



METAL ROOFING

S y s t e m s , I n c

Faster. Smarter. Better. Period.

General Product Submittal

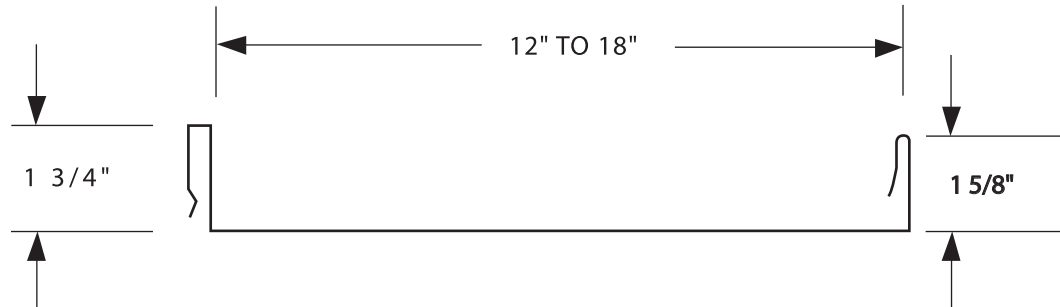
MRS System 2000

Roofing Panel

MRS System 2000

12" - 18" o.c.
1 3/4" high
Snap-lock

.032 or .040 aluminum
22 or 24 gauge steel
16 oz Copper



U.L. 580 Class 90 Certified ASTM E1592 Tested

Ideal for large commercial installations

Material: .032 or .040 Aluminum, 22 or 24 gauge Steel, 16 oz Copper
12" to 18" o.c.

Features: Striations (Recommended)
Flat
Stress Ribs
Optional Sealant in Female Leg

Requirements: Solid Substrate, Open Framing
Ice & Water Shield or Synthetic Underlayment
Minimum Roof Pitch: 3" on 12"

Finish: Hylar 5000[®] or Kynar 500[®]

Locations:

7670 Mikron Drive
Stanley, NC 28164
Tel: 704-820-3110
Fax: 704-820-0113

2451 Bulk Plant Road
Conway, SC 29526
Tel: 843-365-6673
Fax: 843-365-6683

5512 Fort Henry Drive
Kingsport, TN 37663
Tel: 423-239-0013
Fax: 423-447-7150



METAL ROOFING
Systems, Inc

Website: www.metalroofingsystems.biz



Metal Construction Association

OIL CANNING POSITION PAPER

INTRODUCTION

"Oil canning" can be defined as a perceived waviness in the flat areas of roofing and siding panels. Generally the period and amplitude of the wave depend on the continuous width of the flat.

Oil canning is an inherent part of light gauge cold formed metal products, particularly those with broad flat areas. Profiles having wide flat surfaces are often referred to as "architectural" roofing and siding panels. Such panels are distinguished from corrugated shapes as the latter are more fluted in design, have much narrower flats, and are less likely to exhibit oil canning.

BACKGROUND

Oil canning has a number of causes:

1. Metal Coil:

Residual stresses induced during coil production can contribute. Examples of other contributing features are:

- a. Full center -- the coil is longer in the middle of the strip: This is the most common example. (The gradation manifests as ripples or buckles near mid coil.)
- b. Wavy edge -- the coil is longer on the edge of the strip.
- c. Camber -- the deviation of a side edge from a straight line. (This is not always a problem.)

These conditions exist to some extent in all metal and tend to become more exaggerated as the strength level of the rolled sheet product increases and also for thinner and wider sheet product. When excessive, each circumstance can cause oil canning after roll forming by the manufacturer.

2. Fabrication:

- a. Slitting -- the slitting of a master coil can release and redistribute residual forces. The coil's response can create or increase oil canning. The economics of rolling and coating wider coils makes slitting almost mandatory.
- b. Forming -- New residual stresses can be created during some forming operations. Architectural panel profiles typically require more forming along sides than in the middle, and more often require more forming along one side than the other. This dictates that forming com-

mences along the sides. This sequential "working" of the sheet will have a tendency to "trap" uneven metal contained within the coil in the panel central areas (corrugated ribbed profiles are most often worked from the center out, thereby "pushing" the uneven metal to the edges).

3. Installation:

- a. Misalignment of the support system -- structural supports that are produced, fabricated and installed within allowable tolerances can create a "non-planar" or contoured bearing surface. Stresses induced when panels conform to this surface can contribute to oil canning.
- b. Over engagement of panels -- Most panels accommodate transverse thermal expansion by flexing of webs and by "take up" at side joints. When panels are over engaged, these relief features are hindered or eliminated. In the extreme the "over engagement" process itself can generate waviness. Either cause can contribute to oil canning.
- c. Over driving of fasteners -- This operation creates stresses in the panel and provides a "reading line" at the fasteners.
- d. Longitudinal Expansion -- The surface temperature of exposed panels cycles throughout the year and even fluctuates daily. The temperature and the cycle depend on many variables, e.g. project location and orientation, cloud cover, panel inclination, surface finish or color, system thermal insulation characteristics. The panels' physical response is to expand or contract. If panels are restrained by "thru-fasteners", clips, or perimeter details, they try to accommodate or relieve thermal forces through several mechanisms, i.e. "slotting" around fasteners, out-of-plane "bowing", local distortion of flat areas -- "waviness". The magnitude of thermal force depends on the restraint provided (hence the panel stiffness and support stiffness), on the base materials' physical properties, and on the temperature differential between the support structure and the external skin.

