EC CRYOSTAT TEST

COOLDOWN PROCEDURE

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D-ZERO ENGINEERING NOTE NUMBER

3740.220-EN-250

Approved G. T. Mulholland 6/7/90

3/28/90
R. A. Rucinski
(Rev.6/06/90)

D-ZERO EC CRYOSTAT TEST COOLDOWN PROCEDURE

1.) The CHECKLIST attached to these procedures must be completed before carrying out this procedure.

2.) The engineer on duty shall inspect the installation of all the lines connected to the vessel and verify that the piping and valves are installed per the piping schematic. Special attention should be given to insure that the proper vacuum space relief valve and inner vessel rupture disc are in place.

3.) A check of the inner vessel's tightness is to be made. Make sure all caps are on tight. Close MV1, MV2, MV3, PV1, and MV5. Instrumentation lines should be open to the instruments.

4.) Pressurize the inner vessel to 10 psig with nitrogen bottles or instrument air connected to the 3/4" pressurization line feeding into nozzle N2V.

5.) Listen for leaks. Snoop around flange joints and connections. Tighten/repair any leaky connections.

6.) Open MV3 to depressurize the inner vessel.

7.) Connect vacuum pump to the inner vessel at MV3. Pump on the vessel overnight or to a 50 torr vacuum or less using the Leybold mechanical pump. Use ballasting to prolong pump oil life. Shunt pump exhaust to a safe location to avoid excessive build up of oil vapor. Read the vacuum locally at the pump during pump down and record it noting the time of the reading. Failure to make consistent progress indicates a system leak.

8.) Leaks are signaled by a gross deviation from the ideal vacuum pump down time as indicated in the graph attached to this procedure. The approximate volume of the EC for use with the graph is 1200 cubic feet. If a leak is suspected, valve out the inner vessel vacuum pumps and valve in nitrogen bottles or instrument air. Pressurize the vessel to about 10 psig and snoop all suspected areas. Tighten leaky connections. Depressurize the vessel and repeat step 7. Continue this process until the vessel's "tightness" is established.

9.) At this point a vacuum "rate of rise" for the isolated inner vessel should be made. The supervising engineer should record and approve the results before continuation of this procedure.

10.) Disconnect the vacuum pump from the inner vessel.

11.) Let up the inner vessel to nitrogen gas to 1 atomosphere pressure.

12.) Replace the flat plate on nozzle N4V with the relief valve SV1. SV1 is to be set for 13 psig.

13.) All instrumentation should be hooked up (Liquid level probe, differential pressure gauge, pressure gauge, thermometry, vacuum readback). Start the chart recorder.

14.) When the vacuum space is at a reasonable vacuum level (10 microns), obtain and record an insulating vacuum space pressure reading from the Granville Phillips T/C and Fredrics Televac T/C in the relay rack.

15.) Move scaffolding out of the way.

16.) Roll the vessel out of Lab A and into the "cold test" position outside. Obtain and record another warm insulating vacuum space pressure reading.

17.) Connect the vaporizer. Bring the LN2 supply into position. Valve out insulating vacuum pumps.

18.) To begin cooldown, open PV1 and connect the LN2 supply to the LN2 hook-up. MV1, MV2, MV3, MV4 and MV5 should be closed.

19.) Make sure that the LN2 delivery pump is OFF. Regulate the LN2 supply such that the feed is pressure induced (Not pump) at roughly 20-30 psig supply pressure.

20.) Open MV1. LN2 should now be flowing into the vessel. Watch the pressure instrumentation, try to maintain a steady flow.
Purge the drain line with N2 gas by opening MV4 at the very start of the fill and flowing some N2 for 5 minutes . Close MV4.

Note: SV1 may blow - this should not be a concern unless it blows repeatedly. In that case, cut back on the supply of liquid nitrogen with MV1 to insure that SV1 does not remain open.

21.) As the vessel cools, LN2 will begin to collect in the bottom.

22.) For the remainder of the fill (see below step 23) the engineer may supervise LN2 filling with the delivery pump ON subject to the following:

I. The engineer is present at all times when the pump is on.
II. PV1 is in a locked open position.
III. The driver is prepared to shut off the pump if needed without delay.
IV. The differential pressure liquid level gauge shows there is at least 16" of LN2 in the vessel.
V. The pump outlet pressure is regulated to 60 psig or less.
VI. The delivery truck must not have enough liquid to overfill the vessel. (Vessel capacity is about 9000 gallons.)

23.) Close MV1 when about 8 resistors on the liquid level probe are submerged. This should coincide with about 40" H20 on the differential pressure gauge. (About 50" of LN2 should be in the vessel at this point.)

