DCD

July 13, 1984

Carolina Power and Light Company
ATTN: Mr. E. E. Utley
Executive Vice President
Power Supply and Engineering
and Construction
411 Fayetteville Street
Raleigh, NC 27602

Gentlemen:

SUBJECT: BRUNSWICK EXAMINATION REPORT

On May 25, 1984, the NRC administered a written examination to an employee of your company who had applied for a license to operate the Brunswick Steam Electric Plant. At the conclusion of the examination, the examination questions and answers were discussed with Mr. T. Backes of your staff. A copy of the written examination questions and answer key are included in this report.

A table summarizing the examination results is provided as Enclosure 2.

In accordance with 10 CFR 2.790(a), a copy of this letter and Enclosures 1 and 3 will be placed in the NRC's Public Document Room unless you notify this office by telephone within ten days of the date of this letter and submit written application to withhold information contained herein within thirty days of the date of this letter. Such application must be consistent with the requirements of 10 CFR 2.790(b)(1). Enclosure 2 is exempt from public disclosure pursuant to 10 CFR 2.790(a) and will not be sent to the Public Document Room.

Should you have any questions concerning this letter, please contact us.

Sincerely,

(Original signed by DMVerrelli)

David M. Verrelli, Chief
Reactor Projects Branch 1
Division of Reactor Projects

Enclosures:
1. Examination Report
2. Table of Examination Results
(Official Use Only - Privacy
Act Information)
3. RO Examination Questions and
Answer Key

cc w/encls 1 and 2:
P. W. Howe, Vice President
Brunswick Nuclear Project
C. Dietz, Plant Manager

cc w/encls 1, 2 and 3: (See page 2)

50-324
50-325

A004

cc w/encls 1, 2 and 3:
P. Hopkins, Training Supervisor
Senior Resident Inspector

bcc w/encl 1:
S. Mckay, Project Manager, NRR
State of Georgia

bcc w/encls 1 and 3
Operator Licensing Branch, DHFS, NRR
Document Control Desk

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ENCLOSURE 3

ES-203

TABLE ES-203-1

U.S. NUCLEAR REGULATORY COMMISSION
REACTOR OPERATOR LICENSE EXAMINATION

Facility: BRUNSWICK

Reactor Type: BWR

Date Administered: 5/25/84

Examiner: J. Munro

Candidate: _____

INSTRUCTIONS TO CANDIDATE:

Use separate paper for the answers. Write answers on one side only. Staple question sheet on top of the answer sheets. Points for each question are indicated in parentheses after the question. The passing grade requires at least 70% in each category and a final grade of at least 80%. Examination papers will be picked up 1.7 hours after the examination starts.

Category Value	% of Total	Candidate's Score	% of Category Value	Category
---	---			1. Principles of Nuclear Power Plant Operation, Thermodynamics, Heat Transfer and Fluid Flow
---	---			2. Plant Design Including Safety and Emergency Systems
27.25	27.25			3. Instruments and Controls
---	---			4. Procedures - Normal, Abnormal, Emergency, and Radiological Control
27.25				TOTALS

Final Grade _____%

All work done on this examination is my own. I have neither given nor received aid.

_____
Candidate's Signature

3. INSTRUMENTS AND CONTROLS

3.1 With regard to the reactor recirculation control system:

See Figure 2-11.

a. The plant is operating at 26% power and both recirc pump M/A transfer stations are in manual and set for 28% speed. The recirc flow A limit annunciator is clear. For each of the following instances, indicate how the speed of recirc pump "A" would change (i.e. increase, decrease, or remain same) and which component(s) of the control system is limiting.

-1- Recirc pump "A" M/A transfer station placed to "Auto" (.75)

-2- Tachometer output feedback signal fails low-contact Y_1 opens (.75)

b. Prior to resetting a scoop tube lock out, what must the control room operator do? (.75)

3.2 A downscale trip exists on an ARM. Is this a satisfactory or an unsatisfactory situation? Briefly explain. (1.0)

3.3 Consider the RWM system only:

a. Given the attached withdrawal sequence (abbreviated), assume the following rod position distribution:

- All rods in groups 1 through 3 are fully withdrawn, except for one rod in each group - 14-27 in group 1, 18-19 in group 2, and 18-35 in group 3 which are all fully inserted.

- All rods in group 4 through 8 are fully inserted to position 0 except rod 22-15 in group 4, which is fully withdrawn.

