TECHNICAL SPECIFICATION CHANGES

STEAM GENERATOR LEVEL REACTOR TRIP MODIFICATION

Table 2.2-1	page 2-5 Insert A
Table 3.3-1	pages 3/4 3-3, 6, 6a Inserts B, C, D
Table 3.3-2	page 3/4 3-8 Insert E
Table 4.3-1	page 3/4 3-10 Insert F
Table 3.3-3	pages 3/4 3-17, 18, 21 Inserts G, H, I
Table 3.3-4	page 3/4 3-25 Inserts J, K
Table 3.3-5	pages 3/4 3-31, 32a
Table 4.3-2	page 3/4 3-36 Insert L
Bases	page B 2-7 Insert M

TABLE 2.2-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	SENSOR ERROR Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
~~13. Steam Generator Water Level Low-Low~~	~~23.5~~	~~21.18~~	~~2.0~~	~~≥23.5% of narrow range instrument span~~	~~≥22.0% of narrow range instrument span~~
14. Undervoltage - Reactor Coolant Pumps	7.7	1.33	0	≥10584 Volts A.C	≥10356 Volts A.C.
15. Underfrequency - Reactor Coolant Pumps	3.3	0	0	≥57.2 Hz	≥57.1 Hz
16. Turbine Trip					
a. Low Fluid Oil Pressure	N.A.	N.A.	N.A.	≥598.94 psig	≥539.42 psig
b. Turbine Stop Valve Closure	N.A.	N.A.	N.A.	≥1% open	≥1% open
17. Safety Injection Input from ESF	N.A.	N.A.	N.A.	N.A.	N.A.

INSERT A

REVISION 1

INSERT A CN TABLE 2.2-1

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
13. Steam Generator Water Level-Low-Low					
a. Vessel Delta-T Equivalent ≤ 10% RTP					
Vessel Delta-T (Power-1)	6.0	2.38	2.0	≤ Vessel Delta-T Equivalent to 10% RTP	≤ Vessel Delta-T Equivalent to 14.0% RTP
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
and					
Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span
With a Time Delay, (t)				≤ 232 seconds	≤ 240 seconds
b. 10% RTP < Vessel Delta-T Equivalent ≤ 20% RTP					
Vessel Delta-T (Power-2)	6.0	2.38	2.0	≤ Vessel Delta-T Equivalent to 20 % RTP	≤ Vessel Delta-T Equivalent to 24.0 % RTP
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
And					
Containment Pressure-Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span
With a Time Delay, (t)				≤ 122 seconds	≤ 130 seconds

INSERT A ON TABLE 2.2-1 (Cont.)

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
c. Vessel Delta-T Equivalent > 20% RTP					
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
And Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span

TABLE 3.3-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
11. Pressurizer Water Level-High	3	2	2	1	6#
12. Reactor Coolant Flow-Low					
a. Single Loop (Above P-8)	3/loop	2/loop in any operating loop	2/loop in each operating loop	1	6#
b. Two Loops (Above P-7 and below P-8)	3/loop	2/loop in two operating loops	2/loop each operating loop	1	6#
~~13. Steam Generator Water Level-Low-Low~~ INSERT B	~~4/stm. gen.~~	~~2/stm. gen. in any operating stm. gen.~~	~~3/stm. gen. each operating stm. gen.~~	~~1, 2~~	~~6#(1)~~
14. Undervoltage-Reactor Coolant Pumps	4-2/bus	2-1/bus	3	1	6#(1)
15. Underfrequency-Reactor Coolant Pumps	4-2/bus	2-1/bus	3	1	6#
16. Turbine Trip					
a. Low Fluid Oil Pressure	3	2	2	1	6#
b. Turbine Stop Valve Closure	4	4	1	1	11#
17. Safety Injection Input from ESF	2	1	2	1, 2	9

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	MODES	ACTION
13. Steam Generator Water Level-Low-Low					
a. Steam Generator Water Level-Low-Low (Adverse Containment Environment)	4/stm. gen.	2/stm. gen. in any operating stm. gen.	3/stm. gen. each operating stm. gen.	1,2	6 # (1), 7
b. Steam Generator Water Level-Low-Low (Normal Containment Environment)	4/stm. gen.	2/stm. gen. in any operating stm. gen.	3/stm. gen. each operating stm. gen.	1,2	7, 13 # (1)
c. Vessel Delta-T (Power-1, Power-2)	4	2	3	1,2	11 # (1)
d. Containment Pressure - Environmental Allowance Modifier	4	2	3	1,2	11 # (1)

INSERT B ON TABLE 3.3-1

TABLE 3.3-1 (Continued)

ACTION STATEMENTS (Continued)

ACTION 4 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement suspend all operations involving positive reactivity changes.

ACTION 5 - a. With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or open the Reactor trip breakers, suspend all operations involving positive reactivity changes and verify Valves BG-V178 and BG-V601 are closed and secured in position within the next hour.

b. With no channels OPERABLE, open the Reactor Trip Breakers, suspend all operations involving positive reactivity changes and verify compliance with the SHUTDOWN MARGIN requirements of Specification 3.1.1.1 or 3.1.1.2, as applicable, within 1 hour and every 12 hours thereafter, and verify valves BG-V178 and BG-V601 are closed and secured in position within 4 hours and verified to be closed and secured in position every 14 days.

ACTION 6 - With the number of OPERABLE channels one less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided the following conditions are satisfied:

a. The inoperable channel is placed in the tripped condition within 6 hours, and

b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 4 hours for surveillance testing of other channels per Specification 4.3.1.1.

ACTION 7 - ~~Deleted.~~ INSERT C

ACTION 8 - With less than the Minimum Number of Channels OPERABLE, within 1 hour determine by observation of the associated permissive annunciator window(s) that the interlock is in its required state for the existing plant condition, or apply Specification 3.0.3.

ACTION 9 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, be in at least HOT STANDBY within 6 hours; however, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.1.1, provided the other channel is OPERABLE.

ACTION 10 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or open the Reactor trip breakers within the next hour.

ACTION 11 - With the number of OPERABLE channels less than the Total Number of Channels, operation may continue provided the inoperable channels are placed in the tripped condition within 6 hours.

INSERT C ON TABLE 3.3-1

ACTION 7 - With an inoperable delay timer in the Trip Time Delay circuitry, STARTUP and/or POWER OPERATION may proceed provided that the Vessel Delta-T (Power-1, Power-2) channels are placed in the tripped condition within 6 hours.

TABLE 3.3-1 (Continued)

ACTION STATEMENTS (Continued)

ACTION 12 - With one of the diverse trip features (Undervoltage or Shunt Trip Attachment) inoperable, restore it to OPERABLE status within 48 hours or declare the affected breaker inoperable and apply ACTION 9. The breaker shall not be bypassed while one of the diverse trip features is inoperable except for the time required for performing maintenance to restore the breaker to OPERABLE status.

ACTION 13 - INSERT D

INSERT D ON TABLE 3.3-1

ACTION 13- With the number of OPERABLE channels less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided that the Containment Pressure-Environmental Allowance Modifier channels in the affected protection sets are placed in the tripped condition within 6 hours.

TABLE 3.3-2 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION RESPONSE TIMES

FUNCTIONAL UNIT	RESPONSE TIME
12. Reactor Coolant Flow-Low	
a. Single Loop (Above P-8)	≤ 1.0 second
b. Two Loops (Above P-7 and below P-8)	≤ 1.0 second
~~13. Steam Generator Water Level-Low-Low~~	~~≤ 2.0 seconds~~ INSERT E
14. Undervoltage-Reactor Coolant Pumps	≤ 1.5 seconds
15. Underfrequency-Reactor Coolant Pumps	≤ 0.6 second
16. Turbine Trip	
a. Low Fluid Oil Pressure	N.A.
b. Turbine Stop Valve Closure	N.A.
17. Safety Injection Input from ESF	N.A.
18. Reactor Trip System Interlocks	N.A.
19. Reactor Trip Breakers	N.A.
20. Automatic Trip and Interlock Logic	N.A.

REVISION 1

INSERT E ON TABLE 3.3-2

FUNCTIONAL UNIT	RESPONSE TIME
13. Steam Generator Water Level-Low-Low	
a. Steam Generator Water Level-Low-Low (Adverse Containment Environment)	≤ 2.0 seconds (1)
b. Steam Generator Water Level-Low-Low (Normal Containment Environment)	≤ 2.0 seconds (1)
c. Vessel Delta-T (Power-1, Power-2)	≤ 6.0 seconds (1)
d. Containment Pressure - Environmental Allowance Modifier	≤ 2.0 seconds (1)

(1) Does not include Trip Time Delays. Response times noted above include the transmitters, 7300 process protection cabinets, solid state protection cabinets, and actuation devices only. This reflects the response times necessary for THERMAL POWER in excess of 20% RATED THERMAL POWER.

TABLE 4.3-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
~~13. Steam Generator Water Level Low-Low~~ INSERT F	~~S~~	~~R~~	~~Q(14,15)~~	~~N.A.~~	~~N.A.~~	~~1, 2~~
14. Undervoltage - Reactor Coolant Pumps	N.A.	R	N.A.	Q(14,15)	N.A.	1
15. Underfrequency - Reactor Coolant Pumps	N.A.	R	N.A.	Q(14)	N.A.	1
16. Turbine Trip						
a. Low Fluid Oil Pressure	N.A.	R	N.A.	S/U(1, 10)	N.A.	1
b. Turbine Stop Valve Closure	N.A.	R	N.A.	S/U(1, 10)	N.A.	1
17. Safety Injection Input from ESF	N.A.	N.A.	N.A.	R#	N.A.	1, 2
18. Reactor Trip System Interlocks						
a. Intermediate Range Neutron Flux, P-6	N.A.	R(4)	R	N.A.	N.A.	2##
b. Power Range Neutron Flux, P-8	N.A.	R(4)	R	N.A.	N.A.	1
c. Power Range Neutron Flux, P-9	N.A.	R(4)	R	N.A.	N.A.	1

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
13. Steam Generator Water Level-Low-Low						
a. Steam Generator Water Level-Low-Low (Adverse Containment Environment)	S	R	Q (14,15)	N.A.	N.A.	1,2
b. Steam Generator Water Level-Low-Low (Normal Containment Environment)	S	R	Q (14,15)	N.A.	N.A.	1,2
c. Vessel Delta-T (Power-1, Power-2)	S	R	Q (14,15)	N.A.	N.A.	1,2
d. Containment Pressure-Environmental Allowance Modifier	S	R	Q (14,15)	N.A.	N.A.	1,2

INSERT F ON TABLE 4.3-1

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
5. Feedwater Isolation & Turbine Trip					
a. Automatic Actuation Logic and Actuation Relay (SSPS)	2	1	2	1, 2	
b. Steam Generator Water Level-High-High	4/stm. gen.	2/stm. gen. in any operating stm gen.	3/stm. gen. in each operating stm. gen.	1, 2	19*
c. Safety Injection	See Item 1. above for all Safety Injection initiating functions and requirements.				
6. Auxiliary Feedwater					
a. Manual Initiation	3(1/pump)	1/pump	1/pump	1, 2, 3	24
b. Automatic Actuation Logic and Actuation Relays (SSPS)	2	1	2	1, 2, 3	21
c. Automatic Actuation Logic and Actuation Relays (BOP ESFAS)	2	1	2	1, 2, 3	21
d. Steam Generator Water Level- Low-Low					
~~1) Start Motor-Driven Pumps~~	~~4/stm. gen.~~	~~2/stm. gen. in any operating stm. gen.~~	~~3/stm. gen. in each operating stm. gen.~~	~~1, 2, 3~~	~~19*~~

INSERT G

CALLAWAY - UNIT 1

3/4 3-17

REVISION 1

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	MODES	ACTION
6.d. Steam Generator Water Level-Low-Low					
1) Start Motor-Driven Pumps					
a) Steam Generator Water Level-Low-Low (Adverse Containment Environment)	4/stm. gen.	2/stm. gen. in any operating stm. gen.	3/stm. gen. each operating stm. gen.	1,2,3	19*,27(a)
b) Steam Generator Water Level-Low-Low (Normal Containment Environment)	4/stm. gen.	2/stm. gen. in any operating stm. gen.	3/stm. gen. each operating stm gen.	1,2,3	27(a),27(b)*
c) Vessel Delta-T (Power-1, Power-2)	4	2	3	1,2,3	27 (c)*
d) Containment Pressure-Environmental Allowance Modifier	4	2	3	1,2,3	27 (c)*

INSERT G ON TABLE 3.3-3

TABLE 3.3-3 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
6. Auxiliary Feedwater (Continued)					
d. Steam Generator Water Level-Low-Low (Continued)					
~~2) Start Turbine Driven Pump~~ INSERT H	~~4/stm. gen.~~	~~3/stm. gen. in any 2 operating stm. gen.~~	~~3/stm. gen. in each operating stm. gen.~~	~~1, 2, 3~~	~~19*~~
e. Safety Injection Start Motor-Driven Pumps	See Item 1 above for all Safety Injection initiating functions and requirements.				
f. Loss-of-Offsite Power-Start Turbine-Driven Pump	2	1	2	1, 2, 3	22
g. Trip of all Main Feedwater Pumps - Start Motor-Driven Pumps	4-(2/pump)**	2-(1/pump in same separation)	3	1, 2###	19
h. Auxiliary Feedwater Pump Suction Pressure-Low (Transfer to ESW)	3	2	2	1, 2, 3	15*
7. Automatic Switchover to Containment Sump					
a. Automatic Actuation Logic and Actuation Relays (SSPS)	2	1	2	1, 2, 3, 4	14
b. RWST Level - Low-Low Coincident With Safety Injection	4	2	3	1, 2, 3, 4	18
	See Item 1 above for Safety Injection initiating functions and requirements.				

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	MODES	ACTION
6.d. Steam Generator Water Level-Low-Low					
2) Start Turbine-Driven Pump					
a) Steam Generator Water Level-Low-Low (Adverse Containment Environment)	4/stm. gen.	2/stm. gen. in any operating stm. gen.	3/stm. gen. each operating stm. gen.	1,2,3	19*,27(a)
b) Steam Generator Water Level-Low-Low (Normal Containment Environment)	4/stm. gen.	2/stm. gen. in any operating stm. gen.	3/stm. gen. each operating stm. gen.	1,2,3	27(a),27(b)*
c) Vessel Delta-T (Power-1, Power-2)	4	2	3	1,2,3	27(c)*
d) Containment Pressure-Environmental Allowance Modifier	4	2	3	1,2,3	27(c)*

INSERT H ON TABLE 3.3-3

REVISION 1

TABLE 3.3-3 (Continued)

ACTION STATEMENTS (Continued)

b. The Minimum Channels OPERABLE requirement is met; however, the inoperable channel may be bypassed for up to 2 hours for surveillance testing of other channels per Specification 4.3.2.1.

ACTION 20 - With less than the Minimum Channels OPERABLE, within 1 hour determine by observation of the associated permissive annunciator window(s) that the interlock is in its required state for the existing plant condition, or apply Specification 3.0.3.

ACTION 21 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours; however, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1 provided the other channel is OPERABLE.

ACTION 22 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or be in at least HOT STANDBY within 6 hours and in at least HOT SHUTDOWN within the following 6 hours.

ACTION 23 - With the number of OPERABLE channels one less than the Total Number of Channels, restore the inoperable channel to OPERABLE status within 48 hours or declare the associated valve inoperable and take the ACTION required by Specification 3.7.1.5.

ACTION 24 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, declare the affected auxiliary feedwater pump inoperable and take the ACTION required by Specification 3.7.1.2.

ACTION 25 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, declare the affected diesel generator and off-site power source inoperable and take the ACTION required by Specification 3.8.1.1.

ACTION 26 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, restore the inoperable channel to OPERABLE status within 48 hours or initiate and maintain operation of the Control Room Emergency Ventilation System.

ACTION 27 - With the number of OPERABLE channels one less than the Minimum Channels OPERABLE requirement, be in at least HOT STANDBY within 6 hours; however, one channel may be bypassed for up to 2 hours for surveillance testing per Specification 4.3.2.1 provided the other channel is OPERABLE.

INSERT I

INSERT I ON TABLE 3.3-3

ACTION 27(a) - With an inoperable delay timer in the Trip Time Delay circuitry, STARTUP and/or POWER OPERATION may proceed provided that the Vessel Delta-T (Power-1, Power-2) channels are placed in the tripped condition within 6 hours.

ACTION 27(b) - With the number of OPERABLE channels less than the Total Number of Channels, STARTUP and/or POWER OPERATION may proceed provided that the Containment Pressure-Environmental Allowance Modifier channels in the affected protection sets are placed in the tripped condition within 6 hours.

ACTION 27(c) - With the number of OPERABLE channels less than the Total Number of Channels, operation may continue provided the inoperable channels are placed in the tripped condition within 6 hours.

TABLE 3.3-4 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION TRIP SETPOINTS

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
5. Feedwater Isolation (Continued)					
b. Steam Generator Water Level-High-High	5.0	2.18	2.0	≤ 78% of narrow range instrument span	≤ 79.8% of narrow range instrument span
c. Safety Injection	See Item 1. above for all Safety Injection Trip Setpoints and Allowable Values.				
6. Auxiliary Feedwater					
a. Manual Initiation	N.A.	N.A.	N.A.	N.A.	N.A.
b. Automatic Actuation Logic and Actuation Relays (SSPS)	N.A.	N.A.	N.A.	N.A.	N.A.
c. Automatic Actuation Logic and Actuation Relays (BOP ESFAS)	N.A.	N.A.	N.A.	N.A.	N.A.
d. Steam Generator Water Level-Low-Low					
~~1) Start Motor Driven Pumps~~	~~23.5~~	~~21.18~~	~~2.0~~	~~≥ 23.5% of narrow range instrument span~~	~~≥ 22.0% of narrow range instrument span~~
INSERT J					
~~2) Start Turbine Driven Pump~~	~~23.5~~	~~21.18~~	~~2.0~~	~~≥ 23.5% of narrow range instrument span~~	~~≥ 22.0% of narrow range instrument span~~
INSERT K					

INSERT J ON TABLE 3.3-4

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
6.d. Steam Generator Water Level-Low-Low					
1) Start Motor-Driven Pumps					
a. Vessel Delta T Equivalent ≤ 10% RTP					
Vessel Delta-T (Power-1)	6.0	2.38	2.0	≤ Vessel Delta-T Equivalent to 10% RTP	≤ Vessel Delta-T Equivalent to 14.0% RTP
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
and					
Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span
With a Time Delay, (t)				≤ 232 seconds	≤ 240 seconds
b. 10% RTP < Vessel Delta-T Equivalent ≤ 20% RTP					
Vessel Delta-T (Power-2)	6.0	2.38	2.0	≤ Vessel Delta-T Equivalent to 20 % RTP	≤ Vessel Delta-T Equivalent to 24.0 % RTP
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
And					
Containment Pressure-Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span
With a Time Delay, (t)				≤ 122 seconds	≤ 130 seconds

INSERT J ON TABLE 3.3-4 (Cont.)

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
c) Vessel Delta-T Equivalent > 20% RTP					
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
And					
Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span

INSERT K ON TABLE 3.3-4

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
6.d. Steam Generator Water Level-Low-Low					
2) Start Turbine-Driven Pump					
a. Vessel Delta-T Equivalent ≤ 10% RTP					
Vessel Delta-T (Power-1)	6.0	2.38	2.0	≤ Vessel Delta-T Equivalent to 10% RTP	≤ Vessel Delta-T Equivalent to 14.0% RTP
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
and					
Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span
With a Time Delay, (t)				≤ 232 seconds	≤ 240 seconds
b. 10% RTP < Vessel Delta-T Equivalent ≤ 20% RTP					
Vessel Delta-T (Power-2)	6.0	2.38	2.0	≤ Vessel Delta-T Equivalent to 20 % RTP	≤ Vessel Delta-T Equivalent to 24.0 % RTP
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
And					
Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span
With a Time Delay, (t)				≤ 122 seconds	≤ 130 seconds

INSERT K ON TABLE 3.3-4 (Cont.)

FUNCTIONAL UNIT	TOTAL ALLOWANCE (TA)	Z	SENSOR ERROR (S)	TRIP SETPOINT	ALLOWABLE VALUE
c) Vessel Delta-T Equivalent > 20% RTP					
Coincident with					
Steam Generator Water Level Low-Low (Adverse Containment Environment)	20.2	17.58	2.0	≥ 20.2 % of Narrow Range Instrument Span	≥ 18.4 % of Narrow Range Instrument Span
And					
Containment Pressure - Environmental Allowance Modifier	3.3	0.71	2.0	≤ 1.5 psig	≤ 2.3 psig
OR					
Steam Generator Water Level Low-Low (Normal Containment Environment)	14.8	12.18	2.0	≥ 14.8 % of Narrow Range Instrument Span	≥ 13.0 % of Narrow Range Instrument Span

TABLE 3.3-5 (Continued)

ENGINEERED SAFETY FEATURES RESPONSE TIMES

INITIATING SIGNAL AND FUNCTION	RESPONSE TIME IN SECONDS
5. Containment Pressure-High-3	
a. Containment Spray	$\leq 32^{(1)}/20^{(2)}$
b. Phase "B" Isolation	≤ 31.5
6. Containment Pressure-High-2	
Steam Line Isolation	$\leq 2^{(5)}$
7. Steam Line Pressure-Negative Rate-High	
Steam Line Isolation	$\leq 2^{(5)}$
8. Steam Generator Water Level-High-High	
a. Feedwater Isolation	$\leq 2^{(5)}$
b. Turbine Trip	≤ 2.5
9. Steam Generator Water Level-Low-Low	
a. Start Motor-Driven Auxiliary Feedwater Pumps	$\leq 60^{(8)}$
b. Start Turbine-Driven Auxiliary Feedwater Pump	$\leq 60^{(8)}$
10. Loss-of-Offsite Power	
Start Turbine-Driven Auxiliary Feedwater Pump	N.A.
11. Trip of All Main Feedwater Pumps	
Start Motor-Driven Auxiliary Feedwater Pumps	N.A.

TABLE NOTATIONS (Continued)

(7) Diesel generator starting and sequence loading delays included. Sequential transfer of charging pump suction from the VCT to the RWST (RWST valves open, then VCT valves close) is not included. Response time assumes only opening of RWST valves.

(8) Does not include Trip Time Delays. Response times noted above include the transmitters, 7300 process protection cabinets, solid state protection cabinets, and actuation devices only. This reflects the response times necessary for THERMAL POWER in excess of 20% RATED THERMAL POWER.

TABLE 4.3-2 (Continued)

ENGINEERED SAFETY FEATURES ACTUATION SYSTEM INSTRUMENTATION

SURVEILLANCE REQUIREMENTS

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
6. Auxiliary Feedwater (Continued)								
c. Automatic Actuation Logic and Actuation Relays (BOP ESFAS)	N.A.	N.A.	N.A.	K.A.	M(1)(2)	N.A.	N.A.	1, 2, 3
~~d. Steam Generator Water Level Low-Low~~	~~S~~	~~R~~	~~M~~	~~N.A.~~	~~N.A.~~	~~N.A.~~	~~N.A.~~	~~1, 2, 3~~
INSERT L								
e. Safety Injection	See Item 1. above for all Safety Injection Surveillance Requirements.							
f. Loss-of-Offsite Power	N.A.	R	N.A.	M	N.A.	N.A.	N.A.	1, 2, 3
g. Trip of All Main Feedwater Pumps	N.A.	N.A.	N.A	R	N.A.	N.A.	N.A.	1, 2
h. Auxiliary Feedwater Pump Suction Pressure-Low	S	R	M	N.A.	N.A.	N.A.	N.A.	1, 2, 3
7. Automatic Switchover to Containment Sump								
a. Automatic Actuation Logic and Actuation Relays (SSPS)	N.A.	N.A.	N.A.	N.A.	M(1)	M(1)	Q(3)	1, 2, 3, 4
b. RWST Level - Low-Low Coincident With Safety Injection	S	R	M	N.A.	N.A.	N.A.	N.A.	1, 2, 3, 4
	See Item 1. above for all Safety Injection Surveillance Requirements.							
8. Loss of Power								
a. 4 kV Undervoltage-Loss of Voltage	N.A.	R	N.A.	M	N.A.	N.A.	N.A.	1, 2, 3, 4
b. 4 kV Undervoltage-Grid Degraded Voltage	N.A.	R	N.A.	M	N.A.	N.A.	N.A.	1, 2, 3, 4

FUNCTIONAL UNIT	CHANNEL CHECK	CHANNEL CALIBRATION	ANALOG CHANNEL OPERATIONAL TEST	TRIP ACTUATING DEVICE OPERATIONAL TEST	ACTUATION LOGIC TEST	MASTER RELAY TEST	SLAVE RELAY TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
6. Auxiliary Feedwater								
d. Steam Generator Water Level-Low-Low								
1) Steam Generator Water Level-Low-Low (Adverse Containment Environment)	S	R	M	N.A.	N.A.	N.A.	N.A.	1,2,3
2) Steam Generator Water Level-Low-Low (Normal Containment Environment)	S	R	M	N.A.	N.A.	N.A.	N.A.	1,2,3
3) Vessel Delta-T (Power-1, Power-2)	S	R	M	N.A.	N.A.	N.A.	N.A.	1,2,3
4) Containment Pressure - Environmental Allowance Modifier	S	R	M	N.A.	N.A.	N.A.	N.A.	1,2,3

INSERT L ON TABLE 4.3-2

REVISION 1

LIMITING SAFETY SYSTEM SETTINGS

BASES

Steam Generator Water Level

The Steam Generator Water Level Low-Low trip protects the reactor from loss of heat sink in the event of a sustained steam/feedwater flow mismatch resulting from loss of normal feedwater. ~~The specified Setpoint provides allowances for starting delays of the Auxiliary Feedwater System.~~ INSERT M

Undervoltage and Underfrequency - Reactor Coolant Pump Busses

The Undervoltage and Underfrequency Reactor Coolant Pump Bus trips provide core protection against DNB as a result of complete loss of forced coolant flow. The specified Setpoints assure a Reactor trip signal is generated before the Low Flow Trip Setpoint is reached. Time delays are incorporated in the Underfrequency and Undervoltage trips to prevent spurious Reactor trips from momentary electrical power transients. For undervoltage, the delay is set so that the time required for a signal to reach the Reactor trip breakers following the simultaneous trip of two or more reactor coolant pump bus circuit breakers shall not exceed 1.2 seconds. For underfrequency, the delay is set so that the time required for a signal to reach the Reactor trip breakers after the Underfrequency Trip Setpoint is reached shall not exceed 0.3 second. On decreasing power the Undervoltage and Underfrequency Reactor Coolant Pump Bus trips are automatically blocked by P-7 (a power level of approximately 10% of RATED THERMAL POWER with a turbine impulse chamber pressure at approximately 10% of full power equivalent); and on increasing power, reinstated automatically by P-7.

Turbine Trip

A Turbine trip initiates a Reactor trip. On decreasing power the Reactor trip from the Turbine trip is automatically blocked by P-9 (a power level of approximately 50% of RATED THERMAL POWER); and on increasing power, reinstated automatically by P-9.

Safety Injection Input from ESF

If a Reactor trip has not already been generated by the Reactor Trip System instrumentation, the ESF automatic actuation logic channels will initiate a Reactor trip upon any signal which initiates a Safety Injection. The ESF instrumentation channels which initiate a Safety Injection signal are shown in Table 3.3-3.

INSERT M

or a feedwater system pipe break, inside or outside of containment. This function also provides input to the steam generator level control system, therefore, the actuation logic must be able to withstand both an input failure to the control system (which may then require the protective function actuation) and a single failure in the remaining channels providing the protection function actuation. This results in a 2/4 actuation logic. With the transmitters (d/p cells) located inside containment and thus possibly experiencing adverse environmental conditions (due to a feedline break), the Environmental Allowance Modifier (EAM) was devised. The EAM function (Containment Pressure with a setpoint of $\leq$ 1.5 psig) senses the presence of adverse containment conditions (elevated pressure) and enables the Steam Generator Water Level - Low-Low trip setpoint (Adverse) which reflects the increased transmitter uncertainties due to this environment. The EAM allows the use of a lower Steam Generator Water Level - Low-Low trip setpoint (Normal) when these conditions are not present, thus allowing more margin to trip for normal operating conditions. The Trip Time Delay (TTD) creates additional operational margin when the plant needs it most, during early escalation to power, by allowing the operator time to recover level when the primary side load is sufficiently small to allow such action. The TTD is based on the continuous monitoring of primary side power through the use of Vessel Delta-T. Two time delays are possible, based on the primary side power level, the magnitude of the trip delay decreasing with increasing power. In the event that the EAM or TTD functions do not meet the minimum channels operable requirements, it is acceptable to place the inoperable channels in the Tripped Condition and continue operation. Placing the inoperable channels in this mode will result in the enabling of the Steam Generator Water Level - Low-Low (Adverse) function, for the EAM, or in the removal of the trip delay, for the TTD. In the event that the Steam Generator Water Level - Low-Low (Normal) function does not meet the minimum channels operable requirement, it is acceptable to place the associated EAM channels in the Tripped Condition and continue operation. Performing this action will result in the enabling of the Steam Generator Water Level - Low-Low (Adverse) function which has a more conservative (higher level) trip setpoint. At this time it would also be acceptable to place the inoperable Steam Generator Water Level - Low-Low channels in the Bypassed Condition to prevent an inadvertent Reactor Trip or ESFAS actuation.

SIGNIFICANT HAZARDS EVALUATION

STEAM GENERATOR LEVEL REACTOR TRIP MODIFICATION

SIGNIFICANT HAZARDS EVALUATION
CALLAWAY STEAM GENERATOR
LOW-LOW LEVEL REACTOR TRIP MODIFICATION

I. Introduction

This evaluation supports Union Electric Company's license amendment request to modify the Callaway Plant steam generator low-low level reactor trip circuitry. The changes will include the addition of an Environmental Allowance Modifier (EAM) and Trip Time Delay (TTD) circuitry. The design of these circuits has been developed by the Westinghouse Owners Group as a means to reduce the frequency of unnecessary feedwater-related reactor trips. The EAM and TTD conceptual designs are documented in WCAP-11325-P-A and WCAP-11342-P-A, which were approved by the Nuclear Regulatory Commission in January, 1988.

Technical specification changes being made in conjunction with this change include revised steam generator low-low level trip setpoints and allowable values for reactor trip and auxiliary feedwater initiation, new trip setpoints and allowable values for the EAM/TTD circuitry, and new operability, trip time delay, and surveillance requirements.

In support of the requested amendment Union Electric has reviewed the impact of the modifications to steam generator level circuitry on the analysis described in the Callaway Final Safety Analysis Report (FSAR) and the Callaway Uprating which was approved by the Nuclear Regulatory Commission in Amendment 35, dated March 30, 1988, to Callaway Facility Operating License NPF-30. On the basis of the results of this review Union Electric has concluded that the changes do not involve a significant hazard. The following are summaries for each change and the conclusions reached.

II. Environmental Allowance Modifier

The design of the Environmental Allowance Modifier (EAM) selects a setpoint for the steam generator low-low level trip which includes an environmental uncertainty associated with the applicable plant environmental conditions. In the event that an onset of an adverse containment environment is sensed by the EAM circuitry via containment pressure, a higher steam generator low-low level trip setpoint is automatically selected to account for larger environmental uncertainties associated with the adverse environmental conditions due to a feedwater line rupture inside containment. Since a lower setpoint is used by the EAM circuitry during normal operation, improved operating margin (larger steam generator level operating band) with respect to feedwater

inventory control can be realized. These features act to reduce feedwater-related trips especially during plant startup and load change maneuvers.

a) This change does not involve a significant increase in the probability or consequences of an accident previously evaluated. No changes are involved in accident initiators which would change the probability of an accident. The consequences of previously analyzed accidents remain unchanged because the new setpoints and allowable values for the steam generator low-low level trip, vessel Delta-T, and containment pressure bistables have been determined using the methodology in WCAP-11342-P-A, which has been approved by NRC.

b) This change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The design assures that the appropriate environmental allowance is included in setpoints for events requiring protective action during which an adverse environment exists.

c) This change does not involve a significant reduction in a margin of safety. This is based on the fact that the analysis and setpoints associated with the incorporation of EAM have been performed and established using the models and methodologies from WCAP-11342-P-A, which has been approved by NRC.

III. Trip Time Delay

Once the low-low water level trip setpoint (either the normal environment setpoint or the adverse environment setpoint) is reached, the Trip Time Delay (TTD) acts to delay reactor trip, main feedwater isolation, and auxiliary feedwater system actuation to allow time for operator corrective action or for natural stabilization of shrink/swell water level transients. The TTD is designed for low power or startup operations. The TTD design may be generally described as a system of predetermined programmed trip delay times that are based upon the prevailing power level at the time a low-low level trip setpoint is reached.

The Callaway TTD design is based on two unique power level interlocks at 10% and 20% of Rated Thermal Power (3565 MWt) for implementation of the TTD logic. These power level interlocks are well within the power level range defined by the NRC in the WCAP-11325-P-A SER for plant-specific applications. Consistent with the WCAP-11325-P-A methodology, appropriate trip time delays have been established to preserve existing safety analysis limits. No time delays are utilized for power levels greater than 20% of Rated Thermal Power.

a) This change does not involve a significant increase in the probability or consequences of an accident previously evaluated. No changes are involved in accident initiators which would change the probability of an accident. The consequences of previously analyzed accidents remain unchanged because the time delays associated with the TTD modification and supporting transient analyses utilize the methodology in WCAP-11325-P-A, which has been approved by NRC.

b) This change does not create the possibility of a new or different kind of accident from any accident previously evaluated. The design assures that a Condition II event, as defined in ANSI-N18.2-1973, does not lead to a Condition III or IV event.

c) This change does not involve a significant reduction in a margin of safety. This is based on the fact that the analysis and time delays associated with the incorporation of TTD have been performed and established using the models and methodologies from WCAP-11325-P-A, which has been approved by NRC.

IV. Summary

Based on the above discussions, the amendment request does not involve a significant increase in the probability or consequences of an accident previously evaluated; does not create the possibility of a new or different kind of accident from any accident previously evaluated; and does not involve a reduction in the required margin of safety. Based on the foregoing, the requested amendment does not present a significant hazard.

DRAFT FSAR CHAPTER 7 CHANGES
STEAM GENERATOR LEVEL REACTOR TRIP MODIFICATION

7.2 REACTOR TRIP SYSTEM

7.2.1 DESCRIPTION

7.2.1.1 System Description

The reactor trip system (RTS) automatically keeps the reactor operating within a safe region by shutting down the reactor whenever the limits of the region are approached. The safe operating region is defined by several considerations, such as mechanical/hydraulic limitations on equipment and heat transfer phenomena. Therefore, the reactor trip system keeps surveillance on process variables which are directly related to equipment mechanical limitations, such as pressure, and pressurizer water level (to prevent water discharge through safety valves and uncovering heaters), and also on variables which directly affect the heat transfer capability of the reactor (e.g., flow and reactor coolant temperatures). Still other parameters utilized in the reactor trip system are calculated from various process variables. Whenever a direct process or calculated variable exceeds a setpoint, the reactor will be shut down in order to protect against either damage to fuel cladding or loss of system integrity, which could lead to the release of radioactive fission products into the containment. and any applicable ~~trips~~ have expired trip delays

REV.

The following systems make up the reactor trip system (see Ref. 1, 2, and 3 for additional background information).

a. Process instrumentation and control system

b. Nuclear instrumentation system

c. Solid state logic protection system

d. Reactor trip switchgear

e. Manual actuation circuit

The reactor trip system consists of sensors that monitor various plant parameters and are connected with analog circuitry, consisting of two to four redundant channels, and digital circuitry, consisting of two redundant logic trains, that receives inputs from the analog channels to complete the logic necessary to automatically open the reactor trip breakers.

