



**WMU Design Guidelines Instructions:** These guidelines are to be used by the Design Professional to inform the design process and outline WMU-specific desires for University projects. Text appearing in blue indicates a WMU design guideline which must be met for all campus projects unless approved in writing by the University. Blue text that is struck out indicates products or practices that are **not** acceptable, and shall not be included unless similarly approved. Any text remaining in black is to be edited by the Design Professional as part of the normal specifications-writing process. Guidelines language shall be included in the project specifications and their intent incorporated into the drawings.

## SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **[Project site]** <Insert location>.

#### 1.3 ACTION SUBMITTALS

- A. **Product Data:** For each type of product.

**Designer Note:** For projects seeking LEED certification, include sustainable design submittals as required.

- B. Sustainable Design Submittals:
  - 1. <Double click to insert sustainable design text for recycled content.>
  - 2. <Double click to insert sustainable design text for ceilings.>
- C. **Samples:** For each exposed product and for each color and texture specified, 6 inches in size.
- D. Samples for Initial Selection: For components with factory-applied finishes.
- E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Panels: Set of **[full-size]** **[6-inch-square]** <Insert size> Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of **[6-inch-]** <Insert dimension> long Samples of each type, finish, and color.
  - 3. Clips: Full-size **[hold-down]** **[impact]** **[and]** **[seismic]** clips.



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- F. Delegated-Design Submittal: For seismic restraints for ceiling systems.
  - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
    - 1. Ceiling suspension-system members.
    - 2. Structural members to which suspension systems will be attached.
    - 3. Method of attaching hangers to building structure.
      - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
    - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
    - 5. Size and location of initial access modules for acoustical panels.
    - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
      - a. Lighting fixtures.
      - b. Diffusers.
      - c. Grilles.
      - d. Speakers.
      - e. Sprinklers.
      - f. Access panels.
      - g. Perimeter moldings.
      - h. **<Insert item>**.
    - 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
    - 8. Minimum Drawing Scale: **[1/4 inch = 1 foot] [1/8 inch = 1 foot] [1:50] [1:100] <Insert scale>**.
  - B. Qualification Data: For testing agency.
  - C. Product Test Reports: For each acoustical panel ceiling, for tests performed by **[manufacturer and witnessed by a qualified testing agency] [a qualified testing agency]**.
  - D. Evaluation Reports: For each acoustical panel ceiling suspension system **[and anchor and fastener type]**, from ICC-ES.
  - E. Field quality-control reports.
- ### 1.5 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For finishes to include in maintenance manuals.



## 1.6 MAINTENANCE MATERIAL SUBMITTALS

**Designer Note:** The amount of attic stock is determined on a project-by-project basis. This needs to be discussed with WMU during the design phases of the project, including where the extra materials will be stored.

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: Full-size panels equal to [2] <Insert number> percent of quantity installed.
  - 2. Suspension-System Components: Quantity of each exposed component equal to [2] <Insert number> percent of quantity installed.
  - 3. Hold-Down Clips: Equal to [2] <Insert number> percent of quantity installed.
  - 4. Impact Clips: Equal to [2] <Insert number> percent of quantity installed.

## 1.7 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockup of typical ceiling area as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.



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## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. **Source Limitations:** Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. <Double click to insert sustainable design text for ceilings.>
- B. **Delegated Design:** Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design seismic restraints for ceiling systems.
- C. **Seismic Performance:** Suspended ceilings shall withstand the effects of earthquake motions determined according to [ASCE/SEI 7] **<Insert requirement>**.
- D. **Surface-Burning Characteristics:** Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. **Flame-Spread Index:** Class [A] [B] [C] according to ASTM E1264.
  - 2. **Smoke-Developed Index:** [50] [450] **<Insert value>** or less.
- E. **Fire-Resistance Ratings:** Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL or from the listings of another qualified testing agency.

### 2.3 ACOUSTICAL PANELS **<Insert drawing designation>**

**Designer Note:** WMU prefers Armstrong World Industries, Inc. 2 x 2 Lay-in Optima (fine texture) and Calla (smooth texture) ceiling tiles for standard applications.

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. **Acoustical Panel Standard:** Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. <Double click to insert sustainable design text for recycled content.>
- D. **Classification:** Provide [**fire-resistance-rated**] panels as follows:
  - 1. **Type and Form:** Type III, mineral base with painted finish; [**Form 1, nodular**] [**Form 2, water felted**] [**Form 4, cast or molded**].
  - 2. **Type and Form:** Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with [**glass-fiber cloth**] [**washable vinyl-film**] overlay.



