LOUISIANA POWER & LIGHT / 142 DELARONDE STREET
P. O. BOX 6008 • NEW ORLEANS, LOUISIANA 70174 • (504) 366-2345
MIDDLE SOUTH UTILITIES SYSTEM

December 23, 1983

W3P83-4180
3-A1.01.04
3-A1.10
Q-3-N21

Director of Nuclear Reactor Regulation
Attention: Mr. G. W. Knighton, Chief
Licensing Branch Number 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: Waterford SES Unit Number 3
Docket Number 50-382
Emergency Feedwater (EFW) Control System

Dear Sir:

On November 15, 1983 a meeting was held in Bethesda to discuss various questions pertaining to the EFW Control System at Waterford 3. During this meeting several questions were raised which required additional information be submitted. Subsequent to the Bethesda meeting, LP&L received your letter dated November 18, 1983 requesting that this information be submitted by not later than December 23, 1983. Further, a follow-up telecon with Mr. R. Stevens, NRC-ICSB, clarified and quantified the specific information which was required. A synopsis of the action items follows:

(1) Provide a more detailed description in the FSAR of both automatic and manual EFAS operation/logic;

(2) Describe the failure of a single control valve, its effect on overall EFW system operation in specific postulated scenarios and the acceptability of this event;

(3) Redesign, as appropriate, the EFW control system to overcome the postulated single failure of a level transmitter which defeats automatic initiation of EFW flow;

(4) Provide documentation or information to verify that the NLP isolation card (NLP2 on 5817-7074) is class 1E qualified;

(5) Provide further justification and information on the Priority Open and Priority Close signals' override of manual control;

(6) Evaluate the possibility of a D.C. power supply overcurrent event causing all valves on that power train to freeze;

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(7) Clarify statements on valve opening/closure due to EFAS failure on Priority Open or Priority Close.

Each of these items are addressed separately in the following paragraphs and/or attachments.

Item (1) involves amending the FSAR to clarify EFAS operation and/or logic. Attachment One indicates those FSAR revisions which have been proposed to address this item. These revisions will be included in Amendment 34 to the Waterford 3 SES FSAR.

Item (2) refers to the failure of a single control valve. This event will result in the operator(s) being unable to cease EFW flow to an intact steam generator while EFAS is actuated. Such an event can indeed occur under certain postulated failures. However, LP&L considers this to be an acceptable fail-safe condition. Furthermore, this failure does not defeat the ability to automatically isolate this steam generator on a Priority Closed signal. There is no postulated event in which feeding a steam generator while EFAS is actuated causes a less safe condition than not feeding that same steam generator.

Item (3) requires that LP&L evaluate and overcome the postulated event where the single failure of a steam generator level transmitter can inhibit the automatic initiation of EFW flow to an intact steam generator. This event is possible because both "A" channel valves or both "B" channel valves are controlled by a single "A" or "B" level transmitter for a particular steam generator. This postulated event can be overcome by removing the level contacts to the shut-off valves of both "A" and "B" trains for each steam generator at the PAC panels. This results in these shut-off valves being opened by an EFAS signal rather than simply being released to the control of the level transmitter. Since there is no longer a contact between a particular level transmitter and its associated shut-off valve, the failure of any one level transmitter can at most disable only one control valve. Therefore, under this configuration, the failure of a single level transmitter will no longer inhibit either automatic or manual initiation of EFW flow. This configuration is shown in detail for Channel "A" of Steam Generator No. 1 by Attachment Two.

Item (4), qualification of the NLP isolation card was addressed by our qualification report WCAP-8892-A submitted on January 15, 1977 and accepted via NRC letter from R. L. Tedesco to C. Eicheldinger dated April, 1977.

Item (5) requires further discussion on the Priority Open and Priority Close signals associated with the EFW control scheme. A detailed description of all operating modes of the Priority Open and Priority Close contacts for any particular valve along with a description of all postulated possible failures is included in Attachment Three. It is LP&L's position, as supported by Attachment Three, that the Priority Open and Priority Close signals enhance the safety and operability of the EFW System.

Item (6) requests that LP&L evaluate the effect of an overcurrent condition on the D.C. power trains which operate the EFW valves. The results of this evaluation indicate that a failure of the D.C. power supply to a channel will fail that channel, but will neither block nor establish EFW flow. Protective devices are provided to guard against such an overcurrent condition. Should an overcurrent occur, these protective devices will cause failure of that power train which will in turn cause both valves operated by this train to fail open. Under this condition control is still maintained by the redundant channel. Furthermore, there is no postulated single failure of the D.C. power supply which causes both channels of EFW to fail; either to actuate or to fail to actuate. These conclusions are supported by FSAR Figures 8.1-7 and 8.1-8 as shown in Attachment Four.

Item (7) requests clarification of certain statements made in our May 13, 1983 letter pertaining to EFAS failures associated with Priority Open and Priority Close. The particular statements made were: "Failure of EFAS will not result in valve opening" for Priority Open and "Failure of EFAS will not result in valve closure" for Priority Close. Our May 13, 1983 letter defined the scope of the term "EFAS" to include only the PPS cabinet, in which case these statements are accurate. Expanding this scope to include the contacts to the valves will result in these statements being reworded as follows: "A failure within EFAS may cause a valve to open or remain opened, but will not result in defeating the EFW control system" for Priority Open and "A failure with EFAS may cause a valve to close or remain closed but will not inhibit EFW flow" for Priority Close. These statements are clarified by Attachment Three and our response to Item (5).

The information contained herein and supported by the attachments to this letter should adequately address the concerns raised previously. If there are any questions, please do not hesitate to call.

