



**SPECIAL CONSTRUCTION SECTION 13-21-48
SOUND CONDITIONING ROOMS
FOR AUDIOMETRIC TESTING & MEDICAL LIFE SCIENCES**

PART 1 – GENERAL

1.0 SCOPE:

This specification prefabricated Audiometric Examination booths and suites suitable for use in testing, calibration and recording of aural acuity. A booth is defined as a freestanding examination room. A suite is defined as an examination room and a control room. An audiometric booth covered by this specification includes all enclosure panels, components, wiring, light fixtures, ventilation silencers, etc. for a complete structure.

2.0 ENCLOSURE CONFIGURATION AND SIZE:

**2.1 Configuration: Audiometric Booths shall be one of the following configurations:
(CHOOSE ALL THAT APPLY)**

- 2.1.1 Quiet Test – Single Wall Examination Booths
- 2.1.2 Quiet Test – Double Wall Examinations Booths
- 2.1.3 Quiet Test – Single Wall Exam/Single Wall Control Booth Suites
- 2.1.4 Quiet Test – Double Wall Exam/Single Wall Control Booth Suites
- 2.1.5 Quiet Test – Double Wall Exam/Double Wall Control Booth Suites
- 2.1.6 Quiet Test – Multi - Person Single Wall Test Chamber
- 2.1.7 Quiet Test – Multi - Person Double Wall Test Chamber

**2.2 Audiometric Booths shall have the following minimum I.D.
(inside dimensions) (CHOOSE ALL THAT APPLY)**

- 2.2.1 Single Wall Examination Booth
I.D.= _____ X _____ X _____ High
- 2.2.2 Double Wall Examination Booth
I.D.= _____ X _____ X _____ High
- 2.2.3 Single Wall Control/Single Wall Examination Booth Suite
Exam Booth I.D.= _____ X _____ X _____ High
Control Room I.D.= _____ X _____ X _____ High
- 2.2.4 Single Wall Control/Double Wall Examination Booth Suite
Exam Booth I.D.= _____ X _____ X _____ High
Control Room I.D.= _____ X _____ X _____ High
- 2.2.5 Double Wall Control/Double Wall Examination Booth Suite
Exam Booth I.D.= _____ X _____ X _____ High
Control Room I.D.= _____ X _____ X _____ High

- 2.3 A maximum four-inch tolerance is allowed on length and width to permit booth to fit into standard footages of space. Heights specified in section 2.2 are without ventilating units or discharge silencers, roof or wall mounted.
- 2.4 **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 are airspaces required to meet the specified acoustical performance criteria.
- 2.5 **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 in section 5.2 of this document. Specifications of audiometric rooms or suites to utilize a common outer shell shall be noted on the attachment.
- 2.6 **Installation in Pits:** For audiometric booth installations that are recessed into the facility floor, the overall outside dimension will be determined by the size of the pit, less the required clearances.

3.0 CONSTRUCTION:

- 3.1 **Design: 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:**
- 3.1.1 Vibration isolation system
 - 3.1.2 Floor assembly
 - 3.1.3 Wall and roof panel assembly
 - 3.1.4 Acoustical door units
 - 3.1.5 Acoustical window units
 - 3.1.6 Assembly hardware, including connecting panel joints
 - 3.1.7 Electrical and lighting wiring, components and fixtures
 - 3.1.8 Silenced forced air ventilation system or packaged air conditioning silencers for connection to building HVAC systems
 - 3.1.9 Commercial grade 2'x2' high traffic carpet squares
 - 3.1.10 Paint and other specified finishes

4.0 REFERENCES:

A. American Society for Testing and Materials:

1. ASTM C423-90A - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
2. ASTM E336-97 - Standard Test Method for Measurement of Airborne Sound insulation in Buildings.
3. ASTM E90-97 - Laboratory Measurements of Airborne Sound Transmission of Building Partitions.
4. ASTM E 413-87 - Classification for Determination of Sound Transmission Class.
5. ASTM E596-96 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound Isolating Enclosures.

4.1 QUALITY ASSURANCE:

- A. Manufacturer shall have been engaged in the manufacture of Sound Conditioning Rooms for at least five years immediately prior to the start of this Work, and demonstrate a history of successful design, manufacture and installation acceptable to the, Owner and/or Architect.
- B. References in this Section to industry-wide standards or nationally recognized testing agencies shall denote the latest edition of such publications.
- C. Installation company shall have been engaged in the installation of Noise Barriers, LLC. acoustical enclosures for at least five years immediately prior to the start of this work.

