

ICC-ES Evaluation Report

ESR-1308

Reissued December 2018 Revised February 2019 This report is subject to renewal December 2019.

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DIVISION: 09 00 00—FINISHES Section: 09 22 26—Suspension Systems Section: 09 53 00—Acoustical Ceiling Suspension Assemblies

REPORT HOLDER:

WORTHINGTON ARMSTRONG VENTURE (WAVE)

EVALUATION SUBJECT:

FIRE- AND NONFIRE-RESISTANCE-RATED SUSPENDED CEILING FRAMING SYSTEMS

ADDITIONAL LISTEE:

ARMSTRONG WORLD INDUSTRIES, INC.

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2015, 2012, and 2009 International Building Code[®] (IBC)
- 2013 Abu Dhabi International Building Code (ADIBC)[†]

[†]The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Interior finish
- Fire resistance
- Structural

2.0 USES

The Worthington Armstrong Venture (WAVE) ceiling framing systems described in this report are suspended, exposed framing systems of ceiling assemblies used in fire-resistance-rated and nonfire-resistance-rated construction for interior applications.

3.0 DESCRIPTION

3.1 Grid Components:

3.1.1 Main Runners, Nonfire-resistance-rated: Main runners for use in nonfire-resistance-rated ceiling assemblies include the 6100, AL7200, SS7200, 7300, 7302, 7305, 7500, 7502, 6500B, EA7900, 7600, and 76008 7602, 76028, 7603, 76038, 76068, 7607, series. All members are classified as intermediate-duty in accordance with ASTM C635, except the following, which are classified as heavy-duty: 6501, ES7901, EA7903, 6101, 6121A,

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6127A, 6132, 6195A, 7301, 7306, 7307, 7501, 7504, 7507, 7508, 7509, 7601, 7604, 7605, 7612, 76128, 76018, 76048 and 76058. Profiles of runners are shown in Figure 1.

The 6100, 6101, 7300, 7500, 7600, and 76008 runners are cold-formed from ASTM A568 steel. The runners have a hot-dipped galvanized coating and a factory-installed polyester-painted steel cap or aluminum cap along the entire length of the bottom flange. The 6100, 6500B, 6501, ES7901 and 7600 series have a painted coating in addition to the hot-dipped galvanized coating, and have no cap. The AL 7200, EA7900 and EA7903 runners are cold-formed from 3003-H14 aluminum and have a baked polyester paint coating. The 6500B, 6501 and ES7901, EA7900 and EA7903 runners have a polyurethane-filled upper bulb in addition to a polyurethane-coated lower flange.

The EA7900C runners are cold-formed from 3105-H24 aluminum and have a baked polyester paint coating and an integral extruded PVC gasket. The EA7900C main runners are classified as intermediate-duty in accordance with ASTM C635 and shall be used in conjunction with EA7920C and EA7940C cross runners listed in Table 3 of this report.

The SS 7200 runners are cold-formed from 300 series stainless steel complying with ASTM A480. Table 2 specifies dimensions, lengths, and allowable transverse loads.

3.1.2 EAC Main Runners, Low Voltage, Nonfireresistance-rated: Main runners for use with low voltage powered lighting systems include the following: EAC Prelude Main Runners: DC730112, DC730110, DC730108, and DC730106; non-powered 730106; EAC Suprafine Main Runners: DC750112, DC750110, DC750108, and DC750106; the non-powered 750106; EAC Silhouette Main Runners: DC760112, DC760110, DC760108, and DC760106; and the non-powered 760106. The EAC Prelude, EAC Silhouette, and EAC Suprafine are classified as heavy-duty in accordance with ASTM C635. See Table 2 for the listed runners, and Figure 1 for a profile of these runners.

The EAC main runners are cold-formed from ASTM A568 steel. The runners have a hot-dipped galvanized coating and a factory-installed, polyester-painted steel cap along the entire length of the bottom flange. The EAC Silhouette series has a painted coating in addition to the hot-dipped galvanized coating and have no cap on the bottom flange.

The EAC Prelude, EAC Silhouette, and EAC Suprafine main runners have a snap-on upper polymerprofile that supports two tin-plated copper conducted strips that serve

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to carry the low voltage current. The EAC Silhouette main runners also have a lower conductive snap-on polymer conductive strip in the lower box profile in addition to the upper conductive snap-on polymer profile. The snap-on polymer has a flame-spread index of 25 or less and a smoke-developed index of 50 or less, when tested in accordance with ASTM E84.

The EAC main runners are used in conjunction with the XL 7300 (Prelude), XL 7500 (Suprafine) and XL 7600 (Silhouette) cross runners listed in Table 3 of this report.

3.1.3 Main Runners, Gravity Loaded, and Nonfireresistance-rated: Main runners for use to support gravity loads only in non-fire-resistance-rated ceiling assemblies include 730145 series. The suspended ceiling framing system must be installed in accordance with the 2015, 2012, and 2009 IBC Section 808 for ceiling systems up to 4 psf (19.5 kg/m²) of uniform gravity load. The 730145 main runners are cold-formed from ASTM A568 steel. The runners have a hot-dipped galvanized coating and a factory-installed, polyester-painted steel cap along the entire length of the bottom flange. The 730145 main runners are used in conjunction with XL7325 and XL 7345 cross runners listed in Table 3 of this report. Profiles of the runners are shown in Figure 1.

3.1.4 Cross Runners, Nonfire-resistance-rated: Cross runners for use in nonfire-resistance-rated ceiling assemblies are the XL6100 series (Interlude), XL6500 series (Sonata), XL7100 series (Prelude), XLAL7200 series (Aluminum Prelude), XLSS7200 series (Stainless Prelude), XL7300 series (Prelude), XL7500 series (Suprafine), XL7600 series (Silhouette), EA7900 series (Aluminum $^{15}/_{16}$ inch Clean Room), and ES7900 series (Steel $^{15}/_{16}$ inch Clean Room).

The XL 6100 series, XL6500 series, XL7100 series, XL 7300 series, XL7500 series, XL7600 series and XL76008 series ES7900 series cross runners are cold-formed from ASTM A568 steel. The cross runners have a hot-dipped galvanized coating and a factory-installed polyesterpainted steel cap or aluminum cap along the entire length of the bottom flange. The XL 6100 XL6500, ES7900 and XL 7600and XL 76008 series have a baked polyester painted coating in addition to the hot-dipped galvanized coating, and have no capping on the lower flange. The XLAL 7200, EA7900 and EA7903 series runners are cold-formed from 3003-H14 aluminum and have a baked polyester painted coating. The XL6500 series, ES7900 series, EA7900 series and EA7903 series runners have a polyurethane-filled upper bulb in addition to a polyurethane-coated lower flange. The XLSS 7200 runners are cold-formed from 300 series stainless steel complying with ASTM A480. Table 3 specifies dimensions, lengths, and allowable transverse loads.

3.1.5 Main Runners, Fire-resistance-rated: Main runners for use in fire-resistance-rated ceiling assemblies are the HD 8201, 8300, 8301, 8500 and 8501 runners listed in Table 2. The 8300 and 8500 runners are classified structurally as intermediate-duty in accordance with ASTM C635; Models 8301, 8501, and HD 8201 main runners are classified as heavy-duty. Profiles of runners are shown in Figure 1.

All members have an inverted T-shape. Members are cold-formed from ASTM A568 steel with a hot-dipped galvanized coating.

Models 8300, HD 8201 and 8301 have a factory-installed steel cap along the entire length of the bottom flange. The HD 8201 member has a hot-dipped galvanized coating and a bottom flange cap made from either 3003-H16 or 3105-

H16 aluminum. Table 2 specifies dimensions, lengths and allowable transverse loads.

3.1.6 Cross Runners, Fire-resistance-rated: Cross runners for use in fire-resistance-rated ceiling assemblies are the XL 8200 series (Prelude Plus Fire Guard), XL 8300 series (Prelude Fire Guard), and XL 8500 (Prelude Suprafine Fire Guard) series runners listed in Table 3. Profiles of runners are shown in Figure 1. Members are cold-formed from ASTM A568 steel with a hot-dipped galvanized coating. The XL 8300 and XL 8500 series have a factory-installed steel cap along the entire length of the bottom flange. The XL 8200 series members have a hot-dipped galvanized coating and a bottom flange cap made from either 3003-H16 or 3105-H-16 aluminum. Table 3 specifies dimensions, lengths and allowable transverse loads.

