45.5

Davis-Besse Nuclear Power Station SP 1105.02

Unit No. 1

System Procedure SP 1105.02

Reactor Protection System (RPS) and Nuclear Instrumentation (NI)
Operating Procedure

Record of Approval and Changes

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Recommended by Jack Lewis, SRB Chairman — 6/24/75 (Date)

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Approved by Jack Lewis, Station Superintendent — 6/24/75 (Date)

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2		5/17/77	NA			6/3/77
3		5/23/79	NA		TO Memo	5/20/79
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5	TO Memo	7/18/82	NA		TO Memo	7/30/82
6	TO Memo	10/11/83	NA		TO Memo	10/24/83
7	D. W. Breiden	9/5/84	NA		TO Memo	9/18/84

1. PURPOSE

The purpose of this procedure is to provide a procedure for operating the Reactor Protection System (RPS) and the Nuclear Instrumentation (NI). The following modes of operation are covered:

Mode	Section
Energization of a RPS Channel	4
De-Energization of a RPS Channel	5
Removal of the RPS from the Shutdown Bypass Mode (RCS Pressure >1820 PSIG)	6
RPS Operation During Normal Station Operation	7
Placing of the RPS into the Shutdown Bypass Mode (RCS Pressure <1820 PSIG)	8
RPS Operation During Abnormal Conditions	9

The Reactor Protection System (RPS) is that combination of protection channels and associated circuitry which forms the automatic system that protects the reactor by control rod trip. It includes the four protection channels, their associated instrument channel inputs, manual trip switches, and all rod drive control protective trip breaker activation relays or coils.

The RPS utilizes four (4) independent logic channels to provide trip signals to the Control Rod Drive Control (CRDC) System, specifically the AC breakers (C4603, C4606, C4612, C4806) and the SCR gate drive supplies (Motor Return Control Assembly Cabinet in the CRDC System). Attachment 1 is a simplified drawing of the four logic channels.

A separate sensor provides an input to each logic channel for each associated trip parameter. The monitor variables are:

1. Reactor Neutron Flux
2. Reactor Coolant System Flow
3. Reactor Coolant Outlet Temperature
4. Reactor Coolant System Pressure
5. Containment Vessel Pressure
6. Reactor Coolant Pump Motor Current

The reactor trip signals are derived directly and in combinations of these variables.

An out-of-limit condition, if sensed by each of the four (4) sensors, will cause all four (4) RPS channels to trip. Any two (2) out of four (4) channels tripped will interrupt power to the Control Rod Drive Mechanisms (CRDM) by opening the AC and SCR Gate Drive supply circuits. The AC breakers are in series with all CRDM power supplies. The SCR Gate Drives control the power to the Control Rod Drive motors.

Due to the importance of the RPS, it is important to include all operations and a list of all RPS tests in one procedure. For situations

other than the above six modes of operation, the following procedures are required. Note that the nuclear instrumentation and other input parameters are considered part of the Reactor Protection System.

1. IC 2002.01, NI Detector Receipt Inspection: provides a procedure for inspecting new (spare) NI detectors to insure they are acceptable for installation and were not damaged during shipment.

2. IC 2002.02, NI Detector Removal and Replacement: provides a procedure for removing and replacing a NI detector.

3. IC 2002.03, NI Detector Post Installation Test: provides a procedure to insure that a NI detector was not damaged during installaton; also checks the NI cables.

4. IC 2002.04, Source Range Detector High Voltage and Discriminator Level Setting: provides a procedure for setting the operating high voltage and discriminator level for both the initial setting of a new source range detector and any subsequent setting which may be required during the life of the detector.

5. IC 2002.05, Intermediate and Power Range Detector Voltage Setting: provides a procedure for setting the operating high voltage and compensating voltage of an intermediate range detector and the operating high voltage of a power range detector for both the initial setting and any subsequent settings which may be required the life of the detector.

(T.S. 4.3.1.1.1, 7 4.3.1.1.2) 6. ST 5030.01, RPS Daily Heat Balance Check: specifies how to perform the heat balance check of the RPS Power Ranges, once per twenty-four hours.

(T.S. 4.3.1.1.1, 7 4.3.1.1.2, 4.3.3.6) 7. ST 5030.02, RPS Monthly Test: specifies the test to be performed on each RPS channel once per thirty-one days.

(T.S. 4.3.1.1.1, 7 4.3.1.1.2, 4.3.1.1.3) 8. ST 5030.04, RCS Pressure to the RPS Refueling Period Calibration: checks the calibration of the RCS pressure inputs to the RPS once each eighteen months.

(T.S. 4.3.1.1.1, 7 4.3.1.1.2, 4.3.1.1.3) 9. ST 5030.05, RCS Flow to the RPS Refueling Period Calibration: checks the calibration of the RCS flow input to the RPS once each eighteen months.

(T.S. 4.3.1.1.1, 7 4.3.1.1.2, 4.3.1.1.3, 4.3.3.6) 10. ST 5030.06, RCS Temperature to the RPS Refueling Period Calibration: checks the calibration of the RCS temperature input to the RPS once each eighteen months.

(T.S. 4.3.1.1.1, 4.3.1.1.2) 11. ST 5030.07, Containment Pressure to RPS Refueling Calibration: checks the calibration of the containment pressure input to the RPS once each eighteen months and monthly.

(T.S. 4.3.1.1.1, 4.3.1.1.2 4.3.1.1.3) 12. ST 5030.09, RPS Response Time Test: checks the response time of the RPS logic circuits once each 18 months.

(T.S. 4.3.1.1.2) 13. ST 5030.10, RPS Monthly Imbalance Check: describes how to determine power range detector imbalance error with respect to the incore imbalance error.

(T.S.) 14. ST 5030.11, RPS Power Range Calibration: specifies how to calibrate the power range NI's.

(T.S. 4.3.1.1.2) 15. ST 5030.12, Reactor Trip Module Logic and CRD Trip Breaker Functional Test: checks the functional operation of the RPS trip logic and CRD trip breakers performed monthly.

(T.S. 4.3.1.1.1, 4.3.1.1.2) 16. ST 5030.13, Channel Functional Test of the Manual Reactor Trip: check the functional operation of the manual reactor trip pushbuttons.

(T.S. 4.3.1.1.3) 17. ST 5030.14, RPS Overall Response Time Calculation: describes how to calculate the overall response times of the various RPS channels.

(T.S. 4.3.1.1.2) 18. ST 5030.15, RPS Shutdown Bypass Hi Pressure Trip Monthly: specifies the test to be performed on this RPS function once each month while in SDBP.

(T.S. 4.3.1.1.1, 4.3.1.1.2) 19. ST 5030.16, RPS Monthly Test in Shutdown Bypass: specified the test to be performed on each RPS channel once each month when in Shutdown Bypass.

(T.S. 4.3.1.1.2) 20. ST 5030.17, Intermediate Range Prestartup Test: specifies the test to be performed on each intermediate range N.I. prior to startup.

(T.S. 4.4.1.1, 4.4.1.2.a, b, 4.4.1.2.2, 4.4.1.2.3, 4.4.1.2.1) 21. ST 5030.18, Check of RPS Flux/ΔFlux/Flow Bistable Setpoint: checks the bistable setpoint following an RC pump combination change.

(T.S. 4.3.1.1.2, 4.9.2.a, b,c) 22. ST 5091.01, Source Range Functional Test: specifies the test to be performed on each source range channel when shutdown.

(T.S. 4.3.1.1.1, 4.3.1.1.2) 23. ST 5099.01, Miscellaneous Instrumentation Shift Checks: describes the checks which must be performed on the RPS once each twelve hours.

2. PRECAUTIONS AND LIMITATIONS

2.1 The RPS contains two types of bistables: 1) those which provide a trip signal to the Reactor Trip Modules (Trip Bistables); 2) those which provide a signal which functions other than tripping the Reactor Trip Module. The following is a list of the above type bistables, their setpoints and their allowable values (where applicable).

(T.S. 2.2.1) 2.2.1 Trip Bistables

Functional Unit	Trip Setpoint	Allowable Values
1. Manual reactor trip	Not applicable.	Not applicable.
2. High flux	≤104.94% of RATED THERMAL POWER with four pumps operating.	≤104.94% of RATED THERMAL POWER with four pumps operating.
	≤78.85% of RATED THERMAL POWER with three pumps operating.	≤78.85% of RATED THERMAL POWER with three pumps operating.
3. RC high temperature	<618°F	<618°F
4. Flux - Δflux/flow	Trip setpoint not to exceed the limit line of Figure 2.2-1	Allowable values not to exceed the limit line of Figure 2.2-1.
5. RC low pressure	≥1983.8 psig	≥1983.8 psig ≥1983.8 psig
6. RC high pressure	≤2300 psig	≤2300.0 psig ≤2300.0 psig
7. RC pressure-temperature	≥(12.60 T_{out} °F-5662.2) psig	≥(12.60T_{out} °F-5662.2) psig
8. High flux/number of RC pumps on	≤55 1% of RATED THERMAL POWER with one pump operating in each loop	≤55.1% of RATED THERMAL POWER with one pump operating in each loop.
	≤0.0% of RATED THERMAL POWER with two pumps operating in one loop and no pumps operating in the other loop	≤0.0% of RATED THERMAL POWER with two pumps operating in one loop and no pump operating in the other loop.

