Basis of Design

This section applies to the design and installation of noise and vibration control components for HVAC and plumbing systems.

Design Criteria

- Select duct velocities to meet N.C. requirements of each occupied space. NC level requirements shall be identified in the Basis of Design narrative. Coordinate required NC levels with University Project Manager and users.
- Noise criteria should be the following: Office space: NC level 35, Laboratory space: See EH&S Laboratory Safety Design Guide, Classroom: See Classroom Services section. Identify NC levels for spaces on the design documents.
- Many campus buildings have vibration-sensitive equipment such as electron microscopes. Establish acceptable vibration criteria early in the technical program so that equipment, piping, and ductwork that require vibration isolation can be identified. Provide a table in the design documents which lists the vibration isolation requirements for piping, equipment and ductwork.
- Analyze mechanical system equipment sound levels to control noise transmission. Select all mechanical equipment to meet the noise criteria (NC) requirement of each occupied space. Identify NC level requirements in Contract Documents. Coordinate required NC levels with University Project Manager and users.
  1) Minimize the use of fiberglass liner inside ventilation ducts. Do not install liner between the supply fan cooling coil and the terminal unit. Do not install liner on outside air intake ductwork. Minimize liner in the return air duct. Do See Ductwork and Duct Accessories section. Consult with Engineering Services if noise control is a concern.
  2) Reduce fan and air noise by the use of sound attenuators, round or oval ducts, where feasible, instead of rectangular, as well as larger ducts and fans at lower RPM.
  3) Duct liner downstream of the terminal box is acceptable to mitigate cross-talk noise between rooms.
  4) Insulate fan powered boxes with fiberglass and a hard, cleanable surface exposed to the air stream.
  5) Existing HVAC systems with fiberglass liner in good condition may be left in place until the entire building is renovated.
  6) Identify when floating slab are required for acoustical isolation and review options with Engineering Services.
- At University of Washington Medical Center projects, ductwork sound lining is not acceptable.
- Provide acoustic treatment in mechanical room walls and ceilings if adjacent areas will be affected by noises generated in the mechanical room. Coordinate interior finishes with Architect.
- Avoid “Floating Slabs” i.e., slabs that are acoustically isolated from the structural slab with insulation between the two slabs. These slabs are usually constructed before the building is “closed in” or protected from rain. Consequentially they are exposed to rain which saturates the insulation, making the acoustical performance ineffective and providing a breeding place for mold and mildew. Consult with Engineering Services if floating slabs are considered.

Design Evaluation
The following information is required to evaluate the design:

- **Programming Phase**: Establish acceptable vibration criteria for vibration sensitive equipment.
- **Schematic Design Phase**: Provide a preliminary basis of design narrative and identify noise criteria levels for each occupied space.
- **Design Development Phase**: Provide a schedule listing vibration isolation requirements, including isolator type and model number, isolator loading and deflection. Provide a schedule listing equipment sound power levels. Provide outline specifications.
- **Construction Document Phase**: Provide a schedule listing vibration isolation requirements for equipment, piping and ductwork, including isolator type and model number, isolator loading and deflection. Provide a schedule listing equipment sound power levels. Provide final specifications.

**Construction Submittals**

- Provide catalog cut sheets of all noise and vibration control components, including rubber-in-shear isolators, spring isolators, neoprene pads, inertia bases, flexible connectors, and sound attenuators. Identify isolator mounting deflections, spring diameters, compressed spring heights at rated load, and equipment operating speed.
- Coordinated shop drawings provide by the contractor shall be reviewed by the design team, specifically the acoustical consultant, to verify systems shown on the shop drawings will meet noise/vibration criteria set by the consultant during design. Any revisions to systems and equipment causing variance from the approved shop drawing noise/vibration design shall be reviewed and approved by the acoustical consultant.

**Products, Material and Equipment**

**Vibration Control**

- Provide spring-type or rubber-in-shear vibration isolators for rotating equipment on grade.
- Provide spring-type vibration isolators and inertia bases for rotating equipment in areas not on grade.
- Provide springs that are large diameter, stable type which do not require guides or snubbers.

**Noise Control/Acoustic Treatment**

- If sound attenuators are used, pack-less types are strongly recommended.
- Fan powered boxes that have lining exposed to the air stream shall have a cleanable surface.

**Installation, Fabrication and Construction**

**Vibration Control**

- Do not make rigid connections between rotating equipment and the building structure that short-circuit vibration isolation systems.
- Provide slack electrical circuit connections to isolated equipment.
- Verify mounting systems are not resonant with supported equipment forcing frequencies.
- Level vibration-isolated equipment while equipment is under full operational load.
- Do not use vibration isolation components to correct misaligned sections of pipe.

END OF DESIGN GUIDE SECTION