

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes: The requirements for furnishing and installing X-Ray Protection Materials including lead backed gypsum wallboard, lead lined doors, lead lining of door frames, window frames and x-ray protective lead glass.

1.02 RELATED DOCUMENTS

- A. The requirements of the General Conditions, Supplementary Conditions, and Division 1, General Requirements apply to the work of this Section.
- B. Section 09 2960-Lead Backed Drywall, Section 08 8860-X-Ray Lead Glass, Section 08 1420-Flush Wood doors, Section 08 1426-Plastic Faced Flush Wood doors, as applicable.

1.03 QUALITY ASSURANCE

- A. **Standards:** Comply with all applicable requirements of National Council on Radiation Protection and Measurement (NCRP) Report No. 147 titled "Structural Shielding and Design Evaluation for Medical Use of X-rays and Gamma Rays of Energies up to 10MeV"
 - 1. Comply with any applicable requirements of local, regulatory agencies where safety standards or criteria exceed NCRP Report Numbers 49 and 147.
- B. **Acceptable Manufacturer:** Ray-Bar Engineering Corporation, Toll Free (800) 444-XRAY (9729)
Phone:(626) 969-1818 · Fax (800) 333-XRAY(9729) · www.raybar.com · e-mail:sales@raybar.com / (no known equal). A recognized manufacturer regularly engaged in the successful production of the products as specified herein for over 70 years.
- C. **Fabricator-Installer Qualifications:** Fabricator-Installer shall be experienced in and equipped for work of fabrication and installation equal to standards specified. The contractor shall furnish evidence of Fabricator-Installer having not less than ten (10) years experience in successful fabrication-installation of radiation protection similar to work specified herein utilizing properly trained personnel with good hygiene practices and proper lead handling training and procedures meeting Cal-OSHA 1532 and Kaiser's LCP requirements.
 - 1. Fabricator-Installer shall furnish proof of insurance certifying Fabricator-Installer is specifically insured in the fabrication and installation of X-ray Protection Materials for Shielding.

1.04 SUBMITTALS

- A. **Product Data:** Submit manufacturers printed data and specifications for each item of radiation shielding and accessories proposed for use and indicate compliance with all applicable building and safety codes.
- B. **Shop Drawings:** Submit shop drawings indicating thickness of lead, in compliance with Radiation Shielding Report, details of construction products and all other details to clearly define method of installation to assure that the required lead shielding protection will be obtained.
- C. **Certification:** Submit at completion of work, certificate of compliance from manufacturer and Fabricator-Installer stating that all material has been produced and installed in accordance with this specification.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Leadlined Door and Window Frames: Comply with requirements of Section 08 1420-Steel Doors and Frames.
- B. Leadlined Wood Doors: Comply with requirements of Section 08 1400 -Flush Wood Doors or Section 08 1426 -Plastic Faced Flush Wood Doors, as applicable.
Specifically 08 3440 – Radiation Protection Doors
Product Handling: Keep flat until ready to use. NEVER store outdoors, Never store in sun or near moisture.
- C. Lead Backed Gypsum Wallboard: Comply with requirements of Section 09 2900- Gypsum Board.
Specifically 09 2960 – Lead Backed Drywall
Product Handling: Keep flat until ready to use. NEVER store outdoors, Never store in sun or near moisture.
- D. X-Ray Lead Glass: Comply with requirements of Section 08 8000 – Glazing.
Specifically 08 8860 – X-Ray Lead Glass
Product Handling: Follow Manufacturer / Fabricator specific handling MSDS instructions and storage requirements to prevent damage, scratches or breakage of fragile X-Ray Lead Glass. NEVER store outdoors, set flat or use knives or strong cleaners on X-Ray Lead Glass.

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Ray-Bar Engineering Corporation, Ray-Bar Engineering Corporation, Toll Free (800)444-XRAY (9729)
Phone:(626) 969-1818 · Fax (800)333-XRAY(9729) · www.raybar.com · e-mail:sales@ray-bar.com / (no known equal). A recognized domestic manufacturer regularly engaged in the production of X-Ray Protection Materials (no known equal).

