CRYOGENIC & GAS SYSTEM

PIPING PRESSURE TESTS

{A collection of PT permits}

D-ZERO ENGINEERING NOTE # 3823.115-EN-566

August 22, 2002

Author: Russell A. Rucinski

Project Engineer

PPD/MSD/D0 Operations

This engineering note is a collection of pipe pressure testing documents for various sections of piping for the D-Zero cryogenic and gas systems.

High pressure piping must conform with FESHM chapter 5031.1. Piping lines with ratings greater than 150 psig have a pressure test done before the line is put into service. These tests require the use of pressure testing permits.

It is my intent that all pressure piping over which my group has responsibility conforms to the chapter. This includes the liquid argon and liquid helium and liquid nitrogen cryogenic systems. It also includes the high pressure air system, and the high pressure gas piping of the WAMUS and MDT gas systems.

This is not an all inclusive compilation of test documentation. Some piping tests have their own engineering note. Other piping section test permits are included in separate safety review documents. So if it isn't here, that doesn't mean that it wasn't tested.

Russ Rucinski, PPD/MD/D0 Operations.

8/20/02

LN2 FILL LINE, WELD REPAIR

Pressure Testing Permit*

Type of Test: [✓] Pneumatic – Gas nitrogen or argon
Test Pressure: Nitrogen lines = 110% (225 psig) = 248 psid
Maximum Allowable Working Pressure: 225 psig set by ST-569-N
Items to be Tested: LN2 dewar 42 fill line up to PV-540-N
Location of Test: D-Zero Ass'y Building, south parking lot.
Date: August 20, 2002

Hazards Involved: Minimal hazards, very little store energy.
Safety Precautions Taken: Will stand to the side of and away from the strainer/fill area.
Special Conditions or Requirements: Check valve flapper must be disabled. Pressurize through MV-568N.

Test Coordinator: Russ Rucinski Dept/Date PPD/MD/D0 8/02/2002
Division/Section Safety Officer: [Signature] Dept/Date PPD/ESH 8/20/02
Division/Section Head: [Signature] Dept/Date 8/21/02

Results PRESSURIZED TO 50 PSIG AND FOUND MV-568-N PACKING LEAK. ALSO STEM DEFORMED FROM EXCESSIVE FORCE CLOSING. WE REPLACED MV-568-N WITH A DIFFERENT VALVE RATED FOR > 400 PSIG. RESUMED TEST. SNOOPED ALONG WXY. HELD 250 PSIG

Witness: [Signature] Dept/Date PPD/MD/D0 8/20/02
(Safety Officer or Designee)

FOR 10 MINUTES. NO LEAKS OR FAILURES ON SECTION AT FULL TEST PRESSURE (EXCEPT END CAP COVER & SV-541-N). SV-541-N CHANGED AFTER TEST, SET & TESTED @ 190 PSIG TO PROTECT SECTION.

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

DØ PIPING COMPONENTS

2/1) 32

DEVICE	DESCRIPTION	MANUFACTURER/MODEL	SIZE	RATING
CV549N	LN2 FILL CHECK VALVE	LADISH 5260 STAINLESS STEEL	1-1/2"	
MV550N	VAPORIZER LIQUID SHUT OFF	POWELL 70-102	1/2"	400 psi
PSV551N	SAFETY RELIEF VALVE, GN2 HEATERS	NUPRO SS-4CPA2-150	1/4"	150psi set
MV552N	RELIEF MANIFOLD TEST VALVE	NUPRO B-4JA1	1/4"	600 psi
	FOR NITROGEN DEWAR			
PI553N	RELIEF MANIFOLD PRESSURE	ASHCROFT	1/4"	0-160 psi
	INDICATOR NITROGEN DEWAR			
MV554N	RELIEF MANIFOLD TEST VALVE	NUPRO B-4JA1	1/4"	600 psi
	FOR NITROGEN DEWAR			
PI555N	RELIEF MANIFOLD PRESSURE	ASHCROFT	1/4"	0-160 psi
	INDICATOR NITROGEN DEWAR			
MV556N	GAS SUPPLY SHUT-OFF NITROGEN DEWAR	POWELL 70-102	1"	400 psi
PSV557N	PRESSURE BUILD CIRCUIT INLET RELIEF	NUPRO B-4CPA2-150		150 psi
FM558N	CRYOSTAT CONDENSER OVERFLOW SENSOR	DEITERICH STANDARD DNW-10	1-1/2", SCH. 40	
559	NOT ASSIGNED	WAS mv559N		
DPS560N	SWITCH FOR FM558N	AMERICAN FLUIDPOWER SERIES 20	1/4"	2.5"-45 W.C.
		#22TA-K614		
FM561N	DEWAR CONDENSER OVERFLOW SENSOR	FNAL DESIGN, VENTURI TYPE	1"	150 PSI
562	NOT ASSIGNED	WAS mv562N		
DPS563N	SWITCH FOR FM561N	AMERICAN FLUIDPOWER SERIES 20	1/4"	2.5"-45 W.C.
		#22TA-K614		
MV564N	SOUTH PRESSURE INDICATOR SHUT OFF VALVE	NUPRO B-4HK	1/4"	1000 psi
PI565N	SOUTH END DEWAR PRESSURE INDICATOR	U.S. GAGE 33004	1/4"	
MV566N	SOUTH END DPI 3 VALVE MANIFOLD	ANDERSON GREENWOOD MM1VDB-2	1/4"	3000 psi
DPI567N	SOUTH END DPI (DEWAR LEVEL INDICATOR)	BARTON 227A-B021503	1/4"	0-100" W.C.
MV568N	ST569 DRAIN VALVE	REGO 9454DA	1/2"	
ST569N	FILL STRAINER	MEULLER #351	100 mesh 1-1/2"	225 psig
EV570I	3-WAY AMBIENT HEATER SWITCHING	WORCESTER SERIES 75 1275 R1	1"	
	SOLENOID VALVE			
HX571N	NORTH AMBIENT COLD GAS HEATER	THERMAX INC., ALL ALUMINUM,	3/4"	400 psi design pressure
		MODEL #TF0410-HF-SG	I/O Connection	500 psi test pressure
HX572N	SOUTH AMBIENT COLD GAS HEATER	THERMAX INC., ALL ALUMINUM,	3/4"	400 psi design pressure
		MODEL #TF0410-HF-SG	I/O Connection	500 psi test pressure
MV573UV	UV LINE SHUTOFF AT NITROGEN DEWAR	NIBCO.	1"	800 psi
574	NOT ASSIGNED			
MV575N	PRV530N SHUT OFF VALVE	WORCESTER C466PMSW	1/2"	1500 psi max
DPR576N	AUTOMATIC LN2 OVERFILL SHUTOFF RELAY	FAIRCHILD MODEL 24	1/4"	1-60, 120 psig max
MV1500I	I/A SHUT-OFF VALVE FOR LN2 DEWAR	NIBCO CF-8M	1"	300psi WOG
PI1501I	I/A PRESSURE INDICATOR, LN2 DEWAR LINE	US GAGE	1/4"	0-200psi
MV1502I	I/A SHUT-OFF VALVE	WORCESTER (STK#1075-0029)	1/4" BRASS	250psi

COORDINATOR: R. RUCINSKI

TECHNICIAN: BOB KUBINSKI

RAW NOTES DURING TEST

CHG'D VALVE → 10:00
13:07

TEST FOUND MV-568-N LEAKING & PACKING & STEM FROM 50 PSI & HOLDING. LEAK @ END CONN. RELIEF @ END LEAKING PSV-541-N

DEFORMED
TWISTING.
Replace13:12 PRESSURE @ 35 PSIG
PRESSURE TO 150 PSIG.13:15 145 PSIG. SV-541-N LEAKING, NOT BAD BUT BUBBLES.
13:18 105 PSIG. - END CONNECTION, BAD
HISSING13:19 OPENED MV TO PRESSURING @ 145 PSIG.
13:20 SET REGULATOR FOR 250 PSI
OPENED TO SYSTEM

13:21 210 PSI

200
-0.5

13:23 220 PSIG

13:24 220 PSIG - STABILIZED WITH LEAKS

13:26 INCREASED REGULATOR TO 250 PSIG
TO GET PRESSURE.

