ENCLOSURE 3

Florida Power
CORPORATION

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August 22, 1986
TRA 86-0143

Mr. John Munro
Chief, Operator Licensing Section
Region II
U.S. Nuclear Regulatory Commission
Suite 2900
101 Marietta Street, NW
Atlanta, Georgia 30323

Subject: Crystal River Unit 3
8/19/86 NRC-Issued License Exam

Dear Mr. Munro:

As per the current practice for examination reviews after NRC-issued operator examinations, please find enclosed our review and comments on the August 19, 1986, Reactor Operator and Senior Reactor Operator Examinations given at Crystal River Unit 3. We are including our comments and recommended action for each question under review.

If you desire any further information, please contact Mr. Johnie Smith, Nuclear Operations Training Supervisor, at (904) 795-0504, Ext. 107. Thank you for your attention in this very important matter.

Very truly yours,

Larry C. Kelley

Larry C. Kelley
Manager, Nuclear Operations Training

JGS/LCK/mkw

REACTOR OPERATOR EXAMINATION

Question 1.05

This question does not ask for derivation or explanation for the fraction of flow to each OTSG. This information is included as a part of the answer key.

RECOMMENDATION

Give full credit for fraction of flow to each generator.

Question 1.13

The wording of this question does not adequately solicit the desired response. To arrive at the answer given, the candidate must assume that HPI/PORV cooling is initiated and that a swapover to the RB sump is required. An equally probable answer would be to address the rapid cooldown rate associated with an OTSG tube leak/rupture and the effect on this from actuation of the HPI system via the RB pressure actuation of the RBS system. (HPI would accelerate the cooldown rate which is a positive reactivity addition.) Neither case is specifically addressed by the reference given.

RECOMMENDATION

Accept cooldown considerations as correct as well as sump dilution.

Question 1.14

The initial step power change from 0 to 100% power is drawn along the vertical axis of the diagram. For this reason, it is easily missed.

RECOMMENDATION

Credit should be given for xenon traces which start from 100% equilibrium conditions as well as from xenon free conditions.

Question 2.05

The reference given states that hydrogen is the primary gas in the low pressure vent header---not that hydrogen is the primary gas of concern. Based on reference 1 (STS 3.7.11), credit should also be given for oxygen since this is the gas which the operator can control (by excluding from the system). Both gases must be present for a dangerous condition to exist.

RECOMMENDATION

Accept either hydrogen or oxygen as correct.

Question 2.12

This question asks for nameplate ratings of the diesel ENGINE. The answer given is for GENERATOR ratings. Credit should be given for either answer--that intended or that actually requested. Diesel engine ratings are given on reference 2.

RECOMMENDATION

Accept either engine or generator ratings.

Question 2.14

The information in the reference listed is wrong. Correct information is supplied in reference 3.

RECOMMENDATION

Change answer key to reflect correct information.

Question 2.18

This question assumes that an AUTOMATIC Main Steam Line Actuation has occurred. This assumption is not stated. No feedwater valves are affected by a manual actuation of the Main Steam Line Actuation circuit. See reference 4.

RECOMMENDATION

Accept "NONE" as correct in addition to valves listed.

Question 2.21

Answer key is wrong. Correct answer supplied in reference 5.

RECOMMENDATION

Change answer key to 330 psig (+ or - 50)

Question 2.23

Answer key is wrong. Correct answer is "C". See reference 6.

RECOMMENDATION

Change answer key as indicated.

Question 3.6

Knowledge of the physical operation of control board switches is normally only required when that switch has characteristic which differ from most other switches. The switches listed in this question do not meet this requirement. We do not feel that this question tests required operator knowledge.

RECOMMENDATION

Delete question from exam.

Question 3.19

The answer key states "causes all of the EFW control valves to come open if they are in hand". This should read "causes all of the EFW control valves to come open if they are in AUTO.

RECOMMENDATION

Change answer key as indicated.

Question 4.2

This question asks "...What is done with DHV-3,DHV-4, and DHV-41?" No reference is made to why these actions are taken. The answer for this question states "...to prevent isolation of the DHR system upon spurious ACI."

RECOMMENDATION

Remove reason for actions from answer key.

Question 4.3

To complete the requested flow path, the operator must also open MUV-103. See reference 7.

RECOMMENDATION

Add "open MUV-103" to list. Accept any five actions.

Question 4.7

HPP-101 lists normal dose limits as 200 and 1000 mrem. These limits may be approved by personnel other than the Nuclear Plant Manager. This reference also states that doses above 1250 mrem/quarter must be approved by the Nuclear Plant Manager. No instructions are given for doses between 1000 and 1250 mrem. Either limit could be considered as correct with the wording of this question. See reference 8.

RECOMMENDATION

Accept either 1000 or 1250 mrem/quarter as correct.

Question 4.13

The installation of the EFIC control system changed the setpoint for operation with no reactor coolant pumps and adequate subcooling to 65%. The referenced VP has not been changed to reflect this change. See reference 9.

RECOMMENDATION

Change the answer for part b to 65%.

Questions 4.11 and 4.13

These questions require that the operator memorize steps from verification procedures. This is not supported by a performance based approach to training.

RECOMMENDATION

No recommendation is being made on this exam, however, it is requested that this knowledge not be required on future exams.

Question 4.19

AP-320 has recently been revised. There are now no immediate actions for this AP. See reference 10.

RECOMMENDATION

Delete question from exam.

SENIOR REACTOR OPERATOR EXAMINATION

Question 5.2

While it is true that reactive load is proportional to excitation current, equally valid arguments can be made to say that both real load and output voltage are also proportional as follows:

1. Excitation current is varied to vary output voltage. This in turn varies reactive load. Thus for reactive load to be proportional to excitation current, output voltage must also be proportional.

2. Real load may be calculated when given power factor and/or apparent power and/or reactive load. Since power factor is determined primarily by the

grid, a change in reactive load will result in a change in read load.

No reference can be found which sites a direct proportionality between these parameters, there is also no reference which states that reactive load is the only one which is proportional.

RECOMMENDATION

Delete question from exam.

Question 5.9

Linear heat rate is also limited to maintain an acceptable DNBR. See reference 11.

RECOMMENDATION

Accept DNBR as correct.

Question 5.22

Answer only considers B^- decay. Should also address decay by B^+.

RECOMMENDATION

Accept answer for B^+ decay. See Reference 12.

Question 6.2

There is no correct answer to this question. The same instrument is used to monitor both differential flow to the R C Drain tank and the Letdown coolers. See Reference 13.

RECOMMENDATION

Delete question from exam.

Question 6.3

Due to changes in system operation based on experience, both A and B are incorrect. See reference 14.

RECOMMENDATION

Accept either A or B.

Question 6.6

B and D are both correct. See reference 15.

RECOMMENDATION

Accept B or D.

Question 6.8

Answer as written is incorrect. See reference 16.

RECOMMENDATION

Change answer per reference 16.

Question 6.18

The automatic actions for ACI are closure of DHV-3 & 4. If DHV-41 or 91 are open, an alarm will be actuated to alert the operator. See reference 17.

RECOMMENDATION

Delete "...if DHV-41 or 91 are open" from answer key

Question 6.21

There are two possible answers to this question. An actuation of the RBIC by a 4 psig RB signal will "arm" the spray system by aligning the valves as noted by the answer key. However, the RBS system is also armed by the activation of the HPI ES channels from either the 1500 or 500 RCS pressure setpoint or by the 4 psig R.B. pressure setpoint. This completes the circuit for the R.B. spray permissive which must exist for an actuation of the RBS system on a 30 psig signal. See reference 18.

RECOMMENDATION

Revise answer key to reflect either answer above.

Question 6.25

Answer key states "...to match actual neutron power to feedwater". It should state "...to maintain feedwater flow within 5% of actual reactor power." See reference 19.

RECOMMENDATION

Revise answer key as indicated.

Question 6.26

Answer key as written is vague. Should read "...in the 'A' 4160 ES switchgear room.

RECOMMENDATION

Revise answer key as indicated.

Question 6.28

Due to lines connecting the two steam chest, the two OTSG's are actually cross connected by a variety of valve combinations. See reference 20.

RECOMMENDATION

Delete question from exam.

Question 7.7

Per GET training, PIC's must be rezeroed prior to entering a radiation area if they are reading in excess of 30 mrem. Question does not specify source of required information. See reference 21.

RECOMMENDATION

Accept 30 mrem as a required time to rezero PIC's.

Question 7.8

The required observations prior to frisking are posted at the frisking stations. There is no requirement for the operator to memorize these steps.

RECOMMENDATION

Delete question from exam.

Question 7.11

On a loss of one RCP, the ICS will run the unit back to 75% and not 70% as listed on the answer key. See reference 22.

RECOMMENDATION

Change part iv to 75%.

Question 7.13

This question tests the operators knowledge of procedure names (numbers). This is not required operator knowledge.

RECOMMENDATION

Delete question from exam.

Question 7.19

Due to the installation of the EFIC system, this precaution is no longer applicable. Startup range instruments have no input to EFIC logic.

RECOMMENDATION

Delete this question from future exams.

2.05

1

PLANT SYSTEMS

WASTE GAS DECAY TANK - EXPLOSIVE GAS MIXTURE

LIMITING CONDITION FOR OPERATION

3.7.13.5 The concentration of oxygen in any Waste Gas Decay Tank shall be limited to less than or equal to 2% by volume whenever the concentration of hydrogen in that Waste Gas Decay Tank is greater than or equal to 4% by volume.

APPLICABILITY: At all times.

ACTION:

Whenever the concentration of hydrogen in any Waste Gas Decay Tank is greater than or equal to 4% by volume, and:

a. The concentration of oxygen in that Waste Gas Decay Tank is greater than 2% by volume, but less than 4% by volume, without delay begin to reduce the oxygen concentration to within its limit.

b. The concentration of oxygen in that Waste Gas Decay Tank is greater than or equal to 4% by volume, immediately suspend additions of waste gas to that Waste Gas Decay Tank and without delay begin to reduce the oxygen concentration to within its limit.

c. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.7.13.5 The concentrations of hydrogen and oxygen in the in-service Waste Gas Decay Tank shall be continuously monitored with the hydrogen and oxygen monitors required OPERABLE BY Specification 3.3.3.10 or by sampling in accordance with Specification 3.3.3.10 if the hydrogen and/or oxygen monitors are inoperable.

Rev. 6/76

TD NUC Prior to S s Air

B. DATA

Engine Data (All data is based on full load engine speed as tabulated.)

SPECIFICATIONS AND RATINGS

RATINGS	
Number of Cylinders	12
RPM	900
KW . . (168 hr maintenance interval rating)	3250
BMEP - psi	160.
Compression Ratio (Total swept volume)	13.8
Total Piston Displacement - cu. in.	12443
Piston Speed - fpm	1500
BLOWER (Turbo-Compressor at Rated Load & Speed)	
Air Delivery (Turbocharger) Approx. - cfm	12740
Scavenging Pressure (Approx.) - psi	18
INJECTION NOZZLE (Pintle Type)	
Discharge Pressure - psi	2200 + 100 - 0
PUMP - Water	
Type	Centrifugal
PUMP - Fuel Oil	
Type	Gear
PUMP - Lubricating Oil	
Type	Gear
Pump Relief Valve Setting - psi	80

SUMMARY OF OPERATING FIGURES

A summary of the normal operating figures at the speeds listed as determined by factory tests is given as follows for reference: (Continuous full load rating 2850 kw)

PRESSURE - psi	
(1) Firing Pressure - Max. - psi	1325
TEMPERATURES - °F.	
(2) Exhaust - Max. (Individual Cyl. at Exhaust Port)	1100
(3) Exhaust - (Variation Between Cylinders)	300

(1) As indicated, the values given are maximum, however, the AVERAGE full load values are approximately 100 psi lower.