Sincerely yours,

K. W. Cook
Nuclear Support and Licensing Manager

KWC/RAS/cb
Attachments: (1) Revised FSAR pages
(2) LOU-1564-B424 sheet 1564S, Revised
(3) Contact States for PO and PC actuation of the EFW control valves
(4) FSAR Figures 8.1-7 and 8.1-8

cc: W. M. Stevenson, E. Blake, J. Wilson (NRC), R. Stevens (NRC),
L. Constable (NRC Sr. Resident Inspector)

ATTACHMENT ONE

REVISED FSAR

PAGES 7.3-19a
7.3-20
7.3-20a
7.3-20b
7.3-20c

FIGURES 7.3-8
7.3-10

The EFAS performs the following functions:

a) Starts the emergency feedwater pumps;

b) Opens the emergency feedwater shutoff valves to the steam generators. 32

The control valves respond to the automatic signals as described in subsection 7.3.1.1.6.2.

32

Manual control switches for the emergency feedwater pumps and emergency feedwater valves are provided in the main control room.

Automatic emergency feedwater actuation is initiated at the setpoints listed in Table 7.3-2.

The safety-related display instrumentation for the EFS, which provides the operator with sufficient information to monitor and perform the required safety functions, is described in Section 7.5.

Instrumentation location layout drawings showing the location of the steam generator pressure and level sensors which actuate the emergency feedwater system are discussed in Subsection 7.3.1.3. The actuated equipment is listed in Table 7.3-10.

The emergency feedwater control valves may be operated by operator manually or may be left in automatic mode of control.

In automatic mode, the control valves are positioned by the signals derived from the emergency feedwater flow and steam generator wide range level measurement instrumentation loops.

19

The control logic for one steam generator is outlined below, the control logic for the other steam generator being identical.

Figure 7.3-12 identifies the valves, flow meters, and the level setpoints in the steam generator.

7.3.1.1.6.2 Automatic Control

The following is a description of the automatic EFW Control System operation on regulating the flow of EFW to the steam generators so as to minimize adverse effects on the Reactor Coolant System. 32

1. Emergency Feedwater Actuation is Reset

   Plant being in normal operation, the administrative procedures will call for the emergency feedwater shut-off valves to be in closed position and the control valves to be in automatic mode.

   The automatic mode will drive the control valves into a fully closed position due to a relative high water level that is normally maintained in the steam generators. 19

   The emergency feedwater pumps are off.

2. Emergency Feedwater Actuation Signal is Generated by ESFAS

   The shut-off valves are opened, and the modulating control valves remain in the the fully closed position.

   However, the ~~shut-off and~~ modulating control valves are available for the ~~to~~ operator's manual control.

The shutoff valves are not available for the operator's manual control unless EFAS is reset.

The emergency feedwater pumps are started. 25

3. Steam Generator Level Falls to the "Critical Level"

The shut-off valves ~~open fully.~~ remain fully open.

Control valve "B" opens to a fixed predetermined position equivalent to 200 gpm flow of emergency feedwater to the steam generator.

Flow meter FA inputs to a flow controller demanding 175 gpm. Control valve "A" moves to satisfy that demand. If the positioning of control valve "B" fails to produce at least 175 gpm, control valve "A" will be automatically controlled to satisfy the controller demand. The modulating control valves are available for the operator's manual control.

4. Steam Generator Level Falls to "Lo Level"

The shut-off valves remain fully open.

Control valve "B" remains in a fixed predetermined position equivalent to 200 gpm flow of emergency feedwater to the steam generator.

The flow controller set point increases to 400 gpm. Flow meter FA measures the flow and the controller automatically controls valve "A" to maintain 400 gpm.

The logic operates a "Steam Generator Emergency Level Lo" alarm in the main control room.
The modulating control valves are available for the operator's manual control.

5. Steam Generator Falls to the "Lo-Lo Level" 19

The shut-off valves remain fully open.

The control valves "A" and "B" are driven to the fully open position. (Priority open - see subsection 7.3.1.1.6.4).

6. Steam Generator Level Trend Reverses

When the steam generator level begins to rise above any of the three levels identified in 3, 4 and 5 above, all valves and controllers remain in the status set by the lowest level reached.

7. Steam Generator Level Rises to Level "X" (Automatic Mode)

The shutoff valves remain fully open.

Control valve "A" transfers from flow control to level control with Level "Y" as the setpoint.

Control valve "B" is transferred from the fixed position to level control with level "X" as the setpoint.

The valves will remain in the level control mode unless the steam generator level falls to the Critical Level, in this case the Control reference will return to step No. 2.

7.3.1.1.6.3 Isolation of a Ruptured Steam Generator

In the case of a MSLB, inside containment (either as the initiating event or after EFW actuation) it becomes necessary to isolate the ruptured steam generator. The detection and isolation of the ruptured steam generator is performed by an interface between EFAS and MSIS.

The EFAS-MSIS interface as shown on Figure 7.3-13 is implemented in the Plant Protection System (PPS) Cabinet and at the actuated components (i.e., valves). Only the PPS interface is discussed herein with respect to single failure.

MSIS is initiated by low steam generator pressure or high containment pressure.

EFAS is initiated to steam generator 1 either by low steam generator water level coincident with no low pressure trip present for steam generator 1 or by low steam generator water level coincident with differential pressure between the two generators with the higher pressure in generator 1. This EFAS logic is provided for each steam generator.

The low steam generator pressure signal is provided to the EFAS and MSIS logic from a single bistable comparator output in each PPS channel. A single channel failure of this signal would have no effect on EFAS or MSIS operation. This is the only EFAS-MSIS interface present on the PPS.

The interrelationship between EFAS and MSIS operation is described by the following scenario assuming a ruptured steam generator: 32

EFAS logic permits emergency feedwater to be supplied to each steam generator upon receipt of a valid low steam generator water level condition.

