REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR: 8710070692 DOC. DATE: 87/09/30 NOTARIZED: NO DOCKET #
FACIL: 50-261 H. B. Robinson Plant, Unit 2, Carolina Power & Light C 05000261
AUTH. NAME AUTHOR AFFILIATION
SAYRE, D. Carolina Power & Light Co.
MORGAN, R. E. Carolina Power & Light Co.
RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 87-023-00: on 870826 & 0908, diesel generator A automatically tripped on overspeed upon starting. Caused by relaxation of overspeed trip device weight spring due to age. Governor replaced & lubricant changed. W/870930 ltr.

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TITLE: 50.73 Licensee Event Report (LER), Incident Rpt, etc.

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	AEOD/DSP/ROAB	2	2	AEOD/DSP/TPAB	1	1
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	NRR/DEST/RSB	1	1	NRR/DEST/SGB	1	1
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	NRR/DOEA/EAB	1	1	NRR/DREP/RAB	1	1
	NRR/DREP/RPB	2	2	NRR/DRIS/SIB	1	1
	NRR/PMAS/ILRB	1	1	REG FILE 02	1	1
	RES DEPY GI	1	1	RES TELFORD, J	1	1
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EXTERNAL:	EG&G GROH, M	5	5	H ST LOBBY WARD	1	1
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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)
SHORT TERM LOSS OF AVAILABLE ONSITE EMERGENCY AC POWER DUE TO DIESEL GEN. OVERSPEED TRIPS

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
										0 5 0 0 0
0 8	2 6	8 7	8 7	— 0 2 3	— 0 0	0 9	3 0	8 7		0 5 0 0 0

OPERATING MODE (9)	N	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	X 50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
DON SAYRE, SENIOR SPECIALIST - REGULATORY COMPLIANCE	AREA CODE 8 0 3 3 8 3 - 1 2 4 2

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
F	E K	D G	F 0 1 9	Y							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On August 26, at 0145 hours, and at 2236 hours on September 8, 1987, with Unit 2 operating at 100 percent power and Diesel Generator "B" (DG-B) out of service for maintenance, Diesel Generator "A" (DG-A) automatically tripped on overspeed upon starting. A second start attempt on both dates resulted in a second automatic overspeed trip. On both occasions, daily operability testing of DG-A was being conducted as required by the Limiting Condition for Operation of Plant Technical Specification 3.7.2.d. On both occasions, DG-A was declared inoperable. The licensee, on each occasion, notified the NRC Senior Resident of the incident and notified the NRC of a Significant Event via the Emergency Notification System pursuant to 10 *CFR* 50.72(b)(2)(iii). Following the incident on August 26, DG-A was declared operational and returned to service within 2.25 hours. Following the incident on September 8, DG-B was returned to service within 5.5 hours while DG-A underwent troubleshooting to determine cause. During this period, Unit 2 entered a forced outage for unrelated repair activities. Examination of DG-A determined that a high load limiter setting coincident with a low overspeed trip point were resulting in automatic overspeed trips on starting. The governor was replaced, the load limiter setting lowered, and the overspeed trip device reworked to compensate for relaxation in the weight spring to provide a higher overspeed trip point. The fuel injection pumps were rebuilt or replaced to alleviate a minor contributing factor to the overspeed. DG-A was declared operational and returned to service and Unit 2 was returned to power at 1604 hours, September 19, 1987. The event is reportable under 10 *CFR* 50.73(a)(2)(v)(D).

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U.S.GPO:1984-0-454-481/18759

NRC Form 366A (9-83)

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

I. DESCRIPTION OF EVENT

On Wednesday, August 26, 1987, Unit 2 was operating at 100 percent power. Diesel Generator "B" (DG-B)[1] had been taken out of service the previous morning, August 25, at 0800 hours for scheduled maintenance. Plant Technical Specification 3.7.2.d provides a Limiting Condition for Operation (LCO) which allows one diesel generator to be inoperable for up to seven days if the alternate diesel generator is tested daily to ensure operability and the engineered safety features associated with this diesel generator are operable. During the required operability testing of Diesel Generator "A" (DG-A)[1] under an Operations Surveillance Test (OST) procedure, OST-401, the diesel automatically tripped on overspeed upon starting at 0145 hours. The OST was then run again, and again DG-A tripped on overspeed upon starting. The utility-licensed operator performing the OST and attempting to locally start DG-A notified the Shift Foreman of the overspeed trip condition, and DG-A was declared inoperable. The engineered safety features associated with DG-A were operable throughout the incident.

Following the two overspeed trips, DG-A was then started successfully under OST-401. A fourth start was also successful, and DG-A was declared operational and returned to service at 0400 hours, approximately 135 minutes following the initial overspeed trip. DG-B remained out-of-service for scheduled maintenance.

The licensee notified the NRC Senior Resident for the H. B. Robinson Plant by telephone at 0404 hours. The NRC was notified of a Significant Event by the licensee at 0408 hours via the Emergency Notification System (ENS) pursuant to 10 *CFR* 50.72(b)(2)(iii).

At 0501 hours, OST-401 was again performed and DG-A again started successfully. The diesel generator was brought to full load (2500 kW continuous rating) and operated satisfactorily.