(2) As indicated, the values given are maximum, the AVERAGE full load values are approximately 100°F. lower and vary considerably with the ambient temperature, installation, operating conditions, etc

(3) Exhaust temperature variation between cylinders should not exceed 300°F at full load. Any significant variation, over a period of time, in the exhaust temperature of any one cylinder indicates an instrumentation or engine operational malfunction and a detailed inspection should be performed to determine and correct the malfunction.

Refer to Plant Operating Instructions "Switch and Valve Setting Chart."

Rev. 2/76

MISCELLANEOUS

CRANK LEAD	18^{o}
OVERSPEED GOVERNOR TRIPS AT RPM (UG8 Governor)	990 - 1010
OVERSPEED GOVERNOR TRIPS AT RPM (EGB10 Governor)	1035 - 1053

ENGINE WEAR LIMIT CHART

Part	New Dimension	Max. Wear Limit No Less Than	Max. Wear Limit No More Than
CAMSHAFT			
Bearing Shell ID	2.499 to 2.5005		2.5025
Camshaft Dia.	2.4945 to 2.4955	2.4925	
Thrust Bearing End Clearance - Adjustable			.022
CRANKSHAFT			
Crankpin Journal - OD	6.745 to 6.747	6.740	
Main Bearing Journal - OD	7.994 to 7.996	7.988	
Crankpin Bearing Shell Thickness	.3722 to .3730	.370	
Outboard Bearing - 12 Cyl.	5.0025 to 5.004		5.005
Outboard Bearing Stub Shaft	4.994 to 4.9955	4.992	
MAIN BEARING			
Shell Thickness			
Upper Crank - Blower End - Upper Shell	.740 to .741	.738	
Upper Crank - Blower End - Lower Shell	.754 to .755	.752	
Remainder of Main Bearing Shells	.747 to .748	.745	
Thrust Bearing End Clearance			.020
PISTON AND LINER			
Piston Diameter - OD		See Note	
Cylinder Liner - ID (Reapplication)			8.145
(Cylinder liner wear limit may be extended by removing ridge in combustion area. Dimension of 8.153 condemns liner for further application.)			
Cylinder Liner Out-of-roundness at Assembly			.003
Piston Pin - OD	2.995 to 2.9955	2.992	
Piston Pin Bushing (Floating) - ID	3.000 to 3.0005		3.004
Piston Pin Bushing (Floating - OD	3.4955 to 3.496	3.492	
Conn. Rod Bushing Bore (Assembled) - ID	3.499 to 3.4995		3.503
Piston Insert Bushing (Assembled) - ID	3.001 to 3.002		3.004

Note: Use ring groove dimensions and new dimension of piston rings to determine the ring groove wear. The top ring groove only can be machined for a .015 or .030 oversize width piston ring.

Part	New Dimension	Max. Wear Limit No Less Than	Max. Wear Limit No More Than
PISTON RINGS ("Fixed" Piston)			
Compression - End Clearance	.045 to .055		3/16
Oil Scraper - End Clearance	.020 to .035		3/32
Oil Drain - End Clearance	.015 to .030		3/32
Compression (No. 1 and 2) - Side Clearance	.004 to .007		.015
Compression (No. 3) - Side Clearance	.003 to .006		.015
Oil Scraper - Side Clearance	.0015 to .007		.010
Oil Drain - Side Clearance	.0015 to .0045		.008
TORSIONAL DAMPER - Monofilar Type			
(12 Cyl. Engines) Upper			
Bushing (2.996 OD) (ID	2.374 to 2.376		2.386
(OD	2.995 to 2.996	2.9935	
Pin - OD	1.845 to 1.847	1.842	
Pin - OD	2.136 to 2.138	2.133	
Weight (5.750 OD) (ID	2.374 to 2.376		2.386
Weight (6.188 OD) (ID	2.374 to 2.376		2.386
Spider Bushing Bore - 8 Holes	2.9985 to 3.000		3.010

1.4.7 Standby Coolant Heating System

* Standby Coolant Pump -
  A: DJP-3, B: DJP-4
  Location : In EGDG radiator compartment.

* Electric Standby Heater -
  A: DJHE-1, B: DJHE-2
  Location : In EGDG radiator compartment.

* Coolant Drain Tank -
  A: DJT-3, B: DJT-4
  Location : In bottom of EGDG radiator compartment.
  Note - This tank is used for draining the Jacket Coolant or Air Cooler Coolant to and can be returned using the Standby Coolant Pump.

1.4.8 Radiator Fan and Drive

* Radiator Fan -
  Location : In EGDG radiator compartment.

* Right Angle Drive Gear Box -
  Location : In EGDG radiator compartment.

* Coupling and Clutch Assembly -
  Location : Radiator end of engine.

* Gearbox Oil Cooler -
  Location : In EGDG radiator compartment.

1.4.9 Diesel Engine

* Name Plate Ratings:
  - o 2750 KW at 0.8 power factor - Continuously with an expected maintenance period.
  - o 3000 KW at 0.8 power factor - 2000 hours, no maintenance.
  - o 3300 KW at 0.8 power factor - Not more than 30 minutes.

* Description:
  Fairbanks Morse Model 38TD8-1/8 Diesel Engine.
  It is a 12 cylinder, opposed piston, turbo-charged, fast air start, internal combustion engine. It provides the function of prime-mover for the emergency generator to which it is attached. A vertical drive unit couples the upper crank shaft to the lower for power transmission.

Question 2.14

3

ENCLOSURE 1

TITLE	6900V. Reactor Aux Bus 3A
LOCATION	119' Turbine Bldg.

BKR. NO.	LOAD COMPONENT IDENTIFICATION	
1	Breaker 3101	Unit 3 Aux. Trans. Feed
2	RCP-1A 3A1	'A' Reactor Coolant Pump
3	RCP-1C 3B1	'C' Reactor Coolant Pump
4	Breaker 3103	Unit 3 Start Up Trais. Feed

Referenced document in error (STM Ch 420)

Document to be revised.

ENCLOSURE 2

TITLE	6900V. Reactor Aux Bus 3B
LOCATION	119' Turbine Bldg.

BKR. NO.	LOAD COMPONENT IDENTIFICATION	
1	Breaker 3102	Unit 3 Aux. Trans. Feed
2	RCP-1B 3A2	'B' Reactor Coolant Pump
3	RCP-1D 3B2	'D' Reactor Coolant Pump
4	Breaker 3104	Unit 3 Start Up Trans. Feed

Question 2-18

4

from ROT-4-15 Rev 1

2.1.4 Maintenance Bypassing

Each EFIC channel is provided with a key operated bypass switch located on the cabinet alarm panels (Fig.7). All switches are keyed alike and the key is captive when the switch is in the bypass position. The channel bypass function is subject to the following interlock features:

* If a NI/RPS channel is in channel bypass only the corresponding EFIC channel may be bypassed.
* If an EFIC channel is in maintenance bypass, and any other but the corresponding NI/RPS channel is placed in bypass, the bypass for the EFIC channel will be removed.
* Placing a NI/RPS channel in bypass will cause the corresponding EFIC channel's maintenance bypass indication to actuate and the bypass condition for the EFIC channel will be annunciated, even though the EFIC channel is NOT actually in maintenance bypass.
* Only one EFIC channel may be bypassed at a time.
* The EFIC maintenance bypass feature does NOT bypass the EFW initiation from ES-HPI.

2.1.5 Main Steam Line and Feedwater Isolation

In addition to the initiation of EFW, EFIC will also initiate Main Steam Line Isolation (MSLI) and Main Feedwater Isolation (MFWI) in the event of a low OTSG outlet pressure condition (<600 PSIG.) The initiation logic for these functions is the same as for the initiation of EFW in that it takes at least two channels to agree that the function is necessary before it will be initiated. (See Fig.10 A-H) The manual and reset functions also work in the same fashion except that in most cases the initiations will have to be reset, or taken manual control of, in both the "A" and the "B" EFIC systems in order for the operator to regain control of equipment. See Fig. 9 and 9B.

When Main steam line isolation occurs the MSIV's on the affected OTSG (s) will be closed and, if the MSLI function is **AUTOMATICALLY** initiated by low OTSG pressure, Main Feedwater will be isolated by:

* Closing the main block valve (s)
* Closing the startup block valve (s)
* Closing the low load block valve (s)
* Closing the MFWP suction valve (s)
* Closing the MFW cross connect valve (FWV-28)
** Tripping the MFW Pump (s)

Main feedwater isolation will **NOT** occur coincident with MSLI if MSLI is **MANUALLY** initiated. If MFWI is required it must also be manually initiated by pressing the "Main Feed Isolation" pushbuttons for the required OTSG (s). The initiation of MFWI will not cause the MSLI function to actuate.

The main steam and feed water isolation functions initiated by low OTSG outlet pressure may be bypassed during plant shutdown and cooldown, by the same switches that bypass the EFW initiation. OTSG outlet pressure must be below 750 PSIG before bypassing will be allowed. In order to prevent an initiation from occurring the system must be bypassed before OTSG pressure decreases to 600 PSIG. The bypass will be automatically reset when steam pressure increases back above 750 PSIG when the plant is returned to operation.

1.4.2.2 PUMP DESCRIPTION

The pumps were manufactured by Byron-Jackson. Each pump is a type DVS, 14x18x27 horizontal,double-bearing pump. It has a sleeve type thrust bearing and sleeve radial bearing. An integral (attached) main pivot shoe oil pump is supplied. Looking from the pump end, suction is on the left and the discharge is on the right. The pump is rated at 12,700 GPM with a 630 ft. head (about 275 #). The shutoff head is 760 ft (about 330 #).

