SECTION 07 41 00

STANDING SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work described in this section includes installation of new underlayment and specified pre-formed metal roofing system complete with clips, perimeter and penetration flashing, closures, gutter system, and downspouts.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General Supplementary Conditions apply to this section.

B. Related work specified elsewhere:

1. Division 6 Section “Rough Carpentry” for wood nailers and blocking, and for wood-based, structural-use roof deck.
2. Division 7 Section “Re-Roofing Procedures”.
3. Division 7 Section “Joint Sealers”.
4. Division 7 Section “Manufactured Roof Specialties”.

1.3 REFERENCES

A. American Architectural Manufacturer Association (AAMA):
1. AAMA 501.1 Standard Test Method for Metal Curtain Walls for Water Penetration using Dynamic Pressure.

B. American Iron and Steel Institute (AISI):
1. 1996 Ed. Specification for the Design of Cold-Formed Steel Structural Members.

C. American Society of Civil Engineers (ASCE):
1. ASCE 7-10 Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):

1. A792-96 Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

2. A875-99 Specification for Steel Sheet, Zinc-5% Aluminum Alloy-Coated by the Hot Dip Process.

3. A653-96 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

4. B209-96 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

5. D1056-91 Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

6. D3575-84 Test Methods for Flexible Cellular Materials made from Olefin Polymers.

7. E283-93 Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

8. E331-86 Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

9. E1592-95 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

10. E1646-95 Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.

11. E1680-95 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

1. 1993 Ed. Architectural Sheet Metal Manual, 5th edition.

F. Underwriters' Laboratories (UL):

1. UL-263 Fire Tests of Building Constructions and Materials.

2. UL-790 Tests for Fire Resistance of Roof Covering Materials.

1.4 SUBMITTALS

A. Shop Drawings

1. Show roofing system with flashings and accessories in plan, sections and details. Include metal thickness' and finishes, panel lengths, joining details, anchorage details, flashings, and special fabrication provisions for termination and penetrations; thermal expansion provisions and special supports.

2. Indicate relationships with adjacent and interfacing work. Indicate fastener types and spacing; and provide fastener pullout values.

3. Shop drawings must be specific to this project and completed by the metal panel manufacturer's engineering department. Any and/or all changes recommended by the successful bidder must be approved by the manufacturer in writing prior to submittal.

B. Product Data: Include manufacturer's detailed material and system description, sealant and closure installation instructions, engineering performance data and finish specifications. Indicate fastener types and spacing; and required fastener pullout values.

C. Design Loads: Submit copy of manufacturer's minimum design load calculations according to ASCE 7-10, Method 2 for Components and Cladding, prepared by a an engineer employed by the system manufacturer as a full-time staff engineer. In no case shall the design loads be taken to be less than those detailed in article 1.9 of this specification.

D. Design Test Reports: Provide certified test reports from an independent testing laboratory that bear the seal of a registered professional engineer to show compliance with the performance criteria specified in article 1.9. Each of the following test reports must be submitted:

1. ASTM E1592-95: Test results must clearly demonstrate compliance with the following requirements:

   a. The ultimate test failure load shall be reduced by the safety factor specified in article 1.9 to determine the **allowable working load** for the panel system.

   b. The proposed system has been tested to insure that the **allowable working load** of the panel system meets or exceeds the specified negative wind uplift pressures listed in article 1.9 of this specification for all roof zones.

   c. The test results are applicable for the panel material, grade, thickness, width, and profile specified. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested.

   d. The results must clearly show that the allowable clip spacing meets or exceeds the requirements specified in article 3.3 C for all roof areas. Clip spacing shall not be increased for any roof zone from that which is specified.

2. ASTM E283-93 and E331-86: Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.

3. ASTM E1646-95 and E1680-95: Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9. Results are not applicable for systems that are thinner, wider, lower grade, or different material/profile than the system which was tested. The differential test pressures must be equal to those specified in article 1.9.

1.5 DISCLOSURE OF MATERIALS

A. Disclosure of Materials: The materials outlined herein are the basis of design and the type of materials to be used on this project. When a particular make or trade name is specified, it shall be indicative of the minmum standard required. This specification is based on the performance characteristics of the system identified in section 2.1.