Upon initialization or relatch of the RWM what will be indicated in the following:

1. Insert error windows (2) (.5)
2. Withdraw error window (.5)
3. Rod group window (.5)

b. What is the LPSP setpoint and what is the sensor that provides this power reference? (1.0)

3.4 a. The plant is operating at 80% power with the FWCS in single element control and with LT-C34-N004A selected as the FWCS input. An instrument technician assigned to perform an instrument calibration on LT-C34-N004B mistakenly goes to LT-C34-N004A and begins opening the equalizing valve. Explain WHAT will happen to the plant and WHY; answer on the attached handout page and refer to figures 10 and 12 as necessary. (2.5)

NOTE: Limit your answer to the effects on and of FW, FWCS, RPS, level indicating and actual vessel level as directed by the handout.

b. The RFPT is equipped with two (2) speed control devices, the MSC and the MGU. The MSC covers a speed range of approximately _____ to _____ RPM, while the MGU covers a speed range of approximately _____ to _____ RPM. The MSC and MGU are arranged so that the device in the (lower or higher) speed position provides the control signal to the RFPT TCV's. (1.5)

3.5 Consider the Nuclear Instrumentation Systems (SRM, IRM, APRM):

a. Refueling is in progress and the SRM shorting links have been removed thereby significantly altering the functioning of the RPS system in two (2) ways. Briefly describe these two alterations. (1.5)

b. The APRM scram function actually consists of two separate setpoints; i.e. .66w + 54% and a fixed 120% scram.

1. Where, specifically, is/are the sensor(s) located which measure the variable "w"? (0.5)

2. While operating at power, one MSIV fails shut resulting in a brief (1 Second) flux spike to 121% power. Which of the two scram setpoints mentioned above (or both) should initiate a reactor scram? Justify your choice. (1.0)

c. Which AGAF value (P-1 Printout) is more conservative? (0.5)

1. -.99
2. -1.01

3.6 Answer the following with regard to ATWS AND RPT:

a. What signals will initiate each trip (ATWS and RPT)? (1.0)

b. When is each trip bypassed? (.5)

c. How is power removed from the recirculation pumps in each case? (1.0)

d. The RPT trip was added to keep from approaching MCPR limits late in core life. What are two (2) reasons why EOL would be more limiting than BOL? (.5)

3.7 a. With the plant operating at 100% power (Unit 1), recirc in Master Manual, an operator inadvertently decreases the "Pressure Set" by 5 psi. What will be the initial response and final status of the following parameters due to this action? Briefly explain. Assume no operator action. See Fig. 3.3-15. Answer on attached handout page.

1. TCV position
2. BPV position
3. Power
4. Pressure (2.5)

b. Using attached Figure 9.4, draw the variation of Rx Pressure and Turbine Inlet Pressure (Throttle) from 0% to 100% steam flow. Be sure you identify the following:

- Pressure of above listed parameters at 0% and 100% steam flow (1.5)

3.8 The reactor is operating at 90% power when the LOAD REJECT circuitry is actuated.

a. What actuates the LOAD REJECT circuit? (1.0)
b. Does the turbine trip due to the LOAD REJECT signal? If not, what prevents the turbine from overspeeding? (1.0)

3.9 a. With the mode switch in REFUEL, what conditions will prevent control rod withdrawal? (1.5)

3.10 a. The RSCS enforces Group Notch Control from ___% rod density to ___% reactor power as sensed by _____. (1.0)

