The Light company
Houston Lighting & Power

P.O. Box 1700 Houston, Texas 77001 (713) 228-9211

December 22, 1987
ST-HL-AE-2444
File No.: G9.17, J47,G9.1
10CFR50.62

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

South Texas Project Electric Generating Station
Units 1 and 2
Docket Nos. STN 50-498 and STN 50-499
Additional Information Concerning AMSAC

References:

(1) AMSAC FSAR Submittal and Response to 10CFR50.62 - Closure of Confirmatory Item No. 29, M. R. Wisenburg, HL&P, Letter to Vincent S. Noonan, NRC; ST-HL-AE-1780; October 20, 1986

(2) Transmittal of Topical Report: WCAP-10858-P-A, Revision 1: "AMSAC Generic Design Package," Roger A. Newton, WOG, Letter to James Lyons, NRC; OG-87-35; August 3, 1987

(3) Schedule for Response to 10CFR50.62, M. R. Wisenburg, HL&P, Letter to Hugh L. Thompson, Jr., NRC; ST-HL-AE-1371; October 8, 1985

(4) Technical Specification Requirements for the Westinghouse Owner's Group (WOG) AMSAC System, L. D. Butterfield, WOG, Letter to Harold R. Denton, NRC; OG-171; February 10, 1986

A conference call was held on September 3, 1987, to support the NRC Staff's review of Houston Lighting & Power Company's (HL&P) AMSAC Submittal provided in the letter of Reference (1) and subsequently incorporated into FSAR Amendment 57. During that call, four areas were identified where additional information is required for the NRC Staff's review. The information requested is provided in Attachment 1.

Attachment 2 contains an update to FSAR Section 7.8 which reflects the information provided in Attachment 1, as appropriate. The addition of a variable time delay to the AMSAC actuation logic, as discussed in the Westinghouse Owner's Group submittal of Reference (2), is also included in our FSAR description. These changes will be incorporated into a later FSAR amendment.

A055
1/1

L2/NRC/e

The schedule for installation and testing of AMSAC at the South Texas Project remains as described in Reference (3):

Unit 1 - No later than the first refueling outage

Unit 2 - No later than issuance of a license for operation above 5 percent power

If you should have any questions on this matter, please contact Mr. A. W. Harrison at (713) 993-1239.

M. R. Wisenburg
Manager, Engineering and Licensing

THC/ljm

Attachments: 1) Additional AMSAC Information
2) Revised AMSAC Description FSAR Section 7.8

cc:
Regional Administrator, Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

N. Prasad Kadambi, Project Manager
U. S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, MD 20814

Dan R. Carpenter
Senior Resident Inspector/Operations
c/o U. S. Nuclear Regulatory Commission
P. O. Box 910
Bay City, TX 77414

Claude E. Johnson
c/o U. S. Nuclear Regulatory Commission
P. O. Box 910
Bay City, TX 77414

J. R. Newman, Esquire
Newman & Holtzinger, P.C.
1615 L Street, N.W.
Washington, DC 20036

R. L. Range/R. P. Verret
Central Power & Light Company
P. O. Box 2121
Corpus Christi, TX 78403

R. John Miner (2 copies)
Chief Operating Officer
City of Austin Electric Utility
721 Barton Spring Road
Austin, TX 78704

R. J. Costello/M. T. Hardt
City Public Service Board
P. O. Box 1771
San Antonio, TX 78296

Rufus S. Scott
Associate General Counsel
Houston Lighting & Power Company
P. O. Box 1700
Houston, TX 77001

Revised 11/20/87

ADDITIONAL AMSAC INFORMATION

1. REQUEST

Provide a composite logic figure in the FSAR to show all inputs, outputs, and the location of logic functions, time delays, and isolation devices in the overall system.

RESPONSE

A composite logic is provided as Figure 7.8-2 in Attachment 2.

2. REQUEST

Provide a commitment relative to compliance with the QA requirements of GL 85-06 (items XI - XIV) for operation and maintenance of AMSAC.

RESPONSE

AMSAC equipment will be handled, stored, installed, calibrated, tested, operated, and maintained in accordance with approved plant procedures. These will be Quality-Related procedures consistent with the requirements of Generic Letter 85-06 for the non-safety related AMSAC equipment.

3. REQUEST

Provide a commitment to identify the scheduled maintenance intervals for various components of the AMSAC system. Also identify which components will be tested at power and which will be tested only during shutdowns.

RESPONSE

The AMSAC system will be tested and calibrated during plant shutdown, on a refueling outage basis. Work will be controlled through approved plant procedures. Review of the AMSAC design, including test features, is in process to determine which components should reasonably be tested while the plant is at power and what the appropriate test interval is. Development of maintenance procedures will be coordinated with equipment installation such that the necessary procedures will be implemented when AMSAC is declared operational.

4. REQUEST

Document the STP position relative to Tech Specs on AMSAC.

RESPONSE:

HL&P concurs with the Westinghouse Owner's Group position (Reference (4)) that Technical Specifications for AMSAC are unnecessary, would impose a significant administrative burden, and would not enhance the overall safety of nuclear power plants. Use of administrative controls is deemed adequate for control of the non-safety related AMSAC system.

REVISED AMSAC DESCRIPTION

FSAR Section 7.8

7.8 ATWS Mitigation System Actuation Circuitry (AMSAC)

7.8.1 Description

7.8.1.1 System Description. The ATWS (Anticipated Transient Without Scram) Mitigation System Actuation Circuitry (AMSAC) provides a backup to the Reactor Trip System (RTS) and ESF Actuation System (ESFAS) for initiating turbine trip and auxiliary feedwater flow in the event of an anticipated transient without scram. The design of the AMSAC is based upon the limiting AMSAC event, a complete loss of main feedwater without an ensuing reactor trip, As described in Reference 7.8-1. The AMSAC is independent of and diverse from the Reactor Trip System and the ESF Actuation System with the exception of the final actuation devices and is classified as control-grade equipment. It is a highly-reliable, microprocessor-based, single train system powered by a non-Class 1E source. X

The AMSAC continuously monitors main feedwater flow, which is an anticipatory indication of a loss of heat sink, and initiates certain functions when the flow drops below a predetermined setpoint and remains below this setpoint for longer than a preset time delay in three of the four main feedwater lines. These functions are the tripping of the turbine, the initiation of auxiliary feedwater, isolation of the steam generator blowdown lines, and isolation of the steam generator sample lines.

