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September 16, 1988

Re: Indian Point Unit No. 2  
Docket No. 50-247

Document Control Desk  
U.S. Nuclear Regulatory Commission  
Mail Station Pl-137  
Washington, DC 20555

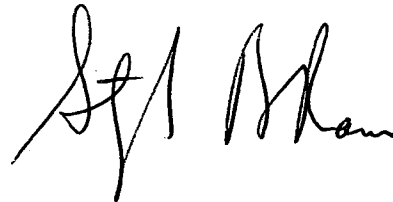
SUBJECT: ATWS Mitigation System Actuation Circuitry ("AMSAC")

By letter dated January 16, 1987, we responded to the NRC's September 19, 1986 Safety Evaluation Report ("SER") for the Westinghouse Owners Group generic design of the ATWS Mitigation System Actuation Circuitry ("AMSAC") required by 10 CFR §50.62. Additional design and programmatic information was provided in our November 2, 1987 letter.

The purpose of this letter is to notify you that we have re-evaluated our AMSAC design and Westinghouse WCAP-10858P-A, Revision 1, and consequently have modified our proposed AMSAC design. Our modification of the AMSAC design maximizes the benefits of the system and minimizes the complexity of design and installation. We believe that the design as described in Attachment I and depicted in Attachment II fully meets the requirements of 10 CFR §50.62, facilitates system installation, and enhances operation, maintenance, and testing of the system. We are planning for AMSAC installation during Indian Point Unit No. 2's ("IP-2") 1989 refueling outage.

Should you have any questions regarding this matter, please contact Mr. Jude G. Del Percio, Manager, Regulatory Affairs.

Very truly yours,



Attachments

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P PNU

A055  
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Attachment I

Response to NRC's SER  
Plant Specific AMSAC Design

Consolidated Edison Company of New York, Inc.  
Indian Point Unit No. 2  
Docket No. 50-247  
September 16, 1988

IP-2 has selected the AMSAC design which actuates on low steam generator water level as described in Westinghouse WCAP-10858P-A, Revision 1, with minor modifications. Our AMSAC design is described below. In addition, deviations from our previous submittals and/or from the generic low steam generator water level design are described below. Two sketches of our AMSAC design are provided in Attachment II to supplement this information.

I. IP-2 AMSAC Design Overview:

A. Selected Design:

IP-2's AMSAC design is based on a modified Logic 1 option "AMSAC Actuation on Low Steam Generator Water Level" as described in Westinghouse WCAP-10858P-A, Revision 1. The modification to the generic design involves the deletion of the C-20 permissive and time delay circuits.

B. Setpoints:

AMSAC will be set to actuate between 5% and 8% of narrow range span ("NRS"); 8% of NRS is the current RPS steam generator low-low level setpoint.

AMSAC actuation will not be delayed. This choice is within the 30-second turbine trip response time for an AMSAC signal, as described in Westinghouse WCAP-10858P-A, Revision 1. Our current steam generator level reactor trip setpoint is 8% of NRS and is actuated by a 1/4 logic. If the AMSAC setpoint (below 8% of NRS in 3/4 steam generators) is reached without RPS actuation, then from a safety point of view we want AMSAC immediately to actuate.

C. Alarms and Annunciation:

An output signal is provided for alarms and annunciation whenever any of the following conditions exist:

1. AMSAC is actuated
2. AMSAC is removed from service or bypassed
3. An AMSAC system deviation, such as loss of power or partial trip, occurs.

D. Interlocks and Permissives:

The C-20 permissive, as described in WCAP-10858P-A, Revision 1, is not required in the IP-2 specific design. AMSAC will be armed during power operation except for maintenance and testing. Alarms associated with an expected AMSAC actuation which occur during a planned shutdown will be treated in the same manner as steam generator low-level alarms.

E. Trips/Actuations and Associated Logic:

1. AMSAC initiation will be generated by steam generator very-low water level signals from existing sensor/transmitter units. The IP-2 design consists of one existing narrow-range level transmitter signal from each steam generator as input to AMSAC; a coincidence of 3 out of 4 signals is required to actuate AMSAC.
2. An AMSAC signal will result in a turbine trip, start-up of the three auxiliary feedwater pumps, isolation of steam generator blowdown and closure of sample valves.
3. Completion of the mitigating action, once initiated, will be consistent with existing turbine trip, auxiliary feedwater, steam generator blowdown and sample valve isolation circuitry.

F. Time Response:

1. Turbine trip response time from an AMSAC signal will be less than or equal to 30 seconds.
2. Motor-driven auxiliary feedwater pump flow initiation response time from an AMSAC signal will be less than or equal to 90 seconds. The turbine-driven auxiliary feedwater pump is an auto-start pump which requires manual flow initiation.

G. Test and Calibration:

Provisions will be incorporated to allow AMSAC to be removed from service during power operation for test and calibration purposes.

H. Requirements for Associated Equipment:

1. The logic power supply for the new components of the AMSAC system will be independent from power supplies for the existing Reactor Protection System.
2. AMSAC will be capable of performing its intended function without off-site power.

