ANCHORAGE OF SEISMIC RESTRAINTS FOR PIPE AND DUCT

S6.1 – Introduction:

The 2006/2009 IBC has some strict requirements on the types of attachment hardware to be used to anchor the seismic restraints for pipe or duct to the building structure. This section will discuss these requirements and provide some guidance for interpreting them.

S6.2 – Load Path:

Section 13.4 of ASCE/SEI 7-05 requires that there be a continuous load path of sufficient strength and stiffness between the pipe or duct and the building structure to support the design loads discussed in section S5.0 of this manual. Globally speaking, this load path will be continuous all the way down to the supporting soil structure. The seismic restraints and anchorage hardware provided by Kinetics Noise Control form a part of this continuous load path. The design professional that has responsibility for the pipe or duct must coordinate with the structural engineer of record to ensure that the selected anchorage locations on the building structure will;

1. Have a continuous load path leading to the main building structure and from there to ground. This means that stud walls, unless specifically designed for the purpose, may not be used for anchorage of seismic restraints.
2. Have sufficient strength and stiffness to carry the expected seismic design loads as well as the other normal service loads for which the structure was designed.
3. Have the proper attachment conditions for the type of anchor being used. This is especially critical for post installed concrete anchors which have limiting requirements for concrete strength, anchor embedment, anchor spacing, and anchor distance from the edge of the concrete.

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S6.3 – Post Installed Concrete Anchors:

2006/2009 IBC requires the use of "cracked concrete anchors" when using post installed anchors to attach seismic restraints to the building structure. These anchors are those which have been pre-qualified for seismic applications by testing in accordance with ACI 355.2. Anchors which satisfy the requirements of ACI 355.2 will have an ICC/ES report issued which will specify the following.

1. The IBC code year(s) for which the anchors are qualified.
2. The conditions of use. Whether they are qualified for seismic applications, and if so for which Seismic Design Categories they may be used. Also, the report will indicate whether the anchors may be used in outdoor wet environments, or must be confined to indoor dry applications.
3. The allowable loads, embedment depths, critical spacing, and edge distance.

The concrete anchors supplied by Kinetics Noise Control with their seismic restraint kits meet the requirements of 2006/2009 IBC.

S6.4 – Additional Anchorage Limitations:

There are additional fastener types which may not be used for seismic applications. Some of these are obvious, and some are used regularly without question.

1. Friction Clips – Fasteners which rely on friction for their holding power may not be used for seismic anchorage applications. This is because friction clips require continuous and intimate contact between the friction surfaces for the proper holding forces to be developed. The vibrations introduced by an earthquake may cause this intimate contact to be broken which will lead to slippage in the fastener. Once a friction type clip has begun to slip, it will continue to slide under a much lower force than that which it was designed to resist.

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2. Power Actuated Fasteners – Power actuated fasteners may not be used to resist tensile loads for seismic applications in Seismic Design Categories D, E, or F, unless specifically designed to do so. It is probably good practice to not use power actuated fasteners in Seismic Design Category C as well. A favorite type of this fastener is the powder shot pin. These types of fasteners rely on the elastic nature of the material into which they are driven to provide enough friction force to prevent withdrawal of the fastener under a tensile load. When a vibratory load is introduced, especially in concrete which is weak in tension, these fasteners may tend to "back out' under tensile loads.
3. Beam Clamps w/o Retainer/Safety Straps – Even with a pointed set screw these devices rely strongly on friction to hold their position. If a retainer/safety strap is used with the beam clamp to mechanically prevent it from "walking" off the beam under a cyclic load, and the strap is of adequate size to resist the expected seismic load, then it may be used to anchor the seismic restraint to the structure.

S6.5 – Summary:

1. Be sure there is a continuous load path from the seismic restraint to the building structure. Ultimately the engineer of record must be responsible for the installation of the restraints, and for interfacing with the structural engineer to ensure the validity of the structural connection.
2. Be sure the proper anchor type is being specified for the attachment of the seismic restraint to the building structure.
3. Coordinate with the structural engineer of record to ensure that the structural anchorage points for the seismic restraints have enough strength and stiffness to resist the design seismic loads as well as the other normal service loads.

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