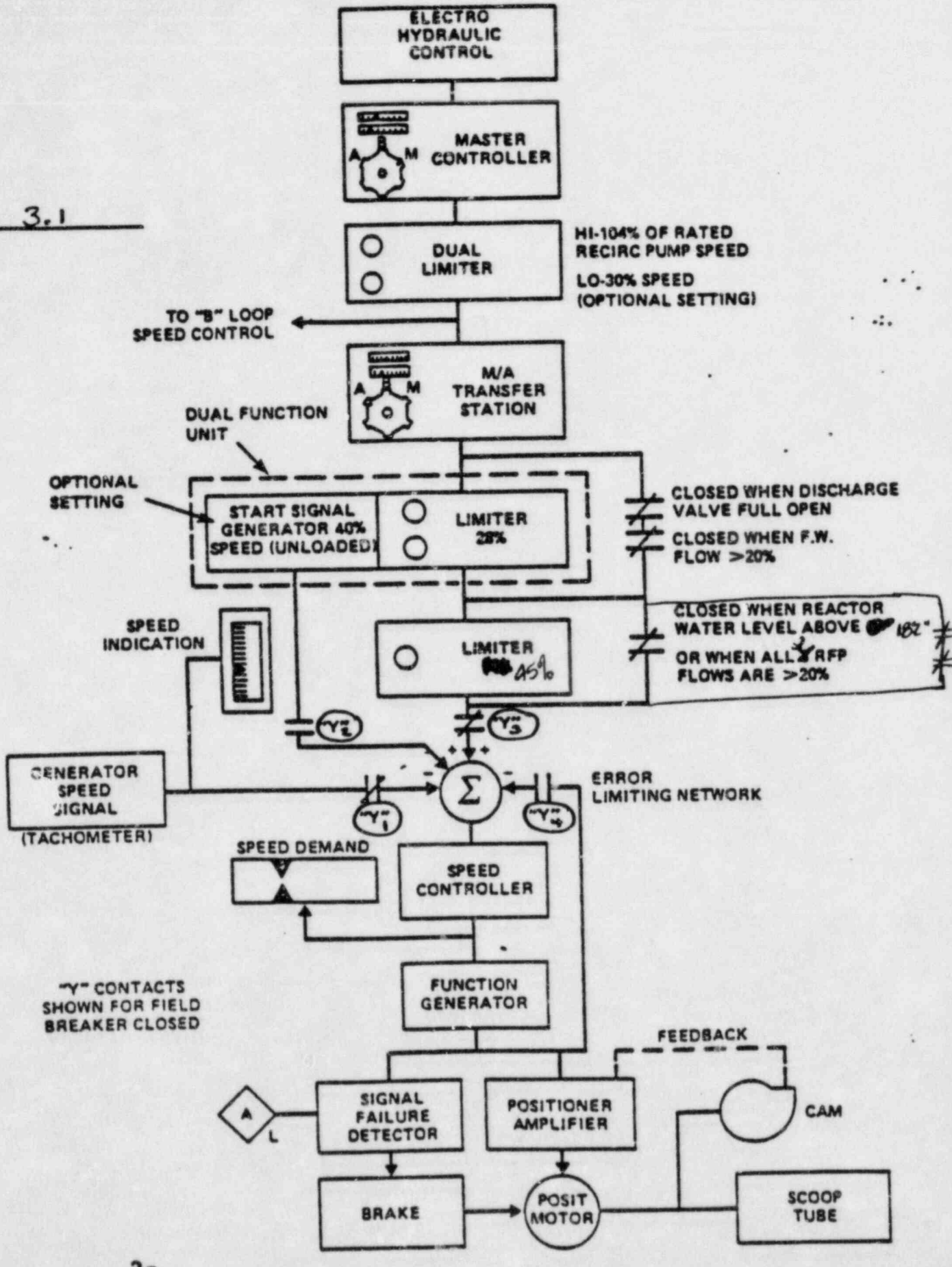
b. When in GNC with the Sequence Mode Selector (SMS) switch in normal, how does the RSCS determine control rod position? (1.0)

3.11 Upon a loss of instrument air, how will the following valves fail? (Closed, open, as is)

a. CRD flow control valve (.5)
b. F&C SU level control valve (.5)
c. Scram discharge volume drain valve (.5)

Assume this is a complete loss interruptible and non-interruptible instrument air.

