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Section 08 56 49
RADIATION SHIELDING GLAZING AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of radiation shielding frames and glazing where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following:
 - 1. Furnish and install the following:
 - a. Lead lined telescopic hollow metal frames for view windows, complete with internal reinforcing.
 - b. Lead glass.
 - c. Acrylic lead glazing.
 - d. All materials required to properly install glass furnished hereunder, including tapes, setting blocks, and spacers.

1.3 RELATED SECTIONS

- A. Section 01 73 00 - EXECUTION: Waste management and recycling during Final Cleaning.
- B. Section 08 80 00 - GLAZING: Conventional glazing.
- C. Section 09 91 00 - PAINTING: Applied opaque finish coatings to frames.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section.
 - 1. American Conference of Government Industrial Hygienists – Industrial Ventilation Manual.
 - 2. American National Standards Institute (ANSI):
 - a. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
 - b. ANSI A250.8 (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
 - 3. American Society for Testing and Materials (ASTM):
 - a. ASTM A 109 - Standard Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled.



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- b. ASTM A 415 - Standard Specification for Hot-Rolled Carbon Steel Sheets, Commercial.
- c. ASTM A 568 - Standard Specification for Steel, Carbon and High Strength Low Alloy Hot Rolled Strip, and Cold Rolled Sheet.
- d. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- e. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- f. ASTM A 1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- g. ASTM B 29 - Standard Specification for Refined Lead.
4. Glass Association of North America.
 - a. Glazing Manual (2004 edition).
5. International Organization for Standardization (ISO): ISO 9001:2008.
6. National Council on Radiation Protection and Measurements (NCRP):
 - a. NCRP Report No. 038 – Protection Against Neutron Radiation.
 - b. NCRP Report No. 147 – Structural Shielding for Medical X-Ray Imaging Facilities.
 - c. NCRP Report No. 148 – Radiation Protection in Veterinary Medicine.
 - d. NCRP Report No. 151 – Structural Shielding Design and Evaluation for Megavoltage X- and Gamma Ray Radiotherapy Facilities.
7. Steel Door Institute (SDI):
 - a. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
 - b. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
8. U.S. Department of Labor Occupational Safety and Health Administration (OSHA):
 - a. OSHA standard 29 CFR 1910.1025 – Lead.
 - b. OSHA standard 29 CFR 1926 – Safety and Health Regulations for Construction.
 - c. OSHA standard 29 CFR 1926.62 – Lead.
 - d. CAL-OSHA Title 8 Sec 1532.1, Sec 5198, and Sec 5216
9. All applicable federal, state, and municipal codes, laws, and regulations for fire rated assemblies.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, and installation instructions for each item furnished hereunder.
 - a. Recycled material content: Indicate recycled content and provide manufacturer's written certification of recycled steel and lead products (LEED™ NC Version 2.2 Credits MR 4.1 and 4.2).
 - 1) Indicate percentage both post-consumer and pre-consumer recycled content per unit of product.

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- b. Local / regional materials (LEED™ NC Version 2.2 Credit MR 5.1):
 - 1) Indicate location of extraction, harvesting, and recovery; indicate the distance between extraction, harvesting, and recovery and the project site.
 - 2) Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
- c. Include certification of data indicating Volatile Organic Compound (VOC) content of all joint sealants. Submit MSDS highlighting VOC limits. (LEED™ NC Version 2.2 Credit EQ 4.1)
2. Product data sheets on door and frame products: Provide chemical, functional, and environmental characteristics, size limitations, and special application requirements. Identify available colors.
3. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, and special application requirements.
4. Shop drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - a. 1/4 inch scale elevations and plans of each type of glazing assembly; Verify dimensions with field measurements.
5. Certification: Manufacturer's written certification stating that frames, and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section; that specified shop priming/finishing has been performed.
6. Manufacturer's instructions: Manufacturer's installation instructions and diagrams for components installed under other trades.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA - Glazing Manual.
- B. Installers:
 1. Installers, foreman, and job supervisors for the Work of this Section shall be trained by, and approved by, product manufacturer. Foreman and job supervisors shall be certified by manufacturer to have not less than 5 years experience in the installation of neutron / radiation shielding.
 2. All construction workers, foreman, and job supervisors for the work of this section shall have a minimum certification of 10 hours of OSHA training in occupational safety and health.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store and handle glass and acrylic in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.
 1. Carefully store materials to avoid overloading any building component or structure.
- B. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- C. Prior to shipping, identify each lead lined frame with a removable metal or plastic label which corresponds with door schedule identifying opening number and location.