3.1.7 Cross Runners, Gravity Loaded, and Nonfireresistance-rated: Cross runners for use to support gravity loads only and in non-fire-resistance rated ceiling assemblies are the XL 7325 and XL 7345 series runners listed in Table 3. The suspended ceiling framing system must be installed in accordance with the 2015, 2012, and 2009 IBC Section 808 for ceiling systems up to 4 psf (19.5 kg/m²) of uniform gravity load. Profiles of the runners are shown in Figure 1. Members are cold-formed from ASTM A568 steel with a hot-dipped galvanized coating and a factory-installed, polyester-painted steel cap along the entire length of the bottom flange. Table 3 specifies dimensions, lengths, and allowable transverse loads.

3.1.8 Materials: Steel runners are cold formed from ASTM A653 CS Type B steel and have a hot-dipped galvanized minimum protective zinc coating of G30, G60, or G90. The steel runners have a carbon steel composition that conforms to ASTM A568 and a zinc protective coating that conforms to ASTM A653. Aluminum runners are cold-formed from 3003-H14 and 3105-H24 aluminum, and the stainless steel runners are cold formed from 300 series stainless steel.

3.2 Hanger Wire:

Hanger wire for suspended ceilings, framing members, and any fixtures must comply with Section 13.5.6 of ASCE 7 and IBC Section 2506.2.1.

3.3 BERC Clip:

The BERC (Beam End Retaining Clip) System is illustrated in Figure 3. The BERC clip is used to connect main and cross runners to wall molding at the ceiling perimeter. The clip is similar to the BERC-2 clip, described below, except the horizontal leg of the BERC clip is shorter than that of the BERC-2.

3.4 BERC-2 and AL BERC-2 Clips:

The BERC-2 and AL BERC-2 clips are illustrated in Figure 2. The clips are used to connect main and cross runners to wall molding at the ceiling perimeter. The BERC-2 clip is manufactured from 0.034-inch-thick (0.864 mm), hot-dipped galvanized, cold-rolled steel complying with ASTM A568. The AL BERC-2 clip is fabricated from 0.034-inch-thick (0.864 mm) 3003-H16 or 3105 H16 Aluminum.

3.5 Accessories:

Each framing system has accessory items that include support angles and corner caps. Steel for accessory items is manufactured from hot-dipped galvanized, cold-rolled steel complying with ASTM A568 and ASTM A653.

4.0 DESIGN AND INSTALLATION

4.1 General:

The suspended ceiling framing system must be installed in accordance with this report and the manufacturer's

published installation instructions. The suspended ceiling framing system must be installed in accordance with the 2015, 2012, and 2009 IBC Sections 808, 1613 and 2506.2.1 for ceiling systems up to 4 psf (19.5 kg/m²).

4.2 Main Runners:

Main runners must be installed and leveled to within 1/4 inch in 10 feet (6.4 mm in 3048 mm), with the supporting wire taut. Vertical support hanger wire must be installed within 3 inches (51 mm) of the main runner fire expansion relief. The design loads for main runners must be less than or equal to the capacities allowed in Table 2 of this report. Supports for the main runners that consist of vertical hangers, perimeter hangers, and lateral force bracing must be installed in accordance with the applicable code.

4.3 Cross Runners:

Main runners, or other cross runners, must support cross runners to within $\frac{1}{32}$ inch (0.80 mm) of the required center-to-center spacing. This tolerance must be noncumulative beyond 12 feet (3658 mm). Intersecting runners must be installed to form a right angle to the supporting members.

The maximum design load capacities for cross runners must be less than or equal to the capacities allowed in Table 3 of this report.

4.4 Seismic Design:

4.4.1 Seismic Design Requirements: Seismic design and installation details of the ceiling systems, excluding 730145 main runner, and XL7325 and XL7345 cross runners, must be in accordance with Section 13.5.6 of ASCE 7-10 for the 2015 and 2012 IBC (Section 13.5.6 of ASCE 7-05 for the 2009 IBC) as referenced in IBC Section 1613, except as noted in Section 4.4.2 of this report. Systems classified as intermediate-duty are limited to use in Seismic Design Categories A, B and C.

4.4.2 Ceiling Framing Systems with BERC, BERC-2 and AL BERC-2 Clips:

4.4.2.1 Alternate Installation with BERC-2 and AL BERC-2, for Seismic Design Categories D, E and F: Under this installation, the main runner must be rated heavy-duty and have a minimum simple span allowable uniform load of 16.35 pounds per lineal foot (238 N/m); with a maximum ceiling weight permitted for systems with BERC-2 clips at 4 pounds per square foot (19.5 kg/m²); with a maximum celling weight permitted for systems with AL BERC-2 clip at 2 pounds per square foot (9.75 kg/m²). With this installation under Section 4.4.2.1, the main and cross runners must be as described in Table 2 and 3 of this report. The BERC-2 and AL BERC-2 clips are used to secure the main runners and cross runners to the wall molding, as detailed below and shown in Figure 2. A nominally ¹/8-inch (22 mm) wall molding is used in lieu of the 2-inch (51 mm) perimeter supporting closure angle required by Section 5.2.2 of ASTM E580 and Section 13.5.6.2.2 of ASCE 7-10 for the 2015 and 2012 IBC [Section 13.5.6.2.2 (b) of ASCE 7-05 for the 2009 IBC] for Seismic Design Categories D, E and F. The ceiling system must be as prescribed by the applicable code except for the use of the BERC-2 and AL BERC-2 clips and the ⁷/8-inch (22 mm) wall molding and elimination of spreader bars.

The BERC-2 and AL BERC-2 clips are attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding (see Figure 2). The AL BERC-2 clip requires an additional No. 7 by $^{7}/_{16}$ -inch long (minimum) self-piercing sheet metal screw connecting the AL BERC-2 clip to the wall modling as shown in Figure 2.

BERC-2 and AL BERC-2 clips installed on the two adjacent walls where the runners must be fixed (attached wall), are attached to the runner by a No. 7 by $^{\prime}/_{16}$ -inch long (minimum) self-piercing sheet metal screw through the fixed hole in the clip and the top flange bulb of the runner. BERC-2 and AL BERC-2 clips installed on opposite walls where the runners must not be fixed to the clips (unattached walls), the clips must not be mechanically connected to the runner by any fastener and must allow the terminal runner end to move $\frac{3}{4}$ inch (19.1 mm) towards and away from the wall, and installation of a No. 7 by (/16-inch long (minimum) self-piercing sheet metal screw through the horizontal slotted hole is optional, as shown in Figure 2. BERC-2 and AL BERC-2 clips installed in this manner are an acceptable means of preventing runners from spreading in lieu of spacer bars (stabilizer bars) required in Section 5 of ASTM E580 for the 2015 and 2012 IBC (CISCA 3-4 for the 2009 IBC). ASTM E580 is referenced in 2015 and 2012 IBC Section 1613 (CISCA 3-4 is referenced in ASCE 7-05, Section 13.5.6.2.2, which is referenced in 2009 IBC Section 1613). The assemblies descriebd in in this Section 4.4.2.1 are equivalent to that required by CISCA 3-4 and Section 5 of ASTM E580. See Figure 2.

A single $\frac{1}{8}$ -inch-diameter (3.175 mm) steel pop rivet complying with Industrial Fastener Institue Standard IFI-114 may be used in lieu of BERC-2 and AL BERC-2 perimeter clips to secure the main runners and cross runners to the wall molding on two adjacent walls (attached walls). The center of the rivet must be 0.25 inch (6.35 mm) from the edge of the wall angle. See Figure 2.

4.4.2.2 Alternate Installation with BERC, BERC-2 and AL BERC-2, for Seismic Design Category C: Terminal ends of the runners are secured by attaching either the BERC, BERC-2 or AL BERC-2 clip to the wall molding and attaching the runners to the clip. The runners have zero clearance at the perimeter on two adjacent walls (attached walls) and $\frac{3}{8}$ -inch (9.5 mm) clearance on the opposite walls (unattached walls), as detailed in this section and shown in Figure 3. The clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding; the AL BERC-2 clip also requires an additional No. 7 by $7/_{16}$ -inch long (minimum) self-piercing sheet metal screw through the clip and into the wall molding. When the runners must be fixed (attached walls) at two adjacent walls, attach a No.7 by ¹/₁₆-inch long self-piercing screw through the fixed hole of a BERC-2 or AL BERC-2 clip and the top flange bulb of the runner, or through the fixed hole of a BERC clip and into the web of the runner. BERC-2, AL BERC-2, or BERC clips installed on opposite walls where the runners must not be fixed to the clips (unattached walls), the clips must not be mechanically connected to the runner by any fastener and must allow the terminal runner end to move 3/8-inch (9.5 mm) towards and away from the wall, and installation of a No. 7 by $\frac{7}{16}$ -inch long (minimum) self-piercing sheet metal screw through the horizontal slotted hole is optional, as shown in Figure 2. BERC or BERC-2 or AL BERC-2 clips installed in this manner are an acceptable means of preventing runners from spreading, in lieu of spacer bars (stabilizer bars) required in Section 4 of ASTM E580, which is referenced in Section 13.5.6.2.1 of ASCE 7-10, which is referenced in 2015 and 2012 IBC Section 1613 (CISCA 0-2, which is referenced in ASCE 7, Section 13.5.6.2.1, which is referenced in 2009 IBC Section 1613). Except for the use of the BERC or BERC-2 or AL BERC-2 clip as noted above, installation of the ceiling system must be as prescribed by the applicable code. The maximum ceiling weight permitted is 2.5 pounds per square foot (12.2 kg/m²) for ceiling systems using BERC or BERC-2 clips and 2 psf (9.75 kg/m²) for ceiling systems using the AL BERC-2 clip. With this installation, the main and cross runners must be as described in Tables 2 and 3 of this report, except for CleanRoom AL series (EA7900C, EA7920C, and EA7940C). The assemblies described in this Section 4.4.2.2 are equivalent to that required by Section 4 of ASTM E580, which is referenced in Section 13.5.6.2.1 of ASCE 7-10, which is referenced in 2015 and 2012 IBC Section 1613 (CISCA 0-2, which is referenced in 2009 IBC Section 1613).

