

Donn® Suspension System Seismic Solutions



Categories D, E, and F Category C

Since 1957 DONN® brand suspension systems have set the standard, using the strongest gauge steel to produce the tightest systems available with the greatest lateral and torsional stiffness. Building on this commitment to quality, USG teamed with the University at Buffalo (SUNY), the Department of Civil, Structural and Environmental Engineering – Structural Engineering and Earthquake Simulation Laboratory (SEESL) and the Earthquake Engineering Research Center (EERC) University of California, Berkeley to conduct full-scale seismic testing to evaluate and qualify the seismic performance of these systems. This testing proved that DONN suspension systems provide a superior code-compliant solution to meeting International Building Code (IBC) requirements, including installations in Categories D, E and F, and Category C. USG is the only manufacturer to team with two separate earthquake engineering laboratories to qualify the performance of our systems.

When seismic requirements are a critical design issue, architects, contractors and building officials can rely on DONN suspension systems to:

- Meet or exceed all national code requirements with 7/8" wall molding.
- Fulfill requirements for IBC seismic design categories C, D, E, and F.
- Provide evidence of compliance (and greatly exceed) ICC Evaluation Service, Inc. (ICC-ES) AC156 and AC368 requirements.
- Offer an aesthetically attractive option to traditional 2" angle molding.
- Provide approved solutions certified with the maximum sq. ft. weights accommodating complete ceilings systems.
- Offer compliant systems tested and verified by two separate earthquake engineering laboratories.
- Offer a seismic clip laboratory-tested to greatly exceed all structural requirements including tension, compression and tee fallout.

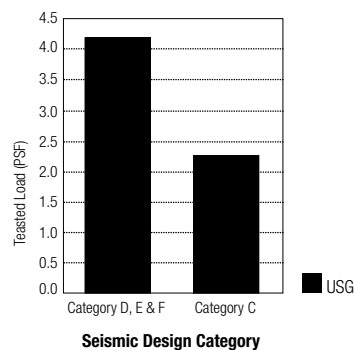
Seismic Qualification

Specifications

Seismic testing typically focuses primarily on the suspension system itself. Any ceiling panel can be installed in the test assembly regardless of how little it weighs, and components such as light fixtures and air handling equipment are usually excluded. In practical application, however, the suspension system must support and carry the weight of a fully functional ceiling system, including ceiling panels that can weigh as much as 2 lb./sq. ft.

Therefore, USG tested suspension systems with weights commensurate with those found in real-world installations, including light fixtures and air handling equipment, using a wide variety of the ceiling panels that USG offers. Full-scale testing performed at the University at Buffalo (SUNY) the department of Civil, Structural and Environmental Engineering – Structural Engineering and Earthquake Simulation Laboratory (SEESL) and the Earthquake Engineering Research Center (EERC) University of California, Berkeley certifies that USG IBC-compliant assemblies are able to accommodate loads commensurate with those found in real-world installations.

Maximum Ceiling System Weight Tested

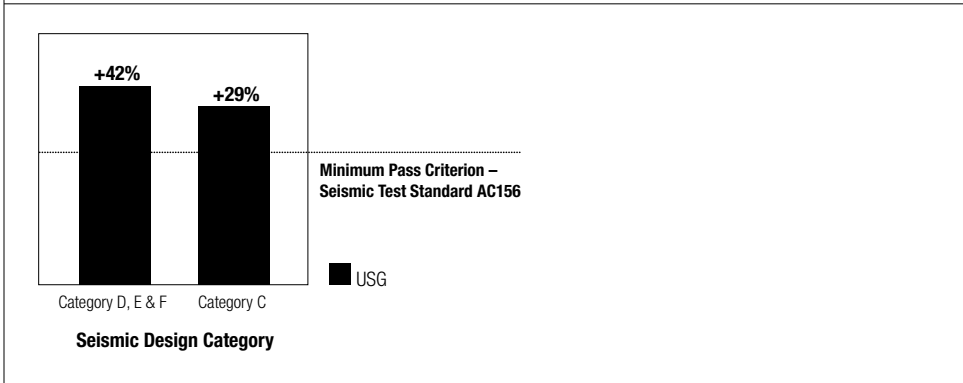


The USG figures presented are based on full-scale testing and evaluation performed at the University at Buffalo (SUNY) the department of Civil, Structural and Environmental Engineering – Structural Engineering and Earthquake Simulation Laboratory (SEESL) and the Earthquake Engineering Research Center (EERC) University of California, Berkeley. Comparative data obtained from public sources includes ICC-ES Reports, product literature and Web sites.

