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April 23, 1948

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INSPECTION AND REPLACEMENT OF VAN STONE FLANGES
B, D, AND F PILES

BACKGROUND

Routine inspections of selected Van Stone flanges have been made at all three piles since start-up. In September, 1947, these inspections indicated that corrosion effects were becoming dangerously severe. Some of the flanges appeared to be corroded and pitted to a depth of two-thirds of the original flange thickness.

To determine the extent and severity of the corrosion, residual flange thickness measurements were made on the flanges of about 64 scattered tubes. Included were front and rear flanges of tubes from all four orifice zones. Results of the survey indicated the immediate need for an extensive repair program to preclude the possibility of failure of some of the flanges.

PROGRAM

Measurements indicated that the original thickness of all flanges averaged about 55 mils, with very little variation of individual flanges from the average. It was decided that the minimum flange thickness of all tubes in water service should be measured, and that all flanges with residual thickness less than 30 mils should be replaced.

It was further decided to replace the rear flanges and cut a sufficient additional amount from the rear gun-barrels of 510 selected tubes in the upper central one-third of each pile to provide 3/8" additional gun barrel clearance. Included in this group are tube numbers 59 through 88 inclusive on rows 30 through 46 inclusive. It was felt that loss of gun barrel clearance due to graphite expansion would be most pronounced in these tubes. Measurements had indicated that upward and outward expansion of the graphite was bowing the tubes and reducing their gun barrel gun clearance. In some of the top central tubes clearance was reduced to less than the 3/8" required for measurement of the thickness of the flanges. Further bowing could conceivably tear off the flanges or draw them into the gun barrels. A program to assure minimum clearance for all tubes was a logical addition to the overall program of replacement of flanges of less than a minimum thickness.

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In execution, the program varied somewhat from these plans. At B Pile, the decision to provide additional clearance on the above mentioned selected tubes was not made until work had progressed through several rows including tubes of the group. However, since it is not possible to measure flange thicknesses unless a tube has at least 3/8" gun-barrel clearance, and since all flanges at B Pile were measured, it is certain that the pile contains no tubes with less than this minimum clearance. At D and F Piles, the plan for provision of additional gun-barrel clearance on selected tubes was modified to include all tubes with less than 3/8" clearance. Also, on a few tubes above row 40, on which it was necessary to replace both front and rear flanges, 3/4" additional clearance was provided by cutting an additional amount from both gun barrels.

Soon after work was begun at D Pile, it was decided to replace all flanges with residual thicknesses less than 40 mils. This change in plan was necessary to take full advantage of the manpower and equipment available for the repairs since very few flanges with residual thicknesses less than 30 mils were being encountered. Later on, as it became necessary to replace many flanges to provide the tubes with additional gun barrel clearance, the standard of less than 30 mils residual thickness for replacement was resumed.

TIME REQUIRED

Work was begun at B Pile soon after the plans were formulated and was completed in November, 1947. At D and F Piles some work was done during routine one-day shutdowns in October and November of 1947. Once each month during November and December, 1947, and January, February and March, 1948, week-long extended outages were scheduled at D and F Piles to facilitate the program. Work was completed at both piles in March, 1948.

A major portion of the lost production resulting from extended outages was made up by increasing the nominal operating level of D Pile from 250 to 275 MW, and F Pile from 200 to 275 MW.

SUMMARY OF RESULTS

All flanges of tubes in water service in all three piles, having residual thicknesses less than 30 mils, were replaced. On about half of the rows of D Pile, flanges with residual thicknesses between 30 and 40 mils were also replaced.

All tubes in all three piles, having less than 3/8" gun barrel clearance, were provided additional clearance of at least 3/8". On a few tubes on row 40 and above in D and F Piles, 3/4" additional gun barrel clearance was provided.

Attached is a summary of the work for the three piles.

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B PILE

ORIFICE ZONE	FRONT FLANGES Number Measured	Number Less Than 30 Mils	% Less Than 30 Mils	Number Replaced	REAR FLANGES Number Measured	Number Less Than 30 Mils	% Less Than 30 Mils	Number Replaced	GUN BARRELS GIVEN ADDITIONAL CLEARANCE
.140"	512	113	22.1	113	512	177	34.6	177	-
.175"	402	86	21.4	86	402	90	22.4	90	-
.200"	98	16	16.3	16	98	10	10.2	10	-
.240"	991	103	10.4	103	991	40	4.0	40	-
Totals:	2003*	318	15.9	318	2003*	317	15.8	317	155

Total Flanges Replaced: 635

Gun Barrels Given Additional Clearance: 155

* Tube No. 0U.6 is not in water service and was not measured.

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D PILE

ORIFICE ZONE	FRONT FLANGES Number Measured	Number Less Than 30 Mils	% Less Than 30 Mils	No. Between 30 & 40 Mils	% Between 30 & 40 Mils	REAR FLANGES Number Measured	Number Less Than 30 Mils	% Less Than 30 Mils	No. Between 30 & 40 Mils	% Between 30 & 40 Mils	GUNBARRELS GIVEN ADD'L. CLEARANCE
.140"	444	77	17.4	55	12.4	444	096	21.6	42	9.5	-
.175"	462	27	5.8	28	6.1	462	18	3.9	4	.9	-
.200"	256	12	4.7	7	2.7	256	7	2.7	4	1.6	-
.240"	836	37	4.4	10	1.2	836	28	3.3	3	.4	-
Totals:	1998*	153	7.7	100	5.0	1998*	149	7.5	53	2.7	387

Total Flanges Replaced: 629

Gun Barrels Given Additional Clearance: 387

Residual thicknesses of flanges removed from tubes with insufficient clearance for measurement are not included in the above table, except in the "Number Measured" column.

* Tubes 3469, 3478, 3574, 4453, 4659, and 4688 are not in water service and were not measured.

On rows 01 through 12 inclusive, 14 and 15, and 37 through 46 inclusive, all flanges with a minimum residual thickness less than 30 mils were replaced.

On rows 13, and 16 through 36 inclusive, all flanges with a minimum residual thickness less than 40 mils were replaced.

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F PILE

ORIFICE ZONE	FRONT FLANGES Number Measured	FRONT FLANGES Number Less Than 30 Mils	FRONT FLANGES % Less Than 30 Mils	FRONT FLANGES Number Replaced	REAR FLANGES Number Measured	REAR FLANGES Number Less Than 30 Mils	REAR FLANGES % Less Than 30 Mils	REAR FLANGES Number Replaced	GUN BARRELS GIVEN ADDITIONAL CLEARANCE
.140*	381	87	22.8	90	381	258	67.7	282	-
.175*	325	46	14.1	46	325	169	52.0	218	-
.200*	264	24	9.1	24	264	109	41.3	140	-
.240*	972	30	3.1	30	972	508	52.3	547	-
Totals:	1942*	187	9.6	190	1942*	1044	53.7	1187	458

Total Flanges Replaced: 1377

Gun Barrels Given Additional Clearance: 473

Residual thicknesses of flanges removed from tubes with insufficient clearance for measurement are not included in the above table except in the "Number Measured" column.

* The flanges of 62 fringe tubes, not in water service, were not measured.

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