Later in the day on August 26, DG-B was returned to service, and DG-A was removed from service under Plant Technical Specification 3.7.2.d to allow for troubleshooting of the cause of the overspeed trips. Inspection by Plant Maintenance personnel found a single fuel injection pump[2] on the number 4 cylinder that appeared to be "sticking" open, i.e., slow in returning to the normal position for an engine speed of 900 revolutions per minute (rpm) during the engine start cycle. The pump was removed and replaced with a pump from Plant stock. Since none of the other 23 fuel injection pumps on DG-A or the 24 fuel injection pumps on DG-B exhibited characteristics similar to those found on the suspect pump, the condition was considered to be intermittent and isolated to the one pump.

DG-A was tested operable under OST-401 and returned to service at 0130 hours, Friday, August 28.

[1]EIIS Codes: System - EK; Component - DG; Manufacturer - F019
[2]EIIS Codes: System - EK; Component - P; Manufacturer - F019

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Unit 2 remained at 100 percent power throughout the event.

DG-A was tested under OST-401 on September 1 and 7, 1987, and performed satisfactorily.

On Tuesday, September 8, 1987, with Unit 2 operating at 100 percent power and DG-B out of service for scheduled maintenance since 0545 hours under Plant Technical Specification 3.7.2.d, DG-A automatically tripped on overspeed upon starting at 2236 hours during the required operability testing under OST-401. A second local start also resulted in an automatic overspeed trip, and DG-A was declared inoperable pending resolution of the overspeed trip condition. DG-B was returned to service at 0406 hours the following morning, Wednesday, September 9, approximately 270 minutes following the initial overspeed trip of DG-A on September 8. The engineered safety features associated with DG-A were operable throughout the incident.

Inspection by Plant Maintenance personnel found two fuel injection pumps which appeared to be sticking open: one on the number 5 cylinder and one on the number 9 cylinder. Both were replaced with pumps from Plant stock.

Unit 2 remained at 100 percent power throughout the event.

The licensee notified the NRC Senior Resident for the H. B. Robinson Plant by telephone at 2350 hours. The NRC was notified of a Significant Event by the licensee at 0219 hours, September 9, via the ENS pursuant to 10 *CFR* 50.72(b)(2)(iii).

The LCO allowed DG-A to remain inoperable for up to seven days if DG-B was tested daily to ensure operability and the engineered safety features associated with DG-B were operable. On Thursday, September 10, however, Unit 2 was taken into a forced outage to repair a leak on the main generator hydrogen coolers, and the Plant was taken off-line at 2015 hours that evening. This forced outage was also to include resolution of the overspeed trip problems of DG-A.

During the forced outage, troubleshooting into the cause of the overspeed trips of DG-A was performed by Plant Maintenance personnel as well as the diesel manufacturer's technical representative, a diesel engineering consultant, and the diesel governor manufacturer's technical representative under contract to Carolina Power & Light Company (CP&L). The investigation considered the sticking fuel injection pumps and determined this condition could have aggravated the situation but was a minor contributing factor in causing the engine to reach the overspeed trip point. The diesel governor[3] and associated components were also examined. It was determined that the governor load limiter setting should be lowered to decrease the engine "overshoot" speed during starting, i.e., the injection pumps maximum fuel rate to achieve and maintain 2750 kW (110 percent of continuous rating). In addition, results of testing showed that the overspeed trip point was low: the weight spring of the overspeed

[3]EIIS Codes: System - EK; Component - 65; Manufacturer - W290

governor[4] (hereinafter referred to as the overspeed trip device) had apparently relaxed with age; also, the shim washers used in the device to adjust the trip point were burred along the edges as a result of original fabrication. The relaxation of the spring may have caused the overspeed trip point to drift downward while the burred edges on the shim washers may have caused an intermittent variation to occur in the shimpack thickness, resulting in a large trip point variation. These two conditions, combined, apparently created a low overspeed trip point.

Testing was performed to establish the necessary overspeed trip point and maximum diesel engine speed overshoot on starting. The testing revealed an overspeed trip point below the diesel manufacturer's recommended range of 990 to 1053 (optimum setting of 1020 rpm). The shim washers were reworked to remove the burred edges and additional shim thickness was installed, consistent with the manufacturer's recommendations. The governor load limiter setting was then investigated. A setting of 9.0 had been used on both diesels based on load data (governor load indicator vs kW) taken on DG-B. This load limiter setting was conservative for DG-A from the standpoint of load capacity but resulted in a higher engine speed overshoot on starting due to efficiency differences between the two engines. Although DG-A was capable of carrying greater than 2750 kW, the load limiter setting created an initial throttle setting which resulted in excessive speed overshoot on starting. The setting was then lowered to decrease maximum engine speed on starting and to increase the margin to the overspeed trip point.

Following the troubleshooting, testing, and repair and replacement activities, DG-A was determined operable under OST-401 prior to completion of the forced outage. Unit 2 was returned to power operation at 1604 hours, Saturday, September 19, 1987.

II. CAUSE OF EVENT

The automatic overspeed trips of DG-A on August 26 and September 8 were apparently caused by a relaxation of the overspeed trip device weight spring due to age and a high load limiter setting on the diesel governor. The normal variation in both the maximum rpm on starting and the overspeed trip point resulted in occasional, intermittent automatic overspeed trips. The sticking fuel injection pumps were a minor contributing factor to the situation and only slightly increased the maximum engine rpm on starting.

