RESPONSE TO QUESTIONS ON SALT WATER COOLING SYSTEM RELIABILITY STUDY SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 1

Introduction

By letter dated November 24, 1987, from John O. Bradfute, NRC, to Mr. Kenneth P. Baskin, SCE, several questions were posed regarding SCE's Reliability Evaluation of the Saltwater Cooling System submitted by SCE letter dated April 1, 1987. This response first restates the NRC question and then provides an appropriate answer.

Responses

Responses to NRC questions are attached.

Question No. 1

The SWCS reliability study does not address specifically the responses of the SWCS to various initiating events (for example, the loss of offsite power event). Show that the estimated SWCS unreliability is bounding for all the initiating events that would affect the SWCS unreliability.

Response to Question No. 1

The Saltwater Cooling System (SWC) reliability study specifically addresses the response of the SWC System to random failures in the system and its support systems, and a conditional loss of offsite power given a turbine trip. Other initiating events were not specifically considered in the analysis since there are limited support system dependencies on the SWC System. However, in response to the question, a more complete review of initiating event impacts on SWC System reliability has been performed.

The initiating events listed in Table 1 were evaluated for their affect on the Saltwater Cooling System (SWCS) operation and reliability. In many cases, various groups of initiating events evoke similar system responses, or none at all. Events grouped under such categories as reactivity control, core heat removal, RCS heat removal, and RCS inventory and pressure control, do not affect the Saltwater Cooling System in any manner. Initiating events such as reactivity excursions or RCS pressure/level faults coupled with a single system failure would not result in the loss of Saltwater Cooling System function. Initiating events which have no impact on the Saltwater Cooling System or any of its support systems will not have an affect on system reliability. Thus, the bounds established by the current reliability study, which focuses on random failures, envelope the initiating events identified above.

However, initiating events affecting the Saltwater Cooling System or its vital support systems can affect overall system reliability. Such events as loss of offsite power or loss of service air will reduce SWCS reliability.

In this study, a loss of service air is considered because service air supplies the eductor in the primary system for the auxiliary saltwater cooling pump. The service air compressors are primarily dependent on AC power. However, in accordance with technical specifications, the auxiliary saltwater cooling pump can only be used as a backup to a normal saltwater cooling pump. That is, the plant will not be permitted to remain at power if only the auxiliary saltwater cooling pump is available. Further, the compressed air system is needed only to start the auxiliary pump; not to keep it running. Hence, the likelihood that a loss of service air would affect overall SWCS reliability is small in that it would require not only a loss of air but also a loss of both normal and alternate means of saltwater water cooling. While the loss of service air was considered in this analysis, it was not subsequently analyzed quantitatively.

Since the primary contributors to SWC System unreliability in the current study are power related, the SWCS was further evaluated under a loss of offsite power condition. In a loss of offsite power, the Saltwater Cooling System is dependent upon the Onsite AC Power System. A loss of the diesels (as SWCS support systems) results in similar failure combinations as those currently seen in the study.

To further assess the influence of AC power on the SWCS, a sensitivity analysis was conducted assuming that AC power was always available. Thus, the failure combinations obtained were a direct result of SWC system random component failures such as pump, and valve mechanical failures, and were not driven by support system failures.

The results indicate that the primary contributor to the reliability and operation of the Saltwater Cooling System is the AC power support system.

The attached computer printouts from the IMPORTANCE code show the significant basic events and the dominant minimal cutsets for cases analyzed. The following list will help the reader review the attached output:

Case 1: Loss of Offsite Power, Normal Heat Load
Case 2: AC Power Available, Normal Heat Load
Case 3: Loss of Offsite Power, Maximum Heat Load
Case 4: AC Power Available, Maximum Heat Load

The top event probability for the loss of offsite power case under a normal SWCS heat load (CASE 1) is 3.64×10^{-2} failure/ hour. The top event probability for the separate case where it is assumed that AC power is 100% available (CASE 2) for the normal heat load condition is 4.2×10^{-8} failure/hour. The contribution of SWCS failures related to the support power systems is the difference between the two values presented:

$$3.64 \times 10^{-2} - 4.2 \times 10^{-8} = 3.64 \times 10^{-2} \text{ failure/hour}$$

The maximum heat load cases behave similarly to the normal heat load case. The top event probability given loss of offsite power (CASE 3) is 3.64×10^{-2} failure/hour. The top event probability for the maximum heat load case (CASE 4) with AC power assumed to be 100% available is 3.58×10^{-6} failure/hour. Again, the major difference between these two values is the power support system contribution to the SWCS failures:

$$3.64 \times 10^{-2} - 3.58 \times 10^{-6} = 3.64 \times 10^{-2} \text{ failure/hour}$$

Note that the resultant failure probabilities for both the normal heat load case and the maximum heat load case are the same. This is due to the fact that the AC power support systems are the major contributors to the SWCS reliability regardless of heat load condition.

Table 1

Initiating Events Considered For The SWCS Reliability Study

Loss of RCS Flow (1 or 2 Loops)
Total Loss of RCS Flow
Uncontrolled Rod Withdrawal
CRDM Malfunction, Break, or Failure
Dropped Rod
Core Power Excursion
Leakage in Primary System
High Pressurizer Pressure
Low Pressurizer Pressure
Pressurizer Leakage
Pressurizer Spray Failure
Pressurizer Heater Failure
Pressurizer Relief or Safety Valve Opening
Inadvertent Safety Injection/Signal
Containment Pressure Problems
CVCS Malfunction - Boron Dilution
Pressure, Temperature, Power Imbalance-Rod Position Error
Startup of Inactive Coolant Pump
Loss or Reduction in Feedwater Flow (1 or 2 Steam Generators)
Total Loss of Feedwater Flow (All Steam Generators)
Reduction in Feedwater Temperature
Increase in Feedwater Flow (1 or 2 Steam Generators)
Feedwater Flow Instability - Operator Error
Feedwater Flow Instability - Miscellaneous Mechanical Causes
Loss of Condensate Pumps (1 pump)
Loss of Condensate Pumps (All pumps)
Loss of Condenser Vacuum
Steam Generator Leakage
Steam Generator Tube Rupture
Condenser Leakage
Miscellaneous Leakage in Secondary System

Table 1 - continued

One or More Steam Generator Safety Valves Fails Open
One or More Steam Dump Valves Fails Open
Loss of Circulating Water
Loss of Component Cooling Water
Loss of Saltwater Cooling
Throttle Valve Closure - EHC Problems
Throttle Valve Opening - EHC Problems
Generator Trip or Generator-caused Faults
Reduction of External Load on Generator
Loss of External Load on Generator
Turbine Generator Overload
Loss of Offsite Power/Station Blackout
Loss of Power to Necessary Plant Systems
Loss of One or More DC Buses
Loss of One or More Emergency AC Buses
Loss of One or Any Combination of Vital Buses
Automatic Reactor Trip - No Transient Condition
Auto/Manual Trip Due to Operator Error
Spurious Reactor Trip - Cause Unknown
Manual Trip Due to False Signals
Manual Scram - No Transient Condition
Spurious Trip - Cause Unknown
Planned Shutdown
Loss of Coolant Accidents
    Large, Medium, Small, and Small-Small
Feedwater Line Break
Steam Line Break
Loss of Instrument Air System
Loss of Decay Heat Removal
Reactor Vessel Rupture
Interfacing System LOCA

Question No. 2

The common-cause failures are not treated explicitly in the fault tree for the SWCS unreliability. Show that the estimated SWCS unreliability includes the contribution of common-cause failure that may affect the operation of pumps, valves and other components in the SWCS.

Response to Question No. 2

Common-cause failure of the diesel generators was treated explicitly in the fault tree models. By use of POSTPROCESSOR code, the common-cause contribution to the diesel failures was factored in the model. Common-cause failure of the valves in the Saltwater Cooling System was also considered, but was not modeled since the valves in the SWC System are all normally open, manually operated valves. To this extent, there are no failures modes, other than "left closed after test or maintenance," which are common to these valves. Failure of the valves to be in the correct position following test or maintenance is specifically included in the fault tree models.

Common-cause failure of the SWC pumps was also considered. In this regard, it was determined that the pumps do not have significant design, operation, or maintenance features in common for the conditions analyzed. Pumps G-13A and G-13B are of a different design than pump G-13C, and as such do not employ similar types of maintenance or control features. Pump G-13A and G-13B are vertically mounted centrifugal pumps capable of pumping 4620 gpm.

Each pump is powered by a 100 HP 480V AC induction motor. Pumps G- 13A and G-13B are designed for continuous operation. Pump G-13C is a horizontally mounted suction lift centrifugal pump. A suction lift pump must be primed by an air operated eductor in conjunction with a vacuum priming tank. Pump G-13C is not designed for continuous operation because it takes suction before the screen and rakes. Pumps G-13A and G-13B are functionally different since one pump is normally running while the other is normally in standby (the pumps are usually alternated on a monthly schedule, i.e., G-13A is run for a month then shutdown, G13B is then run for a month, etc.). The causes for one pump failing to start from a standby configuration would not be common to those of the other pump which had previously demonstrated a successful start and run period. In the case of common-cause failure to run, it is assumed that maintenance is not performed simultaneously or sequentially on both SWC pumps. This results in the conclusion that common-cause failures to run would not be expected to affect the standby pump for the same time period during which the normally operating pump successfully ran.

Common-cause failure of the screen wash pumps and firewater pumps was also considered. Based on the requirement that both pumps of either set operate to provide sufficient heat removal capability in place of the normal SWCS pumps, common-cause failure of the second pump is inconsequential given the first fails.

Question No. 3

The SWCS unreliability may be affected by testing. For example, an operator may leave a manual valve in the closed position after a test. Show that the testing contribution to the SWCS unreliability is not significant.

Response to Question No. 3

In accordance with "Operations In-Service Valve Testing Procedure" (No. SO1-12.4-2) the auxiliary saltwater cooling pump valve SWC-381 is cycled for testing. This valve is opened to verify flow through the discharge check valve. If left in the open position, there would not be any adverse affects on the SWC System. Other SWCS valves are aligned in the open position by normal operating procedures and have valve position verified monthly. They are not required to be cycled for their respective check valve flow verification since they are normally open. Hence, the SWC System reliability is not affected by testing.

Question No. 4

It is not obvious whether the SWCS fault tree includes failures of pump breakers and their instrumentation and controls. Determine their contribution to the SWCS unreliability.

Response to Question No. 4

Modifications were made to the Saltwater Cooling System fault trees to include pump breakers. The pressure switch which starts the adjacent pump on low discharge pressure was already included in the model. The results of the modifications are included in the analysis output for the cases specified in Question No. 1.

Question No. 5

The SWCS at SONGS-1 has experienced many failure events relating to its pumps and valves. Hence, provide a technical basis that the generic failure rates in the Interim Reliability Evaluation Program (IREP) data base are appropriate for use in the SWCS reliability study for SONGS-1.

Response to Question No. 5

While SONGS-1 has experienced several failures to start of its pumps, records indicate that the failures were generally attributable to design features of the system, and not the pumps. Further, the design features contributing to the failures have been modified to eliminate the failures.

The most significant incident which resulted in a total loss of Saltwater Cooling System flow occurred on March 10, 1980. This event involved a triple failure consisting of (1) shearing of the south saltwater cooling pump shaft, (2) failure of the redundant pump's discharge power operated valve to open, and (3) excessive air in-leakage to the auxiliary saltwater cooling pump air

priming system. The operators cross-connected the backup screen wash pumps to the SWC System in order to provide cooling flow to the component cooling water heat exchangers.

Shearing of the pump shaft was determined to be due to excessive vibration caused by worn bearings. The loss of that pump due to shaft failure in itself would have resulted in the subsequent starting of the standby SWCS pump and opening of the pump discharge power operated valve. The standby pump did start but flow was prevented due to the discharge power operated valve failing to open. This condition has since been corrected by removing the discharge valve power operators (on both pumps), installing manual operators, and leaving the valves normally open. Additionally, since the discharge valves remain open during normal operation, a check valve has been installed upstream of each discharge valve to prevent back flow through the idle pump. The auxiliary saltwater cooling pump was started upon loss of saltwater cooling flow but was prevented from supplying saltwater due to air leaks in the air priming system. Leaks in the air priming system have since been identified and resealed and the priming system upgraded. To date, there have been no further reported failures of the air priming system.

The failures identified above have been addressed specifically by design changes. Each of these is a unique failure which has been corrected and is not expected to re-occur in the future. Hence, the probabilistic models developed to support this analysis did not include these failures.

Pump failure rates and associated error factors are taken directly from the generic data base defined in the IREP Procedures Guide. This data is consistent with the plant specific data analyzed. For example, plant personnel indicated that the SWC pumps have failed four times while running over the past ten years, resulting in a failure to run rate of 4.6×10^{-5}/hr. This value is consistent with the IREP Procedures Guide failure rate of 3.0×10^{-5}/hr. Because of the lack of sufficient plant-specific data, the values from IREP were used throughout the study for component failure rates. The significant amount of failure data incorporated in the IREP Procedures Guide data base makes its importance to this analysis more valuable than the plant-specific data. However, the plant specific data trend is generally consistent with the IREP Procedure Guide data.

