

## SECTION 23 05 49 - NOISE CONTROL AND ACOUSTICAL PERFORMANCE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions for Heating, Ventilating and Air Conditioning Work, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

#### 1.2 SUMMARY

- A. It is the objective of this Specification to provide the necessary design requirements for the noise control measures and acoustical performance criteria for mechanical systems.

Work in this section includes the providing of labor, materials, equipment and services necessary for a complete installation of sound control for every mechanical system including piping and ductwork within and on the roof of the building, complete, as shown and specified per the contract documents and all applicable codes and authorities having jurisdiction for the following:

1. Sound attenuating units
2. Sound linings
3. Sound Packing
4. Special cleaning and packaging for all operating rooms and pharmacy attenuating units.

- B. Related section include the following:

1. Mechanical Vibration Isolation and Seismic Control, Section 230548.

#### 1.3 SUBMITTAL DATA REQUIREMENTS

- A. Submit data for each product indicated.
- B. Sound Traps and Silencers:
  1. Including certified test data of sound attenuation and self-generated flow noise.

- C. Sound Linings:
  - 1. Certification that sound lining meets erosion test method described in UL Publication No. 181.
  - 2. Certification that sound lining meets ASTM standards C1071, G21 and G22.
- D. Include product description, list of materials for each service, and locations.
- E. Submit manufacturer's installation instructions.

#### 1.4 CODE AND REFERENCE STANDARDS

- A. Published Specifications' standards, tests or recommended methods of trade, industry or governmental organizations that apply to work in this Section.
- B. Comply with all applicable national, state and local codes. Refer to General Provisions Section for additional reference standards.
- C. ANSI/ASTM C553 - Mineral Fiber Blanket And Felt Insulation.
- D. ANSI/ASTM C612 - Mineral Fiber Block And Board Thermal Insulation.
- E. ASTM E84 - Surface Burning Characteristics Of Building Materials.
- F. NFPA 255 - Surface Burning Characteristics Of Building Materials.
- G. UL 723 - Surface Burning Characteristics Of Building Materials.
- H. UL 181 - Factory-Made Air Ducts And Air Connectors
- I. ASTM C1071-00 - Standard Specification For Fibrous Glass Duct Lining Insulation
- J. ASTM C423-02 - Standard Test Method For Sound Absorption And Sound Absorption Coefficients By The Reverberation Room Method
- K. ASTM E795-00 - Standard Practices For Mounting Test Specimens During Sound Absorption Tests
- L. ASTM C919-02 - Standard Practice For Use Of Sealants In Acoustical Applications
- M. NFPA 90A - Standard For The Installation Of Air-Conditioning And Ventilating Systems
- N. NFPA 90B - Standard For The Installation Of Warm Air Heating And Air-Conditioning Systems
- O. ARI 885-98 - Procedure For Estimating Occupied Space Sound Levels In The Application Of Air Terminals And Air Outlets

- P. ASTM E1414-91 - Standard Test Method For Airborne Sound Attenuation Between Rooms Sharing A Common Ceiling Plenum.

1.5 QUALITY ASSURANCE

- A. Applicator: Company specializing in sound trap construction with five years minimum experience.
- B. Acoustical Criteria:
  - 1. Noise levels due to equipment and ductwork shall permit attaining sound pressure levels in all 8 octave bands in occupied spaces conforming to noise Criteria (NC) curves as follows:

Offices	NC 35
Public Areas	NC 40
Operating Rooms	NC 40
Procedure and Examination Rooms	NC 35
Dining Facilities	NC 35

C. MECHANICAL EQUIPMENT ACOUSTICAL DESIGN PERFORMANCE

- 1. Air Distribution System:
  - a. Pressure Reducing Device Noise: Maximum permissible sound-power levels in octave bands of airborne transmission through the combination of grille, registers, diffusers, and terminal units or related pressure reducing devices, when operated at the maximum inlet pressure and cfm in installed condition per plans and specifications shall be as follows:

AIR DISTRIBUTION SYSTEM EQUIPMENT/TERMINAL DEVICE NOISE  
 MAX PWL (dB re 10<sup>-12</sup> Watt)

Octave Band	NC-30	NC-35	NC-40	NC-45	NC-50+
1	58	62	66	68	70
2	50	56	60	63	66
3	45	49	54	58	62
4	41	46	51	56	61
5	38	43	48	53	58
6	37	42	47	52	57
7	36	41	46	51	56
8	37	42	47	52	57