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- D. Deliver materials boxed or crated to provide protection during transit and job storage.
- E. Inspect frames upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- F. Store frames at the building site upright and under cover. Place the units on wood dunnage and cover in a manner that will prevent rust and damage.

1.8 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on products of NELCO, 800 West Cummings Park, Suite 3950, Woburn, MA 01801, www.nelcoworldwide.com (telephone 800-635-2613).
 - 1. Manufacturing Facilities:
 - a. NELCO Boston: 3 Gill St - Unit D, Woburn, MA 01801
 - b. NELCO Houston: 4600 Homestead Road, Houston, TX 77028
 - c. NELCO San Francisco: 1840 Williams Street, San Leandro, CA 94577
- B. Alternative products (substitutions): Contractor must furnish appropriate and complete product data, proof of ISO 9001:2008 certification, worker OSHA certifications, environmental characteristics, and sample warranty with bid for the Architect to consider the substitutions as "equal" to the manufacturer, product specified and quality assurance requirements. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified products. There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.
 - 1. Requesting substitutions is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and for additional requests of information. Delays of work which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Owner.

2.2 LEAD LINED HOLLOW METAL FRAMES

- A. General: Refer to the Drawings for various types of frames, sizes, and profiles, UL fire-resistant label frames, and other characteristics of frames and related items.
 - 1. Frame type: Telescopic frames with mitered joints arc-welded, reinforced and ground smooth.

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2. Frame type: Shop welded frames with mitered joints arc-welded, reinforced and ground smooth.
- B. Materials for frames, reinforcement, anchors, anchor clips, and related items: commercial grade cold-rolled steel conforming to ASTM A109 or commercial grade hot-rolled and pickled steel conforming to ASTM A415.
1. Frame gage: 16-gage, 0.053 inch thick.
 2. Hinge, lock, and strike reinforcement: 7 gage thick.
 3. Door closer reinforcement: 12 gage, minimum 0.093 inch thick.
 4. Glazing stops: 16 gage, minimum 0.053 inch thick.
 5. Shop-fabricate frames as whole single units per opening, except when frame size is too large to ship as a single unit. Oversized frames may be shipped in large sections as practicable for field assembly with concealed splice plates or channels.
 6. Reinforcements, stiffeners, and base angle clips: Welded to interior surfaces of frames to provide a stable base and so as to not interfere with installation of hardware.
 7. Appearance of finished frames: Strong, rigid, completely free from warp and buckle, with miters well formed and in true alignment, and with surfaces smooth and free from defects of any kind.
 8. Glazing beads: Carefully place to properly accommodate the various thicknesses of glass and glazing materials, and loosely-attach to frames with flathead galvanized steel screws through pre-drilled holes having countersunk depressions.
 9. Line frames with sheet lead of same thickness as scheduled for partitions in which they occur.
 - a. Install sheet lead free of waves, lumps, and wrinkles with as few joints as possible.
 - b. Form and permanently adhere lead around and concealed behind the frame.
 10. Anchorage:

Note to Specifier: SELECT ANCHOR TYPE(S) BASED ON CONSTRUCTION

- a. Anchor clips for frames in metal stud partitions: 16-gage steel z-shaped clips, 1-1/2 inch upturned and downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.
- b. Anchor clips for frames in wood stud partitions: 18-gage steel with 3/4-inch high bendable straps, or equivalent type standard with the manufacturer, contained, for screw attachment to wood studs.
- c. Anchors for frames in masonry walls (new construction): Adjustable, T-shaped, positively engaging the retainers on both flanges of each jamb member, when placed. The stem of the anchors shall be 2 inches wide by 12 gage, minimum, corrugated or perforated for mortar bond, and extend 10 inches into the masonry, unless otherwise indicated.
- d. Anchors for frames in existing masonry walls: Counter-sunk bolts of minimum 3/8 inch diameter, set into masonry expansion shields.
- e. Provide not less than 3 anchors, clips, or bolts, per jamb, as applicable.