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BASIC EVENTS EXHIBITING SIGNIFICANT IMPORTANCE

RANK	BASIC EVENT NAME	BASIC EVENT DESCRIPTION	FUSSELL-VESELY IMPORTANCE
1	UNASDGEH	1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	0.829
2	UGE10.5Y	1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	0.425
2	UGE0001S	DIESEL GENERATOR NO. 1 FAILS TO START	0.425
3	UGE0001R	1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	0.403
4	UGE20.5Y	1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	0.289
5	DG2/1R	1-AC-DG2 FAILS TO RUN 24HR GIVN DG1 FAILS	0.278
6	DG2/1S	1-AC-DG2 FAILS TO START GIVN DG1 FAILS	0.224
7	UGE0002R	1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	0.196
8	UGE0002M	DIESEL GENERATOR NO. 2 IN MAINTENANCE	0.177
9	UOPSDGEV	1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	0.176
10	UGE0001M	DIESEL GENERATOR NO. 1 IN MAINTENANCE	0.119
11	UGE0002S	DIESEL GENERATOR NO. 2 FAILS TO START	0.065
12	UOPDGCMW	1-AC-OPERATORS INADVERT PARALLEL 4160V BUS	0.032
13	UOPCB15W	1-AC-OP INCORRECTLY CLOSES BKR 12C15	0.027
14	UOPCB14V	1-AC-OP FAILS TO CORRECTLY CLOSE BKR 11C14	0.020
15	UCB2C15N	1-AC-BREAKER 12C15 FAILS TO CLOSE	0.016
16	UCB1C14N	1-AC-CIRCUIT BREAKER 11C14 FAILS TO CLOSE	0.012

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
8.360E-03	DG2/1R - 1-AC-DG2 FAILS TO RUN 24HR GIVN DG1 FAILS	1.600E-01	0.2297	0.2297
	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
6.726E-03	DG2/1S - 1-AC-DG2 FAILS TO START GIVN DG1 FAILS	1.200E-01	0.1848	0.4146
	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
3.083E-03	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0847	0.4993
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
2.578E-03	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0709	0.5702
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
2.403E-03	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0661	0.6362
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
2.403E-03	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0661	0.7023
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
1.760E-03	DG2/1R - 1-AC-DG2 FAILS TO RUN 24HR GIVN DG1 FAILS	1.600E-01	0.0484	0.7506
	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
1.416E-03	DG2/1S - 1-AC-DG2 FAILS TO START GIVN DG1 FAILS	1.200E-01	0.0389	0.7896
	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
9.927E-04	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0273	0.8168
	UGE0002S - DIESEL GENERATOR NO. 2 FAILS TO START	1.900E-02		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.500E-04	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01	0.0261	0.8429
	UOPDGCMW - 1-AC-OPERATORS INADVERT PARALLEL 4160V BUS	1.000E-03		
8.303E-04	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0228	0.8658
	UGE0002S - DIESEL GENERATOR NO. 2 FAILS TO START	1.900E-02		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
6.490E-04	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0178	0.8836
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
5.428E-04	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0149	0.8985
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
5.060E-04	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0139	0.9124
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
5.060E-04	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0139	0.9263
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
2.802E-04	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0077	0.9340
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB15W - 1-AC-OP INCORRECTLY CLOSES BKR 12C15	5.000E-03		
2.612E-04	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02	0.0072	0.9412
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB14V - 1-AC-OP FAILS TO CORRECTLY CLOSE BKR 11C14	5.000E-03		
2.612E-04	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0072	0.9484
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB15W - 1-AC-OP INCORRECTLY CLOSES BKR 12C15	5.000E-03		
2.185E-04	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02	0.0060	0.9544
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB14V - 1-AC-OP FAILS TO CORRECTLY CLOSE BKR 11C14	5.000E-03		

BASIC EVENTS EXHIBITING SIGNIFICANT IMPORTANCE

RANK	BASIC EVENT NAME	BASIC EVENT DESCRIPTION	FUSSELL-VESELY IMPORTANCE
1	PHV720AP	MOV-720A FAILS TO OPEN (RAND CAUSES)	0.429
2	PCBG13AN	BREAKER TO PUMP G-13A FAILS TO CLOSE	0.325
3	FCV0382N	1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	0.299
4	PFOREBYJ	1-SWC-NO WATER IN FOREBAY	0.275
5	POPDIASW	OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	0.252
5	POP0526U	1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	0.252
6	PPMG13BR	1-SWC-SWC PUMP G-13B FAILS TO RUN	0.173
7	G13A/BR	1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	0.168
8	PHEE20BE	HEAT EXCH. E-20B TUBE SIDE FOULED	0.157
9	PPMG13CM	1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	0.119
10	PCBG13CN	BREAKER TO PUMP G-13C FAILS TO CLOSE	0.096
10	POP0381U	1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	0.096
10	PPMG13CS	1-SWC-SWC PUMP G-13C FAILS TO START	0.096
10	POPG13CU	1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	0.096
11	PPMG13AR	1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	0.075
12	PPMG13BM	1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	0.033
13	PPMG13BS	1-SWC-SWC PUMP G-13B FAILS TO START	0.027
13	PCBG13BN	BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	0.027
14	PPMG13CR	1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	0.022
15	PXV0301X	1-SWC-MANUAL VALVE SDW-301 LEFT CLOSED AFTR MA	0.015
16	PXV0303X	MAN VALVE SWC-303 LEFT CLOSED AFTR MAINT	0.014
16	PXV0331X	MAN VALVE CCW-331 LEFT CLOSE AFTR MAINT.	0.014

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.000E-09	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.2134	0.2134
	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03		
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		
6.000E-09	PHEE20BE - HEAT EXCH. E-20B TUBE SIDE FOULED	2.000E-06	0.1422	0.3556
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		
2.160E-09	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.0512	0.4068
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		
	PPMG13AR - 1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	7.200E-04		
1.110E-09	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0263	0.4331
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
1.110E-09	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0263	0.4595
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
9.000E-10	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03	0.0213	0.4808
	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.000E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0213	0.5021
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
9.000E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0213	0.5235
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
9.000E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0213	0.5448
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
9.000E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0213	0.5661
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
9.000E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0213	0.5875
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.000E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0213	0.6088
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
9.000E-10	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03	0.0213	0.6302
	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04		
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
7.992E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0189	0.6491
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
7.992E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0189	0.6681
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.6834
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.6988
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.7141
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.7295
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.7449
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.7602
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.7756
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
6.480E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0154	0.7910
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
3.000E-10	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.0071	0.7981
	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03		
	PXV0303X - MAN VALVE SWC-303 LEFT CLOSED AFTR MAINT	1.000E-04		
3.000E-10	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.0071	0.8052
	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04		
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
3.000E-10	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.0071	0.8123
	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03		
	PXV0331X - MAN VALVE CCW-331 LEFT CLOSE AFTR MAINT.	1.000E-04		
3.000E-10	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.0071	0.8194
	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03		
	PXV0301X - 1-SWC-MANUAL VALVE SDW-301 LEFT CLOSED AFTR MA	1.000E-04		
2.160E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0051	0.8245
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		
2.160E-10	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0051	0.8296
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		
2.000E-10	PHEE20BE - HEAT EXCH. E-20B TUBE SIDE FOULED	2.000E-06	0.0047	0.8344
	PXV0331X - MAN VALVE CCW-331 LEFT CLOSE AFTR MAINT.	1.000E-04		
2.000E-10	PHEE20BE - HEAT EXCH. E-20B TUBE SIDE FOULED	2.000E-06	0.0047	0.8391
	PXV0303X - MAN VALVE SWC-303 LEFT CLOSED AFTR MAINT	1.000E-04		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
2.000E-10	PHEE20BE - HEAT EXCH. E-20B TUBE SIDE FOULED	2.000E-06	0.0047	0.8439
	PXV0301X - 1-SWC-MANUAL VALVE SDW-301 LEFT CLOSED AFTR MA	1.000E-04		
1.555E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0037	0.8476
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		
1.555E-10	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0037	0.8512
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		
1.232E-10	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0029	0.8542
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
1.232E-10	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0029	0.8571
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8595
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8618
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8642
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8666
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8689
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8713
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8737
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8760
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	POP0526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8784
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8808
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	POPDIASW - OP FAILS TO DIAGNOSE LOSS OF SWC SYSTEM	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8831
	POPO526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
9.990E-11	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0024	0.8855
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	POPO526U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-2.4-1	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		

BASIC EVENTS EXHIBITING SIGNIFICANT IMPORTANCE

RANK	BASIC EVENT NAME	BASIC EVENT DESCRIPTION	FUSSELL-VESELY IMPORTANCE
1	UNASDGEH	1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	0.828
2	UGE0001S	DIESEL GENERATOR NO. 1 FAILS TO START	0.425
2	UGE10.5Y	1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	0.425
3	UGE0001R	1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	0.403
4	UGE20.5Y	1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	0.289
5	DG2/1R	1-AC-DG2 FAILS TO RUN 24HR GIVN DG1 FAILS	0.278
6	DG2/1S	1-AC-DG2 FAILS TO START GIVN DG1 FAILS	0.224
7	UGE0002R	1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	0.196
8	UGE0002M	DIESEL GENERATOR NO. 2 IN MAINTENANCE	0.177
9	UOPSDGEV	1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	0.176
10	UGE0001M	DIESEL GENERATOR NO. 1 IN MAINTENANCE	0.119
11	UGE0002S	DIESEL GENERATOR NO. 2 FAILS TO START	0.065
12	UOPDGCMW	1-AC-OPERATORS INADVERT PARALLEL 4160V BUS	0.032
13	UOPCB15W	1-AC-OP INCORRECTLY CLOSES BKR 12C15	0.027
14	UOPCB14V	1-AC-OP FAILS TO CORRECTLY CLOSE BKR 11C14	0.020
15	UCB2C15N	1-AC-BREAKER 12C15 FAILS TO CLOSE	0.016
16	UCB1C14N	1-AC-CIRCUIT BREAKER 11C14 FAILS TO CLOSE	0.012

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
8.360E-03	DG2/1R - 1-AC-DG2 FAILS TO RUN 24HR GIVN DG1 FAILS	1.600E-01	0.2297	0.2297
	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
6.726E-03	DG2/1S - 1-AC-DG2 FAILS TO START GIVN DG1 FAILS	1.200E-01	0.1848	0.4145
	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
3.083E-03	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0847	0.4991
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
2.578E-03	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0708	0.5700
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
2.403E-03	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0660	0.6360
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
2.403E-03	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0660	0.7020
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
1.760E-03	DG2/1R - 1-AC-DG2 FAILS TO RUN 24HR GIVN DG1 FAILS	1.600E-01	0.0484	0.7504
	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
1.416E-03	DG2/1S - 1-AC-DG2 FAILS TO START GIVN DG1 FAILS	1.200E-01	0.0389	0.7893
	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
9.927E-04	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0273	0.8166
	UGE0002S - DIESEL GENERATOR NO. 2 FAILS TO START	1.900E-02		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
9.500E-04	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01	0.0261	0.8427
	UOPDGCMW - 1-AC-OPERATORS INADVERT PARALLEL 4160V BUS	1.000E-03		
8.303E-04	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0228	0.8655
	UGE0002S - DIESEL GENERATOR NO. 2 FAILS TO START	1.900E-02		
	UGE20.5Y - 1-AC-NO REPAIR OF DIESEL NO. 2 BY T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
6.490E-04	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0178	0.8833
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
5.428E-04	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0149	0.8982
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
5.060E-04	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0139	0.9121
	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
5.060E-04	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0139	0.9260
	UGE0002M - DIESEL GENERATOR NO. 2 IN MAINTENANCE	4.600E-02		
	UOPSDGEV - 1-AFW-OP FAILS TO REALIGN BUS #2 TO SDGE LINE	2.000E-01		
2.802E-04	UGE0001S - DIESEL GENERATOR NO. 1 FAILS TO START	5.900E-02	0.0077	0.9337
	UGE10.5Y - 1-AC-NO REPAIR OF DIESEL NO. 1 T=30 MIN	1.000E+00		
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB15W - 1-AC-OP INCORRECTLY CLOSES BKR 12C15	5.000E-03		
2.612E-04	UGE0001R - 1-AC-DG #1 FAILS TO RUN FOR 24 HOURS	5.500E-02	0.0072	0.9409
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB15W - 1-AC-OP INCORRECTLY CLOSES BKR 12C15	5.000E-03		
2.612E-04	UGE0002R - 1-AC-DIESEL GENERATOR NO. 2 FAILS TO RUN	5.500E-02	0.0072	0.9481
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB14V - 1-AC-OP FAILS TO CORRECTLY CLOSE BKR 11C14	5.000E-03		
2.185E-04	UGE0001M - DIESEL GENERATOR NO. 1 IN MAINTENANCE	4.600E-02	0.0060	0.9541
	UNASDGEH - 1-AC-SDGE 12KV LINE UNAVAIL AFTR LOSS OF SWYRD	9.500E-01		
	UOPCB15W - 1-AC-OP INCORRECTLY CLOSES BKR 12C15	5.000E-03		

BASIC EVENTS EXHIBITING SIGNIFICANT IMPORTANCE

RANK	BASIC EVENT NAME	BASIC EVENT DESCRIPTION	FUSSELL-VESELY IMPORTANCE
1	PFOREBYJ	1-SWC-NO WATER IN FOREBAY	0.462
2	PPMG13BR	1-SWC-SWC PUMP G-13B FAILS TO RUN	0.342
3	G13A/BR	1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	0.332
4	PPMG13CM	1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	0.218
5	PCBG13CN	BREAKER TO PUMP G-13C FAILS TO CLOSE	0.177
5	PPMG13CS	1-SWC-SWC PUMP G-13C FAILS TO START	0.177
5	POP0381U	1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	0.177
5	POPG13CU	1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	0.177
6	PCBG13AN	BREAKER TO PUMP G-13A FAILS TO CLOSE	0.166
7	PPMG13BM	1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	0.064
8	PCBG13BN	BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	0.051
8	PPMG13BS	1-SWC-SWC PUMP G-13B FAILS TO START	0.051
9	PPMG13CR	1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	0.042
10	PPMG13AR	1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	0.038
11	PHV720AP	MOV-720A FAILS TO OPEN (RAND CAUSES)	0.024
12	POP0302U	1-SWC-FLOW DIV - OPER FAILS TO CLOSE SWC-302	0.011
12	POP0300U	1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11(SWC-3	0.011

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
3.700E-07	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.1032	0.1032
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
3.000E-07	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03	0.0837	0.1869
	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04		
3.000E-07	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0837	0.2707
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
3.000E-07	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0837	0.3544
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
3.000E-07	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0837	0.4381
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
2.664E-07	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0743	0.5124
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
2.160E-07	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0603	0.5727
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
2.160E-07	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0603	0.6329
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
2.160E-07	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0603	0.6932
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
2.160E-07	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0603	0.7535
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
7.200E-08	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04	0.0201	0.7736
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		
5.184E-08	G13A/BR - 1-SWC-G-13A FAILS TO RUN GIVN 13B FAILS	1.000E-01	0.0145	0.7880
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		
4.107E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0115	0.7995
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
3.330E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0093	0.8088
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
3.330E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0093	0.8181
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
3.330E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0093	0.8274
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
3.330E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0093	0.8367
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
3.330E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0093	0.8460
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
3.330E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0093	0.8552
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.8628
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.8703
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.8778
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.8854
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.8929
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.9004
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		
	POP0300U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11(SWC-3	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.9080
	PCBG13BN - BREAKER TO SWC PUMP G-13B FAILS TO CLOSE	3.000E-03		
	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.9155
	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03		
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.9230
	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03		
	PPMG13BS - 1-SWC-SWC PUMP G-13B FAILS TO START	3.000E-03		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
2.700E-08	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0075	0.9306
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		
	POP0302U - 1-SWC-FLOW DIV - OPER FAILS TO CLOSE SWC-302	3.000E-03		
1.000E-08	PCV0338P - 1-SWC-CHECK VALVE SWC-338 FAILS TO OPEN	1.000E-04	0.0028	0.9334
	PFOREBYJ - 1-SWC-NO WATER IN FOREBAY	1.000E-04		
9.857E-09	PPMG13AR - 1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	7.200E-04	0.0028	0.9361
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
9.000E-09	FCV0382N - 1-SWC-FLOW DIV-CHECK VLV SWC382 FAILS TO CLOSE	1.000E-03	0.0025	0.9386
	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03		
	PHV720AP - MOV-720A FAILS TO OPEN (RAND CAUSES)	3.000E-03		
7.992E-09	PPMG13AR - 1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	7.200E-04	0.0022	0.9409
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CS - 1-SWC-SWC PUMP G-13C FAILS TO START	3.000E-03		
7.992E-09	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0022	0.9431
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
	PPMG13CR - 1-SWC-AUX SWC PUMP G-13C FAILS TO RUN	7.200E-04		

