

PIPING AND DUCTWORK ACOUSTICAL LAGGING

Noise radiating from piping and ductwork can be a serious problem in modern building construction. Turbulent flow piping noise can be caused by water or other liquids passing through elbows, valves, or other transition pieces. Duct noise is caused by air flowing past obstructions or branches which results in the vibration of the metal ductwork. This vibration then radiates noise into the building.

Current building construction materials cause piping and ductwork noise to be more of a concern today than in the past. Lightweight PVC plastic pipe is commonly used to replace cast iron, copper, or mild steel tubing. Sheet metal ducting becomes thinner and lighter in weight so as to minimize the initial material cost. These light construction materials are more easily set into motion due to air and fluid flow, with the result being an increase in client concerns and complaints directed towards noise. These problems are particularly an issue in multi-family residential construction since piping which serves adjacent living spaces frequently passes through other quarters on its way into or out of the building.

It is important to note that there are two (2) different types of piping and ductwork noise that are typically encountered. Breakout noise is noise that radiates radially out away from the pipe or duct. Breakout noise is caused by the wall of the pipe or duct vibrating due to the fluid passage within. Stream noise is noise carried along with the fluid as it flows down the pipe or duct. This noise is most apparent at outlet grills or registers in ducting systems. Stream noise must be controlled via the introduction of silencers, attenuators, turning vanes and similar into the air path within the ductwork which serve to minimize air turbulence. This paper will not discuss the control of stream noise.

The simplest and most effective treatment method for the control of pipe and duct breakout noise is to wrap the piping and ductwork with acoustical cladding. This acoustical material consists of three (3) components:

1. Vibration damping material (for sheet metal)
2. Light density decoupling material
3. Acoustical barrier overwrap

Specific information on these components follows:

1. Vibration damping material is frequently specified for use on light-gage rectangular sheet metal ductwork in order to minimize “ringing” of the metal. This damping material is available in the form of sheets of self-adhesive mastic or in a paste form for spraying or troweling onto the duct. This material stiffens the sheet metal and renders it less susceptible to excitation. Generally, the need for vibration damping material is greatest with large rectangular ducts and becomes less with round or small rectangular ducts. Examples of vibration damping material include Kinetics Model KDD (self-adhesive mastic sheets) and Kinetics Model KDC-E-162 (semi-liquid sprayable paste).

2. Light density decoupling material provides an air space separation between the pipe or duct and the exterior barrier cladding. This decoupler material is commonly specified to be light density fiber glass with a minimum of 1" (25 mm) thickness. Thicknesses greater than 1" offer improved capabilities up to a practical upper limit of approximately 2" to 3" (50 to 75 mm). The decoupler material needs to be light and porous as it is the air trapped within the material which serves the purpose of acoustically separating the wall of the pipe or duct from the exterior barrier cladding. As an analogy, it is the air space between two (2) panes of glass which provides the insulation properties of a window. Care should be taken in the event that a pipe carrying steam or hot water is to be wrapped to ensure that the temperature insulation capabilities of the decoupler satisfy the project requirements.
3. Acoustical barrier wrap improves the transmission loss of the pipe or duct and therefore minimizes breakout noise. This barrier needs to be a heavy material which is sufficiently flexible so as to permit wrapping around small diameter piping. In the past lead sheeting was utilized for this purpose but recent concerns over lead exposure and legal restrictions concerning its use have rendered this material obsolete. Current barium sulfate loaded vinyls are best suited for this application as this material presents no known health hazards. It is important that there be no barrier gaps or open areas over the region of the installation as these represent significant acoustical "leaks" that greatly reduce effectiveness. Barrier weights of 0.5 lb./sq. ft. to 1.0 lb./sq. ft. (2.5 to 5.0 kg/sq. meter) are commonly specified as these materials are thin enough to permit good workmanship by the installing contractor. Should additional acoustical performance beyond the capabilities of a single barrier layer be required for a particularly sensitive project, it is recommended that a second layer be applied over the first. For optimum results, this second layer should be separated from the first barrier layer with a decoupler as discussed in paragraph 2 above. This "double layer" of acoustical cladding provides superior acoustical performance compared to the use of a single, heavier layer.

Acoustical cladding material should be used around all piping and ductwork which passes through noise-sensitive areas within buildings. While it is recommended that, for most applications, the wrapping should be continuous over the length of the pipe or duct, it is appreciated that there are some instances where this represents a large amount of material. Partial wrapping may be acceptable for some non-critical applications. It is recommended that cladding be used a minimum of 10 pipe diameters upstream and 20 diameters downstream of all transitions, tees, valves, branch takeoffs or similar to ensure laminar flow beyond the cladding.

Relevant local building and fire codes should always be referenced for the suitability of all materials used within an occupied space within a building.

All piping and ductwork should be supported from the deck above via vibration isolation hangers in lieu of rigid rods. Vibration isolation hangers suppress any vibration which might be present within the piping from traveling up the rod into the building structure. Further, at through-wall passage points the piping or ductwork must be prevented from making any rigid connection with the building via the use of conventional insulation sleeves between the piping and the wall.

Kinetics Noise Control has developed a unique and specific combination absorber/barrier material which is well suited for pipe and duct wrapping applications. KNM-100ALQ combines a 1.0 lb./sq. ft. barrier material with an aluminum foil facing on one surface and a 1" or 2" (25 or 50 mm) thick quilted fiber glass decoupler layer on the opposite surface. This product thus combines the decoupler and the barrier into a single product which significantly minimizes the cost, time and labor required to use both a separate barrier and a separate decoupler layer. The reinforced barrier aluminum outer layer provides a clean surface that is easily adhered with tape. This aluminum covering also increases the mechanical strength, wearability and fire retardancy of the barrier. The barrier used in this product features an STC of 28, which is more than sufficient for most normal HVAC plumbing and duct applications. In the event that higher acoustical performance should be required to suite an unusual application, a second layer of KNM-100ALQ can be overlaid on top of the first layer, with care taken to stagger and overlap the joints.

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