1.6 INSTALLER QUALIFICATIONS

A. Engage an experienced metal roofing contractor (erector) to install standing seam system who has a minimum of five (5) years experience specializing in the installation of structural standing seam metal roof systems.

B. Contractor must be certified by manufacturer specified as supplier of structural standing seam system and obtain written certification from manufacturer that installer is approved for installation of specified system. If requested, contractor must supply owner with a copy of this certification.

C. Successful contractor is required to maintain a full-time supervisor/foreman who is on the job-site at all times during installation of new roof system. Foreman must have a minimum of five (5) years experience with the installation of system similar to that specified.

D. Successful contractor must obtain all components of roof system from a single manufacturer, including any roll good materials if required. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.

E. If required, fabricator/installer shall submit work experience and evidence of adequate financial responsibility. The owners representative reserves the right to inspect fabrication facilities in determining qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's responsibility:

1. Protect components during fabrication and packing from mechanical abuse, stains, discoloration, and corrosion.

2. Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.

B. Installer's responsibility:

1. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.

2. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from the site.

3. Protect panels from wind-related damages.

4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.8 JOB CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal roofing system.

B. Protection:

1. Provide protection or avoid traffic on completed roof surfaces.

2. Do not overload roof with stored materials.

3. Support no roof-mounted equipment directly on roofing system.

C. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place and approved prior to installation of roofing.

1.9 DESIGN AND PERFORMANCE CRITERIA

A. Thermal Expansion and Contraction.

1. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

2. The design temperature differential shall be not less than 200 degrees F.

3. Interface between panel and clip shall provide for **unlimited** thermal movement in each direction along the longitudinal direction.

4. Location of metal roofing rigid connector shall be at roof ridge unless otherwise approved by the Manufacturer. Metal ridge connector may require design as per job conditions by specified manufacturer.

B. Uniform Wind Uplift Load Capacity. (Calculations to be provided)

1. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as spacing given in article 3.3 C.

   a. Design Code: ASCE 7-10, Method 2 for Components and Cladding.

   b. Safety Factor: TBD

   c. Category TBD

   d. Wind Speed: TBD

   e. Ultimate Pullout Value: TBD

   f. Exposure Category: TBD

   g. Design Roof Height: 34 feet

   h. Minimum Building Width: 80 feet

   i. Roof Slope: 8:12

Roof Area	**Design Uplift Pressure:**
Zone 1 – Mid Roof	TBD
Zone 2 – Eaves, Rakes & Ridge	TBD
Zone 3 – Corners	TBD

2. Capacity shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above. In order to comply with the building code, panel system must be tested to withstand these listed pressures at clip spacings no closer than those listed in article 3.3.C.

C. Uniform Positive Load Capacity.

1. The installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 30 psf; Ground Snow Load of 40 psf; Balanced Uniform Roof Snow Load of 30.5 psf; and Maximum Unbalanced Surcharged Load of 26.3 psf; and an Unbalanced Width of 8.78 feet.

2. Capacity to resist positive loads shall be determined by empirical calculations in accordance with AISI. Calculation shall be sealed by a registered professional engineer.

3. Installed roof system shall carry positive uniform design loads with a maximum system deflection of L/180 as measured at the rib (web) of the panel.

D. ASTM E283: **Static pressure air infiltration (doors, windows, curtain walls):**

Pressure	**Leakage Rate**
1.57 PSF	0.0007 cfm/sq.ft.
6.24 PSF	0.0002 cfm/sq.ft.
20.0 PSF	0.0036 cfm/sq.ft.

E. ASTM E331: **Static pressure water infiltration (doors, windows, curtain walls):**

Pressure	**Result**
5 Gal/Hr Per S.F. and Static Pressure Of 20.0 Psf for 15 minutes	No Leakage

F. ASTM E1680: **Static pressure air infiltration (roof panels):**

Pressure	**Leakage Rate**
1.57 PSF	0.0012 cfm/sq.ft.
6.24 PSF	0.0001 cfm/sq.ft.
20.0 PSF	0.0011 cfm/sq.ft.

