ATTACHMENT

MID-CYCLE

STEAM GENERATOR INSPECTION

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286
OCTOBER 29, 1980

The details of the Steam Generator Inspection program to be performed on #32 Steam Generator, during the Unit's mid-cycle outage were submitted in a letter from Mr. J. P. Bayne of the Power Authority to Mr. Steven A. Varga, of the NRC, dated August 28, 1980. The mid-cycle steam generator outage commenced on October 1, 1980.

The inspection program of #32 Steam Generator consisted of the following:

1) Steam Generator Eddy Current Examination

The program called for a multi-frequency eddy current inspection of 800 tubes in #32 Steam Generator Hot Leg (inlet). The tubes to be inspected were located in the "hard" peripheral areas, at the flow slots for Row 2 and Row 3 tubes, and in selected tubes throughout the center of the generator. Additionally, gauging of the tubes was performed using a 720, 700, 650, 610, and 540 mil eddy current probe, as far as the upper support plate. If a tube was found to be restricted to a 650 mil probe, the tubes surrounding the restricted tube would also be gauged with a 650 mil probe, in order to "box in" the restricted tube and determine the extent of denting.

795 tubes, or about 25% of the active tubes in Steam Generator #32 inlet were inspected up to the top support plate.

The results of the inspection, detailed in this report, were relayed verbally to Messrs. L. Olshan, E. Murphy and D. Wang of the NRC in phone conversations held on October 16, 17, and 20, 1980 with the Authority's staff.

2) Flow Slot & Support Plate Inspection

A photographically documented examination of the flow slots, first and second support plates, was performed in all four steam generators. This was accomplished using the hand holes above the tube sheet for access.

Since return to power in February 1980 for Cycle III Indian Point 3 has been following a "Boric Acid Program" involving addition of boric acid to the steam generator secondary side in order to arrest the denting process. This program is being conducted in conjunction with Westinghouse and EPRI and is similar to programs being conducted at Indian Point 2, a Korean Westinghouse reactor and at the North Anna nuclear plant. This treatment is being performed in order to demonstrate the utility of boric acid addition in arresting the denting process. This effect has been conclusively demonstrated in model boiler experiments.

Although the flow slot closure rate from Cycle 3 is lower than that from Cycle II there is no conclusive evidence that this reduction is due to the boric acid treatment. However, the "Boric Acid Program" will be continued at least for the balance of Cycle III.

1) Eddy Current

The inspection consisted of the insertion of a 720 mil probe through the tube, to the upper support plate. If an obstruction prevented the passage of this probe, successively smaller size probes were then used to determine the size of the restriction. The sizes of the probes used were 720, 700, 650, 610 and 540 mils.

If a tube failed to pass a 650 mil probe, all the tubes adjacent to this tube were also inspected with a 650 mil probe. This "box-in" procedure insured sufficient data to determine the extent of denting in areas that it was more pronounced.

The location of the tubes in Steam Generator #32 inlet side which were eddy current inspected and gauged are listed in Table 1 and depicted on Figure 1.

The results of the gauging inspection are shown in Table 2. Figures 2, 3, 4, and 5 identify the locations of restrictions for the different size probes.

As can be seen, all tubes restricted to a 610 mil probe passed a 540 mil probe. In addition, the four (4) tubes restricting a 610 mil probe were plugged and the five (5) tubes restricted to a 650 mil probe, which are located adjacent to the four tubes restricting the 610 mil probe, were preventatively plugged. Table 3 lists the numbers of the tubes which were plugged this outage and Figure 6 shows the locations of these tubes. Table 4 presents a complete listing of all tubes plugged to date.

2) Flow Slot Photography

Photographs of the flow slots show that "hourglassing" is still a factor in all four steam generators but the rate has been reduced since the last evaluation. In an evaluation comparison with the

photographs taken in September 1979, the average rate of "hourglassing" has been calculated to be approximately 24.5 mils per Effective Full Power Month (EFPM). This is a 37.2% reduction in the average rate of "hourglassing" calculated for the period of operation prior to September 1979. Table 5 catalogs the flow slots and calculations utilized in determining this rate.

TABLE 1

Tubes Inspected

Steam Generator No. 32 Inlet

Row	Column	No. of Tubes
2	1-6, 8-43 49-52, 55-68 72-83, 85, 87-92	79
3	1-43, 49-92	87
4	1-4, 6, 12, 88-92	11
5	1-6, 8, 12, 16, 20, 24 28, 32, 48, 52, 56, 60, 64 68, 72, 76, 80, 84, 88-92	28
6	1-5, 40, 44, 88-92	12
7	1-5, 88-92	10
8	1-5, 88-92	10
9	2-5, 8, 12, 16, 20, 24, 28, 32, 40, 44, 48, 52, 56, 60 64, 68, 72, 76, 80, 84, 88-91	28
10	2-5, 88-91	8
11	2-5, 88-91	8
12	2-5, 88, 89, 91	7
13	3-5, 8, 12, 16, 20, 24, 28 32, 36, 40, 44, 48, 52, 56 60, 64, 68, 72, 76, 80, 84 88-90	26
14	3-5, 88-90	6
15	3-5, 88-90	6
16	4-6, 87-89	6
17	4-6, 8, 12, 16, 20, 24, 28 32, 36, 40, 44, 48, 52, 56 60, 64, 68, 72, 76, 80, 84 87-89	26
18	5-8, 87,88	6
19	5, 6, 8, 85, 87, 88	6
20	5-8, 85-88	8

TABLE 1 (cont.)

