Seismic Technical Guide

Seismic Separation Joints

Code Requirements[1]

According to ASCE/SEI 7 section 13.5.6.2.2.d, for seismic design categories D, E and F in ceiling areas exceeding 2,500 sq. ft. (232m^2), a seismic separation joint or full height partition that breaks the ceiling up into areas not exceeding 2,500 sq. ft. shall be provided unless structural analyses are performed.

The requirement is clear, however the actual construction and placement of the seismic separation joint is left for interpretation. USG® has a long history of product development and innovation for suspended ceiling systems in seismic applications and continues to commit significant resources to this endeavor. We have thoroughly examined this separation joint requirement and conducted full-scale seismic shake-table tests of our DONN DH4 4-way seismic separation joint clip at the University of California Berkeley, Pacific Earthquake Engineering and Research Center (PEER). The findings of this study and our recommendations are presented in this technical guide to assist in the interpretation of this important requirement. Seismically tested and listed in PEI Evaluation Report, PER-12060. There are many factors that affect the arrangement of seismic separation joints and USG recommends that the design team, consulting engineers and code officials work together to analyze these factors and determine the appropriate construction and application of seismic separation joints.

Guidelines

- Seismic separation joints can be installed in any combination of main tees or cross tees.
- Seismic separation joints may be constructed at a main tee/cross tee intersection to conceal the separation joint from below.
- Suspension system tees may be broken to construct a seismic separation joint provided a device is used to secure the tees together that allows movement or supplementary hanger wires should be installed.
- Care should be taken to avoid the construction of a seismic separation joint on a suspension system tee that directly supports a light fixture or diffuser.
- A device may be inserted onto a suspension system tee to conceal a seismic separation joint from below provided the device allows sufficient movement of the joint.
- Lateral force bracing should not be attached directly to seismic separation joints.
- The requirements for seismic separation joints are meant for the suspension system alone and ceiling panels should not be installed differently.
- Where several separation joints occur in a large suspended ceiling, the border of the joint in the field of the suspended ceiling should not be treated as a perimeter.
- A braced partition or kicker may be constructed to minimize or eliminate seismic separation joints.
- Seismic separation joints shall be capable of allowing ± 3⁄4 in [18 mm] axial movement.
- Seismic separation joints should be installed such that the area less than 2,500 sq. ft. (232m^2) has a ratio of the long to short dimension less than or equal to 4.
- A structural engineer should be consulted for very large suspended ceilings where multiple separation joints are necessary to break the ceiling into areas less than 2,500 sq. ft. (232m^2).

[1] See last page for Seismic Code Reference Standards

USG

Seismic Separation Joints

Accessories

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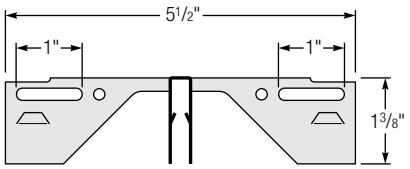
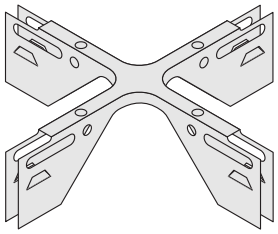
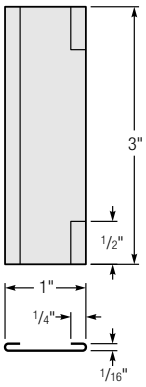
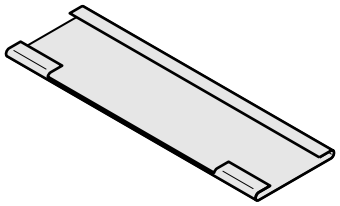
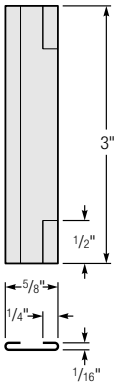
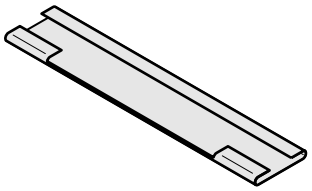
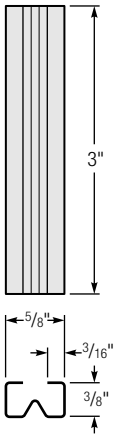
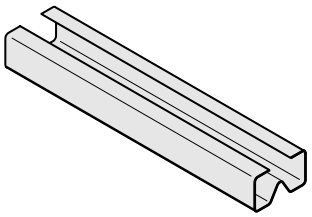
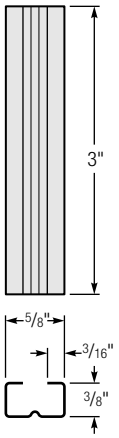
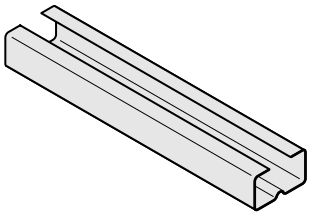
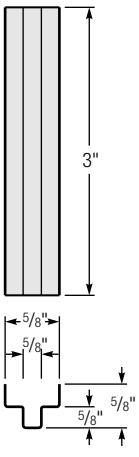
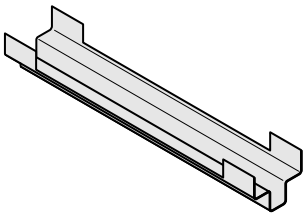
DH4	4-Way Seismic Separation Joint Clip		
TFS-1	**DX/DXL** Tee-Face Sleeve (3″ long) for 15/16″ systems		
TFS-2	Tee-Face Sleeve (3″ long) for 9/16″ DXT Systems		

Note: Construction details can be found in the subsequent pages.