A single $\frac{1}{8}$ -inch-diameter (3.175 mm) steel pop rivet complying with Industrial Fastener Institue Standard IFI-114 may be used in lieu of BERC-2, AL BERC-2, and BERC perimeter clips to secure the main runners and cross runners to the wall molding on two adjacent walls (attached walls). The center of the rivet must be 0.25 inch (6.35 mm) from the edge of the wall angle. See Figures 2 and 3.

4.5 Lighting Fixtures:

Lighting fixtures must be installed in accordance with Section 13.5.6 of ASCE 7-10. Lighting fixtures may also be attached to the grid with clips complying with the ICC-ES Acceptance Criteria for Attachment Devices for Recessed Lighting Fixtures (Luminaires) in Suspended Ceiling Systems (AC184). The lighting fixtures may also be attached to the framing members with sheet metal screws having a minimum allowable shear strength of 314 lbf (1395 N) and minimum allowable tension strength of 137 lbf (609.6 N) for a No. 20/20 gage metal-to-metal connection.

4.6 Partitions:

Partitions must be laterally supported as required by Section 13.5.8 of ASCE 7, as referenced by the applicable IBC Section 1613.

4.7 Two-hour Fire-resistance-rated Floor-ceiling Assembly:

The floor-ceiling assembly described in Section 4.7 has a two-hour fire-resistance rating (refer to Figure 5 for details):

4.7.1 Structural Beams: The structural floor beams supporting the floor-ceiling assembly are minimum W8x15, or an equivalent-sized steel beam having a minimum weight-to-heated-perimeter ratio, W/D, of 0.54.

In accordance with Section 704.3 of the 2015, 2012, and 2009 IBC, structural steel floor beams need not be individually fire-protected when the suspended ceiling forms the protective membrane for the fire-resistance-rated assembly. However, structural floor beams must be individually protected on all sides for the full length with materials having the required fire-resistance rating, when they support directly applied loads from a floor and roof or more than one floor, or where the required fire-resistance rating of such members is greater than two hours.

4.7.2 Floor Joists: Floor joists are minimum 10K1 steel bar joists, spaced a maximum of 24 inches (610 mm) on center. Each joist must be welded to end supports, and must have 1/2-inch-diameter (12.7 mm) steel bar bridging members welded to top and bottom chords of each joist at midspan.

4.7.3 Steel-floor Decking: The concrete deck is either supported by minimum No. 22 gage [0.0299 inch (0.759 mm)] galvanized steel deck panels with $1^{19}/_{32}$ -inch-deep (32.5 mm) flutes spaced 6 inches (152 mm) on center, or is supported by minimum No. 20 gage [0.0359 inch (0.91 mm)] galvanized steel cellular panels having 3-inch-deep (76 mm) flutes.

When a blend of fluted and cellular steel deck panels is used, the concrete topping thickness is measured from the top plane of the cellular deck panels. The steel deck panels must be welded to supports at 12 inches (305 mm) on center. Adjacent deck panels must be button-punched or welded together at 36 inches (914 mm) on center at side joints.

Where fluted and cellular floor deck panels are installed end-to-end, galvanized steel angles must be tack-welded to the cellular floor deck panels in such a manner as to cover the cells.

4.7.4 Concrete Floor: The concrete floor must be a minimum of $2^{1}/_{2}$ inches (63.5 mm) thick, measured from the top of the metal deck panels, and normal-weight concrete with carbonate or siliceous aggregates. The concrete must have a minimum density of 150 ± 3 pcf (2400 ± 48 kg/m³), and a minimum compressive strength of 3,000 psi (20.7 MPa). The middle of the slab must be reinforced with 6x6–W1.4xW1.4 welded wire fabric.

4.7.5 Suspended Ceiling Members:

4.7.5.1 Main Runners: Main runners are either the 8300, 8301 or HD 8201. The main runners are 12 feet (3657.6 mm) long and spaced a maximum of 4 feet (1219.2 mm) on center. The design loads for main runners must be less than or equal to the capacities shown in Table 2. Vertical hangers, perimeter hangers, and lateral-force bracing for the main runners are installed in accordance with the code. The distance from the bottom side of the floor decking to the bottom side of the main runners is a minimum of $19^{3}/_{4}$ inches (502 mm).

4.7.5.2 Cross Runners: Cross runners are either the XL 8200 series (Prelude Plus Fire Guard) or XL 8300 series (Prelude Fire Guard). Main runners must be located within $1/_{32}$ inch (0.79 mm) of the required center distances, and this tolerance must be noncumulative beyond 12 feet (3657.6 mm). Intersecting runners must be installed to form a right angle to the supporting members. The design loads for cross runners must be less than or equal to the capacities shown in Table 3. A cross runner that supports another cross member must have a minimum uniformly distributed load capacity of 12 pounds per linear foot (175 N/m).

4.7.5.3 Hanger Wire: The suspended ceiling is supported by No. 12 SWG [0.105 inch (2.7 mm) in diameter] galvanized steel wire that is attached to the concrete slab through the steel floor units, before concrete placement, or attached to hanger clips. The hanger clips are minimum 0.045-inch-thick (1.14 mm), 2-inch-wide (51 mm), $3^{1}/_{2}$ -inch-long (90 mm), galvanized steel clips that are hooked at one end, for attachment over the male leg of steel floor units, and spaced as required for hanger wire attachment.

Hanger wires are spaced a maximum of 48 inches (1219 mm) on center or must be located at every other main runner/cross-tee intersection, whichever dimension is less along main runners. Hanger wire must be located at all four corners of light fixtures, at mid-span of cross tees next to 4- and 5-foot-long (1219 and 1524 mm) light fixtures and air duct outlets, and next to each main runner splice. Additional hanger wires are required at the mid-span of those cross tees running parallel and nearest to the walls and those near the end of cut cross tees longer than 2 feet (610 mm) that abut walls.

4.7.6 Acoustical Material: Acoustical lay-in ceiling panels used with the suspended ceiling system are the nominal panel sizes and types shown in Table 1. Panels are nominally $\frac{5}{8}$ inch (15.9 mm) or $\frac{3}{4}$ inch (19.1 mm)

thick. Border panels are supported at walls by 24 MSG painted steel channels, 1 inch (25 mm) deep, with a 2-inch (23.8 mm) bottom flange. Optional support method consists of BERC-2 clip at wall attached to $^{15}/_{16}$ inch x $^{15}/_{16}$ inch No. 24 MSG painted steel channels.

4.7.7 Hold-down Clips: Hold-down clips, produced from No. 24 gage spring steel, must be used for ceiling panels weighing less than one pound per square foot. When the ceiling is composed of nominally 24-by-24-inch (610 by 610 mm), 24-by-36-inch (610 by 914 mm), or 30-by-30-inch (762 by 762 mm) lay-in panels, one clip is placed over bulbs of cross tees near cross tee midpoints. When the ceiling is composed of 20-by-60 inch (508 by 1524mm), 36-by-36-inch (914 by 914 mm), 24-by-48-inch (610 by 1219 mm), 30-by-60-inch (762 by 1524 mm), 36-by-60-inch (914 by 1524 mm) or 48-by- 48-inch (1219 mm) lay-in panels, two clips are placed over bulbs of each cross tee near cross tee quarter-points. One leg of each clip is cut off when placement is over bulbs of cross tees adjacent to the long side of light fixtures.