Testing

A complete range of USG ceiling systems was subjected to various levels of earthquake acceleration levels for the purpose of seismic qualification. The experimental studies were performed in the University at Buffalo (SUNY) the department of Civil, Structural and Environmental Engineering – Structural Engineering and Earthquake Simulation Laboratory (SEESL) and the Earthquake Engineering Research Center (EERC) University of California, Berkeley using an earthquake simulator. System performance was certified to tolerate forces in seismic Categories D, E and F that exceeded the minimum pass criterion of AC156 and AC368 by 42%.

USG Exceeds AC156 Test Criteria



Testing per ICC Evaluation Service, Inc. (ICC-ES) AC156 and AC368:

System Design	Seismic Design Category	Maximum Ceiling System Weight Tested	Allowable Suspension System Load Carrying Capacity	Test Result
System DXL-H	D, E, F	2.50 lbs./sq. ft.	Heavy Duty	Passed
System DXL-I-C	C	2.27 lbs./sq. ft.	Intermediate Duty	Passed

- With these certified IBC-compliant assemblies, USG is the only manufacturer to offer:
- A seismic system that exceeds the minimum pass criterion of AC156 and AC368 by more than 42%.
 - Seismic-system weights commensurate with typical ceiling systems.
 - A seismic clip laboratory-tested to greatly exceed all structural and seismic requirements including tension, compression and tee fallout.
 - Compliant systems tested and verified by two separate earthquake engineering laboratories.

Code Approval

Testing and evaluation performed at the University at Buffalo (SUNY), the Department of Civil, Structural and Environmental Engineering – Structural Engineering and Earthquake Simulation Laboratory (SEESL) and the Earthquake Engineering Research Center (EERC) University of California, Berkeley qualify the performance of these systems according to the AC156 – Seismic Qualification Specification, and AC308 – Acceptance Criteria for Suspended Ceiling Framing Systems. Several alternative materials, designs and methods of construction were evaluated and tested. Results of this investigation indicate that these tested alternative designs are at least the equivalent of that prescribed in the code for quality, strength, effectiveness, fire resistance, durability and safety. The data and test results presented provide technical evidence on which a code official can base approval.

Construction details for these systems are shown on the following pages.

Seismic Test Results

	System DXL-H	System DXL-I-C
Seismic Category	D, E, F	C
Suspension System	DOWN double-web, hot-dipped galvanized steel meeting or exceeding ASTM C635	DOWN double-web, hot-dipped galvanized steel meeting or exceeding ASTM C635
Duty rating:	Heavy Duty	Intermediate Duty
Wall molding:	7/8"	7/8"
Seismic clip:	ACM7	ACM7
Shake Table	Six degrees of freedom	Six degrees of freedom
Test Protocol	Simulated earthquake	Simulated earthquake
Qualification	AC156 and AC368	AC156 and AC368
Result	Passed	Passed
Minimum Acceleration Requirement	Exceeds by 42%	Exceeds by 29%
Two Adjacent Floating Sides – With Gap	Fastener attachment to tee through slot (optional), no fastener through wall molding	Fastener attachment to tee through slot (optional), no fastener through wall molding
Two Adjacent Fixed Sides – Tight, No Gap	Fastener attachment to tee (optional), one fastener through wall molding (optional)	Fastener attachment to tee (optional), one fastener through wall molding (optional)
Perimeter Wires	Yes	No
Stabilizer Bars	No	No
System Weight	2.50 lbs./sq.ft.	2.27 lbs./sq.ft.

Convenience holes located in the tee bulb may be used for any and all hanger wires. Load tests performed on 12-gauge hanger wires through convenience holes found the failure to be in excess of 400 lbs. This far exceeds the required 200 lbs.

The performance of DOWN 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.

Systems Summary

Category D, E, F		
	Alternate Seismic Application	Standard Seismic Application
	DXL-H	
	Heavy Duty DXL-H System	Heavy Duty System
	7/8" Molding	2" Molding
Suspension System Duty Rating	Heavy	Heavy
Wall Molding	7/8"	2"
Seismic Clip	ACM7	None
Two Adjacent Floating Sides – With Gap	ACM7 seismic clip with fastener attachment to tee through slot (optional), and no fastener through wall molding	No attachment of tee to molding
Two Adjacent Fixed Sides – Tight, No Gap	ACM7 seismic clip with fastener attachment to tee (optional), and one fastener through wall molding (optional)	Pop-rivet attachment of tee to molding
Perimeter Hanger Wires	Yes	Yes
Stabilizer Bars	None	Yes

