

NATIONAL RADIO ASTRONOMY OBSERVATORY
Green Bank, WV

MEMORANDUM

February 26, 1987

To: R. Thompson
VLBA Electronics Group

From: R. Norrod and R. Simon

Subj: CTI Model 22 Test Chronology

Attached are chronologies of five Model 22 refrigerators that have been running under computer monitor since late 1984 and early 1985.

S/N 11G43342 experienced a catastrophic failure on 18 February 1987 and has been removed from the system for service. The other four units are still operating, but we consider them ready for service as their temperatures are 25-30 K. They have not shown any sudden failure; the temperatures gradually increased from about 16 K to current values since early December, 1986.

Eleven times since starting the test, we have judged it necessary to disassemble and repair one of the units. The average refrigerator hours at maintenance was 8100 hours. The minimum time was 684 hours, and the maximum was 17,114 hours. Several other times we cold-trapped and purged the refrigerators to attempt to improve their performance (either lower the operating temperature or reduce temperature variations). In most cases, this resulted in a few weeks of acceptable performance but rarely was a long-term solution to a problem.

We will shortly remove the remaining units for service and we should consider whether there is a need to continue this test.

RDN/cjd

Enclosures

Chronologies for Refrigerator Model 22:

S/N 11D43246, 11E43294, 11E43300,
11F43356, 11G43342, Miscellaneous

REFRIGERATOR MODEL
S/N 11D43246

Note: CH = Cumulative Hours

09/07/84 Installed in dewar 2. Began operation.
09/17/84 CH = 257.5.
12/14/84 Drift in the zero circuitry on the sensor card caused
some false readings. Rotated dewar 90 degrees.
01/01/85 CH = 2738.
01/29/85 Removed from dewar 2 and returned to CTI for rework.
CH = 3410.
04/13/85 After rework by CTI, refrigerator was returned and
installed in dewar 3.
04/14/85 Began operation.
04/22/85 Dewar 3 set to state heat. Once warm, supply pressure
was set to 250 pounds. Concerned with lower limit of
the supply pressure when all 5 dewars are cooling down
at the same time.
05/01/85 CH = 350.5 (since being installed in dewar 3).
02/03/86 CH = 7023.
05/06/86 Returned dewar 3 to vertical orientation.
05/27/86 Warm up, then cooled back down. Dewar 4 (a cold trap)
remained cold.
08/07/86 CH = 11463.
10/02/86 CH = 12807.
10/10/86 Warm up and removed from system. Disassembled and
cleaned. Black dust/oil found on displacers. CH =
13023 (first maintenance).
11/05/86 Began operation after cleaning.
02/25/87 CH = 15711, 2688 hours since last maintenance.
Now running 27-30 K with ± 2 K variations.

REFRIGERATOR MODEL 22
S/N 11E43294

Note: CH = Cumulative Hours

07/15/84 Install in dewar zero.
07/16/84 Began operation.
07/18/84 Install cardcage.
07/19/84 Began computer control.
07/27/84 Warm up. Heater appears to be open.
08/02/84 Repair open heater.
08/06/84 Stressdown.
08/13/84 H. Brown disassembled refrigerator. T. Henderson re-assembled. Trying to correct high temperature (first maintenance). CH = 684.
08/16/84 Refrigerator is ratcheting. Isolated helium lines and purged (second maintenance).
08/21/84 Interface tests. Changed relays.
08/30/84 Moved to 85-1 control building.
09/18/84 CH = 1156.5.
11/30/84 CH = 2893.
12/14/84 Warm up and pump. Attempting to fix high temperature. Did not purge.
01/01/85 CH = 3661.
01/23/85 Cold trapped and purged.
01/28/85 CH = 4302.
03/08/85 Disassembled and cleaned. Replaced worn seals (second maintenance). CH = 5200.
04/22/85 Set to state heat. Once warm, supply pressure was set to 250 pounds. Concerned with the lower limit of the supply pressure when all 5 dewars are cooling down at the same time.
05/01/85 CH = 6534.
12/05/85 CH = 11766.
12/18/85 Installed a 10 foot section of refrigerator line on the return side of dewar zero. This will be used to sample the quality of helium gas being used in the test system.
02/03/86 CH = 13206, 8006 hours since last maintenance.
05/13/86 Dewar zero warm up and the 10 foot helium line was removed.
Dewar zero was then set to state stressdown.
05/27/86 Dewar zero was warmed up and then cooled back down.
Dewar 4 (the cold trap) remained cold.
06/05/86 CH = 16134, 10,896 hours since last maintenance.
10/02/86 CH = 17992.
10/22/86 Possibility of helium contamination exists. Dewar zero was cold-trapped and purged. Pumped a vacuum on supply and return lines including compressor and charcoal filter.
11/06/86 CH = 19688.
02/25/87 CH = 22352, 17114 hours since last maintenance.
Now running 25-30 K with intermittend \pm 2 K variations.

