Revision B: Added drawing revisions, 12/2/04 Checked:

Photon Shutter / Personnel Safety Shutter Assembly (PS/PSS) Beamline 6.0 Front End

1.0 General Description

1.1 This specification describes the fabrication of an ultra-high vacuum Photon Shutter / Personnel Safety Shutter assembly for synchrotron radiation.

1.2 A complete drawing set will be provided and parts shall be fabricated as shown on the drawings. Fabrication details may be modified in circumstances where documented vendor experience suggests improvements, with LBNL/ALS approval, on a case-by-case basis.

1.3 In addition to fabrication, this specification calls for assembly, vacuum qualification and testing of the PSS mechanism.

1.4 A complete set of drawings and a parts list is provided with this specification. One master assembly drawing 26B625C, “PS/PSS Assembly” refers to sub-assemblies that refer to all detailed drawings.

1.5 Certain components will be provided by LBNL to ensure compatibility with other systems at the ALS. These components are listed in section 7.0.

1.6 The vendor shall assemble one complete PS/PSS assembly and perform certain tests to verify that all parts are fabricated correctly and that ultra-high-vacuum can be achieved. These tests are described in section 8.0.

2.0 Design Features

2.1 The PS/PSS assembly is comprised of one vacuum chamber housing one horizontal aperture assembly, one vertical aperture assembly, one beam splitter assembly and two personnel safety shutter assemblies.

2.2 Air cylinder and limit-switch assemblies are outside the vacuum envelope.

2.3 The stand is a weldment of rectangular structural steel tubes. The stand supports the vacuum chamber with a 6-strut alignment system. See drawing 26B625C.

3.0 Components to be Provided

3.1 Vendor shall provide PS/PSS assembly as described on drawing 26B625C,

Quantity = **see purchase order**

3.2 One PS/PSS assembly is the main assembly constituting several sub-assemblies as listed below: **Note: Only fabricated parts are listed below. Other purchased hardware required to complete the assembly are listed on assembly drawings.**

3.2.1 Additional fabricated parts added to main assembly 26B625C:

26B619A, Flow Meter Mounting Panel

26B628A, Pump Tie Down Bar

26B886A, Pump Spool (Supplied by LBNL)

25D8986U, 3/4" Basic Turnbuckle Strut (Supplied by LBNL)

3.2.2 26B541A, PS/PSS Aperture Masks Chamber Alignment Assembly

3.2.3 26B558A, Chamber Bremsstrahlung Absorber Assembly

This sub-assembly includes the following fabricated parts:

26B293A, Long Spacer

26B392A, Absorber Support Plate 1 – RH

26B593A, Short Spacer

26B594A, Outer Absorber 1 – RH

26B595A, Outer Absorber Plate – LH

26B596A, Absorber Support Plate 2 – LH

3.2.4 26B603A, PSS Actuators Vacuum Chamber Alignment Assembly

3.2.5 26B192B, Vacuum Chamber Weldment

This sub-assembly includes the following fabricated parts:

26B185A, Vertical Strut Boss

26B186A, Horizontal Strut Boss

26B187A, Boss Hoist Ring

26B188A, Strut Angle Boss

26B190A, Fastener Plate

26B200A, Limit Switch Spacer

20Q5363A, Survey Fiducial Post (Supplied by LBNL)

3.2.6 26B565A, PSS Photon Shutter Actuator Assembly – RH

This sub-assembly includes the following fabricated parts:

26B557A, Absorber 1 Assembly - RH

26B560A, Absorber 1 Brazement Assembly – RH

*26B561A, Tungsten Absorber 1

26B580B, Absorber 1 Sub-assembly - RH

26B581A, PSS Paddle - RH

26B582A, RH Absorber Tube

*26B583A, Absorber Water Block

*26B588A, Drive Assembly Spool

*26B589A, Drive Plate

*26B590A, Water Tube

*26B597A, Solenoid Support Side

*26B598A, Solenoid Support Top

*26B609A, 2.73 in Conflat Flange Assembly

*23G5614E, Actuator Gantry – Actuator System

*23G8961A, Limit Switch Standoff – Actuator System

*23G9584E, Linear Actuator – Photon Shutter (Modified Purchased Component)

*23K0332, Limit Switch Cam – Photon Shutter

*23K2782A, Clamp, LCW Tube – Photon Shutter

*23K4112A, Air Solenoid Spacer – Photon Shutter

Note: Drawings shown with * are reproduced in left hand assembly as outlined in paragraph 3.2.7.

