

SECTION 09820

SOUND DIFFUSIVE WOOD PLANKS (FLUTTERFREE®)

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound Diffusive Wood Planks (FlutterFree®) and Installation.
- B. Fiberglass insulation.
- C. Coordination with all trades having elements that attach to, penetrate through or are concealed behind/above the wood panels of this section.

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- A. Fiberglass insulation (6lb pcf) as shown in architectural details behind sound diffusive wood planks if C-mount (Helmholtz mount) or gapping is required.
- B. Wood blocking/shims and fastening hardware.

1.03 RELATED SECTIONS

- A. Section 06400 – Architectural Woodwork
- B. Section 06420 – Wood Paneling
- C. Section 09120 – Suspension Framing/Furring for Plaster/Gypsum Board Assemblies
- D. Section 09250 – Gypsum Board
- E. Division 15 Sections – Mechanical Work
- F. Division 16 Sections – Electrical Work
- G. Division 17 Sections – Audio, Data, Telecommunication Work

1.04 ALTERNATES

- A. Prior Approval: Proposed substitutions for products in this section may be submitted to the architect and acoustical consultant no later than ten (10) working days prior to the bid due date. Substitutions shall only be considered if submitted with complete information, including acoustic data and a sample not smaller than 45 cm x 10.2 cm (18" x 3-29/32") showing product design, composition, size, groove pattern, finish, etc. Acceptance of substituted products is contingent on the architect's and acoustical consultant's approval and the substitution's compliance with all specified criteria. The architect shall approve substitution request via addendum.
- B. Unapproved Substitutions. Substitutions not approved via addendum shall not be submitted to the architect or acoustical consultant.

1.05 REFERENCES

- A. Local Building Code – Current Edition
- B. International Organization for Standardization
 - 1. ISO 354 Measurement of Sound Absorption in a Reverberation Room
 - 2. ISO 10534 - Determination of sound absorption coefficient and impedance in impedance tubes - Part I: Method using standing wave ratio.
 - 3. ISO 17497-1 Sound-scattering properties of surfaces- Part 1: Measurement of the random-incidence scattering coefficient in a reverberation room.
- C. AES-4id-2001: AES Information Document for Room Acoustics & Sound Reinforcement Systems – Characterization & Measurement of Surface Scattering Uniformity.
- D. American Society for Testing & Materials (ASTM)
 - 1. ASTM E 1050-98 - Standard Test Method for Impedance and Absorption of Acoustical Materials Using a Tube, Two Microphones, and a Digital Frequency Analysis System
 - 2. ASTM C 423 - Sound Absorption & Sound Absorption Coefficients by the Reverberation Room Method
 - 3. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials
- E. Published technical papers
 - 1. T.J. Cox, B-I.Dalenback, P. D'Antonio, J.J. Embrechts, J.Y. Jeon, E. Mommertz and M. Vorlaender, "A tutorial on scattering and diffusion coefficients for room acoustic surfaces", Acta Acustica uW Acustica, 92, 1-15 (2006)

2. AES-4id-2001, "AES Information document for room acoustics and sound reinforcement systems- Characterization and measurement of surface scattering uniformity", J. Audio Engineering Soc., 49(3), 149-165 (2001)
3. E. Mommertz, Appl. Acoust., 60(2), 201-204 (2000)
4. DEFINITIONS
 - a. Helmholtz Mount (optional): Similar to a standard C-Mount, whereby the sound diffusive planks are mounted/firred off the substrate a specific distance, as shown in the architectural details, with medium density glass-fiber insulation in the air cavity between the furring strips. Additionally, the sound diffusive planks do not abut. Instead, they are separated by a 1/16" gap between the planks.