II. Key Elements of the IP-2 AMSAC Design:

A. Diversity:

Existing protection system instrument sensing lines, sensors and sensor power supplies will be used as AMSAC inputs. Existing final actuation devices (auxiliary feedwater pump breakers, turbine trip solenoids, etc.) will be utilized as AMSAC outputs. The existing reactor protection system logic for Indian Point Unit No. 2 utilizes Foxboro H-line bistable equipment inputting

to Westinghouse relay protection logic. To achieve one of the desired degrees of diversity, AMSAC will utilize YEW Series 80 Alarm (bistable) unit(s) and relay logic consisting of Struthers-Dunn, Inc. Type No. 219 relays.

Indian Point Unit No. 2 is a four-loop Westinghouse plant equipped with three narrow-range level channels per steam generator and four separate battery-backed instrument buses powered from off-site power or on-site emergency diesel generators. AMSAC will utilize one level channel from each steam generator.

AMSAC logic input (analog) signals will be normally energized; de-energized to trip. AMSAC logic signals will be normally de-energized; energized to trip. This is diverse from existing reactor protection logic equipment. Dual AMSAC logic will maximize system availability in the event a single DC bus is lost. Each analog level channel selected for AMSAC input will be powered from a different instrument bus as follows:

	<u>Channel</u>	<u>Instrument Tag No.</u>
Steam Generator 21	IV	LT-417A
Steam Generator 22	III	LT-427B
Steam Generator 23	I	LT-437C
Steam Generator 24	II	LT-447C

LT-427B is the only level channel used for AMSAC input that also inputs to the feedwater control system. The consequences of potential adverse interactions with the existing feedwater control system are minimized since the bus arrangement and sensor selection preclude a failure of LT-427B from affecting the other three steam generator transmitters. Since channel III on all steam generators is used for feedwater control, an additional isolator is required for steam generator No. 22 to preclude postulated control/protection interactions. This isolation is currently provided by an existing Model 66-BR I/I isolator LM-427F. Thus, for steam generator No. 22, we have single isolation from the feedwater control system and double electrical isolation from the RPS. Furthermore, the existing steam flow/feedwater flow mismatch coincident with low steam generator level reactor trip serves as a backup to the existing low-low steam generator level reactor trip for postulated control/protection interactions.

B. Logic Power Supplies:

Power for AMSAC, a non-safety grade system, will be derived from the class 1E 125 VDC distribution panels Nos. 23 and 24. These 1E panels are safety-related battery-backed and capable of being

operated from either an off-site power source or on-site emergency diesel generators. Existing Reactor Protection System ("RPS") logic is supplied from 125 VDC distribution Panels 21 and 22 (Train A and Train B respectively) such that AMSAC and RPS logics will utilize power supplies independent of each other.

Battery Charger No. 23 (associated with distribution panel No. 23) is connected to Motor Control Center ("MCC") No. 22 and is stripped in preparation for diesel loading. Battery Charger No. 24 (associated with distribution panel No. 24) is connected to MCC No. 26B and is not stripped in preparation for diesel loading. Therefore, during the transition from station or grid service to emergency diesel generator service, distribution panel No. 23 is stripped but distribution panel No. 24 is not stripped. Since batteries can supply power to the DC bus for two hours without interruption, and battery chargers can be used to charge the batteries, AMSAC power will not be interrupted.

The AMSAC logic circuits will be connected to the DC distribution panels via class 1E circuit breakers that provide both overcurrent and short-circuit protection. The circuit breakers are acceptable isolation devices that protect the class 1E buses from faults on the load side; whatever the load, be it class 1E or non-class 1E.

The attached Figure I-1 is a copy of IP-2 Updated FSAR Figure 8.2-17 and is a one-line diagram depicting bus arrangement from the 480 VAC buses down to the 125 VDC and 118 VAC buses for all four channels (trains) of power supply. This figure shows the line-up to 125 VDC distribution panels Nos. 23 and 24.

C. Safety-related Interface:

Signals to AMSAC from the Steam Generator level instrument loops will be derived from existing Foxboro 66-BR approved isolators (I/I isolation amplifiers). Safety systems actuated by AMSAC will be isolated from AMSAC by Struthers-Dunn, Inc. coil-to-contact relay isolation devices. We will confirm that the Struthers-Dunn relays meet the NRC's September 19, 1986 AMSAC SER Appendix A Criteria in a subsequent submittal.

Qualification of the existing I/I isolation amplifiers that will isolate the safety-related portion of the steam generator level channel from AMSAC is described in FSAR section 7.2.2.9 which references WCAP-9011 "Test Report of Isolation Amplifier." Part II of this report is identical to WCAP-7507L which has been previously provided to NRC by Westinghouse in October, 1970. In addition, our response to the isolator qualification requirements (see NRC SER App. A) was previously provided as Attachment 2 to our SAS/SPDS submittal dated July 31, 1986.

Isolators will comply with environmental and seismic qualification requirements which were the basis for plant

licensing. Qualification acceptance is predicated on demonstrating no loss of isolation capability. AMSAC equipment will be reviewed to determine its potential for generating electrical interference. As appropriate, measures will be taken to protect safety-related systems from such interference. Analog input signal isolators associated with AMSAC will be powered from the same class 1E power source as that used for the associated analog input channel.