Upon receipt of a low steam generator pressure condition, EFAS and MSIS logic will terminate emergency feedwater by causing the emergency feedwater valves to close by resetting EFAS and tripping MSIS. This isolation of the EFW valves will not affect the operation of the EFW pumps. MSIS logic will isolate the steam generators by causing main feedwater and main steam isolation valves to close, thus allowing steam generator pressures to vary independently. The ruptured steam generator pressure will decrease while the intact steam generator pressure will remain constant or increase, thereby causing a differential pressure condition to exist. EFAS logic will permit emergency feedwater to be supplied to the intact steam generator while maintaining isolation of the ruptured steam generator.

7.3.1.1.6.4 Priority Signals

The EFW control system utilizes two signals (priority open, priority close) that override all other automatic or manual controls to the EFW valves.

Priority close is generated when the system is determining which steam generator is ruptured (Subsection 7.3.1.1.6.3). Once this determination is made the priority close signal is deactivated to the intact steam generator only. Upon deactivation of the signal, control of the EFW will ~~return to~~ remain in

manual.

the status (automatic or manual) that existed prior to the generation of the priority close signal.

DELETE

Priority open is generated when the water level reaches "Lo-Lo Level" (Subsection 7.3.1.1.6.2, Item 5). Once the water level rises above the "Lo-Lo Level", control of the EFW will return to the status (automatic or manual) that existed prior to the generation of the priority open signal. | 32

DELETE

the priority open signal is removed and control of EFW will remain in manual.

In the case of the ruptured steam generator, the EFAS command that generates the priority close signal will prevent a priority open signal.

7.3.1.1.6.5 Initiating Circuits

The initiating circuits are identical to those described in Subsection 7.3.1.1.1.1 for SIS except that the parameters monitored are steam generator level and pressure.

7.3.1.1.6.6 Logic | 32

7.6.1.1.6.6.1 Initiating Logic

The initiating logic is identical to that described in Subsection 7.3.1.1.1.2.1 for SIS except that the provision for multiple initiating signals does not apply.

7.3.1.1.6.6.2 Actuating Logic | 32

Actuating logic is similar to that described in Subsection 7.3.1.1.1.2.2 for SIS. Refer to Figure 7.3-10. | 25

7.3.1.1.6.7 Group Actuation | 32

Group Actuation is identical to that described in Subsection 7.3.1.1.1.3 for SIS.

7.3.1.1.6.8 Bypasses | 32

Bypasses are identical to those described in Subsection 7.3.1.1.1.4 for SIS.

7.3.1.1.6.9 Interlocks | 32

Interlock provisions are identical to those described in Subsection

7.3.1.1.1.5 for SIS.

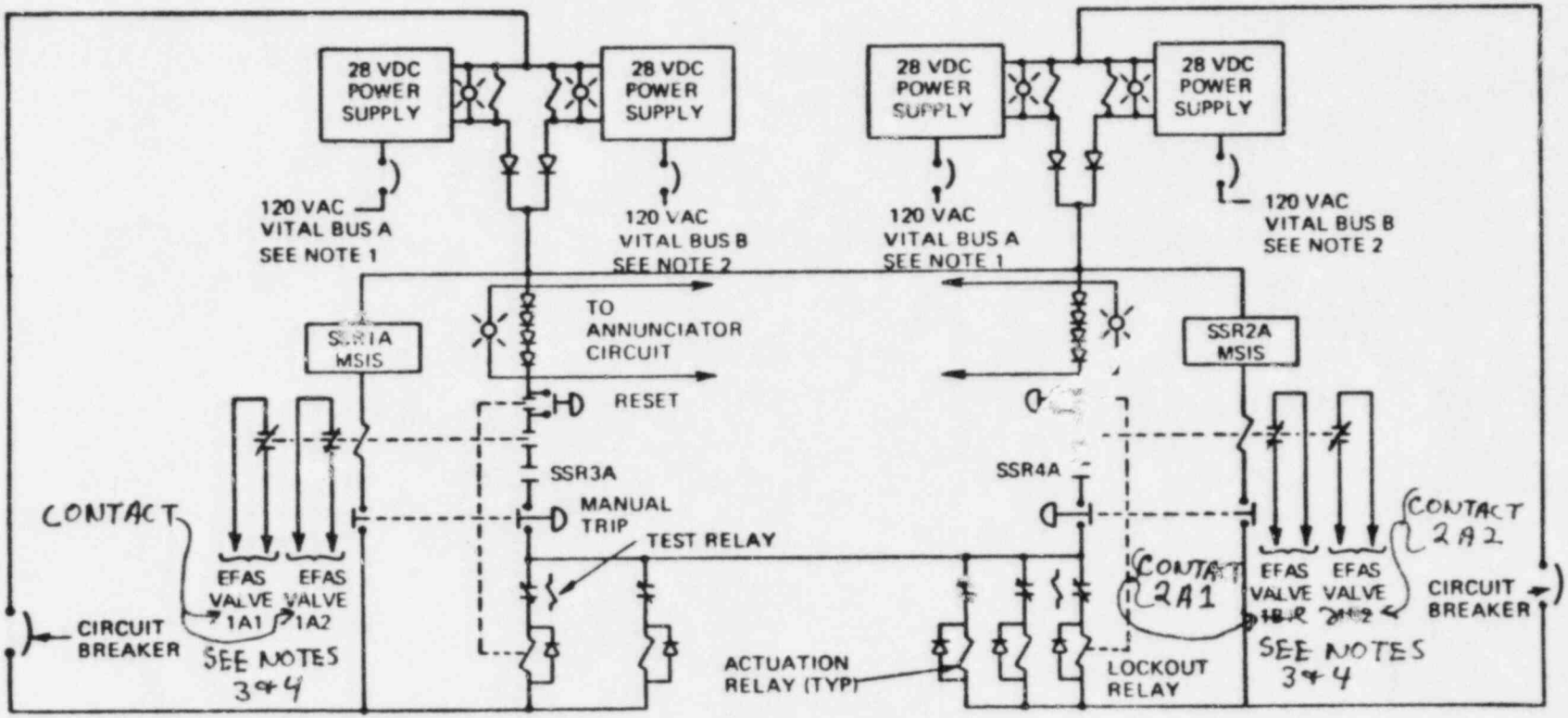
7.3.1.1.6.10 Redundancy | 32

Redundancy features are identical to those described in Subsection 7.3.1.1.1.6 for SIS.

LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

NSSS ESFAS AUXILIARY RELAY CABINET SCHEMATIC DIAGRAM FOR MSIS INITIATION CIRCUIT

Figure 7.3-8



NOTES: 1. FOR CABINET 'B', SUBSTITUTE "VITAL BUS C" FOR "VITAL BUS A"
2. FOR CABINET 'B', SUBSTITUTE "VITAL BUS D" FOR "VITAL BUS B"

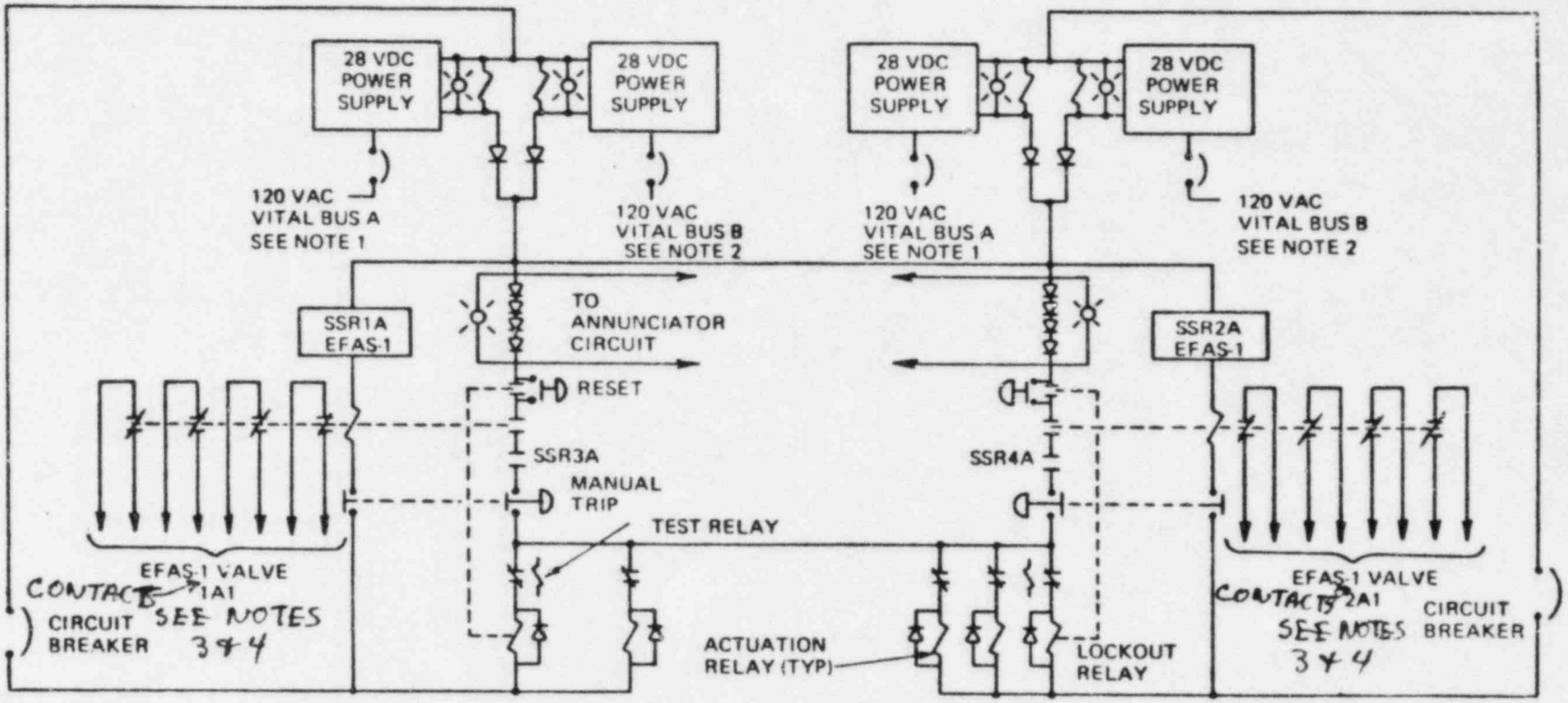
3. VALVE CONTACTS 1A1 and 1A2 are for both shut-off valves in Train A and VALVE CONTACTS 2A1 and 2A2 are for both control valves in Train A

4. FOR CABINET 'B', SUBSTITUTE "3B1", "3B2", "4B1" and "4B2" for "1A1", "1A2", "2A1" and "2A2" respectively

LOUISIANA POWER & LIGHT CO.
Waterford Steam Electric Station

NSSS ESFAS AUXILIARY RELAY CABINET SCHEMATIC DIAGRAM FOR EFAS-1 (EFAS-2) INITIATION CIRCUIT

Figure 7.3-10



NOTES:
1. FOR CABINET 'B', SUBSTITUTE "VITAL BUS C" FOR "VITAL BUS A"
2. FOR CABINET 'B', SUBSTITUTE "VITAL BUS D" FOR "VITAL BUS B"
3. VALVE CONTACTS 1A1 are for the shut-off valve in Train A and VALVE CONTACTS 2A1 are for the control valve in Train A
4. FOR CABINET 'B', SUBSTITUTE "3B1" and "4B1" for "1A1" and "2A1" respectively

ATTACHMENT TWO

REMOVAL OF LEVEL CONTACTS FOR

STEAM GENERATOR 1, CHANNEL "A"