REFRIGERATOR MODEL 22
S/N 11E43300

Note: CH = Cumulative Hours

02/01/85 Installed in dewar 1 and began operation.
02/08/85 Repaired faulty wiring in card cage. Temperature sensor was giving false readings.
03/07/85 CH = 769.
04/22/85 Dewar 1 set to state heat. Once warm, supply pressure was set to 250 pounds. Concerned with the lower limit of the supply pressure when all 5 dewars are cooling at the same time.
05/01/85 CH = 2069.
06/03/85 Warmed up for maintenance due to high temperature. Eccentric worn from interference with scotch yolk. Grey and black dust on displacers. No obvious uneven wear on seals or bushings. Grey dust on return valve with black filaments. Could be teflon burrs. Metal filings on supply valve. Small wear on micarda button. Cleaned and replaced seals. CH = 2900 (first maintenance).
02/03/86 CH = 8741, 5841 hours since last maintenance.
05/27/86 Dewar 1 was warmed up, then cooled back down. Dewar 4 (the cold trap) remained cold.
05/28/86 Cold trapped and purged.
06/05/86 CH = 11669, 8802 hours since last maintenance.
07/16/86 Warm up, disassembled and cleaned. CH = 12653, 9753 hours since last maintenance (second maintenance).
10/02/86 CH = 14525.
10/22/86 Possibility of helium contamination exists. Dewar 1 was cold-trapped and purged. Pumped on vacuum on supply and returns lines including compressor and charcoal trap.
10/28/86 Dewar 1 set to state stressdown.
11/06/86 CH = 15221.
02/25/87 CH = 17885, 5232 hours since last maintenance. Now running 24-30 K with minor variations.

REFRIGERATOR MODEL 22
S/N 11F43356

Note: CH = Cumulative Hours

02/01/85 Installed in dewar 2 and began operation.
03/07/85 CH = 791.
04/22/85 Dewar 2 set to state heat. Once warm, supply pressure was set to 250 pounds. Concerned with the lower limit of the supply pressure when all 5 dewars are cooling down at the same time. CH = 1895.
05/01/85 CH = 2087.
02/03/86 CH = 8749.
05/06/86 Returned dewar 2 to vertical orientation.
05/27/86 Dewar 2 was warmed up and then cooled back down. Dewar 4 (the cold trap) remained cold.
08/07/86 CH = 13185.
10/02/86 CH = 14529.
10/10/86 Warm up, disassembled and cleaned. Black dust/oil substance found on displacers. CH = 12888 (first maintenance).
10/29/86 Dewar 2 set to state stressdown.
11/06/86 CH = 15201.
02/25/87 CH = 17865, 4977 hours since last maintenance.
Now running 25±30 K with minor variations.

REFRIGERATOR MODEL 22
S/N 11G43342

Note: CH = Cumulative Hours

08/30/84 Installed in dewar 1 and began operation.
09/05/84 Noted squeak in ref.
09/07/84 Warm up and purge.
09/18/84 CH = 437.5
01/23/85 Cold trapped and purged.
01/29/85 CH = 3704.
01/29/85 Removed from test and returned to CTI for rework.
04/15/85 Received from CTI after rework. Mounted in dewar 4 and began operation.
04/22/85 CH = 346 (since return from CTI).
05/06/86 Rotated dewar 4 90 degrees.
05/21/86 CH = 9586.
05/21/86 Removed dewar 4 from system. Did not disassemble. Replaced with uninstrumented, unloaded refrigerator. (This will be used as a cold trap.)
06/02/86 Removed dewar 4 (the cold trap) from system.
06/13/86 Began operation of dewar 4 (S/N 11G43342).
10/02/86 CH = 12442.
10/22/86 Possibility of helium contamination exists. Dewar 4 was cold trapped and purged. Pumped a vacuum on supply and return lines including compressor and charcoal trap.
10/28/86 Dewar 4 set to state stressdown. CH = 12922.
02/05/87 CH = 15322.
02/18/87 Dewar 4 failure. T2 went from ~ 26 K to ~ 80 K.
02/25/87 Warm up of dewar 4 (due to high temperatures).
02/25/87 CH = 15802.

MISCELLANEOUS

09/20/84 Add gas to compressor.
10/03/84 Disconnected supply line to install pressure gauge.
10/18/84 Installed baffle tank on supply line.
11/01/84 Add gas to compressor.
11/05/84 Switched baffle tank from supply line to return line.
11/26/84 Computer failure.
11/30/84 Computer is back in operation after repair.
02/19/85 Start operation of model 350 refrigerator.
02/20/85 Add gas to compressor.
04/15/85 Removed model 350 from system. CH = 1305.
05/29/85 Installed rotary compressor.
12/20/85 Add gas to compressor.
05/05/86 Add gas to compressor.
11/05/86 Increased supply pressure to 277 pounds.
11/07/86 Compressor failure. All dewars warmed up.
11/10/86 Stressdown of all dewars, after repairing compressor.
12/10/86 Add gas to compressor.
02/25/87 System hours = 89615.