

## Light Duty Suspension Systems

ASTM C635<sup>1</sup> addresses the load carrying capability of main tees, categorizing them as Light, Intermediate or Heavy Duty. This is also known as deflection criteria.

**Main Tee Load Carrying Classifications**

The associated load ratings are:

Light Duty	Intermediate Duty	Heavy Duty
5 lbs./LF (7.4 kg/m)	12 lbs./LF (17.9 kg/m)	16 lbs./LF (23.8 kg/m)

Per ASTM C635, a suspension system main tee, when supported 48 in. o.c. and subjected to the respective load for its particular classification, cannot deflect more than L/360, where L equals the length of the unsupported span, or in this case, 48. For suspension system main tees, this deflection cannot exceed 0.133 in. If a main tee cannot carry the required load without exceeding its associated allowable deflection, it must, per ASTM C635, reduce its categorization appropriately (i.e. from Intermediate to Light Duty).

Deflection	Example
$\text{Deflection} = \frac{L}{360} \text{ or } \frac{\text{Length of span}}{360}$	$\frac{48''}{360} = 0.133'' \approx 1/8''$ <p>Note: 1/8" is noticeable to the human eye.</p>

L/360 deflection criteria is measured for commercial construction because it is considered that 1/8 in. of deflection is typically noticeable to the human eye. Any deflection less than 1/8 in. would not be noticeable. The ultimate purpose of measuring main tees and assigning associated duty ratings per deflection criteria is for aesthetic purposes. This practice is commonly misunderstood as having a safety element; however the practice is purposely aesthetic.

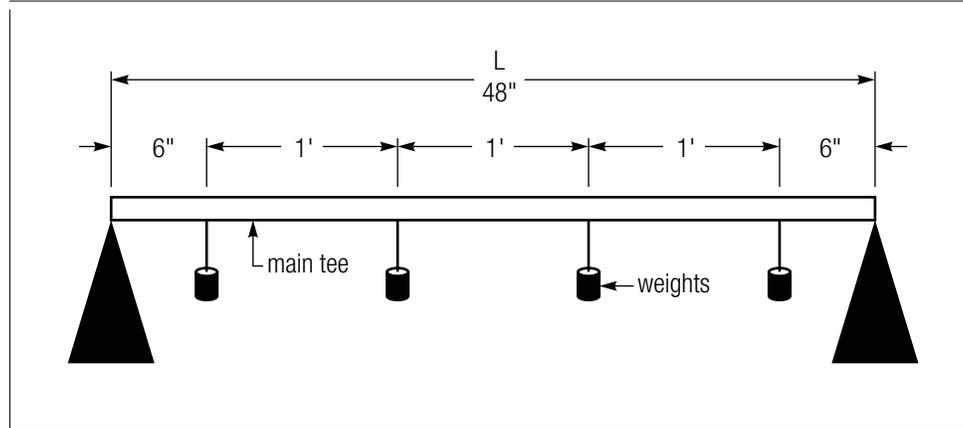
<sup>1</sup> See last page for Seismic Code Reference Standards



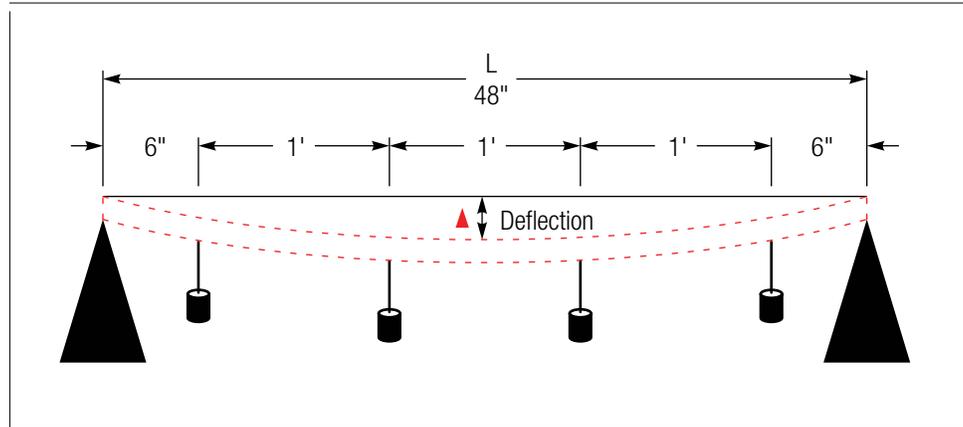
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## L/360 Deflection Criteria Test Method

16 lb. load is applied to main tee test specimen supported by a 4 ft. simple span



After load is applied any deflection is measured.



