

Connection Options for Awkward Situations

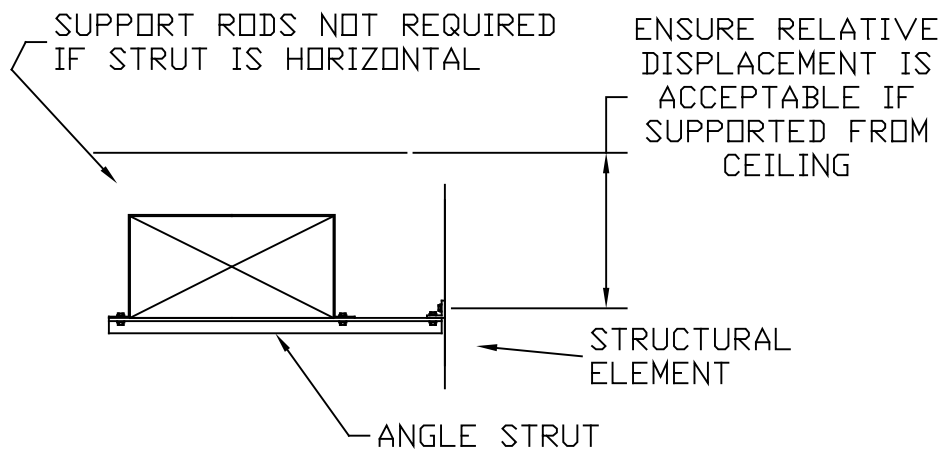
Almost every project will include some areas where installing restraints in a conventional fashion will be difficult. This segment of the manual offers options to consider when confronted with various situations.

Long, Narrow Hallways

Probably the most common issue in the field is how to deal with lateral restraints in long, narrow hallways. Normally there is considerable congestion in these areas and not enough room to angle restraints up to the ceiling structure. Often the walls are not structural and do not offer a surface to which to anchor.

When evaluating halls, the first issue is to determine if either of the walls of the hall is structural. If either wall is structural, it offers a surface to which the restraints can often be attached. For structural walls, any relative displacement issues between the wall and the structure supporting the pipe must be identified. The maximum permitted relative displacement is $\frac{1}{4}$ inch, which for most structures corresponds to a difference in elevation of approximately 2 feet (see also the structural attachment section of this chapter).

Assuming the wall meets both of the above requirements, a lateral restraint can be run either directly over to the wall or up at a slight angle to the wall. Normally this would be done with a strut as shown below.



Trapeze-Mounted Duct Restrained to Structural Wall or Column with a Horizontal Strut

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PAGE 1 OF 5

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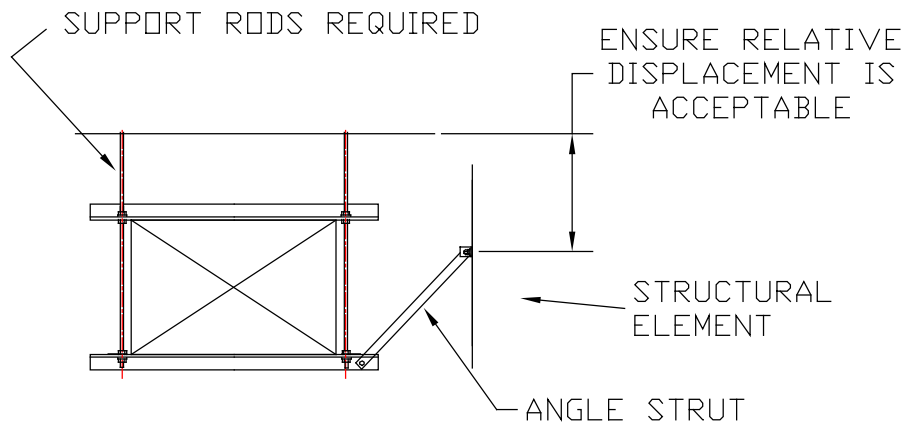


