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Rev. 16

INDIAN POINT STATION

UNIT 2

SYSTEM OPERATING PROCEDURE 1.2 REV. 16

DRAINING REACTOR COOLANT SYSTEM

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DRAINING REACTOR COOLANT SYSTEM

1 PRECAUTIONS AND LIMITATIONS

1.1 Maintain two RHR heat exchangers with CCW in service until minimum RCS temperature can no longer be maintained. 16

1.2 Maintain RHR flow balanced between both RHR heat exchangers when two are in service.

1.3 WHEN Reactor Coolant System (RCS) level is lowered below 63 ft. EL, frequently monitor level indication to ensure RHR pumps are not cavitating.

1.4 PRIOR to draining RCS below 63 ft. EL following shall be met:

1 RCS Iodine 131 Activity less than $9.0E^{-3}$ uc/cc.
2 At least one safety injection pump available.

NOTE: SI Pump may be held off for RCS protection but shall not be held off for maintenance. 16

1.5 IF RHR is lost in mid loop drained down condition, RCS boiling could occur in as little time as 2.5 minutes.

1.6 WHEN RCS is in drained down condition, close HCV 638 AND HCV 640 prior to starting RHR pump to prevent vortexing.

1.7 Level indicating system is vented to Pressurizer. PORVs and block valves should be open to Pressurizer Relief Tank (PRT) and Reactor Vessel Head should also be vented to PRT. This prevents pressure differential between Reactor Head and reference leg on RCS level indicating system. This also ensures all points of RCS are under common atmosphere.

1.8 WHEN loops are being drained, indicated hose level will lag actual level.

1.9 To prevent false RCS level hose indication, do NOT use loop 21 drains IF drain-down level transmitter, LIT 3100, is aligned to loop 21 Intermediate Leg.

1.10 To ensure steam generator tubes remain full, do NOT lower water level in pressurizer surge line to point where air or nitrogen enters RCS loop piping, unless required for maintenance operations.

1.11 WHEN RCS is initially drained to 63 ft. 2 inch EL, level will increase due to breaking of vacuum in steam generator tubes, if vacuum is not broken with nitrogen.

1.12 WHEN nitrogen is introduced to steam generator tubes, displacing coolant, operator should anticipate slight level increases on drain down level indicator.

1.13 WHEN venting Pressurizer to PRT, pressure in PRT should not exceed 25 psig AND Pressurizer should be less than 200F.

1.14 Maintain seal injection in service until RCS level is below Reactor Coolant Pump (RCP) seal package (64 ft. 6 inch EL).

1.15 Hydrogen concentration in RCS should be less than 5 cc/Kg and gaseous activity should be less than 0.01 uc/cc.

1.16 Observe applicable Health Physics procedures when venting potentially contaminated liquids or vapors.

1 Install vent lines to prevent water traps from forming OR collection device should be used to collect water.

1.17 Ensure sufficient gas decay tank usable volume to receive cover gas when draining RCS water to any Chemical and Volume Control System (CVCS) tank.

1.18 RWP shall be obtained when ever RCS is to be opened to atmosphere.

1.19 Radiation release permit shall be completed prior to opening any steam generator manway diaphragm or valve which may cause rapid venting of RCS to Containment exhaust system.

1.20 DO NOT place Purification Booster Pump in service UNTIL RCS pressure is 50 psig or less.

2 INITIAL CONDITIONS

2.1 IF draining for refueling, RCS temperature is less than 140F. _____

2.2 IF draining for maintenance, RCS temperature is less than 180F. _____

2.3 RHR system in service with ONE RHR pump in service. _____ 16

2.4 Purification path through demineralizers in service utilizing all possible beds, including cation demineralizer. _____

2.5 RCPs are shutdown. _____

2.6 Seal injection is maintaining positive thermal barrier delta P. _____

2.7 Pressurizer is on nitrogen bubble and pressure is 0 to 450 psig OR is at atmospheric conditions (SOP 3.3, Pressurizer Bubble). _____