G. ASTM E1646: **Static pressure water infiltration (roof panels):**

Pressure	**Result**
5 Gal/Hr Per S.F. and Static Pressure Of 20.0 Psf for 15 minutes	No Leakage

H. Water penetration (dynamic pressure): No water penetration, other than condensation, when exposed to dynamic rain and 70 mph wind velocities for not less than five minutes duration, when tested in accord with principles of AAMA 501.1.

I. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolation for conditions outside test range are not acceptable.

1.10 WARRANTIES

A. Owner shall receive ONE (1) warranty from manufacturer of roof panels covering all of the following criteria.

1. Manufacturer's 30 year No Dollar Limit (NDL) watertight warranty, including coverage for all roof panels, trim, flashings, and penetrations associated with the standing seam roof area.

2. 30 year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.

3. 20 year material coverage.

4. Warranty shall commence on date of substantial completion.

5. Installer shall provide manufacturer with a five (5) year warranty covering roofing system installation and watertightness.

6. At the request of the Owner, the Manufacturer will provide an annual inspection. The request for annual inspections shall be applicable for the life of the warranty.

1.11 MANUFACTURER'S INSPECTIONS

A. When the project is in progress, the roofing system manufacturer will provide the following:
   1. Keep the Owner informed as to the progress and quality of the work as observed.
   2. Provide job site inspections a **minimum of three (3) days a week with reports to the Architect.**
   3. Report to the Architect in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
   4. Confirm after completion that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

PART 2 - PRODUCTS

2.1 STANDING SEAM ROOFING SYSTEM

A. General.

1. Whenever a particular make of material, trade name and/or manufacturer's name is specified herein, it shall be regarded as being indicative of the minimum standard of quality required. A bidder who proposes to quote on the basis of an alternate material and/or system will only be considered if the proposed alternate is submitted and approved as being equivalent or superior in quality to the specified system in accordance with article 1.5. Additionally, all manufacturer and contractor/fabricator guidelines, performance criteria and warranty criteria must be met as specified in article 1.4, 1.5, 1.6, 1.9, and 1.10.

2. Product names for the metal roof panel system and waterproofing materials used in this section shall be based on performance characteristics of the R-MER Span System manufactured by **The Garland Company, Cleveland, OH (516) 717-5051 and shall form the basis of the contract documents.**

3. Manufacturers: The following manufacturers are acceptable, providing they meet these specifications and the minimum standards stated.

A. **The Garland Company, Inc. (Basis of Design).** Garland Company, Inc. (The); 3800 E. 91st St., Cleveland, OH 44105. ASD. Toll Free: 800-321-9336. Phone: 216-641-7500. Fax: 216-641-0633. Web Site: www.garlandco.com. Contact: Tim Roth (917) 662-7385 – troth@garlandind.com

B. Materials.

1. Panel material: 24 ga., Galvanized steel, smooth as per ASTM A653-96.

2. Flashing and flat stock material: Unless noted otherwise, fabricate in profiles indicated on approved manufacturer's shop drawings of same material, thickness, and finish as roof system, unless indicated otherwise. Gutters, downspouts, and leaders shall be fabricated as specified in 0.050" aluminum with a kynar paint finish to match the roof panel. Gutter mill finished external brackets shall be covered with aluminum having a kynar paint finish to match the roof panel.

C. Finish on surfaces:

1. Exposed surfaces for coated panels:

a. Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.

b. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.

c. Color shall be from Garland's Standard Color offering.