Waviness can be amplified when there is uneven fastener restraint along the panel. Such restraint is common on "concealed fastener" systems having fasteners along one edge and an interlock along the other. Waviness caused by thermal forces differs from other forms of oil canning in that waves can appear and

disappear as the sun rises and moves around the building.

e. Movement of the primary structure -- Excessive differential deflection, racking, drift, or settlement within the primary structure can cause noticeable waviness within panel flats. This distortion can be temporary or sustained.

f. Handling -- Carrying of panels in the flat or twisting of panels can induce a wavy appearance to a previously flat panel. Twisting can occur if one corner of a panel is used to lift a panel or to remove the panel from a bundle.

Coil producers and panels manufacturers attempt to minimize these conditions and produce quality products. On going research seeks improved production methods. Regardless all of the above factors can and do occur and can cause oil canning in architectural roofing or siding product. While a number of factors are dictated by the panel design, there are steps that the designer, panel manufacturer, and erector can take to reduce the chances of oil canning:

1. Coil:

Tension or stretcher leveling, a process whereby the metal is "stretched" in coil form beyond its yield point, will provide a flatter surface less prone to oil canning. In general the heavier the gauge the less likely a product is oil can. The possibility of oil canning can be reduced by ordering tension leveled and resquared material.

2. Design:

The addition of stiffening beads or other configuration "breaks-up" the flat surface and makes oil canning less apparent. Embossing will also help hide surface waviness in the metal. The selection of lower gloss coatings and lighter colors tend to minimize the visual effect of oil canning.

3. Installation:

More stringent specification regarding the alignment of the supporting structure will focus attention on this critical aspect. Instructions to the erection forces regarding proper handling, spacing and fastening should be a part of the manufacturer's delivery packet.

CONCLUSION

Oil canning is an aesthetic problem. Normally structural integrity is not affected. However, structural integrity must be reviewed if the distortion results form an extreme external influence. Since many uncontrollable factors are involved, no manufacturer can realistically assure the total elimination of oil canning. With careful attention to the production and selection of material, to the panel design, and to installation practice, oil canning can be effectively minimized.

Unless specified tolerance have been accepted by the panel provider and panel manufacturer and are incorporated into the contract documents prior to fabrication, and if reasonable precautions have been taken, oil canning is not grounds for panel rejection.

BIBLIOGRAPHY

1. American Iron & Steel Institute, "Sheet Steel Coils & Cut Lengths". Steel Products Manual, October 1979.
2. USS "USS Sheet & Strip Handbook" July 1983.

Note: This position paper was written and furnished by the Metal Construction Association (MCA).



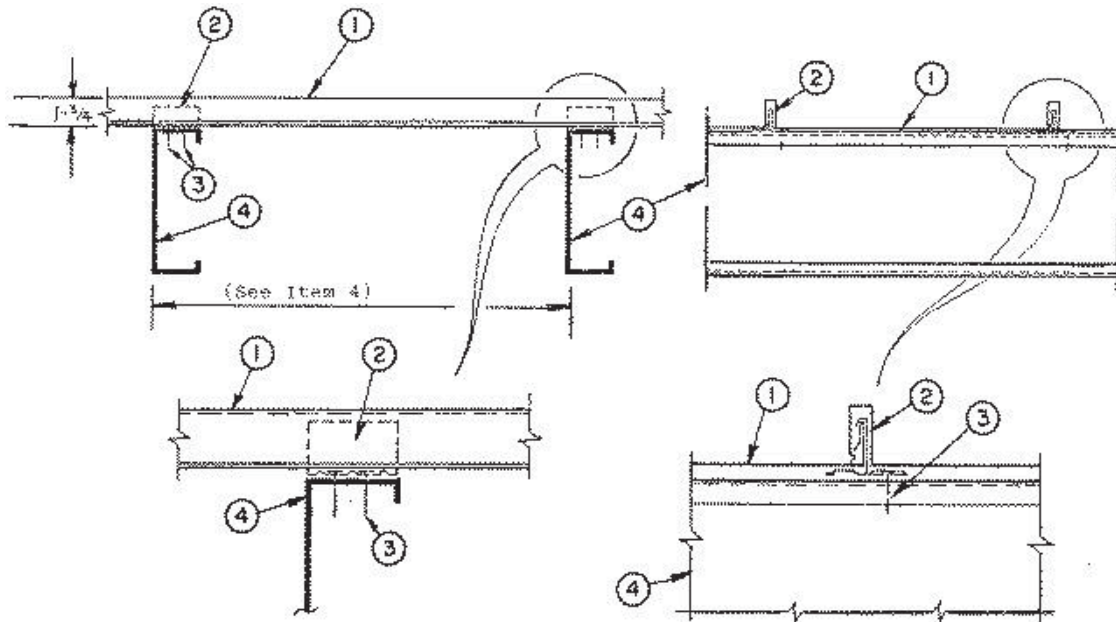
11 S. LaSalle St. Suite 1400 Chicago, IL 60603
(312) 201-0193 i Fax (312) 201-0214
or P.O. Box 697 Chicago, IL 60690-0697

U.L. Constructions

Construction No. 254

Wind-Uplift — Class 90 (See Item No. 4)

Fire Not Investigated



1. **Metal Roof Deck Panels *** — No. 22 MSG or No. 24 MSG min thickness coated steel panels. Panels 12 in. wide, 1-3/4 in. high at the ribs. Panels continuous over two or more spans. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners * (Panel Clips)** — One piece assembly, 3-1/2 in. wide, 1-7/8 in. high, thickness 0.048 in. One panel clip located at each purlin intersection.

