SUSPENDED CEILING Guide

VERSION 1.0 REVISED 07/01/15

GENERAL

The purpose of this checklist is to clarify the minimum building code requirements when preparing for a suspended ceiling inspection.

The information provided in this document is general and intended as a guide only. Each project is unique and additional requirements may be enforced as deemed appropriate.

TIP! Failure to complete items below prior to inspection may result in a re-inspection fee.

PLAN SUBMITTAL REQUIREMENTS

All existing tenant improvement suspended ceiling systems installed prior to January 1, 2008 in areas affected by renovation, structural repair, or alterations must be upgraded to meet seismic requirements set forth in CISCA 3-4/UBC Standard 47-18. (See CISCA Seismic Construction Handbook for Suspended Ceilings for current standards).

PLANS/SHOP DRAWINGS/ICC ES REPORT

1. The designer shall include engineered “heavy duty” suspended ceiling system plans, shop drawings and manufacturer’s installation requirements in the submittal packet.
2. Plan must include engineering specifications for compression struts, wall attachments, and layout for seismic joints when installed in areas in excess of 2500 square feet.
3. Include the current ICC ES Report for specified suspended ceiling system.

SPECIFIC DESIGN REQUIREMENTS

Suspended Ceilings

1. Requirements are based on the 2013 CBC, ASCE 7-10, and 2013 CISCA Seismic Construction Handbook. In the previous code cycle (2010), the requirements were to be designed and installed in accordance with ASCE 7-05, ASTM C635 and ASTM C636. The current code now references ASCE 7-10 and ASTM E580, with changes as follows:
    a. ASTM E580 is specified in ASCE 7-10 instead of the two previous CISCA Standards.
    b. Much of the specification in ASCE 7-05 has been eliminated as it is also contained in ASTM E580.
    c. These two changes make determining the requirements much simpler, as virtually all requirements are contained in E580, instead of spread out over ASCE 7 and two CISCA documents.
    d. When dividing a very large ceiling into 2,500 square feet (230 m2) such as using seismic separation joints or other means, the aspect ratio is now limited. The ratio of the longest dimension to the shortest must be less than or equal to four.
    e. Power actuated fasteners are now permitted to be used for loads not greater than 90 lbs. (400 N) in concrete and not greater than 250 lbs. (1000 N) in steel. This makes them suitable

for suspension wires, but not for lateral bracing. Lateral bracing connections must be capable of holding at least 250 lbs. (1000 N). This is the equivalent of the 180 pound (800 N.) connection force at 45 degrees. Lath and Plaster ceilings are no longer exempt and will require custom solutions.

2. Seismic Design Categories D and E requirements for suspended ceiling systems shall be modified by the following:

   a. A heavy duty T-bar grid system shall be used.

   b. The width of the perimeter supporting closure angle shall be not less than 2 inches. Approved perimeter seismic clips may be used in lieu of 2 inch wall angle and shall be installed per manufacturer's instruction and ICC-ESR reports information.

   c. In each orthogonal (orthogonal means "involving right angles") horizontal direction, one end of the ceiling grid shall be attached to the closure angle.

   d. The other end in each horizontal direction shall have a 0.75 inches clearance from the wall and shall rest upon and be free to slide on a closure angle.

   e. For ceiling areas exceeding 1,000 ft^2, horizontal restraint of the ceiling to the structural system shall be provided. The tributary areas of the horizontal restraints shall be approximately equal. Manufacturer may require a vertical post every 12 square feet).

      1) Rigid braces are permitted to be used instead of diagonal splay wires.

      2) Braces and attachments to the structural system above shall be adequate to limit relative lateral deflections at point of attachment of ceiling grid to less than 0.25 inch for the loads prescribed in Section 13.3.1.

   f. For ceiling areas exceeding 2,500 ft^2, seismic separation joints or a full height partition that breaks the ceiling up into areas not exceeding 2,500 ft^2 shall be provided.

      1) **EXCEPTION**: Structural analyses of the ceiling bracing system for the prescribed seismic forces that demonstrate ceiling system penetrations and closure angles provide sufficient clearance to accommodate the anticipated lateral displacement.

   g. Except where rigid braces are used to limit lateral deflections, sprinkler heads and other penetrations shall have a 2 inches oversize ring, sleeve, or adapter through the ceiling tile to allow for free movement of at least 1 inch in all horizontal directions.

      1) Alternatively, a swing joint that can accommodate 1 inch of ceiling movement in all horizontal directions is permitted to be provided at the top of the sprinkler head extension. (See example illustrations for flex drops, below).

   h. Changes in ceiling plan elevation shall be provided with positive bracing. (See example illustrations below).

   i. Cable trays and electrical conduits shall be supported independently of the ceiling per ASCE 7-10 chapter 13 requirements.

   j. Integral Construction. As an alternate to providing large clearances around sprinkler system penetrations through ceiling systems, the sprinkler system and ceiling grid are permitted to be designed and tied together as an integral unit. (ASCE 7-10)

      1) Such a design shall consider the mass and flexibility of all elements involved, including the ceiling system, sprinkler system, light fixtures, and mechanical (HVAC) appurtenances. Such design shall be performed by a registered design professional.

