CAROLINA POWER & LIGHT COMPANY

SHEARON HARRIS NUCLEAR POWER PLANT

PROCESS INSTRUMENTATION CONTROL SCALING CALCULATIONS

CALCULATION TYPE: NUCLEAR STEAM SUPPLY SYSTEM (NSSS)

CALCULATION NUMBER: SC-N-061

TITLE: RCS WIDE RANGE PRESSURE LOOP 1 P-403

REVISION 4

PREPARED BY _____ TITLE Engineer DATE 10/2/92

REVIEWED BY _____ TITLE System Eng DATE 10/5/92

APPROVED BY _____ TITLE Manager-Elect/I&C DATE 10/5/92

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1.0 PURPOSE

This document provides the Scaling necessary to calibrate the containment RCS Wide Range Pressure loop P-403, which includes inputs to the Main Control Board (MCB), Auxiliary Control Panel (ACP), and the Solid State Protection System (SSPS).

2.0 REFERENCES

1. MOD-110
2. MST-I0081
3. NSSS EQUIPMENT REFERENCE MANUAL (VM-PYC)
4. NSSS BLOCK DIAGRAMS 1364-1328 SH 29
5. PL&S pg 49 (1364-53872, SH 56)
6. CAR-2166-B-432
7. CAR-2166-B-508
8. CAR-2166-S-3015
9. FCR-I-2229
10. TECH SPEC pg 3/4 5-5, 3/4 3-65, 3/4 3-70
11. IS/1-RC-489
12. CAR-2166-G-452
13. CAR-2166-B-431 SH L-74
14. FSAR pg 5.4.7-4, 5.4.7-8, 5.4.7-13, 5.4.7-14, 7.4.1-12, 7.4.1-13, 7.6.1-1
15. CWD CAR-2166-B-401 SH's 325 thru 328
16. IR-85-1066
17. SC-N-178, SC-N-179
18. 1364-46577 SH 8
19. VM-PUK WESTINGHOUSE RECORDERS
20. VM-BFL TOBAR TRANSMITTERS
21. Calculation HNP-I/INST-1044
22. PCR-2898
23. PCR-6547

3.0 GENERAL SCALING CALCULATIONS AND REVISION COMMENTS

3.1 TOLERANCE - Most process cards are assigned a tolerance of ±0.50% or ±0.050 VDC. This is obtained by ±0.50% • 10 VDC = ±0.050 VDC. Computer points are ±0.75% of the span. All indicators and recorders are ±2.0% of the span.

3.2 Revision 5 incorporates PCR-6547. PCR-6547 adds a bistable for the CSIP Alternate Miniflow Permissive.

4.0 SPECIFIC SCALING CALCULATIONS

4.1 PT-01RC-0403-IVW

Description: Pressure Transmitter
Location: A1-R45B
Model: Tobar 32PA2

Known:

1. Input: 0.0 to 3000.0 PSIG.

2. Output: 4.0 to 20.0 mA (1.0 to 5.0 VDC @ input to NLP)

3. The following drawings were used to determine that the transmitter taps into the Reactor Coolant Hot Leg at elevation 252'-6¼"; IS/1-RC-489, CAR-2166-G-452, CAR-2166-B-431 Sheet L-74 and CAR-2166-B-431 Sheet L-78. The transmitter is mounted in rack A1-R45B, which is located on elevation 236'. Field measurements place the centerline of the transmitter 5'9" from the floor.

4. Per ASME Steam Tables, the specific volume of water at 90.0°F is 0.016099 FT^3/LB.

Determine the transmitter head correction by→

1. Determine the distance between the centerline of the transmitter and the centerline of where the transmitter impulse line taps into the Reactor Coolant System by →

$$\begin{array}{rl} 252.0' + 6.25" & = 252.5208' \\ -\underline{236.0' + 5.0' + 9"} & = \underline{241.7500'} \\ & = 10.7708' \end{array}$$

2. Convert the 10.7708' into PSI by→

$(0.016099\ FT^3/LB)^{-1} \cdot (10.7708') / (144.0\ IN^2/FT^2) = 4.646$ PSI

NOTE: It it assumed the transmitter impulse line is at 90.0°F for the above calculation.