AMSAC outputs to final actuation devices, alarms, plant computer and indications will be provided via dry contact outputs.

D. Quality Assurance:

In our response to item No. 4 "Quality Assurance," contained in our January 16, 1987 submittal, we stated that we will treat the AMSAC equipment as "Class A" which for Quality Assurance purposes invokes Con Edison's 10 CFR 50 Appendix B program. Should any aspect of our 10 CFR 50 Appendix B QA program prove overly restrictive or otherwise unnecessary, provision will be made to waive only that aspect provided that, as a minimum, the quality assurance guidance contained in Generic Letter 85-06 is met.

E. Maintenance Bypasses:

The AMSAC design will provide for manually bypassing the mitigating function of either of the two logic circuits for testing and maintenance. For either AMSAC logic circuit, a two-position selector switch and push buttons (providing a push-to-test feature) will be provided. For each of the four analog input channels to the AMSAC logic a two-position selector switch for channel testing will be provided. When any one of these switches is placed in the off-normal test (bypass/maintenance) position an audible annunciation window tile will be lit indicating that the respective logic circuit is bypassed for testing.

The bypass/maintenance condition will be continuously indicated to the operator in the control room by an annunciator window tile located above the flight panel whenever any one of the two position switches are turned to the bypass/maintenance position.

Integration of AMSAC annunciation into the control room will conform to good human engineering practices in design and layout.

F. Operating Bypasses:

The only operating bypass associated with the generic AMSAC design is the C-20 permissive which would automatically block AMSAC below 40% power based on first stage turbine pressure.

The C-20 permissive, as described in WCAP-10858P-A, Revision 1, is not required in the IP-2 specific design. AMSAC at IP-2 will



be armed during power operation except for maintenance and testing. Alarms associated with an expected AMSAC actuation which occur during a planned shutdown will be treated in the same manner as steam generator low level alarms.

G. Means for Bypassing:

As stated in response to item II.E, "Maintenance Bypasses," the AMSAC design will incorporate for the AMSAC logic circuits two position switches for bypass/maintenance that will block the mitigating function at the system level when turned to the test (bypass/maintenance) position. Accordingly, the disallowed methods for bypassing mentioned in the guidance will not be utilized. The manual bypass does not require and will not be provided with automatic bypass removal capability, as stated in our response in item I.D.

As stated earlier, human factors of the design will be a consideration with respect to bypass switch design.

H. Manual Initiation:

Manual initiation of turbine trip and auxiliary feedwater will continue to be performed as they are currently. This is accomplished by operating control switches/push buttons located in the control room or at local panels. The system level AMSAC installation will have no effect on these existing control functions.

Furthermore, the AMSAC design will not affect automatic auxiliary feedwater flow initiation and associated turbine trip since the normal RPS associated steam generator low level setpoint is more restrictive than AMSAC.

I. Electrical Independence from Existing Reactor Protection System:

As noted previously, the AMSAC logic will be powered from batteries 23 and 24 which are Class 1E and are completely separate from the battery-backed busses used for the Reactor Protection System Logic.

Input to the AMSAC logic from the existing steam generator level sensors will be provided through existing class 1E circuit isolators. A discussion of how these isolators satisfy NRC's qualification criteria is contained in item II.C, "Safety-related Interface." AMSAC outputs for turbine trip, auxiliary feedwater initiation, steam generator blowdown and sample valve isolation, and alarms and indication will be through dry contact outputs from the AMSAC logic installed to initiate the individual components control circuit. Except for the existing steam generator level sensors and final actuation devices, electrical independence will be maintained between AMSAC and the RPS.

J. Physical Separation from Existing Reactor Protection System:

Electrical physical separation at IP-2 was designed and approved by the Atomic Energy Commission ("AEC") prior to the issuance of Regulatory Guide 1.75 "Physical Independence of Electrical Systems." AMSAC will follow the physical separation criteria established for IP-2, as described in Section 7.2.4.1 of the Updated FSAR in lieu of R.G. 1.75 guidelines. In our January 16, 1987 submittal we stated, in part, that as available space permits, the AMSAC logic, logic test panel, setpoint comparators and isolation devices will be installed in existing control room cabinets and that existing reactor protection system separation criteria will not be violated as a consequence of AMSAC installation. In addition, separation criteria in the Plant are also discussed in Section 8.2.2.6 of the IP-2 Updated FSAR, as it pertains to equipment layout and load distribution. Since it is the original criteria, this too will be followed in lieu of R.G. 1.75. We believe that these sections of our Updated FSAR and our January 16, 1987 response address AMSAC physical separation.

K. Environmental Qualification:

AMSAC equipment installed to meet 10 CFR §50.62 will be located in the Central Control Room ("CCR"). The CCR is a mild environment. The equipment will be designed to operate in the CCR environment for normal and anticipated operational occurrences.