4.7.8 Recessed Light Fixtures: Fluorescent-lamp-type, steel housing fixtures can be used in the fire-resistance-rated assembly, provided the fixtures measure 1 by 4 feet (305 by 1219 mm), 2 by 2 feet (610 by 610 mm), 2 by 4 feet (610 by 1219 mm), 20 by 48 inches (508 by 1219 mm) or 20 by 60 inches (508 by 1524 mm). The nominally 1-by-4-foot (305 by 1219 mm), 2-by-2-foot (610 by 610 mm) and 2-by-4-foot (610 by 1219 mm) fixtures may include vented sides for air boots and vented tops for air-return purposes. Linear air diffusers and linear air returns must be used with nominally 20-by-48-inch (508 by 1219 mm) fixtures. When nominally 20-by-60-inch (508 by 1524 mm) fixtures are used, fixture stabilizers are used to supplement the hanger wires occurring at the mid-span of the 5-foot-long (1524 mm) cross tees.

When nominally 1-by-4-foot (305 by 1219 mm) fixtures are used, the aggregate number of fixtures must not exceed four per 100 square feet (9.3 m²) of ceiling area. When nominally 2-by-2-foot (610 by 610 mm) fixtures are used, the aggregate number of fixtures must not exceed five per 100 square feet (9.3 m²) of ceiling area. When nominally 2-by-4-foot (610 by 1219 mm), 20-by-48-inch (508 by 1219 mm), or 20-by-60-inch (508 by 1524 mm) fixtures are used, the aggregate number of fixtures must not exceed three per 100 square feet (9.3 m²) of ceiling area. The fixtures must be wired in conformance with an approved electrical code.

The recessed light fixture must be protected on the topside with acoustical ceiling tile panel material having a minimum thickness of $\frac{5}{8}$ inch (15.9 mm). The panels are cut into pieces to form a five-sided enclosure which is rectangular or trapezoidal in cross section, depending upon fixture type, and which is approximately 1/2 inch (12.7 mm) longer and wider than the fixture, with sufficient depth to provide at least 1 inch (12.7 mm) of clearance between the fixture and the enclosure. The pieces are held together with 8d nails. Spacers provide the 1¹/₄-inch (31.7 mm) clearances when placed on top of fixtures located away from the ballasts. When no air-handling or air-return fixtures are used, a maximum 1¹/₄-inch (31.7 mm) separation must be maintained between the long fixture protection sidepieces and the top piece. When air supply light fixtures with air boots are used, fixtures and air boots must be fully enclosed except for the nominally 28-square-inch (18 064 mm²) opening needed for the connection to air-supply ducts.

4.7.9 Air Duct: Air ducts are permitted in the assembly provided the ducts are constructed of minimum No.22 MSG galvanized steel and aggregate duct opening area is

less than or equal to 113 square inches (72 903 mm²) per 100 square feet (9.2 m²) of ceiling area. The maximum air duct-opening dimension is 12 inches (305 mm).

4.8 8500 (Prelude SupraFine Fire Guard) Series Onehour Fire-resistance-rated Roof-ceiling System:

This exposed grid system consists of the 8500 series main runners and the XL 8520 or XL 8540 cross runners, and is part of a one-hour fire-resistance-rated floor-ceiling system. The rating applies to restrained and unrestrained assemblies as described in ASTM E119. See Figure 4 for assembly details. General requirements in 2015 and 2012 IBC Section 711 and 2009 IBC Section 712 must be observed.

4.9 Special Inspection:

Suspended ceilings in Seismic Design Categories C, D, E and F are subjected to periodic special inspections during the installation of the suspended ceiling systems and their anchorage in accordance with the following requirements:

- For installations in accordance with Section 4.4.2 of this report, special inspection must be conducted as indicated in 2015 IBC Sections 1704.3, 1704.5, 1705.1.1 and 1705.13.2; 2012 IBC Sections 1704.3, 1705.1.1, 1705.11.4 and Item 3 of Section 1705.12; and 2009 IBC Section 1704.15, Item 3 of Section 1708.1, and 1708.4, as applicable.
- For installation in accordance with Section 4.4.1 of this report, special inspection must must be in compliance with the following: Section 11A.1.3.9, Item 2, of ASCE 7-10 for the 2015 and 2012 IBC [Section 13.5.6.2.2 (h) of ASCE 7-05, and 2009 IBC Section 1705.3.4, Item 3 for the 2009 IBC; Section 13.5.6.2.2 (h) of ASCE 7-05, as applicable].
- The special inspector must verify that the ceiling framing systems are as described in this report, and comply with the this report and the approved construction documents.

A statement of special inspection must be provided as required by 2015 and 2012 IBC Section 1704.3 (2009 IBC Sections 1705.2 and 1705.3 for the 2009 IBC).

5.0 CONDITIONS OF USE

The suspended ceiling systems described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 The ceiling suspension main runners, cross runners, and BERC, BERC-2 and AL BERC-2 clips must be fabricated and installed in accordance with this report and the manufacturer's published installation instructions. In the event of a conflict between the manufacturer's installation instructions and this report, this report governs.
- **5.2** Design loads and spans of main and cross runners must comply with Tables 2 and 3 of this report.
- 5.3 Suspended ceiling systems must be designed and installed in accordance with ASCE 7 Section 13.5.6 as referenced by the applicable IBC Section 1613. The documents must be prepared by a registered design professional where required by statutes of the jurisdiction in which the project is to be constructed.
- **5.4** Special inspections must be provided in accordance with Section 4.9 of this report.
- 5.5 For Seismic Design Category C, D, E or F, a quality assurance plan complying with IBC Chapter 17, including 2015 and 2012 IBC Section 1704.3 (2009)

IBC Sections 1705.2 and 1705.3) must be submitted to the code official.

- **5.6** The ceiling framing systems must not be used to provide lateral support for walls or partitions, except as provided for in ASCE 7, Section 13.5.8.1 as referenced in the applicable IBC Section 1613.
- **5.7** The ceiling systems must be braced to resist seismic forces as determined from Section 1613 of the IBC.
- 5.8 The systems are limited to ceilings not considered accessible in accordance with Item 28 of 2015 and 2012 IBC Table 1607.1 (Item 31 of 2009 IBC Table 1607.1).
- **5.9** The supporting construction for the ceiling system has not been evaluated and is outside the scope of this report. The code official must approve the floor or roof construction supporting the suspended ceiling system.
- **5.10** The ceiling systems recognized in this report have been evaluated for use in interior applications. Exterior applications are outside the scope of this report.
- **5.11** Lay-in ceiling panels must be justified to the satisfaction of the code official as complying with the interior finish requirements of Chapter 8 of the applicable code.
- **5.12** The electrical safety of the EAC main runners is outside the scope of this report. EAC main runners must be installed in accordance with the applicable provisions of the National Electrical Code.
- **5.13** Suspended ceiling system with 730145 main runner, and XL7325 and XL7345 cross runners have only been evaluated for gravity loads only. Seismic design is outside the scope of this report.

6.0 EVIDENCE SUBMITTED

- **6.1** Data in accordance with the ICC-ES Acceptance Criteria for Suspended Ceiling Framing Systems (AC368), dated July 2015.
- **6.2** Reports of fire-resistance tests in accordance with ASTM E119.
- 6.3 Reports of comparative seismic qualification tests in accordance with the ICC-ES Acceptance Criteria for Seismic Certification by Shake-table Testing of Nonstructural Components (AC156), dated October 2010 (editorially revised May 2015).

7.0 IDENTIFICATION

- 7.1 Cartons of framing members, clips and accessories are identified with the name and address of Armstrong World Industries, Inc.; the acronym "WAVE"; number designations specifying gage of steel, depth of section and length; and the evaluation report number (ESR-1308).
- **7.2** The report holder's contact information is the following:

WORTHINGTON ARMSTRONG VENTURE (WAVE) 101 LINDENWOOD DRIVE, SUITE 350 MALVERN, PENNSYLVANIA 19355 (610) 722-1218 www.armstrong.com jrameen@armstrongceilings.com

7.3 The Additional Listee's contact information is the following:

ARMSTRONG WORLD INDUSTRIES, INC. POST OFFICE BOX 3001 LANCASTER, PENNSYLVANIA 17604

ACOUSTICAL PANEL SIZE (inches)	ACOUSTICAL MATERIAL TYPE ¹	STEEL FLOOR DECK PANEL TYPE ²
0 by 60	P(S OR P) OR PC(S)	F, C or B
20 by 60	P(S OR P) OR PC(S)	F or B1
24 by 24	BF(S)	F, C or B
24 by 24	BF(S)	F
24 by 24 or 36	P(S)	F, C or B
24 by 24 or 36	PC(S)	C or B
24 by 24 or 36	P(Š)	F
24 by 48 or 60	P(S OR P) OR PC(S)	F, C or B
24 by 48 or 60	P(S OR P) OR PC(S)	F or B1
30 by 30	P(S)	F, C or B
30 by 30	PC(S)	C or B
30 by 30	P(S)	F
30 by 60	P(S) OR PC(S)	F, C or B
36 by 36	PC(S)	F, C or B
36 by 36	PC(S)	F or B1
36 by 60	PC(S)	F, C or B
48 by 48	PC(S)	F, C or B

TABLE 1—ACOUSTICAL MATERIALS

For SI: 1 inch = 25.4 mm.

