

NATIONAL RADIO ASTRONOMY OBSERVATORY
GREEN BANK, WV 24944

MEMORANDUM

October 12, 1984

To: VLBA Electronics Group
From: R. Norrod
Subj: Report on CTI Model 22 Refrigerator Test

1.0 Introduction

This is a report on the status of the Model 22 refrigerator test now in progress at Green Bank. This test was initiated in order to obtain some experience with the Model 22 refrigerators and also to test the electronic circuitry that controls the refrigerator motor and the solenoid activated vacuum valve. The test has been implemented by assembling five 8.4 GHz type dewars and card cages and a microcomputer system that controls and monitors the dewars. A detailed description of the system implementation has been written, and anyone interested may obtain a copy by contacting me. Four dewars are completed and running; we are waiting for delivery of the fifth refrigerator from CTI.

2.0 Dewar Status

The four units now running are:

<u>Dewar No.</u>	<u>Reference Serial No.</u>	<u>Cumulative Hours *</u>
0	11E43294	1549.0
1	11G43342	823.5
2	11D43246	658.0
3	11E43289	336.0

* As of 10/5/84, 09:00.

All dewars have 3.5 lbs of copper mass and an electrical load of approximately 0.5 W on the refrigerator second stage (15 K station). The electrical load is left on even during cooldowns.

Dewar #0 is programmed to run continuously. This refrigerator, when we first began running it, suffered from some severe temperature drifts and the motor would occasionally ratchet, or almost stall. H. Brown and T. Henderson disassembled, examined, and re-assembled the cold head. Ratcheting still occurred when cold, so the helium lines were disconnected and the dewar warmed up. The refrigerator

was then purged with helium and reconnected to the compressor. Since that time, that particular unit has been running smoothly with no evident problems.

Dewars #1 and 3 are programmed to cycle from cold to room temperature once each week. Dewar #3 is programmed to cycle three times each week. None of these cold heads have had any maintenance performed, although we did try the helium purge on #1 to cure a squeak that was evident when cold. The squeak did seem to improve for a couple of weeks, but soon returned.

Dewar #3 has shown some of the intermittent temperature variations that have concerned us. Figure 1 shows the refrigerator temperatures on two contrasting days. (The dewar was placed in the HEAT state at 05:00 on 10/4/84, so ignore the off-scale points in Figure 1a.) Note: The computer reads the dewar interfaces each minute and averages the readings for a half hour. It then records to disk the average, the standard deviation, and the peak deviation for that half hour. The graphics program draws a horizontal line at the average of length corresponding to the sample period; a vertical line of length corresponding to the deviation; and a plot symbol (e.g., "+") at the peak deviation.

3.0 Compressor Coupling

There is evidence that a coupling exists between the four refrigerators' temperatures, in that when one refrigerator is warmed up, the temperatures of the other refrigerators change. The link seems to be through the compressor supply pressure. Figure 2 shows one day's data that illustrates the phenomenon.

It has been suggested that a reserve volume of helium in the supply line might reduce this effect, so we will try that soon.

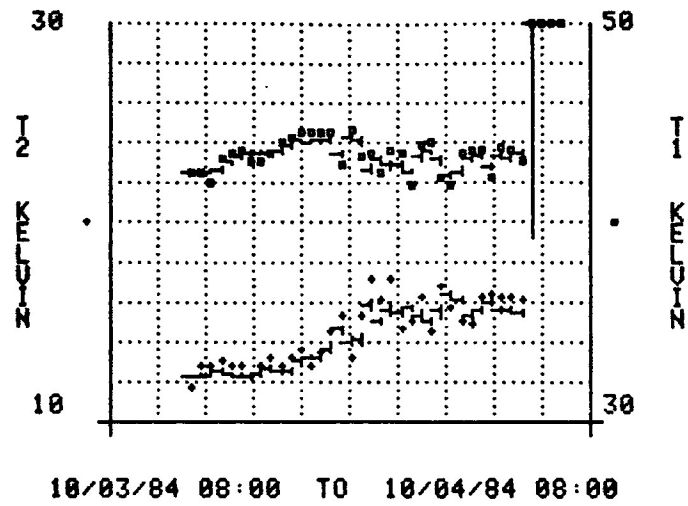
4.0 Power Failures

We have simulated power failures by turning the compressor and refrigerator power off for various lengths of time. System response has been quite good. After a one-hour failure, all four dewars are returned to operating temperature in 20-30 minutes. Pump requests are not generated by any of the dewars, implying that their vacuums do not exceed 5 microns. We will continue to do this, trying to see if the system response to a power failure changes over the long term.

