



800 West Cummings Park, Suite 3950
Woburn, Massachusetts 01801

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

0Section 08 34 50 (08346)

NEUTRON / RADIATION SHIELDING SLIDING DOORS

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 pre-engineered neutron / radiation shielding sliding doors with framing 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. Neutron / radiation shielding sliding doors complete with internal reinforcing.
 - b. Linear motion system and support framing.
 - c. Programmable door operators.
 - d. Emergency hand crank.
 - e. Safety edge sensing system.
 - f. Battery backup system.
 - g. Presence detection system.
 - h. Optional accessories

1.3 RELATED SECTIONS

- A. Section 01 73 00 - EXECUTION: Waste management and recycling during Final Cleaning.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Openings for doors into concrete, placing concrete slabs and walls.

*Note to Specifier: OPTIONAL FACING MATERIALS MUST BE INSTALLED IN FIELD.
Optional facing materials may be furnished by others and installed by NELCO, or provided by NELCO.*

- C. Section 06 40 00 - ARCHITECTURAL WOODWORK: Furnishing of plastic laminate facing or wood veneer facing as indicated by the Contract Documents.
- D. Section 09 91 00 - PAINTING: Field-applied primer and finish coatings.
- E. Division 26 - ELECTRICAL: Conduit and power wiring for door operators, controls, and switches.

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1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section.
1. American National Standards Institute (ANSI) Standard A156.10-2005 – Power Operated Pedestrian Doors.
 2. American Society for Testing and Materials (ASTM):
 - a. ASTM A36/A36M - Standard Specification for Carbon Structural Steel
 - b. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - c. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 - d. ASTM B29 - Standard Specification for Refined Lead.
 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. 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.
 5. Underwriters' Laboratories, Inc. (UL) Standard 325 – Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems.
 6. 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

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 for each item furnished as part of the work of this Section. Additionally, furnish the following detailed information:
 - a. Product data sheets with power requirements for all door operator and safety components.
 - 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 of post-consumer and pre-consumer recycled content per unit of product.



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- 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 adhesives used for optional (wood veneer or plastic laminate) field facing. Submit MSDS highlighting VOC limits. (LEED™ NC Version 2.2, EQ Credit 4.1).
 2. Certification: Manufacturer's written certification stating that doors, and all related items to be furnished hereunder, meet or exceed the shielding performance requirements required by Physicist of Record's report(s).
 3. Manufacturer's instructions: Manufacturer's installation instructions and diagrams for components installed under other trades.
 4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 5. Shop drawings: Large-scale design details of door construction, including elevations and sections indicating all materials, gages, reinforcing, and anchorage.
 - a. Provide door elevations indicate seaming of optional applied veneer facing and substrate, or plastic laminated facing when facing materials are required as work of this Section.
 6. Welders' certificates as specified under Article entitled "QUALITY ASSURANCE", when requested.
- 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 materials and installation for compliance with shielding requirements based on Physicist of Record report(s).
 3. Operation and Maintenance Data, including information on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.6 QUALITY ASSURANCE

- A. Obtain neutron / radiation shielding sliding door, frame, and related hardware products furnished under this Section from a single ISO 9001:2008 certified manufacturer.
- B. Professionally designed and engineered.
- C. Welders' Certificates: Utilize only qualified welders employed on the Work. Submit verification that welders are AWS D1.1 and D1.4 qualified within the previous 12 months.
- D. 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 protective doors.



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2. All construction workers, foreman, and jobs 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 PRE-INSTALLATION CONFERENCE

- A. General Contractor shall prior to commencing the Work of this Section, conduct a pre-installation conference. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 1. Required attendees: Architect, General Contractor's Project Superintendent, Neutron / Radiation Shielding Sliding Door Manufacturer's Representative (as available by telephone conference call or webcast), and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - a. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
 - b. Division 26 - ELECTRICAL.
 2. Agenda:
 - a. Scheduling of concrete work and review of tolerance requirements.
 - b. Review of staging, material storage locations, and temporary protection during storage.
 - c. Review of installation schedule and access requirements.
 - d. Coordination of work by other trades.
 - e. Installation procedures for door controls and ancillary equipment.
 - f. Protection of completed Work.
 - g. Establish working environmental (exposure, temperature, and humidity) conditions to which Architect and Contractor must agree.
 - h. Discuss process for Owner's and manufacturer's inspection and acceptance of completed Work of this Section.