Row	Column	No. of Tubes
21	6-8, 12, 16, 20, 24, 28 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72 76, 80 84-87	25
22	7-9, 84-86	6
23	7-9, 84-86	6
24	8-10, 83-85	6
25	8-12, 16, 20, 24, 28 32, 36, 40, 44, 48, 52 56, 60, 64, 68, 72, 76 80, 82-85	26
26	9-13, 20, 80-84	11
27	10-14, 79-83	10
28	11-15, 78-81	9
29	11-18, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64 68, 76, 76-81	28
30	12-16, 18, 76-81	12
31	15-18, 76-78	7
32	15-18, 39-54, 75-78	24
33	15-18, 20, 24, 28, 32, 36, 39-54, 56, 60, 64, 68, 72, 75-78	34
34	16, 18-21, 39, 40, 53, 54, 73-77	14
35	17-21, 39, 40, 53, 54, 72-76	14
36	19-22, 39, 40, 53, 54 71-74	12
37	20-24, 28, 32, 36, 39, 40, 44, 48, 52-54, 56, 60, 64 68-73	24
38	21-26, 39, 40, 53, 54, 67-7	16

TABLE 1 (cont.)

Row	Column	No. of Tubes
39	23-28, 39, 40, 53, 54, 65-70	16
40	25-30, 39, 53, 54, 63-68	15
41	27, 29-40, 44, 48, 52-66	30
42	30-40, 53-64	23
43	32-40, 53-61	18
44	35, 36, 39, 40, 43-49, 53, 54, 57, 58	15
45	39-54	16

Table 2

Categorization of Restrictions - Steam Generator No. 32 - October, 1980

Total Tubes Inspected	Restricted A 720 Mil Probe	Restricted A 700 Mil Probe	Restricted A 650 Mil Probe	Restricted A 610 Mil Probe	Restricted A 540 Mil Probe
795	448	258	50	4	0

Of the 795 Tubes Inspected during this test - 247 were also inspected September 1979. Of these, 86 exhibited no progression of denting.

Table 3

Tubes Plugged - October 1980

Steam Generator No. 32

610 Mil Restricted Tubes

Row	Column
2	26
3	23
8	3
18	88

650 Mil Restricted Tubes

Row	Column
2	21
3	22
9	4
16	89
19	88

Table 4

Tubes Plugged To Date

Steam Generator No. 32

Previous	115
Additional (Oct. '80)	9
Total	124
% Plugged	3.80

Note: Tubes Previously Plugged:

S/G 31	S/G 33	S/G 34
104	117	119
3.19%	3.59%	3.65%

Total - 464 Tubes Plugged

TABLE 5

CALCULATED FLOW SLOT CLOSURE - OCTOBER, 1980

S/G 31

SIDE †	FLOW SLOT	SUPPORT PLATE	RATIO	DISTANCE (inches)	CLOSURE (inches)	Δ *	NUMBER OF CRACKS OLD	NEW
N	1	1	39/46	2.33	.42	.07	0	0
N	1	2	15/18	2.29	.46	.01	2	0
N	2	1	38/45	2.32	.43	.20	0	0
N	2	2	15/19	2.17	.58	.08	1	0
N	3	1	35/42	2.29	.46	.15	0	0
N	3	2	13/18	1.99	.76	.26	0	0
M	1	1	28/39	1.97	.78	.23	1	0
M	1	2	14/18	2.14	.61	.11	0	0
M	2	1	38/42	2.49	.26	.04	0	0
M	2	2	16/18	2.44	.31	.11	1	0
M	3	1	34/43	2.17	.58	.11	0	0
M	3	2	10/18	2.44	.31	.20	0	0
				AVERAGE CLOSURE	.50	.13		

Average Closure Rate - (5EFPM) = 26 MILS/EFPM

S/G 32

N	1	1	16/21.5	2.05	.7	.20	0	1
N	1	2	10/14	1.96	.79	.29	0	0
N	2	1	36.5/42	2.39	.36	.11	0	0
N	2	2	21.5/25.5	2.32	.43	-.07	1	0
N	3	1	31/41.5	2.05	.7	.39	0	0
N	3	2	12/16.5	2.00	.75	.25	0	0
M	1	1	37/44.5	2.29	.46	.12	0	0
M	1	2	6/18	.92	1.83	.45	2	0
M	2	1	36/45.5	2.18	.57	.01	0	0
M	2	2	14/19	2.03	.72	.06	0	0
M	3	1	33.5/44.5	2.07	.68	.18	1	0
M	3	2	13/19	1.88	.87	.18	0	0
				AVERAGE CLOSURE	.74	.18		

Average Closure Rate (5EFPM) = 36 MILS/EFPM

* Δ - Signifies comparison of closure with data from 9/79 test.
† Refer to Figure 7 for location of data.