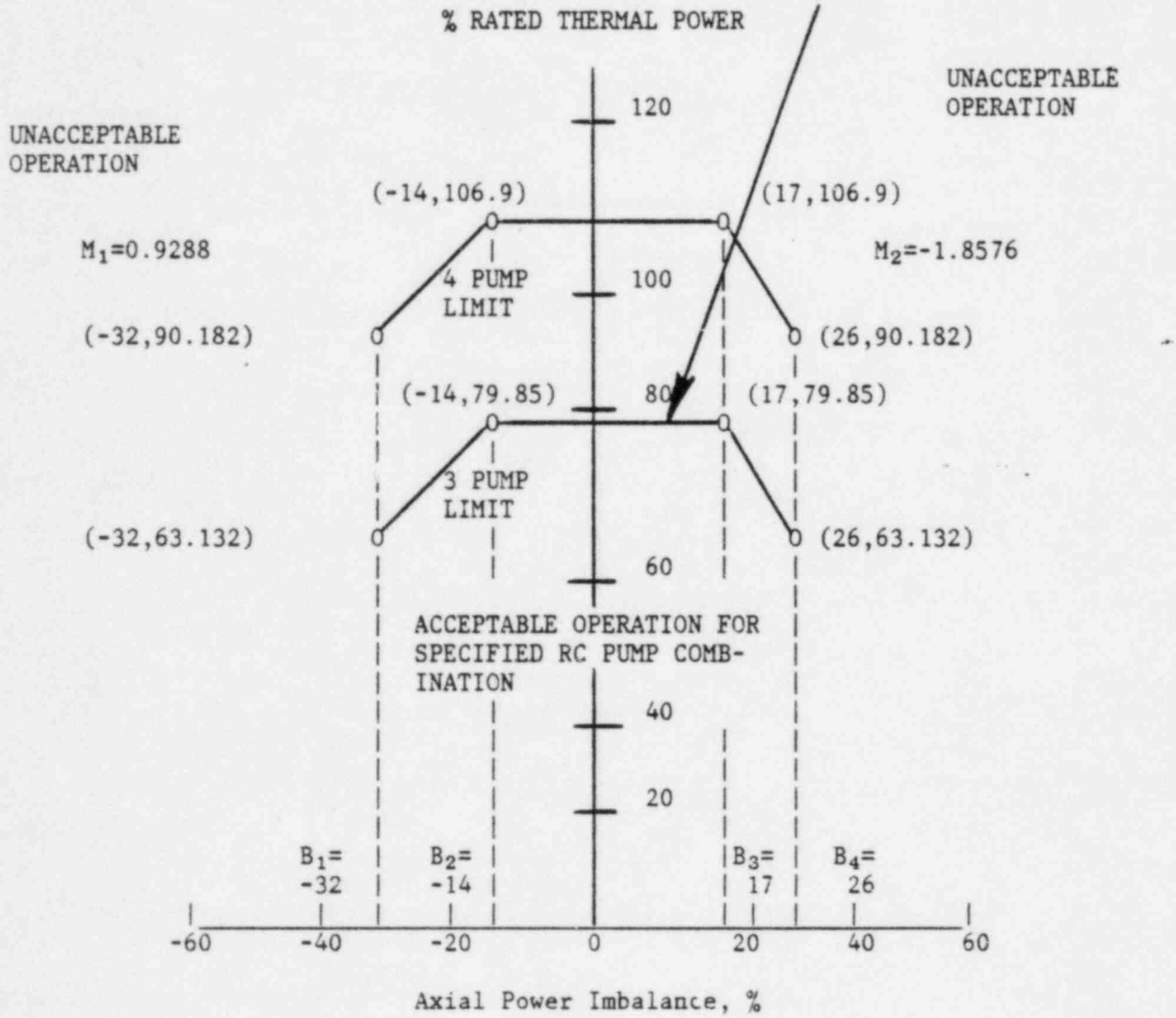
		≤0.0% of RATED THERMAL POWER with no pumps operating or only one pump operating	≤0.0% of RATED THERMAL POWER with no pumps operating or only one pump operating.
	9. Containment pressure high	≤4 psig	≤4 psig
5	10. Shutdown Bypass High Press Trip Bistable (This trip is applicable only when the Shutdown Bypass is in effect. During normal operation, the trip bistable will be tripped.)	≤1820 psig	I/A

2.1.1 Bistable providing protective functions other than tripping the Reactor Trip Module.

		Trip	Reset
1.	SUR Rod Withdrawal Inhibit NI-1 (NI-2) Bistable	2 DPM	1.0 DPM
2.	SUR Rod Withdrawal Inhibit NI-3 (NI-4) Bistable	3 DPM	1.0 DPM
3.	Source Range SUR BYPASS/ Highvoltage Cutoff from NI-3 (NI-4) Bistable During operation this bistable will be tripped.	10^{-9}amps	5 x 10^{-10}amps

Figure Trip Setpoint for Flux - ΔFlux/Flow
(Tech. Spec. Figure 2.2-1)

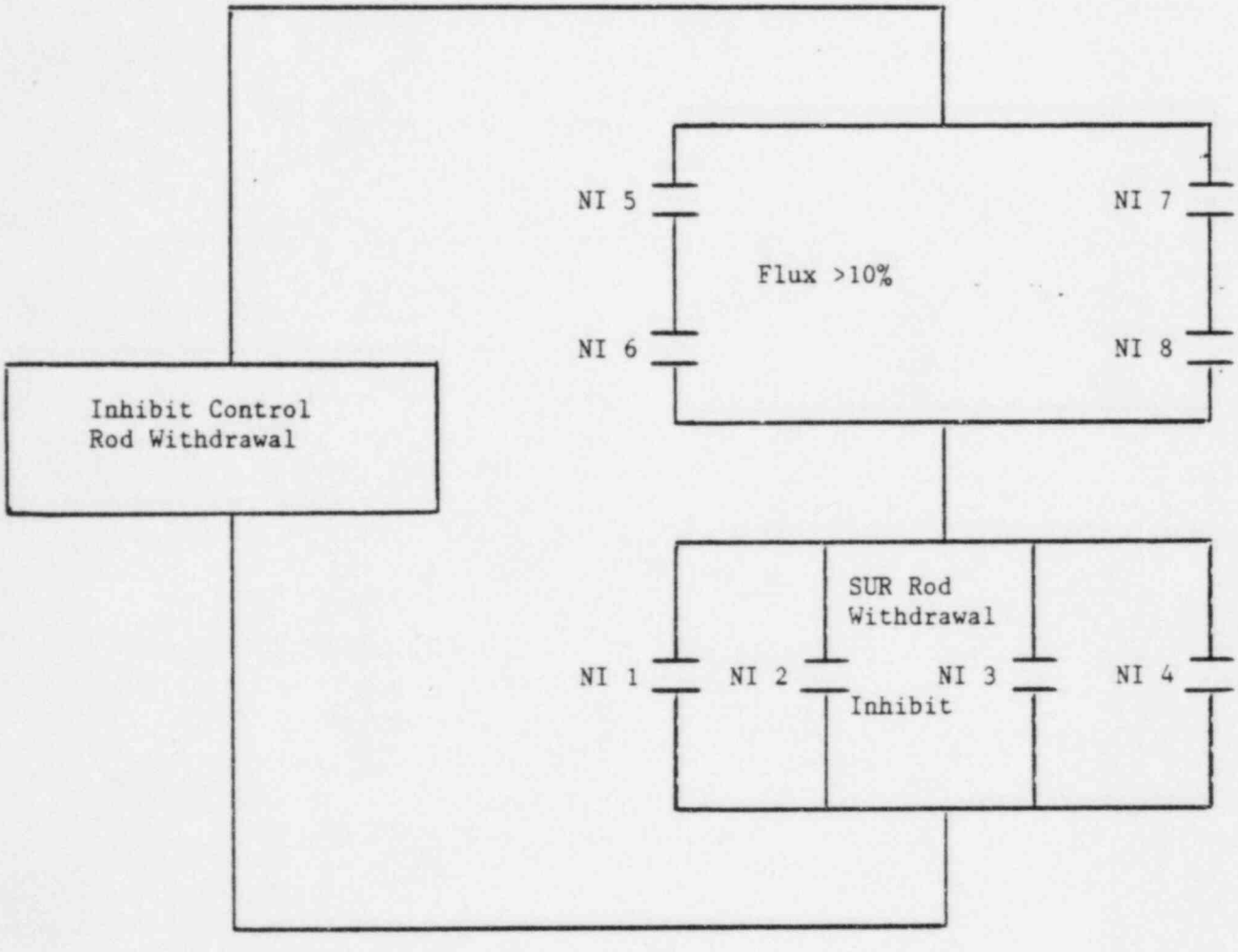
Curve shows trip setpoint for a 25% flow reduction for three pump operation (290,100 gpm). The actual setpoint will be directly proportional to the actual flow with three pumps



		Trip	Reset
4.	Flux >10% F.P. Bistable (Power Range) During normal operation this bistable will be tripped.	10% Rated	5% Rated

NOTE: The following drawings depict the operation of the above protective bistables.

This drawing depicts the control rod withdrawal inhibit and control rod withdrawal inhibit bypass functions of the nuclear instrumentation:



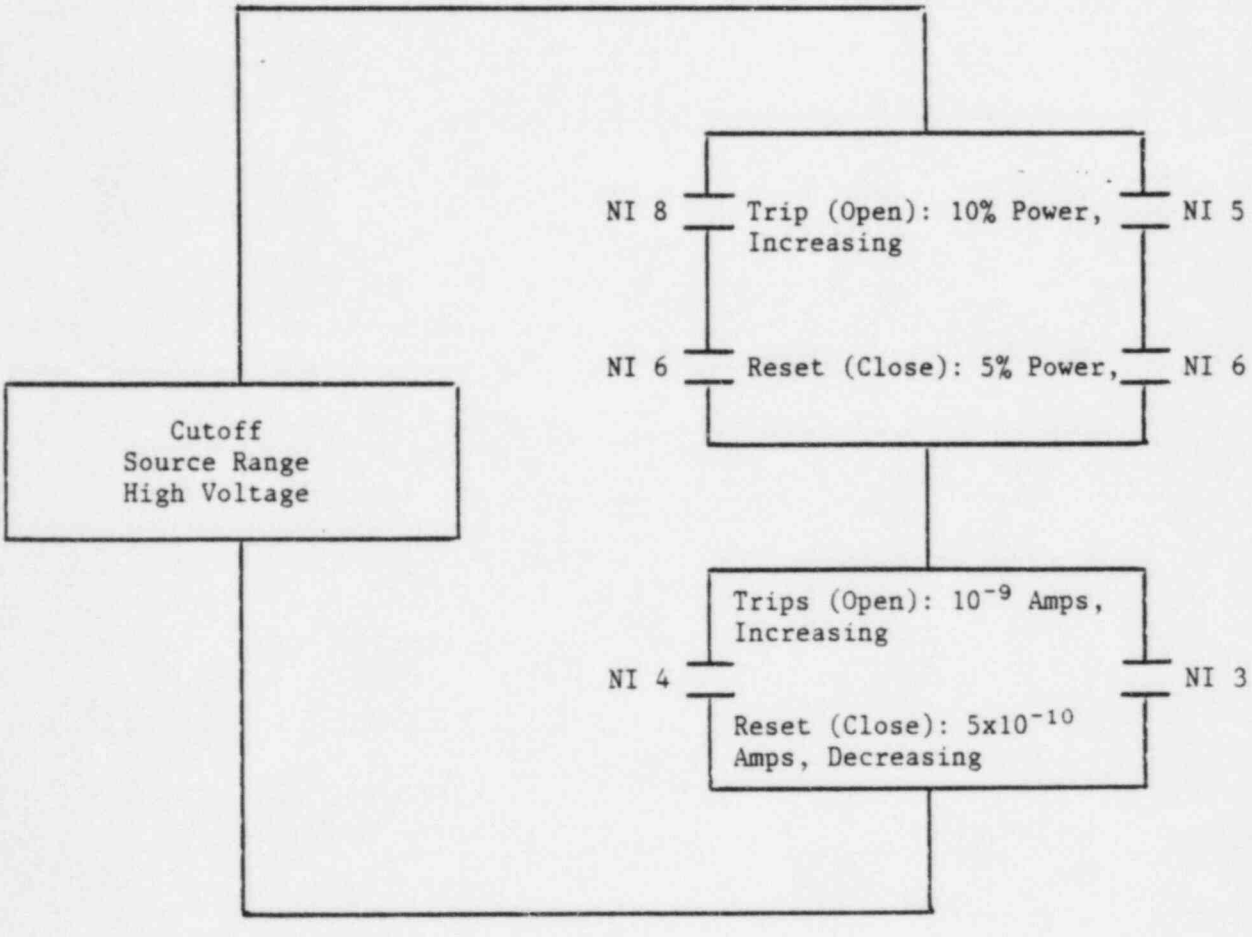
Flux 10% >Setpoint
NI 5, 6, 7, & 8: Trip (Open): 10% Power, Increasing
Reset (Close: 5% Power, Decreasing