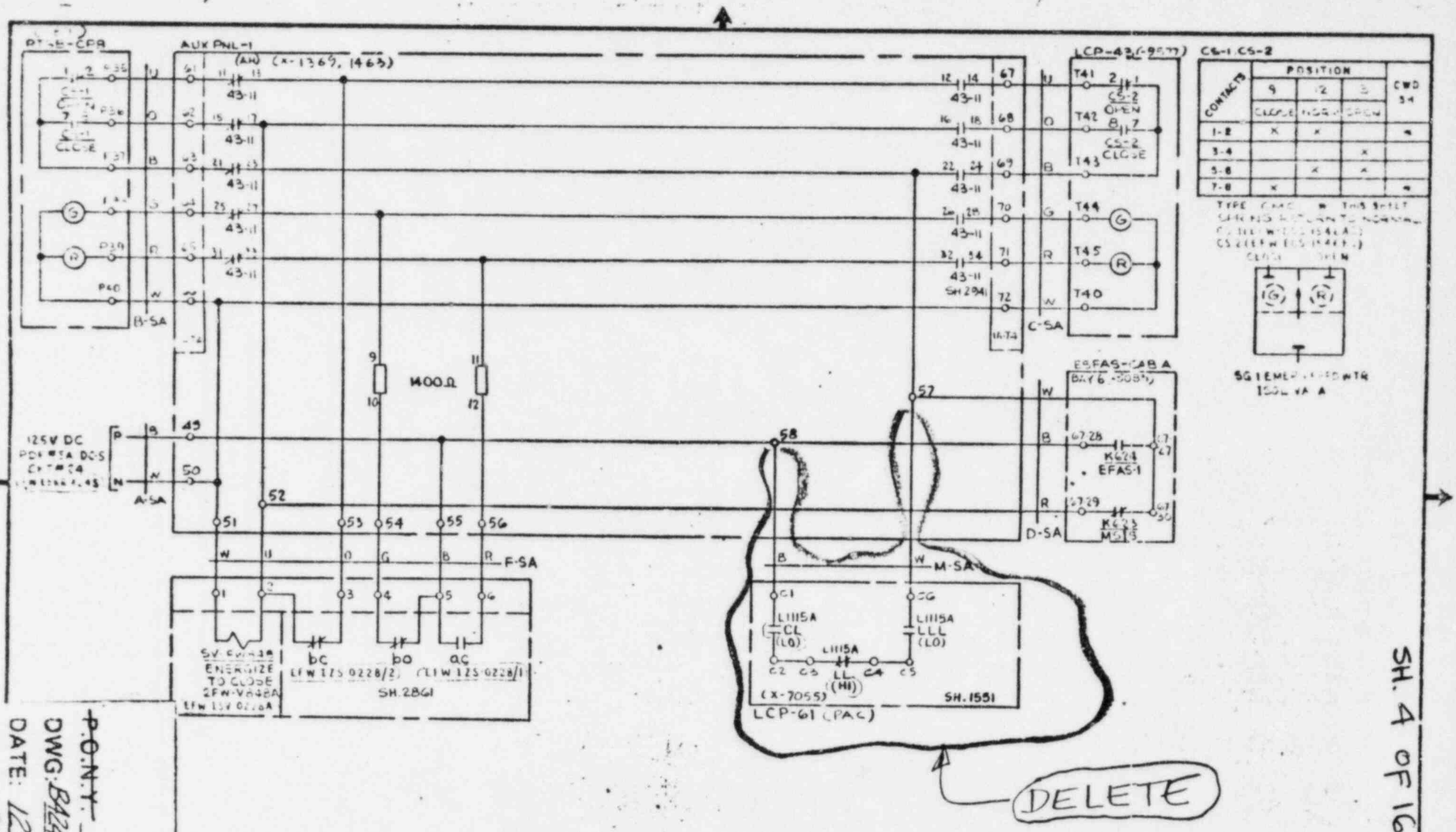
SHUT-OFF VALVE AT PAC PANEL

SHEET 4 OF 16 OF DCN-IC-1817

REVISION TO LOU-1564-B424

SHEET 1546S

FOR INFORMATION ONLY



SH. 4 OF 16

P.O.N.Y.
DWG: BAZA SH 1546 RS
DATE: 12-21-93
BY: JK
CH: BR
SK - DCN IC 1817

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REV	DATE	BY	APPROVED
4	10-30-81	EF	
3	11-27-78	FV	
2	6-30-78	FV	
1	4-4-78	FV	

EBASCO SERVICES INCORPORATED
DIV I & C DR V.Z
CH M.A. ZIEMSKI
DATE DEC 3 1981
APPROVED

LOUISIANA POWER & LIGHT CO.
WATERFORD S.E.S. UNIT No. 3
CONTROL WIRING DIAGRAM
SG NO.1 EMERG FW ISOLATION VA
2FW-V848A

LOU-1564
B-424
SHEET 1 OF 6 SHEETS

(G-153-2)

LV FCR'S INCORPORATED THIS REV

ATTACHMENT THREE

Description of Contact States For Priority Close (PC)
and Priority Open (PO) Actuation of the EFW Control Valves

Case	Description
I	This case outlines the de-energized state of the contacts. This case is shown for informational purposes only. Note that: 1) actuation of EFAS or MSIS de-energizes the contacts and 2) the EFAS contacts on PC and PO are on the same relay and that it is highly improbable that these contacts will be in the same state at the same time.
II	This case shows normal operation. A failure which causes the MSIS contact to close generates a PC signal. This would have no effect since the valves are already closed and flow, when needed, can be provided by the parallel line.
III	This case shows EFAS actuated and above LLL (Low-Low Level). A failure which causes the LLL contact to close, would generate a PO signal. This failure is identical to a stuck-open control valve.
IV	This case shows EFAS actuated and below LLL. Priority Open is generated. A failure which causes either the EFAS (PO) or the LLL contact to open, would defeat a PO signal. If this signal defeat causes a valve to close, the parallel line will continue to supply EFW.
V	This case shows MSIS actuated, EFAS-Reset and below LLL. Priority Close is generated. A failure which causes either the EFAS (PC) or the MSIS contact to open, would defeat a PC signal. If this signal defeat causes a valve to open, the series valve will continue to isolate. A failure which causes the EFAS (PO) contact to close, would generate a PO signal. If this signal causes a valve to open, the series valve will continue to isolate. If in the highly improbable event that PC is still generated when the PO is generated and this renders a valve inoperable, the series valve will continue to isolate and flow, when needed, can be provided by the parallel line. If the inoperable control valve is open, the failure is identical to a stuck-open control valve.