24.) Close PV1.

25.) Wait for thermal equilibrium. Equilibrium is reached when the temperature at the top of the vessel's shell is below 120 K and changes less than 15 K/hr. During this period, it may be necessary to add LN2 by pressure transfer to maintain the liquid level described in step 23.

26.) MV1 should be closed. Close the valves that were opened in the supply line of the truck. Disconnect the LN2 supply and remove it from the area.

27.) After reaching equilibrium, a "rate of rise" test of the vacuum space can be made. After an hour or so of steady state recording, shut off the recorders. The pressure should not have increased in the vacuum space.

28.) Prepare for draining and warming up the vessel. Care should be taken to prevent outside air getting into the vessel during the draining process. Moisture could freeze and block the drain line causing a delay.

29.) Clear the nitrogen venting area.

30.) Close MV4. Open MV5. Open MV2 slowly to increase the pressure of the inner vessel to about 13 psig. Close MV5. Open MV4 to begin draining. Use caution around the area where the nitrogen is venting.

31.) Throttle the flow with MV2 so that no liquid exits the vaporizer. If the vessel pressure drops below 5 psig, repeat step 30 above.

32.) Drain overnight if necessary. The vessel will be empty when the vessel pressure cannot be increased using step 30 and the differential pressure level gauge indicates no liquid.

33.) When the vessel is empty, open PV1. Close MV2, MV5, and MV4. Use caution not to stand in front of MV3 when opening. Open MV3. Connect the hot air source to MV3.

34.) Blow hot air into MV3 through the vessel and out PV1 to warm the vessel. If necessary, regulate the hot air supply so that SV1 does not relieve. Let up the insulating vacuum to one atomosphere of dry N2 gas to aid the warm up.

35.) When the exhaust oxygen content is > 18% the vessel can be moved inside.

36.) The vessel can now be rolled back into Lab A per scheduling. Continue to warm up the vessel with heated air until the thermometry indicates a vessel temperature of at least 280 K.

37.) After a 280 K vessel temperature is reached, shut off the heaters. Shut off the air compressors. Close MV3. Leave PV1 open. remove all the lines. Erect scaffolding as necessary. Disconnect all the test apparatus.

38.) Store all the test equipment in one location for use on the future test (if applicable).

3/21/90
R. A. Rucinski
(Rev. 5/10/90)

CHECKLIST TO BE COMPLETED PRIOR TO EC COLD TEST

1. Cryostat secured to transporter cart inside Lab A.

2. Thermocouple or RTD mounted on the inner vessel shell in Nozzle N13V. Wires to come through N19V. Properly seal N13V and N19V.

3. Shipping trunion, N12V, has been removed, and the cover plate is constrained, but free to act as the vacuum space relief plate.

4. Turbo cart (vertical turbo w/ roughing pump) connected to nozzle N14V, the vacuum space.

5. Vacuum space established below 100 microns. Vacuum space tightness checked by valving off the pump for 1 hour and noting pressure increase.