13:29 HOLDING @ 250 PSIG. SV-541-N LEAKING BAD.

MV-568-N REGO BY 484T 400 GWP

13:38 Pressure still @ 250 PSIG. CALL IT GOOD.
PULLED SV-541-N, REWORKED & SET TO 190 PSIG. BY J.P.

REFERENCE SUBSET
OF EN-563 RUCINSKI
12/02

PAGE 1 OF 4

HIGH PRESSURE BACK UP AIR PIPING PRESSURE TEST

D-ZERO ENGINEERING NOTE # 3823.115-EN-563

March 12, 2002

Author: Russell A. Rucinski

Project Engineer

PPD/MSD/D0 Operations

TABLE OF CONTENTS

PAGE 2 OF 4

Pressure Testing Permit – 2 Pages

Handwritten Log of activity during Pressure test – 2 Pages

Historical Trend Chart of PT-744-I, pressure versus time record - 1 Page

Pressure test schematic, drg. 3740.510-MC-295633 – 1 Page

Pressure test procedure – 2 Pages

Pressure ratings of all components in test – 1 Page

Handwritten calcs of stored energy and pumping speed during test - 2 Pages

E-mail of recommendations and approval to proceed with test – 3 Pages

Fermilab

PAGE 3 of 4

2/12/2002

**HP Air Compressor connection tubing
Pressure Testing Permit (Page 1 of 2)***

Type of Test: ☒ Pneumatic

Test Pressure: 110%(2200 psi) = 2420 psig

Maximum Allowable Working Pressure: 2200 psig (Set by the rating of several ball valves)

Items to be Tested: Short length (12") of flex hose, Approx. 50 feet of 1/2" OD x 0.049 " wall tubing run from gas shed to existing piping. Will includes some compression fittings. Will also test about 300 feet of existing 1/2" piping and components from tube trailer isolation valve to final regulator PRV-745-I in utility room. Ref. P&I Drg. 3740.000-ME-273995.

Location of Test: South side DAB tank farm _____ Date: March ~~February~~ 2002

Hazards Involved: Sudden mechanical release of high pressure gas could cause flying debris, whipping hoses, loud noise. Equivalent stored energy is 620,000 Joules = 460,000 ft-lbs or the equivalent of 134 grams of TNT.

Safety Precautions Taken: Test personnel will be excluded from the gas shed and pump room during the pressurization portion of the test unless behind a barrier. Ear plugs will be required for personnel within vicinity of gas shed in case 2500 psig relief goes off. Flex hoses greater than 24" long are safety chained.

*Shed door locked
/ Technician posted*

Special Conditions or Requirements: We will control perimeter during the test. We will use the HP air compressor to achieve test pressure. Pumping rate will be about 100 psi/min. The 2500 psig relief on the discharge of the HP compressor will limit overpressure during the test. A 2200 psig relief will be installed on the piping after the test.

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

Fermilab

PAGE 4 of 4

2/12/2002

HP Air Compressor connection tubing
Pressure Testing Permit (page 2 of 2)

Test Coordinator: Russ Rucinski Dept/Date PPD/MD/D0 OPs 2/11/2002

Division/Section Safety Officer Martha Heflin #8971 Dept/Date PPD/ESH 3-7-02

Division/Section Head J. Lopez Dept/Date 3/8/02

Results SUCCESSFUL TEST. FIXED A COUPLE OF SMALL
LEAKS AT COMPRESSION FITTINGS. LEAKS DETECTED BY
SNOOP (SOAP WATER), PRESSURE REDUCED DURING
TIGHTENING OF FITTINGS. NO FAILURES OR
SURPRISES. TEXT OF TEST ACTIVITY AND PRESSURE
TREND OF PT-744-I IS ATTACHED. DOCUMENTATION
STORED LOCALLY AS DØ ENGINEERING NOTE 3823.115-EN-563.

Witness Russell Rucinski #8351 Dept/Date PPD/MD/DØ OPS 3/12/02
(Safety Officer or Designee)

DØ CRYO INSTRUMENT AIR BACKUP SYSTEM

DØ ENGINEERING NOTE
3740.214-EN-268
JOHN URBIN
20 NOV 90

REVIEWED:

G. T. Melhollan

DATE: _____

11/20/90

EXHIBIT B

PAGE 2 of 2
Date: 14 NOV 80

Pressure Testing Permit*

Type of Test: ☐ Hydrostatic ☒ PneumaticTest Pressure: 3000 psig Maximum Allowable Working Pressure: 2400 psigItems to be Tested: PIPING SYSTEM WHICH SUPPLIES GN_2 TO BACKUP THE
DOP CRYO INSTRUMENT AIR SYSTEMLocation of Test: DOP SOUTHSIDE CRYO AREA
PUMA ROOM

Date and Time: _____

Hazards Involved: HAZARDS ASSOCIATED WITH HIGH PRESSURE PIPINGSafety Precautions Taken: TEST AREA WILL BE CLEARED OF PERSONNEL. TEST AREA WILL
BE MOVED OFF WITH SIGNS POSTED. ALL APPROXIES OF ENTRANCE TO THE TEST AREA WILL BE
MONITORED BY TEST PERSONNEL. ANNOUNCEMENT OF THE TEST WILL BE MADE ON THE P.A. SYSTEM.
ANOTHER ANNOUNCEMENT WILL BE MADE WHEN THE TEST IS COMPLETED.Special Conditions or Requirements: NONEForward a copy of the test procedures to RD Safety for review prior to
beginning the pressure test.Test Coordinator: John B. Urban / John B. Urban Dept/Date: 19 Nov 90Division/Section Safety Officer: J. B. Urban Dept/Date: 16 Nov 90Division/Section Head: Peter B. Urban Dept/Date: 18 Nov 90Results: TEST WAS SUCCESSFULLY COMPLETED WITHOUT INCIDENT
SEVERAL SMALL LEAKS WERE REPAIRED ALONG THE WAY.Witness: John B. Urban / Kelly N. Smith Dept/Date: RD/Cryo 19 NOV 80
(Safety Officer or Designee)*Must be signed by division/section safety officer and division head prior to
conducting test. It is the responsibility of the test coordinator to obtain signatures.

Safety Documentation for review of

D-Zero's Emergency Air Supply High pressure piping

D-Zero has a back up air supply system to add reliability to air compressor systems. The system includes high pressure piping which requires a review per FESHM 5031.1.

The core system consists of a pressurized tube trailer, supply piping into the building and a pressure reducing regulator tied into the air compressor system discharge piping. Air flows from the trailer if the air compressor discharge pressure drops below the regulator setting. The tube trailer is periodically pumped back up to approximately 2000 psig. A high pressure compressor housed in one of the exterior buildings is used for that purpose.

The system was previously documented, tested and reviewed for Run I, except for the recent addition of piping to and from the high pressure compressor.

The following documents are provided for review of the system:

- 1.) Instrument air flow schematic, drg. 3740.000-ME-273995 rev. H
- 2.) Component list for air system
- 3.) Pressure testing permit for high pressure piping
- 4.) Documentation from Run I contained in D-Zero Engineering note 3740.214-EN-268, John Urbin 11/20/90.
- 5.) Pressure test procedure
- 6.) Schematic for pressure test
- 7.) List of component pressure ratings

The goal of this independent review is to:

- A.) Reviewer makes recommendation to the Division/Section Safety Officer to approve the testing permit.
- B.) Reviewer is satisfied the FESHM 5031 is met, and recommends to the division head that approval to operate be granted.