2. Pressure reducing valve radiated noise, including VAV and CV Boxes.
  - a. Maximum permissible radiated sound-power levels in octave bands of pressure reducing valves when operated at the maximum inlet pressure and air quantity in an installed condition over occupied spaces shall be as follows:

RADIATED SOUND POWER (dB re 10<sup>-12</sup> WATT)

Octave Band	NC-35	NC-40	NC-45	NC-50+
1	72	76	79	82
2	70	74	77	80
3	61	65	68	71
4	60	64	68	72
5	57	62	68	72
6	56	60	65	70
7	66	70	75	80
8	65	70	75	80

3. Acoustical Performance within Equipment Spaces: Equipment room noise levels and noise transmission to adjacent buildings shall comply with all Federal, State and City Noise Ordinances.

## PART 2 - PRODUCTS

### 2.1 BASE BID MANUFACTURERS

#### A. Sound Traps and Silencers:

1. Industrial Acoustics Company
2. United McGill Corporation
3. Semco
4. Vibro-Acoustics

#### B. Sound-Linings:

1. Johns-Manville Corp.
2. Owens-Corning Fiberglas Corp.

### 2.2 DUCT SOUND TRAPS:

#### A. Available shape:

1. Rectangular straight with splitters or baffles.
  2. Round straight with center bodies or pods.
  3. Rectangular elbow with splitters or baffles.
  4. Round elbow with center bodies or pods.
  5. Rectangular transitional with splitters or baffles.
- B. Factory fabricated.
1. Shell:
    - a. Galvanized steel: minimum 22 USSG (0.85 mm).
    - b. Leakproof at pressure differential of 8 inch wg (200 mm wg).
  2. Media:
    - a. Flamespread: maximum 25.
    - b. Fuel contributed and smoke developed: maximum 20.
    - c. Minimum 1.5 lbs per cubic foot (24 kg/m) density glass or mineral fiber packed under 5 percent compression.
    - d. Filler to be inert, vermin and moisture proof.
  3. Provide all required duct transition pieces and connections. Connections to match ductwork being connected to.
  4. Internal Construction: Galvanized perforated steel baffles: minimum 26 USSG (0.5 mm).
  5. Protective Tedlar film shall be provided between air stream and fill to prevent any intermingling of the airstream with the fill material.
  6. Silencers for any system and/or equipment serving operating rooms, and any fume hoods or other hazardous exhaust systems shall have no media (packless type attenuators). All fume hood or hazardous exhausts, packless sound attenuators shall be stainless steel when installed in stainless steel ductwork.
  7. Net Insertion Ratings: Determined by duct-to-reverberant room test method at design airflow shall be as follows:

SOUND TRAP DYNAMIC INSERTION LOSS (FORWARD FLOW) SPECIFICATION TYPES  
(INDUSTRIAL ACOUSTICS COMPANY TYPE AS STANDARD)

Octave Band	IAC Type as Std	2	3	4	5	6
A	3L	5	9	14	23	24
B	5L	7	13	21	29	39
C	7L	13	18	28	40	47
D	3MS	7	12	19	23	23
E	5MS	10	18	30	42	34
F	7MS	14	24	36	48	44
G	3S	12	16	28	35	36
H	5S	18	24	40	45	46
I	7S	20	35	45	50	48
J	3HL	4	4	7	9	19
K	5HL	6	7	14	19	37
L	3HS	9	14	19	22	28
M	5HS	13	19	26	35	44
N	12TXS	11	19	22	14	11
O	12TXL	8	16	16	7	7
P	8TXLB	14	26	18	14	14

8. Maximum self-generated noise shall be as follows:

SOUND TRAP SELF-GENERATED NOISE AT 2000 FPM MAX PWL  
 (dB re 10<sup>-12</sup> WATT) ( 10.2 m/sec)

Octave	Band	2	3	4	5	6
A,B,C, J,K	Type L,HL	51	51	49	47	50
D,E,F	Type MS	54	52	50	47	48
G,H,I,L,M	Type S, HS	69	63	64	61	63
N	Type TXS	34	35	35	35	28
O	Type TXL	22	28	28	25	<20
P	Type TXLB	29	27	32	30	23

9. Certified Tests:

- a. Submit certified test data from approved laboratory for pressure drop and insertion loss ratings.
- 1) For square or rectangular attenuators: 24 inch x 24 inch (610 mm x 610 mm).
  - 2) For round attenuators 24 inch (610 mm) diameter.

10. Certification data for pressure drop and net insertion loss based on tests of same attenuator.

11. Attenuators and tests: subject to inspection upon request of Architect or Engineer.
12. Similar to Industrial Acoustics Company (IAC).
13. All operating room packless sound attenuators shall have all surfaces factory cleaned and caulked with VOC free sealants and then shrink wrapped prior to shipment.

