

SECTION 13 21 49
AUDIOLOGY BOOTH

SPEC WRITER NOTE: Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs. VA Standard equipment schedules and installation details may be shown on architectural drawings.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This specification addresses prefabricated audiometric examination on booths and rooms/suites suitable for the use in testing, calibration, and recording of aural acuity.
- B. A booth is defined as a free-standing double walled examination room.
- C. A suite is defined as a combination of a single or double walled control room and a double walled examination room (rooms are parts of suites).
- D. Henceforth, the term "audiometric booth" will be used generically when referring to booth, room, or suite. An audiometric booth covered by this specification includes all enclosure panels, components, wiring, lighting fixtures (including dimmers), ventilation silencers, and installation to make the booth completely operable.

1.2 RELATED WORK

- A. Section 21 13 13 WET-PIPE SPRINKLER SYSTEMS: Sprinkler connections.
- B. Section 23 05 11 COMMON WORK RESULTS FOR HVAC: HVAC systems.
- C. Section 26 05 11 REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Electrical work.

1.3 DESIGN CRITERIA

- A. This specification addresses prefabricated audiometric examination on booths and rooms/suites suitable for the use in testing, calibration, and recording of aural acuity. A booth is defined as a free-standing double walled examination room. A suite is defined as a combination of a single or double walled control room and a double walled examination room (rooms are parts of suites). Henceforth, the term "audiometric booth" will be used generically when referring to booth, room, or suite. An audiometric booth covered by this specification includes all enclosure panels, components, wiring, lighting fixtures (including

dimmers), ventilation silencers, and installation to make the booth completely operable.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
- C. 1. Diagrams and details of piping, wiring and controls.
- D. Operating Test Data.
- E. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS. Product Data:
- F. Shop drawing submittal shall include, at a minimum, the following:
 - 1. Booth layout
 - 2. Booth roof plan
 - 3. Booth exterior elevations
 - 4. Booth interior elevations
 - 5. Booth floor plan, including dimensions
 - 6. Details including, but not limited to, roof connection, floor seam, wall connection, and door header details.
 - 7. HVAC Details
 - 8. Electrical plan and details
 - 9. Sprinkler details
- G. Operational Test Reports: Provide reports on filed inspections and testing:
 - 1. Panel weight and finish
 - 2. Connectivity of components
 - 3. Ambient and noise reduction levels

1.5 QUALITY ASSURANCE

- A. Quality Assurance Inspection: Upon delivery of materials, VA may conduct the following pre-installation and post-installation inspections. Should the audiometric booth fail to meet any of the requirements of this specification, contractor shall replace or repair the defective components.
- B. Inspection of Material Prior to Installation: Upon delivery of the audiometric booths, contractor to inspect the panels and materials to be used to construct the booths. Individual panels and enclosure components may be visually inspected to ensure that they are identical to the physical description provided on the test reports submitted by the contractor. In the event that there are substantial deviations

between the actual construction of the materials utilized to construct the enclosure and the physical description of the components on the contractor's test reports, the non-complying materials may be rejected. Individual panels may be weighed and panels that weigh more than 10% less than the panel weights indicated on contractor's test report may be rejected.

- C. Inspection after Completion of Installation: Upon completion of installation, COR shall conduct reviews to ensure that:
 - 1. Audiometric booths are installed such that the floors are level and the walls are plumb.
 - 2. The audiometric booth finish has proper paint coverage and no dents or scratches. Any finish defects shall be repaired by the contractor.
 - 3. Audiometric booth doors are properly aligned and swing freely without binding other than as necessary for proper sealing.
 - 4. All electrical components and jack panels are operational.
- D. Compliance with Ambient Noise Level and Noise Reduction Requirements: Prior to acceptance and upon completion of installation, connection of building services, and with all electrical, lighting, and HVAC systems in operation, contractor will conduct ambient noise level measurements at the typical patient location in the completed enclosure to ensure compliance with the maximum ambient sound pressure levels permitted by ANSI S3.1-1991. Measurements of enclosure noise reduction will be made in accordance with ASTM E336-90 to ensure compliance with requirements of section
- E. 13.2. Results of these noise reduction measurements made in completed enclosures shall be within 6 dB of the specified laboratory noise reduction figures in section 13.2.
- F. If the audiometric booth fails to meet the requirements of section 16.3 and 16.4, (or special requirements specified in the attachment), the contractor shall correct the deficiencies in the audiometric booth and retest the booth until it meets all requirements of this specification. All costs associated with testing and repair of the audiometric booth shall be borne by the contractor.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