Seismic Separation Joints

Accessories

Catalog Number	Description	Profile	Isometric
TFS-3	Tee-Face Sleeve (3" long) for DXF Systems with 1/4" Reveal		
TFS-4	Tee-Face Sleeve (3" long) for DXFF Systems with 1/8" Reveal		
TFS-5	Tee-Face Sleeve (3" long) for DXI Systems		

Note: Construction details can be found in the subsequent pages.

Seismic Separation Joints

DX®/DXL™ Systems

Construction

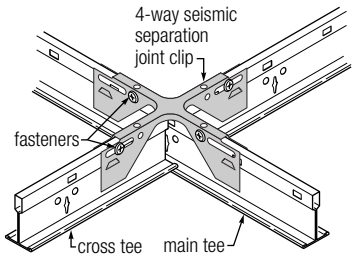
USG offers a clip developed and designed to provide the most robust hold in the most stringent seismic design categories.

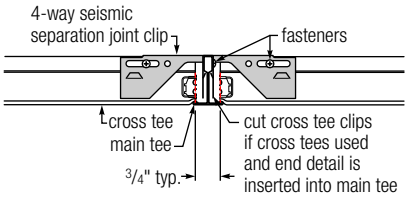
Note: Please see DONN DH4 4-way seismic separation joint clip submittal sheet (AC3271) for more information.

Application

Seismic Separation Joint

Sample layout on pages 9 and 10.
Symbol: ═══

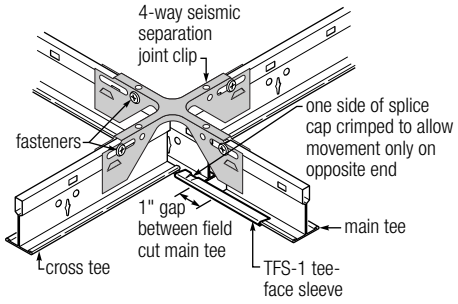


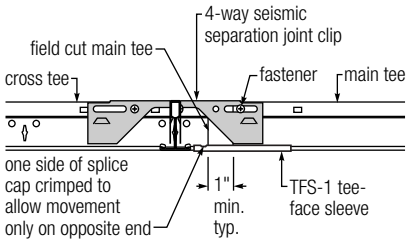


For additional clearance 1 1/2" DXW may be used.

Alternative

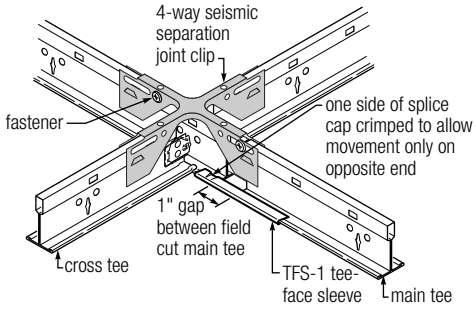
Sample layout on pages 9 and 10.
Symbol: ═══

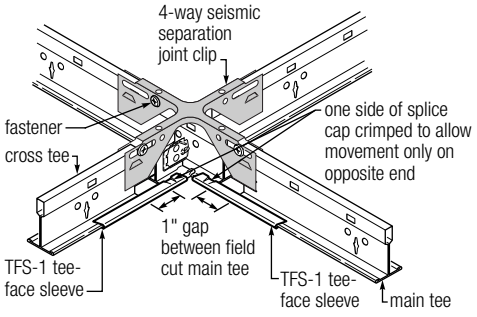




Adjacent Separation Joints

Sample layout on pages 9 and 10.
Symbol: ✚





Note: The performance of DONN seismic systems is based on the specific combination of superior components and design and installation methods shown. Components from other manufacturers were not evaluated, and their use or any mixed use is not recommended.

Seismic Separation Joints

Centricitee™ DX/DXLT Systems

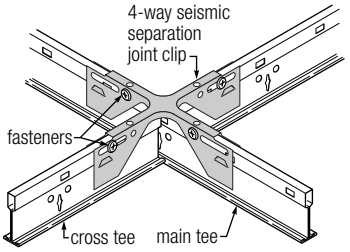
Construction

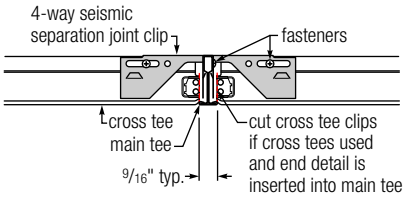
USG offers a clip developed and designed to provide the most robust hold in the most stringent seismic design categories.