TABLE 5 (cont'd)

CALCULATED FLOW SLOT CLOSURE - OCTOBER, 1980

S/G 33

SIDE †	FLOW SLOT	SUPPORT PLATE	RATIO	DISTANCE (inches)	CLOSURE (inches)	Δ *	NUMBER OF CRACKS OLD	NEW
N	1	1	42/47	2.46	.29	.14	0	0
N	1	2	17/19	2.46	.29	.02	1	0
N	2	1	46/47	2.69	.06	.06	0	0
N	2	2	28.5/29	2.70	.05	.05	0	0
N	3	1	37.5/46	2.24	.51	.09	0	0
N	3	2	17/18.5	2.53	.22	-	0	0
M	1	1	39/41	2.44	.31	.13	0	0
M	1	2	10/18	1.53	1.24	.20	2	0
M	2	1	43.5/48.5	2.47	.28	.01	0	0
M	2	2	22/28	2.16	.59	.32	0	0
M	3	1	40/49	2.25	.50	.04	0	0
M	3	2	13.5/19.5	1.90	.65	.10	0	1
				AVERAGE CLOSURE	.42	.11		

Average Closure Rate - (5EFPM) = 22 MILS/EFPM

S/G 34

N	1	1	39/43.5	2.47	.28	.01	0	0
N	1	2	15/18.5	2.23	.52	.36	2	0
N	2	1	39.5/44.5	2.44	.31	.02	0	0
N	2	2	16/18.5	2.39	.36	.11	0	0
N	3	1	36/45	2.36	.39	.06	0	0
N	3	2	14/18	2.14	.61	.06	0	0
M	1	1	35/40.5	2.38	.46	.14	0	0
M	1	2	16.5/18	2.52	.23	.03	0	0
M	2	1	44/44	2.75	0.00	.00	0	0
M	2	2	19/19	2.75	0.00	.00	0	0
M	3	1	54/54	2.75	0.00	.00	0	0
M	3	2	25/26	2.64	.11	.00	0	0
				AVERAGE CLOSURE	.27	.07		

Average Closure Rate (5EFPM) = 14 MILS/EFPM

* Δ - Signifies comparison of closure with data from 9/79 test.
† Refer to Figure 7 for location of data.