Question 3.1



2-

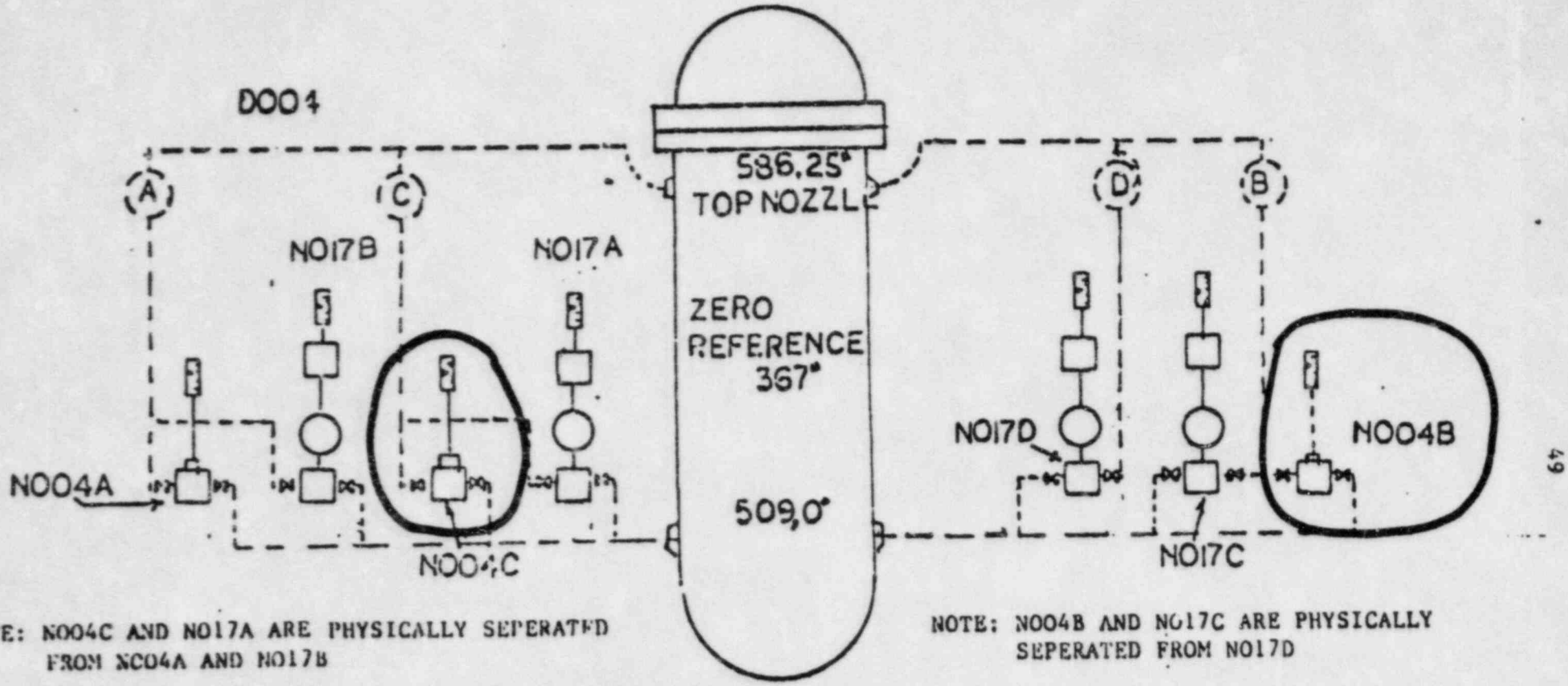
FIG-11 RECIRCULATION SYSTEM FLOW CONTROL NETWORK (A LOOP, TYP. (OR B))

Question 3.3

Withdrawal Sequence

GROUP	RODS	GROUP INSERT LIMIT	GROUP WITHDRAW LIMIT
1	14-15, 14-19, 14-23, 14-27	0	48
2	14-31, 14-35, 18-15, 18-19	0	48
3	18-23, 18-27, 18-31, 18-35	0	48
4	22-15, 22-19, 22-23, 22-27	0	48
5	22-31, 22-35, 26-15, 30-31	0	24
6	26-19, 26-23, 26-27, 30-35	0	48
7	26-31, 26-35, 30-15, 34-15	0	48
8	30-19, 30-23, 30-27, 34-19	0	48
9	22-31, 22-35, 26-15, 30-31	24	48