SUR Rod Withdrawal Inhibit Setpoints
NI 1, 2: Trip (Close): 2 DPM, increasing
Reset (Open): 1 DPM, decreasing

NI 3, 4: Trip (Close): 3 DPM, increasing
Reset (Open): 1 DPM, decreasing

NOTE: In order to inhibit the withdrawal of control rods a closed path must be established.

This drawing depicts the Source Range High Voltage Cutoff function of the Intermediate Range and Power Range.



NOTE: In order to cutoff the high voltage to both Source Range Detectors (NI-1, NI-2), an open path must be established. Whenever a Source Range Detector (NI-1, NI-2) is energized the red "Nuclear Instr HV Pwr" indicating light on the ICS and Reactor Control Console in he control room for the respective detector (IL 3003, NI 1; IL 3302, NI 2) will be on.

2.2 All bistables have two lamps on their face: "Output Memory" and "Output State". The "Output State" lamp is bright when the bistable is in the tripped state. The "Output Memory" lamp is bright when the bistable is or has been in the tripped state. The following occurs when a bistable trips and must be reset.

2.2.1 Trip Bistable

1. When the input parameter reaches setpoint, the trip bistable trips. Both the "Output Memory" and "Output State" lamps go from dim to bright.

2. When the input parameter no longer exceeds the setpoint, the "Output Memory" and "Output State" lamps remain bright.

3. The trip bistable may now be reset by depressing the "Output State" reset toggle. The "Output State" lamp will go dim.

4. The "Output Memory" lamp is reset by depressing the "Output Memory" reset toggle. The "Output Memory" lamp will go dim.

2.2.2 Bistables providing protective functions other than tripping the Reactor Trip Module.

1. When the input parameter reaches setpoint, the bistable trips and both the "Output Memory" and "Output State" lamps go from dim to bright.

2. When the input parameter reaches the reset setpoint, the "Output State" lamp will go dim.

3. The "Output Memory" lamp is reset by depressing the "Output Memory" reset toggle. The "Output Memory" lamp will go dim.

3 2.3 Removal of any of the following RPS modules from a channel will initiate a channel trip.

A one (1) out of four (4) trip signal will be sent to the other three channels.

1. Power Range Test Module (PRTM)
2. Power Range Detector Power Supply Module
3. Top Chamber Linear Amp Module
4. Bottom Chamber Linear Amp Module
5. Total Flux Summing Amp Module
6. Delta Flux Scaled Difference Amp Module
7. Function Generator Module
8. Contact Monitor Module (CMM)
9. Contact Monitor Auxiliary Power Supply Module
10. Flow Loop A Square Root Extractor Module
11. Flow Loop B Square Root Extractor Module
12. Total Flow Buffer Amp Module
13. Temperature Signal Converter Module
14. Temperature Linear Bridge Module
15. Pressure Buffer Amp Module
16. High Pressure Trip Bistable
17. Low Pressure Trip Bistable
18. Shutdown Bypass High Pressure Trip Bistable
19. Pressure/Temperature Trip Bistable
20. Overpower Trip Bistable
21. Power/Imbalance/Flow Trip Bistable
22. Power/Pump Trip Bistable
23. High Temperature Trip Bistable
24. High Building Pressure Trip/Reset Contact Buffer Module
25. Shutdown Bypass Auxiliary Relay Module
26. Shutdown Bypass Key Switch Module

Removal of a Reactor Trip Module will trip the associated control rod drive trip mechanism and at the same time, a one (1) out of four (4) trip input is sent to the other three Reactor Trip Modules.

2.4 The sources of 120 V AC power for the RPS are the Essential 120V AC Instrumentation Distribution Panels (CH 1, Panel Y1; Ch 2, Panel Y2; Ch 3, Panel Y3; Ch 4, Panel Y4). Within the RPS cabinets, each RPS channel is powered by one +15V DC channel power supply. All bistables operate in a normally energized state and go to a deenergized state to initiate a trip action (fail-safe). Loss of power thus automatically forces the bistables into the tripped state. Failure of an essential bus or a channel power supply causes the affected channel to trip. This function cannot be bypassed.

2.5 A key-operated "Shutdown Bypass" is provided in each RPS channel to allow rod withdrawal testing with the unit in a shutdown condition. To initiate the bypass the operator must turn a key switch in the Shutdown Bypass Key Switch Module on each RPS

channel. The key switch is of the capture type such that once the switch is in the bypass position, the key cannot be removed. These keys will be under administrative control. The Shift Supervisor will have 4 of these keys, one for each channel. Turning the key switch removes the following trips from the RPS logic train:

2.5.1 Power/Imbalance/Flow Trip

2.5.2 Power/Pumps Trip

2.5.3 Pressure/Temperature Trip

2.5.4 Low Pressure Trip

The "Shutdown Bypass" key switch adds an additional trip, the
6 Shutdown Bypass High RCS Pressure trip (setpoint: <1820 PSIG).

2.6 The "On Test" lamps on the RPS test modules should be dim when the Test Selector Switches are in the "Operate" position. In all other positions, the "On Test" lamp should be bright.

2.7 General lamp indications are dim for normal; bright for abnormal or tripped.

2.8 RPS locations of all modules are given as follows: loc. cabinet number, row number, module number.

For example: Channel 1 (loc 2-3-4) i.e., the location is in RPS; Channel 1, cabinet 2, row 3, position 4.

2.9 For on-line testing and on-line maintenance of the RPS, the key operated "Manual Bypass" switch on the Reactor Trip Module associated with the channel being tested, should be used to modify the respective logic to a two (2) out of three (3) mode. An electronic interlock prevents any other channel from being placed in the bypass position, once one of the four channels is bypassed. The keyswitch is of the capture type such that once the switch is in the bypass position, the key cannot be removed. The "Manual Bypass" key is under administrative control. The Shift Supervisor will have only one of these keys.

2.10 Various references refer to the RPS being divided into either channels or subassemblies. Therefore, the following is a method for cross referencing the terms and the color coding of the RPS.

Subassembly	Channel	Color Code	Cabinet Numbers
B	1	Green	C5762 E & F
A	2	Orange	C5755 E & F
D	3	Blue	C5763 E & F
C	4	Maroon	C5756 E & F

The RPS was manufactured by Bailey Meter Company and is referred to as the Bailey 880 System in their literature.

2.11 Each of the four (4) RPS channels is split into two (2) cabinets. Each channel has a 880 Indicating Panel above it. The indicating panel allows the operator to observe the state of the RPS channels without opening the cabinet doors. The following is a summary of the information available to the operator from each of the 880 Indicating Panels.

2.11.1 Left-Fan Failure Lamp: a bright lamp indicates that air flow through the left cabinet has been lost.

2.11.2 Right-Fan Failure Lamp: a bright lamp indicates that air flow through the right cabinet has been lost.

2.11.3 Protective Subsystem No. 1: bright lamp indicates that Channel 1 has tripped.

2.11.4 Protective Subsystem No. 2: bright lamp indicates that Channel 2 has tripped.

2.11.5 Protective Subsystem No. 3: bright lamp indicates that Channel 3 has tripped.

2.11.6 Protective Subsystem No. 4: bright lamp indicates that Channel 4 has tripped.

2.11.7 Manual Bypass: bright lamp indicates that channel is in the Shutdown Bypass condition or that the channel is in "Manual Bypass".

2.11.8 Breaker Trip: bright lamp indicates that the associated trip device for the channel has tripped.

2.12 The following is a list of annunciator alarms for the RPS:

2.12.1 RPS FAN FAILURE - This alarm is generated when air flow through any one (1) of the eight (8) RPS cabinets has been lost.

2.12.2 RPS PWR SUPPLY TRBL - This alarm is generated when one (1) of the eight (8) RPS DC System Power Supply Modules is tripped or de-energized.

2.12.3 RPS RCP DC MNTR VOLT LO - This alarm is generated when one (1) of the four (4) RPS Contact Monitor Auxiliary Power Supply Modules is tripped or de-energized.

2.12.4 RPS SUR ROD WITHDRAWAL INHIBIT - This alarm is generated

when control rod withdrawal is inhibited by either the Source Range or Intermediate Range Nuclear Instrumentation.

2.12.5 RPS, SFAS, or SFRCS CABINET DOOR OPEN - This alarm is generated when at least one of the thirty-six (36) doors in the RPS, SFAS and SFRCS cabinets is open.

2.12.6 RPS SHUTDOWN BYPASS INITIATED - Indicates that the RPS Shutdown Bypass Keyswitch in at least one (1) of the four (4) RPS channels has been placed in the "Bypass" position.

2.12.7 RPS SHUTDOWN BYPASS HI PRESS TRIP - This alarm is generated when any one (1) of the four (4) RPS Shutdown Bypass High Pressure Bistables trip, and the channel is in Shutdown Bypass. 4

2.12.8 RPS RC HI PRESS TRIP - This alarm is generated when any one (1) of the four (4) RPS High Pressure Trip Bistables Trip.

