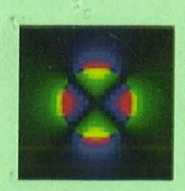

Superconducting Magnet Division

sPhenix Solenoid Low Power pre-Test Inspection

Rev Date: 11/04/2015
Author: M. Anerella
Approved: 12/03/2015

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Electrical Systems	P. Joshi	11/24/2015
Design Engineering	P. Kovach	12/03/2015
Cognizant Physicist	J. Muratore	11/18/2015

Serial No	Part No	Part	P/L	ECN	Rev	P/L	ECN	Rev	P/L

Work Order #: _____ **Deviation & Waiver:** _____

OP	Description	Name/Life #	Date	DR
5	Reference Documents: 25-2043020 Revision A			
10	This traveler covers only the work described herein. Moving, lifting, or reorienting the magnet is not a part of the work described here.			
20	The technicians shall be instructed by their cognizant technical supervisor in the operation of the required electrical test equipment and the electrical testing procedures.			
30	Hipot ("Hypot") and impulse testing pose an electrical hazard. At least two properly trained technicians must be present to perform this testing. When testing, a trained technician shall be stationed at any point where the item under test is accessible to unauthorized people, and barriers shall be set up. Signs shall be posted reading "DANGER HIGH VOLTAGE" and warning lights shall be turned on.	S. DiMaiuta 15371	2/12/16	
40	The technician is responsible for notifying the technical supervisor and/or the cognizant engineer of any discrepancies occurring during the performance of this procedure. All discrepancies shall be identified and reported in accordance with SMD-MAG-1003. Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with the SBMS Subject Area 'Calibration', where applicable.	S. DiMaiuta 15371	2/12/16	

SE01

OP	Description	Name/Life #	Date	DR
50	Technicians performing Pressure Testing shall be instructed in the procedures prescribed by the SBMS Subject Areas by the Cognizant Engineer or Technical Supervisor: * Compressed Gas Cylinders and Related Systems * Pressure Safety * Cryogenics Safety All relief devices and gauges used for pressure tests shall meet the requirements of the SBMS Subject Area. Examine all pressure test equipment before pressure is applied to ensure it is tightly connected. Suitable precautions shall be taken during pressure testing to eliminate hazards to personnel in the proximity of the test in the event of a rupture. The area shall be roped off.	K-Y/22397	2/12/16	
60	All work performed herein shall be done in a manner compliant with the document "Work Plan for S-Phenix Magnet". All work which has not been categorized as 'worker planned work' shall require an approved work permit.	K-Y/22397	2/12/16	

Done yesterday by the Cryo Group (Document 002-16) on Feb-11, 2016

OP	Description	Name/Life #	Date	DR
70	Open fittings 3 places each end on cryostat end flange and 4 places on cryostat o.d. each end loosen coil support tie rods per P. Kovach instructions. See below & op 72	115846	2/12/16	

BaBar SOLENOID SUPPORT ROD TIGHTENING FOR SHIPMENT TO ITALY

Wes Craddock/SLAC

RADIAL / VERTICAL SUPPORT RODS

END	POSITION	POINTING	TURNS	D_{before}	D_{after}	ΔD
BACK	Lower Left	Down	3	31.51	27.22	4.29
BACK	Upper Left	Down	4 1/3	35.5	29.98	5.52
BACK	Lower Right	Down	3	31.7	27.57	4.13
BACK	Upper Right	Down	3	33.07	29.13	3.94
FRONT	Lower Left	Down	3	32.47	28.7	3.77
FRONT	Upper Left	Down	3	34.18	30.02	4.16
FRONT	Lower Right	Down	3	30.95	26.77	4.18
FRONT	Upper Right	Down	3	34.62	30.69	3.93
average				33		

BACK END AXIAL SUPPORT RODS

POSITION	TURNS
3 o'clock	3 1/4
7 o'clock	3 3/4
11 o'clock	3 3/4

NOTES:

1) Back end is the solenoid chimney end or the ANSALDO designation LU
2) For radial arms, distance D is from the top nut to the aluminum pipe end
3) For the radial arms, the back upper left arm required 4 1/3 turns. It was apparently mistightened at the factory. It should be loosened three turns, just like all the others.
4) All the radial arms pointing up had weight on them. They were not touched.
5) Only the back end axial rods were tightened. They were tightened by turning the large spherical nut by hand. Tightening proceed by taking out the axial rod spring travel with the three point jack until resistance rapidly increased.
6) Tightening the back end axial rods also tightens the front end axial rods.