Fire rating and separation requirements

1. Fire ratings shall comply with the requirements of the 2013 California Building Code chapter 7, UL listing, Office of the State Fire Marshal's listing, and installation per the manufacturer's suspended ceiling system installation manual.

    a. The components and installation details must conform to the U.L. or SFM approval for the design number specified.

    b. Custom designs which combine components from different approved designs but have not been tested as a complete assembly are ***not acceptable***.

    c. For schools and Essential Services Buildings, bracing assemblies are required for each 96 square feet.

    d. The first bracing assembly is required not more than four (4) feet from each wall.

    e. A minimum of one bracing assembly is required between any two adjacent expansion cut-outs on runners being braced.

Fire Separation Marking and Identification Requirements

1. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

    a. Be located in accessible concealed floor, floor-ceiling or attic spaces;

    b. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and

    c. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.

    d. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

SPECIAL INSPECTION

The City of San Mateo adopted policy #15 on 07/09/2009 of ICC Tri-Chapter Uniform Code Committee. Accordingly, special Inspection is not required for suspended ceilings.

SPECIFIC INSPECTION REQUIREMENTS

☐ Perimeter hangers - terminal ends of each cross runner and main runner shall be supported independently a maximum of 8" inches from each wall or ceiling with number12 gage wire or approved wall support.

☐ Vertical wires shall be attached to the suspension member and to the support above with a minimum of three turns.

☐ Trapeze or equivalent device may be used where obstruction precludes direct suspension.

☐ Seismic separation joints shall be installed per manufacturer's specifications & approved plans.

☐ Vertical hangers: Suspension wires shall not be smaller than #12 gauge spaced at 4' on center or #10 gauge at 5' on center along each main runner.

☐ Compression strut/seismic posts are typically required every 144 sq. ft., starting a maximum 6'-0" from perimeter with seismic wires (4) directions @ max. 45 degrees from horizontal.

☐ Partitions that are tied to the ceiling and all partitions greater than 6ft in height shall be laterally braced to the building structure. Such bracing shall be independent of any ceiling splay bracing.

☐ Bracing shall be spaced to limit horizontal deflection at the partition head to be compatible with ceiling deflection requirements for suspended ceilings and elsewhere in this section for other systems.

EXCEPTION: Partitions that meet all of the following conditions:

1) The partition height does not exceed 9 ft.
2) The linear weight of the partition does not exceed the product of 10lb times the height (ft) of the partition.
3) The partition horizontal seismic load does not exceed 5 psf.

ABOVE CEILING INSULATION

☐ Insulating materials, where concealed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450. [CBC 720.2]

☐ Where insulating materials with facings are installed in concealed spaces in buildings of Type III, IV or V construction, the flame spread and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil insulation that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish. [CBC 720.2.1]

☐ All layers of single and multilayer reflective plastic core insulation shall comply with CBC Section 2613.

☐ Insulating materials, where exposed as installed in buildings of *any type of construction*, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450. [CBC 720.3]

☐ Surface insulation or other materials shall be considered *interior finish* if they cover 10 percent or more of the wall or of the ceiling area, and shall not be considered *decorative materials* or furnishings. [CBC 806.1]

☐ Paper faced insulation is not permitted in exposed above ceiling areas, the open side of furred spaces, and ventilated interstitial spaces due to the potential of embers igniting the paper.

☐ Quilted foil-backed or un-faced fiberglass batts and blankets are better suited to conditions of potential fire hazards.

☐ Use approved quilted foil-backed insulation such as "Reflectix Insulation" in areas where a vapor barrier is required and use as a fix when paper back insulation is exposed.

ELECTRICAL

☐ Abandoned cables are not permitted to remain. [CEC 800.25]

☐ Junction boxes and similar enclosures shall be accessible and shall have required working clearances. [CEC 314.29, 110.26 (a)]

☐ Cables and raceways shall not be supported by ceiling grids. [CEC 300.11 (a)]]

CEILING MOUNTED AIR TERMINALS

☐ Air terminals weighing less than 20 pounds shall be positively attached using sheet metal screws. Minimum of two screws are to be installed on each side of the terminal, near the corners, and fastened into the main runners.

☐ Air terminals weighing 20 pounds but not more than 56 pounds, in addition to the above, shall have two #12-gage hangers connected from the terminal or service to the ceiling system hangers or to the structure above. These wires may be installed with limited slack.

☐ Air terminals weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.

RETURN AIR PLENUMS

☐ Verify that all materials meet the applicable flame spread rating for return air plenums and ducts noted as “plenum rated”.

☐ Equipment and devices shall be permitted only when necessary for their direct action upon, or sensing of, the contained air. [CEC 300.22 (B)]

☐ Verify that fire damper is clear and operational.

☐ Communication plenum rated cable (CMP) shall be listed as suitable for use in ducts, plenums and listed as having adequate fire resistant and low smoke producing characteristics. [CEC 800.179 (A), 800.154]

LIGHTING FIXTURE SUPPORTS

☐ Only “Heavy-Duty” systems listed for Seismic Design Category D shall be used in the City of San Mateo.

