2 Burlington Woods Dr, Suite 300
Burlington, Massachusetts 01803

800-NELCO-13 (800-635-2613)
www.nelcoworldwide.com

Section 13 49 19
LEAD-LINED PLYWOOD

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 lead-lined plywood 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 plywood.
      b. Lead batten strips, ribbons, and tabs as required for a complete installation.
   2. Daily and final cleaning of Work of this Section.

1.3 RELATED SECTIONS

A. Section 01 73 00 - EXECUTION: Administrative and procedure requirements for final cleaning and waste management.

B. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal support framing for lead-lined plywood.

C. Section 09 91 00 - PAINTING: Field-applied prime and finish coatings.

D. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.

E. Division 26 - ELECTRICAL: Electrical boxes and receptacles.

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 Society for Testing and Materials (ASTM):
      a. ASTM B 29 – Standard Specification for Refined Lead.
      b. ASTM D 5516 – Standard Test Method for Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to Elevated Temperatures
      c. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials

d. ASTM E 119 – Fire Tests of Building Construction and Materials.

3. International Organization for Standardization (ISO): ISO 9001:2008.
4. National Council on Radiation Protection and Measurements (NCRP):
   a. NCRP Report No. 144 – Radiation Protection for Particle Accelerator Facilities.
   b. NCRP Report No. 145 – Radiation Protection in Dentistry.
   c. NCRP Report No. 147 – Structural Shielding for Medical X-Ray Imaging Facilities.
   d. NCRP Report No. 148 – Radiation Protection in Veterinary Medicine.
   e. NCRP Report No. 151 – Structural Shielding Design and Evaluation for Megavoltage X- and Gamma Ray Radiotherapy Facilities.
5. 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
6. 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: Product data on lead-lined plywood products, performance data, physical properties, and installation instructions for each item furnished hereunder.
   a. Include material characteristics, size limitations, and special application requirements.
   b. Recycled material content: Indicate recycled content and provide manufacturer's written certification of recycled steel and lead products (LEED™ NC Version 2.2, MR Credits 4.1 and 4.2).
      1) Indicate percentage both post-consumer and pre-consumer recycled content per unit of plywood and lead products.
   c. Local / regional materials (LEED™ NC Version 2.2, MR Credit 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.
   d. Include certification of data indicating Volatile Organic Compound (VOC) content of all field-applied adhesives. Submit MSDS highlighting VOC limits. (LEED™ NC Version 2.2, EQ Credit 4.1)
2. Certifications:
   a. Manufacturer's written certification stating that lead-lined plywood systems and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section and are in compliance with Physicist of Record report(s), and that the applicator is qualified and approved to install the materials in accordance with manufacturer's product data.
   b. Installer certifications for OSHA 29 CFR 1926.

3. Shop drawings: Manufacturer's standard design details of critical intersections within assemblies and complete installation details where plywood shielding will interface with work of other sections.

B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
   1. Manufacturer's ISO 9001:2008 field quality control reports of field inspections, including manufacturer's final punch list.
   2. Manufacturer's warranties: Include coverage of installation for compliance with shielding requirements based on Physicist of Record report(s).

1.6 QUALITY ASSURANCE

A. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

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 DELIVER, STORAGE AND HANDLING

A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect. Do not deliver items to the site, until facility is enclosed, weather-tight, and an ambient temperature above 50 degrees Fahrenheit can be maintained by General Contractor.

B. Deliver lead-lined plywood on pallets, with tops and sides fully protected, and shrink-wrapped with polymer plastic film. Clearly identify brand name, identification, and address of manufacturer or supplier.

C. General Contractor is responsible to store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion, and damage from construction traffic and other causes.
   1. Neatly stack plywood materials flat to prevent sagging.
   2. Store sheets a minimum of 3 inches above concrete floor slabs.
   3. Cover lead-lined plywood with a polyethylene vapor retarder.

D. Handle board materials so to prevent damage to edges, ends, and surfaces.
   1. Avoid breaking adhesive bond between lead sheets and plywood.

E. Provide protection against contamination during handling, storage, and installation procedures.

1.8 ENVIRONMENTAL REQUIREMENTS

A. General Contractor is fully responsible, maintain ambient temperature above 50 degrees Fahrenheit for 24 hours before, during, and 48 hours after installation of lead-lined plywood assemblies.

1.9 SEQUENCING AND SCHEDULING

A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their 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 “Lead-lined Plywood” as manufactured by NELCO, 2 Burlington Woods Dr, Suite 300, Burlington, MA 01803, 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 MATERIALS

A. General Sustainability Requirements: Use maximum available percentage of recycled materials but not less than that required to meet LEED™ Credit MR 5.2

1. Lead Backing: Lead sheet incorporated into the work shall contain not less than 90 percent of post-consumer recycled materials.

