

Failure Analysis Associates

ENGINEERING AND METALLURGICAL CONSULTANTS
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PO BOX 51470, PALO ALTO, CALIFORNIA 94303 (415) 856-9400



MEMORANDUM

TO: Mike Milligan
Bill Judge

DATE: February 17, 1984

FROM: Donald O. Johnson *DOJ*

RE: Shoreham Nuclear Power Station
FaAA Job # PA07396

SUBJECT: Report on trip to Kodiak Electric Association, Inc. on January 22 to 27, 1984.

The trip to Kodiak, Alaska, with Bill Judge from Long Island Lighting Project Office (LILCO) at the Shoreham Nuclear Power Plant Station included inspection of AE pistons and gathering of operating information on their Transamerica Delaval (TDI) diesel engines.

The people we contacted at Kodiak Electric Association, Inc. (KEA) were Rosahul Baldurn and Carl Gronn. They were very helpful in our inspection and gathering of information.

The piston skirts that were examined came from engine number 4, serial number 79026-3029, model DSRV 16-4, date of manufacturing 8 August 1980, horse power 8750BHP, RPM 450. There were two pistons that were pulled for inspection, one piston was for LILCO and the other for TDI to inspect. I did an informational inspection on the replacement pistons for KEA. I found no crack-like indications above the recording threshold.

8412140449 840910
PDR ADCK 05000322
G PDR

February 17, 1984
Page -2-

The AE piston that was designated for LILCO was penetrant tested to NDE-6.2 and Eddy-Current tested to NDE-11.5. The penetrant test was the first part of the inspection and eddy-current was to verify any penetrant indications.

The inspection was of the boss areas as directed by NDE Procedures 6.2 and 11.5. One area was found to have a penetrant indication 3/4" long. Upon inspection with eddy-current there were no crack-like indications noted. The piston was shipped to Palo Alto to be examined at FaAA's lab. In the laboratory, I reinspected the piston to both NDE-6.2 and NDE-11.5 and found no crack-like indications.

PEAK FIRING PRESSURE ON ENGINE #4

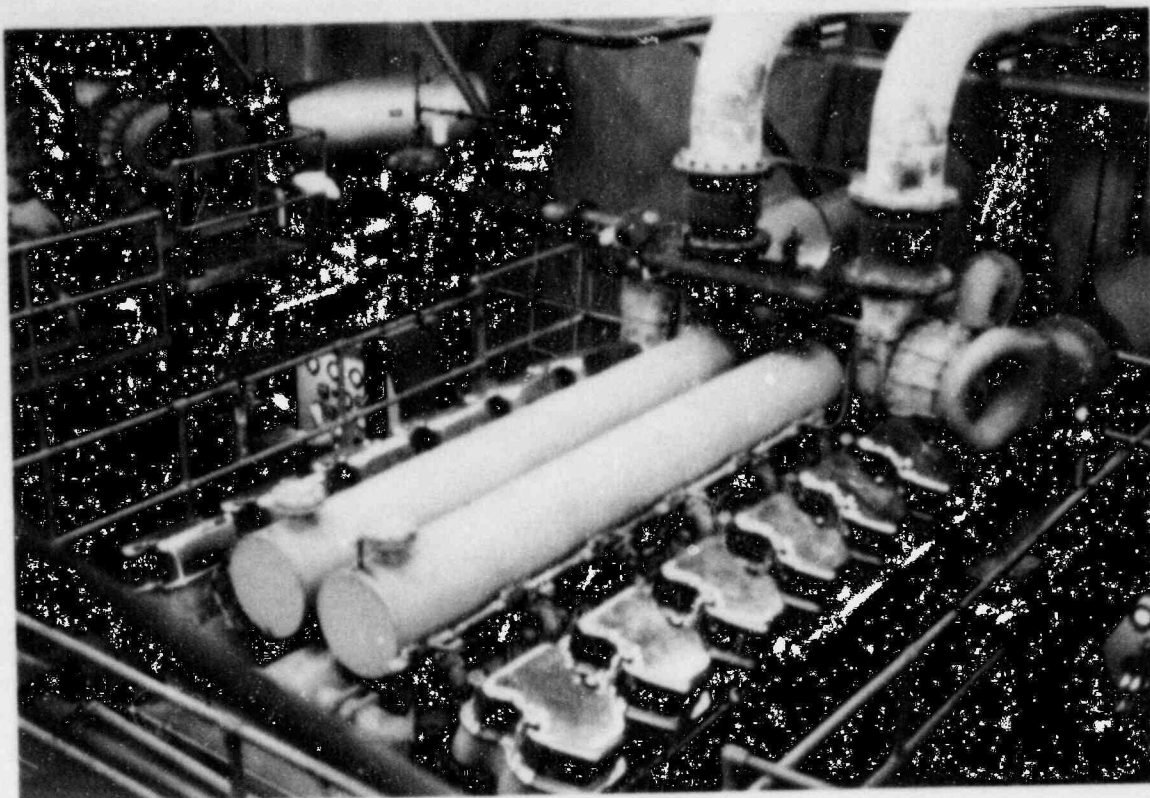
March 31, 1983, 4000 kW, 7200 hours

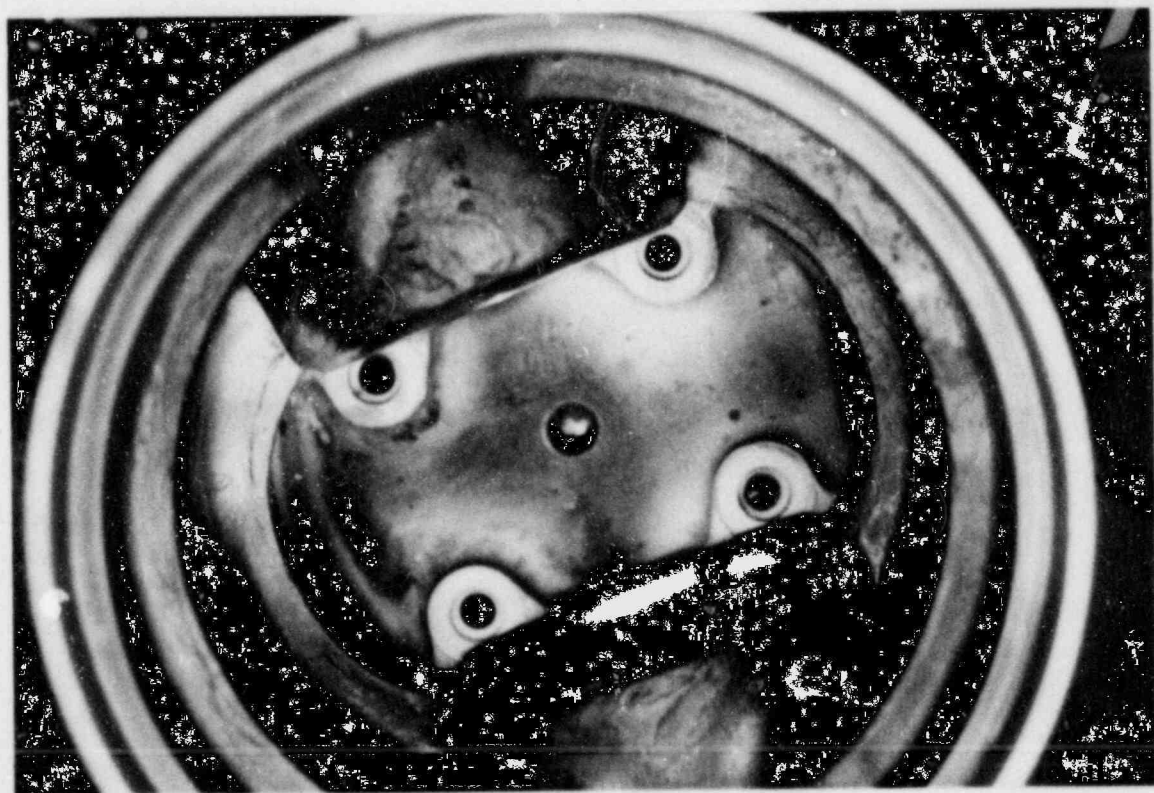
1R	890	1L	970
2R	790	2L	960
3R	1000	3L	980
4R	970	4L	940
5R	990	5L	920
6R	990	6L	930
7R	890	7L	910
8R	930	8L	920

