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Argonne National Laboratory

9700 Cass Avenue

Argonne, Illinois 60439

DOCUMENT NO. 41050203-00002

TECHNICAL SPECIFICATION

FOR APS MONOCHROMATIC BEAM

EXPERIMENTAL STATIONS IN SECTORS 1, 2 AND 3

WBS 1.4.1.5.2.3.6
WBS 1.4.1.5.4.2.7
WBS 1.4.1.5.3.2.15
WBS 1.4.1.5.3.2.10
WBS 1.4.1.5.5.3.4
WBS 1.4.1.5.5.4.6

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1.0 SCOPE

This Technical Specification establishes the requirements for the fabrication, inspection, delivery, erection, and testing of the APS Monochromatic Beam Experimental Stations: 1-BM-C per drawing P41050903-310000, 2-BM-B per drawing P41050903-520000, 2-ID-D per drawing P41050903-440000, 2-ID-E per drawing P41050903-450000, 3-ID-C per drawing P41050903-610000, and 3-ID-D per drawing P41050903-640000. These items are lead lined enclosures for experiment instrumentation hardware, and are located on the APS experimental floor. The quantities required are listed in Section 2.1 of the Statement of Work 41050203-00001.

1.1 Construction: The APS Monochromatic Beam Experimental Stations shall be free standing, self-supported structures fixed to the floor. These enclosures shall be modular in construction and the module is a panel l meter wide and 3.3 meters high for side panels, except for MBES 3-ID-C which is 5.5 meters high, and MBES 3-ID-D which is 4.0 meters high. Overall dimensions are shown on drawings. These panels shall be manufactured as a steel, lead, steel sandwich with a steel frame welded to the inside wall. The assembled panels must create a structural system capable of supporting the enclosure and attached equipment.

1.2 Access Doors: The enclosures shall have pneumatically actuated personnel access doors and manually actuated equipment access panels. The personnel access doors and the equipment access panels shall be physically identical; but the interlocking and the functions are different. The equipment access panels shall be latched to the floor, and limit switches shall be used to detect the "panel closed" position. The pneumatic personnel access doors shall be locked with a Kirk-key actuated magnetic lock and limit switches shall be used to detect the "door closed" position.

1.2.1 The location of the pneumatic personnel access doors and equipment access panels are defined on the MBES drawings . The typical APS Monochromatic Beam Experimental Station (MBES) shall require two door panels, one pneumatically operated for personnel access, with manual override, and one manually operated, fixed with a latch, for equipment access. The exception, MBES 1-BM-C, shall have a one panel doorway with a pneumatically operated door for personnel access and a two panel doorway with manually operated door panels equipped with a latch for equipment access.

1.3 Utility Access: The cable and utility access for the APS Monochromatic Beam Experimental Stations shall be through labyrinth side and ceiling panels, and the beam transport pipe access shall be through a sliding "entry" panel. Two ceiling panels shall be provided with a cut out for a labyrinth but closed with a blank cover as shown on the applicable assembly drawing.

1.4 Shielding Integrity. The APS Monochromatic Beam Experimental Stations shall be X-radiation tight. All panel joints and corners, access penetrations, doors and removable panels shall be suitably overlapped and fitted to prevent any X-radiation leakage. The enclosure shall be considered radiation tight in a given area if the radiation shielding integrity for ionizing X-radiation is shown and demonstrated to be equivalent to the thickness of lead specified on the drawings listed in Section 2.2 of this specification for the area in question.

1.5 Cranes: The APS Monochromatic Beam Experimental Stations shall be equipped with 500 Kg (1/2 Ton) bridged cranes with manual hoists for equipment handling as shown on the applicable drawings, except for MBES 3-ID-C which requires a 1000 Kg (1 Ton) bridged crane.

2.0 APPLICABLE DOCUMENTS AND /OR SPECIFICATIONS

2.1 Application.

2.1.1 Deviations. The documents listed in paragraphs 2.2 through 2.7 of the exact issue shown form a part of this standard to the extent specified herein. Any deviations from these documents or their requirements shall be requested by the contractor and approved by the Laboratory prior to any contractor action being taken. Requests for Deviations shall be made on a Supplier Disposition Request (ANL-311).