2. Unexposed surfaces for coated panels shall be baked-on polyester coating with .20 - .30 dry film thickness (DFT).

D. Characteristics:

1. Provide the same panel profile from a single manufacturer for ALL standing seam roof areas.

2. Configuration: Provide standing seam panels incorporating mechanically interlocked, concealed anchor clips allowing unlimited thermal movement, and of configuration which will prevent entrance or passage of water.

a. Panel/Cap configuration must have a total of four (4) layers of steel surrounding anchor clip for prevention of water infiltration and increased system strength designed to limit potential for panel blow-off.

b. Profile of panel shall have mesa's every two (2) inches on center continuous throughout panel which are a minimum of one point five (1.5) inches wide. These will absorb thermal stresses, reduce oil canning, and increase load carrying capacity.

c. Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at trim details (as per manufacturer's guidelines).

d. **Panels must be fabricated and furnished in continuous lengths from eave to eave with no joints/splices/overlaps.**

e. Panels lengths which exceed maximum shipping lengths shall be field rolled on equipment owned by the panel manufacturer. Contractor rolling equipment is NOT allowed. Equipment shall have at least 12 rolling stations and provide a product identical to factory manufactured product. The equipment shall be operated by a trained full time experienced technician. All requirements of Section 1.5 B shall apply.

f. Seam caps shall be manufactured in the factory and shall be installed with NO endlaps. Seam sealant must be factory applied.

3. Seam must be two and three-eights (2-3/8) inches minimum height for added upward pressures and aesthetic appeal. Seam shall have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow unlimited expansion and contraction of panels due to thermal changes. Integral (not mechanically sealed) seams are unacceptable.

4. Concealed Standard Anchor Clips: Clips must be sixteen (16) gauge galvanized steel, ONE (1) piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.

a. Two-piece (2) clips are **NOT** acceptable.

b. Sealant applied in panel cap must be isolated from clip to insure that no sealant damage occurs from the movement of the panel during expansion and contraction.

c. Clip must maintain a clearance of a minimum of three-eights (3/8) inches between panel and substrate for proper ventilation to help prevent condensation on underside of panel and eliminate the contact of panel fastener head to panel.

5. Seam cap: Snap-on cap shall be a minimum of 1" wide "T" shaped of continuous length up to forty-five (45) feet according to job conditions and field seamed by means of manufacturer's standard seaming machine.

   a. Cap shall be designed to receive two (2) beads of continuous hot applied gasketing sealant which will be applied independent of anchor clip to allow unlimited thermal movement of panel without damage to cap sealant.

   b. Sealant shall be a SIS (Styrene-Isoprene-Styrene) block copolymer type thermoplastic rubber adhesive, non-fatigue water barrier.

6. Standing Seam Panel Width: 18"

7. Stiffening ribs: Located in flat of panel to minimize oil canning and telegraphing of structural members.

8. Replaceability: Panels shall be of a symmetrical design with snap on cap configuration such that individual panels may be removable for replacement without removing adjacent panels.

9. Panel ends shall be panned at ridge or where applicable per the manufacturer's approved shop drawings.

10. <u>Panel length: Full length without joints.</u>

E. Accessories.

1. Gable anchor clips: Standing Seam style, galvanized steel, minimum thickness 16 gauge.

2. Fasteners:

   a. Standing Seam Roof Clip fasteners and Concealed fasteners: Corrosion resistant steel fasteners (zinc plated, stainless steel or equal) designed to meet structural loading requirements and in accordance with recommendations from the manufacturer of the wood roof decking and wood blocking. Provide #14-13 DP1 as the minimum fastener size.

   b. Exposed fasteners: Series 410 stainless steel fasteners or one-eighth (1/8) inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the standing seam panels.

3. Closures: Factory precut closed cell foam meeting ASTM D1056 or ASTM D3575, enclosed in metal channel matching panels when used at ridge, rake, and jamb.

4. Provide all miscellaneous accessories for complete installation.

2.2 ACCESSORY PRODUCTS

A. Sealant:

1. Acceptable product:

a. Concealed Application : Garland Butyl Sealant or approved equal.

b. Exposed Application : Garland Tripolymer Sealant or approved equal.

2. Colors: As selected by Architect from sealant manufacturer's standard selection.

B. Roof Deck Substrate:

1. Continuous wood roof deck over metal framing stud structure.

C. Underlayment:

1. Underlayment shall be applied over entire roof area, and turned down over the perimeter edge blocking in accordance with the manufacturer’s approved shop drawings.