The AMSAC is designed to be highly reliable, resistant to inadvertent actuation, and easily maintained. Reliability is assured through the use of internal redundancy and continual self-testing by the system. Inadvertent actuations are minimized through the use of internal redundancy and majority 57
voting at the output stage of the system. The time delay on low feedwater flow and the coincidence logic used also minimize inadvertent actuations.

The AMSAC is armed automatically allowing it to perform its actuations whenever reactor power exceeds a preselected power level, determined using turbine impulse chamber pressure. AMSAC remains armed sufficiently long after turbine impulse pressure drops below the setpoint to ensure that its function will be performed in the event of a turbine trip.

7.8.1.1.1 Equipment Description. The AMSAC consists of a single train of equipment located in the control-grade cabinet of the Qualified Display Processing System (QDPS). With the exception of the common (non-Class 1E) AC cabinet power supply, the AMSAC is independent of the QDPS. The QDPS is described in detail in Section 7.5.6.

The design of the AMSAC is based on the industry standard Intel multibus format, which permits the use of various readily available, widely used microprocessor cards on a common data bus for various functions. This system uses INTEL 8086 microprocessors.

Feedwater flow is measured with four dedicated differential pressure-type flow transmitters, one on each of the main feedwater lines. These transmitters have been added to the main feedwater system; the existing Class 1E transmitters do not interface with AMSAC.

The AMSAC is housed in the control-grade cabinet (Remote Processing Unit N) of the QDPS. The system hardware consists of two primary systems: the Actuation Logic System (ALS) and the Test/Maintenance System (T/MS). A simplified block diagram of the AMSAC architecture is presented in Figure 7.8-1.

Actuation Logic System

The ALS monitors the analog and digital inputs, performs the functional logic required, provides actuation outputs to trip the turbine and initiate auxiliary feedwater flow, and provides status information to the Test/ Maintenance System. The ALS consists of three groups of input/output (I/O) modules, three actuation logic processors (ALPs), one majority voting module, and one output relay panel. The I/O modules provide signal conditioning, isolation, and test features for interfacing the ALS and T/MS. Conditioned signals are sent to three identical ALPs for analog-to-digital conversion, setpoint comparison, and coincidence logic performance. Each of the ALPs performs identical logic calculations using the same inputs and derives component actuation demands, which are then sent to the majority voting module. The majority voting module performs a two-out-of-three vote on the ALP demand signals. This module drives the relays providing outputs to the existing turbine trip and auxiliary feedwater initiation component circuits.

The ALS is designed such that a single failure of an input channel, ALP majority voting module component or output relay shall neither actuate nor prevent actuation of the diverse turbine trip and auxiliary feedwater start. The ALS is designed to operate on the energize-to-actuate principle. On loss of power to AMSAC or failure of an integral power supply, the system outputs will not actuate. 57

Test/Maintenance System

The T/MS consists of a test/maintenance processor, a digital-to-analog conversion board, a memory board, expansion boards, a self-health board, digital output modules, a test/maintenance panel, and a portable terminal/printer.

The Test/Maintenance System provides the AMSAC with automated and manual testing as well as a maintenance mode. Automated testing is the continuously performed self-checking done by the system during normal operation. ALP status is monitored by the T/MS and sent to the Emergency Response Facilities Data Acquisition and Display System (ERFDADS, refer to Section 7.5.7) and the plant annunciator. Manual testing of the system by the maintenance staff can be performed on-line to provide assurance that the ALP system is fully operational. The maintenance mode permits the maintenance staff, under administrative control, to modify channel setpoints, bypass status and calibration values, and initiate channel calibration.

The output relay panel provides component actuation signals to separately mounted isolation relays, which provide output contacts for initiation of auxiliary feedwater and for turbine trip. AMSAC utilizes existing component final actuation devices.

7.8.1.1.2 Functional Performance Requirements. Analyses have shown that the most limiting ATWS is a loss of feedwater event without a reactor trip. The AMSAC automatically initiates auxiliary feedwater flow, trips the turbine, and isolates steam generator blowdown and sampling lines:

1) to ensure a secondary heat sink following an anticipated transient (ANS Condition II) without a reactor trip,

2) to limit core damage following an anticipated transient without a reactor trip, and

3) to ensure that the energy generated in the core is compatible with the design limits to protect the reactor coolant pressure boundary by maintaining the reactor coolant pressure to within ASME Stress Level C.

7.8.1.1.3 AMSAC Interlocks. A single interlock, designated as C-20, is provided to allow for the automatic arming and blocking of the AMSAC. The system is blocked at reactor power levels below which the actions taken by the AMSAC following an ATWS need not be automatically initiated. Turbine impulse chamber pressure in a two-out-of-two logic scheme is used for this permissive; both turbine impulse chamber pressures above the setpoint will automatically arm the AMSAC. Dropping below this setpoint will automatically block the AMSAC following a preset time delay ~~of approximately 120 seconds~~. The operating status of the AMSAC is displayed on the main control board. (See Figure 7.2-17 for the functional logic diagram showing development of this interlock.)