2.1.2 Conflicts. Any conflicts between the requirements of this Technical Specification and those of any applicable document shall be brought to the attention of the Laboratory' s Subcontract Administrator prior to any related action on the part of the contractor.

2.1.3 Exceptions. Where the materials or standards to be employed in the manufacture of any part are not identified in this Technical Specification or the documents referenced herein, the contractor shall submit for the Laboratory's approval the materials or standards he proposes to use.

2.1.4 Referenced Documents. Documents which are referenced without citation of section or paragraph shall apply in their entirety. Where there is a citation of section or paragraph, only that cited portion is applicable.

2.1.5 Sub-Tier References. When a referenced document cites additional references, those sub-tier references shall not apply unless the Technical Specification or the Statement of Work specifically mentions them as required documents.

2.2 Drawings.

The following drawings, and their associated sub-tier drawings, specify the APS Monochromatic Beam Experimental Stations which are to be fabricated by the contractor. These drawings, and their associated sub-tier drawings, are attached to this Technical Specification.

Drawing Number	Description
41050903-310000	1-BM-C Monochromatic Beam Experimental Station Ass'y
41050903-520000	2-BM-B Monochromatic Beam Experimental Station Ass'y
41050903-440000	2-ID-D Monochromatic Beam Experimental Station Ass'y
41050903-450000	2-ID-E Monochromatic Beam Experimental Station Ass'y
41050903-610000	3-ID-C Monochromatic Beam Experimental Station Ass'y
41050903-640000	3-ID-D Monochromatic Beam Experimental Station Ass'y

2.3 Welding.

2.3.1 Weld Symbols. Weld symbol interpretation shall be in accordance with the Standard Symbols for Welding, Brazing and Nondestructive Examination, ANSI/AWS A2.4-86.

2.3.2 Weld Practice. Welding practice shall conform to the Structural Welding Code, ANSI/AWS D1.1-90.

2.4 Materials.

2.4.1 Lead. Lead sheet materials shall conform to Federal Specification QQ-L-201f, Lead Sheet.

2.4.2 Paint. Paint shall comply with APS document number 4105-00024, Technical Specification for Painting Beamline Structures, and its associated sub-tier documents.

2.5 Design

The design of the APS Monochromatic Beam Experimental Stations shall be in compliance with the applicable sections of the following documents and their sub-tier documents.

2.5.1 DOE Order 6430.1A, General Design Criteria.

2.5.2 International Conference of Building Officials, Uniform Building Code.

2.5.3 National Fire Protection Association, National Electric Code.

2.6 Cranes and Hoists:

Cranes and hoist shall be in compliance with the following applicable specifications and standards.

2.6.1 Crane Manufacturers Association of America Specification No. 70 (CMAA).

2.6.2 "Cranes," American National Standards Institute, B30 Series, current editions, including the following:

2.6.2.1 Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist), ANSI/ASME B30.2-1990, 2a-1991, 2b- 1992.

2.6.2.2 Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Underhung Hoist), ANSI/ASME B30.17-1992.

2.6.2.3 Overhead Hoists (Underhung), ANSI/ASME B30.16-1993.

2.6.2.4 Hooks, ANSI/ASME B30.10-1993.

2.6.2.5 Monorail Systems and Underhung Cranes, ANSI/ASME B30.11-1988, 11a-1989, 11b-1990, 11c-1992.

2.7 References.

The following documents provide useful information for implementing and/or a basis for the requirements of this Specification

2.6.1 DOE Order 5480.11, Radiation Protection for Occupational Workers.

2.6.2 DOE Order 5480.25, Safety of Accelerator Facilities.

2.6.3 DOE Order 5480.6, Radiological Control Manual, EH-0256T, June 1992.

2.6.4 Argonne National Laboratory, Environment, Safety and Health Manual, May 1, 1993.

2.6.5 NBS Handbook 111, Radiation Safety for X-Ray Diffraction and Fluorescence Analysis Equipment, ANSI N43.2-1977.

2.6.6 NBS Handbook 114, General Safety- Standards for Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV, ANSI N543-1974.