Category C		
	Alternate Seismic Application	Standard Seismic Application
	DXL-I-C	
	Intermediate Duty System	Intermediate Duty System
	7/8" Molding	7/8" Molding, Stabilizer Bars
Suspension System Duty Rating	Intermediate	Intermediate
Wall Molding	7/8"	7/8"
Seismic Clip	ACM7	None (unless utilized in lieu of stabilizer bar)
Floating Sides – 3/8" Gap	ACM7 seismic clip with fastener attachment to tee through slot (optional), and one fastener through wall molding and one fastener through wall molding (optional)	No attachment of tee to molding
Perimeter Hanger Wires	None	None
Stabilizer Bars	None	Yes

All main DONN suspension systems – DX®/DXL™, FINELINE® DXF™, FINELINE® 1/8 DXFF™, CENTRICITEE™ DXT™/DXLT™, CE™, DXW™, DXLA™, and ZXLA™ – include the code-compliant intermediate-duty and heavy-duty main tees for Seismic Design Categories C, D, E, and F.

For ceiling areas exceeding 2,500 ft.² (232 m²), a seismic separation joint may be required. See SC2496 for information on seismic separation joints.

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.

Convenience holes located in the tee bulb may be used for any and all hanger wires.

Categories D, E, F

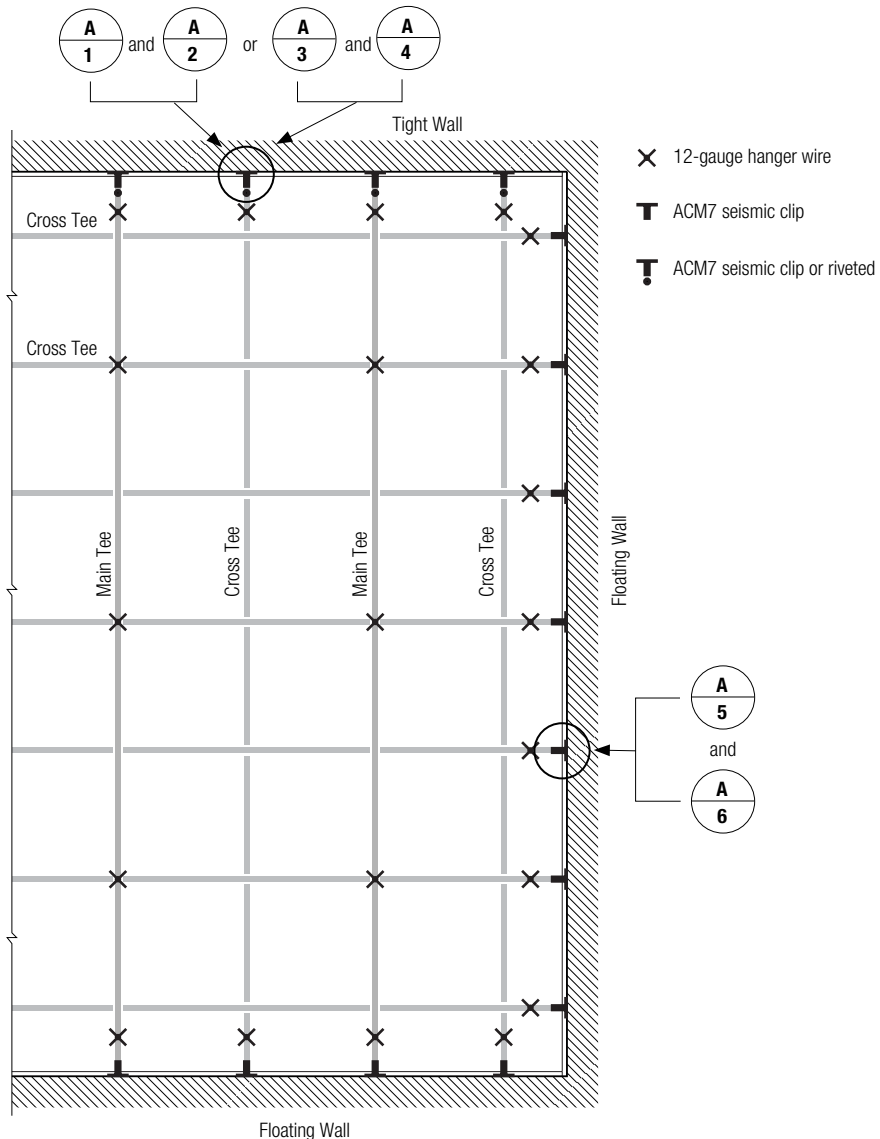
Alternate Seismic Application

Heavy Duty DXL-H System 7/8" Molding

Systems Summary

Suspension System Duty Rating	Heavy
Wall Molding	7/8"
Seismic Clip	ACM7
Two Adjacent Floating Sides	3/4" gap; ACM7 seismic clip with fastener attachment to tee through slot (optional), and no fastener through wall molding.
Two Adjacent Fixed Sides	Tight, no gap; ACM7 seismic clip with fastener attachment to tee (optional), and one fastener through wall molding (optional)
Perimeter Hanger Wires	Yes
Stabilizer Bars	None