1.8 SEQUENCING AND SCHEDULING

- A. General Contractor is responsible to coordinate schedule of neutron / radiation shielding sliding doors, provide sufficient sized access route to location of installation and to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section is the responsibility of the General Contractor.
- B. Coordinate the work of this Section with the respective related trades responsible for field installed electrical and auxiliary components and for setting of frames in concrete.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site until all specified submittals have been submitted to, and approved by, the Architect.



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- B. General Contractor is responsible to store materials under cover and in a manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion, and damage from construction traffic and other causes.
- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the finished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.

1.10 FIELD MEASUREMENTS

- A. General Contractor is responsible to take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

1.11 WARRANTY

- A. Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. If, within one year after the Date of Substantial Completion of the Work or Designated portion thereof, or after the date for commencement of warranties, or by terms of an applicable special warranty required by the contract documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. The period of one year shall be extended with respect to portions of Work first performed after substantial completion by the period of time between Substantial Completion and the actual performance of the work. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives his or her right to require correction by the Contractor and to make a claim for breach of warranty. The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor.

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 "Neutron / Radiation Shielding Sliding Door" as manufactured by 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, 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



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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. Steel: ASTM A 36/A36M Standard Specification for Carbon Structural Steel.
- B. Lead sheet / brick: conforming to ASTM B-29, defect free. Uniform thickness(es) as required by Physicist of Record report(s).
- C. Borated polyethylene: High-density polyethylene consisting of polyethylene and 5 percent boric oxide in green color as required by Physicist of Record report(s).
- D. Rigid Polyethylene Sheet: HDPE (Rigid High-Density Polyethylene) as required by Physicist of Record report(s).
- E. Concrete as required by Physicist of Record report(s).

*Note to Specifier: OPTIONAL FACING MATERIALS ARE INSTALLED IN FIELD, AND MAY EITHER BE FURNISHED BY OTHERS OR PROVIDED BY NELCO AS REQUIRED
MODIFY OR DELETE VENEER FACING / PLASTIC LAMINATED FACING AS REQUIRED
Note: Wood veneer facings are installed over a composite board substrate which is attached to door.*

- F. Optional Veneer Facing: Face veneer shall be minimum 1/28 inch thick meeting AWI Premium Grade Standards (installed). Each exposed face shall be of tight smooth veneer with joints parallel to vertical edges with no sharp contrasts.
 1. Matching to other work: Match species, cut and appearance of veneers on wood doors specified under Section 08 14 16 - FLUSH WOOD DOORS.
 2. Veneer Grade: "A"
 3. Wood Species: _____, [Rift] [Quartered] [Plain] [Flat] [Rotary] Sawn.
 4. Matching of adjacent pieces of veneer: [book matched] [slip matched].
 5. Panel face assembly: [Balanced] [Running].
 6. Direction of Grain: Vertical
 7. Matching of Adjacent Panels: Sequence matched uniform size sets.
 8. Substrate for Veneer Facing: Medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 45 pounds per cubic foot.
- G. Optional Plastic Laminate Facing: conforming to NEMA LD3.1 -1991 Grade GP50, nominal 0.050 inch thickness, in a low non-directional texture.
 1. Matching to other work: Match laminate manufacturer, pattern, and color on wood doors specified under Section 08 14 16 - FLUSH WOOD DOORS.



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2. Laminate manufacturer, pattern, and color: Match Architect furnished sample.