2.02 MATERIALS AND FABRICATION

- A. **Lead Sheet:** In compliance with Federal Specification QQ-L-201f, Grade C, 99.9% pure, and ASTM B 749, Type L5 1121. Thickness as indicated on Lead Protection Schedule, to 7'0" high, minimum national standard on walls (unless otherwise noted).
- B. **Lead Backed Gypsum Board:** As manufactured by Ray-Bar Engineering Corporation; ASTM C 36, and as follows:
 - 1. **Sheet Size:** Width and length as required for support spacing to prevent cracking during handling. Not to exceed 4'0" X 10'0", Type X Standard (RB-LBG), also available in Abuse Resistant (AR), Mold Resistant (MR), Water Resistant (WR) and High Impact (HI) gypsum panels where required.
 - 2. Thickness: Not less than 5/8" inch - unless otherwise indicated
 - 3. A single thickness of unpierced lead sheet must be laminated to the back of gypsum board units with lead thickness value clearly identified on each sheet. Lead thickness as indicated on Lead Protection Schedule.
Provide minimum 1-1/2" wide lead batten strips for lapping at all vertical joints and inside and outside vertical corners, same height and lead thickness as on lead backed gypsum board.
- C. **Fire rated lead backed 5/8" gypsum board** (type RB-LBG) to be utilized at any fire rated lead lined partitions (such as partition design U430) and identified with proper yellow U.L Label laminated on actual lead side indicating shielding material manufacturer and current fire resistance listing and U.L. classification per the current U.L. certification directory and as tested in accordance with the standard fire test of building construction and materials per ANSI / UL263 (ASTM E119, NFPA 251). There are absolutely no substitutions allowed by UL.
 - 1. **Accessories and Fasteners:** Manufacturer's standards, maintaining the equivalent protection as the system.
Lead shielding of fasteners: size, type and design as recommended by the manufacturer of protection system such as lead discs or tabs, or simply 1-1/4" long steel screws when appropriate per NCRP Report No. 147

and approved by physicist of record for 1/16" / 4# lead areas or less.

D. Lead Lined Wood Doors: Comply with applicable requirements of Section 08 1420, "Flush Wood Doors" and Section 08 1426, "Plastic Faced Flush Wood Doors", as applicable.

1. Fabricate doors of solid core flush construction with one or more continuous unpierced lead sheets to make up total lead thickness as indicated. Apply lead sheet continuously from top to bottom and edge to edge. Lead lining may be constructed in core or between core and cross banding at manufacturer's option. Lead must be the same thickness as the partition in which door occurs in. Top of door to be clearly marked with manufacturer's name and lead thickness.
2. Shield cutouts for lock sets with sheet lead lapping, lead lining of lock sets or door lining, of equal thickness lead as used in door of same opening.

E. Leadlined Hollow Metal Door Frames: Comply with requirements of Section 08 1420-Steel Doors and Frames.

1. Provide additional reinforcements and internal supports to adequately carry weight of lead lined doors. Perform all such work before installation of any lead lining into frames.

2. Line inside of frames with unpierced strips of sheet lead of not less than same thickness as lead in doors and walls in which installed. Form lead sheet to match contour of frame on radiation exposure side of frame, continuous in each jamb and across head and over lap into formed stop. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective 1/2" minimum overlap lap with lead of same thickness value as adjoining shielding.

F. View Window Frames: Ray-Bar lead lined Telescopic Steel View Window Frame, fabricated from 16 gauge jetcoat electro-Galvanized Steel lead lined with equal or greater lead as in wall that window occurs in and telescope to wall thickness required. (Optionally Stainless Steel or Brushed Aluminum if indicated on plans)

1. Match concealed lead lining in frame to that of surrounding wall system. Optional bottom sill voice passage in frame sill only where specifically required / indicated on plans.

G. Lead Glass: As specified in Section 08 8000, "Glass and Glazing". X-Ray Protective type, (Ray-Bar X-Ray Lead Glass) Federal Specification DD-G-451, in single or multiple layers of x-ray lead glass with lead equivalent not less than that of system in which it is installed. Glass must be clearly labeled or identified as "X-Ray Lead Glass" with lead shielding equivalency protective value. X-Ray Safety Glass permanently labeled as impact resistant and must be utilized in any door vision lites or windows that occur within 24" of any door opening and must be permanently labeled in compliance with ANSI Z97.1 and CPSC 16 CFR Part 1201, CAT II for impact resistance, such as Ray-Bar X-Ray Safety Glass, manufactured solely by Ray-Bar Engineering Corp Toll Free (800) 444-XRAY Phone (626) 969-1818 • Fax (800) 333-XRAY(9729)

• email: sales@raybar.com • www.raybar.com (no known equal)

H. Floor Lead: If required or indicated on Lead Protection Schedule, a single layer of unpierced lead sheet meeting Federal Specification QQ-L-201f, Grade C, 99.9% pure and of the thickness specified on Lead Protection Schedule and utilizing a compatible adhesive to bond metal to the concrete or wood floor prior to finish flooring

1. Sheet Size: Required width, length and area as shown on plans or shielding report, multiple pieces for overall required area coverage is acceptable with proper overlaps not less than 1/2".

