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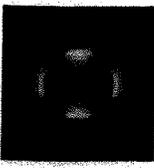
07/29/2015
07/14/2015
07/29/2015
07/29/2015
07/29/2015
07/20/2015

| Serial No | Part No | Part | P/L | ECN | Rev | P/L | ECN | Rev | P/L |
|---------------|---------|------|-----|-----|---------------------|-----|-----|-----|-----|
| SE01 | | | | | | | | | |
| Work Order #: | | | | | Deviation & Waiver: | | | | |

| OP | Description | Name/Life # | Date | DR |
|----|---|-------------------|-----------|----|
| 10 | This traveler covers only the work described herein. Moving, lifting, or reorienting the valve box is not a part of the work described here. | R Ceruti 15846 | 8/11/2015 | |
| 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. | RC | 8/11 | |
| 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. | RC | 8/11 | |
| 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. | RC | 8/11 | |

Measuring and test equipment used for this procedure shall contain a valid calibration label in accordance with the SBMS Subject Area 'Calibration', where applicable.

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: | R Ceruti 15846 | 8/11/15 | |

- * 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.

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.

| | | |
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| RC | 8/11 | |
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70 Ensure excess solder is recycled or disposed of properly.

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| RC | 8/11 | |
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80 Eye protection must be worn when removing flux, especially on hot surfaces. If surfaces are above 140F, thermally insulated gloves (such as welder's gloves) must be worn to protect from burns.

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| RC | 8/11 | |
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100 Perform hypot test of valve box leads - leakage shall be <50uA :

| | | |
|----|------|--|
| RC | 8/12 | |
|----|------|--|

CAUTION: BE SURE THE "HYPOT" IS GROUNDED AND GROUND LEADS ARE ATTACHED DURING TESTING. FAILURE TO OBSERVE THIS CONDITION MAY RESULT IN ELECTROCUTION.

Perform hypot. Slowly increase voltage to 520V (320V?).

Record leakage current (<50uA): 1.1uA

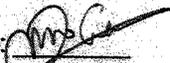
| OP | Description | Name/Life # | Date | DR |
|-----|--|-----------------------------|-------------|----|
| 110 | Prepare valve box for pressure & leak testing: 1. Install valve box covers with O-rings. <u>X</u> 2. Solder blank off fittings to magnet end of valve box helium lines <u>X</u> <i>Return lines were soldered in place to reduce pressure tests to only one pressurization.</i> | <i>R Ceruti K 15846</i> | <i>8-25</i> | |
| 120 | Pressure Leak Check: CAUTION: Move all personnel away from the valve box and the connections to the helium bottle. NOTE 1: The valve box has 2 separate helium circuits, and a single vacuum jacket. <i>two helium circuits were Hooked Together</i> 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 | <i>R Ceruti K 15846</i> | <i>8-31</i> | |
| 130 | Verify Valve Box Relief Valve: 1) Verify existing relief valve acting on the lead box vacuum space is in place and is operative. | <i>R Ceruti K 15846</i> | <i>8-31</i> | |
| 140 | Connect the 1st helium circuit to a helium bottle with a flex hose capable of 81PSIG through a regulator and gauge. | <i>R Ceruti K 15846</i> | <i>8-31</i> | |
| 150 | Connect the vacuum pump line to the valve box 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. | <i>R Ceruti K 15846</i> | <i>8-31</i> | |
| 160 | Calibrate the leak detector. | <i>RC</i> | <i>8-31</i> | |

| OP | Description | Name/Life # | Date | DR |
|--------|--|-------------------|----------|----|
| 170 | Allow to pump down to approximately 10 microns before leak check is started. | R Ceruti 15846 | 8-31 | |
| 180 | Pressurize the 1st 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. | R Ceruti 15846 | 10/20/15 | |
| 190 | Monitor the leak detector for a minimum of 10 minutes. The maximum acceptable leak rate at test pressure is 1×10^{-8} std. cc. he./sec. | RC | 10/20 | |
| 40 PSI | Leak detector 7.3×10^{-9} @ start of test " 2.7×10^{-6} after 10 minutes 2.9×10^{-7} 25 min. | | | |
| | Leak Rate 1st Helium Circuit: _____ → 20 PSI 2.2×10^{-7} 20 min. | | | |
| 200 | Shut down the helium supply. Bleed the helium pressure from the 1st helium circuit using a method compliant with Building 912 requirements. | RC | 10/20 | |
| 210 | Move the helium flex line with gauge and regulator to the 2nd helium circuit. | NA | | |
| 220 | Pressurize the 2nd 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. | NA | | |