Sincerely submitted,

Russ Rucinski, Project engineer, PPD/MD/D0 operations

2 of 4

Russ Rucinski

From: "Robert Barger" <barger@fnal.gov>
To: "Russell Rucinski" <rucinski@fnal.gov>
Cc: "Robert k Barger" <barger@fnal.gov>; "James E. Fagan" <jefagan@fnal.gov>
Sent: Wednesday, January 30, 2002 11:31 AM
Subject: High Pressure Modifications for Emergency Air Backup System

Russ,

Have completed the relocation of the High Pressure Air Compressor to the new protected location in the Gas Shed. Tim has completed the supporting electrical modifications providing a 480 VAC/3ph outlet inside the shed. I have completed the extended piping runs to the shed.

Relevant physical data for the changes:

- 1) High Pressure extended piping consists of 1/2" O.D. x .049 wall 304 S.S. tubing per ASTM-A269 rated @ 3.06 ksi; connecting fittings are 316 S.S. commercial threaded and compression type fittings rated at 4.5 ksi or higher, a Dragon 1/4" NPT 303 S.S. Model 816033KR needle valve rated @ 6.0 ksi, and a braid reinforced corrugated hose section salvaged from high pressure cylinder manifolding. The hose was devoid of identifying marks, but had been in a previously approved high pressure service application, without failure. *BNL GUIDE, 3.5 ksi - PARKER CHART - SWAGelok 4900 psi*
- 2) Low Pressure inlet extended piping consists of 1/2" O.D. x .049" wall 304 S.S. tubing as above, combined with one section of 1/2" O.D. x .035" wall rated @ 2.14 ksi; connecting fittings as above.
- 3) Low pressure dry air source is relieved @ 150 psig via a Circle Seal B 4MP-5159-150 1/2" NPT relief at a ballast tank fed from a 3/8" instrument air line.
- 4) High pressure compressor discharge relief is an Anderson-Greenwood Model 81MS66-3 set @ 2500 psig, rated @ 1137 scfm.
- 5) High pressure compressor is an Ingersoll-Rand type 30, model 223 with a capacity of 5.0 cfm at rated pressures (up to 3000 psi).
- 6) As this is not a cyogenic or fired boiler application, no trapped volume reliefs were installed in either line extension. The Dragon valve was installed inside the shed for maintenance safety/control reasons.

At this time, preparations are underway for a hydrotest of the high pressure line segment, pending selection of desired MAWP rating and receipt of testing permit.

Bob

1/30/2002

Flexible Metal Hose

Model M1F

Scott's Stainless Steel Flexible Metal Hoses are fabricated from corrugated Stainless Steel Type 316L innercore reinforced with stainless steel braid. Both innercore and double braids are heliarc welded to the end fitting.

FEATURES

- Stainless steel construction for excellent corrosion and diffusion resistance.
- Close pitch, high convolution count annular innercore has excellent flexibility, less force to bend and can withstand continual flexing.
- All hoses cleaned for oxygen service.

- Metal I.D. tags: Product is identified as to pressure rating, part number and date of manufacture.

SPECIFICATIONS

Internal Diameter: 1/4" minimum
Working Pressure: 3200 psig @ 70°F (20°C), 2500 psig @ 500°F (260°C)
Proof Testing of Assemblies: 4800 psig
Burst Pressure (minimum): 13,000 psig

MATERIALS OF CONSTRUCTION

Innercore: 316L Stainless Steel
Braid: 321 Stainless Steel
End Fittings: 316L Stainless Steel

End Fittings inches	Length	All Metal Flexible Hose		All Metal Flexible Hose With Interlock Armor	
		Model No.	Price	Model No.	Price
1/4" NPT(F)	24"	58-1M1F-4A24	\$102.00	58-2M1F-4A24	\$114.00
1/4" NPT(F)	42"	58-1M1F-4A42	150.00	58-2M1F-4A42	177.00
1/4" NPT(F)	60"	58-1M1F-4A60	199.00	58-2M1F-4A60	239.00

Tubing

Model No.	O.D. (inches)	Wall (inches)	Minimum Bore (inches)	Price per Foot
Type 304 Stainless Steel Standard Tubing				
58-1TS4-0282	1/8	.028	8200	\$3.50
58-1TS4-0284	1/4	.028	3900	4.00
58-1TS4-0356	3/8	.035	3220	5.50
Type 304 Stainless Steel Tubing Degreased and Passivated				
58-1TSP4-0282	1/8	.028	8200	7.00
58-1TSP4-0284	1/4	.028	3900	8.00
58-1TSP4-0356	3/8	.035	3220	11.00
Type 316 Stainless Steel Standard Tubing				
58-1TS6-0282	1/8	.028	8200	4.00
58-1TS6-0284	1/4	.028	3900	4.50
58-1TS6-0356	3/8	.035	3220	6.00
Type 316 Stainless Steel Tubing Degreased and Passivated				
58-1TSP6-0282	1/8	.028	8200	7.50
58-1TSP6-0284	1/4	.028	3900	9.00
58-1TSP6-0356	3/8	.035	3220	12.00
Standard Copper Tubing (Annealed)				
58-1TC-0302	1/8	.030	2500	2.00
58-1TC-0496	1/4	.049	2200	2.50
58-1TC-0656	3/8	.065	2412	4.50

Stainless Steel sold in random lengths 17 to 24 feet. Copper sold in 50 foot coil. Special cuts subject to \$13.00 charge.

Note: Contact the nearest Scott facility for pricing of tubing quantities above 100 feet.

We offer straight lengths of stainless steel tubing (for corrosive service) as well as coils of copper tubing (for non-corrosive service) to allow flexibility in the design of specific industrial and laboratory fluid systems. They are ideal for use in remote ventilation systems so that hazardous gases do not endanger the immediate work area in the event of equipment failure. The option of having the stainless steel tubing degreased and passivated is available. This process removes all traces of oil, grease and dirt and insures optimal corrosion resistant performance. Consideration should be given to pressure, flow, and corrosion resistance requirements when selecting the proper tubing.

EQUIPMENT

SECTION 6
Gas Delivery Systems

Multi-Purpose Automatic Change-Over Manifold

Model 8501

The Scott Multi-Purpose Automatic Change-Over Manifold offers a safe, economical means to deliver an uninterrupted supply of gas. It is designed to maintain a constant delivery pressure during automated cylinder bank change-over. By preventing unscheduled downtime, it reduces operating costs and increases productivity. Includes pressure regulators for a complete gas handling system.

BENEFITS

- Eliminates costly downtime by providing constant uninterrupted gas flow.
- Enhances safety by consolidating cylinders into a centralized location.
- Improves system purity with system vent for purging flexible pigtails.

Automatic cylinder bank change-over reduces operating and labor costs.

- Alerts operator when cylinder changeout is required (with optional annunciator).

SPECIFICATIONS

Inlet Pressure Rating: 3,000 psig

Operating Temperature: -50°F to 150°F

Delivery Pressure: 2-75 psig, 2-90 psig for O₂ service (other ranges available)

Flow Capacity: 200 SCFH (other ranges available)

Power Requirement (for optional annunciator): 115/60 Vac

Connections (Process/Vent):

1/4" NPT - Outlet

Weight: 35 lbs.