6. Liquid level probe installed in nozzle N11V.

7. Rupture disc mounted on nozzle N6V.

8. Vent valve mounted on nozzle N8V.

9. Spray nozzle and fill line mounted in nozzle N2V.

10. Warm up line connected to nozzle N2V. Thermocouple or RTD mounted in the warm up port as deep as possible.

11. Drain line welded to nozzle N5V.

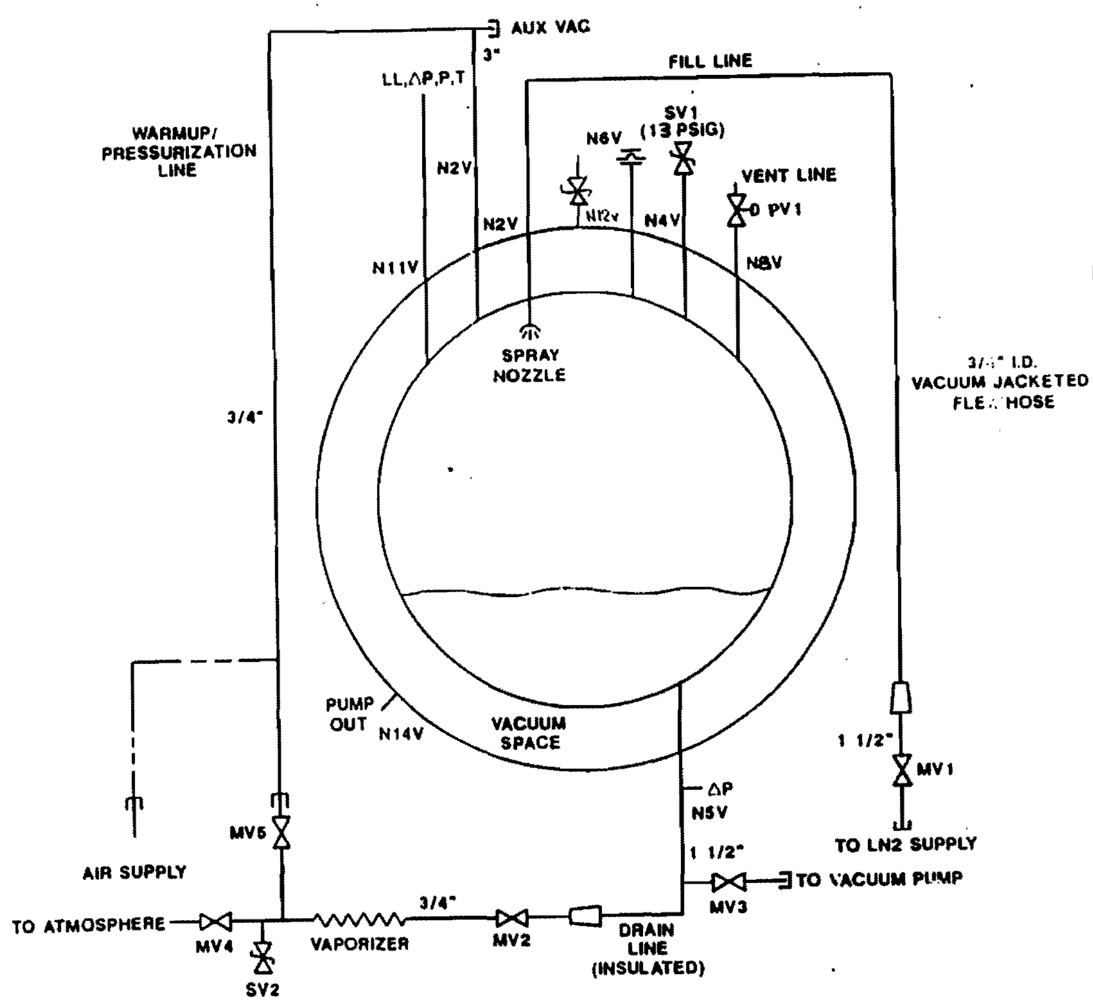
12. All other ports/nozzles not used checked for O-rings and tightness of blank flange bolts. C-seals should not be used for the cold test.

13. External plumbing connected to the vessel as required per the test piping schematic.

Note: Many of the above tasks can be carried out in parallel with vacuum space pumping efforts.

REV. A	REMOVED N3V, ADDED N12V	3/9/90 RAR
REV B	PVI WAS HV1	3/30/90 RAR

REV.	DESCRIPTION	DRAWN / APPD.	DATE / DATE



NOZZLES USED IN EC COLD TEST

NOZZLE	DESCRIPTION/DRAWING	REMARKS
N2V	FLANGED PER DRG. MD-273063	SAME AS CC
N2V	FLANGED PER DRG. MD-273063	SAME AS CC
N12V	FLANGED PER DRG. MD-273055	
N4V	FLANGED PER DRG. MD-273064	SEE NOTE 2
N5V	1 1/2" PIPE WITH CAP	SAME AS CC
N6V	FLANGED PER DRG. MD-273063	SEE NOTE 2
N8V	2" PIPE WITH CAP	SAME AS CC
N11V	FLANGED PER DRG. MD-273052	SAME AS CC
N14V	FLANGED PER DRG. MD-273059	SAME AS CC

NOTE 1: CC flange had 12 holes for 7/8" bolts on a 14 3/4" bolt circle.
EC flange has 4 tapped holes for 1/2" bolts on 14 3/4" bolt circle.

NOTE 2: The CC had capped pipes for this nozzle.

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ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY. REQ.