3.0 TECHNICAL REQUIREMENTS

3.1 Design Requirements.

The designs of the APS Monochromatic Beam Experimental Stations are defined in the drawings, and their associated sub-tier drawings, which are listed in Section 2.2 of this Technical Specification. Complete definition is given only for the MBES 1-ID-C Ass'y which is to be used as a reference for the construction details of the Experimental Stations being constructed to this Technical Specification. Since the Experimental Stations are fabricated from standardized panels, the construction details are applicable to the other enclosures. The size of the panels, the lead thicknesses, the number and placement of the door panels and like items must be adjusted to conform to the specific requirements of each enclosure, as defined on the applicable assembly drawing as listed in Section 2.2.

3.1.1 Mechanical.

3.1.1.1 Enclosure Dimensions. The outside dimensions for each enclosure are defined on the applicable assembly drawing as listed in Section 2.2.

3.1.1.2 Shielding Requirements. The shielding requirements are given on each assembly drawing as listed in Section 2.2. "Back wall" .if separately specified, refers to the wall through which the X-ray beam exits the enclosure. "Side walls" are all other walls. "Entry Panels" are the specific panels through which the X-ray beam pipe passes.

3.1.1.3 Construction Guidelines. The enclosures must meet DOE and Argonne radiation shielding requirements as set forth in DOE Radiological Control Manual and the Argonne Environment, Safety and Health Manual. Guidelines for appropriate construction practices are given in ANSI N43.2, ANSI N543, DOE Order 5480.11 and DOE Order 5480.25.

3.1.1.4 Structural System. Structures and their elements shall be designed following DOE 6430.lA, Section 0111-2, Loads.

3.1.1.4.1 Dead loads shall include roof dead loads of 100 psf, and the use of the interior unistrut for shelves supporting 200 lbs per linear foot of wall.

3.1.1.4.2 Live loads shall include live loads of 40 psf. and the scenario of the pneumatic doors flying open.

3.1.1.4.3 Design loads shall include loads that can occur during construction and installation of the enclosure.

3.1.1.5 Piping. The piping for each enclosure shall be four lines of 1/2 inch stainless steel tubing for water (two for DI water and two for chilled water) and one line of 1/2 inch copper tubing for compressed air. These tubes shall penetrate the enclosure through a labyrinth panel and extend at least 1 meter on the outside of hutch for utility hookup, and terminate on a suitable manifold plate. The air and water lines shall terminate with wall mounted shut-off valves on the enclosure interior at the locations shown on the drawings. The shut off valves shall all be stainless steel ball valves with EPR seals and seats.

3.1.1.6 Personnel Access Door. The personnel access doors shall be pneumatically actuated. Push buttons to open and close each door shall be located on the out side of the enclosure. Door release buttons shall be located on the inside of the enclosures to vent the cylinders and permit egress from the enclosures. The leading edge of each door shall be equipped with a safety bar which, when contacting an obstacle while closing, will cause the door to open.

3.1.1.7 Cranes and Hoists: The enclosures' cranes and hoists shall comply with the appropriate specifications as listed in Section 2.6 of this Specification.

3.1.1.7.1 The 1-BM-C Monochromatic Beam Experimental Station crane shall have a span of 2,500 mm (8.2 ft) across the enclosure, a runway length of 6,000 mm (19.5 ft) and a clear height of 3,000 mm (10 ft). The hoist shall have a minimum vertical clearance of 2,450 mm (8 ft) to the hook.

3.1.1.7.2 The 2-BM-B Monochromatic Beam Experimental Station crane shall have a span of 2,500 mm (8.2 ft) across the enclosure, a runway length of 7,000 mm (23.0 ft) and a clear height of 3,000 mm (10 ft). The hoist shall have a minimum vertical clearance of 2,450 mm (8 ft) to the hook.

3.1.1.7.3 The 2-ID-C Monochromatic Beam Experimental Station crane shall have a span of 3,000 mm (9.8 ft) across the enclosure, a runway length of 7,000 mm (23.0 ft) and a clear height of 3,000 mm (10 ft). The hoist shall have a minimum vertical clearance of 2,450 mm (8 ft) to the hook.