ROSEMOUNT AND GEMAC LEVEL INSTRUMENTS



NOTE: N004C AND N017A ARE PHYSICALLY SEPERATED FROM NC04A AND N017B

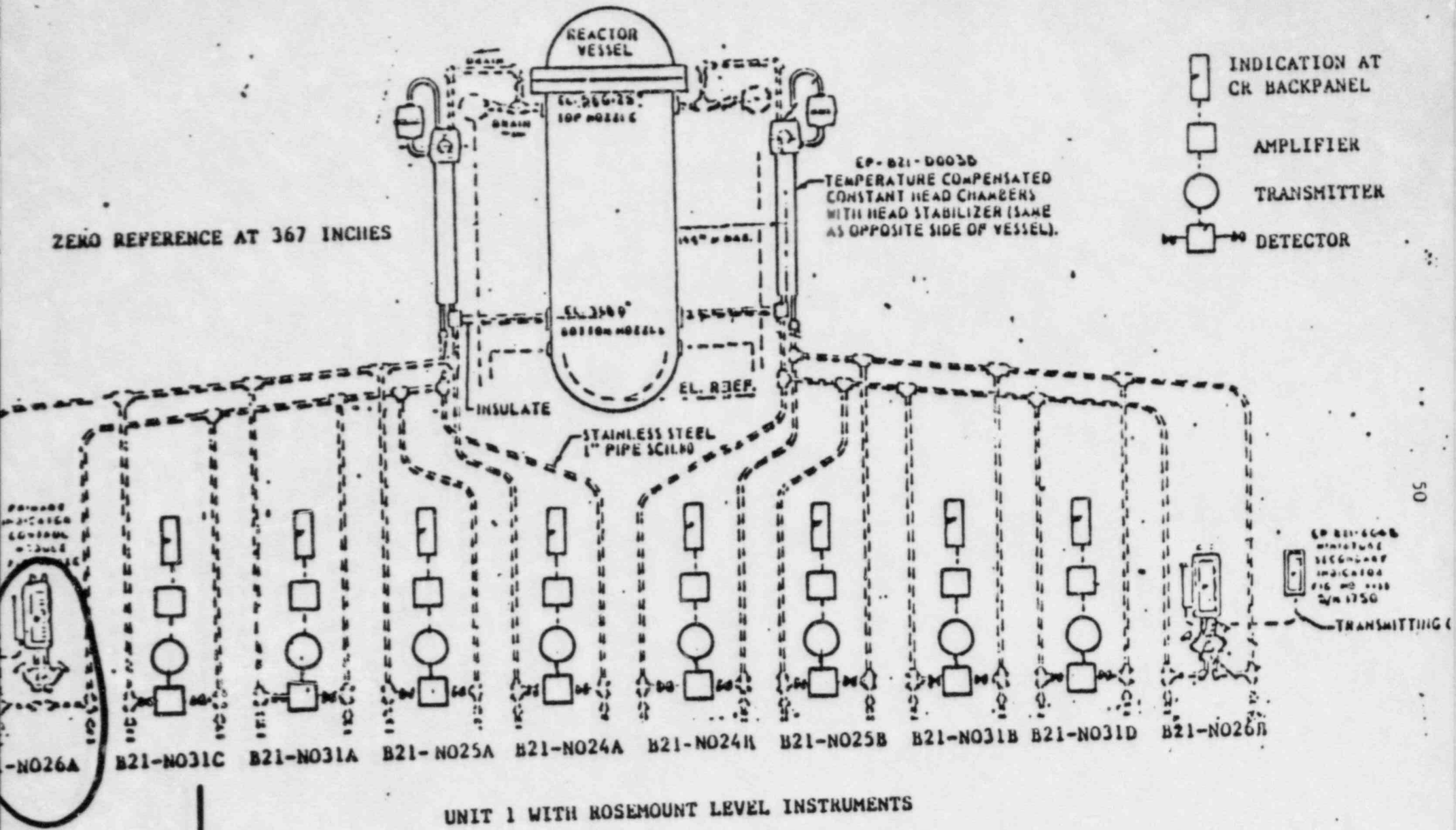
NOTE: N004B AND N017C ARE PHYSICALLY SEPERATED FROM N017D

UNIT 1 AND UNIT 2 ARE ALIKE EXCEPT THAT

UNIT 2 HAS BARTON DIFFERENTIAL INSTRUMENTS.

FIGURE 10

Question 8.4



UNIT 1 WITH ROSEMOUNT LEVEL INSTRUMENTS

FIGURE 12

Question 8.4

QUESTION 3.4/6.B

-1. LT-C34-N004A - indicates _____ (↑, →, ↓)

-2. FWLCS response and action on RFP's - _____

_____

_____

-3. Actual Vessel Level - _____ (↑, →, ↓)

-4. Functioning of RPS (include reason(s), effect(s) - _____

_____

_____

-5. Proper/Improper Indication:
- N004C - _____
- N004B - _____
- N026A - _____

QUESTION 3.7

- Initial Response

a) TCV Position - _____

b) BPV Position - _____

c) Power - _____

d) Pressure - _____

- Explanation of Response - _____

_____

_____

- Final Status

a) TCV Position - _____

b) BPV Position - _____

c) Power - _____

d) Pressure - _____

- Explanation of Status - _____

_____

_____

Notes: 1 - Position - % open, % closed
2 - Power/Pressure - Initial : Increase, Decrease, No Change
Final : Higher, Lower, No Change

