

SECTION 13 51 00
RADIATION PROTECTION
SHIELDED DOORS AND FRAMES
SWING-STYLE DESIGN

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Radiation protection products including the following:
1. Radiation Shielded Swing Door and support structure.
 2. Shielding content - Interlocking Radiation Shielding Modules.

1.02 RELATED SECTIONS

- A. Section 05 12 00 - Structural Steel
8. Section 05 12 10 - Structural Steel Erection
C. Section 05 50 00 - Miscellaneous Metals
D. Section 13 49 00 - Modular Radiation Shielding
E. Section 13 55 00 - Lead Sheets and Lead Plates.

1.03 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A568/S68M - Standard Specification for Steel, Sheet, Carbon, Structural, and High Strength, Low Alloy, Hot Rolled and Cold Rolled.
 3. ASTM A 366 - Standard Specification for Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent) Cold-Rolled.
 4. ASTM A 500 - Standard Specification for Cold Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 5. ASTM 829 - Standard Specification for Refined Lead.
- B. National Council on Radiation Protection and Measurements (NCRP):
1. NCRP Report No. 038 - Protection Against Neutron Radiation.
 2. NCRP Report No. 144 - Radiation Protection for Particle Accelerator Facilities.
 3. NCRP Report No. 147 - Structural Shielding for Medical X-Ray Imaging Facilities.
 4. NCRP Report No. 148 - Radiation Protection in Veterinary Medicine.
 5. NCRP Report No. 151 - Structural Shielding Design and Evaluation for Megavoltage X and Gamma Ray Radiotherapy Facilities.
- C. U.S. Department of Labor Occupational Safety and Health Administration (OSHA):
1. OSHA standard 29 CFR 1910.1025 - (Alloy) Lead.
 2. OSHA standard 29 CFR 1926 - Safety and Health Regulations for Construction
 3. OSHA standard 29 CFR 1926.62 - Lead.
 4. CAL-OSHA Title 8 Sec 1532.1, Sec 5198, and Sec 5216.
- D. British Journal Supplement No. 11.

1.04 DEFINITIONS

- A. Modular/Modules: Radiation shielding components shall be individual elements or modules that are combined together to form a composite structure to create the required radiation attenuating environment.

- B. Interlocking: Modules shall interlock together to form a solid and stable structure comprised primarily of dry stacked module system.
- C. Proper Attenuation: Shielding of all photon, neutron and electron radiation to the levels specified by the governing regulatory agencies as identified in the final physics report.
- D. Radiation Shielded Environment: The overall structure providing the radiation shielding along with associated components such as doors and duct shielding, thus forming the full shielded room.

1.05 SYSTEM DESCRIPTION

A. Furnish all labor, materials and equipment, and perform all work required to install radiation-shielded door system as shown on manufacturer's drawings, including shielding modules, steel support structure, prefabricated metalwork, and all necessary incidental work in connection therewith. Manufacturer shall be responsible for the radiation shielding design and related physics report, manufacturing, fabrication and installation of the shielding system inclusive of frame, door shell, operating system and shielding as may be required.

1. Detailed physics analysis and shielding design – Door shielding shall ensure proper attenuation of emitted radiation fields to limits prescribed by client physics parameters or governing regulatory agencies.
2. Structural Engineering Design - Furnish and install complete structural support system.
3. Radiation Shielding - Provide and install all items of radiation shielding work as required for neutron, photon or electron radiation attenuation per contract documents.