3. For calibration purposes the head corrections will be 4.6 PSIG.

4.1 PT-01RC-0403-IVW (continued)

Determine any 1→5 VDC output from any PSIG input to transmitter by →

(1→5 VDC Output) = [(PSIG Input)-(4.6 PSIG)]•(4 VDC)/(3000 PSIG) + 1 VDC

Tolerance = ±0.50% = ±0.02 VDC

Percent of Input	RCS Pressure Represented PSIG	Input Pressure to Transmitter PSIG	Output @ NCT2 TP1 CAB 04-0824 VDC (mA)
0.18%	5.4	10.0	1.007 (4.028)
24.85%	745.4	750.0	1.994 (7.976)
49.85%	1495.4	1500.0	2.994 (11.976)
74.85%	2245.4	2250.0	3.994 (15.976)
99.85%	2995.4	3000.0	4.994 (19.976)

4.2 PQY-403

Description: Loop Power Supply (Isolated & Non-Isolated)
Location: CAB 04-0241
Model: Westinghouse NLP2

Known:

1. INPUT: 1.0 to 5.0 VDC
2. OUTPUT: 0.0 to 10.0 VDC

Determine any 0→10 VDC output from any 1→5 VDC input by →

(0→10 VDC Output) = [(1→5 VDC Input)-1]•(10 VDC)/(4 VDC)

Tolerance = ±0.50% = ±0.05 VDC

Note: 1. See Section 4.5 for data table.

2. Both Isolated and Non-Isolated outputs must be tested.

4.3 PY-403

Description: Isolator
Location: CAB 04-0242
Model: Westinghouse NLP3

Known:

1. INPUT: 0.0 to 10.0 or 1.0 to 5.0 VDC from input of PQY-403
2. OUTPUT: 0.00 to 10.00 VDC

Determine any 0→10 VDC output from any 1→5 VDC input by →

(0→10 VDC Output) = [(1→5 VDC Input)-1]•(10 VDC)/(4 VDC)

Tolerance = ±0.50% = ±0.05 VDC

Note: See Section 4.5 for data table.

4.4 PY-403A
Description: Isolator
Location: CAB 04-0253
Model: Westinghouse NLP3

Known:
1. INPUT: 0.0 to 10.0 or 1.0 to 5.0 VDC from input of PQY-403
2. OUTPUT: 0.0 to 10.0 VDC

Determine any 0→10 VDC output from any 1→5 VDC input by →

(0→10 VDC Output) = [(1→5 VDC Input)-1]•(10 VDC)/(4 VDC)

Tolerance = ±0.50% = ±0.05 VDC

Note: See Section 4.5 for data table.

4.5 PY-403B
Description: Isolator
Location: CAB 04-0254
Model: Westinghouse NLP3

Known:
1. INPUT: 0.0 to 10.0 or 1.0 to 5.0 VDC from input of PQY-403
2. OUTPUT: 0.00 to 10.00 VDC

Determine any 0→10 VDC output from any 1→5 VDC input by →

(0→10 VDC Output) = [(1→5 VDC Input)-1]•(10 VDC)/(4 VDC)

Tolerance = ±0.50% = ±0.05 VDC

Percent of Input	Input @ TJ @ CAB 04-0824 1→5 VDC	Output PQY-403 0→10 VDC	Output PY-403 0→10 VDC	Output PY-403A 0→10 VDC	Output PT-403B 0→10 VDC
0%	1.000	0.000	0.000	0.000	0.000
25%	2.000	2.500	2.500	2.500	2.500
50%	3.000	5.000	5.000	5.000	5.000
75%	4.000	7.500	7.500	7.500	7.500
100%	5.000	10.000	10.000	10.000	10.000

Note: 1. Both Isolated and Non-Isolated outputs of PQY-403 must be tested.

4.6 PI-01RC-0403-.1SBW

Description: Pressure Indicator
Location: MCB 1A2
Model: Westinghouse VX-252

Known:

1. INPUT: 0.0 to 10.0 VDC or 1.0 to 5.0 VDC from input of PQY-403
2. OUTPUT: 0.0 to 3000.0 PSIG

Determine any 0→3000 PSIG output from any 1→5 VDC input by →

(0→3000 PSIG Output) = [(1→5 VDC Input)-1]•(3000 PSIG)/(4 VDC)

Tolerance = ±2.00% = ±60 PSIG

Note: See Section 4.7 for data table.