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3. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with **[vinyl overlay on face]** **[vinyl overlay on face and back]** **[vinyl overlay on face, back, and sealed edges]** **[fiberglass-fabric overlay on face]**.
  4. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; **[Form 1, plastic]** **[Form 2, cloth]** **[Form 3, other]**. Binder shall not contain urea formaldehyde.
  5. Type and Form: Type XX, high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
  6. Type and Form: **<Insert type and form>**.
  7. Pattern: **[C (perforated, small holes)]** **[CD (perforated, small holes and fissured)]** **[CE (perforated, small holes and lightly textured)]** **[D (fissured)]** **[E (lightly textured)]** **[F (heavily textured)]** **[G (smooth)]** **[GH (smooth and printed)]** **[I (embossed)]** **[J (embossed-in-register)]** **[K (surface scored)]** **[Z (other patterns as described)]** **[and]** **[as indicated by manufacturer's designation]** **<Insert pattern>**.
- E. Color: **[White]** **[As selected from manufacturer's full range]** **[Match Architect's sample]** **[As indicated by manufacturer's designation]** **[As indicated on Drawings]** **[As indicated in a schedule]** **<Insert color>**.
- F. Light Reflectance (LR): Not less than **[LR indicated in a schedule]** **[0.65]** **[0.70]** **[0.75]** **[0.80]** **[0.85]** **[0.90]** **<Insert LR>**.

**Designer Note:** Coordinate acoustical properties of ceiling tiles with function of space within which it is to be installed.

- G. Ceiling Attenuation Class (CAC): Not less than ~~[CAC indicated in a schedule]~~ ~~[20]~~ ~~[25]~~ ~~[30]~~ **35** ~~[40]~~ **<Insert CAC>**.
- H. Noise Reduction Coefficient (NRC): Not less than ~~[NRC indicated in a schedule]~~ ~~[0.40]~~ ~~[0.50]~~ ~~[0.55]~~ ~~[0.60]~~ ~~[0.65]~~ ~~[0.70]~~ ~~[0.75]~~ ~~[0.80]~~ ~~0.85~~ ~~[0.90]~~ ~~[0.95]~~ ~~[1.00]~~ **<Insert NRC>**.
- I. Articulation Class (AC): Not less than **[AC indicated in a schedule]** **[170]** **[180]** **[190]** **[200]** **[210]** **<Insert AC>**.
- J. Edge/Joint Detail: **[Square]** **[Reveal sized to fit flange of exposed suspension-system members]** **[Flush reveal sized to fit flange of exposed suspension-system members]** **[Beveled, kerfed, and rabbeted long edges and square, butt-on short edges]** **[As indicated by manufacturer's designation]** **<Insert requirement>**.
- K. Thickness: **[5/8 inch]** **[3/4 inch]** **[7/8 inch]** **[As indicated on Drawings]** **[As indicated in a schedule]** **<Insert thickness>**.
- L. Thickness: **[1/8 inch]** **[7/16 inch]** **[9/16 inch]** **[5/8 inch]** **[3/4 inch]** **[7/8 inch]** **[1 inch]** **[1-1/2 inches]** **[2 inches]** **[3 inches]** **[As indicated on Drawings]** **[As indicated in a schedule]** **<Insert dimension>**.
- M. Modular Size: **[24 by 24 inches]** **[24 by 48 inches]** **[24 by 72 inches]** **[24 by 96 inches]** **[48 by 48 inches]** **[600 by 600 mm]** **[600 by 1200 mm]** **[As indicated on Drawings]** **[As indicated in a schedule]** **<Insert size>**.
- N. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.



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### 2.4 METAL SUSPENSION SYSTEM <Insert drawing designation>

**Designer Note:** WMU prefers that ceiling panels and suspension system be from the same manufacturer. If separate manufacturers are specified, the systems must be compatible.

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.
- C. <Double click to insert sustainable design text for recycled content.>
- D. Wide-Face, Capped, Double-Web, **[Fire-Rated,]** Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.
1. Structural Classification: **[Intermediate]** **[Heavy]**-duty system.
  2. End Condition of Cross Runners: **[Override (stepped)]** **[or]** **[butt-edge]** type.
  3. Face Design: Flat, flush.
  4. Cap Material: **[Cold-rolled steel]** **[or]** **[aluminum]**.
  5. Cap Finish: **[Painted white]** **[Painted in color as selected from manufacturer's full range]** **[Painted to match color indicated by manufacturer's designation]** **[Painted to match color of acoustical unit]** **[Plated with metallic finish as selected from manufacturer's full range]** **[Plated with metallic finish indicated by manufacturer's designation]** **[Natural finish for aluminum]**.
- E. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.
1. Structural Classification: **[Intermediate]** **[Heavy]**-duty system.
  2. End Condition of Cross Runners: **[Override (stepped)]** **[or]** **[butt-edge]** type.
  3. Face Design: **[Flat, flush]** **[Flanges formed with an integral center reveal]**.
  4. Cap Material: **[Cold-rolled steel]** **[or]** **[aluminum]**.
  5. Cap Finish: **[Painted white]** **[Painted in color as selected from manufacturer's full range]** **[Painted to match color indicated by manufacturer's designation]** **[Painted to match color of acoustical unit]** **[Plated with metallic finish as selected from manufacturer's full range]** **[Plated with metallic finish indicated by manufacturer's designation]** **[Natural finish for aluminum]**.
- F. Narrow-Face, Steel-Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished, cold-rolled, 9/16-inch-wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
  2. Face Design: Flat, flush.