[4]EIIS Codes: System - EK; Component - 65; Manufacturer - F019

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Following installation of new or rebuilt fuel injection pumps and installation of a new governor with a load limit setting of 9.0, DG-A continued to trip on overspeed during starting. The engine, however, was operating more efficiently. The governor load limiter setting for 2750 kW (110 percent of continuous rating) was investigated and the limiter was reset from 9.0 to 8.1. Engine starts were then attempted while monitoring speed with an automatic trace-type tachometer which produced a tracing of rpm vs time. The overspeed trip setpoint was found to be low. The diesel manufacturer was contacted and recommended a setpoint between 990 and 1053 rpm, with an optimum of 1020 rpm. The manufacturer also suggested that the problem might be a relaxation of the overspeed trip device weight spring due to age.

The overspeed trip device setpoint was raised to about 1020 rpm, and the engine was restarted four times in sequence with overspeed trips occurring around 1018 rpm, +/- 10 rpm. An attempt was made to optimize the governor's sensitivity by changing oil from the existing SAE 30 to a lower viscosity synthetic lubricant (Mobil 1) to improve the governor's response. This lowered the overshoot speed and was considered an acceptable action by the governor manufacturer.

Similar testing of DG-B was also performed. The overspeed trips occurred between 1003 and 1006 rpm for a range of 3 rpm. Although the range for DG-A was acceptable for operability, it was decided to investigate the overspeed trip problem further by disassembling the existing device for additional inspection and examination and replacing the overspeed trip device if warranted. Installation of the replacement device was scheduled within the following 24 hours and prior to returning the Plant to power operation.

The original variation for the DG-A overspeed trip setpoint was discovered to be in error: rpm readings, taken and evaluated during the testing in a high noise, high activity location, when reviewed, were actually closer in rpm, resulting in a narrower range of readings. To confirm the validity of the revised trip points, four additional overspeed tests were performed, resulting in a total of seven successive trips between 1007 and 1015, for a range of 8 rpm. Based on this testing, it was determined that the overspeed trip point for DG-A was satisfactory and compared favorably with that of DG-B.

V. ADDITIONAL INFORMATION

A. FAILED COMPONENT IDENTIFICATION

DG-A - Manufactured by the Fairbanks-Morse Engine Division of Colt Industries, a 12 cylinder opposed piston turbocharged diesel engine and a 2500 kW 480 volt AC generator, Model 38TD8-1/8.

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III. ANALYSIS OF EVENTS

The events of August 26 and September 8, 1987, are reportable under 10 ¥≤0 50.73(a)(2)(v)(D) since the onsite emergency AC power supply was unavailable for a short time on two occasions. At no time, however, did the Plant require emergency AC power from either DG-A or DG-B: the main Unit generator, through the auxiliary transformer, and offsite power, through the startup transformer, were in normal lineup and provided sufficient power for all systems required for safe Plant Shutdown or emergency response. In addition, the dedicated shutdown diesel was operational and available to supply power to the engineered safety features required to achieve a safe, stable Plant hot shutdown. Also, the steam driven Auxiliary Feedwater pump was operational and available for feeding the steam generators.

The basis for Plant Technical Specification 3.7.2.d is that two diesel generators have sufficient capacity to start and run at design load all of the engineered safety features equipment. The safety features operated from one diesel generator can adequately respond to any design basis event.

Plant Technical Specification 3.0 requires that, if an LCO cannot be satisfied because of circumstances in excess of those addressed in the specification, the Unit shall be placed in hot shutdown within eight hours and in cold shutdown within the next 30 hours unless corrective measures are taken that permit operation under the permissible LCO statement for the specified time interval as measured from initial discovery or until the reactor is placed in a condition in which the specification is not applicable. Since at least one diesel generator was declared operable within eight hours following each overspeed trip, the Unit was not taken to hot shutdown.

IV. CORRECTIVE ACTIONS

The DG-A governor was replaced and its lubricant changed to one of lower viscosity to improve responsiveness. The governor compensation was adjusted for more responsive control of the engine during starting.

The DG-A overspeed trip device shim washers were reworked to remove the burred edges and additional shims were installed to compensate for the spring relaxation.

The DG-A overspeed trip setpoint was raised nearer to the optimum setpoint recommended by the diesel manufacturer.

The governor load limiter setting was lowered from 9.0 to 8.1 to further restrict the stroke position of the injection pumps during starting of the engine.

OST-401 was revised by a temporary procedure change effective September 15 to reflect the new load limiter setting for the DG-A governor with a permanent revision to the procedure due October 6, 1987.

The 24 fuel injection pumps on DG-A were rebuilt or replaced although the sticking pump conditions were only a minor contributing factor to the automatic overspeed trips.

The main generator hydrogen cooler leaks mentioned in this report were not related to the event.

For information purposes, the following component identification is provided.

1. Governor - Manufactured by the Woodward Governor Company for the Fairbanks-Morse Engine Division of Colt Industries, Model UG-8.

2. Overspeed trip device (overspeed governor) - Manufactured by the Fairbanks-Morse Engine Division of Colt Industries, no model number available.

3. Fuel injection pumps - Manufactured by the Fairbanks-Morse Engine Division of Colt Industries, no model number available.