- E596-96(2016)Laboratory Measurement of the Noise Reduction
of Sound Isolating Enclosures.
- C423-17Sound Absorption and Sound Absorption
Coefficients by the Reverberation Room Method
- E90-09(2016)Laboratory Measurement of Airborne Sound
Transmission Loss of Building Partitions
- E413-16Determination of Sound Transmission Class (also
NIC)
- E84-20Test Method for Surface Burning Characteristics
of Building Materials (or equivalent UL or NF-FA
test standards)
- E119-20Fire Tests of Building Construction and
Materials (or equivalent UL or NFPA test
standards)
- E2257-17Fire Tests of Wall, Ceiling Materials, Door
Assemblies (or equivalent UL or NFPA est
standards)
- E336-20Standard Test Method for Measurement of
Airborne Sound Insulation in Buildings

C. American National Standards Institute standards numbered:

- S3.1-1991Criteria for Permissible Ambient Noise,
Audiometric Testing
- S3.6-1989Specifications for Audiometers

D. Federal Specification (Fed Spec

- DDD-C-95Carpets and rugs, wool, nylon, acrylic.

E. Federal Flammability Standard FF-1-70, Standard for the Surface
flammability of Carpets and Rugs (Pill Test).

F. National Electric Code (NEC)

- Article 545.....Manufactured Buildings.

G. American Society of Heating, Refrigeration and Air Conditioning
Engineers (ASHRAE)

- Guide Data Book (1982) Chapter 3, Systems and Equipment Duct Manual

H. American Concrete Institute (ACI)

- ACI 117-81Standard Tolerances for Concrete Construction
and Materials

I. National Security Agency (NSA)

Specification NSA No. 65-6, 30 October 1964

Specification for RF Shielded for Communications Equipment: General
Specification.

- J. National Fire Protection Association (NFPA)
NFPA 257(1990).....Standard for Fire Tests of Window Assemblies
(or equivalent industry test method).

1.7 WARRANTY

- A. The manufacturer shall provide the hospital with a limited warranty that covers mechanical equipment for 12 months and computer and electronic equipment for 24 months. During the warranty period, any defective part(s) returned to the manufacturer shall be repaired or replaced at the manufacturer's discretion.
- B. "Warranty of Construction" articles of FAR clause 52.246-21. The one-year Warranty shall commence after final inspection, completion of performance test, and upon full acceptance of the installation and run concurrent with the guarantee period of service.
- C. Ordinary wear and tear of equipment, damage caused by improper use, and damage caused by improper maintenance is excluded from the limited warranty. During warranty period if a device is not functioning properly in accordance with specification requirements, more maintenance than the contract requires keeping device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

PART 2 - PRODUCTS

2.1 CONFIGURATION

- A. Audiometric booths shall be Single Wall Control/Double Wall Exam Suite and Double Wall Exam Booth
- B. Size: See drawing. Booth inner heights shall be minimum 6 feet-8 inch.
- C. A maximum four inch tolerance is allowed on length and width to permit booth to fit into standard footages of space. Heights specified herein are without ventilating units or discharge silencers, roof or wall mounted.
- D. Exterior Enclosure Dimensions: Outside dimension of enclosure will be determined by the specified interior enclosure dimensions, the enclosure

configuration, and the thickness of the enclosure panels and airspaces required to meet the specified acoustical performance criteria.

- E. Exterior Dimensions of Suites with Common Outer Shells: Installations requiring multiple audiometric booths may be installed in common outer shells in order to conserve floor space. Installations involving common outer shells shall be designed such that the acoustical isolation between enclosures at least equals that specified for double wall enclosures herein.

2.2 DESIGN

- A. Audiometric booth and all components thereof shall conform to the requirements specified herein. All parts of the booth having the same manufacturer's part number shall be completely interchangeable with respect to installation and performance. Booth shall consist basically of the following components:
 1. Vibration isolation system.
 2. Floor assembler.
 3. Wall and roof panel assembly.
 4. Acoustical door units.
 5. Acoustical window units.
 6. Assembly hardware, including connecting panel joints.
 7. Electrical and lighting wiring, components and fixtures.
 8. Silenced forced air ventilation System or packaged air conditioning silencers for connection to building HVAC systems.
 9. Carpeting.
 10. Paint and other specified finishes.
 11. Dust seals/shields and closure strips.
 12. Jack panel.