3.2.7 26B566A, PSS Photon Shutter Actuator Assembly – LH

This sub-assembly includes the following fabricated parts:

*26B561A, Tungsten Absorber 1

26B579A, Absorber 2 Assembly – LH

*26B583A, Absorber Water Block

26B584A, LH Absorber Tube

26B585A, Absorber 2 Sub-assembly – LH

26B586A, PSS Paddle – LH

*26B588A, Drive Assembly Spool

*26B589A, Drive Plate

*26B590A, Water Tube

*26B597A, Solenoid Support Side

*26B598A, Solenoid Support Top

*26B609A, 2.73 in Conflat Flange Assembly

*26B614B, Absorber 2 Brazement Assembly - LH

26B853A, LH Absorber Tube 2

*23G5614E, Actuator Gantry – Actuator System

*23G8961A, Limit Switch Standoff – Actuator System

*23G9584E, Linear Actuator – Photon Shutter (Modified Purchased Component)

*23K0332, Limit Switch Cam – Photon Shutter

*23K2782A, Clamp, LCW Tube – Photon Shutter

*23K4112A, Air Solenoid Spacer – Photon Shutter

Note: Drawings shown with * are reproduced in right hand assembly as outlined in paragraph 3.2.6.

3.2.8 26B502A, Horizontal Aperture Mask Weldment Assembly

This sub-assembly includes the following fabricated parts:

26B504A, RH Horizontal Mask Cooling Block

26B505A, RH Horizontal Mask Cooling Braze Plate

26B506A, RH Horizontal Mask Brazing Assembly

26B507A, LH Horizontal Mask Cooling Block

26B508A, LH Horizontal Mask Cooling Braze Plate

26B509A, LH Horizontal Mask Brazing Assembly

26B510A, Horizontal Mask Mounting Flange

3.2.9 26B512A, Vertical Aperture Mask Assembly

This sub-assembly includes the following fabricated parts:

26B513A, Upper Vertical Cooling Mask Block

26B517A, Upper Vertical Mask Cooling Braze Plate

26B518A, Upper Vertical Mask Brazing Assembly

26B519A, Lower Vertical Cooling Mask Block

26B520A, Lower Vertical Mask Cooling Braze Plate

26B521A, Lower Vertical Mask Brazing Assembly

26B522A, Vertical Mask Mount Flange

3.2.10 26B523A, 10 Degree Splitter Mask Assembly

This sub-assembly includes the following fabricated parts:

26B524A, Splitter Mask Cooling Block

26B525A, Splitter Mask Cooling Supply Block

26B526A, Splitter Mask Cooling Braze Plate

26B527A, Splitter Mask Cooling Braze Assembly

26B528A, Splitter Mask Mounting Flange

3.2.11 26B559A, PS/PSS Stand Assembly

This sub-assembly includes the following fabricated parts:

26B562A, Horizontal Strut Boss - 1

26B563A, PS/PSS Stand Weldment Assembly

26B564A, PS/PSS Stand Base Plate

26B568A, Ion Pump Base Plate

26B569A, Ion Pump Support Tube

26B570A, Column 1 Cap

26B571A, Column 2 Cap

26B572A, Strut Boss Vertical Sub-assembly

26B573A, Strut Boss Vertical

26B574A, Vertical Strut Angle

26B575A, Column 1 Sub-assembly

26B576A, Flow Meter Mounting Angle

26B577A, Gusset at Base Plate

26B578A, Column 2 Sub-assembly

3.2.12 26B608A, PSS Lower Limit Switch Assembly

This sub-assembly includes the following fabricated parts:

23L7981A, Lower Limit Switch Actuator

23L7993B, Lower Limit Switch Guide

23L8002A, Lower Limit Mount Bar

23Q6682D, PSS Sensor Bellows (Modified Purchased Component, Supplied by LBNL)

3.2.13 23G8593, Limit Switch Assembly – Actuator System

This sub-assembly includes the following fabricated parts:

23G8323A, Limit Switch Bracket – Actuator System

23G8561A, Limit Switch Nut Plate – Photon Shutter

3.2.14 23G5603B, Bellows Assembly – Photon Shutter

This sub-assembly includes the following fabricated parts:

24B5323A, Weld Ring, Lower Bellows – Photon Shutter

23G5573C, Flange, Bellows Lower – Photon Shutter

23G5582B, Flange, Bellows Upper – Photon Shutter

23G5592C, Bellows – Photon Shutter (Purchased Component)

4.0 Vacuum Seals and Bellows

4.1 The main vacuum chamber is a welded stainless steel assembly, type 304 or equivalent, using standard stainless steel conflat flanges with metal seals for all ports.

4.2 Bellows suppliers and part numbers are specified in the drawings and parts lists. Substitutions are permissible provided the critical dimensions and design intent are maintained.

5.0 Fasteners

5.1 All fasteners shall be made of stainless steel unless specified differently on the drawings. All fasteners that are to be utilized in the UHV environment shall be silver or gold plated. No lubricants of any type may be used without LBNL/ALS approval.

5.2 Fasteners shall be vented as necessary to avoid trapped volumes in ultra high vacuum.

6.0 Materials

6.1 Materials are called out on the detailed fabrication drawings.

6.2 Surface treatments are called out on the detailed fabrication drawings.

6.3 For UHV parts, no operation that results in contaminants becoming embedded in the material may be used. Grinding under power with resin-bonded wheels, using rouge, emery cloth, crocus cloth, or similar abrasives are prohibited. No lubricant or wax may be used which might result in contamination that cannot be removed by acceptable cleaning procedures.