2A. **Roof Deck Fasteners (Bearing Plate)** — (Not Shown) - No. 16 MSG coated steel, 4 in. by 5 in. with guide holes. Used when Rigid Insulation (Item 5) is used.

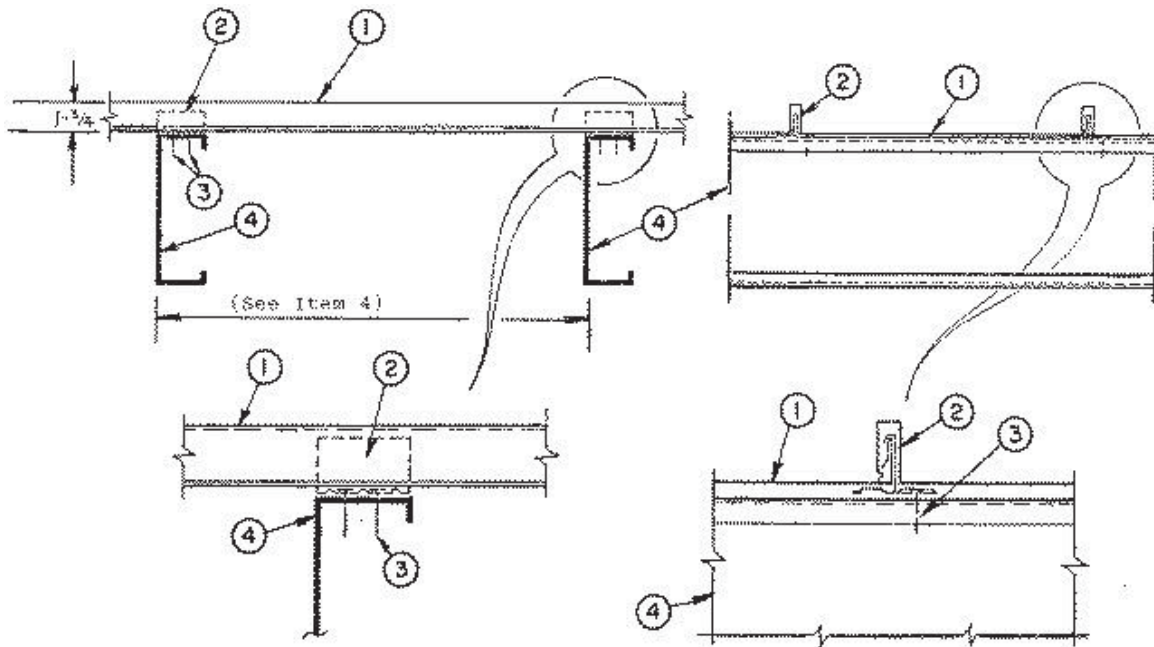
3. **Panel Fasteners (Screws)** — Fasteners used to attach panel clips (Item 2) to purlins (Item 4) when no rigid insulation (Item 5) is used to be No. 10-16 by 1 in. long, self-drilling, self-tapping, pancake head, No. 3 point, plated steel screws. When rigid insulation is used, No. 14-13 DPI carbon, pancake head combination Square/Phillips Drive screws to be used. Length to penetrate steel minimum of 5/8 in. Two screws per clip to be used, inserted through panel clip guide holes.

4. **Purlins** — No. 16 MSG min thickness steel (50,000 psi min yield strength).
Spacing — For 22 MSG thickness panels - 60 in. OC
For 24 MSG thickness panels - 48 in. OC

Construction No. 255

Uplift — Class 90 and 60 (See Item No. 4)

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min thickness coated steel. Panel width 18 in. max., 10 in. min. Rib height 1-3/4 in. at female side. Panels continuous over two or more spans. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* — (Panel Clips)** — One piece assembly, 3-1/2 in. wide, 1-7/8 in. high. One panel clip located at each purlin intersection.

2A. **Roof Deck Fasteners (Bearing Plate)** — (Not Shown) - No. 16 MSG coated steel, 4 in. by 5 in. with guide holes. Used when Rigid Insulation (Item 5) is used.