2.3 MODULAR COMPONENTS

- A. The audiometric booth shall be constructed of modular, prefabricated panels and assembly hardware. Enclosure must be capable of being disassembled, moved, and reassembled at some future date with minimal loss of material or acoustical integrity.

2.4 INDEPENDENT STRUCTURE

- A. Audiometric booths shall be independent, free standing structures, providing all required structural support for the enclosure as an integral part of its design. Booth shall not make structural contact with the facility at any place except at the floor/wall connection and at the vibration isolation systems and, except for the floor, shall not

depend on the facility for any of its structural support. Audiometric booths shall be furnished as completely prewired, upon assembly, and ducted for HVAC services. Electrical service shall be wired so as to allow for single point electrical tie-in for each booth by the Project General Contractor or VA Engineering Service personnel. HVAC silencers shall be configured so as to allow the connection of standard flexible vibration isolating ductwork from the main facility HVAC ductwork to the audiometric booth silencers by the audiology booth contractor/vendor.

2.5 STRUCTURAL REQUIREMENTS

- A. Audiometric booth panels and structural support system shall be of sufficient structural design so as to be capable of supporting uniformly distributed roof loads of 55 pounds per square foot and lateral wall loads of 20 pounds per square foot.
 - 1. Load on Facility Floor: Audiometric booths shall present a maximum average live load to the facility of no more than 100 pounds per square foot. The average live load of the audiometric booth is defined as the total assembled weight of the booth divided by the exterior plan area it occupies and does not include any additional loads added by the personnel or equipment that occupies the booth. Contractor shall supply COR with a detailed floor loading distribution, specifying location and magnitude of point and line loads presented to the facility floor by the enclosure outer shell and vibration isolation rails.

2.6 FLOORS

- A. All audiometric booths shall employ isolated acoustical floor systems in both control and examination room areas. Isolated floor systems on all examination rooms shall support the examination room walls so as to fully isolate the floor, walls and ceiling of the enclosure from facility area vibrations. Isolated floors in control room areas of single wall control/double wall exam suites may be set inside of the wall panels to facilitate efficient construction of the suite. Isolated floors in control room areas of double wall control/double wall exam suites shall fully support and isolate the wall and ceiling panels of the control room.
- B. Floor panels shall be constructed of welded framework of formed steel channel, sheet steel top and bottom skins, and shall be fully insulated. Structural framing shall be minimum 11 gauge cold rolled

- steel channel sections, spaced as required to meet the structural requirements specified herein. Top walking surface shall be minimum 11 gauge sheet steel. Bottom floor panel closure skin shall be minimum 20 gauge sheet steel. Floor panels shall be fully insulated with acoustical filler material which is inert, mildew resistant, and vermin resistant.
- C. Floor panel and isolation system shall accommodate a 60 pound per square foot live load without structural deflection which exceeds L/240.
 - D. Floor panels shall be welded so as to provide a flat, smooth walking surface, and sheet steel shall be attached to floor panel framework in a manner so as to prevent "popping" or "oil-canning". Any defects in floor panels that are caused as a result of broken welds or other defective construction methods shall be fully repaired by the contractor at the time of installation.
 - E. Unless otherwise specified due to unique site conditions, all audiometric booths shall be provided with a vibration isolation system with a cutoff frequency of 6 1/4 Hz. The load from each required isolator in the isolation system shall be distributed to the facility floor through a steel channel isolation rail. The concentrated point load in the isolation rail system shall not exceed 800 pounds at any point.
 - F. Unless otherwise specified, audiometric booths shall be installed in a pit with a depth of 4 5/8 inch. Booths will have flush entry to control and exam room without any modification needed to existing 4 5/8 inch concrete depression Pits shall be prepared in accordance with the following guidelines:
 - 1. Pit Depth: Audiometric booth pits shall be 4 5/8 inch deep, from the bottom of the pit to the top of the facility building floor. Allowance for area floor coverings must be made when determining pit depth to ensure that audiometric booth doors will clear the building floor coverings.
 - 2. Pit Size: The length and width of the pit shall be 4 inch larger in each direction than the outside dimensions of the audiometric booth, except at the front of the booth (the entry side), where the pit need only allow a 1 inch clearance. The pit shall be square to within 1/4 inch in 20 feet.
 - 3. Pit Edges: The edges of the pit shall be square and true through the length and width of the pit. The radius of the corner between the bottom of the pit and the pit edge wall shall not exceed 1/2 inch.