4.2 SUBMITTALS:

- A. General: Submit in accordance with General Conditions Division 1.
- B. Product Data: Submit applicable reference standards, current performance data and application recommendations and product limitations.
- C. Shop Drawings: Submit assembly and installation drawings showing product components and assembly detail with adjacent materials and products.
- D. Contract Close-out documents (refer also to Section 01700):
 - 1. Operation and Maintenance Data for all products provided under this section.
 - 2. Warranty: Warranty documents in accordance with General Conditions Division 1 of this specification.
 - 3. Submit for Owners acceptance, manufacturer's standard written warranty for a period of one year from date of completion.

4.3 PROJECT CONDITIONS:

- A. Entire area where rooms are installed shall be free of debris and broom clean prior to beginning installation.
- B. Floor shall be level and true to within ¼" non-cumulative in 10 feet for the entire area supporting the room.

PART 2 - PRODUCTS

5.0 DESIGN:

- A. Design is based on Quiet-Test Audiometric Series Line manufactured by:
Noise Barriers, LLC. 2001 Kelley Court, Libertyville IL. 60048
(Tel: 847- 843-0500) (Fax: 847-843-0501)

(CHOOSE ALL THAT APPLY)

- 5.0.1 Quiet Test - Single Wall Examination Booths
- 5.0.2 Quiet Test - Double Wall Examinations Booths
- 5.0.4 Quiet Test - Single Wall Exam/Single Wall Control Booth Suites
- 5.0.5 Quiet Test - Double Wall Exam/Single Wall Control Booth Suites
- 5.0.6 Quiet Test - Double Wall Exam/Double Wall Control Booth Suites

- B. Audiometric Booth shall be pre-engineered for environments to conduct valid pure tone air- and bone-conduction tests, speech tests, and audiological, psychological, heart sounds, auscultation and cardiograph examination and research.
- C. Booths shall be constructed from standard components to form an unlimited variety of configurations. Windows and door assemblies shall be interchangeable at locations within the wall system. Rooms shall be completely demountable and transportable to be reassembled without loss in acoustic performance. Caulking or gasket shall be permitted but concealed at all locations including at panel joints.

5.1 WALL AND CEILING PANELS: (CHOOSE ALL THAT APPLY)

A. Single Wall Examination Room:

Wall panels shall be 4 in. thick incombustible panels with solid face sheet facing the exterior not less than 14-gauge cold rolled steel and perforated interior face sheet to be 16-gauge galvanized steel with 3/32" diameter holes on 3/16" staggered centers, with minimum open area of 23%. **(no exceptions)**

B. Double Wall Examination Room:

Wall panel construction shall incorporate two (2) 4 in. thick incombustible panels with solid face sheet facing the exterior not less than 14-gauge cold rolled steel and perforated interior face sheet to be 16 gauge. Assembly shall provide a 4 in. air space between the two (2) panel assemblies. **(no exceptions)**

C. Roof panel shall be 7" thick incombustible panels with solid face sheet facing the exterior not less than 14-gauge cold rolled steel and perforated interior face sheet to be 16-gauge galvanized steel with 3/32" diameter holes on 3/16" staggered centers.

D. Panel shall be filled with sound absorbing dampening material, inert, mildew resistant, vermin-proof, with an Underwriter's Laboratories fire hazard classification per ASTM Specifications equal to or better than: Flame Spread – 0; Smoke Developed – 5; Fire Contributed – 0. Density shall be variable to meet a variety of acoustic applications.

5.2 ACOUSTICAL PERFORMANCE:

- A. The minimum allowable sound transmission loss (TL) and absorption coefficient (NRC) of the Sound Conditioned Room (SCR) components as tested in accordance with ASTM Standards in NVLAP accredited laboratory facilities and certified by a recognized independent and approved organizations shall be as follows:

PANEL COMPONENT SOUND TRANSMISSION LOSS

Octave band Center Frequency Hz	125	250	500	1K	2K	4K	8K	STC
Single Wall	29	46	53	58	63	64	60	55
Décor	34	49	53	63	72	81	80	61
Double Wall	48	58	69	75	82	86	76	70