Each of two logic trains, A and B, is capable of opening a separate and independent reactor trip breaker, RTA and RTB, respectively. The two trip breakers in series connect three-phase ac power from the rod drive motor generator sets to the rod drive power cabinets, as shown in Figure 7.2-1 (Sheet 2). During plant power operation, a dc undervoltage coil on each reactor trip breaker holds a trip plunger out against its spring, allowing the power to be available at the rod control

the reactor if the power level is above P-7. The coincidence logic and interlocks are given in Table 7.2-1.

e. Steam generator low-low water level trip

The specific trip function generated is low-low steam generator water level trip.

This trip protects the reactor from loss of heat sink. This trip is actuated on two out of four low-low water level signals occurring in any steam generator. Insert A

Rev.

The logic is shown on Figure 7.2-1 (Sheet 7).

f. Reactor trip on a turbine trip (anticipatory)

The reactor trip on a turbine trip is actuated by two-out-of-three logic from emergency trip fluid pressure signals or by all closed signals from the turbine steam stop valves. A turbine trip causes a direct reactor trip above P-9. The reactor trip on turbine trip provides additional protection and conservatism beyond that required for the health and safety of the public. This trip is included as part of good engineering practice and prudent design.

The turbine provides anticipatory trips to the reactor protection system from contacts which change position when the turbine stop valves close or when the turbine emergency trip fluid pressure goes below its setpoint.

Components specified for use as sensors for input signals to the reactor protection system for "emergency trip oil pressure low" and "turbine stop valves close" will conform to the requirements of IEEE 279-1971 and be environmentally qualified. However, seismic criteria are not included in qualification regarding mounting and location for that portion of the trip system located within nonseismic Category I structures.

Evaluations indicate that the functional performance of the protection system would not be degraded by credible electrical faults such as opens and shorts in the circuits associated with reactor trip or the generation of the P-7 interlock. The contacts of redundant sensors on the steam stop valves and the trip fluid pressure system are connected through the grounded side of the ac supply circuits in the solid state protection system. A ground fault would, therefore, produce no fault current. Loss of signal caused by open circuits would produce either a partial or full

hot leg coolant stream, contains five inlet orifices distributed along its length. In this way, a total of 15 locations in the hot leg stream are sampled, providing a representative coolant temperature measurement. The 2-inch-diameter pipe leading to the resistance temperature detectors manifold provides mixing of the samples to give representative temperature measurement.

Care has been taken to distribute the flow evenly among the five orifices of each probe by effectively restricting the flow through the orifices. This has been done by designing a smaller overall orifice flow area than that of the common flow channel within the probe. This arrangement has also been applied to the flow transition from the three probe flow channels to the pipe leading to the temperature element manifold. The total flow area of these channels has, therefore, been designed to be less than that of the 2-inch pipe connecting the probes to the manifold.

The cold leg reactor coolant flow is well mixed by the reactor coolant pump, thereby eliminating any cold leg temperature spatial dependence. Therefore, the cold leg sample is taken directly from a 2-inch pipe tap off the cold leg downstream of the pump.

7.2.1.1.5 Pressurizer Water Level Reference Leg Arrangement

The design of the pressurizer water level instrumentation employs the usual tank level arrangement, using differential pressure between an upper and a lower tap on a column of water. A reference leg connected to the upper tap is kept full of water by condensation of steam at the top of the leg.

7.2.1.1.6 Analog System

The analog system consists of two instrumentation systems - the process instrumentation system and the nuclear instrumentation system.

Process instrumentation includes those devices (and their interconnection into systems) which measure temperature, pressure, fluid flow, fluid level as in tanks or vessels, and occasionally physiochemical parameters, such as fluid conductivity or chemical concentration. Process instrumentation specifically excludes nuclear and radiation measurements. The process instrumentation includes the process measuring devices, power supplies, indicators, recorders, alarm actuating devices, timers, controllers, signal conditioning devices, etc., which are necessary for day-to-day operation of the NSSS, as well as for monitoring the plant and providing initiation of plant protective functions.

REV

The primary function of nuclear instrumentation is to protect the reactor by monitoring the neutron flux and generating appropriate trips and alarms for various phases of reactor

7.2.1.2 Design Bases Information

The information given below presents the design bases information requested by Section 3 of IEEE Standard 279-1971. Functional diagrams are presented in Figure 7.2-1.

7.2.1.2.1 Generating Station Conditions

The following are the generating station conditions requiring reactor trip.

a. DNBR approaching 1.30.

b. Linear power density (kilowatts per foot) approaching rated value for Condition II events (see Chapter 4.0 for fuel design limits).

c. Reactor coolant system overpressure creating stresses approaching the limits specified in Chapter 5.0.

7.2.1.2.2 Generating Station Variables

The following are the variables required to be monitored in order to provide reactor trips (see Table 7.2-1).

Neutron flux

b. Reactor coolant temperature

c. Reactor coolant system pressure (pressurizer pressure)

d. Pressurizer water level

e. Reactor coolant flow

f. Reactor coolant pump operational status (voltage and frequency)

g. Steam generator water level (Reference 5)

REV.

h. Turbine-generator operational status (trip fluid pressure and stop valve position)

7.2.1.2.3 Spatially Dependent Variables

The only spatially dependent variable is the reactor coolant temperature. See Section 7.3.8.1.2 for a discussion of this spatial dependence.

7.2.1.2.4 Limits, Margins, and Setpoints

The parameter values that will require reactor trip are given in Chapter 15.0 and the Callaway Technical Specifications. The

7.2.1.2.6 Minimum Performance Requirements

a. Reactor trip system response times

Typical time delays in generating the reactor trip signal are tabulated in Table 7.2-3. See Section 7.1.2.6.2 for a discussion of periodic response time verification capabilities.

b. Reactor trip accuracies

Reactor trip accuracies are tabulated in Table 7.2-3. An additional discussion on accuracy is found in Section 7.3.2.1.2.7.

c. Protection system ranges

Typical protection system ranges are tabulated in Table 7.2-3. Range selection for the instrumentation covers the expected ranges of the process variable being monitored during power operation. Limiting setpoints are at least 5 percent from the end of the instrument span.

7.2.1.3 Final Systems Drawings

Functional block diagrams, electrical elementaries, and other drawings required to assure electrical separation and perform a safety review are provided in the Safety-Related Drawing Package (refer to Section 1.7).

7.2.2 ANALYSES

7.2.2.1 Failure Mode and Effects Analyses

An analysis of the reactor trip system has been performed. Results of this study and a fault tree analysis are presented in Reference 4.

7.2.2.2 Evaluation of Design Limits

Rev. While most setpoints used in the reactor protection system are fixed, there are variable setpoints, most notably the over-temperature ΔT and overpower ΔT setpoints. All setpoints in the reactor trip system have been selected on the basis of engineering design or safety studies. The capability of the reactor trip system to prevent loss of integrity of the fuel cladding and/or reactor coolant system pressure boundary during Condition II and III transients is demonstrated in Chapter 15.0. Accident analyses are carried out using those setpoints determined from results of the engineering design studies. Setpoint limits are presented in the Callaway Technical Specifications. A discussion of the intent for each of the various reactor trips and the accident analyses

INSERT B

i. Capability for sensor checks

The operational availability of each system input sensor during reactor operation is accomplished by cross checking between channels that bear a known relationship to each other and that have readouts available. Channel checks are discussed in Chapter 16.0.

j. Capability for testing

The reactor trip system is capable of being tested during power operation. Where only parts of the system are tested at any one time, the testing sequence provides the necessary overlap between the parts to ensure complete system operation. The testing capabilities are in conformance with Regulatory Guide 1.22, as discussed in Section 7.1 7.5.2.

The protection system is designed to permit periodic testing of the analog channel portion of the reactor trip system during reactor power operation without initiating a protective action, unless a trip condition actually exists. This is because of the coincidence logic required for reactor trip. These tests may be performed at any plant power from cold shutdown to full power. Before starting any of these tests with the plant at power, all redundant reactor trip channels associated with the function to be tested must be in the normal (untripped) mode in order to avoid spurious trips. Setpoints are referenced in the precautions, limitations, and setpoints portion of the plant technical manual.

Analog Channel Tests

Analog channel testing is performed at the analog instrumentation rack set by individually introducing dummy input signals into the instrumentation channels and observing the tripping of the appropriate output bistables. Process analog output to the logic circuitry is interrupted during individual channel test by a test switch which, when thrown, deenergizes the associated logic inputs and inserts a proving lamp in the bistable output. Interruption of the bistable output to the logic circuitry for any cause (test, maintenance purposes, or removed from service) will cause that portion of the logic to be actuated (partial trip), accompanied by a partial trip alarm and channel status light actuation in the control room. Each channel contains those switches, test points, etc. necessary to test the channel. See References 1 and 2 and 5 for additional background information.

Insert C

REV.

REV.

o. Multiple setpoints

Rev.

For monitoring neutron flux, and steam generator low-low level multiple setpoints are used. When a more restrictive trip setting becomes necessary to provide adequate protection for a particular mode of operation or set of operating conditions, the protective system circuits are designed to provide positive means or administrative control to ensure that the more restrictive trip setpoint is used. The devices used to prevent improper use of less restrictive trip settings are considered part of the protective system and are designed in accordance with the criteria of this section.

p. Completion of protective action

The protection system is so designed that, once initiated, a protective action goes to completion. Return to normal operation requires action by the operator.

q. Manual initiation

Switches are provided on the control board for manual initiation of protective action. Failure in the automatic system does not prevent the manual actuation of the protective functions. Manual actuation relies on the operation of a minimum of equipment.

r. Access

The design provides for administrative control of access to all setpoint adjustments, module calibration adjustments, and test points.

s. Identification of protective actions

Protective channel identification is discussed in Section 7.1.2.3. Indication is discussed in item t below.

t. Information readout

The protective system provides the operator with complete information pertinent to system status and safety. All transmitted signals (flow, pressure, temperature, etc.) which can cause a reactor trip will be either indicated or recorded for every channel, including all neutron flux power range currents (top detector, bottom detector, algebraic difference, and average of bottom and top detector currents).

to the automatic high pressurizer pressure reactor trip actuating at a pressure sufficiently below the safety valve setpoint.

For control failures which tend to empty the pressurizer, two-out-of-four logic for safety injection action on low pressure ensures that the protection system can withstand an independent failure in another channel. In addition, ample time and alarms exist to alert the operator of the need for appropriate action.

7.2.2.3.5 Steam Generator Water Level

The basic function of the reactor protection circuits associated with low-low steam generator water level is to preserve the steam generator heat sink for removal of long term residual heat. Should a complete loss of feedwater occur, the reactor would be tripped on low-low steam generator water level. In addition, redundant auxiliary feedwater pumps are provided to supply feedwater to maintain residual heat removal capability after trip. This reactor trip acts before the steam generators are dry. This reduces the required capacity, increases the time interval before auxiliary feedwater pumps are required, and minimizes the thermal transient on the reactor coolant system and steam generators.

Therefore, a low-low steam generator water level reactor trip circuit is provided for each steam generator to ensure that sufficient initial thermal capacity is available in the steam generator at the start of the transient. Two-out-of-four low-low steam generator water level trip logic ensures a reactor trip, if needed, even with an independent failure in another channel used for control and when degraded by an additional second postulated random failure. Insert D

REV.

A spurious low signal for the feedwater flow channel being used for control would cause an increase in feedwater flow. The mismatch between steam flow and feedwater flow produced by the spurious signal would actuate alarms to alert the operator of the situation in time for manual correction (see Figure 7.2-1, sheets 13, 14). If the condition continues, a two-out-of-four high-high steam generator water level signal in any loop, independent of the indicated feedwater flow, will cause feedwater isolation and trip the turbine. The turbine trip will result in a subsequent reactor trip if power is above the P-9 setpoint. The high-high steam generator water level trip is an equipment protective trip preventing excessive moisture carryover which could damage the turbine blading.

In addition, the three-element feedwater controller incorporates reset action on the level error signal, such that with expected controller settings a rapid increase or decrease in the flow signal would cause only a small change in level before the controller would compensate for the level error. A slow

7.2.4 REFERENCES

1. Reid, J. B., "Process Instrumentation for Westinghouse Nuclear Steam Supply Systems (4 Loop Plant Using WCID 7300 Series Process Instrumentation)," WCAP-7913, January 1973. (Additional background information only.)

2. Lipchak, J. B., "Nuclear Instrumentation System," WCAP-8255, January 1974. (Additional background information only.)

3. Katz, D. N., "Solid State Logic Protection System Description," WCAP-7488-L (Proprietary), January, 1971 and WCAP-7672 (Non-Proprietary), June 1971. (Additional background information only.)

4. Gangloff, W. C. and Loftus, W. D., "An Evaluation of Solid State Logic Reactor Protection in Anticipated Transients," WCAP-7706-L (Proprietary) and WCAP-7706 (Non-Proprietary), July 1971.

5. Insert E

REV.

TABLE 7.2-1 (Sheet 2)

	Reactor Trip	Coincidence Logic	Protection Interlocks	Comments
9.	Pressurizer high pressure	2/4	No interlocks	-
10.	Pressurizer high water level	2/3	Interlocked with P-7	Blocked below P-7
11.	Low reactor coolant flow	2/3 in any loop	Interlocked with P-7 and P-8	Low flow in one loop will cause a reactor trip when above P-8, and a low flow in two loops will cause a reactor trip when above P-7; blocked below P-7
		1/4	Interlocked with P-8	Blocked below P-8
12.	Reactor coolant pump undervoltage	1/2 in both busses	Interlocked with P-7	Low voltage on all busses permitted below P-7
13.	Reactor coolant pump underfrequency	1/2 in both busses	Interlocked with P-7	Underfrequency on one motor in both busses will trip all reactor coolant pump breakers and cause reactor trip; reactor trip blocked below P-7
14.	Low-low steam generator water level	2/4 in any loop	No interlocks	Insert F -
15.	Safety injection	Coincident with actuation of safety injection	Interlocked with P-11. (If reactor coolant is less than 2000 psig, P-11 allows manual block)	See Section 7.3 for engineered safety features actuation conditions

REV.

TABLE 7.2-3 (Sheet 2)

	Reactor Trip Signal	Typical Range	Typical Trip Accuracy	Typical Time Response (sec)*
10.	Pressurizer high water level	Entire cylindrical portion of pressurizer (distance between taps)	± 2.3% of full range Δp between taps at design temperature and pressure	1.2
11.	Low reactor coolant flow	0 to 120% of rated flow	± 2.5% of full flow within range of 70 to 100% of full flow	0.3
12.	Reactor coolant pump undervoltage	0 to 100% rated voltage	± 1%	0.7
13.	Reactor coolant pump underfrequency	50 to 65 Hz	± 0.1 Hz	0.3
14.	Low-low steam generator water level	± 6 feet approximately from nominal full load water level	See Reference 5. ~~± 2.3% of Δp signal over pressure range of 700 to 1,200 psig~~	See Reference 5. ~~1.2~~
15.	Turbine trip	-	-	0.3

*The overall allowable response time for each reactor trip channel is given in Table 3.3-2 of the Callaway Technical Specifications. The channel response time value is the elapsed time from when the parameter being sensed by the channel reaches the safety set point until the undervoltage trip coil in the reactor trip breaker is de-energized. The additional time until the rods are free to fall into the core is 0.3 second, or less, for the breaker mechanism.

AFAS-M is generated on the occurrence of any one of the following events:

1. Trip of both main feedwater pumps (Manual block of the main feed pump trip signals is provided at the main control board, and is indicated on the ESFAS status panel. This block permits startup and shutdown of the plant without automatic start of the AFPs, while allowing the AFPs to remain available to respond to a demand from any other source.)

2. 2 out of 4 low-low level signals for any one steam generator (at solid state protection system)

REV.

3. Manual AFAS-M initiation

The turbine-driven pump is started on the occurrence of either of the following signals:

1. Manual start

2. Auxiliary feedwater actuation (AFAS-T)

AFAS-T is generated on the occurrence of any one of the following events:

1. Loss-of-offsite-power

2. Low-low level for any two steam generators (at solid state protection system)

REV.

3. Manual AFAS-T initiation

The steam generator sample line containment isolation valves and the steam generator blowdown isolation valves are all automatically closed on the occurrence of a safety-injection signal, a loss-of-offsite-power signal, or an AFAS. The signal which causes this closure is reset automatically upon reset of the AFAS.

b. Logic

See Figure 7.3-1.

c. Bypass

There is no device level override on this system.

INSERTS FOR CHAPTER 7 OF FSAR

INSERT A

The Environmental Allowance Modifier (EAM) circuitry in the low-low level channel provides for two level setpoints corresponding to an adverse and a normal containment environment. The trip actuation signal may then be delayed by the Trip Time Delay (TTD) timers depending on the plant power level at the time that the low-low level signal is sensed. A detailed description of the EAM/TTD design basis and functional implementation is provided in Reference 5.

INSERT B

Additionally, for steam generator low-low level reactor trip, the Environmental Allowance Modifier (EAM) circuitry allows for two setpoints, one for a normal containment environment and another enabled when an adverse environment is detected. Also, the Trip Time Delay (TTD) allows possible time delays dependent on power levels.

INSERT C

places any applicable Environmental Allowance Modifier (EAM) and/or Trip Time Delay (TTD) functions into a conservative state.

INSERT D

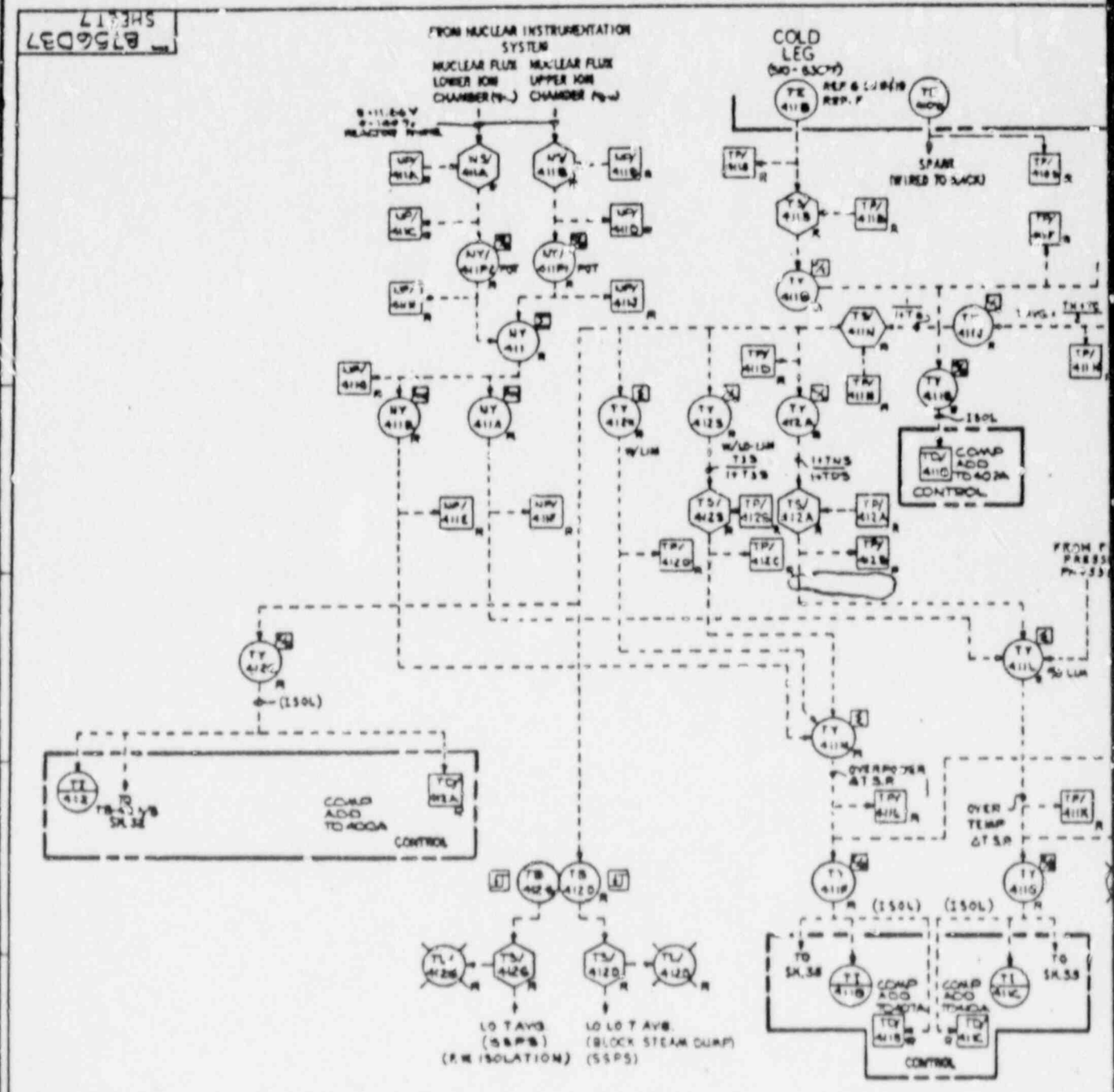
Of the two available low-low level setpoints, one corresponding to an adverse and one, a normal containment environment, the Environmental Allowance Modifier (EAM) enables the appropriate setpoint. This trip is actuated on two-out-of-four low-low water level signals occurring in any steam generator after the expiration of any enabled Trip Time Delay (TTD) system timers (see Section 7.2.1.1.2 and Reference 5).

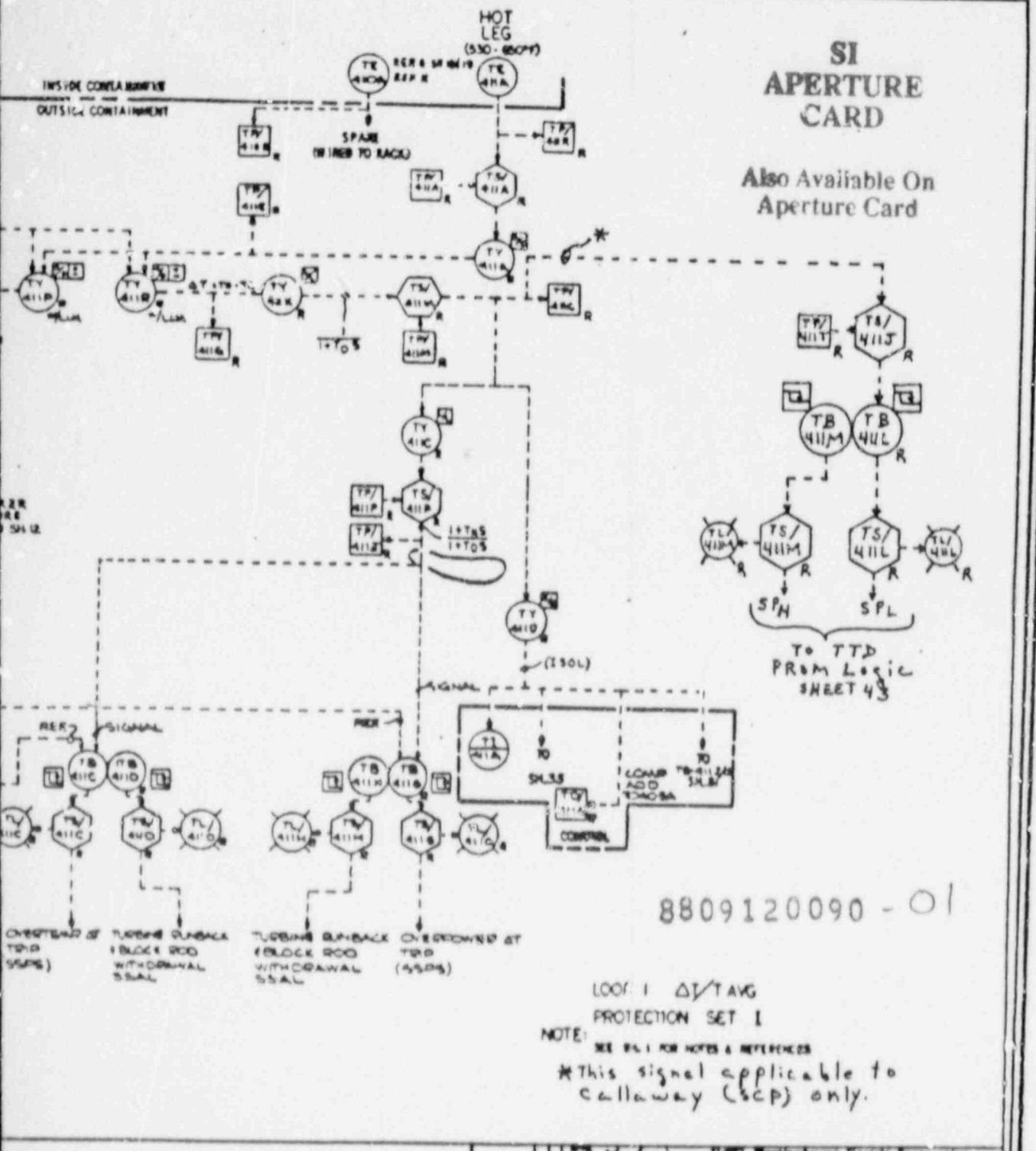
INSERT E

Leach, C. E., Gongaware, B. L., Tuley, C. R., Erin, L. E., Miranda, S., "Implementation of Steam Generator Low-Low Level Reactor Trip Time Delay and Environmental Allowance Modifier in the Callaway Plant," WCAP-11883 (Proprietary) and WCAP-11884 (Non-Proprietary), August, 1988.

INSERT F

Two level setpoints corresponding to normal and adverse environments. Also trip may be delayed depending on plant power level (Reference 5).


FROM NUCLEAR INSTRUMENTATION SYSTEM
NUCLEAR FLUX LOWER ION CHAMBER
NUCLEAR FLUX UPPER ION CHAMBER
COLD LEG
SPARE WIRED TO SI-ACCU
ISOL
COMP ADD TO 402A CONTROL
W/LO-LIM
W/HI-LIM
1 OF N 3
2 OF N 3
COMP ADD TO 402A
CONTROL
OVERPOWER ΔT S.P.
OVER TEMP ΔT S.P.
(ISOL)
(ISOL)
TO SK. 58
TO SK. 55
COMP ADD TO 402A
COMP ADD TO 402A
CONTROL
LO T AVG (SSPS) (RX ISOLATION)
LO LO T AVG. (BLOCK STEAM DUMP) (SSPS)



SI APERTURE CARD

Also Available On Aperture Card

8809120090 - 01

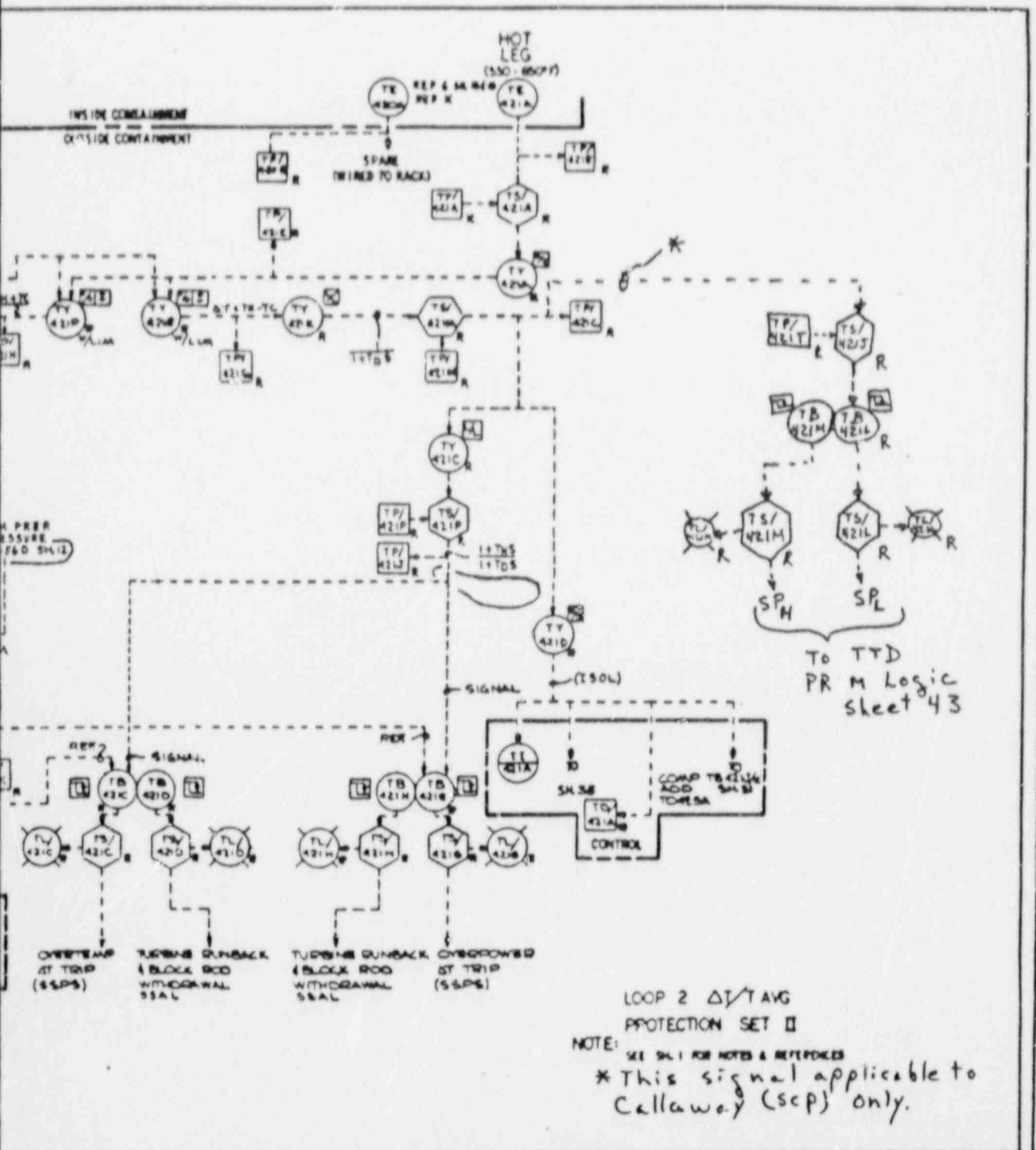
Westinghouse Electric Corporation

SHUTDOWN

PROCESS CONTROL BLOCK DIAG

8756D37

SHEET 7



LOOP 2 ΔT/T AVG
PROTECTION SET II

NOTE: SEE SH. 1 FOR NOTES & REFERENCES

* This signal applicable to Callaway (scp) only.