Construction Details



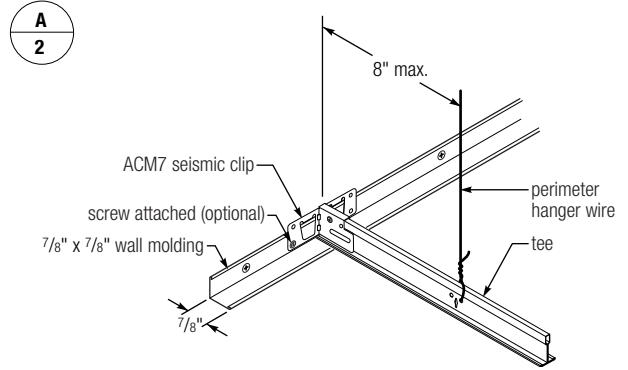
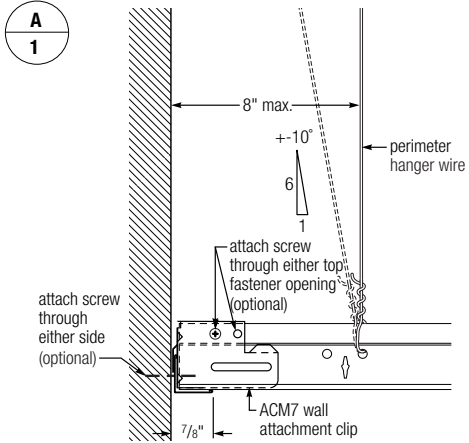
All main DOWN suspension systems – DX/DXL, FINELINE DXF, FINELINE 1/8 DXFF, CENTRICITEE DXT/DXLT, CE, DXW, DXLA, and ZXLA – include the code-compliant and heavy-duty main tees for Seismic Design Categories D, E, and F.

For ceiling areas exceeding 2,500 ft.² (232 m²), a seismic separation joint may be required. See SC2496 for information on seismic separation joints.

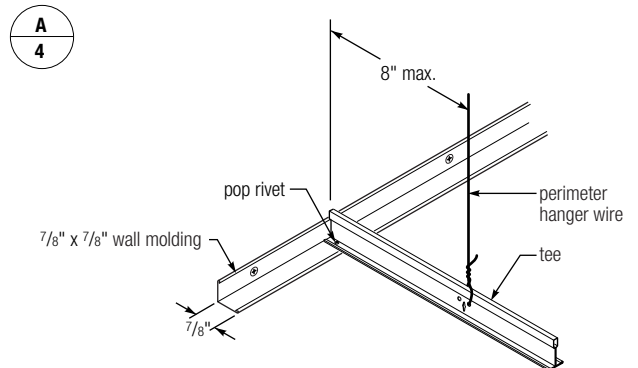
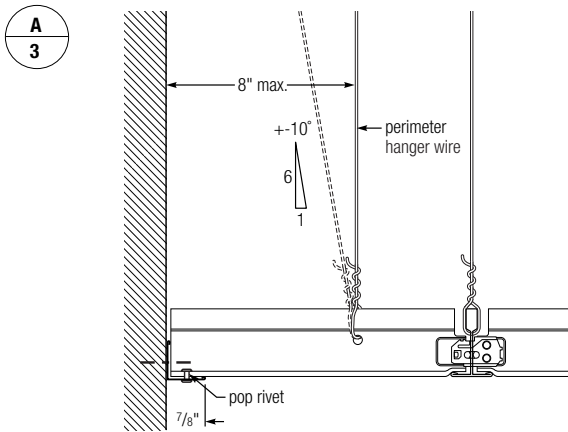
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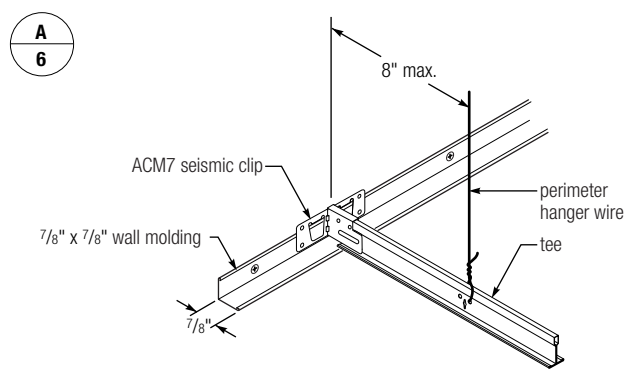
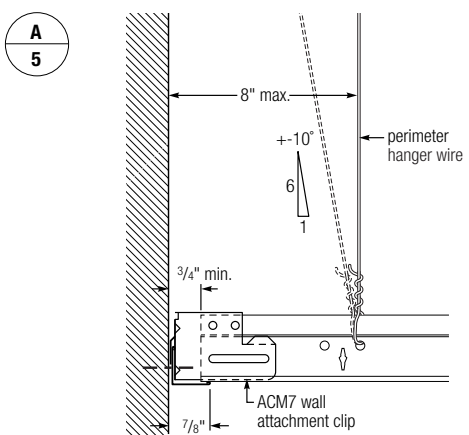
ACM7 Clip, Tight Wall