Included in this LER are the following information drawings to familiarize the reader with typical diesel engine components as related to this event:

- Cross section of a diesel engine (typical)
- Fuel control linkage (typical)
- Schematic diagram of a UG dial governor (typical)
- UG8 dial governor (typical)
- Outline drawing of a UG dial governor (typical)
- Overspeed governor - non-reversible engines (typical)
- Injection pump (typical)
- Oil diesel fuel injection pump (typical)

B. PREVIOUS SIMILAR EVENTS

There are no known prior LERs similar to this event.

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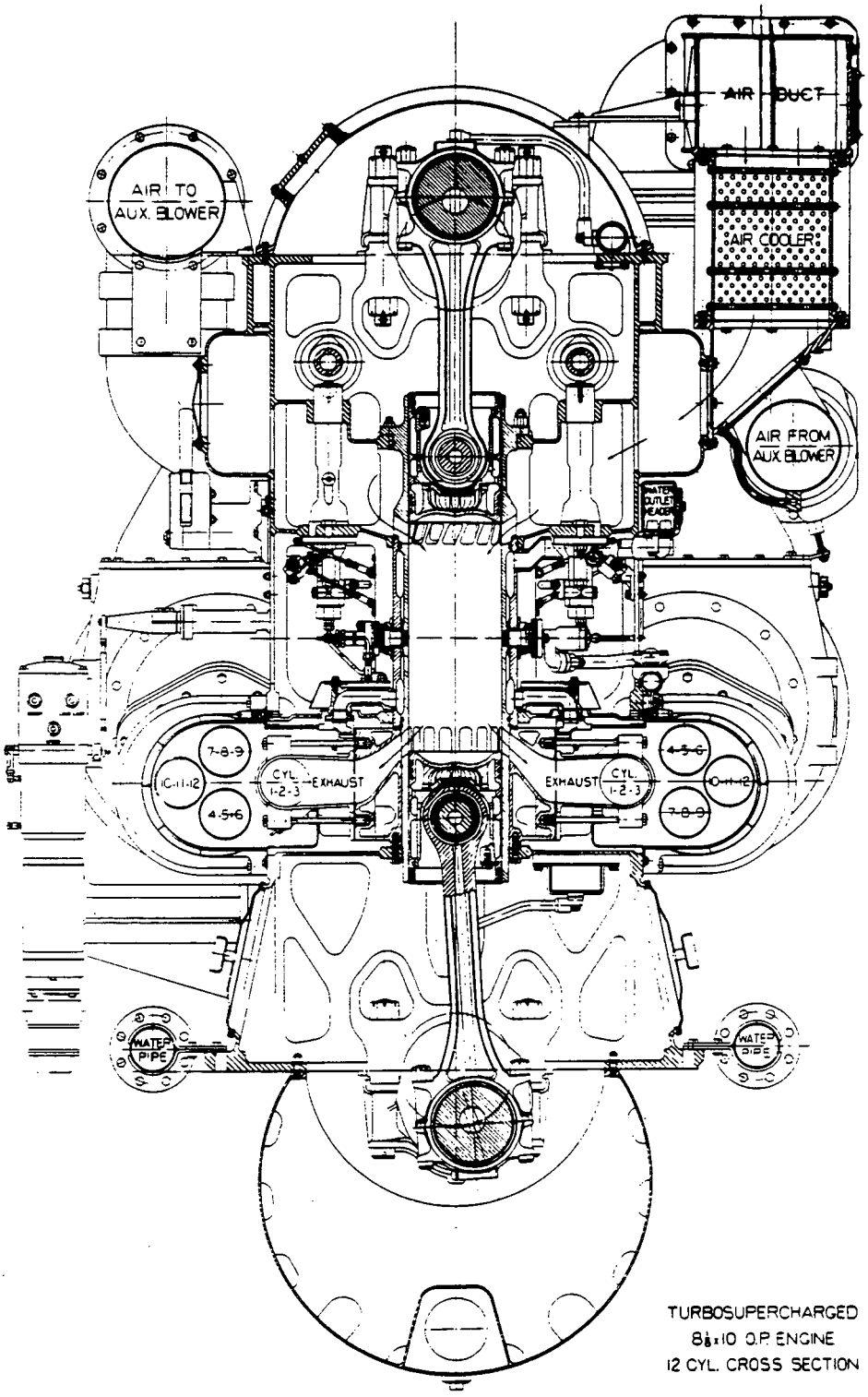