2.3 COMPONENTS

- A. Structural Steel Supports: Structural steel complying with ASTM A36 for beams and rectangular tubing complying with ASTM A500. Engineer structural support system based upon the length, width, thickness, and weight of the door.
 1. Maximum allowable deflection of overhead support beam under full loading: .015 inch over length of beam.
- B. Linear Motion System: Block type linear motion system, upper side mounted dual rail system with a minimum of four slide units (blocks). The blocks shall be mounted below a manufactured spacer plate which will allow for limited vertical height adjustment. Rails shall be mounted a main support beam and bolted with M-10 cap bolts as required.
 1. Accuracy Class: High.
 2. Lubrication: Pre-packed, high quality, lithium soap based grease containing extreme pressure additives.
- C. Door Operators: Electric, self-contained ball screw/nut automatic door operator, with power opening and power closing features including two press wall switches. Two kill switches for use with power cutoff when radiation machines are in use shall also be provided. Operators shall conform to the following criteria:
 1. General: Underwriters Laboratories (UL) listed, self contained, surface mounted electro-mechanical device mounted to the transom bar and shall include all required controls.
 - a. Supply Voltage: 115 Volt AC, 50/60 Hertz, single phase. Provide in-line circuit breakers, surge protection, line filters and EMI ferrites.
 - b. Enclosure Type and Rating: NEMA 1 vented enclosure / control box.
 2. Door Operator Performance Criteria (for doors weighing up to 30,000 pounds).
 - a. Peak Operating Force (maximum): 700 pounds [3115kg].
 - b. Continuous Operating Force (maximum): 500 pound [2225kg].
 - c. Travel (maximum in one direction): 60 inches [152.4cm].
 - d. Rated Linear Speed (Maximum): 4.5 inches per second [11.43 cm/sec].
 - e. Rated Door Weight (Maximum): 30,000 pounds [13,620 kg].
 - f. Minimum Rated Cycles (openings and closings): 500,000.
 - g. Acceptable Manufacturer and Model: Brookfield Industries, Inc., Thomaston, CT., Model "NB-4000".
 3. Function: Doors shall be activated on each side by a press wall switch. Operator to function as a manual door closer in the event of any power loss. Manual operation is provided by disconnecting the operator from the door by operation of emergency hand crank.
 4. Operation: The door is automatically opened or closed by pushing one of the four button switches located on the interior and exterior walls.
 - a. Sequence of Operations:
 - 1) OPEN: When button is pushed, door will travel to the full open position. The open button will override both the partial open and close buttons. When the



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- open button is pushed, there will be a one-second delay before the door begins to open.
- 2) CLOSE: When button is pushed, door will travel to the full close position. The close button will not override any other buttons. The door must stop before it can close.
 - 3) STOP: When button is pushed, door will stop from any current position along its path of travel.
 - 4) PARTIAL OPEN / PARTIAL CLOSE: When button is pushed, door will travel to the preset partial open position and stop. Button will over-ride close and has a one second delay before opening.
- D. Electric Sensing Edges: Provide 5 reversing edges on the lead edge of the door. When more than 4 pounds (18N) of pressure is applied to the reversing edge, an electronic signal shall be sent to the door operator and cause the door to stop and then open.
1. Edges shall be UL rated.
 2. Mounting channel: Extruded aluminum.
 3. Housing cover: Low-profile type, Black PVC, and provided with end closure covers.
- E. Switches: Furnished and installed by door manufacturer, with field connections provided under Division 26 – ELECTRICAL.
- F. Presence Detection System: Active infrared presence sensor providing two infrared curtains (one on each side of door) that shall detect stationary humans or objects within the sensing pattern.
1. General characteristics:
 - a. Infrared curtains, comprised of 2 rows of 24 focused infrared spots, shall have angle adjustment capability, and shall be capable of reaching within 2 inches (51 mm) of the face of the sliding door.
 - b. Sensor shall have a narrow or wide sensing pattern as determined by a user-selectable lens. Pattern size adjustments made by field masking a lens shall not be acceptable.
 - c. Sensor shall provide a 6 feet 6 inches (1.98 m) wide (wide lens) pattern when mounted at 7 feet (2.13 m), and a 3 feet 3 inches (1 m) wide pattern when using the narrow lens.
 - d. Sensor shall have a minimum self-adaptation time of 30 seconds that enables the sensor to learn permanently changed environments.
 2. Model, approved equal to: BEA, Inc., Pittsburgh, PA., Model "Iris".
- G. Emergency Power Supply: Provide battery backup system for operator to allow for the emergency opening of the door during loss of power supply. In an emergency situation the OPEN button shall operate in a "dead man" mode, requiring the OPEN button to be continuously pressed to operate the door.
1. Battery Backup: Two 12 VDC, 7.0 Ah battery with float chargers and test switch shall be assembled in a grounded and vented NEMA 1 control box.
 2. Location selected by customer.