5.3 FLOOR PANEL SYSTEM:

- A. Quiet Test floor shall be 4" (102mm) thick with 11 gauge (3.04mm) hot rolled steel (HRS) walking surface and 16 gauge (1.52mm) cold rolled steel (CRS) bottom sheet structurally reinforced. All floors shall be covered with carpeting. Average weight not to be less than 10 lb./sq. (49 kg/sq. m). Floor shall float on properly loaded isolator rails.
- B. Quality of Construction: 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 vendor at the time of installation.
- C. Vibration Isolation Systems: All audiometric booths shall be provided with a vibration isolation system with a cutoff frequency of 6 ¼ Hz. The load from each required isolator in the isolation system shall be distributed to the facility floor through a structural steel channel isolation rail. The concentrated point load in the isolation rail system shall not exceed 800 pounds at any point.
- D. Pits: Audiometric booths shall be installed in existing pits whose nominal depth from the adjacent corridor slab is 5 1/2" which shall be field verified by the vendor.

5.4 JOINERS AND CONNECTORS:

- A. Panels shall be of welded construction, free of internal reinforcement, and form a rugged module. Panels shall be joined with a one-piece flexible "H" connector of not more than 20 ga to insure flexibility to provide a tight seal. All joints shall form sound absorbing labyrinths and tight mechanical joints. Combined peripheral and panel joiners shall form structural member with a section module of not less than 1.5 square inches to permit external roof load of 30 lb./ sq. ft. for roof spans up to 12 ft. (**"three piece" welded "h" joiner is not acceptable**)
- B. Cam-locks and similar externally operated mechanical fasteners and pressure gaskets shall not be permitted.
- C. Peripheral ceiling channel system shall be designed to frame all panels into unified structure without use of locking type fasteners.
- D. Floor framing channels shall have 3/16 in. thick sound/vibration seals attached to the underside for acoustical seal and compensation for uneven surfaces. Wall panels shall be set into channel frame in strict accordance with manufacturers' detailed instructions.

5.5 WINDOW:

- A. QuietLite Window panels shall have double-glazed ¼" thick acoustical laminated safety glass with sound absorbing material in air space to dampen window resonance along with desiccant material to prevent condensation. 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! (**no exceptions**)

5.6 DOOR:

- A. QuietSwing 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. Door leaf shall be 2½ in. thick with a clear opening of 33 in. wide x 73 ½ in. high. 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.
- B. Optional door openings available in 36" and 42" clear opening.
- C. 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.
- D. Door leaves, frames, seals, and hinges shall be factory assembled, adjusted and shipped, ready for installation after the sound-conditioning booth is completely assembled.
- E. 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.
- F. Doors and frames shall be mortised, reinforced, drilled and tapped for mortise type hardware listed under the Finish Hardware Section of the Specification (Section 08710) and factory supplied and installed by the door manufacturer prior to shipment.

DOOR SOUND TRANSMISSION LOSS

Octave band Center Frequency Hz	125	250	500	1K	2K	4K	8K	STC
QuietSwing STC-50	37	42	50	49	51	55	50	50
QuietSwing STC-51	40	44	48	52	52	55	53	51
QuietSwing STC-52	41	44	50	53	53	57	58	52
QuietSwing STC-54	37	47	53	56	55	61	58	54

5.7 VENTILATION AND AIR CONDITIONING SYSTEMS: *(CHOOSE ALL THAT APPLY)*

- 5.7.1 Self-Contained Ventilation Systems: (When specified) the audiometric booth will be provided with a self-contained, Quiet-Air® fan-forced ventilation system. Ventilation silencers and fan assemblies shall be roof mounted. The fan-forced ventilation system shall be designed so as to draw conditioned air from the facility area through the audiometric booth and to return it to the facility area. The fan-forced ventilation system shall provide a minimum of one complete air change every 10 minutes. Fans shall operate on 110-volt, 60 Hz., single-phase power. The fan system for each booth shall be provided with a wall mounted switch to operate the ventilation system.
- 5.7.2 Direct Coupled Ventilation Systems: (When specified) 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" 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.
- 5.7.3 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.