Description of Contact States For Priority Close (PC)
and Priority Open (PO) Actuation of the EFW Control Valves (continued)

Case	Description
VI	This case shows MSIS actuated, EFAS-Reset and above LLL. Priority Close is generated. A failure which causes either the EFAS (PC) or the MSIS contact to open, would defeat a PC signal. If this signal defeat causes a valve to open, the series valve will continue to isolate.
VII	This case shows MSIS actuated, EFAS actuated and above LLL. A failure which causes the EFAS (PC) contact to close, would generate a PC signal. If this signal causes a valve to close, the parallel line will continue to supply EFW. A failure which causes the LLL contact to close, would generate a PO signal. This failure is identical to a stuck-open control valve.
VIII	This case shows MSIS actuated, EFAS actuated and below LLL. Priority Open is generated. A failure which causes either the EFAS (PO) or the LLL contact to open, would defeat a PO signal. If this signal defeat causes a valve to close, the parallel line will continue to supply EFW. A failure which causes the EFAS (PC) contact to close, would generate a PC signal. If this signal causes a valve to close, the parallel line will continue to supply EFW. If in the highly improbable event that PO is still generated when the PC is generated and this renders a valve inoperable, the parallel line will continue to supply EFW and isolation, when needed, can be provided by the series valve. If the inoperable control valve is open, the failure is identical to a stuck-open control valve.

General Notes

1) The above descriptions outline the PC and PO contacts for the control valves. The shutoff valves cannot be closed unless EFAS is reset.

2) Below LLL, the PO signal to the control valves prevents manual closure of these valves.

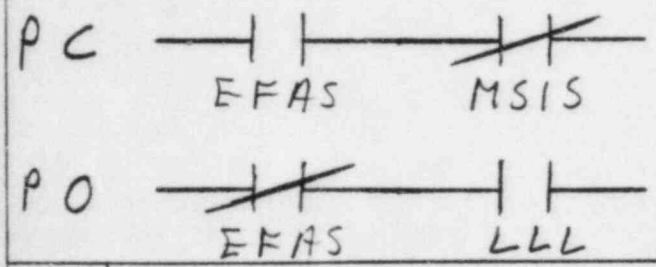
3) EFAS actuation opens the shut-off valves and provides a permissive to the control valves.

4) A PC or PO to the control valves places the EFW Control System into the manual mode.

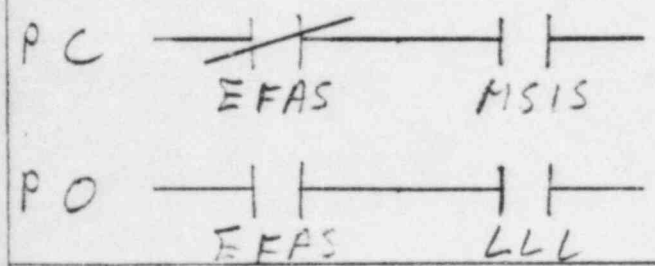
5) A stuck-open control valve failure will cause overfilling of the SG unless the operator manually closes the shut-off valve that is in series with the control valve.

Contact States For Priority Close (PC) And Priority Open (PO) Actuation OF The EFW Control Valves