1.4.3. FW BOOSTER PUMP AUXILIARY OIL PUMPS (FWP-6A, 6B)

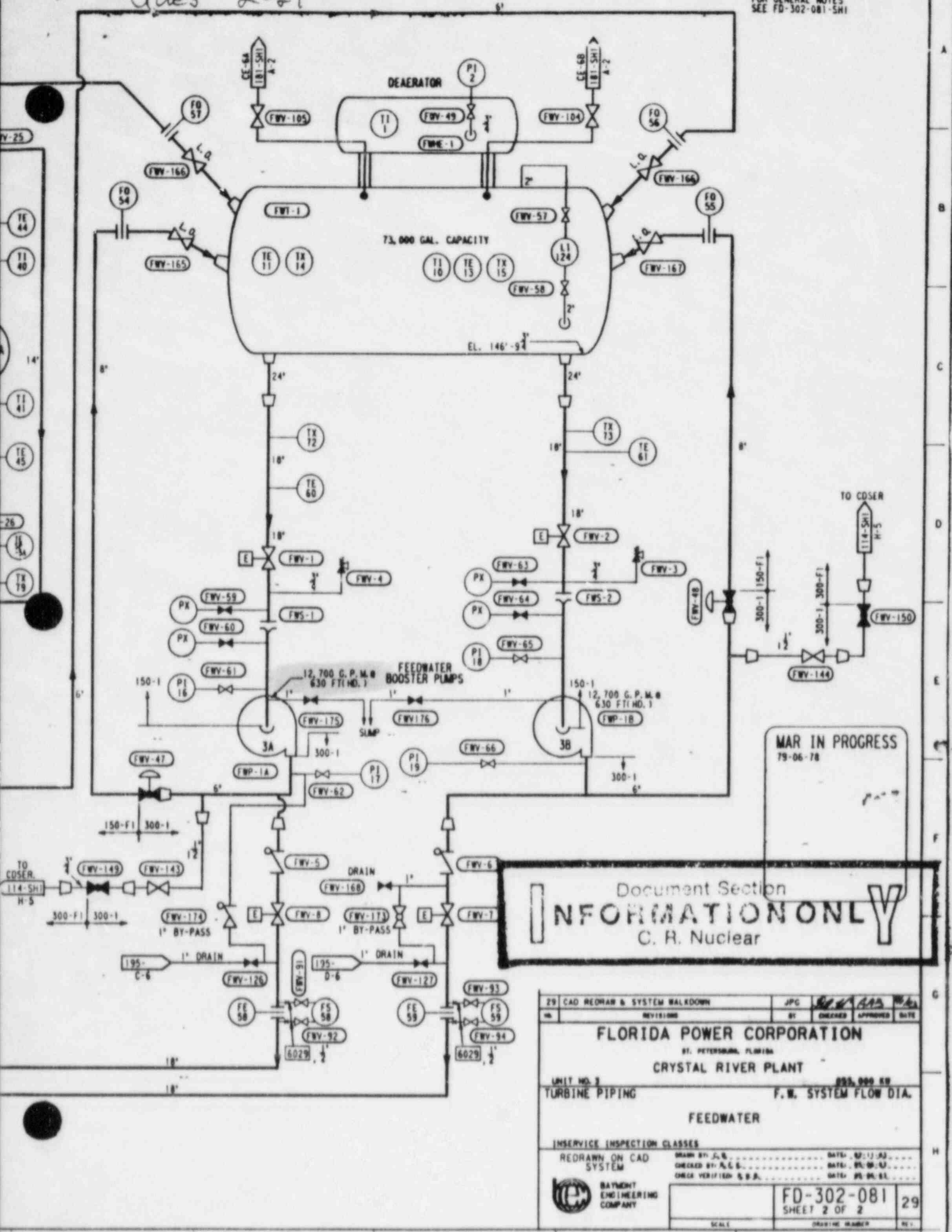
Each of the FW Booster Pumps has an auxiliary oil pump. The auxiliary oil pump is manually started 5 minutes before starting the FW Booster Pump. Once booster pump is up to speed, the auxiliary oil pump is manually secured.

1.4.4. MAIN FEEDWATER PUMPS (FWP-2A, 2B)

1.4.4.1 TURBINE DESCRIPTION

Each of the Main Feedwater Pump Turbines is a Delaval, type KJDF, 10 stage, duel inlet condensing steam turbine. Each of the turbines is rated 8,500 H.P. at 5,500 RPM. Rotation is counter clockwise in the direction of steam flow. Critical speed is 3,500 RPM.

Ques 2-21



Document Section
INFORMATION ONLY
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29	CAD REDRAW & SYSTEM WALKDOWN	JPC			
NO.	REVISIONS	BY	CHECKED	APPROVED	DATE

FLORIDA POWER CORPORATION
ST. PETERSBURG, FLORIDA
CRYSTAL RIVER PLANT
UNIT NO. 3
TURBINE PIPING — F.W. SYSTEM FLOW DIA.
FEEDWATER
INSERVICE INSPECTION CLASSES
REDRAWN ON CAD SYSTEM
GILBERT ENGINEERING COMPANY
FD-302-081
SHEET 2 OF 2
29

2.2.2 Construction

Figure 3 is a sectional view of the OTSG. Structurally, the OTSG consists of 15,531 Inconel tubes surrounded by a 137.875 - inch-ID carbon steel sheel which is 4.188 inches thick. The tubes and the shell are joined by tubesheets which are circular, perforated plates 24 inches thick. Inconel was selected for the tube material for two reasions: It has good corrosion resistance, and its coefficient of thermal expansion is very near that of carbon steel, as shown in Figure 4.

Que 2.23 per this ref. C is the correct answer

First consider that, since the OTSG is of straight-shell, straight-tube design, and since the coefficient of thermal expansion of Inconel is slightly greater than that of carbon steel, certain accident or upset conditions might arise during which the tubes could become significantly warmer than the shell. The tube would then become axially loaded in compression and its behavior as a column would have to considered. On the OTSG, the tubes act structurally as columns in the space between tube support plates rather than between tubesheets. The tube-sheets constitute a built-in boundary, and the tube support plates approximate a pin-end for the tube passing through the plate.

Similarly, should the tubes become substantially cooler than the shell, they would be in tension. During normal plant operation, these temperature limitations will create no problems for the plant operators. It is during upset and accident times that these limits become critical to the structural integrity of the steam generator. For example, if the unit were allowed to boil dry, then the tubes would become much warmer than the shell and could

Over →

Multiplier- normally left in the "100" position. In this position the totalizer will count up 1 digit every 100 pulses.

Clear Button- will clear the totalizer when pushed if the stop- start switch is in the stop position.

Test Button- this button is normally not used.

To perform a feed operation the following steps are performed:

Determine the required batch size and enter this number into the Batch Controler "Batch Size" thumbwheels.

Enter a "Preshutdown" value of 10-20 gallons less than batch size.

Clear the "Totalizer" by placing the "Start-Stop" to "Stop", pressing the "Clear" button until the totalizer goes to 0, and the placing the "Start-Stop" switch to "Start"

This provides the "Makeup and Purification Feed Permit".

Select a feed source by turning the "Feed Select Sw" to the desired source, and pulling the handle up.

Feed may be supplied from any one of 5 sources. (Fig. 18)

Any one of the three RC Bleed tanks.

Demineralized Water

Boric Acid Storage Tank

When the source is selected and the handle pulled up, the white light below the selected source will come on and all of the red and green lights in the column below the selected source will also come on. These lights are located on the "Waste Disposal Feed Permit" panel, (Fig. 18) on the back of the main control board on the Heating and Ventilation panel. This indicates that these valves are being commanded to travel to the required position as required by the permit.

When all of the valves reach their required position, the "Waste Disposal Feed Permit" is established and the "Waste Disposal Feed Permit" light comes on.

If MUV-112 is in its normal (to MUT) position, or a "CRD Dilution Permit" exists the "Feed Permit" light on MUV-103 (Feed Valve) will come on and the valve may be opened.

If the feed source is an RC bleed tank, the pump associated with the selected tank will automatically start when MUV-103 reaches its fully open position. The pump will stop if MUV-103 leaves its fully open position for any reason.

If the selected source is demin water, it will be supplied from the Auxiliary Building Demin Water system.

When the batch size is reached, the feed permit will be terminated, MUV-103 will close, The Waste Transfer (RC Bleed Tank) pumps will stop and all valves in the WD flowpath will close.

If the selected feed source is the Boric Acid Storage Tank, the supply valve to the MU&P system (CAV-57) must be manually opened to complete the feed permit, and the boric acid pump must be manually started after MUV-103 is opened. The boric acid pump must be manually stopped and CAV-57 must be manually closed when the batch has been completed.

During the Feed operation, feed flowrate into the MU&P system may be controled using the "Valve" knob on the batch controler. This knob controls the position of MUV-108.

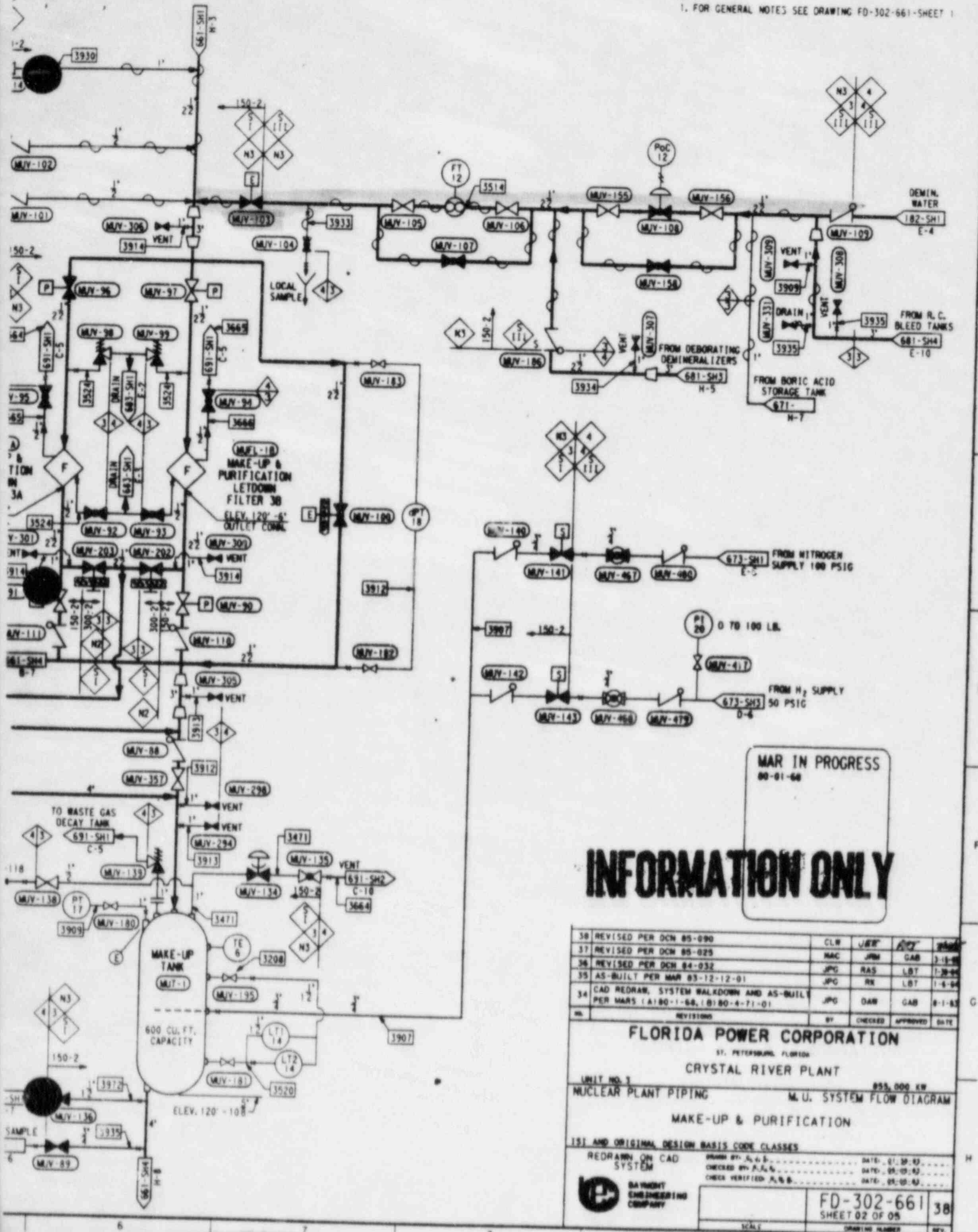
When the batch has been completed the "Feed Select SW" handle should be pushed back in.