Westinghouse Electric Corporation

SHUPPS

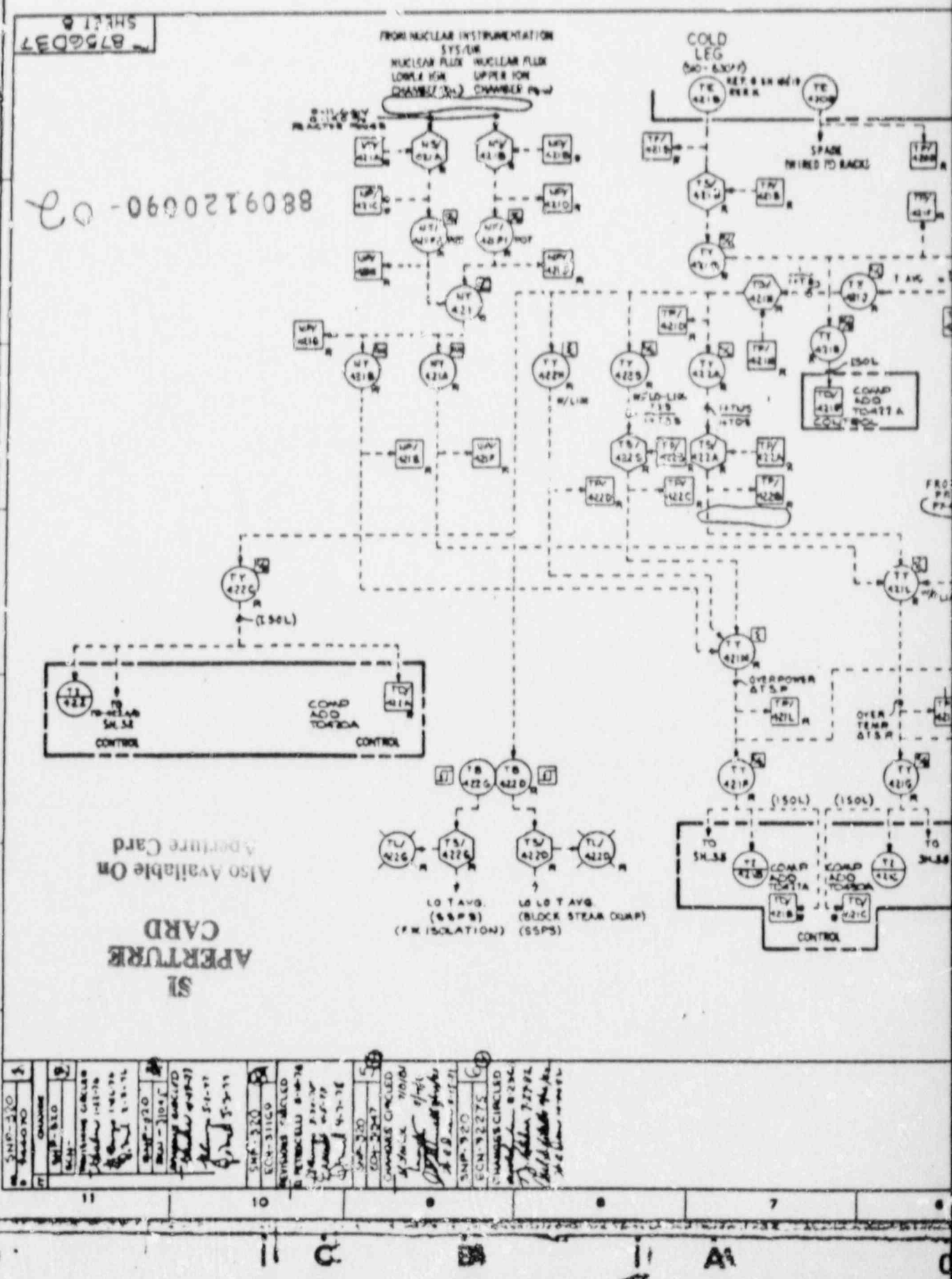
PROCESS CONTROL BLOCK DIAG

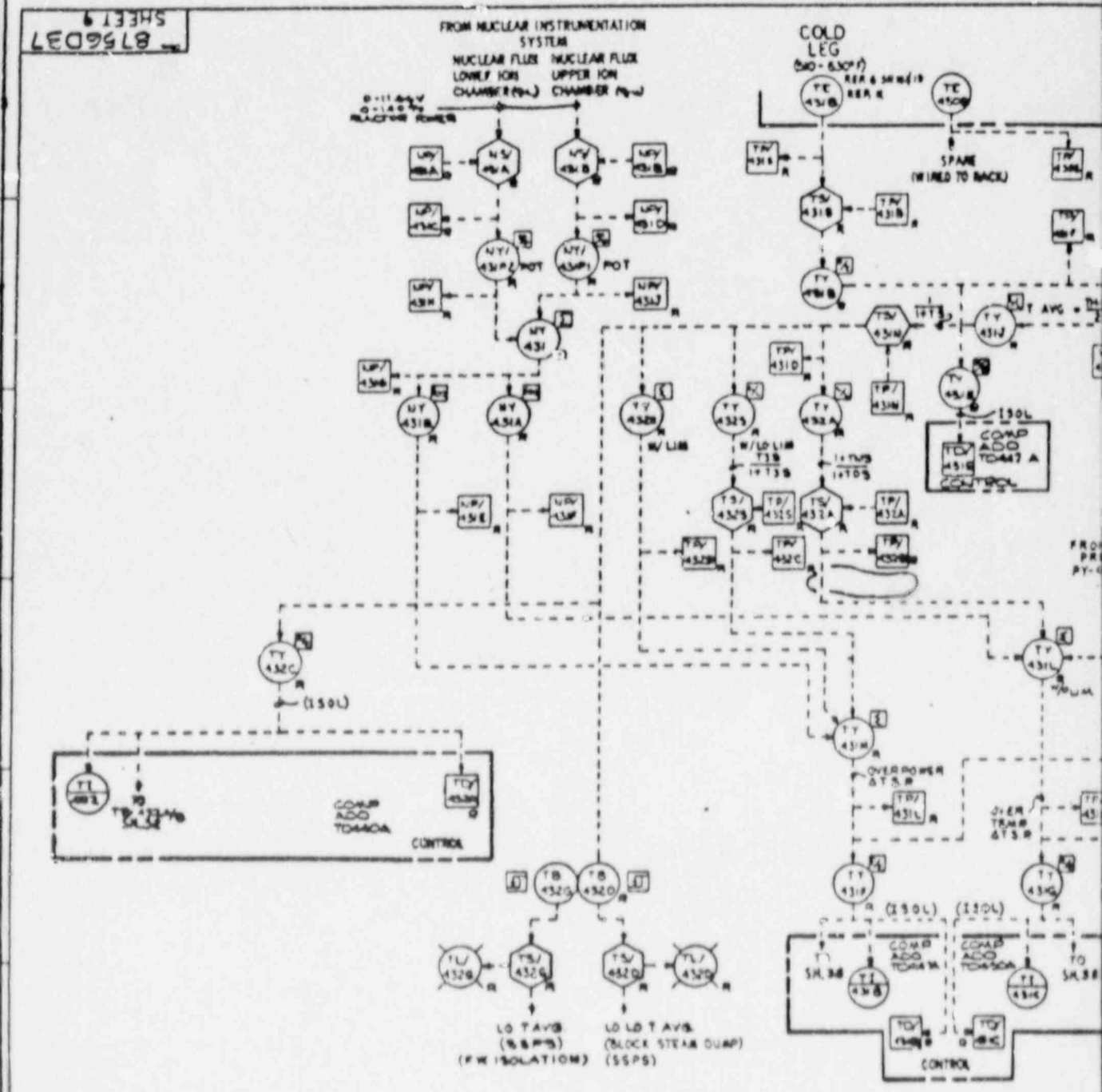
8756037

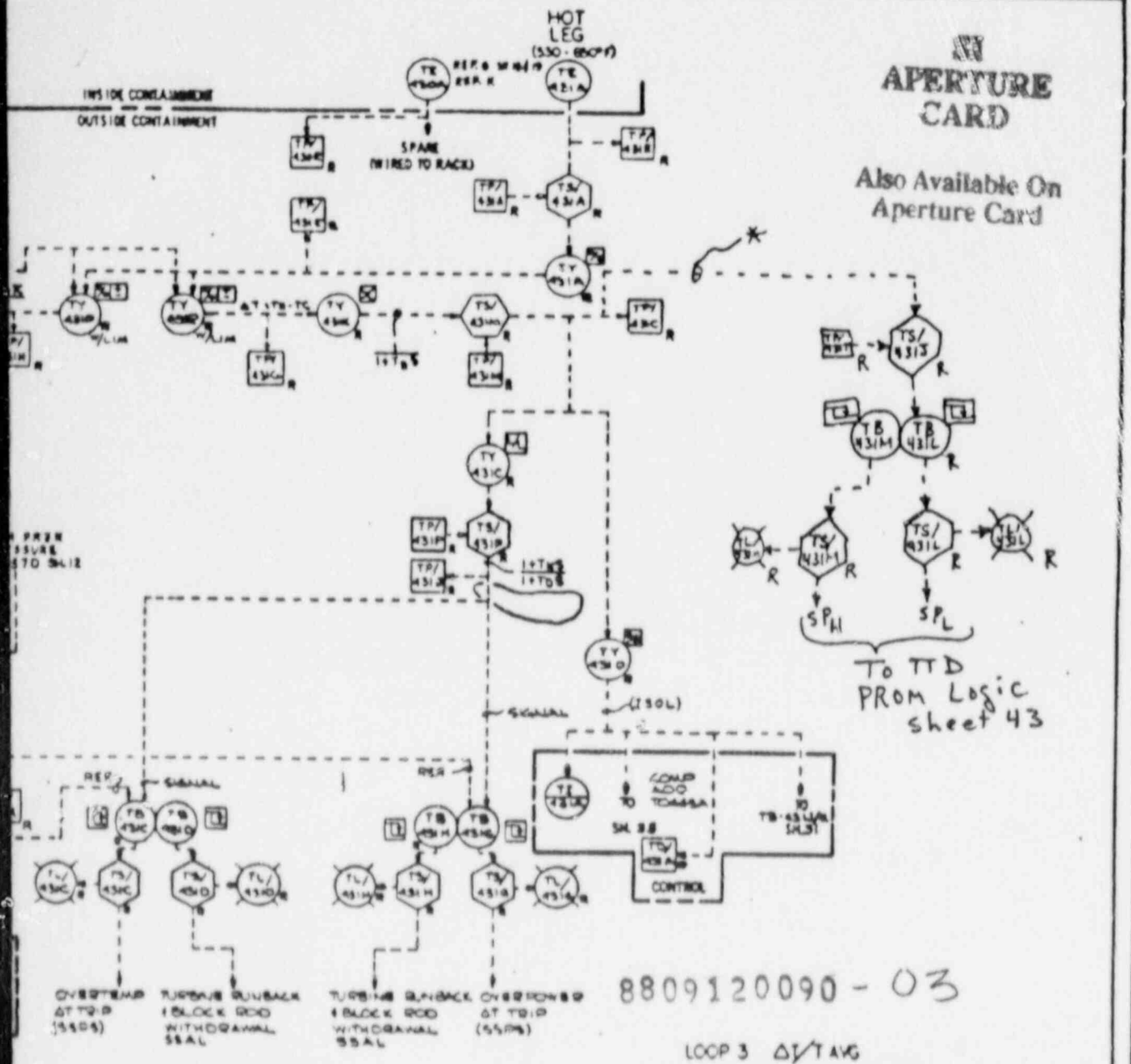
SHEET 8

5 4 3 2 1

A B C D


FROM NUCLEAR INSTRUMENTATION SYSTEM
NUCLEAR FLUX LOWER ION CHAMBER
NUCLEAR FLUX UPPER ION CHAMBER
COLD LEG
SPARE
WIRED TO RACKS
COMP ADD TO 422 A
COMP ADD TO 422 A
COMP ADD TO 422 A
COMP ADD TO 422 A
CONTROL
CONTROL
CONTROL
OVERPOWER ΔT S.P.
OVER TEMP ΔT S.P.
LO T AVG. (SSPS) (FW ISOLATION)
LO LO T AVG. (BLOCK STEAM DUMP) (SSPS)
Also Available On Aperture Card
SI APERTURE CARD


8756037
SHEET 9
FROM NUCLEAR INSTRUMENTATION SYSTEM
NUCLEAR FLUX LOWER ION CHAMBER (NIS)
NUCLEAR FLUX UPPER ION CHAMBER (NIS)
COLD LEG
560 - 630°F
SPARE (WIRED TO BACK)
T AVG
COMP ADD TD447 A
COMP ADD TD440A
CONTROL
OVERPOWER ΔT S.P.
OVER TEMP ΔT S.P.
COMP ADD TD443A
COMP ADD TD443C
LO T AVG (SSPS) (FW ISOLATION)
LO LO T AVG (BLOCK STEAM DUMP) (SSPS)



8809120090 - 03

LOOP 3 ΔT/T AVG
PROTECTION SET III

NOTE: SEE SHT 1 FOR NOTES & REFERENCES

* This signal applicable to Callaway (scp) only.

Westinghouse Electric Corporation

SHUPPS

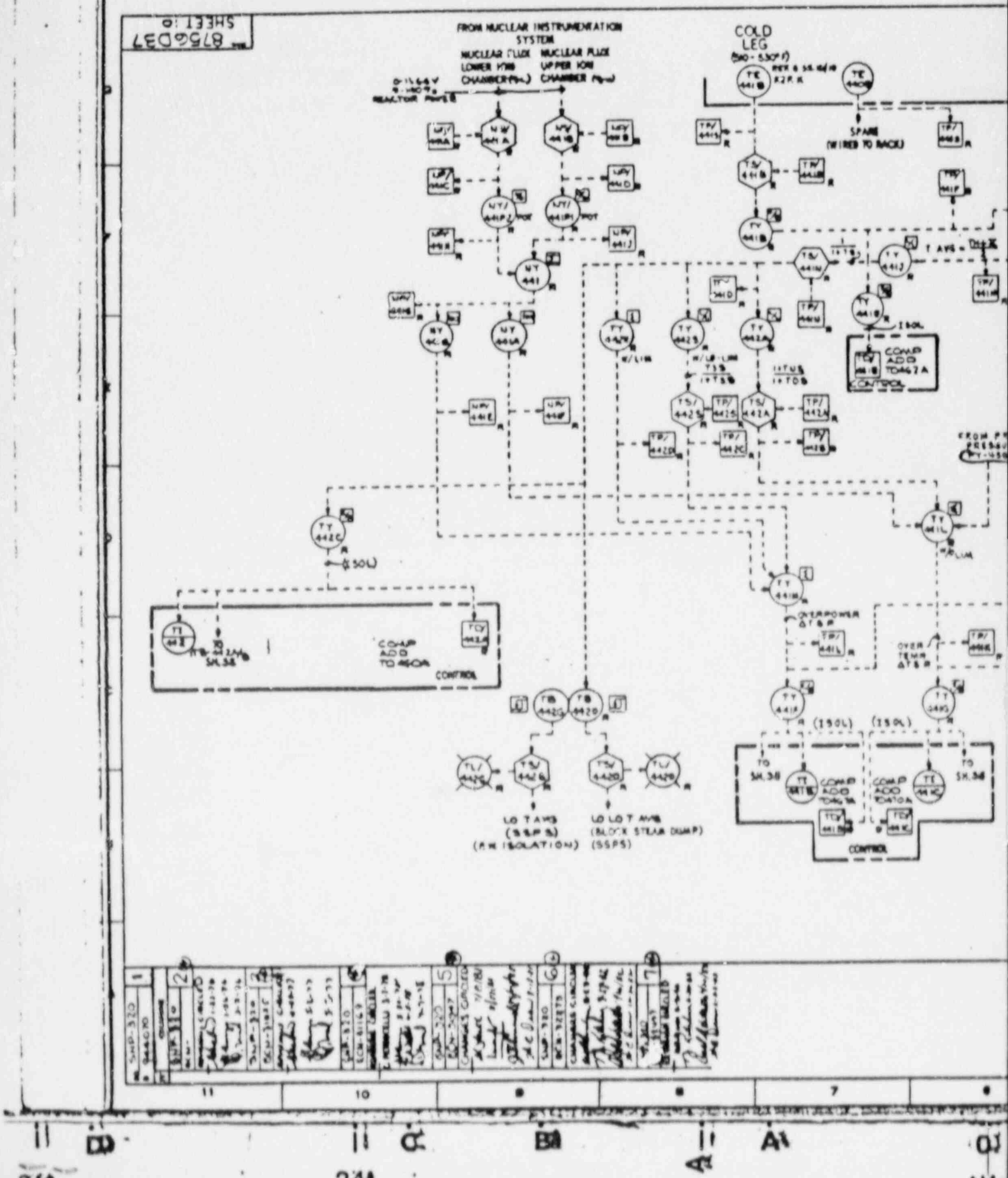
CHEMICAL & VOLUME CONTROL, BLOCK DIAG.

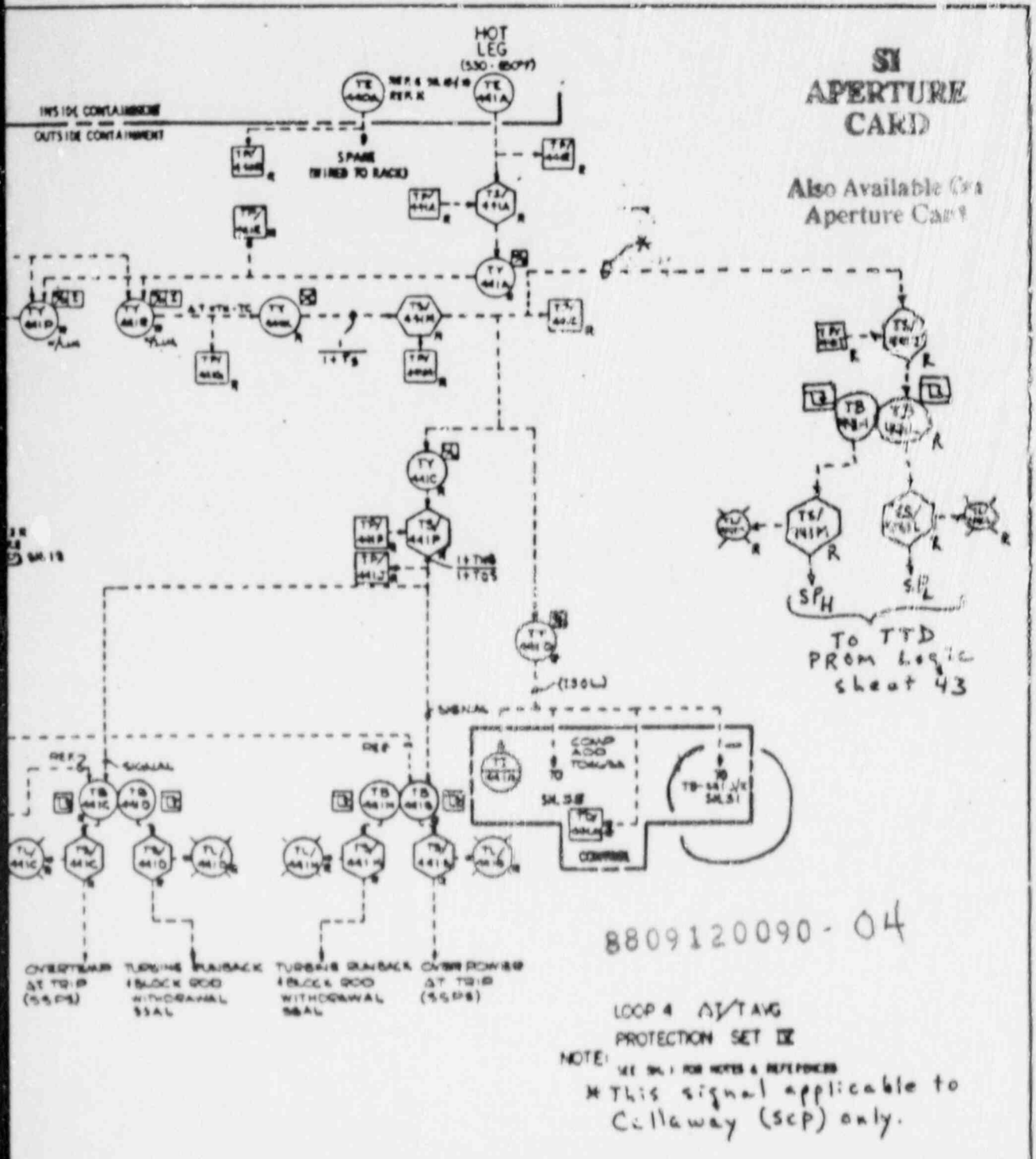
8756037

SHEET 9

24

3A

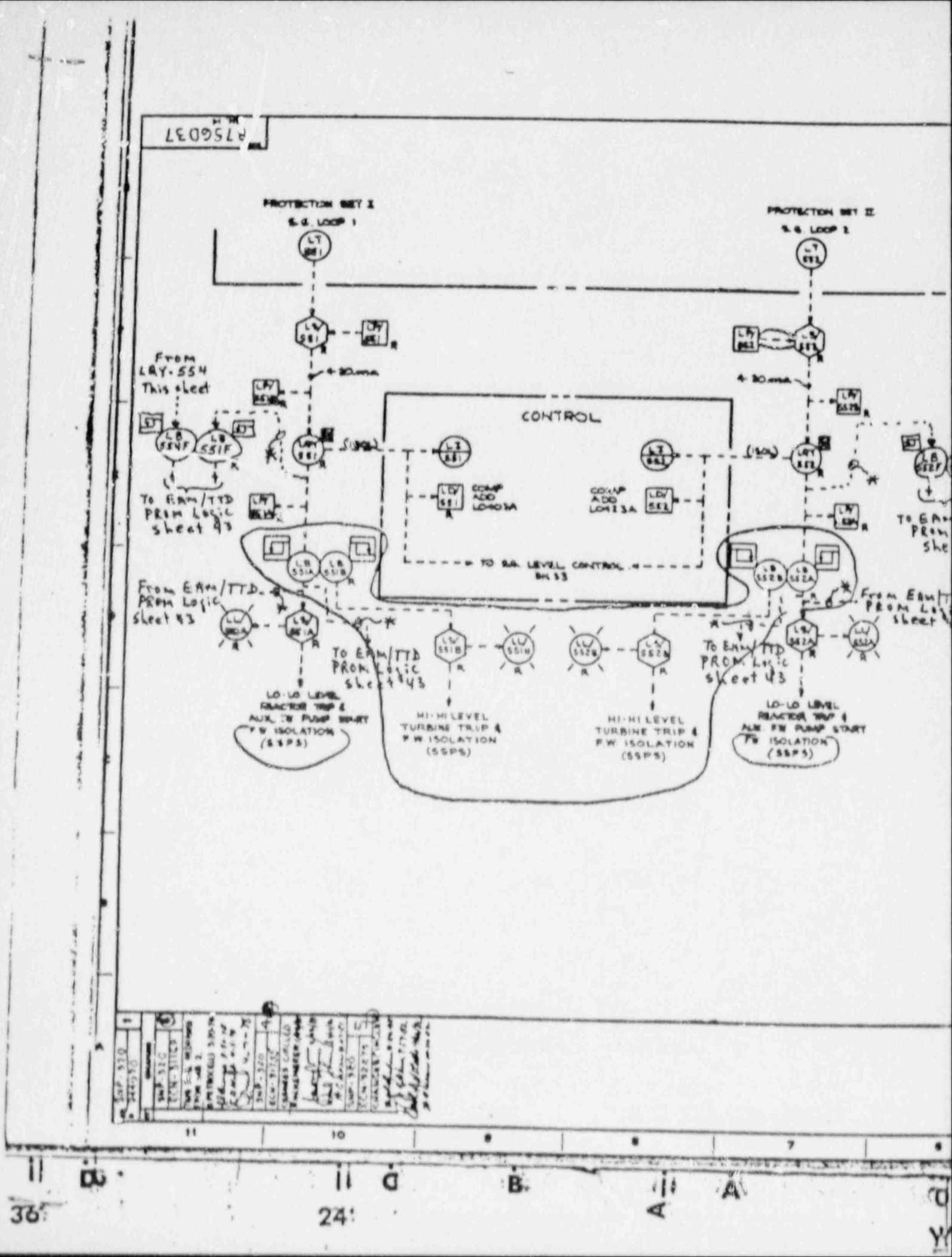

SHEET 10
FROM NUCLEAR INSTRUMENTATION SYSTEM
NUCLEAR FLUX LOWER (CHAMBER)
NUCLEAR FLUX UPPER (CHAMBER)
REACTOR VESSEL
COLD LEG
SPARE (WIRED TO RACK)
T AVG
COMP ADD TO 462A
CONTROL
COMP ADD TO 460A
OVERPOWER ΔT & P
OVER TEMP ΔT & P
LO T AVG (SSPS) (RX ISOLATION)
LO LO T AVG (BLOCK STEAM DUMP) (SSPS)
11
10
7

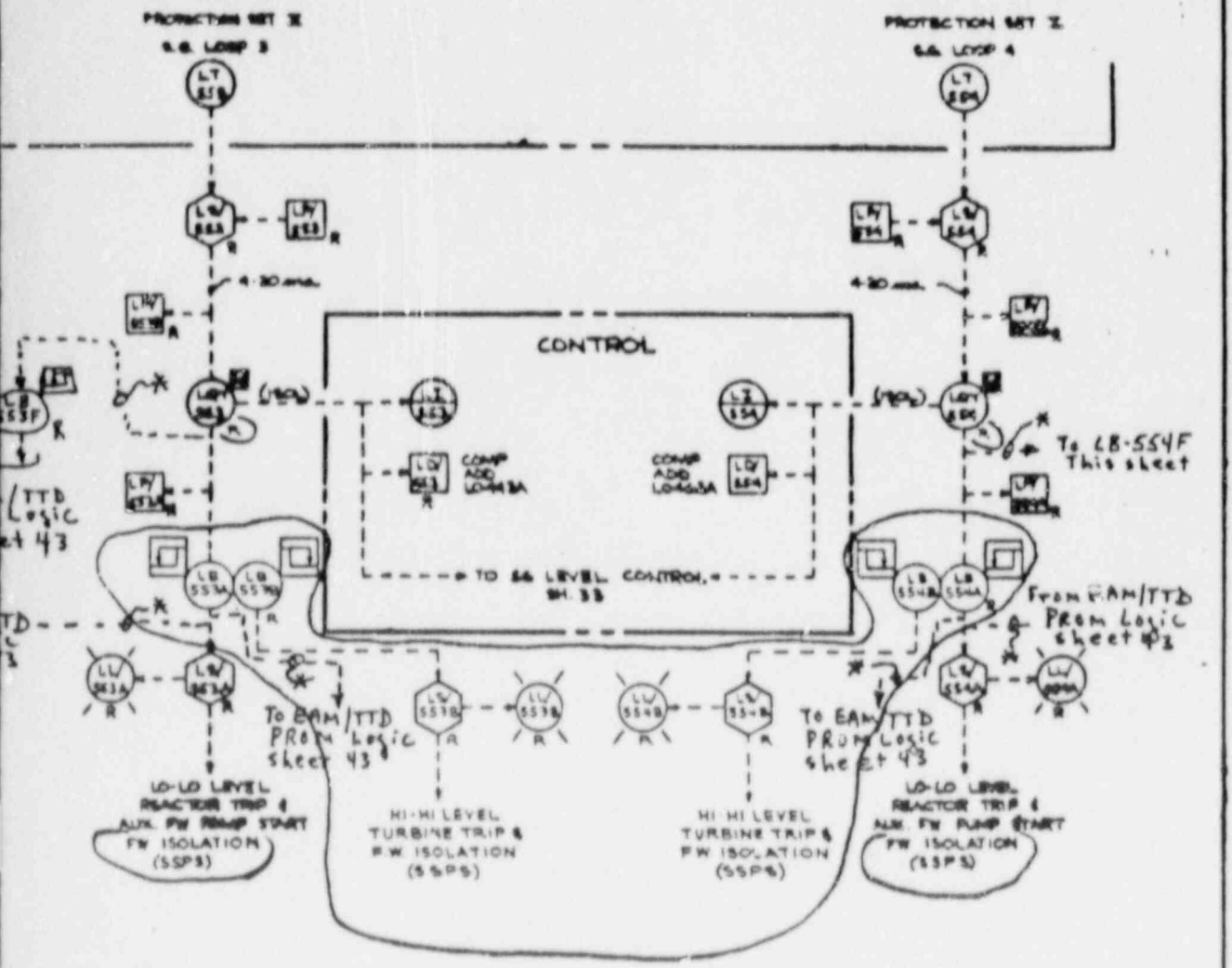


8809120090-04

Westinghouse Electric Corporation

8756037 SHEET 16


PROTECTION SET I
S.G. LOOP 1
PROTECTION SET II
S.G. LOOP 2
From LRY-554 This sheet
CONTROL
4-20 ma
To EAM/TTD PROM Logic sheet 43
From EAM/TTD PROM Logic sheet 43
TO EAM/TTD PROM Logic sheet 43
TO R.V. LEVEL CONTROL SH 33
LO-LO LEVEL REACTOR TRIP & AUX. FW PUMP START FW ISOLATION (SSPS)
HI-HI LEVEL TURBINE TRIP & FW ISOLATION (SSPS)
HI-HI LEVEL TURBINE TRIP & FW ISOLATION (SSPS)
LO-LO LEVEL REACTOR TRIP & AUX. FW PUMP START FW ISOLATION (SSPS)

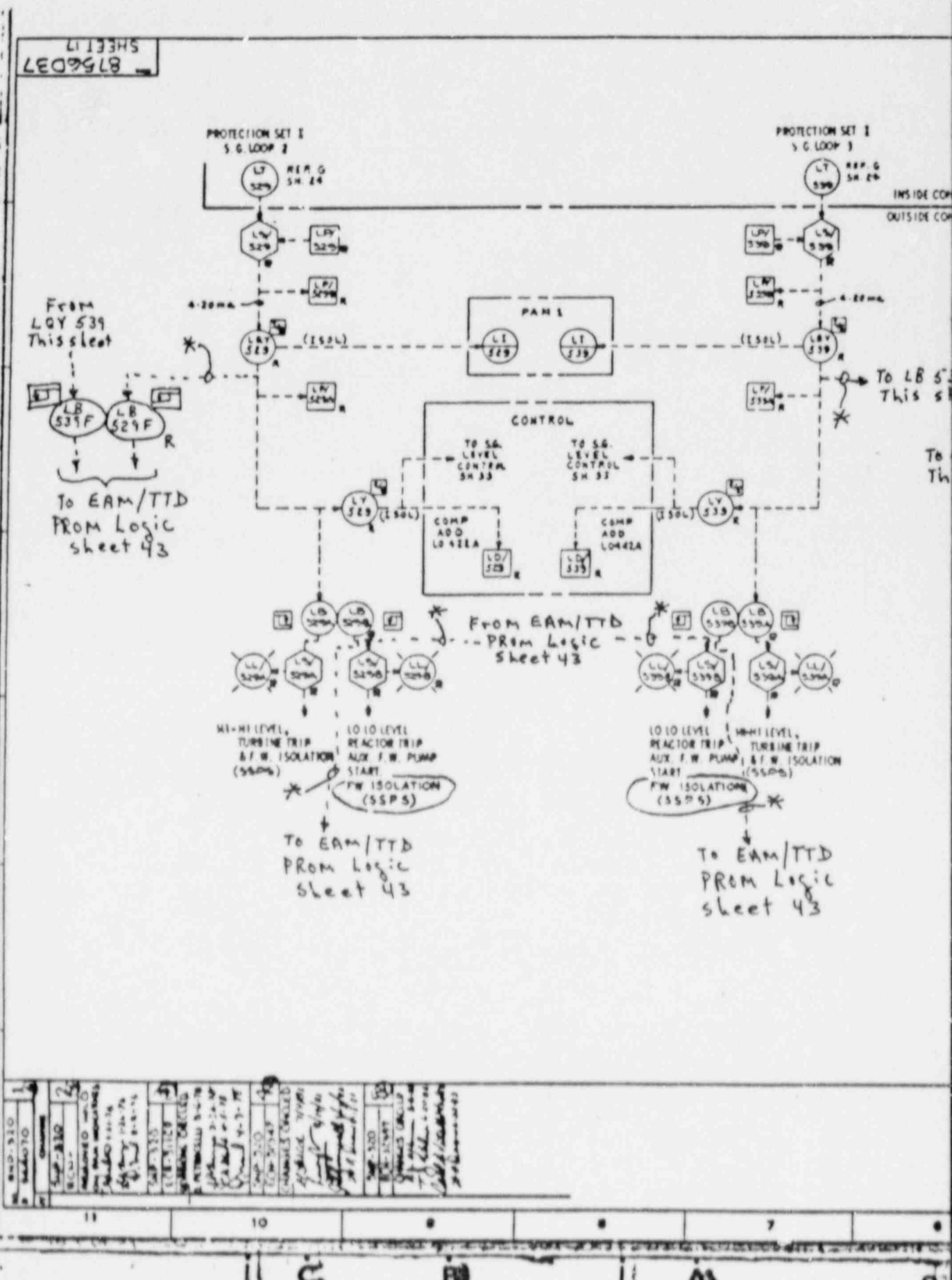


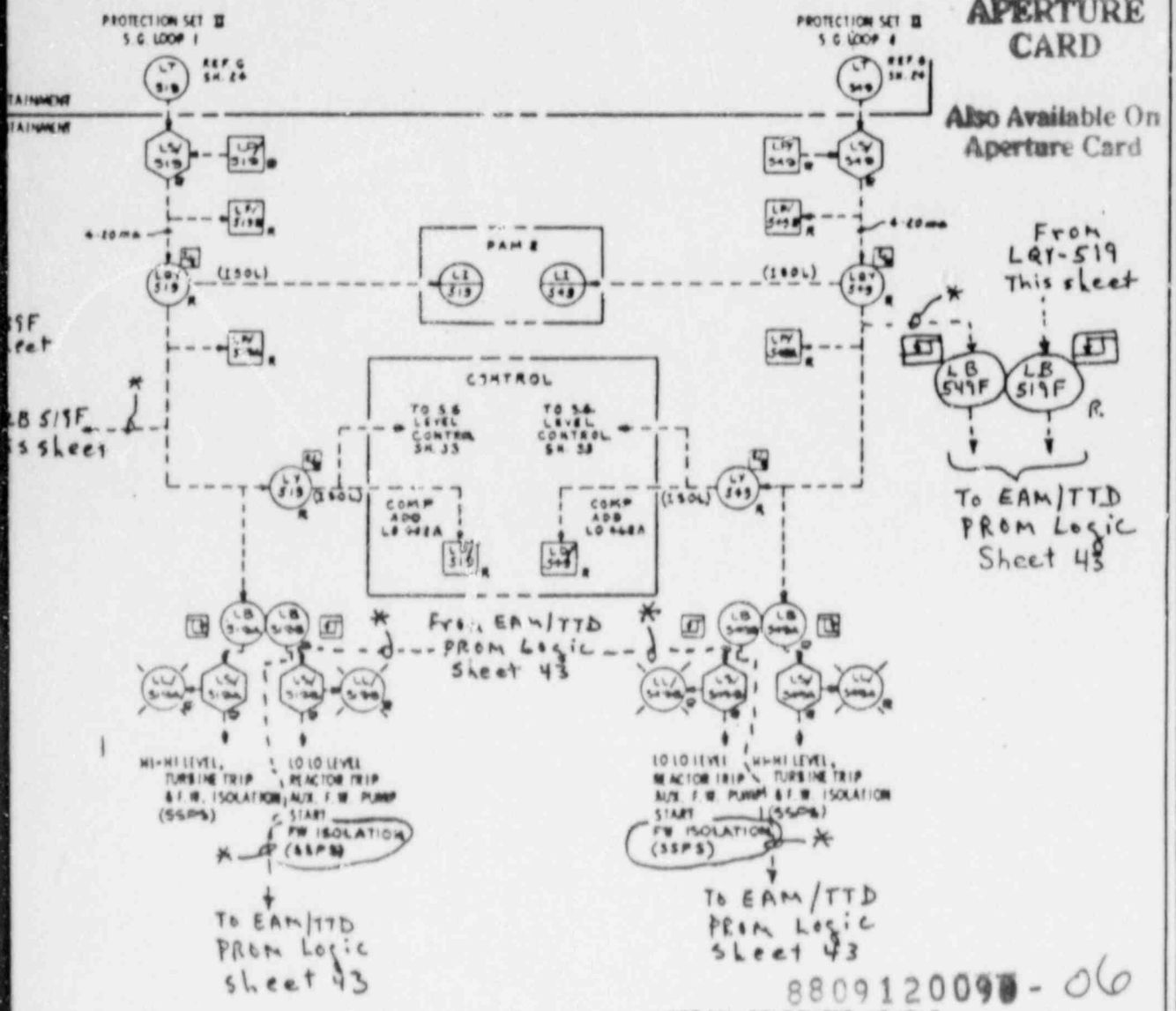
STEAM GENERATOR LEVELS
PROTECTION SETS I & II

* This signal applies to Callaway (SCP) only.

SNUPPS

8756037


LI 133HS
8705037
PROTECTION SET I
S.G. LOOP 2
PROTECTION SET I
S.G. LOOP 3
INSIDE CON
OUTSIDE CON
From LOY 539 This sheet
4-20 mA
PAM I
CONTROL
TO S.G. LEVEL CONTRL SH 33
TO S.G. LEVEL CONTROL SH 33
COMP ADD LO 42EA
COMP ADD LO 42LA
To LB 5
This s
To
Th
To EAM/TTD PROM Logic sheet 43
From EAM/TTD PROM Logic sheet 43
HI-HI LEVEL, TURBINE TRIP & F.W. ISOLATION (SSPS)
LO LO LEVEL REACTOR TRIP AUX. F.W. PUMP START F.W. ISOLATION (SSPS)
LO LO LEVEL REACTOR TRIP AUX. F.W. PUMP START F.W. ISOLATION (SSPS)
HI-HI LEVEL, TURBINE TRIP & F.W. ISOLATION (SSPS)
To EAM/TTD PROM Logic sheet 43
To EAM/TTD PROM Logic sheet 43



8809120098 - 06

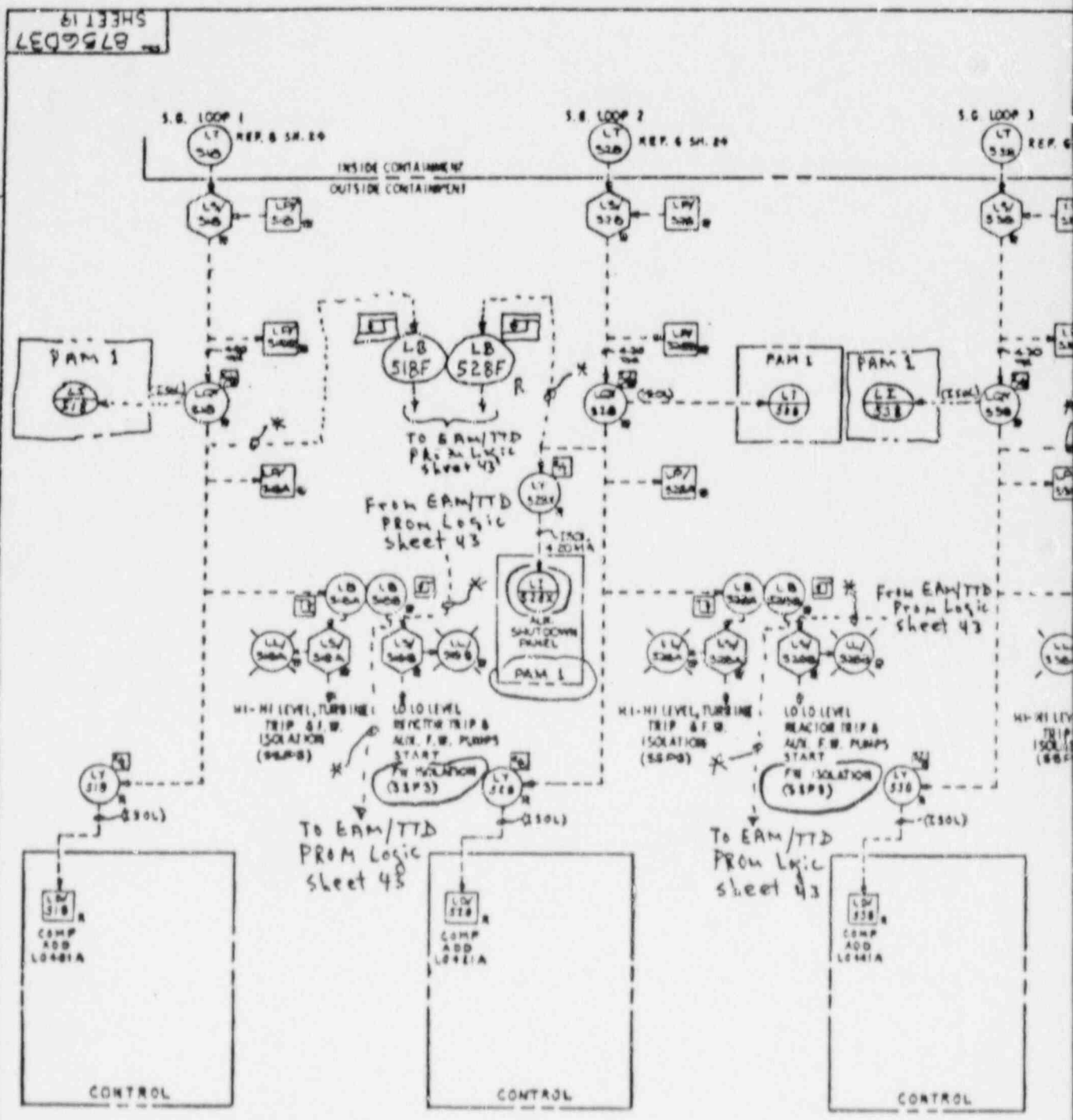
STEAM GENERATOR LEVELS
PROTECTION SETS I, II

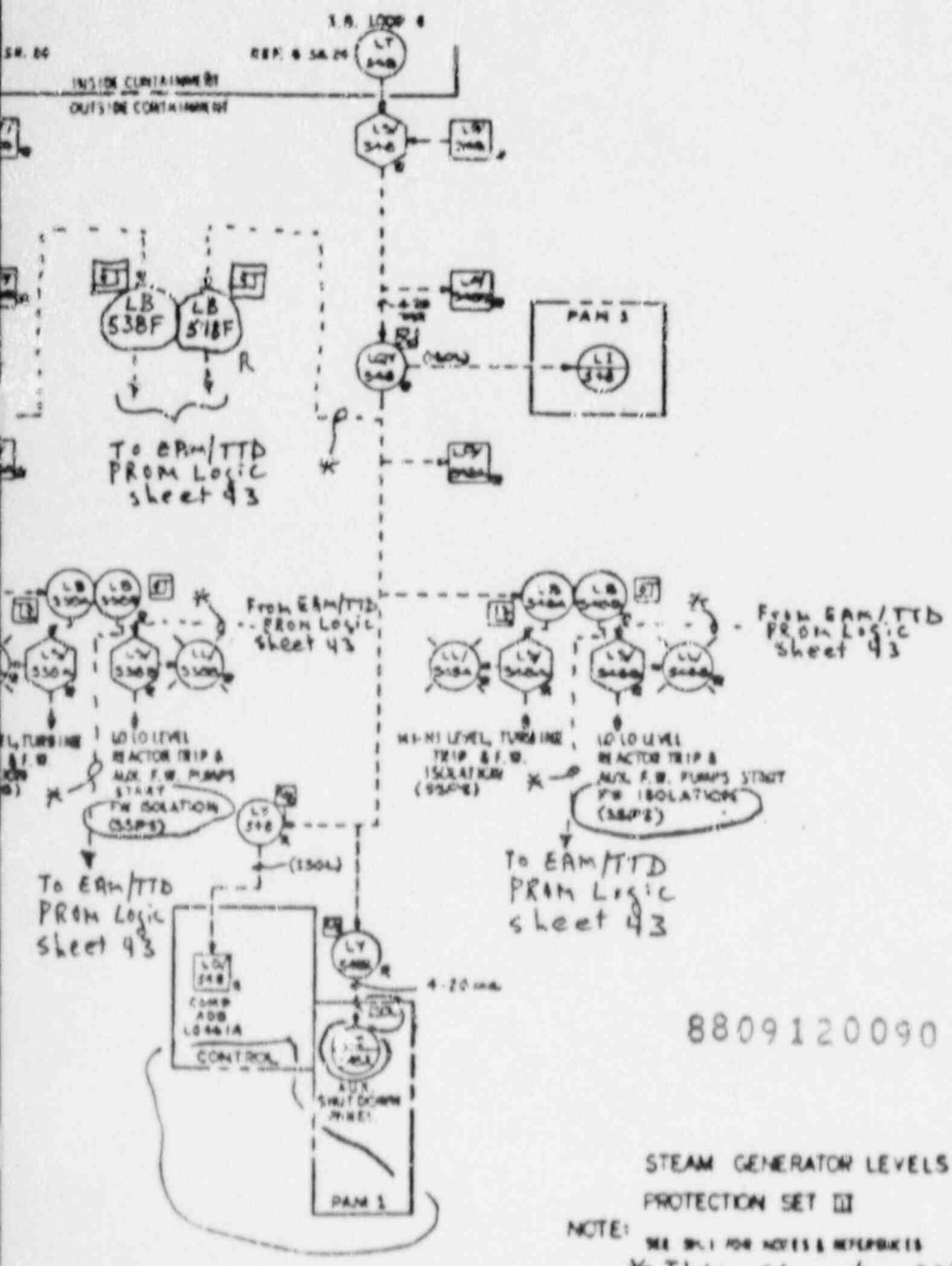
NOTE: SEE SH.1 FOR NOTES & REFERENCES

* This signal applies to Calloway (scp) only.

