

Section 09 54 47 - Modular Curved Metal Ceiling System

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Perforated and un-perforated curved metal ceiling panels
2. Acoustical backing.
3. Suspension assemblies
4. Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles required for a complete installation.
5. Supplemental support framing: Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung metal ceilings suspension system.
6. Coordinate layout and installation of items penetrating or being installed in ceiling systems with responsible trades.

B. Related Sections / Work:

1. Sections 05 40 00 – Cold-Formed metal Framing
2. Sections 09 20 00 – Plaster and Gypsum Board
3. Sections 09 50 00 – Acoustical Ceilings
4. Sections 09 90 00 – Paintings and Coatings
5. Division 23 – Heating, Ventilating and Air Conditioning
6. Division 26 - Electrical

C. Alternates (Substitutions):

1. Prior approval: unless otherwise provided for in the contract documents, proposed product substitutions may be submitted no later than 10 working days prior to the date established for receipt of bids. Approval of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability. Approved products will be set forth by addenda. If substitute products have not been approved by addenda, but are included in a bid, the specified products shall be provided without additional compensation.
2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet the requirements for this section, including but not necessarily limited to the following: single source materials supplier

(specified in Section 1.5); panel design, size, composition, color and finish; suspension system component profiles and sizes; and compliance with the referenced standards

- D. This Section covers the general requirements only for Acoustical Curved Metal Ceilings as shown on the drawings. The supplying and installation of additional accessory features and other items not specifically mentioned herein, but which are necessary to make a complete installation shall also be included or clarified accordingly.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A641 - "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"
2. A653 - "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc- Iron Alloy Coated (Galvannealed) by the Hot-Dip process"
3. B209 - "Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate"
4. B633 - "Standard Specification for Electrodeposited Coatings of Zinc on Iron or Steel"
5. C423 - "Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method"
6. C635 - "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings"
7. C636 - "Recommended Practice for Installation of Metal Ceiling Suspensions Systems for Acoustical and Lay-in Panels"
8. E84 - "Standard Test Method for Surface Burning Characteristics of Building Materials"
9. E488 - "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"
10. E580 - "Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint"
11. E795 - "Standard Practices for Mounting Test Specimens during Sound Absorption Tests"
12. E1190 - "Standard Test Methods for Strength of Power Actuated Fasteners Installed in Structural Members"
13. E1264 - "Classification for Acoustical Ceiling Products"
14. E1477 - "Standard Test Method for Luminous Reflectance factor of Acoustical Materials by use of Integrating-Sphere Reflectometers"

B. Applicable LEED Environmental Categories and Credits and performance requirements as indicated:

1. Material and Resources (MR)
 - a. MR Credit 4.1 & 4.2 – Recycled Content
 - b. MR Credit 5.1 & 5.2 – Regional Materials
2. Innovation in Design (IC)
 - a. IC Credit 1.1 – Enhanced Acoustical Performance

- C. American Architectural Manufacturers Association (AAMA) 620-02 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Aluminum Substrates.
- D. Ceiling & Interior Systems Construction Association (CISCA) "Ceiling Systems Handbook".
 - 1. Guidelines for Seismic Restraint
 - a. Acoustical Tile and Lay-in Panels - Zones 0 - 2
 - b. Direct Hung Suspended Ceiling Assemblies - Zones 3 & 4
- E. Local Building Code (UBC or IBC), current edition requirements.

1.4 SUBMITTALS

- A. Product Data: Manufacturers product data for each type of product specified in this section.
- B. Product Certification: Manufacturer's certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.
- C. Shop (Coordination) Drawings: Submit shop drawings for reflected ceiling plans (RCP's), drawn to scale, and coordinating penetrations and ceiling mounted items. Show the following details:
 - 1. Reflected ceiling plan including joint patterns & details.
 - 2. Ceiling suspension system plan with appropriate components, suggested hanger locations and details.
 - 3. Method of attaching suspension system hangers to building structure as coordinated by installer.
 - 4. Ceiling-mounted items including: light fixtures, air outlets and inlets, speakers, sprinklers, and other interfaces. Coordinate all appliances to be installed in ceiling system. Product selection shall be compatible with ceiling system.
 - 5. Special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 - 6. Framing and support details for work supported by ceiling suspension system.
 - 7. List of materials, dimensions, hanger fastenings and any special details.
 - 8. Minimum drawing scale: 1/8" = 1'-0".
 - 9. Provide full scale drawings of perforation patterns. Provide minimum 1"=1'-0" scale layout for each panel type showing perforation layout and orientation as required.
 - 10. Shop drawings shall originate from manufacturer. Subcontractor drawings will not be acceptable, except to show attachment to structure.
 - 11. Where requested by architect, provide engineered drawings with direction from consulting SE confirming design integrity to the satisfaction of specification requirement.
 - 12. Coordinate with other work supported by, adjacent to or penetrating through the ceiling system.
- D. Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.