2.8 Pressurizer temperature is less than 200F. _____

2.9 Communications exist between Central Control Room (CCR) and Vapor Containment (VC). _____

2.10 Reactor Coolant Drain System is available to transfer coolant to holdup tanks or Refueling Water Storage Tank (RWST) if loop drains are to be used. _____

2.11 IF known steam generator tube leak exists, secondary side of steam generator has been drained (SOP 7.1). _____

2.12 Pressurizer heater circuit breakers are open AND tagged. _____

2.13 All SI branch valves closed.

MOV 856A	CLOSED	_____
MOV 856B	CLOSED	_____
MOV 856C	CLOSED	_____
MOV 856D	CLOSED	_____
MOV 856E	CLOSED	_____
MOV 856F	CLOSED	_____

3 PROCEDURE

3.1 Preparation for Draindown

3.1.1 Record starting levels by filling out Section 2.1, 2.2 and 2.3 of Table 1. _____ 16

3.1.2 Place RCS low level alarm in service at panel SGF by connecting points 2-9 and H. Close out jumper in jumper log. _____

1 Ensure RCS Level Transmitter is calibrated prior to use. (PM-382). _____

3.1.3 IF desired to add nitrogen to primary side of steam generators, ensure sufficient supply of Nitrogen is available to fill each steam generator tube bundles and channel heads 900 cubic ft. _____ 16

NOTE: Single nitrogen bottle contains approximately 240 cubic ft. when fully pressurized to greater than 2000 psig. Approximately 16 bottles will be required. (Alternate supply such as nitrogen manifold with flow integrator could be substituted).

3.1.4 Place PRT jet eductor in service (SOP 1.6, PRT).

_____

3.1.5 Close nitrogen pressure regulator isolation and bypass valves:

Isolation	CLOSED	_____
Bypass	CLOSED	_____

3.1.6 Commence draindown until Pressurizer level of 20 percent is reached by one of following methods:

```
* * * * * * * * * * * * * * * * * * * * * * * * * *
*                    CAUTION                        *
*                                                   *
*     Use only one drain down path at any given     *
*     time.                                         *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * *
```

1 Draining via RHR letdown to CVCS holdup tank(s) (normal flow path). (SOP 1.2.1)

_____

2 Draining via RHR to RWST (normally used during refueling). (SOP 1.2.2) _____ 16

3 Draining via Reactor Coolant Drain Tank (RDCT) to CVCS or waste holdup tanks (alternate flow path). (SOP 1.2.3) _____

3.1.7 IF RCS level is to be drained below 20 percent, as indicated on cold calibrated level indicators, place RCS level system in service by: (see Figure 1)

1 Ensure RCS level system vent valves to Pressurizer are open (VC, on top of Pressurizer).

RCS Level Vent to Pressurizer 4179 OPEN _____

RCS Level Vent to Pressurizer 4180 OPEN _____

Pressurizer Vent 527 OPEN _____

2 Ensure Level Indicating Tygon Hose Drain Valve 4174 closed. CLOSED _____

3 Ensure Level Reference Leg Drain Valve 4177 is closed (VC, 46 ft. EL by RCP 21 ladder). CLOSED _____

4 IF RCS pressure is less than 30 psig, open Level Indicating Tygon Hose Lower Stop Valve 4175 (VC, 46 ft. EL by RCP 21 ladder). OPEN _____

5 Open Level Reference Leg Stop Valve 4176 (VC, 46 ft. EL by RCP 21 ladder). OPEN _____

6 IF RCS pressure is less than 30 psig, open Level Indicating Tygon Hose Upper Stop valve 4178 (VC, 95 ft. EL under bedspring stairs by grating above RCP 21). OPEN _____