1.06 SUBMITTALS

- A. Refer to Section 01 30 00 -Administrative Requirements, for submittal procedures.
- B. Guarantee: Written documentation guaranteeing that the design, shielding material and finished installation will meet or exceed the attenuation performance required by the Physicist of Record, or should testing indicate any deficiencies in shielding performance, these will be remedied by the shielding manufacturer at no additional cost.
- C. Manufacturer's Physics Report documenting the full shielding design and certifying that the high density interlocking modules and all related items in this section fully comply with the requirements stated by the Physicist of Record.
- D. Product Data: Manufacturer's data sheets including:
 1. Performance data and physical properties.
 2. Preparation instructions and recommendations.
 3. Installation methods.
 4. Operation and Maintenance
- E. Shop Drawings: Drawings detailing construction and assembly shall be submitted for approval prior to the start of any fabrication.
 1. Drawings shall be prepared, signed and sealed by a qualified Professional Engineer. A letter of certification shall state that all structural shop drawings were prepared under their direction, and their seal will appear on all shop drawings.
- F. Trade Instructions: Manufacturer's installation instructions and diagrams for components installed under other trades.
- G. Welders' certificates.
- F. Closeout and Maintenance Documents:
 1. Closeout Conference: Including all parties as may be appropriate.
 2. Onsite inspection reports and final punch list.
 3. Operator manuals, maintenance schedules and contact information as necessary.
 4. Shielding Guarantee Certificate

1.07 QUALITY ASSURANCE

A. Qualifications: Shielding supplier with minimum of 5 years successful experience manufacturing radiation protection products similar to those specified for this project.

B. Single Source Responsibility: Obtain radiation protection materials and accessories produced as standard products from single manufacturer regularly engaged in production of high energy shielding materials, equipment, and accessories.

C. Radiation Protection Survey: Employ registered Health Physicist, certified by American Board of Radiology, for testing specified radiation protective work and to conduct radiation protection survey of facility.

D. Radiation Protection Work: Shall comply with National Council of Radiation Protection (NCRP) Report No. 049 - Structural Shielding Design and Evaluation for Medical Use of Gamma Rays of Energies up to 18 MV.

1. Comply with requirements of local regulatory agencies where local standards and criteria exceed requirements for NCRP Report No. 049.
2. Door shall be installed per the recommended practices of National Council on Radiation Protection as outlined in handbooks #151, #51 (#144) and #49.

E. Shielding Guarantee: Completed installation shall be 100% guaranteed to meet agreed upon shielding requirements applicable at the time of contract and that any shielding deficiencies will be rectified by the shielding manufacturer at no additional charge.

F. Warranty: Manufacturer shall warrant all labor and materials to be furnished and work performed in conjunction with this project, will be free from defects due to defective materials or workmanship for the period of one year.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's instructions for receiving, handling, storing, and protecting materials.

1. Provide reasonable access to the building site and protect existing floors, carpets, tile, plumbing/electric stub up fixtures, walls, etc. as necessary.
2. Provide hard surfaced storage area capable of supporting 2 ton pallets.
3. Ensure that all routes into the building site to be accessible and capable of supporting the loads noted herein.

B. Exercise care to prevent damage to operating system and individual shielding modules.

1.09 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.10 SCHEDULING WITH OTHER WORK:

A. Coordinate with other trades to ensure they have ample opportunity to build in their work as the door installation work progresses.

1.11 PRE-INSTALLATION MEETINGS

A. There shall be a pre-installation conference at the job site at the beginning of the project, or at least two months prior to shielding installation to review all requirements of construction including shielding placement, protection and inspection.

B. Conduct the conference to comply with the requirements in Division 01 Section "Project Management and Coordination". Review methods and procedures related to radiation protection.

1. The manufacturer shall prepare a comprehensive "Shielding Construction Plan (SCP)" addressing all procedures associated with supply and placement of the door and associated assemblies. Submit plan to Architect and Owner's Testing and Inspection Agency a minimum of seven (7) days prior to Pre-installation Conference. SCP to include:
 - a. Design and door system requirements.
 - b. Consistency of materials.
 - c. Staging, scheduling and access.
 - d. Plant and field manpower.
 - e. Procedures for placement with sufficient backup equipment.
 - f. Coordination with other trades.
 - g. Inspections and acceptances.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. To ensure that all design criteria are met, the specifications and construction drawings are based on the use of Radiation Shielded Swing-Style Door System as manufactured by:

Veritas Medical Solutions, LLC,
160 Cassell Road, Harleysville, PA 19438
Phone: 484.991.8928
www.veritas-medicalsolutions.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.02 HIGH DENSITY SHIELDING MODULES

A. Door shall be loaded with High Density VeriShield® interlocking modules in full and half module increments to provide the necessary radiation attenuation as specified by Physicist of Record.