6.4 For UHV parts, no contaminating materials, especially organics and high vapor-pressure inorganics, may be left on any location of the finished parts.

7.0 Components to be Provided by LBNL/ALS

7.1 The following components shall be provided to the vendor by LBNL/ALS for assembly prior to testing if required.

7.1.1 One Ion Pump with controller.

7.1.2 One UHV nude ion gauge with controller.

7.1.3 One TSP Assembly as shown on drawing 26B625C.

7.1.4 One Bellows assembly connecting spool piece to vacuum chamber.

7.1.5 One spool piece connecting bellows to ion pump. (LBNL dwg. 26B886A)

7.1.6 One PSS Sensor Bellows (LBNL dwg. 23Q6682D).

7.1.7 Four survey fiducial posts (20Q5363) as shown on drawing 26B192B.

7.1.8 Six 0.75 in Basic Turnbuckle Struts (25D8986U) as shown on drawing 26B625C.

8.0 Assembly, Testing and Preparation for Ultra-High-Vacuum Service

8.1 The vendor shall provide the facilities and instrumentation, unless otherwise specified, to perform all specified tests to ensure compliance with this specification.

8.2 The vendor shall allow a representative from LBNL/ALS to witness, at LBNL/ALS discretion, each stage of this assembly and test and preparation sequence. The vendor shall provide LBNL/ALS technical representative with at least 14 days notice of the commencement of assembly and testing.

8.3 Fiducialization measurements must be made after final assembly locating the vertical and horizontal masks and the splitter with respect to the center of the end flanges of the vacuum chamber and/or the fiducial posts located on the top of the chamber. This measurement procedure must be approved by a representative from LBNL.

8.4 Cleaning for UHV service shall follow LBNL specification M20013 that is appended to this specification. This cleaning specification supercedes cleaning specifications referred to on all drawings.

8.5 The vendor shall clean the interior of the vacuum vessel and the vessel lid by scrubbing and washing with solvent suitable for UHV cleaning. All internal tapped holes shall be cleaned. See LBNL specification M20013.

8.6 The vendor shall clean all other vacuum components, including all bellows, by scrubbing and washing with solvent suitable for UHV cleaning. See LBNL specification M20013.

8.7 The vendor shall prebake all internal vacuum components manufactured from stainless steel, glidcop or oxygen free copper including all bellows, under vacuum, to 200°C+/-20°C to evaporate residual hydrocarbons. These parts shall be kept wrapped at all times thereafter in lint-free paper and aluminum foil and shall be handled only with clean gloves in a clean assembly area.

8.8 The vendor shall assemble all parts of the PS/PSS assembly. Parts shall be assembled with clean gloves in a clean assembly area.

8.9 The vendor shall verify by inspection, that all internal blind holes are vented to ultra-high-vacuum and that no virtual leaks exist.

8.10 The vendor shall perform helium leak checks as follows. Both linear PSS mechanisms are to be moved from end to end of the available range of motion through twenty cycles during this test to verify leak tight operation. Acceptance criteria shall be less than 1 x 10^{-9} std atm cc/sec.

8.11 The vendor shall flow water through all cooling circuits with inlet pressure 60 psi and verify leak-tight operation by maintaining vacuum in the guard volume during this test. Both linear mechanisms are to be moved from end to end of the available range of motion through twenty cycles during this test to verify leak tight operation.

8.12 The vendor shall bake the assembled PS/PSS system under vacuum to eliminate water vapor from the UHV volume. After cool-down the system shall achieve a base pressure lower than $5*10^{-10}$ Torr when pumped by the ion pump alone. Both linear mechanisms are to be moved from end to end of the available range of motion through twenty cycles during this test to verify leak tight operation.

8.13 The vendor shall perform an RGA scan of the PS/PSS system under vacuum. Partial pressure of species higher than mass 40 amu must be less than $1*10^{-12}$ Torr. Results of the RGA scan are to be communicated to the LBNL/ALS technical representative for approval prior to shipment.

9.0 Shipping

9.1 Vendor shall communicate test results verifying that acceptance criteria have been met and photographic evidence that all specified procedures have been followed prior to shipment.

9.2 Vendor shall supply all shipping containers and packaging. Vendor shall assume responsibility for packing and for safe shipment to LBNL in Berkeley, California.

9.3 The PS/PSS assembly is to be shipped pre-assembled, except for such disassembly as is necessary to provide secure shipment and to prevent damage or degradation of performance.

9.4 The main vacuum vessel shall be shipped filled with 1atmosphere of dry nitrogen.

9.5 The water lines shall be drained, dried and sealed.

9.6 All ports shall be sealed with blank flanges or view ports as indicated in the drawings.

9.7 The packaging shall be sufficient to survive a 1.2m drop, in any orientation, and prevent damage or degradation of performance.

9.8 The assemblies shall be shipped on pallets and all assemblies shall have suitable lifting points for removal from their packaging.

11.0 Additional Information

For additional information or technical questions regarding this specification, please contact:

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