7 Close Reactor Vessel Flange Leakoff Stop 544 (CCR, SAF panel). CLOSED _____

8 Close "old" level Column Isolation Stop 540 (VC, 46 ft. EL, Recirculation Sump Room) CLOSED _____

9 Close Route Stop To RCDT 539 (VC, 46 ft. EL, Intermediate Leg 21). CLOSED _____

10 Close Route Stop To RCDT 508B (VC, 46 ft. EL, Intermediate Leg 21). CLOSED _____

11 Open Intermediate Leg 21 to Level Indicator Stop 508A (VC, 46 ft. EL, under Intermediate Leg 21). OPEN _____

12 Open Intermediate Leg 21 to Level Indicator Stop 542 (VC, 46 ft. EL, under Intermediate Leg 21). OPEN _____

13 Open Intermediate Leg 21 to Level Indicator Stop 541 (VC, 46 ft. EL, under Intermediate Leg 21). OPEN _____

14 Open Intermediate Leg 21 to Level Indicator Stop 4128 (VC, 46 ft. EL, under Steam Generator 21 platform). OPEN _____

15 Ensure vents and drain from 21 Hot Leg Supply to level system are closed (VC, 46 ft. EL, under steam generator platform).

Hot Leg 21 Vent 4172 CLOSED _____
Hot Leg 21 Vent 4173 CLOSED _____
Hot Leg 21 Drain 4171 CLOSED _____

16 Open loop 21 hot leg supply valves to level system (VC, 46 ft. EL, under steam generator platform).

Hot Leg 21 Supply RL-1 OPEN _____
Hot Leg 21 Supply RL-2 OPEN _____

17 Open loop 21 Hot Leg Supply Stop Valve 4138 (VC, 46 ft. EL Hot Leg). OPEN _____

18 Ensure loop 21 Hot Leg Sample Stop Valve 954A is open (VC, 46 ft. EL Hot Leg). OPEN _____

19 Ensure transmitter vent and drain stops are closed (VC 46 ft. EL at LIC 3100s and LIT 3100).

Transmitter Vent Stop Dry Leg 4163. CLOSED _____
Transmitter Vent Stop Wet Leg 4162. CLOSED _____
Transmitter Drain Stop Dry Leg 4170. CLOSED _____
Transmitter Drain Stop Wet Leg 4169. CLOSED _____

20 Ensure Common Transmitter Equalizing Valve 4164 is closed. CLOSED _____

21 Ensure transmitter root stops are open.

Transmitter Root Stop Dry Leg 4168. OPEN _____
Transmitter Root Stop Wet Leg 4167. OPEN _____
Transmitter Root Stop Dry Leg 4166. OPEN _____
Transmitter Root Stop Wet Leg 4165. OPEN _____

22 OPEN Dry Leg vent and drain until dry, THEN CLOSE.

Dry Leg Vent 4163	CLOSED	_____
Dry Leg Drain 4170	CLOSED	_____
Dry Leg Drain 4177	CLOSED	_____

23 OPEN Level Indicating Tygon Hose Drain Valve 4174 and drain 3 to 4 gal. of water, THEN CLOSE. CLOSED _____

24 OPEN Transmitter Drain Stop Wet Leg 4169 and drain 3 to 4 gal. of water, THEN CLOSE. CLOSED _____

25 OPEN Transmitter Vent Stop Wet Leg 4162 until all air is removed, THEN CLOSE. CLOSED _____

26 Vent Wet Leg side of transmitter by using body vent plug until all air is removed. _____

3.1.8 Continue drain down by method selected in step 3.1.6: 16

1 Start taking drain down level data per Attachment 1. Observe all notes in Attachment. _____

TABLE 1

Volume Calculation Method

1 Initial Conditions

Reactor Coolant System calculated capacities

Pressurizer Upper Hemisphere	650 gal
Middle Section	12,122 gal
Lower Hemisphere	650 gal
4 SG Channel Heads (Hot & Cold)	7,360 gal
4 SG Tube Bundles	20,553 gal
4 Cold Legs	3,142 gal
4 Hot Legs	3,172 gal
4 Int Legs	4,070 gal
Surge Line	1,142 gal
Reactor Full	34,764 gal
4 RCPs	7,658 gal
TOTAL = (with Full Pressurizer)	95,383 gal

