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FPL

FLORIDA POWER & LIGHT COMPANY

JAN 15 1986
L-86-13

Dr. J. Nelson Grace
Regional Administrator, Region II
U.S. Nuclear Regulatory Commission
Suite 2900
101 Marietta Street, N.W.
Atlanta, Georgia 30323

Dear Dr. Grace:

Re: **St. Lucie Units 1 and 2**
Docket Nos. 50-335 and 50-389
Special Report on Reactor Coolant Pump Anti-Reverse Rotation Device

As requested by NRC, the attached Special Report is being submitted.

Very truly yours,

C. O. Woody
Group Vice President
Nuclear Energy

COW/SAV:ss

Attachment

cc: Document Control Desk, USNRC, Washington, D.C.
Harold F. Reis, Esquire.

SPECIAL REPORT FOR ST. LUCIE UNITS 1 and 2
REACTOR COOLANT PUMP ANTI-REVERSE ROTATION DEVICE

EVENT SEQUENCE

On August 31,1985, St. Lucie Unit 2 was shut down and in Mode 5 for repairs to its 2A2 Reactor Coolant Pump (RCP). During the repairs it was discovered that a significant number of the Anti-Reverse Rotation Device (ARRD) pins were stuck inside their cavities in the rotating disk. (see figure - 1). An inspection of the other RCP motors revealed that two RCP's, 2A1 and 2B1, also had a significant number of stuck pins. The 2B2 RCP did not have any stuck pins.

It was decided to replace all ARRD pins during the outage. By September 4, all ARRD pins were replaced. On September 6, the repairs to the 2A2 RCP were complete and a reactor startup was commenced. Unit 2 was back on line on September 7.

At 1920 hours on September 10, 1985, Unit 2 was manually tripped due to high vibration of 2A2 RCP (see LER #389-85-9). The ARRD pins were inspected during this outage and again a significant number were stuck. The ARRD pins are rated for 40 hours of cumulative RCP run time at low speeds (<100rpm). However, these replacement pins had failed after only 3 to 6 minutes of RCP run time at low RPM. An analysis of the ARRD pins showed that the pins were made of the correct alloy and had the proper hardness. The new replacement pins were also tested and were found to be made of the correct alloy and had the proper hardness.

After a discussion with Siemen-Allis Engineering, a two part approach to solve the problem was agreed upon. The 72 new replacement pins were alternately exchanged with the existing ARRD pins. In addition, half of the pins were modified. The bottom outer edge of the ARRD pins were machined to a steeper angle (see figure - 2). It was felt that this taper would reduce the "mushrooming" of the pins.

Unit 2 was again returned to operation on September 21, 1985.

Unit 1 was shut down on October 20, 1985 for a scheduled refueling outage. The ARRD pins were inspected and similar problems were noticed on all the RCP's except for the 1B2 RCP. All of the ARRD pins in the 1B2 RCP were found to be in good condition. It is not known why the 1B2 RCP ARRD pins were not damaged like the other RCP ARRD pins. To investigate this further, the 1B2 RCP ARRD pins were divided into four groups with one group being placed in each RCP. The 1B1 RCP ARRD pins were symmetrically placed around the lower bearing ring with old pins placed in the other cavities. The Unit 1 ARRD pin tips were also similarly modified as they were for Unit 2.

Both Units are presently operating. We are planning to inspect the Unit 2 ARRD pins during the upcoming refueling outage currently scheduled for April 1986.

DISCUSSION

The ARRD consists of 36 pins housed in blind holes in the lower balance ring attached to the motor rotor. These pins are free to drop by gravity onto a stationary ratchet. Each pin has a molybdenum-disulfied impregnated tip to minimize wear to the ratchet during startup and coastdown of the RCP.

When the motor starts, the ramps of the ratchet impact with and push the pins up into the rotating disk. Between 75 to 100 RPM the centrifugal force holds the pins in position and they no longer impact with the ramps. As the motor slows below 100 RPM the pins drop and again impact with the ramps. When the motor stops, the pins engage to stop reverse rotation.

During the startup and coastdown of the motor, the molybdenum-disulfide tip absorbs the impacts between the pin and the ramps. All of the damaged ARRD pins had significant damage to, or no molybdenum-disulfide tips left. This allowed metal-to-metal contact between the ARRD pins and the ramps causing the ARRD pins to "mushroom" out. Continued impacting of the ARRD pins caused sufficient deformation such that the pins stuck in their holes.

The cause of the molybdenum-disulfide tip damage is not known. Several theories have been developed, however, Florida Power and Light Engineering is continuing to investigate the problem.

FURTHER INFORMATION

The exact cause of the pin wear is not known. A follow-up report will be generated after the Unit 2 refueling outage. If additional information becomes available, additional reports will be forwarded.

