

CC CRYOSTAT COOLDOWN TEST RESULTS

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DØENGINEERING NOTE #3740.210-EN.122

INTRODUCTION:

A cooldown of the inner vessel of the Central Calorimeter cryostat to 77K was performed during the week of October 12 in order to "cold shock" it, i.e., to check for insulating vacuum integrity with the inner vessel cold. The conclusion from our test results is that the vessel withstood the cold shock, and the insulating vacuum remained good.

Cooldown was analyzed by J.D. Fuerst in DØ note #3740.000-EN-107, dated August 19. Warmup was analyzed by T. Peterson and B. Fitzpatrick in DØ Engineering Note 3740.214-EN-110, dated September 29. Both cooldown and warmup times were in accordance with predictions.

TEST DESCRIPTION:

An initial pumpdown of the insulating vacuum space was done with the vessel warm on October 9. The results of that pumpdown are shown in Figure 1 superimposed on a predicted pumpdown curve generated by Brian Fitzpatrick before the test began. After 24 hours the insulating vacuum was 7 microns. After 48 and 72 hours it was 2-3 microns. At this point (October 12) valving the pumps off resulted in a rise of 6 microns in 3 hours and 20 minutes, or 1.8 microns per hour. Before beginning cooldown, the pumps were valved off and the insulating vacuum was 15 microns.

Cooldown and fill began at 0900 on Tuesday, October 13. At 1650, about 8 hours later, LN₂ flow to the cryostat was shut off. A total of 2600 gallons was consumed during this period based on my readings of the trailer liquid level gauge and chart. An additional 500 gallons was used (according to the same liquid level gauge) in the final blowdown of pressure in the trailer, bringing the total to 3100 gallons. Based on weight in and weight out, 21980 pounds of LN₂ was used, or 3273 gallons of liquid. This is good enough agreement with my readings of the gauge that I will use the 2600 gallon number as our usage in the cryostat;

therefore, the average flow rate for 8 hours was 325 gallons per hour or 5.42 gallons per minute. At the end we had 1600 gallons of stored liquid in the cryostat, so 1000 gallons were consumed in cooling it down. At this time with the pumps still valved off the insulating vacuum was 13 microns. The vacuum had improved slightly while the pumps had been valved out for the entire time; no cold leakage was observed. Over the next 64 hours while draining and warmup were completed the pumps remained valved out and the vacuum rose to 170 microns, a rate of 2.5 microns per hour, not significantly different from the 1.8 microns per hour before the cooldown test.

Except for the period of time when the drain was plugged with ice, the rate of warmup agreed very well with predicted rate. Figure 2 shows the warmup of 4 resistors in the gas space and one on the top of the inner vessel in the vacuum space.

CONCLUSION

The insulating vacuum remained good during the cold shock, and the rate of rise after cold shock was similar to that before. The rate of warmup was in good agreement with predictions, indicating that predicted heat transfer coefficients inside the vessel were reasonably accurate (within 50% of actual).

Figure 1

Data from "CC CRYOSTAT PUMPDOWN TIME DATA"

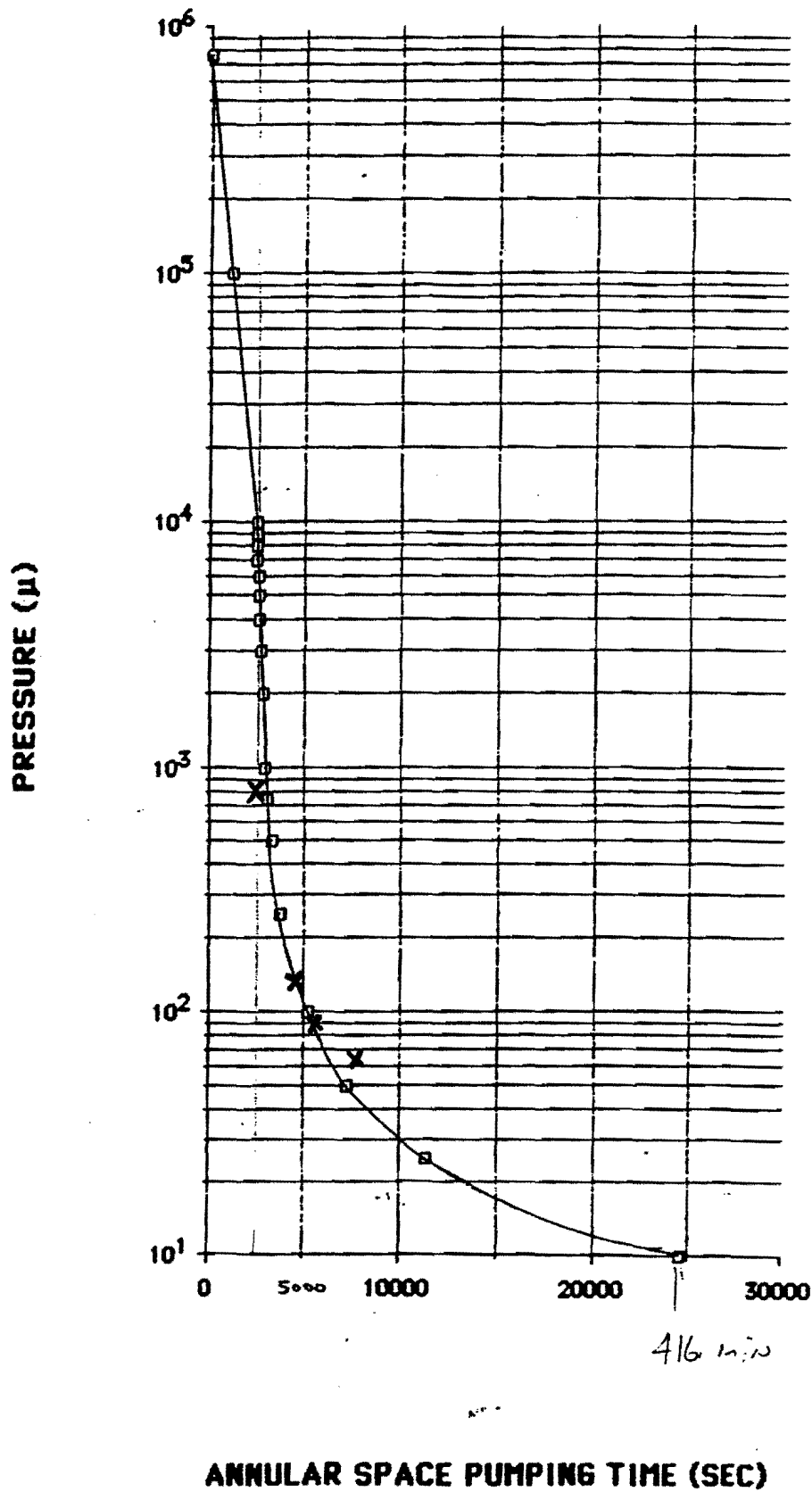


Figure 2

Data from "CC WARMUP DATA 10/87"