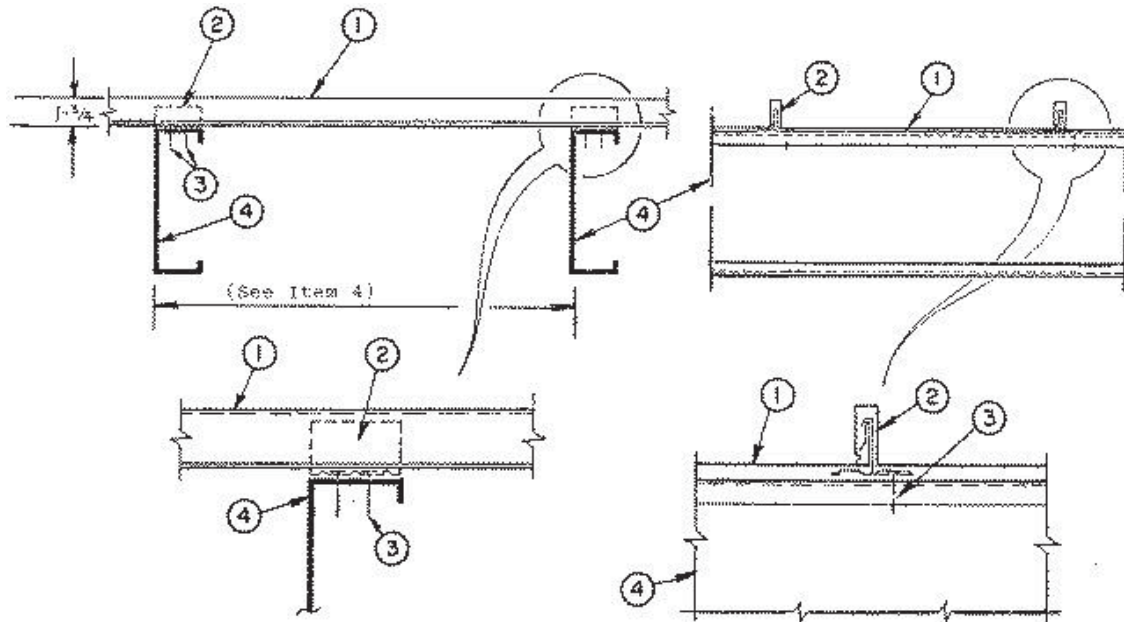
3. **Panel Fasteners (Screws)** — Fasteners used to attach panel clips (Item 2) to purlins (Item 4) when no rigid insulation (Item 5) is used to be No. 10-16 by 1 in. long, self-drilling, self-tapping, pancake head, No. 3 point, plated steel screws. When rigid insulation is used, No. 14-13 DP1 carbon, pancake head combination Square/Phillips Drive screws to be used. Length to penetrate steel minimum of 5/8 in. Two screws per clip to be used, inserted through panel clip guide holes.

4. Purlins — No. 16 MSG min thickness steel (50,000 psi min yield strength). Spacing for Class 90 to be 48 in. OC:
For Class 60 to be 60 in. OC

Construction No. 261

Uplift — Class 90 and 60 (See Item No. 4)

Fire Not Investigated



1. **Metal Roof Deck Panels*** — 0.032 in. thick aluminum or No. 24 MSG min thickness coated steel. Panels 10-1/2 in. wide, 1-3/4 in. high at the ribs. Panels continuous over two or more spans. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* (Panel Clips)** — One piece assembly, 3-1/8 in. wide, 1-7/8 in. high. One panel clip located at each purlin intersection. Min thickness 0.048 in. (No. 18 MSG).

3. **Panel Fasteners (Screws)** — Fasteners used to attach panel clips (Item 2) to purlins (Item 4) when no rigid insulation (Item 5) is used to be No. 10-16 by 1 in. long, self-drilling, self-tapping, pancake head, No. 3 point, plated steel screws. When rigid insulation is used, No. 14-13 DP1 carbon, pancake head combination Square/Phillips Drive screws to be used. Length to penetrate steel minimum of 5/8 in. Two screws per clip to be used, inserted through panel clip guide holes.

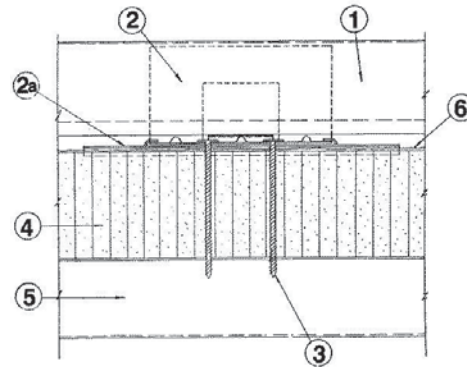
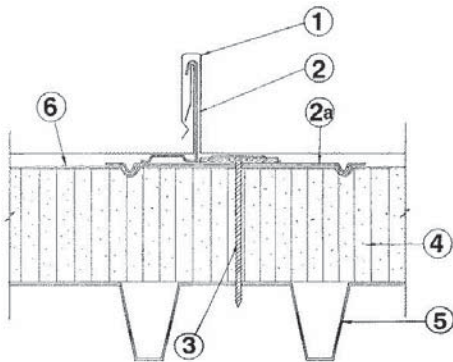
4. **Purlins** — No. 16 MSG min thickness steel (50,000 psi min yield strength).
Spacing:

For aluminum panels:	For Class 90 to be 36 in. OC.
	For Class 60 to be 48 in. OC.
For steel panels:	22 MSG thick to be 60 in. OC.
	24 MSG thick to be 48 in. OC.

Construction No. 303

Uplift — Class 90

Fire Not Investigated (except when 4B is used)



1. Metal Roof Deck Panels* — No. 24 MSG min thickness coated steel. Panel width 18 in. max., 10 in. min. ribs height 1-3/4 in. at female side. Panels continuous over three or more clips with no end laps. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

1A. Metal Roof Deck Panels* — (Not Shown) — To be used with Roof Deck Fastener (2E). 0.032 in. min thick aluminum, 16 in. wide, 1-3/4 in. high at the rib. Panels continuous over three or more clips with no end laps. A bead of sealant may be used at panel side joints.

2. Roof Deck Fasteners* (Panel Clips) — One piece assembly, No. 24 MSG min thickness, 3-1/2 in. wide, 1-15/16 in. high. Clip spacing to be 48 in. OC. Clips to interface with Item 2A (bearing plate).

2A. Roof Deck Fasteners* (Bearing Plate) — One piece assembly, No. 24 MSG min thickness steel, 4-1/2 in. wide, 6 in. long.