 $^{1}(S) =$ surface perforations, (P) = through perforations.

 $^{2}(F)$ = all fluted steel deck panels, (C) = all cellular steel floor deck panels, (B) = any blend of fluted and cellular floor deck panels, (B₁) = blend of one cellular floor deck panels and one or more fluted deck panels.

CATALOG NUMBER	ATALOG NOTE TYPE LENGTH MET UMBER (SEE FIGURE 1) (inches) THICK		METAL THICKNESS	MAXIMUM SPAN	ALLOWABLE LOADS	
				(inch)	(feet)	Simple Span Uniform Load (Ib./lin. ft.)
6100	1	М	144	0.013	4	12.6
6101	1	М	144	0.019	4	16.79
6121A	1	M	144	0.019	4	16.79
6127A	1	M	120	0.019	4	16.79
6132	1	IVI M	132	0.019	4	16.79
6500B	5	P	120	0.019	4	15.02 12.67 **
6501	1.5	P	144	0.018	4	19.42 16.17
AI 7200	1	В	144	0.021	3	13.47
SS 7200	3	В	144	0.015	4	12.23
7300	1	A	144	0.010	4	13.5
7301	1	A	144	0.015	4	16.73
730106	1, 8	S	72	0.017	4	17.35
730145	1, /	U	144	0.0195	4	40.16
7302	1	A	120	0.010	4	13.5
7306	1	Ā	140	0.010	4	17 25
7307	1	A	126	0.015	4	17.25
7500	1	H	144	0.013	4	12.75
7501	1	Н	144	0.018	4	16.86
7502	1	Н	120	0.013	4	12.38
7504	1	Н	120	0.018	4	16.28
7507	1	Н	144	0.018	4	16.28
DC730112	1,8	S	144	0.017	4	17.35
DC730110	1,0	5	120	0.017	4	17.35
DC730106	1,0	S	90 72	0.017	4	17.35
7508	1	Ĥ	132	0.018	4	16.28
7509	1	н	126	0.018	4	16.28
DC750112	1	N	144	0.019	4	16.83
DC750110	1	N	120	0.019	4	16.83
DC750108	1	N	96	0.019	4	16.83
DC750106	1	N	72	0.019	4	16.83
750106	1	N	12	0.019	4	16.83
76008	1	K I	144	0.013	4	13.10
7601	1	ĸ	144	0.017	4	16.35
76018	1	Ĺ	144	0.017	4	16.35
7602	1	К	120	0.017	4	13.10
76028	1	L	120	0.013	4	13.10
7603	1	K	144	0.013	4	12.28
76038	1	K	144	0.013	4	12.28
7604	1	K	120	0.017	4	16.35
76048	1	L K	120	0.017	4	10.30
76058	1		120	0.017	4	16.35
7606	1	ĸ	120	0.013	4	13.07
76068	1	L	120	0.013	4	13.07
7607	1	K	120	0.013	4	12.8
7612	1	K	144	0.018	4	16.48
76128	1	K	144	0.018	4	16.48
DC760112	1	0	144	0.015	4	16.44
DC760110 DC760109	1	0	120	0.015	4	16.44
DC760106	1		90 70	0.015	4 4	16.44
760106	1	ő	72	0.015	4	16.44
EA7900	5	, ă	144	0.026	4	12.26
EA7900C	6, 8	Ť	144	0.021	4	14.09
EA7903	5	R	144	0.022	4	16.74
ES7901	5	Q	144	0.015	4	18.33
HD 8201	1, HD	A	144	0.015	4	16.73
8300		A	144	0.010	4	13.5
8301	1	A H	144	0.015	4	16.73
8501	1		144	0.013	4 4	16.86

TABLE 2-DIMENSIONS AND ALLOWABLE LOADS FOR MAIN RUNNERS

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb./lin. ft. = 14.6 N/m, 1 lb. = 4.44 N.

NOTES:

1 Single stitched web =

2 Double stitched web =

3 4 5 Available stitched or unstitched =

Hanger wire support at mid-span =

Polyurethane filled upper bulb / polyurethane coated lower flange =

=

6 7 Integral PVC gasket. Limited to gravity usage. Seismic design is outside the scope of evaluation. 8 = Lateral support/bracing is required at 24 inches on center. = HD Hot-dipped galvanized finish =

** Revised by the City of Los Angeles

CATALOG NUMBER	NOTE	TYPE	LENGTH (inches)	METAL THICKNESS (inch)	MAXIMUM SPAN (feet)	SIMPLE SPAN UNIFORM LOAD (Ib./lin. ft.)
.			6100 Series			
XL 6110	2	М	12	0.013	1	66.89
XL 6161	2	М	21	0.013	1.75	66.89
XL 6120	2	М	24	0.013	2	66.89
XL 6167	2	М	27	0.013	2.25	49.32
XL 6170	2	М	30	0.013	2.5	38.8
XL 6162	2	М	42	0.013	3.5	20
XL 6140	2	M	48	0.013	4	12.6
XL 6164	2	M	54	0.013	4.5	9.2
XL 6150	2	M	60	0.013	5	5.8
XL 6190 XL 6180	2, 4 2, 4	M	72 96	0.013 0.013	4	12.6 12.6
I			6500 Series			1
XL6521	5	Р	24	0.014	2	42.00 4
XL6541	5	Р	48	0.014	4	15.88
		_	7100 Series			
XL 7128 XL 7148	1 1	E	24 48	0.010 0.010	2 4	33 6
		A	L 7200 Series			
XLAL7220	2	B	24	0.021	2	44.45
ALAL7240	2		40	0.021	4	0.33
XLSS7220	3	B	24	0.015	2	61.66
XLSS7240	3	В	48	0.015	4	10.4
		1	7300 Series			
XL 7318	2	D	12	0.009	1	36.00
XL 7398	2	D	18	0.009	1.5	36.00
XL 7368	2	D	20	0.009	1.67	36.00
XL 7328	2	D	24	0.009	2	36.00
XL 7320 XL 7325	2 7	A	24	0.011	2	01.33
AL 7320 VI 7379	2, 1	D	24	0.0195	25	40.72
AL 7370	2	D	30	0.009	2.0	10.04
XL 7348	2	D	48	0.010	4	6 78
XL 7345	27	IJ	48	0.000	2	46 72
XL 7343	2, 1	C	48	0.0100	4	7.80
XL 7340	2	Ă	48	0.010	4	12.25
XL 7341	2	A	48	0.015	4	16.89
XL 7357	2	А	60	0.015	5	7.61
XL 7358	2	А	60	0.015	5	7.61
XL 7390	2	А	72	0.010	6	3.3
XL 7390	2, 4	A	48	0.010	4	12.24
XL 7380	2	A	96	0.010	8	1.57
XL 7380	2, 4	A	96	0.010	4	12.12
XI 7510	1	ц	7500 Series	0.010	1	51.92
XI 7561	1	H H	21	0.010	1 75	51.83
XL 7560	1	н	20	0.010	1.67	51.83
XL 7520	1	H	24	0.010	2	51.83
XL 7567	1	н	27	0.010	2.25	28.67
XL 7570	1	Н	30	0.010	2.5	28.67
XL 7530	1	Н	36	0.010	3	21.03
XL 7562	1	Н	42	0.010	3.5	12.67
XL 7540	1	H	48	0.010	4	10.34
XL 7541	1	H	48	0.013	4	12.73
XL 7549	1	H	48	0.018	4	16.42
AL /564	1		54	0.010	4.5	6.72
∧L / 000 XI 7500	1 4		00 72	0.013	Э 4	0.0 12.73
XL 7580	1, 4	н	96	0.013	4	12.73
AL 1000	1.4		30	0.013	. 4	14.13

For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb./lin. ft. = 14.6 N/m, 1 lb. = 4.44 N.