OP	Description	Name/Life #	Date	DR
72		R Cerutti 15846	2/12/16	

END	LVDT Port #	LVDT Port Angle (O'Clock)	Measured Distance (inch)	Original Distance Labeled on Shell (inch)
Back	2 (B East)	8	6.804	6.801
Back	B West	4	6.69	6.607
		AVG. VALUE	6.747	6.704
Front	4	7	3.381	*2.213 **
Front	A	12	3.344	3.424
Front	C	3	3.315	*2.157 **
		AVG. VALUE	3.347	3.424
		AVG. DIFFERENCE	3.400	3.280

There is a 3.35" difference between forward and backward ends

Measured distance is from vacuum face to cryostat face

Coil offset 3.2 cm in the forward direction

* is probably a cryostat to shield dimension ; We measured first measured values of ~2.5" which turned out to be depth to shield

The coil windings are displaced 2.5 cm within the winding bobbin.

Vacuum Shell Length = 3849.5 mm

Winding length = 3512 mm

Winding Mandrel to Vacuum Shell (outside) = **89 mm (3.5")** on the forward end and **171 mm (6.73")** on the backward end

Winding Mandrel displaced 171 -89 = 82 mm inside the vacuum shell towards the forward end

Coil is displaced 25 mm towards the backwards end within the winding mandrel

Thus coil is displaced 82 - 25 = 57 mm towards the forward end.

References say it should be ~ 32 mm

75 Confirm calibrations have been completed on linear potentiometer position sensors. Attach calibration information to the traveler. Install 2 position senors at each end of the magnet.	S. DiMaiuta 15371	2/12/16	

SE01

OP	Description	Name/Life #	Date	DR
80	Cognizant Engineer initial complete ____	PIYUSH JOSHI 18477	2/12/16	
140	Set power supply to 25 VDC maximum and apply 1 amp to coil. Measure and record voltage drops and record in Table 1	S. DIMAIUTA 15371	2/1/16	
150	Measure overall resistance, coil inductance and quality factor. Perform tests at three frequencies, 20Hz, 60Hz and 1KHz. Record data below:	S. DIMAIUTA 15371	2/12/16	
160	Prepare coil for hypot & impulse testing:	S. DIMAIUTA 15371	2/12/16	

Temp: 23°C

	120 Hz	100Hz	1kHz
R:	2.5Ω /	2.5Ω /	2.5
L:	41.61mH /	51.96mH /	21.88mH
Q:	1.6 /	1.6 /	1.8

1. Verify (3) blank-off flanges at LE & (3) blank-off flanges at NLE are installed ____
2. Connect mechanical vacuum pump to the feedthrough ____

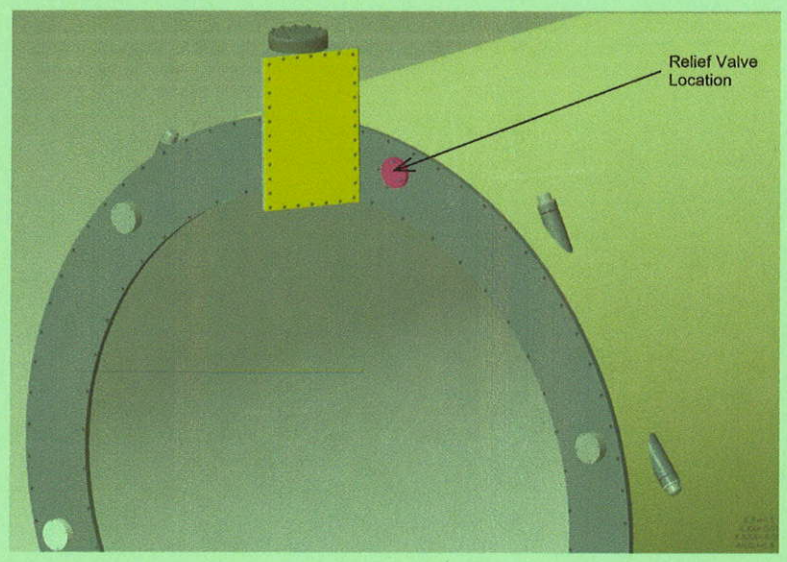
7. Start pump. Continue pumping down until an absolute pressure of <50 millitorr is reached in the vacuum space ____ 53 milliton