INSERT A

INSERT B

7.8.1.1.4 Feedwater Flow Sensor Arrangement. Feedwater flow to each steam generator is determined by a differential pressure-type transmitter, measuring the pressure drop across the feedwater flow venturi in the main feedwater line. These feedwater flow transmitters provide dedicated input to the AMSAC. 57

7.8.1.1.5 Trip System. The feedwater flow inputs are used by the AMSAC to determine trip demand. Signal conditioning, engineering unit conversion and digitization are performed on the transmitter output and used by each of the ALPs to derive a component actuation demand. If three of the four feedwater lines have a low feedwater flow and the reactor power level is greater than the C-20 permissive, then a trip demand signal is generated. This signal drives output relays for performing the necessary mitigative actions. (See Figure 7.2-7 for the functional logic diagram showing development of the trip demand signal and Figure 7.2-15 for the functional logic diagram showing the trip demand signal interface with the final actuation device logic.)

7.8.1.1.6 Isolation Devices. With the exception of common final actuation drives, AMSAC is maintained independent of the Reactor Trip and Engineered Safety Features Actuation Systems with the following two exceptions.

Isolation of the nonsafety-related AMSAC from the RTS and ESFAS is provided through use of MDR isolation relays in isolation relay cabinets. A credible fault occurring in the nonsafety-related AMSAC will not propagate through and degrade the RTS and ESFAS. Isolation between the nonsafety-related remote processing unit (RPU N) and the remainder of the safety-related QDPS is not impacted by the addition of AMSAC to RPU N.

(7.8.1.1.3)

INSERTS TO PG 7.8-3

INSERT A

THIS TIME DELAY IS SET TO AVOID BLOCKING AMSAC BEFORE IT CAN PERFORM ITS FUNCTION IN THE EVENT A TURBINE TRIP OCCURS.

INSERT B

¶ A SEPARATE TIME DELAY ON THE LOW MAIN FEEDWATER FLOW 3/4 LOGIC SIGNAL IS PROVIDED TO ALLOW THE REACTOR PROTECTION SYSTEM TO GENERATE A PROTECTIVE SIGNAL BEFORE AMSAC ACTUATION OCCURS. THIS TIME DELAY IS VARIABLE, AS A FUNCTION OF TURBINE POWER. THE TURBINE IMPULSE CHAMBER PRESSURE SIGNALS ARE AUCTIONEERED HIGH TO DETERMINE TURBINE POWER. (SEE REFERENCE 7.8-3 FOR FURTHER EXPLANATION AND FIGURE 7.8-3 FOR A LOGIC DIAGRAM SHOWING DEVELOPMENT OF THIS TIME DELAY FUNCTION.)

Turbine impulse chamber pressure inputs to AMSAC are obtained through the isolation amplifiers located in the analog protection racks.

7.8.1.1.7 AMSAC Diversity from the Reactor Protection Systems. Equipment diverse from the RTS and ESFAS is used in the AMSAC to prevent common mode failures that might affect the AMSAC and the RTS or ESFAS. The AMSAC is a digital, microprocessor-based system with the exception of the analog feedwater flow transmitter inputs. Except for some microprocessor boards in both the AMSAC and the SG reference leg temperature compensation circuit, equipment is diverse between the AMSAC and RTS/ESFAS systems.

Both the ESFAS and the AMSAC initiate auxiliary feedwater (AFW). Diversity is provided in that the ESFAS monitors a temperature-compensated steam generator water level while the AMSAC monitors feedwater flow in order to determine if AFW actuation is required.

Equipment similarity between the circuits that initiate auxiliary feedwater does not negate the ability of the plant systems to mitigate the consequences of postulated common mode failures in the actuation circuits. A postulated common mode failure of identical components in the analog portion of the RTS that results in the inability to generate a reactor trip signal will not impact the ability of the digital AMSAC to generate the necessary mitigative actuations. Similarly, a postulated common mode failure affecting similar components in the digital QDPS portion of the ESFAS, affecting its ability to initiate auxiliary feedwater, and the same components in the AMSAC would impact the ability to automatically initiate auxiliary feedwater but not the ability of the RTS to generate a reactor trip signal.

7.8.1.1.8 Power Supply and Environmental Variations. The AMSAC power supply is the battery-backed non-Class 1E vital bus supplying QDPS RPU N. The 57
cabinet and all other AMSAC equipment are located in controlled environments such that variations in the ambient conditions are minimized. No AMSAC equipment is located inside the Containment.

7.8.1.1.9 Setpoints. The AMSAC makes use of two setpoints in the coincidence logic in order to determine if mitigative functions are required. Feedwater flow in each main feedwater line is sensed to determine if a loss of secondary heat sink is imminent. The low flow setpoint is selected in such a manner that a true loss of feedwater will be detected by the system. The normal small variations in feedwater flow will not result in a spurious AMSAC signal. This low flow setpoint is approximately 50 percent of nominal full power feedwater flow.

To avoid inadvertent AMSAC actuation on the loss of one main feedwater pump, AMSAC actuation is delayed approximately 25 seconds to permit the standby feedwater pumps to start and return feedwater flow above the setpoint.

The C-20 permissive setpoint is selected in order to be consistent with ATWS investigations showing that the mitigative actions performed by the AMSAC need not be automatically actuated below a certain power level. The maximum allowable value of the C-20 permissive setpoint is defined by these investigations. The C-20 setpoint is approximately 70 percent of nominal full power.

To ensure that the AMSAC remains armed sufficiently long to permit its function in the event of a turbine trip, the C-20 permissive is maintained for approximately 120 seconds after the turbine impulse chamber pressure drops below the arming setpoint.

The setpoints and the capability for their modification in the AMSAC are under administrative control.

7.8.1.2 Final System Drawings. The functional logic of the AMSAC is presented in Figures 7.8-2, 7.2-7, 7.2-15 and 7.2-17. Logic diagrams and electrical elementary drawings for the safety-related final actuation devices and the AMSAC interface are listed in Section 1.7.