2.12.9 RPS RC HI TEMP TRIP - This alarm is generated when any one (1) of the four (4) RPS High Temperature Trip Bistables trip.

2.12.10 RPS HI FLUX/NO RCP ON TRIP - This alarm is generated when any one (1) of the four (4) RPS Power/Pumps Trip Bistables trip.

2.12.11 RPS CTMT HI PRESS TRIP - This alarm is generated when any one (1) of the four (4) RPS High Building Pressure Trip Contact Buffers trip.

2.12.12 RPS RC LOW PRESS TRIP - This alarm is generated when any one (1) of the four (4) RPS Low Pressure Trip Bistables trip.

2.12.13 RPS RC PRESS - TEMP TRIP - This alarm is generated when any one (1) of the four (4) RPS Pressure/Temperature Trip Bistables trip.

2.12.14 RPS FLUX-DEFLUX-FLOW TRIP - This alarm is generated when any one (1) of the four (4) RPS Power/Imbalance/Flow Trip Bistables trip.

2.12.15 RPS HI FLUX TRIP - This alarm is generated when any one (1) of the four (4) RPS Overpower Trip Bistables trip.

2.12.16 RPS CH 1 BYPASS & 2/3 MODE - This alarm is the result of RPS Channel 1 "Manual Bypass" keyswitch on the RPS

Channel 1 Reactor Trip Module, RPS location 2-2-7, being placed in the "Bypass" position.

2.12.17 RPS CH 2 BYPASSED & 2/3 MODE - This alarm is the result of RPS Channel 2 "Manual Bypass" keyswitch on the RPS Channel 2 Reactor Trip Module, RPS location 2-2-7, being placed in the "Bypass" position.

2.12.18 RPS CH 3 BYPASS & 2/3 MODE - This alarm is the result of RPS Channel 3 "Manual Bypass" keyswitch on the RPS Channel 3 Reactor Trip Module, RPS location 2-2-7, being placed in the "Bypass" position.

2.12.19 RPS CH 4 BYPASS & 2/3 MODE - This alarm is the result of RPS Channel "Manual Bypass" keyswitch on the RPS Channel 4 Reactor Trip Module, RPS location 2-7-7, being placed in the "Bypass" position.

2.12.20 RPS CH 1 CH TRIP - The alarm is alarmed when the channel trip relay in the RPS Channel 1 Reactor Trip Module, RPS location 2-2-7, is de-energized.

2.12.21 RPS CH 2 CH TRIP - The alarm is alarmed when the channel trip relay in the RPS Channel 2 Reactor Trip Module, RPS location 2-2-7, is de-energized.

2.12.22 RPS CH 3 CH TRIP - The alarm is alarmed when the channel trip relay in the RPS Channel 3 Reactor Trip Module, RPS location 2-2-7, is de-energized.

2.12.23 RPS CH 4 CH TRIP - The alarm is alarmed when the channel trip relay in the RPS Channel 4 Reactor Trip Module, RPS location 2-2-7, is de-energized.

2.13 There are over one hundred (100) computer points associated with the RPS. The Davis-Besse Unit 1 Computer I/O List should be consulted for these points. Making use of these points will allow the operator to pinpoint the exact channel an annunciator alarm is coming from, without going into the RPS cabinets. For example, computer points P858, P864, P868 and P873 together will indicate which RPS channel(s) cause the RPS RC HI PRESS TRIP annunciator alarm.

2.14 The following is a summary of Control Room indications which are outputs from the RPS:

Instrument	Description	RPS CH	Range	Location
TI-RC3A2 RC	Loop 2 Hlg NR Temp	4	520-620°F	C5705
TI-RC3B4 RC	Loop 1 Hlg NR Temp	3	520-620°F	C5705
PRS-RC2A2	RC Loop 2 Hlg Press	2	1700-2500 psig	C5705
PRS-RC2B RC	Loop 1 Hlg Press	1	1700-2500 psig	C5705
NI-NI1	Source Range Log Count Rate	2	$0.1\text{-}1.0X10^{6}$ CPS	C5706
NYI-NI1	Source Range Startup Rate	2	-0.5-+5.0 DPM	C5706
NR NI1, 3	Source, Intermediate Range Log N Recorder	2,4	$0.1\text{-}10X10^{6}$ CPS $10^{-11}\text{-}10^{-3}$ AMP	C5719
NRNI 2, 4	Source, Intermediate Range Log N Recorder	1,3	$0.1\text{-}10X10^{6}$ CPS $10^{-11}\text{-}10^{-3}$ AMP	C5719
NI-NI2	Source Range Log Count Rate	1	$0.1\text{-}1.0X10^{6}$ CPS	C5706
NYI-NI2	Source Range Startup Rate	1	-0.5-+5.0 DPM	C5706
NI-NI3	Intermediate Range Log N	4	$10^{-11}\text{-}10^{-3}$ AMP	C5707
NYI-NI3	Intermediate Range Startup Rate	4	-0.5-+5.0 DPM	C5707
NR-NI3-1	Intermediate Range Log N Recorder	4	$10^{-11}\text{-}10^{-3}$ AMP	C5707
NI-NI4	Intermediate Range Log N	3	$10^{-11}\text{-}10^{-3}$ AMP	C5707
NYI-NI4	Intermediate Range Rate	3	-0.5-+5.0 DPM	C5707
NI-NI5	Power Range Flux	2	0-125%	C5707
NDI-NI5	Power Range Flux	2	-62.5%-+ 62.5%	C5707
NR-NI6	Power Range Auctioneered Flux Rcdr.		0-125%	C5707
NI-NI6	Power Range Flux	1	0-125%	C5707
NDI-NI6	Power Range Flux	1	-62.5%-+ 62.5%	C5707
NI-NI7	Power Range Flux	4	0-125%	C5707
NDI-NI7	Power Range Flux	4	-62.5%-+ 62.5%	C5707
NI-NI8	Power Range Flux	3	0-125%	C5707
NDI-NI8	Power Range Flux	3	-62.5%-+ 62.5%	C5707

2.15 The following is a summary of the Auxiliary Shutdown Panel indications which are outputs from the RPS:

Instrument	Description	RPS CH	Range
TI-RC3B2	RC Loop 1 Hlg NR Temp	1	520-620°F
TI-RC3A4	RC Loop 2 Hlg NR Temp	2	520-620°F

2.16 The RPS has outputs from its RCS flow and RCS pressure strings to the Non-Nuclear Instrumentation (NNI) and the Station Computer. The following is a list of the inputs to the RPS which may be manually selected to go to the NNI or the Station Computer.

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2.16.1 RCS pressure inputs to the NNI-RCS pressure transmitter PT-RC 2B2 or PT-RC 2A2 may be manually selected to go to the NNI. This signal is the control signal for the pressurizer heaters and pressurizer power relief valve (RC2A).

2.16.2 RCS flow inputs to the NNI-RCS flow transmitter FT-RC1A1 and FT-RC1B1 (Subassembly A) or FT-RC1A2 and FT-RC1B2 (Subassembly B) may be manually selected to go to the NNI. This RCS flow is temperature compensated in the NNI and is used as an input to the Integrated Control System (ICS).

2.16.3 RCS flow inputs to the Station Computer - RCS flow transmitters FT-RC1A1 and FT-RC1B1 (Subassembly A) or FT-RC1A2 and FT-RC1B2 (Subassembly B) may be manually selected to go to the Station Computer. This RCS flow is used for calculating and display purposes in the computer.

2.16.4 The hard-wire connections for the RCS pressure and RCS flow signals are located in RPS Channel 2.

2.17 The following is a summary of the Out-of-Core Nuclear Instrumentation Detectors:

2.17.1 The Source Range Detectors (NI-1, NI-2) are Westinghouse Model WL-2382A proportional counters filled with Boron Trifluoride (BF_3) gas. Source Range Detector NI-1 is the input to RPS Channel 2. Source Range Detector NI-2 is the input to RPS Channel 1.

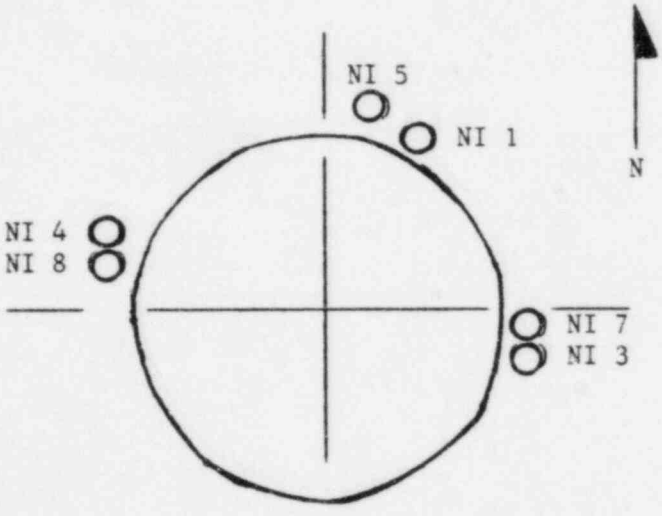
2.17.2 The Intermediate Range Detectors (NI-3, NI-4) are Westinghouse Model WL-23635A compensated ionization chambers lined with B^{10} and filled with nitrogen gas. Intermediate Range Detector NI-3 is the input to RPS

Channel 4. Intermediate Range Detector NI-4 is the input to RPS Channel 3.

2.17.3 The Power Range Detectors (NI-5, NI-6, NI-7, NI-8) are Westinghouse Model W1-23636A uncompensated ionization chambers lined with B^{10} and filled with nitrogen gas. The following table relates the power range detectors to their respective RPS channels.

Power Range Detector	RPS Channel
NI-5	2
NI-6	1
NI-7	4
NI-8	3

2.18 The drawing below depicts the physical layout of the out-of-core nuclear detectors.



3. REFERENCES

(TS) 3.1 Technical Specifications

3.1.1 Reactor Protection System Setpoints, 2.2.1

3.1.2 Reactor Protection System Instrumentation, 3/4.3.1

3.2 Station Setpoints, PP 1101.02

3.3.1 Plant Control and Protection System, Section 6

3.3.2 Reactor Protection System Trip Setting Values, Secton 6.1

3.4 Station Pre-Startup Check, PP 1102.01

3.5 Station Startup Procedure, PP 1102.02

3.6 Station Shutdown and Cooldown Procedure, SP 1102.10

3.7 Pressurizer Operating Procedure, SP 1103.05

3.8 Control Rod Drive System Operating Procedure, SP 1105.09

3.9 Instrumentation AC Switching Procedure, SP 1106.09

3.10 Procedures listed in Section 1 of this procedure.

3.11 250/125v DC and Instrumentation AC One Line Diagram, Bechtel Drawing E-7.

