SEVEN WALLS

[ Between us, ideas become reality ]

Seismic Installations
What You Need to Know – The Basics
NEW Armstrong Seismic Rx – A Code-Compliant Solution

Armstrong®
What you need to know: Current Seismic Code Development and Adoption

Purpose of Installation Requirements for Suspended Ceilings

- Suspension systems strong enough to resist lateral forces imposed upon it without failing
- Prevent border panels from falling from the ceiling plane

Federal Emergency Management Agency (FEMA)

Seismic performance during recent large California earthquakes prompted FEMA to address several concerns including suspended ceiling performance during a seismic event. Research and tests demonstrated that current industry seismic standards (UBC Standard 25-2) were not adequate. FEMA determined that the key to good seismic performance was support of individual panels at walls and expansion joints and interaction with sprinkler systems.

Source: FEMA 368 NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures

Adoption of the International Building Code


New Seismic Categories

According to the International Building Code, a Seismic Design Category must be established for each construction project based on:

1. anticipated ground motion
2. type of soil in a specific geographic area
3. seismic use group designation

Ask us about our new CES course on current seismic code requirements for commercial ceiling systems. Contact your Armstrong rep or call 877-ARMSTRONG for more information.

IBC Seismic Installation Requirements

<table>
<thead>
<tr>
<th>IBC Category</th>
<th>IBC Installation Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Ceiling installation should conform to basic minimums established in ASTM C 636.</td>
</tr>
<tr>
<td>C</td>
<td>To be installed to CISCA recommendations for areas subject to light to moderate seismic activity.</td>
</tr>
<tr>
<td></td>
<td>• Minimum 7/8&quot; wall molding</td>
</tr>
<tr>
<td></td>
<td>• Grid must not be attached to the wall molding</td>
</tr>
<tr>
<td></td>
<td>• Minimum 3/8&quot; clearance on all sides</td>
</tr>
<tr>
<td></td>
<td>• Minimum 3/8&quot; overlap of grid on the wall molding</td>
</tr>
<tr>
<td></td>
<td>• Ends of main beams and cross tees must be tied together to prevent their spreading</td>
</tr>
</tbody>
</table>

NOTE: Requirements for essential use facilities may be different. Contact TechLine for details.

<table>
<thead>
<tr>
<th>D, E, F</th>
<th>Installation must conform to CISCA recommendations for areas subject to severe seismic activity. IBC categories D, E and F must also meet these additional requirements:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Minimum 2&quot; wall molding</td>
</tr>
<tr>
<td></td>
<td>• Grid must be attached to two adjacent walls – opposite walls must have a 3/4&quot; clearance</td>
</tr>
<tr>
<td></td>
<td>• Ends of main beams and cross tees must be tied together to prevent their spreading</td>
</tr>
<tr>
<td></td>
<td>• Heavy-duty grid system</td>
</tr>
<tr>
<td></td>
<td>• Ceiling areas over 1,000 SF must have horizontal restraint wire or rigid bracing</td>
</tr>
<tr>
<td></td>
<td>• Ceiling areas over 2,500 SF must have seismic separation joints or full height partitions</td>
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<tr>
<td></td>
<td>• Ceilings without rigid bracing must have 2” oversized trim rings for sprinklers and other penetrations</td>
</tr>
<tr>
<td></td>
<td>• Changes in ceiling plane must have positive bracing</td>
</tr>
<tr>
<td></td>
<td>• Cable trays and electrical conduits must be independently supported and braced</td>
</tr>
<tr>
<td></td>
<td>• Suspended ceilings will be subject to special inspection</td>
</tr>
<tr>
<td></td>
<td>• Perimeter support wires</td>
</tr>
</tbody>
</table>

NOTE: Consult your local code professional for information specific to your region.

Additional Resources on Seismic Codes and Requirements

- TechLine at 1 877 ARMSTRONG (1 877 276 7876)
- armstrong.com/seismic
- Visit these code related web sites:
  - ASTM: www.astm.org
  - BSSC: www.nibs.org
  - FEMA: www.fema.gov
  - ICC: www.icc-es.org
  - USGS: geohazards.cr.usgs.gov

The Code Official is the Only Authority to Enforce Code Compliance

The building code was established to set minimum requirements for life safety and preservation of property. It is important to know that while the building code establishes the requirements, it is the code official that has the power to enforce its provisions. The code official also has the latitude to allow materials and methods of construction that are not addressed in the code. In this case, an official can perform their own analysis of evidence presented or can rely on independent, qualified sources such as ICC-ES to do the analysis and provide their findings. The resulting report is specific, technical evidence on which the code official can base approval of a particular design without delaying construction.
ICC-ES Recognizes Armstrong Seismic Rx™ Suspension System as a code-compliant solution (ESR-1308)

Evaluation and confirmation by ICC-ES provides evidence supporting the Armstrong Seismic Rx Suspension System as a code-compliant alternative to IBC requirements.