Tee Rivet, Tight Wall



ACM7 Clip, Floating Wall



Categories D, E, F

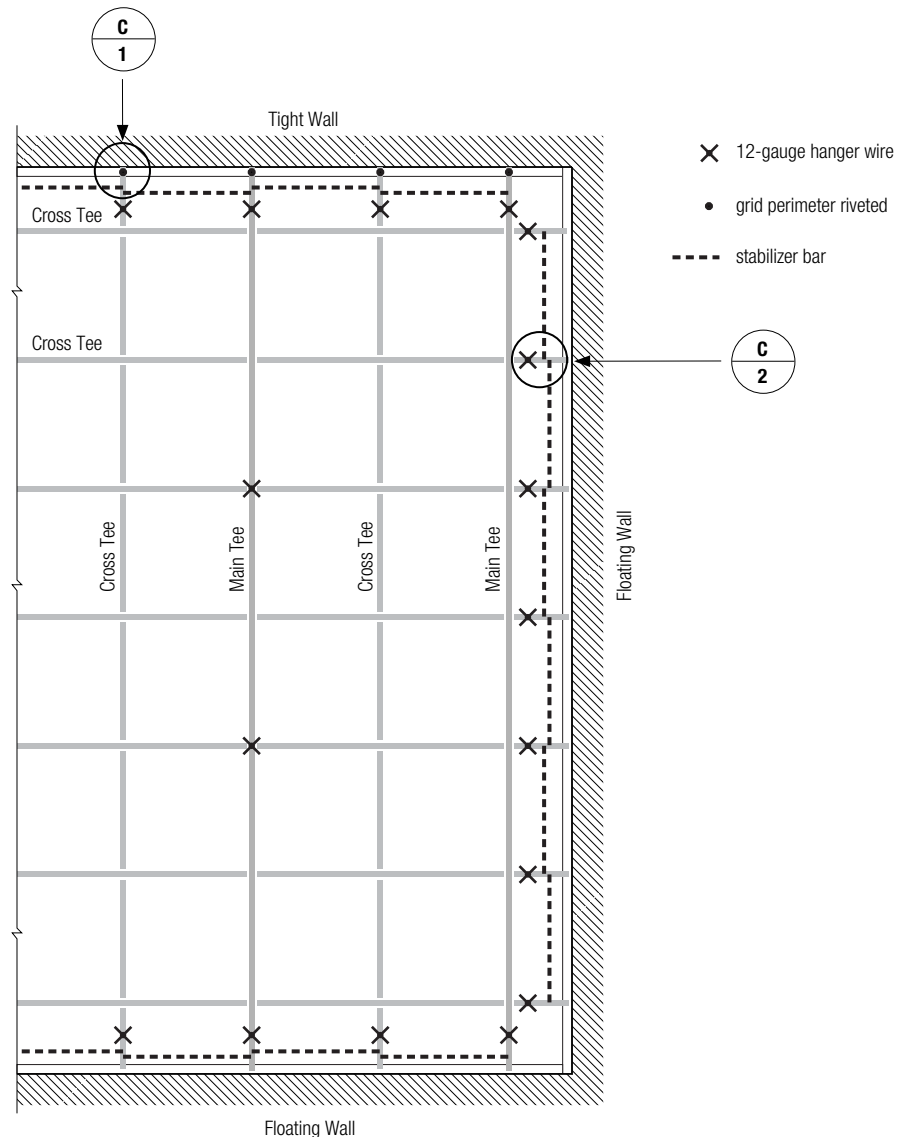
Standard Seismic Application

Heavy Duty System 2" Molding

Systems Summary

Suspension System Duty Rating	Heavy
Wall Molding	2"
Seismic Clip	None (unless utilized in lieu of stabilizer bars)
Two Adjacent Floating Sides	3/4" gap; no attachment of tee to molding
Two Adjacent Fixed Sides	Tight, no gap; pop-rivet attachment of tee to molding
Perimeter Hanger Wires	Yes
Stabilizer Bars	Yes

