SECTION 13090

RADIATION SHIELDING ENCLOSURE
Low Intensity Radiation Protection

Prepared by:

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LOW INTENSITY RADIATION PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section.

1.2 SECTION INCLUDES

A. Lead sheet, strip, and plate.
B. Lead glass.
C. Lead-lined building materials and products including the following:
   1. Gypsum board.
   2. Steel hollow-metal door frames.
   3. Wood doors.
   4. Observation-window frames.
   5. Informational signs.

1.3 RELATED SECTIONS

A. Section 08 71 00 - Door Hardware: Door hardware for lead-lined steel hollow-metal doors.
B. Section 09 91 00 - Painting: Field finishing doors and frames.

1.4 DEFINITIONS

A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.
   1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Provide materials and workmanship, including joints and fasteners that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.

   1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.
B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.

C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

1.6 SUBMITTALS
A. Submit under provisions of Section 01 33 00.
B. Product Data: For each type of product indicated.
C. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
   1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.
D. Samples for Initial Selection: For units with factory-applied color finishes.
E. Other Action Submittals:
   1. Schedule: Provide a schedule of observation windows, doors and frames prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
F. Qualification Data: For qualified installer.
G. Warranty: Sample of special warranty.

1.7 QUALITY ASSURANCE
A. Installer Qualifications: Fabricator of products.
B. Glazing: Comply with requirements in Section 08 80 00.
C. Pre-installation Conference: Conduct conference at project site.
   1. Review methods and procedures related to radiation protection including, but not limited to, the following:
a. Sequence and schedule of radiation protection work in relation to other work.
b. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
c. Methods of attaching other construction and equipment to lead-lined finishes.
d. Notification procedures for work that requires modifying radiation protection.
e. Requirements for field quality control.

1.8 DELIVERY, STORAGE AND HANDLING

A. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.
B. Lead-Lined Wood Doors: Comply with manufacturer's written instructions and requirements in WDMA I.S.1-A.
   1. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
   2. Mark each door on top and bottom rail with opening number used on shop drawings.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. This section is based on products manufactured by Global Partners in Shielding; 90 Dayton Avenue, Unit 4B, Passaic, NJ 07055; Tel: 973-574-9077; Fax: 973-574-9078.
B. Substitutions: Not permitted.
2.2 MATERIALS

A. Lead Sheet, Strip, and Plate: ASTM B749, alloy UNS No. L51121 (chemical-copper lead).

B. Lead Glass: Lead-barium, polished float glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.

   a. Outer Lite: Clear float glass; thickness as indicated.
   b. Interlayer: Clear polyvinyl butyral or cured resin of manufacturer's standard thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
   c. Inner Lite: Lead-barium, polished float glass; thickness [as indicated.

A. Lead-Lined Gypsum Board: ASTM C36 A82.27, USDA SSL 30D Type III Grade X. 5/8-inch thick gypsum board of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.

1. Provide lead sheet lining the full width of board and length necessary to extend from floor to 84 inches above floor unless otherwise noted.

B. Accessories and Fasteners: Provide manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.

C. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D1187.


2.3 LEAD-LINED STEEL HOLLOW-METAL DOOR FRAMES

A. General: Steel door frames complying with ANSI/NAAMM-HMMA 861, and lined with lead sheet of thickness not less than that required for doors and walls where frames are used.

1. Provide additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.

2. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
3. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

2.4 LEAD-LINED WOOD DOORS

A. General: Flush solid-core wood doors with lead lining, thickness not less than that required for partition in which door is installed.

1. Basis of Design Products: Subject to compliance with requirements, provide the product specified or a product of equal or better quality and performance by another manufacturer as approved by the Architect:

2. Door Construction: Veneer face, five (5) ply, bonded structural composite lumber core.

3. Lead Lining: One (1) or more continuous sheets of lead extending from top to bottom and edge to edge, constructed either in the core or between the core and faces, at manufacturer's option.

4. Comply with Section 08 14 16 for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.


7. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.

8. Factory fit doors to suit frame openings indicated with 1/16-inch clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

2.5 LEAD-LINED OBSERVATION-WINDOW FRAMES

A. General: Fabricate from 0.043-inch thick, formed-steel sheet or 0.064-inch thick aluminum extrusions with mitered corners, welded or bolted with concealed fasteners.

1. Line with lead sheet formed to match frame contour, continuous in each jamb and across head and sill, lapping the stops, and fabricated wide enough to maintain an effective lap with lead of adjoining assemblies.

2. Construct so lead lining overlaps glazing material perimeter by at least 3/8-inch and provide removable stops.

2.6 INFORMATIONAL SIGNS
A. Informational Signs, General: Comply with Section 10 14 00.
   1. Color: As selected by Architect from manufacturer's full range of colors.
   2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
   3. Indicate lead equivalence in millimeters and heights of radiation protection in inches

B. Rooms Where the Level of Protection Is Uniform Throughout: Provide one (1) sign for each room indicating lead equivalence of partitions, ceilings, floors, doors, and other portions of radiation protection enclosure. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.

C. Rooms Where the Level of Protection Is Not Uniform Throughout: Provide one (1) sign for each room with different lead equivalences in different locations. Indicate, in tabular form, lead equivalence of each wall, partition, ceiling, floor, door, and window. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height. Indicate where lead equivalence changes or is not continuous.

D. Rooms Where Some Partitions Are without Radiation Protection: Provide one (1) sign for each partition that contains radiation protection and indicate its lead equivalence. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.

E. Rooms Where Only the Door Has Radiation Protection: Provide one (1) sign for each door indicating its lead equivalence.

2.7 DOOR AND DOOR FRAME FABRICATION

A. Hardware Preparation: Factory prepare doors and frames to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Concrete Surfaces: Proceed with installation only after surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

3.2 INSTALLATION OF LEAD-LINED GYPSUM BOARD

A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.

B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Install lead strips covering face of framing and wrap around flange to cover points of screws.

   1. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied.

C. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least one (1) inch. Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.

3.3 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

A. Install lead-lined wood doors according to Section 08 14 16.

B. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.

   1. Provide three (3) anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
   2. In metal stud construction, use wall anchors attached to studs with screws.

C. Lap lead lining of frames over lining in walls at least one (1) inch

D. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.

E. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 08 71 00 for other installation requirements.

F. Touch up damaged finishes with compatible coating after sanding smooth.

G. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.
3.4 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

A. Install observation windows according to manufacturer’s written installation instructions.

B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.

C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least one (1) inch.

D. Glazing: Comply with installation requirements in Section 08 80 00 and with manufacturer’s written instructions.

3.5 INSTALLATION OF PENETRATING ITEMS

A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.

B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.

C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.

D. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least one (1) inch. Wrap conduit with lead sheet for a distance of not less than 10 inches.

E. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three (3) times the largest opening dimension. Lap lead sheet with adjacent lead lining at least one (from box 1) inch.

F. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 inches from point of penetration.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.

B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.
3.7 PROTECTION

A. Lock radiation-protected rooms once doors and locks are installed and limit access to only those persons performing work in the rooms.

END OF SECTION