Installation

- a) Floor to be smooth, flat, level, clean and free of dust or oil for application of the lead shielding.
- b) Lead to be clean and degreased. Adhesive or mastic to be rated for the proper bonding of metal. .
- c) Apply sheet lead in required single thickness and size, or as multiple pieces for area coverage.
- d) Joints to have a minimum of 1/2" overlap. All lead to be bonded tight and rolled flat on floor.

I. Ceiling Lead Shielding: Lead backed 5/8" drywall to be installed on ceiling areas when required to provide shielding for occupancy above on areas where appropriate and indicated on plans per shielding report provided by physicist of record for project. All penetrations and joints between lead backed drywall sheets are to be properly shielded with same techniques as on wall partitions.

- a) Ceiling must be framed for "hard lid" at 12" on center for support and to prevent sagging.
- b) Framing to be of size and gauge of metal as determined and specified by the project structural engineer.
- c) T-Bar, grids and suspended ceilings are not acceptable systems for proper radiation shielding.
- d) All penetrations in leadlined ceilings such as HVAC, fire sprinklers, ducts, etc. must be properly backed with lead of same thickness as in ceiling with proper overlaps. Lead Lined access panels to be installed where required to provide continuous radiation protection

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lead Backed Gypsum Wallboard

1. Apply gypsum board vertically with long edges parallel to supports and lead lining facing supports and lead lining facing supports. Provide blocking at end joints. Install lead strips minimum 1-1/2 inches wide and same height and thickness as gypsum board lead lining to inside of face of supports and blocking where all vertical joints, inside and outside corners occur. Secure lead batten strips to studs, lead shielding to 7'0" high, minimum national standard on walls (unless otherwise noted). No untrained persons or trades to occupy room or work area during any lead material installation per OSHA requirements.
2. Secure gypsum board to supports with fasteners spaced as recommended by board manufacturer. Drive fasteners slightly below exposed surface and shield with either lead discs, tabs or internally with 1-1/2" wide batten strips, or simply 1-1/4" long steel screws when appropriate per NCRP Report No. 147 and specifically approved by project physicist of record.
3. Refer to Section 09250 for joint treatment and preparation for taping and finishing.

3.02 BUILT-IN ITEMS

- A. Leadlined Door and Relite Frames: Refer to Section 08100, "Steel Doors and Frames" for installation requirements of leadlined metal door and relite frames.
- B. Leadlined Doors: Refer to Section 08211, "Flush Wood Doors" and Section 08212, "Plastic Faced Flush Wood Doors" as applicable, for installation requirements.
 1. Finish hardware is specified in Section 08710, "Finish Hardware". Locksets are to be leadlined.
- C. Built-In Items: Where other built-in items penetrate lead lining, provide lead shield of same thickness as in surrounding wall partition as required to maintain continuity of shielding system. Install in strict accordance with manufacturer's instructions and recommendations.
- D. Where outlet boxes, junction boxes, ducts, conduit and similar items prevent the use of shields, provide lead sleeves or lead lining or backing as required with proper overlaps.
 1. Provide lead lining, sleeves, shields and other protections of equivalent thickness of lead as used in the wall partition shielding system that each penetration occurs in.
 2. Properly clean up and disposal or recycle all sheet lead trimmings and debris. Never dispose of lead materials in general trash or refuse.

3.03 CERTIFICATION

- A. Upon completion of X-ray Shielding, Manufacturer and Fabricator-Installer shall furnish a certificate of compliance stating that all materials are in accordance with this specification and the physicist shielding report.

3.04 TESTING

- A. After the X-Ray equipment has been installed and placed in operating condition or with a similar adjustable radiation source, prior to occupancy and use, the radiation shielding will be tested by the original calculating project health radiation physicist of record at Owners expense.

END OF SECTION 13 49 00, X-RAY PROTECTION