D-0 NORTH END CAP CALORIMETER

COLD TEST RESULTS

Written: Russ Rucinski - August 2, 1990

Graphs: Jay Michael

D-ZERO ENGINEERING NOTE 3740.224-EN-260

Approved _____ Date 10/11/90

ECN COLD TEST RESULTS

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INTRODUCTION

The North endcap calorimeter vessel was recieved on July 1, 1990. A cooldown of the pressure vessel with liquid nitrogen was performed on July 10-11 to check the vessel's integrity. With the pressure vessel cold, the insulating vacuum was monitored for leaks. Through out the testing, the insulating vacuum remained good and the vessel passed the test.

The cold test was carried out per the procedures of D-Zero engineering note 3740.220-EN-250. The test was very similar to the cold test performed on the Central Calorimeter in October of 1987. Reference D-Zero engineering notes 3740.210-EN-122, 3740.000-EN-107, and 3740.210-EN-110 for information about the CC cold test.

INSULATING VACUUM

The insulating vacuum space was pumped on while equipment was being connected to the pressure vessel. Two hours after starting to pump with the blower the vacuum space pressure was at about 210 microns. Pumping on the vacuum space for the next 15 hours showed no progress and a leak detector was connected to the pumping line.
A leak check showed a leak in a thermocouple feedthru on the vacuum space relief plate. After fixing the leak, the pressure dropped to 16 microns in less than one hour. A rate of rise test was performed starting at a pressure of 13 microns. The pressure rose to 39 microns within 8 minutes and then only rose to 43 microns in 2.5 hours (1.6 microns/hour).

PRESSURE VESSEL

After all connections were made to the pressure vessel, a vacuum pump with an estimated effective pumping speed of about 70 scfm was valved on. The lowest pressure achieved after 2 days of pumping was 80 microns. Valving out the pump for 30 minutes resulted in a 5 micron per minute rate of rise. The rate of rise was considered acceptable since there were known leak paths through the bolts of the signal ports.

COLD TEST

The EC North vessel was rolled outside of Lab A in preparation for a 5000 gallon liquid nitrogen trailer which arrived July, 10 at 8:00am. Before filling the vessel, the vacuum space pump was valved off. The pressure in the vacuum space was 12 microns at that point. During the next 24 hours of the test, the vacuum space pressure decreased to 5 microns. A plot of the vacuum space pressure with time is included at the end of this note.

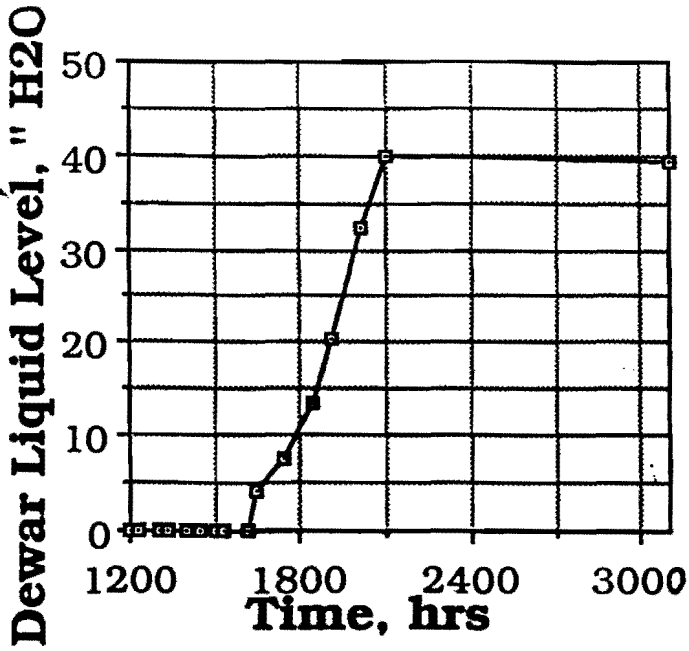
The liquid nitrogen was pressure transferred from the trailer at 29 psig to the pressure vessel at 1 psig for ten hours. At that time there was sufficient (16") of liquid nitrogen in the vessel to turn the LN2 trailer delivery pump on. Thirteen and one half hours after starting the fill, the vessel had 50" of LN2 collected. During the latter part of the filling, about twelve loud metallic bangs were heard. The noises came at random intervals with sometimes five minutes between and other times an hour between. The best way to describe the sound is to imagine the sound made if someone was trapped inside the vessel with a baseball bat and took a good swing.