CATALOG NUMBER	NOTE	ТҮРЕ	LENGTH (inches)	METAL THICKNESS (inch)	MAXIMUM SPAN (feet)	SIMPLE SPAN UNIFORM LOAD (Ib./lin. ft.)	
7600 Series							
XL 7610 XL 7660	1		12 20	0.015	1 1.67	71.66 71.66	
XL 7620 XL 7670	1	l	24 30	0.015 0.015	2 2.5	71.66 39.86	
XL 7640 XL 7646	1		48 48	0.015 0.015	4	13.53 13.21	
XL 7645 XL 7650 XL 7655	1		48 60 60	0.015 0.015 0.015	4 5 5	12.85 6.09 5.71	
XL 7657 XL 7690	1 1, 4	i K	60 72	0.013 0.015 0.013	5 4	5.90 12.59	
XL 7680	1, 4	К	96	0.013	4	12.59	
VI 76109	1		76008 Series	0.015	1	60.60	
XL 76608 XL 76208 XL 76708	1 1 1	JJJ	20 24 30	0.015 0.015 0.015 0.015	1.67 2 2.5	69.69 69.69 47.76	
XL 76408 XL 76468	1	JJ	48 48	0.015 0.015	4 4	14.11 13.01	
XL 76508 XL 76558 XL 76558	1	J J J	48 60 60	0.015 0.015 0.015	4 5 5	9 7	
XL 76578 XL 76908 XL 76808	1 1, 4 1 4	J L I	60 72 96	0.015 0.013 0.013	5 4 4	7 12.6 12.6	
X2 70000	., .	, - F	A7900 Series	0.010	•	12.0	
EA 7920	5	Q	24	0.026	2	66.62	
EA 7920C	6	Т	24	0.021	2	41.92	
EA 7940C	6, 8	T	48	0.020	4	12.67	
		E	A7903 Series				
EA 7927 EA 7947	5 5	R R	24 48	0.022 0.022	2 4	60.55 17.66	17.00**
		E	S7901 Series		-		
ES 7920 ES 7940	5 5	Q Q	24 48	0.015 0.015	2 4	60.83 16.83	
	1	X	(L8200 Series	T		1	
XL 8223 XL 8240	2, HD 2, HD	B B	24 48	0.013 0.013	2 4	38.63 12.75	_
¥1. 0040			8300 Series	0.000		45.4	_
XL 8313 XL 8323 XL 8320	2 2 2 2	D D A	12 24 24	0.009 0.009 0.011	1 2 2	45.4 40.45 61.33	40.5 **
XL 8378 XL 8330	2 2	AA	30 36	0.011 0.011	2.5 3	20.84 23.11	
XL 8340 XL 8341 XL 8357	2 2 2 2	A A A	48 48 60	0.011 0.015 0.015	4 4 5	12.25 16.89 7.47	
XL 8358	2	A	60	0.015	5	7.53	_
XL 8520	1	Н	8500 Series	0.013	2	58.5	-
AL 0040		11	40	0.015	4	12.15	

TABLE 3—DIMENSIONS AND ALLOWABLE LOADS FOR CROSS RUNNERS (Continued)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb./lin. ft. = 14.6 N/m, 1 lb. = 4.44 N.

NOTES:

Single stitched web Double stitched web 1 =

=

Available stitched or unstitched = Hanger wire support at midspan =

Polyurethane filled upper bulb / polyurethane coated lower flange =

2 3 4 5 6 Integral PVC Gasket =

7 8 Limited to gravity usage. Seismic design is outside the scope of evaluation. =

= Lateral support/bracing is required at 24 inches on center.

HD = Hot-dipped galvanized finish









TYPE F





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FIGURE 1—RUNNER PROFILES



















TYPE R



FIGURE 1—RUNNER PROFILES (Continued)







FIGURE 3—BERC CLIP



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 psf = 4.88 kg/m², 1 gallon = 3.81 L, 1 sq. ft. = 0.0929 m², 1 psi = 6.89 kPa, 1 lbm = 0.45 kg, 1 sq. in. = 645.16 mm².

- 1. **Roof Covering:** Roof covering consisting of hot-mopped or cold application materials compatible with insulation(s) described in Item 2 that provide Class A, B or C coverings.
- 2. Roof Insulation—Mineral and Fiber Boards: The boards must comply with ASTM C612, Type 1A or 1B; 24-by-48-inch minimum size, maximum size 48 by 96 inches, to be applied in six layers. Boards to be installed perpendicular to gypsum wallboard direction, with end joints staggered 2 feet in adjacent rows. Each layer of board must be offset, in both directions, from layer below a minimum of 12 inches in order to lap all joints. Minimum board thickness is 1 inch (No limit on maximum overall thickness.)
- 3. Sheathing Material (Optional): Vinyl film vapor barrier, applied with adhesive to the gypsum wallboard. Adjacent sheets overlapped 2 inches.
- 4. Gypsum Sheathing: Water-resistant core gypsum sheathing complying with ASTM C79. Supplied in sheets nominally 2 by 4 feet to 4 by 12 feet, by nominal ⁵/₈ inch thick. Minimum weight is 2.0 psf. Applied perpendicular to the steel roof deck direction with adhesive, or laid loosely. End joints to occur over crests of steel roof deck, with end joints staggered 2 feet in adjacent rows.
- 5. Steel Roof Deck: Minimum 0.019-inch-thick (26 gage), minimum 1-inch-deep, minimum 25-inch-wide, painted or galvanized, fluted steel deck. Flutes must be approximately 4 inches on center, crests approximately 2³/₄ inches wide. As an alternate, 1¹/₂-inch-deep, minimum 18-inch-wide fluted galvanized steel deck is permitted. Minimum 0.029-inch-thick (22 gage) flutes must be 6 inches on center, crest width ranging from 3¹/₂ to 5 inches. Deck must be welded to supports with welding washers spaced 12 inches on center. Side lap joints of adjacent units welded or secured together with No. 12 by ¹/₂-inch self-drilling, self-tapping steel screws midway between steel joists.
- 6. Fasteners:
 - A. Adhesive (Optional): BMCA Insulation Products Inc.: May be applied between crests of steel roof deck and gypsum sheathing in ¹/₂-inch-wide ribbons, 8 inches on center, at 0.4 gallon per 100 square feet. May also be applied in ¹/₂-inch-wide ribbons, 6 inches on center, at 0.4 gallon per 100 square feet, between gypsum sheathing and vapor barrier, and between gypsum boards and roof insulation when vapor barrier is omitted. May also be applied at the same rate between layers of roof insulation.
 - B. **Mechanical Fastener:** (Not shown) Any steel nail or steel clip designed for the purpose may be used to attach one or more layers of insulation to steel roof deck (through gypsum sheathing). The gypsum sheathing may also be attached directly to the steel roof deck with the mechanical fasteners.
 - C. Hot Asphalt or Coal Tar Pitch: (Not shown) May be used as an alternate to adhesive between layers of roof insulation, at a rate not to exceed 35 pounds per 100 square feet.
- Steel Joists: Type 10J4 or 12K1 minimum size. 10K1 size may be used when limited to a span of 12 feet 0 inches, maximum. As an alternate, any LH Series steel joists spanning no greater than 60 feet may be used. For spans greater than 60 feet, LH Series joists may be used, provided their vertical deflection under total load must not be greater than ¹/₂₄₄ of the joist span.
- 8. Bridging: Steel bars, ¹/₂ inch in diameter, welded to top and bottom chords of each joist.
- Cold-rolled Channels: Number 16 MSG cold-rolled steel channels, 1¹/₂ inches deep with ⁹/₁₆-inch flanges must be placed on lower chord of joists and secured with 18 SWG galvanized steel wire. Installed perpendicular to joists, the channels must be located as required to provide hanger wire attachment points.

When steel joists are spaced more than 5 feet on center, two cold-rolled channels must be placed back to back and tied together with a double strand of 18 SWG galvanized steel wire at 24 inches on center. The double channels installed perpendicular to the joists and spaced a maximum of 48 inches on center may be placed on top of the joists' bottom chord and tied to each joist with a double strand of 18 SWG galvanized steel wire, or suspended below the joists with 12 SWG galvanized steel wire wrapped around the cold-rolled channels and with the other end wrapped around the bottom chord of the joists.