L. Testability at Power:

Non-safety related ATWS equipment will be subject to a post-installation acceptance test. Periodic surveillance tests will be performed quarterly thereafter. Testing of the AMSAC logic will be performed with one of the two AMSAC logic circuits bypassed. The other logic circuit will remain operable to perform its mitigating function. An end-to-end test will be performed each refueling outage. The AMSAC logic test panel will be provided with a lamp to indicate that an output signal has been developed when the appropriate input logic combinations have been made up for test. This approach is consistent with plant practices and human factors considerations. Our testing control document is our Test and Performance procedure, which will be issued prior to declaring the system operational.

M. Completion of Mitigative Action:

The AMSAC system, once actuated, is designed to trip the turbine, initiate auxiliary feedwater flow, isolate steam generator blowdown and close sample valves. The turbine trip and auxiliary feedwater start circuits are self-latching such that these actions go to completion and subsequent return to operation requires deliberate operator action.

N. Technical Specifications:

We do not believe that technical specifications for non-safety related AMSAC equipment are warranted, nor does 10 CFR §50.62 require that technical specifications be developed. Furthermore, AMSAC as a diverse channel is not required to meet the IP-2 license design basis, but rather is required by 10 CFR §50.62 to mitigate beyond license design basis ATWS events.

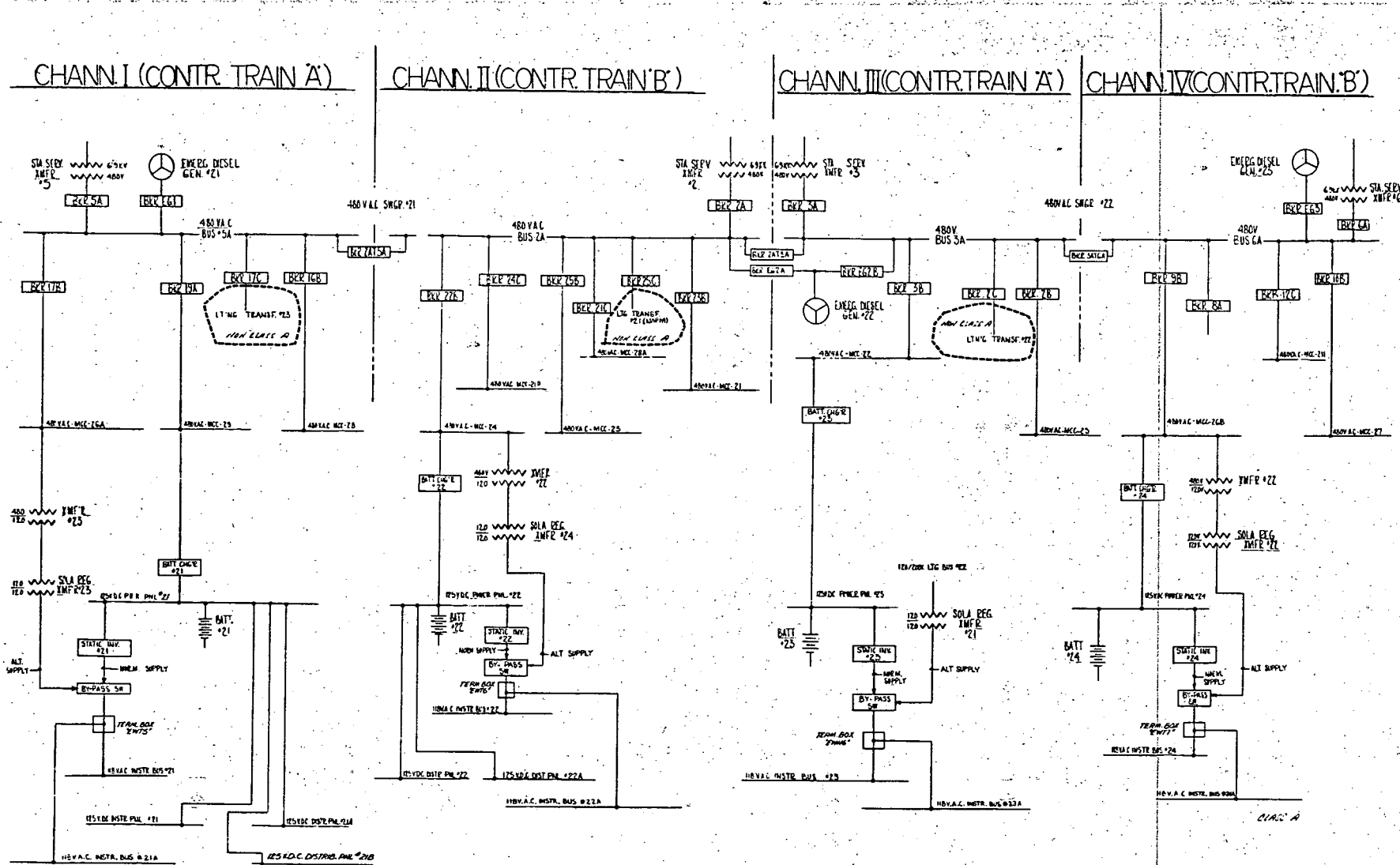


FIGURE I-1

ELECTRICAL SYSTEM CLASS A BOUNDARIES

<p>CONSOLIDATED EDISON CO. INDIAN POINT UNIT 2</p>
<p>Figure 8.2-17 Single Line Diagram of Unit Safeguard Channeling &amp; Control Train Development</p>

Attachment II

IP-2 AMSAC Sketches

Consolidated Edison Company of New York, Inc.  
Indian Point Unit No. 2  
Docket No. 50-247  
September 16, 1988

The plant specific AMSAC design for the Indian Point Unit No. 2 ("IP-2") AMSAC is based on a modified version of generic logic 1 option (Steam Generator Low Level Actuation) described in Westinghouse WCAP-10858P-A Figure 1-3, which is attached (Figure II-1).

