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Research Report No. 61/9-95

RESEARCH REPORTS ON DR. LOMAX

FOR

GENERAL ELECTRIC COMPANY

By

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BOILING TESTS ON DR-DOWNCOMER

INTRODUCTION

Design, Development and Research Contract DDX-95 between General Electric Company and Washington State University required boiling tests to be performed with the DR-Downcomer model. This report covers the boiling tests which have been conducted with the model. The tests which were made at lower temperatures have been reported previously.

DISCUSSION

The results of boiling tests presented herein are based on a limited amount of data taken during demonstrations and/or trial runs to check the equipment. Since changes to the riser and cross-over piping were proposed, additional boiling tests were held in abeyance pending a decision on the piping which has not been made. Although the data are limited, the results are what would be expected and they point-out the necessity of additional "boiling" tests with the existing venting system.

During one run, a temperature of 240°F . was measured at the top of the downcomer. Since this was accidentally obtained, records were not obtained. However, the downcomer behavior was so similar to the behavior at 210°F . that the error which caused the accidental rise in temperature was discovered only by monitoring the Sanborn temperature recorder.

With the limited venting available at the top of the downcomer, the pressure at the top will rise with a temperature rise and will be close to the saturation pressure for each temperature. Air which has been added to the flow to compensate for air dissolved in the cold river water will attempt to escape through the vents and this may raise the pressure at the top above

the saturation pressure. Both air and vapor escape through the vent system. Under these circumstances, boiling cannot occur except at locations where local pressures are reduced due to flow separation. The downcomer will operate as a pressure vessel. Pressures throughout the downcomer and associated piping will rise at the same rate as the top pressure rises except where the effluent back pressure dominates the influence; that is near the base of the downcomer.

Table 1 and Figure 1 present the available data from the boiling tests. Using Run No. 1 as a reference, pressure increases, Δp , at the top of the downcomer, Tap No. 73, have been computed for all runs. This has been done also for Taps 61, 62, 64, 66, and 65. Although there is some variation which is within the limits of experimental error, the Δp for all taps between Runs 1 and 2, 1 and 3, 1 and 4, 1 and 5, and 1 and 6 show essentially the same pressure rise as occurs at the top of the downcomer. Since the pressure at RPL is controlled by the effluent back pressure to a great extent, Δp have not been computed for this point.

The flow rate for all of these tests was equivalent to 80,000 gpm pressure.

CONCLUSIONS

The boiling tests which have been made indicate that the behavior of the downcomer does not change when the temperature is raised above "boiling" because the pressures increase also, and boiling never actually occurs. Boiling at the top cannot occur unless the venting capacity is greatly increased.

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TABLE 1 - DATA FOR PORTING TESTS

Model Pressure in psi

Model Pressure in psi														
Temp.	Cell @ 73	ARI	Cell @ 81	ARI	Cell @ 82	ARI	Cell @ 84	ARI	Cell @ 86	ARI	Cell @ 85	ARI	Cell @ 77	ARI
0°	Δ	AV.	HI	LO	Δ	AV.	HI	LO	Δ	AV.	HI	LO	Δ	AV.
212.4 a	0	1.2	---	---	0	5.6	---	---	0	2.0	---	---	0	1.3
213.4 b	---	---	---	---	---	---	---	---	---	---	---	---	---	---
206.4 c	---	---	---	---	---	---	---	---	---	---	---	---	---	---
213.4 a	0.1	1.9	---	---	0.3	3.2	6.8	3.1	0.5	3.3	---	---	0.3	1.6
214.4 b	---	---	---	---	---	---	---	---	---	---	---	---	---	---
216.0 a	1.1	2.3	---	---	1.0	7.3	---	---	1.0	3.0	---	---	---	---
216.0 b	---	---	---	---	---	---	---	---	---	---	---	---	---	---
217.0 c	---	---	---	---	---	---	---	---	---	---	---	---	---	---
217.6 a	1.2	2.4	---	---	2.1	7.5	7.0	7.0	1.2	4.0	---	---	---	---
219.4 b	---	---	---	---	---	---	---	---	---	---	---	---	---	---
219.4 c	---	---	---	---	---	---	---	---	---	---	---	---	---	---
218.0 a	1.7	2.5	---	---	2.2	7.6	---	---	1.9	3.7	---	---	---	---
219.0 b	---	---	---	---	---	---	---	---	---	---	---	---	---	---
221.2 c	---	---	---	---	---	---	---	---	---	---	---	---	---	---
222.6 a	2.0	4.0	---	---	3.0	3.2	10.6	---	---	---	---	---	---	---
223.4 b	---	---	---	---	---	---	---	---	---	---	---	---	---	---
224.0 c	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Location of Temperature Sensor

Δ = Top of Porting

HI = Top of Porting

LO = Top of Porting

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