

C. H. Rode

There have been two major magnet runs at Al; the first was the 10 magnet "cell test" (August, 1978) and the second was the 25 magnet "mini-sector test" (December 1978).

The "cell test" started with the magnets at 125°K. (Due to a prior attempt which failed because of high pressure instabilities in the magnets and lack of tunnel access). The timetable was as follows:

Hour 0	Start Refrigerator
3 1/2	Refrigerator cold, 6°K
8 1/2	Al6 (half way cold) - 27°K
13 1/2	Al7 (end of string cold) - 43°K; Al6 - 9°K
14 1/2	Al7 - 13°K; Al6 - 9°K
	Start heat leak data (3 1/2 hour)
18	Start transition
19	Total string less than 6°K
20	Total string 2Ø liquid
22	Al7 sub cooled liq.
23	Al6 sub cooled liq.
25	Total string sub cooled liquid

The cell test was run with only one major problem; the cooling water for the compressor had an inlet temperature of 115°F. This caused the compressors to overheat; we reduced the refrigeration capacity to limit the temperatures to 340°F. This operating temperature did serious damage to the valves and bearings, the full extent of which was not discovered until the December and January mini-sector tests runs.

Since we had 60°F water in December, we felt that since our major problem was gone, we could run without an operating crew. The initial part of the run was plagued with major refrigerator failures, all of which were caused by the following two items:

- 1) Compressor damaged by summer operations,
- 2) Shaft seal on dry expander both over heating and leaking.

Due to the approaching holidays the run was started before the construction of the dry expander was completed. (The original expander had been removed for use at the Switchyard.) The run went as follows (major items only):

Hour 0	Tue.	Turn on N <sub>2</sub>
5		Start up compressor
42	Thur.	Ran out of liq. N <sub>2</sub>
44		Shut down
48		Turn on N <sub>2</sub> and start up compressor
53		Install and start up dry expander; start up wet expander
55		Compressor trip
56		Restart
62	Fri.	Expander trip
67		Restart
73		Compressor trip
74		Restart
77-78		Over haul expanders
80		Compressor trip
91-98	Sat.	Over haul expanders and restart

113	Sun.	A12	95°K
		A13	27°K
		A14	19°K
		A15	10°K
		A16	18°K
		A17	91°K
130		Expander Trip	
140	Mon.	Restart in loop mode (transition)	
		A12	?
		A13	48°K
		A14	58°K
		A15	150°K
		A16	65°K
		A17	52°K

Note: Since the magnets nearest the refrigerator are the hottest there is no easy way to recover. In the final system we would use the quench recovery cooldown lines.

The enthalpy in the magnet was about  $18 \times 10^6$  J (or 50 hr at 100 watt); we therefore decided to varify that there was sufficient capacity to cool the magnets and went directly into transition.

156		Compressor trip and restart	
164	Tue.	Compressor trip	
165		Restart	
166-168		Shut down for compressor valve over haul	

228	Thur.	String superconducting
		A12 < 9.5°K
		A13 9°K
		A14 7°K
		A15 liq.
		A16 7°K
		A17 8°K
229		String powered 435 amp
235	Fri.	Shutdown for Christmas
		String less than < 6°K

The dry expander shaft seal was replaced with the standard Lab 2 design. The system was restarted in January 1979; After 8 hours of operation we had another compressor failure. We are now replacing the Vilter compressor with the much more reliable Mycom.

The starting magnet temperature was  $110^{\circ}\text{K}$  due to previous run; the shields were cold. The run went as follows:

HOUR

0	Start decontamination and cool down of COLDBOX
5	Start cooling magnets
6	Sprung leak in bayonet valve-shut down
7	Restart
25	Shut off magnet shield due to lack of liquid $\text{N}_2$ .
28	Turn on magnet shield
34	A17 Cold $25^{\circ}\text{K}$
38	A12 Cold $\approx 25^{\circ}\text{K}$
39	Transition - magnet control on full automatic
40	Downstream loop super conducting
52	Downstream loop full or liquid
70	Upstream loop super conducting
79	Both loops below $5.2^{\circ}\text{K}$
84-89	Beam studies and quenches
Before 96	Both loops full of liquid

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## APPENDIX II: FEBRUARY 14 A1 RUN

The starting magnet temperature was 110°K due to previous run; the shields were cold. The run went as follows:

<u>HOUR</u>	
0	Start cool down of COLDBOX
3	Start cooling magnets
23	A12 Cold 25°K
25	A17 Cold 25°K
27	Transition
29	Downstream loop superconducting
42	Downstream loop full of liquid
47	Upstream loop superconducting
50	Both loops below 5.2°K
Before 70	Both loops full of liquid (i.e. liquid being returned from magnets to COLDBOX)
101	Sprung leak in bayonet valve
105	Shut down - both loops warm