5.8 LIGHTING:

- A. Lighting Systems: Audiometric booths shall be provided with pre-wired, recessed "LED light fixtures" with standard powers switch/dimmer control.
- B. Standard Lighting Levels and Fixtures: Provide a sufficient number of recessed incandescent lights fixtures so as to achieve a minimum of 80 foot-candles maintained at 36" above the booth floor. Dimming capability is available.
- C. Supplemental Lighting: In each control room, provide an 8' long track with three incandescent track lighting fixtures at the center of the view window wall, located approximately 18" from the wall.
- D. Light Switches: Standard overhead lighting fixtures shall be provided with one wall mounted, recessed light switch adjacent to the door to operate all lights in the enclosure. Exam room standard lighting shall also be operable from the control room with a recessed light switch. Supplemental lighting fixtures shall be operable from the control room with a recessed light switch at the view window wall.
- E. Light Dimmers: Recessed light dimmers for all fixtures in each suite shall be provided in its control room at the view window wall. All light dimmers shall be low noise type dimmers.

5.9 ELECTRICAL

- A. All duplex outlets are recessed mounted in acoustic wall panels.
- B. Optional baseboard electrical/Data raceway system available:
Sound Room shall be fitted with a combination of electrical power and communication cabling, low profile raceway. The system shall install surface mounted at the baseboard (or chair rail height when specified) without penetration to the acoustic perimeter. The system shall be UL listed and CSA approved for min. 300 VAC and manufactured of PVC (black) (with upgrades to vinyl or wood veneer) as shown on the drawings. Raceway system shall be furnished complete including base cover and trims, device brackets, cover clips, corner clips, couplings and wiring.
- C. Duplex receptacles, specification grade grounding type shall be field mounted to device brackets and complete with matching faceplates.
- E. Audiometric jack plate consisting of ten (12) Switchcraft 3-wire Stereo phone-type jacks, (4) USB 3.0 and (1) 2" inch ID hole with grommet and cover shall be provided under the window.
- F. OPTIONAL: RJ11 and RJ45 voice and data, type "F" coax connectors and category 5 UTP STP, coaxial, audio, and fiber optic inserts shall be available (OPTIONAL when specified) for media interface and communication system designs.
- G. Power panels containing switches and/or fixtures shall be wired during the manufacturing process as per National Electrical Code requirements. Latest edition using UL approved components. Wiring shall be terminated in surface junction box mounted on exterior of Power Panel.
- G. The Noise Barriers, LLC. Audiometric Test Chambers are "UL" Underwriters Laboratory Labeled with the American/Canadian Mark of Safety Classification. (no exception)**

6.0 DÉCOR ENHANCEMENT TREATMENT (WHEN SPECIFIED)

DÉCOR Enhancement treatment shall consist of the following: (no exceptions)

- A. 4" wide PVC black chair rail by 1" thick mounted approximately 3'-0" above isolated floor. Chair rail system shall come complete with factory molded corner and end caps. All components will assemble without any exposed fasteners. Chair rail shall overlap the bottom of fabric panel and top of metal panel by 1".
- B. 1" thick, scuff abusive, #16- gauge metal panel, perforated with 3/32" diameter. Holes staggered on 3/16" centers, with a 23% open area. Metal panel shall be mounted below chair rail, without the need of any exposed fasteners or joiner channels.
- C. 1" fabric wrapped rigid fiberglass panel shall be mounted above chair rail. Fabric wrapped panel shall be mounted without the need of fasteners. Fabric panels can be easily replaced without the need of any other components.
- D. DÉCOR Enhancement treatment is available in five (5) decorator colors.

6.1 ELECTROMAGNETIC SHIELDING ATTENUATION (EM-SA) REQUIREMENTS:

- A. EM-SA General Requirements: (When specified) All exam rooms and control rooms shall be shielded for minimum values of shielding effectiveness for Level I, II or III. (Choose one)
- B. Specific Requirements: At a minimum, shielded audiometric booths shall be constructed to meet requirements for EM-SA specified in Tables. These requirements are applicable to shielded audiometric booths located to avoid potential interference from electromagnetic fields. Measurement methods shall be in accordance with paragraphs d. (U) Acceptance Tests, e. (U) Electric and Magnetic Fields, and f. (U) Reference Level of B16. (U) Quality Assurance Provisions of Specifications NSA No. 65-6, 30 October 1964, with the following exceptions, additions and clarifications:
- C. In addition to the requirements in the cited paragraphs of NSA No. 65-6, leakage checks must also be made at all windows, doors, hatches, jack panels, computer interface interconnection panels, cable pass-through ports, penetrations for electrical, lighting, ventilation, and sprinkler systems, and at representative accessible panel seams.

