

SECTION 09 51 13 – ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide the work of this Section in accordance with requirements of the Contract Documents.
- B. Section Includes:
 - 1. Acoustical ceiling panels and suspension system **AC-02, AC-03, AC-04, AC-05, AC-06.**
 - 2. Perimeter trim.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data for each ceiling panel and grid component with installation instructions indicating special procedures, perimeter conditions requiring special attention, and seismic conditions.
- B. Shop Drawings: Submit grid layout and related dimensioning, splicing, junctions with adjacent work or ceiling finishes, interrelation of mechanical and electrical items related to system.
- C. Samples: Submit 12 inches by 12 inches (300 mm by 300 mm) samples illustrating material and finish of acoustical units; submit 12 inch (300 mm) long sample of each suspension system main runner, cross runner, edge trim, and retention clips.
 - 1. Acoustical Panels: Set of 12 inches by 12 inches (300 mm by 300 mm) Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch (300 mm) long Samples of each type, finish, and color.
- D. Certificate: Submit manufacturer's certification that suspension system is capable of supporting light fixtures, grilles and acoustical panels.
- E. Sustainable Design Submittals:
 - 1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
 - a. Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
 - b. Bio-based Materials: For bio-based products and materials other than wood, submit documentation of product data and testing results in compliance with LEED requirements.
 - c. Wood Products: Submit documentation of Forest Stewardship Council or USGBC equivalent certification.
 - d. Materials Reuse: For products that are salvaged, refurbished, or reused, include a statement indicating costs for each product.
 - e. Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
 - 1) Include statement indicating costs for each product having recycled content.

- f. Regional Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
 - 1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
- 2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010 or v1.2 2017, using the applicable exposure scenario.
 - a. Adhesives and Sealants: For wet applied on-site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005, and rule amendment date of January 7, 2005.
 - b. For flooring products, submit documentation of VOC emissions testing compliance for hard surface flooring products, containing any material in addition to composite wood, in the form of FloorScore certification or CDPH Standard Method v1.2 compliance verification.
 - c. Composite Wood: Submit documentation showing that wood used in the project has low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
 - d. For Gypsum Board/Wall Covering/Ceiling/Insulation products, submit documentation of VOC emissions testing compliance in the form of Greenguard Gold certification, SCS Indoor Advantage Gold certification or CDPH Standard Method v1.2 compliance verification. Alternative tests for VOC above include ASTM D2369-10; ISO 11890 part 1; ASTM D6886-03; or ISO 11890-2.

1.3 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.
- B. Product Test Reports: Submit for each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

- C. Evaluation Reports: Submit ICC-ES report for each acoustical panel ceiling suspension system and anchor and fastener type.
- D. Field quality control reports.
- E. Sustainable Design Submittals:
 - 1. Building Product Disclosure and Optimization - Environmental Product Declarations
 - a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.
 - 2. Building Product Disclosure and Optimization - Material Ingredients
 - a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000ppm) with at least one of the following:
 - 1) Submit published manufacturer inventory of ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
 - 2) Submit documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
 - 3) Submit Declare product label indicating that all ingredients have been disclosed down to 1000 ppm or designated as Red List Free or Declared
 - 4) Living Product Challenge
 - 5) Product Lens Certification
 - 6) USGBC approved program.
 - b. Material Ingredient Optimization: Submit documentation confirming chemical inventory of products to at least 0.01 % (100ppm) and/or that has a compliant material ingredient optimization report with at least one of the following:
 - 1) Submit GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
 - 2) Submit third-party verified documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
 - 3) Submit third-party verified Cradle to Cradle v3 Material Health certificate at the Bronze Level or better
 - 4) Submit third-party verified Declare product label indicating that all ingredients have been disclosed down to 100 ppm
 - 5) Submit third-party verified documentation that product is Living Product Challenge certified with a Red List Free or LBC Red List Free Declare label.
 - 6) Submit documentation that product has a manufacturer prepared action plan with material inventory to at least 1000 ppm.
- F. Fabrication Engineering and Design Data Submittal: Submit for acoustical panels to verify compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Grid Manufacturer: Entity having minimum 5 years documented experience who specializes in manufacturing ceiling grids.
 - 2. Acoustical Unit Manufacturer: Entity having minimum 5 years documented experience who specializes in manufacturing acoustical units.

3. Installer: Entity having minimum 5 years documented experience who employs trained and experienced installers.
- B. Source Limitations:
 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Comply with applicable regulations regarding toxic and hazardous materials.
 1. Coating Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
 2. Panel Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.
- D. Preinstallation Conference: Conduct conference at site.
- E. 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 room corner mockups of the public toilet room to be constructed in the field include the following:
 - a. Wall tile.
 - b. Floor tile / wall base,
 - c. Corner guards.
 - d. Acoustical panel ceiling system.
 - e. Lighting in accordance with Division 26.
 - f. Linear floor drain in accordance with Division 23.
 - g. Toilet partitions.
 - h. Water closets in accordance with Division 22.
 - i. Washroom accessories.
 - a. Typical countertop with plumbing fixtures in accordance with Division 22.
 - b. Restroom traffic management system.
 2. Build room corner mockups of the Gate and Boarding area to be constructed in the field include the following:
 - a. Carpet tile.
 - b. Transitions to terrazzo flooring.
 - c. Ceiling
 - d. Lighting in accordance with Division 26.
 - e. Gate counter.
 - f. Furniture.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to site and store 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.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.6 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.
- B. Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression system components (if any) and partition system (if any).