1. Cementitious modular shielding with a sine wave shape.
2. 100% interlocking edge with no straight line seams.
3. Provide appropriate density modules to fully meet Physics Requirements.
 - a. 150 lbs./cu. ft.
 - b. 220 lbs./cu.ft.
 - c. 250 lbs./cu.ft.
 - d. 300 lbs./cu.ft.

B. Should conditions warrant, alternate shielding materials such as lead, steel or borated polyethylene may be substituted for the VeriShield modules.

2.03 DOOR SYSTEM

A. Manufacturer shall be responsible for the complete design, fabrication, and installation of door assembly and shall determine size, door lap, hinge loading, and structural elements based on shielding requirements and clear opening dimensions. Unless otherwise specified, shielding thickness shall be determined by manufacturer based on client-provided physics parameters. Door will be finished with high pressure laminates, stainless steel or anodized aluminum per client selection.

B. Mechanism: Door shall consist of a single leaf swing style shielded door complete with support and drive systems.

1. Door shall be supported by a radial/thrust pivot bearing surface mounted to the concrete floor and a top radial bearing installed into a steel frame support.
2. Drive mechanism shall be a direct drive assembly concealed behind panelized safety doors.

- C. Operating Speed: Door shall rotate to a full open or close position in ten (10) seconds.
- D. Safety System: Door shall be equipped with top mounted infra-red or ultrasonic presence-sensing devices mounted on the face of each door panel.
- E. Materials and Construction: Door shell shall be constructed of A36 carbon steel plate face panels and minimum 1/2 inch thick edge banding. Door shall be prime coated with 2 coats of rust inhibitive primer. All exposed surfaces of the door shall be fully finished with materials selected from manufacturer's standard plastic, wood or metal laminated finishes.
- E. Electrical Requirements: Door system shall operate on 220 volt, 3 phase, 30 amp power supply with low voltage wiring to all controls, presence sensors and safety systems.
- F. Controls and Operation: A programmable touch screen Human Machine Interface (HMI) will be utilized for primary door control. Two independent Push Button Operating Stations (PBOS) will be provided and installed per architectural plans.
- G. Manual Operation: Door system shall be "free-wheeling" in power-off conditions, such that the door can be opened and closed manually.
- H. Radiation Shielding Protection: Door shell shall be filled with homogeneous high atomic number materials and neutron moderating additives as required to meet levels prescribed by the physicist of record and other Governing Regulator Agencies.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify and correct conditions detrimental to proper or timely completion.
- 8. Prior to installation of door system, carefully inspect all prior work of other trades that may impact on the installation of the door components to insure that conditions are acceptable.
- C. Do not proceed until any unsatisfactory conditions have been corrected.

3.02 INSTALLATION

Installation of structural frame, door assembly system, shielding contents and operating system shall be the responsibility of the manufacturer and/or its assigns.

3.03 FIELD QUALITY CONTROL

- A. Field Inspection: Owner will engage qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Manufacturer will correct deficiencies in, or remove and replace, all radiation protection that inspection reports indicate does not comply with specified requirements.

3.04 CLEANING

- A. Cleaning work will be conducted per Section 01 73 00 – Execution.
- B. Remove excess materials from site daily. Vacuum surfaces in compliance with OSHS Standard 1926.62.

3.05 PROTECTION

- A. Take reasonable care to protect installed materials from damage. Repair any existing materials that may be damaged by shielding work to match original.

END OF SECTION

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