7.8.2 Analysis

7.8.2.1 Safety Classification/Safety-Related Interface. The AMSAC is not safety-related and therefore need not meet the requirements of IEEE 279-1971. The AMSAC has been implemented such that the Reactor Trip System and the ESF Actuation System continue to meet all applicable safety-related criteria. The AMSAC is independent of the RTS and ESFAS with the exception of the items discussed in Section 7.8.1.1.6. The isolation provided between the RTS and the AMSAC and between the ESFAS and the AMSAC by the isolation relay cabinets and the turbine impulse chamber pressure circuits ensures that the applicable safety-related criteria for the RTS and the ESFAS are not violated.

7.8.2.2 Redundancy. AMSAC system redundancy is not required and has not been provided. To ensure high system reliability, portions of the AMSAC have been implemented as internally redundant, such that a single failure of an 57
input channel or ALP will neither actuate nor prevent actuation of the AMSAC.

7.8.2.3 Diversity from the Existing Trip System. A discussion of the diversity between the RTS and the AMSAC and between the ESFAS and the AMSAC is presented in Section 7.8.1.1.7.

7.8.2.4 Electrical Independence. The AMSAC is electrically independent of the RTS and ESFAS from the sensors up to the final actuation devices with the exception of the turbine impulse chamber pressure input used in the permissive logic of the AMSAC. WCAP-8892A addresses the Westinghouse analog protection cabinet isolation, encompassing the existing isolation amplifier in the turbine impulse chamber pressure circuit. (See also Sections 7.1.2.2.1 and 7.7.2.1.). Isolation relays are provided to isolate the nonsafety AMSAC circuitry from the safety-related actuation circuits of the auxiliary feedwater system. These isolation relays have been tested in a manner consistent with NRC requirements for Class 1E qualified isolation devices. (See also Section 8.3.1.5.)

7.8.2.5 Physical Separation from the RTS and ESFAS. Because the AMSAC is nonsafety-related, it is included in separation group N (see Section 8.3.1.4). Separation criteria of Section 8.3.1.4 are used to separate the AMSAC from the safety-related circuits of the RTS, ESFAS and safety-related components.

7.8.2.6 Environmental Qualification. Equipment related to the AMSAC is qualified to operate under conditions resulting from anticipated operational occurrences for the respective equipment location. (See Section 3.11).

7.8.2.7 Seismic Qualification. Seismic qualification is not required for the AMSAC. Thus, the system has been classified as non-seismic Category I.

7.8.2.8 Test, Maintenance and Surveillance Quality Assurance. NRC Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment that is not Safety-Related", requires quality assurance procedures commensurate with the nonsafety-related classification of the AMSAC. The quality controls for the AMSAC are, at a minimum, consistent with existing plant procedures or practices for nonsafety-related equipment.

Design of the AMSAC followed established procedures relating to equipment procurement, document control, and specification of system components, materials and services. In addition, specifications also define quality assurance practices for inspections, examinations, storage, shipping and tests as appropriate to a specific item or service.

A computer software verification program and a firmware validation program have been implemented commensurate with the nonsafety-related classification of the AMSAC to ensure that the system design requirements implemented with the use of software have been properly implemented and to ensure compliance with the system functional, performance and interface requirements. 57

System testing is completed prior to the installation and operation of the AMSAC, as part of the normal factory acceptance testing and the validation program. Periodic testing is performed both automatically, through use of the system automatic self-checking capability, and manually, under administrative control via the AMSAC test/maintenance panel.

7.8.2.9 Power Supply. Power to the AMSAC is from a battery-backed, non-Class 1E vital bus independent of the power supplies for the RTS and ESFAS. The station battery supplying power to the AMSAC is independent of those used for the RTS and ESFAS. The AMSAC is an energize-to-actuate system capable of performing its mitigative functions with a loss of offsite power. The Class 1E portion of each isolation device is powered by Class 1E power.

7.8.2.10 Testability at Power. The AMSAC is testable at power. This testing is done via the system test/maintenance panel. The capability of the AMSAC to perform its mitigative actuations is bypassed at a system level while in the test mode. Total system testing is performed as a set of three sequential, partial, overlapping tests. The first of the tests checks the analog input portions of the AMSAC in order to verify accuracy. Each of the analog input modules is checked separately. The second test checks each of the ALPs to verify that the appropriate coincidence logic is sent to the majority voter. Each ALP is tested separately. The last test exercises the majority voter and the integrity of the associated output relays. The majority voter and associated output relays are tested by exercising all possible input combinations to the majority voter. The integrity of each of the output relays is checked by confirming continuity of the relay coils without operating the relays. The capability to individually operate the output relays, confirm integrity of the associated field wiring, and operate the corresponding isolation relays and final actuation devices at plant shutdown is provided.

7.8.2.11 Inadvertent Actuation. The AMSAC has been designed such that the frequency of inadvertent actuations is minimized. This high reliability is ensured through use of three redundant ALPs and a majority voting module. A single failure in any of these modules will not result in a spurious AMSAC actuation. In addition, a three-out-of-four low feedwater flow coincidence logic and a time delay have been selected to further minimize the potential for inadvertent actuations.

7.8.2.12 Maintenance Bypasses. The AMSAC is blocked at the system level during maintenance, repair, calibration or test. While the system is blocked, the bypass condition is continuously indicated by the ERFDADS computer.

7.8.2.13 Operating Bypasses. The AMSAC has been designed to allow for operational bypasses with the inclusion of the C-20 permissive. Above the C-20 setpoint, the AMSAC is automatically unblocked (i.e., armed); below the setpoint, the system is automatically blocked. (JUSTIFICATION FOR THE C-20 SETPOINT WAS PROVIDED BY THE WESTINGHOUSE OWNERS GROUP VIA REFERENCE 7.8-2. The operating status of the AMSAC is continuously indicated in the main control room via an annunciator window and the ERFDADS computer.