☐ All lighting fixtures shall be positively attached to the suspended ceiling system with 4 screws - typically one at each corner.

☐ Wires required to the fixture:

- ☐ Fixture less than 56 lbs: two no. 12-gage hangers connected from the fixture housing to the structure above. These wires may be installed with limited slack.
- ☐ Fixtures more than 56 lbs shall be supported directly from the structure above by approved hangers.
- ☐ Pendant Hung Fixtures shall be supported directly from the structure above with #9 gauge wire without using the ceiling suspension system for direct support.

ASCE 7-10 - SEISMIC BRACING EXEMPTIONS FOR PIPING SYSTEMS

The exemptions that apply specifically to seismic bracing for piping systems are covered in ASCE 7-10. The provisions of this section do not cover elevator system piping. Also not covered in this section is fire protection piping. Fire protection piping will be covered in a separate publication.

☐ The piping considered in this section is assumed to be high-deformability piping. This implies pipes made from ductile materials that are joined by welding, brazing, or groove type couplings, similar to Victaulic couplings, where the grooves in the pipe have been roll formed rather than cut.

☐ Limited deformability piping on the other hand, would be pipes made of ductile materials that are joined by threading, bonding, or the use of groove type couplings where the grooves in the pipe have been machine cut. Low deformability piping would be comprised of pipes made from relatively brittle materials such as cast iron or glass.

☐ No restraints will be required for piping that meets the requirements of the 12 inch Rule (ASCE 7-10) for the entire piping run. The 12 inch Rule will be said to apply to a piping run if:

- ☐ The piping is supported by rod hangers.
- ☐ For single clevis supported pipe, all of the hangers in the piping run are 12 inches or less in length from the top of the pipe to the supporting structure.
- ☐ For trapeze supported pipe, all of the hangers in the piping run are 12 inches or less in length from the top of the trapeze bar to the supporting structure.

☐ The past practice by SMACNA and other recognized authorities in the industry to call for the connection between the hanger and the supporting structure to be “non-moment generating”.

☐ This means that the connector must be one that allows the piping run to swing freely on its hangers without introducing a bending moment in the hanger.

- ☐ There must be sufficient space around the piping run to accommodate the expected motion of the pipe as it sways back and forth with the earthquake motion in the building.
- ☐ Connections between the piping and the interfacing components must be designed and/or selected to accept the full range of motion expected for both the pipe and the interfacing component.

ASCE 7-10 - SINGLE CLEVIS SUPPORTED PIPE IN SEISMIC DESIGN CATEGORY D

☐ For single clevis supported piping in buildings assigned to Seismic Design Categories D for which the Component Importance Factor is equal to 1.5, and for which the nominal size is 1 inch or less; no seismic restraint is required.

☐ For single clevis supported piping in buildings assigned to Seismic Design Categories D for which the Component Importance Factor is equal to 1.0, and for which the nominal size is 3 inches or less; no seismic restraint is required.

EXEMPTIONS FOR TRAPEZE SUPPORTED PIPE PER VISCMA RECOMMENDATIONS

Neither ASCE 7-98-02 nor ASCE 7-10 specifies how the piping is to be supported. The point is that many pipes of the exempted size may be supported on a common trapeze bar using hanger rods of the same size as would be specified for a single clevis supported pipe.

- ☐ Keep in mind that the purpose of the seismic restraints is to make sure the pipe moves with the building.
- ☐ The amount of force that the hanger rod must carry will be a direct function of the weight of pipe being supported.
- ☐ There must be some limit to how much weight a trapeze bar can support for a given hanger rod size before seismic restraint is required.

VISCMA (Vibration Isolation and Seismic Control Manufacturer's Association) has investigated this issue and can make the following recommendations on the application of the exemptions in Sections 5.4 and 5.5 above to trapeze supported pipe. The following basic provisions must apply:

- ☐ The hangers must be ASTM A36 all-thread rod.
- ☐ The threads must be roll formed.
- ☐ The pipes must be rigidly attached to the hanger rods.
- ☐ Provisions must be made to avoid impact with adjacent pipe, duct, equipment, or building structure, or to protect the pipe from such impact.

ASCE 7-10 - TRAPEZE SUPPORTED PIPE IN SEISMIC DESIGN CATEGORY D

1. For trapeze supported piping in buildings assigned to Seismic Design Category D, which have a Component Importance Factor equal to 1.5, and for which the nominal size is 1 inch or less, no seismic restraint is required if:
   - ☐ The trapeze bar is supported by 3/8-16 UNC, or larger, hanger rods.
   - ☐ The maximum hanger spacing is 7 ft. on center.
   - ☐ The total weight supported by the trapeze bar is 4 lbs/ft or less.
2. For trapeze supported piping in buildings assigned to Seismic Design Category D, which have a Component Importance Factor equal to 1.0, and for which the nominal size is 3 inches or less, no seismic restraint is required if:
   - ☐ The trapeze bar is supported by ½"-13 UNC, or larger, hanger rods.
   - ☐ The maximum hanger spacing is 10 ft. on center.
   - ☐ The total weight supported by the trapeze bar is 25 lbs/ft or less.
3. The Seismic Design Category to which the project has been assigned must be known.
   - ☐ This should be noted on the issued permit plans.