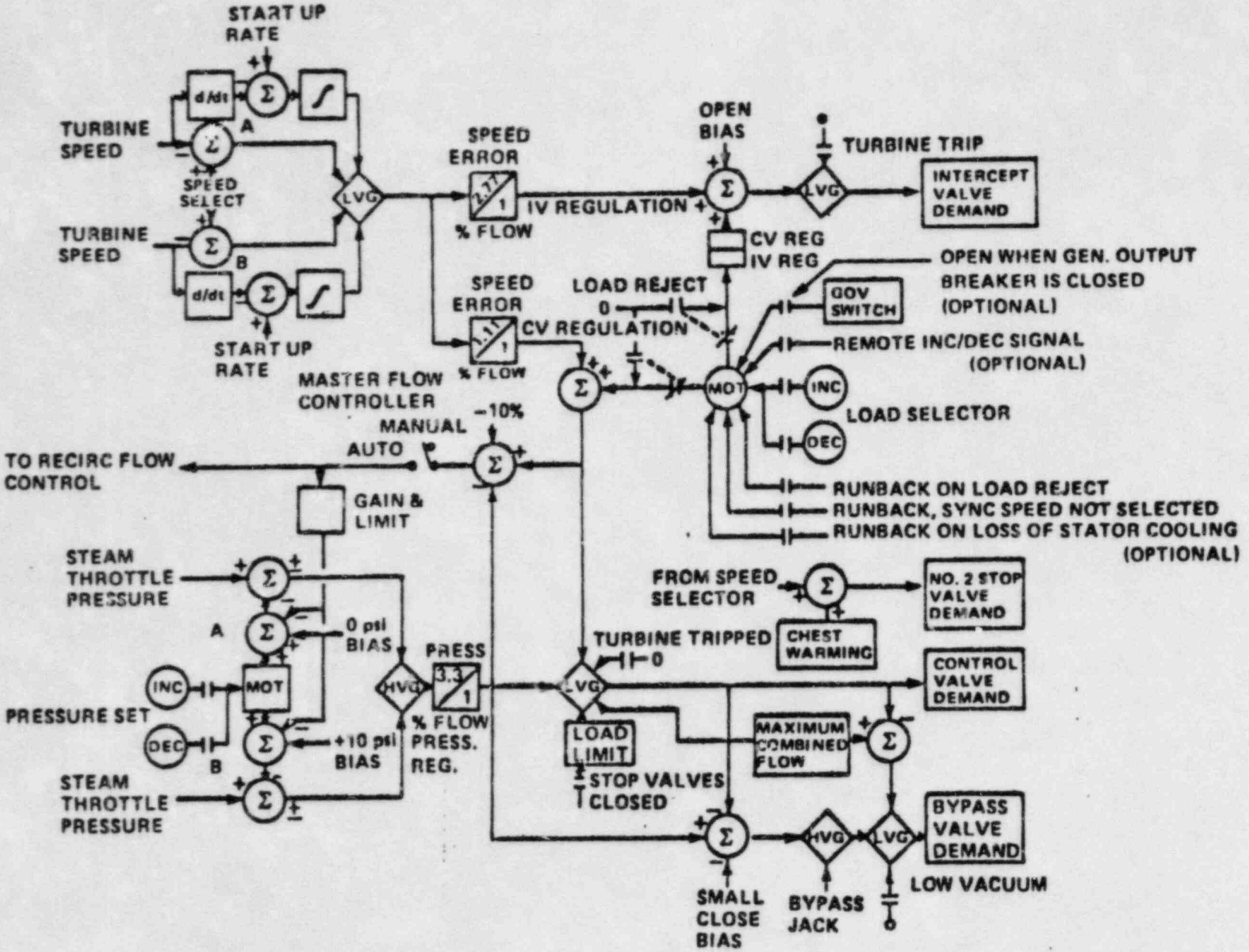


FIGURE 3.3-15 Electro-Hydraulic Control Logic

Question 3.7

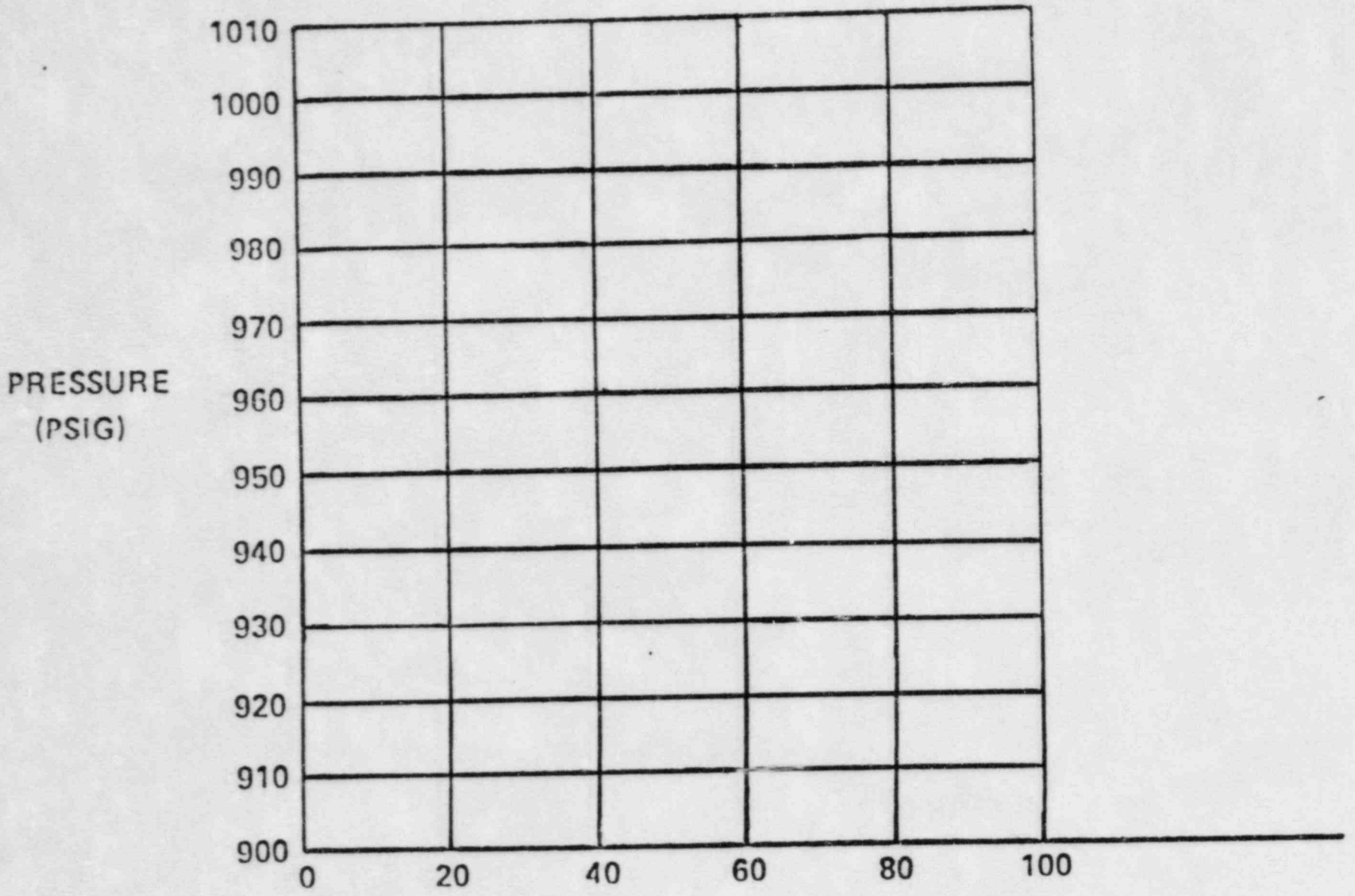


Figure 9.4

SECTION 3 - ANSWERS

3.1 a. -1- Increase (30%), master limiter (.75)

-2- Increase, scoop tube positioning unit (full range, LS/Mech. stop) (.75)

b. Match speed demand indicator with actual speed. (.75)

Ref: Brunswick RTN 010, Brunswick RTN Ques 10-5, Brunswick Recric SG

3.2 Unsat (.5), this indicates electronic malfunction (.5) (since all ARM's indicate reading due to background or bug source).

Ref: Brunswick RTN 032, Brunswick Rad Con II SG, Brunswick Requal. Exam Ques.

3.3 a. 1 - 14-27, 18-19 (.5)
2 - 22-15 (.5)
3 - 3 (.5)

b. 25% (.5), FWLC STM Flow (.5)

Ref: Brunswick RTN-002C, Brunswick RTN Ques. Brunswick RWM SG, Brunswick Requal. Exam Ques.