TURBOSUPERCHARGED
8½×10 O.P. ENGINE
12 CYL. CROSS SECTION

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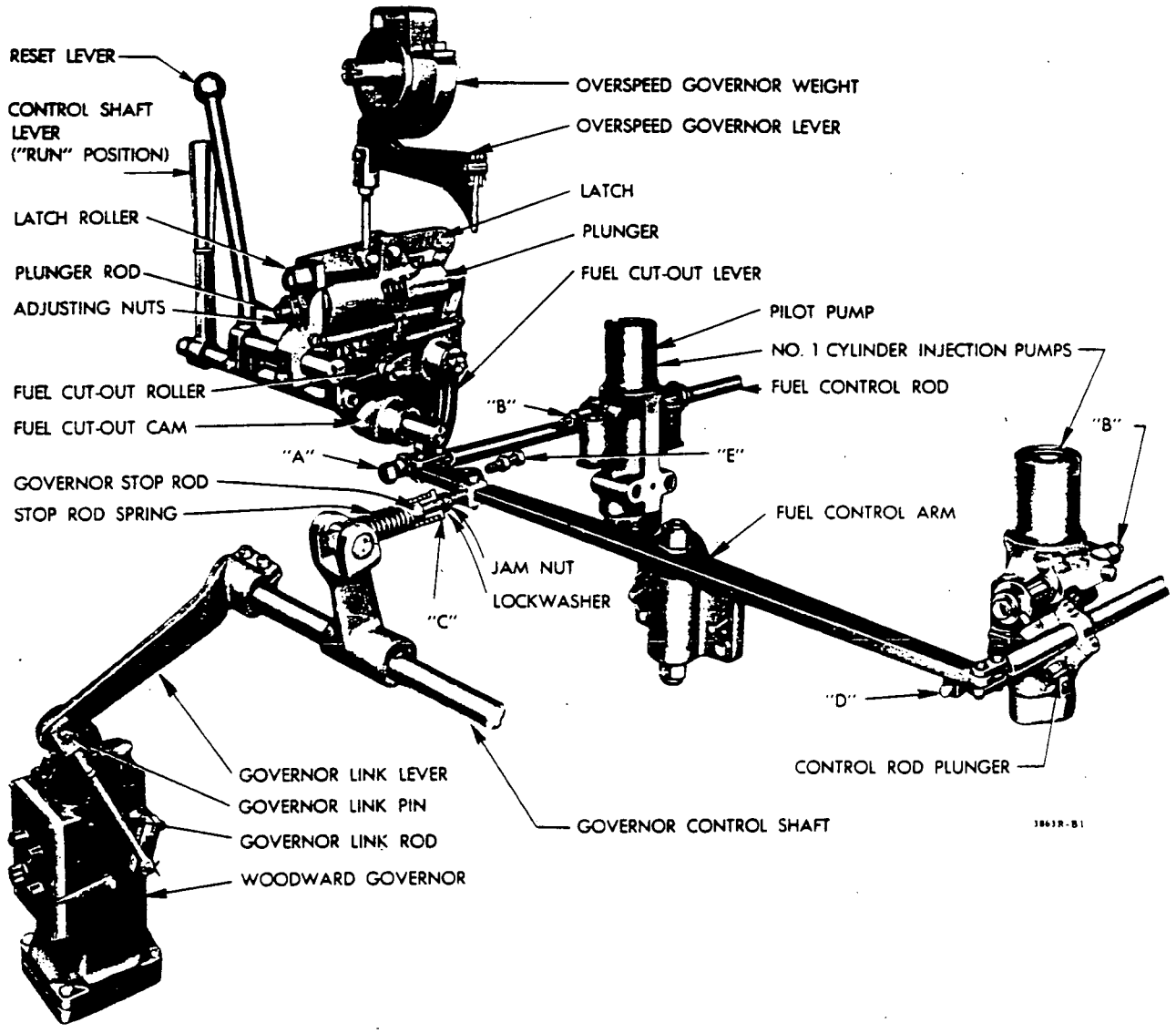

Fuel Control Linkage

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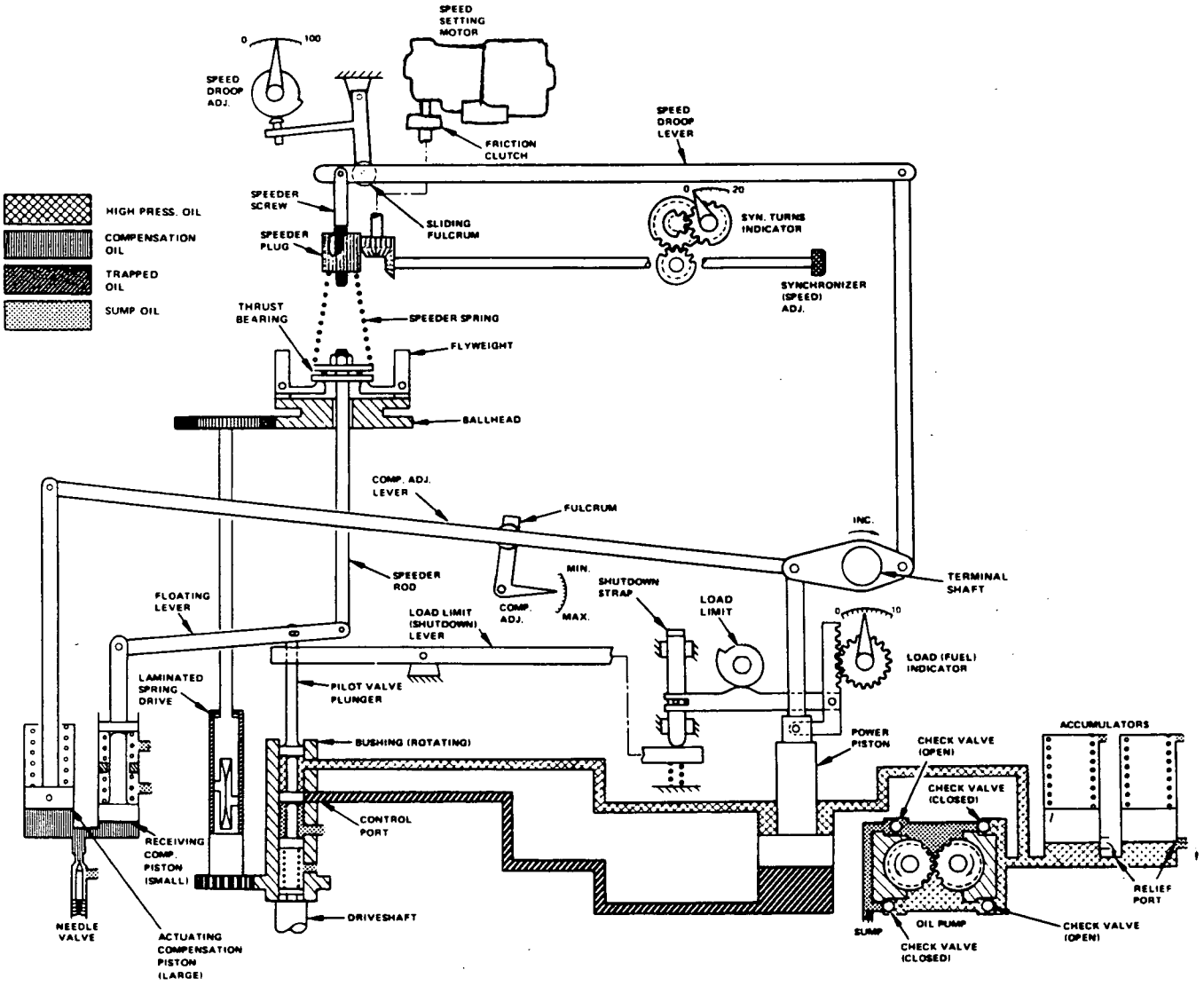