☐ The design professional responsible for the piping system must assign an appropriate Component Importance Factor to the system.

As a sidebar to the previous statement, it should be noted that the specification for the building may increase the Seismic Design Category in order to ensure an adequate safety margin and the continued operation of the facility. This is a common practice with schools, government buildings, and certain manufacturing facilities.

The building owner has the prerogative, through the specification, to require all of the piping systems to be seismically restrained. Careful attention to the specification must be paid, as some or all of the exemptions in this section may be nullified by specification requirements that are more stringent than those provided by the code.

DETAILS

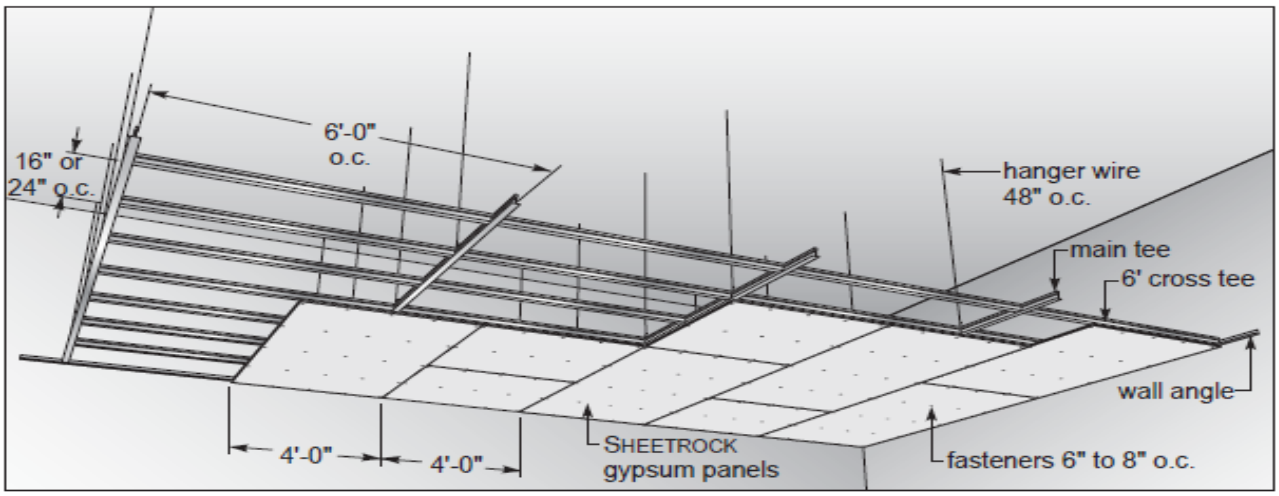
REFERENCES

STANDARDS

EXAMPLES OF DRYWALL SUSPENDED CEILING SYSTEM - *NO MIXING COMPONENTS*

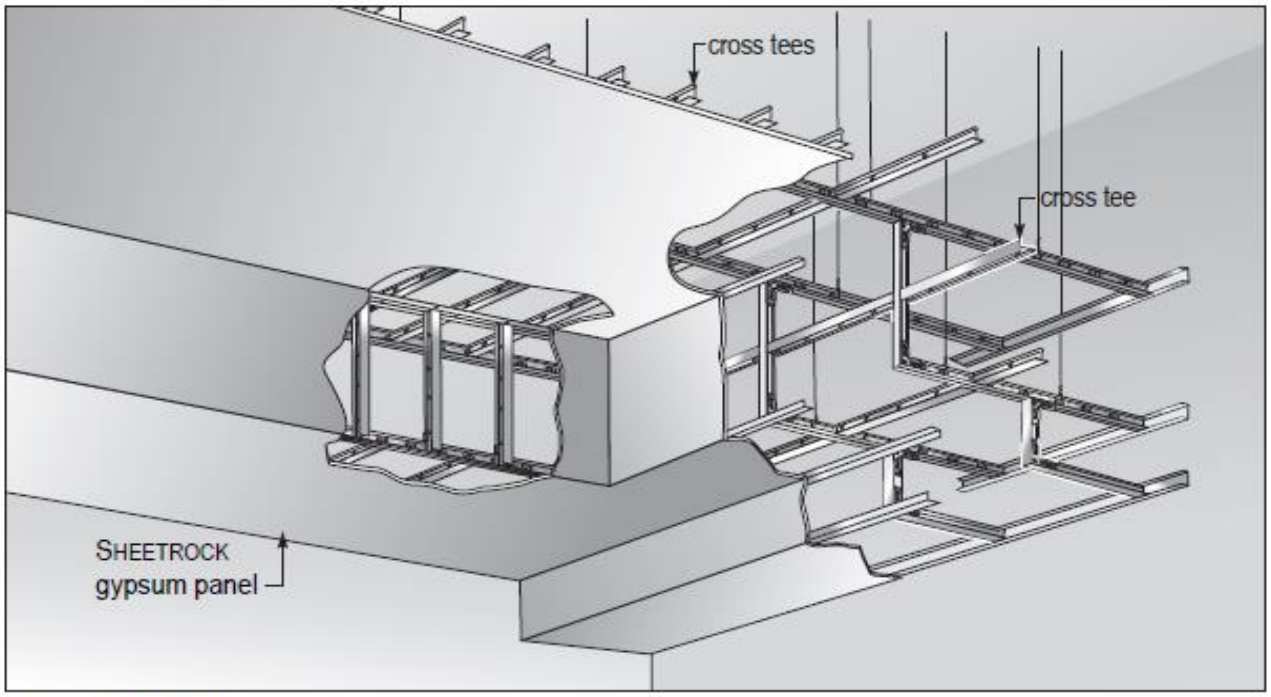
Flat Ceilings

Main tees shall be spaced a maximum of 72" on center and supported with hanger wires spaced a maximum 48" on center. Cross tees, if required, are spaced in accordance with manufacturer's recommendations. For fire-resistive assemblies, the hanger wire, main tees and cross tees shall