To summarize the things required for a "Feed" permit:

a. A flowpath must be aligned from the selected feed source to the MU&P system. (WD Feed Permit)

b. The preset feed cannot have been obtained. This means that the number on the batch size thumbwheels must be larger than the number on the totalizer.

(MU&P Feed Permit)



NOTE:
1. FOR GENERAL NOTES SEE DRAWING FD-302-661-SHEET 1

INFORMATION ONLY

NO.	REVISIONS	BY	CHECKED	APPROVED	DATE
38	REVISED PER DCN 85-090	CLW	JEF	[illegible]	[illegible]
37	REVISED PER DCN 85-025	MAC	JRM	GAB	3-13-8[illegible]
36	REVISED PER DCN 84-032	JPG	RAS	LBT	1-30-8[illegible]
35	AS-BUILT PER MAR 83-12-12-01	JPG	RK	LBT	1-6-8[illegible]
34	CAD REDRAW, SYSTEM WALKDOWN AND AS-BUILT PER MARS (A)80-1-68, (B)80-4-71-01	JPG	DAW	GAB	8-1-83

FLORIDA POWER CORPORATION
ST. PETERSBURG, FLORIDA
CRYSTAL RIVER PLANT
UNIT NO. 3 — 855,000 KW
NUCLEAR PLANT PIPING — M.U. SYSTEM FLOW DIAGRAM
MAKE-UP & PURIFICATION
ISI AND ORIGINAL DESIGN BASIS CODE CLASSES

REDRAWN ON CAD SYSTEM
GILBERT ENGINEERING COMPANY

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CHECKED BY: [illegible] DATE: [illegible]
CHECK VERIFIED: [illegible] DATE: [illegible]

SCALE | DRAWING NUMBER: FD-302-661 SHEET 02 OF 05 | REV. 38

2.3.9 Dose

The quantity of "Radiation" absorbed, per unit of mass, by the body or by a portion of the body. (10 CFR 20.4(a))

2.3.10 Dose Rate

The total quantity of "Radiation" absorbed, per unit of mass, by the body or by any portion of the body during a specified period of time (normally one (1) hour). (10 CFR 20.3(a))

2.3.11 Exposure

A measure of the ionization produced in air by X or gamma "Radiation" (RHH).

2.3.12 Exposure Limits (Administrative)

The maximum dose an individual may accumulate over a specific period of time as specified by a "RWP/SRWP" or Health Physics Personnel (normally 200 mrem/week or 1000 mrem/week not to exceed 1250 mrem/quarter without prior authorization from the Nuclear Plant Manager). 2

2.3.13 Health Physics

See "Radiological (Radiation) Protection".

2.3.14 High Radiation Area

An area with very high "Dose Rates" (i.e., greater than 100mr/hr).

2.3.15 Personnel Monitoring Equipment/Dosimetry Devices

Devices designed to be worn or carried by an individual for the purpose of measuring the dose received. (10 CFR 20.202.b.1)

2.3.16 Protective Clothing (PCS)

Clothing worn for the purpose of protecting individuals from "Radioactive Material" and/or "Radiation".

4-13
ROT-4-13 (EFIC)
REV 1

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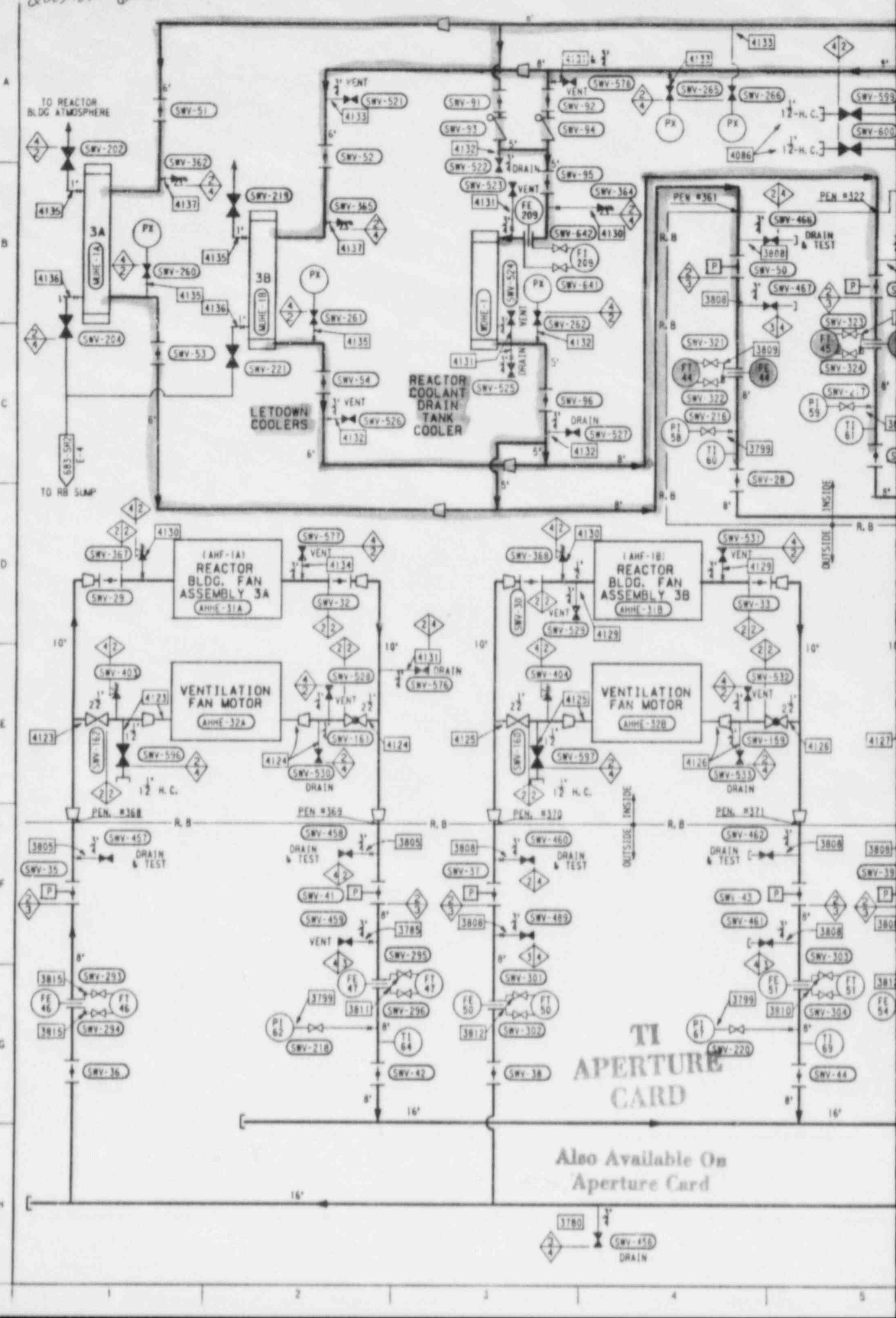
EFW TRAIN "B"

* Valves ASV-5, ASV-204, MSV-55, and MSV-56 receive Open signals.
* Valves EFV-1 receives an open signal.
* The EFW control valves EFV-55 and EFV-56 are released and allowed to control flow. These valves are normally in the full open position when no EFW actuation signal is present.
* Vector logic is enabled

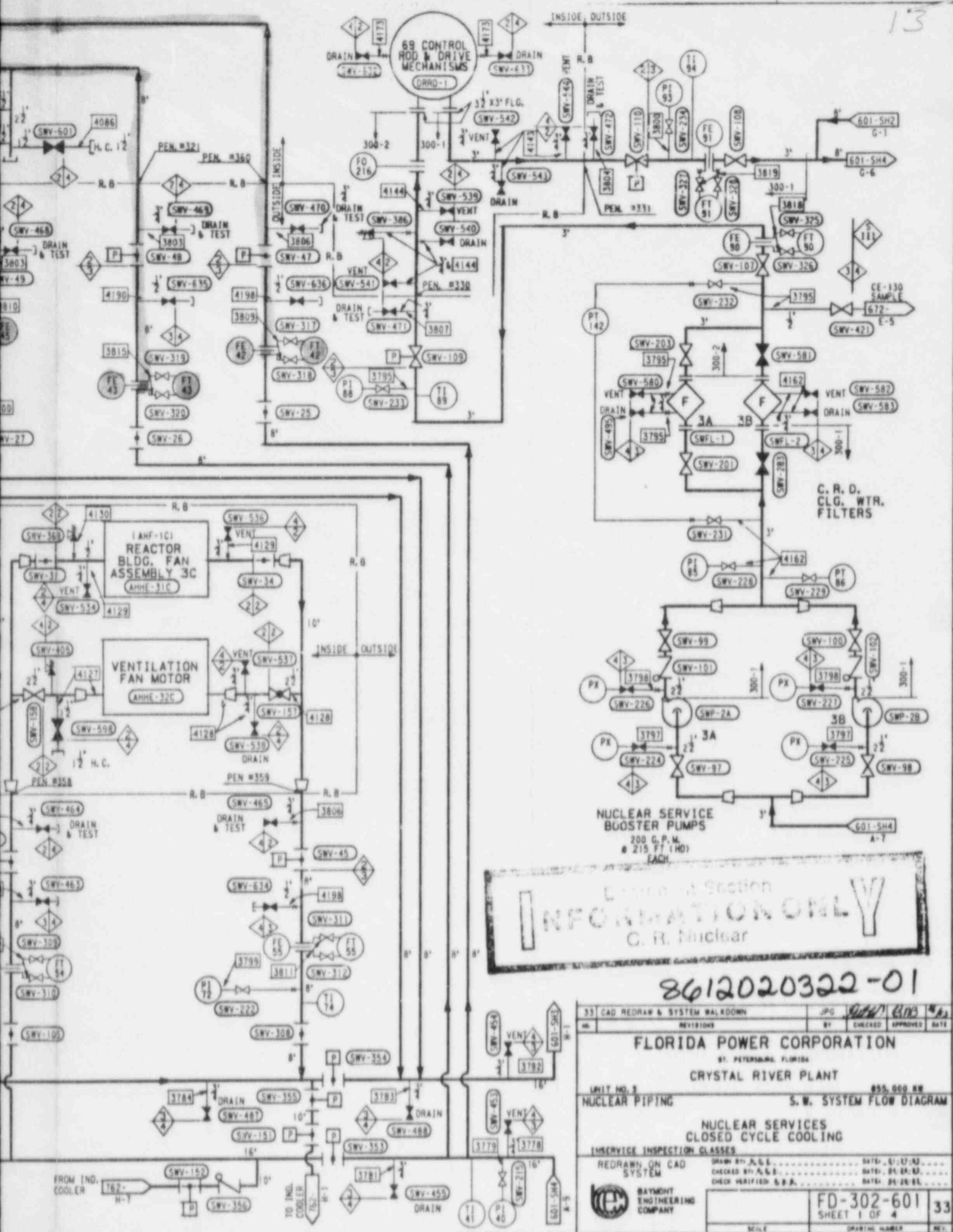
After EFW has been actuated, flow will be controlled by modulating the EFW control valves to maintain OTSG level at setpoint. If the control valves H/A stations had not been in Auto, the EFW actuation would have caused them to be placed in Auto. The setpoint to be maintained is automatically determined by the control modules located in the "A" and "B" EFIC cabinets. The module in the "A" cabinet controls flow from the "A" EFW train to the A and B OTSG and the module in the "B" cabinet controls flow from the "B" EFW train to the A and B OTSG.