2. Underlayment shall be R-Mer Seal, a 45 mil self-adhering, SBS modified membrane, fiberglass reinforced, high temperature underlayment. Install in accordance with manufacturer's recommendations.

E. Prefabricated Shims:

1. Install prefabricagted high density polyethelene plastic shims under the roof panel clip and over the bearing plates to maintain a level/plumb plane to prevent buckling of the roof panel.

F. Snow Retention System:

1. Shall be S-5 Snow Retention System as supplied by the standing seam panel manufacturer designed for the appropriate local code ground snow load of 40 psf resulting in the required balanced and unbalanced snow loads, specified roof slopes and lengths, and an 18 inch wide panel. Two (2) rows of the S-5! Color Guard snow retention system will be required on each roof section. One (1) row at the eave end of the roof section, and one (1) row mid point of the roof section. An S-5! Clip shall be installed at each panel seam, and one (1) Snow Clips between each panel. Color shall match standing seam roof panel color.

2.3 FABRICATION

A. Shop fabricate metal roofing and flashing components to the maximum extent possible, forming metal work with clear, sharp, straight, and uniform bends and rises. Hem exposed edges of flashings.

B. Form flashing components from full single width sheet in minimum ten (10'-0") foot lengths. Provide mitered corners, joined using closed end pop rivets and joint sealant.

C. Fabricate roofing and related sheet metal work in accord with approved shop drawings and applicable standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Examine the alignment and placement of the building structure and substrate. Correct any objectionable warp, waves or buckles in the substrate before proceeding with installation of the pre-formed metal roofing. The installed roof panels will follow the contour of the structure and may appear irregular if not corrected.

B. Establish straight side and crosswise benchmarks.

C. Use proper size and length fastener for strength requirements. Approximately five-sixteenths (5/16) inch is allowable for maximum fastener head size beneath the panel.

D. Rectangular shaped roofs shall be checked for square and straightness. Gable ends may require setting a true line for the gable clips and setting with string line.

E. Measure the roof lengthwise to confirm panel lengths, overhangs, coverage of flashings at eaves and ridges and verify clearances for thermal movement.

F. Pre-roofing conference:

1. Prior to beginning metal roofing work, a pre-roofing conference shall be held to review work to be accomplished.

2. Owner, contractor, metal roofing subcontractor, metal roofing system manufacturer's representative and all other subcontractors who have equipment penetrating roof or whose work involves access to roof shall be present.

3.2 METAL FABRICATION AND EQUIPMENT

A. Mechanical panel fabrication for field panels shall be operated by a trained full time experienced technician.

B. Mechanical equipment shall have a least twelve (12) rolling stations and provide a product identical to factory manufactured product.

3.3 ROOFING AND FLASHING INSTALLATION

A. Comply with all details and install roofing materials and flashings in accordance with approved manufacturer's shop drawings and manufacturer's product data, within specified erection tolerances.

B. Prepare roof for the installation of standing seam panels, including:

1. The roof barrier board shall be installed with joints in continuous straight lines, perpendicular to roof slopes with end joints and side laps staggered between rows. Tightly butt substrate boards together. Substrate boards shall be attached to the deck with the specified fasteners using the approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with the following:

- Fix (5) fasteners per 4' x 4' board

a. Filler pieces of roof barrier board require at least two fasteners per piece if size of roof barrier board is less than four square feet.

b. Placement of any fastener from edge of the roof barrier board shall be a minimum of three inches, and a maximum of six (6) inches.

c. Minimum penetration into deck shall be as recommended by the fastener manufacturer. There is a one (1) inch for wood roof decks where not specified by the manufacturer.

2. Install the specified and approved underlayment as required in this specification over the properly installed roog barrier board. The specified underlayment shall be applied over the entire roof area.

C. Directly over the completed roof substrate, install one (1) piece panel anchor clips. All anchor clips shall be fastened with two (2) approved fasteners through the underlayment and into the wood roof deck based on the following fastener spacing pattern. As required, install prefabricated high density polyethlene plastic shims to maintain a level/plumb surface/plane for the standing seam panel to prevent buckling.