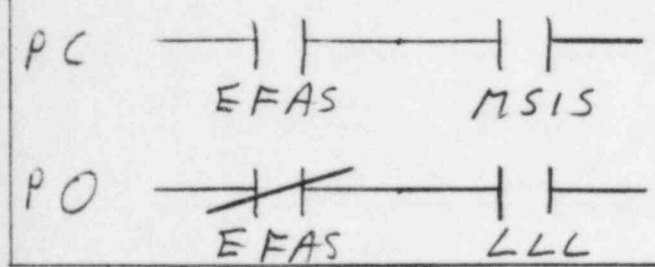
I De-Energized



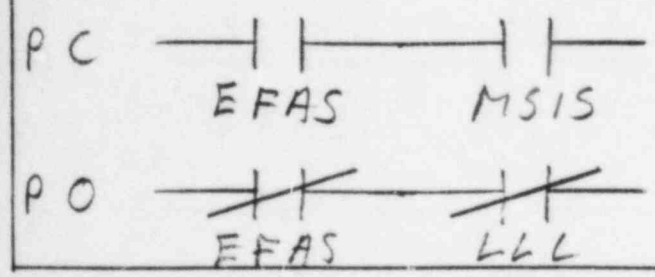
II Normal Operation



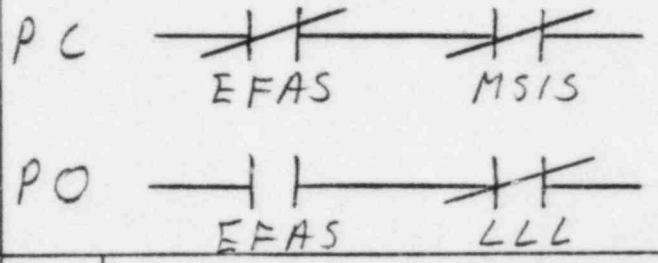
III EFAS ↑LLL



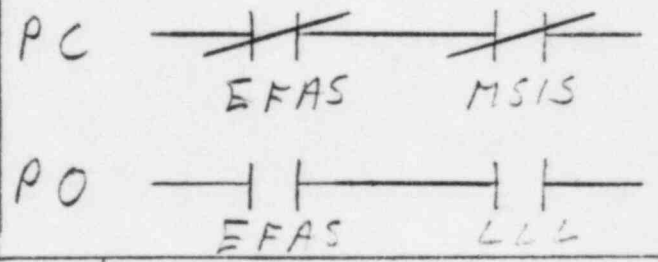
IV EFAS ↓LLL



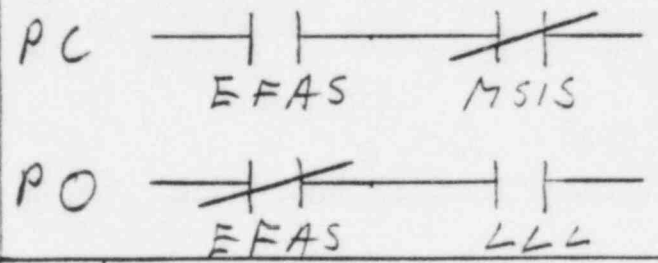
V MSIS EFAS-Reset ↓LLL



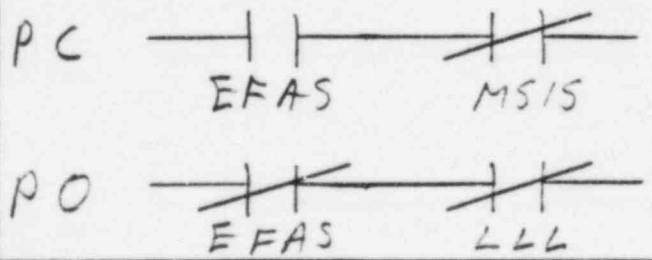
VI MSIS EFAS-Reset ↑LLL



VII MSIS EFAS ↑LLL



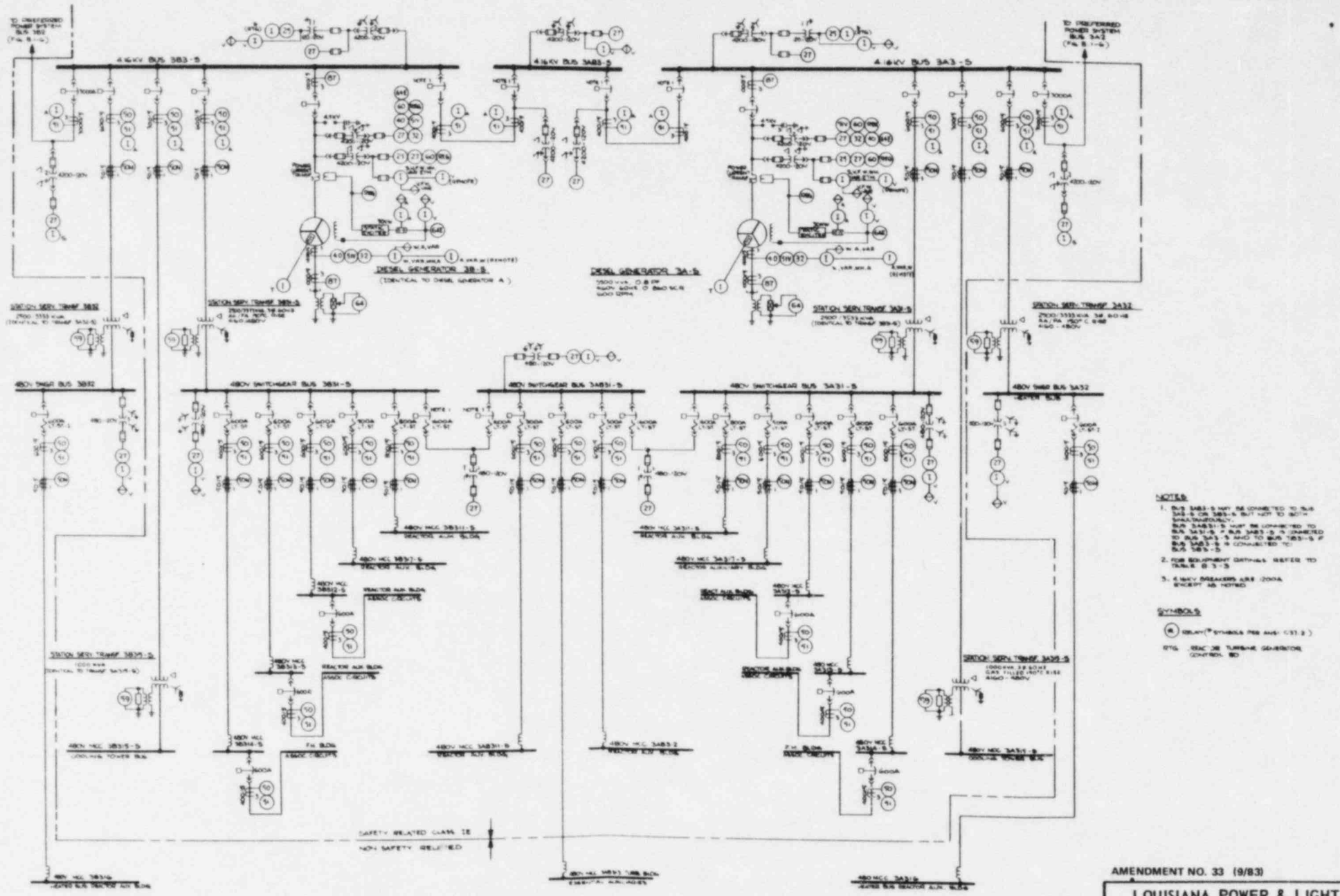
VIII MSIS EFAS ↓LLL



ATTACHMENT FOUR

D.C. REDUNDANCY

FSAR FIGURES 8.1-7 & 8.1-8



NOTES

1. BUS 3A83-S MAY BE CONNECTED TO BUS 3A3-S OR 3B3-S BUT NOT TO BOTH SIMULTANEOUSLY. BUS 3A83-S MAY BE CONNECTED TO BUS 3A31-S. IF BUS 3A83-S IS CONNECTED TO BUS 3A3-S AND TO BUS 3B3-S IF BUS 3A83-S IS CONNECTED TO BUS 3B3-S.
2. FOR EQUIPMENT RATINGS REFER TO TABLE 8.3-3.
3. 4.16KV BREAKERS ARE 2000A EXCEPT AS NOTED.