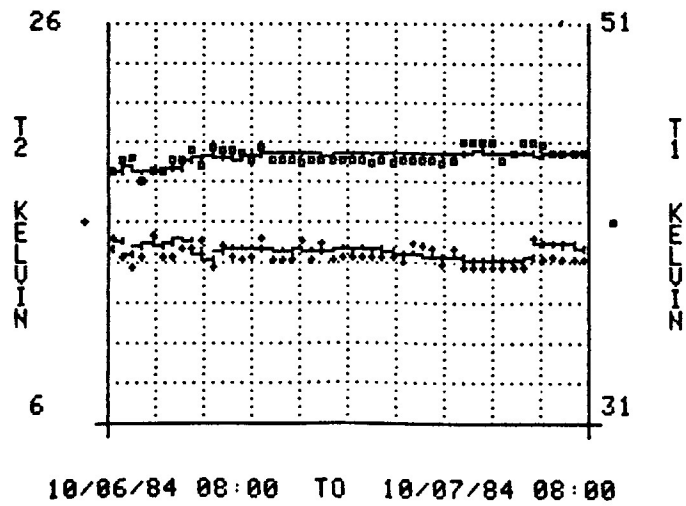
RDN/cjd

Enclosures

- Figure 1: (a) Dewar #3 on a bad day;
(b) Dewar #3 on a good day.
- Figure 2: Compressor Coupling

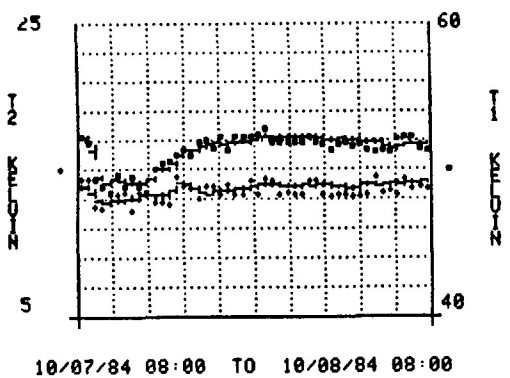


(a)

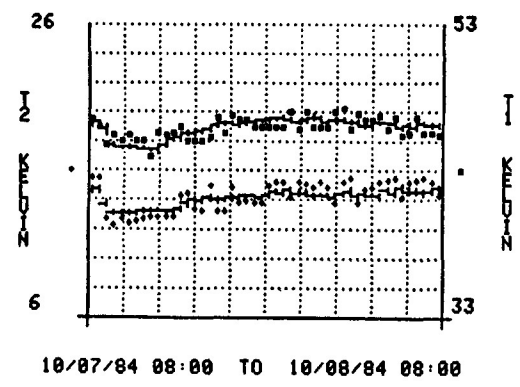


(b)

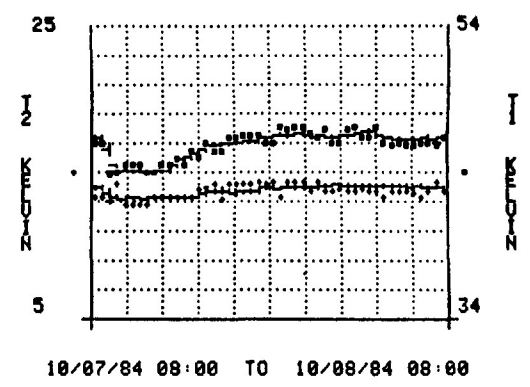
Dewar #3 on a bad day (a) and good day (b).



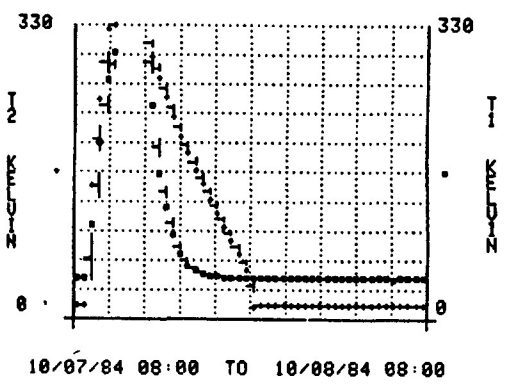
(a) Dewar #0



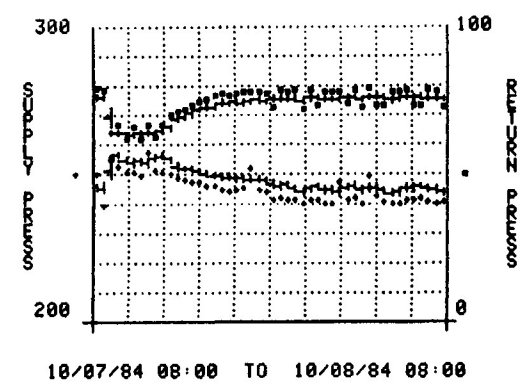
(b) Dewar #1



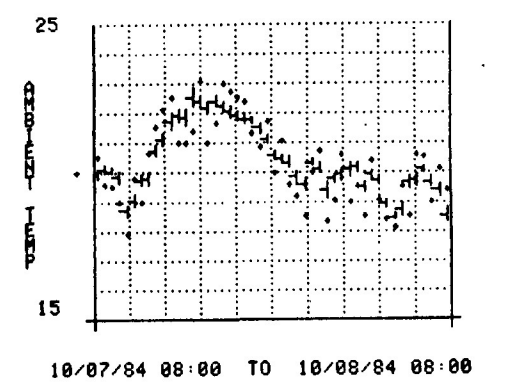
(c) Dewar #2



(d) Dewar #3



(e) Compressor Pressures



(f) Ambient Temperatures

FIGURE 2
Compressor Coupling