EDDY CURRENT INSPECTION PROGRAM - OCTOBER, 1980

SERIES 44

INT-32

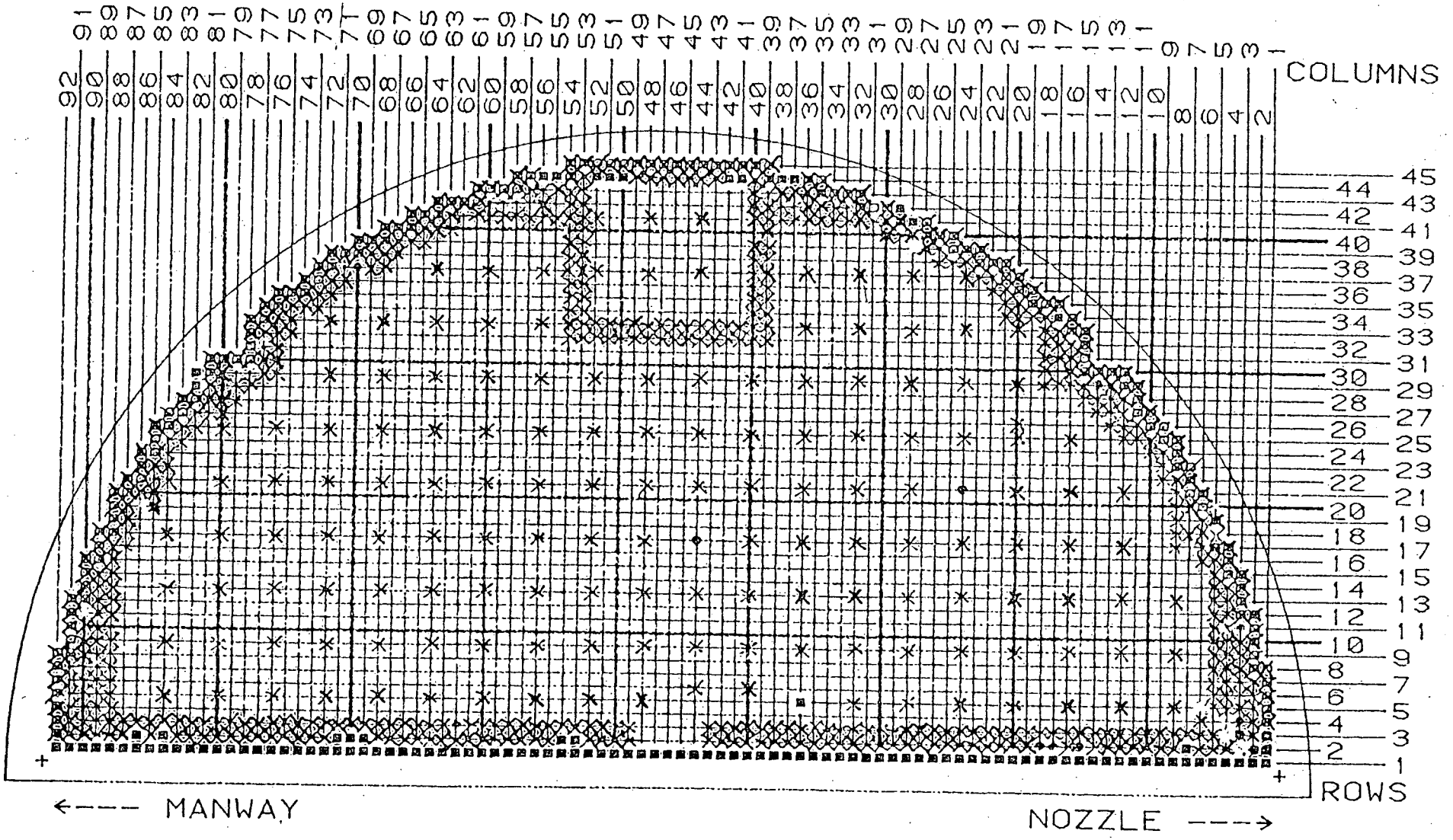


FIGURE 1

■ Tubes Previously Plugged

X Tubes to be Inspected

EDDY CURRENT INSPECTION PROGRAM - OCTOBER, 1980

TUBES RESTRICTING A 720 MIL PROBE

SERIES 44

INT-32

INLET

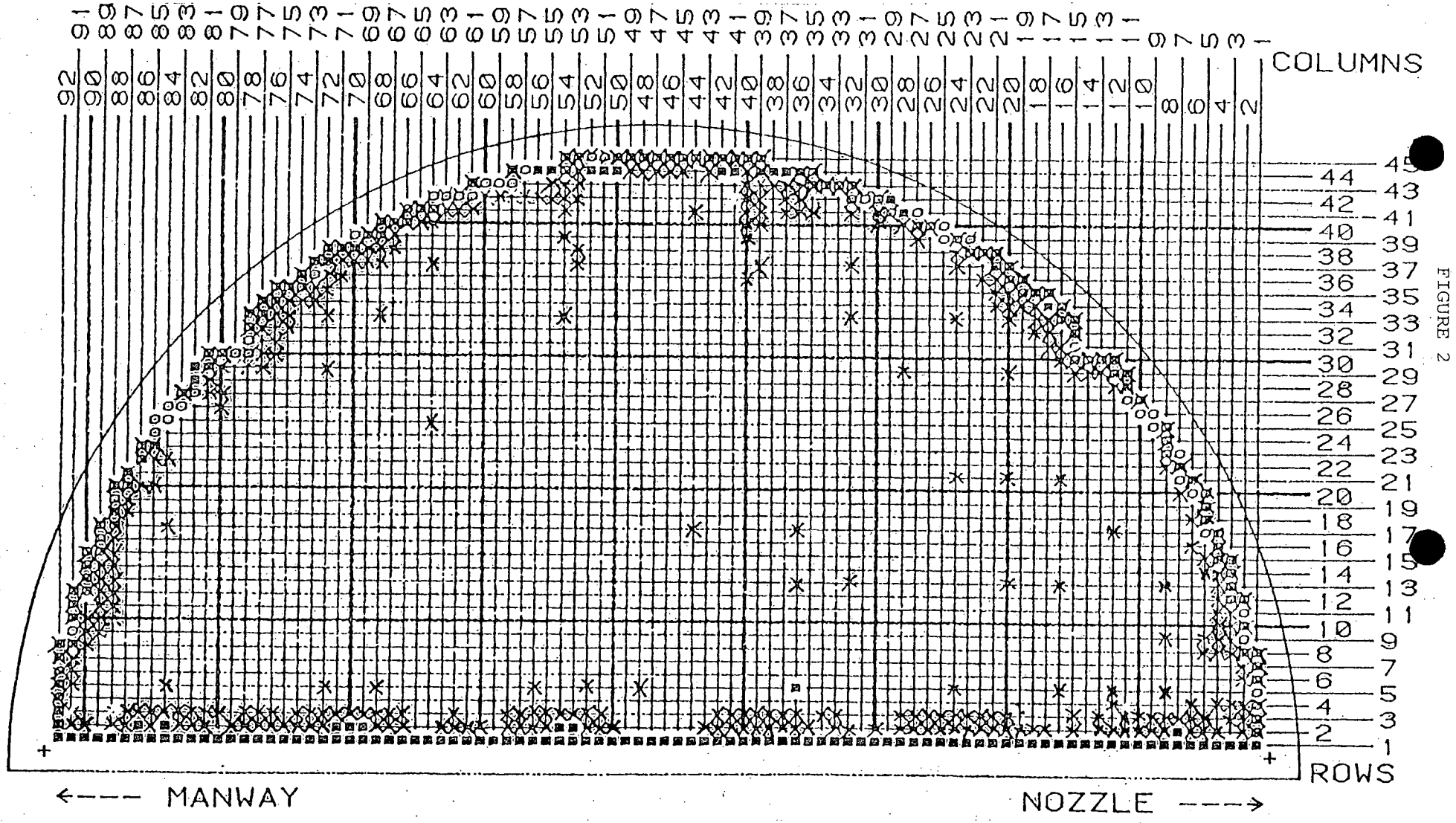