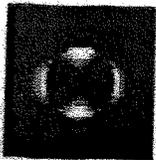
Leak detector 7.3×10^{-9} @ start of test
" 2.7×10^{-6} after 10 minutes

40 PSI 2.9×10^{-7} 25 min.

Leak Rate 1st Helium Circuit: _____
→ 20 PSI 2.2×10^{-7} 20 min.

Witness - ES&H Rep: 
25314

Both helium circuits are hooked together,
Only one Pressurization is required.



| OP | Description | Name/Life # | Date | DR |
|-----|--|------------------|-------|----|
| 230 | Monitor the leak detector for a minimum of 10 minutes. The maximum acceptable leak rate at test pressure is 1×10^{-8} std. cc. he./sec. | NA | | |
| | Leak Rate 2nd Helium Circuit: _____ | SEE NOTE | | |
| | Witness - ES&H Rep: _____ | | | |
| 240 | Shut down the helium supply. Bleed the helium pressure from the 2nd helium circuit using a method compliant with Building 912 requirements. | NA | | |
| 250 | With the vacuum space still under vacuum, perform leak check of vacuum space by spraying helium over outside of valve box. | NA | | |
| | Leak Rate: _____ | | | |
| 260 | Relieve vacuum and remove lines. | R Cerut 15846 | 10/21 | |
| 270 | Verify All Traveler Operations Complete | RC | 10/24 | |
| 991 | Revision History: Rev. A: Initial Release 6/25/15 | | | |

Weld Inspection

Perform weld inspection of 46010901 assembly IAW drawing 46010901

Certified (AWS) Weld Inspector: _____

Date: _____ *See Drawing*

Leak Check

Perform leak check of 46010901 assembly IAW drawing 46010901

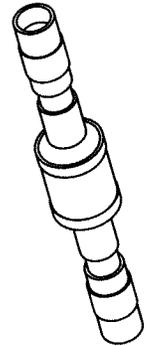
Technician: *Ray Ceruti*

Date: *9-15-2015*

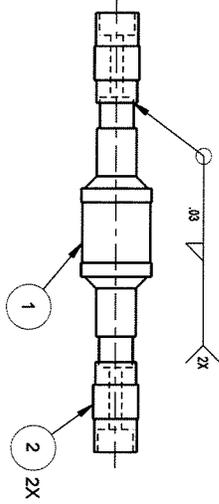
Leak Rate: *NONE*

NOTES:
 1. VACUUM /PRESSURE TEST: PRESSURE TEST TO 75 PSI (PNEUMATIC).
 LEAK CHECK USING HELIUM MASS SPECTROMETER. LEAK RATE SHALL NOT
 EXCEED 2X10⁻¹⁰ STD CC HE/SEC

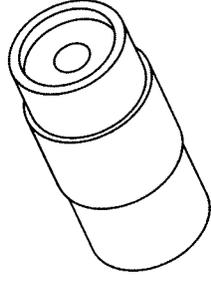
| ITEM NO. | QTY | DESCRIPTION | MATERIAL, DIM'G OR PART NO. | REV |
|----------|-----|------------------------------------|-----------------------------|-----|
| 1 | 1 | MPE PRODUCTS 3/8 TUBE VACUUM BREAK | A0572-2-W | |
| 2 | 2 | 3/8 TUBE TO 10 MM TUBE ADAPTOR | 304 SS | |