Note: Please see DONN DH4 4-way seismic separation joint clip submittal sheet (AC3271) for more information.

Application

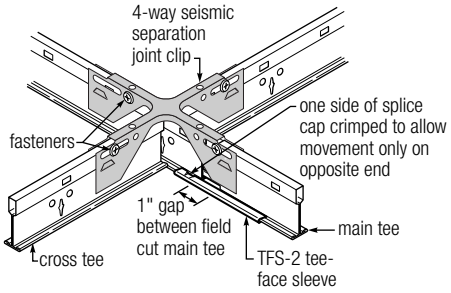
Seismic Separation Joint

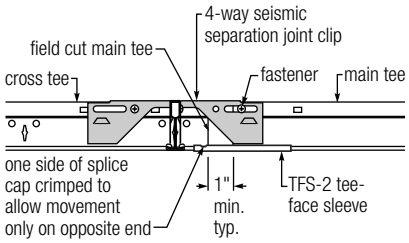




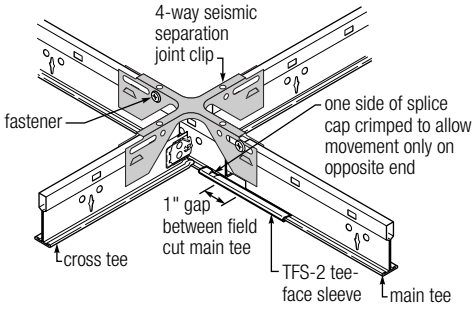
For additional clearance 1 1/2" DXW may be used.

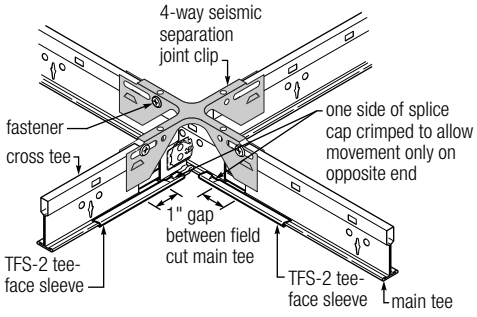
Alternative





Adjacent Separation Joints





Note: The performance of DONN seismic systems is based on the specific combination of superior components and design and installation methods shown. Components from other manufacturers were not evaluated, and their use or any mixed use is not recommended.

Seismic Separation Joints

Fineline®/DXF/DXLF Systems

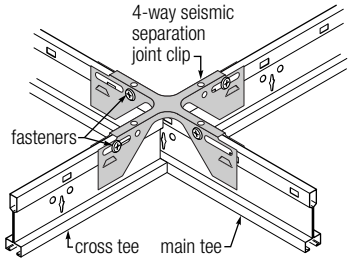
Construction

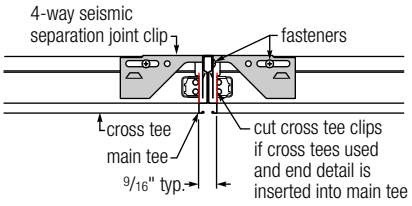
USG offers a clip developed and designed to provide the most robust hold in the most stringent seismic design categories.

Note: Please see DONN DH4 4-way seismic separation joint clip submittal sheet (AC3271) for more information.

Application

Seismic Separation Joint





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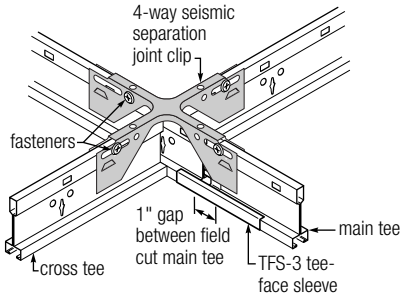
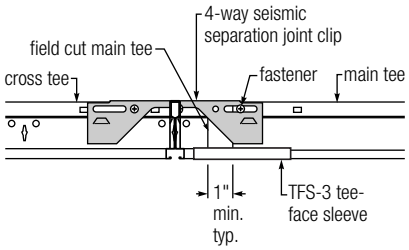
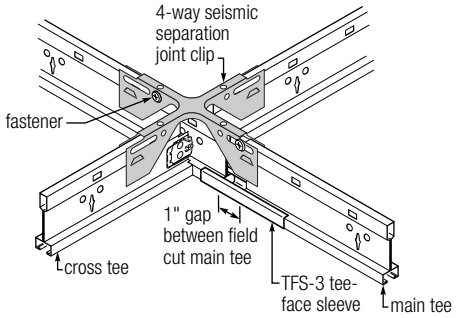
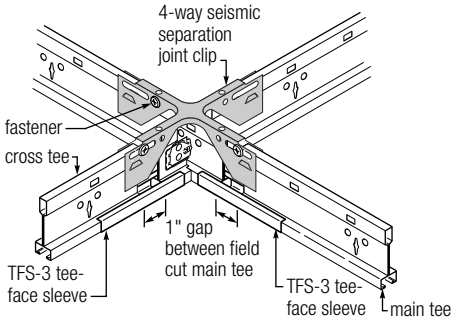




Adjacent Separation Joints





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Seismic Separation Joints

Fineline® 1/8 DXFF Systems

Construction

USG offers a clip developed and designed to provide the most robust hold in the most stringent seismic design categories.