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2.3 LEAD SHEET

- A. General Sustainability Requirements: Use maximum available percentage of recycled materials but not less than that required to meet LEED™ NC, Version 2.2 Credit MR 5.2
 - 1. Lead Backing: Lead sheet incorporated into the work shall contain not less than 100 percent of pre-consumer recycled materials.
- B. Lead sheet: Conforming to ASTM B 29 in uniform thickness(es) as required by Physicist of Record report(s).

2.4 LEAD GLASS

- A. Provide clear x-ray lead glass with a thickness approximately 5/16 to 3/8 inch and installed in single or multiple layers to provide a lead equivalent as required by Physicist of Record report(s).

2.5 LEAD ACRYLIC GLAZING

Note to Architect: Typically available up to 6 by 8 feet in size. Larger by special order.

- A. Provide shatter-resistant, distortion-free optical clarity lead acrylic glazing.
- B. Fabricate lead acrylic glazing from acrylic copolymer resin into which lead is chemically introduced as an organolead salt compound. Provide polished lead acrylic glazing containing 30 percent minimum lead by weight.
- C. Install in single or multiple thicknesses to provide a lead equivalent as required by Physicist of Record report(s).

2.6 ACCESSORIES

- A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing, equal to one of the following or an approved equal:
 - 1. CRL 74418X38BL
 - 2. Pemko FG3000S45
 - 3. Pemko FG3000S90
 - 4. CRL 98418x38BL
- B. Setting blocks/Spacers: As required

2.7 FABRICATION TOLERANCES

- A. Maximum variation for lead lined frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

2.8 FACTORY FINISHING

- A. Preparation: Pressure-sand all surfaces of all frames, accessory items, anchors, and related items, to remove blemishes and foreign matter and provide paint grip. Spot-fill

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imperfections with metallic filler and sand smooth. Thoroughly clean the surfaces by applying hot or cold phosphate treatment standard with the manufacturer.

- B. Following cleaning apply one dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection. Bake, or oven dry, the primer at time and temperature recommended by the manufacturer for developing maximum hardness and resistance to abrasion.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable and in compliance with these specifications and applicable codes.
- B. Inspect glazing receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- C. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
- D. Beginning of installation means acceptance of existing conditions.

3.2 PROTECTION

- A. During the operation of the Work of this Section, protect existing work against damage by the exercise of reasonable care and precautions. Repair all existing materials which are damaged by Work of this Section, to match original profiles and finishes. Existing materials repaired shall be removed and replaced with new work to match existing.

3.3 INSTALLATION OF FRAMES

- A. Pre-coordination for rough openings in framing.
- B. General: Install frames in accordance with the manufacturer's recommendations, and applicable parts of ANSI A250.8. Install with a maximum diagonal distortion of 1/16 inch measured with a straight edge, corner to corner.
- C. Place in position all steel frames, in accordance with the approved shop drawings and frame schedule.
 - 1. Coordinate installation of frames with the various trades installing abutting wall construction for anchor placement and continuity of lead lining.
 - 2. Provide rigid temporary bracing for frames as required to ensure maintenance of positioning, and remove only after frames have been permanently anchored.
 - 3. Where exposed fastener heads occur in frames, fill with automotive body filler and sand smooth.

3.4 GLAZING

- 1. Utilize dry glazing methods for field installation of glass in interior doors and frames.



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2. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (2 mm) above sight line.
3. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane.
4. Place glazing tape on free perimeter of glazing in manner as described above.
5. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
6. Trim protruding tape neatly.

3.5 INSTALLED TOLERANCES

- A. Maximum variation from plumb or level: 1/8 inch.
- B. Maximum offset from true dimensional alignment: 1/8 inch.

3.6 FIELD QUALITY CONTROL AND ADJUSTING

- A. Field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
 1. Physicist testing will be performed under separate contract with Owner.

3.7 CLEANING

- A. General: Clean work under provisions of Section 01 73 00 - EXECUTION.
 1. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area.
- B. Daily clean work areas by disposing of debris, scraps, and lead. Vacuum floor surfaces with HEPA (High Efficiency Particulate Air filter) vacuum in compliance with OSHA Standard 1926.62.
- C. After completion of the work of this Section, remove rubbish, tools and equipment, and clean all wall, partition, and floor areas free from deposits of lead, and other materials installed under this Section. Vacuum surfaces with HEPA vacuum in compliance with OSHA Standard 1926.62.
- D. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

3.8 PROTECTION

- A. General Contractor is responsible to protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.

End of Section