Per ASTM C635, a main tee is supported 4 ft. o.c. and subjected to the load for its duty classification; the tee may not deflect more than 0.133 in. or  $L/360$ , where  $L$  equals the unsupported span.

# Light Duty Suspension Systems

## Special Applications

Some applications present exceptional functional requirements or are subject to stringent criteria mandated by third parties such as USDA. USG offers several **DOWN®** systems that provide excellent design flexibility and meet the environmental demands found in some of the most challenging spaces such as:

Special Applications	Environmental Concerns
Cleanrooms	Contamination, humidity, pressure and airborne particles.
Indoor swimming pools	Temperature and humidity.
Non-magnetic environments	Standard suspension systems can interfere with the performance of MRI and other equipment that uses or creates magnetic fields.
Food service areas	USDA Food Safety Inspection Service requirements.
Restrooms and shower areas	Temperature, humidity and wet cleaning.
Parking garages and exterior soffits	Temperature, humidity and wet cleaning.
Laboratories	Corrosive agents.

Due to the materials used to produce these specialized suspension systems, some are classified as Light Duty. USG understands that these specialized suspension systems may be necessary for their particular application. This can create a challenge in a seismic application when a specialized suspension system is necessary to meet an exceptional functional requirement. USG analyzed these requirements and prepared the following section to assist in these specialized applications..

## Seismic Code Standards<sup>1</sup>

The International Building Code (IBC), through references to *ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) and *ASTM International E 580/E 580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions*, defines the requirement for the main tee used in various seismic design categories. The associated requirements are:

Seismic Design Category A, B	Seismic Design Category C	Seismic Design Category D, E, F
No requirement	Intermediate Duty	Heavy Duty

Although the duty rating system for main tees exists for aesthetic purposes, it has been an accepted part of seismic ceiling standards for decades though the origin and logic for this remains unknown. It has been proven that the connection strength of the suspension system is the critical factor needed to endure the lateral forces exerted on the suspension system in a seismic event, and **DOWN** suspension systems have set the standard, using the strongest gauge steel to produce the tightest systems available with the greatest lateral and torsional stiffness. As a result, 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 Pacific Earthquake Engineering Research Center (PEER) University of California, Berkeley to conduct full-scale seismic testing to evaluate and qualify the seismic performance of our systems.

<sup>1</sup> See last page for Seismic Code Reference Standards

# Light Duty Suspension Systems

## Light Duty Systems

USG offers the following products.

**AX™** AX™, an aluminum suspension system for high-humidity or wet-cleaned areas such as food-processing areas. The aluminum components can also be used in non-magnetic environments such as magnetic-free zones and MRI rooms.

**DXSS™** USG also offers DXSS™, a stainless steel system for non-magnetic requirements and resistant to direct and indirect contact with many corrosive agents, making it an ideal material for use in industrial and laboratory applications.

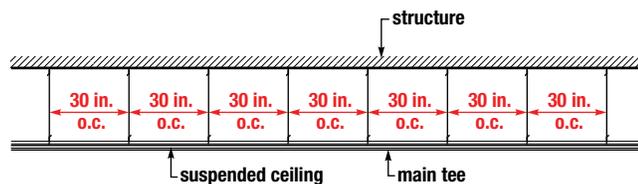
Both systems meet USDA/FSIS requirements. Both the AX™ and DXSS™ suspension systems have main tees that are classified as Light Duty per ASTM C635.

**Note:** USG recommends that the design team, consulting engineers and code officials work together to analyze these factors and determine the appropriate construction and application. Because codes continue to evolve, check with local officials prior to designing and installing a suspension system.