Pit edges shall be trowled smooth and cleaned of all debris that may contact the audiometric booth.

4. Level of Facility Slab: Facility building concrete floor or pit shall be poured in accordance with American Concrete Institute Standard Tolerances for Concrete Construction and Materials standard ACI 117-81 as a minimum requirement. Facility area concrete floor or pit shall be level to 1/4 inch in any 10 foot section for proper installation of audiometric booth.
5. Facility Slab Structural Requirements: The area floor or pit shall support a minimum live load of 200 psf (100 psf for the audiometric booth plus a 100 psf allowance for audiometric booth equipment, patients, and personnel).
- G. Where above floor units are provided in existing construction, provide accessible ramp and rail system.

2.7 WALL AND CEILING PANELS

- A. Prefabricated Panels: The audiometric booth shall be constructed of prefabricated steel wall and ceiling panels that meet the modularity requirements of section 3.2. Panels shall be 4 inch thick, unless specified otherwise due to special acoustical considerations. Panels shall be constructed of a welded framework of formed steel channel, a solid sheet steel outer panel skin, a perforated steel inner panel skin, and shall be fully insulated. Structural framing shall be minimum 18 gauge steel channel sections on no less than 24 inch centers. Panel outer skin shall be minimum 16 gauge electro-galvanized, bonderized cold rolled steel. Panel inner skins shall be minimum 22 gauge electro-galvanized, bonderized perforated steel, with perforations not exceeding 1/8 inch diameter and a perforation pattern that provides at least the minimum sound absorption required in section 13.4.
- B. Panel Weight: Audiometric booth wall and ceiling panels shall meet the acoustical requirements indicated. The actual per square foot weight of the wall and ceiling panels required to meet these acoustical requirements may vary, provided that the overall enclosure floor loading does not exceed the requirements of noted. In no case shall the average per square foot weight of the wall and ceiling panels used in construction of the booth be less than 8 pounds per square foot.
- C. Panel Fill Materials: Audiometric booth walls, ceilings, floors, and doors shall be fully insulated with acoustical filler material which is inert, mildew resistant and vermin resistant. Insulation shall be packed

into the panel so as to fully fill the panel cavities, leaving no voids. Fill materials shall provide at least the minimum sound absorption properties required. All fire rating requirements specified herein shall be met.

- D. **Quality of Construction:** Panels shall be welded so as to secure outer panel skins to the panel framework to prevent bulges, creases, or looseness in the skin. Inner panel skins shall be spot welded or pop-riveted to the panel framework to secure the perforated steel to the framework, to constrain the acoustical fill material, and to prevent "oil-canning" of the inner panel skin. All exposed welds shall be ground smooth.

2.8 DOORS

- A. **Door Assemblies:** Each audiometric booth shall be provided with one acoustical door and frame assembly per room. Door and frame assembler shall consist of one door on single wall enclosures and two doors on double wall enclosures.
- B. **Door Construction:** Noise-Lock Doors shall be flush mounted and pre-hung. Assemblies complete with leaf, frame, seal, cam-lift hinges, glass and glazing (when specified) and finish hardware shall be provided. Door leaf shall be 2 1/2 inch thick with a clear opening 6 feet 1/2 inch high and widths as shown on drawings. Door frame shall be a factory welded split design and filled with an acoustical dampening material. The assembly shall be designed to install after the room is completely assembled. Acoustic performance of the assembly shall meet or exceed the wall.
- C. **Door Acoustical Performance:** The transmission loss of the door and frame assembly shall have a minimum STC (Sound Transmission Class) rating of 47 as specified in section 13.3.
- D. **Door Hardware:** Doors shall be furnished with a minimum of two (2) cam-lift butt-type hinges finished in US 26D dull chrome. Hinges must meet fatigue test requirements of cycling a minimum of 125,000 times while supporting a door leaf of 550lb. Submit test report. Provide entry and exit handles, push and pull plates, self-closer, and all required door seals. Door leaves, frames, seals, and hinges shall be factory assembled, adjusted and shipped, ready for installation. Door hardware or locking mechanisms may be specified.