Water Removed to Level 62 Feet 10 inches:

Pressurizer	13,422 (Full)
Surge Line (partial)	58
4 SG Channel Hds	7,360
4 SG Tubes	20,553
Water Removed from Rx	12,568
4 RCS Loops	829
4 RCPs	2,727
Total Removed	57,517 gal (Full Pressurizer)

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2 Measure Water Removed as Follows:

2.1 Record Pressurizer level (corrected for temperature). _____

2.2 Determine difference between actual pressurizer level and full (solid) pressurizer by using RCS Draindown Curve RCS 17A and place value on calculation worksheet Table 2.

NOTE: 1 IF Steam Generator tubes have NOT been drained, use left hand curve on Graph 17A to determine water removed.

2 IF Steam Generator tubes HAVE been drained use right hand curve.

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TABLE 1 (Continued)

Volume Calculation Method

2.3 Record starting tank levels and record time _____.

21 HUT _____
22 HUT _____
23 HUT _____
RCDT _____
VCT _____

2.4 When indicated RCS level is at 62 ft. 10 inches EL, record ending tank levels _____ and record time _____.

21 HUT _____
22 HUT _____
23 HUT _____
RCDT _____
VCT _____

2.5 Determine change in tank levels and convert to gallons via Graphs Book. (Section TC)

NOTES: 1 Observe algebraic signs. Take into account any processing of holdup tanks.

2 Use Table 2 for Calculation Worksheet.

TABLE 2

Calculation Worksheet

1 Amount of Water NOT in Pressurizer (2.2) _____

Time of start of Draindown _____ Finished _____

2 Amount of Water in Tanks (2.3,2.4,2.5)

21 HUT level Initial _____% level Final _____ %
Gal Initial _____ Gal Final _____ %
TOTAL added gal = _____

22 HUT level Initial _____% level Final _____ %
Gal Initial _____ Gal Final _____ %
TOTAL added gal = _____

23 HUT level Initial _____% level Final _____ %
Gal Initial _____ Gal Final _____ %
TOTAL added gal = _____

VCT level Initial _____% Final _____ %
Gal Initial _____ Gal Final _____ %
TOTAL added gal = _____

RCDT level Initial _____% Final _____ %
Gal Initial _____ Gal Final _____ %
TOTAL added gal = _____

3 Water NOT in Pressurizer _____
Total in item 2 21 + _____
22 + _____
23 + _____
VCT + _____
RCDT + _____

TOTAL = + _____

4 Compare total in item 3 to curve RCS 17A and determine calculated RCS Level. _____

5 Compare calculated level to actual RCS level to determine expected inventory tracking. _____

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ATTACHMENT 1

RCS DRAIN DOWN LEVEL LOG

START TIME_____ FINISH TIME_____ DESIRED LEVEL_____

NOTES: 1 Readings will be taken at one hour intervals until level is at 64 ft. THEN readings shall be taken every 15 minutes until 62 ft. 10 inches is reached.

2 When level system is lined up, level difference between Tygon Column vs V.C. Barton indication, and Tygon Column vs CCR indication shall be less than plus or minus 6 inches.