FIGURE 4-8500 SERIES ONE-HOUR FIRE-RESISTANCE-RATED ASSEMBLY

- 10. Hanger Wire: Number 12 SWG galvanized wire must be twist-tied to steel joists or cold-rolled steel channels. When the ceiling consists of nominal 24-by-24-inch panels or 24-by-48-inch panels, hanger wires must be spaced a maximum of 48 inches on center on main runners adjacent to cross tee intersections. Hanger wires must occur at all four corners of light fixtures, at midspan of cross tees adjacent to 4-foot light fixtures and air duct outlets, and adjacent to each main runner splice. When the ceiling consists of nominal 20-by-60-inch panels, hanger wires must be spaced 40 inches on center along main runners, and one wire must occur at each corner of light fixtures, at midspan of all cross tees, and adjacent to each main runner splice.
- 11. Air Duct: Minimum 0.019-inch-thick (26 gage) galvanized steel. Total area of duct openings must not exceed 576 square inches per each 100 square feet of ceiling area. Area of individual duct openings must not exceed 576 square inches. Maximum opening dimension is 18 inches. Inside and outside faces of duct throat must be protected with ¹/₁₆-inch-thick ceramic fiber paper, laminated to the metal. Maximum dimension of opening is 30 inches. Duct supported by 1¹/₂-inch-deep, minimum 0.053-inch-thick (16 gage) cold-rolled steel channels spaced not over 48 inches on center, suspended by No. 12 SWG galvanized steel wire.
- 12. **Damper:** Minimum 0.056-inch-thick (16 gage) galvanized steel, sized to overlap duct opening a minimum of 2 inches. Protected on both sides with ¹/₁₆-inch-thick ceramic fiber paper, laminated to the metal, and held open with a fusible link.
- 13. Fixtures, Recessed Light: Fluorescent-lamp-type steel housing, nominally 2 by 4 feet or 20 by 60 inches in size. Fixtures must be spaced so their total area does not exceed 24 square feet per each 100 square feet of ceiling area. When 20-by-60 inch fixtures must be used, fixture stabilizers formed from No. 16 gage steel channels, must be used in addition to the hanger wires at midspan of the cross tees. Fixture must be wired in conformance with the National Electrical Code. Fixture and ballasts must be considered for ambient temperature conditions before installation.
- 14. Fixture Protection—Acoustical Material—Armstrong World Industries, Inc.: Type ⁵/₈-inch P (S) or ⁵/₈-inch PC (S) is cut to form a five-sided enclosure, trapezoidal in cross section, approximately ¹/₂ inch longer and wider, and ⁵/₈ inch higher, than the light fixture housing. For 2-by-4-foot fixtures, the protection consists of a 23³/₄-by-47³/₄-inch top piece, two 5⁷/₈-by-47³/₄-inch side pieces, and two 4¹/₂-by-23³/₄-inch end pieces. For 20-by-60-inch fixtures, the protection consists of a nominal 20-by-60-inch top piece, two nominal 6-by-60-inch side pieces, and two nominal 4¹/₂-by-20-inch end pieces. The top edge of each fixture protection side piece may be provided with a 1-inch-deep-by-maximum-20-inch-long notch near its midpoint. The side and top pieces must be laid in place and the end pieces must be held in place with three 8d nails spaced 8 inches on center. (S) Surface perforations.
- 15. Steel Framing Members—Armstrong World Industries, Inc.: Type 8500 systems with a ¹⁵/₁₆-inch-wide flange grid must be used. Main runners, nominally 12 feet long, must be spaced 4 feet on center. Cross tees, nominally 4 feet long, must be installed perpendicular to main runners and spaced 2 feet on center. Cross tees, nominally 2 feet long, must be installed perpendicular to 4-foot cross tees and spaced 4 feet on center. Grid modules containing light fixtures must employ a fixture-centering clip at each corner. The No. 24 gage electrogalvanized steel clip is nested on the flange of the intersecting grid tees, has two 1⁷/₁₆-inch-long legs with their sides perpendicular to each other, and has a U-shaped return at the top of each leg for engaging over the bulb of the intersecting grid tees.
- Acoustical Material: Nominal 24-by-24-inch or -48-inch lay-in panels. Border panels must be supported at walls by minimum 0.016-inch-thick (26 gage) painted steel angles with ⁷/₈-inch legs; or, minimum 0.016-inch-thick (26 gage) painted steel channels, 1¹/₈ inches deep with ⁷/₈-inch flanges.
- 17. Hold-down Clips: (Not shown) Number 24 MSG spring steel, placed over cross tees at 2 feet on center.

FIGURE 4—8500 SERIES ONE-HOUR FIRE-RESISTANCE-RATED ASSEMBLY (Continued)



- 1. Beam:
- 2. Normal-weight Concrete
- 3. Welded Wire Fabric
- 4. Steel Form Units
- 5. Steel Joists
- 6. Bridging
- 7. Hanger Wire
- 8. Air Duct
- Damper: No. 16 MSG minimum galvanized steel, sized to overlap duct opening 2 inches, minimum. Protected on both sides with ¹/₁₆-inch-thick ceramic fiber paper laminated to the metal with adhesive and held open with a listed fusible link.
- 10. Fixtures, Recessed Light
- 11. Fixture Protection—Batts and Blankets
- 12. Steel Framing Members—Worthington Armstrong Venture
- 13. Acoustical Material
- 14. Hold-down Clips (Not illustrated)

For **SI:** 1 inch = 25.4 mm.

FIGURE 5-TWO-HOUR FIRE-RESISTANCE-RATED FLOOR-CEILING ASSEMBLY (REFER TO SECTION 4.6 OF THIS REPORT)



ICC-ES Evaluation Report

ESR-1308 CBC Supplement

Reissued December 2018 Revised February 2019 This report is subject to renewal December 2019.

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DIVISION: 09 00 00—FINISHES Section: 09 22 26—Suspension Systems Section: 09 53 00—Acoustical Ceiling Suspension Assemblies

REPORT HOLDER:

WORTHINGTON ARMSTRONG VENTURE (WAVE)

EVALUATION SUBJECT:

FIRE- AND NONFIRE-RESISTANCE-RATED SUSPENDED CEILING FRAMING SYSTEMS

1.0 EVALUATION SCOPE

Compliance with the following code:

2016 California Building Code (CBC)

Properties evaluated:

- Interior finish
- Fire resistance
- Structural

2.0 PURPOSE OF THIS SUPPLEMENT

This supplement is issued to indicate that the fire- and non-fire-resistance-rated suspended ceiling framing systems described in master report ESR-1308, comply with the CBC, when design and installation are in accordance with the master evaluation report and the additional requirements in CBC Chapters 8, 16, 16A, 17, 17A and 25, as applicable, with modifications as follows:

Modify Section 3.2 (Hanger Wire) as follows:

Hanger wire for suspended ceilings framing members, and fixtures, must comply with ASTM C636 as referenced in 2016 CBC Sections 808, 1616.10.16 and 1616A.1.21 ; and Section 13.5.6 of ASCE 7-10 as referenced in 2016 CBC Sections 1613, 1613A, 1616.10.16, and 1616A.1.21 and 2506.2.1 ; and with ASTM E580 as referenced in 2016 CBC Sections 1616.10.16 and 1616A.1.21.

Modify Section 4.1 (General) as follows:

The suspended ceiling framing systems must be installed in accordance with this report and the manufacturer's published installation instructions. The suspended ceiling framing system must be installed in accordance with Section 13.5.6 of ASCE 7-10 as referenced in 2016 CBC Sections 808.1, 1613, 1613A and 2506.2.1 and modified by 2016 CBC Sections 1616.10.16 and 1616A.1.21.

Modify Section 4.4.1 (Seismic Design Requirements) as follows:

Seismic design and installation details of the ceiling systems, excluding 730145 main runner, and XL7325 and XL7345 cross runners, must be in accordance with Section 13.5.6 of ASCE 7-10 as referenced in 2016 CBC Sections 808.1, 1613, 1613A and 2506.2.1, and modified by 2016 CBC Sections 1616.10.16 and 1616A.1.21, except as noted in Section 4.4.2 of this report. Systems classified as intermediate-duty are limited to use in Seismic Design Categories A, B and C.

Modify Section 4.4.2.1 (Alternate Installation with BREC-2 and AL BERC-2, for Seismic Design Categories D, E and F) as follows:

Under this installation, main runner must be rated heavy-duty and have a minimum simple span allowable uniform load of 16.35 pounds per lineal foot (238 N/m); with a maximum ceiling weight permitted for systems with BERC-2 clips at 4 pounds per square foot (19.5 kg/m²); with a maximum ceiling weight permitted for systems with AL BERC-2 clips at 2 pounds per

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square foot (9.75 kg/m²). With the installation under Section 4.4.2.1, the main and cross runners must be as described in Tables 2 and 3 of the master evaluation report. The BERC-2 and AL BERC-2 clips are used to secure the main runners and cross runners to the wall molding, as detailed below and shown in Figure 2 of the master evaluation report. A nominally 7 /₈-inch-wide (22 mm) wall molding is used in lieu of the 2-inch-wide (50.8 mm) perimeter supporting closure angle required by Section 5.2.2 of ASTM E580 as referenced in Section 13.5.6.2.2 of ASCE 7-10 for the 2016 CBC for Seismic Design Categories D, E and F. The ceiling system must be installed as prescribed by the applicable code except for the use of the BERC-2 and AL BERC-2 clips and the nominally 7 /₈-inch-wide (22 mm) wall molding and the elimination of spreader bars.