The attached logic diagram SK-15805-12 (Figure II-2) and the Test Panel assembly diagram SK-15805-22 (Figure II-3) depict our proposed implementation of AMSAC. We wish to point out that as work progresses the design may be revised slightly. The final design modification package will be available onsite prior to installation for review.

WESTINGHOUSE PROPRIETARY

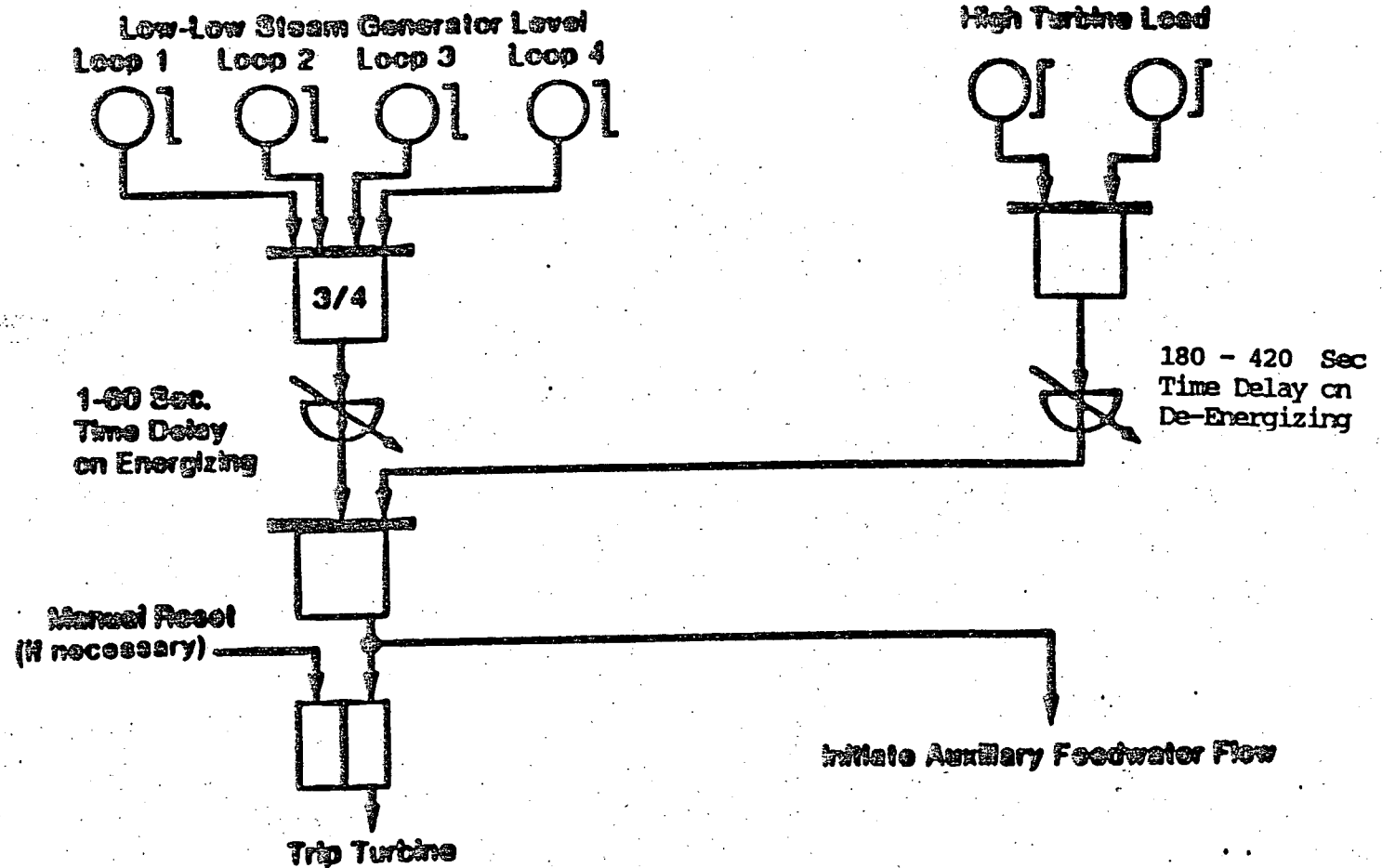
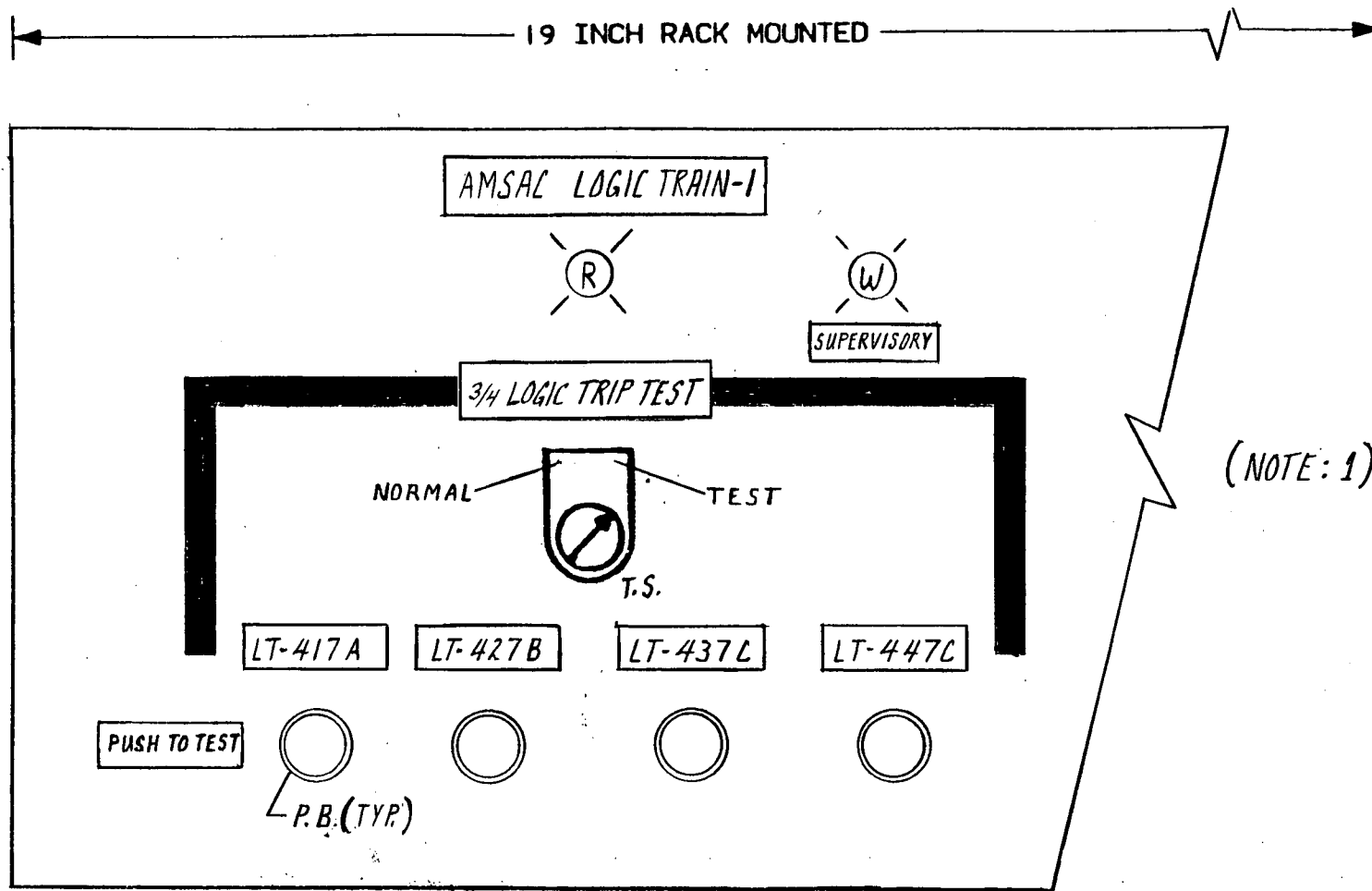