- E. Jambs and head of doors and frames shall have two (2) sets of self-aligning magnetic-sound absorptive compression seals. Latches shall not be required to hold the door closed or to achieve an acoustical seal. Bottom of door leaf shall contain continuous gravity compression seal and shall not have any moving parts. The door leaf shall compress against sill plate as door is closed by cam lift action. Raised sills, threshold drop seals, and sweep seals shall not be permitted. The door threshold shall not be raised more than 1/4 inch above the floor coverings inside or outside the booth, whichever is higher.
- F. Quality of Construction: Door leaves and frames shall be welded so as to secure skins to the internal framework in a manner that prevents bulges, creases, or looseness. All exposed welds shall be ground smooth. Exposed surfaces of door and frame shall be filled as required and ground smooth prior to painting.
- G. Door Configurations: Enclosure door configuration for double wall examination rooms shall be one of the following:
1. Inswing/Outswing
 2. Piggyback
 3. Tandem Outswing
- H. Door Clear Openings: The clear opening of all doors shall not be less than 3 feet 0 inches wide by 6 feet 1 1/2 inch high. One suite at each location shall have an opening of 3 feet 6 inch. Discuss door configurations during design.
- I. Door Dust Shields: Door openings on double wall booths shall be furnished with dust shields between door openings. Dust shields shall be flexible, non-metallic, black material and shall not compromise the vibration isolation between the inner and outer enclosures.
- J. Door Fire Ratings: Acoustical door and frame assemblies shall meet the fire rating, requirements of section 14 of this document.

2.9 WINDOWS

- A. Window Assemblies: Each audiometric booth or room shall be provided with one patient viewing window and windows in doors as specified in this section.
- B. Window Construction: Windows shall be double glazed, clear, 1/4 inch minimum thickness, laminated (safety) glass. Window panes shall be mounted in acoustically tight, neoprene-gasketed frames and shall be separated by 4 inch airspace. Airspace within the frame shall be filled with an acoustical insulation to dampen window resonances and shall be

covered by a perforated steel liner. Desiccant material shall be installed between window panes to prevent condensation, and shall be so placed that the view through the window is not obstructed. Glazing shall be mounted in aluminum trimmed acoustically tight resilient rubber seals. Window replacement shall be possible without removing any panel or part of the sound room wall. Acoustic performance of the window assembly shall meet or exceed the wall. Exposed fasteners shall not be allowed.

- C. Patient Viewing Window Size: Unless specified otherwise, the size of the patient viewing window shall be no less than 2 feet 6 inch wide and 2 feet 10 inches high and shall be located no less than 32 inches above the examination room floor. Patient viewing windows of larger sizes may be specified on the attachment.
- D. Windows in Doors: Audiometric booth doors shall be provided with a minimum of 12 inch by 12 inch windows in the door leaves as specified.
- E. Window Dust Shields: Double wall enclosures and suites shall be provided with dust shields between the window units. Dust shields shall be flexible, non-metallic, black material and shall not compromise the acoustical and vibration isolation between the inner and outer enclosures.
- F. Window Fire Rating: All windows in wall assemblies shall meet fire rating requirements specified.

2.10 VENTILATION AND AIR CONDITIONING SYSTEMS

- A. Ventilation System: Audiometric booths shall have a ventilation system that provides airflow to each enclosure. Ventilation systems shall include air transfer silencers to meet the acoustical performance requirements and ventilation openings and grills on the interior of booths. The ventilation system shall be ducted to facility building HVAC services.
- B. Materials and Construction: The audiometric booth ventilation system silencer and fan housings shall be either an integral part of the enclosure design or packaged HVAC silencers inserted in the facility ductwork. Outer casings for HVAC silencers and fan housings shall be of galvanized sheet steel construction and shall be constructed in accordance with ASHRAE guidelines. Liner materials shall be of inorganic mineral or glass fiber materials of a sufficient density to obtain the required acoustical performance. Acoustical liner materials shall be

inert, mildew resistant and vermin resistant and shall have ASTM E84-87 fire ratings that meet or exceed the requirements of section 15.