Model 8501 Multi-Purpose Automatic Change-Over Manifold with Optional Annunciator

MATERIALS OF CONSTRUCTION

Panel: 14 Gauge Sheet Steel, Epoxy Painted

Pigtails: Rigid Brass with Brass CGA

Check Valves: Brass/Viton

Ball Valves: Brass/Teflon

Regulators (Model 51-711):

Brass/316L SS/Tefzel/Teflon

OPTIONAL EQUIPMENT

- Flow Limit Shut-off Valve
- Pressure Relief Valve
- Indicating Pressure Switch
- Annunciator Panel
- Gas Cabinet
- Flash Arrester
- Regulator Bonnet Venting
- Stainless Steel Flexible Pigtails
- Armored Pigtails

8501

Betalert (8501)

Model No.	Description	Price*
8501-B-XX-2B-0-00	Multi-Purpose Automatic Change-Over Manifold (Brass)	\$2,087.00†
8501-S-XX-22-0-00	Multi-Purpose Automatic Change-Over Manifold (Stainless Steel), Not Available for O ₂ Service	3,796.00
8501-B-XX-2B-0-BA	Multi-Purpose Automatic Change-Over Manifold (Brass) with Annunciator	3,519.00†
3501-S-XX-22-0-BA	Multi-Purpose Automatic Change-Over Manifold (Stainless Steel) with Annunciator, Not Available for O ₂ Service	5,228.00

* These prices do not include options. Refer to Product Datasheet 8500 for complete model number and pricing information.
† Add \$385.00 for Oxygen Service.

EQUIPMENT

Fermilab

2/15/2001

MDT tube trailer connection tubing

Pressure Testing Permit*

Type of Test: [✓] Hydrostatic

Test Pressure: 110%(2500 psi) = 2750 psigMaximum Allowable Working Pressure: 2500 psigItems to be Tested: Connection flex hose, tube trailer fill station, and 3/8" OD tubing run to Scott Manifold in gas shed.Location of Test: South side DAB tank farm Date: February 2001 or March 2001Hazards Involved: Minimal hazards, small size tubing, hydrostatic test.Safety Precautions Taken: Flex hose will be safety chained (as it normally will be).Special Conditions or Requirements: Test location is in a minimal traffic area. Will control perimeter during the test. Temperature must be above 32 F.Test Coordinator: Russ Rucinski Dept/Date PPD/ETT/D0 2/15/2001Division/Section Safety Officer: Martin Hefner Sr Dept/Date PPD/ESM 2/19/01Division/Section Head: J. J. Varela Dept/Date 2/19/01

Results _____

Witness

(Safety Officer or Designee)

Dept/Date

3/8/2001

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

Fermilab

2/14/2001

Assembly Hall to Collision Hall jumpers, internal pipes

Pressure Testing Permit*

Type of Test: ☒ Pneumatic – Gas nitrogen or argon

Test Pressure: Helium lines = 110%(365 psid) = 400 psid;

Nitrogen lines = 110% (165 psid) = 180 psid

Maximum Allowable Working Pressure: Helium: 350 psig + vacuum

Nitrogen: 150 psig + vacuum

Items to be Tested: VLPC lines (6), Solenoid lines (5) Note: Lead flow lines are EXCLUDED.

These are all small lines, < 3/4" pipe.

Location of Test: D-Zero Ass'y Building Date: Last two weeks of February 2001

Hazards Involved: Minimal hazards, very little store energy.

Safety Precautions Taken: Relief valve on source will ensure no overpressurization. Bayonet ends will be pointed in a safe direction. 15 foot radius in vicinity of ends will be evacuated.

Special Conditions or Requirements: Vacuum Jacket will be evacuated to < 5 torr.

Test Coordinator: Russ Rucinski

Dept/Date PPD/ETT/D0 2/15/2001

Division/Section Safety Officer Martina Diefen

Dept/Date PPD/ESH 2/19/01

Division/Section Head John for T.J. Sauer

Dept/Date PPD 2/14/01

Results _____

Witness

Detmar Miller
(Safety Officer or Designee)

Dept/Date Mar 2 2001

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

Fermilab

COMPRESSOR DISCHARGE PIPING

Date MAY 5, 1997

EXHIBIT B

Pressure Testing Permit*

Type of Test: ☐ Hydrostatic ☒ Pneumatic GHe

Test Pressure: 390 psig Maximum Allowable Working Pressure: 350 psig ^{+ INSUL. VACUUM}

Items to be Tested 2" COMPRESSOR DISCHARGE PIPE, GAS HELIUM COOL DOWN PIPING, LIQUID HELIUM TRANSFER LINES, GAS HELIUM TANK FILL LINE. 6 FT³ VOLUME. 2" PIPE MAXIMUM SIZE.

Location of Test DØ ASS'Y BLDG. Date and Time GHe TANK FILL 2 5/8
ALL OTHERS 5/15/97

Hazards Involved STORED ENERGY = 537,000 ft-lbs ≈ 157 GRAMS TNT DISTRIBUTED OVER 650 FEET OF PIPING.

Safety Precautions Taken WILL KEEP PERSONNEL AWAY FROM NON VACUUM JACKETED PIPING UNDER PRESSURE. WILL THROTTLE VALVES TO COMPARTMENTALIZE THE STORED ENERGY & DAMPEN POSSIBLE RELEASE RATE.

Special Conditions or Requirements PIPING WILL BE DOUBLE ISOLATED FROM THE TEVATRON HIGH PRESSURE HEADER. NEED TO USE CLEAN GAS HELIUM (450 PPM CONTAMINANT) FOR TEST.

Test Coordinator RUSS RUCINSKI Dept/Date PPD/ETT/DØ 5/6/97

Division/Section Safety Officer [Signature] Dept/Date PPD/ESH 7 May 97

Division/Section Head [Signature] Dept/Date PPD 5/7/97

Results GHe TANK FILL LINE TEST DONE ON 5/12 WAS UNEVENTFUL. COMPRESSOR DISCHARGE PIPING, HE COOLDOWN PIPING, AND HELIUM TRANSFER LINES WERE SUCCESSFULLY TESTED TO 392 PSIG ON 5/20. THERE WERE ABOUT A DOZEN LEAKS FOUND AND FIXED AT FITTINGS DURING THE LATTER TEST. AT FULL TEST PRESSURE, THE PRESSURE DROP WAS 0.1 PSI IN TEN MINUTES. THE INSULATING VACUUM PRESSURES REMAINED UNCHANGED BEFORE AND AFTER THE TEST.

Witness [Signature] Dept/Date PPD/ETT/DØ 5/20/97
(Safety Officer or Designee)

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

COMPRESSOR DISCHARGE & HELIUM PIPING

PRESSURE TESTING PROCEDURE

[Pressure testing piping per ANSI/ASME B31.3 Piping code]

R. Rucinski

Date: 5/6/97

Notes:

- A. 350 psig trapped volume reliefs are not installed for test.
- B. 400 to 425 psig relief on source is required.
- C. Walk thru by the engineer before pressurizing to check valve line up and throttle valves (MV-2005-H, MV-3024-H, MV-4023-H, MV-4024-H).
- D. Vacuum jackets around pipes shall be at full vacuum during test.
- E. Record vacuum jacket pressure before and after test for indication of leak to vacuum.

Procedure:

1. Pump and backfill to 1 psig with clean helium to < 50 ppm.
To accomplish this do at least;
One pump to 34 microns and a backfill, or
Two pump and backfill cycles to 5 Torr, or
Three pump and backfill cycles to 27 Torr, or
Four pump and backfill cycles to 62 Torr, or
Five pump and backfill cycles to 103 Torr
2. Take care of notes listed above.
3. Meet special conditions and requirements on permit.
4. Get a hold of the pressure test "Witness".
5. Pressurize piping to 195 psig and hold. Check accessible gages or transmitters on system to confirm pressure is in all test sections.
6. Watch 195 psig pressure for at least 3 minutes. If no or little pressure drop is seen, proceed.
7. Pressurize in steps of 40 psig up to full test pressure. Holding for at least 3 minutes at each step. Note, full test pressure is 390 psig.
8. Watch isolated system for 5 to 10 minutes at full test pressure. If no pressure drop is seen, bleed down piping system to 310 psig.
9. Snoop fittings, flanges, valve stems and threaded fittings for leaks. A helium sniffer detector can also be used.
10. After the leak check, bleed down the system.
11. Pressure test can be considered complete.

After the test:

12. Remove pipe plugs and install 350 psig trapped volume reliefs.
13. Bring system up to 325 psig and isolate source.
14. Snoop relief threaded connection and outlets to be sure they are sealed.
15. After the leak check, bleed down the system. Remove test equipment.