DOMINANT MINIMAL CUTSETS

CUTSET PROBABILITY	BASIC EVENTS IN CUTSET	BASIC EVENT PROBABILITY	FRACTION OF TOTAL UNAVAILABILITY	CUMULATIVE FRACTION OF TOTAL UNAVAILABILITY
7.992E-09	PCBG13AN - BREAKER TO PUMP G-13A FAILS TO CLOSE	3.000E-03	0.0022	0.9453
	PPMG13BR - 1-SWC-SWC PUMP G-13B FAILS TO RUN	7.200E-04		
	PPMG13CM - 1-SWC-SWC PUMP G-13C DOWN DUE TO MAINT.	3.700E-03		
7.992E-09	PCBG13CN - BREAKER TO PUMP G-13C FAILS TO CLOSE	3.000E-03	0.0022	0.9476
	PPMG13AR - 1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	7.200E-04		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
7.992E-09	POP0381U - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11	3.000E-03	0.0022	0.9498
	PPMG13AR - 1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	7.200E-04		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		
7.992E-09	POPG13CU - 1-SWC-OPER FAILS TO FOLLOW PROC SO1-7-11 (G13C	3.000E-03	0.0022	0.9520
	PPMG13AR - 1-SWC-SWC PUMP SWC-G-13A FAILS TO RUN	7.200E-04		
	PPMG13BM - 1-SWC-SWC PUMP G-13B DOWN DUE TO MAINT	3.700E-03		