Schematic Diagram of the UG Dial Governor.

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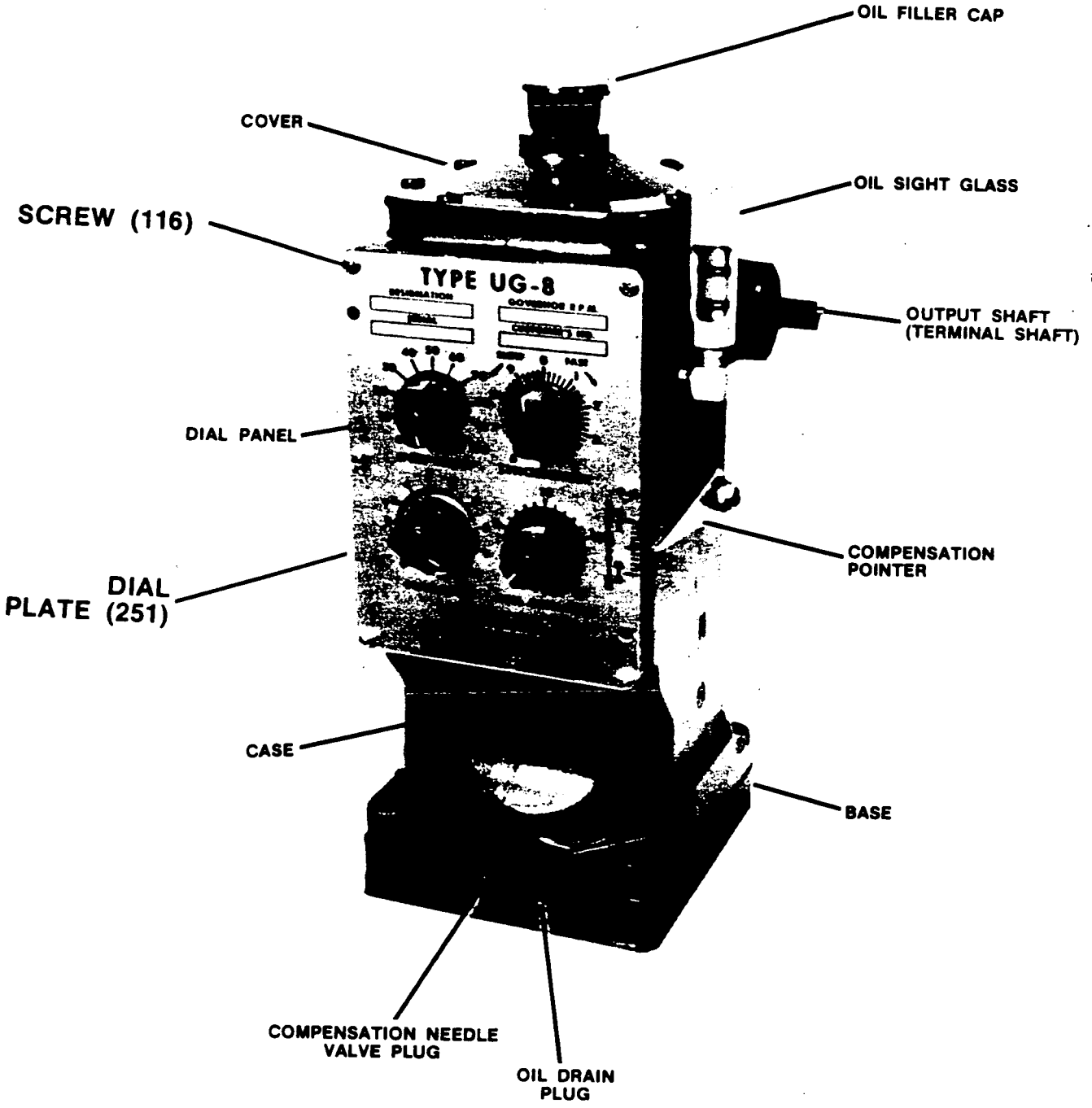