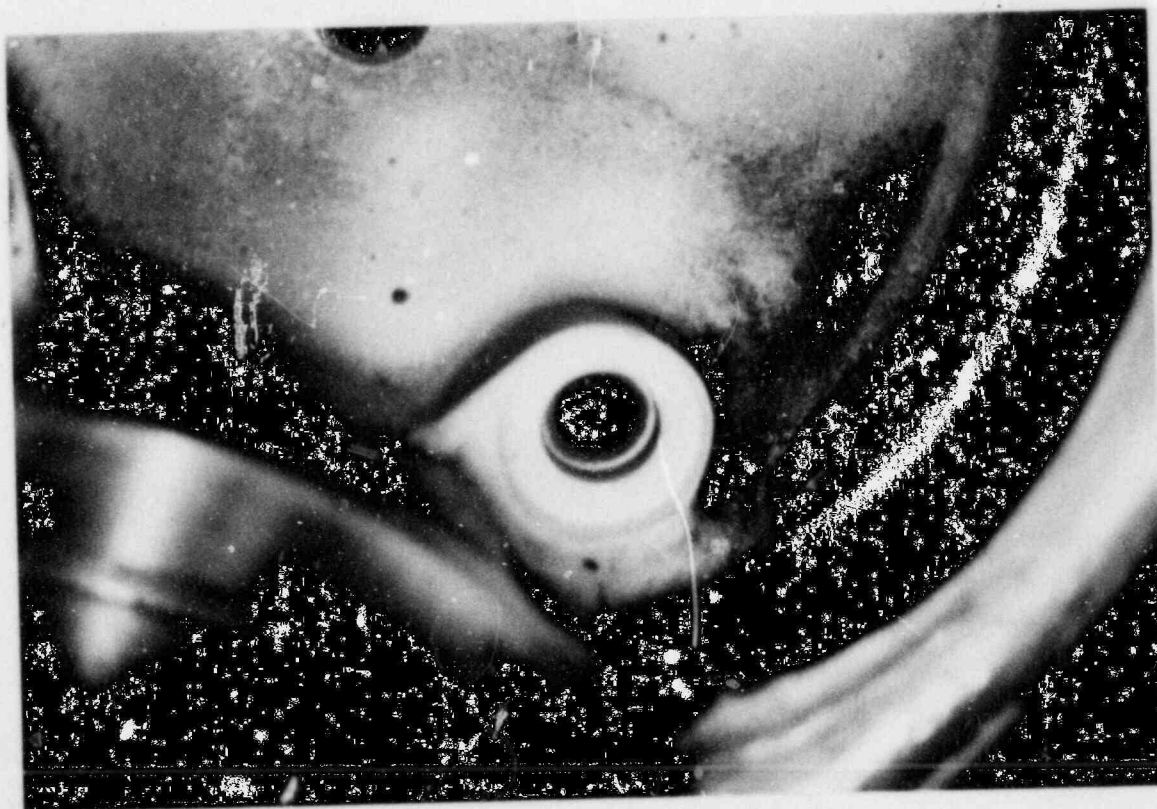
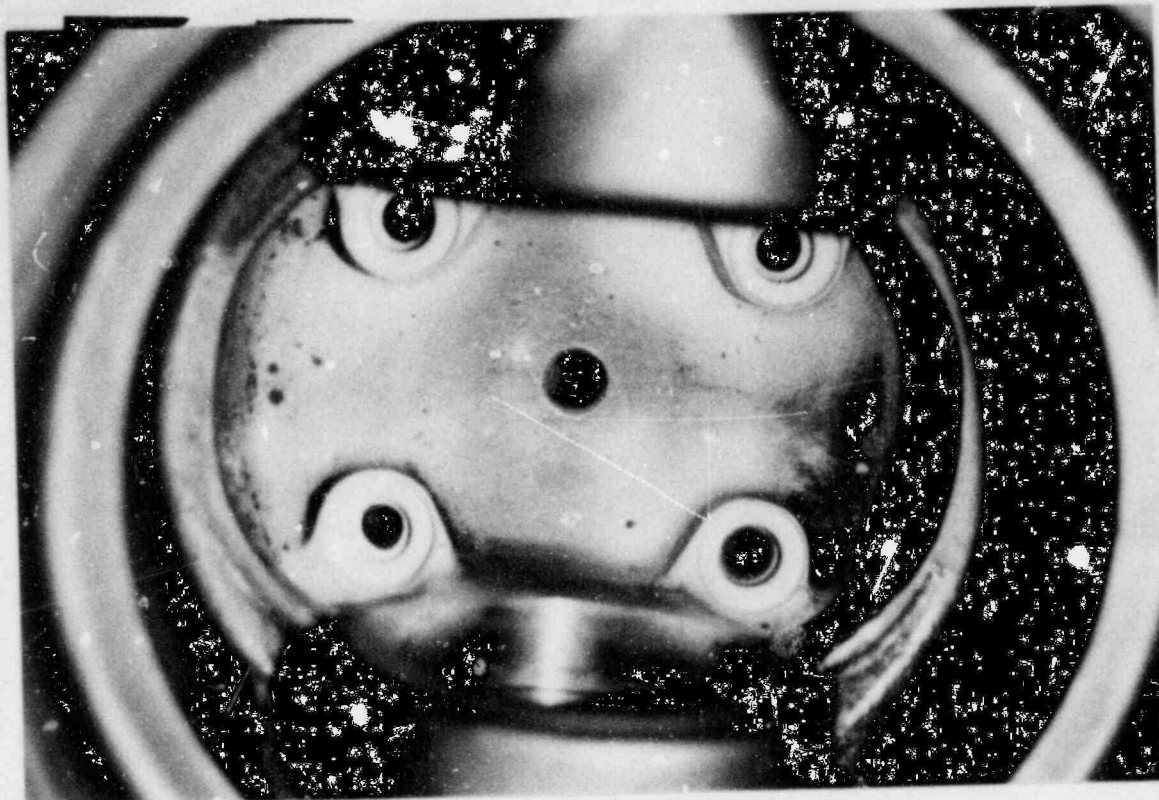
March 2, 1982, 5600 kW, 4201 hours

1R	1320	1L	1320
2R	1300	2L	1280
3R	1300	3L	1280
4R	1310	4L	1260
5R	1340	5L	1300
6R	1300	6L	1240
7R	1340	7L	1240
8R	1300	8L	1240