If EFW is actuated and at least 1 RC pump is running, the system will control OTSG level at approximately 24 inches. This control set point is completely separate from the ICS low level limits. If no RC pumps are running the control module will select a setpoint of 65% on the EFIC "High Range" instrument. The control modules also have a ramp rate function that controls the rate of OTSG level increase between approximately 2 and 8 inches per minute. The parameter that determines the actual ramp rate is OTSG outlet pressure. When pressure is at the low end of the control band (about 800 PSIG), the lower ramp rate is selected.

Question 6.2


TO REACTOR BLDG ATMOSPHERE
TO RB SUMP
LETDOWN COOLERS
REACTOR COOLANT DRAIN TANK COOLER
(AHF-1A) REACTOR BLDG. FAN ASSEMBLY 3A
(AHF-1B) REACTOR BLDG. FAN ASSEMBLY 3B
VENTILATION FAN MOTOR
PEN. #368
PEN. #369
PEN. #370
PEN. #371
PEN #361
PEN #322
OUTSIDE INSIDE
DRAIN & TEST

13



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No.	Revisions	By	Checked	Approved	Date
33	CAD REDRAW & SYSTEM WALKDOWN	JPG			

FLORIDA POWER CORPORATION
ST. PETERSBURG, FLORIDA
CRYSTAL RIVER PLANT

UNIT NO. 3 855,000 KW
NUCLEAR PIPING S.W. SYSTEM FLOW DIAGRAM

NUCLEAR SERVICES
CLOSED CYCLE COOLING

INSERVICE INSPECTION CLASSES

REDRAWN ON CAD SYSTEM

DRAWN BY: A.G.S. DATE:
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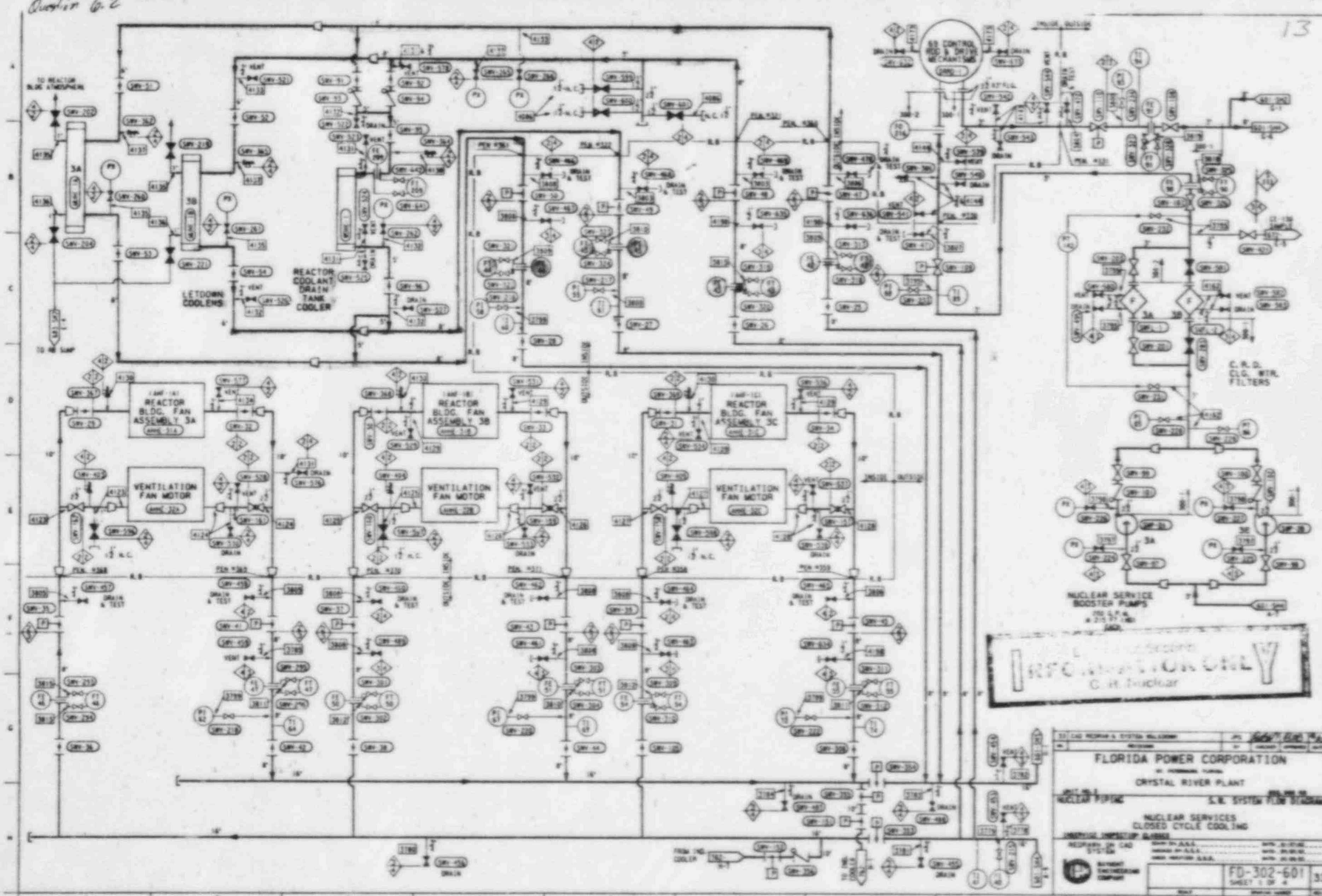
BAYMONT ENGINEERING COMPANY

FD-302-601 SHEET 1 OF 4 — REV. 33



Question 6.2
13
TO REACTOR BLDG ATMOSPHERE
TO RB SUMP
LETDOWN COOLERS
3A
3B
REACTOR COOLANT DRAIN TANK COOLER
(AHF-1A) REACTOR BLDG. FAN ASSEMBLY 3A
(AHF-1B) REACTOR BLDG. FAN ASSEMBLY 3B
(AHF-1C) REACTOR BLDG. FAN ASSEMBLY 3C
VENTILATION FAN MOTOR
CRD CONTROL ROD & DRIVE MECHANISMS
C.R.D. CLG. WTR. FILTERS
NUCLEAR SERVICE BOOSTER PUMPS
FROM IND. COOLER
DRAIN
VENT
DRAIN & TEST
OUTSIDE INSIDE
INFORMATION ONLY
C.R. Nuclear
33 CAD REDRAW & SYSTEM RELABEL
FLORIDA POWER CORPORATION
CRYSTAL RIVER PLANT
NUCLEAR PIPING
S.W. SYSTEM FLOW DIAGRAM
NUCLEAR SERVICES CLOSED CYCLE COOLING
REDRAWN ON CAD SYSTEM
FD-302-601
SHEET 1 OF 4
33

4.19

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LPMS	REV 02	Date 06-09-86	AP-320

LOOSE PARTS MONITORING SYSTEM

ENTRY

INFORMATION ONLY
Document Section
C. P. Number

SYMPTOMS

1. Loose Parts Monitor alarm.

NOTE

There are NO immediate actions in this abnormal procedure.

THIS PROCEDURE ADDRESSES NON-SAFETY RELATED COMPONENTS

Reviewed By PRC [signature] Date 06-09-86 Mtg.# 86-23

Approved By NPM [signature] Date 6/18/86

b. The measurement of enthalpy rise hot channel factor, $F^N_{\Delta H}$, shall be increased by 5 percent to account for measurement error.

For Condition II events, the core is protected from exceeding 20.5 kW/ft locally, and from going below a minimum DNBR of 1.30 by automatic protection on power, AXIAL POWER IMBALANCE, pressure and temperature. Only conditions 1 through 3, above, are mandatory since the AXIAL POWER IMBALANCE is an explicit input to the Reactor Protection System.

The QUADRANT POWER TILT limit assures that the radial power distribution satisfies the design values used in the power capability analysis. Radial power distribution measurements are made during startup testing and periodically during power operation. For QUADRANT POWER TILT, the safety (measurement independent) limit for Steady State is 4.49, for Transient State is 11.07, and for the Maximum Limit is 20.0.

The QUADRANT POWER TILT limit at which corrective action is required provides DNB and linear heat generation rate protection with x-y plane power tilts. The limit was selected to provide an allowance for the uncertainty associated with the power tilt. In the event the tilt is not corrected, the margin for uncertainty on F_Q is reinstated by reducing the power by 2 percent for each percent of tilt in excess of the limit.

3/4.2.5 DNB PARAMETERS

The limits on the DNB related parameters assure that each of the parameters are maintained within the normal steady state envelope of operation assumed in the transient and accident analyses. The limits are consistent with the FSAR initial assumptions and have been analytically demonstrated adequate to maintain a DNBR of 1.30 or greater throughout each analyzed transient.

The 12 hour periodic surveillance of these parameters through instrument readout is sufficient to ensure that the parameters are restored within their limits following load changes and other expected transient operation. The 18 month periodic measurement of the RCS total flow rate is adequate to detect flow degradation and ensure correlation of the flow indication channels with measured flow such that the indicated percent flow will provide sufficient verification of flow rate on a 12 hour basis.

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producing an electric voltage when the junctions of two dissimilar metals are kept at different temperatures are one form of an energy-conversion device. A thermionic converter in which electrons emitted by a hot surface are collected to produce an electric current is another form of an energy-conversion device.

The fuel for a radioisotopic power generator must be safe and reliable and low in both weight and cost. These requirements would result in a rejection of radioisotopes with a half-life less than 100 days because they would have to be replaced too often. Half-lives greater than 100 years would be rejected because the activity would be too low to obtain an initial power density greater than 0.1 watts/gram. Among the candidates that would qualify as fuel sources for radioisotopic power generation are ^{3}H, ^{60}Co, ^{85}Kr, ^{90}Sr, ^{106}Ru, ^{137}Cs, ^{144}Ce, ^{147}Pm, ^{170}Tm, ^{210}Po, ^{238}Pu, ^{241}Pu, ^{242}Am and ^{244}Cm. The calculated initial power density in watts/gm for these sources are indicated by the values in the triangular box along the diagonal line through the appropriate mass chain.