He PIPING PRESSURE TEST SCOPE

R. RUCINSKI 3/31/97

NO.	DATE	BY	CHKD.	REVISION
1	3/31/97	R. RUCINSKI		1

- GENERAL NOTES
1. ALL TYPING MUST BE DONE IN ACCORDANCE WITH PROJECT
 2. ALL TYPING MUST BE DONE IN ACCORDANCE WITH PROJECT
 3. ALL TYPING MUST BE DONE IN ACCORDANCE WITH PROJECT

NO.	DATE	BY	CHKD.	REVISION
1	3/31/97	R. RUCINSKI		1

3/10

3.07 TIER - THERMO UNL. 400 μ @ UV MW. PUMP. HX - VALVED CLOSED., PV-2013-H OPEN
CLOSED PV2013-H 450 μ T6713 MW.
VACUUMS FOR P.T. : UTILITY FEED CAN, SOLE. V.B., VLPC. V.B., HE 310, HE 304, HE 311
12 TORR. 1.2 TORR. 1.2 TORR
120 μ 16 μ 71 μ

BARRUM
EVERYTHING
OK

9:52 2.12 TORR

10:15 31 μ EVAC. UPTO PURIFIER BALL VALVES. IF OPENED, GET
LEAKS FROM HP HEADER.

22 μ .

11:00 BARRUM HAS DAI & DAR ISOLATED FROM TEN HEADERS
DISCHARGE @ FULL PRESS., SUCTION @ SUCTION. ELECTRIC VAL.
282 psig 1.8 psig

Checked all loops 9 thru 13 closed.

TIE IN HP HE SOURCE TO DOWNSTREAM OF MV-4001-H WITH
TEE.

11:45 560 μ ← PIPING. CHECKING VALVE LINE UP & VACUUMS, BACKFILLED TO > 1 ATM.
VLPC EAST FEED CAN 72 μ
SOLENOID EAST FEED CAN 16 μ
UTILITY FEED CAN .11 TORR .11 TORR
VLPC V.B. QREF. 71 μ 72 μ
SOLE. V.B. QREF. 12 μ 12 μ
OK!

$$Q = V_{LEAK} \left(\frac{6 \text{ ft}^3}{14.7 \text{ psi}} \right) \left(\frac{1.1 \text{ psi}}{14.7 \text{ psi}} \right) \left(\frac{1 \text{ atm}}{14.7 \text{ psi}} \right) \rightarrow 0.41 \text{ ft}^3 \text{ LEAK.}$$

12:50 477 μ PIPING., 2nd BACKFILL

THROTTLED VALVES LISTED ON PROCEDURE
GNE ~~CHL~~ @ 2000 psi PRIOR TO BACKFILL
BARRUM TO 195 PSI.

PT'S & PI'S.	14:35	14:45
D0PCPDIS	154.06 psi	153.13 psi
D0BPXHP	154.2 psi	153.1 psi
PI-2027H	160 psi	
PI-2042-H	160 psi	
PT-2043-H	153.4 psi	152.5 psi
PT-4084-H	7.5 psi OVER RANGE	
PT-4086-H	7.5 psi	"
PT-3006-H	7.5 psi	"
TEST GAGE	154 psi	233 psi

13:30 154 psi @ TEST GAGE. CHECKING PI'S

13:35 CHECKING PT'S. SNOOPED ALL FITTINGS etc.

13:48 CHECKING PT'S AGAIN → 1.1 PSI/13 MIN. NOTE SOME LEAK THRU VALVES PPS

14:20 PRESSURIZING TO 195 PSI

14:23 @ 195 psi

14:27 194 psi

14:30 194

14:33 235 psi

$$6 \text{ ft}^3 \left[\frac{234 + 15}{14.7} - \frac{233 + 15}{14.7} \right] = 0.41 \text{ SCF} \rightarrow 2.4 \text{ scfh.}$$

TOTAL.

RAW TEST NOTES

R. RUCINSKI 5/19/97

(2)

8 OF 10

5/19 5/20

↓

14:46 PRESSURIZING to 275 psi

14:52 AT 275 psi

DØ PCPDIS	273.75	272.97	272.19	282.03	281.56
DØ BPXHP	273.8	273.0	272.0	281.9	281.6
PT 2043	272.7	271.9	270.8	280.6	280.3
TEST GAUGE	275		272.	282	282
TIME	14:55	15:00	15:05	15:20	15:25
DØ PCPSUC		0.6 PSIG.	0.6	0.5	0.5
DØ BPX3HP		1.6 PSIG.	1.6	1.4 psig	1.4

279.38	280.4
279.4	280.3
278.1	279.1
280	282
16:55	8:00
0.4	0.1
1.4	1.4

15:07 TAKING IT UP TO 315 psi

15:15 288 psi OUT OF GAS. He. ISOLATED. PRESSURE PROP?

280 psi

↳ 19 ATM.

$$950 \times 10^{-6} \times \frac{1 \text{ atm}}{760,000}$$

$$50 \text{ ppm} \times \frac{1}{20} \rightarrow 950 \text{ ppm OK}$$

$$\frac{950 \text{ PARTS AIR}}{10^6 \text{ PARTS TOTAL}} \times 760,000 \text{ TORR} = 722 \mu.$$

STOPPED FIX LEAKS @ PARKER FITTINGS

REPLACE SWAGelok FERRULE w/ NO BAKING RING IN PARKER UNION
PUMP & BACKFILL to 296 TORR.
PUMP 5 TORR

16:55 288 TOOK READINGS

8:00 PRESSURE HELD OVERNIGHT.

8:10 GOING UP TO 320 PSIG.

SOLENOID VJ @ 12 μ

UTILITY FEED VALVE 11 TORR

VLPC FROM V.B. 73 μ

WON'T HOLD PRESSURE, BLEEDS DOWN TO 282 PSI PUT 2000-300 PSI OF A 6HR CYL.

8:35 P = 329 psi ISOLATED CLOSED EV-2000 & EV-2014 - HOLD SETBACK

EV-2004 OPEN EV-2000 & CLOSE.

8:38 P = 325.0

4 PSI / 3 min

> 1.3 PSI / min. OK.

4013, 4014 OPEN

4023, 4024, 4021, 4022, 4011, 4012 CLOSED.

TIGHTENED PACKING ON PV-2013-H

8:52 CLOSED PV-2013-H. TAKING UP TO PV-2013

8:53 326 psi ON TEST GAUGE HOLD 110 PSI FROM CYL.

8:

$$\frac{\Delta P}{t} = \frac{75 \text{ psi}}{6 \text{ min}} = 1.25 \text{ PSI / min}$$

FIXED LEAK @ INLET TO MV-4003-H, PARKER FITTING.

9:14 CLOSED MV-4011, 4012, 3024-H.