FIGURE 2

■ Tubes Previously Plugged

o Outermost Tube

X Tubes Restricting 720 Mil Probe

EDDY CURRENT INSPECTION PROGRAM - OCTOBER, 1980

TUBES RESTRICTING A 700 MIL PROBE

SERIES 44

INT-32

INLET

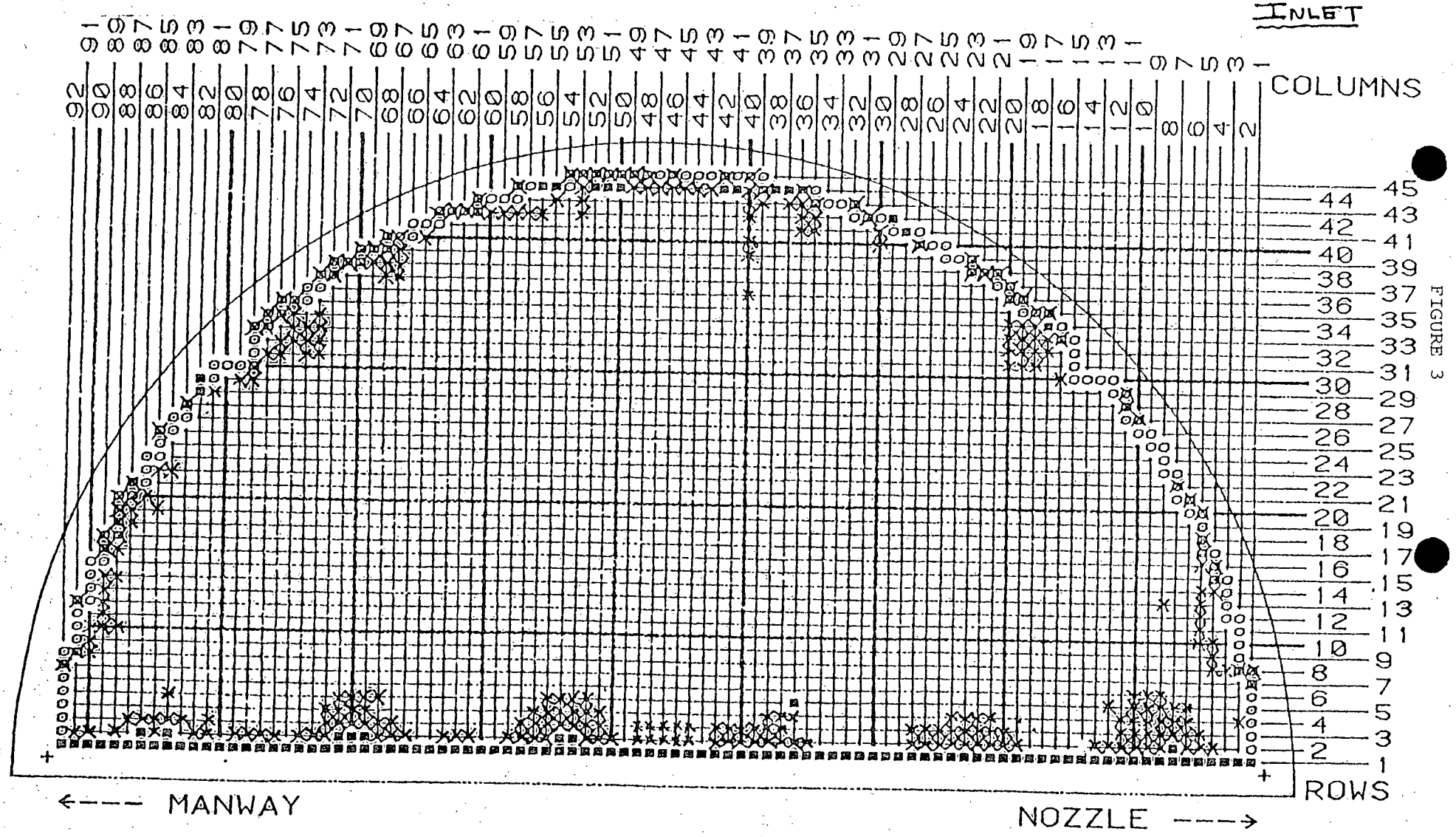


FIGURE 3

■ Tubes Previously Plugged

o Outermost Tube