In reactor technology, the term fuel burnup refers to the amount of fissionable material that is consumed (or the amount of power produced) before the fuel element is removed from the reactor for processing. A common unit is the number of megawatt-days of heat energy produced per metric ton of fuel (MWD/MT), where a metric ton is 1000 kilograms, or 2200 lb. For light-water reactors, enriched fuel lifetimes would correspond to an optimum exposure of 30,000 MWD/MT. As a result of the various nuclear reactions and decays that occur over this long exposure, various transuranium and fission product nuclides will be produced in quantity. Many of these nuclides are of interest for special power applications. The production data for these nuclides are given on the Chart in two ways:

1. Grams per metric ton of light water reactor fuel exposed to 30,000 MWD/MT.
2. Kilograms per megawatt year of electric energy delivered from a reactor exposed to 30,000 MWD/MT.

The grams per ton (metric) values are quoted at discharge and are listed in the circle along the diagonal to the appropriate mass chain for both low enrichment uranium fuel and plutonium mixed oxide fuel. The kilograms per 1000 megawatt years of electric energy values assume a thermal-to-electric efficiency of 33% and are listed in the rectangular box along the diagonal to the appropriate mass chain.

Radioactive Decay Chains

As nuclear processes occur, whether in natural radioactivity or under artificially induced conditions, the nuclides change in accordance with the scheme shown in Fig. 2. To understand the use of this scheme more fully, consider the uranium-238 decay chain (one of three such chains found in nature). On the Chart we start with the parent uranium-238 which emits an alpha particle. The daughter nucleus is in the second space diagonally down to the left (see Fig. 2). This square represents the isotope thorium-234. (This nuclide is also identified by the historical symbol UX_1, which is the name given to it before it was identified as thorium.)

Thorium-234 in turn emits a negative electron, so the loss of mass is not appreciable. However, there is a loss of one negative charge, which means that the atomic number Z increases by one. In effect, one neutron has changed into a proton. The move one space up and one space to the left (see Fig. 2) leads to protactinium-234 which has isomeric states. Each of these states undergoes negative beta emission, so another move diagonally upward to the left leads to uranium-234.

Uranium-234 emits an alpha particle ending at

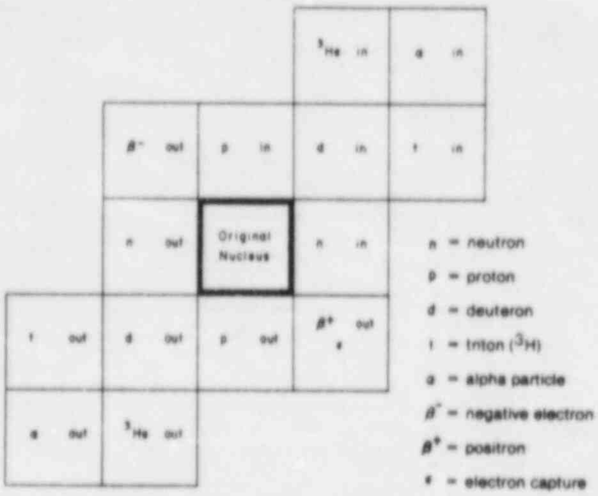
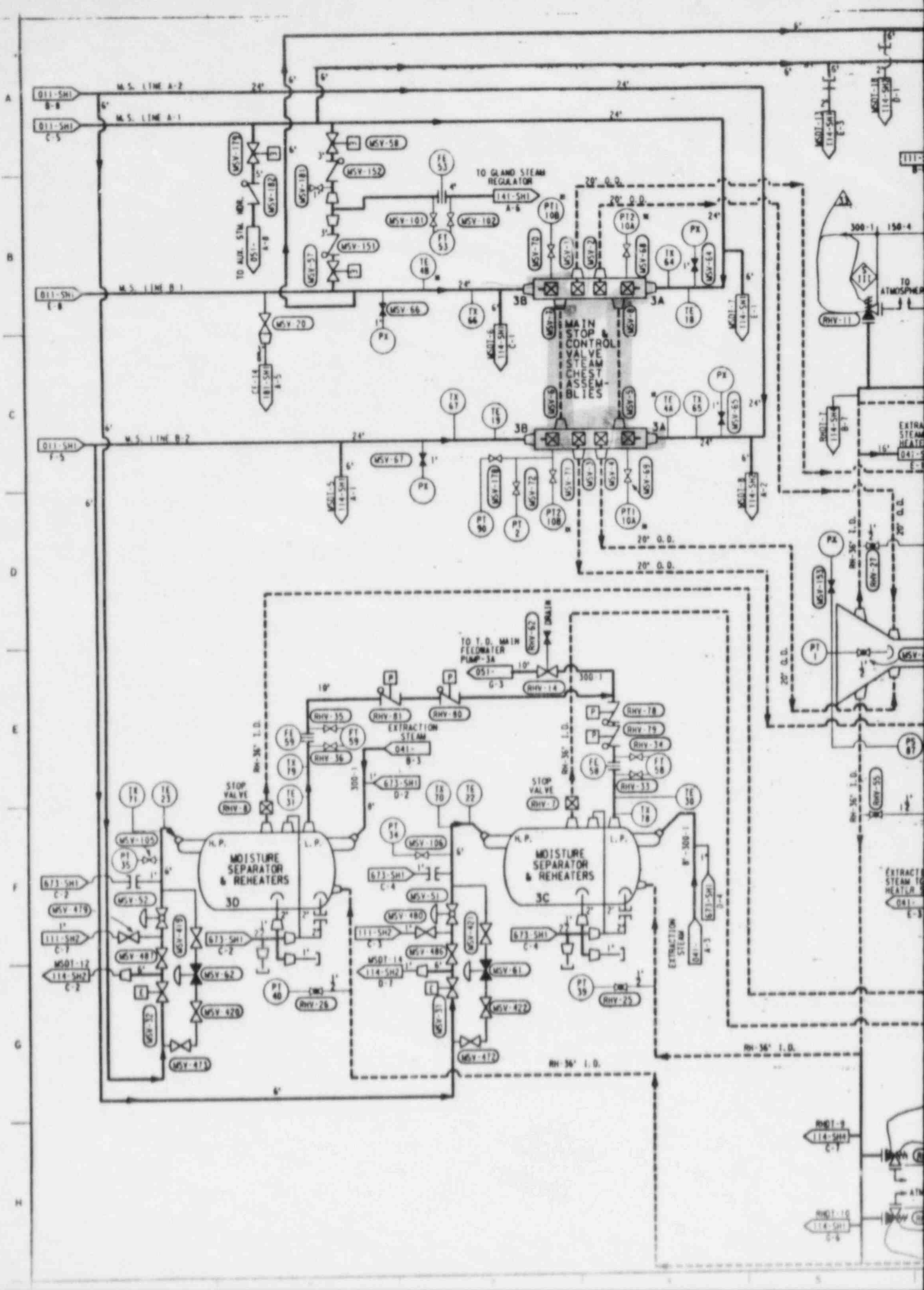


Figure 2. Relative Locations of the Products of Various Nuclear Processes



M.S. LINE A-2
M.S. LINE A-1
M.S. LINE B-1
M.S. LINE B-2
TO GLAND STEAM REGULATOR
TO AUX. STM. HDR.
MAIN STOP & CONTROL VALVE STEAM CHEST ASSEMBLIES
20" O.D.
TO ATMOSPHERE
TO T.D. MAIN FEEDWATER PUMP-3A
DRAIN
EXTRACTION STEAM
STOP VALVE
MOISTURE SEPARATOR & REHEATERS
3D
3C
H.P.
L.P.
RH-36" I.D.
EXTRACTION STEAM

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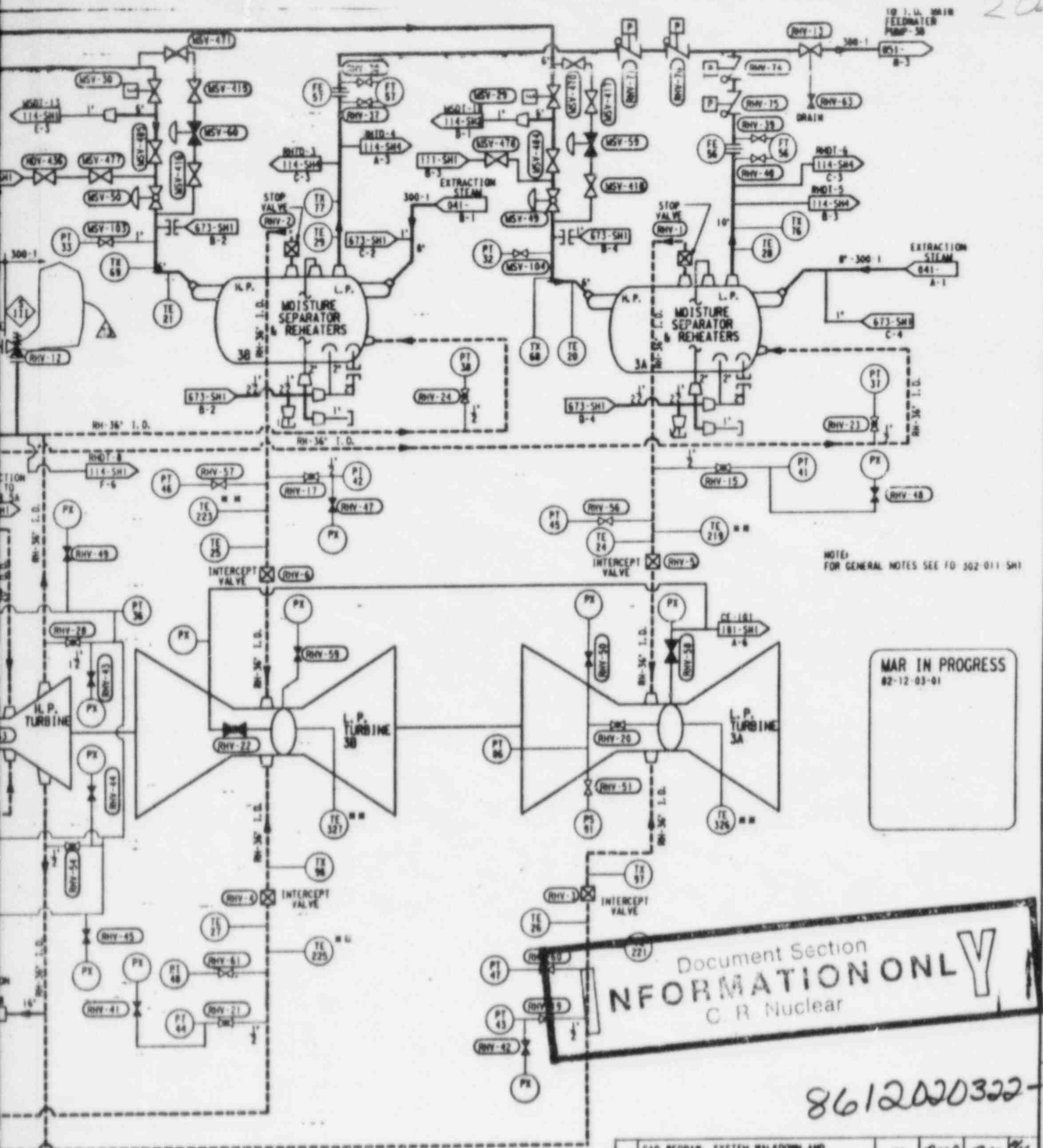