1. 12-inch square metal pan units.
 2. 12-inch long samples of each exposed molding or trim.
 3. 12-inch long samples of each suspension component.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" (Section 1.5). Provide documents to demonstrate their capabilities and experience. Include lists of at least 5 completed projects with project names and addresses, names and addresses of Architects and employers, and other information specified.
- F. BIM (Building Information Modeling): Provide 3-D models (as applicable) of the ceiling system including, panels, suspension and necessary components to make the system complete; compatible with "NavisWorks" or other appropriate 3-D model interfacing software.

1.5 QUALITY ASSURANCE

- A. Unless accepted otherwise by the Architect, use manufacturer and installers that employ a Quality Management System complying with the program described in ISO 9001-2008, or similar system.
- B. Installer
1. To certify a minimum 5 years experience installing similar systems and scope to those specified or approved in written form by "Basis of Design" manufacturer.
 2. Provide list of at least 5 successful installations with similar products and scope. Include names and contact numbers of Architect and employer for reference.
- C. Manufacturer
1. To certify a minimum of 5 years experience as a manufacturing enterprise engaged in sales and production of similar products to those specified.
 2. Provide support documentation including name and date of similar projects completed. Include names and contact numbers of Architect and employers for reference.
 3. Manufacturer shall be single source, original equipment, engineering and design, and shall be the fabricator and supplier of appropriate major components. Broker / Package of components will not be acceptable.
- D. Fire-Test-Response Characteristics: Provide metal ceilings that comply with the following requirements:
1. The panels are made from a non-combustible aluminum core and tested in accordance with ASTM E84. Class A (0-25 flame spread) Surface-burning characteristics of acoustical metal pan ceilings per IBC Chapter 8 Section 803.
- E. Mock-Ups: Before releasing acoustical metal ceilings, if requested, construct mock-ups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following minimum requirements, using materials indicated for completed work:
1. Locate mock-ups in the location and of the size indicated or, if not indicated, as directed by the Architect. Minimum mock-up size to be 10'x 10' unless otherwise specified.
 2. Notify Architect seven days in advance of the dates and times when mock-ups will be constructed.
 3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Site Coordination Mock-up:
 - a. For approval of assembly, sequence of installation, coordination of trades involved, including ceiling panel types and shapes.
 - b. Sized large enough to include a minimum of 2 adjacent panels. Demonstrating interface work of fire protection sprinklers, lighting, mechanical diffusers, anchoring method at steel structure; adjacent vertical wall; skylight and fascia, trim and accessories.
 5. Obtain Architect's approval of mock-ups before starting construction of acoustical curved metal pan ceilings. Submit detailed, ACAD shop drawing illustrating extent and scope of mock-ups. Do not proceed without approval of these drawings.
 6. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.
 - a. When directed, demolish and remove mock-ups from project site
 - b. Approved mock-ups in an undisturbed condition at the time of initial Acceptance may become part of the completed work, subject to Architect / Employer approval.
- F. Pre-installation Conference: Conduct conference at Project site as directed by the project Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical metal ceiling units and suspension system components in original, unopened packages clearly labeled with the following information: name of manufacturing source and location; product type, description and quantity; clients name and shipping address.
- B. Panels, suspension system components, and accessories to be stored in original, unopened packages 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.
- C. Exercise care in handling components to prevent damage to the surfaces and edges and prevent distortion or other physical damage. Comply with prescribed stacking instructions to prevent damage to the components. Panel's protective layer to be removed only after installation is complete to help prevent panel surface damage.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations
 1. Do not install acoustical metal pan ceilings until after spaces are enclosed and weather tight and after wet work and work above ceilings is complete and accepted by project Architect. Do not store in unprotected space.
 2. Maintain environmental conditions within limits recommended by manufacturer for optimum results.
 - a. Maintain within a temperature range of 50-100 degrees.
 - b. Maintain within a 20%-60% relative humidity.
- B. Do not install products in exterior space unless the system has been specifically designed and approved for exterior application.

- C. If the project is located within range of moisture associated with large bodies of water (fresh or salt), necessary materials shall be finished with coatings appropriate to condition of use.

1.8 WARRANTY

- A. Provide specified manufacturer warranty against defects in workmanship.
- B. This warranty shall remain in effect for a minimum period of one (1) year from date of installation.