Note: Please see DONN DH4 4-way seismic separation joint clip submittal sheet (AC3271) for more information.

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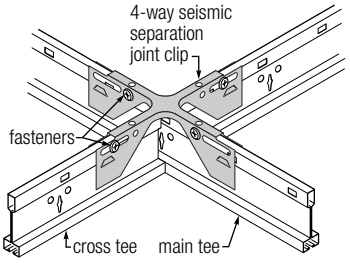
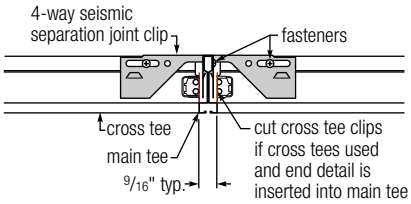
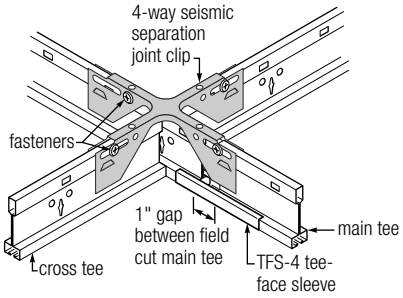
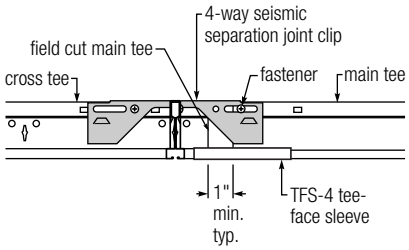
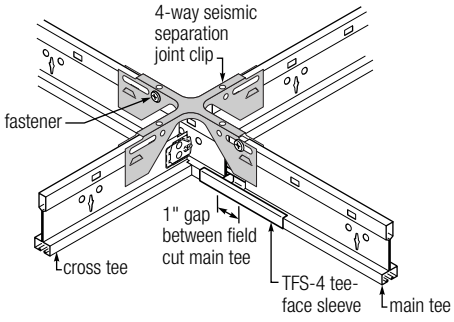
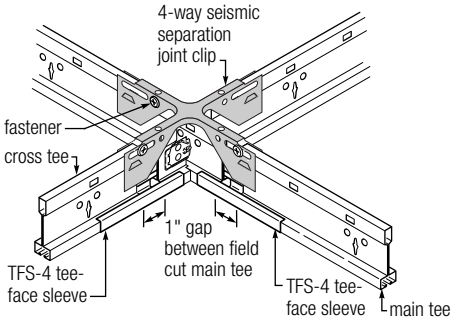
Seismic Separation Joint		
Alternative		
Adjacent Separation Joints		

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Seismic Separation Joints

DXI Identitee™ Systems

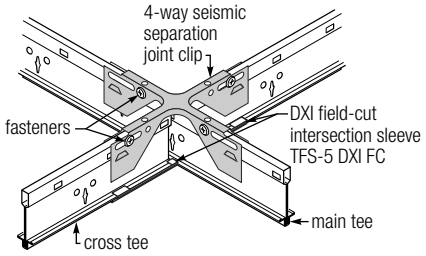
Construction

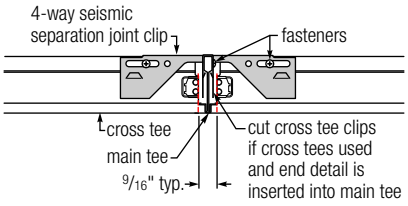
USG offers a clip developed and designed to provide the most robust hold in the most stringent seismic design categories.

Note: Please see DONN DH4 4-way seismic separation joint clip submittal sheet (AC3271) for more information.

Application

Seismic Separation Joint





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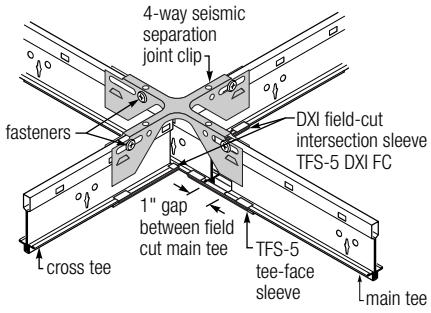
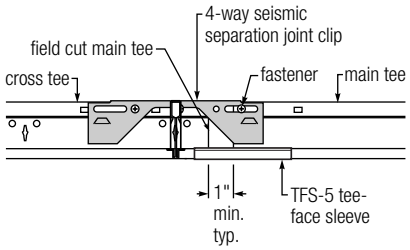
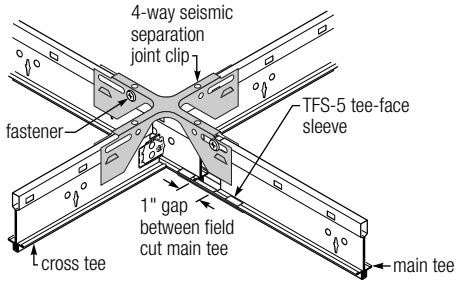
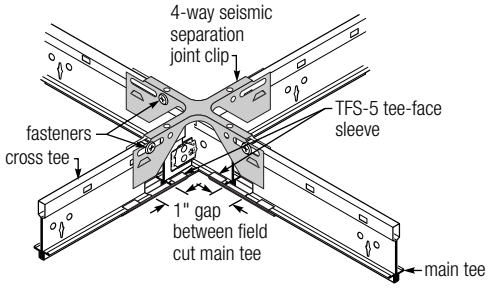