SYMBOLS

(R) RELAY (* SYMBOLS PER ANSI C37.2)

RTG - REACTOR TURBINE GENERATOR CONTROL BD

AMENDMENT NO. 33 (9/83)

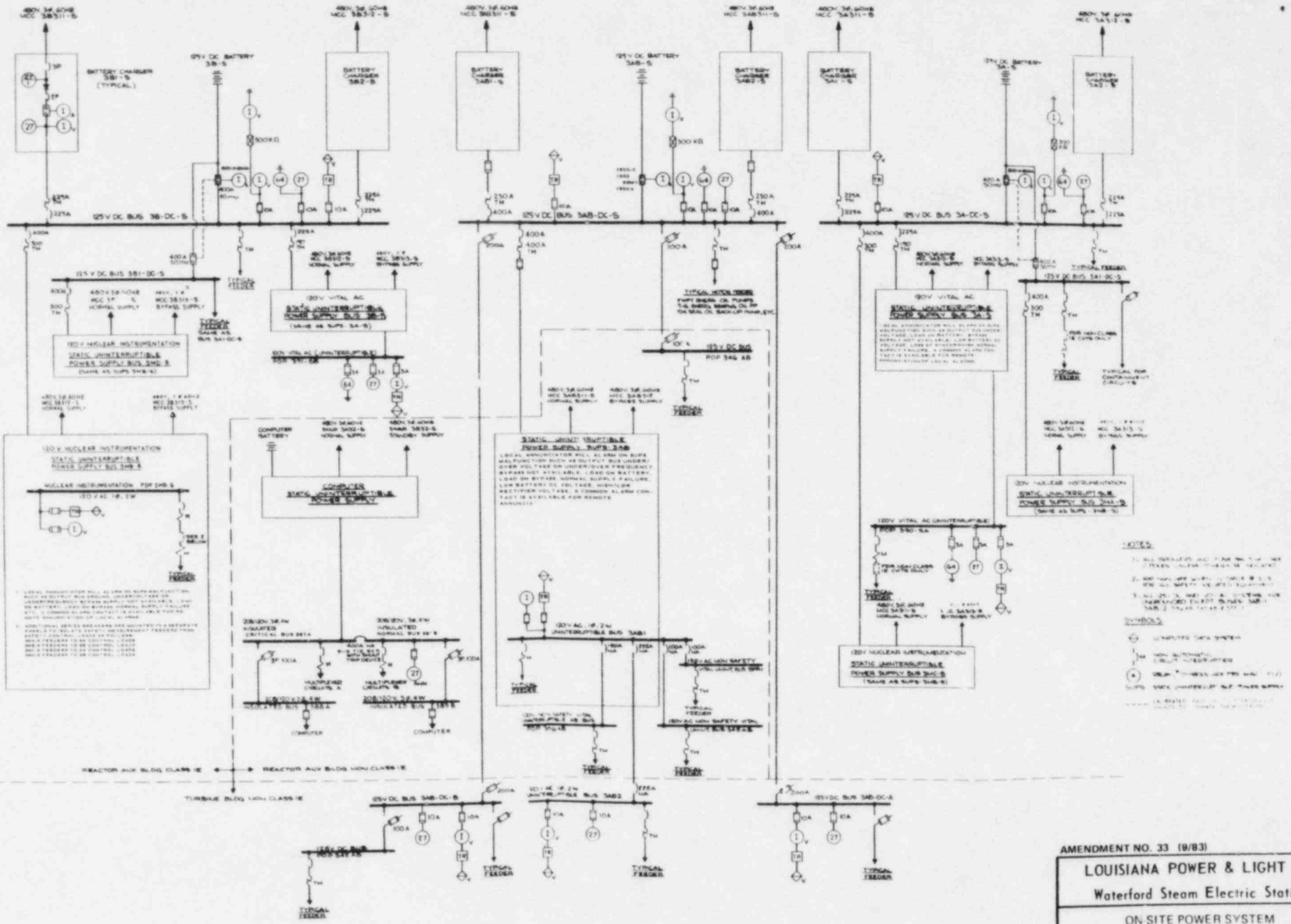
LOUISIANA POWER & LIGHT CO.

Waterford Steam Electric Station

ON-SITE POWER SYSTEM
MAIN ONE-LINE DIAGRAM

FIGURE 8.1-7

THIS FIGURE IS A SIMPLIFIED REPRESENTATION OF DESIGN DRAWINGS, PREPARED TO SUPPLEMENT THE FSAR TEXT. FOR ACTUAL DESIGN CONFIGURATION SEE DRAWING LOU 1564G-286



THIS FIGURE IS A SIMPLIFIED REPRESENTATION OF DESIGN DRAWINGS, PREPARED TO SUPPLEMENT THE FSAR TEXT. FOR ACTUAL DESIGN CONFIGURATION SEE DRAWING LOU 1564G-287

AMENDMENT NO. 33 (9/83)

LOUISIANA POWER & LIGHT CO.

Waterford Steam Electric Station

ON SITE POWER SYSTEM
125V DC & 120V AC ONE LINE DIAGRAM

FIGURE 8.1-8