FIGURE P-1: SALTWATER COOLING SYSTEM FAULT TREE

UNIT 1

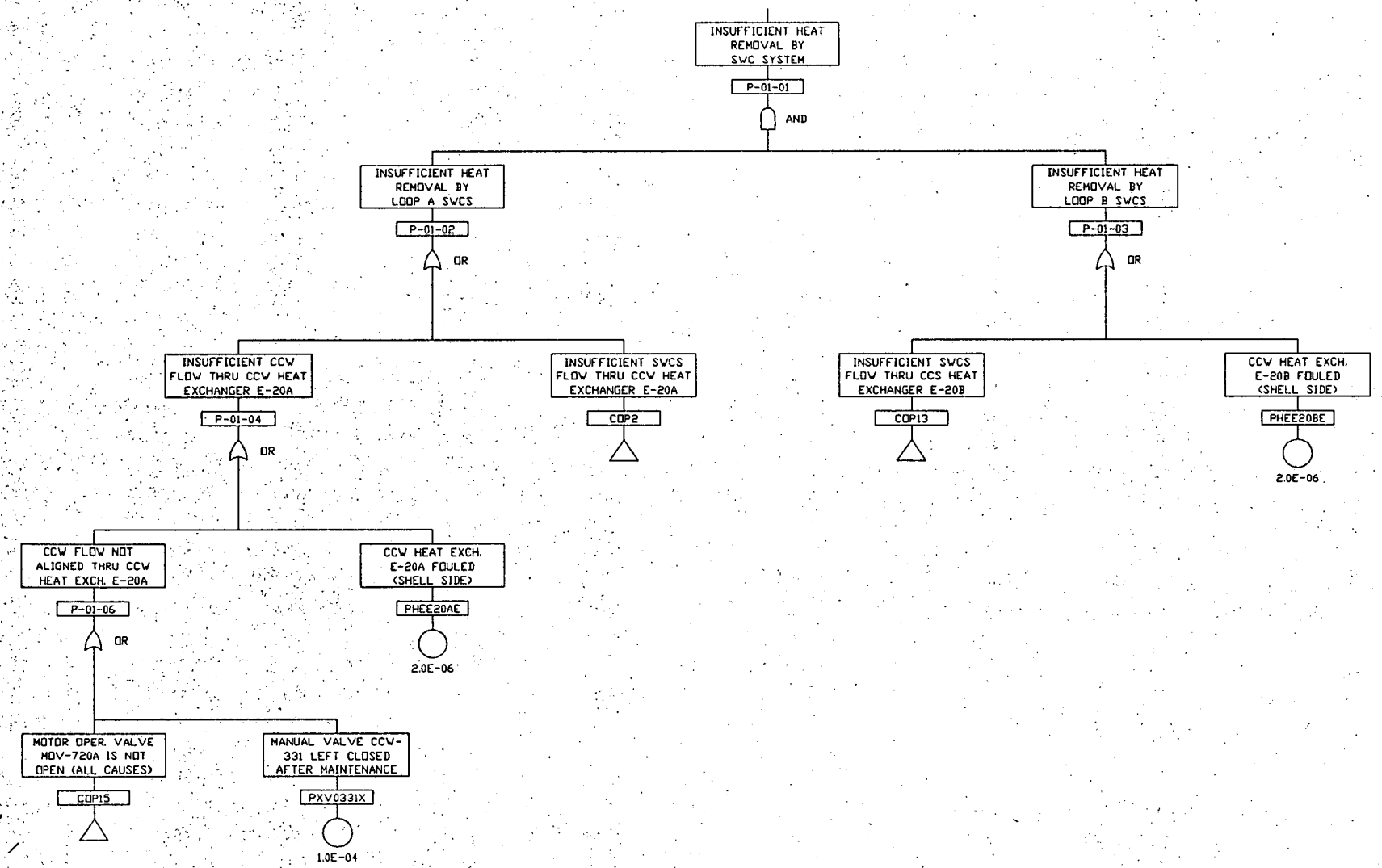

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FIGURE P-1, SHEET 2

UNIT 1

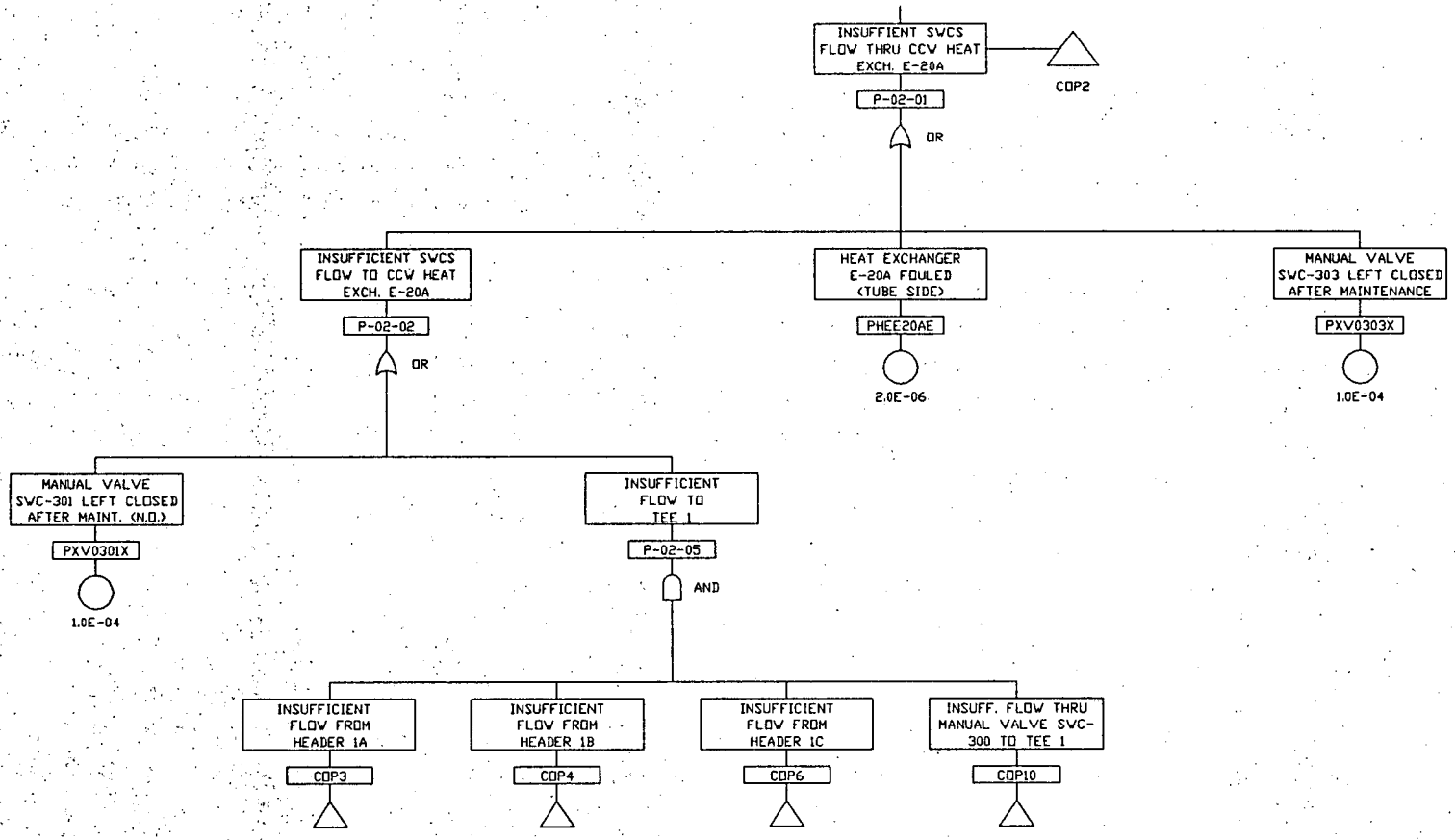

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FIGURE P-1, SHEET 3

UNIT 1

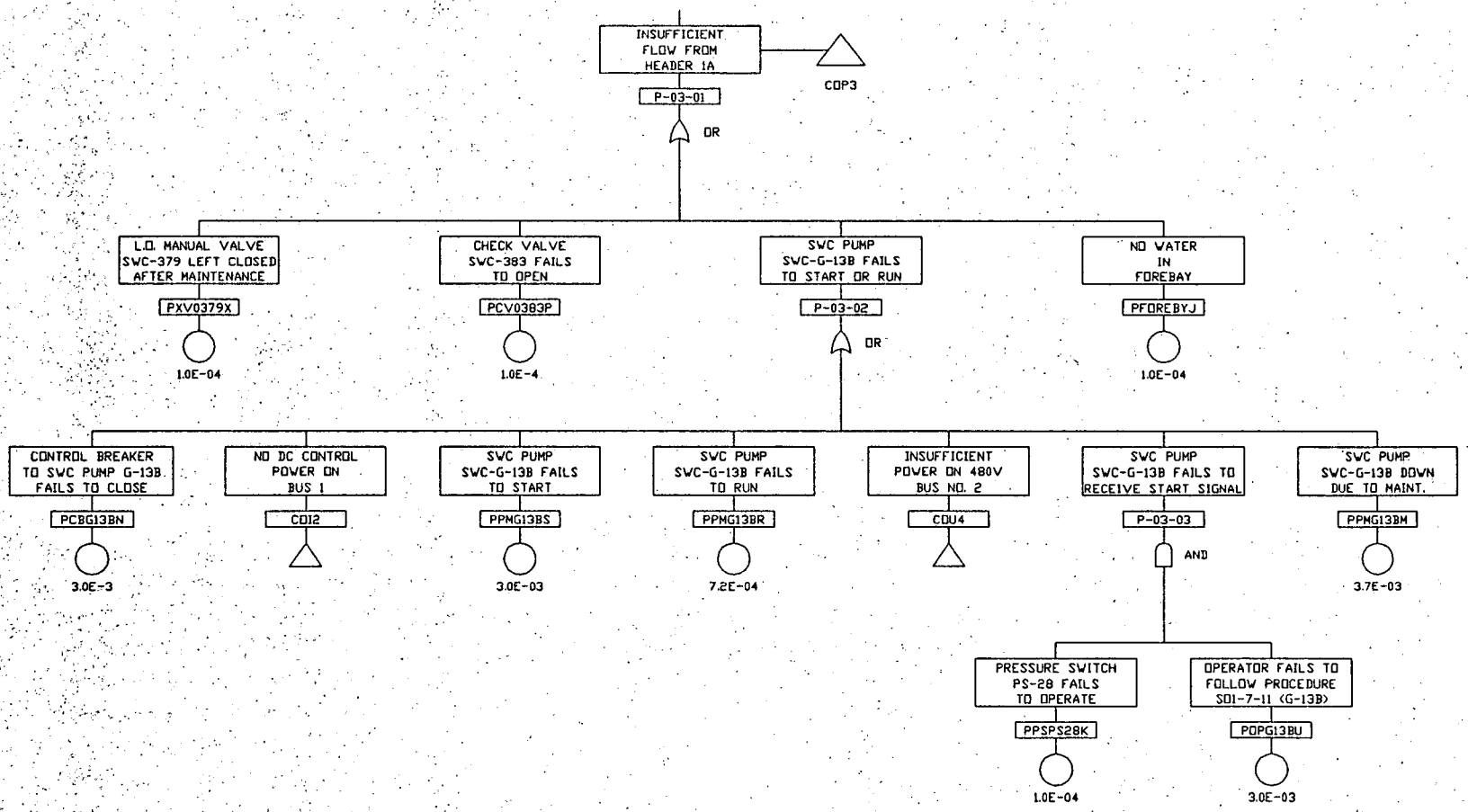

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FIGURE P-1, SHEET 4

UNIT 1

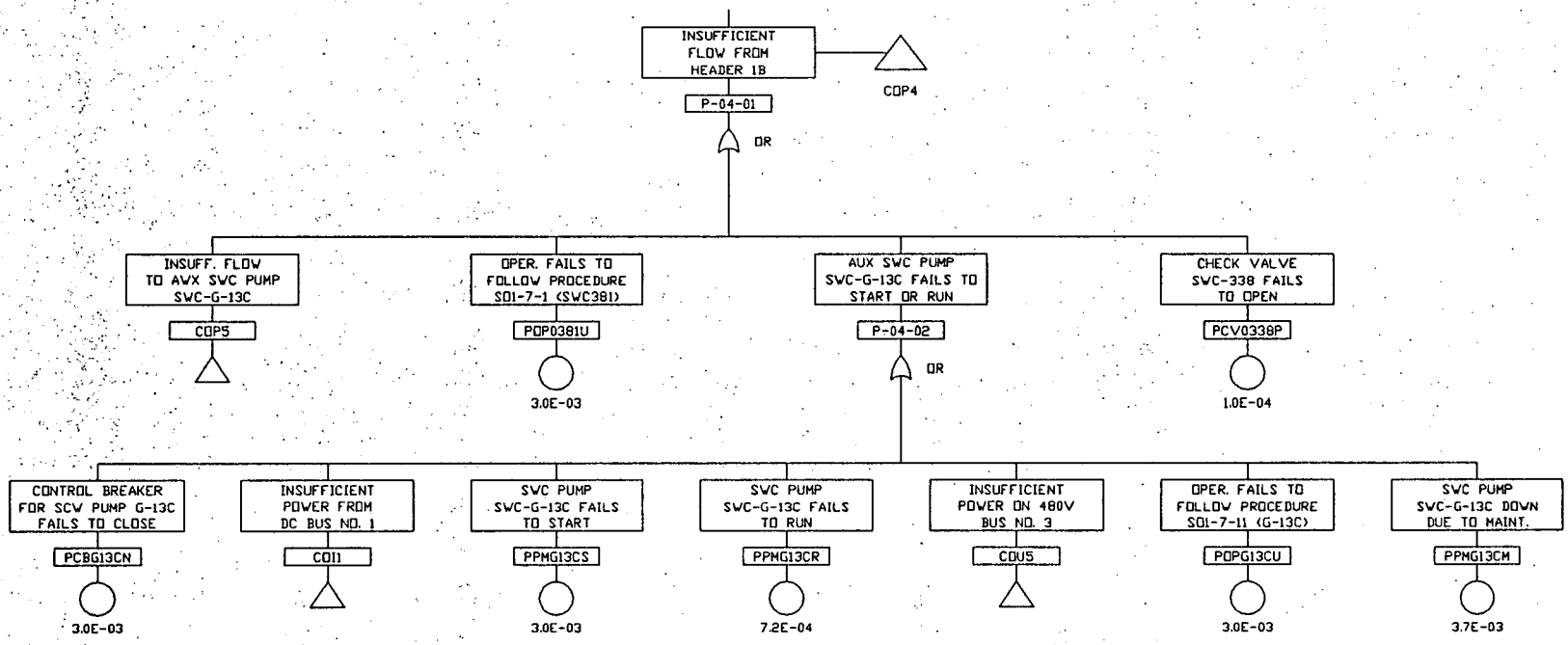

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FIGURE P-1, SHEET 5

UNIT 1

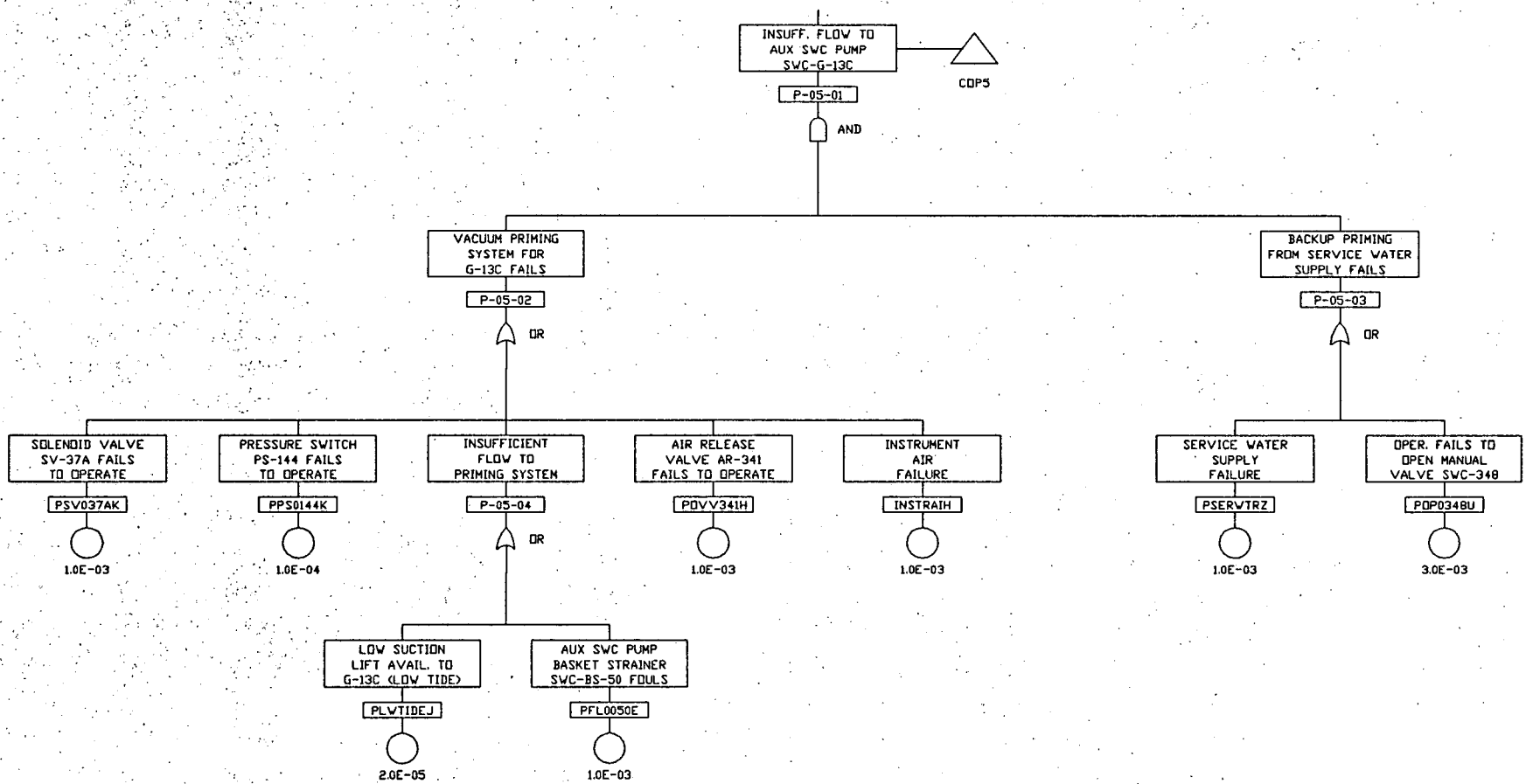

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FIGURE P-1, SHEET 6

UNIT 1

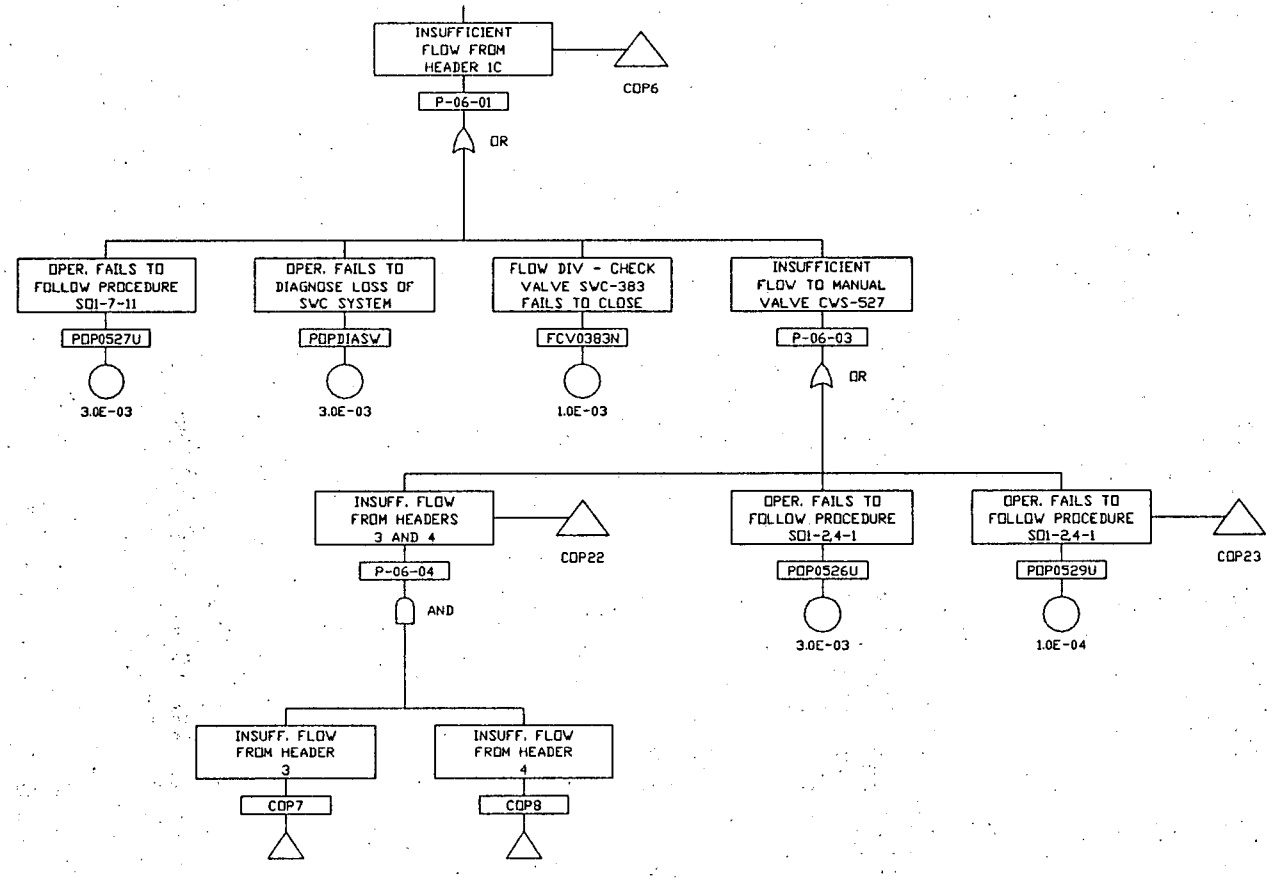

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FIGURE P-1, SHEET 7

UNIT 1

