783 • Ill. Dept. of Public Health #17135 • Amer. Spice Trade Assn. • F.D.A. Reg. #1419676 • Ill. EPA #100191

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4140 LITT DRIVE

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EARL I. ROSENBERG  
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February 25, 1985

Inryco, Inc.  
Concrete Systems Division  
7200 South Narragansett Avenue  
Bedford Park  
Chicago, Illinois 60638

Attention: Mr. H. Hendrickson

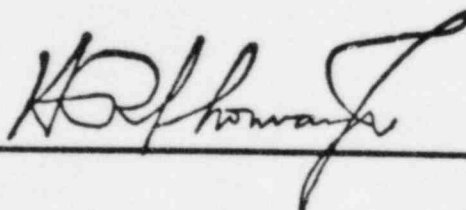
Sample Received: 2/22/85

Source: S/L #1880 - Water from V-21 Field Cap

Chloride (ppm)

180.80

ANALYSIS CERTIFIED BY:



, Director (HRT:lh)

Members of American Chemical Society • American Society for Microbiology  
Water Pollution Control Federation • Institute of Food Technology

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