X Tubes R-stricting 700 Mil Probe

EDDY CURRENT INSPECTION PROGRAM - OCTOBER, 1980

TUBES RESTRICTING A 650 MIL PROBE

SERIES 44

INT-32

INLET

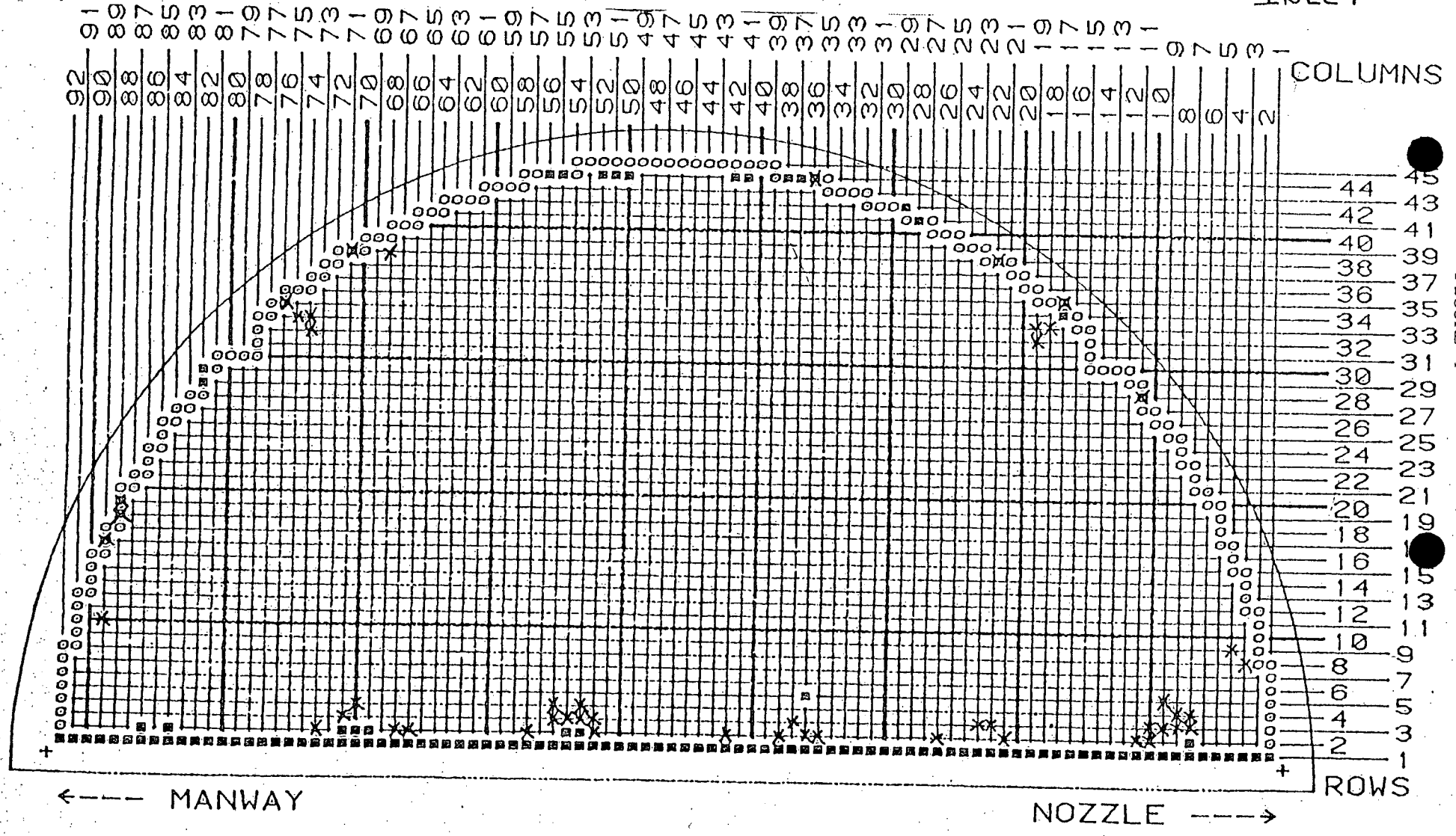


FIGURE 4

■ Tubes Previously Plugged

o Outermost Tube

X Tubes Restricting 650 Mil Probe