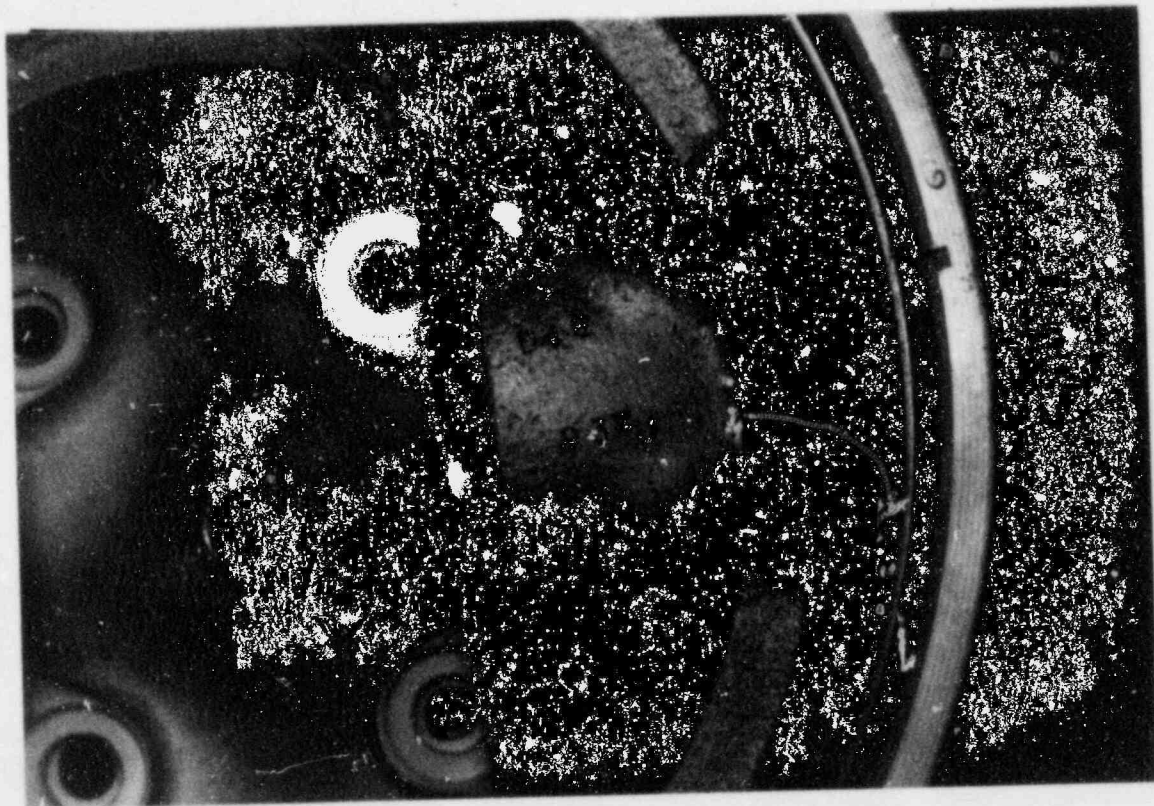
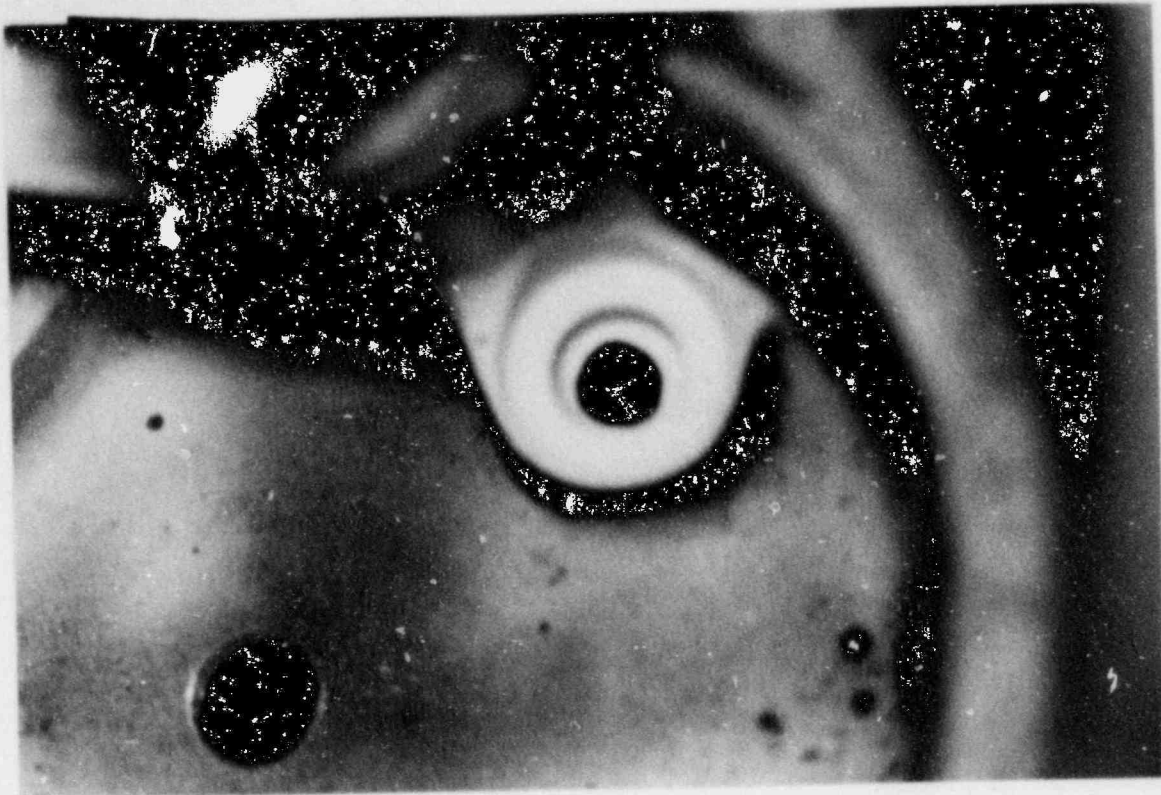