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2.4 FABRICATION

- A. General: Refer to Drawings for location of doors. Comply with door sizes, thickness(es), and details indicated on reviewed and approved shop drawings.
- B. Construction: Full flush type, component thickness as indicated on Drawings and as specified in Physicist of Record's report(s).
 - 1. Doors shall be fabricated from perimeter frames of flat steel bar or plate complying with ASTM A36.
 - 2. Door faces: 3/8 inch thick steel plate complying with ASTM A36.
 - 3. Stiles: 3/4 inch thick flat steel bar or plate.
 - 4. Rails: 1 inch thick flat steel bar or plate.
 - 5. Core Construction: Manufacturer's standard lead sheet / brick, borated polyethylene, and concrete core.
- C. Fabrication
 - 1. Fabricate exposed faces of door panels, concealed stiffeners, and reinforcement from either cold-rolled or hot-rolled steel (at manufacturer's option).
 - 2. Fabricate doors with hardware reinforcement welded in place.
 - 3. Doors shall be all welded construction, grind all welds smooth, and provide shop applied primer.

2.5 FABRICATION TOLERANCES

- A. Maximum variation for doors: Maximum diagonal distortion 1/4 inch measured with straight edge, corner to corner.

2.6 FACTORY FINISHING

- A. Provide temporary painted finish for corrosion protection during delivery, storage, and handling. Sand surfaces of doors and related exposed steel components. Clean surfaces and apply one rolled, or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all exposed to view surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes and tolerances are acceptable and in compliance with these specifications and applicable codes.

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.



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3.3 INSTALLATION

- A. General: Doors, operators, switches, and related safety equipment shall be installed by the manufacturer's trained installers as indicated on the approved shop drawings.
 - 1. Door speeds: Custom set by the manufacturer.
 - a. 20 to 22 seconds to fully open.
 - b. 10 seconds to 24" partial open.
 - 2. Electrical components and switches shall be connected to the electrical distribution system under Division 26 - ELECTRICAL.
 - 3. Removal of temporary finish, preparation for painting and field painting shall be performed under Section 09 91 00 - PAINTING.

*Note to Specifier: OPTIONAL FACING MATERIALS MUST BE INSTALLED IN FIELD
MODIFY OR DELETE VENEER FACING / PLASTIC LAMINATED FACING AS REQUIRED.
Note: Standard door edges are painted exposed steel; wood or laminated faced edgings are not recommended.*

- B. Installation of Optional Facing Materials:
 - 1. Prerequisite Environmental Requirements: General Contractor is required to ensure that building and storage areas are maintained sufficiently dry so that facing materials will not be damaged by excessive changes in ambient humidity and relative moisture content. All Concrete masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage, and installation of facing materials.
 - a. General Contractor shall maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of facing materials; maintain temperature after installation until Owner's Final Acceptance.
 - b. General Contractor shall maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of facing materials: maintain relative humidity after installation until Owner's Final Acceptance.
 - 2. Optional Wood Veneer Facing: Specified wood veneer adhered to composite board substrate which is permanently fastened to steel face of neutron / radiation shielding sliding doors.
 - a. Seam locations of plywood substrate and veneer indicated on Shop Drawings.
 - 3. Optional Plastic Laminate Facing: Specified plastic laminate adhered directly to steel face of neutron / radiation shielding sliding doors.

3.4 INSTALLED TOLERANCES

- A. Maximum variation from plumb or level: 1/4 inch [6 mm].
- B. Maximum offset from true dimensional alignment (offset of jamb walls being parallel and aligned with each other): 1/4 inch [6 mm].

3.5 FIELD QUALITY CONTROL AND ADJUSTING

- A. Field inspection will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.

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1. An authorized representative of Door Manufacturer shall inspect installation and certify that operating and safety hardware, and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.
- B. Adjust and check each operating item of hardware and each door.
 1. Ensure proper operation or function of every unit.
 2. Replace faulty items or components which cannot be adjusted to operate freely and smoothly as intended for the application made.
- C. Physicist testing will be performed under separate contract with Owner.

3.6 DEMONSTRATION AND TRAINING

- A. Neutron / radiation shielding sliding doors must be operated by trained personal only. Manufacturer shall furnish Owner with prerecorded training demonstration on DVD disc, which will include a demonstration on door safety features and emergency operation. Additional manufacturer's training assistance, if required, shall be made available by webcast or telephone conference call.

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