6.2 ELECTROMAGNETIC SHIELDING EFFECTIVENESS TEST DATA

Specification for Minimum Values of Shielding				
Effectiveness (SE), in dB / FOR NOISE BARRIERS SOUND CONTROL ROOMS				
		Level I	Level II	Level III
Type of Field	Frequency	SE, (db.)	SE, (db.)	SE, (db.)
	1 kHz	10	10	20
	10 kHz	20	20	55
Magnetic	100 kHz	30	35	90
	500 kHz	37	37	90
	1 MHz	40	45	100
	1 kHz	50	50	70
	10 kHz	50	50	100
Electric	100 kHz	50	50	100
	500 kHz	50	50	100
	1 MHz	50	50	100
	10 MHz	45	45	100
	18 MHz	40	40	100
	50 MHz	50	50	100
	100 MHz	42	50	100
Plane Wave	200 MHz	37	37	100
	400 MHz	20	44	100
	1000 MHz	17	40	100

6.3 FIRE RATING REQUIREMENTS: (WHEN SPECIFIED)

- A. Fire Protections Requirements: As a minimum, audiometric booth shall be constructed of fire rated components, as specified below, to obviate the need for a fire sprinkler system and the associated roof panel penetration necessary for installation.
1. Wall and ceiling panels and liner materials used in ventilation system, silencers and fan housings, tested in accordance with ASTM E84-87, shall not exceed a rating of 25 for Flame Spread and 50 Smoke Developed.
 2. Carpeting shall meet the requirements of the Federal Flammability of Concepts and rugs (Pill Test).
 3. Wall and ceiling panels, tested in accordance with ASTM E119-88 (or equivalent industry standard test method), shall be rated for a minimum of 60 minutes. Test data for both solid and perforated surfaces exposed to fire shall be provided.
 4. Door assemblies, tested in accordance with ASTM E152-81 (or equivalent industry standard test method), shall be rated for a minimum of 45 minutes.
 5. Windows installed in wall assemblies, tested in accordance with NFPA 257, Standard for Fire Tests of Window Assemblies (or equivalent industry test method), shall be rated for a minimum of 60 minutes.

PART 3 – EXECUTION

7.0 QUALITY ASSURANCE

- A. Noise Reduction* - The minimum allowable noise reduction of completely assembled rooms as tested in accordance with ASTM Designation: E596 shall be as shown in Table below:

NOISE REDUCTION, dB**

1/1 Octave Band Center Frequency, Hz.	125	250	500	1K	2K	4K	8K	NIC
Single-Wall Rooms†	27	40	48	52	59	58	59	50
Single Wall w/ DÉCOR Treatment	42	55	64	72	74	76	77	60
Double-Wall Rooms	51	75	94	91	96	96	93	74

*Defined as the difference between sound-pressure-level in a reverberation room outside the booth and that inside the booth. Copy of Laboratory Report available on request.

Note:

**± 3dB for field instrument accuracy.

† Excluding Model "QT-S-SD" control room.

NIC – Noise Isolation Class, single number rating system for noise-reduction characteristics.

7.1 GENERAL:

- A. Sound Conditioned Rooms shall be installed by the manufacturer or an installer acceptable to the manufacturer and approved by the architect.
- B. Verify that all installation areas are dry and that all dust generating activities have terminated.
- C. Coordinate the installation with the work of other trades and as shown on the approved shop drawings.
- D. Check job site for as-built dimensions and compatibility of approved shop drawings prior to the start of construction. Maintain minimum clearances to partitions and adjacent rooms as required by the approved shop drawings and manufacturer's recommendations.
- E. Broom clean all areas prior to beginning installation.
- F. Install the work of this section in strict accordance with approved Shop Drawings positioning all components plumb and in accordance with the design criteria to insure acoustic integrity.
- G. Furnish and install vertical closure panels between Sound Conditioned Rooms and/or walls as shown on the Drawings. Closure panels shall be 16-gauge galvanized steel over ½" thick gypsum board backing and finished to match rooms. Closure panels shall be full length dampened and gasket so as to minimize sound conduction.

7.2 TESTING:

- A. Rooms may be tested by the Owner to comply with the allowable noise reduction as specified. Should rooms fail to meet minimum standards, the manufacturer shall correct the deficiency and retest at the manufacturer's expense.

7.3 DEMONSTRATION:

- A. Instruct the owner's maintenance personnel regarding the operation and maintenance of NOISE BARRIERS, LLC products and systems.

END OF THIS SECTION