PARTS LIST

UNLESS OTHERWISE SPECIFIED			ORIGINATOR	RUCINSKI	
FRACTIONS	DECIMALS	ANGLES	DRAWN	RUCINSKI	2-28-90
±	±	±	CHECKED		
			APPROVED		

1. BREAK ALL SHARP EDGES 1/64 MAX.
2. DO NOT SCALE DWG.
3. DIMENSIONING IN ACCORD WITH ANSI Y14.5 STD's.
√ MAX. ALL MACHINED SURFACES

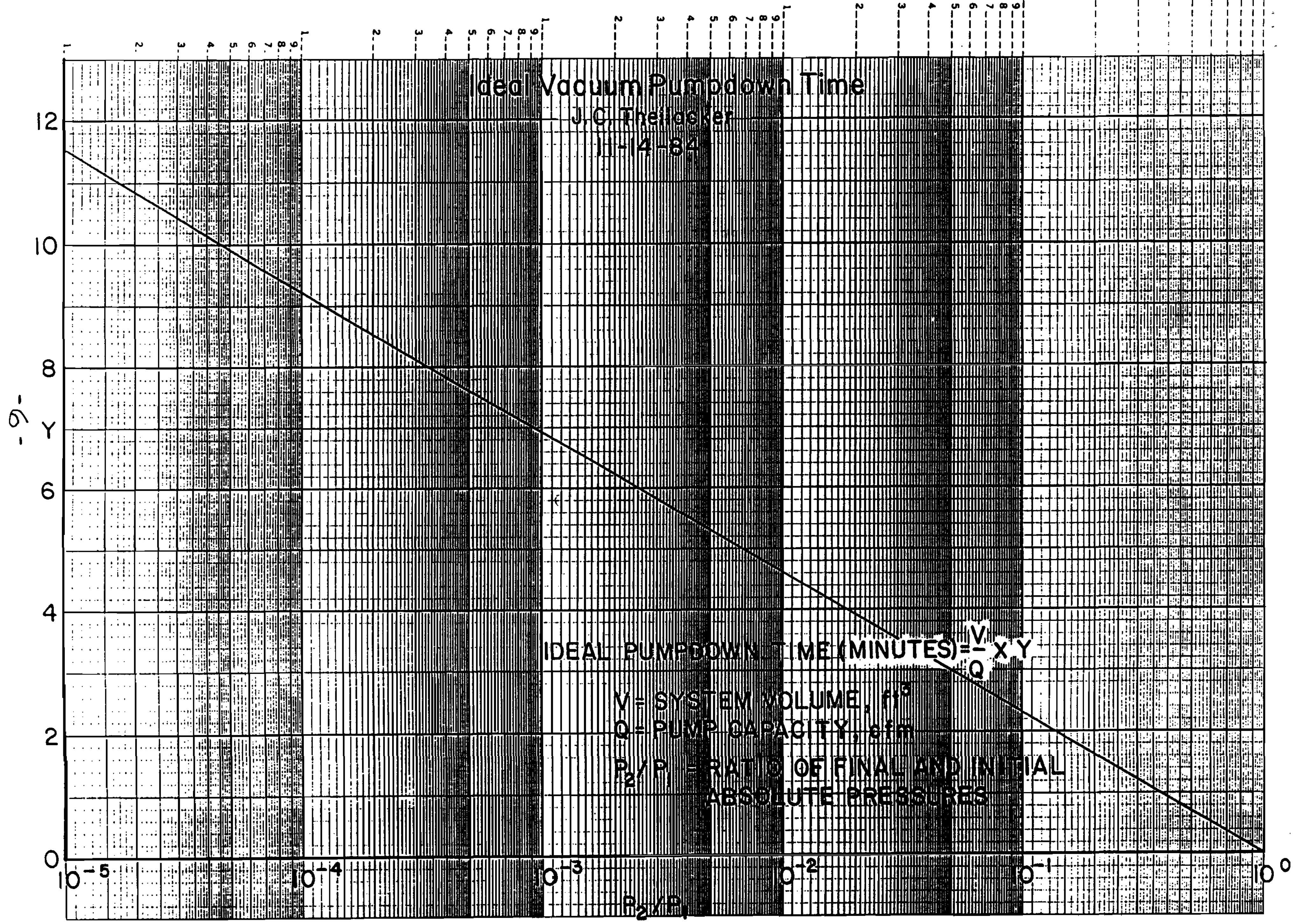
USED ON

MATERIAL-

FERMI NATIONAL ACCELERATOR LABORATORY
UNITED STATES DEPARTMENT OF ENERGY

RD/CRYO
EC COLD TEST PIPING

SCALE	FILMED	DRAWING NUMBER	REV.
			B


Ideal Vacuum Pumpdown Time
J.C. Theilacker
11-14-84
IDEAL PUMPDOWN TIME (MINUTES) = V/Q X Y
V = SYSTEM VOLUME, ft³
Q = PUMP CAPACITY, cfm
P2/P1 = RATIO OF FINAL AND INITIAL ABSOLUTE PRESSURES
Y
0
2
4
6
8
10
12
10⁻⁵
10⁻⁴
10⁻³
10⁻²
10⁻¹
10⁰
P2/P1