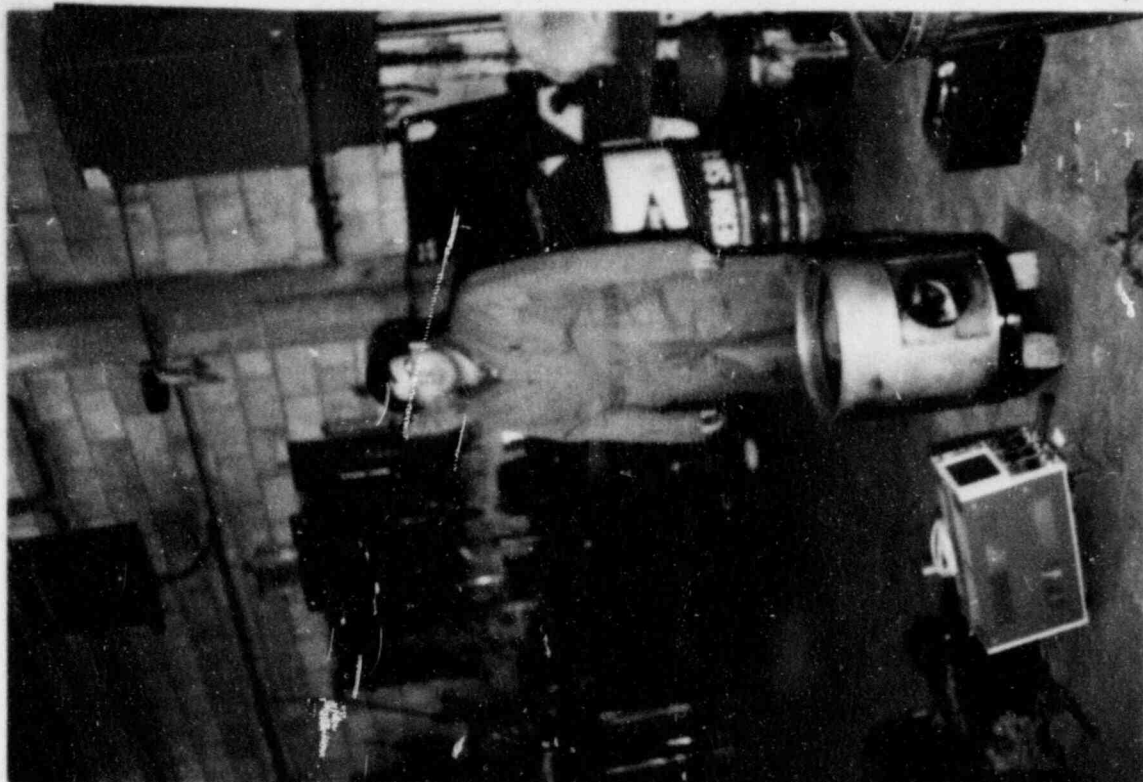








P-29-11



MEMORANDUM

TO: Mike Milligan
Nelson Irvine

DATE: February 3, 1984

FROM: Donald O. Johnson *DOJ*

RE: Shoreham Nuclear Power
Station FaAA Job # PA07396

SUBJECT: Report of Trips on 1/10/84 to Transamerica Delaval,
Oakland, California

I went to Transamerica Delaval (TDI) in Oakland on January 10, 1984, to inspect two AE-type piston as representative of Long Island Lighting Company (LILCO). I used a color contrast penetrant method of inspection described in the FaAA Nondestructive Examination Procedure, NDE 6.2, Revision 0, dated October 12, 1983. The procedure was accepted by LILCO's Nelson Irvine, Level III inspector of their Field Quality Assurance Division.

Al Fleischer at TDI arranged the tests of two pistons that were run 687 hours. The two pistons were crated when we went to their training center to do the inspection. There was a description of the material on top of one crate.

R5 Test Pistons - 03-341-04-AE

Piston Skirts were tested in R5-V12 for 687 hours at 302 BMEP and 514 RPM. Testing included 51 start-and-stop sequences. Heat numbers were 7085 C-31 and 7085 C-33. The crates were opened, and I photographed the pistons showing the heat numbers and other markings. I noted that these pistons were the old style: the wrist pin boss area was thin, and the first rib above the boss area where the crown bolts to the skirt was very narrow, the same as the AN-type pistons.

The next step was to complete the color contrast penetrant test to FaAA Procedure, NDE 6.2. During the inspection I observed that there was a layer of plating on the inside of the skirt and that the casting was very smooth, different from general production runs of cast material. The inside of the skirt was cleaned, and all the flash was removed. The boss area was very smooth, as if polished by cratex, and all the ground areas were very carefully polished, with smooth radius into boss.

There were no indications noted according to our acceptance criteria. The next step was to use eddy-current to inspect the boss areas and the lower web. I also checked plating inside and out. There was evidence of plating on the inside below normal areas. The plating was very thin, approximately 0.0005 inch to 0.0001 inch.

I found three indications with eddy-current on piston C-31 as shown on drawing 11.5.8.4. The attached reports and a photo pack will document the report.

11.1.10

Failure
Analysis
Associate:

EDDY CURRENT CALIBRATION REPORT

Job No. PA07396 Date 1-10-84 Report No. PA07396-841001
 Material Description NODULAR CAST IRON
 Code or Specification NDE 10.5 Full On -1.5 Full Off +1.5
 Reference Standard PA0-C-1 Instrument M12 17 S/N

Instrument
 Freq. 2MHz Gain 30 Volts/div 0.5 Phase 218
 Test Probe FABA EEP-100-P-1 S/N ECP-100-P-1
 Reference Probe FABA ECP-100-B-1 S/N ECP 100 B-1

CALIBRATION

4 units @ -1.5 L/O
3.5 units @ -1 L/O
3.2 units @ -0 L/O
2.6 units @ +1 L/O

STRIP CHART RECORDER

Type N/A S/N N/A
 Channel 1
 Sen N/A
 Position @ Null Point N/A
 Chart Speed N/A mm/sec
 Channel 2
 Sen N/A
 Position @ Null Point N/A

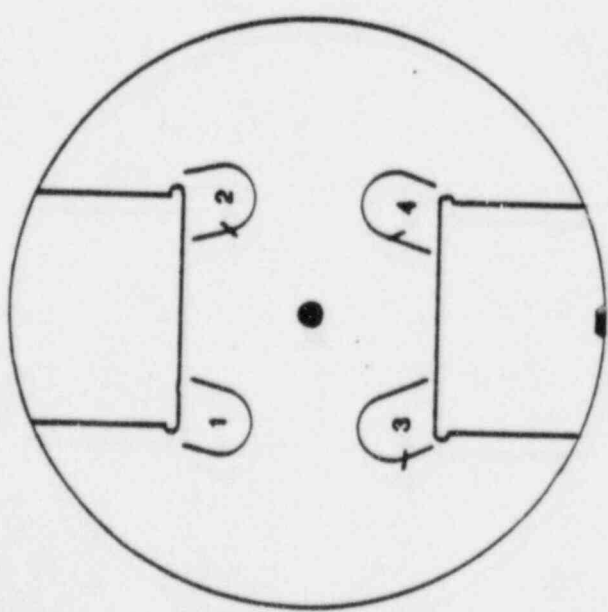
Calibration Check

Time <u>2 PM</u>	Phase <u>218</u>	Gain <u>30</u>
Time <u>2:15 PM</u>	Phase <u>218</u>	Gain <u>30</u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>
Time <u></u>	Phase <u></u>	Gain <u></u>