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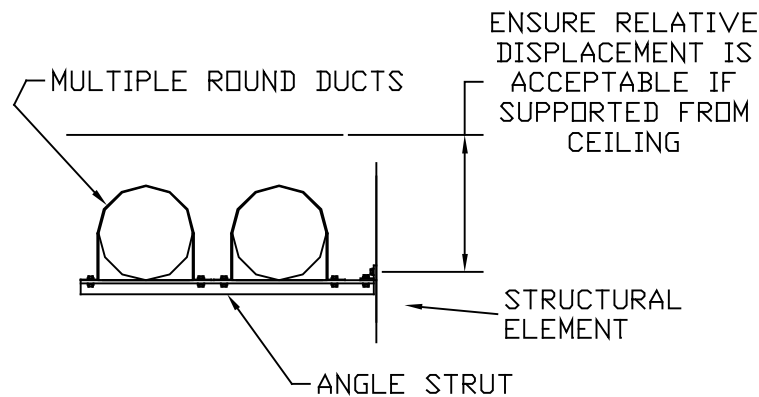
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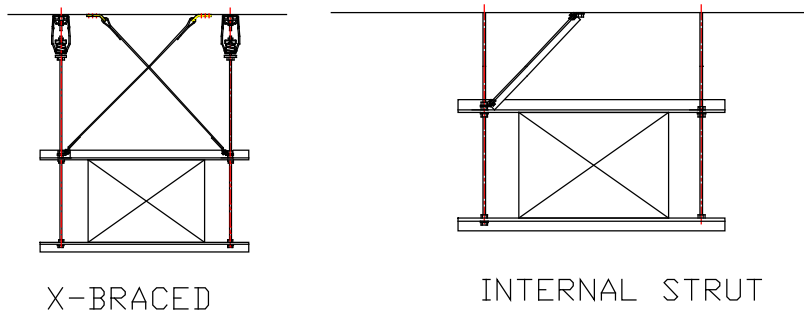
Trapeze-Supported Duct Restrained to Structural Wall or Column with an Sloping Strut



Clevis-Supported Ductwork Restrained to Structural Wall or Column

For the case where there are no nearby structural connection points or where the nearby structural elements are not suitable, there are several options that can be considered.

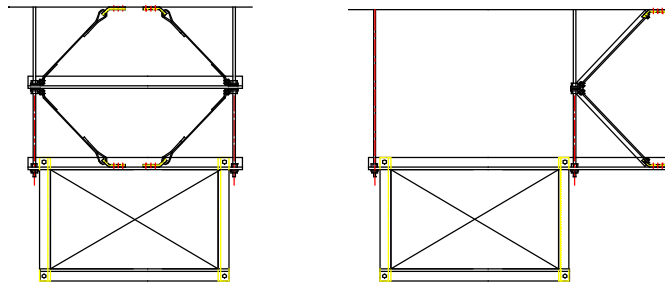
The first option is to restrain to the ceiling using “X” bracing or a diagonal strut.



“X” or Diagonally Braced Restraint Arrangement

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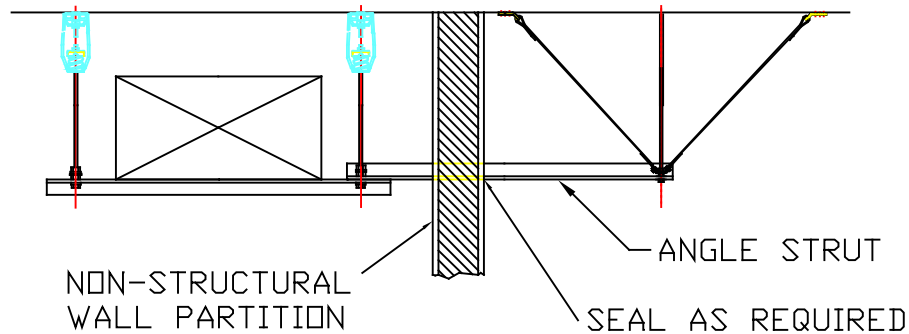
A "K" or double "K" brace can also be used. The "K" can either be located inside the support rods or outside the support rods, but in the case of a double "K", both sides must be identical (either inside or outside).



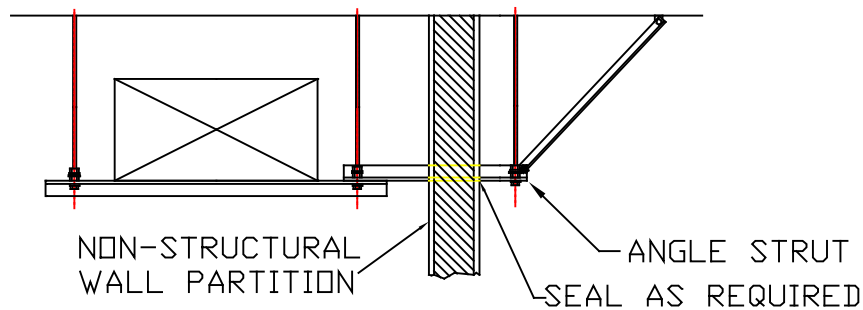
DOUBLE K-BRACE (INTERNAL) SINGLE K-BRACE (EXTERNAL)

Single and Double "K" Brace Restraint Arrangement

In cases where only non-structural walls limit access for restraint, it is frequently possible to penetrate the non-structural wall and shift the lateral restraint device to the opposite side of the wall or partition as shown here.