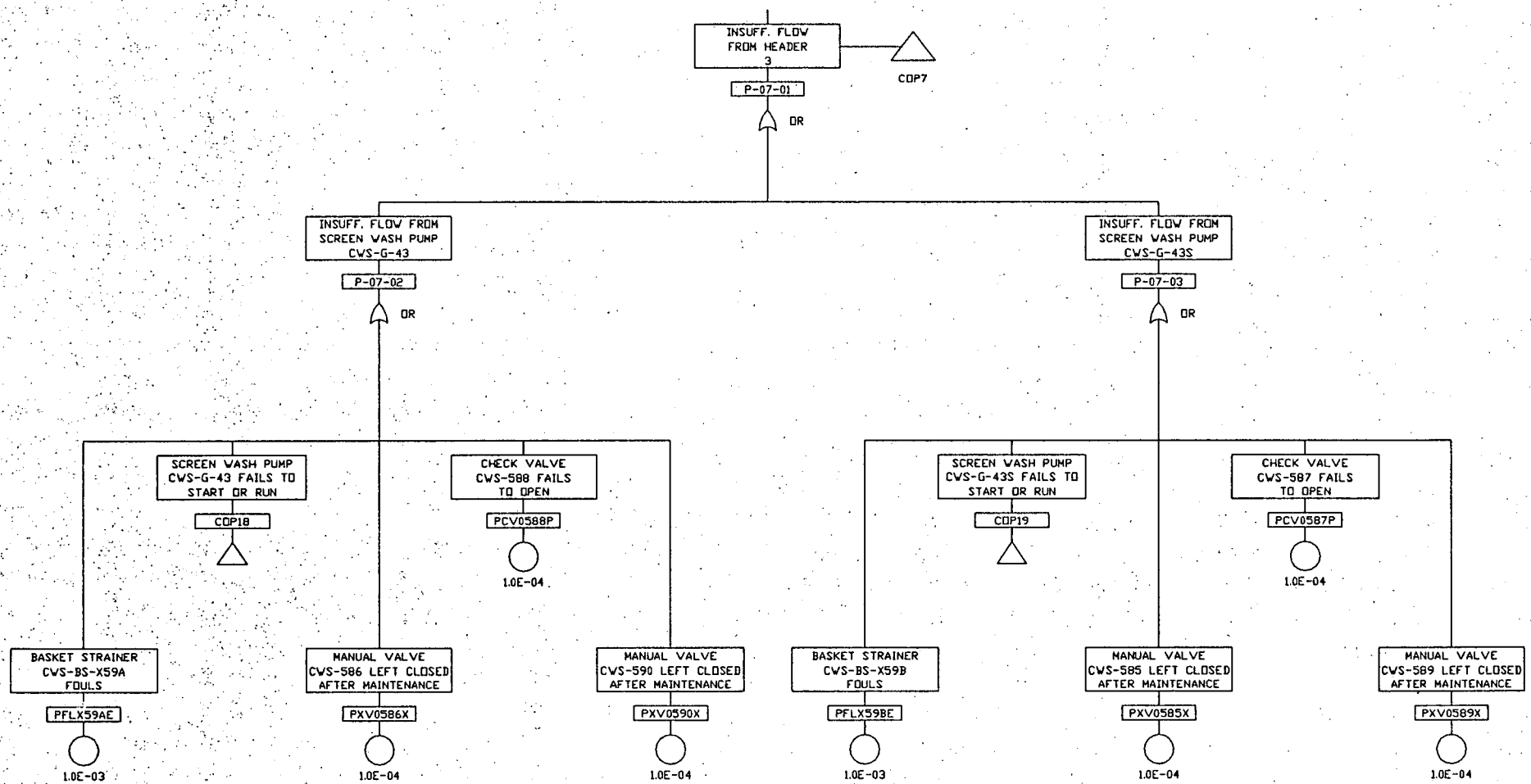

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FIGURE P-1, SHEET 8

UNIT 1

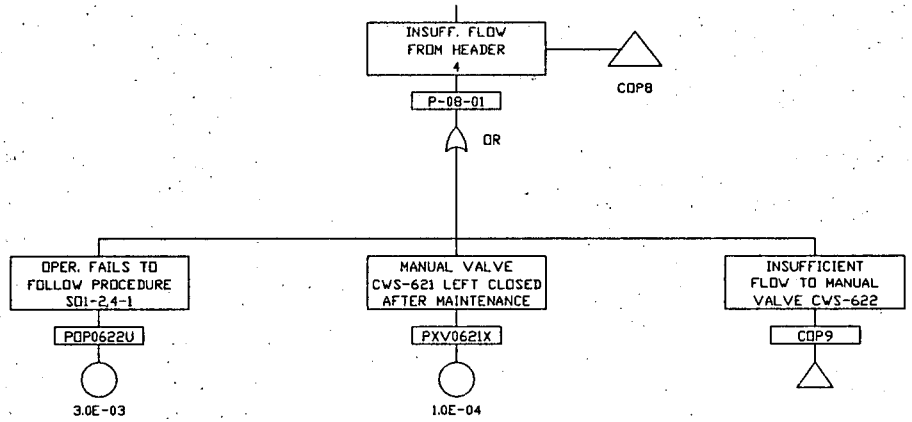

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FIGURE P-1, SHEET 9

UNIT 1

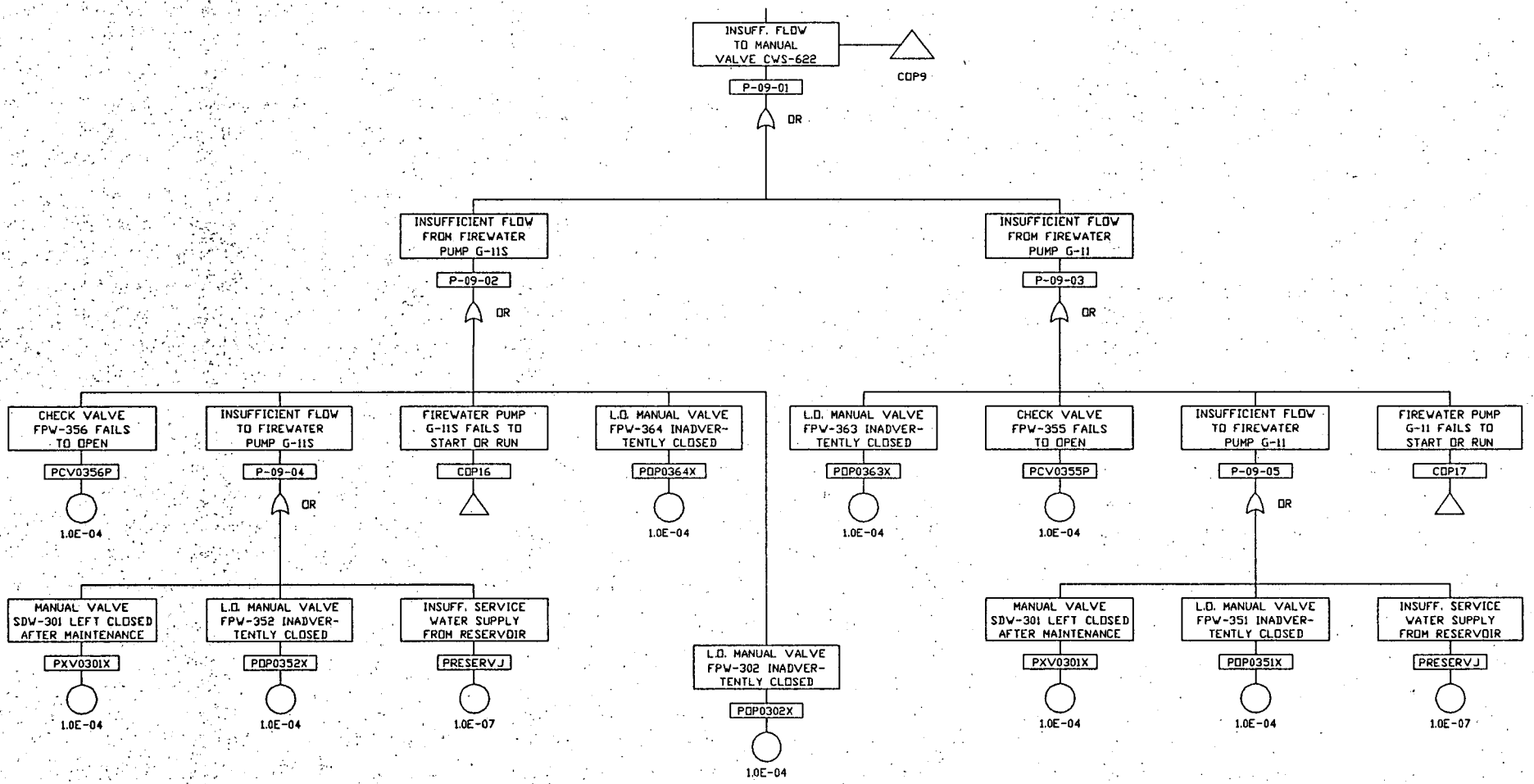

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FIGURE P-1, SHEET 10

UNIT 1

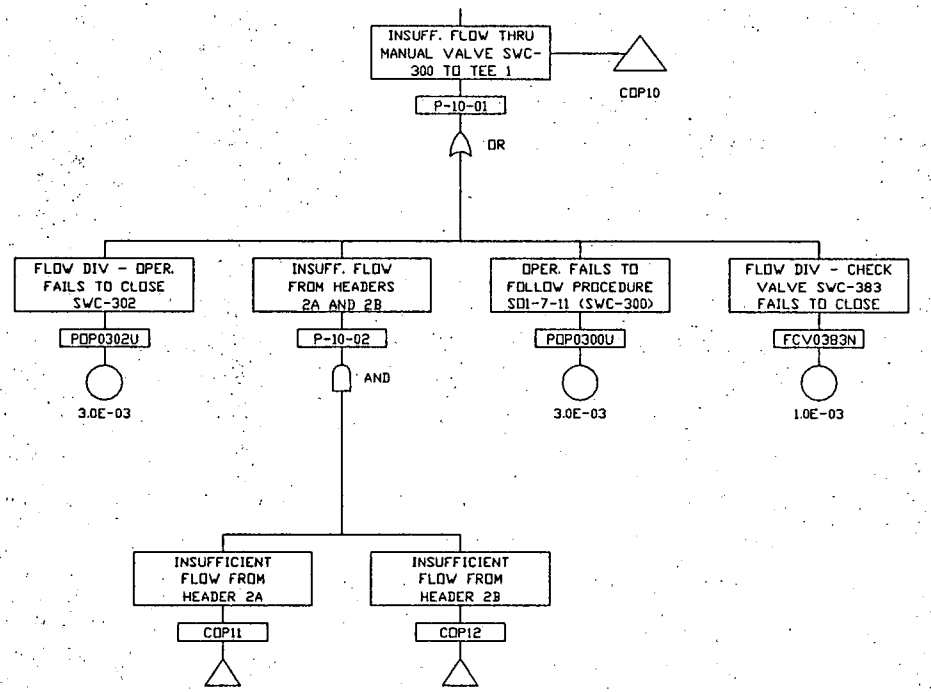

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FIGURE P-1, SHEET 11

UNIT 1

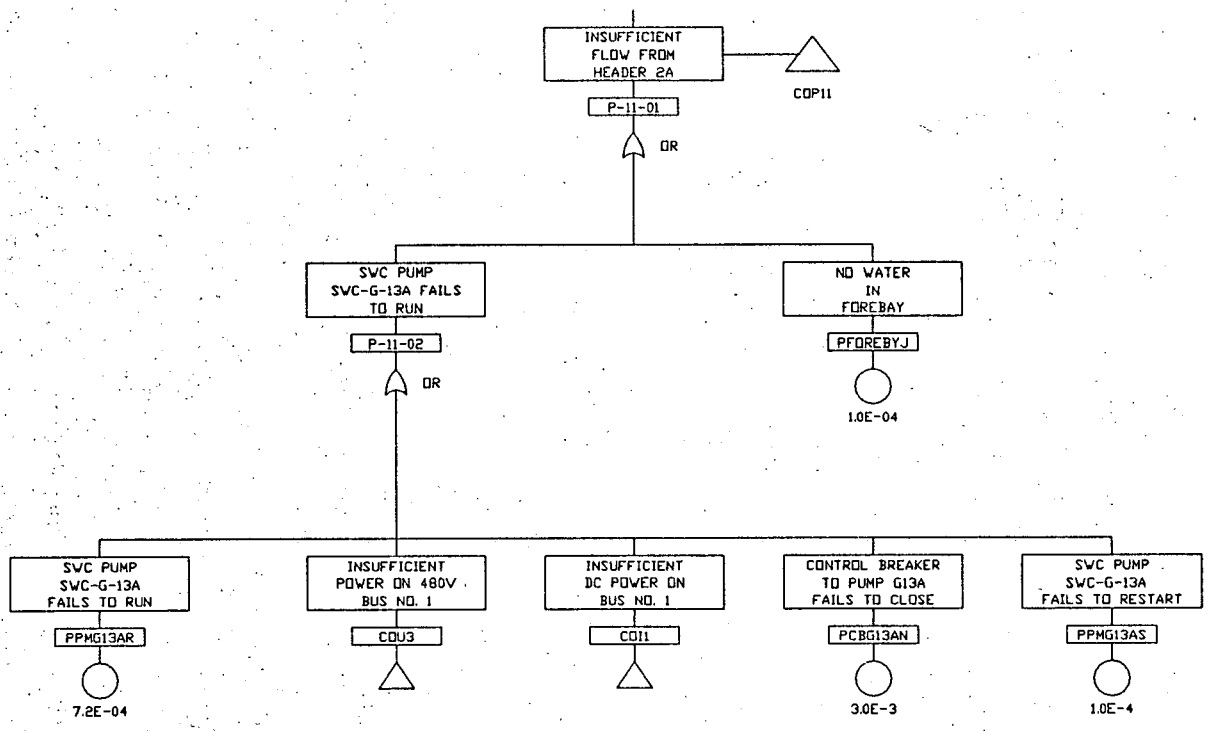

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FIGURE P-1, SHEET 12

UNIT 1

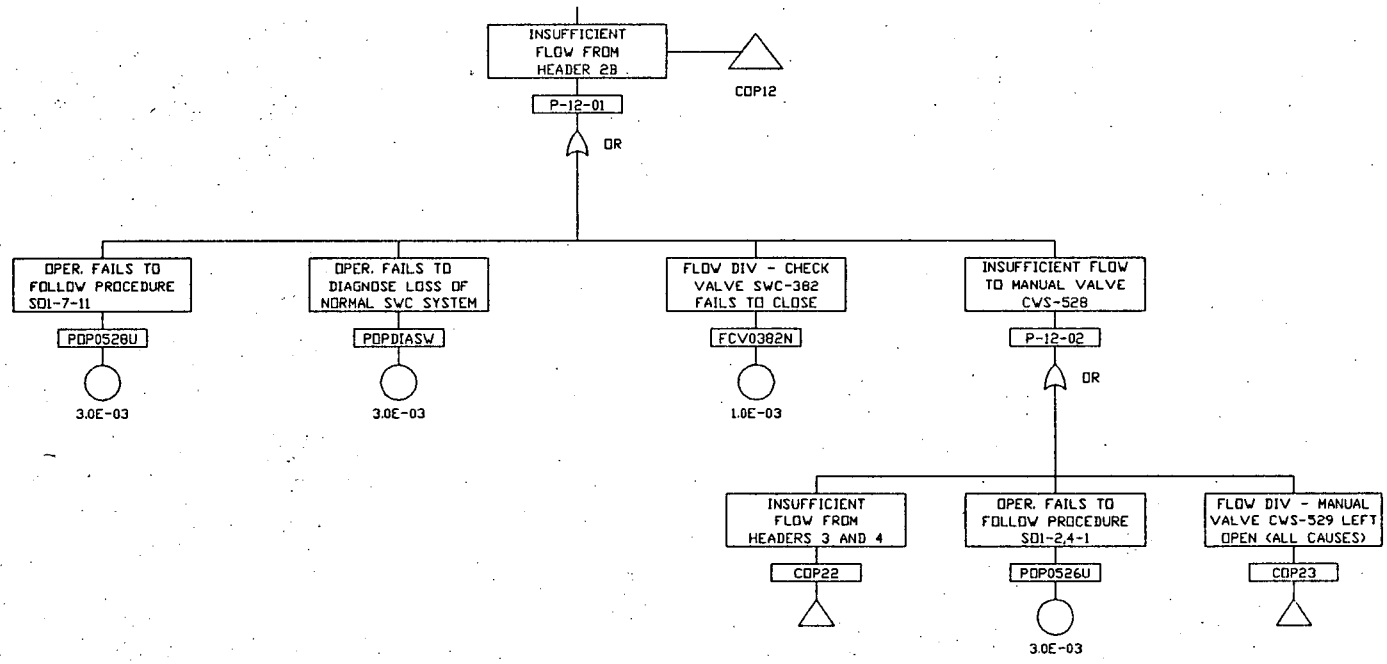

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FIGURE P-1, SHEET 13

UNIT 1

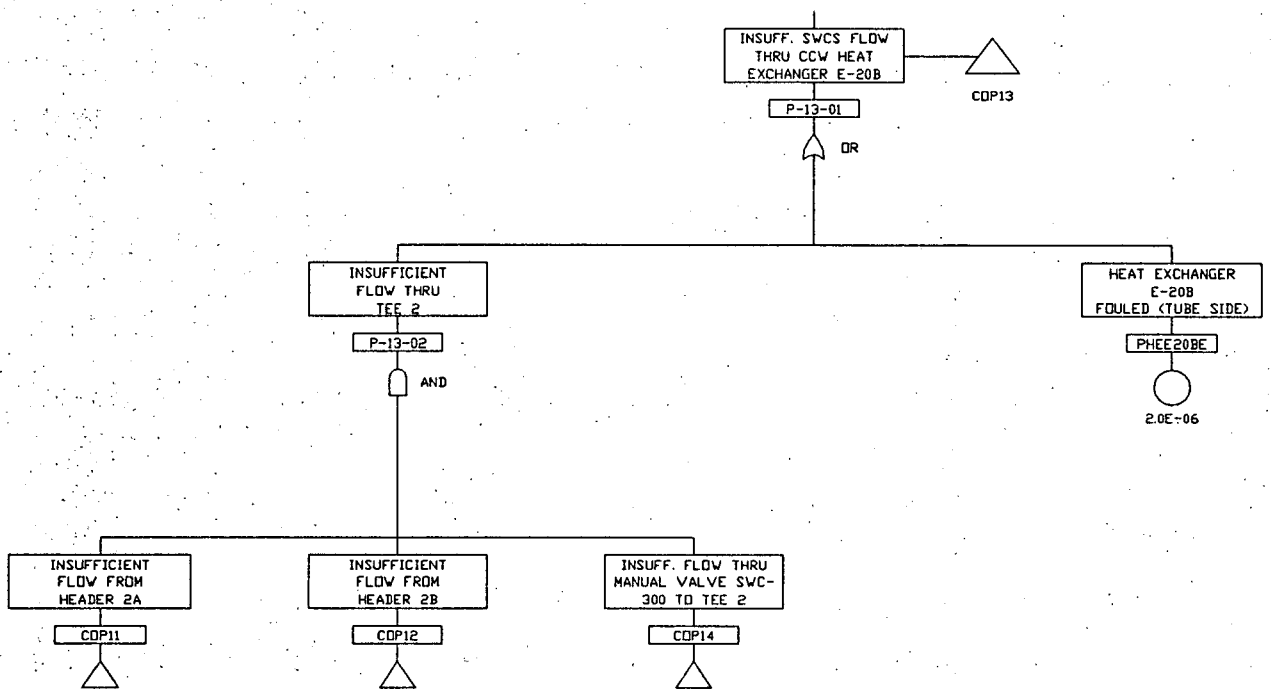