7.8.2.14 Indication of Bypasses. Whenever the mitigative capabilities 57
of the AMSAC are bypassed or deliberately rendered inoperable, this condition is continuously indicated in the main control room. In addition to the operating bypass, any manual maintenance bypass is indicated via the AMSAC general warning sent to the ERFDADS computer.

7.8.2.15 Means for Bypassing. A system bypass selector switch permanently installed in QDPS RPU N is provided to bypass the system. This is a two-position selector switch with "NORMAL" and "BYPASS" positions. At no time is it necessary to use any temporary means, such as installing jumpers or pulling fuses, to bypass the system.

7.8.2.16 Completion of Mitigative Actions Once Initiated. The AMSAC mitigative actions go to completion as long as the coincidence logic is satisfied and the time delay requirements are met. If the flow in the feedwater lines is re-initiated before the timer expires and increases to above the low flow setpoint, then the coincidence logic will no longer be satisfied and the actuation signal disappears. If the coincidence logic conditions are maintained for the duration of the time delay, then the mitigative actions go to completion. The auxiliary feedwater initiation signal is latched in at the component actuating devices and the turbine trip is latched at the turbine electro-hydraulic control system. Deliberate operator action is then necessary to terminate auxiliary feedwater flow, clear the turbine trip signal using the main control board turbine trip reset switch, and proceed with the reopening of the turbine stop valves.

7.8.2.17 Manual Initiation. Manual initiation of AMSAC at the system level is not required. The capability to initiate AMSAC mitigative functions manually, i.e., initiate auxiliary feedwater, trip the turbine, and isolate steam generator blowdown and sampling lines, exists at the main control board.

7.8.2.18 Information Readout. The AMSAC has been designed such that the operating and maintenance staffs have accurate, complete and timely information pertinent to the status of the AMSAC. A system level general warning alarm is indicated in the control room. Diagnostic capability exists from the test/maintenance panel to determine the cause of any unanticipated inoperability or deviation. 57

7.8.3 Compliance with Standards and Design Criteria

The AMSAC meets the applicable requirements of Part 50.62 of Title 10 of the Code of Federal Regulations and the quality assurance requirements of NRC Generic Letter 85-06.

ADD PAGE

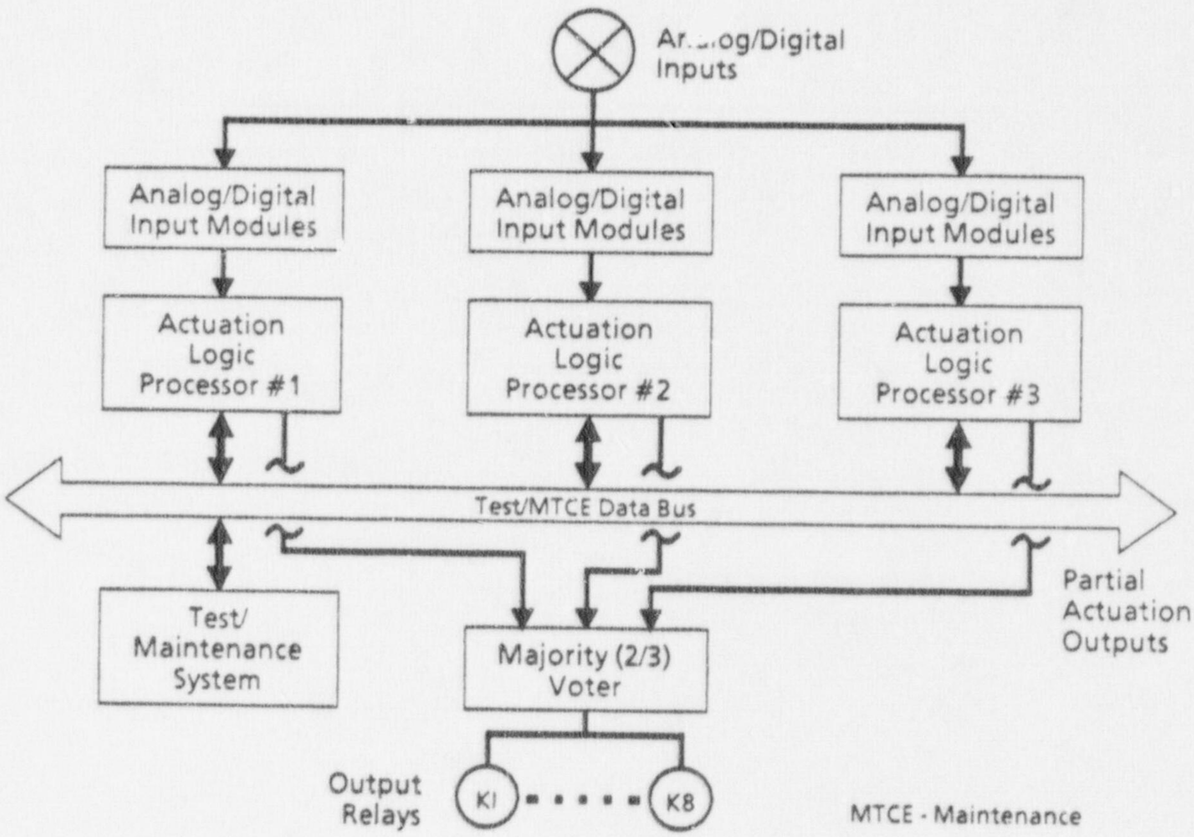
REFERENCES

SECTION 7.8:

7.8-1 ADLER, M. R., "AMSAC GENERIC DESIGN PACKAGE," WCAP-10858-P-A, JUNE 1985.

7.8-2 ADLER, M. R., "AMSAC GENERIC DESIGN PACKAGE," WCAP-10858-P-A, ADDENDUM 1, FEBRUARY 1987, SUBMITTED BY WOG LETTER OG-87-10, DATED FEBRUARY 26, 1987.