- C. Direct Coupled Ventilation Systems: The audiometric booth shall be provided with a ventilation system designed to be connected to the facility building HVAC systems. Audiometric booth silencers shall be equipped with 8 inch diameter flexible duct ring connection points to be used for connection to the building HVAC systems to provide vibration isolation from the duct work of the building HVAC system. Ventilation silencers shall be wall or roof mounted. Ventilation silencers shall accommodate an airflow rate that will allow for one complete air change every 10 minutes.
- D. Pressure Drop in Direct Coupled HVAC Systems: Audiometric booths which are connected to building HVAC systems shall be equipped with silencer systems that provide pressure drops that do not exceed 0.25 inches H₂O at an airflow rate corresponding to one complete air change every 10 minutes. All airflow and pressure drop measurements shall be in accordance with ASHRAE guidelines.
- E. Acoustical Performance of Direct Coupled HVAC Systems: The resultant noise levels inside of the audiometric booth shall not exceed the values specified, provided that the facility HVAC system sound pressure levels at the connection point to the audiometric booth silencers do not exceed the levels in Table 1 in this section.

Table 1
Maximum Allowable Sound Pressure Levels (SPL) at Connection Point
of Facility HVAC System to Audiometric Booth Silencer

Octave Band Preferred Center	Single Wall Control Room	Double Wall Booths/Rooms/Suites
Frequency (Hz)	Maximum Allowable SPL (dB)	Maximum Allowable SPL (dB)
63	57	64
125	48	57
250	41	51
500	35	45
1000	31	41
2000	29	39
4000	28	38
8000	27	37

F. Noise Levels of Ventilation Systems Outside the Audiometric Booth: For a free-standing, double walled examination booth which is located within a room in the facility, the fan assembly used in the ventilation system shall not produce noise levels which would preclude live-voice testing or other activities in the room housing the booth.

G. Thermostats for Control of Direct Coupled HVAC Systems: Audiometric booths shall be provided with recessed junction box and conduit for use in providing thermostatic control of HVAC systems. The thermostat and connection to HVAC systems are the responsibility of the construction contractor.

2.11 ELECTRICAL

A. Electrical Systems: All electrical components and conduits shall be recessed into the wall panels and shall be wired in accordance with NEC standards. All electrical components shall be UL (or equivalent laboratory approved) listed Hospital Grade components and shall operate on 110 V, 60 Hz, single phase power. Audiometric booths shall be supplied completely pre-wired, when assembled, to a single plug or electrical junction box for each booth. Power source shall be provided by the property owner. Connection of power to booth is the responsibility of the audiology booth contractor/vendor.

- B. Electrical Outlets: The following minimum number of recessed duplex 110V electrical outlets shall be provided:
 - 1. Four each recessed duplex outlets in the control room and 2 each 6 outlet plug strip in each room.
- C. Electrical Service: The audiology booth contractor/vendor will connect each audiometric booth to a 110 volt, 20 amp, electrical service.
- D. Electrical Systems Grounding: All audiometric booth electrical systems shall be grounded in accordance with NEC standards.
- E. Grounding of Booth: Connection to earth ground is the responsibility of the property owner. Proper grounding arrangements must be available at the site. If not, the audiology booth contractor/vendor is responsible for notifying the VA.
- F. Provide conduit drops with faceplate and receptacle for quad data/double voice connections on exam and control side.
- G. Provide conduit drop for installation of fire strobe.

2.12 LIGHTING

- A. Lighting Systems: Audiometric booths shall be provided with pre-wired, recessed no heat LED light fixtures or recessed incandescent light fixtures to achieve a minimum of 80 foot-candles maintained at 36 inches above the booth floor.
- B. Supplemental Lighting: Track or bullet type lighting may be specified in order provide supplemental or spot lighting.
- C. Light Switches: Lighting fixtures shall be provided with one light switch to operate all lights in the enclosure.
- D. Light Dimmers: Provide light dimmers. All light dimmers shall be low noise type dimmers.

2.13 JACK PANELS

- A. Jack Panel System: Each audiometric booth shall be provided with a flush mounted, pre-wired jack panel system for connection of test equipment between control and examination rooms.
- B. Flush mounted ".125 thick Aluminum" Jack Plate Assembly consisting of the following:
 - C. (12) .25 Switchcraft Gold Tip Stereo Phone Jacks
 - D. (4) USB connections
 - E. (2) 2 inch ID cable pass through shall be provided under the window.
- F. Jack Panel Wiring: All jack panel connections shall be made with minimum 22 gauge shielded cable. All connections shall be soldered and tested

at the factory. Each jack connection shall be independently grounded and isolated from the jack panel face plate.