NOTE:
FOR GENERAL NOTES SEE FD-302-011 SH1

MAR IN PROGRESS
02-12-03-01

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33	CAD REDRAW, SYSTEM WALKDOWN AND AS-BUILT PER MAR 02-05-18-01	JPG			
NO.	REVISIONS	BY	CHECKED	APPROVED	DATE

FLORIDA POWER CORPORATION
ST. PETERSBURG, FLORIDA

CRYSTAL RIVER PLANT

UNIT NO. 3

TURBINE PLANT PIPING M.S. & R.H. SYSTEM FLOW DIAGRAM

MAIN & REHEAT STEAM

INSERVICE INSPECTION CLASSES

REDRAWN ON CAD SYSTEM

BAYMONT ENGINEERING COMPANY

FD-302-011
SHEET 3 OF 3

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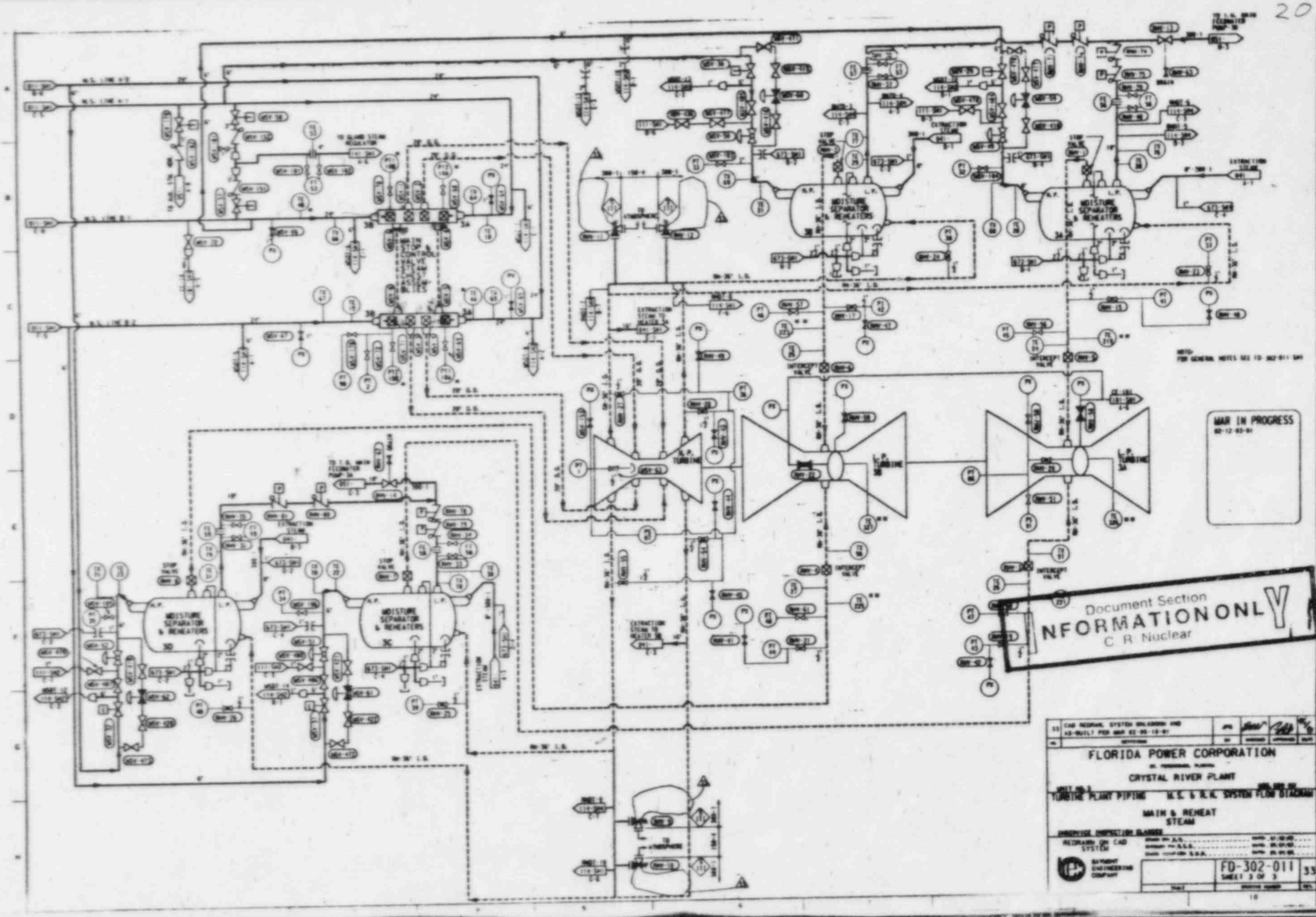

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MOISTURE SEPARATOR & REHEATERS 3A
MOISTURE SEPARATOR & REHEATERS 3B
MOISTURE SEPARATOR & REHEATERS 3C
MOISTURE SEPARATOR & REHEATERS 3D
H.P. TURBINE
L.P. TURBINE 3B
L.P. TURBINE 3A
INTERCEPT VALVE
STOP VALVE
EXTRACTION STEAM
MAR IN PROGRESS
NOTE: FOR GENERAL NOTES SEE FD 302-011 SH1
Document Section
INFORMATION ONLY
C R Nuclear
33 CAD REDRAW, SYSTEM BREAKDOWN AND AS-BUILT PER MAR 82-05-19-01
FLORIDA POWER CORPORATION
CRYSTAL RIVER PLANT
TURBINE PLANT PIPING
M.S. & R.H. SYSTEM FLOW DIAGRAM
MAIN & REHEAT
STEAM
REDRAWN ON CAD SYSTEM
FD-302-011
SHEET 3 OF 3
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Low Pressure Turbine Hood Sprays

The seal and spray water system supplies water to the LP turbine exhaust hood spray nozzles. The flow of this water is controlled by valves CDV-119 and CDV-120. Operation of these valves is discussed in the Condensate System lesson.

Condenser Isolation Valve Sealing Water Supply

Valves that are exposed to main condenser vacuum are supplied with gland sealing water from the seal and spray water system through GWV-8. This water is supplied through a lantern ring to the packing glands of the valves. The supplied seal water flows down along the valve stem and iont the condenser.

System Operation

The Seal and Spray Water System (GW) is aligned, filled and vented, and operated per OP-603 "Condensate System" operating procedure. Normally the GW system is one of the first systems started when the plant is being started up and one of the last systems shutdown when the plant is shutdown and cooled down. While the plant is operating, the GW system runs continously and the only operator functions required are monitoring of system parameters and period adjustments and lubrication as required. As the GW system was originally designed, the Condensate System was to provide all seal and spray water requirements once it was operating. Plant operating experience later demonstrated the the condensate system could not supply sufficent amounts of water to the GW system so the system is now run continously.

Ovcs 6.6.

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from ANO 82 Rev 1

is manually placed in the demineralizer vessel through a fill connection located on the floor above. As with filters, exhausted resin beds are extremely large radiation hazards and all operating and radiation control procedures must be strictly adhered to to prevent excessive exposures or contamination problems. Instructions for changing demineralizer resins are found in OP-407-K, "Operations Involved While Changing Resins".

4.2.4. System Shutdown

The MU&P system is kept in operation maintaining pressurizer level and RC Pump seal injection during plant shutdown and for most of the plant cooldown. When RCS temperature decreases below 300 Deg F, the circuit breakers for the non-running MUPs and the HPI valves (MUV-23, 24, 25, 26) racked/locked out and red tagged. This is done to limit the possibility of an inadvertant HPI actuation causing an overpressure situation when the RCS is below normal operating temperatures. When the RCS temperature is < 200 Deg F, and pressure is less than150 PSIG, the running makeup pump is stopped and its circuit breaker locked out and red tagged.

4.3 <u>ABNORMAL</u> <u>OPERATION</u>

4.3.1 MUV-16, 31, & 51 Air Failure and Reset

Pnuematically operated valves MUV-16, MUV-31, and MUV-51 have an air failure protection scheme in their control circuits that will allow limited operation of the valves in theevent of a failure of their instrument air supply. (See Fig. 15) If the air pressure to either the valve positioner or the E/P controler decreases to 41 PSIG, the solenoid valve will be de-energized. This will vent the air pressure off of the air-lock valve, causing it to close. In this situation, the air pressure signal going to the valve operating diaphram will be "locked in" and will not change regardless of what happens to the air pressure up stream. When the solenoid is de-energized, an annunciator alarm is actuated and the "Air Fail Reset" pushbuttons are backlighted. In the case of MUV-16 and MUV-31, their control stations will be automatically shifted to manual.

If the operator wants to change position of the valves while they are in the air failure mode, he can press and hold the "Air Fail Reset" button. This will energize the solenoid valve and allow whatever air pressure remains to go to the air-lock valve. The operator can then attempt to position the valve from its control station. When the "Air Fail Reset" is released, the system will revert to its air failure mode.

When air pressure is restored, the "Air Fail Reset" Button will have to be pressed in order to open the solenoid valve and allow air pressure to be applied to the pressure switch. After the system is reset MUV-16 and 31 will have to be returned to automatic operation.

4.3.2. Loss of NNI/ICS Power

If power to the Non-Nuclear Instrumentation (NNI) system is lost, many of the MU&P System instrumrntation will also be lost. The most important of these instruments will be letdown flow and HPI flow. Present guidelines call for the isolation of letdown and initiation of full HPI if NNI or

To reset the automatic function or stop the screens, an operator must do so at the local push button.

3.1.2 Manual operation is covered in OP 604 Circulating Water System

3.2 Circulating Water Pumps

3.2.1 To start any circulating water pump the four (4) start permissives must be satisfied.

a. Lube water flow is normal > ~~10~~ 5 gpm to the upper bearing.

b. Water box has been primed to ≥ 115 feet.

c. Pump trip permit: thirty (30) seconds have elapsed since pump last ran.

d. Cooling & seal water flow normal: pressure > 15 psi at bearing.

3.2.2 Once cooling water is flowing through the condenser, the heat exchanger valve (CWV) may be aligned and placed in automatic as per OP 604 Circulating Water System.

3.2.3 When the ARV's are placed in automatic position, if a circulator trips, the associated (ARV's) priming valves will close and the vacuum breaker on the inlet & outlet water boxes will open in 1.25 seconds, draining the water box.

3.2.4 When the heat exchanger inlet & outlet valves (CWV) are in automatic and a circulator trips, the affected heat exchanger valve will close in 4 seconds.