7.8-3 ADLER, M.R., "AMSAC GENERIC DESIGN PACKAGE," WCAP-10858-P-A, REVISION 1, JULY 1987, SUBMITTED BY WOG LETTER OG-87-35, DATED AUGUST 3, 1987.

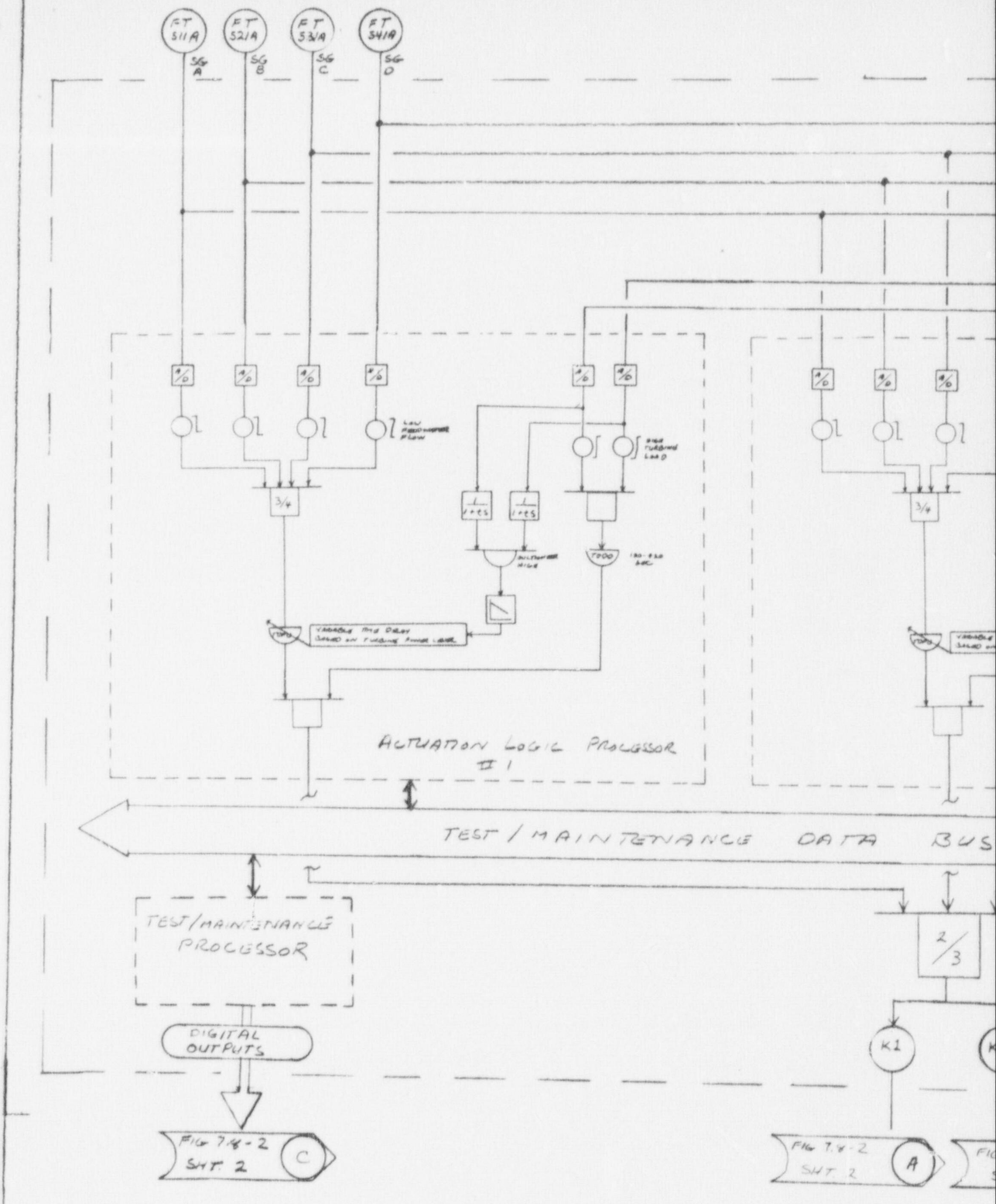


Flow - F2 (Simp. AMSAC B Dia.)