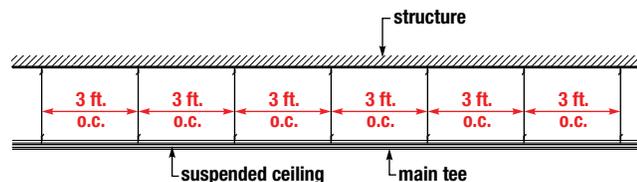
## Hanger Wire Spacing

Reducing the hanger wire spacing on the main tees from 4 ft. o.c. to 30 in. o.c. for AX and 4 ft. o.c. to 3 ft. o.c. for DXSS can achieve Heavy Duty load carrying capacity values to satisfy this requirement.

### AX Construction



### DXSS Construction



# Light Duty Suspension Systems

## Code Approval

USG believes these alternative designs are at least the equivalent of that prescribed in the code for quality, strength, effectiveness, durability and safety. The data and test results presented below provide technical evidence on which a code official can base approval.

	Main Tee	
	AX	DXSS
<b>Hanger Support Spacing</b>	30" o.c.	36" o.c.
<b>Maximum Allowable Load (Lbs./LF) at L/360 Deflection</b>	19 lbs	23 lbs
<b>Equivalent Duty Rating<sup>1</sup></b>	Heavy	Heavy
<b>Suspension System Seismic Requirements<sup>2</sup></b>		
– Heavy Duty Main Tee Classification <sup>3</sup>	Satisfies Requirement	Satisfies Requirement
– Minimum main tee and cross tee intersection strength limits = 180 lbs.	Exceeds Requirement: Cross Tee = 207 lbs Main Tee = 205 lbs	Exceeds Requirement: Cross Tee = 462 lbs Main Tee = 536 lbs
– Connection device from vertical wire to the structure above must sustain min. 100 lbs.	Exceeds Requirement: 205 lbs	Exceeds Requirement: +500 lbs

<sup>1</sup> Reducing the hanger wire spacing on main tees can achieve heavy duty load carrying capacity values to satisfy this requirement, but does not change the duty classification of the main tee.

<sup>2</sup> There are various product and installation seismic requirements for suspended ceilings. Listed are the suspension system requirements only. For a complete listing of the seismic requirements for suspended ceilings please visit [seismicceilings.com](http://seismicceilings.com) or refer to The International Building Code (IBC), ASCE/SEI7 Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) and ASTM International E 580/E 580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

<sup>3</sup> Heavy Duty is required for IBC Seismic Design Category D-F and Intermediate Duty is required for IBC Seismic Design Category C.

### Notes:

- The performance of DONN suspension systems is based on the specific combination of superior components, and the design and installation methods shown. Components from other manufacturers were not evaluated, and their use or any mixed use is not recommended.
- Many jurisdictions accept the installation of Light Duty main tees with additional supports, however, some jurisdictions will not accept this application. Check with a local official prior to designing and installing a Light Duty ceiling system.

# 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)	CISCA Zones 0-2	CISCA Zones 0-2	CISCA Zones 0-2	ASTM E580
or ASTM International (ASTM)	CISCA Zones 3-4	CISCA Zones 3-4	CISCA Zones 3-4	

**International Building Code (IBC)** defines Seismic Design Categories A, B, C, D, E, and F.  
[www.iccsafe.org](http://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](http://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](http://www.cisca.org)

### ASTM International E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.

ASTM International (formerly American Society for Testing and Materials)  
[www.astm.org](http://www.astm.org)

## Further References

### USG Seismic Ceiling Resource Center

Seismic Technical Guides  
[seismicceilings.com](http://seismicceilings.com)

### Product Information

See [usg.com](http://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. ASTM E580 and the current building code limit the installation of suspended ceiling main tees in Seismic Design Category C to Intermediate Duty and suspended ceiling main tees in Seismic Design Categories D-F to Heavy Duty. Many jurisdictions accept the installation of Light Duty main tees with additional supports, however, some jurisdictions will not accept this application. Check with a local official prior to designing and installing a Light Duty ceiling system.

### 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 1222. Evaluation Reports are subject to reexamination, revision and possible cancellation. Please refer to [usgdesignstudio.com](http://usgdesignstudio.com) or [usg.com](http://usg.com) for current reports.

### L.A. Research Report Compliance

Down 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.

### 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.