COMP. DISCHARGE
PIPING PRESSURE TEST

RAW TEST NOTES

R. RUCINSKI 5/20/97

9 of 10
(3)

TIME	DP/PC/DIS	PXHP	PT2043	TEST GAGE	PCPSUC	PXJHP	COMMENTS
8:56							PV-2013-H CLOSED
8:58	293.13	293.0	315.9	316 ^{3:19}	0.2	1.4	
9:02			310.8				
9:04	293.44	293.3	308.4	309 ^{9:14}	0.2	1.6	Y FIXED LEAK.
9:15	293.9	293.9	318.4	324	0.2	1.4	SDL V.B ISOLATED, PV2013 CLOSED.
9:20	294.22	294.1	302.3	296	0.2	1.6	3.22 PSI/min
9:52				364 psi			VIPC CIRCUIT ISOLATED, PPT'S ISOL.
10:01				361.5			0.3 PSI/MIN.
10:10				368			OPEN 4023, 4024, 3024
10:11	284.06	283.9	365.8		0.2	1.4	
10:16	285.00	285.0	364.1	364 10:19	0.2	1.4	0.34 PSI/MIN.
10:24	286.5	286.1	363.8 ^{10:23}	365.5	0.2	1.4	
10:27	287.0	286.9	363.3		0.2	1.6	
10:30	287.34	287.3	363.0	364 10:33	0.2	1.4	0.13 PSI/MIN.
10:38	365.00	364.8	363.3	365 10:37	0.2	1.4	
10:43	364.69	364.5	363.0		0.2	1.4	.3 PSI / MIN = .06 PSI/MIN
10:49	366.09	365.9	364.4	366	0.2	1.4	UP TO PRESSURE, MV-2005 CLOSED
10:54	365.94	365.6	364.1		0.2	1.6	.06 PSI/MIN.
10:56	367.72	326.6	325.2		0.2	1.4	2005 MV-2005 OPENED.
10:59	326.88	326.7	325.2		0.2	1.6	
11:04	367.34	367.0	365.5	367.5	0.2	1.6	
11:08	367.19	366.9	365.3		0.2	1.4	
11:10	366.88	366.7	365.2	= PI	0.2	1.6	0.077 PSI/MIN
11:16	392.34	392.0	390.3	312 VALVED OUT	0.2	1.6	FULL TEST PRESSURE, SET UP VALVED OUT w/ 100000 PSI/MIN.
11:20	392.19	392.0	390.3		0.2	1.0	
11:26	392.19	391.9	390.2		0.2	1.6	
11:30							TEST COMPLETED, BLOWING DOWN TO 310 PSI

FIXED LEAK 2 INLET TO MV4062.

ISOLATED DPT'S, BLEEDING DOWN VLPC CIRCUIT TO CHANGE JUMPER OUT. FROM PT LINE TO UPSTREAM GHE COOLDOWN,

10 of 10

9:50 366 psi 364 PULLED OF 0-200 PSI PRESSURE GAGE., PEGGED

9:52 364 psi $\rightarrow \frac{2 \text{ psi}}{6 \text{ min}} = 0.333 \text{ psi/min}$

9:58 382 psi

10:10 OPENED UP GHE COOLDOWN SUPPLY LINE TO TEST REGION.
BY OPENING. 4023, 4024, 5024 $\rightarrow$ CLOSED.

10:10

10:20 OPENED MV-3024-H OPENING UP SOLENOID SYSTEM

(10:35 OPENED PV-2013-H, ~~MAINT~~ REMAINING VALUES ON VLPC CAN.
EU-2000-H STILL CLOSED

11:44 $\Delta P/\Delta t = .06 \text{ psi/min}$ OPENED EU-2000-H PRESSURIZING PIPING TO MV-2005-H.
PRESSURE RATTED TO 330 PSI DUE TO EXTRA VOLUME.

11:12 GOING UP TO FULL TEST PRESSURE 370 PSI

11:30 CHECKING VJ'S

VLPC WAVE BOX 72 μ

UTILITY FEED CAN .11 TORR

SOL. VALVE BOX .012 $\rightarrow$ 12 μ

He 310 1.4 TORR

He 304 1.3 TORR

He 313 1.4 TORR

BLOW DOWN PRESSURE OUTSIDE.

12:25 DAS COMP. DISCHARGE PRESSURE = 281.88 PSIG.

SUCTION @ 1.36 PSIG.

ABOUT SAME AS BEFORE TEST.

Fermilab

MODIFICATION
Compressor Discharge pipe section

Dec. 30, 1998

EXHIBIT B
Pressure Testing Permit*

Type of Test: ☐ Hydrostatic ☒ Pneumatic – Gas Helium
 Test Pressure: 390 psig Maximum Allowable Working Pressure: 350 psig
 Items to be Tested: Approximately 150 feet of 2" sch. 10s pipe which includes several valves and fittings. The pipe is the compressor discharge pipe from MV-2005-H on the berm to EVX1 and EVX2 the STAR heat exchanger inlet valves.
 Location of Test: D-Zero Ass'y Building Date and Time: January 1999
 Hazards Involved: Minimal hazards, very little store energy.
 Safety Precautions Taken: Personnel will be at least 5 feet away from piping at maximum pressure. 400 to 425 psig relief on Ghe source is required.
 Special Conditions or Requirements: This section has been previously tested, only 4 new welds have been added. Tev system is isolated by three (two locked) valves from this system.
 Procedure: Bag new weld joints. Pressurize to 195 psig hold for 3 minutes, pressurize in 50 psig increments holding 3 min. each step. Full pressure is 390 psig. Hold at 390 psig for 5 minutes. Bleed down to 310 psig and sniff bagged weld joints with helium sniffer. Repair weld and repeat if leaks are detected. After successful leak check, bleed down and test is complete.

Test Coordinator: Russ Rucinski ¹⁰⁸³⁵¹ Dept/Date PPD/ETT/D0 12/30/98
 Division/Section Safety Officer: [Signature] Dept/Date PPD/ESH 25 Jan 99
 Division/Section Head: [Signature] Dept/Date 2/3/99

Results SYSTEM HELD PRESSURE FOR EXTENDED HOLD TIMES.
NOTHING UNUSUAL TO REPORT. HELIUM LEAK CHECK WAS NEGATIVE.

Witness: [Signature] ¹⁰⁸³⁵¹ Dept/Date PPD/ETT 4-14-99
 (Safety Officer or Designee)

[Signature] ^{#2316} 4/14/99

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

4/14/99 Pressure Test of DØ Helium Compressor
DISCHARGE LINE MODIFICATIONS

- 0825 - START PRESSURE TO 194 - Snoop check fittings
 0829 - Isolate + hold @ 194
 0833 P=194 system holding
 0837 P increased to 247 psig + isolated.
 0841 P=247 psig system holding.
 0844 P increased to 295 + isolated
 0853 P=295 psig system holding.
 0856 P increased to 345 + isolated
 0905 P=345 psig system holding
 0907 P=390 psig test pressure.
 0920 P=390 psig system holding
 0924 P=310 system bled down to 310 psig for leak check

1002: Leak check w/ sniffer complete. No response
 Equipment: ASM 121h Alcotel/Leak Detector.
 Sniffer levels: initial: 6.0×10^{-8}
 final: 5.2×10^{-8}

1005: System bled down.

1030: Test rig removed; system restored

JR. Byrne #2316 4/14/99

[illegible]

- GENERAL NOTES**
1. ALL WORKING JACKET LINES ARE PROTECTED WITH PROFOUT REINFORCED RUBBER AND THERMOPLASTIC SHEET.
 2. ALL END OF TUBES MUST BE LOCAL, OTHERWISE LOCALS OVERSHORE NOTED.
 3. LINES WITHIN CABLE PROTECTION SYSTEMS MAY NOT BE BOUND IN LINES WITHIN THE CABLE, TRANSFER LINES, AND CABLES OR PLATE COMPONENTS.

[illegible]

TO NEXT PAGE

6 of 4

Fermilab

1 of 6

PRESSURE PIPING

EXHIBIT B

Pressure Testing Permit*

Date 4/16/97

Type of Test: ☒ Hydrostatic

☐ Pneumatic

Test Pressure: 2800 psig Maximum Allowable Working Pressure: 2500 psig

Items to be Tested HELIUM TUBE TRAILER FILL STATION.

INCLUDES TWO 12 FOOT LONG HOSES AND A GAGE

PANEL RELOCATED FROM THE 15' BUBBLE CHAMBER.

Location of Test DAB SOUTH LOT

Date and Time 4/18 7:00 AM

Hazards Involved WHIPPING HOSE, BLOWING DUST AND GRAVEL

IF FAILURE OCCURS, LOUD NOISE

Safety Precautions Taken HOSES WILL BE ANCHORED AT EACH END.

AREA WILL BE ROPED OFF. TEST PERSONNEL WILL BE

BEHIND A BARRIER (SHIELDING BLOCK). EAR PLUGS & SAFETY GLASSES.