Construction Details



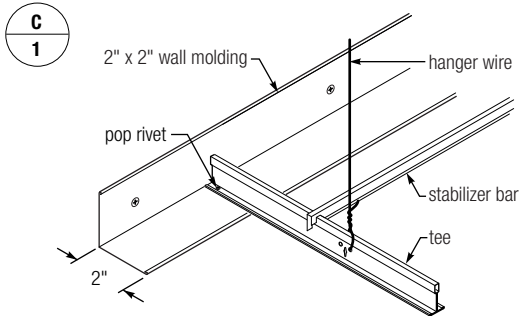
All main DOWN suspension systems – DX/DXL, FINELINE DXF, FINELINE 1/8 DXFF, CENTRICITEE DXT/DXLT, CE, DXW, DXLA, and ZXLA – include the code-compliant heavy-duty main tees for Seismic Design Categories D, E, and F.

For ceiling areas exceeding 2,500 ft.² (232 m²), a seismic separation joint may be required. See SC2496 for information on seismic separation joints.

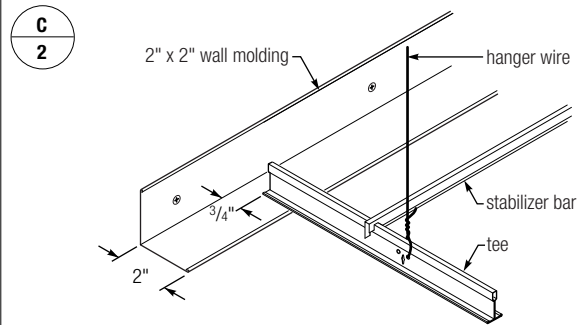
The performance of DOWN seismic systems is based on the specific combination of superior components, and design and installation methods shown. Components from other manufacturers were not evaluated, and their use or any mixed use is not recommended.

Convenience holes located in the tee bulb may be used for any and all hanger wires.

Pop Rivet, Tight Wall



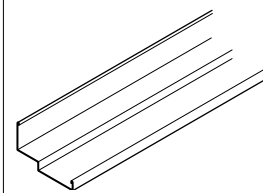
Tee Unattached, Floating Wall



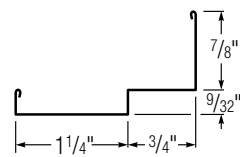
2" Seismic Shadow Molding

With a 3/4" reveal located by the wall to disguise its width, 2" shadow molding provides an aesthetically pleasing option to traditional 2" seismic molding. Designed for use with 15/16" exposed DONN DX/DXL suspension systems, this seismic shadow molding meets or exceeds all national code requirements and fulfills requirements for Seismic Design Categories D, E, and F.

MS274

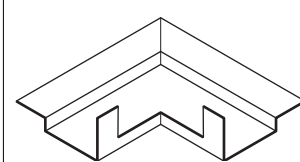


Profile

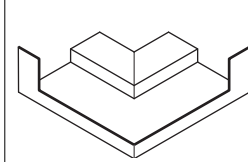


Preformed corners are available, eliminating the need to miter this molding.

Inside Corner Molding



Outside Corner Molding



For more information about the MS274 2" seismic shadow molding, see *Seismic Mold* data sheet (AC3184) or *Ceiling Systems* catalog (SC2000).