Adjacent Separation Joints





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Seismic Separation Joints

DXW™ Systems

Construction

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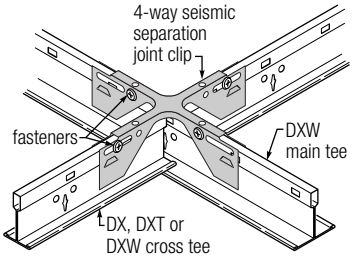
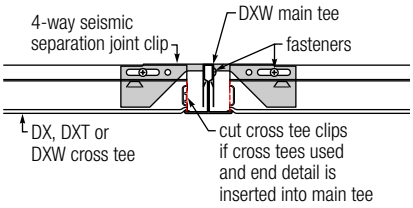
Note: Please see DONN DH4 4-way seismic separation joint clip submittal sheet (AC3271) for more information.

Application

Seismic Separation Joint





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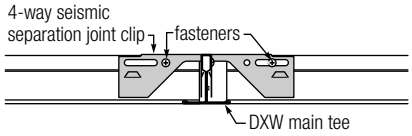

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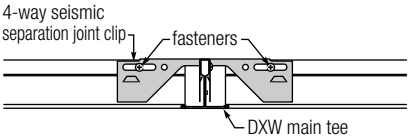
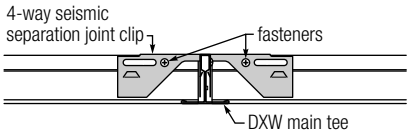


Fixed/Fixed

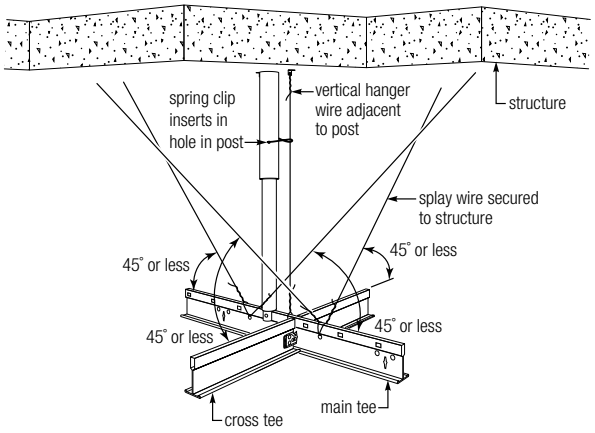


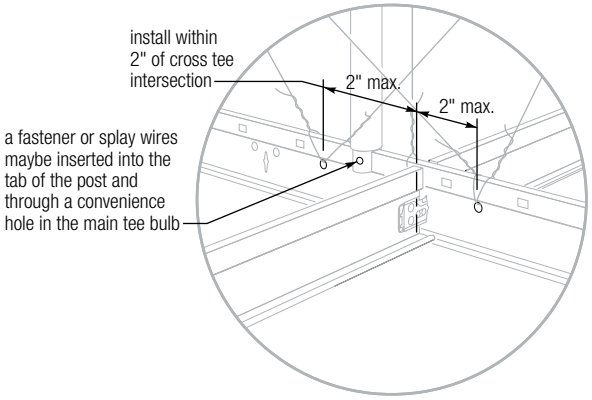
Note: The performance of DONN seismic systems is based on the specific combination of superior components and design and installation methods shown. Components from other manufacturers were not evaluated, and their use or any mixed use is not recommended. Other seismic construction elements, restrictions and exemptions may apply. The specific application and location of seismic separation joints should be verified by a design professional before installation.

Lateral Bracing

Lateral Force Bracing

Sample layout
on pages 9 and 10.
Symbol: ●





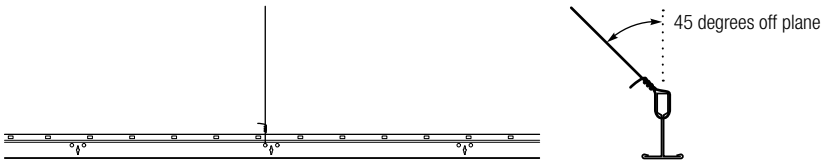
Note: Please refer to SC2552 for more information about lateral bracing.

Lateral Bracing Loads

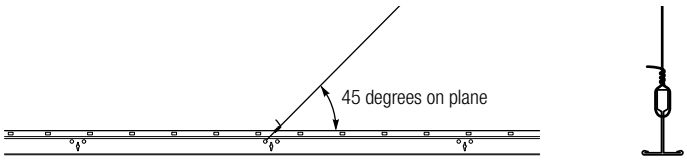
Strength Analysis

USG has conducted extensive testing and verified the strength analysis of lateral bracing on our various suspension system profiles. Tests were conducted in three different configurations: 45 degrees off plane, 45 degrees on plane and 90 degrees on plane.