Roof Section

1. Field clip spacing must be TBD ft. o.c. for Zone 1 (mid roof)

2. Field clip spacing must be TBD ft. o.c. for Zone 2 (eaves, rakes and ridge).

3. Field clip spacing must be TBD ft. o.c. for Zone 3 (corners)

4. Gable clip spacing must be TBD ft. o.c. (rakes)

   * This clip spacing must be followed to ensure integrity of the completed installation. These have been determined based on the uplift calculations for the specified roof and the test results of ASTM E-1592.

D. Installation of Roof Panels: Roof panels can be installed by starting from either end and working towards the opposite end. Due to the symmetrical design of the specified panel system, it is also acceptable to start from the middle of the roof and work toward each end.

1. Stainless steel pop rivets shall be secured through the anchor reveal of the panel leg and extend into the arms of the panel clip located at the ridge of the roof. The panel is then anchored at both sides of each of the clip. Four (4) rivets per panel are required and shall be installed.

   a. Be sure to capture all drilling debris during this operation with a rag or cloth placed on the panels at the drilling operation.

   b. Panels are not securely attached to the roof until fixed to the anchor clip. To avoid damage and injury, all panels shall be fixed to the anchor clip immediately as they are installed.

2. The seam caps are shipped with two (2) beads of factory applied hot melt sealant located inside the caps. To install the caps, hook one side of the cap over the panel edge and rotate over the opposite panel leg. For ease of installation, start at one end of the panel and work toward the opposite end.

3. A hand crimping tool is used to crimp the cap around the top of two adjacent panels

4. Caps shall then be permanently seamed with manufacturers mechanical seamer.

5. At the end of each day's work, seam caps shall be mechanically seamed or hand crimped (crimp 4 inches every 8 feet) to reduce the possibility of wind damage prior to completion of the project.

6. Un-installed panels which are temporarily stored on the ground or roof shall be secured in place at the end of each day's work to prevent possible damage or injury.

E. Isolate dissimilar metals and masonry or concrete from metals with bituminous coating. Use gasketed fasteners where required to prevent corrosive action between fastener, substrate, and panels.

F. Limit exposed fasteners to extent indicated on shop drawings.

G. Anchorage shall allow for temperature expansion/contraction movement without stress or elongation of panels, clips, or anchors. Attach clips to structural substrate using fasteners of size and spacing as determined by manufacturer's design analysis to resist specified uplift and thermal movement forces.

H. Seal laps and joints in accordance with roofing system manufacturer's product data.

I. Coordinate flashing and sheet metal work to provide weathertight conditions at roof terminations. Fabricate and install in accordance with standards of SMACNA Manual.

J. Provide for temperature expansion/contraction movement of panels at roof penetrations and roof mounted equipment in accordance with system manufacturer's product data and design calculations.

K. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

L. Maximum variation from true planes or lines shall be one-fourth (1/4) inch in twenty (20) feet and three-eighth (3/8) inch in forty (40) feet or more.

M. Form joints in linear sheet metal to allow for one-fourth (1/4) inch minimum expansion at twenty (20) feet on center maximum and eight (8) feet from corners.

N. At joints in linear sheet metal items, set sheet metal items in two(2), one-fourth (1/4) inch beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

O. Remove damaged work and replace with new, undamaged components.

P. Touch up exposed fasteners using paint furnished by roofing panel manufacturer and matching exposed panel surface finish.

Q. Clean exposed surfaces of roofing and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

R. Snow Retention System

1. At all eaves and mid point of each roof section, install one (1) row of the S-5! Color Guard Snow retention system as as supplied by the standing seam panel manufacturer in accordance with the manufacturer's recommendations. This will result in two (2) rows per roof section. S-5! Clamps are require at EACH panel seam, and the S-5! Clamp set screws shall be tightened to a tension of 115 in-lbs per each screw with proper torque setting tightening equipment. Additionally, a S-5! Snow Clip is required in each panel.

END OF SECTION 07 41 00