2B. Bearing Plate — (Not Shown) To be used with "Lock-Seam UL 90 Clip", "Permaseam Clip", "K-Lok Structural Clips" or "MP-175 Clip" only, (Item 2). Bearing plates to be 16 MSG min coated steel, 3-7/8 wide by 5 in long (50,000 psi min yield strength).

2C. Bearing Plate* — (Not Shown) — To be used with "Snap-Clad Clips" only (Item 2). To be 24 MSG thick coated steel, nom 4-5/8 in. wide by 6 in. long.

2D. Bearing Plate — (Not Shown) — To be used with "Vertical Seam Clip" only (Item 2) — Flat plate, 4 in. wide, 5 in. long fabricated from No. 20 MSG coated steel. Two 1/4 in. diam guide holes located to accommodate panel clip screw fasteners. (50,000 psi min yield strength).

2E. Roof Deck Fasteners* (Panel Clips) — (Not Shown) — One piece assembly, 3-1/2 in. wide, 1-7/8 in high with a 1-3/8 in. wide horizontal leg. No. 18 MSG min thick coated steel. Two 1/4 in. guide holes located in horizontal leg. Clips spaced 18 in. OC.

3. Panel Fasteners — (Screws) — Fasteners used to attach panel clips and bearing plates (Items 2 & 2A) through rigid insulation and optional OSB and/or gypsum board and into light gauge steel deck (Item No. 5) to be No. 14 truss head type with No. 3 Phillips drive, self-drilling steel screws. Two screws per clip to be used, inserted through 1/4 in. diam guide holes. Fasteners to penetrate liner panel 3/4 in. min.

3A. Panel Fasteners (Screws) — (Not Shown) — For Steelox Systems L L C, as an alternate, when no Rigid Insulation (Item 4) is used, No. 10-16 by min 1 in. long TEK 3 Carbon pancake head, self-drilling, self-tapping screws to be used. When rigid insulation is used, No. 14-13 by varying lengths, DP1, carbon, pancake-head, Square/Phillips Head screws to be used. Two fasteners per clip to be used for either type.

4. Foamed Plastic — (Rigid Insulation) — Min thickness 1 in., max thickness 4-1/2 in. Density to be a min of 1.8 pcf. or see products Classified under TJBX Category. Note: For Steelox Systems L L C, rigid insulation may be omitted. See Item 3A for fastener type.

4A. Oriented Strand Board (OSB) — (Optional) — (Not Shown) — Located over foamed plastic (Item 4). Max thickness 7/16 in. Note: Bearing plates not required when OSB is used.

4B. Gypsum Board — (Optional) — Max thickness 5/8 in. Located over liner panel (Item 5).

4C. Foamed Plastic* — (optional) (Not Shown) Rigid Foamed Plastic Insulation, "Foamular Thermapink 18" or "Foamular Thermapink 25", loose laid or mechanically fastened in one or more layers. Total thickness of insulation not to exceed 8 in.

5. Liner Panel — Min thickness No. 22 MSG. Coated steel (33000 psi) min yield strength min depth 1-1/2 in., max pitch 6 in. fabricated to various profiles.

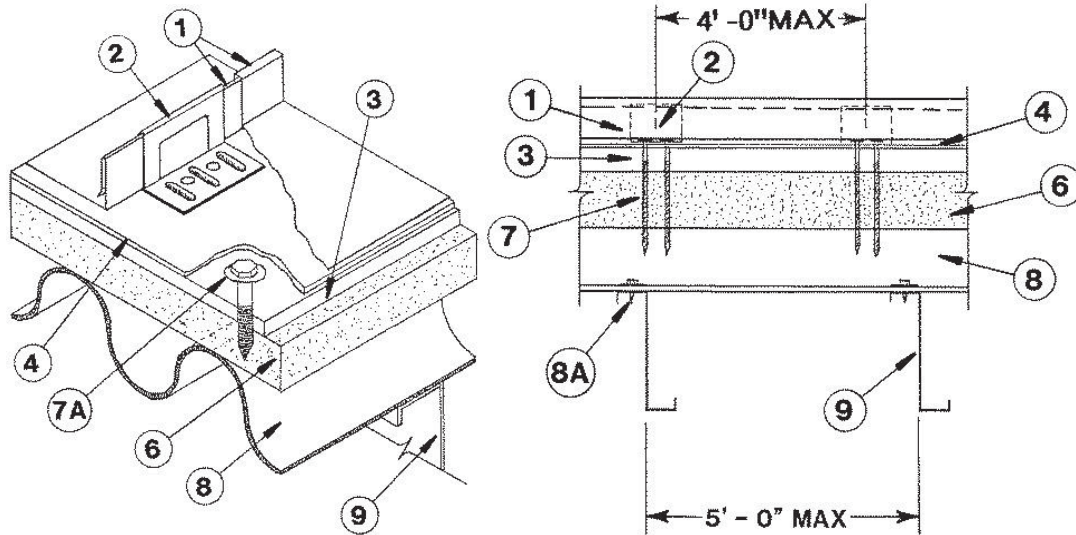
6. Underlayment — (Not shown) — One ply of 30 lb roofing felt or one layer of bituminous resin type water proofing membrane.