3 As RCS is draining down difference between indications shall NOT change by more than plus or minus 2 inches.

4 IF level difference change exceeds 2 inches, STOP drain down; allow system to stabalize; THEN proceed.

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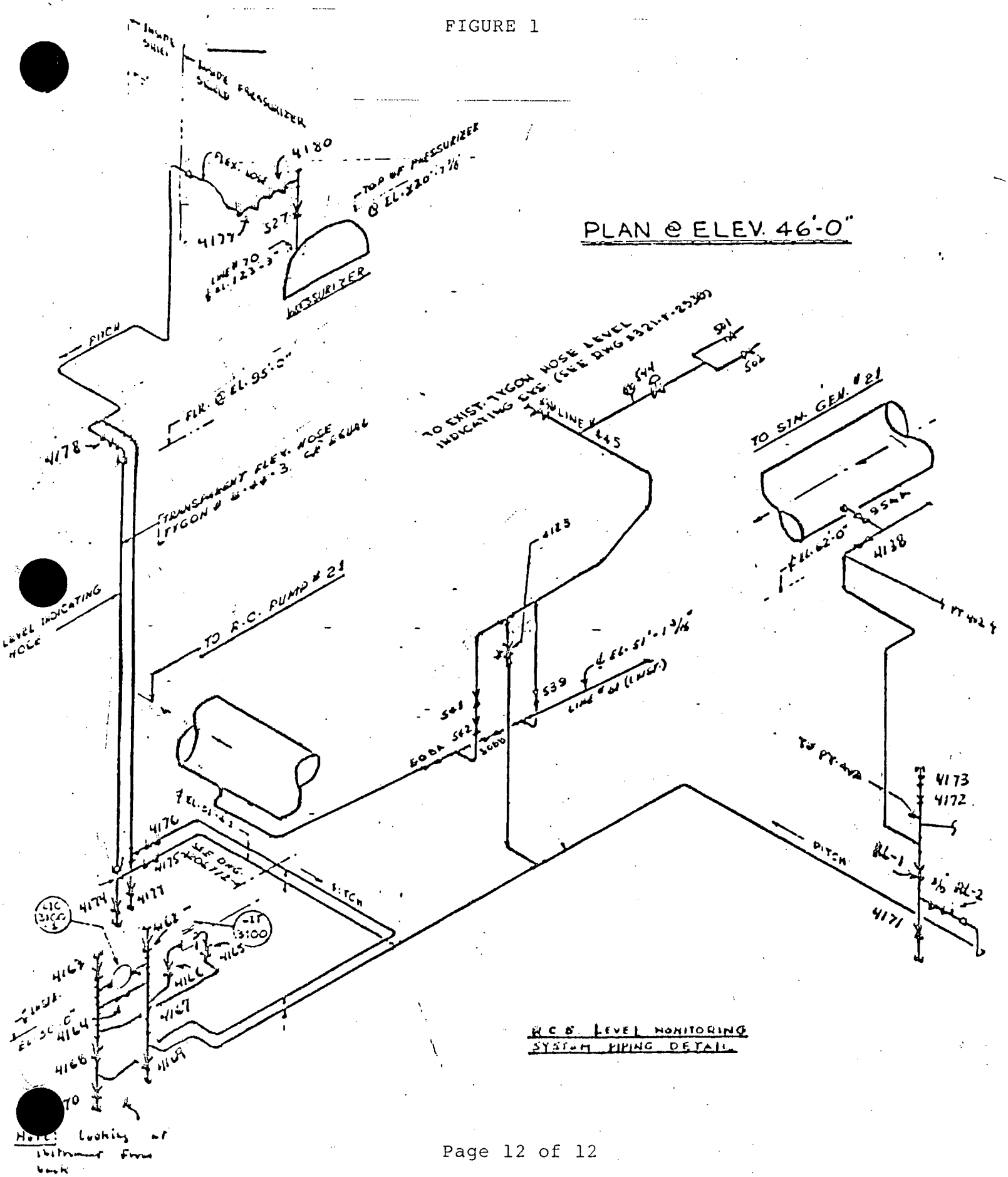
Time	CCR Indication	CCR/Tygon Difference	Tygon Column	Tygon/Barton Difference	VC Barton Indication	Pressurizer Cold Indication
Start						
1st Hr.						
2nd Hr.						
3rd Hr.						
4th Hr.						
5th Hr.						
6th Hr.						
7th Hr.						
8th Hr.						
9th Hr.						
10th Hr.						
11th Hr.						
12th Hr.						

Time 15 Minute Readings	CCR Indication	Time 15 Min Readings	CCR Indication
Start			

FIGURE 1



Note: Looking at instrument from back