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FIGURE P-1, SHEET 14

UNIT 1

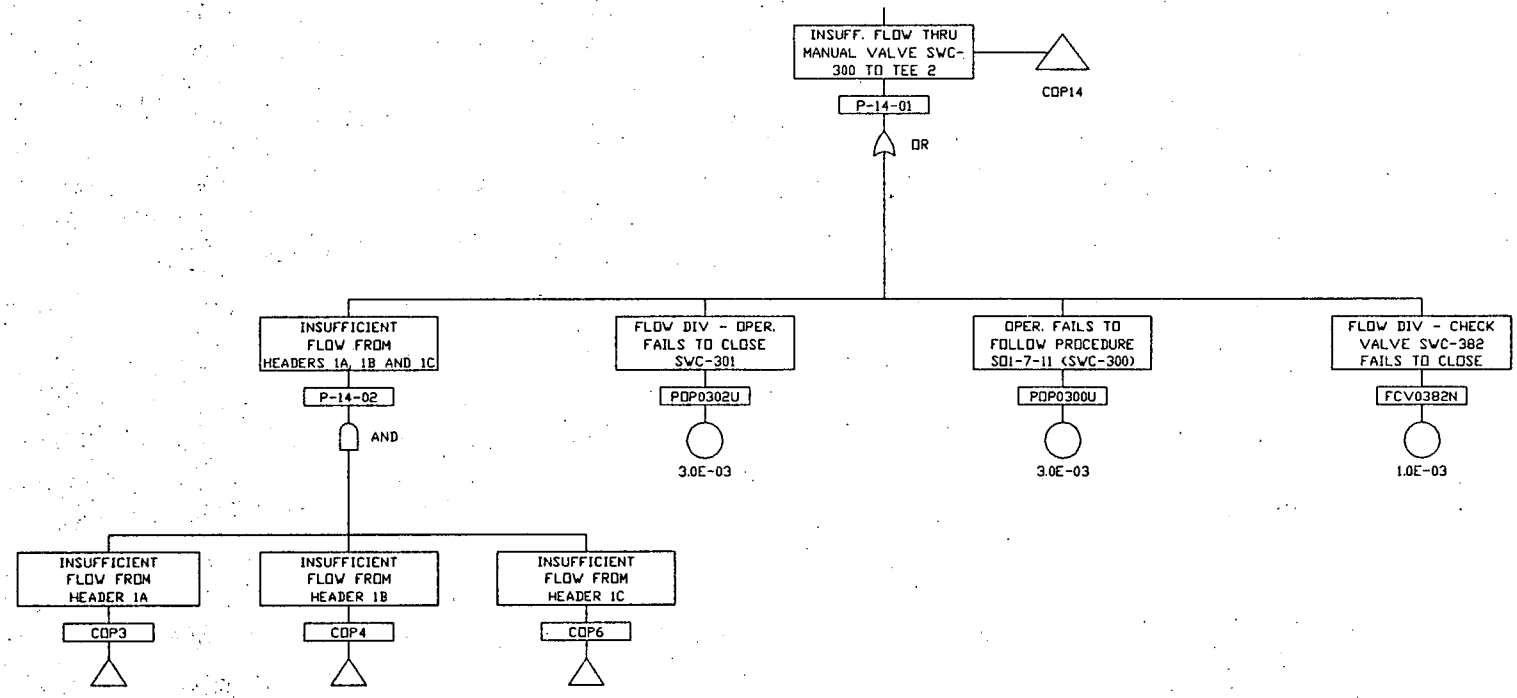

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FIGURE P-1, SHEET 15

UNIT 1

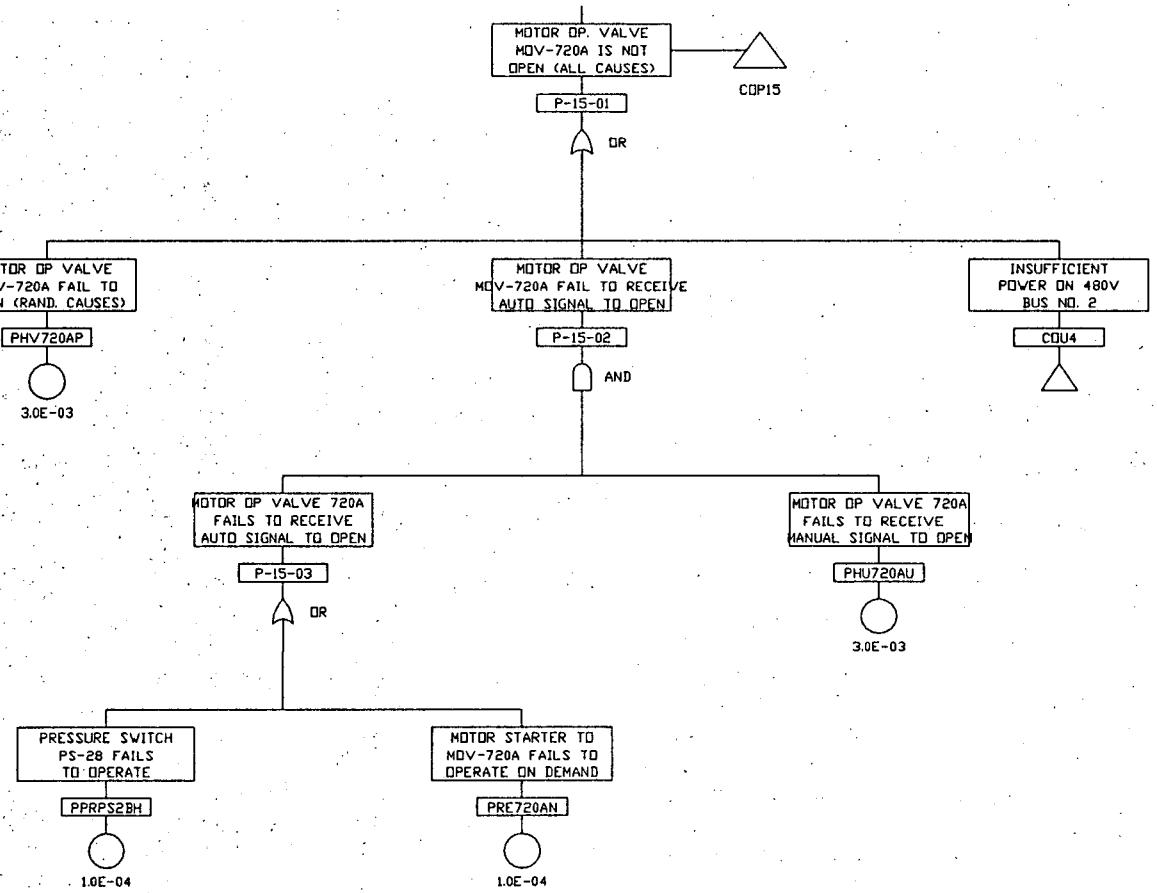

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FIGURE P-1, SHEET 16

UNIT 1

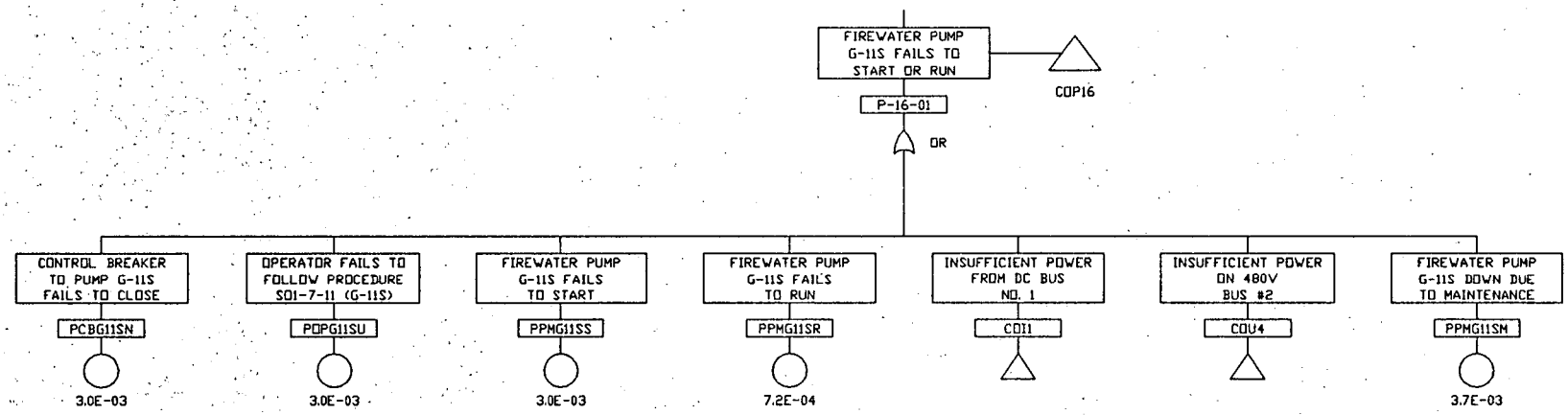

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FIGURE P-1, SHEET 17

UNIT 1

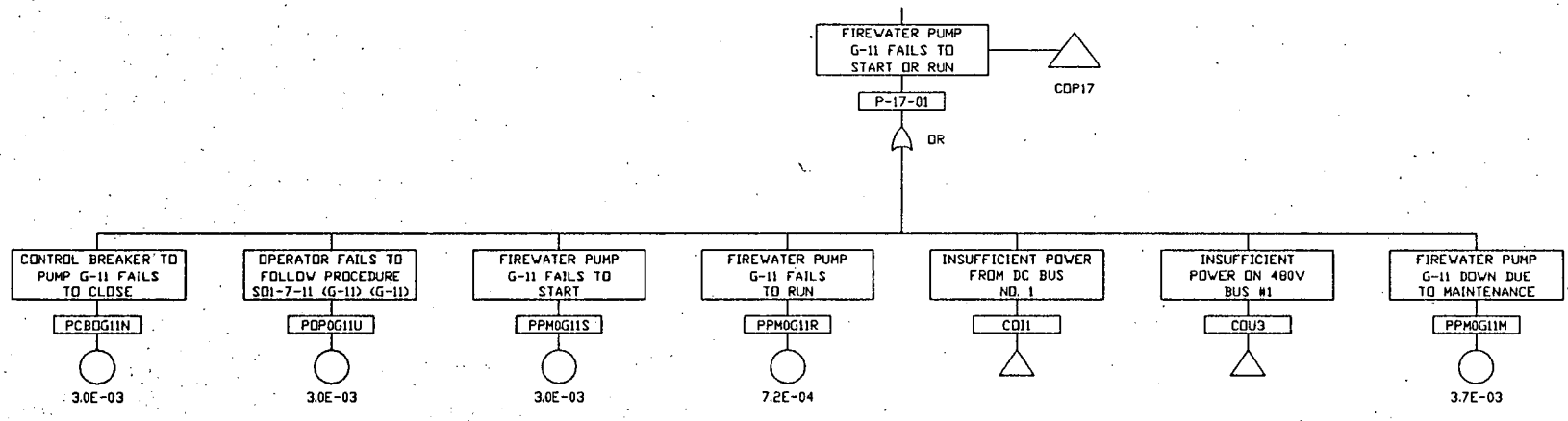

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FIGURE P-1, SHEET 18

UNIT 1

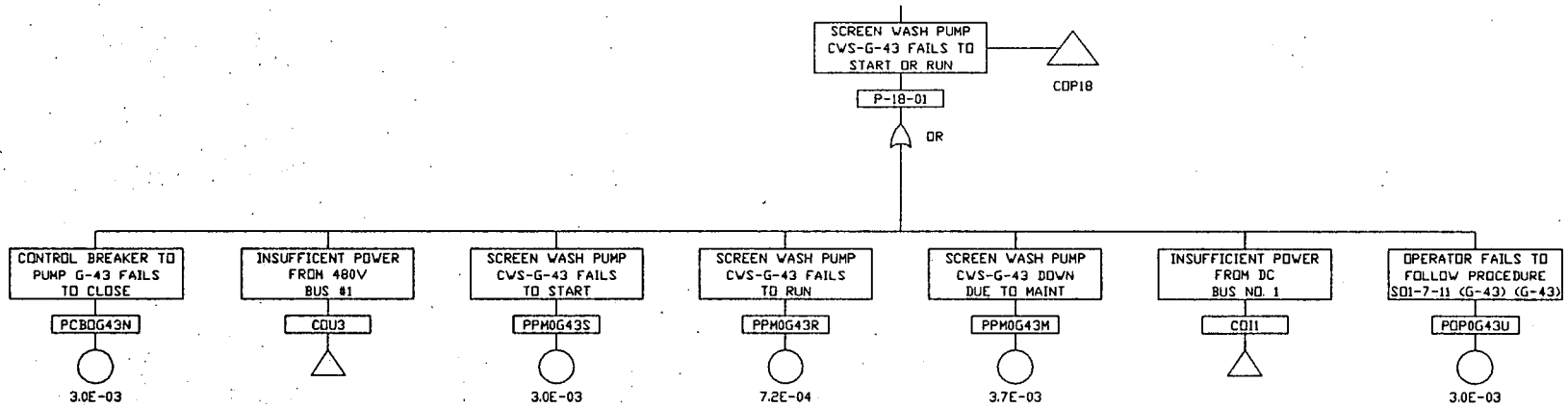

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FIGURE P-1, SHEET 19

UNIT 1

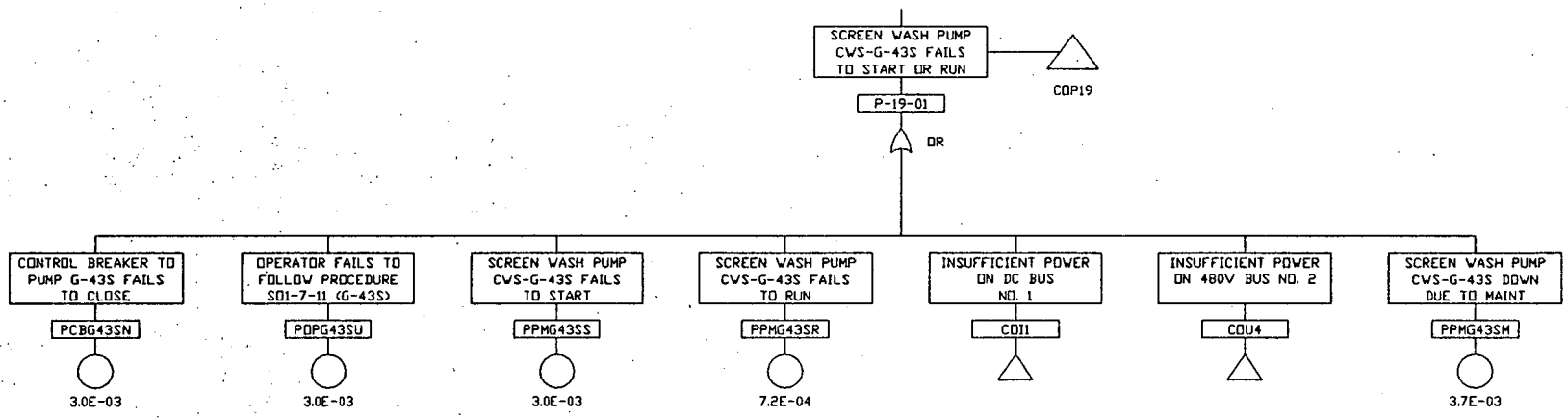

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FIGURE U-1: AC POWER FAULT TREE