3.1.1.7.4 The 2-ID-E Monochromatic Beam Experimental Station crane shall have a span of 2,500 mm (8.2 ft) across the enclosure, a runway length of 6,000 mm (19.5 ft) and a clear height of 3,000 mm (10 ft). The hoist shall have a minimum vertical clearance of 2,450 mm (8 ft) to the hook.

3.1.1.7.5 The 3-ID-C Monochromatic Beam Experimental Station crane shall have a span of 3,500 mm (11.5 ft) across the enclosure, a runway length of 7,500 mm (24.6 ft) and a clear height of 5,500 mm (18 ft). The hoist shall have a minimum vertical clearance of 4,877 mm (16 ft) to the hook.

3.1.1.7.6 The 3-ID-D Monochromatic Beam Experimental Station crane shall have a span of 4,000 mm (13.12 ft) across the enclosure, a runway length of 8,000 mm (26.25 ft) and a clear height of 3,600 mm (12 ft). The hoist shall have a minimum vertical clearance of 3,000 mm (10 ft) to the hook.

3.1.2 Electrical

Each enclosure shall be wired for 120/208 VAC. Each enclosure shall supply "clean power" (low noise) and "dirty power" (regular). The main disconnect switches shall be located on the outside of each enclosure and the power distribution panels on the inside of each enclosure at the locations shown on the applicable drawing as listed in Section 2.2 of this specification.

3.1.2.1 Main Disconnect Switches:

3.1.2.1.1 The "dirty power" main disconnect switch shall be a 240 VAC, 3-pole, 4 wire with solid neutral, fusible rated for 200 Amps and equipped with Cu lugs (for copper wire). The fuses shall be type RK5.

3.1.2.1.2 The "clean power" main disconnect switch shall be a 240 VAC, 3-pole, 4 wire with solid neutral, fusible rated for 100 Amps and equipped with Cu lugs (for copper wire). The fuses shall be type RK5.

3.1.2.2 Power Distribution Panels:

3.1.2.2.1 The "dirty power" distribution panel shall be a main lug (MLO) three phase, 4 wire, 120/208 V, 225 Amp, copper bus bar, sized for a minimum of 30 circuits. Sufficient circuit breakers shall be installed for the existing installed circuits.

3.1.2.2.2 The "clean power" distribution panel shall be a main lug (MLO) three phase, 4 wire, 120/208 V, 125 Amp, copper bus bar, sized for a minimum of 24 circuits. Sufficient circuit breakers shall be installed for the existing installed circuits.

3.1.2.3 Electrical Conduit: All wiring runs shall be in appropriately sized rigid galvanized steel conduit. The conduit from the main disconnect switch to the power distribution panel shall penetrate the enclosure through a labyrinth panel.

3.1.2.4 Electrical Outlets. The electrical outlet power strips inside each Enclosure shall alternate between 120 VAC "clean power" and dual voltage single phase 120 VAC, and three phase 208 VAC, power strips. Each enclosure shall have six outlet power strips at the location shown on the applicable drawing. Each "clean power" outlet strip shall have a minimum of four 120 VAC outlets and each "dirty power" outlet shall have a minimum of four 120V and one 208 VAC outlet, each rated for 20 Amps.

3.1.2.5 Ground Detection. Each electrical outlet strip shall be equipped with a Ground Fault Circuit Interrupt unit.

3.1.2.6 Illumination. Sufficient fluorescent lighting shall be provided to give an illumination level of 100 to 150 foot-candles at any point within the enclosure. The lighting shall be installed on the ceiling between the ceiling supports and clear of the crane bridge. Two three-way switches for controlling the lights shall be installed in the locations indicated on the applicable drawing, one switch located inside the enclosure and the other on the outside.

3.1.2.7 Exhaust Fans. The ceiling exhaust fans shall be "quiet" fans producing less than 65 dB of noise at distances greater than 1 meter. The fans shall have the capacity in excess of 250 l/s of air. Each Experimental Station shall be equipped with two fans. The fans shall be provided with an on-off switch and a variable speed control that permits adjustment from 100% to at least 40%. The speed control setting shall be a screwdriver adjustment.

3.2 Material Requirements.

The contractor shall use the materials specified in the drawings, and their associated sub-tier drawings, which are listed in Section 2.2 of this Technical Specification, and certification of materials used in the fabrication shall be submitted to ANL.

