SC diesel #78 10-31-84

50-322 OL

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10/31/84

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April 14, 1983 NSD-83-190

Mr. A. W. Zeuthen

Trip report - Diesel Generators at Kansas
and Delaval, California

This report summarizes the findings on a dual trip to investigate the probable cause of the linear indications found in Shoreham's Diesel Blocks, and to try and determine their behavior during operation of the diesels.

The attached notes describe the activities and results thereof, during the investigative trip.

Concerning the cast iron (gray iron) blocks, the indications appear to be a result of the casting process and not the operation of the engines. This is supported by the magnetic particle tests' results performed on the cast blocks indicated in the attached notes. A possible cause for the indications may be core shrinkage during casting. Here, as the molten iron is poured in the mold, a very thin layer of metal solidifies on the surface of the core. Therefore, as the core expands under heat, the expansion causes a thin layer of solidified metal to crack. Thus, surface cracks are formed in these areas. Due to the geometry of the mold in certain areas, this core expansion phenomena seems likely.

In viewing such indications on new cast blocks at Delaval, and on a block with 50,000 hours operation (in Kansas) there seems to be no effect due to operation on these indications. Therefore, it can be concluded that such indications do not seem to be a problem during operation; thus, they should not propagate; and it did not appear as though propagation occurred on the operating engine.

Of concern to the undersigned is some of the repairs Delaval performed on the cylinder heads. Most of these repairs are outlined in the attachment, however, one of Shoreham's heads required welding of a steel piece into the valve hot-face due to an existent crack (see attachment). This repair, if not adequate, may cause severe damage to the engine, and may render the engine inoperable if this weld fails and metal falls into the valve seats (or engine block). It is recommended that LILCO require the newer design heads from Delaval, and preclude the use of any rebuilt heads. This may seem unnecessary, however, if these diesels are to operate properly under the prescribed conditions, LILCO should maintain a superior quality engine.

NUCLEAR REGULATORY COMMISSION

Docket No. 50-322 Official Exh. No. 78

In the matter of LILCO

Staff

Applicant

Intervenor ✓

Cont'g Off'r

Contractor

Other

IDENTIFIED ✓

RECEIVED ✓

REJECTED

DATE 10-31-84

Witness ✓

Recorter WKB

Kansas Municipal Power
Lincoln, Kansas

Tues 4/5 - Wed 4/6 '83

Diesel Engine identical to that at Shoreham 50,000 hours operation.

Engine:
Enterprise
Div. of Delaval Turbine, Inc. Oakland, California
No. 70036-2287; Date 12-27-70
Mod. DGSR-48; Bore & Stroke 17 x 21
(Dual fuel - gas/diesel)
H.P. 3588 @ 400 RPM
Full Load Diesel 34.5 MM
Rotation Clockwise
Fuel Advance 20° BTC
Valve Clearance; Int 0.040, Ext 0.040, Start N/A
Firing Order 1-4-7-3-8-5-2-6

Torque Valves: (ft-lbs)
Cyl. Head Nut 3000
Con. Rod Bearing Bolts & Nuts 875
Link Con Rod Cap Screw N/A
Main Bearing Bolt Nut 1200
Cam Bearing Cap Screw 120
Fuel Inj. Pump Stud Nut 80
Fuel Pump Base Cap Screw 120
Foundation Bolt Nut 1400
Nozzle Holder Retainer Nut 75 Min

Generator:
85% Load
Syn EP Generator
KVA 3187.5
KW 2550

Operating Experience:

- Two cracked heads repaired by Delaval.
- No bolting problems.
- Other - Misc. normal operating problems.
- Summer Temps 145°F @ Governor

- All instr. tubing secure & insulated from each other (pictures).
- Note only 4 support brackets (pictures).

Mag Part Insp. Results:

Inspected No.'s 8 and 9 cam shaft pillars. Found indications identical to SNPS (diagrams).