The BERC-2 and AL BERC-2 clips are attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding (see Figure 2 of the master evaluation report). The AL BERC-2 clip requires an additional No. 7 by $^{7}/_{16}$ -inch long (minimum) self-piercing sheet metal screw connecting the AL BERC-2 clip to the wall molding as shown in Figure 2 of the master evaluation report. BERC-2 and AL BERC-2 clips installed on the two adjacent walls where the runners must be fixed (attached walls), are attached to the runner by a No. 7 by $^{7}/_{16}$ -inch long (minimum) self-piercing sheet metal screw through the fixed hole in the clip and the top flange bulb of the runner. BERC-2 and AL BERC-2 clips installed on opposite walls, where the runners must not be fixed to the clips (unattached walls), the clips must not be mechanically connected to the runner by any fastener and must allow the terminal runner end to move $^{3}/_{4}$ inch (19.1 mm) towards and away from the wall, and installation of a No. 7 by $^{7}/_{16}$ -inch long (minimum) self-piercing sheet metal screw through the is optional, as shown in Figure 2. BERC-2 and AL BERC-2 clips installed in this manner are an acceptable means of preventing runners from spreading, in lieu of spacer bars (stabilizer bars) required in Section 5 of ASTM E580. ASTM E580 is referenced in the CBC Sections 1616.10.16 and 1616A.1.21. The assemblies described in this section are equivalent to that required by Section 5 of ASTM E580.

Modify Section 4.4.2.2 (Alternate Installation with BERC, BERC-2 and AL BERC-2, for Seismic Design Category C) as follows:

Terminal ends of the main and cross runners are secured by attaching either the BERC, BERC-2 or AL BERC-2 clips to the wall molding and attaching the runners to the clip. The runners have zero clearance at the perimeter on two adjacent walls (attached walls) and ³/₈ inch (9.5 mm) clearance on the opposite walls (unattached walls), as detailed in this section and shown in Figure 3 of the master evaluation report. The clip is attached to the wall molding by sliding the locking lances over the hem of the vertical leg of the wall molding. When the runners must be fixed (attached walls) at two adjacent walls, attach a No.7 by $\frac{1}{16}$ -inch long self-piercing screw through the fixed hole of a BERC-2 or AL BERC-2 clip and the top flange bulb of the runner, or through the fixed hole of a BERC clip and into the web of the runner. BERC-2, AL BERC-2, or BERC clips installed on opposite walls where the runners must not be fixed to the clips (unattached walls), the clips must not be mechanically connected to the runner by any fastener and must allow the terminal runner end to move 3/8-inch (9.5 mm) towards and away from the wall, and installation of a No. 7 by 7/16-inch long (minimum) self-piercing sheet metal screw through the horizontal slotted hole is optional, as shown in Figure 2. The AL BERC-2 clip also requires an additional No. 7 by T_{16} -inch long (minimum) self-piercing sheet metal screw through the clip into the wall molding. BERC or BERC-2 or AL BERC-2 clips installed in this manner are an acceptable means of preventing runners from spreading, in lieu of spacer bars (stabilizer bars) required in Section 4of ASTM E580, which is referenced in 2016 CBC Sections 1616.10.16 and 1616A.1.21. Installation of the ceiling must be as prescribed by the applicable code, except for the use of BERC or BERC-2 or AL BERCs, as noted above. The maximum ceiling weight permitted is 2.5 pounds per square foot (12.2 kg/m²) for ceiling systems using BERC or BERC-2 clips and 2 psf (9.75 kg/m²) for ceiling systems using the AL BERC-2 clip. With the installation under Section 4.4.2.2, the main and cross runners must be as described in Tables 2 and 3 of the master evaluation report, except for CleanRoom AL series (EA7900C, EA7920C, and EA7940C. The assemblies described in this Section 4.4.2.2 are equivalent to that required by Section 4 of ASTM E580, which is referenced in 2016 CBC Sections 1616.10.16 and 1616A.1.21.

Modify Section 4.5 (Lighting Fixtures) as follows:

Lighting fixtures must be installed in accordance with Section 13.5.6 of ASCE 7-10 as referenced in 2016 CBC Sections 1613, 1613A and 2506.2.1 and modified by 2016 CBC Sections 1616.10.16 and 1616A.1.21. Lighting fixtures may also be attached to the grid with clips complying with the ICC-ES Acceptance Criteria for Attachment Devices for Recessed Lighting Fixtures (Luminaires) in Suspended Ceiling Systems (AC184). The lighting fixture may also be attached to the framing members with sheet metal screws having a minimum allowable shear strength of 314 lbf (1395 N) and minimum allowable tension strength of 137 lbf (609.6 N) for a No. 20/20 gage metal-to-metal connection.

Modify Section 4.6 (Partitions) as follows:

Partitions must be laterally supported as required by Section 13.5.8 of ASCE 7-10 as referenced by 2016 CBC Sections 1613, 1613A and 2506.2.1, and modified by 2016 CBC Sections 1616.10.16 and 1616A.1.21.

Modify Section 4.7.1 (Structural Beams), by revising the first sentence of the second paragraph as follows:

In accordance with Section 704.3 of the 2016 CBC, structural steel floor beams need not be individually fire-protected when the suspended ceiling forms the protective membrane for the fire-resistance-rated assembly.

Modify Section 4.8 [8500 (Prelude SupraFine Fire Guard) Series One-hour Fire-resistance-rated Roof-ceiling Systems] by revising the second and last sentences as follows:

The rating applies to restrained and unrestrained assemblies as described in ASTM E119, which is referenced in CBC Section 703. General requirements of 2016 CBC Section 711.1 must be observed.

Modify Section 4.9 (Special Inspection) as follows:

Suspended ceilings that are part of building structures assigned to Seismic Design Categories C, D, E and F must be subjected to periodic special inspections during the installation of the suspended ceiling systems and their anchorage, in accordance with the following requirements:

- For installations in accordance with Section 4.4.2, special inspection must be conducted as indicated in 2016 CBC Sections 1704.3, 1704.5, 1705.1.1,1705.13.2, 1704A.3, 1704A.5, 1705A.1.1, 1705A.12.5 and 1705A.13.2 for the 2016 CBC.
- For installations in accordance with Section 4.4.1, special inspections must be in compliance with 2016 CBC Sections 1704.3, 1704A3, 1704A5, 1704A.5, 1705A.12.5 and Section 11A.1.3.9, Item 2, of ASCE 7-10 for the 2016 CBC.
- The special inspector must verify that the ceiling system is as described in this report, and complies with the installation instructions in this report, and with the approved construction documents.

A statement of special inspections must be provided as required in 2016 CBC Sections 1704.3 and 1704A.3.

Modify Section 5.3 as follows:

Suspended ceiling systems must be designed in accordance with Section 13.5.6 of ASCE 7-10 as referenced by 2016 CBC Sections 808.1, 1613, 1613A and 2506.2.1, and modified by 2016 CBC Sections 1616.10.16 and 1616A.1.21 (. The documents must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

Modify Section 5.4 as follows:

Special inspections must be provided in accordance with Section 4.9 of this report.

Modify Section 5.5 as follows:

For Seismic Design Category C, D, E or F, a quality assurance plan complying with CBC Chapters 17 and 17A, as applicable, must be submitted to the code official for approval.

Modify Section 5.6 as follows:

The ceiling framing systems must not be used to provide lateral support for walls or partitions, except as provided for in ASCE 7, Section 13.5.8.1, as referenced in CBC Sections 1613, 1613A and 2506.2.1, and modified by 2016 CBC Sections 1616.10.16 and 1616A.1.21, and must comply with applicable code provisions referenced in Section 4.6 of this report.

Modify Section 5.7 as follows:

The ceiling framing systems must be braced to resist seismic forces as determined from Sections 1613 and 1613A of the CBC, and modified by 2016 CBC Sections 1616.10.16 and 1616.1.21

Modify Section 5.8 as follows:

The ceiling framing systems are limited to ceilings not considered accessible in accordance with Item 28 of 2016 CBC Tables 1607.1 and 1607A.1.

Modify Section 5.11 as follows:

Lay-in ceiling panels must be justified to the satisfaction of the code official as complying with the interior finish requirements of Chapter 8 of the CBC.

This supplement expires concurrently with the master evaluation report, reissued December 2018 and revised February 2019.