be spaced in accordance with the assembly design. Searchable fire resistive assemblies with downloadable PDF, CAD or REVIT files are available on **usgdesignstudio.com** or refer to the UL directory.



Flat ceilings

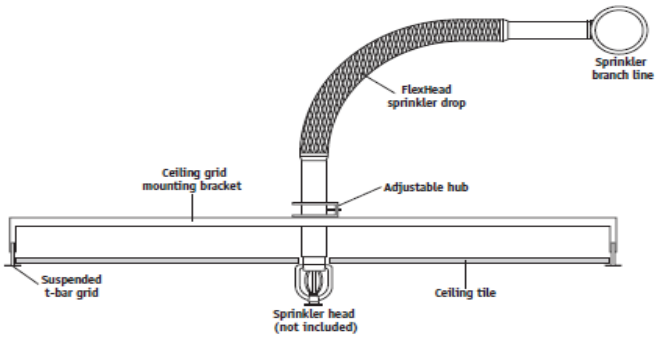
EXAMPLES OF DRYWALL SUSPENDED CEILING SYSTEM - *NO MIXING COMPONENTS*



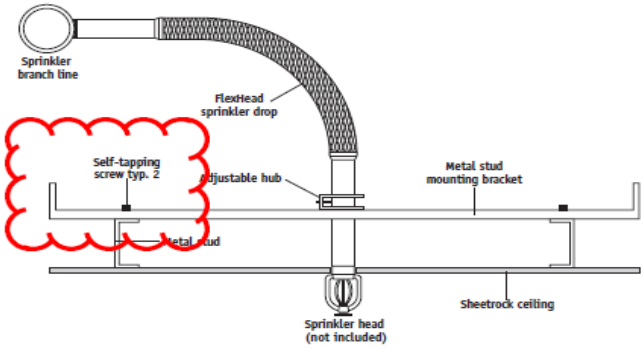
Soffits on Ceilings

EXAMPLES OF FLEXIBLE SPRINKLER SUSPENDED CEILING SYSTEM ATTACHMENTS

FlexHead Suspended Ceiling Detail

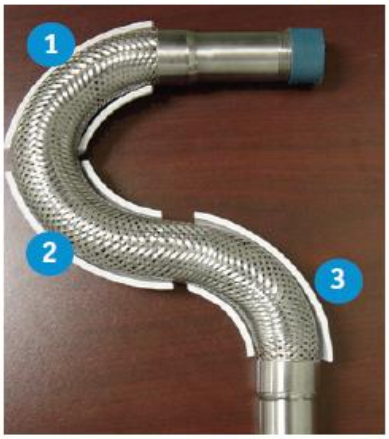


FlexHead Sheetrock Ceiling Detail



FlexHead 3" Bend Radius per UL Guidelines (2 Bends Shown)

FlexHead Shown with 3 Bends



SEISMIC JOINT CLIP

Cross Tee

It's simple to install with these easy steps:

How to install the Seismic Separation Joint Clip:

Step One: Install suspension system completely, in a conventional manner.

Step Two: Decide upon which run(s) of Main Runners to create the seismic separation. **NOTE:** The Seismic Joint Clip allows for cross tees to move along the axis of the cross tees. **NOTE:** Divide 2500 SF by the length of the run of mains in feet. The result will be the maximum spacing, in feet, for the separation joint. Round this result down to the nearest 4' increment when mains are installed 4' on center.