Armstrong Full-Scale Testing Provided Key Evidence Submitted to ICC-ES

IBC code allows alternative designs if tests are conducted and evidence of compliance is submitted. The following evidence was submitted by Armstrong:

- Dynamic Testing – Seismic Qualification by Shake Table Testing
- Static Testing – Vertical, Compression and Tension Loads

ESR-1308 lists specific Armstrong components and method of installation

The performance of the Armstrong Seismic Rx Suspension System is based on the specific combination of components and method of installation. Other manufacturer’s components and installation methods were not tested and are not covered in this evaluation. Substitution of other components puts the system at risk and is not allowed by this ESR report.

ICC-ES Evaluation Committee

ICC-ES employs a large staff of professionally licensed architects and civil, structural, mechanical and fire protection engineers. The members of the ICC-ES technical staff are experts in the application of model codes, and also have access to historical information relating to product evaluation. In addition, when developing acceptance criteria, ICC-ES routinely seeks input from experts in the building industry, through a process of open public hearings conducted by an independent committee composed of code officials who actually enforce building regulations.
Armstrong Seismic Rx™ Suspension System
Saves Time and Money

Armstrong is the only manufacturer to have an ICC-ES evaluated system utilizing 7/8” wall molding for ceiling installations in IBC Categories C, D, E and F. The Armstrong Seismic Rx Suspension System offers a labor and cost saving method of meeting seismic code without the risk of delaying your construction schedule.

Seismic Rx allows you to eliminate unsightly 2” wall angle in Category D, E, F seismic-compliant installations.

2” wall angles are prone to the following problems:
• Difficult to keep “tight” to wall
• Difficult to install corners
• Prone to twisting and warping

In IBC Category D, E and F – Armstrong Seismic Rx benefits include:
• Reduce material costs by using 7/8” molding
• Eliminate stabilizer bars
• Eliminate installation hassles from 2” wall molding

<table>
<thead>
<tr>
<th>IBC Category</th>
<th>Armstrong Seismic Rx Suspension System</th>
<th>IBC Installation Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>D, E, F</td>
<td>• Minimum 7/8” wall molding&lt;br&gt; • Grid must be attached on two adjacent walls – opposite walls require BERC2 with 3/4” clearance&lt;br&gt; • BERC2 maintains main beam and cross tee spacing; no other components required&lt;br&gt; • Heavy-duty systems as identified in ICC-ESR-1308 (refer to Suspension Systems listed on page 9)</td>
<td>• Minimum 2” wall molding&lt;br&gt; • Grid must be attached to two adjacent walls – opposite walls must have a 3/4” clearance&lt;br&gt; • Ends of main beams and cross tees must be tied together to prevent spreading&lt;br&gt; • Heavy-duty grid system</td>
</tr>
</tbody>
</table>

In IBC Category C – Armstrong Seismic Rx benefits include:
• Easier to square the system by attaching to adjoining walls
• Tighter, more secure installation
• Eliminate stabilizer bars

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<th>IBC Category</th>
<th>Armstrong Seismic Rx Suspension System</th>
<th>IBC Installation Requirements</th>
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<tbody>
<tr>
<td>C</td>
<td>• Minimum 7/8” wall molding&lt;br&gt; • Grid may be attached on two adjoining walls&lt;br&gt; • Minimum 3/8” clearance on two unattached walls&lt;br&gt; • BERC2 on all runners</td>
<td>• Minimum 7/8” wall molding&lt;br&gt; • Grid must not be attached to the wall molding&lt;br&gt; • Minimum 3/8” clearance on all sides&lt;br&gt; • Minimum 3/8” overlap of grid on the wall molding&lt;br&gt; • Ends of main beams and cross tees must be tied together to prevent spreading</td>
</tr>
</tbody>
</table>

NOTE: For complete seismic requirements contact TechLine® at 877-ARMSTRONG
Two Approaches to IBC Categories D, E and F

Armstrong Seismic Rx™ Suspension System (ESR-1306)

Solution Benefits

- Narrow, sleek aesthetic with standard 7/8" molding
- Eliminates installation and aesthetic problems associated with 2" wall molding
- Lower cost solution
- Better access to the plenum
- Eliminates stabilizer bars
- Eliminates visible pop rivets through the wall angle
- More profiles from which to choose

Armstrong Seismic Rx Suspension System

- 7/8" molding
- Attached grid on two adjacent walls with the BERC2 or pop rivets
- BERC2 clip with 3/4" clearance on unattached walls
- Heavy-duty grid systems (refer to Suspension Systems listed on page 9)

Attached Wall

BERC2 Clips or Pop Rivets

Attached Wall

Screw tightened through main runner web restricting separation from wall molding

Unattached Wall

BERC2 Clips

X Hanger Wire

B BERC2 Clip

P Pop Rivets

To download CAD drawing details go to www.armstrong.com/seismic

Unattached Wall

2' o.c.
**IBC Requirements**

- **2” molding**
  - Attached grid on two adjacent walls with pop rivets, screws or other means
- **3/4” clearance at perimeter on unattached walls and stabilizer bars to prevent the spread of mains beams and cross tees**
- **Heavy-duty grid**