Delaval's operating test diesel engine was inspected for strain gauge placement in preparation for a test to measure the loads in the areas of concern. This engine was also examined using magnetic particle and was found to have the same indications as noted in the other engines.

A detailed trip report will be prepared by SWEC and reviewed by the LILCO trip participants.

J. J. Cirilli

J. J. Cirilli

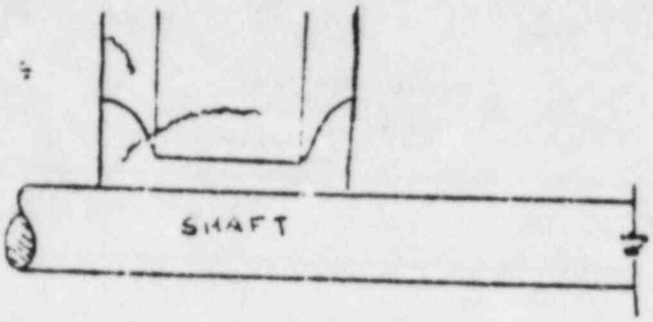
JJC/bd

Attachments

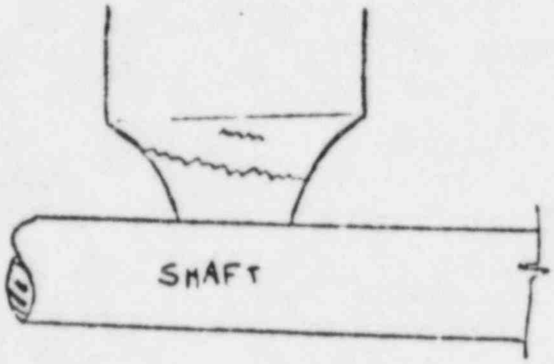
cc: Mr. R. M. Kascsak

Lincoln, Kansas - Ind. Found

No. 9



No. 8



Transamerica Delaval, Inc.
(TDI)

Thurs 4/7/83 Dick Pratt

Mag Test Five (5) Block Castings by LILCO

o Painted Blocks - 3 6 cyl.
1 8 cyl.

- All had linear indications like those found at SNPS & Lincoln, Kansas

o Unpainted Block - Crude Casting
- Similar indications as noted above.
- Mag Part by TDI, also. Same results.

o TDI Mag Part Exams all critical parts, i.e.,
cyl. heads
pistons
etc.

- Weld repair blocks only in areas of compression (cosmetic)

Ed Dobrec - Mgr. Castings

o Cast blocks head side down (SNPS method)
- better feeding of iron

o TDI feels indications due to: hot spots
shrink
geometry

o Shake-out - by weight of casting
- usually 5-7 days

o Elec. Arc Furnaces - Acid Arc

o Test bars - Cast inside core of barrel

o Weld Repairs - Ni Rod 55
- Cosmetic only
- Mechanical fix if strength req'd. (plug)

o Zircon & Graphite Cores

o Spectrograph - chemicals

Fri 4/8 Cyl. Head Repair

1) Each listed by S/N; trace to heat no. (4 heads/heat)

2) Since SNPS (1974) Design - TDI redesigned heads - better

3) When cyl. head goes to TDI for repair:

   a. Disassemble
   b. Clean
   c. Water Test Casting
   d. Die-Check Valve Seats
   e. If Wall Thin (3/4") - Weld Repair
      Grind
      Die-Check
      Fill with Mild Steel (if Die-Check O.K.)