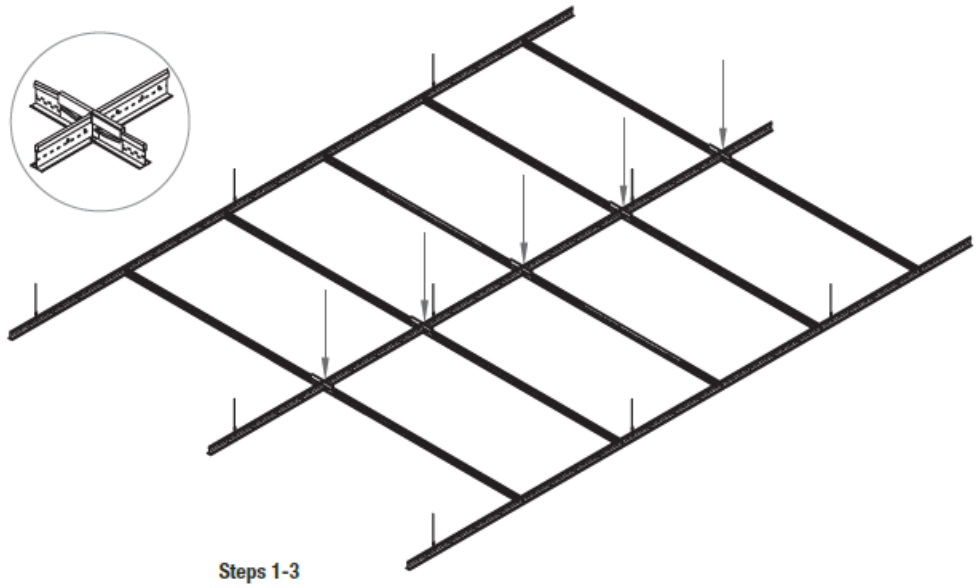
Step Three: Attach two adjacent sides of each section of the divided ceiling to the structure. Where these sections touch the wall, the attachment may be by riveting to the wall molding or by means of the BERC2 clip with a tight screw. Sections that do not touch walls on two adjacent sides must be braced to structure.

Step Four: Cut XL through the end details of cross tees inserted into the Main Runner designated for the seismic separation. **NOTE:** This should be done one intersection at a time or the grid system will fall apart.

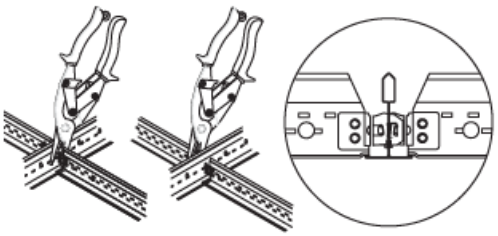
Step Five: Assemble the two sides of the Seismic Joint Clip into one unit.

Step Six: Snap completed assembly over the bulb of the Main Runner at the intersection of the cross tees.

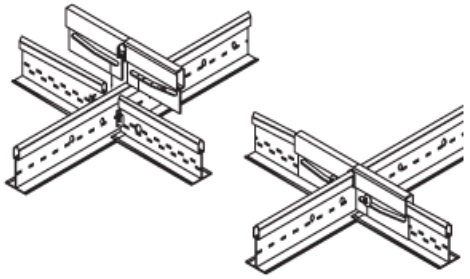
Step Seven: Insert a 1/4" long #10 screw through slot in clip, into the upper XL clip stake hole. Use vertical stamp mark below the horizontal slot to properly position the screw within the clip. Install one screw from each side of the assembled clip to hold the proper shape. Do not allow screw threads to strip out the stake hole.



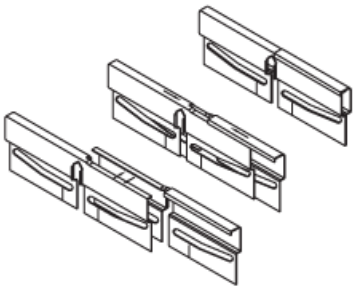
Steps 1-3



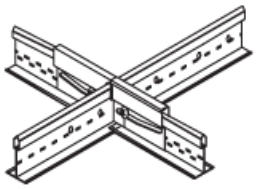
Step 4



Step 6



Step 5



Step 7

SEISMIC JOINT CLIP

Main Beam

It's simple to install with these easy steps:

How to install the Seismic Joint Clip – Main Beam.

Step 1: Determine which splices will receive the separation joint by dividing the total area into sections not greater than 2500 sf. Attach a hanger wire within 3" of the splice that will receive the clip.

Step 2: Install complete grid system. Follow typical procedures except that all main beam splices must line up across the space.