7. Supports — (Not Shown) Used to support liner panels, spaced per deck manufacturer's specifications for uplift.

Construction No. 342

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min gauge coated steel. Panel width 18 in. max., 10 in. min. Rib height 1-3/4 in. at female side. A bead of sealant may be used at panel side joints. Panels continuous over three or more clips with no end laps.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* (Panel Clips)** — One piece assembly, No. 24 MSG min thickness, 3-1/2 in. wide, 1-15/16 in. high. Clip spacing to be 48 in. OC.

3. **Gypsum Board* (Mineral Board)** — Min thickness 1/2 in. Opposite side edges have a tongue and groove configuration. Butt (end) joints to be staggered and occur over steel deck crests. Wallboard installed perpendicular to steel deck corrugations.

4. **Vapor Barrier** — (Optional) Installed on top of metal deck (Item 8) or on top of gypsum wallboard (Item 3). Minimum 6 mil plastic sheet.

5. **Joint Tape** — (Not Shown) All wallboard joints shall be taped with 2.5 in. wide joint tape supplied by the manufacturer.

6. **Foamed Plastic — (Rigid Insulation)** — (Optional) — Expanded polystyrene supplied in 4 by 8 ft sheets, min thickness 13/16 in., min density 1.0 pcf, or (Rigid Insulation) Polyisocyanurate supplied in 4 by 8 ft sheets or (Rigid Insulation) Phenolic supplied in 4 by 8 ft sheets. All end joints to be staggered with respect to adjoining rows. All joints to be offset from joints in mineral board (Item 3).

7. **Fasteners** — For attaching panel clips to steel deck to be two 0.140 in. diam threaded shank Phillips, bugle or trumpet head, self-drilling, self-tapping corrosion resistant coated steel screws supplied by roof deck manufacturer. Screws shall penetrate steel deck min 1/2 in.

7A. **Fasteners** — For attaching wallboard to steel deck (Item 8) to be min 0.140 in. diam threaded shank Phillips, bugle or trumpet head, self-drilling, self-tapping, corrosion resistant coated steel screws supplied by the manufacturer. Screws are installed into top corrugations of steel deck through nom 3 by 3 in. corrosion resistant steel roof deck plates, spaced in a pattern as determined by the pitch of the steel deck with the min density of 21 fasteners per 4 by 8 ft sheet (Item 3).

7B. **Panel Fasteners (Screws)** — For Steelox Systems L L C, as an alternate, when no Rigid Insulation (Item 4) is used, No. 10-16 by min 1 in. long TEK 3 Carbon pancake head, self-drilling, self-tapping screws to be used. When rigid insulation is used, No. 14-13 by varying lengths, DP1, carbon, pancake-head, Square/Phillips Head screws to be used. Two fasteners per clip to be used for either type. See Item 8 for steel deck thickness.

8. **Steel Deck** — Fabricated to various profiles, min yield strength 33,000 psi. Steel deck profile, support spacing and method of positioning (end and side laps) and fastening of deck to supports to be per deck manufacturers requirements for uplift loading. Deck thickness to accommodate panel clip screw fastener pullout strength. When fasteners described in Item 7B are used, min thickness to be No. 22 MSG

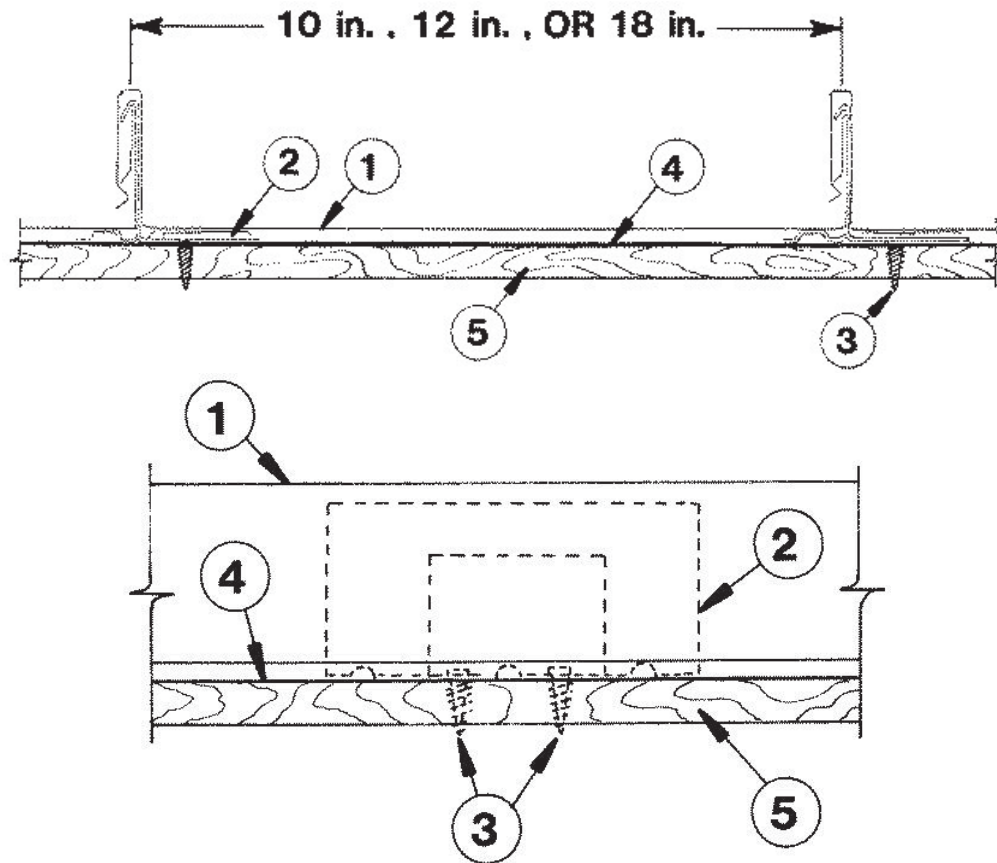
8A. **Deck Fasteners** — Steel deck panels to be fastened to structural supports and at laps using ARC spot welds with weld washers or screw fasteners per deck manufacturer's requirements for uplift loading.