Westinghouse Electric Corporation
SNUPPS
8756037
SHEET 17

A B C D


S.G. LOOP 1
S.G. LOOP 2
S.G. LOOP 3
INSIDE CONTAINMENT
OUTSIDE CONTAINMENT
PAM 1
LB 518F
LB 528F
TO EAM/TTD PROM Logic sheet 43
From EAM/TTD PROM Logic sheet 43
ALT SHUTDOWN PANEL
PAM 1
HI-HI LEVEL, TURBINE TRIP & F.W. ISOLATION
LO LO LEVEL INJECTION TRIP & AUX. F.W. PUMPS START
F.W. ISOLATION
LO LO LEVEL REACTOR TRIP & AUX. F.W. PUMPS START
To EAM/TTD PROM Logic sheet 43
COMP ADD LOGIC A
CONTROL



8809120090 - 07

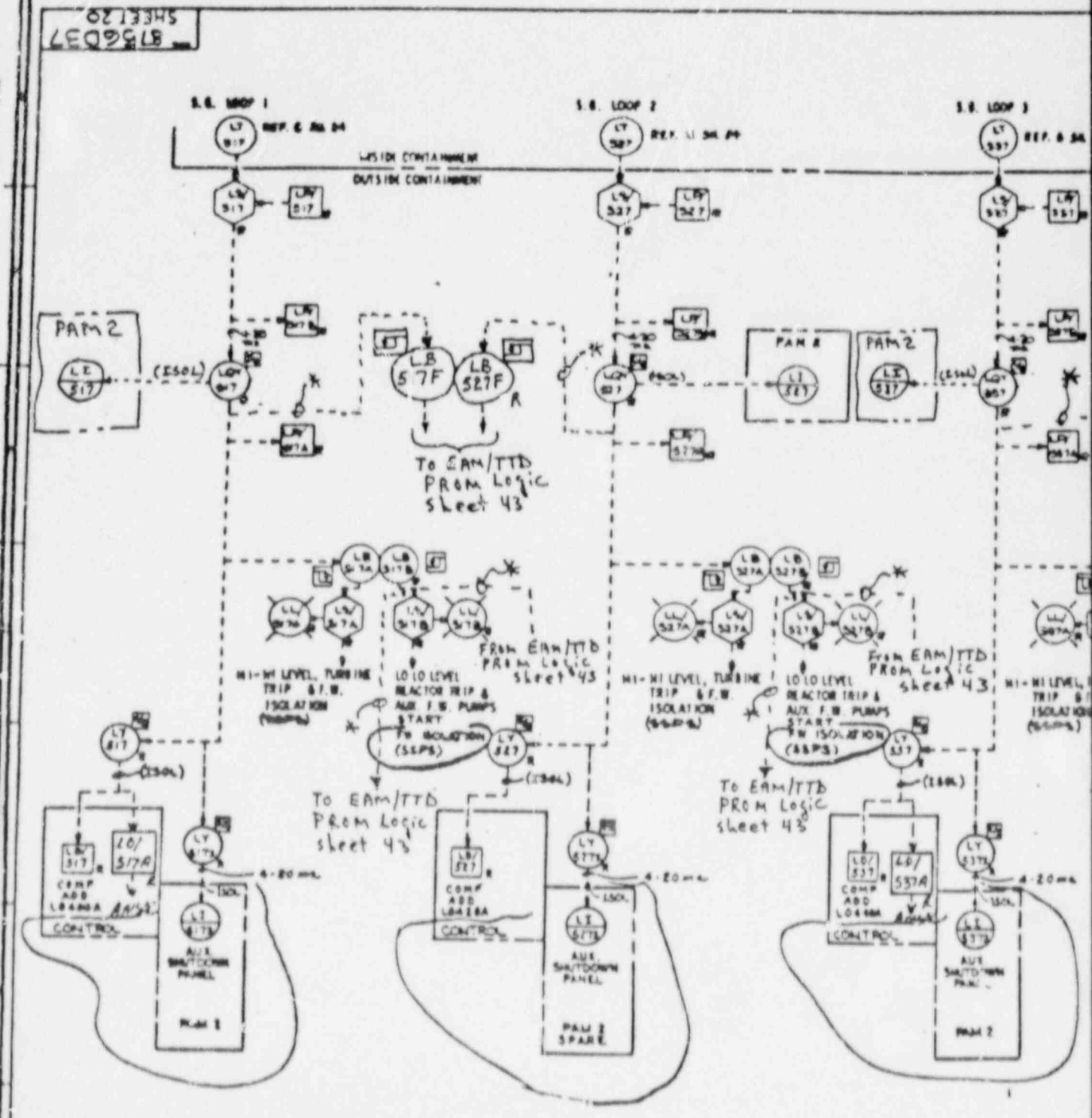
STEAM GENERATOR LEVELS
PROTECTION SET III

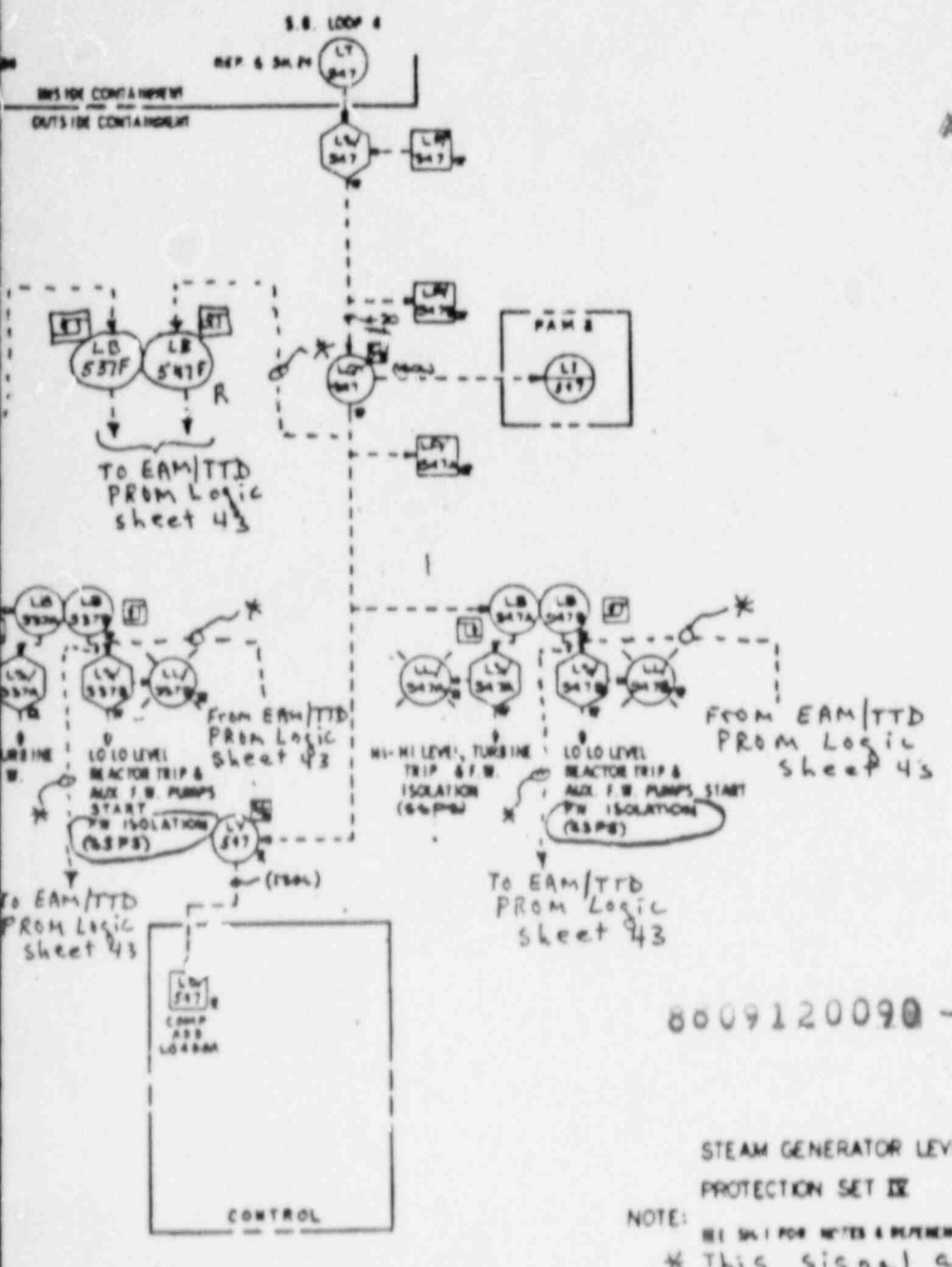
NOTE: SEE SH.1 FOR NOTES & REFERENCES

* This signal applies to Callaway (scp) only.

Westinghouse Electric Corporation
SNUPPS
8756037
SHEET 19

A B C D


S.G. LOOP 1
S.G. LOOP 2
S.G. LOOP 3
INSIDE CONTAINMENT
OUTSIDE CONTAINMENT
PAM 2
PAM 2
PAM 2
PAM 2 SPARE
(ESOL)
LB 517F
LB 527F R
To EAM/TTD PROM Logic sheet 43
From EAM/TTD PROM Logic sheet 43
From EAM/TTD PROM Logic sheet 43
To EAM/TTD PROM Logic sheet 43
To EAM/TTD PROM Logic sheet 43
HI-HI LEVEL, TURBINE TRIP & F.W. ISOLATION
LO LO LEVEL REACTOR TRIP & AUX. F.W. PUMPS START
F.W. ISOLATION (SSPS)
COMP ADD LO4-88A
CONTROL
AUX. SHUTDOWN PANEL
4-20 ma

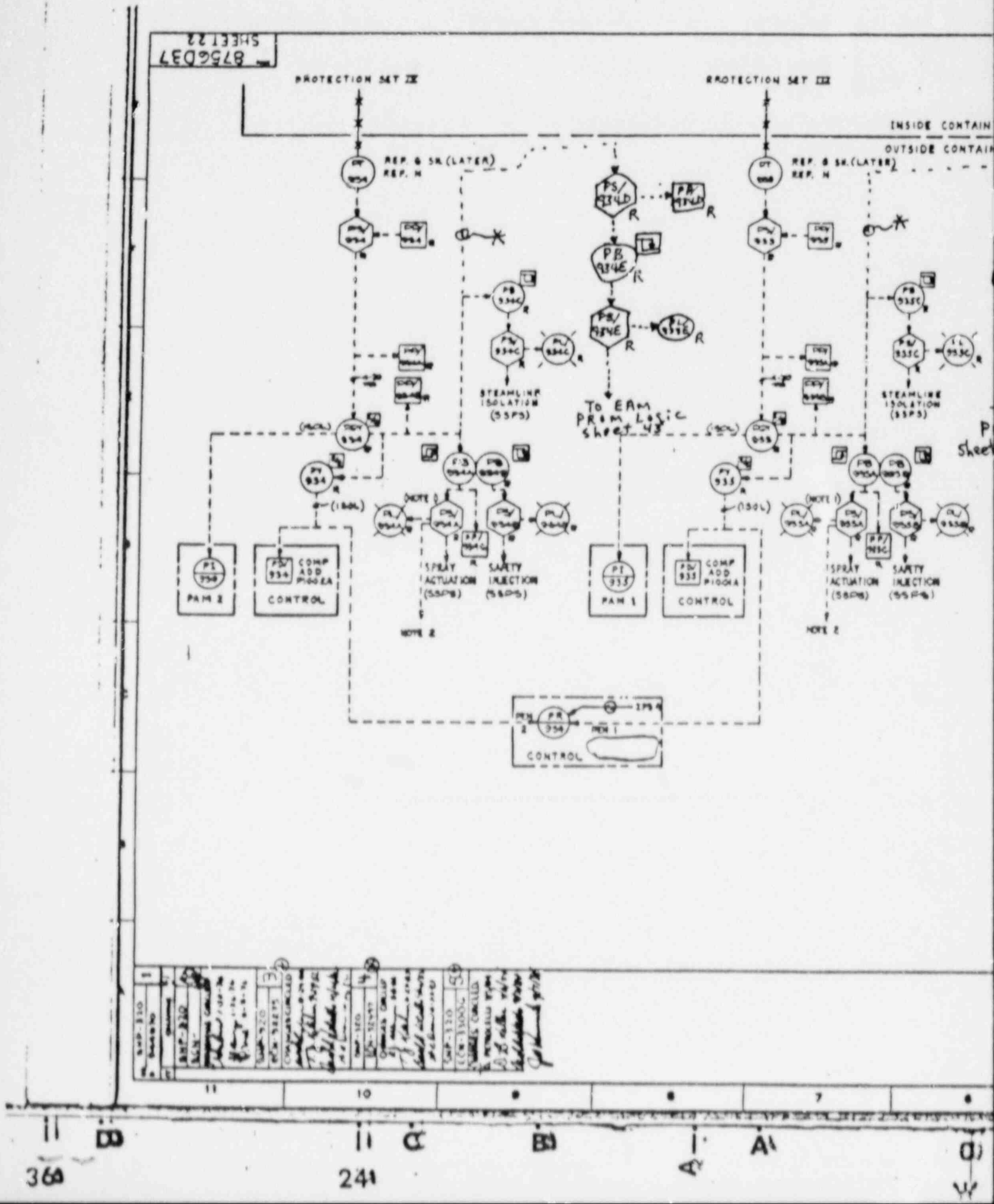


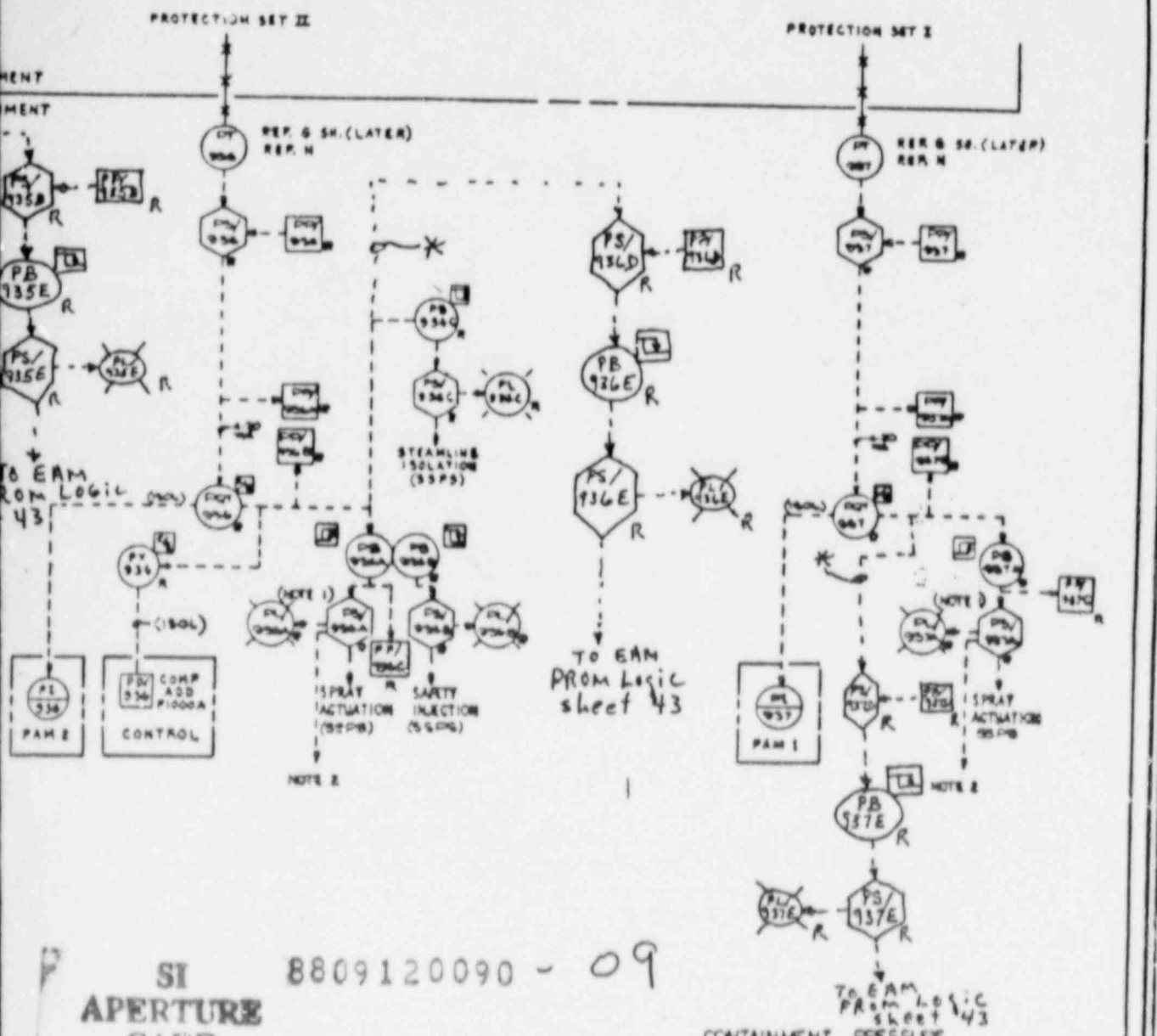
8009120090 - 08

STEAM GENERATOR LEVELS
PROTECTION SET IV

NOTE: SEE SH 1 FOR NOTES & REFERENCES
* This signal applies to Callaway (scp) only.

Westinghouse Electric Corporation
SNUPPS
8756D37
SHEET 20


8756037
SHEET 22
PROTECTION SET IX
PROTECTION SET III
INSIDE CONTAIN
OUTSIDE CONTAIN
REF. & SH. (LATER)
REF. N
REF. & SH. (LATER)
REF. N
PS/ 933LD
PB/ 933E
PB/ 933E
R
STEAMLINE ISOLATION (SSPS)
To EAM PRAM Logic sheet 43
STEAMLINE ISOLATION (SSPS)
PT 934
PT 935
(NOTE 1)
PAM 2
COMP ADD PIGGEA
CONTROL
SPRAY ACTUATION (SSPS)
SAFETY INJECTION (SSPS)
NOTE 2
PAM 1
COMP ADD PIGGEA
CONTROL
SPRAY ACTUATION (SSPS)
SAFETY INJECTION (SSPS)
NOTE 2
PR 934
CONTROL
11
10
9
8
7
6
D
C
B
A
36
24



NOTES:

1. SEE SH. 1 FOR NOTES & REFERENCES.
2. 8 STABLE SWITCHES (PB936A, PB936B, PB936C & PB936D) BLOCK SPRAY INITIATION WHEN IN THE TEST POSITION.
3. CONTACT CLOSES WHEN SPRAY 8 STABLE TEST SWITCH IS IN TEST POSITION. STATUS LIGHT IS PROVIDED FOR EACH 8 STABLE.
   a) ALARM ON MAIN ANNUNCIATOR WHEN 3/4 SPRAY 8 STABLE TEST SWITCHES ARE IN TEST POSITION.

* This signal applicable to Callaway (SCP) only.

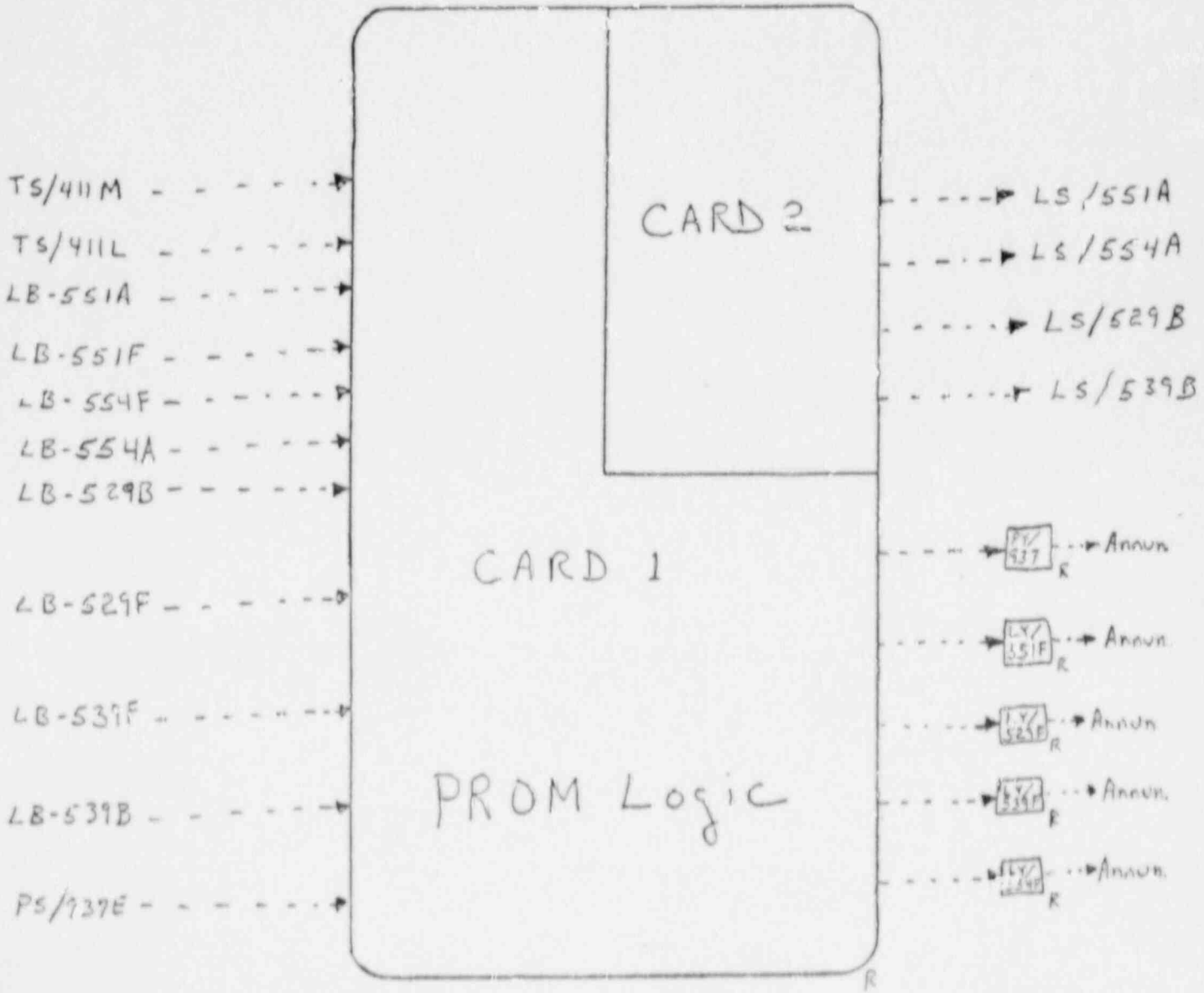
Westinghouse Electric Corporation

SHUPPS

ENGINEERED CONTROL BLOCK DIAG.

8756D37 SHEET 22

Protection I
Typical of II, III & IV



PROT. I	PROT II	PROT III	PROT. IV
TS/411M	TS/421M	TS/431M	TS/441M
TS/411L	TS/421L	TS/431L	TS/441L
LB-551A	LB-519B	LB-518B	LB-517B
LB-551F	LB-519F	LB-518F	LB-517F
LB-554F	LB-549F	LB-548F	LB-547F
LB-554A	LB-549B	LB-548B	LB-547B
LB-529B	LB-552A	LB-528B	LB-527B
LB-529F	LB-552F	LB-528F	LB-527F
LB-539F	LB-553F	LB-538F	LB-537F
LB-539B	LB-553A	LB-538B	LB-537B
PS/937E	PS/936E	PS/935E	PS/934E
PY/937	PY/936	PY/935	PY/934
LS/551A	LS/519B	LS/518B	LS/517B
LS/554A	LS/549B	LS/548B	LS/547B
LS/529B	LS/552A	LS/528B	LS/527B
LS/539B	LS/553A	LS/538B	LS/537B
LY/551F	LY/519F	LY/518F	LY/517F
LY/529F	LY/552F	LY/528F	LY/527F
LY/539F	LY/553F	LY/538F	LY/537F
LY/554F	LY/549F	LY/548F	LY/547F

8809120090-10

EAM/TTB PROM Interface

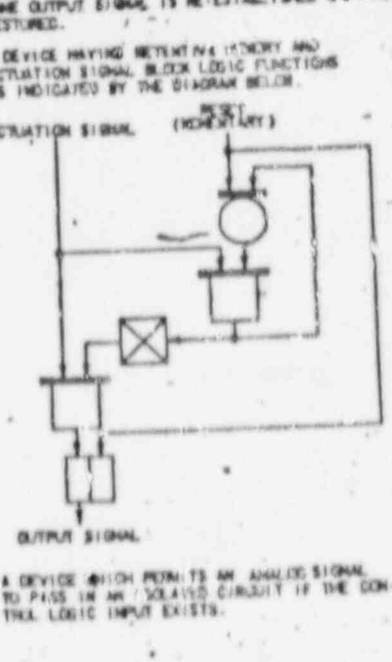
Note: This sheet applicable to Callaway (SCP) only.

7250D64
SHEET - 1

LOGIC SYMBOLS

SYMBOL	LOGIC FUNCTION	DESCRIPTION
	OR	A DEVICE WHICH PRODUCES AN OUTPUT WHEN ANY ONE INPUT (OR MORE) EXISTS.
	NOT	A DEVICE WHICH PRODUCES AN OUTPUT ONLY WHEN THE INPUT DOES NOT EXIST.
	AND	A DEVICE WHICH PRODUCES AN OUTPUT ONLY WHEN EVERY INPUT EXISTS
2/3	COINCIDENCE (2 OUT OF 3 SHOWN)	A DEVICE WHICH PRODUCES AN OUTPUT WHEN THE PRESCRIBED NUMBER (OR MORE) OF INPUTS EXIST (EXAMPLE 2 INPUTS MUST EXIST FOR AN OUTPUT).
	ADJUSTABLE TIME DELAY	A DEVICE WHICH PRODUCES AN OUTPUT FOLLOWING A DEFINITE INTENTIONAL TIME DELAY AFTER RECEIVING AN INPUT.
	OFF RETURN MEMORY	A DEVICE WHICH RETAINS THE CONDITION OF OUTPUT CORRESPONDING TO THE LAST ENERGIZED INPUT, EXCEPT UPON INTERRUPTION OF POWER IT RETURNS TO THE OFF CONDITION.
	RETENTIVE MEMORY	A DEVICE WHICH RETAINS THE CONDITION OF OUTPUT CORRESPONDING TO THE LAST ENERGIZED INPUT (REGARDLESS OF POWER INTERRUPTION). UPON INTERRUPTION OF POWER, CONDITION STATUS IS MAINTAINED (NO RESET OCCURS) AND THE SAME OUTPUT SIGNAL IS RE-ESTABLISHED WHEN POWER IS RESTORED.
L R	RETENTIVE MEMORY WITH ACTUATION BLOCK	A DEVICE HAVING RETENTIVE MEMORY AND ACTUATION SIGNAL BLOCK LOGIC FUNCTIONS AS INDICATED BY THE DIAGRAM BELOW.

ACTUATION SIGNAL
RESET (MOMENTARY)



OUTPUT SIGNAL

SYMBOL	LOGIC FUNCTION	DESCRIPTION
ANALOG INPUT; CONTROL LOGIC INPUT; ANALOG OUTPUT	ANALOG GATE	A DEVICE WHICH PERMITS AN ANALOG SIGNAL TO PASS IN AN ISOLATED CIRCUIT IF THE CONTROL LOGIC INPUT EXISTS.

ADDITIONAL SYMBOLS

PS 143A ← INSTRUMENT CHANNEL BISTABLE
← OUTPUT INDICATOR

BISTABLE OUTPUT IS A LOGIC "1" WHEN THE ... PARAMETER IS GREATER THAN THE SETPOINT V...

BISTABLE OUTPUT IS A LOGIC "1" WHEN THE ... PARAMETER IS LESS THAN THE SETPOINT VALU...

BISTABLE OUTPUT IS A LOGIC "1" WHEN THE ... DEVIATES FROM THE NORMAL VALUE BY MORE ...

OR OR — SAME AS ABOVE EXCEPT WITH ... ADJUSTED SETPOINT

OR OR — SAME AS ABOVE EXCEPT WITH ...

27 ← NON-INSTRUMENT BISTABLE
← OUTPUT INDICATOR (SAME AS EXPLAINED ABOVE)

A 2 ← ALARM ANNUNCIATOR (ALARMS ON THE SAME SHEET W... SUBSCRIPT SHARE A COMMON ANNUNCIATOR WINDOW)

R ← REACTOR TRIP "FIRST OUT" ANNUNCIATOR

T ← TURBINE TRIP "FIRST OUT" ANNUNCIATOR

T ← INDICATOR LAMP
A - ACTUATION STATUS LIGHTS, T - TRIP STATU...
P - PERMISSIVE STATUS LIGHTS, B - BYPASS STA...

C ← COMPUTER INPUT

LOGIC INFORMATION TRANSMISSION
ANALOG INFORMATION TRANSMISSION

I ← ANALOG DISPLAY
I - ANALOG INDICATOR, R - RECORDER, RS - RE...
R3-RECORDER 3 PEN, R8 - RECORDER 8 POINT

Σ ← ANALOG SUMMER

GENERAL NOTES: (FOR ALL SHEETS)

1. IN ALL LOGIC CIRCUITS, THE INDICATED ACTUATION OF A SY... EXCEPT WHERE INDICATED OTHERWISE. ALL BISTABLES ARE ... DEFINED TO BE PRESENT WHEN THE BISTABLE OUTPUT VOLTAGE...
2. EXCEPT WHERE INDICATED OTHERWISE, THE FOLLOWING IS TR... HAS A DUPLICATE LOCATED IN A SEPARATE CABINET. ALL ... LAMPS ARE NOT REDUNDANT. MANUAL CONTROLS DO NOT HAVE... WHERE LOGIC IS REDUNDANT. ALL INDICATOR LAMPS ... BOTH TRAINS (WHERE LOGIC IS REDUNDANT) SO THAT ...
3. WHENEVER A PROCESS SIGNAL IS USED FOR CONTROL ... MUST BE PROVIDED.
4. THIS SET OF DRAWINGS ILLUSTRATES THE FUNCTIONA... SYSTEM, INCLUDING ENGINEERED SAFEGUARDS. THESE DRAW... HARDWARE IMPLEMENTATION, REFER TO THE FOLLOWING LIST...
FUNCTIONAL DIAGRAM
REACTOR PROTECTION SYSTEM
(SHEETS 1 TO 8 AND 16 TO 18)
REACTOR CONTROL SYSTEM
(SHEETS 9 TO 14 AND 17 TO 18)

5. FOR THIS SET OF DRAWINGS ALL SWITCHES, PUSHBUTTONS, ... SYSTEMS INDICATORS, CONTROLLERS, AND MANUAL-AUTO ST... SUPPLIED BY OTHERS. IN ADDITION TO THE ABOVE, SCOP... SET.

1	2	3	4	5	6	7	8
SNP-300	SNP-300 ECN-30255	SNP-300 ECN-31218	SNP-300 ECN-32035	SNP-300 ECN-32709	SNP-300 ECN-33930	SNP-300 ECN-35645	SNP-300 ECN-36259

EASURED
LUE.

EASURED
.

EASURED PARAMETER
HAN THE SETPOINT AMOUNT.