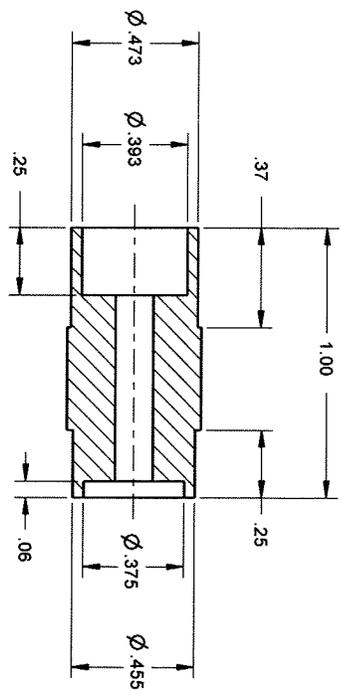
SCALE 1/1



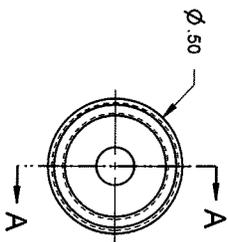
VACUUM BREAK REPAIR ASSEMBLY
 SCALE 1/1



SCALE 3/1



2 ADAPTOR DETAIL
 SECTION A-A
 SCALE 3/1



| REV | DESCRIPTION | PEK | DATE | BY | DATE | CHKD | DATE | APP |
|-----|-----------------|-----|------|----|------|------|------|-----|
| A | INITIAL RELEASE | | | | | | | |
| 4 | | | | | | | | |

| | | | | | |
|--|--|-------------------|-----------------------|----------------|-----------------------|
| INTERPRET IN GENERAL ACCORDANCE WITH ASME Y14.24 | UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES DECIMAL TOLERANCES ARE AS FOLLOWS: .005 .010 .015 .020 .030 .040 .050 .060 .070 .080 .090 .100 .125 .150 .175 .200 .250 .300 .375 .450 .500 .625 .750 .875 1.000 1.250 1.500 1.750 2.000 ANGULAR TOLERANCES ARE IN DEGREES | BREAK SHARP EDGES | FINISH | MAX. | MIN. |
| DESIGNED BY: P KOVACH | ENGINEER APPROVAL: [Signature] | DATE: 10/10/73 | APPROVAL: [Signature] | DATE: 10/10/73 | APPROVAL: [Signature] |

| | |
|--|------------------------------------|
| SPERCONDUCTING MANAGER DIVISION | TITLE: SPHENIX VACUUM BREAK REPAIR |
| BROOKHAVEN NATIONAL LABORATORY UPTON, N.Y. 11973 | DRAWING NUMBER: 46010901 |
| MATERIAL: SEE BM | SCALE: NOTED |
| WEIGHT: | SHEET 1 OF 1 |

4

3

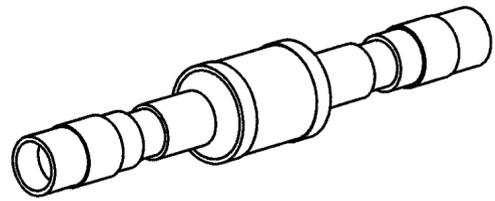
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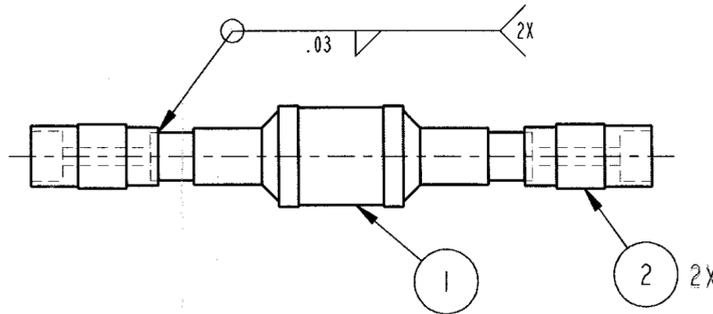
NOTES:

1. VACUUM /PRESSURE TEST: PRESSURE TEST TO 75 PSI (PNEUMATIC).
LEAK CHECK USING HELIUM MASS SPECTROMETER. LEAK RATE SHALL NOT
EXCEED 2×10^{-10} STD CC HE/SEC