3.12 Station Annunciator Window Layout, Bechtel Drawing E-605B, Sheet 6.

3.13 Essential 120V AC Distribution Panel Schedules, Drawing E-641A.

3.14 Reactor Coolant System P&ID, Bechtel Drawing M-030.

3.15 Bailey Meter Company Drawings

3.15.1 Analog Logic Drawing, Nuclear Instrumentation System E8047534

3.15.2 880 Nuclear Instrumentation and Protection System Digital Logic, D8047535, 36, and 37

3.15.3 External Connection Diagrams, Nuclear Instrumentation and Protection System, D8047538, 39, 40, 41, 42, 43, 44 and 45 and 46

3.15.4 880 System Cabinet Layout, D8047547, 48, 49, 50, 51, 52, 53, and 54

3.15.5 Legend and Drawing Reference, Nuclear Instrumentation Reactor Protection System, D8047555

3.15.6 Schematic Diagrams, Reactor Protection System Channel 2 (Subassembly A), D80477556, 57, 58, 59, 60, 61, 62, 63, 64, and 65

3.15.7 Schematic Diagrams, Reactor Protection System Channel 1, (Subassembly B), D8047566, 67, 68, 69, 70, 71, 72, 73, 74, and 75

3.15.8 Schematic Daigrams, Reactor Protection System Channel 4, (Subassembly C), D8047576, 77, 78, 79, 80, 81, 82, 83, 84, and 85

3.15.9 Schematic Diagrams, Reactor Protection System, Channel 3 (Subassembly D), D8047586, 87, 88, 89, 90, 91, 92, 93, 94E, 95D, and 96D

3.15.10 Cabinet Door Open Logic, Nuclear Instrumentation Reactor Protection System, D8047597

3.15.11 Schematic Diagram, Selection Panel Outputs, C80475998

3.15.12 Schematic Diagram, Auctioneered Average Power, D8047599

3.15.13 NI Source and Intermediate Range Level Recorder Signal Characterization, D8034811

7| 3.16 Davis-Besse Unit 1 USAR, Section 7.2, Reactor Protection System (RPS).

3.17 Davis-Besse Computer I/O List.

3.18 RPS Technical Manual (Bailey Meter Company) - B&W Drawing No. 01-0214-02.

4. ENERGIZATION OF A RPS CHANNEL

4.1 Prerequisites

_____4.1.1 All Red - "DANGER - DO NOT OPERATE" - tags and yellow - "DO NOT OPERATE" - Information Tags have been removed from the RPS cabinets and cleared from the Tagging Log.

_____4.1.2 All out-of-core nuclear instrumentation flux monitors (NI-1 through NI-8) are in place, calibrated and connected to the proper RPS cabinet.

_____4.1.3 The Essential 120V AC Instrumentation Distribution Panel for the RPS channel being energized is energized per SP 1107.09, Instrumentation AC Switching Procedure.

_____1. Essential 120V AC Instrumentation Distribution Panel Y1 is the source 120V AC for RPS Channel 1.

_____2. Essential 120V AC Instrumentation Distribution Panel Y2 is the source of 120V AC for RPS Channel 2.

_____3. Essential 120V AC Instrumentation Distribution Panel Y3 is the source of 120V AC for RPS Channel 3.

_____4. Essential 120V AC Instrumentation Distribution Panel Y4 is the source of 120V AC for RPS Channel 4.

4 _____4.1.4 The Shift Supervisor has given his permission to energize the RPS channel.

4.2 Procedure

_____4.2.1 Close the switch corresponding to the RPS channel being energized.

4 NOTE: The channels may be energized and tested in any order as directed by the Shift Supervisor.

_____1. Channel 1: Y106 on Essential 120V AC Instrumentation Distribution Panel Y1.

_____2. Channel 2: Y206 on Essential 120V AC Instrumentation Distribution Panel Y2.

_____3. Channel 3: Y308 on Essential 120V AC Instrumentation Distribution Panel Y3.

_____4. Channel 4: Y408 on Essential 120V AC Instrumentation Distribution Panel Y4.

4 _____4.2.2 Obtain the door key from the Shift Supervisor for the RPS Channel being energized.

_____4.2.3 Perform the following for the RPS channel being energized:

_____1. Verify that the "AC Power Available" lamp on the Power Distribution Panel (Loc. 2-0) is lit.

_____2. Place the "System AC Power" breaker (loc 2-0) in the "On" position.

_____3. Verify that the "AC Power On" lamp (loc 2-0) is lit.

_____4. Place the left and right "System Fans" switches (loc 2-0) in the "On" position.

_____5. Verify that both the "On Left" and "On Right" lamps are lit.

_____6. Place the "+15 VDC Power Supply Breaker" (loc 1-1) and the "-15 VDC Power Supply Breaker" (loc 2-1) in the "On" position simultaneously.

_____7. Place the "System DC Power" breaker (loc 2-0) in the "on" position.

_____8. Verify that the "Right Fan Failure" and "Left an Failure" lamps are dim on the 880 Indicating Panel (mounted on top of the channel cabinet).

NOTE: The +15 VDC and -15 VDC power supply breakers must be in the "ON" position prior to turning the "System DC Power" breaker on. If not the "System DC Power" breaker will trip within one to five seconds.

_____9. Verify that the "AC Power" lamp is lit on both the +15V DC and -15V DC Power Supply module (loc 1-1 and loc 2-1).

_____10. Allow the +15V DC and -15V DC Power Supply Modules to warm up for fifteen (15) minutes.

_____11. On both the +15V DC and -15V DC System Power Supply Modules verify that the voltmeters are reading +15 ± 0.5V DC and 15 ± 0.5V DC respectively.

_____12. On both the +15V DC and -15V DC System Power Supply modules, verify that the amp meters are reading less than 13 amps.

_____4.2.4 Energize the power supplies to the Out-of-Core Nuclear Instrumentation Detectors by performing the following steps that are appropriate to the RPS channel being energized.

SOURCE RANGE DETECTORS: NI-1 (CH2), NI-2 (CH 1)

_____1. Place the "On-Off" switch in the "On" position at the Source Range Detector Power Supply Module (loc 1-2-13).

_____2. Hold the "Reset" switch in the "Reset" position at the Source Range Detector Power Supply Module until the "DC Volts" meter at the module comes on scale.

_____3. Perform ST 5091.01, Source Range Functional Test for the channel if presently in a mode requiring the Source Range to be OPERABLE.

NOTE: Delete Step 4.2.4.3 if only the power to the detector is turned off.

INTERMEDIATE RANGE DETECTORS: NI-3 (CH 4),
NI-4 (CH 3)

____4. Place the "On-Off" switch in the "On" position at the Intermediate Range Detector Power Supply Module (loc 1-3-13).

____5. Hold the "Reset" switch in the "Reset" position at the intermediate Range Detector Power Supply Module until the "DC Volts" meter at the comes on scale.

____6. Place the "On-Off" switch in the "On" position at the Intermediate Range Detector Compensating Power Supply Module (loc 1-2-13).

____7. Hold the "Reset" switch in the "Reset" position at the Intermediate Range Detector Compensating Power Supply Module until the "DC Volts" meter at the module comes on scale.

4 ____8. Perform the sections of ST 5030.17, Intermediate Range Functional Test pertaining to the Intermediate Range if presently in a mode requiring the Intermediate Range to be OPERABLE.

NOTE: Delete step 4.2.4.8 if only the power to the detector is turned off.

POWER RANGE DETECTORS: NI-5 (CH 2), NI-6 (CH 1), NI-7 (CH 4), NI-8 (CH 3)

____9. Place the "On-Off" switch in the "On" position at the Power Range Detector Power Supply Module (Ch 1, 2: loc 1-6-13; Ch 3, 4: loc 1-7-13).

____10. Hold the "Reset" switch in the "Reset" position at the Power Range Detector Power Supply Module until the "DC Volts" meter at the module comes on scale.

____11. Perform the sections of ST 5030.02, RPS Monthly Test pertaining to the Power Range if presently in a mode requiring the Power Range to be OPERABLE.

NOTE: Delete step 4.2.4.11 if only the power to the detector is turned off.

____4.2.5 Energize the power supply to the Contact Monitor Module (Ch 1, 2: loc 1-3-4; CH 3, 4: loc 1-4-4) by performing the following steps:

____1. Place the "On-Off" switch in the "On" position at the Contact Monitor Auxiliary Power Supply Module (Ch 1, 2: loc 1-3-13; Ch 3, 4: loc 1-4-13).

____2. Hold the "Reset" switch in the "Reset" position at the Contact Monitor Auxiliary Power Supply Module until the "DC Volts" meter at the module indicates 125 ± 6 VDC.

____4.2.6 Allow the RPS channel to warm up for at least thirty (30) minutes.

____4.2.7 Verify that the following switches are in the designated position and the lamps are as shown:

Switch Name	Location	Position	Lamps
Source Range Test Module (SRTM) Test Selector Switch	1-2-1 (CH1, 2 only)	"Operate"	"On-Test" -Dim
Intermediate Range Test Module (IRTM) Test Selector Switch	1-3-1 (Ch3, 4 only)	"Operate"	"On-Test" -Dim
Contact Monitor Test Module (CMTM) Test Selector Switch	Ch1, 2: 1-3-1 Ch3, 4: 1-4-1	"Operate"	"On Test" -Dim
Simulated Contact Switches (4)	Ch1, 2: 1-3-1 Ch3, 4: 1-4-1	"Off"	N/A
Flow Channel Test Module (FCTM) Test Selector Switch	Ch1, 2: 1-4-1 Ch3, 4: 1-5-1	"Operate"	"On Test" -Dim
High Bldg. Press	Ch1, 2: 1-5-14	"Normal"	"Input State" Dim

Switch Name	Location	Position	Lamps
Trip/Reset Contact Buffer Module Test and Reset Toggle Switches	Ch3, 4:		
Power Range Test Module (PRTM) Test Selector Switch	Ch1, 2: 1-6-1 Ch3, 4: 1-7-1	"Operate"	"On Test" -Dim
Operate/Simulate Trip Switches (4)	2-2-7	"Operate"	"Operate-Simulate Trip" -Dim
Manual Bypass Switch	2-2-7	"Operate"	"Manual Bypass" Dim
Pressure Test Module (PTM) Test Selector Switch	2-3-1	"Operate"	"On Test" -Dim
Temperature Test Module (TTM) Test Selector Switch	2-4-1	"Operate"	"ON Test" -Dim
Meter Select Switch	2-4-6	"Temp"	N/A

_____4.2.8 Depending upon the RCS pressure, the following steps should be performed (see Step 2.2.1 of this procedure for resetting the trip bistables).