EDDY CURRENT INSPECTION PROGRAM - OCTOBER, 1980

TUBES RESTRICTING A 610 MIL PROBE

SERIES 44

INT-32

INLET

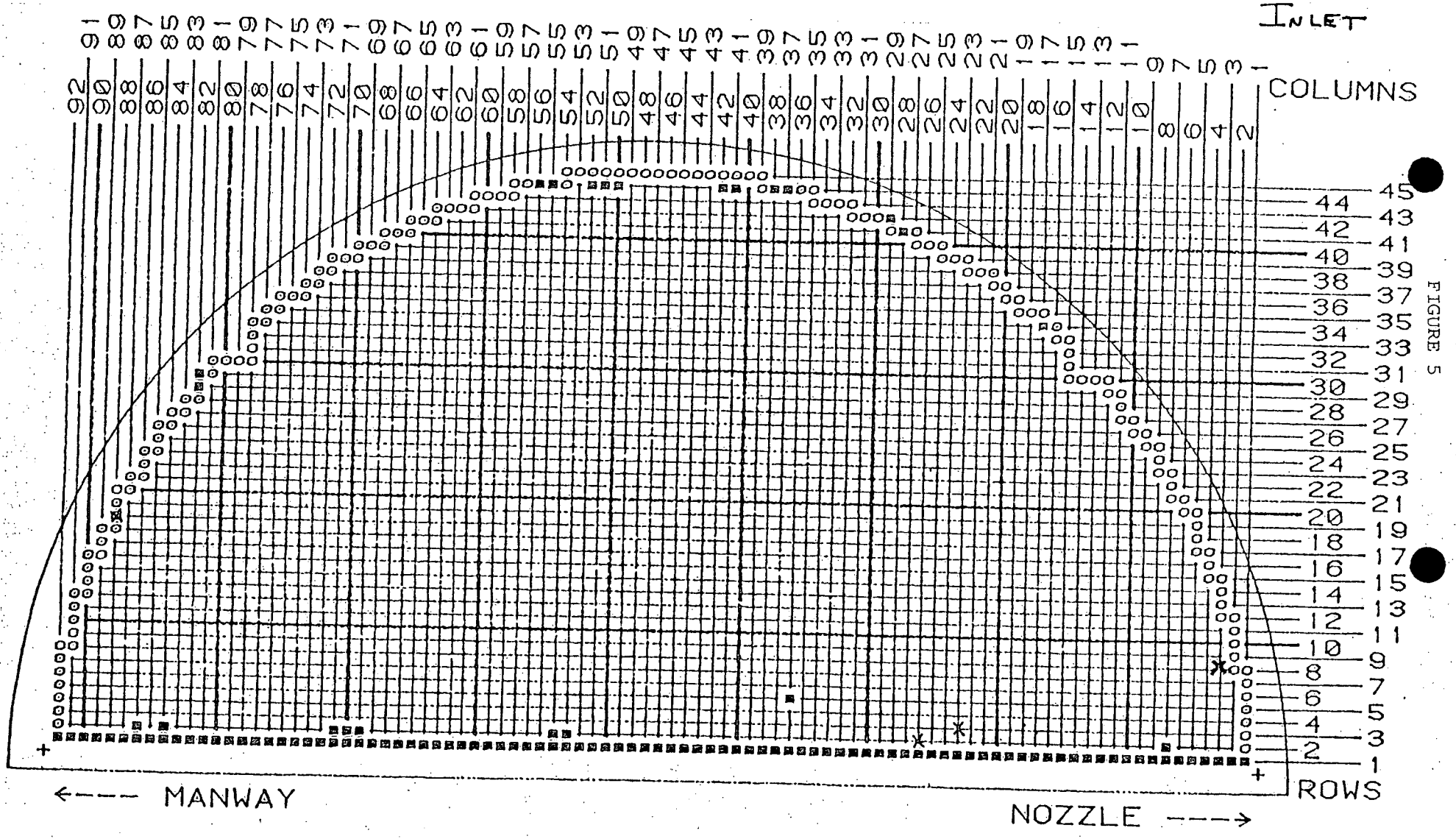


FIGURE 5

■ Tubes Previously Plugged
o Outermost Tube
X Tubes Restricting 610 Mil Probe

SERIES 44

INT-32

TUBES PLUGGED - OCTOBER, 1980

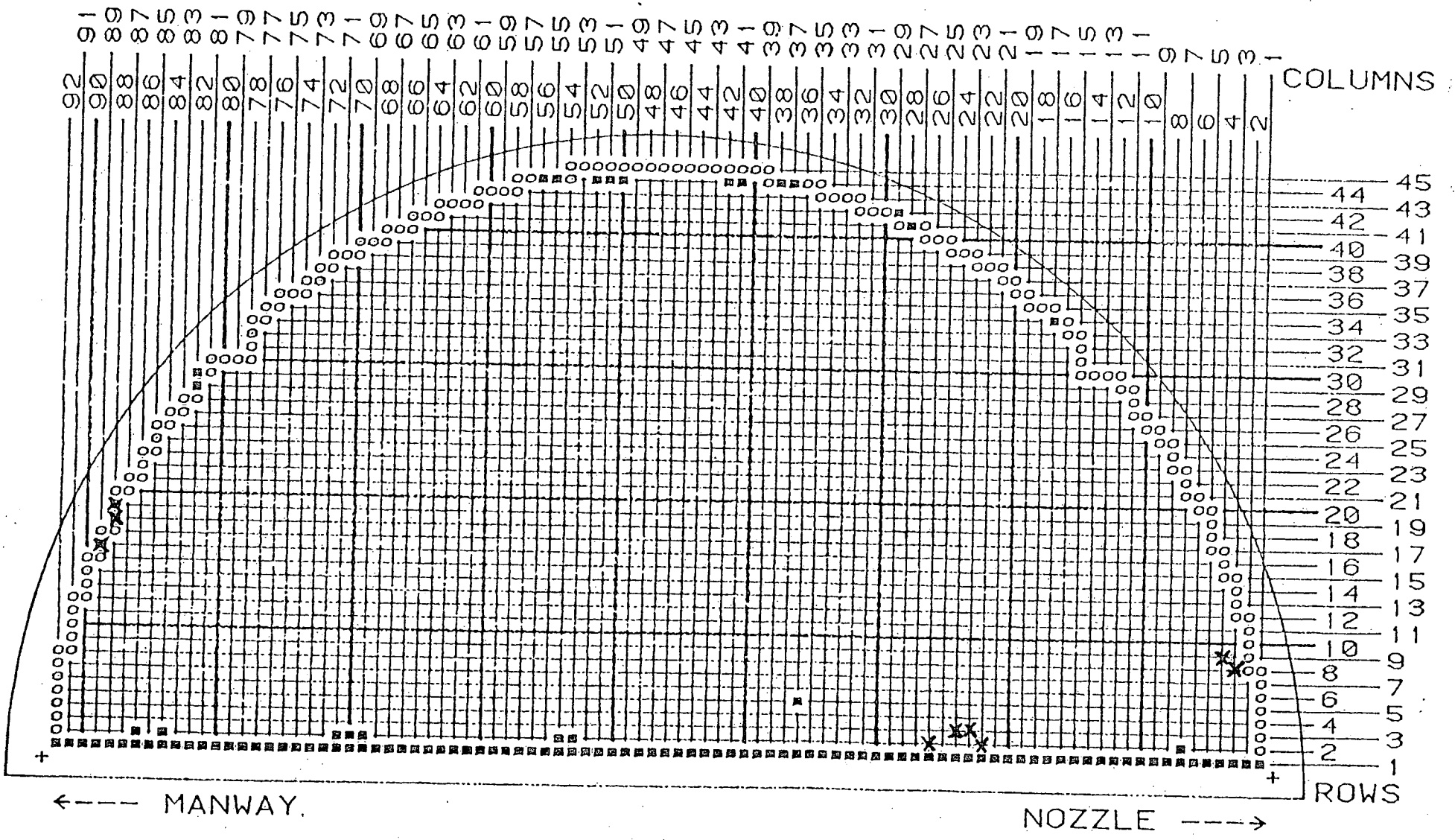