UNIT 1

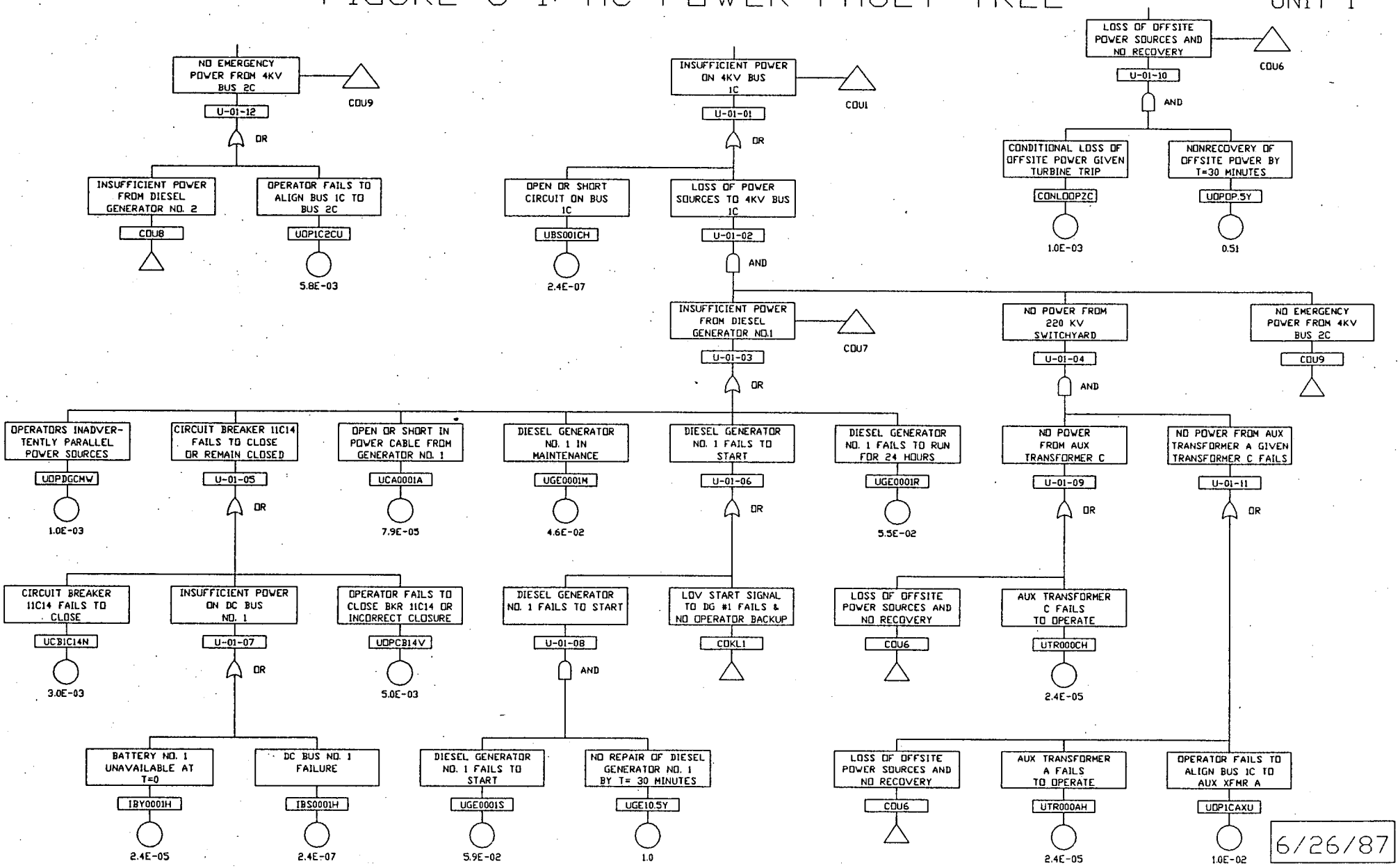

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FIGURE U-1, SHEET 2

UNIT 1

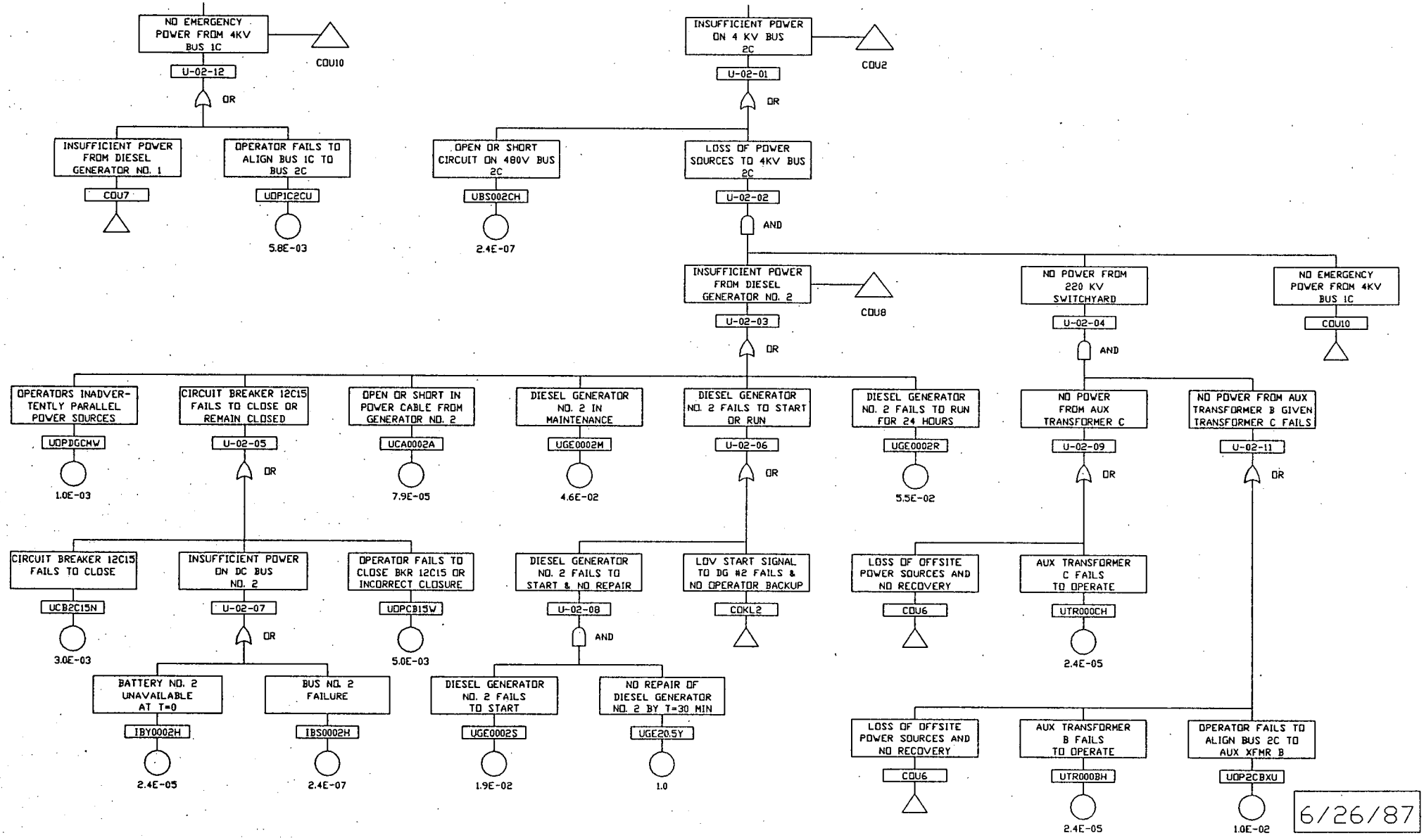

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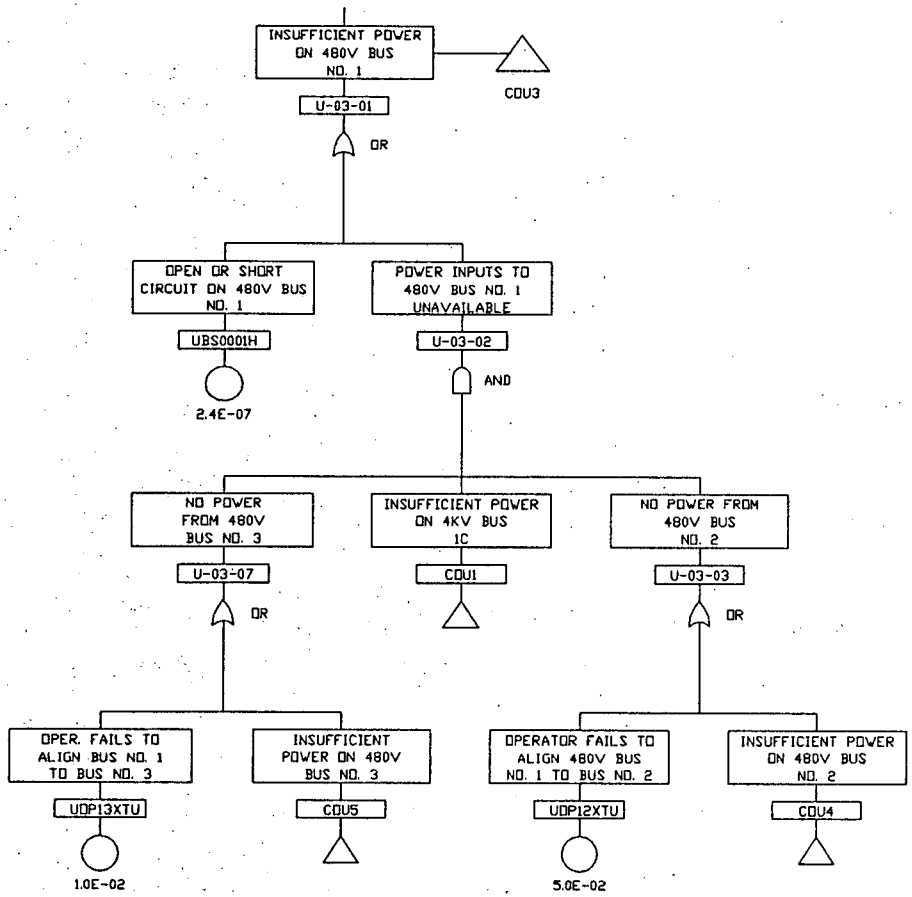
FIGURE U-1, SHEET 3