- G. Jack Panel Face Plates: Jack panel face plate on each side of booth shall be marked and numbered so as to allow easy identification of individual circuits from either side.
- H. Cable Pass-Through Ports: 2-1/2 inch diameter cable pass-through ports shall be provided from the control room to the examination room for use in passing connectors and cables that are not connected through the jack panel. Cable pass-through ports shall be constructed of minimum 2-1/2 inch diameter pipe, shall be capped on both sides and shall be supplied with acoustical putty to seal these ports when the cables are installed. These ports shall not compromise the acoustical and vibration isolation of booths.

2.14 FINISHES

- A. Finish Requirements: Audiometric booths shall be finished in accordance with the requirements listed in this section.
- B. Paint Finish: All interior and exterior exposed surfaces of the audiometric booth shall be factory pre-painted prior to installation. Steel panel surfaces shall be properly cleaned, prepared and primed with a nitrocellulose modified-phenolic coating to a dry film thickness of 0.6-mil. minimum so as to accept the finish paint coat. Panels shall be thoroughly coated with nitrocellulose alkyd modified lacquer, (or functionally equivalent coating) to produce a flat or textured finish. Color shall be specified by the VA.
- C. Floor Carpet: The contractor shall provide carpeting for all inner floors. Carpeting shall meet the requirements of Federal Specification DDD-C-95 and the fire rating requirements of the Federal Flammability Standard FF-1-70 in section 15.1.2. Carpeting shall be cemented to the floor and shall be provided with rubber molding.
- D. Closure Panels: The contractor shall provide closure panels that close off airspaces between booths as well as between the booth and the facility walls. Closure strips shall be finished similarly to the external finish of the booth and shall be installed in a manner so as to not compromise the acoustical and vibration isolation of the booths. Closures between the audiometric booth and the facility ceilings shall be provided by the audiology booth vendor/contractor.
- E. All finishes shall be approved by VA Interior Designer.

2.15 ACOUSTICAL PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Audiometric booths and the components utilized to construct them shall meet the minimum acoustical requirements detailed in this section.
- B. Enclosure Noise Reduction: Audiometric booths shall meet the airborne noise reduction requirements specified in Table 2, when measured in accordance with ASTM E596-90:

Table 2
Minimum Noise Reduction for Audiometric Booths/Rooms/Suites

Octave Band Frequency Center Frequency	Single Wall Control Room Noise Reduction (dB)	Double Wall Booths/Rooms Suites Noise Reduction (dB)
125	28	47
250	37	62
500	48	83
1000	55	91
2000	59	99
4000	60	97
8000	58	>91

1. Noise reduction measurements shall be made in 1/3 octave bands and converted to octave band results using a calculation method appropriate to the source spectrum (eg. pink noise). Audiometric booth must meet at least the minimum specified octave band noise reduction in each octave band.
- C. Transmission Loss of Door and Frame Assembly: The audiometric booth acoustical door and frame assembly shall have a minimum STC rating of 47 when tested in a laboratory environment in accordance with ASTM E90-90 and calculated in accordance with ASTM E413-87.
- D. Panel Sound Absorption Coefficients: The sound absorption coefficients of the wall and ceiling panels (Reference ANSI S3.6-1989) used to construct the audiometric booth shall have the minimum sound absorption coefficients specified in Table 3, when measured in a laboratory environment in accordance with ASTM C423-90a using a sample size of at least 72 square feet.

Table 3
Minimum Sound Absorption Coefficients for Audiometric Booth Panels

Octave Band Frequency Center Frequency	Sound Absorption Coefficient
125	0.40
250	0.70
500	0.70
1000	0.70
2000	0.70
4000	0.70
8000	0.70

- E. Testing laboratories: All tests shall be conducted at either a nationally recognized independent test laboratory, in a laboratory accredited by NIST, NVLAP, or at a U.S. government laboratory.
- F. Test Report Requirements: All laboratory test data shall have been obtained by conducting tests in accordance with the specified procedures and standards. All test data shall have been obtained within the past 5 years, and shall be certified by the bidder as indicative of current production methods. Test reports shall contain complete documentation of the sample's exterior features, salient characteristics and component weights in order to ensure that all test data are based on components of similar construction.