1.06 SYSTEM DESCRIPTION

- A. Design Requirements: 1-Dimensional Sound Diffusers shall work on the reflection phase grating base shape, with 6 full-width wells and two half wells on either end. The depths of the wells shall vary based on a quadratic residue that produces the highest diffusion coefficient. Vertically oriented wells shall provide sound diffusion in the horizontal plane. Horizontally oriented wells shall provide sound diffusion in the vertical plane.
- B. Performance Requirements
 1. Third-octave band acoustical performance requirements from 1000 Hz to 20000 Hz for random incidence sound absorption shall be measured according to ASTM C423 or ISO 354; the normalized random incidence diffusion coefficient shall be the average of measured or calculated directional diffusion coefficients, according to AES-4id-2001 at -60, -30, 0, 30, and 60 degrees and the random incidence scattering coefficient shall be measured according to ISO- 17497-1 (Scattering (ISO)) or determined from the average of the measured directional correlation scattering coefficients (Scattering (c)) according to the method of Mommertz [Reference 1.05/E1 and 1.05/E3]. **Directional polar responses, which indicate the uniformity of scattering in third-octave bands, for sample and reference reflector, shall be provided to the acoustical consultant for approval.** The random incidence diffusion and correlation scattering coefficients shall be as listed in the table.

f (Hz)	Diffusion	Scattering (ISO)
1000	-0.03	0.06
1250	-0.03	0.04
1600	-0.02	0.16
2000	0.07	0.15
2500	0.06	0.39
3150	0.10	0.42
4000	0.27	0.45
5000	0.34	0.68
6300	0.48	0.91
8000	0.58	0.95
10000	0.54	0.83
12500	0.37	0.99
16000	0.36	0.88
20000	0.52	0.89

2. The random incidence absorption coefficient for an A Mount shall be as listed in the following table.

FREQ	A Mount	C Mount w/ Helmholtz	C Mount w/ Slots	D Mount w/ Helmholtz	D Mount w/ Slots
125	0.06	0.34	0.08	0.76	0.41

160	0.06	0.44	0.14	0.58	0.43
200	0.06	0.75	0.21	0.52	0.60
250	0.07	0.69	0.32	0.40	0.77
315	0.06	0.47	0.62	0.31	0.97
400	0.07	0.37	0.85	0.28	1.01
500	0.09	0.26	1.17	0.23	0.91
630	0.11	0.22	1.09	0.21	0.83
800	0.12	0.15	0.81	0.16	0.71
1000	0.14	0.12	0.58	0.16	0.61
1250	0.16	0.11	0.45	0.15	0.55
1600	0.14	0.11	0.38	0.15	0.50
2000	0.14	0.14	0.34	0.18	0.42
2500	0.19	0.22	0.32	0.24	0.38
3150	0.23	0.17	0.33	0.21	0.38
4000	0.25	0.16	0.43	0.22	0.44
5000	0.30	0.15	0.48	0.18	0.49

3. Normalized directional sound diffusion and correlation scattering coefficients shall be measured in accordance with AES-4id-2001 for angles of incidence of -60, -30, 0, 30 and 60 degrees with respect to the normal. The directional coefficients shall be as indicated in the following tables:

f (Hz)	d_n 60°	d_n 30°	d_n 0°	d_n -30°	d_n -60°
1000	-0.02	-0.06	0.00	-0.06	-0.02
1250	-0.02	-0.04	-0.01	-0.04	-0.02
1600	-0.04	0.00	0.00	0.00	-0.04
2000	0.10	0.05	0.03	0.05	0.10
2500	0.02	0.12	0.03	0.12	0.02
3150	0.12	0.06	0.15	0.06	0.12
4000	0.40	0.15	0.24	0.15	0.40
5000	0.32	0.46	0.14	0.46	0.32
6300	0.57	0.44	0.35	0.44	0.57
8000	0.53	0.72	0.42	0.72	0.53
10000	0.52	0.58	0.51	0.58	0.52
12500	0.51	0.30	0.24	0.30	0.51
16000	0.45	0.40	0.12	0.40	0.45
20000	0.61	0.56	0.26	0.56	0.61

f (Hz)	s_c 60°	s_c 30°	s_c 0°	s_c -30°	s_c -60°
1000	0.04	0.01	0.01	0.01	0.04
1250	0.05	0.01	0.01	0.01	0.05
1600	0.12	0.01	0.01	0.01	0.12
2000	0.28	0.05	0.04	0.05	0.28
2500	0.28	0.17	0.04	0.17	0.28
3150	0.27	0.11	0.17	0.11	0.27