UNIT 1



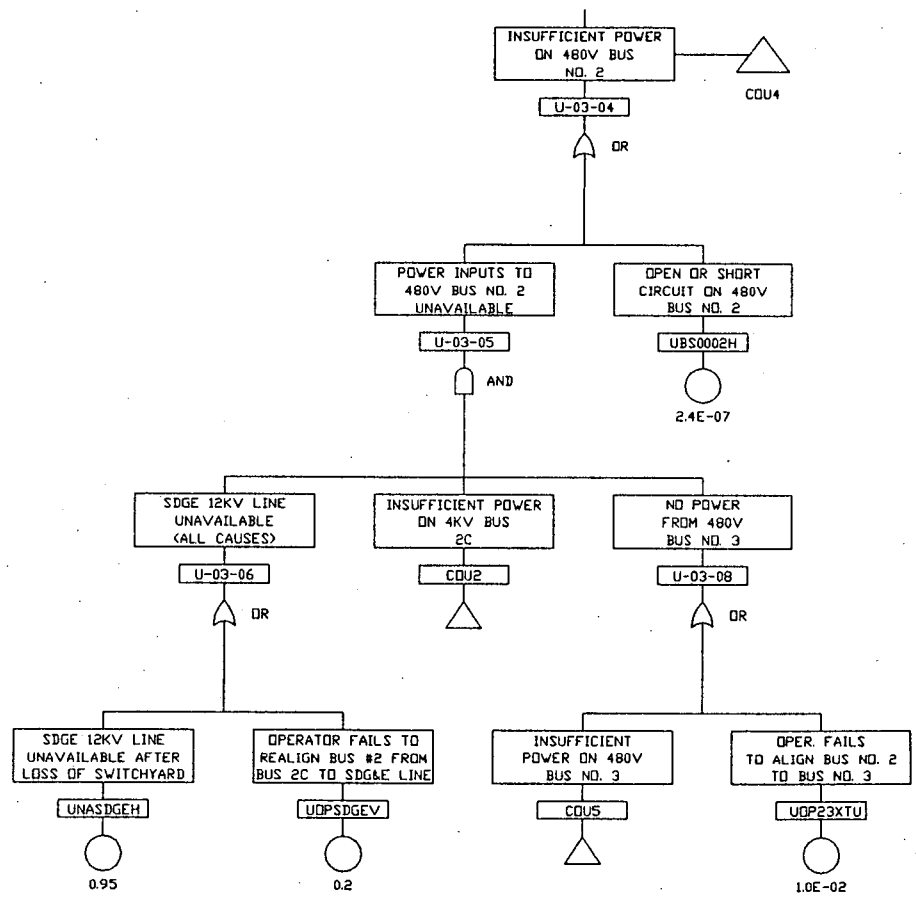


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FIGURE U-1, SHEET 4

UNIT 1

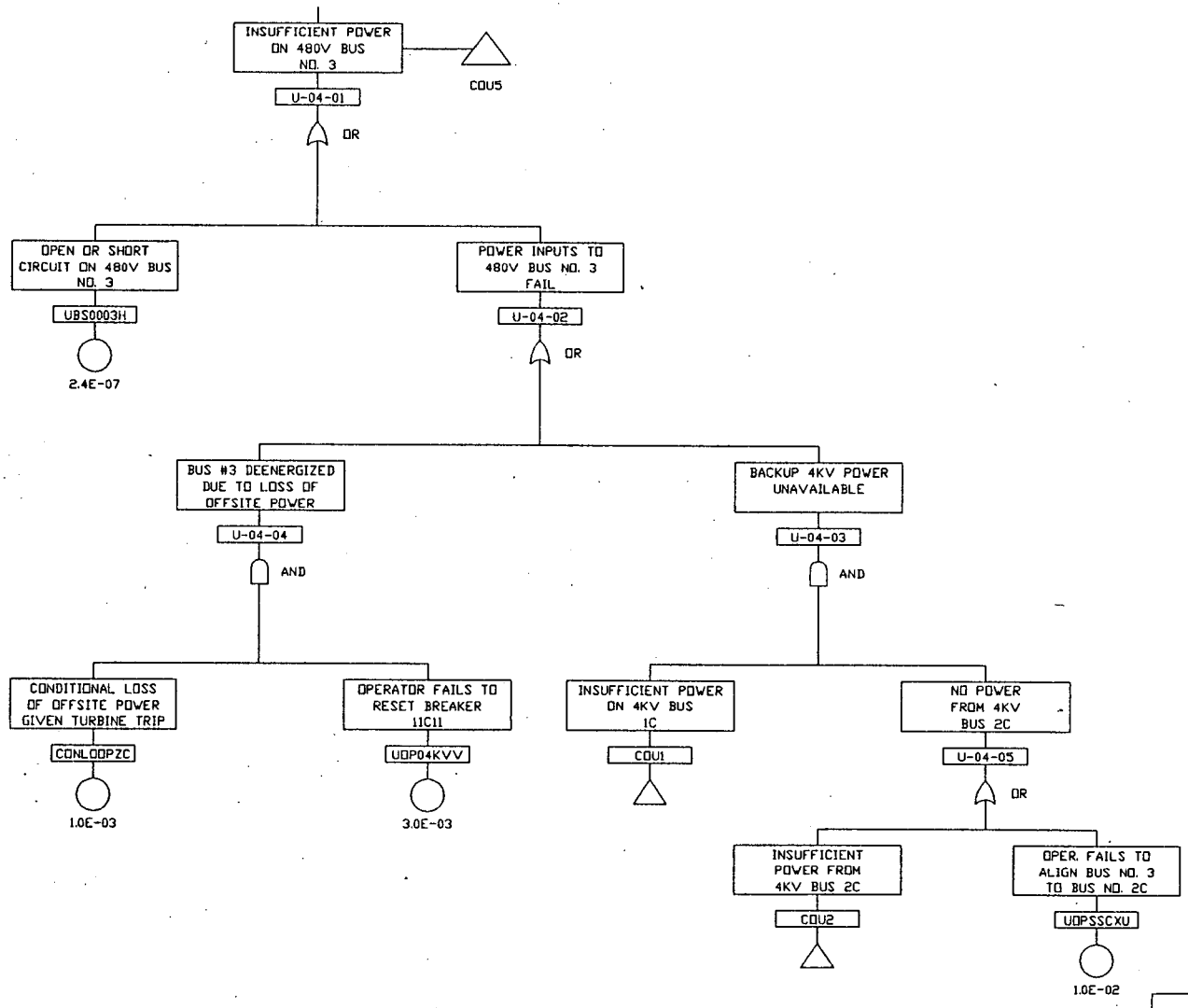

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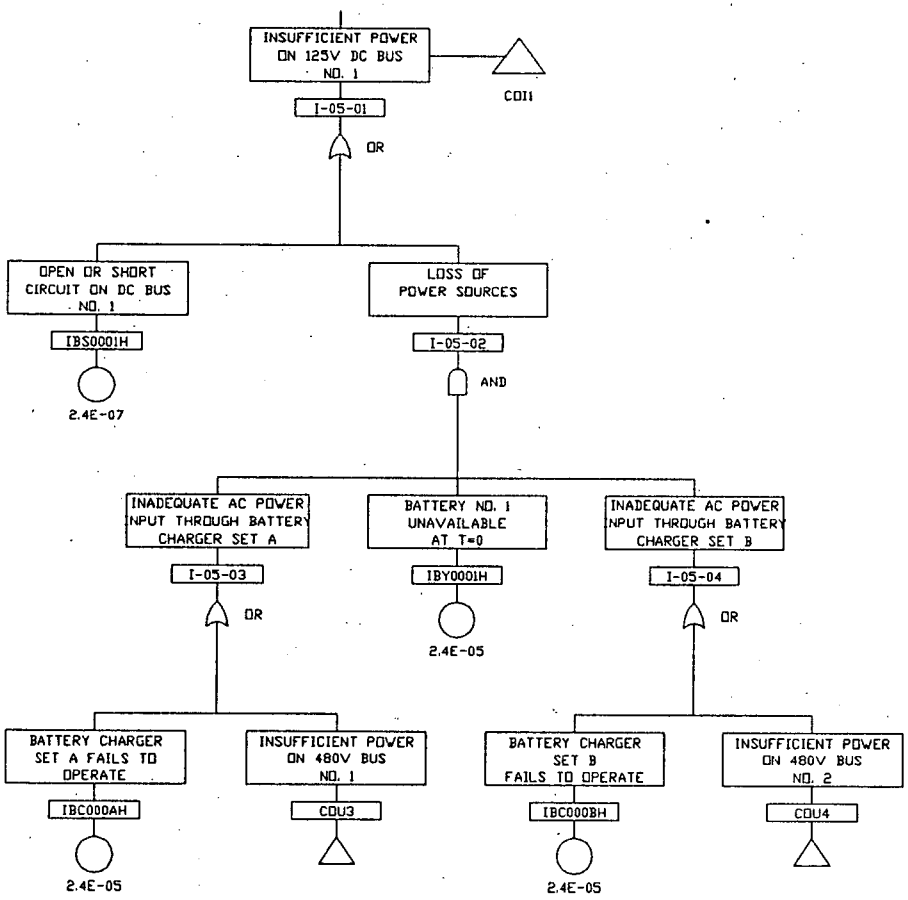
FIGURE U-1, SHEET 5

UNIT 1



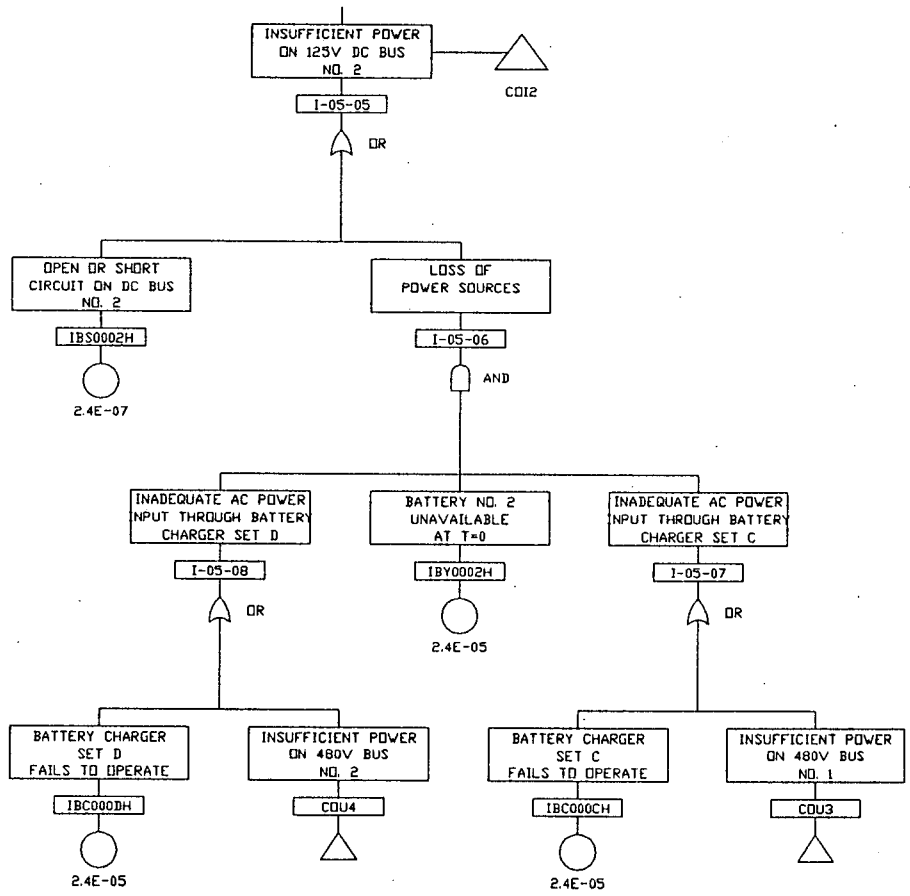


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FIGURE U-1, SHEET 6

UNIT 1

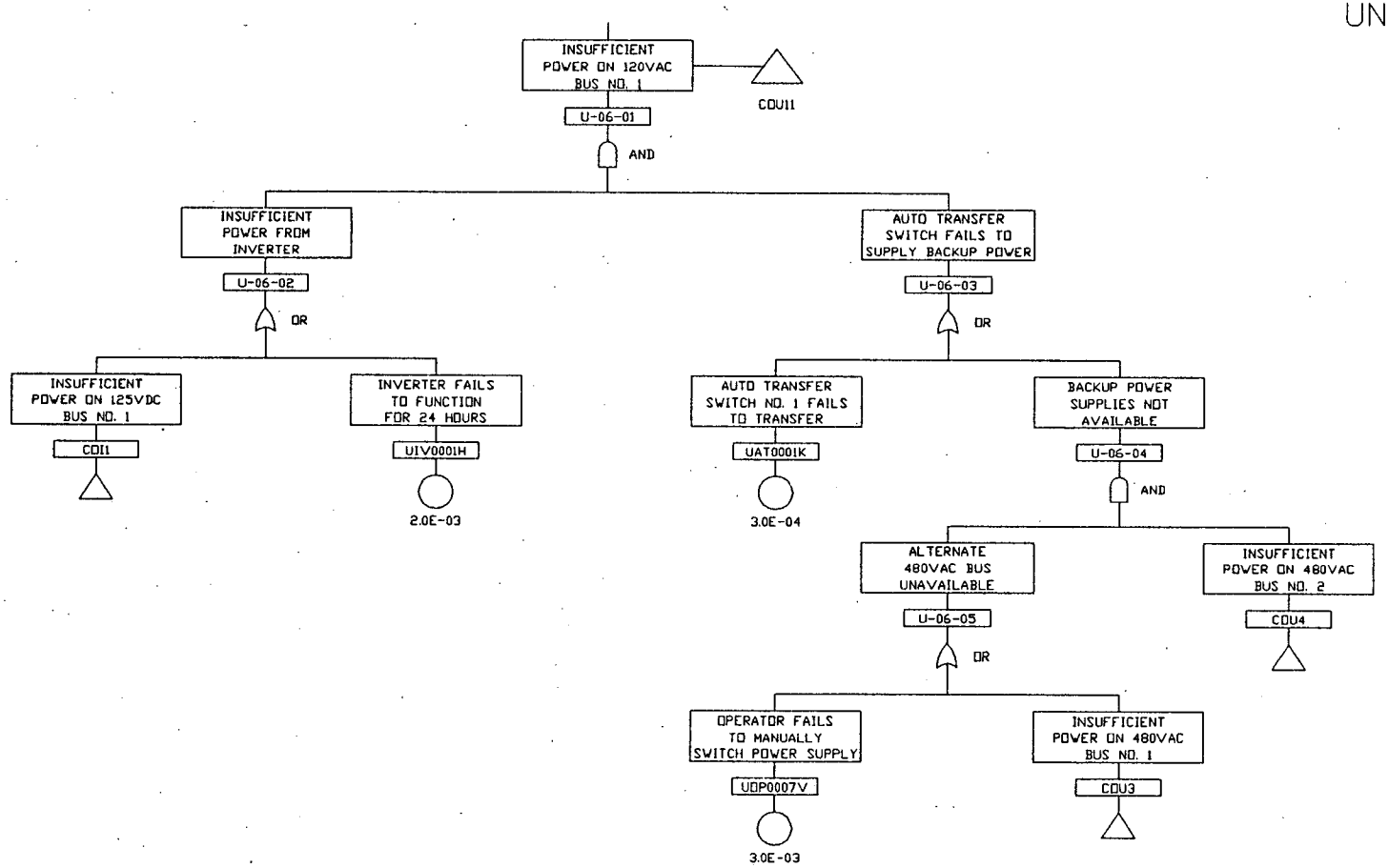

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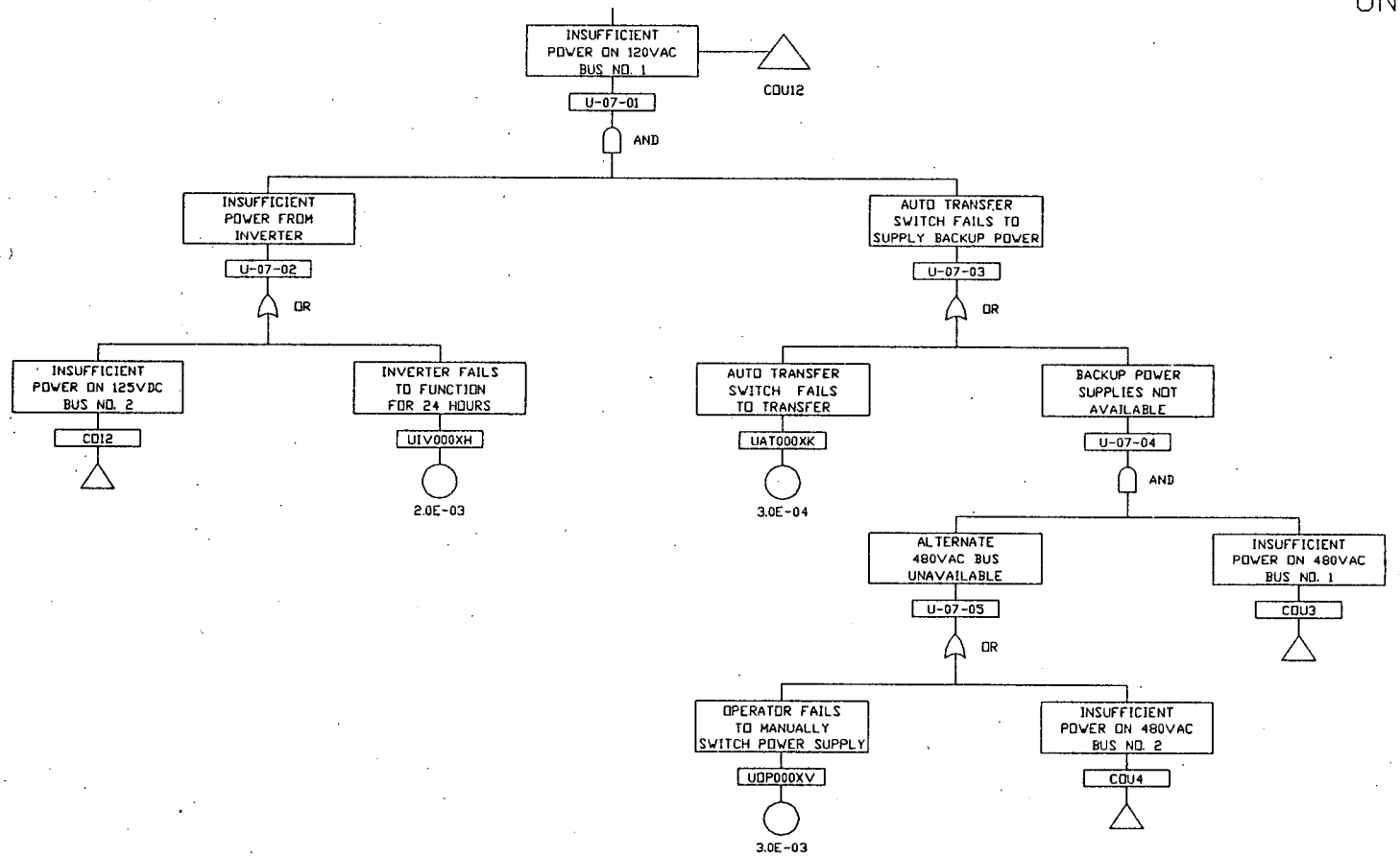
FIGURE U-1, SHEET 7

UNIT 1



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