Examiner
R&D-KR-3Level Examiner [Signature]Level II

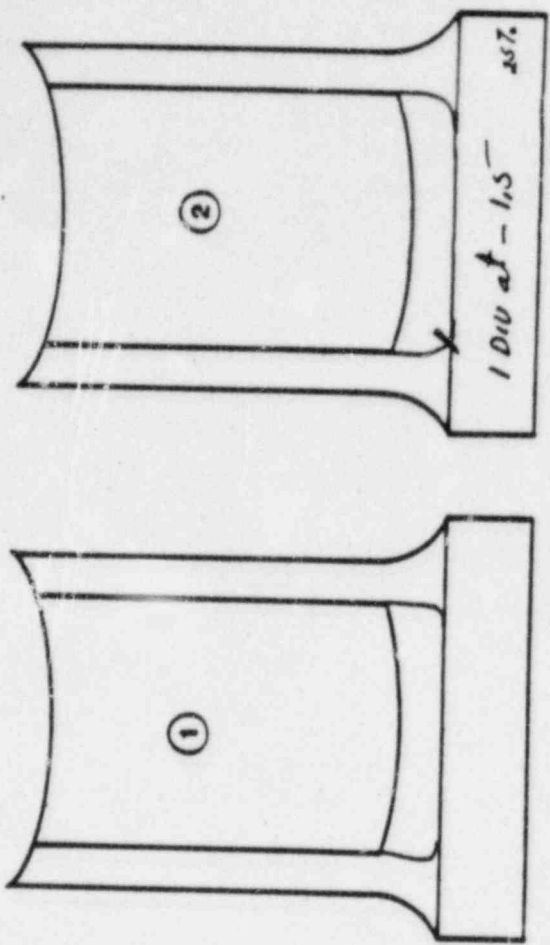
11.5.6.4

Diesel engine ϕ 1 1/4
Piston ϕ C-31

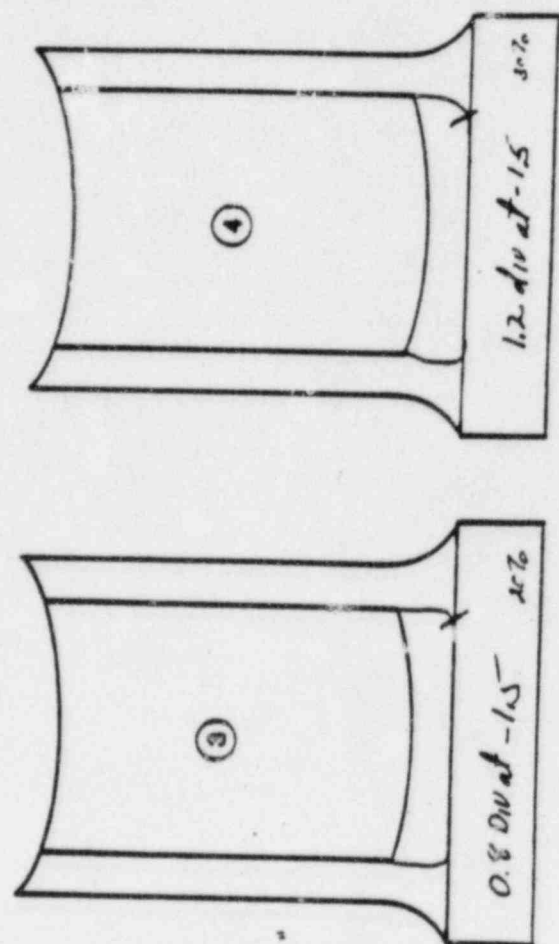


Notch side

Overhead view



Side views, looking out from inside



1

Failure Analysis Associates

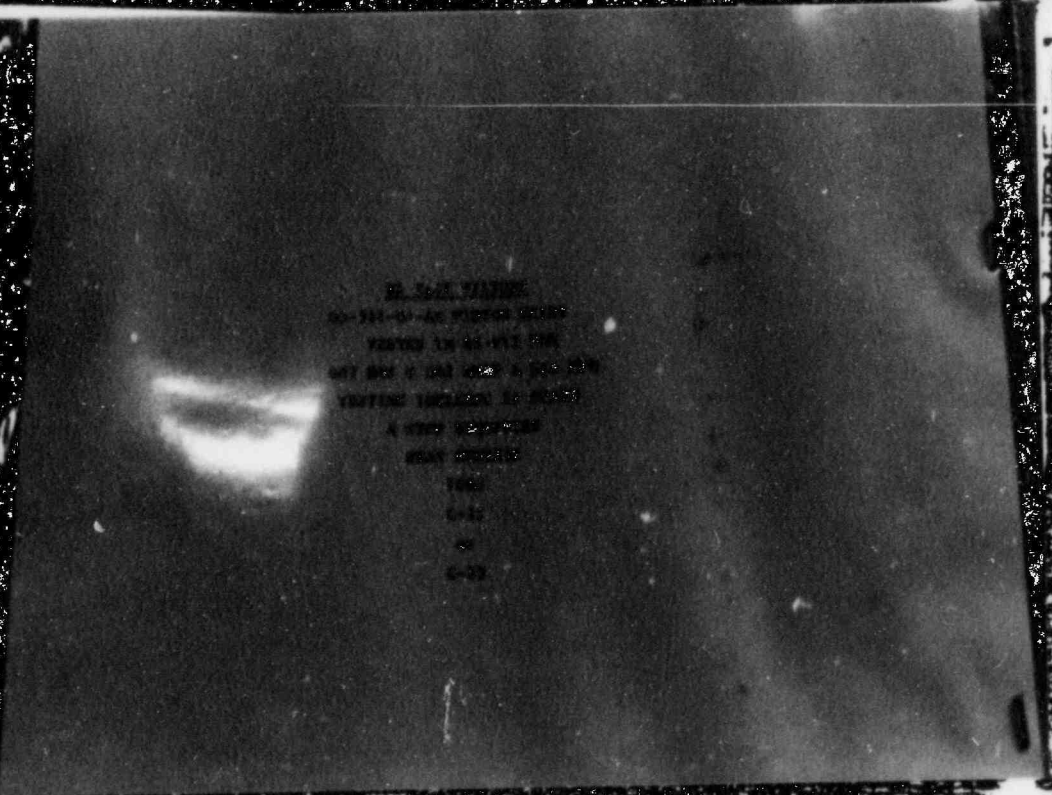
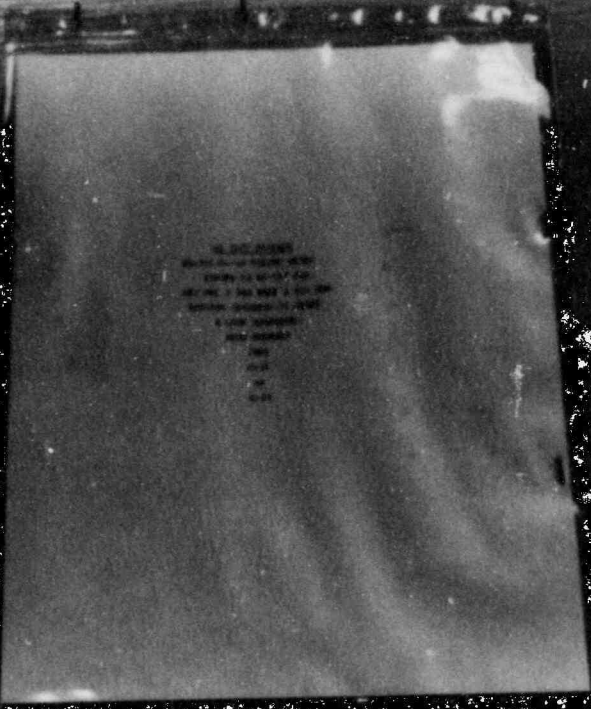
LIQUID PENETRANT EXAMINATION REPORT