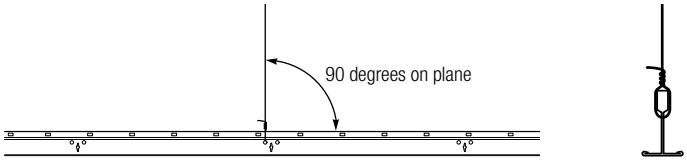
Wire Pull A — **45° Off Plane**

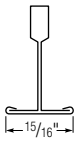
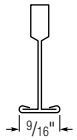
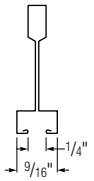


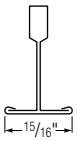
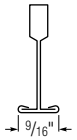
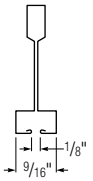
Wire Pull B — **45° On Plane**



Wire Pull C — **90° On Plane**

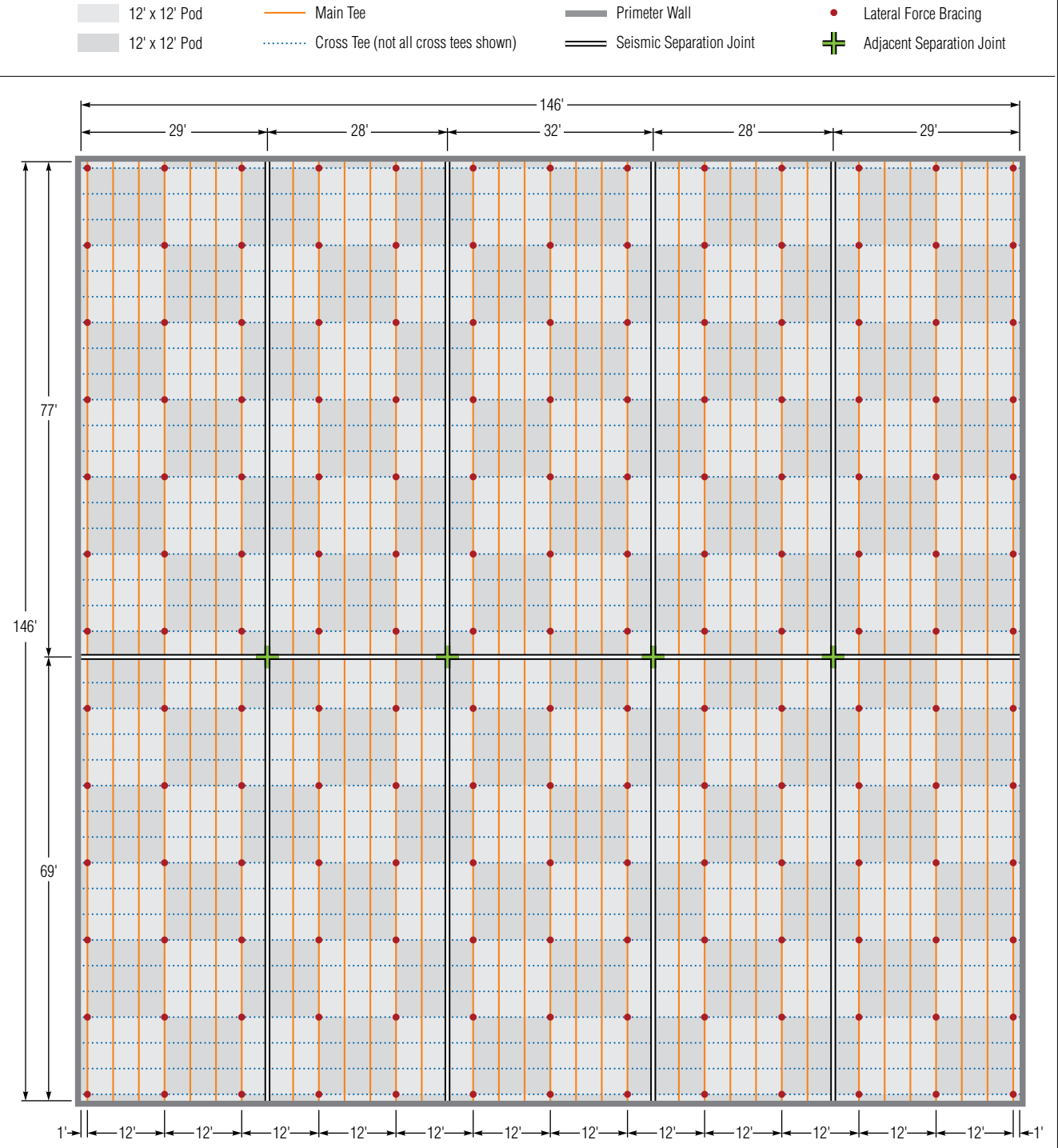


Intermediate Duty				
Main Tee		**Wire Pull A**	**Wire Pull B**	**Wire Pull C**
Product	**Profile**	**45° Off Plane**	**45° On Plane**	**90° On Plane**
DX/DXL24		419 lbs	482 lbs	402 lbs
DXT24		488 lbs.	485 lbs.	430 lbs.
DXFF2824		454 lbs.	499 lbs.	395 lbs.