4.7 PI-01RC-0403-.2SB

Description: Pressure Indicator
Location: ACP II
Model: Westinghouse VX-252

Known:

1. INPUT: 0.0 to 10.0 VDC or 1.0 to 5.0 VDC from input of PQY-403
2. OUTPUT: 0.0 to 3000.0 PSIG

Determine any 0→3000 PSIG output from any 1→5 VDC input by →

(0→3000 PSIG Output) = [(1→5 VDC Input)-1]•(3000 PSIG)/(4 VDC)

Tolerance = ±2.00% = ±60 PSIG

Percent of Input	Input @ TJ @ CAB 04-0824 1→5 VDC	Output PI-01RC-0403-.1SBW PSIG	Output PI-01RC-0403-.2SB PSIG
0%	1.000	0.0	0.0
25%	2.000	750.0	750.0
50%	3.000	1500.0	1500.0
75%	4.000	2250.0	2250.0
100%	5.000	3000.0	3000.0

4.8 PR-01RC-0402-SW

Description: Pressure Recorder, Pen 2
Location: Recorder Panel
Model: Hagan 17450

Known:

1. INPUT: 0.0 to 10.0 VDC or 1.0 to 5.0 VDC from input of PQY-403
2. OUTPUT: 0.0 to 3000.0 PSIG

Determine any 0→3000 PSIG output from any 1→5 VDC input by →

(0→3000 PSIG Output) = [(1→5 VDC Input)-1]•(3000 PSIG)/(4 VDC)

Tolerance = ±2.00% = ±60 PSIG

Percent of Input	Input @ TJ @ CAB 04-0824 1→5 VDC	Output, Pen 2 PR-01RC-0402-SW PSIG
0%	1.000	0.0
25%	2.000	750.0
50%	3.000	1500.0
75%	4.000	2250.0
100%	5.000	3000.0

4.9 PS-01RC-0402-AW

Description: Dual Comparator
Output 1: Open Permissive for RHR valves 1RH-1 & 1RH-39
Output 2: RCS High Pres Alarm for RHR valves 1RH-1 & 1RH-39
Location: CAB 04-0243
Model: Westinghouse NAL2

Known:

1. Input 1: 0 to 10 VDC or 1.0 to 5.0 VDC from input of PQY-403
   Input 2: 0 to 10 VDC or 1.0 to 5.0 VDC from input of PQY-403

2. Output 1: On/Off De-energizes on DECR
   Output 2: Off/On Energizes on INCR

3. Setpoint 1: 363.0 PSIG Open Permissive for valve 1RH-2
   Reset 1: 393.0 PSIG

4. Setpoint 2: 425.0 PSIG High Pressure Alarm for valve 1RH-2
   Reset 2: 410.0 PSIG

Determine any 1→5 VDC input from any PSIG setpoint by →

$$(1\rightarrow5 \text{ VDC Input}) = [(\text{PSIG Setpoint}) \cdot (4 \text{ VDC})/(3000 \text{ PSIG})] + 1 \text{ VDC}$$

Tolerance 1 = ±0.50% = ±0.02 VDC (1→5 VDC) = 15 PSIG
Tolerance 2 = ±0.25% = ±0.01 VDC (1→5 VDC) = 7.5 PSIG

Setpoint #1 Open Permissive for valves 1RH-1 & 1RH-39		Input @ TJ @ CAB 04-0824 (1→5 VDC)	Actuation #1
Trip	363.0 PSIG	1.484	DECR De-energize
Reset	393.0 PSIG	1.524	INCR Energize

Setpoint #2 High RCS Pressure Alarm for valves 1RH-1 & 1RH-39		Input @ TJ @ CAB 04-0824 (1→5 VDC)	Actuation #2
Trip	425.0 PSIG	1.567	INCR Energize
Reset	410.0 PSIG	1.547	DECR De-energize

4.10 PS-01RC-403-B

Description: Single Comparator, Open/Close Permissive for the Alternate Miniflow MOV 2CS-V759SB1
Location: CAB 04-0256
Model: Westinghouse NAL1

Known:

1. Input: 0 to 10 VDC or 1.0 to 5.0 VDC from input of PQY-403
2. Output: Off/On Energizes on INCR
3. Setpoint: 2300 PSIG Open Permissive Alt Miniflow MOV
   Reset: 1750 PSIG Close Permissive Alt Miniflow MOV

Determine any 1→5 VDC input from any PSIG setpoint by →

(1→5 VDC Input) = [(PSIG Setpoint)•(4 VDC)/(3000 PSIG)] + 1 VDC

Tolerance = ±0.50% = ±0.02 VDC (1→5 VDC) = ±15 PSIG

Setpoint Open/Close Permissive for Alt Miniflow MOV		Input @ TJ @ CAB 04-0824 (1→5 VDC)	Actuation
Trip	2300 PSIG	4.067	INCR Energize
Reset	1750 PSIG	3.333	DECR De-energize

ENCLOSURE 3

FLOW TEST EQUIPMENT ACCURACY