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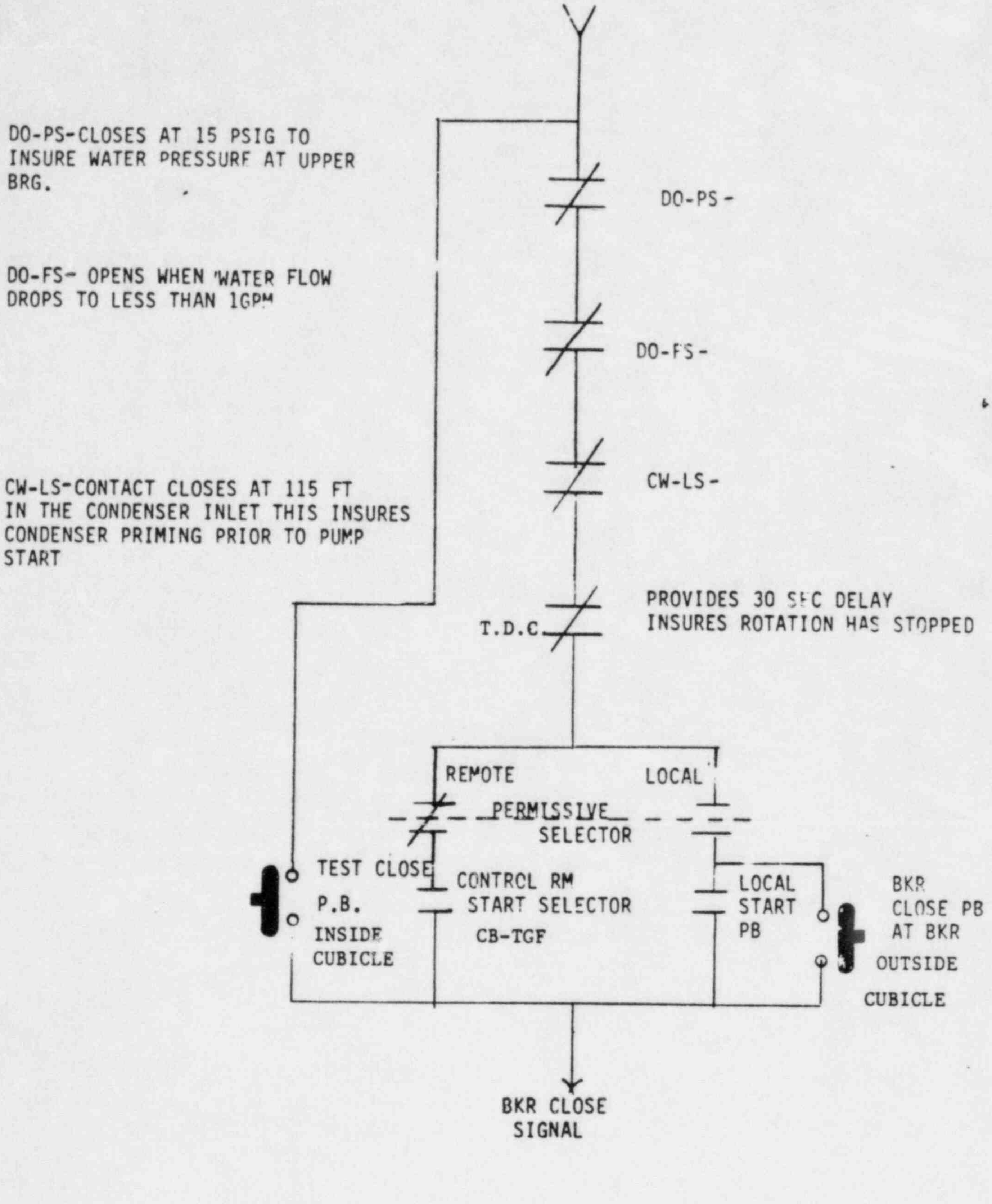
From L.P. ANAD 28 Rev 4



CIRCULATING WATER START PERMISSIVE INTERLOCKS

CONTROL FUNCTIONS

Decay Heat Pumps and DHV-34 & DHV-35

The DH pumps will start on a HPI actuation signal of 1500 psig, a LPI actuation signal of 500 psig, and a RB Isolation and Cooling actuation signal of 4 psig building pressure. The pumps will continue to run until shutdown by the operator. DHV-34 & DHV-35 (if closed) will also open on these actuations.

DHV-5 & DHV-6 - open on a 500 psig LPI actuation to allow LPI water to be injected into the core.

DHV-110 & DHV-111 - LPI flow control valves set at 3000 gpm. valves may be throttled by using a bypass key and operating key operated switches at the ES test cabinet.

INTERLOCKS

BWST level heater interlock to prevent uncovering the heaters while they are energized.

Automatic Closure Initiation - The Decay Heat system is protected from over pressure by the ACI. Decay Heat drop line valves DHV-3 and DHV-4 are closed when RCS pressure exceeds 284 psig as indicated by RC-3A-PS8 and RC-3B-PS9 respectively. This interlock can be bypassed using key operated switches located on the ES test Cabinets.

2.3.4 SYSTEM INTER-RELATIONS

The Decay Heat system is connected to the RCS for normal DH operations via the RCS "B" hot leg and returns via the core flood nozzles.

The discharge of the "A" Decay Heat pump can be directed to the pressurizer spray line via DHV-91 to aid in RCS depressurization during cooldown.

The Decay Heat system is connected to the Spent Fuel Cooling system by a line between DHV-39 and DHV-40 to take a suction on the SF system with the DH pumps and returns to the SF system via a line between DHV-7 and DHV-8. These connections allow the DH system to use the SF connections for chemical addition, filling and draining the repositioned. This can be a problem because spurious RBIC ES B actuations require several valves to be reset quickly at the local control stations to prevent equipment damage. Some examples of the equipment that could be damaged because of loss of cooling are the CRDM and RCP motor stators.

The original reason for this configuration was to meet the three feet electrical separation between trains ES A and ES B. For this reason, a common reset switch for the valves was not provided. It was also not desirable to have two control switches on the MCB for the same device. The final solution was to place switches for AB valves in the ES AB section of the MCB with power provided from ES A. A local control switch was then provided for ES B control. An engineering study, REI 80-4-74, is underway to provide a quicker means of resetting the "AB" valves after an ES B actuation.

2.2.10.5 REACTOR BUILDING ACTUATION

REACTOR BUILDING SPRAY PERMIT

In order to have a reactor building spray permit, one of the following two sets of conditions must be present.

1. HPI block 4 actuated on 2 out of 3 channels

(RC-1, 2, and/or 3)

OR

2. HPI bypassed after an actuation on 2 out of 3 channels.

   NOTE: This is required so that when the operator is required to bypass HPI early in an event in order to regain manual control of the various plant components the RB spray actuation will not be defeated. (This used to be a problem until the BS start circuitry was modified by MAR 85-05-01-01.

In order to have a Reactor Building Spray actuation, the RB spray permit must be coincident with a greater than 30 psig signal on 2 out of 3 RB spray channels (RB-4, 5, and/or 6). 5

The RB spray permit, once set, can be reset in any one of three different ways:

1. Under normal conditions it will be reset by the operator using the two reset pushbuttons on the ESF-A (actuation A) and ESF-B (actuation B) sections of the main control board.
2. If HPI is bypassed and the associated ES 4160V bus undervoltage relays actuate, the permit will automatically be reset to facilitate block loading of the EDG.
3. If HPI is bypassed and is then reactuated by either LPI or RB ISO and COOLING the permit will automatically be reset to faciliate block loading.

The RB spray actuation permit circuits function the same for both ES actuation A (BSP-1A) and ES actuation B (BSP-1B).

A status light labled "AUTO START PERMIT BSP-1A(B)" indicates the status of the BSP auto start

6.25
ROT-4-14
REV 2

A situation where this is not the case is if either the reactor or feedwater subsystem was not in automatic, in which case any signal to automatically change power would be passed to the subsystem in automatic, but would be blocked from the system in manual. This would create an unstable situation.

Cross limits can take one of two forms. The reactor can cross limit feedwater, meaning that the reactor is changing power, but feedwater is either leading or lagging the power change. In this case, there is a problem or condition preventing the reactor from responding to a demanded power change (i.e. a relay failure prevents control rod motion), while feedwater is responding to the signal for the new power level. When the deviation between reactor and feedwater demand exceeds a 5% deadband, that portion of the error in excess of 5% is inverted, and summed with the feedwater demand signal. The effect of this inversion process is to maintain a maximum deviation of 5% between the feedwater demand signal and reactor demand signal to promote stability. If actual feedwater flow exceeds reactor power by 6%, the portion of the demand in excess of 5%, or 1%, is inverted, and summed to feedwater demand. The addition of a -1% demand will reduce feedwater demand by 1%, and actual feedwater flow will be reduced by 1%, and will be maintained a maximum of 1% greater than reactor power.

When reactor power is limiting feedwater demand, cross limits will either raise or lower feedwater demand to maintain feedwater within 5% of reactor power. Cross limits will remain in effect until feedwater has returned to within 5% of reactor output.

The second form of cross limits is when feedwater cross limits the reactor. An example of this situation is when a BTU limit takes effect during an up-power transient. The Integrated Master is increasing its signal to the reactor and feedwater subsystems, but the BTU limit will not allow feedwater to increase as it should. This causes reactor power to increase while feed flow is being limited.

Actual loop "A" and "B" feedwater flows are summed, and the difference between actual feed flow and demanded feed flow, or feedwater flow error, is sent to the cross limits circuit. If feedwater demand exceeds actual feedwater flow by more than 5%, that portion of the error in excess of 5% is inverted, and summed with the reactor demand signal. This limits reactor power to its current value, or causes it to decrease, ensuring heat generation remains less than 5% above heat removal. When reactor power is again within 5% of feedwater flow, cross limits are released, and normal ICS control is be restored.

Techniques	Instructional Content
(SUGGESTION)	** If >30 mR, prior to entering the RCA, REZERO PIC **
TP34 →	c. When reading PIC, scale must be horizontal
TP35 →	d. If lost, wet, contaminated or off-scale report to H.P.
	e. Return PIC to H.P. by date listed on PIC for CALIBRATION EVERY 6 MONTHS
PASSOUT INSTRUMENT TO STUDENTS	f. Demonstrate PIC charging unit operation
TP36	2. Thermoluminescent Dosimeter - T.L.D.
	a. Radiation displaces (and thereby stores energy) electrons in lithium crystals
	b. When heated, light is given off, light is measured to give mR reading - % of light emitted = to dose.
	c. Sent off-site to be read monthly
	d. <u>Reading used for permanent record</u>
PASSOUT INSTRUMENT TO STUDENTS	e. Records Gamma and Beta
TP37	DOSE RATE INSTRUMENTS - indicate the rate of radiation exposure in mR/HR or CPM (counts per minute)
	1. When monitoring for radiation, an Eberline E-130A or similar instrument is used - CONSTANTLY READING SURVEY INSTRUMENT
DEMONSTRATE	a. 0-10, 0-100, 0-1000 mR/Hr (scale 0-10mR with multiplier switch x1, x10, x100)

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NOTES FOR LP MODIFICATION:

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Runbacks are accomplished by "locking up" the ULD (i.e. manual controls are switched out of the circuit), and decreasing demand at a preset specific rate to a pre-determined maximum value. When the demand is again below the limiting value, the ULD reverts to its normal manual mode, and the normal operator input for rate of change and power level are back in the circuit.

RUNBACKS

CAUSE	LIMIT	RATE
RCS FLOW	1.1 x FLOW	20%/MIN
RCP's	75/45%	50%/MIN
FWP's/FWBP's	55%	50%/MIN
ASSYM. ROD	60%	30%/MIN

Should more than one runback condition exist at the same time, the one with the fastest rate of change of power will take precedence. When its load limit is reached, the runback with the next highest rate of change takes place, etc.

B. Tracking:

The ULD transfers to the tracking mode to maintain coordination of the plant under certain limiting conditions. In track, the MWg is used as the MW_d; therefore, tracking is accomplished