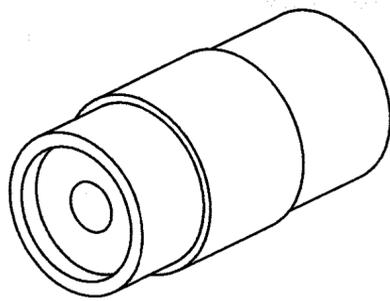
| ITEM NO. | QTY | DESCRIPTION | MATERIAL, DWG. NO. OR PART NO. | REV |
|----------|-----|------------------------------------|--------------------------------|-----|
| 1 | 1 | MPF PRODUCTS 3/8 TUBE VACUUM BREAK | A0572-2-W | |
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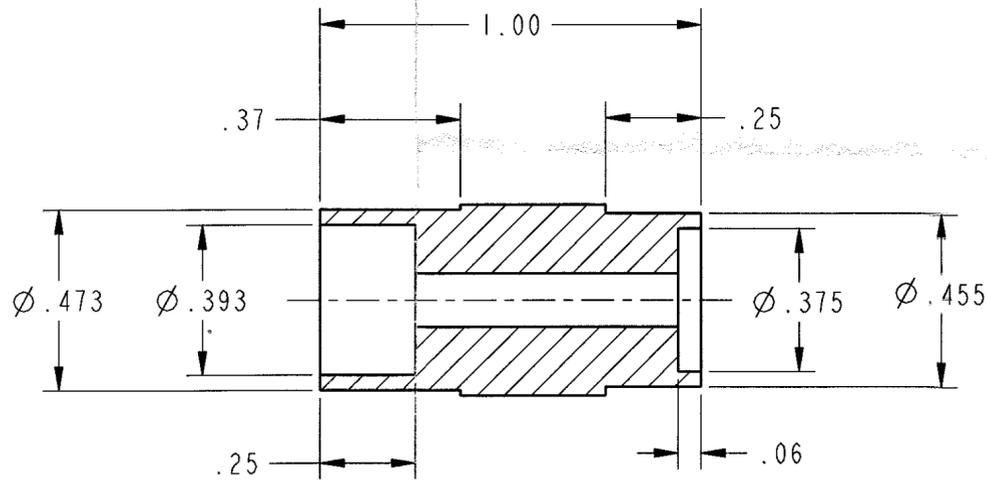
SCALE 1/1



VACUUM BREAK REPAIR ASSEMBLY
SCALE 1/1

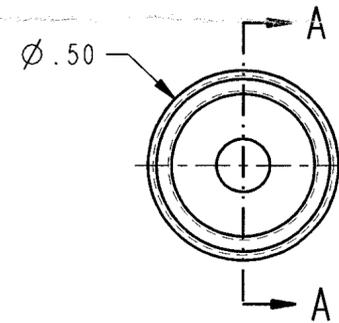


SCALE 3/1



2 ADAPTOR DETAIL

SECTION A-A
SCALE 3/1



Welded & tested 9/21/15
Q. Far

| REV | DESCRIPTION | BY | DATE | CKR | APP |
|-----|-----------------|-----|-----------|-----|-----|
| A | INITIAL RELEASE | PEK | 9/21/2015 | - | - |

| | | | | | |
|--|--------------------------------|---|-------------------|--|-----------------------------|
| INTERPRET IN GENERAL ACCORDANCE WITH ASME Y14.24 UNLESS OTHERWISE SPECIFIED | | SUPERCONDUCTING M MAGNET D DIVISION | | BROOKHAVEN NATIONAL LABORATORY BROOKHAVEN SCIENCE ASSOCIATES UPTON, N.Y. 11973 | |
| DIMENSIONS ARE IN INCHES DECIMAL TOLERANCES .X ± .06 .XX ± .02 .XXX ± .005 ANGULAR TOLERANCE ± 1° | | DRAWN BY P KOVACH | 9/21/2015 | TITLE: SPHENIX VACUUM BREAK REPAIR | |
| ✓ FINISH | BREAK SHARP EDGES MAX. MIN. | CHECKED BY | ENGINEER APPROVAL | SIZE C | DRAWING NUMBER: 46010901 |
| | | SUPERVISOR APPROVAL | SAFETY APPROVAL | REV. A | |
| | | | | MATERIAL: SEE B/M SCALE: NOTED WEIGHT: SHEET 1 OF 1 | |

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