9. **Purlins** — 16 MSG min gauge steel (min yield strength 50,000 PSI) or min Type H open web joists.

Construction No. 343

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min coated steel. Panel width 18 in. max., 10 in. min. Rib height 1-3/4 in. at female side. Panels continuous over three or more clips with no endlaps. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners*(Panel Clips)** — One piece assembly, 3-1/2 in. wide, 1-7/8 in. high. Min thickness No. 18 MSG. Clips spaced 36 in. OC, max, fastened to plywood deck.

3. **Fasteners (Screws)** — Fasteners used to attach panel clips (Item 2) to plywood to be No. 10-12 by 1 in. long pancake head, No. 2 Phillips drive, A-point, coated steel screw. Min two fasteners per clip to be used. When Items 5A (Rigid Insulation) and 5B (Bearing Plate) are used, No. 12 Dekfast fastener to be used and installed through clip (Item 2), bearing plate (Item 5B), rigid insulation (Item 5A) and plywood decking (Item 5A). Length of fastener to be equal to total thickness plus 7/8 in.

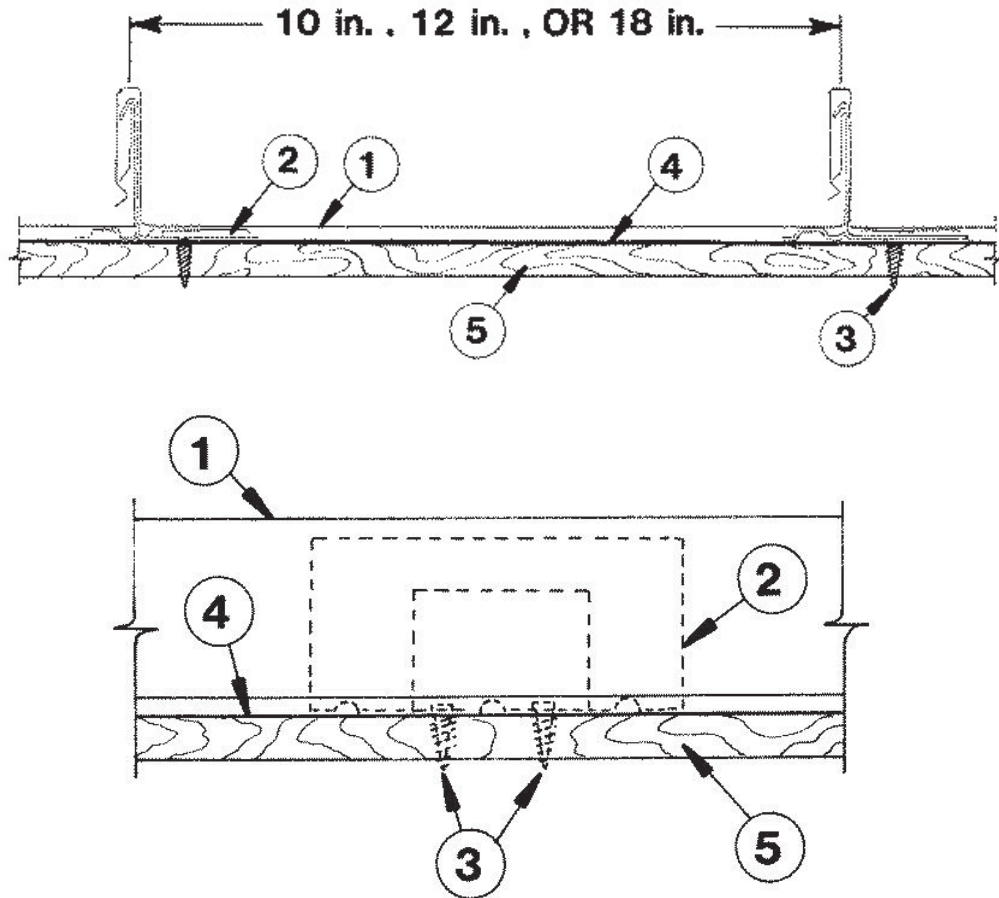
4. **Underlayment** — Underlayment used over plywood deck to be Type 15 or 30 organic felt. Sides overlapped min 2 in., end laps per manufacturer's instructions. Felt nailed to plywood deck with 1-1/4 in. long steel cap nails, located per manufacturer's instructions. Nail spacing to be max 12 in. OC at the side lap and max 24 in. OC in interior rows. **As An Alternate** — A self-adhering modified bitumen water proofing membrane may be used, installed per manufacturer's instructions. Note - when alternate is used the plywood joints need not be sealed.

5. **Plywood Decking** — Plywood decking to be graded per PS83 specifications, 19/32 in. thick, exposure 1, APA Rated Sheathing (42/20) square edged. Butt ends not blocked. All butt and side joints to be sealed with a one part urethane caulk sealant applied with a caulking gun and feathered outward from the joint. (Note exception under Item No. 4, Alternate.)

