

Noise Control for Building Interior Heating, Ventilation and Air Conditioning Equipment Guidance Sheet

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The following is intended to provide guidance and example resources for noise control inside buildings stemming from the operation of heating, ventilation and air conditioning (HVAC) equipment. HVAC equipment involves rotating machinery and air moving devices, all of which can generate noise and vibration levels that easily transfer into and transmit through a building's interior. This is particularly true if the HVAC equipment is centrally located inside a building or on its roof as opposed to being in its basement.

While the general approach to noise control is the same for most buildings, the specific measures and solutions need to be carefully selected and implemented correctly. In general, noise control measures can be applied at the source, along the pathway, or at the receptor directly. For these reasons, it is highly recommended that building owners discuss their situation with a qualified acoustical consultant as early as possible in the design or renovation process. It is always more cost-effective to design for good acoustics from the beginning rather than to rely on retrofit solutions when noise becomes a problem later. To aid in the selection of an acoustical consultant, links to several national professional societies are provided. The NYC DEP can also provide a list of consultants.

This information is not an exhaustive list of noise control products and vendors. It is *intended for guidance and informative purposes only*, and should not be construed as an official endorsement of any product, vendor, or consultant by the City of New York. Furthermore, any noise control work or repair done on HVAC systems in buildings will need to comply with NYC Construction Codes.

HVAC Interior Noise Criteria

Noise criteria, or noise limits, are readily available to evaluate the acceptability of HVAC noise levels. In general, HVAC noise is viewed as background noise inside buildings. HVAC noise criteria are intended to limit interior noise levels based on the intended use or purpose of the space. The goal is to maintain compatible acoustical conditions inside the rooms to allow for activities such as sleeping, conversation, use of telephones, enjoyment of television, etc. The following are a few example of interior HVAC noise criteria that are still in use today. Several similar approaches exist as well.

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| • Room Criteria (RC) | ASHRAE | RC 30 to 35 for residences |
| • Noise Criteria (NC) | ANSI Standard S12.2 | NC 30 to 35 for residences |
| • A-weighted decibels (dBA) | Various Guidelines | 35 to 40 dBA for residences |
| • NYC General Noise Code | Section §24-227 | 42 dBA for residences |

HVAC Noise Control Methods

Many options are available to reduce or avoid excessive noise from HVAC systems. Source controls tend to be the most effective because they prevent the noise from being generated in the first place. The following good housekeeping practices should be considered when installing or retrofitting HVAC systems:

- Do not place HVAC equipment near noise-sensitive spaces
- Place HVAC equipment in a separate mechanical room with massive walls/ceiling
- Select HVAC equipment with lower noise rating
- Select fans to operate at peak efficiency
- Select fan sizes to allow lowest possible motor RPM
- Use gradual transitions in/out of fans to avoid turbulence
- Avoid locating duct turns near inlet or outlet of the fan
- Avoid 90 degree elbows or sharp turns in ducts
- Place duct branches at least 3-dimensions away from noise sources
- Avoid any obstacles in the airflow stream close to fans
- Use bell-shaped transition inlets to fans
- Avoid abrupt, nonsymmetrical duct transitions
- Create symmetrically branching arrays to diffusers
- Attach ducts to stiff/massive structural elements
- Keep airflow below 1,000 FPM for duct elbows, and below 2,000 FPM for ducts
- Use lined ducts with 1 inch (1.5 lb/CF) or 2 inch (3 lb/CF) liners
- Use lined elbows with turning vanes – circular curved elbows are best
- Use large, lined plenums with 4 to 6 inches of absorptive lining
- Use circular ducts – stiffer than rectangular ducts
- Isolate ducts from surrounding walls/ceilings through all penetrations
- Avoid duct break-out noise with lagging cover or gypsum board chase (2 lb/SF)
- Avoid placing noisy ducts next to quiet ducts
- Use flexible collars between all major elements
- Use diffusers/grills with minimal fins sizes – special quiet diffusers are available
- Consider using a displacement ventilation system with air supplied at floor level
- Avoid the need for heavy damper settings – maintain open airflow
- Place dampers well upstream of any diffusers
- Avoid use of flexible connector immediately at diffuser
- Use variable speed drives rather than variable vane controls in VAV systems
- Use acoustical louvers for air intake from outdoors
- Mount HVAC equipment on inertial blocks/rails/curbs
- Use vibration isolation springs/pads under rotating equipment
- Use vibration isolators when equipment is suspended from the ceiling
- Use flexible connection for attaching the duct to the equipment housing a fan
- Mount RTU's on non combustible, stiff roof sections, and use a heavy housekeeping pad
- Discharge RTU's airflow horizontally through a plenum prior to entering the duct
- Run the RTU's duct along the rooftop prior to penetrating the building
- Use high density backing on room acoustical tiles below RTU's
- Use silencers - dissipative/absorptive, reactive/muffler, active electronic
- Use silencers for air intake and discharge pathways with straight/smooth approach
- Place silencers as close to noise source as possible
- Beware silencer pressure drop(do not exceed 0.3 inchH₂O) and self-generated noise