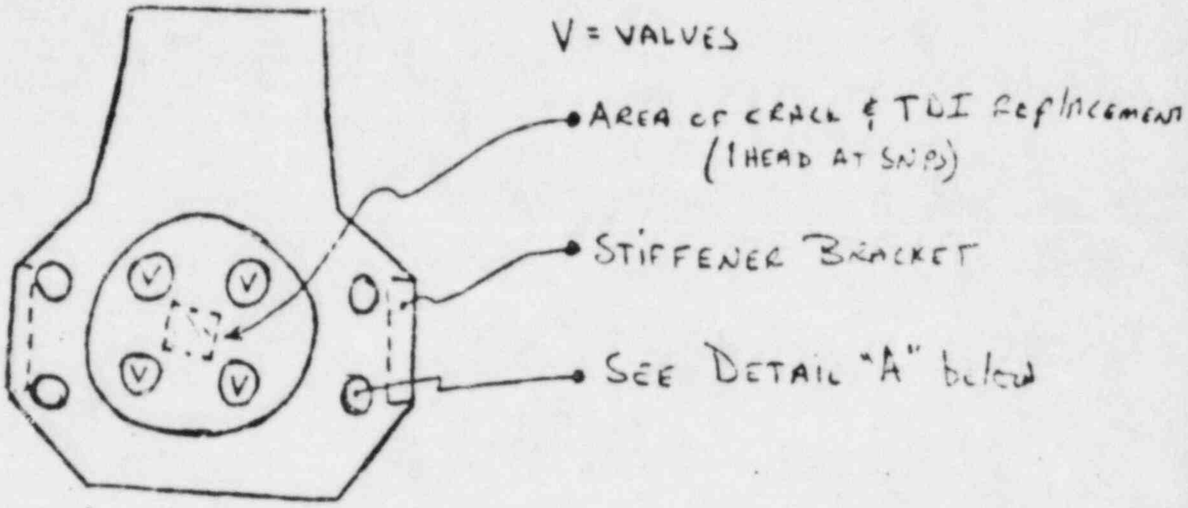
4) Reconditioning of Valve Seats

   - Machine seats to stellite depth plus 1/8".
   * - Die-Check
   - Layer of bare metal (mild steel butter pass)
   * - Mach. & Die-Check
   - Apply Stellite

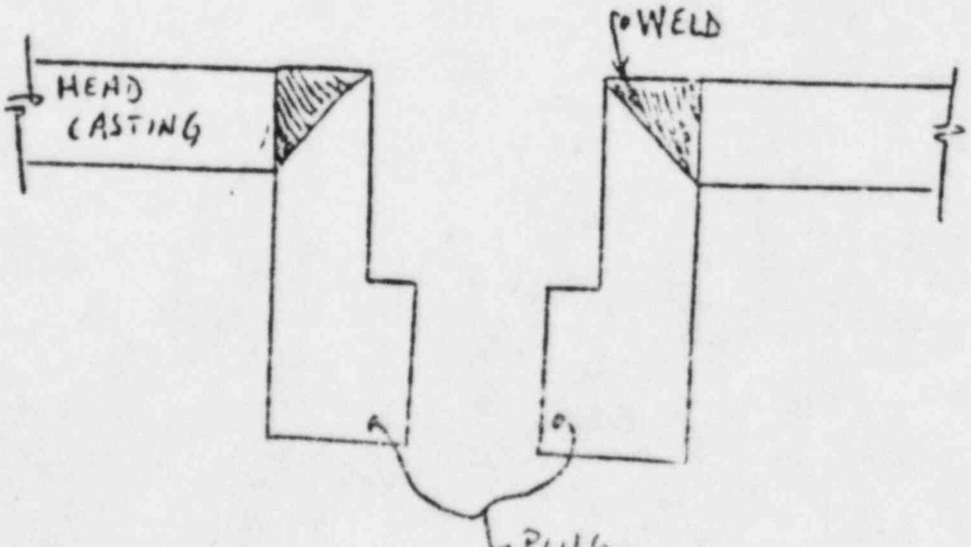
* If Die-Check unsat.; excavate weld, remachine & die-check.

5) Thin Side Wall

- Mill Side
- Weld Stiffener Bracket (Steel)
- Re-build Bolt Holes



DET "A"



6 Cyl. Test Diesel at TDI:

- o Mag No. 6 & 7 Cam Shaft Pillars
- o Mark Areas for Strain Gage Test
- o Faint Indications Seen