1.7 EXTRA MATERIALS

- A. Furnish extra materials 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 percent of quantity installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fabrication Engineering and Design Data: Engage a qualified professional engineer, as defined in Section 01 33 16, "Fabrication Engineering Design Data," to design acoustical panels complying with requirements.
- B. Acoustical Panel Standard: Provide ceiling panels complying with ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Surface Burning Characteristics: Ceiling panels with surface burning characteristics complying with IBC Chapter 8 and ASTM E 1264 for Class A materials determined by testing identical products in accordance with ASTM E 84:
 - 1. Flame Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke Developed Index: 50 or less.
- D. Low-Emitting Materials:
 - 1. Adhesives and Sealants wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
 - 2. All adhesives and sealants wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01, Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C."
 - 3. Provide non-structural composite wood products that contain either No Added Formaldehyde (NAF) resins or Ultra Low Emitting Formaldehyde (ULEF) resins per CARB

- ATCM or equivalent european evaluations criteria noted in Division 01, Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C".
4. Provide structural composite wood products tested per EN 717-1:2014 as compliant with emissions class E1. Structural composite wood, with no added urea-formaldehyde resins or surface treatments, and certified per the following: PS 1-09 or PS 2-10 for plywood, PS 2-10 for OSB, ASTM D 5446-13 for structural composite lumber.
 5. All gypsum panel/wall covering/ceiling panel/insulation products must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.

2.2 ACOUSTICAL PANELS

- A. Manufacturer: Subject to compliance with requirements, provide Basis-of-Design ceiling panels and grid systems, or comparable products by one of the following:
- a. Armstrong World Industries, Inc.
 - b. CertainTeed Corporation.
 - c. Rockfon (Roxul Inc.).
 - d. Tectum Inc.
 - e. USG Interiors.
- B. Acoustic Panel **AC-02**:
1. Size: 24 inches by 24 inches (610 mm by 610 mm).
 2. Composition: Mineral Fiber with vinyl face.
 3. Classification: ASTM E 1264 for type, form, and pattern:
 - a. Type and Form: Type IV, Form 1 and 2, Pattern E, G.
 - b. Color: White.
 4. Light Reflectance: Not less than 0.90.
 5. NRC: Not less than 0.80.
 6. CAC: Not less than 40.
 7. Edge/Joint Detail: SLT.
 8. Thickness: 1 inch (25 mm).
 9. Grid Profile: Standard with aluminum cap.
 10. Basis of Design Product: Mars Healthcare High-NRC/High-CAC Panels 80/40 86343, by USG Interiors.
- C. Acoustic Panel **AC-03**:
1. Size: 24 inches by 48 inches (610 mm by 1220 mm).
 2. Composition: Mineral Fiber.
 3. Classification: ASTM E 1264 for type, form, and pattern:
 - a. Type and Form: Type IV, Form 1 and 2, Pattern E, G, lightly fine textured.
 - b. Color: White.
 4. Light Reflectance: Not less than 0.90.
 5. NRC: Not less than 0.75.
 6. CAC: Not less than 35.
 7. Edge/Joint Detail: FLB.
 8. Thickness: ¾ inch (19 mm).
 9. Grid Profile: Narrow.
 10. Basis of Design Product: Mars Clima Plus 88985, by USG Interiors.
- D. Acoustic Panel **AC-04**:
1. Size: 24 inches by 48 inches (610 mm by 1220 mm).

2. Composition: Wet formed mineral fiber.
3. Classification: ASTM E 1264 for type, form, and pattern:
 - a. Type and Form: Type III, Form 2, Pattern C, E, fine textured.
 - b. Color: White.
4. Light Reflectance: Not less than 0.81.
5. NRC: Not less than 0.50.
6. CAC: Not less than 35.
7. Edge/Joint Detail: 9/16-inch Beveled Tegal.
8. Thickness: 5/8 inch (16 mm).
9. Grid Profile: Narrow.
10. Basis of Design Product: Dune 1777, by Armstrong World Industries.

E. Acoustic Panel **AC-05:**

1. Size: 24 inches by 60 inches (610 mm by 1525 mm).
2. Composition: Mineral Fiber.
3. Classification: ASTM E 1264 for type, form, and pattern:
 - a. Type and Form: Type IV, Form 1 and 2, Pattern E, G.
 - b. Color: White.
4. Light Reflectance: Not less than 0.90.
5. NRC: Not less than 0.80.
6. CAC: Not less than 35.
7. Edge/Joint Detail: FLB.
8. Thickness: 7/8 inch (22 mm).
9. Grid Profile: Narrow.
10. Basis of Design Product: Mars Plank 89550, by USG Interiors.