N AUTOMATICALLY

EQUIRED HYSTERESIS

TH THE SAME

LIGHTS
TUS LIGHTS

CORDER 2 PEN

STEM OR DEVICE OCCURS WHEN A LOGIC "1" SIGNAL IS PRESENT.
E-ENERGIZE TO ACTUATE" SUCH THAT A LOGIC 1 SIGNAL IS
IS OFF.
E: ALL LOGIC CIRCUITS ARE REDUNDANT THAT IS EVERY LOGIC CIRCUIT SHOWN
STABLES, CIRCUIT BREAKERS, ANNUNCIATORS, COMPUTER INPUTS, AND INDICATOR
REDUNDANT ACTUATORS, BUT DO HAVE REDUNDANT CONTACTS
ANNUNCIATORS, AND COMPUTER INPUTS ARE CONNECTED TO
A SIGNAL IN EITHER TRAIN WILL ACTUATE.
ND IS DERIVED FROM A PROTECTION CHANNEL, ISOLATION

REQUIREMENTS OF THE REACTOR CONTROL AND PROTECTION
NGS DO NOT REPRESENT ACTUAL HARDWARE IMPLEMENTATION. FOR

OCK OR WIRING DIAGRAM
ARING NUMBERS: 7255049, 7655210, 5655051, 8756037, 4189E15,
271C335, 1243550, 1084H37

ARING NUMBERS: 5655052, 271C330, 8756037

ANNUNCIATORS, AND INDICATORS (EXCEPT FOR THE Ⓦ N.E.S. PROCESS
TIONS) WHICH ARE MOUNTED ON THE MAIN CONTROL BOARD ARE
BY OTHERS IS ALSO INDICATED DIRECTLY ON SHEETS WITHIN THIS

DEVICE FUNCTION LETTERS AND NUMBERS

FB FLOW CHANNEL
LB LEVEL CHANNEL
NC NUCLEAR CHANNEL
PB PRESSURE CHANNEL
RC RADIATION CHANNEL
SB SPEED CHANNEL
TB TEMPERATURE CHANNEL
ZB POSITION CHANNEL
20 ELECTRIC OPERATED VALVE
27 UNDERVOLTAGE RELAY
33 POSITION SWITCH

52 AC CIRCUIT BREAKER

63 PRESSURE SWITCH
71 LEVEL SWITCH
80 FLOW SWITCH
81 UNDERFREQUENCY REL.

8809120090 - 11

INDEX

TITLE	SH. NO.	SUBS 1	2	3	4	5	6	7	8		
INDEX AND SYMBOLS	1	1	2	3	4	5	6	7	8		
REACTOR TRIP SIGNALS	2	1	2	3	3	3	4	4	5		
NUCLEAR INSTR. AND MANUAL TRIP SIGNALS	3	1	1	1	1	2	2	2	[illegible]		
NUCLEAR INSTR. PERMISSIVES AND BLOCKS	4	1	1	2	2	3	3	4	4		
PRIMARY COOLANT SYSTEM TRIP SIGNALS	5	1	2	3	3	3	3	3	3		
PRESSURIZER TRIP SIGNALS	6	1	1	2	3	3	3	3	3		
STEAM GENERATOR TRIP SIGNALS	7	1	1	2	2	3	3	4	5		
SAFEGUARDS ACTUATION SIGNALS	8	1	2	3	3	3	3	3	5		
ROD CONTROLS & ROD BLOCKS	9	1	2	3	3	3	4	5	5		
STEAM DUMP CONTROL	10	1	2	3	3	3	3	3	5		
PRESSURIZER PRESSURE & LEVEL CONTROL	11	1	2	3	4	4	4	5	5		
PRESSURIZER HEATER CONTROL	12	1	2	2	2	2	2	2	2		
FEEDWATER CONTROL & ISOLATION	13	1	2	3	3	4	4	5	5		
FEEDWATER CONTROL & ISOLATION	14	1	2	3	3	3	3	4	4		
AUXILIARY FEEDWATER PUMPS STARTUP	15	1	2	3	3	4	4	4	5		
TURBINE TRIPS, RUNBACKS & OTHER SIGNALS	16	1	2	3	3	3	3	4	4		
PRESSURIZER PRESSURE RELIEF SYS (TRAIN A)	17	-	-	-	1	1	1	2	2		
PRESSURIZER PRESSURE RELIEF SYS (TRAIN B)	18	-	-	-	1	1	1	2	2		
EAM/TTD (CALLAWAY ONLY)	19	-	-	-	-	-	-	-	1		

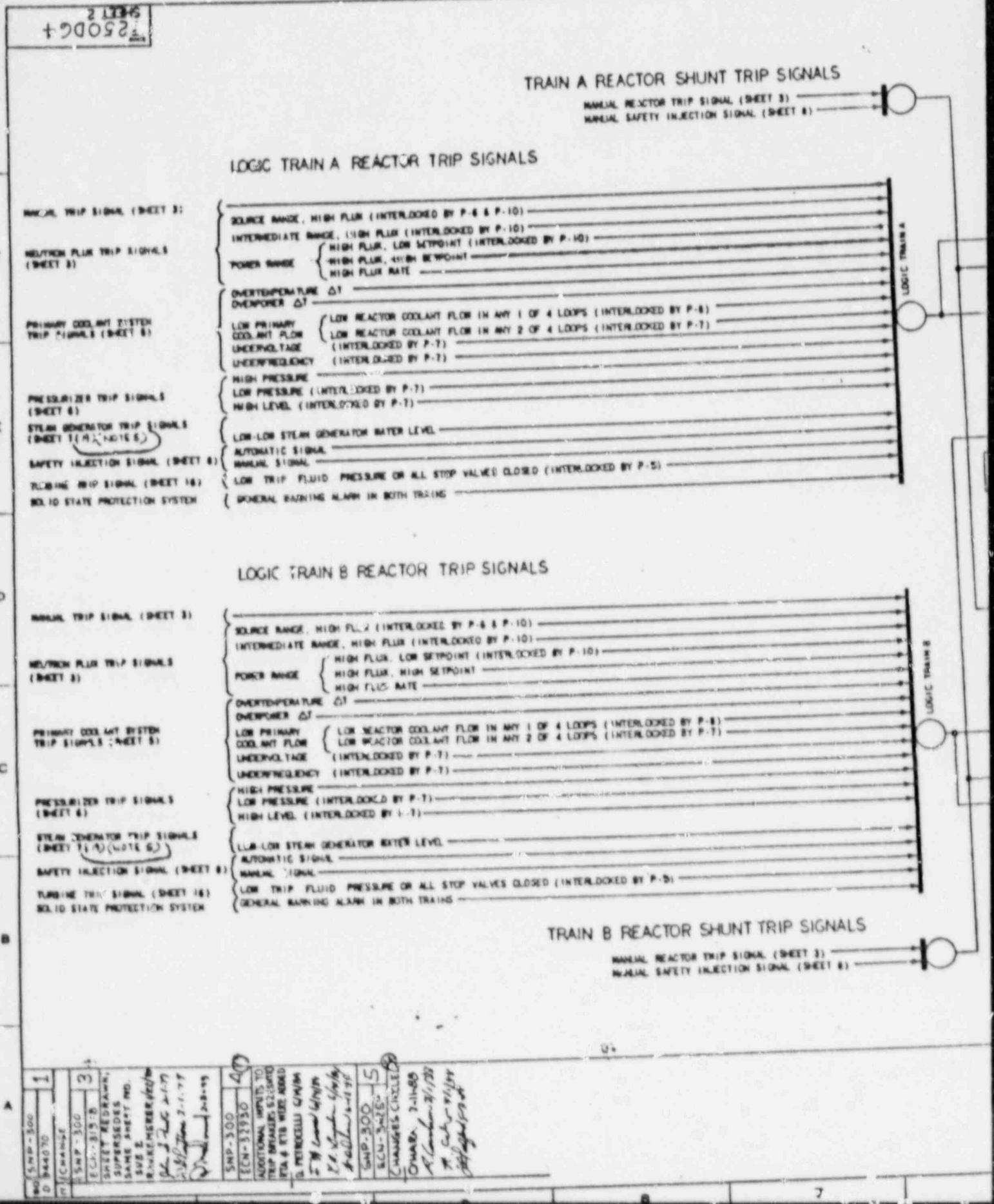
Westinghouse Electric Corporation
NUCLEAR ENERGY SYSTEMS, PITTSBURGH, PA., U.S.A.

TITLE: SNUPPS PROJECTS
FUNCTIONAL DIAGRAM
INDEX AND SYMBOLS

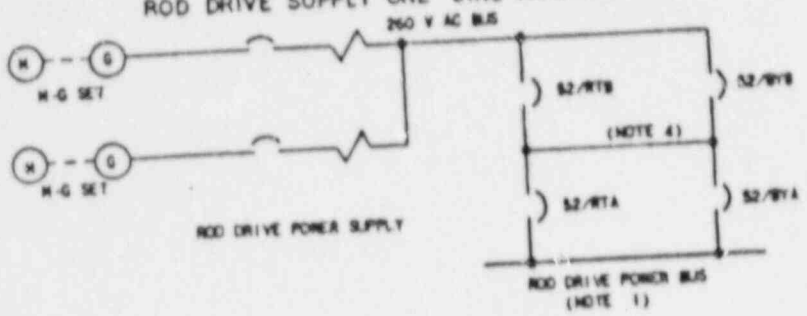
7250D64
SHEET - 1

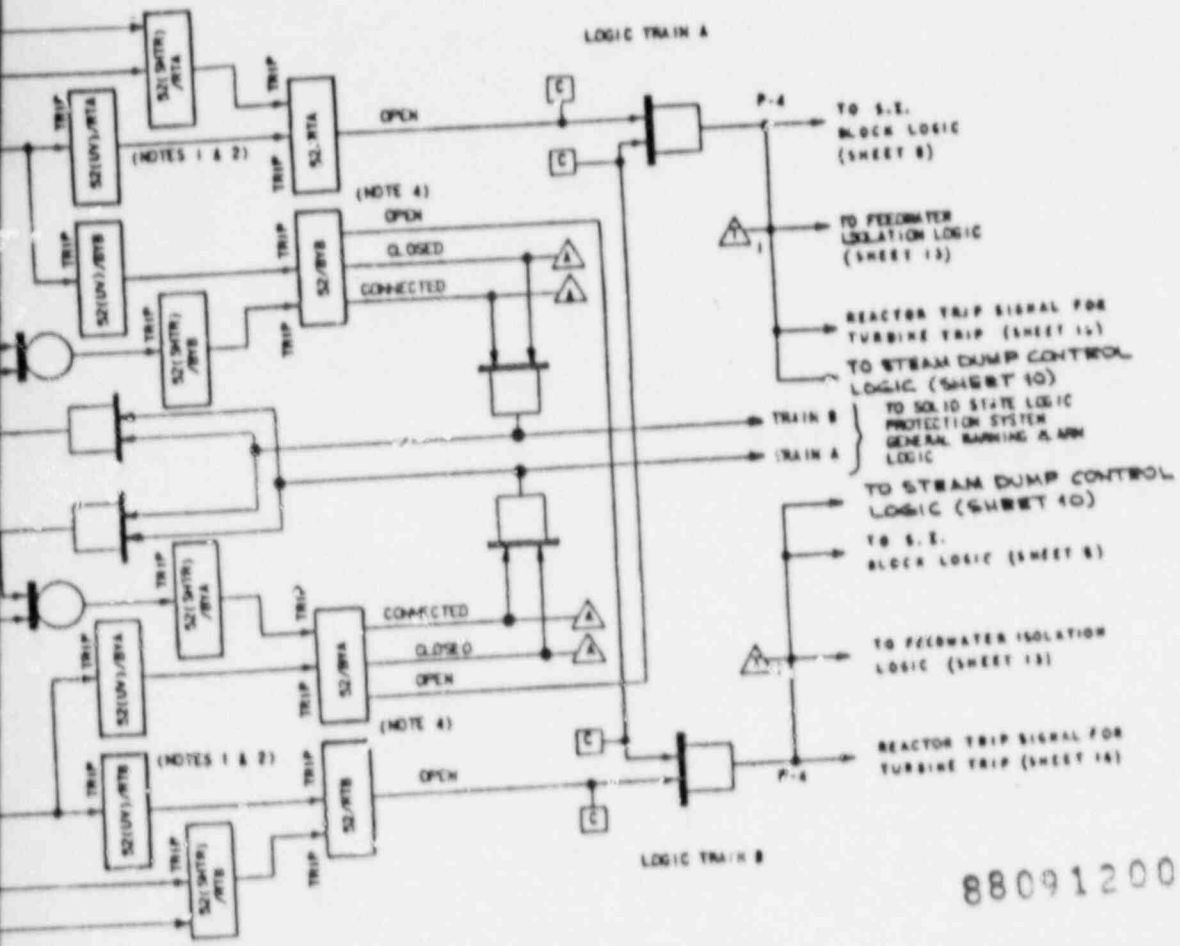
DO NOT SCALE

1 2 3 4 5 6


TRAIN A REACTOR SHUNT TRIP SIGNALS
MANUAL REACTOR TRIP SIGNAL (SHEET 3)
MANUAL SAFETY INJECTION SIGNAL (SHEET 8)
LOGIC TRAIN A REACTOR TRIP SIGNALS
MANUAL TRIP SIGNAL (SHEET 3)
NEUTRON FLUX TRIP SIGNALS (SHEET 3)
SOURCE RANGE, HIGH FLUX (INTERLOCKED BY P-6 & P-10)
INTERMEDIATE RANGE, HIGH FLUX (INTERLOCKED BY P-10)
POWER RANGE
HIGH FLUX, LOW SETPOINT (INTERLOCKED BY P-10)
HIGH FLUX, HIGH SETPOINT
HIGH FLUX RATE
PRIMARY COOLANT SYSTEM TRIP SIGNALS (SHEET 5)
OVERTEMPERATURE ΔT
OVERPOWER ΔT
LOW PRIMARY COOLANT FLOW
LOW REACTOR COOLANT FLOW IN ANY 1 OF 4 LOOPS (INTERLOCKED BY P-8)
LOW REACTOR COOLANT FLOW IN ANY 2 OF 4 LOOPS (INTERLOCKED BY P-7)
UNDERVOLTAGE (INTERLOCKED BY P-7)
UNDERFREQUENCY (INTERLOCKED BY P-7)
PRESSURIZER TRIP SIGNALS (SHEET 6)
HIGH PRESSURE
LOW PRESSURE (INTERLOCKED BY P-7)
HIGH LEVEL (INTERLOCKED BY P-7)
STEAM GENERATOR TRIP SIGNALS (SHEET 7) (NOTE 6)
LOW-LOW STEAM GENERATOR WATER LEVEL
SAFETY INJECTION SIGNAL (SHEET 8)
AUTOMATIC SIGNAL
MANUAL SIGNAL
TURBINE TRIP SIGNAL (SHEET 16)
LOW TRIP FLUID PRESSURE OR ALL STOP VALVES CLOSED (INTERLOCKED BY P-9)
SOLID STATE PROTECTION SYSTEM
GENERAL WARNING ALARM IN BOTH TRAINS
LOGIC TRAIN A
LOGIC TRAIN B REACTOR TRIP SIGNALS
MANUAL TRIP SIGNAL (SHEET 3)
NEUTRON FLUX TRIP SIGNALS (SHEET 3)
SOURCE RANGE, HIGH FLUX (INTERLOCKED BY P-6 & P-10)
INTERMEDIATE RANGE, HIGH FLUX (INTERLOCKED BY P-10)
POWER RANGE
HIGH FLUX, LOW SETPOINT (INTERLOCKED BY P-10)
HIGH FLUX, HIGH SETPOINT
HIGH FLUX RATE
PRIMARY COOLANT SYSTEM TRIP SIGNALS (SHEET 5)
OVERTEMPERATURE ΔT
OVERPOWER ΔT
LOW PRIMARY COOLANT FLOW
LOW REACTOR COOLANT FLOW IN ANY 1 OF 4 LOOPS (INTERLOCKED BY P-8)
LOW REACTOR COOLANT FLOW IN ANY 2 OF 4 LOOPS (INTERLOCKED BY P-7)
UNDERVOLTAGE (INTERLOCKED BY P-7)
UNDERFREQUENCY (INTERLOCKED BY P-7)
PRESSURIZER TRIP SIGNALS (SHEET 6)
HIGH PRESSURE
LOW PRESSURE (INTERLOCKED BY P-7)
HIGH LEVEL (INTERLOCKED BY P-7)
STEAM GENERATOR TRIP SIGNALS (SHEET 7) (NOTE 6)
LOW-LOW STEAM GENERATOR WATER LEVEL
SAFETY INJECTION SIGNAL (SHEET 8)
AUTOMATIC SIGNAL
MANUAL SIGNAL
TURBINE TRIP SIGNAL (SHEET 16)
LOW TRIP FLUID PRESSURE OR ALL STOP VALVES CLOSED (INTERLOCKED BY P-9)
SOLID STATE PROTECTION SYSTEM
GENERAL WARNING ALARM IN BOTH TRAINS
LOGIC TRAIN B
TRAIN B REACTOR SHUNT TRIP SIGNALS
MANUAL REACTOR TRIP SIGNAL (SHEET 3)
MANUAL SAFETY INJECTION SIGNAL (SHEET 8)

ROD DRIVE SUPPLY ONE LINE DIAGRAM





8809120090 - 12

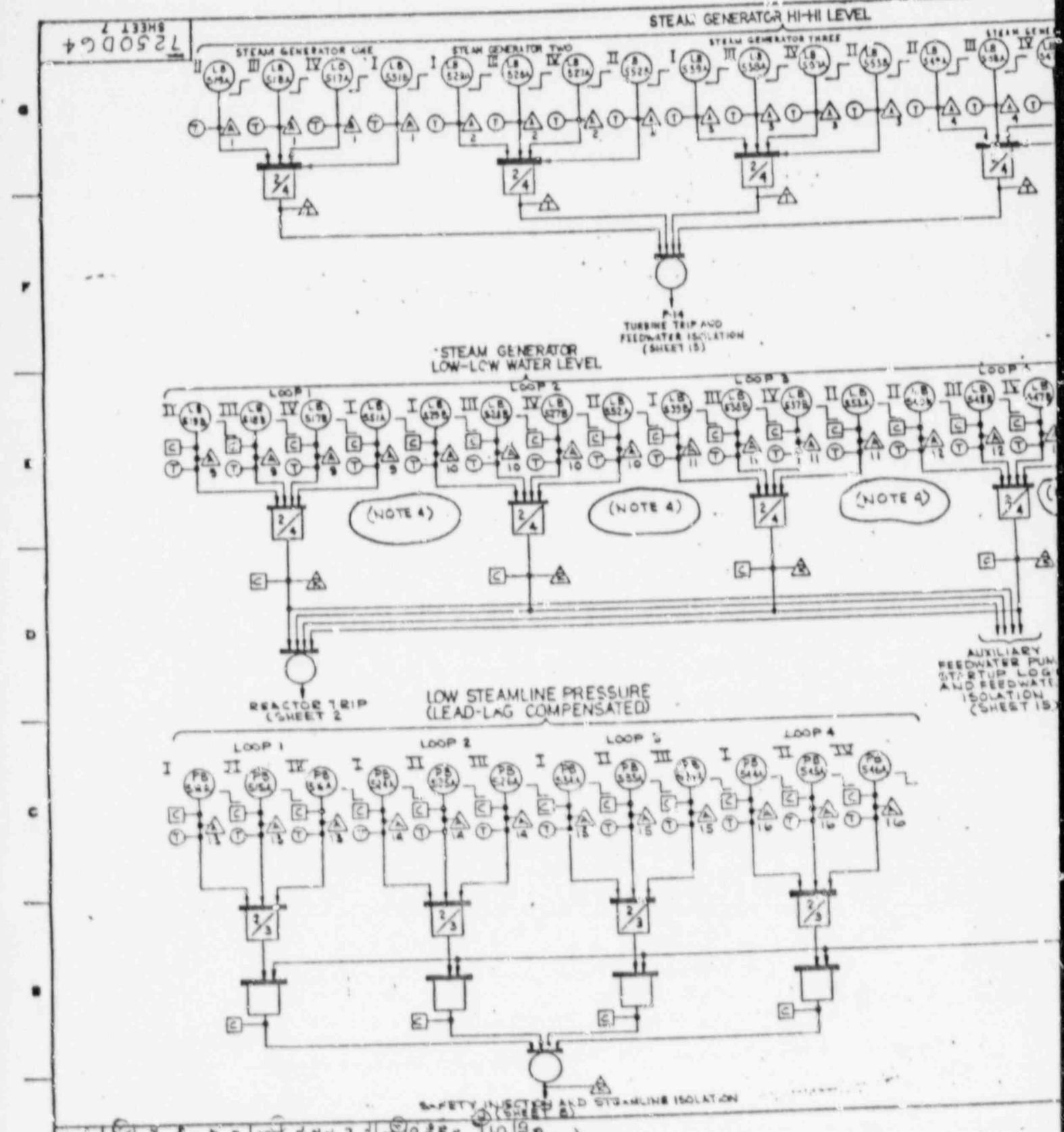
NOTES:

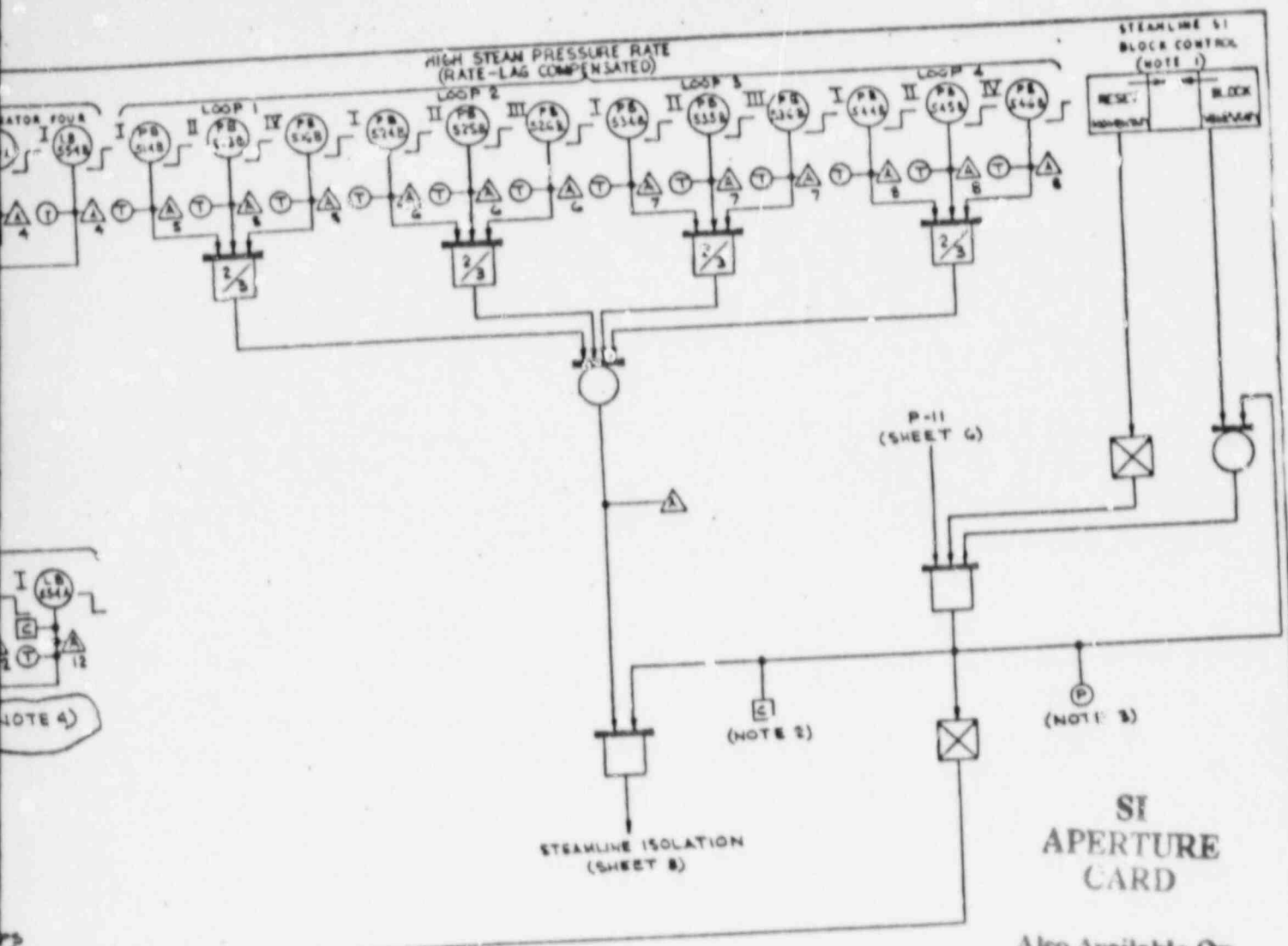
1. TRIPPING THE REACTOR TRIP BREAKERS 52/RTA AND 52/RTB REDUNDANTLY DE-ENERGIZES THE ROD DRIVES. ALL FULL LENGTH CONTROL RODS AND SHUTDOWN RODS ARE THEREBY RELEASED FOR GRAVITY INSERTION INTO THE REACTOR CORE.
2. NORMAL REACTOR OPERATION IS TO BE WITH REACTOR TRIP BREAKERS 52/RTA AND 52/RTB IN SERVICE AND BY-PASS BREAKERS 52/BYA AND 52/BYB WITHDRAWN.
   DURING TEST, ONE BY-PASS BREAKER IS TO BE PUT IN SERVICE AND THEN THE RESPECTIVE REACTOR TRIP BREAKER IS OPERATED USING A SIMULATED REACTOR TRIP SIGNAL IN THE TRAIN UNDER TEST. THE REACTOR WILL NOT BE TRIPPED BY THE SIMULATED SIGNAL SINCE THE BY-PASS BREAKER IS CONTROLLED FROM THE OTHER TRAIN. ONLY ONE REACTOR TRIP BREAKER IS TO BE TESTED AT A TIME.
3. ALL CIRCUITS ON THIS SHEET ARE NOT REDUNDANT BECAUSE BOTH TRAINS ARE SHOWN.
4. OPEN/CLOSED INDICATION FOR EACH TRIP BREAKER AND EACH BYPASS BREAKER IN CONTROL ROOM.
5. SHEET 19 IS APPLICABLE TO CALLAWAY ONLY.

Westinghouse Electric Corporation

SNUPPS PROJECTS
FUNCTIONAL DIAGRAM
REACTOR TRIP SIGNALS

7250D64
SHEET 2
REV 5


7250DG4
SHEET 7
STEAM GENERATOR HI-HI LEVEL
STEAM GENERATOR ONE
STEAM GENERATOR TWO
STEAM GENERATOR THREE
P-14
TURBINE TRIP AND
FEEDWATER ISOLATION
(SHEET 15)
*STEAM GENERATOR
LOW-LOW WATER LEVEL
LOOP 1
LOOP 2
LOOP 3
(NOTE 4)
(NOTE 4)
(NOTE 4)
REACTOR TRIP
(SHEET 2
LOW STEAMLINE PRESSURE
(LEAD-LAG COMPENSATED)
LOOP 1
LOOP 2
LOOP 3
LOOP 4
SAFETY INJECTION AND STEAMLINE ISOLATION



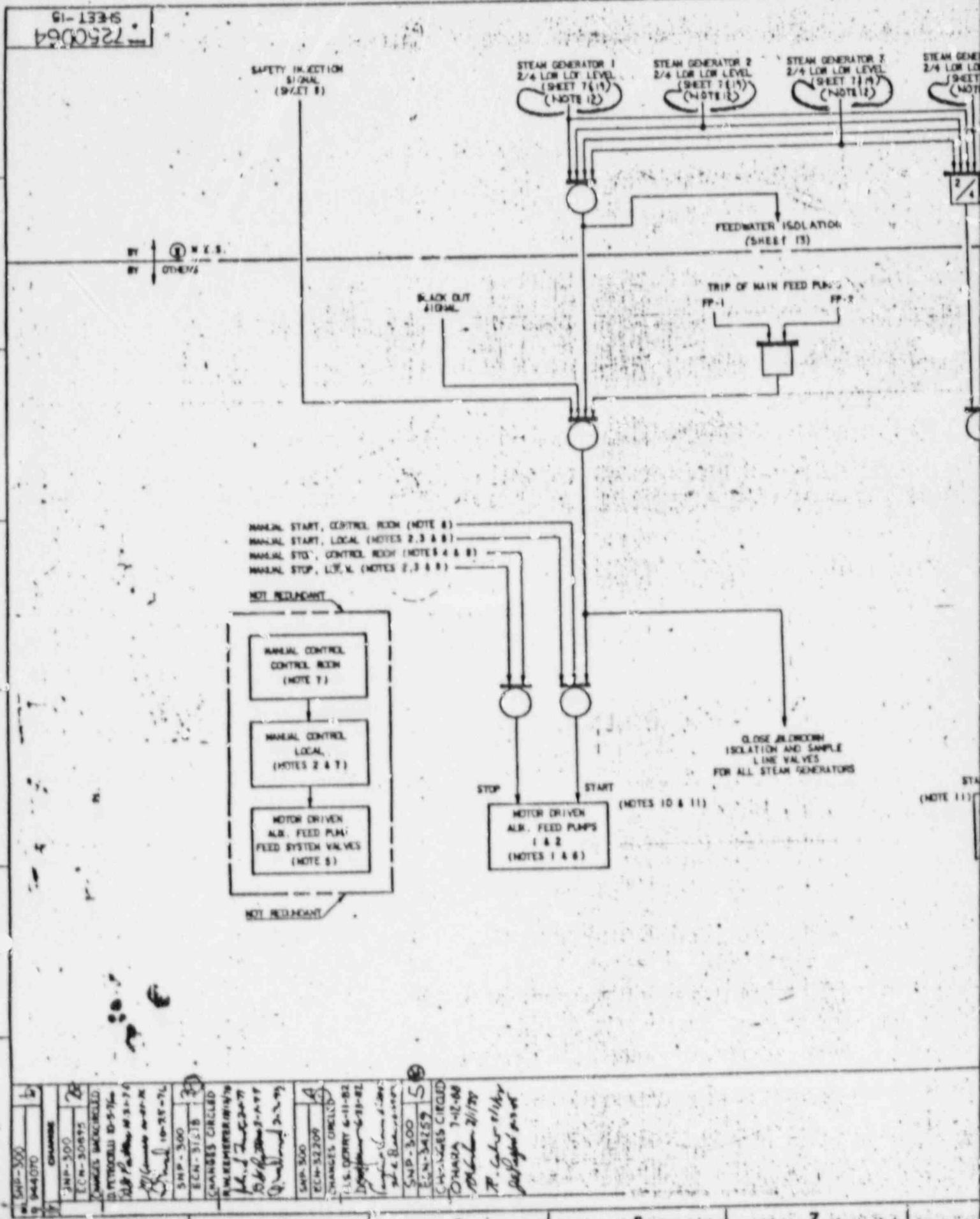
NOTES
1. THE REDUNDANT MANUAL BLOCK CONTROL CONSISTS OF TWO CONTROLS ON THE CONTROL BOARD, ONE FOR EACH TRAIN. SUPPLIED BY OTHERS.
2. TWO COMPUTER INPUTS ARE CONNECTED TO THIS CIRCUIT INDIVIDUAL FOR EACH TRAIN.
3. TWO PERMISSIVE STATUS LIGHTS ARE CONNECTED TO THIS CIRCUIT, INDIVIDUAL FOR EACH TRAIN.
4. THE STEAM GENERATOR LOW-LOW WATER LEVEL LOGIC ON THIS SHEET IS APPLICABLE TO WOLF CREEK UNIT 1 ONLY. SEE SHEET 19 FOR THE LOGIC APPLICABLE TO CALLAWAY UNIT 1.

8809120090 - 13

Westinghouse Electric Corporation

TITLE: SNUPPS PROJECTS
FUNCTIONAL DIAGRAM
STEAM GENERATOR TRIP SIGNALS

7250D64
SHEET 7


SAFETY INJECTION SIGNAL (SHEET 8)
STEAM GENERATOR 1 2/4 LOW LOW LEVEL (SHEET 7 (19) (NOTE 12)
STEAM GENERATOR 2 2/4 LOW LOW LEVEL (SHEET 7 (19) (NOTE 12)
STEAM GENERATOR 3 2/4 LOW LOW LEVEL (SHEET 7 (19) (NOTE 12)
FEEDWATER ISOLATION (SHEET 13)
BLACK OUT SIGNAL
TRIP OF MAIN FEED PUMPS
FP-1
FP-2
MANUAL START, CONTROL ROOM (NOTE 6)
MANUAL START, LOCAL (NOTES 2,3 & 6)
MANUAL STOP, CONTROL ROOM (NOTES 4 & 6)
MANUAL STOP, LOCAL (NOTES 2,3 & 6)
NOT REDUNDANT
MANUAL CONTROL CONTROL ROOM (NOTE 7)
MANUAL CONTROL LOCAL (NOTES 2 & 7)
MOTOR DRIVEN AUX. FEED PUMP FEED SYSTEM VALVES (NOTE 5)
NOT REDUNDANT
STOP
START
MOTOR DRIVEN AUX. FEED PUMPS 1 & 2 (NOTES 1 & 6)
(NOTES 10 & 11)
CLOSE AUTOMATIC ISOLATION AND SAMPLE LINE VALVES FOR ALL STEAM GENERATORS
2/4

BY (W) W.E.S.
BY OTHERS

BY (I) W.E.S.
BY OTHERS

BLACK OUT SIGNAL

MANUAL START, CONTROL ROOM
MANUAL START, LOCAL (NOTES 2 & 3)
MANUAL STOP, CONTRC. ROOM (NOTE 4)
MANUAL STOP, LOCAL (NOTE 2 & 3)

NOT REDUNDANT

MANUAL CONTROL CONTROL ROOM (NOTE 7)

MANUAL CONTROL CONTROL ROOM

MANUAL CONTROL LOCAL (NOTES 2 & 7)

(NOTE 9)

MANUAL CONTROL LOCAL (NOTE 2)

TURBINE DRIVEN AUX. FEED PUMP FEED SYSTEM VALVES (NOTE 5)

C.R. LOCAL

TURBINE SPEED CONTROL

STOP

TURBINE DRIVEN AUX. FEED P (NOTE 6)

NOT REDUNDANT

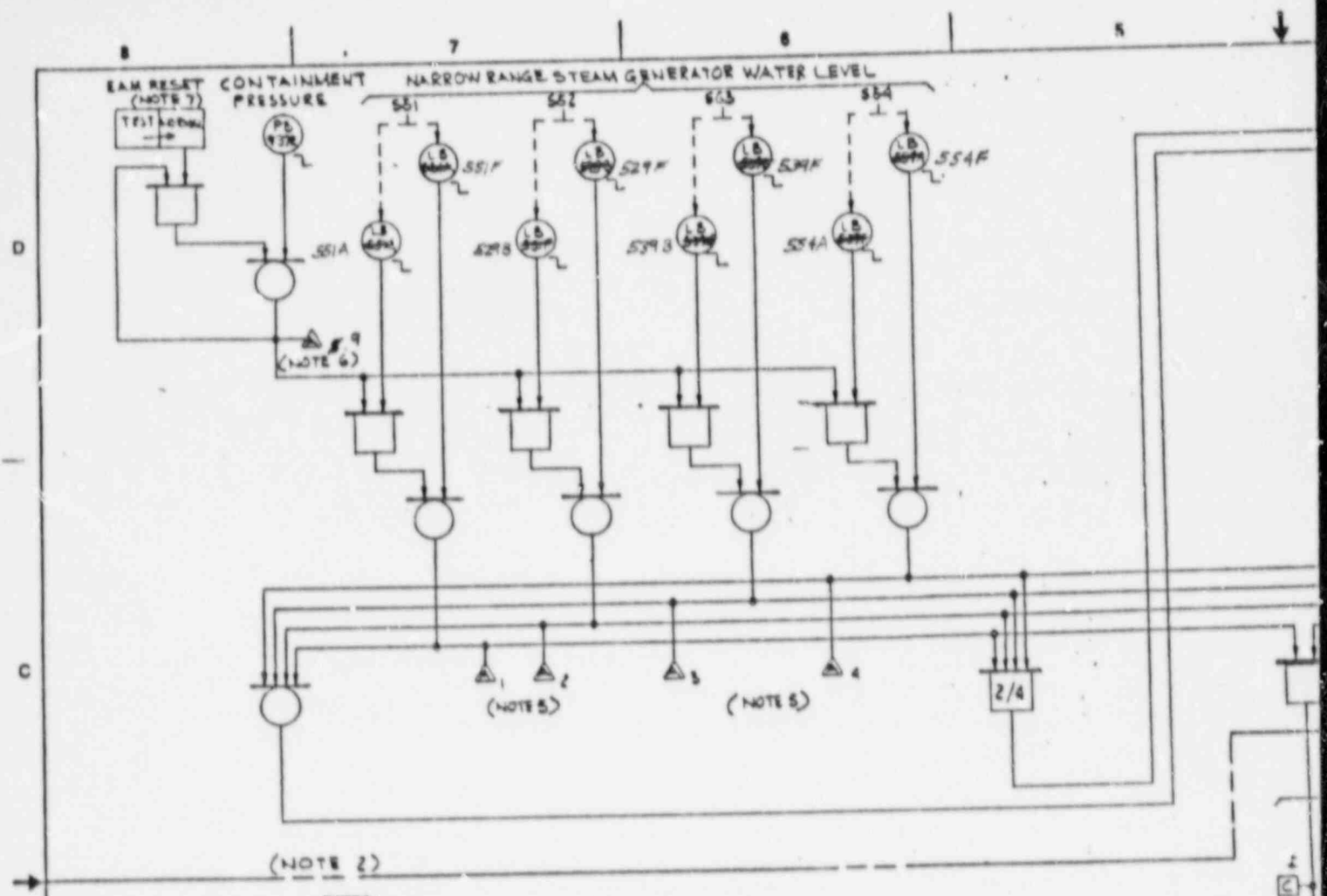
NOTES:

1. TRAIN A CONTROLS MAFP 1: BREAKER NUMBER
   TRAIN B CONTROLS MAFP 2: BREAKER NUMBER
2. LOCAL CONTROL OVERRIDES ALL OTHER SIGNALS.
3. LOCAL OVERRIDE ACTUATES ALARM IN CONTROL ROOM.
4. MANUAL STOP AND PULL OVERRIDES THE AUTOMATIC START. MANUAL STOP OVERRIDE ACTUATES ALARM IN CONTROL ROOM.
5. OPEN/SHUT INDICATION IN CONTROL ROOM.
6. PUMP OPERATING LIGHTS IN CONTROL ROOM.
7. INDIVIDUAL FOR EACH VALVE.
8. INDIVIDUAL FOR EACH PUMP.
9. THE TURBINE SPEED CONTROL IS TYPICAL. ACTUAL IMPLEMENTATION MAY NOT INCLUDE SPEED CONTROL.
10. THE PUMP START MAY BE DELAYED AND SEQUENCED IF THE EMERGENCY DIESEL POWER CAPABILITY IS LESS THAN THE TOTAL LOAD WITH ALL SYSTEMS STARTING. THE TIME DELAY, IF USED, MAY NOT EXCEED THE MAXIMUM STARTING TIME REQUIREMENTS FOR THIS SYSTEM.
11. THE PUMP START MUST BE SEALED IN (LATCHED), SO THAT LOSS OF THE ACTUATION SIGNAL WILL NOT CAUSE THE PUMP TO STOP.
12. SHEET 19 IS APPLICABLE TO CALLAWAY ONLY.