3.2.1 General. All materials used inside the enclosure shall be capable of withstanding a high X-radiation environment.

3.2.2 Lead. Lead sheet used in the enclosure shall conform to Federal Specification. QQ-L-201f, Grade C.

3.2.3 Steel. Steel sheet used in the enclosure shall conform to DOE Order 6430.1A, General Design Criteria., Section 0512.

3.3 Fabrication Requirements.

Fabrication of the APS Monochromatic Beam Experimental Stations shall be in accordance with the drawings which are listed in Section 2.2 of this Technical Specification, and with all the provisions of this Specification.

3.4 Assembly and Workmanship.

3.4.1 The parts shall be free of burrs and sharp edges, and free of dents, gouges and scratches.

3.4.2 The parts shall be clean and free of dirt, oil and grease with the exception of the appropriate lubrication on moving bearing surfaces. Bearing surfaces shall be lubricated as required by the assembly drawing.

3.4.3 All assembly requirements for alignment marks, keying or pinning specified on the appropriate assembly or sub-tier drawing shall be done after verification that the assembly meets the dimensional requirements of the drawing.

3.4.4 All fasteners on moving devices shall be locked by means of wires, jam nuts, set screws, spring washers or similar locking devices to prevent loosening. All drilled head screws shall be wired to lock them in place.

3.4.5 All structural bolts for the wall and ceiling panels shall have the nuts tack welded to prevent loosening after erection of the enclosure.

3.5 Painting.

The APS Monochromatic Beam Experimental Stations shall be painted according to APS document no. 4105-00024, Technical Specification for Painting Requirements of Beamline Structures. The paint color shall be Pratt and Lambert #2127, Snowflake or equivalent, with a semi-gloss finish.

3.6 Drawings.

3.6.1 Since the drawings and documents listed in section 2.2 define the fabrication requirements of the APS Monochromatic Beam Experimental Stations, the preparation of new drawings by the contractor will not be required unless alternate designs and/or modifications to the designs submitted by the Laboratory are proposed by the contractor.

3.6.2 The contractor is required to review the drawings and other documentation provided by ANL for errors and inform ANL of any discrepancies and errors. Any changes or corrections must be documented by the contractor as "marked drawing" changes to the engineering drawings for the affected item and submitted for ANL's approval. If approved, revised drawings will be issued by ANL.

3.6.3 The Contractor shall be responsible for the structural integrity of the enclosure, and shall have the structure reviewed by a certified structural engineer.

3.6.4 The marking and submission of marked drawings to ANL to indicate any "as-built" changes is the responsibility of the Contractor.

3.6.5 The drawing numbers in most cases will be preceded by a "P" prefix on the drawing itself. After the acceptance of the first unit and any corrections as detailed in 3.6.2 and 3.6.3, the "P" prefix on the drawing number on the drawing will be dropped.

3.6.6 Drawings can be furnished to the contractor on disk or by E-mail in AutoCAD (version 12) format (DWG) as the preferred format or in DXF format. The contractor should submit any corrected or modified drawings to ANL for approval in AutoCAD format.

4.0 QUALITY ASSURANCE AND TEST REQUIREMENTS

The following examination requirements shall comprise the minimum acceptable for the APS Monochromatic Beam Experimental Stations.

4.1 Certification.

All certification of designs, materials, hardware, processes, calibrations and test data shall be signed by a contractor representative authorized to sign such certifications.

4.2 Examination Requirements.

4.2.1 Materials Examination. All raw materials shall be examined visually to detect suspect or counterfeit parts, obvious defects and the state of cleanliness.

4.2.2 Fabrication and Weld Examination.

4.2.2.1 General. All items shall be subjected to visual and dimensional examination to verify conformance with drawing requirements.

4.2.2.2 Liquid Penetrant Examination. All welds shall be examined by the liquid penetrant method. The use of liquid penetrant materials from aerosol spray cans using Freon as the propellant is prohibited on austenitic stainless steel.

4.2.2.3 Examination of Weld Repairs. Weld repairs shall be reexamined by the examination method(s) which revealed the original defect. In addition, other nondestructive examination methods which will assure the quality of the material has been maintained may be used upon agreement between the contractor and the Laboratory.