OP	Description	Name/Life #	Date	DR
170	Perform 520V hypot test of coil - leakage shall be <50uA : CAUTION: BE SURE THE "HYPOT" IS GROUNDED AND GROUND LEADS ARE ATTACHED DURING TESTING. FAILURE TO OBSERVE THIS CONDITION MAY RESULT IN ELECTROCUTION. CAUTION: VACUUM SPACE MUST BE UNDER VACUUM (<50 millitorr ABS) DURING THIS TEST. Perform hypot. Slowly increase voltage to 520V. Record leakage current (<50uA): 0.1 uA	S. DiMaiuta 15371	2/12/16	
180	Perform impulse test of coil at 400V. Record waveform data file. CAUTION: VACUUM SPACE MUST BE UNDER VACUUM (<50 millitorr ABS) DURING THIS TEST.	S. DiMaiuta 15371	2/12/16	
190	Cognizant Electrical Engineer to sign-off results "OK to proceed". Cognizant Electrical Engineer:	P. Joshi 18977	2/12/16	
195	Release vacuum			

OP	Description	Name/Life #	Date	DR
200	Pressure Leak Check: CAUTION: Move all personnel away from the magnet and the connections to the helium bottle. NOTE 1: The magnet has a common helium circuit for the coil cooling, heat shield, buffer volume and power leads and a single vacuum jacket. NOTE 2: Vacuum leak testing shall be performed using a helium mass spectrometer leak detector with a sensitivity> 1x10-9 std. cc. he./sec. NOTE 3: Pressure tests need to be witnessed by an ES&H Representative	K. Yip 22397	2/12/16	

Steps 200-310 done by the Cryo Group (Document # 002-16) on Feb. 11, 2016

205	Installation of Cryostat Relief Valve: 1) At lead end of cryostat, remove blank-off flange as shown in illustration below and discard hardware. 2) Install Cryostat Relief Valve IAW SMD Drawing 25-2043020			



210	Connect the helium circuit to a helium bottle with a flex hose capable of 81PSIG through a regulator and gauge.			

OP	Description	Name/Life #	Date	DR
220	Connect the vacuum pump line to the magnet vacuum space and start the mechanical pump. At 60 microns (60 x 10-3 Torr) start the turbo pump and valve it into the test loop. Close valve to the mechanical pump and turn off.			
230	Calibrate the leak detector.			
240	Allow to pump down to approximately 10 microns before leak check is started.			
270	Shut down the helium supply. Bleed the helium pressure from the circuit using a method compliant with Building 912 requirements.			
290	Pressurize the helium circuit with helium gas to 81PSIG as read at the helium bottle regulator. This equates to a 6.6 bar differential between the circuit under test and the vacuum space. This pressure is the equivalent of 1.1 times the operating pressure.			
300	Monitor the leak detector for a minimum of 10 minutes. The maximum acceptable leak rate at test pressure is 1x10-8 std. cc. he./sec.	K-Y. 22397 ~~2/12/16~~	2/12/16	

NOTE: The maximum helium leak rate for any part of the solenoid system not enclosed within the vacuum vessel, e.g. instrumentation feed-throughs, shall not exceed 1x10-6 std. cc. he./sec

Cryo Group Document # 002-16

Leak Rate Helium Circuit: 2.0 X 10^{-5} mbar l/s — no change before or after increasing pressure to 81 psig