RCS PRESSURE <1820 PSIG

_____1. Insure that the Shutdown Bypass Key Switch (loc 2-2-5) is in the "Bypass" position.

_____2. Reset the Overpower Trip Bistable (Ch 1, 2: loc 1-7-10; Ch 3, 4: loc 1-8-10).

_____3. Reset the High Temperature Trip Bistable (loc 2-4-9).

_____4. Reset the High Pressure Trip Bistable (loc 2-3-9).

_____5. Reset the SD Bypass High Pressure Trip Bistable (loc 2-2-1).

_____6. Reset the SUR Rod Withdrawal Inhibit NI-1 (NI-2, NI-3, NI-4) Bistable (Ch's 1, 2: loc 1-2-10; Ch's 3, 4: loc 1-2-11).

_____7. Reset the Reactor Building High Pressure Contact Buffer Module (Ch 1, 2: loc 1-5-15; Ch 3, 4: loc 1-6-14).

_____8. Reset the Source Range SUR Bypass/High Voltage Cutoff from NI-3 (NI-4) Bistable (CH 3, 4: loc 1-2-9).

_____9. Reset the Flux >10% Bistable (Ch 1, 2: loc 1-7-12; Ch 3, 4: loc 1-8-12).

_____10. Reset the Reactor Trip Module (loc 2-2-7) by depressing the "Reset" toggle switch on the Reactor Trip Module. The "Channel Trip" lamp should go dim.

RCS PRESSURE BETWEEN 1820 PSIG AND 1985 PSIG

3

_____1. Discontinue placing the channel in service until RCS Pressure is above 1985 PSIG.

RCS PRESSURE >1985 PSIG

_____1. Insure that the Shutdown Bypass Key Switch (loc 2-2-5) is in the "Normal" position.

_____2. Reset the Overpower Trip Bistable (Ch 1, 2: loc 1-7-10; Ch 3, 4: loc 1-8-10).

_____3. Reset the High Temperature Trip Bistable (loc 2-4-9).

_____4. Reset the High Pressure Trip Bistable (loc 2-3-9).

_____5. Reset the SUR Rod Withdrawal Inhibit NI-1 (NI-2, NI-3, NI-4) Bistable (Ch 1, 2: loc 1-2-10; Ch 3, 4: loc 1-2-11).

_____6. Reset the Reactor Building High Pressure Contact Buffer Module (Ch 1, 2: loc 1-5-14; Ch 3, 4: loc 1-6-14).

_____7. Reset the Source Range SUR Bypass/High Voltage Cutoff from NI-3 (NI-4) Bistable (Ch 3, 4: loc 1-2-9).

_____8. Reset the Flux >10% Bistable (Ch 1, 2: loc 1-7-12; Ch 3, 4: loc 1-8-12).

_____9. Reset the Low Pressure Trip Bistable (loc 2-3-7).

_____10. Reset the Power/Imbal/Flow Trip Bistable (Ch 1, 2: loc 1-4-13; Ch 3, 4: loc 1-5-13).

_____11. Reset the Power/Pumps Trip Bistable (Ch 1, 2: loc 1-3-7; Ch 3, 4: loc 1-4-7).

_____12. Reset the Pressure/Temperature Trip Bistable (loc 2-4-11).

_____13. Reset the Reactor Trip Module (loc 2-2-7) by depressing the "Reset" toggle switch on the Reactor Trip Module. The "Channel Trip" lamp should go dim.

_____4.2.9 Consult the Control Rod Drive System Operating Procedure, SP 1105.09, for the steps necessary for resetting the CRD Trip Devices.

_____4.2.10 Run those portions of ST 5030.02 RPS Monthly test applicable to the present mode. When in Shutdown Bypass perform ST5030.16 instead of ST 5030.02, and ST 5030.15.

5. DEENERGIZATION OF A RPS CHANNEL

CAUTION: Three (3) RPS channels must be energized at all times unless the reactor is tripped. When a RPS Channel is de-energized, its associated CRD trip device will also trip and the RPS will be in a one-out-of-three trip logic.

7 CAUTION: RPS, Ch 1 should never be de-energized for maintenance while unit is on line. The high auctioneer power signal will be lost to ICS and cause undesired plant operation.

5.1 Prerequisites

(T.S. 3.3.1.1) _____5.1.1 Consult Technical Specification 3.3.1.1 for the number of operable RPS channels that is necessary for the existing plant conditions.

_____5.1.2 The Shift Supervisor has given his permission to de-energize the RPS channel.

_____5.1.3 If the reactor is critical, verify that the other three (3) RPS channels are untripped by verifying the

"Channel Trip" lamps on the Reactor Trip Modules (loc 2-2-7) are dim.

_____5.1.4 At least 3 CRD breakers are closed.

_____5.1.5 No ARTS testing is in progress or to be performed.

7 _____5.1.6 Perform Sections 7.3, 7.4 and 7.5 as necessary of this procedure prior to de-energizing any RPS channel.

Section 5.1 Completed By:_____Date_____

5.2 Procedure

_____5.2.1 Obtain the door key to the RPS channel being de-energized from the Shift Supervisor.

NOTE: The channels may be de-energized in any order as directed by the Shift Supervisor.

_____5.2.2 De-energize the power supply to the Contact Monitor Module (Ch 1, 2: loc 1-3-4; Ch 3, 4: loc 1-4-4) by placing the "On-Off" switch in the "Off" position at the Contact Monitor Auxiliary Power Supply Module (Ch 1, 2: loc 1-3-13; Ch 3, 4: loc 1-4-13).

_____5.2.3 De-energize the power supplies to the Out-of-Core Nuclear Instrumentation Detectors by performing the following steps that are appropriate to the RPS channel being de-energized.

SOURCE RANGE DETECTORS: NI-1 (CH 2), NI-2 (CH 1)

_____1. Place the "On-Off" switch in the "Off" position at the Source Range Detector Power Supply Module (loc 1-2-13).

INTERMEDIATE RANGE DETECTORS: NI-3 (CH 4), NI-4 (CH 3)

_____1. Place the "On-Off" switch in the "Off" position at the Intermediate Range Detector Power Supply Module (loc 1-3-13).

_____2. Place the "On-Off" switch in the "Off" position at the Intermediate Range Detector Compensating Power Supply Module (loc 1-2-13).

POWER RANGE DETECTORS: NI-5 (CH 2), NI-6 (CH 1), NI-7 (CH 4), NI-8 (CH 3)

_____1. Place the "On-Off" switch in the "Off" position at the Power Range Detector Power Supply Module (Ch 1, 2: loc 1-6-13; Ch 3, 4: loc 1-7-13).

___5.2.4 Perform the following for the RPS channel being de-energized.

____1. Place the "+15v DC Power Supply Breaker" (loc 1-1) and the "-15v DC Power Supply Breaker" (loc 2-1) in the "off" position.

____2. Place the "System DC Power" breaker (loc 2-0) in the "Off" position.

____3. Place the left and right "System Fans" switches (loc 2-0) in the "Off" position.

____4. Place the "System AC Power" breaker (loc 2-0) in the "Off" position.

____5.2.5 Open the switch corresponding to the RPS Channel being de-energized and hang a Yellow - "DO NOT OPERATE" - Information Tag on the switch.

____1. Channel 1: Y106 on Essential 120V AC Instrument Distribution Panel Y1

____2. Channel 2: Y206 on Essential 120V AC Instrumentation Distribution Panel Y2

____3. Channel 3: Y308 on Essential 120V AC Instrumentation Distribution Panel Y3

____4. Channel 4: Y408 on Essential 120V AC Instrumentation Distribution Panel Y4

4 ____5.2.6 Return the RPS channel door key to the Shift Supervisor.

Section 5.2 Completed by:_____Date_____

6. REMOVAL OF THE RPS FROM THE SHUTDOWN BYPASS MODE (RCS PRESSURE 1820 PSIG)

6.1 Prerequisites

____6.1.1 The Station Startup Procedure, PP 1102.02, has proceeded to the point requiring that the Shutdown Bypass be removed and all control rods are fully inserted.

OR

____6.1.2 It is desired to remove the RPS from Shutdown Bypass and all control rods are fully inserted and RCS pressure _ 1820 psig. (Steps 6.2.1, 6.2.2 and 6.2.6 are the only steps necessary.)

6.2 Procedure

_____6.2.1 Obtain the keys to all four (4) RPS channel doors from the Shift Supervisor.

_____6.2.2 Perform the following steps at each RPS Channel. (Perform all steps for one channel before proceeding to the next.)

_____1. At the Shutdown Bypass Key Switch Module (loc 2-2-5), place the key operated bypass switch in the "Normal" position. Lamps 1, 2, and 3 on the Shutdown Bypass Auxiliary Relay (loc 2-2-3) should go dim.

_____2. Remove the key from the key operated bypass switch on the Shutdown Bypass Key Switch Module (loc 2-2-5).

_____6.2.3 When RCS pressure is above 1985 PSIG, reset the following trip bistables (see Step 2.2.1 of this procedure) in each RPS channel if they are tripped:

_____1. Power/Imbalance/Flow Trip Bistable (Ch 1, 2: loc 1-4-13; Ch 3, 4: loc 1-5-13).

_____2. Power/Pumps Trip Bistable (Ch 1, 2: loc 1-3-7; Ch 2, 4: loc 1-4-7).

_____3. Low Pressure Trip Bistable (loc 2-3-7).

_____4. Pressure/Temperature Trip Bistable (loc 2-4-11).

(T.S. 2.2.1 & 3.3.1.1) _____6.2.4 Notify I&C that the setpoint of the Overpower Trip Bistable (Ch 1, 2: loc 1-7-10; Ch 3, 4: loc 1-8-10) must be reset to 104.75% full power). DO NOT CONTINUE UNTIL I&C HAS COMPLETED THE RESETTING OF THE TRIP SETPOINT.