Heavy Duty				
Main Tee		**Wire Pull A**	**Wire Pull B**	**Wire Pull C**
Product	**Profile**	**45° Off Plane**	**45° On Plane**	**90° On Plane**
DX/DXL26		426 lbs	482 lbs	402 lbs
DXT26		431 lbs.	469 lbs.	468 lbs.
DXFH2924		500 lbs.	500 lbs.	500 lbs.

Sample Layouts

The suspended ceiling layouts are provided as a guide to illustrate potential locations of seismic separation joints. There are many factors that determine the orientation of a suspended ceiling and location of seismic separation joints on a project. These layouts should be used as a reference only. Other restrictions and exemptions may apply. The specific application and location of seismic separation joints should be verified by a design professional before installation.

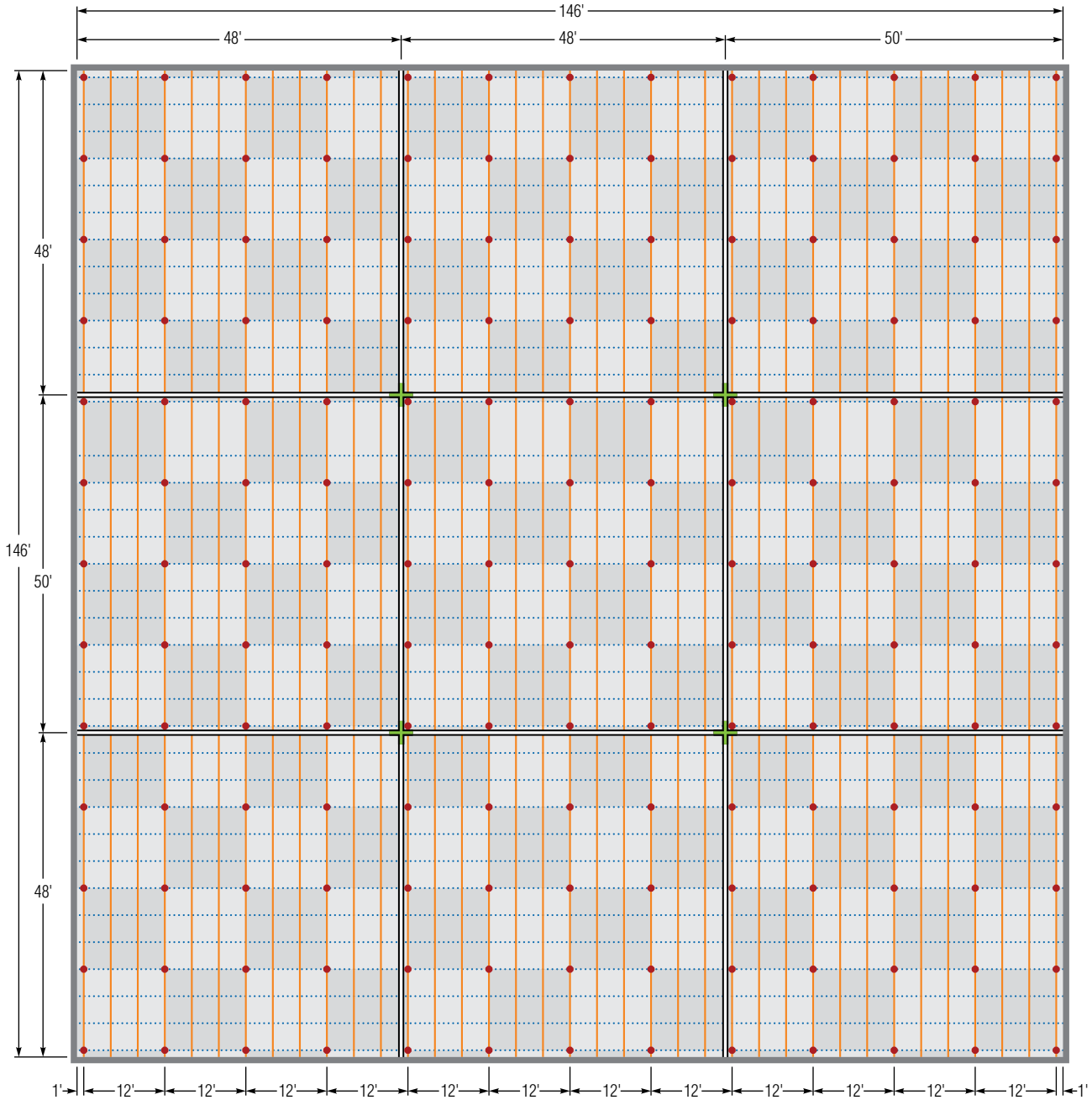


Note: Lateral force bracing shall be placed 12 ft. on center in both directions with the first location within 6ft. of each wall. To avoid installing lateral force bracing on a separation joint the first location may be installed at a point closer to the wall within 6 ft. as illustrated.