FIGURE 11-1

LOGIC DIAGRAM - STEAM GENERATOR LOW LEVEL

FIGURE II-3



**SYMBOLS:**



**NAMEPLATES:**  
 TRAIN - 1, BLACK WITH WHITE LETTERS  
 TRAIN - 2, WHITE WITH BLACK LETTERS



**BLACK DEMARCATION**



**INDICATING LIGHT: R - RED, W - WHITE**

**T.S.**

**2 POSITION SELECTOR TEST SWITCH**

**P.B.**

**PUSH BUTTON**

**NOTES**

1. LEFT SIDE OF TEST PANEL FACE SHOWN, TYPICAL FOR RIGHT SIDE EXCEPT NAME PLATE: AMSAC LOGIC TRAIN-1 IS AMSAC LOGIC TRAIN-2.
2. NUREG-0700 GUIDELINES FOR HUMAN ENGINEERING PRACTICES SHALL BE USED.

DATE

CR'D  
REVIEW

**PRELIMINARY**

TITLE: AMSAC TEST PANEL  
 ASSEMBLY LOGIC CIRCUIT-1  
 (LOGIC CIRCUIT-2)

TRAIN  
BY

SCALE  
NONE

REC'D.

ENG. SK - 15805-22

**Edison**

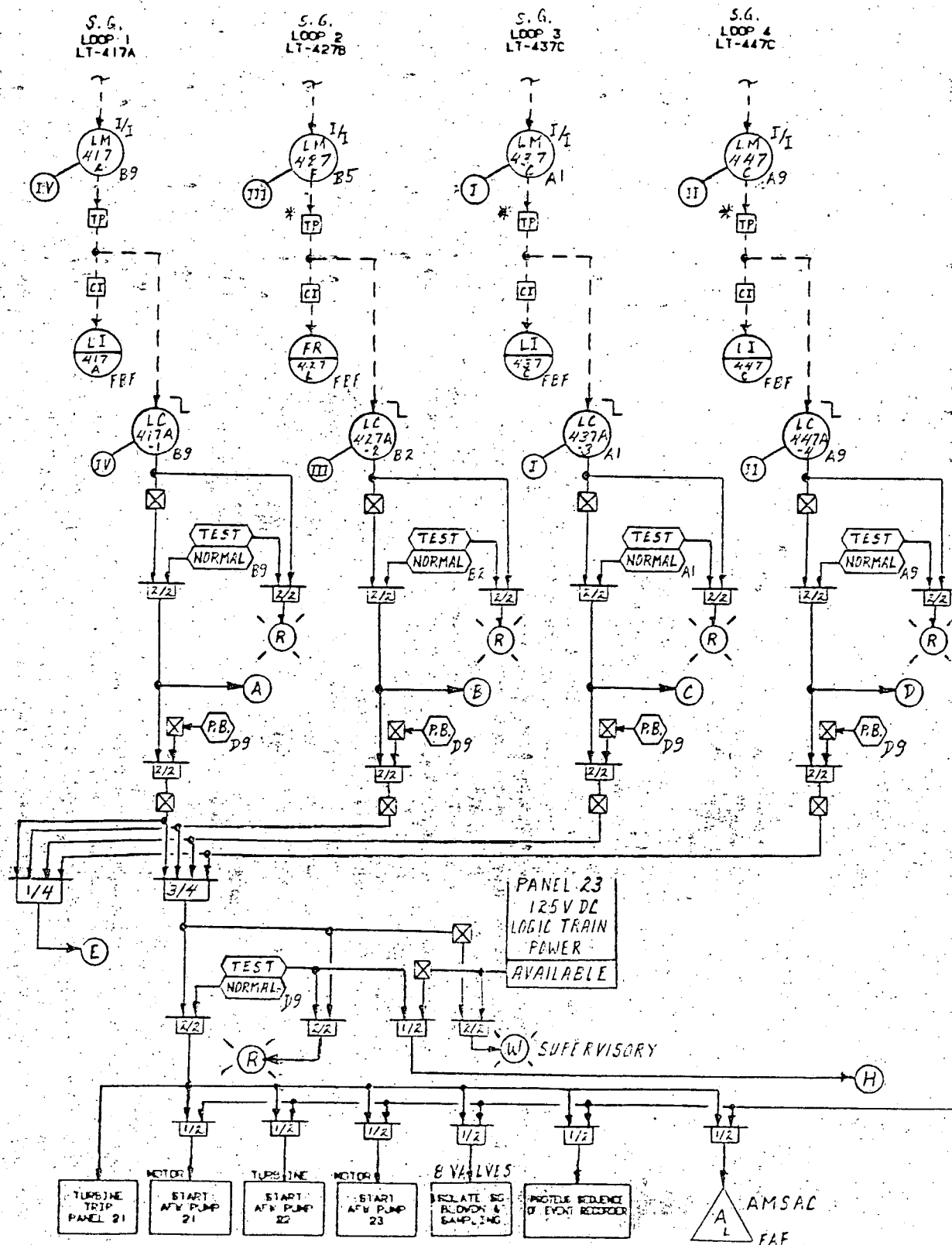
STATION  
INDIAN PT 2

1



SK-15805-12

# VERY LOW STEAM GENERATOR LEVEL



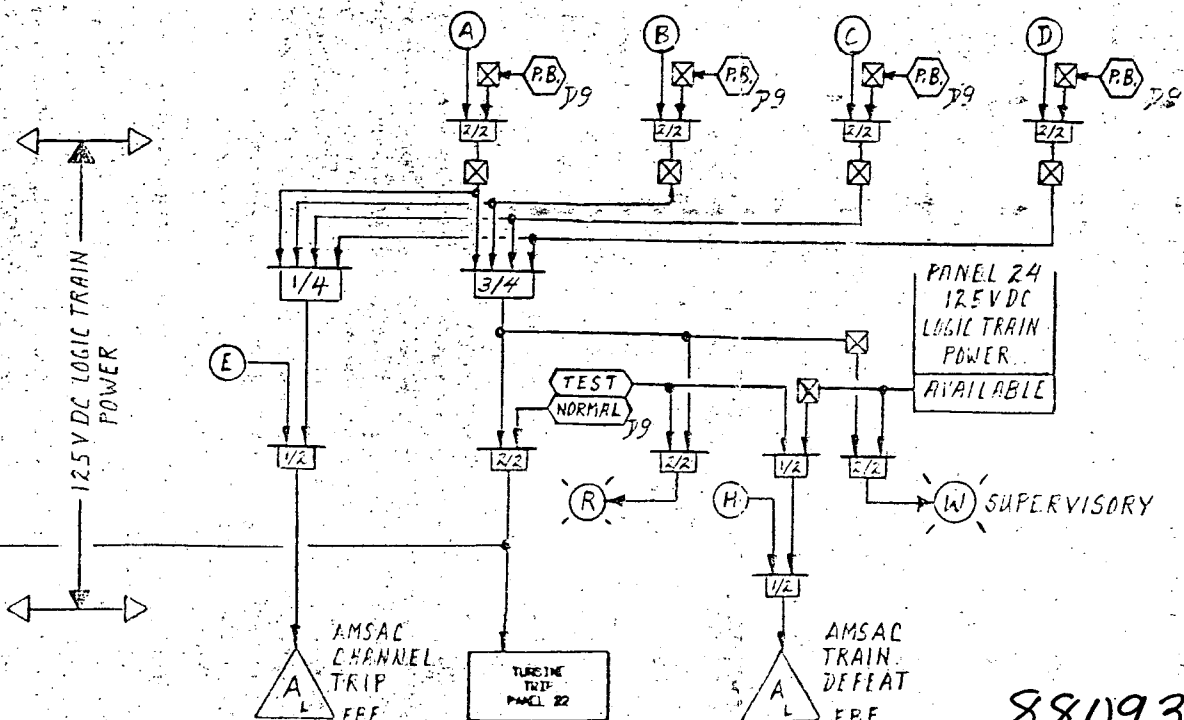
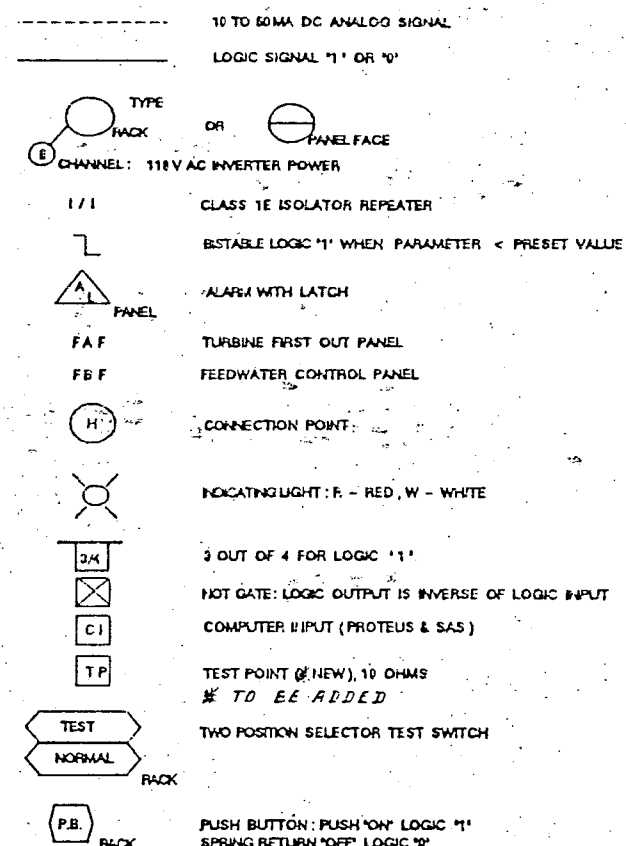
## SI APERTURE CARD

Also Available On Aperture Card

### NOTES

- AMSAC LOGIC SIGNALS SHALL BE NORMALLY DE-ENERGIZED, ENERGIZED TO TRIP.