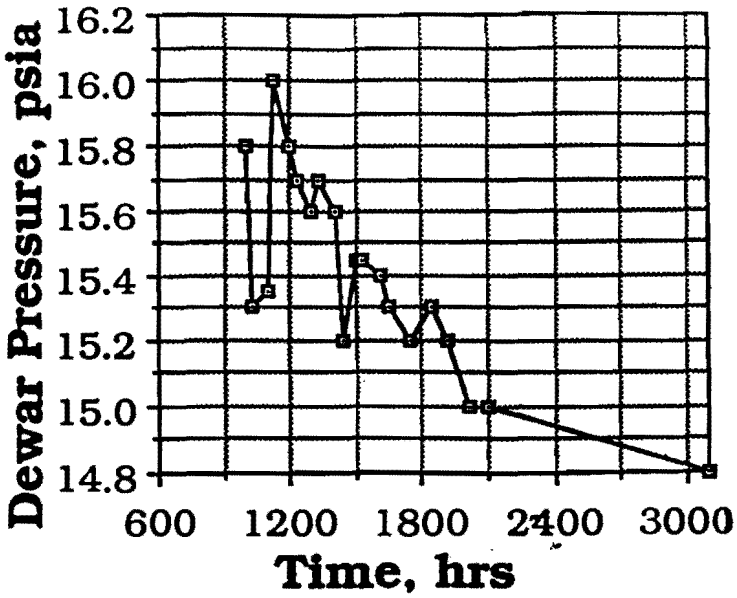
The trailer was disconnected and the the vessel was left overnight for ten hours. Due to the slow LN2 fill rate, the temperature gradient in the pressure vessel shell was not very large, only about 25 kelvin difference was found from a RTD in the warm-up nozzle of the vessel and the resistors of the liquid level probe. A temperature versus time graph is included at the end of this note.

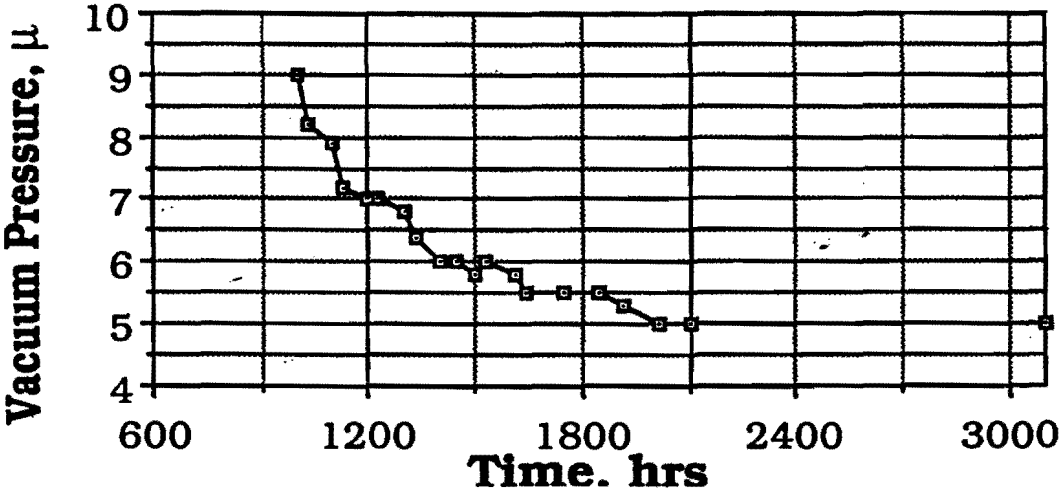
As a final part of the test, the pressure vessel's pressure was increased to 13 psig (relieving pressure) with 50" of LN2 in the vessel's bottom. The vacuum space pressure did not change. The criterea of a successful test was no pressure rise in the vacuum space during the test. This was met and the test was deemed successful.