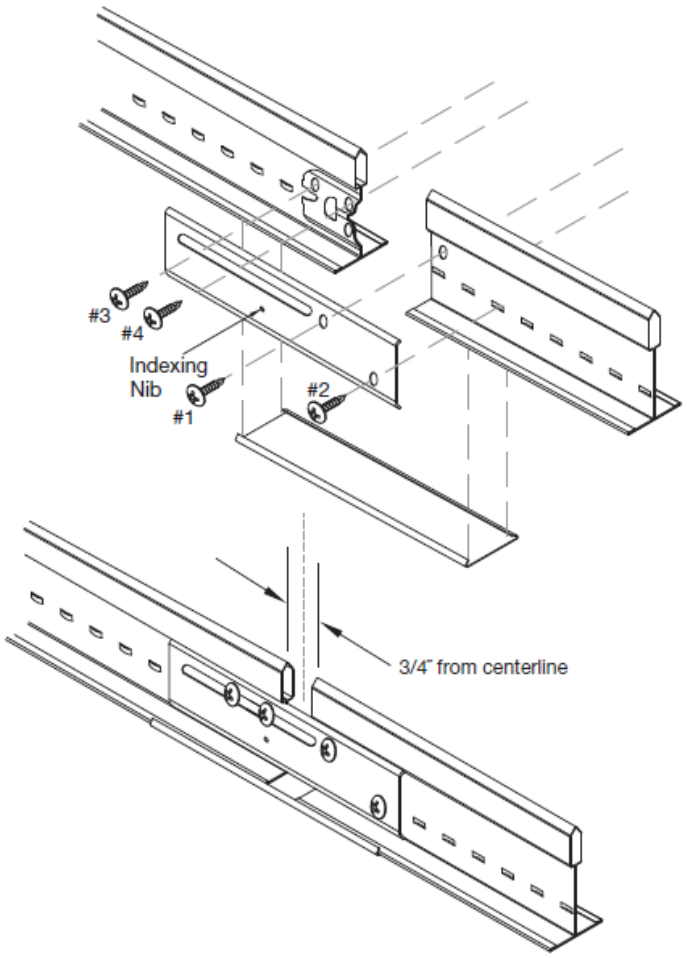
Step 3: Prepare the main beam splice to receive the separation joint clip by cutting the locking tab from the left side of the connection and removing ¾" from the end of the beam on the right.

Step 4: Install the clip using the screws provided. Screws #1 and #2 install through the holes in the clip and into the right hand main beam.

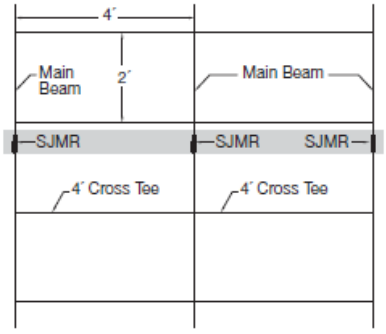
Step 5: Align the indexing nib with the lower hole on the left hand main and insert screws #3 & 4 into the upper holes.

Step 6: Snap the ES4 or ES49 expansion sleeve over the gap at the face of the main beam and crimp the four corners with a pair of pliers.

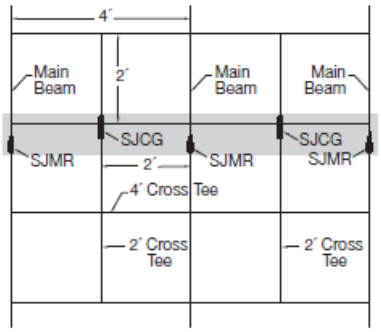
Step 7: Install SJCG cross tee separation joint clips at one end of every cross tee that spans the area of main beam separation. Follow instructions found on the SJCG data page (CS-3815).



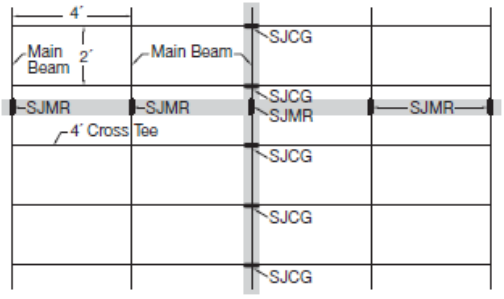
Main Beam in 2 x 4 Layout



Main Beam/Cross Tee in 2 x 2 Layout



Main Beam/Cross Tee in 2 x 4 Layout

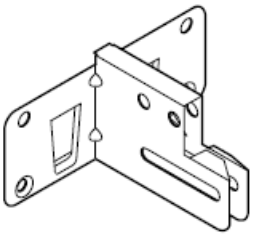


Technical Document

Seismic Technical Guide

Perimeter Cross Tees with ACM7 Seismic Clip

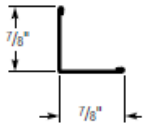
ACM7 Seismic Clip

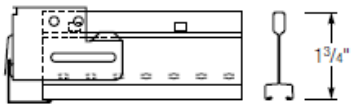
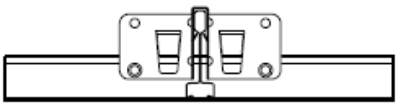


USG® offers numerous DONN® suspension systems cross tees designed to function with the USG ACM7 seismic clip in all seismic design categories A-F. Use this guide to ensure that the connection of the perimeter cross tees with the ACM7 seismic clip functions to meet the required seismic design criteria. Because codes continue to evolve, check with local officials prior to designing and installing a ceiling system.

The ACM7 seismic clip is designed to function with a variety of main tee and cross tee profiles and dimensions. It is common practice to install the clip with cross tees that have a profile height of 1-1/2 in. or greater, however 2 ft. cross tees are produced with a profile height of 1 in. In a 2 ft. x 2 ft. layout, the 4 ft. cross tees are typically utilized at the perimeter and cut to size to meet the perimeter wall. This is an economical method as both ends of the 4 ft. cross tee can be used for cuts smaller than 2 ft. and produces no additional waste versus cutting a 2 ft. cross tee. The following layouts illustrate these differences.