Special Conditions or Requirements NONE. SEE ATTACHED PROCEDURE.

Test Coordinator RUSS RUCINSKI

Dept/Date PPD/ETT/DØ 4/16/97

Division/Section Safety Officer [Signature]

Dept/Date PPD ESH 17 Apr 97

Division/Section Head [Signature]

Dept/Date PPD 4/17/97

Results THE PIPING SYSTEM PASSED THE PRESSURE TEST WITH NO

FAILURES. THE PRESSURE DID NOT HOLD STEADY WHEN ISOLATED

INDICATING SMALL LEAKS. THE $\Delta P/\Delta t$ WAS -5 PSI/MIN.

THE LEAKS WERE FOUND AT THREADED FITTINGS. THE LEAKY

JOINTS WERE REMADE AND THE SYSTEM WAS TAKEN

UP TO TEST PRESSURE AGAIN. THE PRESSURE WAS HELD

FOR 10 MINUTES. A SLIGHT PRESSURE DROP WAS OBSERVED

BUT IS DEEMED ACCEPTABLE.

Witness [Signature]

(Safety Officer or Designee)

Dept/Date PPD/ETT/DØ 4/18/97

PERSONNEL PRESENT: RUSS RUCINSKI
CRAIG ROGERS
DEL MILLER (725-8:15)

* Must be signed by division/section safety officer and division/section head prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

HELIUM FILL STATION PIPING
HYDROSTATIC PRESSURE TESTING PROCEDURE

Equipment

See Exhibit A for pressure testing equipment set up.

See Exhibit C for scope of piping to be tested.

Procedure

1. Pressurize piping to 25 psig and hold.
2. Inspect fittings, flanges, and threaded fittings for leaks. Fix leaks if necessary.
3. Take pressure up to about 2000 psi.. Isolate the source.
4. Watch gage pressure for five minutes. If no pressure drop is seen, proceed.
5. Take to design pressure, 2500 psig and isolate source.
6. Watch gage for 5 to 10 minutes. If no pressure drop is seen, proceed.
7. Take to full test pressure, 2800 psig and isolate source.
8. Watch gage for 5 to 10 minutes. If no pressure drop is seen, proceed.
9. Bleed down the system.
- 10 Test is completed. Record results and have witnesses sign test record.

Notes

Design Pressure: 2500 psig, max. tube trailer pressure.
[Normal maximum tube trailer pressure = 2300 psig.]

Per par. 345.4.2 (a) Normal hydro test pressure would be 150% design pressure = 3750 psig. Paragraph (c) however allows reducing the test pressure if a component would be subject to it's yield strength. The weakest identifiable component in the system are the 1" VCO fitting connection rated at 2800 psig. This is probably due to the o-ring. Exceeding that pressure could cause the o-ring to fail. Therefore the test pressure will be limited to 2800 psig or 112% design pressure.

Valves have 3000 psi rating, the hoses have 3600 psi rating, some of the elbows are stamped rated at 3000 psi. The piping and some of the pipe elbows are not identifiably rated, but making some assumptions, are probably good to 4300 psig.

Independent Review

The mechanical subcommittee chair of the D-Zero ES&H review committee has been notified of the pressure test. Harry Carter, chair of the subcommittee, reviewed the pressure testing permit and made a field visit to look over the installation of the gage panel at D-Zero. His comments were appreciated.

*I HAVE REVIEWED THE DOCUMENTATION AND INSTALLATION AND
RECOMMEND THAT APPROVAL BE GIVEN FOR THIS TEST.*

H. J. Carter 4/17/97

SCHEMATIC SETUP FOR PRESSURE TEST EQUIPMENT

I. PNEUMATIC PRESSURE TEST

II. HYDROSTATIC PRESSURE TEST

Note 1 - Barricade device maybe necessary for large volume and/or high pressure test vessels.

4 of 6

HYDRO TEST EQUIPMENT

BARRIER

EXHIBIT C
TEST SCHEMATIC

R. RUCINSKI
4/14/97

He fill station Pressure Test data

R. RUCINSKI 4/18/97

5
9
6

7:26 1990 psi
7:31 1900 psi
7:36 1875 psi
7:41 1850

1990 psi → 1900 psi 5 min
1960

7:42 2310 psi
7:45 2295 psi
7:47 2285 psi

7:48 2500 psi
7:50 2490 psi
7:53 2470 psi
7:55 2465 psi
7:58 2450 psi
8:00 2440 psi

CHANGED @ PANEL

7:52 7:56
PI 2083 2300 2490
PI 2088 2350 2520
PI 2089 2300 2500
PI 2086 2310 2500

56.4°F

60 = 50 psi/min

FULL TEST PRESSURE

8:01 2805
8:06 2775
8:08 2760
8:10 2750
8:12 2740 psi

45 psi/min

55 psi/min = 6 psi/min

9:02
PI 2088 2800 psi
OTHER PI'S SAME AS

RAW DATA
4/18/97
HE FILL STATION
PRESSURE TEST.

R. RUCINSKI
4/18/97

8:13 BLEED OFF PRESS.
BLEED VALVE SEAL ~~WORKS~~ IS GOOD
CHECK VALVES ON PANEL HOLDING.

PLAN: GO TO 2000 psi & HOLD FOR
1 OR MORE HOURS

8:21 2550 psi
8:47 2495
9:48 2420 psi

CHANGED OUT VALVE
SINCE CV'S ARE
HOLDING NEED
TO GO TO AT
LEAST OTHER SIDE

PI 2073 2545 2400
PI 2088 2570 2440
PI 2086 2575 2450
DI 2080 2600 2500
PI 2083 2560 psi 2430

8:21 2560

10:55 2320

230 psi
120 + 34

CV 2069
1.5 psi/min.

CIRCLE SEAL
259T-4PP

CV 2069

MV 2078

MV 2084

MV 2087

FULL TEST PRESSURE

2805
2795
2790
2785

1:44
1:46
1:49
1:51

20 psi/6 min

3.33 psi/min

2775 1:51
2760 1:55

Fermilab

Date: 12/16/02

EXHIBIT B
Pressure Testing Permit*

Type of Test ☐ Hydrostatic ☒ Pneumatic

Test Pressure 385 psig Maximum Allowable Working Pressure 350 psig
715

Items to be Tested

Dzero Dry engine valve box, Transfer line and New U-tubes
as per drawing 3823.115-ME-399449 (attached markup
copy)

Location of Test Dzero Assembly hall. Date and Time _____

Hazards Involved

pressure failure of piping component resulting in flyin debris.

Safety Precautions Taken

Close off nearby doors, use of barricades and roped off
area as shown on marked up copy of 3823.115-ME-399449
* Complete test off hours. ~~12/17/02~~

Special Conditions or Requirements

Followed attached written procedure

Qualified Person and Test Coordinator
Dept/Date

Robert Sanders. Robert Sanders.
Mech Dept, PPD 12/16/02

Division/Section Safety Officer
Dept/Date

* Martha Hepler
PPD ESH 12/17/02

Results

See attached procedure.
all met well.

Witness

Robert Sanders PPD Dept/Date Dec. 20, 2002
(Safety Officer or Designee)

* Must be signed by division/section safety officer prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

Dzero Engine Valve Box and Transfer line High Pressure Side Pressure Test Procedure

R Sanders
12/16/02

The purpose of this his procedure is to pressure test the piping components of the new Dzero dry engine valve box , transfer-line and u-tubes. The new dry engines and previously existing cryogenic system will not be pressurized during this test.

There are two separate piping subsystems being pressure tested. The high pressure piping subsystem will be rated at 350 psig and tested to 110% above that to 71.5 psig. The low pressure piping subsystem will be rated at 65 psig and tested to 110% above that to 385 psig. The stored energy in the high pressure test is 9479 ft-lbf of energy. The energy in the test of the low pressure piping is much lower.