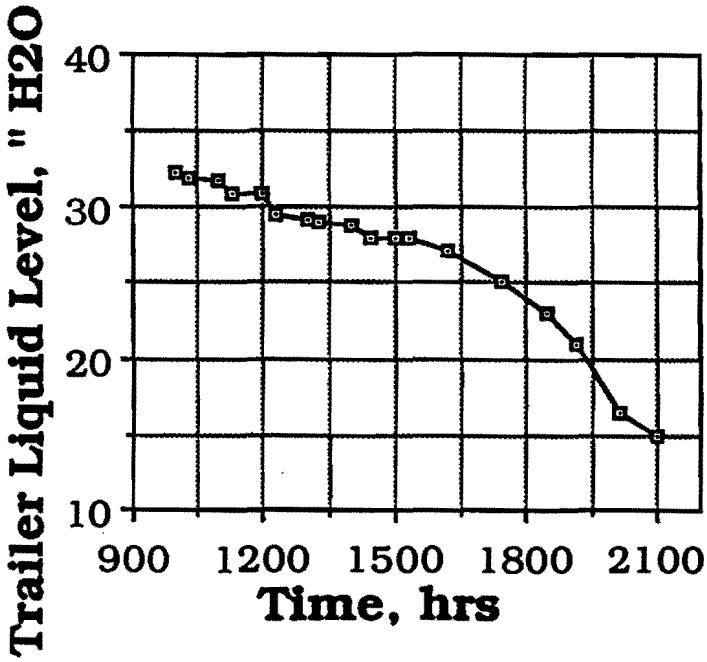
WARM - UP

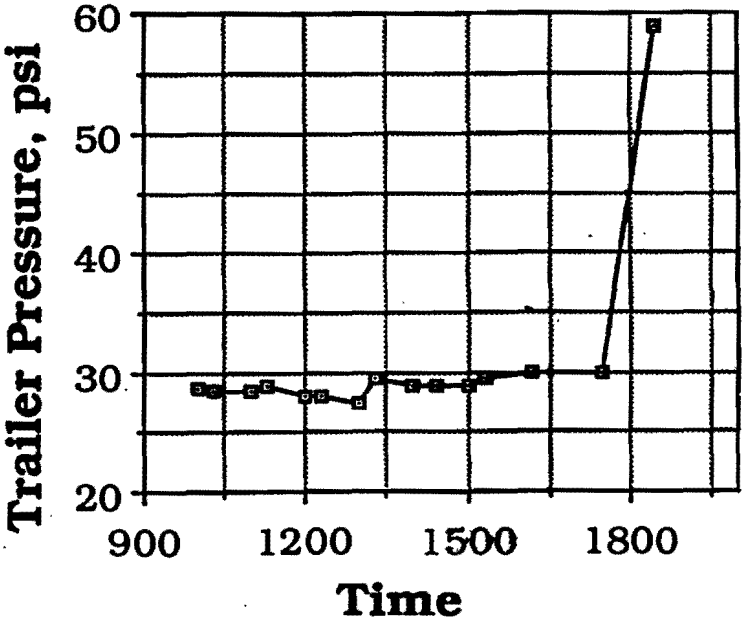
The vessel was drained outside of Lab A and when empty was moved inside. After 24 hours of blowing instrument air in the warm-up nozzle and out the drain line, the vessel was at approximately -30 degrees Celsius. Another 8 hours of circulating air thru the vessel raised the temperature to 5 degrees Celsius which was above the dew point for that day. During the warm-up the heater was only used during working hours (approximately 12 hours).