UG8 Dial Governor

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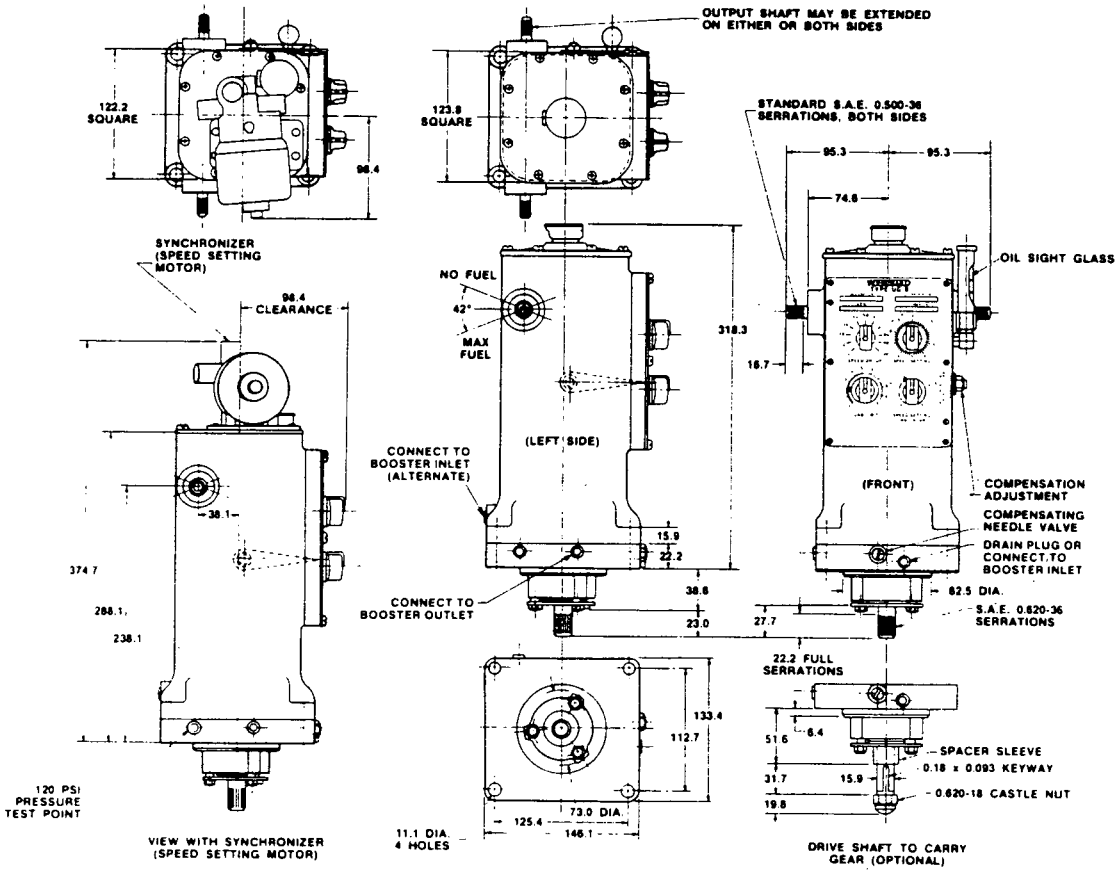

Outline Drawing of UG Dial Governor.

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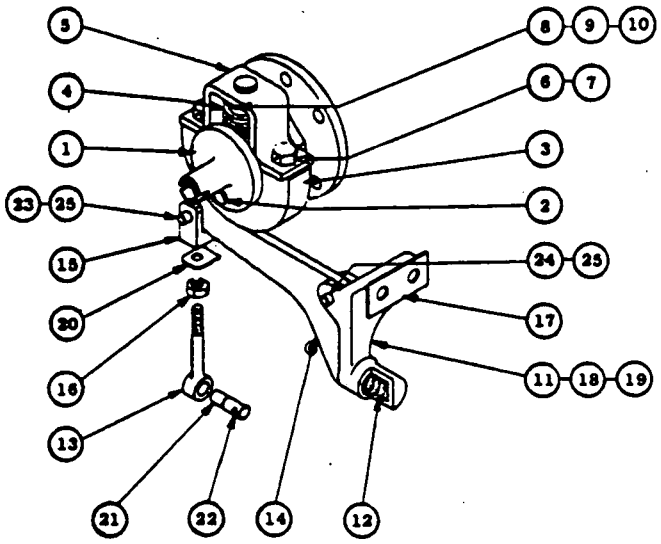