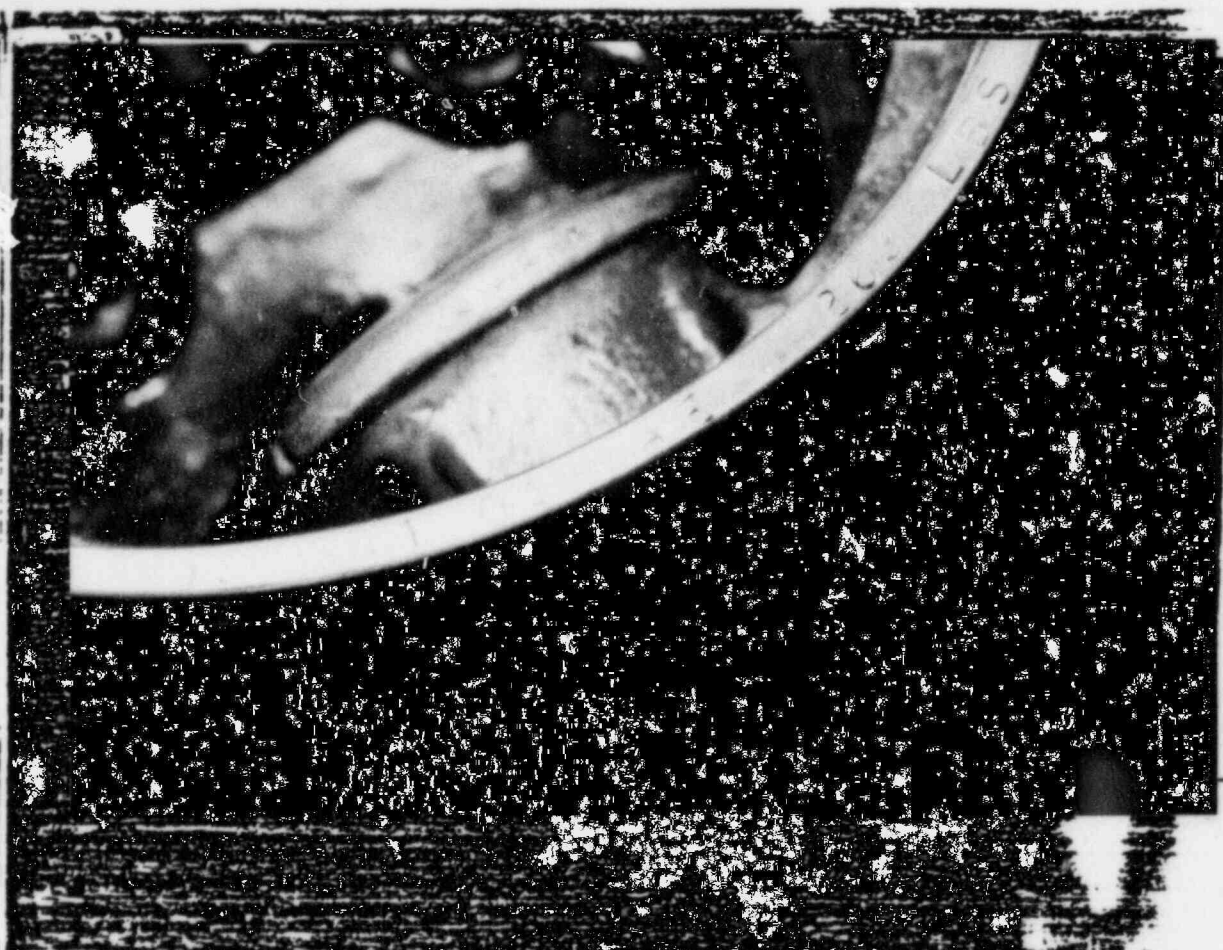
A. Material		Type: <u>MODULAR</u> <u>CAST IRON</u>		Fabricated Process: <u>N/A</u>		<input type="checkbox"/> Welded <input type="checkbox"/> Worked		<input checked="" type="checkbox"/> Cast		PT
		Geometry: <input type="checkbox"/> Pipe <input type="checkbox"/> Plate <input type="checkbox"/> Rod <input checked="" type="checkbox"/> Other: <u>AE PISTON SKIRT</u>								Component I.D. <u>N/A</u>
Cross Section Thickness: <u>N/A</u>	Max <u>N/A</u> Inch	Min <u>N/A</u> Inch	Surface Condition: <input checked="" type="checkbox"/> Machined <input type="checkbox"/> As Fabricated <input type="checkbox"/> Ground <input checked="" type="checkbox"/> Other: <u>AS CAST</u>							
B. NDE Procedure No. <u>6.2</u>		Surface/Mat'l. Temp. <u>110°C</u>		M & TE. No. <u>N/A</u>		MAR/RR. No. <u>N/A</u>				
Inspection Materials		Brand		Designation		Batch No.				
1. Pre-Cleaner		<u>aydrox</u>		<u>9 PR551</u>		<u>C-846</u>				
2. Penetrant		<u>"</u>		<u>966</u>		<u>C1-3551</u>				
3. Emulsifier and/or Remover				<u>9 PR551</u>		<u>C-864</u>				
4. Developer				<u>906</u>		<u>1032</u>				
5. Post Examination Cleaner				<u>9 PR551</u>		<u>C-864</u>				
Sketch or other detail (use other side if necessary): <u>PISTON # C31</u> <u>PISTON # C33</u>										
C. Evaluation		Report below those indications observed and the pertinent information required. Where additional space is required, use other side.								
Location		Size (Inches)	Description		Action (Accept/Reject, and comment as necessary)					
1. <u>NONE FOUND</u>										
2.										
3.										
4.										
D. Acceptance Criteria		<u>NDE 6.1 + 6.2</u>				Operator: <u>D O JOHNSON</u>				
E. Attest						Level: <u>II</u> Date: <u>1-10-84</u>				
		Responsible Certified Personnel				Level _____ Date _____				

 System
 EMERGENCY Diesel
 Crank for Piston Skirts

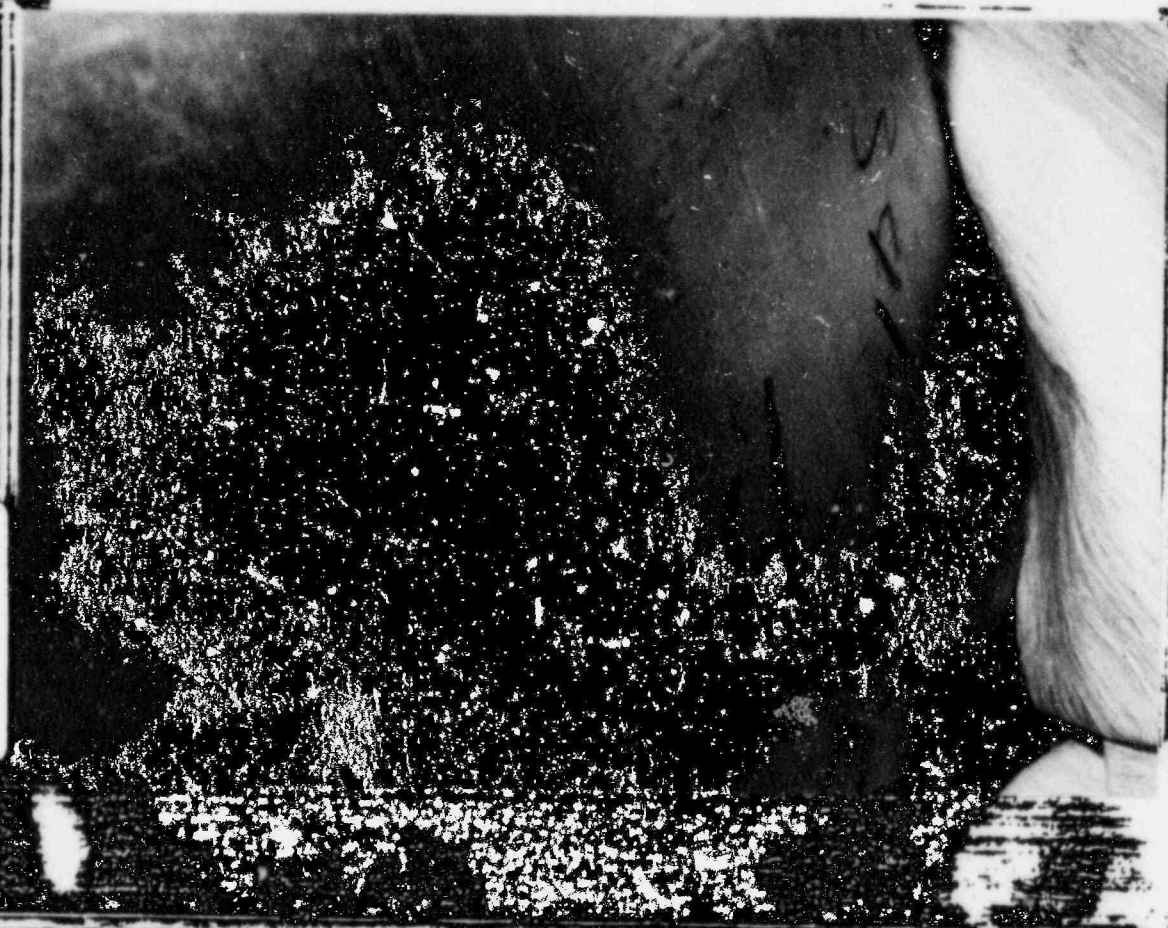
 Plant/Location
 TDI - OAKLAND CA.