Example Products and Vendors

The following provides contact information for finding HVAC noise and vibration control products and vendors. Oftentimes vendors can provide knowledgeable recommendations for suitable products for a given situation; however an independent acoustical consultant should be able to provide more comprehensive noise control assessments and case-specific solutions.

Acoustical Consultants

- Acoustical Society of America <http://acousticalsociety.org>
- Institute of Noise Control Engineering <http://incesa.org>
- National Council of Acoustical Consultants <http://ncac.com>

Ceiling/Floor and Wall Sound Isolation

Products designed to mechanically isolate or add mass to walls and ceilings in order to increase acoustical isolation performance.

- Acoustiblok Acoustiblok, Acoustiblok-Wallcover www.acoustiblok.com
- AcoustiGuard GenieClip, Mass Loaded Vinyl, Barrier Material, Iso-sill www.acoustiguard.com
- Green Glue Noiseproofing Compound, Sealant, and Clip www.greengluecompany.com
- Kinetics Model ICC, KSCH, IsoGrid, IsoMax, PSB, KWSB, Wallmat, IPRB www.kineticsnoise.com
- Mason Industries 30 and 30N Series, NPS, DNSB www.mason-industries.com

Sound Absorptive Wall Treatments

Products designed to mount on interior walls and ceiling surfaces in order to absorb acoustic energy (note - only useful for reducing reverberant noise).

- Acoustiblok QuietFiber www.acoustiblok.com
- Acoustical Surfaces Wall Panel www.acousticalsurfaces.com
- Eckel Industries Model EFP, FFP, ALP, DAP www.eckelusa.com
- Industrial Acoustics Absorption Panels www.industrialacoustics.com
- Pyrok, Inc. Acoustement Plaster www.pyrokinc.com

Acoustical Doors and Windows

Doors and windows specially designed for high acoustic performance.

- Acoustical Surfaces Noise S.T.O.P. Doors and Windows www.acousticalsurfaces.com
- Krieger Specialty Products Acoustical and SCIF Doors and Windows www.kriegerproducts.com
- Overly Door Company Acoustical Doors www.overly.com

Vibration Isolators

Special springs and mats used to absorb vibration and isolate equipment from their surroundings. Care must be practiced to select the correct isolators for a given job or else they can actually make the problem worst due to resonance frequencies.

- Kinetics Floor Mounts, Inertia Bases, Hangers, Flex Connectors www.kineticsnoise.com
- Mason Industries Spring Mounts, Seismic Mounts, Neoprene Mounts, Hangers www.mason-industries.com
- Vibro-Acoustics Floor Mounts, Bases, Curbs, Hangers www.vibro-acoustics.com
- Newport Pneumatic Isolators, Table Isolators www.newport.com

Duct Silencers

Duct silencers are used inside air handling ducts and should be positioned as close to the noise source as possible. Airflow noise is absorbed/reduced within the silencers.

- Kinetics Rectangular Silencers, Circular Silencers www.kineticsnoise.com
- Industrial Noise Control Panl-Flow Silencers www.industrialnoisecontrol.com
- Vibro-Acoustics Dissipative Silencers, Reactive Silencers www.vibro-acoustics.com
- McGill Airflow Soundpak Silencers www.mcgillairflow.com