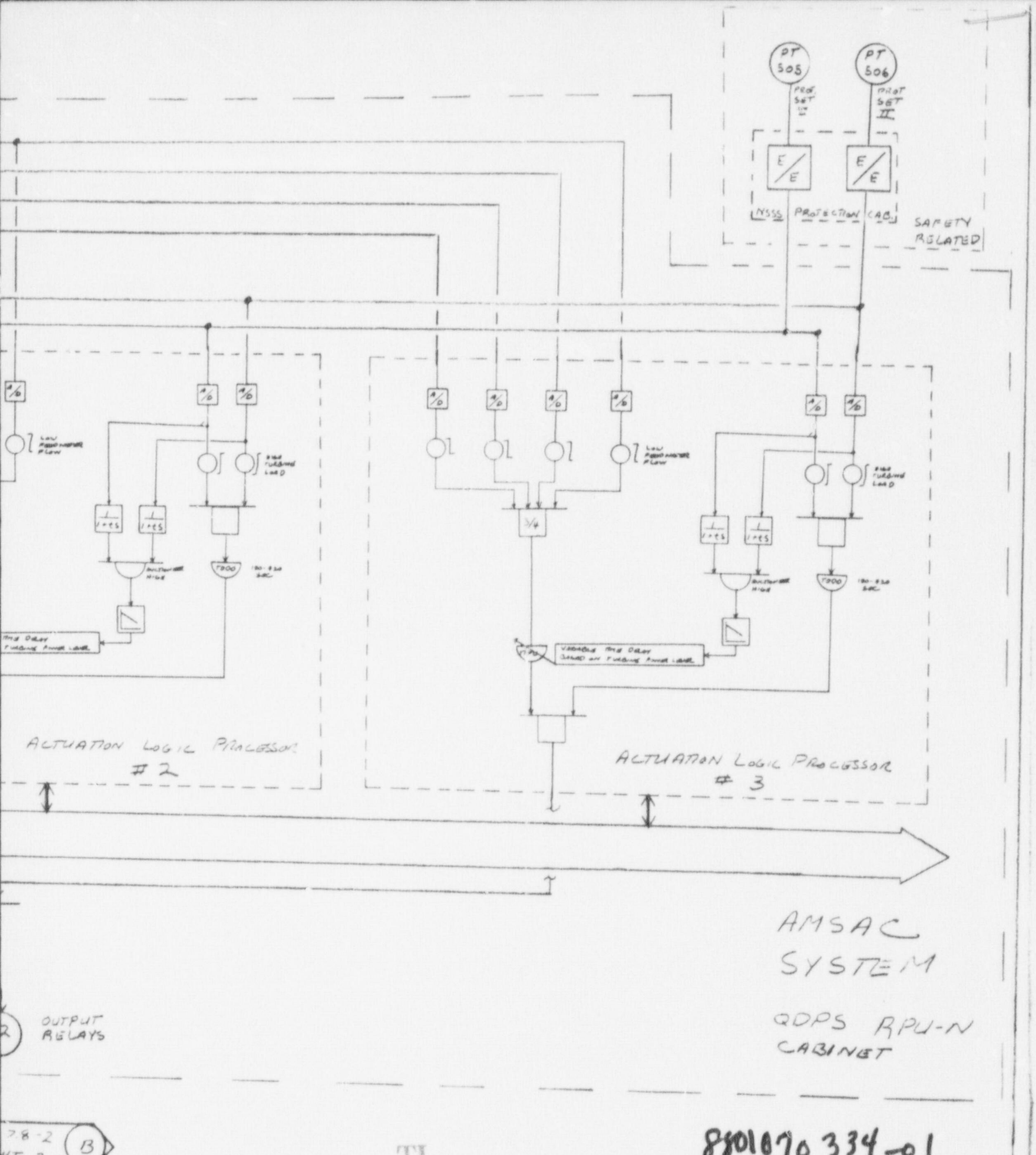
SOUTH TEXAS PROJECT
UNITS 1 & 2

SIMPLIFIED
AMSAC BLOCK DIAGRAM

Figure 7.8-1 Amendment 57



REFER TO SHEET 2 FOR NOTES AND REFERENCES



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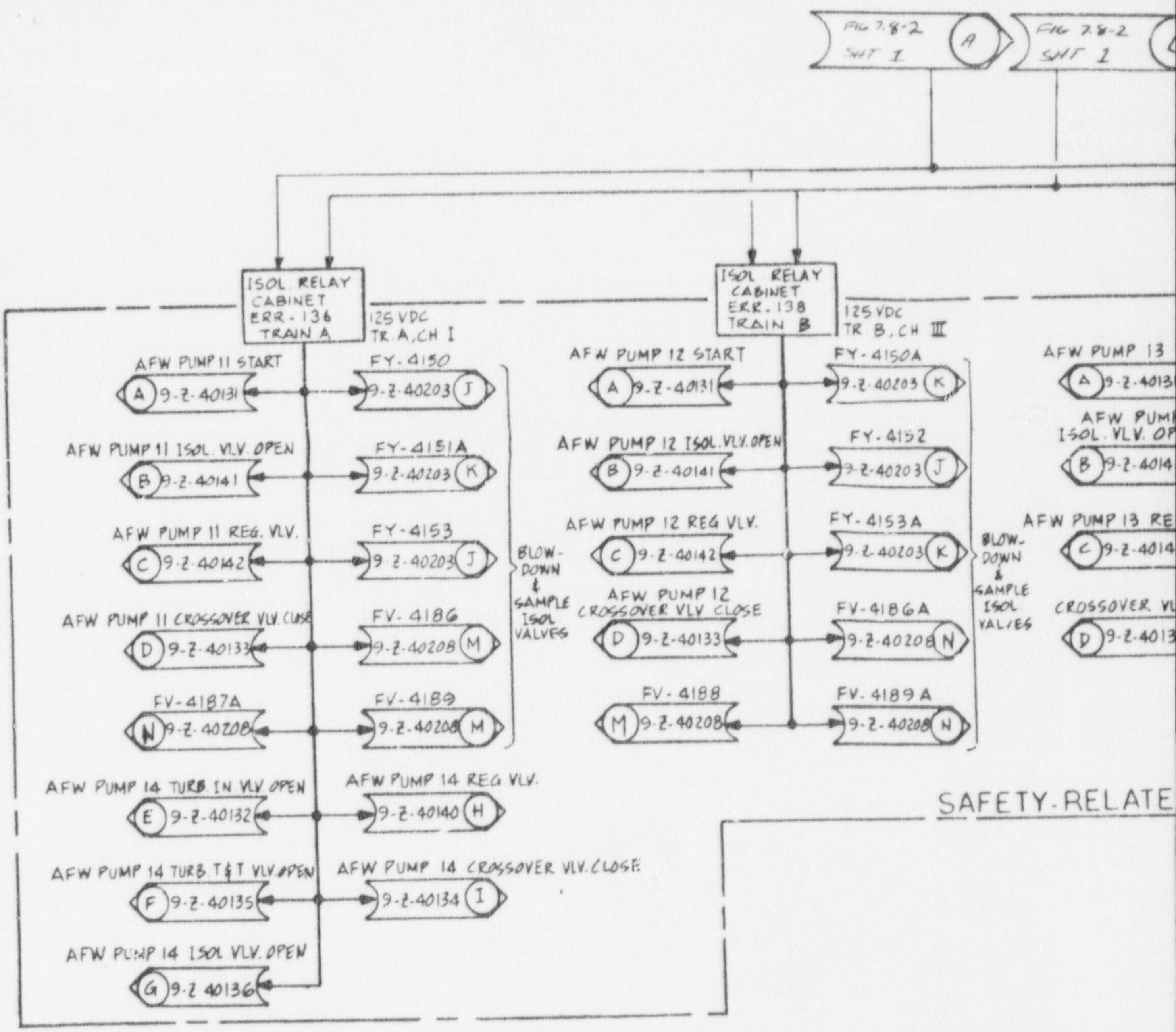
**SOUTH TEXAS PROJECT
UNITS 1 & 2**