3. Cap Finish: [**Painted white**] [**Painted in color as selected from manufacturer's full range**] [**Painted to match color indicated by manufacturer's designation**] [**Painted to match color of acoustical unit**] [**Plated with metallic finish as selected from manufacturer's full range**] [**Plated with metallic finish indicated by manufacturer's designation**].
- G. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; to produce structural members with 9/16-inch-wide faces.
1. Structural Classification: [**Intermediate**] [**Heavy**]-duty system.
  2. Face Design: [**With 1/8-inch-wide, slotted, box-shaped flange**] [**With 1/4-inch-wide, slotted, box-shaped flange**] [**Flanges formed in stepped design with a center protrusion projecting 19/64 inch below flange surfaces supporting panel faces and forming 3/16-inch-wide reveals between edges of protrusion and those of panels**].
  3. Face Finish: Painted [**white**] [**in color as selected from manufacturer's full range**] [**to match color indicated by manufacturer's designation**] [**to match color of acoustical unit**].
  4. Reveal Finish: Painted [**to match flange color**] [**white**] [**black**] [**in color other than flange color as selected from manufacturer's full range of contrasting reveal colors**].
- H. Wide-Face, Aluminum-Capped, Double-Web, [**Fire-Rated,**] Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch-wide aluminum caps on flanges.
1. Structural Classification: [**Intermediate**] [**Heavy**]-duty system.
  2. Face Design: Flat, flush.
  3. Cap Finish: [**Painted white**] [**Painted to match color indicated by manufacturer's designation**] [**Painted to match color of acoustical unit**] [**Natural finish**].
- I. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet electrolytically zinc coated, with prefinished flanges of width indicated.
1. Structural Classification: Heavy-duty system.
  2. Face Finish: Painted [**white**] [**black**].
- J. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from Type 304 or 316 stainless-steel sheet, with prefinished 15/16-inch-wide, stainless-steel caps on flanges.
1. Structural Classification: Intermediate-duty system.
  2. Face Design: Flat, flush.
- K. Narrow-Face, Single-Web, Extruded-Aluminum Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with 9/16-inch-wide faces.
1. Structural Classification: [**Intermediate**] [**Heavy**]-duty system.
  2. Face Design: Screw-slot profile.
  3. Face Finish: [**Painted white**] [**Satin anodized according to AAMA 611, AA-M12C22A31**].
  4. Reveal Finish: [**Match face finish**] [**Painted white**] [**Painted black**].



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- L. Extra-Wide-Face, [Double] [Single]-Web, Metal Suspension System: Main and cross runners formed from [extruded aluminum] [aluminum-capped steel] [steel-capped steel] <Insert description> to produce structural members with [1-1/2-inch-] [2-inch-] wide flanges.
  - 1. Structural Classification: [Intermediate] [Heavy]-duty system.
  - 2. Face Design: Flat, flush.
  - 3. Face Finish: [Painted white] [Satin anodized according to AAMA 611, AA-M12C22A31].
  - 4. Gasket System: Clean-room type.

### 2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to [five] <Insert safety factor> times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: [Cast-in-place] [Postinstalled expansion] [Postinstalled bonded] anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
    - c. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
    - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
  - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to [10] <Insert safety factor> times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
  - 2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
  - 3. Nickel-Copper-Alloy Wire: ASTM B164, nickel-copper-alloy UNS No. N04400.
  - 4. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than [0.106-inch-] [0.135-inch-] <Insert dimension> diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.





- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.
- F. Hold-Down Clips: Manufacturer's standard hold-down.
- G. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- I. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- J. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- K. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including **[manufacturer's standard] [closed-cell PVC] [neoprene] [antimicrobial]** gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

### 2.6 METAL EDGE MOLDINGS AND TRIM <Insert drawing designation>

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
  - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
  - 2. For lay-in panels with reveal edge details, provide **[stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member] <Insert description>**.
  - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
  - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
  - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.



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### 2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 07 9219 "Acoustical Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

### 3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, [**seismic design requirements,**] and manufacturer's written instructions.
  - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required [**and, if permitted with fire-resistance-rated ceilings,**] to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
  - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye



- screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
    - b. Install panels with pattern running in one direction parallel to **[long]** **[short]** axis of space.
    - c. Install panels in a basket-weave pattern.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.



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4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install **[hold-down] [impact] [and] [seismic]** clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
  - a. Hold-Down Clips: Space **[24 inches]** **<Insert dimension>** o.c. on all cross runners.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

### 3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of **[1/8 inch in 12 feet]** **<Insert dimensions>**, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of **[1/8 inch in 12 feet]** **<Insert dimensions>**, non-cumulative.

### 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: **[Owner will engage] [Engage]** a qualified special inspector to perform the following special inspections:
  1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.
- B. Testing Agency: **[Owner will engage] [Engage]** a qualified testing agency to perform tests and inspections.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
  1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
  2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.



- D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113