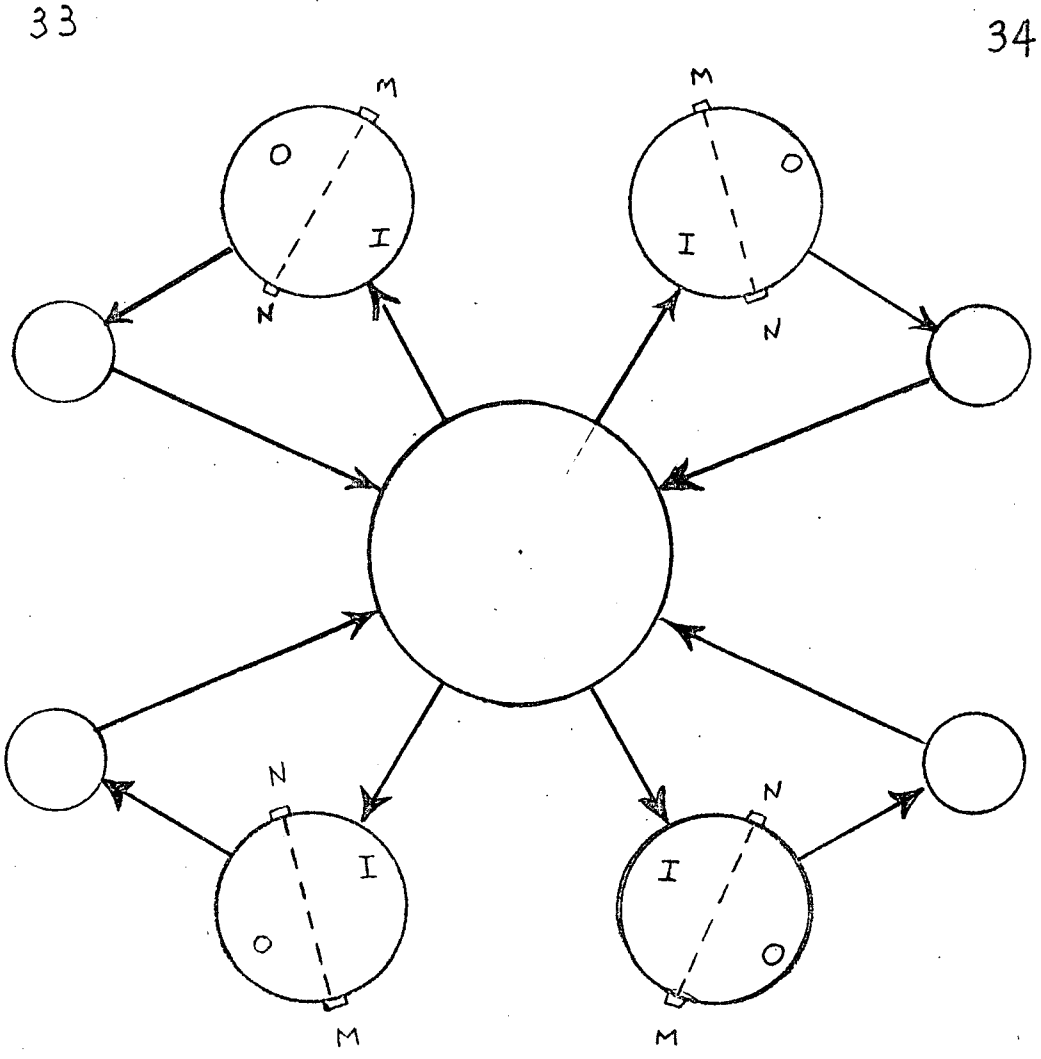


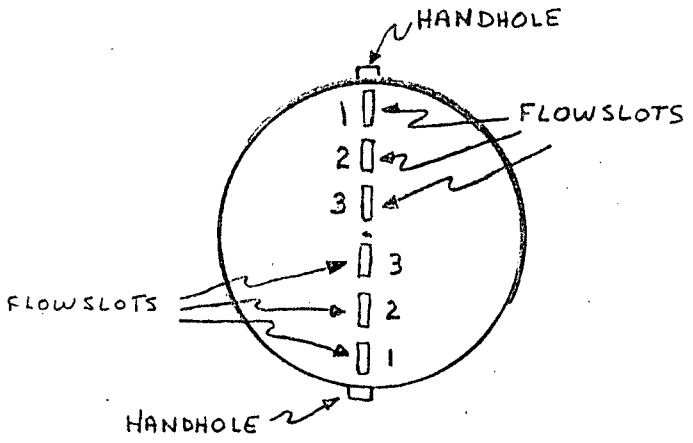
FIGURE 6

■ Tubes Previously Plugged
o Outermost Tube
X Tubes Plugged - October, 1980

FIGURE 7

RCS - View Looking Down





HANDHOLES ARE IDENTIFIED AS BEING EITHER

1) BETWEEN THE MANWAYS (M)
OR
2) BETWEEN THE NOZZLES (N)