- LOSS OF STEAM GENERATOR LEVEL ANALOG SIGNAL, AC CHANNEL POWER AND/OR CONTROL MODULE SHALL PLACE AMSAC IN FAIL SAFE TRIP POSITION, DE-ENERGIZED.
- AMSAC EQUIPMENT SHALL BE CAPABLE OF WITHSTANDING ENVIRONMENTAL CONDITIONS OF 70°F TO 100°F, RELATIVE HUMIDITY OF 15% TO 95% AND NEGLIGIBLE RADIATION.
- AMSAC EQUIPMENT SHALL BE PURCHASED AND INSTALLED AS CLASS A. 10 CFR PART 21 IS NOT APPLICABLE EXCEPT AS REQUIRED, SEE NOTE 7 AND 8.
- AMSAC LOGIC CIRCUITS SHALL BE POWERED FROM 125V DC POWER SUPPLY.
- SEE SK-15805-22 FOR TEST PANEL ASSEMBLY.
- AMSAC EQUIPMENT SHALL BE INSTALLED SUCH THAT NO MISSILE WILL BE GENERATED DURING A SEISMIC DBE.
- OUTPUT CONTROL RELAYS SHALL BE SEISMICALLY QUALIFIED TO PROVIDE COIL/CONTACT ISOLATION.

### SYMBOLS:



8809300020-01

PRELIMINARY

TITLE: ATWS MITIGATION SYSTEM  
ACTUATION CIRCUIT (AMSAC)

STATION  
INDIAN PT 2

Con Edison

DWG. NO. SK-15805-12

1

DATE	CHK.	APPV.	DESIGN ENG.	DISC. ENG.	ENG. MGR.

DOWN BY SCALE NONE REC'D XXXXXXXX