3.4 a. 1. Normal Range - N004A will indicate rising level (.5)
2. FWLCS will runback RFPs to maintain level (.5)
3. Actual vessel level is decreasing (.5)
4. Rx scram due to loRx level (N017 A, C & D) (.5)
5. N004C - indicate properly (.167)
N004B - indicate properly (.167)
N026A - indicate properly (.167)

b. -MSC - Approx. 0 to 5800 RPM (.5)
-MGU - Approx. 2800 to 5800 RPM (.5)
-lower speed position (.5)

Ref: Brunswick RTN 008, Brunswick Rx Vessel Level Insts. SG, Brunswick Cond & F.W. SG, Brunswick FW control SD, Brunswick Requal. Exam. Ques.

3.5 a. 1. The SRM High-High trip (5×10^5 cps) becomes functional.

2. Any single SRM, IRM, or APRM upscale trip will result in a trip of both RPS channels (i.e. a full scram). (.75ea/1.5)

b. 1. Recirc loop flow elements (pump discharge). (.5)

2. Only the 120% fixed scram [.5] because the flow biased scram incorporates a six second time delay (representative of fuel temperature transient time) [.5]. (1.0)

c. 1 - .99 (0.5)

Ref: Brunswick RPS SG, Brunswick Recirc Sys. SG, Brunswick Core Par. & Thm Limits/P-1 printout SG, Brunswick TS's, Brunswick Requal. Exam. Ques.

3.6 a. ATWS - 1120 PSIG Reactor pressure, 112 inches Rx level
RPT - turbine trip or load reject (above 30% power) (1.0)

b. ATWS - never bypassed [.25]
RPT - bypassed automatically when turbine first stage pressure at <30% load [.125] or manually by keylock switches (S12 & S12 B) IAW Procedure OP-2 and TS's. [.125] (.5)

c. ATWS - trips MG set drive motor breaker
RPT - trips two redundant breaker on the pump power bus (1.0)

d. 1. Rods are further out (longer scram times)
2. The core is more reactive (β is smaller)
3. The void coeff. is more negative
4. Rod worth could be less (2@ .25 each/.5)

Ref: Brunswick RTN 009, Brunswick Recirc. Sys. SG, Brunswick TS's, Brunswick OP-2.

3.7 a. - Initially

- TCV's Remain at 100% (or open to 100%) (.25)
- BPV's open 10% as limited by Max combined flow (.25)
- Power and Pressure decrease due to above (.5)
- Above caused by P.C.U calling for approximately 115% ((950-915) x 3.3) (.25)

- Final Condition

- TCVs at 100% position (or initial) (.25)
- BPVs Shut (.25)
- Power & Pressure slightly lower (.5)
- Above caused by decreasing pressure/power causing BPV's to shut - P.C.U. cycling to new equilibrium state ((945-915) x 3.3) (.25)

b. See Figures 3.3-10 (1.5)

Ref: Brunswick RTN 033, 012; Brunswick RTN Ques., Brunswick EHC SG, Brunswick Requal. Exam. Ques.

3.8 a. High pressure turbine exhaust pressure (0.33) compared to stator amps (0.33) indicating a mismatch of 40% (0.33) actuates the load reject circuit. (1.0)

b. No (0.5). The control valves fast close and the intercept valves should shut or throttle to limit turbine speed (0.5). (1.0)

Ref: EHC Study Guide pg. 12, 19; Brunswick Exam. (1/84)

3.9 1. Refueling platform over the core [.25] with a load on any refueling platform hoist or the fuel grapple not fully up [.25]

2. The service platform hoist loaded.

3. Selection of a second rod for movement with any other rod withdrawn from the fully inserted position. (.5 ea/1.5)

Ref: Brunswick Fuel Handling and Refueling Interlocks SG

3.10 a. <50% rod density [0.33] to 22% power [0.33] as sensed by turbine first stage pressure. [0.33] (1.0)

b. Rod position is determined by sensing direction in which the rod movement control switch is moved [0.5] & sensing RMCS timer settle function. [0.5] (1.0)

Ref: Brunswick RSCS and RWM SG

3.11 a. Closed (0.5)

b. As Is (0.5)

c. Closed (0.5)

Ref: Brunswick RTN F&C; Brunswick 4/83 & Requal. Exams.