4.2.3 Calibration and Control of Instruments. Accuracy of instrumentation used during tests shall be verified by the contractor by means of periodic calibration traceable to the National Institute of Standards and Technology. The Laboratory shall be given timely notice of any calibration discrepancies or problems. Calibration records shall be available to the Laboratory's personnel.

4.2.4 Marking and Identification. When raw materials are cut or sectioned, all markings shall be transferred to the unmarked portion of the material.

4.2.5 Examination of Lifting, Handling, and Shipping Fixtures. Following proof load testing of lifting, handling, shipping fixtures and attachment lugs, all structural welds of these items shall be examined by the magnetic particle or liquid penetrant method. In addition, all slings and hooks, not containing structural welds, used in lifting the item shall, as a minimum, be visually examined for structural defects.

4.2.6 Acceptance Testing. The acceptance testing shall be performed in accordance with the ANL approved contractor's test plan, and the results submitted to the Laboratory for approval. The following items are the minimum requirements for inclusion in the acceptance tests.

4.2.6.1 Verification of Overall Dimensions. The maximum width and height of the assemblies with respect to the appropriate reference surfaces shall be verified to be in conformance with the assembly drawing for the item.

4.2.6.2 Verification of Door Panel Motion. The motion of each moving door panel shall be tested for the following: Range of motion, Binding, Locking, Rubbing or Scraping, and Swing or Wobble.

4.2.6.3 Door Cycle Test. Each enclosure's pneumatically operated personnel access doors shall be actuated 100 times to cycle the door through its normal stroke. The proper door closed position (radiation tight) shall be confirmed for each cycle.

4.2.6.4 Verification of Radiation Shielding. The radiation shielding integrity for ionizing X-radiation of each wall and ceiling after erection of the enclosure shall be demonstrated and verified to be equivalent to the thickness of lead specified on the applicable drawings listed in Section 2.2 of this specification.

4.2.6.5 Air Line Leak Check and Flow Test. Only clean, filtered oil free air shall be used for testing.

4.2.6.5.1 Air lines shall be leak checked by pressurizing them to normal line pressure (80 to 110 psi) and having the lines valved off for one hour during which the pressure in the line must not fall more than 10%.

4.2.6.5.2 Air lines shall be flow tested for continuity with 2 cfm minimum flow required at 2 psi or less pressure drop per foot of pipe.

4.2.6.6 Water Pressure and Flow Tests. Only clean, filtered tap water shall be used for testing. After testing, the water lines shall be dried by blowing them out with clean, dry, oil free air.

4.2.6.6.1 Water lines shall be pressure tested to 200 psi. No evidence of leakage is permissible.

4.2.6.6.2 Water lines shall be flow tested for continuity with 5 gpm minimum flow required at 1 psi or less pressure drop per foot of pipe.

4.2.6.7 Electrical Circuit Tests: Each electrical circuit shall be tested for continuity of connection from beginning of the circuit to the end, and for open circuit line-to-line and line-to-ground.

4.2.6.8 Crane and Hoist Tests: The cranes and hoists shall be tested for compliance with the appropriate ANSI/ASME specification as shown in Section 2.6.2 of this specification

5.0 PREPARATION FOR DELIVERY

5.1 **Package Identification**: Each package shipped shall be identified by the appropriate purchase order number, assembly number and a sequential package identity number if there is more than one.

5.2 **Moving Components:** Any moving components on an assembly must be firmly secured for shipment in a manner that precludes damage from motion and vibration.

5.3 **Protection:** Assemblies must be secured for shipment in fashion that protects the assembly from dust, dirt and weather or water damage. The assemblies must be securely fastened, padded, boxed and/or crated for shipment in a suitable manner for prevention of shipment damage to any assembly and its weather/dust protection and insure their safe delivery to the Laboratory.

5.4 **Erection:** The APS Monochromatic Beam Experimental Stations shall be erected on the experimental floor of the Advanced Photon Source at a location to be specified by cognizant APS personnel. Final delivery and acceptance shall be after successful completion of inspection and acceptance testing per section 4.2 above.