NOTE 1: Delete step 6.2.4 if testing is to be done following criticality that will require the Overpower Trip Bistables to be set at less than 104.75% FP.

7 NOTE 2: If RCS boron concentration is at the cold shutdown level, heatup may continue without pulling group one (1) rods while I&C is resetting the Overpower Trip Bistable setpoint.

_____6.2.5 Reset the Reactor Trip Module (loc 2-2-7) in each RPS channel by depressing the "Reset" toggle switch on the Reactor Trip Module. The "Subsystem Trip" lamp should go dim.

4 _____6.2.6 Return the RPS channel keys and shutdown bypass keys to the Shift Supervisor.

_____6.2.7 Consult the Control Rod Drive System Operating Procedure, SP 1105.09, for the steps necessary for resetting the CRD Trip devices.

Section 6 Completed by:_____Date_____

7. RPS OPERATION DURING NORMAL STATION OPERATION

7.1 The RPS provides no interference with reactor operations unless a trip parameter is reached, at which time, the RPS will automatically trip the reactor.

7.2 All lamps in the RPS cabinets should be dim except for the following. These lamps should be bright.

NOTE: The operator is not required to signoff when using Section 7.2 of this procedure.

_____7.2.1 "Output State" and "Output Memory" lamps on the Source Range Bypass Bistable (Ch 3, 4 only; loc 1-2-9).

_____7.2.2 "Output State" and "Output Memory" lamps on the Flux 10% Bistable (dim below 10% power), (Ch 1, 2; loc -7-12; Ch 3, 4; loc 1-8-12).

_____7.2.3 Lamps 1, 2, and 3 on the Flux 10% Auxiliary Relay (dim below 10% power) (Ch 1, 2; 1-7-14; Ch 3, 4; 1-8-14).

_____7.2.4 "Output State" and "Output Memory" on the Shutdown Bypass High Pressure Trip Bistable (loc 2-2-1).

7.3 If it becomes necessary to exchange RCS pressure inputs to the NNI from the RPS, perform the following:

_____7.3.1 Maintain RCS pressure in manual. This is necessary since during the exchanging of the RCS pressure inputs to the NNI, the input to the pressurizer heaters and pressure power relief valve (RC2A) will be 1700 PSIG.

4 _____7.3.2 Obtain the door key from the Shift Supervisor to RPS Channel 2, Cabinet 2.

_____7.3.3 At RPS Channel 2, loc 2-6, remove the cover cap from the selected RCS Pressure input to the NNI.

_____7.3.4 Disconnect the cable from the other RCS pressure input and connect this cable to the newly uncapped receptacle.

_____7.3.5 Place the cover cap on the open receptacle.

4

_____7.3.6 Close and lock RPS Channel 2 and return the keys to the Shift Supervisor.

_____7.3.7 Return RCS pressure control to automatic as per Section 4.2.11 of the Pressurizer Operating Procedure, SP 1103.05.

_____7.3.8 Log the exchange of the RCS pressure signals in the Control Room Log.

Section 7.3 Completed by:_____Date_____

7.4 If it becomes necessary to exchange RCS flow inputs to the NNI from the RPS, perform the following:

_____7.4.1 Place the following ICS Stations in "Manual". This is necessary since during the exchange of the RCS flow inputs to the NNI, the RCS flow input to the ICS will go to zero and a steam generator BTU limit will occur and a runback due to RC flow will occur.

_____1. STARTUP FW/VALVE 2 H/A Station (FIC-ICS33A) located on the Feedpumps Control Console (C5712) in the control room.

_____2. STARTUP FW/VALVE 2 H/A Station (FIC-ICS33B) located on Feedpumps Control Console (C5712) in the control room.

_____3. MAIN FW/VALVE 2 H/A Station (FIC-ICS35A) located on the Feedpumps Control Console (C5712) in the control room.

_____4. MAIN FW/VALVE 1 H/A Station (FIC-ICS35B) located on the Feedpumps Control Console (C5712) in the control room.

_____5. MAIN FEED PUMP/2 SPEED H/A Station (HIC-ICS36A) located on the Feed Pumps Control Console (C5711) in the control room.

_____6. MAIN FEED PUMP/1 SPEED H/A Station (HIC-ICS36B) located on the Feed Pumps Control Console (C5711) in the control room.

_____7. STM GEN REACTOR H/A Station (HIC-ICS13) located on the ICS and Reactor Control Console (C5706) in the control room.

_____8. Turbine EHC located on the Turbine Control Panel (C5713) in the control room.

4 ____7.4.2 Obtain the key from the Shift Supervisor to RPS Channel 2, cabinet 2.

____7.4.3 At RPS Channel 2, loc 2-6, remove the cover cap from the selected RCS flow input to the NNI.

____7.4.4 Disconnect the cable from the other RCS flow input and connect this cable to the newly uncapped receptacle.

____7.4.5 Place the cover cap on the open receptacle.

4 ____7.4.6 Close and lock RPS Channel 2 and return the keys to the Shift Supervisor.

____7.4.7 Place the following ICS Stations in the "Auto" if desired.

____1. STARTUP FW/VALVE 2 H/A Station (FIC-ICS33A) located on the Feed Pumps Control Console (C5712) in the control room.

____2. STARTUP FW/VALVE 1 H/A Station (FIC-ICS33B) located on the Feed Pumps Control Console (C5712) in the control room.

____3. MAIN FW/VALVE 2 H/A Station (FIC-ICS35A) located on the Feed Pumps Control Console (C5712) in the control room.

____4. MAIN FW/VALVE 1 H/A Station (FIC-ICS35B) located on the Feed Pumps Control Console (C5712) in the control room.

____5. MAIN FEED PUMP/2 SPEED H/A Station (HIC-ICS36A) located on the Feed Pumps Control Console (C5711) in the control room.

____6. MAIN FEED PUMP/2 SPEED H/A Station (HIC-ICS36B) located on the Feed Pumps Control Console (C5711) in the control room.

____7. STM GEN REACTOR H/A Station (HIC-ICS13) located on the ICS and Reactor Control Console (C5706) in the control room.

____8. Turbine EHC located on the Turbine Control Panel (C5713) in the control room.

____7.4.8 Log the exchanging of the RCS flow signals in the control room log.

Section 7.4 Completed by:_____Date_____

7.5 If it becomes necessary to exchange RCS flow inputs to the
6| Station Computer from the RPS, perform the following:

_____7.5.1 Obtain the door key from the Shift Supervisor to RPS Channel 2, cabinet 2.

_____7.5.2 At RPS Channel 2, loc 2-6, remove the cover cap from
6| the selected RCS flow input to the Station Computer.

_____7.5.3 Disconnect the cable to the newly uncapped receptable.

_____7.5.4 Place the cover cap on the open receptacle.

_____7.5.5 Close and lock RPS Channel 2 and return the key to the Shift Supervisor.

_____7.5.6 Log the exchanging of the RCS flow signals in the Control Room log.

Section 7.5 Completed by:_____Date_____

8. PLACING OF THE RPS INTO THE SHUTDOWN BYPASS MODE (RCS PRESSURE 1820 PSIG)

8.1 Prerequisites

_____8.1.1 The Station Shutdown and Cooldown Procedure, PP 1102.10, has proceeded to the point requiring that the Shutdown Bypass be put in service or it is desired to return to the Shutdown Bypass mode for testing, etc.

8.2 Procedure

_____8.2.1 Obtain the keys to the four (4) RPS channel doors and the four (4) RPS Shutdown Bypass keys.

(T.S. 2.2.1 & 3.3.1.1) _____8.2.2 Notify I&C that the setpoint of the Overpower Trip Bistable (CH 1, 2 loc 1-7-10; CH 3, 4; loc 1-8-10) must be reduced to 5% full power). DO NOT CONTINUE UNTIL I&C HAS COMPLETED THE RESETTING OF THE TRIP SETPOINT.

_____8.2.3 Perform the following steps at each RPS channel. (Perform all steps for one channel before proceeding to the next.)

_____1. At the Shutdown Bypass Key Switch Module (loc 2-2-5), place the key operated bypass switch in the "Bypass" position. Lamps 1, 2 and 3 on the Shutdown Bypass Auxiliary Relay (loc 2-2-3) should go bright.

_____8.2.4 When RCS pressure is below 1820 PSIG, reset the Shutdown Bypass High Pressure Trip Bistable (loc 2-2-1) in each RPS channel.

_____8.2.5 Reset the Reactor Trip Module (loc 2-2-7) in each RPS channel by depressing the "Reset" toggle switch on the Reactor Trip Module. The "Channel Trip" lamp should go dim.

4| _____8.2.6 Return the RPS cabinet door keys to the Shift Supervisor.

_____8.2.7 Consult the Control Rod Drive System Operating Procedure, SP 1105.09, for the steps necessary for resetting the Reactor Trip Device.

Section 8 Completed by:_____Date_____

9. RPS OPERATION DURING ABNORMAL CONDITIONS

NOTE: The operator is NOT required to signoff when using Section 9 of the procedure.

9.1 Reactor Trip

_____9.1.1 The RPS will automatically trip the CRD Trip Device whenever any trip parameter reaches setpoint.

_____9.1.2 If for any reason the RPS does not trip the CRD Trip Devices, manually trip them by depressing either "Reactor Trip" (HS NI 45 or HS NI 46) pushbutton on the ICS and Reactor Control Console (C5706) in the control room.

_____9.1.3 Upon recovery from a reactor trip, Section 6, 7,or 8 of this procedure must be used in order to place the RPS in the mode appropriate to unit conditions after the condition causing the trip has cleared and the appropriate trip bistables have been reset.

9.2 Tripping of Protective Bistables

_____9.2.1 When any of the following bistables trip, the "Output Memory" lamp (see step 2.2.2 of this procedure) should be manually reset once the parameter has reached the reset value (see Step 2.2.1 for setpoint).

1. SUR Rod Withdrawal Inhibit NI-1 (NI-2) Bistable (CH 1, 2; loc 1-2-9).

2. SUR Rod Withdrawal Inhibit NI-3 (NI-4) Bistable (Ch 3, 4: loc 1-2-11).

3. Source Range SUR Bypass/Hign Voltage Cutoff from NI-3 (NI-4) Bistable (Ch 3, 4; loc 1-2-9).

4. Flux >10% Bistable (Ch 1, 2; loc 1-7-12: Ch 3, 4; loc 1-8-12).

9.3 Over and Under Voltage Protection of the +15v DC and -15v DC System Power Supply Modules in each RPS Channel.

_____9.3.1 Over voltage protection is provided by an overvoltage network within each DC System Power Supply Module. Whenever the output of either DC System Power Supply Module exceeds +17.5 (-17.5)v DC, this network will apply an instantaneous short circuit across the DC System Power Supply Module output terminals. This short circuit is automatically removed when the output voltage goes below the high limit.