8809120090-14

DRN.		Westinghouse Electric Corporation	
DES. ENG.		SNUPPS PROJECTS	
MFG. ENG.		FUNCTIONAL DIAGRAM	
PROJ. ENG.		AUXILIARY FEEDWATER PUMPS STARTUP	
APPD.		SCALE	7250D64
APPD.		DO NOT SCALE	SHEET 15
PROJ. MGR.			KW7385

8 7 6 5 4 3 2 1



NOTES:

1. THE ENVIRONMENTAL ALLOWANCE MODIFIER/TRIP TIME DELAY LOGIC ON THIS SHEET IS APPLICABLE TO CALLAWAY UNIT 1 ONLY. SEE SHEET 2 FOR THE STEAM GENERATOR LOW-LOW WATER LEVEL REACTOR TRIP LOGIC APPLICABLE TO WOLF CREEK UNIT 1.

2. THIS LOGIC IS SPECIFIC FOR PROTECTION SET 1. IT IS TYPICAL OF THE LOGIC IN PROTECTION SETS II, III, AND IV. BISTABLE TAG NUMBERS ARE FOR PROTECTION SET 1 ONLY.

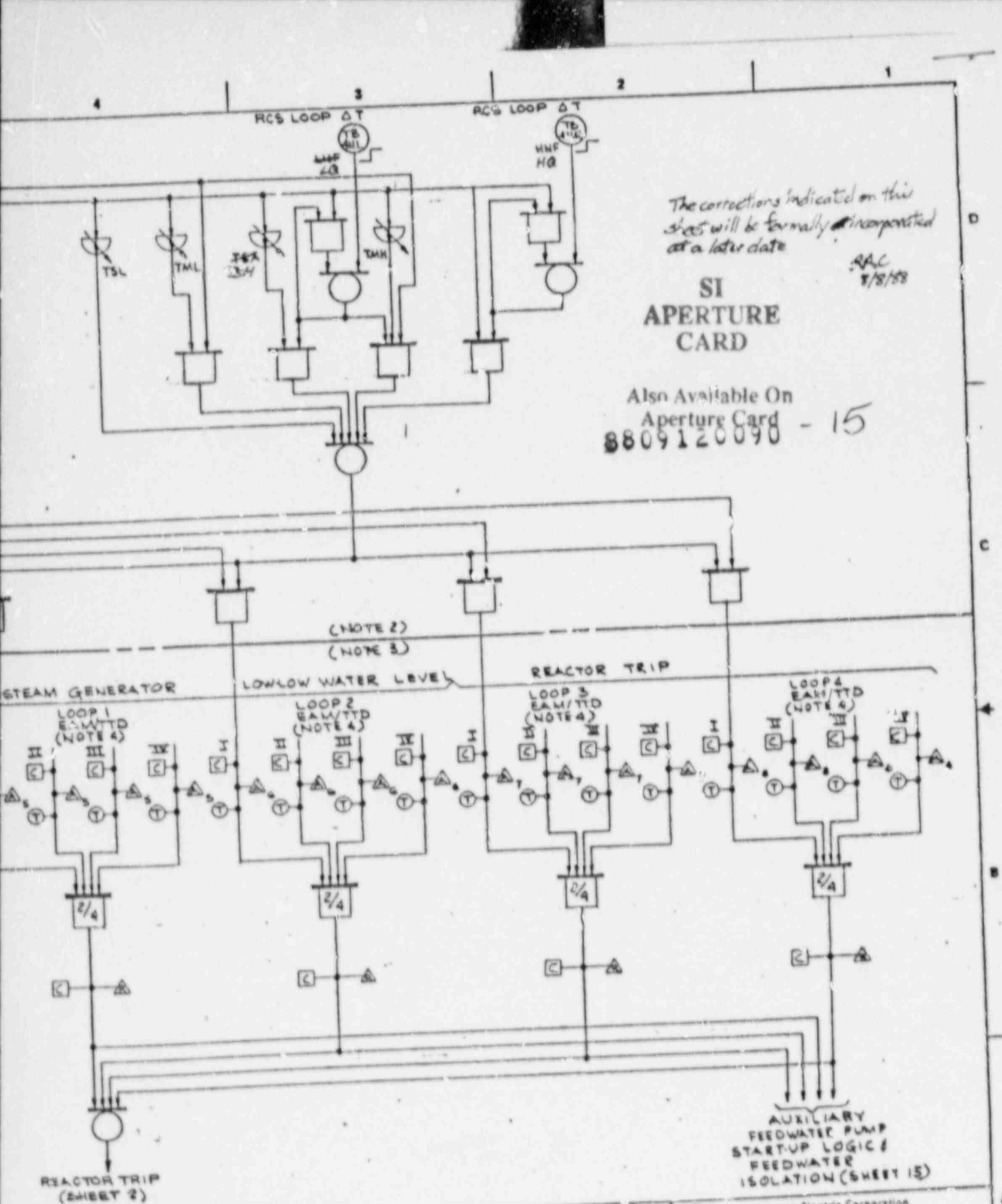
3. THIS LOGIC IS REDUNDANT AND IS PERFORMED IN THE SSPS.

4. LOGIC INPUT COMES FROM THE EAM/TTO LOGIC IN THE OTHER PROTECTION SETS.

5. ONE COMMON ANNUNCIATOR WINDOW FOR EACH STEAM GENERATOR IS SHARED WITH ALARMS GENERATED IN THE OTHER PROTECTION SETS.

6. ONE COMMON ANNUNCIATOR WINDOW IS SHARED WITH ALARM GENERATED IN THE OTHER PROTECTION SETS.

7. THE EAM RESET CONSISTS OF FOUR SWITCHES LOCATED IN THE PROCESS CABINETS, ONE PER PROTECTION SET. MOMENTARY ACTUATION MAY BE REMOVED PROVIDED THE ADVERSE ENVIRONMENT STEAM GENERATOR LOW-LOW WATER LEVEL SETPOINT IS ENABLED WHENEVER THE SWITCH IS IN THE TEST POSITION.



The corrections indicated on this sheet will be formally incorporated at a later date

RAC 9/8/88

SI APERTURE CARD

Also Available On Aperture Card

8809120090 - 15

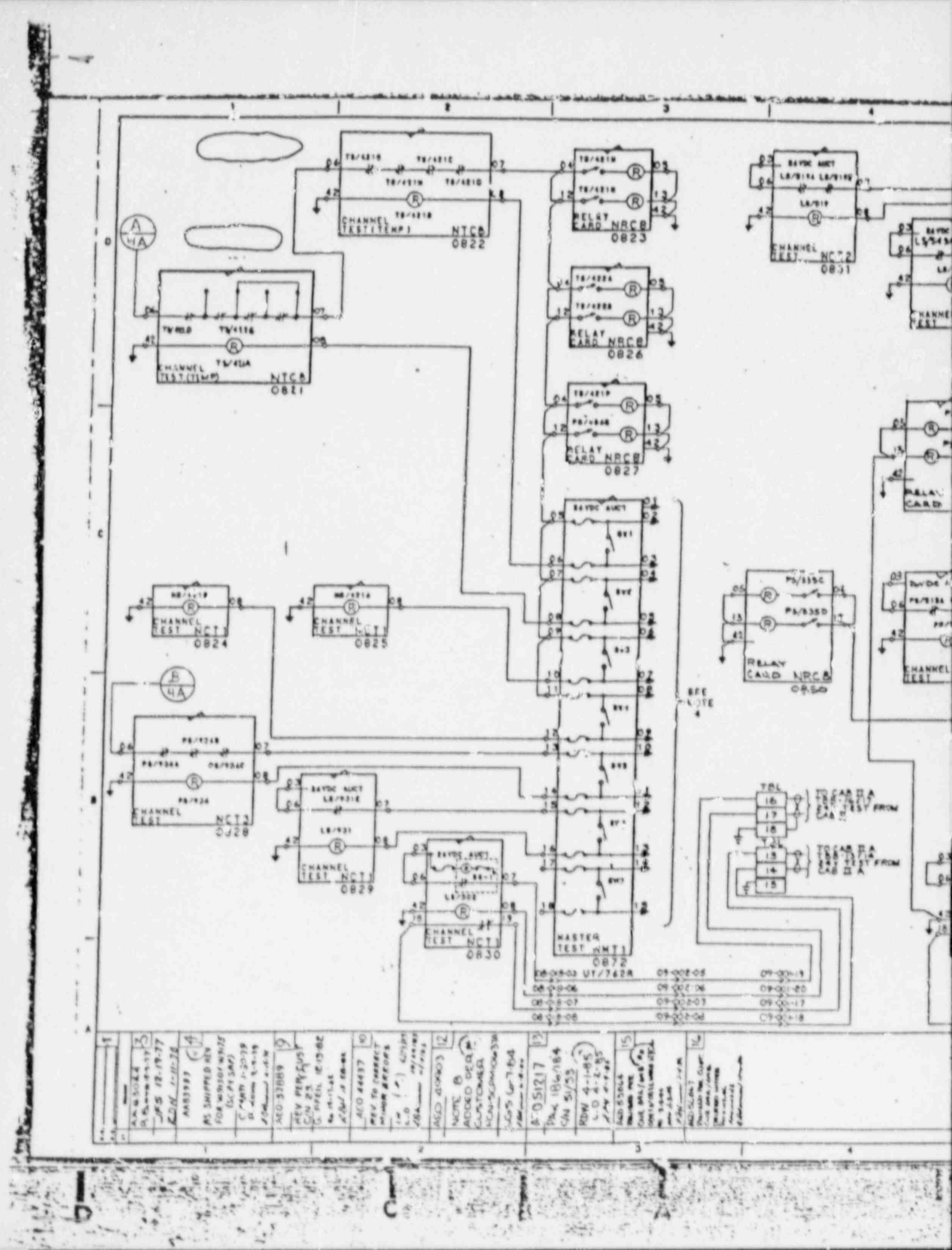
TOLERANCE & MACHINE NOTES

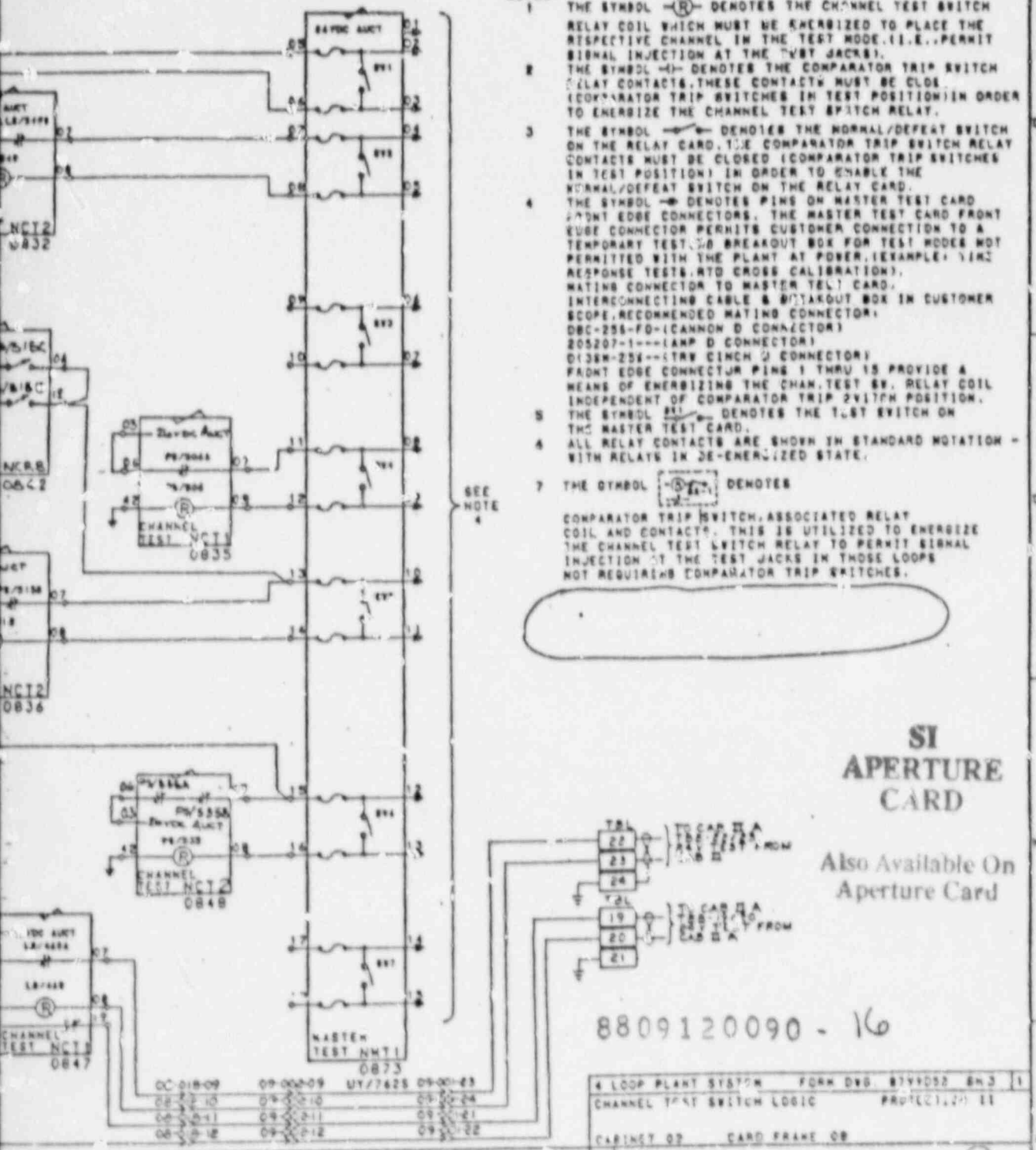
WESTINGHOUSE PROPRIETARY DATA

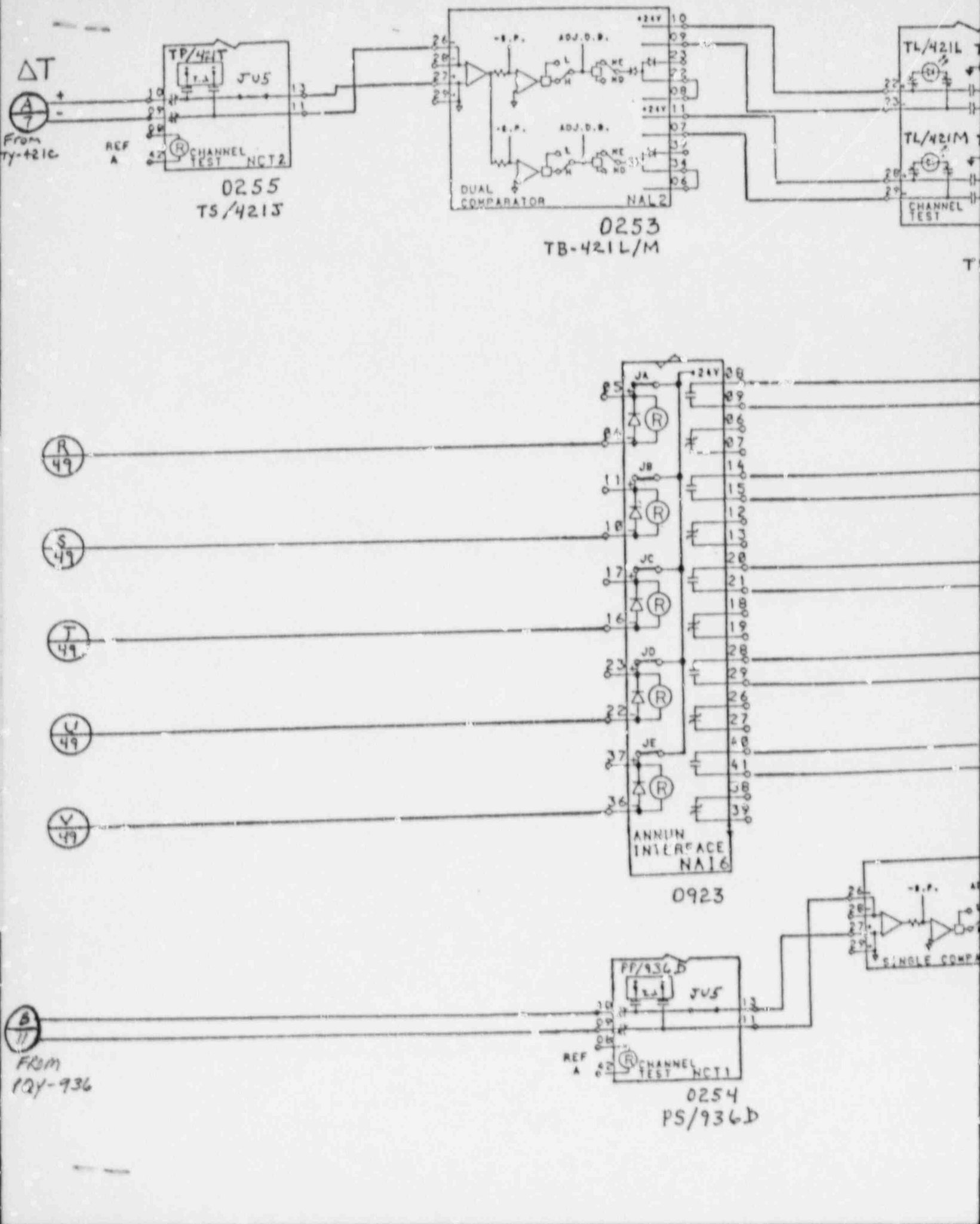
Westinghouse Electric Corporation
WATER REACTOR DIVISIONS - MONROEVILLE, PA. U.S.A.

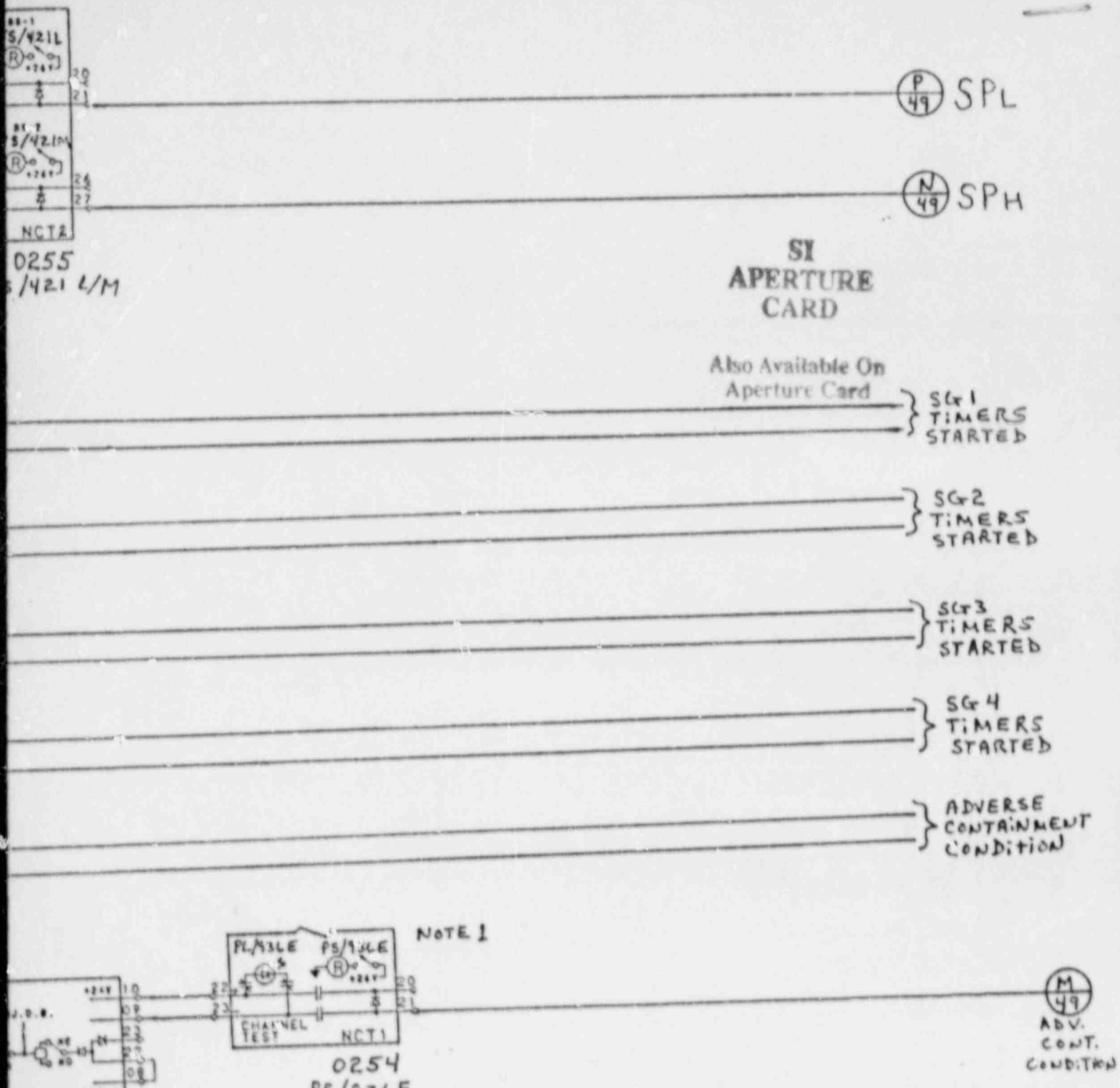
SNUPPS PROJECTS
FUNCTIONAL DIAGRAM
ENVIROMENTAL ALLOWANCE MODIFIER
TRIP TIME DELAY LOGIC

DWG NO. 7250D64 REV 1


CHANNEL TEST (TEMP) NTCB 0822
RELAY CARD NRCB 0823
CHANNEL TEST NCT2 0831
RELAY CARD NRCB 0826
RELAY CARD NRCB 0827
CHANNEL TEST (TEMP) NTCB 0821
CHANNEL TEST NCT1 0824
CHANNEL TEST NCT1 0825
RELAY CARD NRCB 0850
CHANNEL TEST NCT1 0828
CHANNEL TEST NCT1 0829
CHANNEL TEST NCT1 0830
MASTER TEST NMT1 0872
SEE NOTE 4
TO CAB IIA
TO CAB IIA
A 4A
B 4A



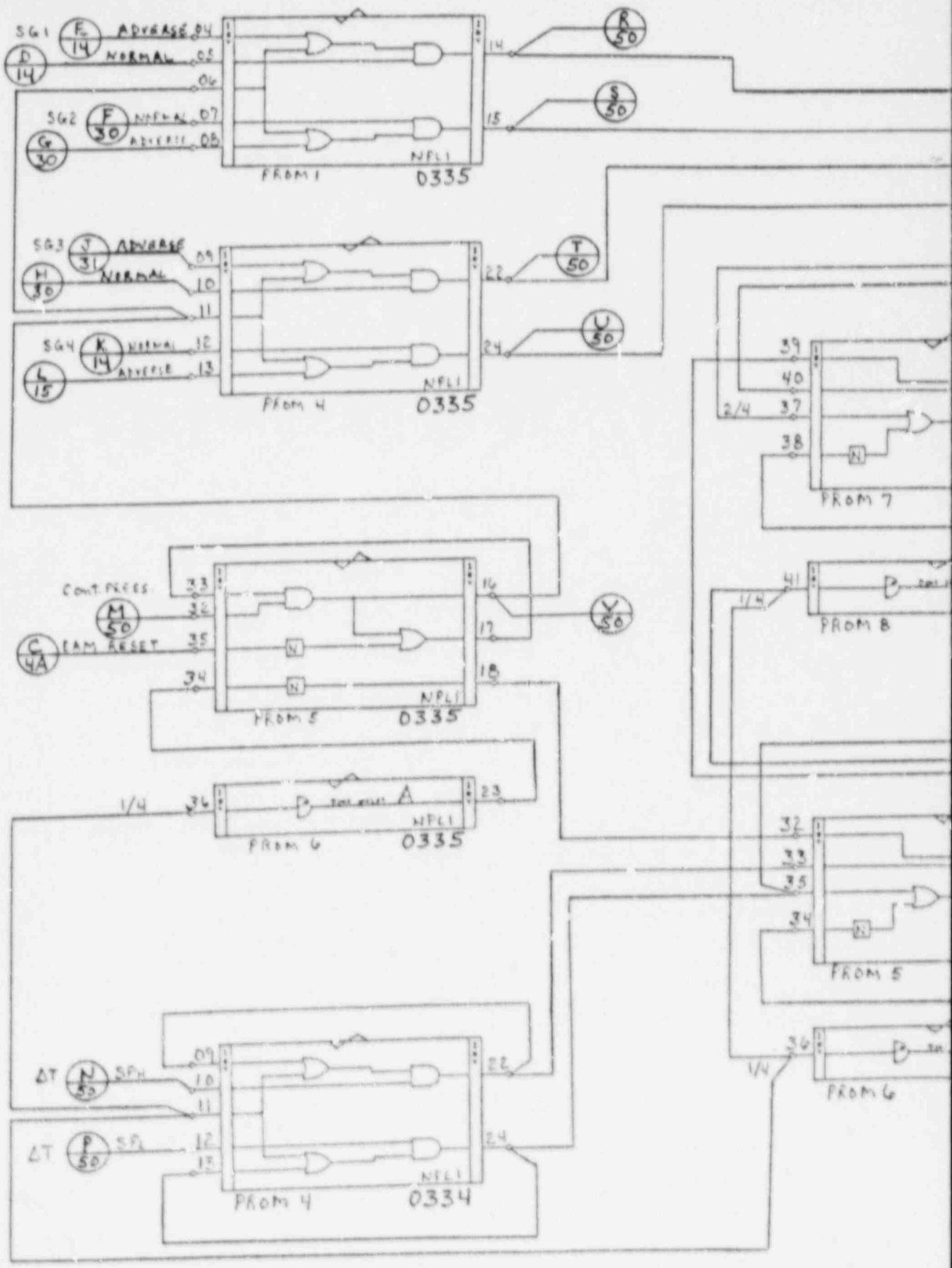

ΔT
From TY-421C
REF A
TP/421T
JV5
CHANNEL TEST NCT2
0255
TS/421S
DUAL COMPARATOR NAL2
0253
TB-421L/M
TL/421L
TL/421M
CHANNEL TEST
R/49
S/49
T/49
U/49
V/49
JA
JB
JC
JD
JE
ANNUN INTERFACE NA16
0923
FF/936D
JV5
CHANNEL TEST NCT1
0254
PS/936D
B/11
FROM 12Y-936

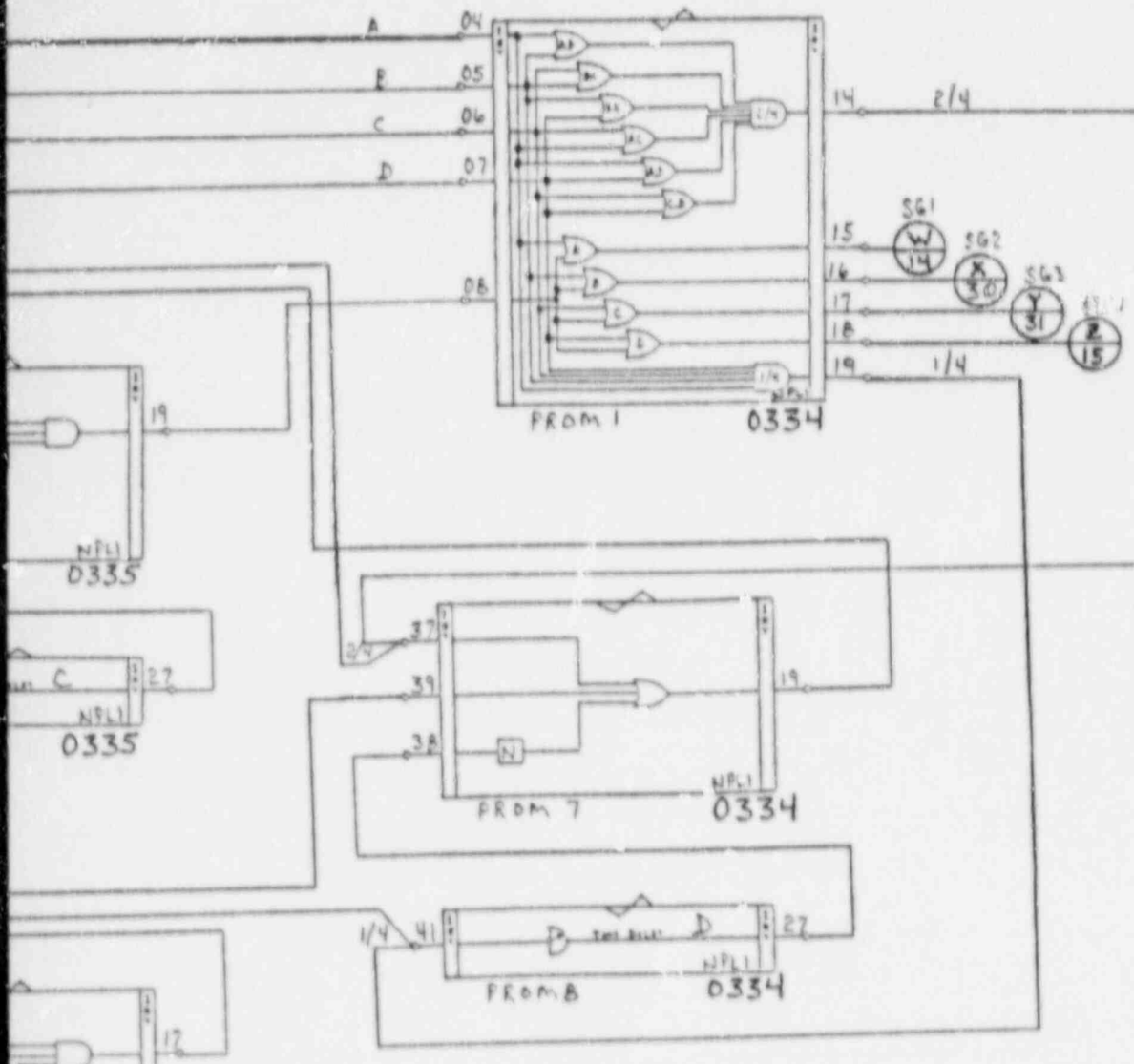


NOTE 1: PS/936E USED TO RESET EAM. SEE SHEET 4A.