COMPOSITE
AMSAC LOGIC DIAGRAM

Figure 7.8-2 SHEET 1 Amendment __



NOTES:

1. THIS DWG REPRESENTS FUNCTIONAL REQUIREMENTS ONLY.
2. AMSAC POWER - 120 VAC, 60 HZ, 1Ø FROM NON-CLASS 1E UPS.
3. EQUIPMENT SHOWN ON THIS DWG IS NON-SAFETY RELATED, EXCEPT AS OTHERWISE NOTED.

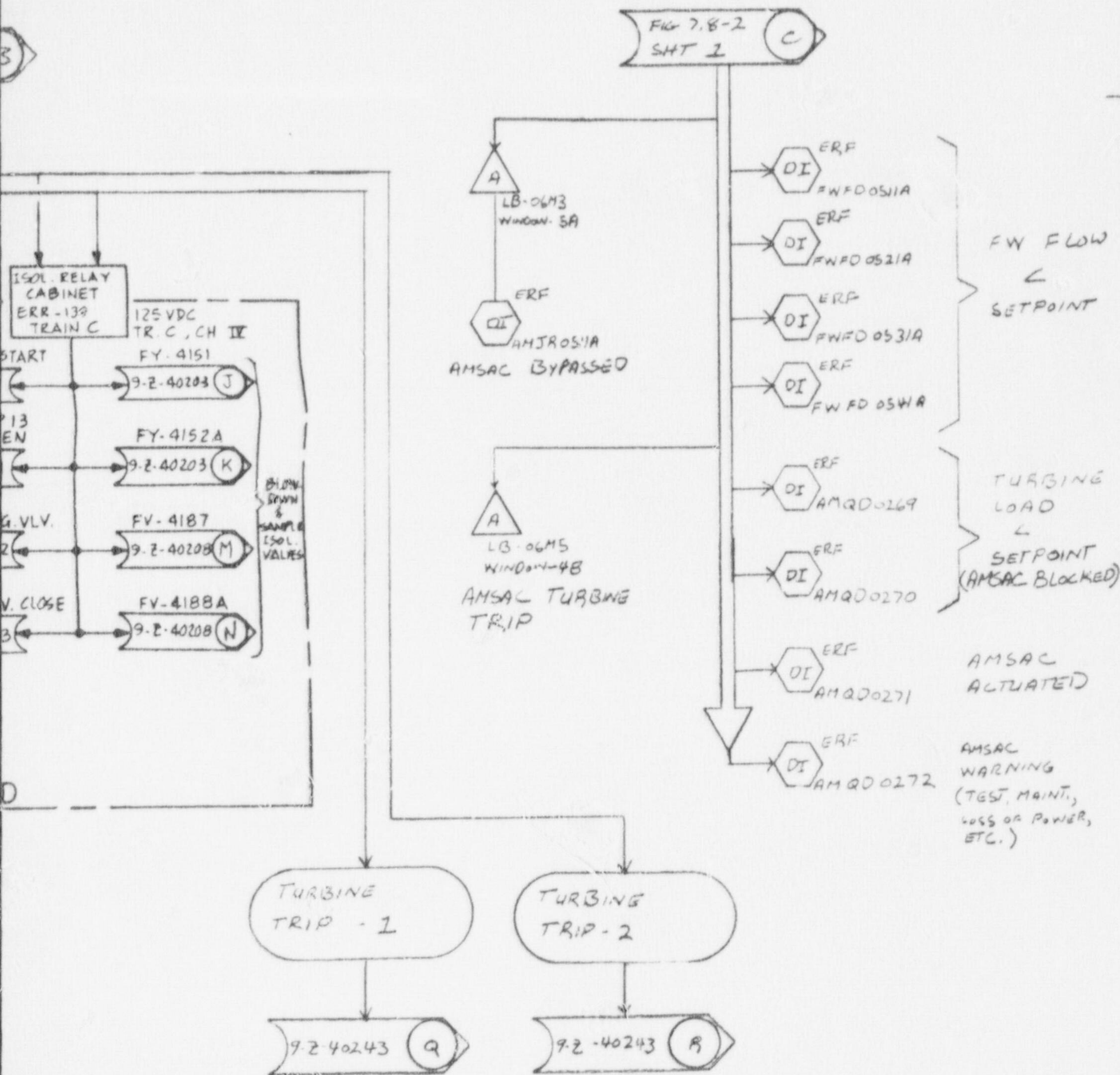
REFERENCE DWGS:

P & ID'S: 9F00024
9F00063
9F00017
9F20001

INTERFACE LOGIC: 1-Z-40143

LOGIC SYMBOLS: 9-Z-40418
THRU 9-Z-4

VENDOR DWGS:
AMSAC TERMINATIONS: 311-( )-
PCC TERMINATIONS: 320-(1)-
ERFDADS TERMINATIONS: 1-Z-47



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SOUTH TEXAS PROJECT
UNITS 1 & 2

COMPOSITE
AMSAC LOGIC DIAGRAM

Figure 7.8-2 Sheet 2 Amendment ___