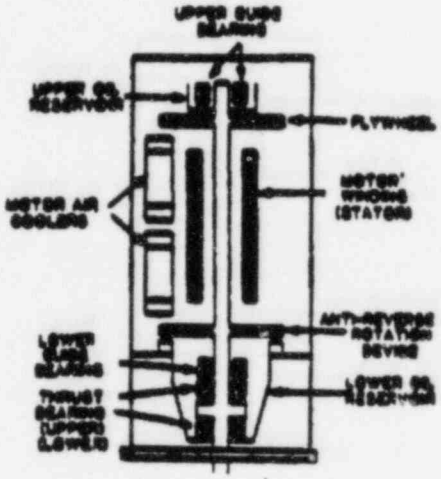
PUMP DESCRIPTION

ALLIS-CHALMERS (SIEMEN-ALLIS)

Machine Type - ANVWG

RATINGS:
Horsepower.....6500
RPM.....881
Volts.....6600
Amps.....502
Phase.....3
Cycle.....60
Service Factor.....1.15

RCP MOTOR



ANTI-REVERSE ROTATION DEVICE

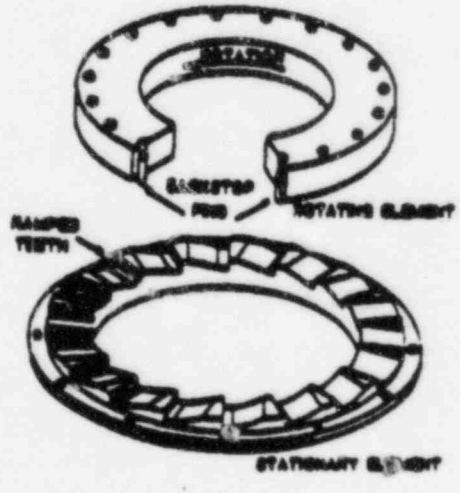


FIGURE 1

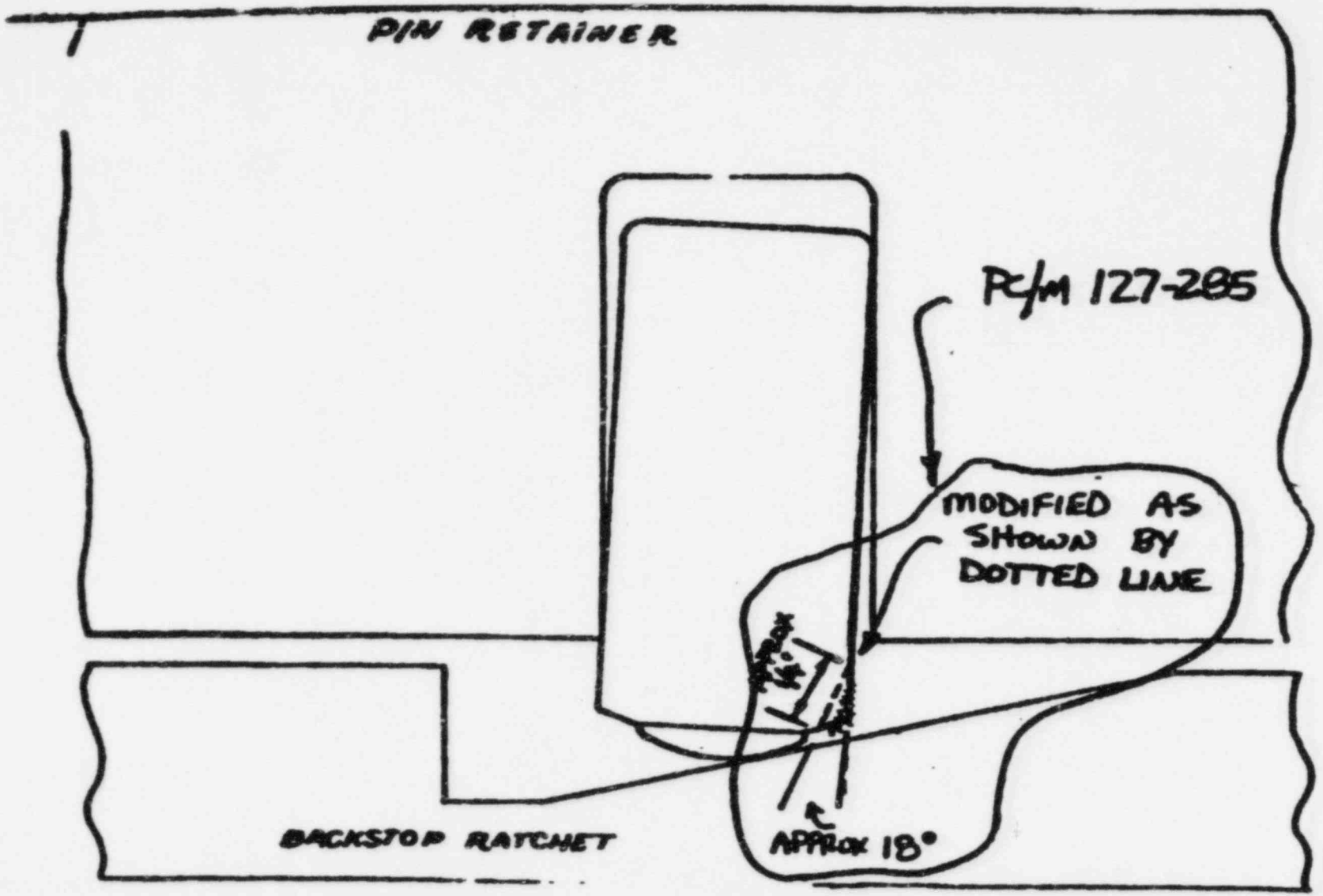

PIN RETAINER
PC/M 127-285
MODIFIED AS SHOWN BY DOTTED LINE
BACKSTOP RATCHET
APPROX 18°

FIGURE 2

FIGURE 5

CEA GUIDE TUBE SLEEVE AZIMUTHAL
EDDY CURRENT STANDARD
(16x16 SGTAZ)