## 2.3 SOUND LINING

- A. Fibrous glass.
- B. Facing for low pressure duct liners.
  1. Airstream Finish: neoprene or acrylic coated 100% coverage with acrylic coating with a United States Environmental Protection Agency registered anti-microbial agent proven resistant to microbial growth per ASTM Standards G21 and G22.
  2. Stenciled NFPA 90A and 90B.
- C. Facing for circular medium and high pressure duct liner: Finish: Perforated 28 percent minimum open area 24 USSG (0.7 mm) sheet metal.
- D. Where lining could be exposed to weather or other sources of moisture and in medium pressure system, protective Tedlar film shall be provided between air stream and fill to prevent contact of the liner material with moisture.
- E. Protective Tedlar film shall be protected by a perforated inner sheet metal liner.
- F. Minimum thickness:
  1. In ductwork less than 10 sq. ft cross section: 1 inch (25 mm).
  2. In ductwork greater than 10 sq. ft cross section: 2 inch (25 mm).
  3. In plenums: 2 inch (50 mm).
- G. Minimum density:
  1. In ductwork: 1-1/2 lb per cu ft (24 kg/cu m).
  2. In plenums: 3 lb per cu ft (48 kg/cu m).
- H. Flamespread: maximum 25.
- I. Fuel contributed and smoke developed: maximum 50.
- J. Suitable for duct velocity of 5000 fpm (20.5 m/sec).

- K. Dynamic loss coefficient: maximum 1.2.
- L. K Factor: maximum 0.25 BTU in/hr/deg F/sq ft (36 mW/m/K).
- M. Noise reduction coefficient:— for 1 inch (25 mm) thick lining: minimum NRC = 0.70 when tested in accordance with ASTM C423 in Type A mounting.
- N. Similar to Johns Manville Permacote Linacoustic meeting ASTM C1071.
- O. Adhesive and Sealer:
  - 1. In conformance with NFPA 90A.
  - 2. Maximum fire hazard ratings; as specified in insulation.
  - 3. Adhesive: similar to Benjamin Foster 81-99.
  - 4. Sealer: similar to Johns Manville Superseal or Benjamin Foster 82-07.
  - 5. In conformance with ASTM C919.

#### 2.4 NON-HARDENING SOUND CAULKING:

- A. Guaranteed to be permanently elastic.
- B. Similar to Tremco Polybutene.

### PART 3 - EXECUTION

#### 3.1 SOUND TRAPS AND SILENCERS:

- A. Install in accordance with manufacturer's recommendations to obtain published performance.
- B. Maximum static pressure loss: refer to schedules.

#### 3.2 SOUND LININGS

- A. Adhere duct liner to duct wall with full coverage of adhesive conforming to ASTM C919.
- B. Secure Insulation with mechanical fasteners per SMACNA, NAIMA or duct liner manufacturer's recommendations. Pin length shall be such as to limit compression of liner.
- C. All exposed edges of duct liner shall be factory or field coated. For systems with air flow in excess of 2,500 fpm (12.7 m/sec) a metal nosing must be installed in all liner leading edges, trailing edges, and at all seams.

- D. Repair all unprotected penetrations, tears and rips in the surface of the liner with liner adhesive meeting ASTM C919 or Johns Manville Superseal.
- E. Dimensions of lined ductwork are clear inside dimensions after lining has been installed.
- F. Provide 28% open perforated metal liner and plastic film, meeting the same fire and smoke characteristics as the duct liner, between air stream and duct liner to prevent any intermingling of the air stream with the liner material, for all medium and high pressure ductwork and for all lined ductwork 25'-0" upstream and downstream from fans and HVAC units.
- G. Extent of ductwork sound linings:
  - 1. Upstream of all exhaust fans for minimum distance of 25'-0".
  - 2. All toilet exhaust branch ducts. Lining can be deleted if duct configuration has at least two 90° elbows between the closest air inlets of the men's and women's toilet rooms.
  - 3. All air transfer and jumper ducts from rooms to return air plenums.
  - 4. Where indicated on drawings.

### 3.3 TESTS

- A. Sound Traps and Duct Silencers:
  - 1. After installation: measure total system pressure before and after attenuators.
  - 2. If pressure loss exceeds maximum static pressure loss schedules on drawings: at no charge, replace attenuators and/or modify entrance and/or discharge aerodynamic flow to obtain specified performance.

END OF SECTION