Sample Layouts

The suspended ceiling layouts are provided as a guide to illustrate potential locations of seismic separation joints. There are many factors that determine the orientation of a suspended ceiling and location of seismic separation joints on a project. These layouts should be used as a reference only. Other restrictions and exemptions may apply. The specific application and location of seismic separation joints should be verified by a design professional before installation.

12' x 12' Pod
12' x 12' Pod
Main Tee
Cross Tee (not all cross tees shown)
Primeter Wall
Seismic Separation Joint
Lateral Force Bracing
Adjacent Separation Joint



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Seismic Separation Joint Exemption

Seismic Separation Joint Exemption by Structural Analysis[1]

There is a provision in the code where structural analysis may eliminate or decrease the requirements for seismic separation joints required in seismic design categories D, E and F. ASCE/SEI 7 section 13.5.6.2.2.d states, for ceiling areas exceeding 2,500 sq. ft. (232 m^2), a seismic separation joint or full height partition that breaks the ceiling up into areas not exceeding 2,500 sq. ft. shall be provided unless structural analyses are performed 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. Please refer to ASCE/SEI 7 section 13.3.2 for the necessary displacement calculations. The typical maximum allowable displacement is 3/4 in. for most ceiling systems.

To examine this approach a structural engineer should be consulted to determine the anticipated lateral displacement in a ceiling. Some of the factors affecting the lateral displacement calculations are:

- Suspension system deformation analysis
- Seismic design force
- Building configuration
- Occupancy category
- Story height

Note: A structural engineer should be consulted for each project. Always check with a local official prior to designing and installing a ceiling system. Other restrictions and exemptions may apply. This is only intended as a quick reference.

[1] For more information please refer to SC2545, Seismic Separation Joint Exemption Through Analysis. Please visit usg.com or seismicceilings.com. The USG resource listed here can be downloaded from these sites.

Seismic Code Reference Standards

	Installation Guidelines for Suspended Ceilings			
International Building Code (IBC)	2003 IBC	2006 IBC	2009 IBC	2012 IBC
American Society of Civil Engineers (ASCE)	ASCE7-02	ASCE7-05	ASCE7-05	ASCE7-10
Ceilings Interior Systems Construction Association (CISCA) or **ASTM International (ASTM)**	CISCA Zones 0-2 CISCA Zones 3-4	CISCA Zones 0-2 CISCA Zones 3-4	CISCA Zones 0-2 CISCA Zones 3-4	ASTM E580

International Building Code (IBC) defines Seismic Design Categories A, B, C, D, E, and F.
www.iccsafe.org

ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures
American Society of Civil Engineers/Structural Engineer Institute (ASCE/SEI)
www.asce.org

Guidelines for Seismic Restraint for Direct-hung Suspended Ceiling Assemblies (Zones 3-4)
Recommendations for Direct-hung Acoustical Tile and Lay-in Panel Ceilings (Zones 0-2)
CISCA Ceilings & Interior Systems Construction Association (CISCA)
www.cisca.org

ASTM InternationI E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical TIle and Lay-in Panels in Areas Subject to Earthquate Ground Motions.
ASTM International (formerly American Society for Testing and Materials)
www.astm.org

Further References

USG Seismic Ceiling Resource Center
Seismic Technical Guides
seismicceilings.com

Product Information
See usg.com for the most up-to-date product information.

Installation
Must be installed in compliance with ASTM C636, ASTM E580, CISCA, and standard industry practices.

Code Compliance
The information presented is correct to the best of our knowledge at the date of issuance. Because codes continue to evolve, check with a local official prior to designing and installing a ceiling system. Other restrictions and exemptions may apply.This is only intended as a quick reference.

Purpose
This seismic technical guide (STG) is intended as a resource for design professionals, to promote more uniform criteria for plan review and jobsite inspection of projects. This STG indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered and adopted.

ICC Evaluation Service, Inc., Report Compliance
Suspension systems manufactured by USG Interiors, Inc., have been reviewed and are approved by listing in ICC-ES Evaluation Report ESR-1222. Evaluation Reports are subject to reexamination, revision and possible cancellation. Please refer to usgdesignstudio.com or usg.com for current reports.

L.A. Research Report Compliance
Donn brand suspension systems manufactured by USG Interiors, Inc., have been reviewed and are approved by listing in the following L.A. Research Report number: 25764.

Progressive Engineering Inc. Evaluation Report Compliance
Seismically tested and listed in PEI Evaluation Report, PER-12060.

Notice
We shall not be liable for incidental and consequential damages, directly or indirectly sustained, nor for any loss caused by application of these goods not in accordance with current printed instructions or for other than the intended use. Our liability is expressly limited to replacement of defective goods. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from date it was or reasonably should have been discovered.

Note
The University of California does not endorse specific products.

Safety First!
Follow good safety/industrial hygiene practices during installation. Wear appropriate personal protective equipment. Read MSDS and literature before specification and installation.

USG

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seismicceilings.com
sustainableceilings.com
usgdesignstudio.com

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