Category C

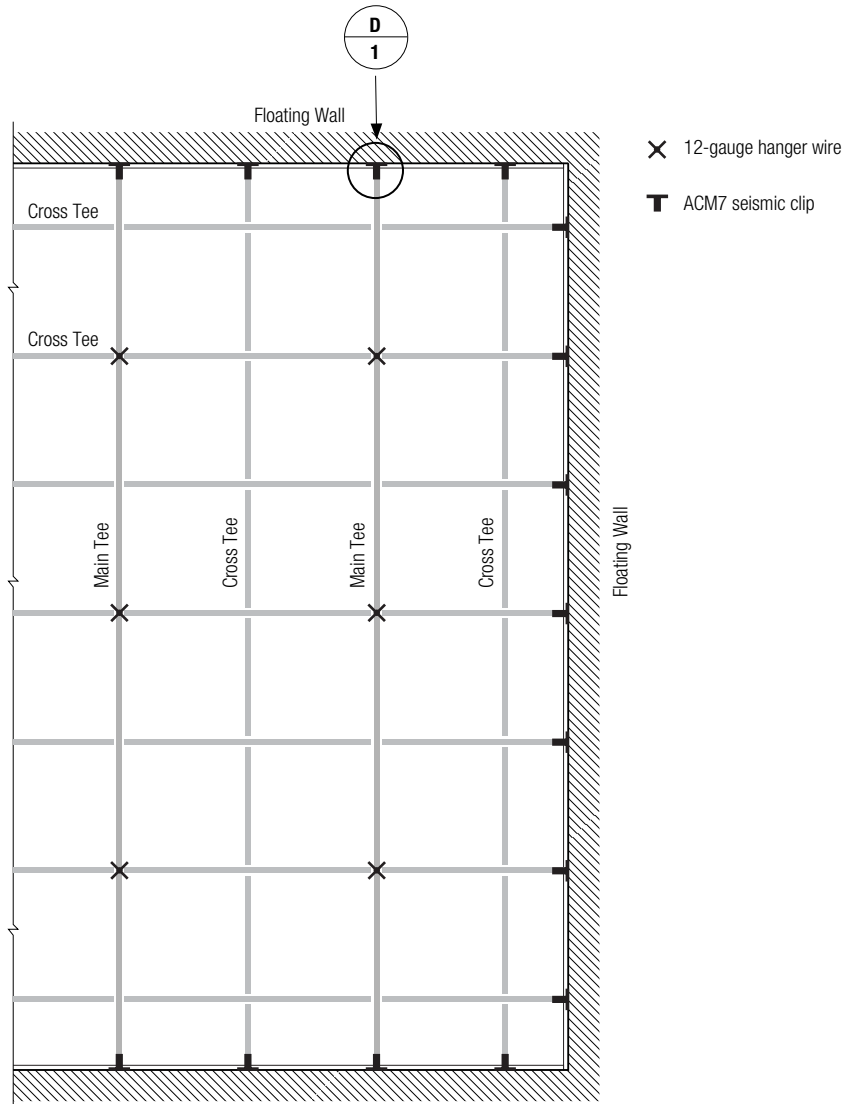
Alternate Seismic Application

Intermediate Duty DXL-I-C System 7/8" Molding

Systems Summary

Suspension System Duty Rating	Intermediate
Wall Molding	7/8"
Seismic Clip	ACM7
Floating Sides – 3/8" Gap	ACM7 seismic clip with fastener attachment to tee through slot (optional), and one fastener through wall molding (optional).
Perimeter Hanger Wires	None
Stabilizer Bars	None

Construction Details



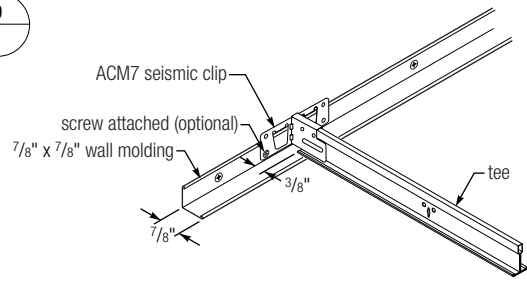
All main DONN suspension systems – DX/DXL, FINELINE DXF, FINELINE 1/8 DXFF, CENTRICTEE DXT/DXLT, CE, DXW, DXLA, and ZXLA – include the code-compliant intermediate-duty main tees for Seismic Design Categories A, B and C.

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.

Convenience holes located in the tee bulb may be used for any and all hanger wires.