4000	0.93	0.41	0.37	0.41	0.93
5000	0.92	0.85	0.40	0.85	0.92
6300	0.77	0.70	0.61	0.70	0.77
8000	0.98	0.89	0.71	0.89	0.98
10000	0.79	0.84	0.75	0.84	0.79
12500	0.71	0.66	0.84	0.66	0.71
16000	0.84	0.69	0.79	0.69	0.84
20000	0.92	0.88	0.87	0.88	0.92

4. Normal incidence sound absorption coefficients for the D Mount configuration with Helmholtz shall be measured according to the impedance tube method according to ASTM E1050-98 or ISO 10534.

f (Hz)	D Mount w/ Helmholtz
16	0.12
20	0.10
25	0.11
32	0.12
40	0.14
50	0.16
63	0.20
80	0.56
100	0.66
125	0.79
160	0.75
200	0.50
250	0.32

1.07 SUBMITTALS

- A. Product Data: Submit manufacturers' technical data including basic system description, options and component sizes. Identify all applicable features and options. Cross out any inapplicable features or options.
- B. Shop Drawings: The contractor shall produce and submit shop drawings of products and suspension or mounting systems overlaid on base drawings (interior elevations or reflected ceiling plans) supplied electronically by the architect. Show overall layout with dimensions and references to details as necessary for penetrations, joints, ends and intersections with other materials or building components. Submit schedule of all quantities, sizes, borders and finishes. Field-verify site conditions with dimensions shown on shop drawings.
- C. Samples: Minimum 45 cm x 10.2 cm (18" x 4") sample of specified panel and finish.
- D. Certifications: Manufacturers' certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

1.08 QUALITY ASSURANCE

- A. Qualifications: Manufacturer and installation contractor shall have a minimum of three years experience with similar systems.
- B. Single Source: All products under this section shall be supplied by a single manufacturer to ensure consistency in product size and finish.
- C. Woodworking Standards: Manufacturer to comply with specified provisions of Architectural Woodworking Institute quality standards.
- D. Pre-Installation Meeting: Installing contractor shall organize and conduct pre-installation meetings with all other trades to coordinate substrate conditions, conditioning of the space (temperature &

humidity), and elements attaching to, penetrating through or concealed above/behind work in this section.

1.09 DELIVERY STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading: Sound diffusive planking are susceptible to damage and shall be removed from packaging and handled with care so as to avoid chipping, scratching, scuffing, or denting the wood finish or edges. Planks shall be carried by a minimum of 1 person for every 40 pounds of weight. Planks shall never be set down on finished faces, only on backsides. Planks shall never be held by thin dividers between wells.
- B. Storage and Protection: Store sound diffusive wood planking in a clean, dry, fully-enclosed storage facility. Protect products from damage that may be caused by exposure to water, moisture, chemicals, direct sunlight, or infestation.
- C. Acceptance at Site: Full or partial installation constitutes complete acceptance of product.
- D. Waste Management and Disposal: Dispose of all packaging materials and debris in a safe and environmentally responsible manner according to the instructions set forth by the General Contractor, local ordinances or codes and the Environmental Protection Agency.

1.10 PROJECT CONDITIONS

- A. Project Environmental Requirements: Prior to unpacking or installing wood products, ensure that the installation area is fully enclosed and protected from moisture and direct sunlight. Ensure that the building's mechanical systems are fully operational and will not be turned off again even for testing and balancing of the mechanical systems. Coordinate with other trades to ensure that all work above or behind wood surfaces is complete and that all wet and dusty trades have completed work.
- B. Product Acclimatization: For a minimum period of seventy-two (72) hours and prior to unpacking or installing any wood products, allow both the installation area and the wood products to stabilize in temperature and humidity levels that are representative of the final temperature and humidity levels expected after building completion and occupation. Do not install products if the humidity exceeds 65%.