2.16 FIRE RATING REQUIREMENTS

- A. Fire Protection Requirements: Installer will provide a channel from roof to ceiling in both the exam and control rooms for sprinkler head installation. Pack channel to maintain acoustical performance requirements.
- B. Fire Code Ratings: B occupancy. Interior finishes are Class B. Interior walls are non-combustible, 1 hour rated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Requirements: The contractor shall be factory trained on proper booth installation techniques and shall install audiometric booths and all specified components in VA facility.
1. Install Scope: Contractor shall completely assemble audiometric booths and all associated components which are provided by the manufacturer. Outlets, plug strips, light fixtures, and all other

electrical components internal to the booth shall be installed and booth wiring shall be connected to the main junction box connection point. HVAC silencers shall be installed on the audiometric booth walls or roof. Final connection of HVAC services, main electrical power, thermostats, and any other building services is the responsibility of the Government.

2. Equipment Manual:
 - a. The contractor shall furnish, with each booth, two copies of equipment manual containing installation, operation, and maintenance instructions; a block diagram showing wiring between related pieces of equipment which make up the complete system; and a parts data section.
 - b. The parts data section shall include a list of parts and all illustration of all replaceable parts with replacement instructions. "Replacement part" is defined as a part or component thereof that can be removed or exchanged for a like item and restored to its original position without breaking welds or requiring a special operation.
 - c. The parts list shall identify the contractor's part number. The parts illustrated shall have an identifying number or name for cross reference to parts list.
 - d. The manual shall include a wiring diagram including ground connections with all major components identified by name.
3. The installation of the audiometric booths will occur in an operational clinic. Install is to be carefully coordinated with the contracting officer. The booths will be tested before acceptance and payment.

SPEC WRITER NOTE: Consider additional spec by unit as outlined below. Multiple units may be specified in this manner for clarity.

3.2 // ADDITIONAL SPECIFICATION REQUIREMENTS FOR AUDIOMETRIC BOOTHS #1

- A. This form is to be utilized to provide project specific requirements in the procurement of AUDIOMETRIC BOOTHS.
 1. Enclosure size:
 - a. Configuration Submittal by vendor: Drawing shall show the (2) Single Wall Control/Double Wall Exam Suites.
 - b. Exam Room Dimensions: See drawing. Size as required to fit in space.

- c. Control Room, Dimensions: See drawing. Size as required to fit in space.
- d. Overall external dimensions: See drawing.
- 2. Vibration Isolation System: Standard system required? Y
- 3. Pits (Spec. Ref. 4): Pit depth: 4 5/8 inch.
- 4. Doors:
 - a. Configuration: See drawing.
 - b. For Booths 1 and 2 (C.O. = clear opening):
 - 1) Exam 1 C.O. 3 feet 0 inches wide by 6 feet 1 1/2 inches high;
 - 2) Exam 2 C.O. 3 feet 6 inches wide by 6 feet 1 1/2 inches high;
 - 3) Control C.O. 3 feet 0 inches wide by 6 feet 1 1/2 inches high;
 - c. Indicate any optional hardware requirements: Control room door shall be lockable from the inside and the outside. A key shall not be required to unlock the door from inside the booth.

5. Windows:

Width	Height	Location	Type of Features
<u>36 inch</u> No window	<u>34 inch</u>	Standard Exam Room Viewing Window Exam Door(s)	_____
<u>12 inch</u>	<u>12 inch</u>	Control Door (s)	_____

- 6. Ventilation Type: Direct coupled to building HVAC. Coordination with the general contractor for the building is required.
- 7. Electrical:
 - a. 4 each recessed duplex outlets in the control room and 2 each 6 outlet plug strip in the control room and exam room.
 - b. Conduit drops on exam and control side for data/voice.
 - c. Provide conduit drop for installation of fire strobe.
- 8. Lighting: Provide no heat LED light with dimmer or recessed incandescent with dimmer
- 9. Jack Panels: Flush mounted ".125 thick Aluminum" Jack Plate Assembly consisting of the following:
 - a. (12) .25 Switchcraft Gold Tip Stereo Phone Jacks
 - b. (4) USB connections
 - c. (2) 2 inch ID cable pass through shall be provided under the window.
- 10. Finish: All finishes shall be approved by VA Interior Designer.
 - a. Standard Paint Finishes required? Y

- b. Standard carpeting required for inner floors? Y
- c. Closure panels between booth and facility ceilings required? To be determined by audiology booth vendor/contractor after coordination with VA. If required, closure panels shall be 16 gauge galvanized steel over ½ inch thick gypsum board backing and finished to match rooms. Closure panels shall be full length dampened and gasketed so as to minimize sound conduction. Closure panels may not be required if contractor provides an alternative arrangement that is acceptable to the contracting officer.
11. Acoustical performance: Standard performance required.//

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