ACM 7 Clip, Floating Walls

D
1



Category C

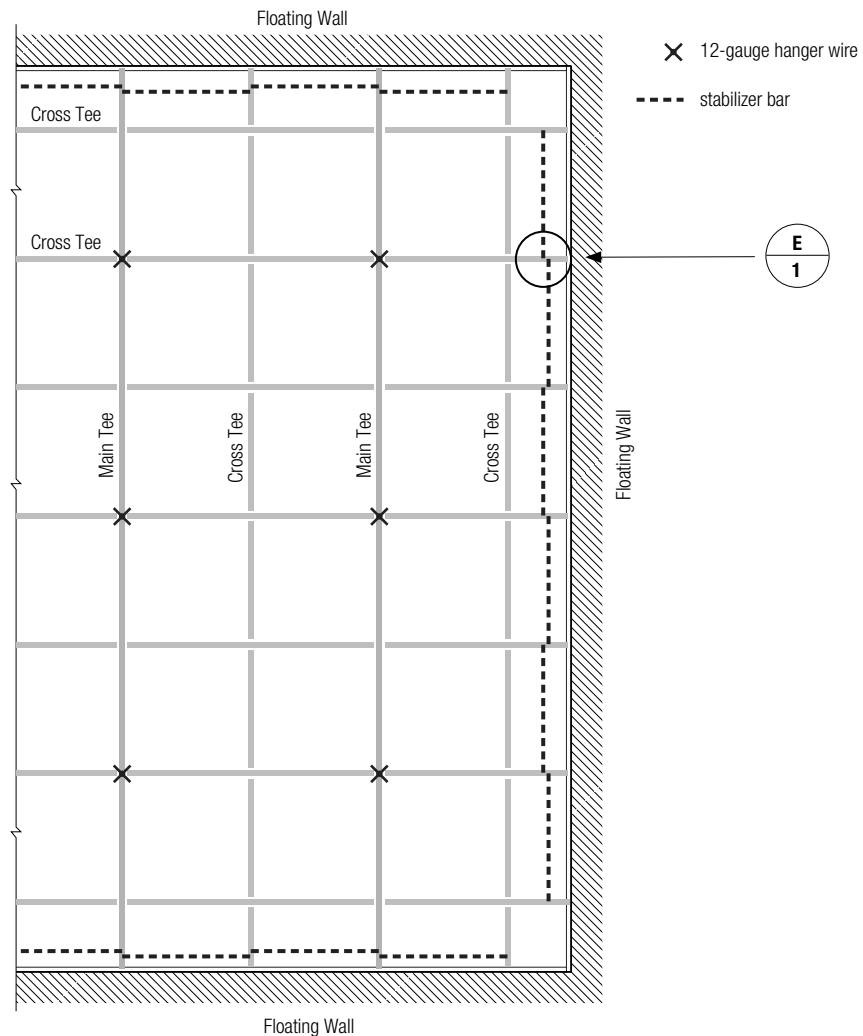
Standard Seismic Application

Intermediate Duty System 7/8" Molding, Stabilizer Bars

Systems Summary

Suspension System Duty Rating	Intermediate
Wall Molding	7/8"
Seismic Clip	None
Floating Sides	3/8" gap; no attachment of tee to molding
Perimeter Hanger Wires	None
Stabilizer Bars	Yes

Construction Details



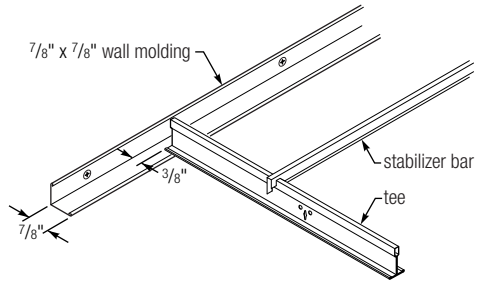
All main DOWN suspension systems – DX/DXL, FINELINE DXF, FINELINE 1/8 DXFF, CENTRICTEE DXT/DXLT, CE, DXW, DXLA, and ZXLA – include the code-compliant intermediate-duty main tees for Seismic Design Categories A, B and C.

The performance of DOWN 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.

Convenience holes located in the tee bulb may be used for any and all hanger wires.

Tee Unattached, Floating Wall

E
1



Product Information

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

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 1222.

Evaluation Reports are subject to reexamination, revision and possible cancellation. Please refer to usgdesignstudio.com or 800.USG.4YOU 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.

AC156 Disclaimer

The current ICC-ES acceptance criterion (AC) used for the testing and evaluation of seismic clips is AC156, Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems. AC156 was not specifically designed to provide testing guidelines or pass/fail criteria for acoustical suspension systems in a seismic event. However, in the absence of a specific AC for this purpose, ICC-ES allowed AC156 to act as the basis for all seismic testing and evaluation for the acoustical ceiling suspended ceilings industry.

Trademarks

The following are trademarks of USG Interiors Inc., or a related company: CE, CENTRICITEE, DONN, FINELINE, DX, DXF, DXFF, DXL, DXLA, DXLT, DXT, DXW, USG, ZXLA.

Note

The University of Buffalo and the University of California do not endorse specific products.

USG assumes no liability for the accuracy of completeness of the drawings for a particular installation or their fitness for a particular purpose. Please consult with a licensed architect or engineer in the particular locale of the installation to assure compliance with all legal requirements. All products described here may not be available in all geographic markets. Consult your local sales office or representative for information.

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.

Safety First!

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