1.9 MAINTENANCE & EXTRA MATERIALS

- A. Maintenance Instructions: Provide manufacturers standard maintenance and cleaning instructions for finishes provided.
- B. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.
 - 1. Acoustical Metal Ceiling Pan Units: Full-size units equal to 1 percent (1%) of amount installed.
 - 2. Ceiling Suspension System Components: Quantity of each grid and exposed component equal to 1 percent (1%) of amount installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of design: Ceilings Plus - 6711 E. Washington Blvd., Los Angeles, CA 90040. 800-822-3411 – www.ceilingplus.com.
- B. Supply specified item or comply with Section 01 60 00 "Substitutions". Specified manufacturer's standard of quality and manufacturing tolerances shall be the criteria for evaluating "equivalent" products. Substitution shall be equal to or of better quality than the specified product in the opinion of the Architect and / or owner.

2.2 MATERIALS

- A. Ceiling Type MCP-1 - Ceilings Plus "Radians" – Perforated – as required, Anodized finish to match Architect's sample, or approved equal.
 - 1. Panels are to be manufactured from single sheets of aluminum selected for surface flatness, smoothness and freedom from surface blemishes where exposed to view in a finished unit. Do not use material where the exposed surface exhibit pitting, seam marks, roller marks, stains, discolorations, or variations in flatness exceeding those permitted by referenced standards for stretcher-leveled aluminum alloy sheets.
 - 2. Panels are to be die formed with a minimum 1-1/2" integral return edge on each of the four panel sides. Steel clips that locate and align panels to the grid with torsion springs, are to be factory machine riveted to the return edge of the panels using counter sunk rivet holes that allow the flat heads of the counter sunk rivets to be flush the face of the panel return. No fasteners of any kind shall be visible on exposed face surfaces of ceiling panels or support tees. Down light openings and other ceiling penetrations shall be factory precision cut whenever viable.

3. Panel material shall be primed aluminum sheet type 5005 series alloy that has 0% recycled content. It shall be machine stretcher-leveled and a minimum of .032" thickness, or greater if required, so that the panel deflection does not exceed L/360.
4. The panel finish shall be:
 - a. "Anodized" finish – 5005 alloy, per finish schedule.
5. Panel sizes as per drawings. Field cut panels at non modular perimeter conditions, at column interfaces or as detailed or specified.
6. Panels to be factory pre-curved as required.
7. Edge Profile: Panel joints are butt condition (concealed tee – as per ASTM A 1264) both directions (as per drawings) unless specified otherwise.
8. Perforation shall be selected by the Architect from Ceilings Plus' standard patterns. Panels to have solid non-perforated borders along each of the four sides.
9. Sound-Absorptive Fabric Layer: Provide manufacturer's acoustic fabric sized to fit and laminated to concealed surface of panel. Material shall be non-flammable and sound-absorptive.
 - a. Fire Class shall be Class A, with surface-burning characteristics for flame-spread rating of 25 or less and smoke developed rating of 50 or less. Provide independent accredited lab test results showing compliance with Class A rating as per ASTM E84.
 - b. Achieve absorption value up to .95 NRC. Provide independent accredited laboratory test results illustrating compliance with acoustical requirements as per ASTM C423.
 - i. Option: Acoustical metal ceilings to provide recycled cotton, "Ultrasorb" in sufficient thickness to achieve up to 0.95 NRC rating specified.
 - ii. Option: Acoustical metal ceilings to provide recycled "Soundtex" fiber fleece. Permanently laminate fleece (Install acoustical pads) to the backside of the perforated panels to achieve up to 0.70NRC rating specified.
10. The plenum shall be 100% accessible. Every panel must be removable. Progressive panel access is not acceptable. Heavy duty torsion springs and steel clip assemblies to be mounted to every panel for downward access, without potential for damage to panel face or hinge assembly. Hinge assembly shall be mounted to every panel with minimum two flush to face, counter sunk chamfered fasteners. Attaching torsion spring directly to panel with fastener will not be acceptable.
11. Provide and install matching finish trim on each side of each suspended area (or as specified). Profile of trim to be minimum 4-1/2" tall @ floating conditions or as detailed.
12. (Optional) Matching light fixture trim surrounding opening where lay-in units are used.

2.3 METAL SUSPENSION SYSTEMS. GENERAL

- A. Metal Suspension Standard: Provide panel manufacturer's pre-curved metal suspension systems of types, structural classifications, materials, and finishes indicated that comply with applicable ASTM C635 requirements.
 1. Main and cross runners to be specified manufactures Standard "Heavy Duty" tee bar (as per ASTM C635).