B. Plywood Panels: EWA graded CDX INT, Group 2 species, touch-sanded, fire-retardant treated having Underwriters Laboratories stamp signifying a FR-S rating certifying a 25 or less flame spread and smoke developed value, when tested in accordance to ASTM E-84. Board thickness shall be as indicated on the Drawings.

1. Fire-retardant-treated wood products shall be free of halogens, sulfates, ammonium phosphate and have no added formaldehyde.
2. Size limitations for CDX Plywood is 48" x 96" x ¾" thickness. Other thicknesses available upon request.

C. Lead sheet: Conforming to ASTM B 29 in uniform thickness(es) as required by Physicist of Record report(s).

1. Plywood panel size up to 48" x 96":
   a. Thickness: 1/64 inch [0.40mm] to 3/4 inch [19.05 mm] lead sheet.

Note to Specifier: NELCO's 1" lead brick may be substituted for plywood lined with lead over 3/4"due to excessive weight; substitution subject to approval by Physicist of Record report(s) and site conditions.

2.3 ACCESSORIES

1. Lead Batten Strips (Ribbon Lead): lead strips, free from any imperfections, conforming to ASTM B29, having same thickness as lead lining on plywood. Provide 2 inch [50mm] wide lead strips for straight runs and 3 inch [76mm] wide lead strips at corners as required.
2. Lead Lining at Electrical Boxes, Medical Gas Penetrations, and Similar Conditions: Shall be shielded with the same thickness as lead in walls.

Note to Specifier: SELECT APPROPRIATE FASTENER TYPE

B. Fasteners: Type S, bugle head screws complying with ASTM C 1002, not less than 1 inch [25mm] length for applying lead-lined plywood to non-structural metal framing.

C. Fasteners: Type S-6 or greater fine thread rust resistant self-drilling screws complying with ASTM C 1002, not less than 1-1/4 inch [31mm] length, for applying lead-lined plywood to light gage metal framing having thickness of 0.033 to 0.112 inch [0.84 to 2.84 mm] thick.

D. Fasteners: Type W, bugle head screws complying with ASTM C 1002, not less than 1-1/4 inch [31mm] length for applying lead-lined plywood to wood framing and furring.

2.4 FABRICATION

A. Lead lining: Un-pierced lead permanently laminated to plywood sheet in factory with manufacturer's recommended adhesive.

2.5 SOURCE QUALITY CONTROL

A. Obtain lead accessories and lead-lined plywood products from a single ISO 9001:2008 certified manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that all items which are to be enclosed by Work of this Section have been permanently installed, inspected, and approved.

B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.

3.2 PREPARATION

A. During the operation of 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 - GENERAL

A. General: Perform erection procedures for the various plywood system conditions, except as otherwise specified, as set forth in GA 201, GA 216, the written instructions of manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.

B. Where fire-resistive rated assemblies are indicated, erect plywood systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.

3.4 INSTALLATION OF LEAD-LINED PLYWOOD

A. Prior to installation of lead-lined plywood:
   1. Plywood will be predrilled on site as required.
   2. Install lead lining at all electrical outlet boxes, medical gas boxes, and similar penetrations occurring in plywood.
   3. Make provisions for connection with lead-lined doorframes and for cutouts for vision panels.

B. Installation of lead battens: (Lead battens may be substituted with corner lapping as shown on approved shop drawings)
   1. For lead thickness less than or equal to 1/8 inch [3.17mm], install lead battens at all vertical stud framing, ceiling joists, and corner intersections of walls and ceilings as required.
   2. For lead thickness greater than 1/8 inch [3.17mm], lead battens are applied after the lead-lined plywood is attached. Corners and perimeter lead may be installed in multiple layers of 1/8 inch [3.17mm] material.

C. Screw-fasten boards to framing and furring, with ends and edges occurring over firm bearing. Screw fasten lead-lined plywood panels 8 inches [200mm] on center at panel edges and 12 inches [300mm] on center to intermediate framing members.
   1. Erect all lead-lined plywood vertically on wall surfaces. Install boards horizontally where required by code.
   2. For lead thickness greater than 1/8 inch [3.17mm], dado/rabbit plywood at vertical edges to equivalent depth of the lead lining. One horizontal edge dado/rabbit may be required depending on shielding height requirements.
   3. Erect ceiling plywood by staggering end joints over supports. Secure plywood with fasteners inserted through ceiling buttons; anchor fasteners directly to framing or suspended support system.
   4. Recess screws slightly into board surface.

D. Wherever items penetrate the plywood surfaces, use extra care in cutting the plywood to ensure a uniformly-dimensioned joint between the penetrating item and the plywood. Verify

the expected deflection factor of the penetrating members, and cut the plywood accordingly, to prevent damage thereto from the deflecting members.

3.5 TOLERANCES

A. Maximum variation for plywood partitions and ceilings from true flatness: 1/8 inch [3mm] per 8 feet [3 m], noncumulative.

3.6 FIELD QUALITY CONTROL

A. Field inspection and 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.

3.8 PROTECTION

A. General Contractor is responsible to protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section