1.11 WARRANTY

- A. Submit to Owner or Owner's Representative a written and dated warranty issued by the planking manufacturer warranting the wood planking against defects in materials or manufacturing for a period of one (1) year from the date of delivery.
- B. Components used in the system, but not provided by the manufacturer are excluded from the manufacturer's warranty. Damage caused by exposure to moisture or rapid or extreme changes in temperature or humidity are excluded from the manufacturer's warranty. Damage caused by improper storage, handling, acclimatization, or installation is excluded from the warranty. Appearance and colorings of wood products, stains and finishes can vary over time and as site conditions change, and are therefore excluded from the warranty.

1.12 OWNER'S INSTRUCTIONS

- A. Installing contractor shall provide to the building owner or to the owner's representative a copy of the manufacturer's maintenance instructions.

1.13 MAINTENANCE

- A. Extra Materials: If provided per the project requirements, extra materials shall remain in the manufacturer's original, unopened packaging and shall be given to the building owner or owner's representative upon substantial completion of work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. RPG Acoustical Systems, LLC, 99 South St, Passaic, NJ 07055 (telephone) 973-916-1166, <http://www.rpgacoustic.com>.

2.02 MATERIALS

- A. Solid hardwood as selected by Architect:
 1. Wood Species: _____

1.1 Finish: Clear Lacquer or Stain and Clear Lacquer _____

2. Colored Lacquer: Paint Code: _____

B. Non-woven black acoustical matte as backing (Slotted or gapped configuration only).

2.03 MANUFACTURED UNITS

A. Unit Dimensions

1. Width 3-29/32", Depth 1-1/32", Standard Length 120" (or custom length)

B. Weight

1. Approximately 1 pound per linear foot (can vary based on wood species)

C. Select Non-Slotted _____ or Slotted _____ configuration per acoustical data provided in Part 1.06 System Description.

2.04 ACCESSORIES

A. Edge Moulding: Edge moulding shall provide a suitable divider allowing a fractal mounting and also provide an end termination. Edge mouldings shall be of the same wood species and finish or as specified by the architect.

2.05 FINISHES

A. Shop Finishing: Units shall be shop-finished with paint per architect selection, clear lacquered without stain, or stained and lacquered per architect selection prior to arrival at site.

PART 3 EXECUTION

3.01 INSTALLERS

A. Only qualified installers with 3 years (minimum) experience installing similar products shall install sound diffusive wood planking.

3.02 EXAMINATION

A. Site Verification of Conditions: Commencement of installation constitutes acceptance of prior work.

3.03 PREPARATION

A. Protection: Protect surrounding work so as to avoid damage during installation of wood planking.

B. Surface Preparation: Inspect substrate and ensure surface is flat, plumb, clean and dry without protruding elements that would otherwise interfere with planking installation.

3.04 INSTALLATION

A. Install wood blocking or furring strips as required to space sound diffusive wood planking off substrate the required distance.

B. If required in the architectural details, friction fit or adhere black, glass-fiber insulation in between wood blocking strips.

C. Install non-woven black acoustical matte (Slotted configuration only).

D. Install planking by placing planks against blocking in opposite direction and toe-nailing through edges of planks into wood blocking. Use biscuits supplied by the manufacturer spaced every 12" on center in the dados along the edges of the planks.

E. Install planking so that finished side with wells faces into occupied space.

3.05 CLEANING

A. After installation, clean dirt and dust from plank surfaces with soft brush tip vacuum. Wood cleaner may be used with care to avoid any non-wood areas. A high quality, furniture-grade wood polish may be used with care to avoid any non-wood areas.

3.06 PROTECTION

A. After installation, protect planks against dirt, water, changes in humidity and contact.

END OF SECTION