2. Face of main and cross runners to be factory finished matte black unless known otherwise.
 3. Face flange of main runners to be factory slotted to receive torsion springs.
 4. Provide suspension system made from steel sheet with an average recycled content such that post-consumer recycled content plus one half or pre consumer content is not less than 25%.
- B. Suspension Systems: Provide complete suspensions systems with main runners, cross runners, hangers, trim molding, seismic retention clips, load resisting struts and other suspension components required to support ceiling and other ceiling supported construction (some of these parts may be supplied by the installer).
- C. Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1, "Direct-Hung", unless otherwise indicated (supplied by installer)
1. Provide anchor, for use in the particular application, as approved by the "Structural Engineer of record".
 2. Structural substrate, as indicated to support attachment device, also to be approved by the "Structural Engineer of record".
 3. Anchors specified must provide corrosion resistance as per metal type and application.
 - a. Anchors into Concrete (with or without steel deck)
 - i. Pre-installed – Cast in Place Anchors
 - ii. Post-installed - Expansion Anchors
 - iii. Post-installed – Chemical Anchors
 - iv. Post-installed – Powder Actuated Fasteners
 - b. Anchors into Wood
 - i. 1/4"min diameter with 1-1/4" minimum penetration
 - c. Anchors into Steel
 - i. Clip or Clamp
 - ii. Shot Pin
 - d. Anchors into Steel Deck: This option requires special attention from both the "Structural Engineer of record" and the Professional Engineer retained to provide structural documents in order to coordinate detailing required to provide anchoring device.
 4. "Direct-Hung" Suspensions Systems: System composed of main runners supported by hangers attached directly to building structure.
 5. "Indirect-Hung" Suspension Systems: System composed of main runners connected to carrying channels that are attached by hangers to building structure, and complying with the following requirements:
 - a. Hangers: Type and metal standard with ceiling system manufacturer, sized to comply with structural classification indicated.
 - b. Wire Hangers, where applicable, Braces, and Ties: Provide wires complying with the following requirements:
 - i. Zinc-Coated Carbon-Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.

- ii. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 2mm diameter wire.
- iii. Extruded Aluminum members shall comply with ASTM B209.
- 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 22mm wide, formed with 1mm thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation, with bolted connections.

2.4 FINISHES, GENERAL

- A. Comply with "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturers standard factory-applied finish for type of system indicated unless specified otherwise.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- C. Appearance of finished work: Painted or Anodized:
 - 1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half range of approved samples.
 - 2. Noticeable variation in same piece is not acceptable.
 - 3. Variations in appearance of other components are acceptable if they are within range of approved samples and are assembled or installed to minimize contrast.

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
- B. Measure each ceiling area and establish layout of acoustical metal pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.
- C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.3 INSTALLATION

- A. General: Install acoustical metal pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below.

1. CISCA "Ceiling Systems Handbook.
 2. Standard for Ceiling Suspension System Installations - ASTM C 636.
 3. Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580
 4. IBC (International Building Code) standard for Seismic Zone for local area.
- B. Suspend ceiling hangers from building's approved structural substrates 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 to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produce hanger spacings that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 4. Where used secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 5. Space hangers not more than 48 inches on center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceed those recommended.
 6. Fine level grid to 1/8 inch in 10 feet from specified elevation(s), square and true.
 7. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- C. Secure bracing wires to ceiling suspension members and to supports acceptable to Architect / Engineer and or inspector. Suspend bracing from building's structural members and / or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs(unless directed otherwise).
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pan. Method of edge trim attachment and design of edge trims to be approved by Architect.
1. Screw attach moldings to substrate at intervals not more than 18" O.C. and not more than 6" from ends, leveling with ceiling suspension system to a tolerance of 1/8" in 10'. Miter corners accurately and connect securely.
 2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval or unless detailed otherwise.
- E. Scribe and cut acoustical metal panel units for accurate fit at penetrations by, other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
- F. Install acoustical metal panel units in coordination with suspension system.

1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated. Install directionally patterned or textured panels in directions indicated on approved shop drawings. Panel-joints shall flow smoothly and in a straight line within 1/8" in 10'. Intersections shall be continuous.
2. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
3. Remove protective film from panels only when space is completely clean and free of airborne particles. Use white cotton gloves for final installation of panels into grid system.

3.4 ADJUSTING AND CLEANING

- A. Adjust ceiling components to provide a consistent finish and appearance in conformity with established tolerances and requirements.
- B. Clean exposed surfaces of acoustical metal panel ceilings and walls. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

End of section