4 LOOP PLANT SYSTEM FORM DRB. 8799050 SH 1
EAM/FTD PROTECTION III
CABINET 02 CARD FRAME 02/09
8809050
WESTINGHOUSE ELECTRIC CORPORATION
TITLE INTERCONNECTING WIRING DIAGRAM CABINET 02
8809052
SHEET 20
INDUSTRY SYSTEMS DIVISION

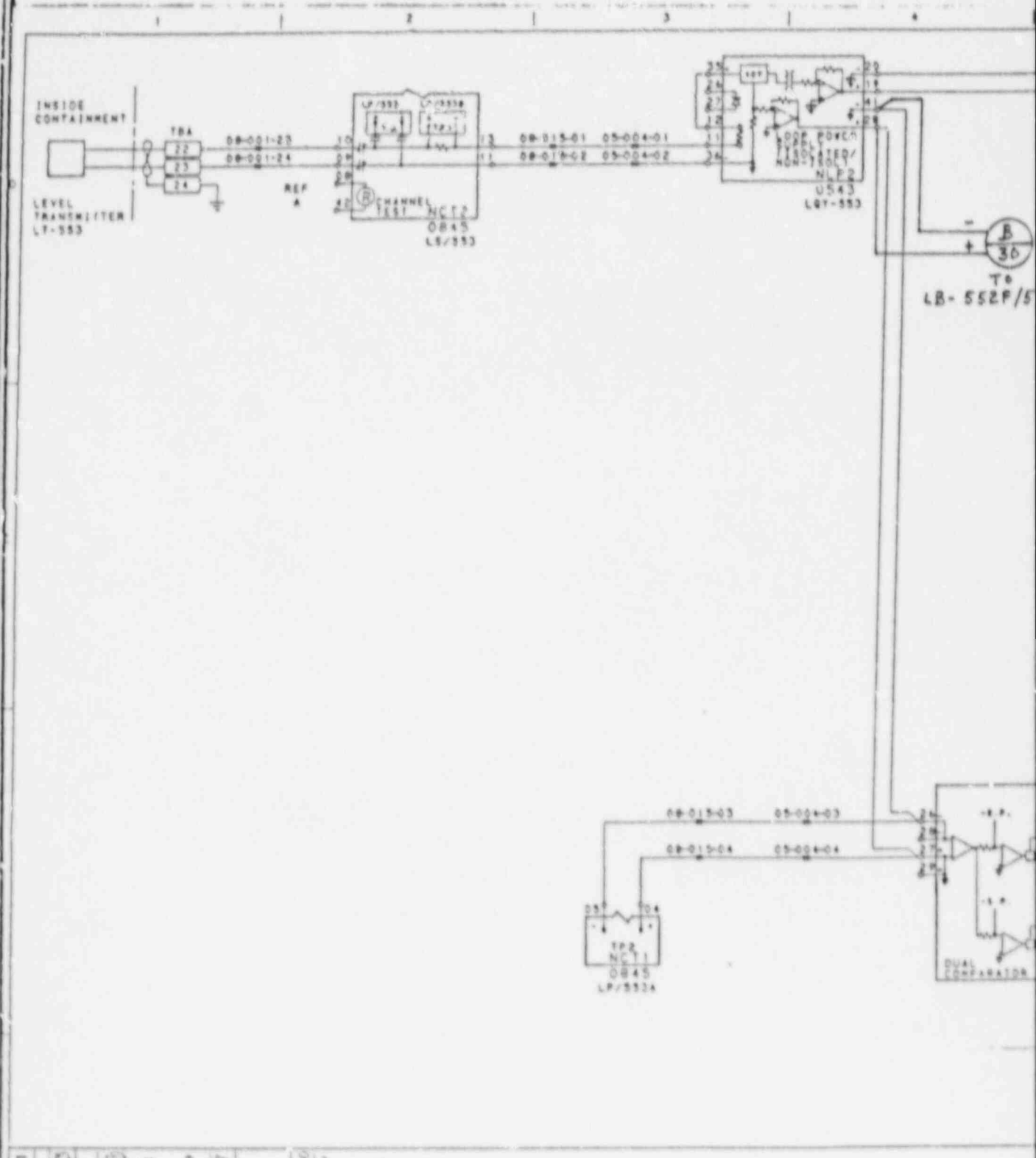
8809120090 - 1

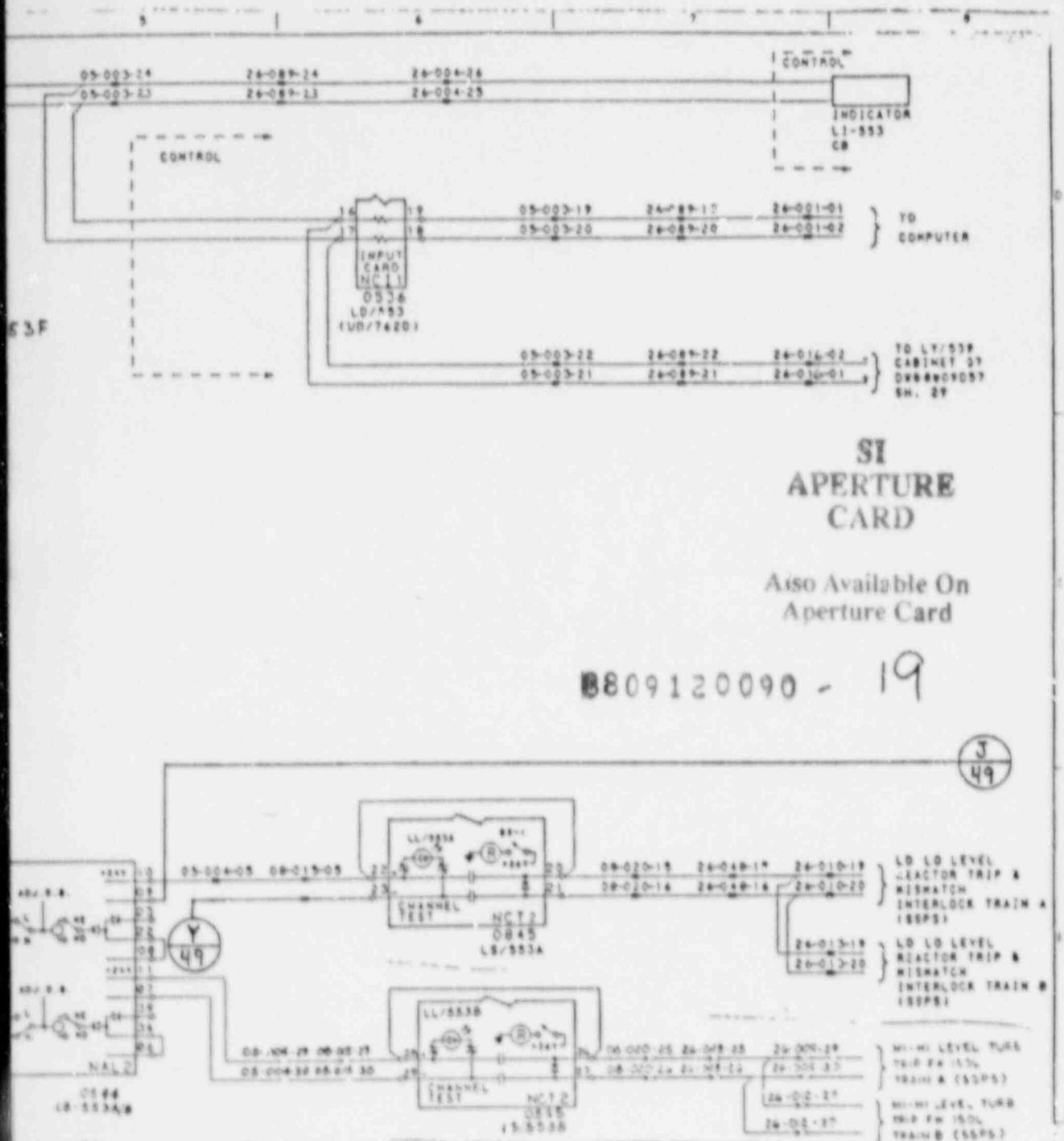

SG1
F 14
ADVANCE 04
NORMAL 05
D 14
06
SG2
F 30
NORMAL 07
ADVANCE 08
G 30
14
15
R 50
S 50
FROM 1
NFL1
0335
SG3
J 31
ADVANCE 09
NORMAL 10
H 30
11
SG4
K 14
NORMAL 12
ADVANCE 13
L 15
22
24
T 50
U 50
FROM 4
NFL1
0335
39
40
2/4
37
38
FROM 7
CONT. FEEDS
33
M 50
32
C 4A
RAM RESET
35
34
16
17
18
Y 50
FROM 5
NFL1
0335
41
1/4
FROM 8
1/4
36
23
FROM 6
NFL1
0335
32
33
35
34
FROM 5
36
1/4
FROM 6
ΔT
N 50
SPH
09
10
11
ΔT
P 50
SPL
12
13
22
24
FROM 4
NFL1
0334



8807120090-18

4 LOOP PLANT SYSTEM	FORM DRD 8700050 SH 1
EAM/TTD PROM Logic	PROTECTION II
CABINET 02	CARD FRAME 03
WESTINGHOUSE ELECTRIC CORPORATION	
TITLE INTERCONNECTING WIRING DIAGRAM CABINET 02	
APPLICABLE PLANT SYSTEMS	
SIZE	
8807120090	
INDUSTRY SYSTEMS DIVISION	


INSIDE CONTAINMENT
TBA
22
23
24
08-001-23
08-001-24
LEVEL TRANSMITTER LT-553
REF A
CHANNEL TEST
NCT2
0845
LB/553
08-015-01
05-004-01
08-015-02
05-004-02
LOOP POWER SUPPLY ISOLATED/ NON-ISOLATED NLP2
U543
LBY-553
B
36
To
LB-552F/5
08-015-03
05-004-03
08-015-04
05-004-04
TP2
NCT1
0845
LP/553A
DUAL COMPARATOR



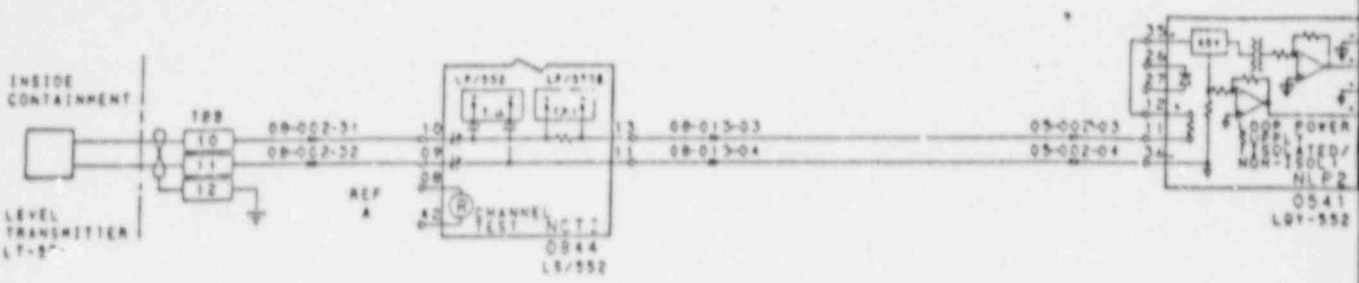
SI
APERTURE
CARD

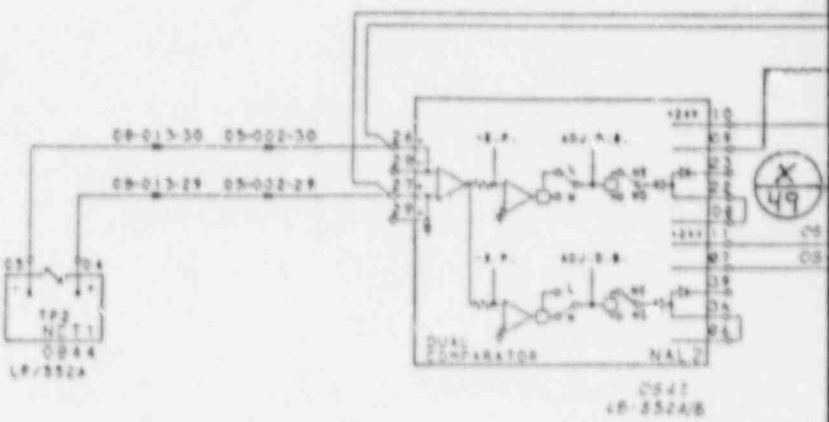
Also Available On
Aperture Card

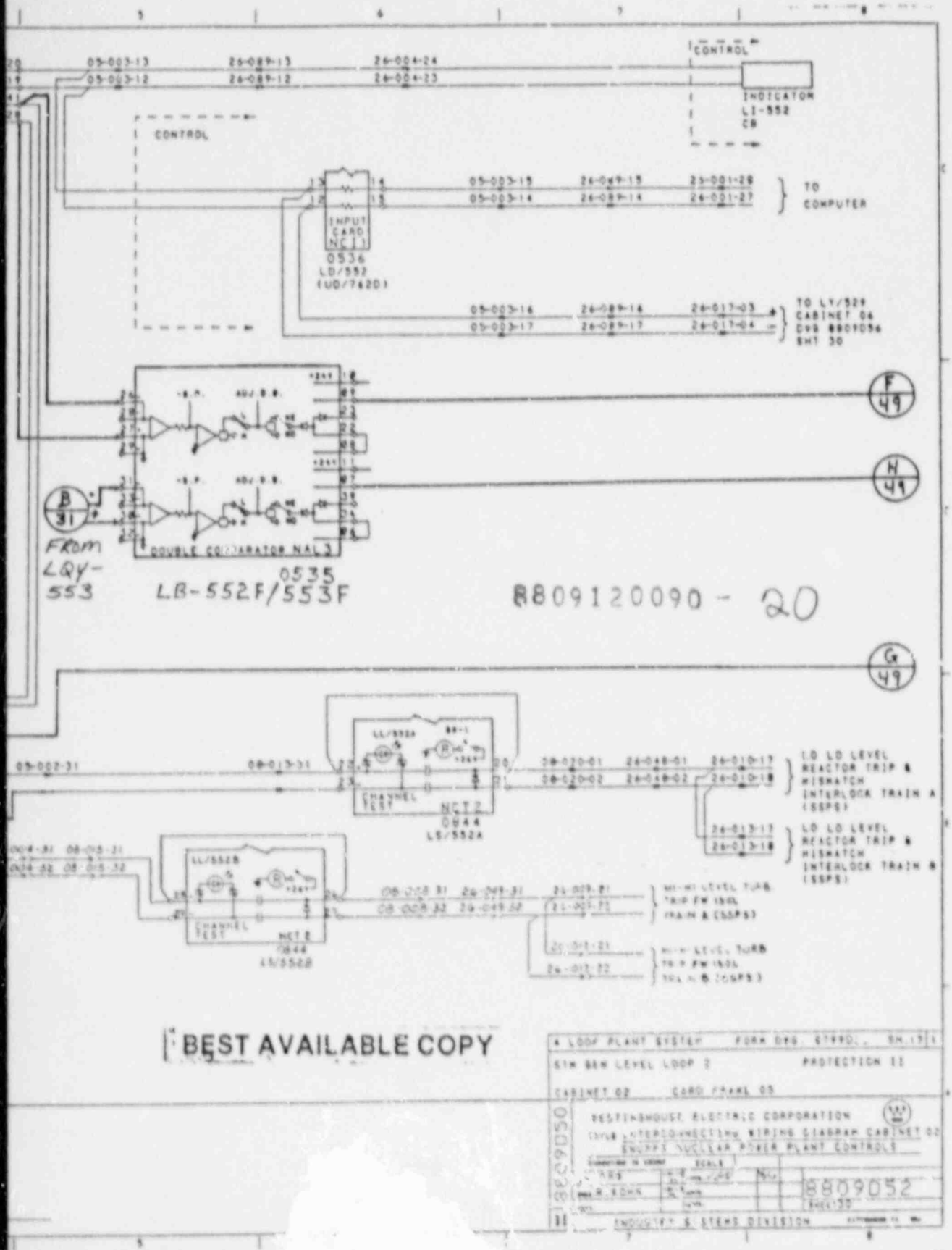
8809120090 - 19

BEST AVAILABLE COPY

4 LOOP PLANT SYSTEM FORM DWG. 8799053 SH. 17 1
STM GEN LEVEL LOOP 3 PROTECTION II
CABINET 02 CARD FRAME 05
WESTINGHOUSE ELECTRIC CORPORATION
TITLE INTERCONNECTING WIRING DIAGRAM CABINET 02
SHIPPS NUCLEAR POWER PLANT CONTROLS
8809050
8809052
INDUSTRY SYSTEMS DIVISION

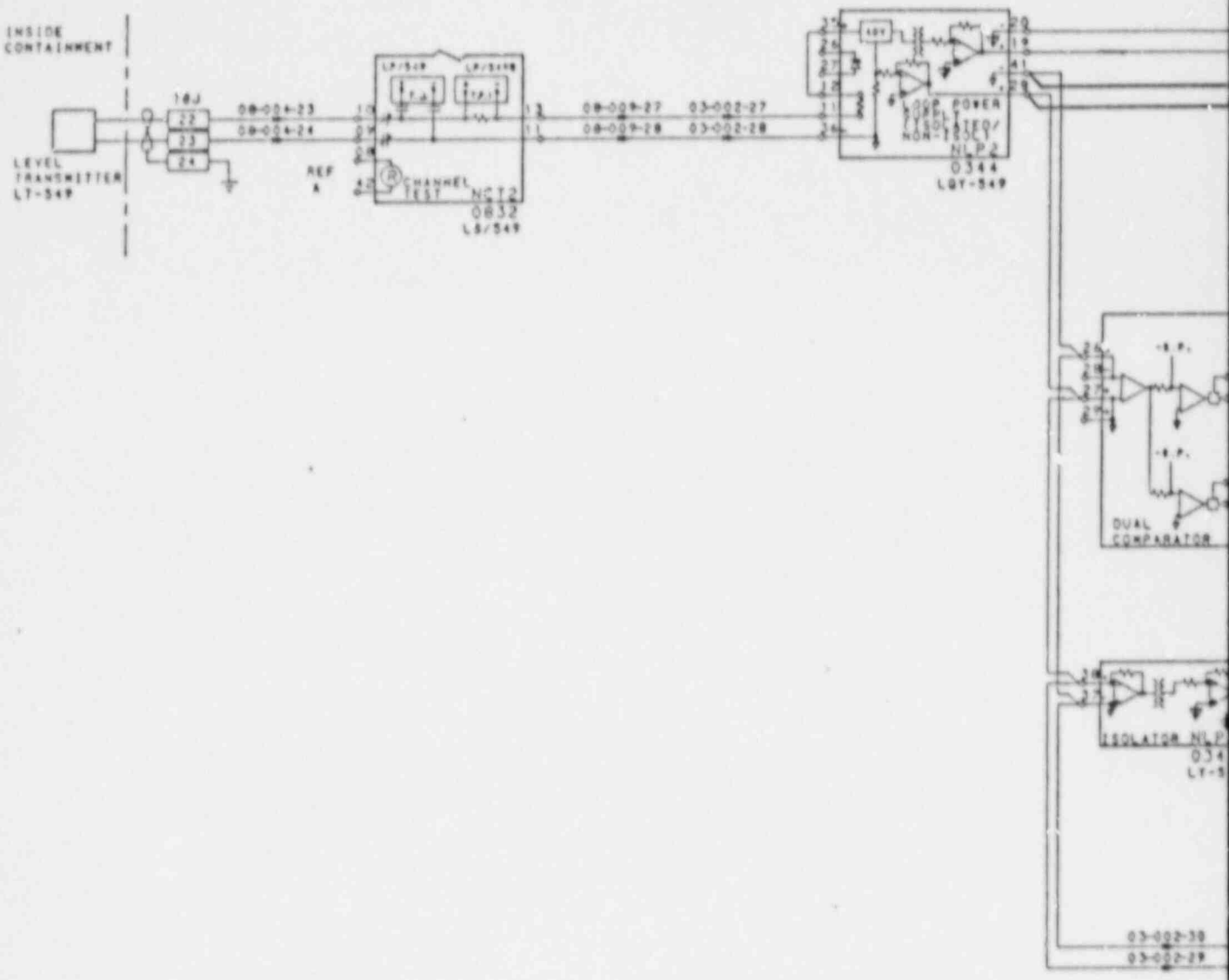


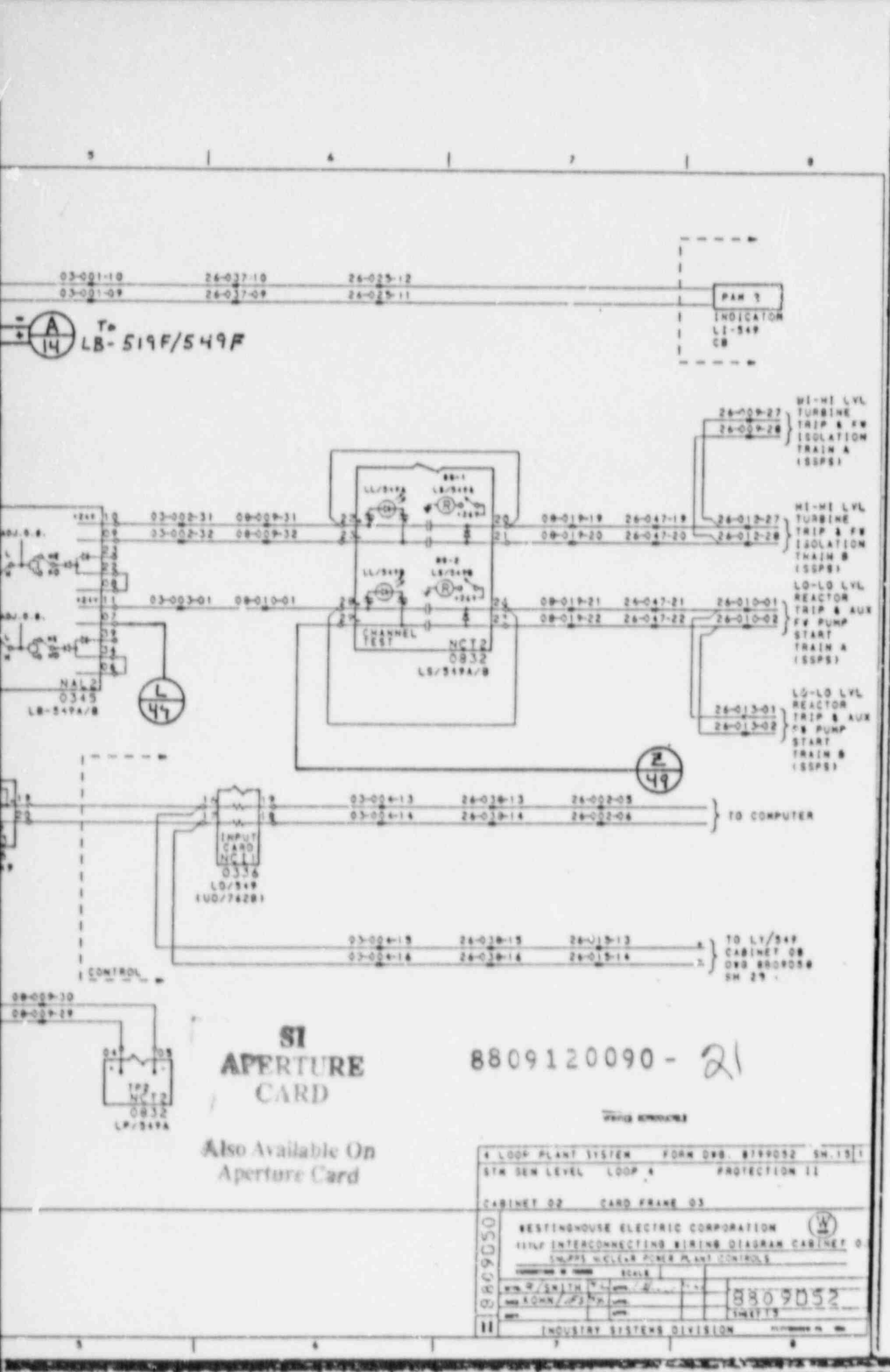




BEST AVAILABLE COPY

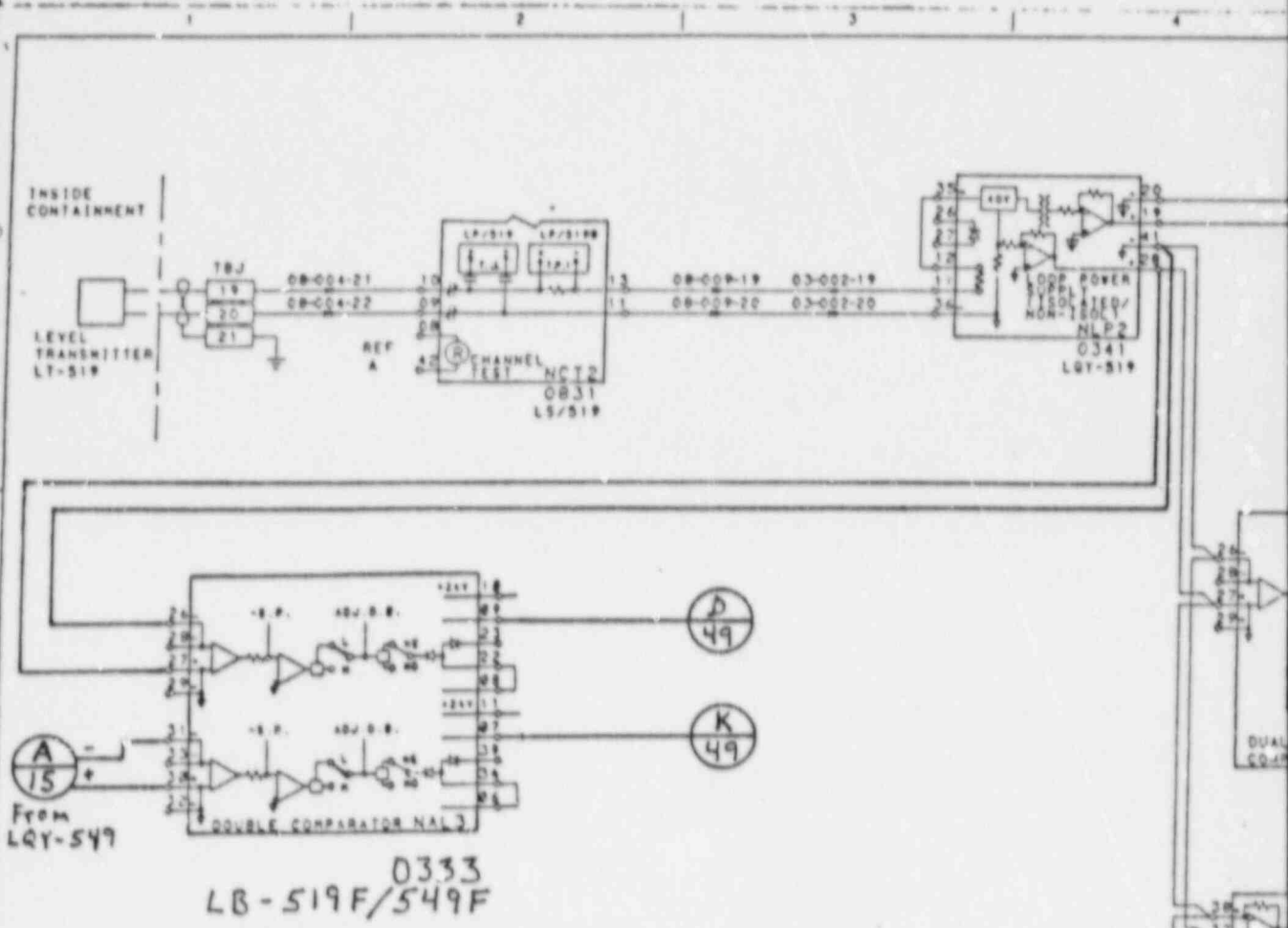
4 LOOP PLANT SYSTEM	FORM DWG 6799D, SH 17
SIM BEN LEVEL LOOP 2	PROTECTION II
CABINET 02	CARD FRAME 05
WESTINGHOUSE ELECTRIC CORPORATION	
TITLE INTERCONNECTING WIRING DIAGRAM CAB SET 02	
ENGRD SYS NUCLEAR POWER PLANT CONTROLS	
8EC9050	8809052
INDUSTRY & SYSTEMS DIVISION	

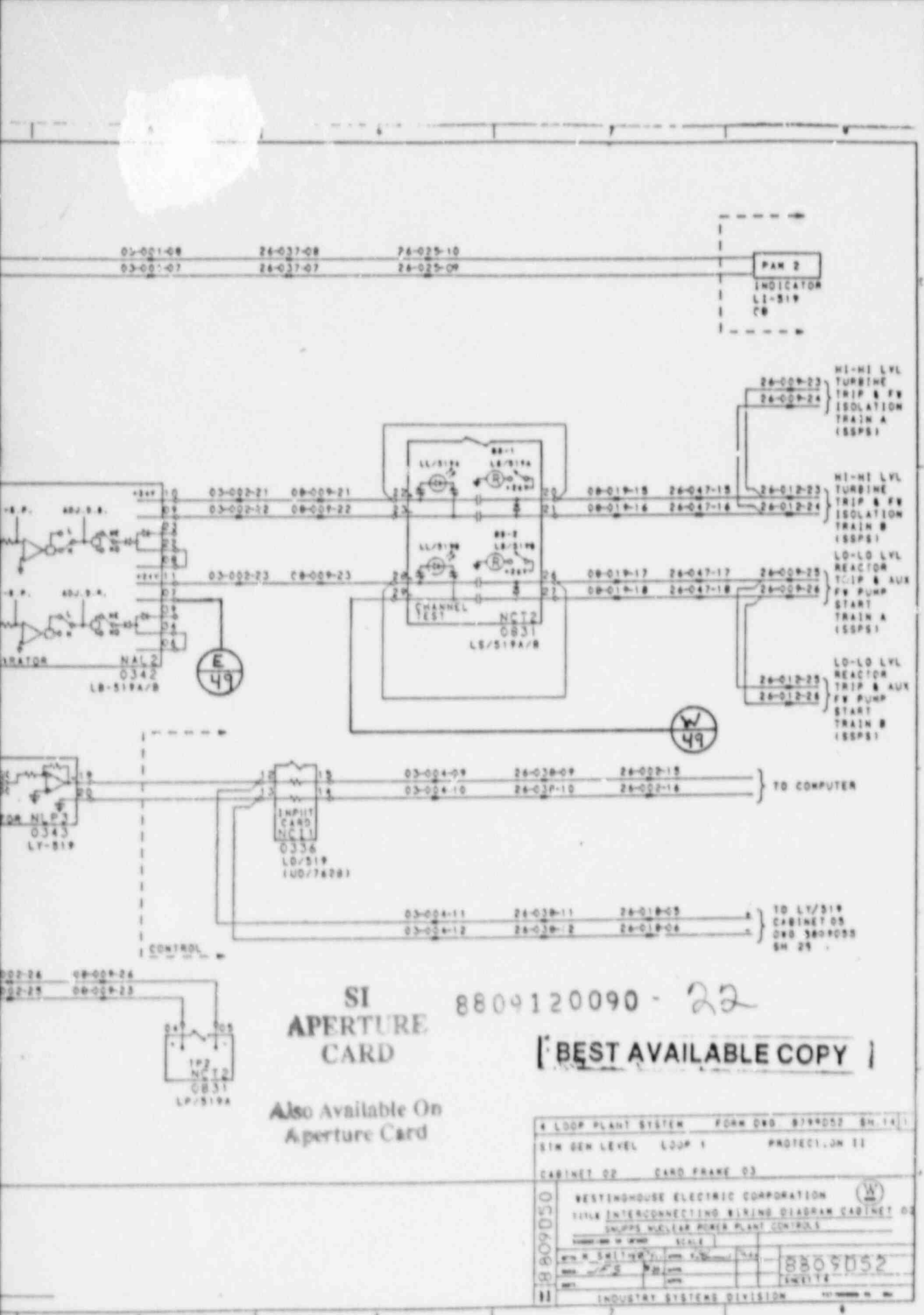

INSIDE CONTAINMENT
LEVEL TRANSMITTER LT-549
10J
22
23
24
09-002-23
09-002-24
REF A
LP/549
LP/549B
CHANNEL TEST
NCT2
0832
LS/549
09-002-27
09-002-28
03-002-27
03-002-28
LOOP POWER ISOLATED/ NON-ISOLATED
NLP2
0344
LQY-549
DUAL COMPARATOR
ISOLATOR NLP
034
LT-5
03-002-30
03-002-29



4 LOOP PLANT SYSTEM	FORM DWG. 8799052 SH. 15 1
STM GEN LEVEL LOOP 4	PROTECTION II
CABINET 02	CARD FRAME 03
WESTINGHOUSE ELECTRIC CORPORATION	
TITLE INTERCONNECTING WIRING DIAGRAM CABINET 0	
SNUPPS NUCLEAR POWER PLANT CONTROLS	
8809050	8809052
INDUSTRY SYSTEMS DIVISION	

A B C D


INSIDE CONTAINMENT
LEVEL TRANSMITTER LT-519
TBJ
19
20
21
08-004-21
08-004-22
REF A
CHANNEL TEST
NCT2
0831
LS/519
08-009-19
08-009-20
03-002-19
03-002-20
LOOP POWER SUPPLY ISOLATED/ NON-ISOLATED NLP2
0341
LQY-519
A 15
From LQY-549
DOUBLE COMPARATOR NAL2
P 49
K 49
0333
LB-519F/549F



4 LOOP PLANT SYSTEM FORM DRD 8799052 SH. 14

SIM GEN LEVEL LOOP 1 PROTECTION II

CABINET 02 CARD FRAME 03

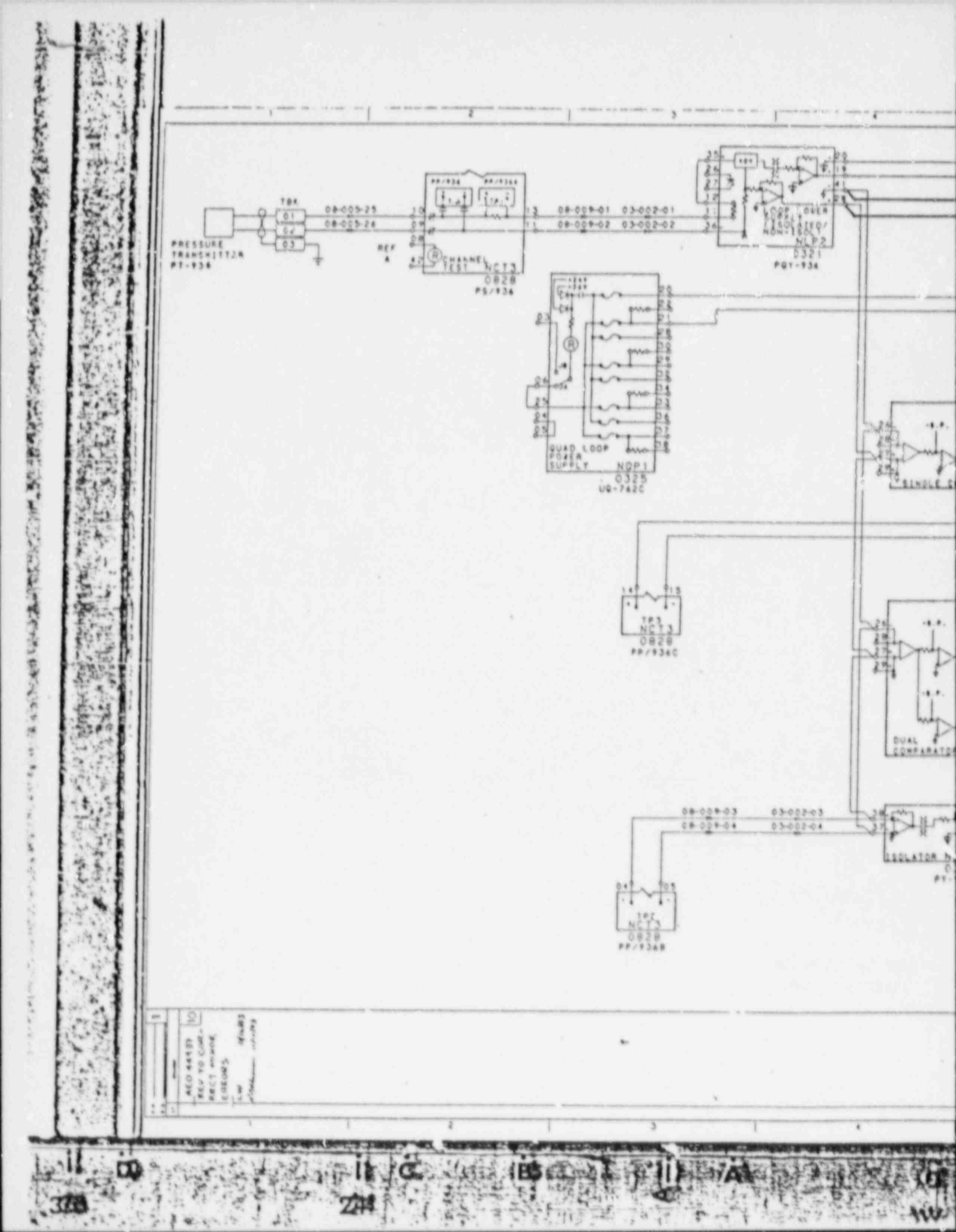
WESTINGHOUSE ELECTRIC CORPORATION

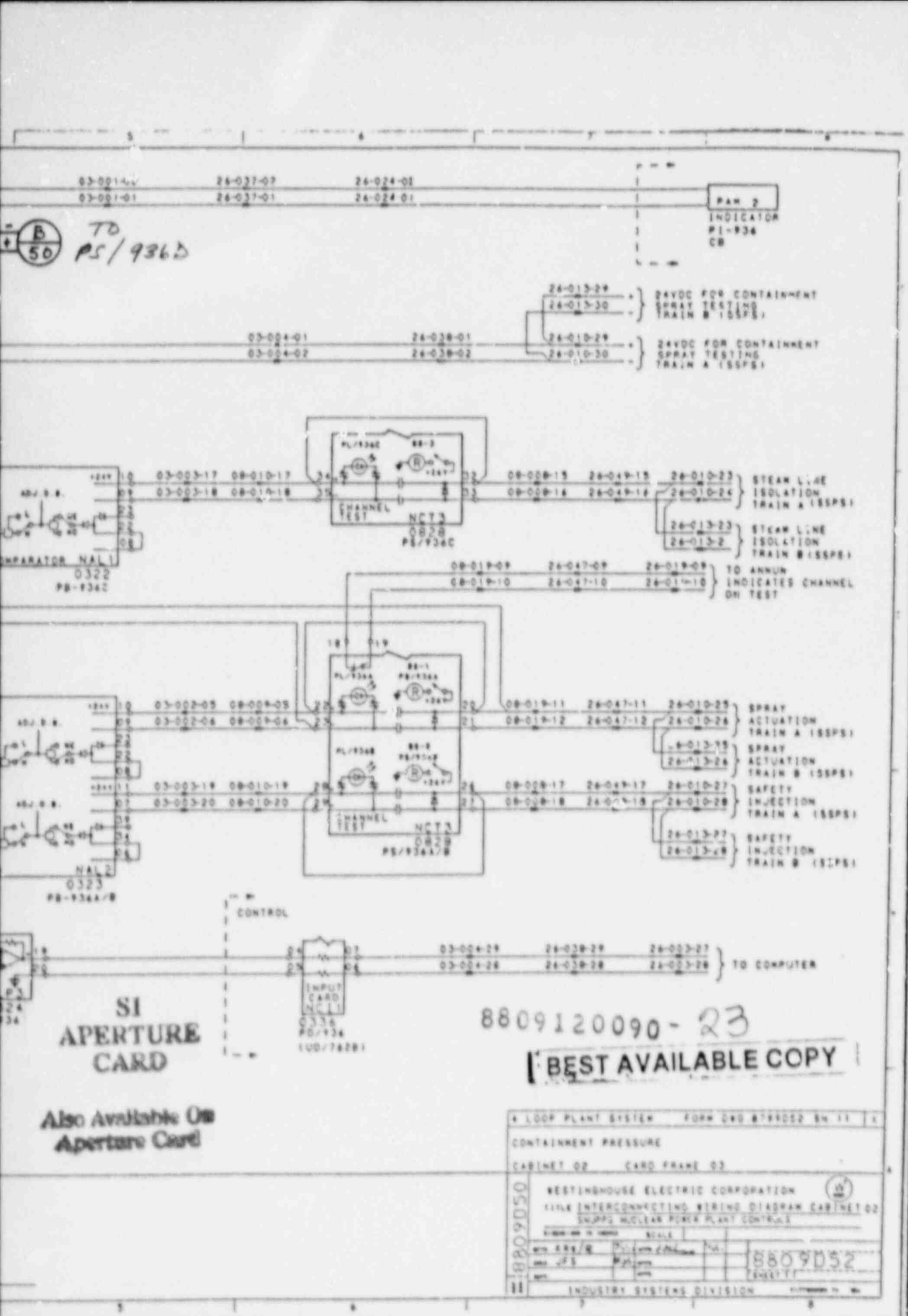
TITLE INTERCONNECTING WIRING DIAGRAM CABINET 02

SHIPPS NUCLEAR POWER PLANT CONTROLS

8809052

INDUSTRY SYSTEMS DIVISION


PRESSURE TRANSMITTER PT-936
TBX
08-005-25
08-005-26
REF A
CHANNEL TEST
PS/936
08-009-01
03-002-01
08-009-02
03-002-02
LOOP POWER SUPPLY ISOLATED/ NON-ISOLATED NLP2 0321
PQ1-936
QUAD LOOP POWER SUPPLY NQP1 0325
UQ-762C
TP3 NCT3 0828
PP/936C
08-009-03
03-002-03
08-009-04
03-002-04
TP5 NCT3 0828
PP/936B
DUAL COMPARATOR
ISOLATOR