F. Acoustic Panel **AC-06:**

1. Size: 24 inches by 48 inches (610 mm by 1220 mm).
2. Composition: Mineral Fiber.
3. Classification: ASTM E 1264 for type, form, and pattern:
 - a. Type and Form: Type IV, Form 1 and 2, Pattern E, G, lightly fine textured.
 - b. Color: White.
4. Light Reflectance: Not less than 0.90.
5. NRC: Not less than 0.75.
6. CAC: Not less than 35.
7. Edge/Joint Detail: Square.
8. Thickness: 3/4 inch (19 mm).
9. Grid Profile: Narrow.
10. Include 12 inch (305mm) wide white service strips
11. Basis of Design Product: Mars Cima Plus 88185, by USG Interiors.

2.3 METAL SUSPENSION SYSTEM

- A. Manufacturer: Subject to compliance with requirements, provide ceiling panels and grid systems by one of the following:
1. Concealed and Exposed Suspension Grid:
 - a. Armstrong World Industries, Inc.
 - b. CertainTeed Corporation.
 - c. Chicago Metallic; Rockfon (Roxul Inc.).

- d. Hunter Douglas.
 - e. USG Interiors.
- B. Metal Suspension System Standard: Provide 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.
 - 2. Special Caps: Provide aluminum cap where specified.
- C. Standard Exposed with Aluminum Cap Ceiling Grid:
 - 1. Basis of Design: ZXLA by USG Interiors.
 - 2. ASTM C635, nonfire rated.
 - 3. Structural Classification: Heavy duty system.
 - 4. End Condition of Cross Runners: butt edge type.
 - 5. Face Design: Flat, flush.
 - 6. Cap Material: Commercial quality aluminum.
 - 7. Face Flange Width: 15/16 inch (23.8 mm)
 - 8. Exposed Finish: Baked on polyester paint, white satin finish, matching ceiling panel color.
- D. Narrow Exposed Tegular Grid- Ceiling Grid:
 - 1. Basis of Design: DXT by USG Interiors.
 - 2. ASTM C635, nonfire rated.
 - 3. Structural Classification: Heavy duty system.
 - 4. End Condition of Cross Runners: butt edge type.
 - 5. Face Design: Flat, flush.
 - 6. Cap Material: Commercial quality cold rolled steel with galvanized coating.
 - 7. Face Flange Width: 9/16 inch (14.5 mm)
 - 8. Exposed Finish: Baked on enamel, white satin finish, matching ceiling panel color.
- E. Rough Suspension: Galvanized steel carrying channels and hangers, sized and type to suit application and to rigidly secure complete acoustic unit ceiling system, with maximum deflection of L/360.
- F. Grid Accessories: Stabilizer bars, furring clips, splices, retention clips (stabilizer clip to retain tile in grid profile), and edge moldings as required to complete, and compliment suspended ceiling grid system.

2.4 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, 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 times that imposed by ceiling construction, determined by testing according to ASTM E 488/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled bonded anchors.
 - b. Corrosion Protection: Stainless steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316.

2. Power Actuated Fasteners in Concrete: Are not permitted, unless approved by Owner in writing, a minimum 48-hours prior to use.
- B. Wire Hangers, Braces, and Ties: Provide wires:
 1. Stainless Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1 Direct Hung) will be less than yield stress of wire, but not less than 0.135-inch (3.5 mm) 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 (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.
- F. Impact Clips: Impact clip system designed to absorb impact forces against acoustical panels. To be used where impact-resistant panels are required.
- G. Acoustical Sealant: Comply with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant.

2.5 METAL EDGE MOLDINGS AND TRIM

- A. Roll Formed, Sheet Metal Edge Moldings and Trim: Type and profile necessary for edges and penetrations that comply with design requirements; formed from sheet metal of same material, finish, and color as that used for ~~635M~~-exposed flanges of suspension-system runners. {Revised by Revision 1}
 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.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Extruded Aluminum Edge Moldings and Trim: Provide 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. Baked Enamel or Powder Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C-635/C~~635M~~ and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish. {Revised by Revision 1}

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements 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 after correcting unsatisfactory conditions.

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 C 636/C 636M and manufacturer's written instructions.
- B. Exposed Grid Suspension System: Suspend ceiling hangers from building's structural members:
 - 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. 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.
 - 3. 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.
 - 4. 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.
 - 5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast in place hanger inserts, postinstalled adhesive anchors that extend through forms into concrete.
 - 6. 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.
 - 7. Do not attach hangers to steel deck tabs.
 - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 9. Space hangers not more than 48 inches (1220 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Edge Moldings: 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 (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners to be square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Acoustical Panels: 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:
 - a. As indicated on reflected ceiling plans, and approved shop drawings.
 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.
 4. 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.
 5. Where bullnose concrete block corners, and other round obstructions, occur, provide preformed closers to match edge molding.
 6. Install impact clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross-runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), noncumulative.
- 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 (3 mm in 3.6 m), noncumulative.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. 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 (890 N) 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 (1957 N) 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.
- C. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- D. 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