M7



	Side	Front
1-3/4 in. Tee Height		

EXAMPLES OF SEISMIC CONNECTORS FOR SUSPENDED CEILING SYSTEMS

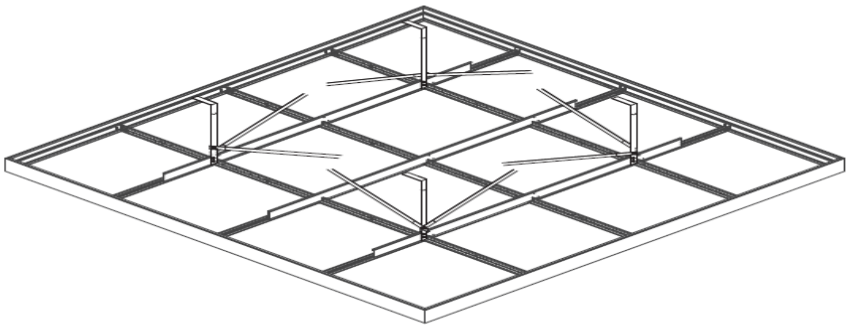
Clouds and Canopies

INSTALLING CLOUDS

Armstrong defines a cloud as a ceiling that is not connected to a wall on any side.

ASCE-7 Design Manual, Section 13 states that the design of architectural components and their supports is required to meet minimum values as calculated in Section 13.3.1 for seismic force and Section 13.3.2 for lateral displacement. Ceilings are a line item on the chart associated with these calculations. Unless specifically exempted by the local authority, it should be assumed that a cloud (architectural component) comprised of grid and panels must be restrained. Part of the formula used in these calculations takes seismic design category into consideration, so the minimum force values will go down or up as the seismic risk changes.

During our testing of cloud ceilings we switched from splayed wires to rigid bracing. The primary reason is so we don't have wires extending beyond the edges of the cloud. We installed a vertical post and two diagonals at the grid intersection closest to each corner of the cloud and then not more than 12 feet in each direction. During testing the plenum is typically 30 inches deep. We have successfully used ½" diameter EMT for post and diagonals on all such tests. The EMT ends are flattened and bent to facilitate attachment to structure and grid. Install the post first, then connect the diagonals to the lower end of the strut just above the grid bulb.



Restraint for a cloud is diagonal bracing to the structure and since clouds are not attached to two walls they must have restraints. In addition to building code requirements, there is a particular installation benefit for a contractor to restrain a ceiling that does not run wall-to-wall. A restrained ceiling is easier to keep straight and square. Some contractors will initially opt to skip this step in an attempt to save money. However, it is not advisable to do so because rework to fix alignment issues can add more labor costs than if the bracing would have been done at the onset.

Typical restraint for a floating ceiling takes the form of rigid diagonal braces that extend from the suspension system members to the overhead structure. Sufficient restraint points must be used to meet the force values required by the code and to prevent movement in all directions. Additionally, the strength of the bracing members must also be matched to the anticipated applied forces. In areas subject to light seismic activity this restraint can often be achieved with sections of wall molding or main beam.

However, as the seismic forces increase so must the rigidity or stiffness of the bracing. When the lateral forces match or exceed the weight of the ceiling assembly or when splay wires are used, a vertical post or strut must be added to prevent the suspension system from lifting. IBC calls for this strut to be added when the project is designated as Seismic Design Category D.

Seismic Design
Categories D, E, & F — Design Intent

For the majority of buildings, the nonstructural components represent a high percentage of the total capital investment. Failure of these components in an earthquake can disrupt the function of a building as surely as structural damage, and can pose a significant safety risk to building occupants as well. Past earthquakes have dramatically illustrated the vulnerabilities of the nonstructural components. Apart from the falling hazard posed by the light fixtures, non-structural failures can create debris that an block egress from the building, and hamper rescue efforts. The basic objective of seismic design is to provide an adequate level of safety, supplying protection that is appropriate for the seismic hazard and the importance of the component or system. Beyond this basic level of safety, which protects occupants from life threatening injury or death, higher levels of performance may be demanded to limit damage or protect against loss of function. Essential facilities, such as hospitals, police and fire stations, and emergency command centers may be designed with the intent that they meet the immediate occupancy or operational performance objectives. Structures designed to these performance objectives are expected to be functional during or after an earthquake. Prevention of panic is also an important goal. When ceiling components fall from the ceiling, inhabitants have been known to flee in panic, even if the building structure is not in danger of collapse. There are numerous instances of panic causing injuries and deaths when no physical danger was actually present. A common failure observed in a moderate earthquake occurs to suspended acoustical tile ceilings. Failure typically occurs at the perimeter of the ceiling. The prescribed construction of Seismic Design Categories D, E, & F, is designed to tie the suspended ceiling system to the structure so that all seismic forces are transferred and dissipated through the building structure. Vertical compression posts are also required at the location of the diagonal wires to resist the upward component of force caused by the lateral loads.