STEP 1) As noted on the attached marked up copy of drawing 3823.115-ME-399556, barricade and rope off areas and post warning signs in the Dzero assembly hall around the piping components being tested.

STEP 2) For the test of the high pressure piping components install the pressure test equipment with a 420 psig set pressure relief valve installed. Remove SV-2174-H and install pressure test line on its port.

STEP 3) setup the following valve line-up which is also shown on the attached marked up copy of the flow schematic 3823.115-ME-399449

MV-2170-H	open, insert u-tube	<i>closed no u-tube (test separately)</i>
✓ MV-2171-H	open	
✓ MV-2172-H	open	
✓ MV-2173-H	open, insert u-tube	
✓ MV-2174-H	open, insert u-tube	
✓ MV-2175-H	open	
✓ MV-2176-H	open	
✓ SV-2170-H	Plug or remove	
✓ SV-2173-H	Plug or remove	
✓ SV-2174-H	remove and connect pressure test line	<i>plugged. (PT line connected to beyond cap piece.)</i>
✓ MV-2136-H	He-212 u-tube not inserted, this valve is not part of pressure test	
✓ MV-2336-H	closed, no u-tube inserted	<i>In operation w/ existing Dry engine.</i>
✓ MV-2436-H	closed, no u-tube inserted	

STEP 4) On each of the u-tubes He-212, He-216, He-218, insert one end into either the engine valve box or transfer line and do not insert the other end. Cap the open ends of

these u-tubes so that they hold pressure. Do not pressure test the dry engines or the satellite refrigerator.

STEP 5) pressurize the piping in steps of 25, 100, 300 and 385 psig. Hold for five minutes at each pressure. There should be no leaks. Fill out the following table. If there are leaks or other problems close off the pressure source and vent the system pressure before investigating.

PRESSURIZE TO:	time start	time finish	comments
25 psig	0400	0410	found loose plug - corrected
100 psig 80 psig	0410	0530	Retention test - passed
200 psig	0533	0539	Background + Vacuum stable, Pressure Retained.
300 psig	0541	0547	Background unchanged, No Pressure loss
385 psig	0554	0603	Background unchanged, No pressure loss.

STEP 6) close off the pressure source and vent the system pressure completely.

STEP 7) Next For the test of the low pressure piping components; replace the pressure relief valve with a 75 psig set pressure relief valve on the pressure test equipment. Remove the pressure test line from the SV-2174-H port. ~~Remove the valve SV-2274-H~~ and connect the test pressure line onto its port. Bayonet cap end.

STEP 8) Setup the following valve line-up which is also shown on the attached marked up copy of the flow schematic 3823.115-ME-399449.

✓ MV-2270-H	open, insert u-tube closed	no U-tube
✓ MV-2271-H	open	
✓ MV-2272-H	open	
✓ MV-2273-H	open, insert u-tube	
✓ MV-2274-H	open, insert u-tube	
✓ MV-2275-H	open	
✓ MV-2276-H	open	
✓ MV-2277-H	closed	
✓ MV-2278-H	closed	
✓ MV-2279-H	open	
✓ MV-2280-H	open	
✓ SV-2270-H	Plug or remove	
✓ SV-2273-H	Plug or remove	

- * SV-2274-H ~~remove and connect pressure test line~~ *plugged*
- ✓ SV-2278-H Plug or remove
- MV-2136-H He-213 u-tube not inserted, this valve is not part of pressure test
- ✓ MV-2447-H closed, no u-tube inserted
- ✓ MV-2347-H closed, no u-tube inserted

STEP 9) On each of the u-tubes He-213, He-217, He-219, insert one end into either the engine valve box or transfer line and do not insert the other end. Cap the open ends of these u-tubes so that they hold pressure. Do not pressure test the dry engines or the satellite refrigerator.

STEP 10) pressurize the piping in steps of 25 and 71.5 psig. Hold for five minutes at each pressure. There should be no leaks. Fill out the following table. If there are leaks or other problems close off the pressure source and vent the system pressure before investigating.

PRESSURIZE TO:	time start	time finish	comments
25 psig <i>47 psig</i>	<i>0852</i>	<i>0902</i>	<i>holds press</i>
71.5 psig	<i>0902</i>	<i>0907</i>	<i>holds press.</i>

STEP 11) close off the pressure source and vent the system pressure completely. Remove plugs from or reinstall relief valves.

0400: Initial Snoop check of High Pressure Setup @ 80 psi - found 2 untightened plugs - corrected.

0405: Leak Detector put on line, filament turned on + opened to cryostat insulating vacuum. Background: 19x5 scale.

Check of U-tube vacuums:

HE-216	=	183 μ
217		370 μ
218		590 μ
219		820 μ
212		> 1000 μ
213		750 μ

Cryostat Piranni reads 0 μ

Note: PI-2173 + 2174-H agree closely with Test Gauge at 80 psi

Test Setup differs from procedure as follows:

1. system is pressurized thru end of a U-tube test cap.
2. U-tubes HE-213 + HE-212 cannot be inserted for test due to overhead clearance of existing U-Tubes. They will be tested separately

0527: Turbo Pump Valved off

0533: Increase to 200 psig. Background @ $\approx 10 \times 5$

0541 " " 300

0554 " " 385

0603 Back off to 350 + Snoop - ok

0615 Set up HE-212 for test Snoop @ 35 psig - ok

0617 increase to 100. - ok @ 5 min.

0622 increase to 200 psig - ok

0634 increase to 300 psig. - ok

0643 increase to 385 psig.

0648 Decrease to ~~300~~ atm.

Low Press Test

0727: Set @ 26 psig. found some packing leaks on extended stem valves - corrected

0745 Set @ 33.

0815: Continued problems with seat leaks on extended stem valves

0824: Found leaking plug valve - may have been problem all along. Pressurized to 31 psig.

0830 increasing to ~~33~~ 73

0837 Vented down all checks ok.

0852: Pressurized ME-213 to 47 psig.

0902 increase to 71.5

0907: Vented down - test complete

Fermilab

Date: 08/07/2006

EXHIBIT B
Pressure Testing Permit*

Type of Test: [] Hydrostatic [x] Pneumatic

Test Pressure 495 psig Maximum Allowable Working Pressure 450 psig

Items to be Tested

1. Dewar # 39 LN₂ fill connector brazed joint (recently repaired)
2. Dewar # 42 LN₂ fill connector brazed joint

Location of Test DAB gas yard Date and Time 08/14/2006

Hazards Involved
Brazed joint rupture

Safety Precautions Taken

Both joints are secured (bolted to posts) to prevent their separation from the pipes. Relief valve cracking pressure set to 499 psig. Fences/yellow safety tape will be used to prevent unauthorized access.. Vessels (Dewar # 39 and Dewar # 32) will be double isolated from pressure source - see attached test flow diagrams.

Special Conditions or Requirements
None

Qualified Person and Test Coordinator Michael Sarychev
Dept/Date PPD/MD/Dzero Ops 08/07/2006

Division/Section Safety Officer
Dept/Date

Eric McHugh x2399
PD/ES&H 8.07.06

Results

Both joints tested. Pressure increased to 0.5 MMAP -
- 225 psig - NO leaks. Pressure then increased to
110% MMAP - 495 psig, and reduced to 100% MMAP.
- 450 psig NO leaks/deformation/ruptures
observed. Test passed for both joints.

Witness

Eric McHugh
(Safety Officer or Designee)

Dept/Date

8.14.06

* Must be signed by division/section safety officer prior to conducting test. It is the responsibility of the test coordinator to obtain signatures.

DEWAR 39 LN2 FILL CONNECTOR BRAZED JOINT TEST FLOW DIAGRAM

DEWAR 42 LN2 FILL CONNECTOR BRAZED JOINT TEST FLOW DIAGRAM

MV-525-N; MV-511-N
AND PV-540-N CLOSED