_____9.3.2 Low voltage protection is provided by an undervoltage network within each DC System Power Supply Module. Whenever the output of either DC System Power Supply Module goes below +12.5 VDC (-12.5V DC), this network will operate to remove the AC supply to the DC Supply Power Supply Modules by energizing the trip coil of the "System DC Power" breaker on the Power Distribution Panel (loc 2-0). Whenever this happens, the affected RPS channel will trip.

_____9.3.3 Below is a summary of annunciator and computer alarms for the above low voltage conditions. There are no alarms for high voltage protection.

Power Supply	Location	Computer Alarms	Annunciator Alarm	Setpoint
Ch 1, +15V	1-1	Q812 E812	RPS Pwr Supply Trbl	+12.5V DC
Ch 1, -15V	2-1	Q812 E811	RPS Pwr Supply Trbl	-12.5V DC
Ch 2, +15V	1-1	Q812 E818	RPS Pwr Supply Trbl	+12.5V DC
Ch 2, -15V	2-1	Q812 E817	RPS Pwr Supply Trbl	-12.5V DC
Ch 3, +15V	1-1	Q812 E824	RPS Pwr Supply Trbl	+12.5V DC
Ch 3, -15V	2-1	Q812 E823	RPS Pwr Supply Trbl	-12.5V DC
Ch 4, +15V	1-1	Q812 E831	RPS Pwr Supply Trbl	+12.5V DC
Ch 4, -15V	2-1	Q812 E830	RPS Pwr Supply Trbl	-12.5V DC

____9.3.4 If any of the above computer or annunciator alarms are received in the Control Room, I&C should be notified and the RPS channel affected should be de-energized as per Section 5 of this procedure.

1 (TS 3.3.1.1) ____9.3.5 Consult Technical Specification 3.3.1.1 for the number of inoperable channels that is permitted.

9.4 Over Voltage Protection of the Out-of-Core Nuclear Instrumentation Detector Power Supplies.

____9.4.1 The following Detector Power Supplies have an overvoltage network within the Detector Power Supply Module. Whenever the output of the Detector Power Supply reaches its associated setpoint the power supply is automatically de-energized.

Power Supply	Location	Overvoltage Setpoint
Source Range (NI-1, 2)	1-2-13 (Ch 2, 1 only)	+2400V DC
Intermediate Range (NI 3, 4)	1-3-13 (Ch 4, 3 only)	+1000V DC
Intermediate Range Compensating (NI 4, 3)	1-2-13 (Ch 4, 3 only)	-400V DC
Power Range (NI 5, 6)	1-6-13 (Ch 2, 1)	+1000V DC
Power Range (NI 8, 7)	1-7-13 (Ch 4, 3)	-1000V DC

The de-energization of a detector power supply is alarmed only by the computer. All of these alarms will indicate a low voltage condition when the detector power supplies de-energize.

Power Supply	Computer Point	Low Voltage Alarm
Source Range, NI-1	E-820	+100V DC
Source Range, NI-2	E-814	+100V DC
Intermediate Range, NI-3	E-833	+100V DC
Intermediate Range Compensating, NI-3	E-832	0 V DC
Intermediate Range, NI-4	E-826	+100V DC
Intermediate Range Compensating, NI-4	E-825	0 V DC
Power Range, NI-5	E-819	+100V DC
Power Range, NI-6	E-813	+100V DC
Power Range, NI-7	E-834	+100V DC
Power Range, NI-8	E-827	+100V DC

____9.4.2 If any of the above computer alarms are received in the Control Room, I&C should be notified and the "On-Off" switch on the affected power supply should be placed in the "Off" position.

1 (STS) (3.3.1.1) ____9.4.3 Consult Technical Specifications 3.3.1.1 for the number of inoperable channels that is permitted.

9.5 Overvoltage Protection of the Contact Monitor Auxiliary Power Supply Module.

____9.5.1 Each Contact Monitor Auxiliary Power Supply Module (Ch 1, 2; loc 1-3-13: Ch 3, 4; loc 1-4-13) is supplied with an overvoltage network within the module. Whenever the output of the module reaches -400VDC the power supply is automatically de-energized. There is no computer or annunciator alarm for a high voltage condition.

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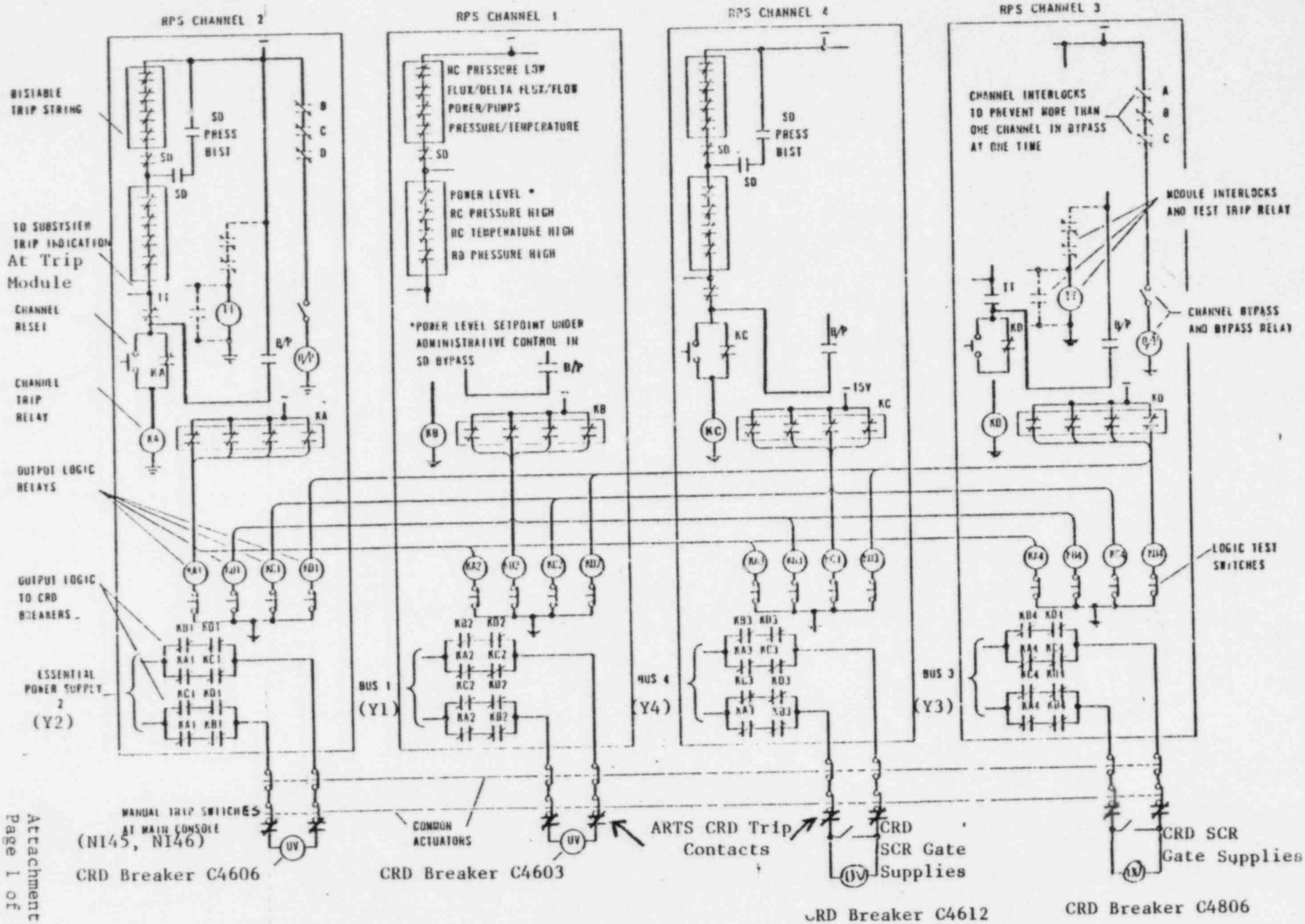
There are computer and annunciator alarms for low voltage output for the Contact Monitor Auxiliary Power Supply Module. This would be indicative of a deenergization of the module. Upon de-energization of a Contact Monitor Auxiliary Power Supply Module, the input to the Power/Pumps trip string will be that all four (4) Reactor Coolant Pumps are off and the affected channel will trip. Computer alarm E837 and annunciator window RPS RCP VOLT LO will be alarmed when the Contact Auxiliary Power Supply Module output is 0 V DC.


RPS CHANNEL 2
RPS CHANNEL 1
RPS CHANNEL 4
RPS CHANNEL 3
BISTABLE TRIP STRING
SD PRESS BIST
TO SUBSYSTEM TRIP INDICATION At Trip Module
CHANNEL RESET
CHANNEL TRIP RELAY
OUTPUT LOGIC RELAYS
OUTPUT LOGIC TO CRD BREAKERS
ESSENTIAL POWER SUPPLY 2 (Y2)
BUS 1 (Y1)
BUS 4 (Y4)
BUS 3 (Y3)
NC PRESSURE LOW
FLUX/DELTA FLUX/FLOW
POWER/PUMPS
PRESSURE/TEMPERATURE
POWER LEVEL *
RC PRESSURE HIGH
RC TEMPERATURE HIGH
RB PRESSURE HIGH
*POWER LEVEL SETPOINT UNDER ADMINISTRATIVE CONTROL IN SD BYPASS
CHANNEL INTERLOCKS TO PREVENT MORE THAN ONE CHANNEL IN BYPASS AT ONE TIME
MODULE INTERLOCKS AND TEST TRIP RELAY
CHANNEL BYPASS AND BYPASS RELAY
LOGIC TEST SWITCHES
MANUAL TRIP SWITCHES AT MAIN CONSOLE (NI45, NI46)
COMMON ACTUATORS
ARTS CRD Trip Contacts
CRD SCR Gate Supplies
CRD SCR Gate Supplies
CRD Breaker C4606
CRD Breaker C4603
CRD Breaker C4612
CRD Breaker C4806

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39. Davis-Besse Emergency Procedure EP 1202.01

see manual