4 LOOP PLANT SYSTEM FORM CMD 87-99052 SH 11

CONTAINMENT PRESSURE

CABINET 02 CARD FRAME 03

WESTINGHOUSE ELECTRIC CORPORATION

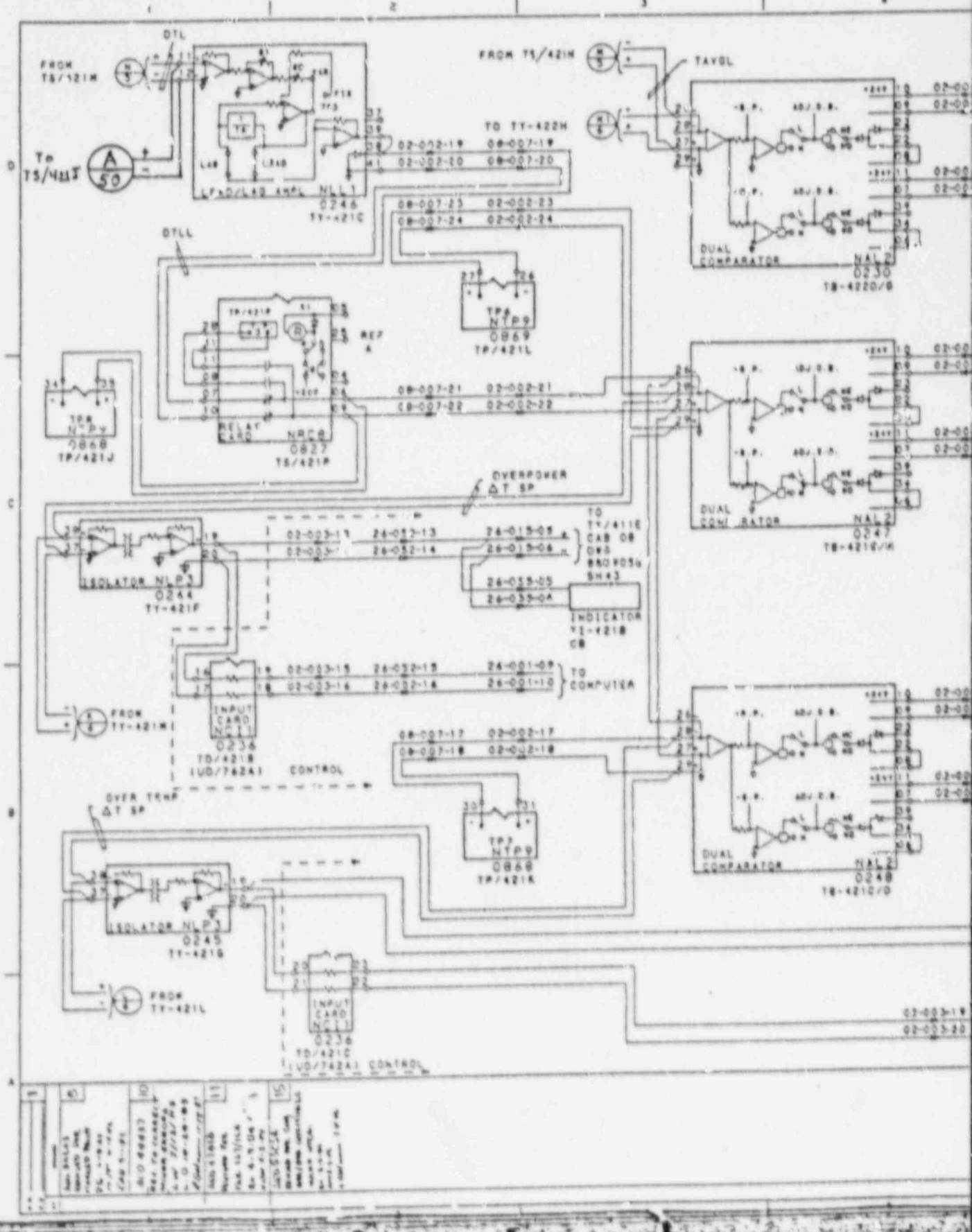
TITLE INTERCONNECTING WIRING DIAGRAM CABINET 02

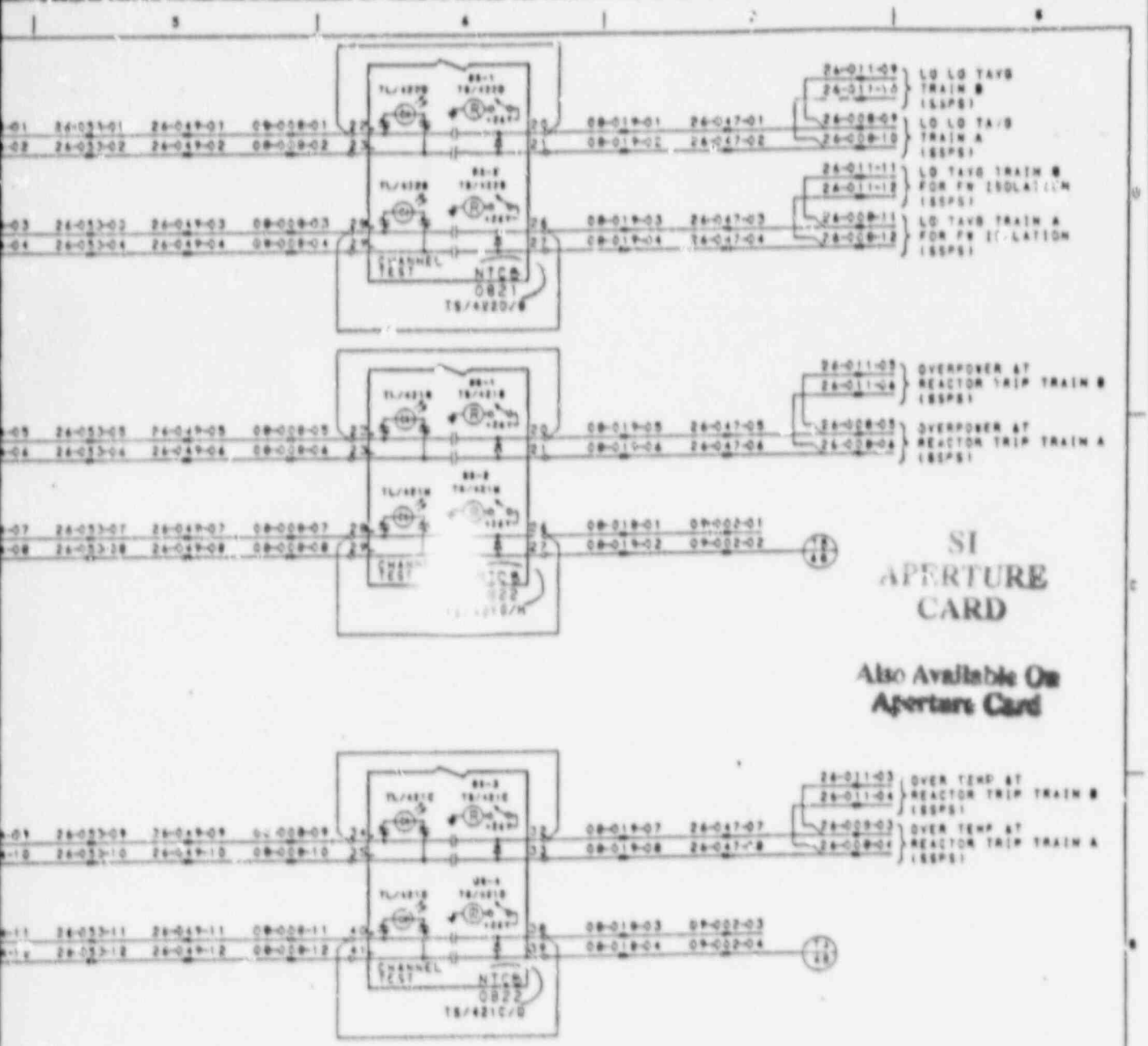
SHIPPG NUCLEAR POWER PLANT CONTROLS

SCALE

8809052

INDUSTRY SYSTEMS DIVISION


DTL
FROM TS/121H
TO TS/411J
LEAD/LAG AMPL NLL1 0246 TY-421C
TO TY-422H
FROM TS/421H
TAVGL
DUAL COMPARATOR NAL2 0230 TB-4220/B
DTLL
TP6 NTP9 0869 TP/421L
RELAY CARD NRC8 0827 TS/421P
TP8 NTP9 0868 TP/421J
DUAL COMPARATOR NAL2 0247 TB-4216/K
OVERPOWER ΔT SP
ISOLATOR NLP3 0244 TY-421F
TO TY/411E CAB 08 ON 8809054 SH43
INDICATOR YI-421B CB
INPUT CARD NCI1 0236 TD/421B (UD/7624) CONTROL
TO COMPUTER
FROM TY-421K
DUAL COMPARATOR NAL2 0248 TB-421C/D
OVER TEMP ΔT SP
TP7 NTP9 0868 TP/421K
ISOLATOR NLP3 0245 TY-421G
FROM TY-421L
INPUT CARD NCI1 0236 TD/421C (UD/7624) CONTROL



SI APERTURE CARD

Also Available On Aperture Card

8809120090 - 24

BEST AVAILABLE COPY

4 LOOP PLANT SYSTEM FORM DWG 879 52 SH 7 1

ΔT/T AVG LOOP D PROTECTION II

CABINET 02 CARD FRAME 02

8809050

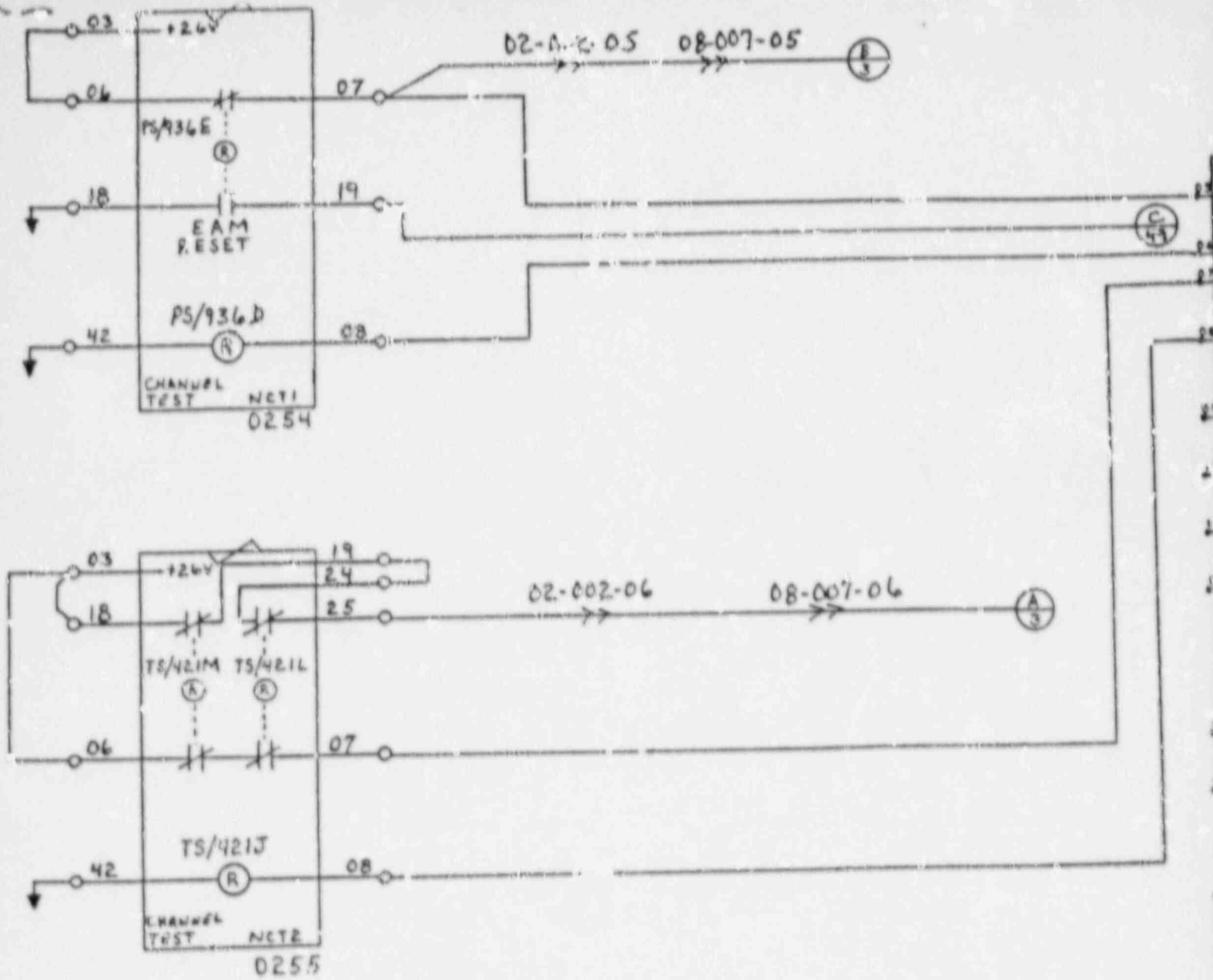
WESTINGHOUSE ELECTRIC CORPORATION

TITLE INTERCONNECTING WIRING DIAGRAM CABINET 02

SHIPPS NUCLEAR POWER PLANT SDN #564

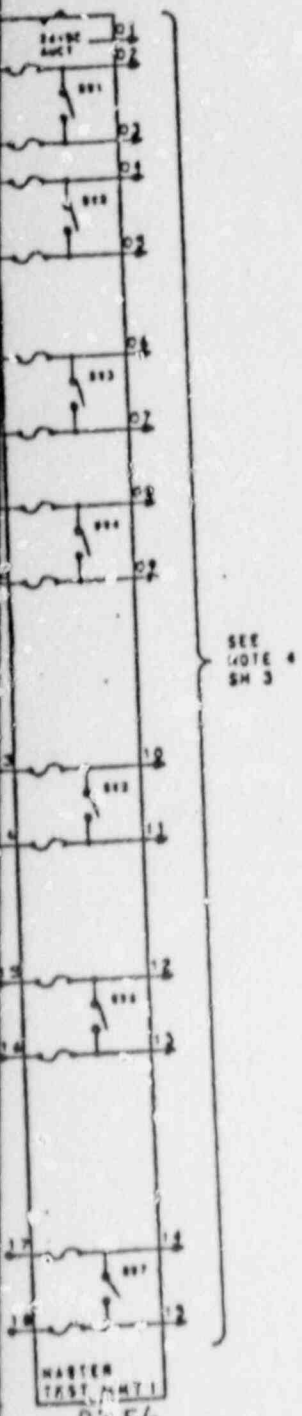
8809052

INDUSTRY SYSTEMS DIVISION


03
+24V
06
07
02-A-2-05
08-007-05
A/3
PS/936E
R
18
19
EAM
RESET
C/43
PS/936D
42
08
R
CHANNEL
TEST
NCT1
0254
03
+24V
19
24
18
25
02-002-06
08-007-06
A/3
TS/421M
TS/421L
R
R
06
07
TS/421J
42
08
R
CHANNEL
TEST
NCT2
0255

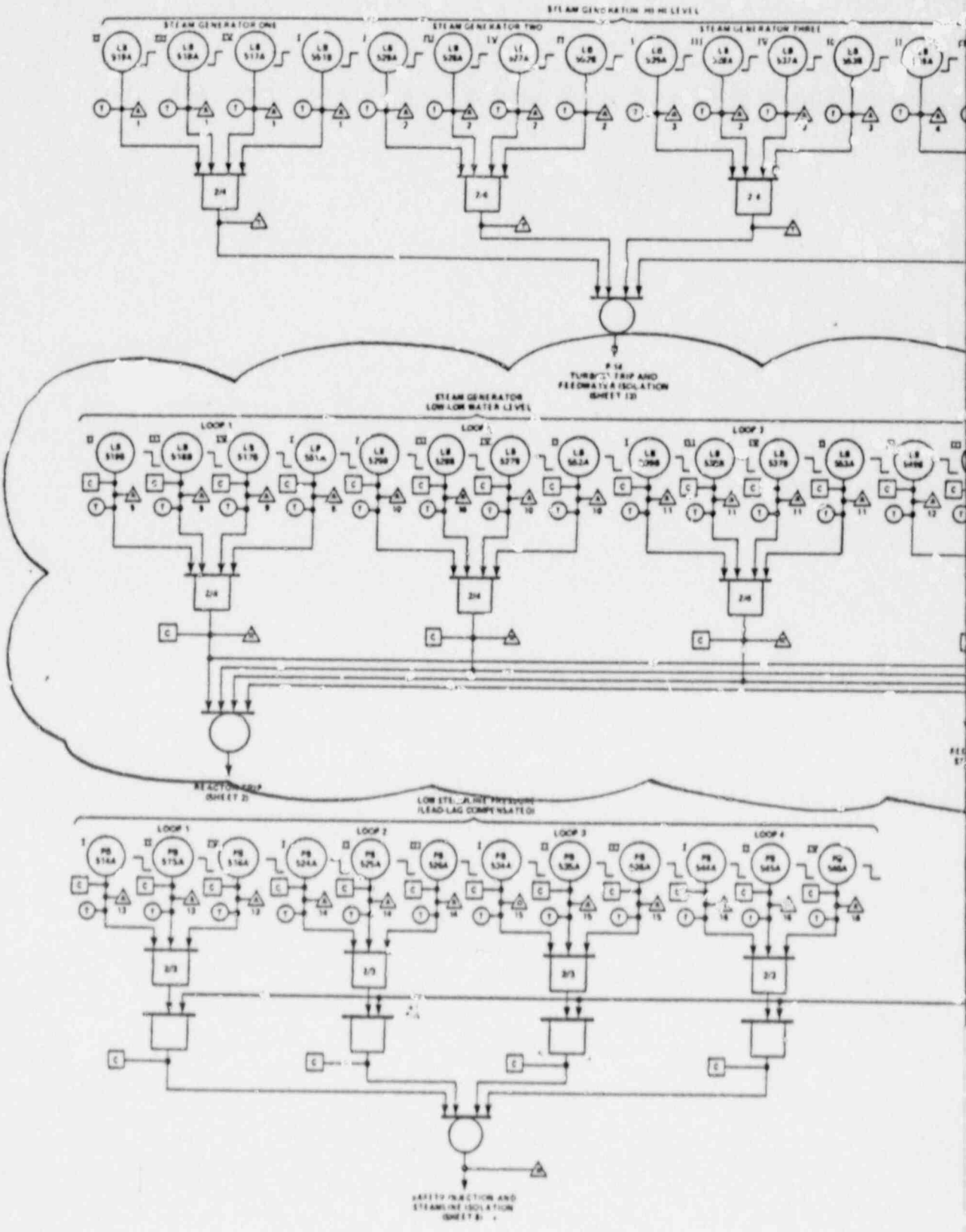
SI
APERTURE
CARD

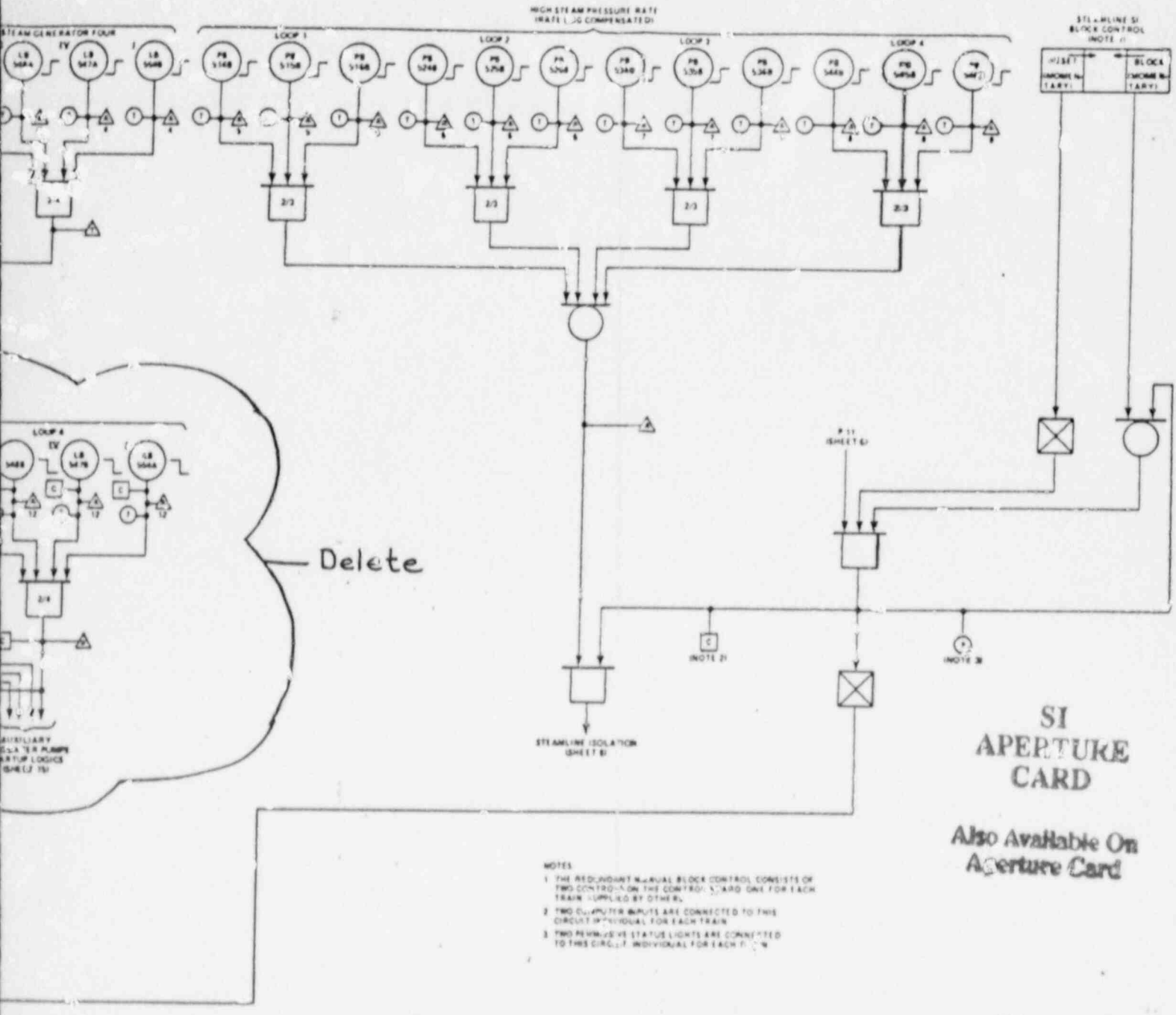
Also Available On
Aperture Card



8809120090 - 25

4 LOOP PLANT SYSTEM
CHANNEL TEST SWITCH LOGIC
PROTECTION II
POINT 02
CARD FRAME 02
WESTINGHOUSE ELECTRIC CORPORATION
TITLE INTERCONNECTING WIRING DIAGRAM CARD SET 02
8809052
INDUSTRY SYSTEMS DIVISION


STEAM GENERATOR ONE
STEAM GENERATOR TWO
STEAM GENERATOR THREE
2/4
2/4
2/4
P-14
TURBINE TRIP AND FEEDWATER ISOLATION
(SHEET 2)
STEAM GENERATOR LOW-LOW WATER LEVEL
LOOP 1
LOOP 2
LOOP 3
2/4
2/4
2/4
REACTOR TRIP
(SHEET 2)
LOW STEAMLINE PRESSURE
(LEAD-LAG COMPENSATED)
LOOP 1
LOOP 2
LOOP 3
LOOP 4
2/3
2/3
2/3
2/3
SAFETY INJECTION AND
STEAMLINE ISOLATION
(SHEET 2)



SI APERTURE CARD

Also Available On Aperture Card

NOTES

1. THE REDUNDANT MANUAL BLOCK CONTROL CONSISTS OF TWO CONTROL ON THE CONTROL BOARD ONE FOR EACH TRAIN SUPPLIED BY OTHERS.
2. TWO COMPUTER INPUTS ARE CONNECTED TO THIS CIRCUIT INDIVIDUAL FOR EACH TRAIN
3. TWO PERMISSIVE STATUS LIGHTS ARE CONNECTED TO THIS CIRCUIT INDIVIDUAL FOR EACH TRAIN

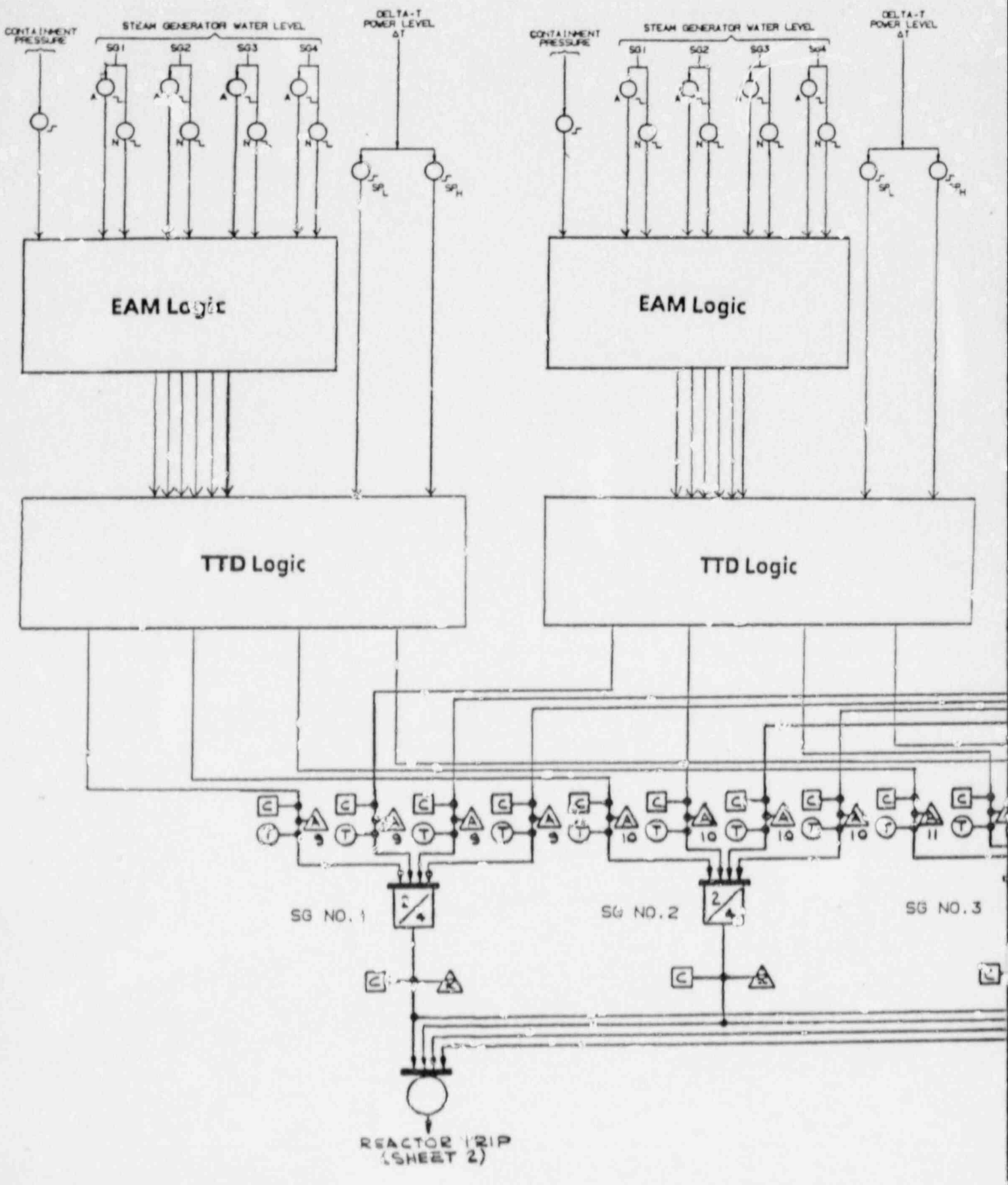
8809120090 - 26

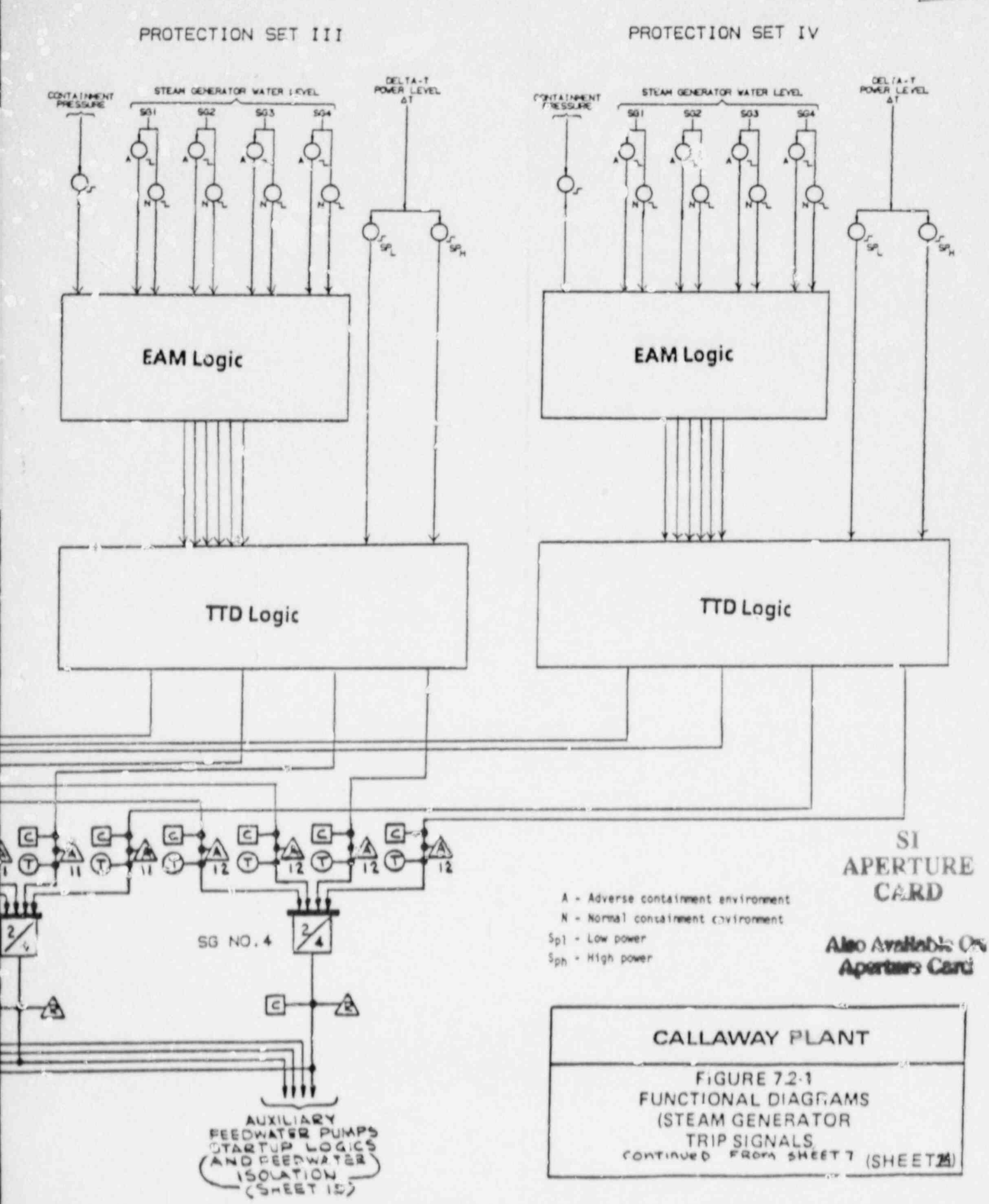
Rev. OL-0
6/86

CALLAWAY PLANT

FIGURE 7.2-1
FUNCTIONAL DIAGRAMS
(STEAM GENERATOR
TRIP SIGNALS,
Continued on SHEET 7A)
(SHEET 7)

Add


PROTECTION SET I
PROTECTION SET II
CONTAINMENT PRESSURE
STEAM GENERATOR WATER LEVEL
SG1
SG2
SG3
SG4
DELTA-T POWER LEVEL ΔT
EAM Logic
EAM Logic
TTD Logic
TTD Logic
SG NO. 1
SG NO. 2
SG NO. 3
REACTOR TRIP
(SHEET 2)



CALLAWAY PLANT

FIGURE 7.2-1
FUNCTIONAL DIAGRAMS
(STEAM GENERATOR
TRIP SIGNALS
CONTINUED FROM SHEET 7 (SHEET 2A)