Witness - ES&H Rep: M. Gaffney

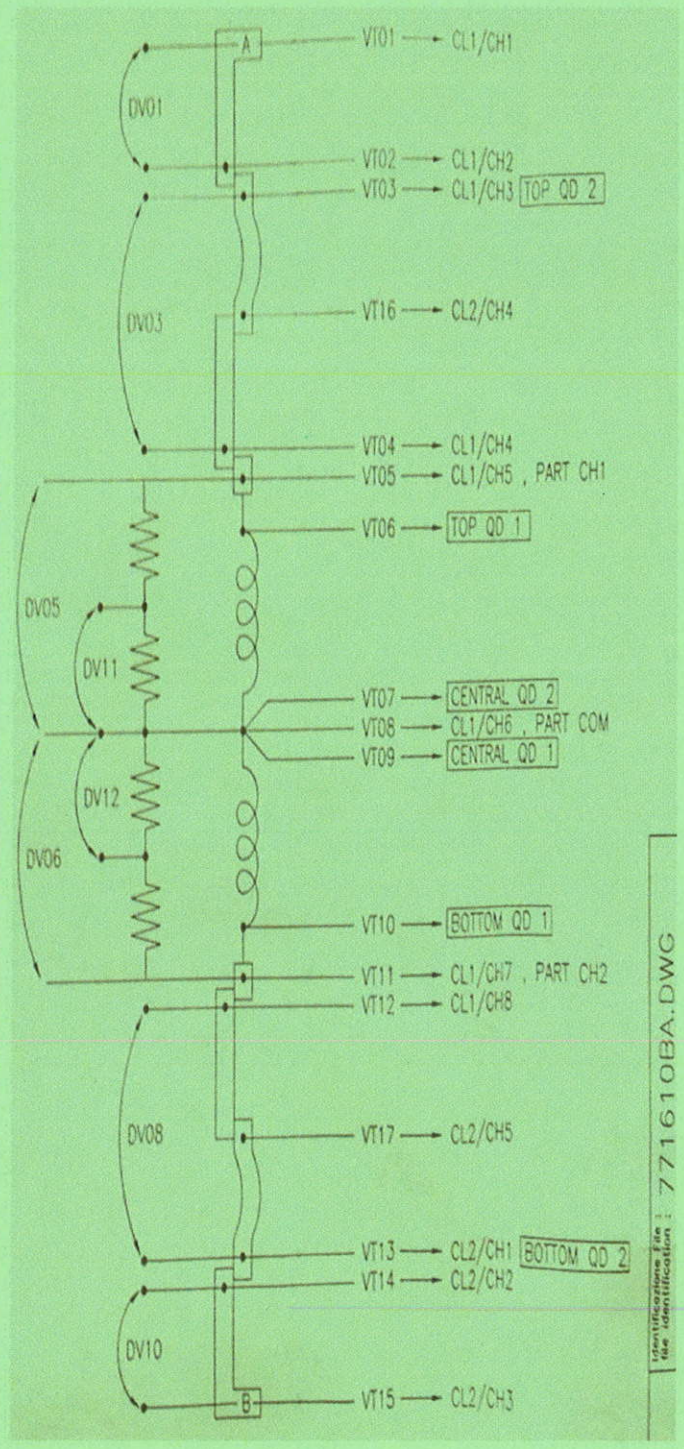
OP	Description	Name/Life #	Date	DR
310	Shut down the helium supply. Bleed the helium pressure from the helium circuit using a method compliant with Building 912 requirements.			

OP	Description	Name/Life #	Date	DR
310	Verify All Traveler Operations Complete	K. Y. 22397	2/12/16	
991	Revision History: Rev. A: Initial Release 11/9/15			

OP	Description	Name/Life #	Date	DR
1000		S. DIMAIUTA 15371	2/1/16	

Babar Voltage Drops @ 1amp
Table 1

Tap	Description	Value
VT01	~~000~~	.000mV
VT02		.050mV
VT03	Top QD 2	.050mV
VT16		.063mV
VT04		.109mV
VT05		.116mV
VT06	Top QD 1	1.246mV
VT07	Central QD 2	1.2612V
VT08		1.2616V
VT09	Central QD 1	1.2620V
VT10	Bottom QD 1	2.4777V
VT11		2.4788V
VT12		2.4789V
VT17		2.4790V
VT13	Bottom QD 2	2.4789V
VT14		2.4790V
VT15		2.4790V
DV	**Description**	**Value**
DV01		.050mV
DV03		.048mV
DV05		1.2597V
DV06		1.2155V
DV08		.050mV
DV10		.069mV
DV11		N/A
DV12		N/A



SE01

OP	Description	Name/Life #	Date	DR
1010		S. DIMAIUTA 15371	2/1/16	

Babar Magnet – Instrumentation Lead Inventory - Table 2

Lead ID As rec'd(V)	Description
VT01 ✓	
VT02 ✓	
VT03 ✓	
VT04 ✓	
VT05 ✓	
VT06 ✓	
VT07 ✓	
VT08 ✓	
VT09 ✓	
VT10 ✓	
VT11 ✓	
VT12 ✓	
VT13 ✓	
VT14 ✓	
VT15 ✓	
VT16 ✓	
VT17 ✓	
Add ID's ↓	
	Continued on next page

See Wiring Diagram for Description of V-Taps

OP	Description	Name/Life #	Date	DR
1020				

Lead ID As rec'd(√)	**Description**
Add ID's ↓	