PA07396





SECRET
PA07306

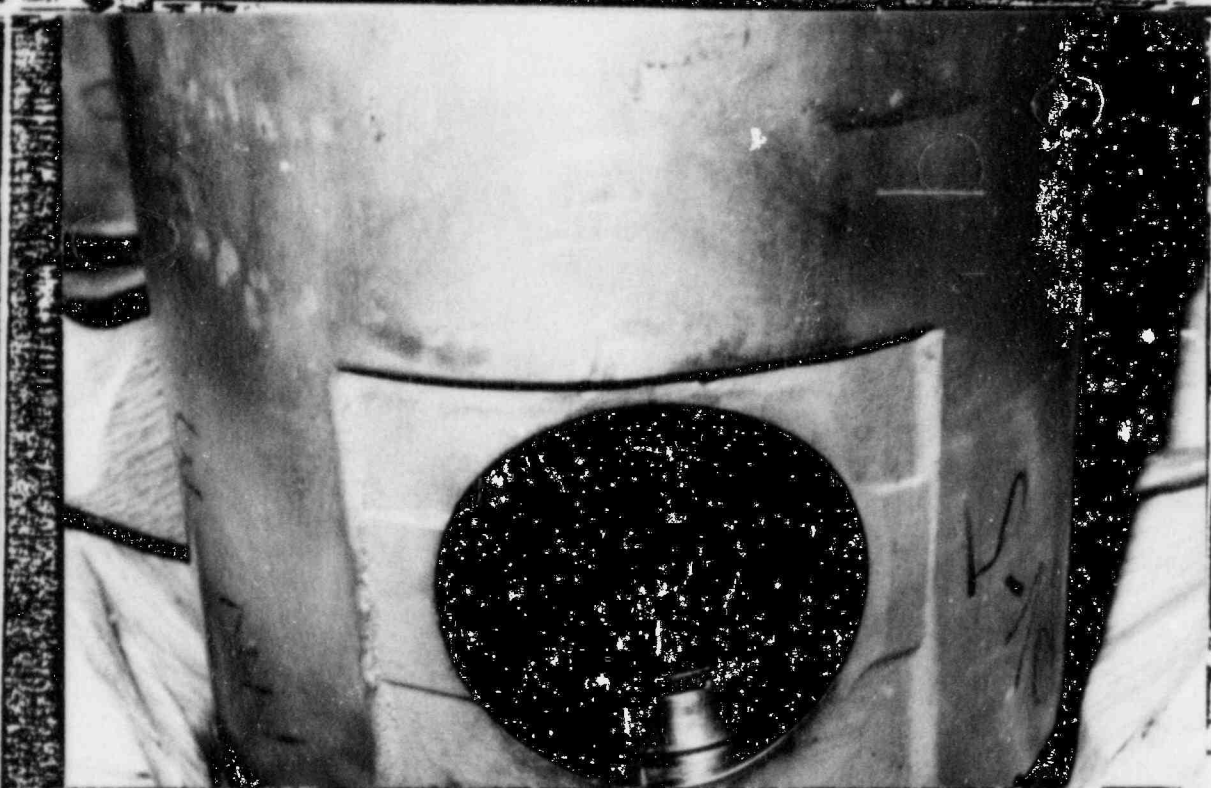






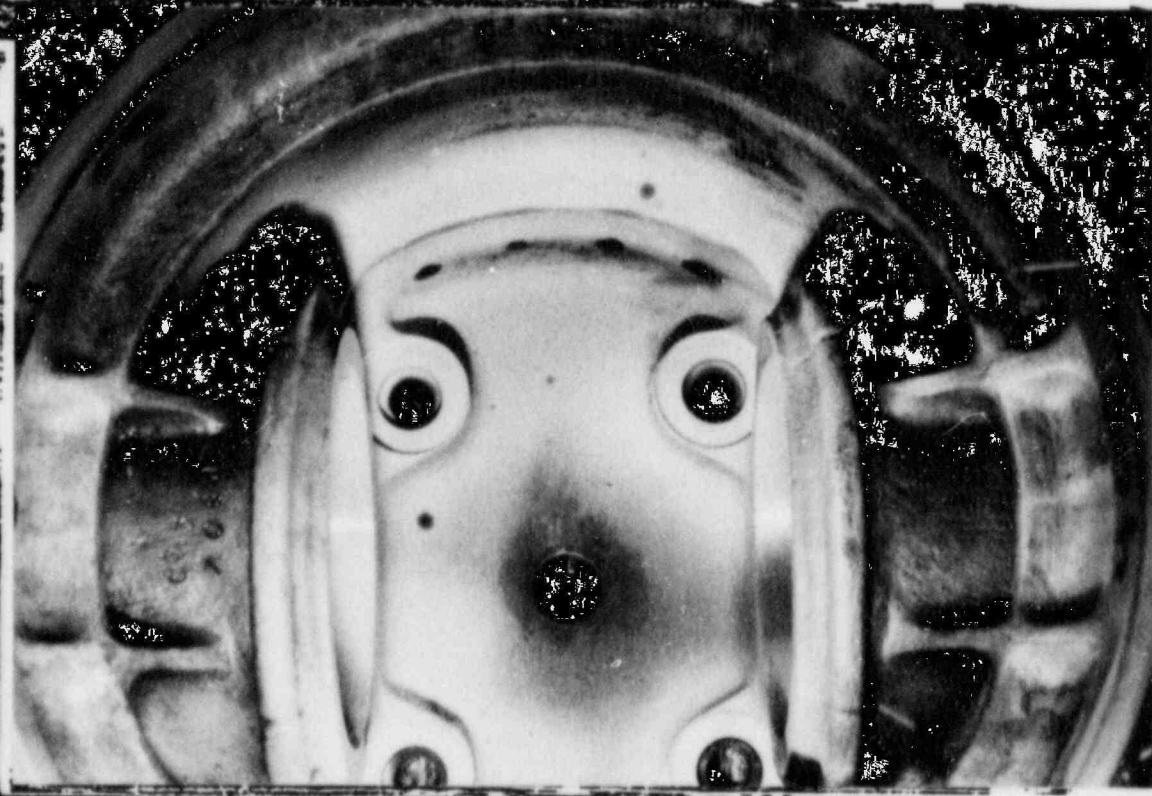
PA87396



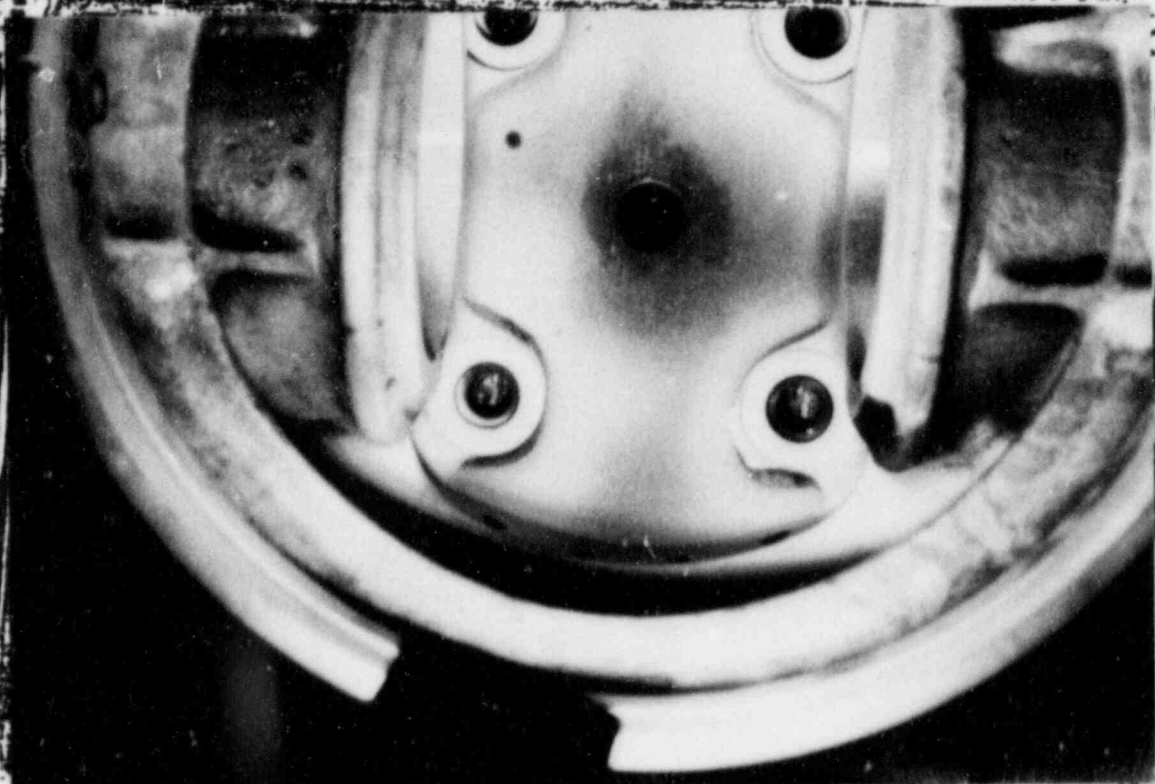


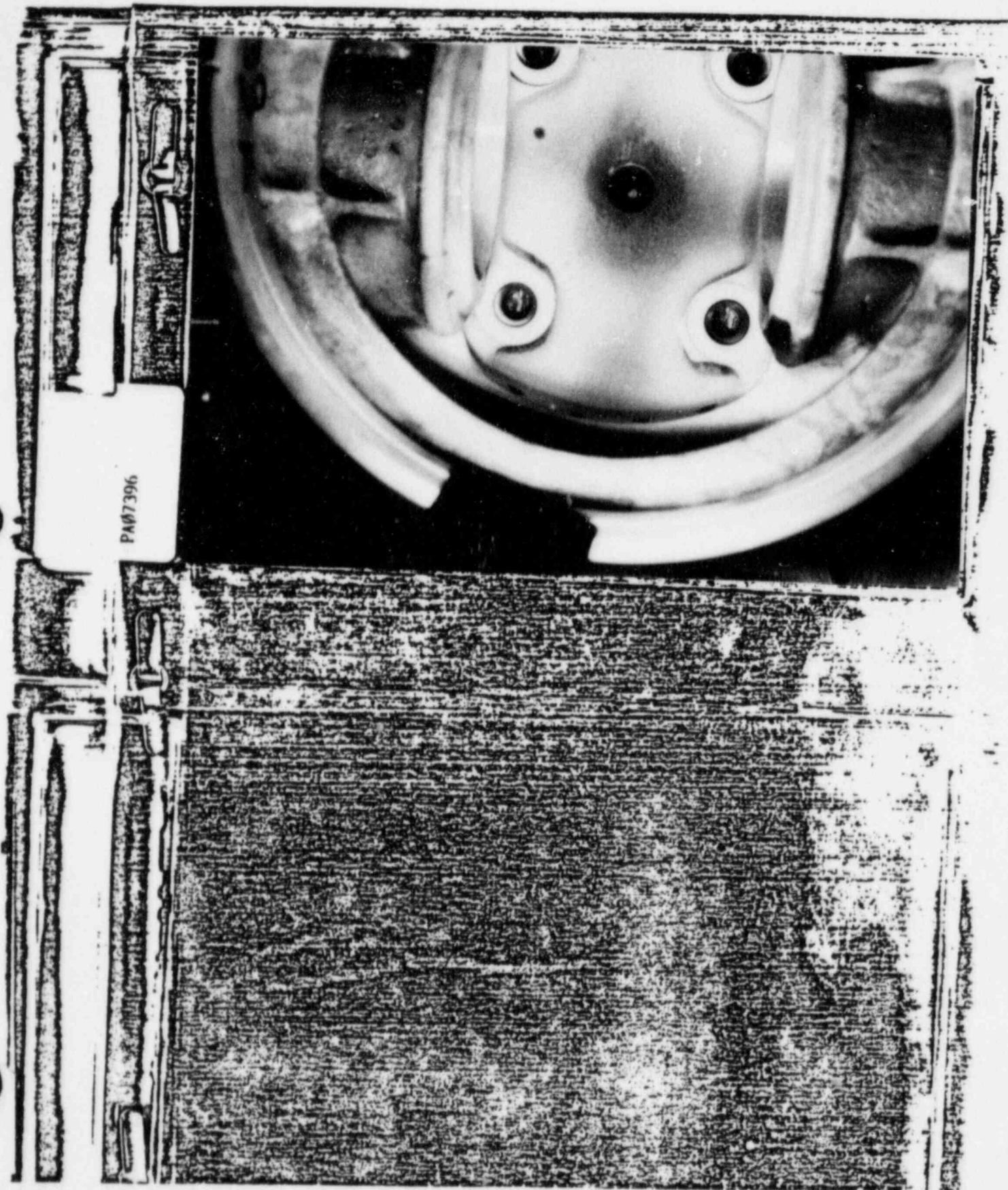
PA07706





PAW7396





11.1.10

P-29-26

Failure
Analysis
Associate:

EDDY CURRENT CALIBRATION REPORT

Job No. PAO 7396 Date 1-13-84 Report No. PAO 7396-841301
 Material Description MODULAR IRON PISTON SKIRT
 Code or Specification NOE 11.5 Full On -1.5 Full Off +3
 Reference Standard _____ Instrument M12 17 S/N B133867

Instrument
 Freq. 2 MHz Gain 15 Volts/div 0.5 Phase 218
 Test Probe 100 ECP-1 S/N 100-P-1
 Reference Probe 100 ECP S/N 100-B-2

Large CALIBRATION med
2.4 units @ -1.5 L/O 2 units @ -1.5 L/O
2.0 units @ -1 L/O 1.4 units @ +1 L/O

STRIP CHART RECORDER

Type N/A S/N N/A
 Channel 1 Channel 2
 Sen N/A Sen N/A
 Position @ Null Point N/A Position @ Null Point N/A
 Chart Speed N/A mm/sec

Calibration Check

Time	Phase	Gain
<u>2:20 PM</u>	<u>218</u>	<u>15 (NO CHANGE)</u>
<u>2:45 PM</u>	<u>218</u>	<u>15 (NO CHANGE)</u>
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain
Time	Phase	Gain

Examiner D O Johnson Level II Examiner _____ Level _____
 R&D-KR-3

COMMENTS

These two pistons were plated on the inside completely

1. Machine areas were very smooth in boss area.
2. Grinding was done very carefully on boss area.
3. Piston # C33 one of the boss areas where lip on outside show smashing like a washer hit edge. The edge was rolled over.
4. These castings look better visually in boss area. Also I could not see any cast material without coating.

C-31

Cylinder #6

C-33

Cylinder #4

John Gee

577-7000

01/10/83

PA07396

Penetrant Inspection at TDI Oakland.

- 1) Meet with Al Fleisher
- 2) Inspected 2 Pistons
- 3) Could Not Pick Up Blue Prints
- 4) Tested Pistons No Relevant Indication

Piston Temperature 11°C

Note on Crate

R5 TEST PISTON

03-341-04-AE Piston Skirt
Tested in R5-V12 for
687 hours at 302 BMEP & 514 RPM
and Stop Sequences

Heat Numbers

708 J

Piston#	C-31
	or
Piston#	C-33

Time of Penetrant was 3:00 p.m. on piston C-31, 3:10pm on piston C-33

cleaming till rag showed no oil
Drying time for cleamer after light wiping 15 minutes before penetrant applied