To download CAD drawing details go to www.armstrong.com/seismic
Two Approaches to IBC Category C

Armstrong Seismic Rx™ Suspension System (ESR-1308)

Solution Benefits

- Meets code requirement
- Easy to square up the system
- Faster, tighter grid installation
- Better overall visual
- Eliminates stabilizer bars
- Lower cost solution
- Better access to the plenum
- Better seismic performance

Armstrong Seismic Rx Suspension System

- 7/8" molding
- Grid can be tight on two adjoining walls and less than 3/8" clearance on other two walls
- BERC2 Clip on all runners
- Intermediate-duty grid

To download CAD drawing details go to www.armstrong.com/seismic
IBC Requirements

- 7/8" molding
- 3/8" clearance on all sides
  - 3/8" overlap of the grid on the wall molding
- Prevent the spread of mains/cross tees with stabilizer bars

- Intermediate-duty grid

NOTE: Requirements for essential use facilities may be different. Contact TechLine for details.
Standard Suspension Systems Included in ESR-1308

The following ceiling and grid systems were tested to withstand seismic forces in all IBC categories. All ceilings have test details and summaries to support the demonstrated performance and integrity of the system.

<table>
<thead>
<tr>
<th>Family Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRELUDE® XL</td>
<td>15/16&quot; Exposed Tee System</td>
</tr>
<tr>
<td></td>
<td>Fire Guard 15/16&quot; Exposed Tee System</td>
</tr>
<tr>
<td></td>
<td>15/16&quot; Environmental Tee System</td>
</tr>
<tr>
<td>SILHOUETTE® XL</td>
<td>1/4&quot; Reveal 9/16&quot; Bolt-Slot System</td>
</tr>
<tr>
<td></td>
<td>1/8&quot; Reveal 9/16&quot; Bolt-Slot System</td>
</tr>
<tr>
<td>SUPRAFINE™ XL</td>
<td>9/16&quot; Exposed Tee System</td>
</tr>
<tr>
<td></td>
<td>Fire Guard 9/16&quot; Exposed Tee System</td>
</tr>
<tr>
<td>AL PRELUDE PLUS XL</td>
<td>15/16&quot; Environmental Tee System</td>
</tr>
<tr>
<td>INTERLUDE® XL</td>
<td>9/16&quot; Dimensional Tee System</td>
</tr>
<tr>
<td>SONATA™</td>
<td>9/16&quot; Dimensional Tee System</td>
</tr>
<tr>
<td>SS PRELUDE PLUS XL</td>
<td>15/16&quot; Environmental Tee System</td>
</tr>
</tbody>
</table>

* Not available in Heavy Duty.

Non-Standard Seismic Suspension Systems

Leader in seismic testing

Armstrong has partnered with the State University of New York, University at Buffalo to test both standard and non-standard ceiling systems for seismic performance, including non-standard systems such as: Concealed Z Grid Systems, Custom T-bar Grid Systems, J-bar Grid Systems, Custom Linear Grid Systems, Custom Grid Modules, DP-59 Grid Systems, Access Grid Systems, and Canopy Cable Systems. Most of the grid systems are used for custom panels such as MetalWorks™ and WoodWorks®. Please visit www.armstrong.com/seismic for a full product listing.
In full scale seismic test evaluations, the common cause of system failure came from damage to cross tee end connectors (Armstrong and competitive systems). Damage occurs in one of two ways:

- Connector clip bends
- Base metal bends

When this damage occurs, it allows unbraced sections of ceiling to move up to 3/8’ at each connection. The cumulative effect of damage at the cross tee connections may move the ceiling more than 2’. Consider the following example:

Without perimeter support wires, test results demonstrate that the load of the ceiling may cause the main beams and cross tees to move beyond the 2” wall molding and drop out. System failure at the perimeter does not conform to the requirements of the code.
Seismic-Ready CSI specifications

When you turn to Armstrong for technical support, specifying your ceiling design for a specific seismic category is easy. Whether you build your spec on our web site or call one of our TechLine experts, you’ll get a detailed seismic-ready specification.

Need Answers Fast?
Get Help from the Experts

Contact our seismic experts to help you with your seismic code questions and ceilings designs. You’ll get selection information, performance and product data with test details, specification details, design details and construction methods.

CEILING SYSTEMS
1 877 ARMSTRONG (1 877 276-7876)

- Customer Service Representatives
  7:30 a.m. to 5:00 p.m. EST, Monday through Friday
- TechLine — Technical information —
  8 a.m. to 5:30 p.m. EST, Monday through Friday
  FAX 1-800-572-8324 or
  email: techline@armstrong.com
- Request a personal copy of the Armstrong Ceiling Systems catalog

armstrong.com/seismic

- Latest product and solution news
- Seismic Test Summaries
- Submittal page
- Specification writing tool
- Literature and samples information
- Seismic Design Solution CAD renderings

Visit these code related web sites:

- ASTM: www.astm.org
- BSSC: www.nibs.org
- FEMA: www.fema.gov
- ICC: www.iccsafe.org
- USGS: geohazards.cr.usgs.gov