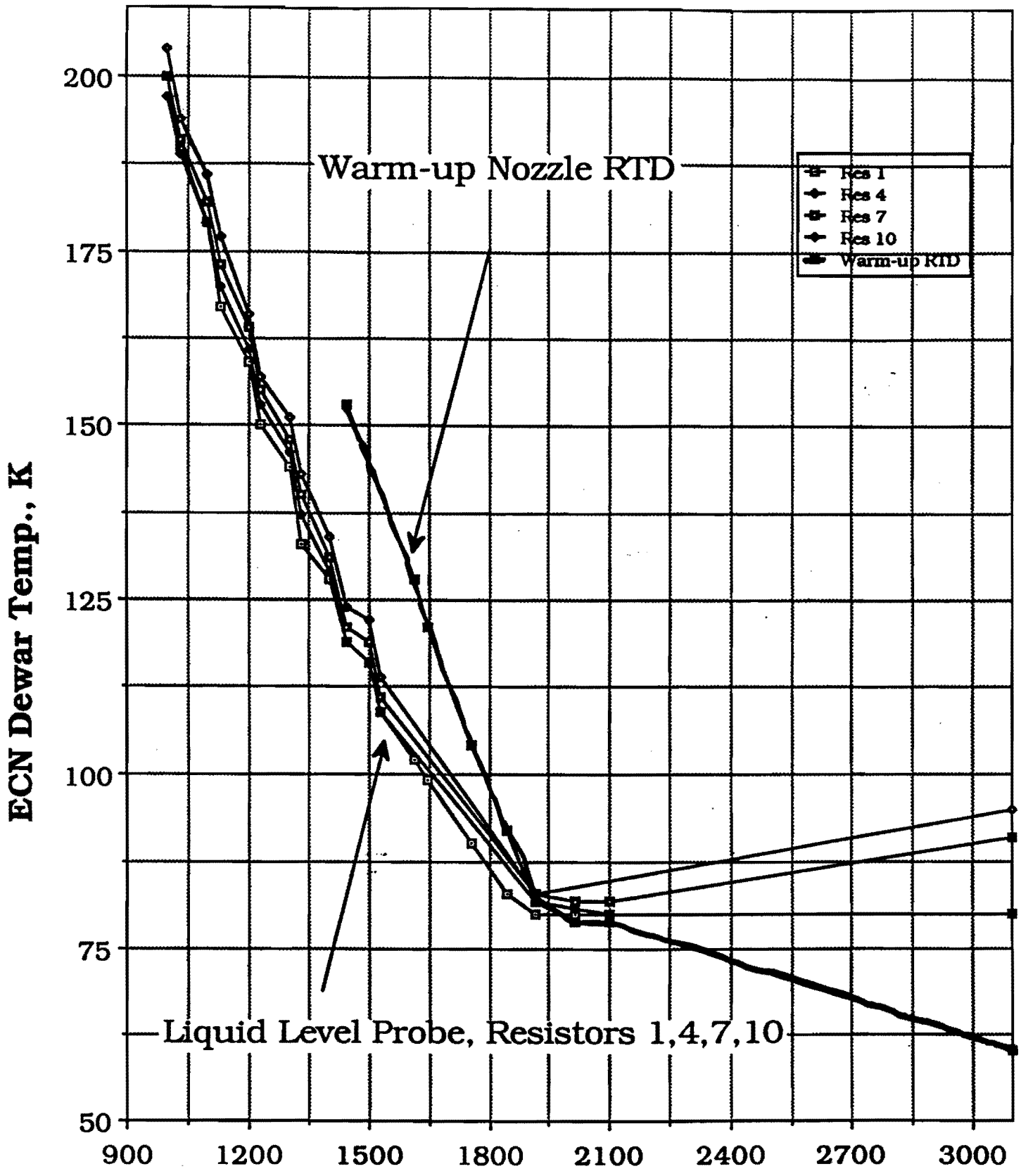

Dewar Liquid Level, " H2O
50
40
30
20
10
0
1200
1800
2400
3000
Time, hrs


Dewar Pressure, psia
16.2
16.0
15.8
15.6
15.4
15.2
15.0
14.8
600
1200
1800
2400
3000
Time, hrs


Vacuum Pressure, μ
10
9
8
7
6
5
4
600
1200
1800
2400
3000
Time. hrs


Trailer Liquid Level, " H2O
40
30
20
10
900
1200
1500
1800
2100
Time, hrs


Trailer Pressure, psi
60
50
40
30
20
900
1200
1500
1800
Time


Warm-up Nozzle RTD
Liquid Level Probe, Resistors 1,4,7,10
Res 1
Res 4
Res 7
Res 10
Warm-up RTD
ECN Dewar Temp., K
200
175
150
125
100
75
50
900
1200
1500
1800
2100
2400
2700
3000
Time