Overspeed Governor - Non-Reversible Engines

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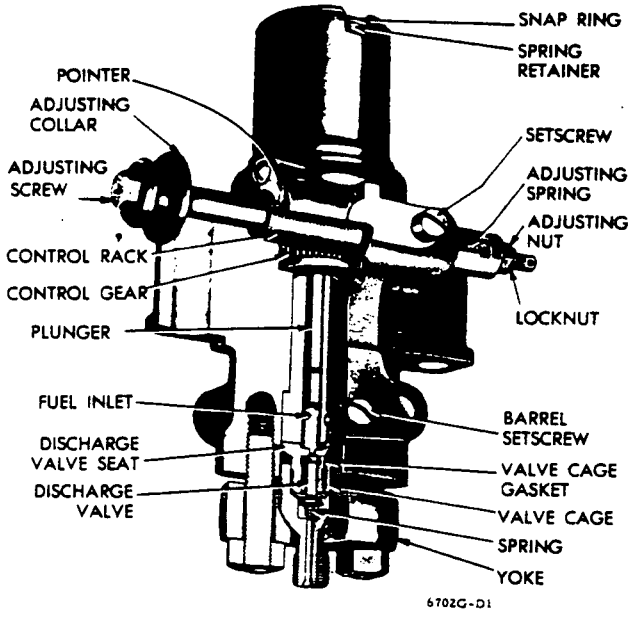
FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
H. B. ROBINSON S. E. PLANT, UNIT 2	0 5 0 0 0 2 6 1	8 7	— 0 2 3	— 0 0	1 4 OF 1 5

TEXT (If more space is required, use additional NRC Form 366A's) (17)



Injection Pump

NRC Form 366A (9-83)

LICENSEE EVENT REPORT (LER) TEXT CONTINUATION

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO 3150-0104
EXPIRES 8/31/85

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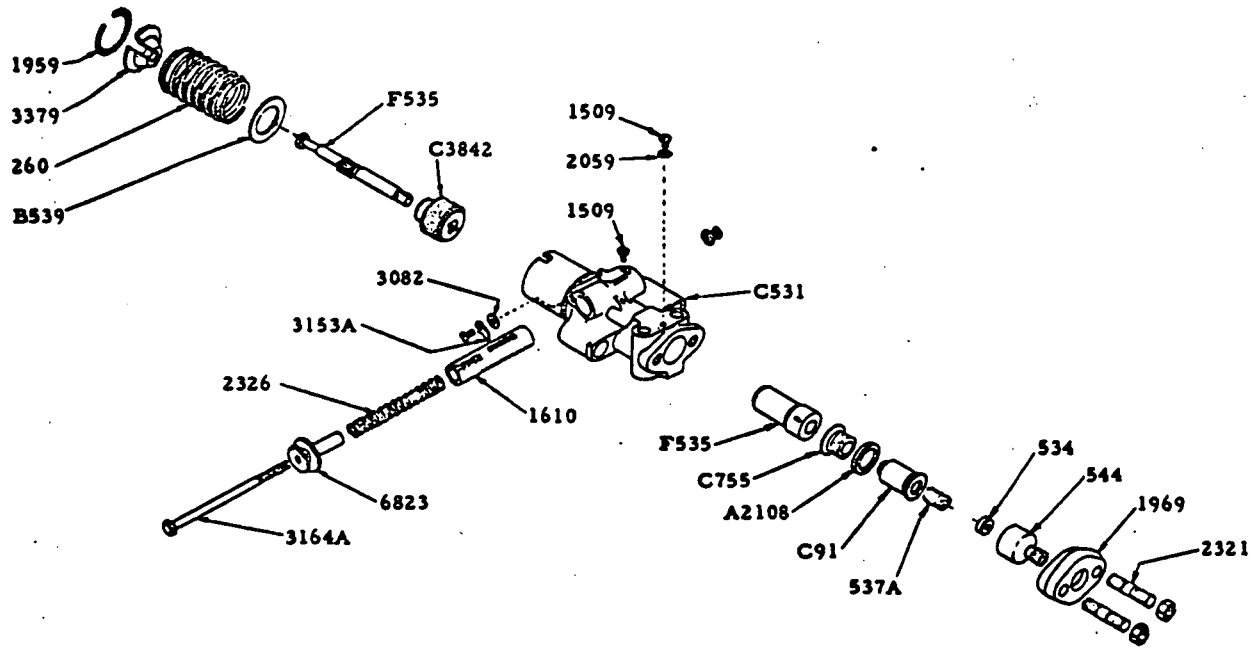

Oil Diesel Fuel Injection Pump

CP&L
Carolina Power & Light Company

ROBINSON NUCLEAR PROJECT DEPARTMENT
POST OFFICE BOX 790
HARTSVILLE, SOUTH CAROLINA 29550

SEP 30 1987

Robinson File No: 13510C

Serial: RNPD/87-4794
(10 CFR 50.73)

United States Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
LICENSEE EVENT REPORT 87-023

Gentlemen:

The enclosed Licensee Event Report (LER) is submitted in accordance with the Licensee Event Report System of 10 CFR 50.73. The format of the LER follows the recommendations of NUREG-1022 and Supplements No. 1 and 2.

This submittal is five days later than required by 10CFR50.73(d), as agreed to by Mr. Paul Fredrickson, NRC Region II Section Chief, Division of Reactor Projects, in a September 15, 1987, telephone conversation with the author of this LER. The extension period is in accordance with Supplement No. 1 of NUREG-1022.

Very truly yours,

R. E. Morgan
General Manager
H. B. Robinson S. E. Plant

DAS:sdm

Enclosure

cc: J. N. Grace
H. E. P. Krug
INPO

IE22
1/1