Wall Penetration Restraint (Cable)

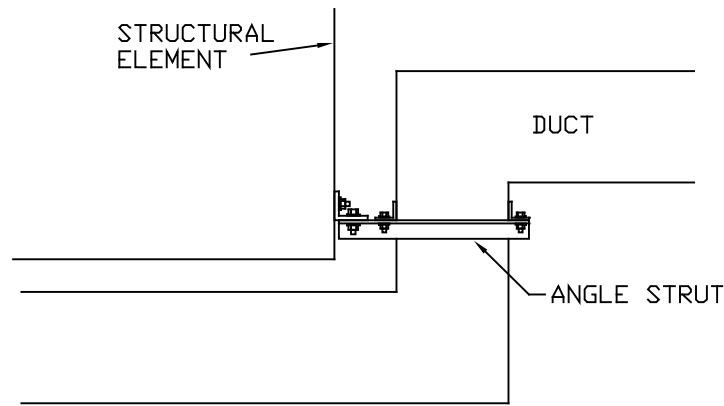


Wall Penetration Restraint (Strut)

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Axial Restraint Strut at a Dogleg

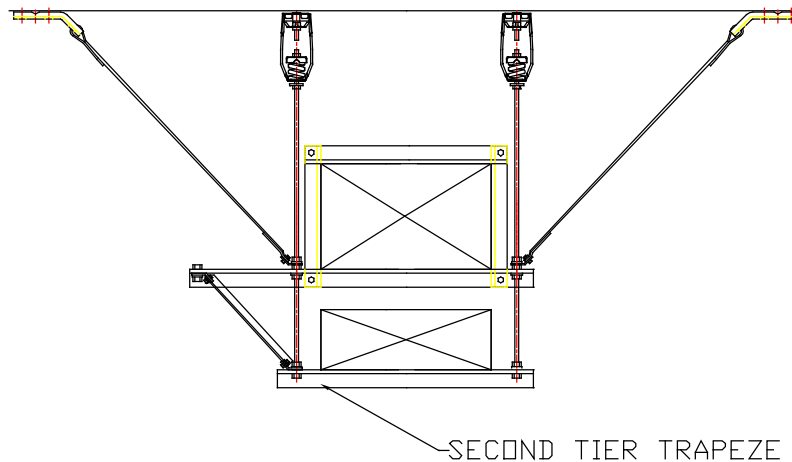
This arrangement is often a convenient way to connect an axial restraint and can occur both in the horizontal and vertical plane. Often it will be found that when installing ductwork, a jog has been added to a run to avoid running into a column or other structural member. Where this occurs, it offers an easy way to connect an axial restraint.



Axial Restraint Strut at a Dogleg

Piggyback or Double-Tier Restraint

In congested areas, occasionally there is a double layer of ductwork supported off a single trapeze arrangement. It is possible under some conditions to brace one trapeze bar to the other, and then restrain the second trapeze bar to the structure. If doing this, there are a couple of cautions. First, the restraint capacity for the second trapeze bar must be adequate to restrain the total load from both bars and, second, the ductwork must be similar in nature and ductility.



Piggyback or Double-Tier Restraint Arrangement

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Restraints for Ductwork Mounted Well Below the Support Structure

This situation is not easily handled. Past history has shown, and the code is quite clear, that it is not a good idea to support the duct from one structural element and restrain it using another structural element that will undergo significantly different motions. Restraints fit in this fashion will likely fail or cause the duct supports to fail. Neither of these outcomes is desirable.

About the only solution to this is to add a support structure for the ductwork that is located either just above or just below the level of the duct. The ductwork can then be both attached and restrained to this structure.

The structure can be supported off the floor, off the ceiling, or from structural walls or columns. The support structure must be rigid enough to absorb all of the seismic loads, and particularly the moments, with minimal deformation, transferring pure shear or tensile forces into the supports.

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PAGE 5 OF 5

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