Construction No. 414

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min coated steel panels, 18 in. max width, 1-3/4 in. high at female side rib. Panels continuous over three or more clips with no endlaps. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* (Panel Clips)** — One piece assembly, 3-1/2 in. wide, 1-7/8 in. high. Min thickness 18 MSG. Clips spaced 36 in. OC, max, fastened to plywood deck.

3. **Fasteners (Screws)** — Fasteners used to attach panel clips (Item 2) to plywood to be No. 10-12 by 1 in. long pancake head, No. 2 Phillips drive, A-point, coated steel screw. Min two fasteners per clip to be used.

4. **Underlayment** — Underlayment used over plywood deck to be Type 15 or 30 organic felt.

As an Alternate-A self-adhering modified bitumen water proofing membrane may be used, installed per manufacturer's instructions. Note - when alternate is used the plywood joints need not be sealed.

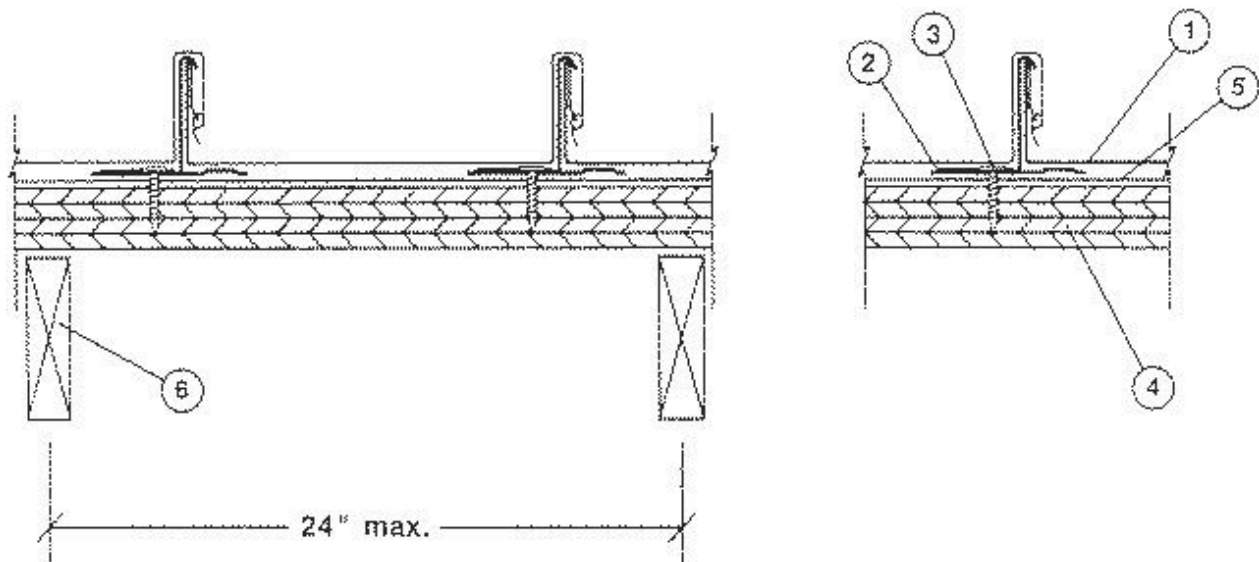
5. **Plywood Decking** — Plywood decking to be graded per PS83 specifications, 19/32 in. thick, exposure 1, APA Rated Sheathing (42/20) square edged. Butt ends not blocked. All butt and side joints to be sealed with a one part urethane caulk sealant applied with a caulking gun and feathered outward from the joint. (Note exception under Item No. 4, Alternate).

*Bearing the UL Classification Mark

Construction No. 436

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min coated steel. Max panel width 18 in., rib height 1-3/4 in. Panels continuous over two or more spans. Endlap for panels to be overlapped 6 in. A bead of sealant may be used at panel ends and side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* — (Panel Clips)** — One piece assembly, 3-1/2 in. wide by 1-7/8 in high. Clip spacing to be 48 in. OC.

3. **Fasteners — (Screws)** — Screws used to attach the panel clips to Substructure (Item 4) to be No. 10 by 1 in long Pancake head wood screws with a No. 2 Phillips head or 10x1 in., 1/4 in. Hex Head Woodgrip. Two screws per clip.

Screws used to attach Substructure (Item 4) to wood trusses or joists (Item 6) to be No. 8 by 2 in. Bugle head screws. As an optional fastener, 2-1/2 in. long 8d common deformed shank nails may be used. Fasteners used at endlaps to be 14x1 in. Type AB or 10x1 in. woodgrip.

When light gauge structural steel joists are used, screws to be No. 12 by 1-5/8 in. long with a Phillips head.

Spacing of screws to be 6 in. OC at plywood or OSB ends and 12 in. OC at interior joists.

4. **Substructure (Plywood or OSB)** — Plywood decking or oriented strand board (OSB) to be a nom 5/8 in. thick, exposure sheathing span C-D, 40/20 plywood. (All butt joints to be sealed against leakage by using tape and/or caulking). In lieu of plywood, 1 in. tongue and groove decking may be used.

5. **Moisture Barrier — (Optional)** — Any suitable membrane to protect Substructure (Item 4).

6. **Joists** — Joists, spaced at 2 ft, 0 in. OC max (when tongue and groove decking is used, joist spacing may be 30 in. OC max), may be one of the following:

A. Nom 2 by 6 in. wood joists, No. 2 or better.

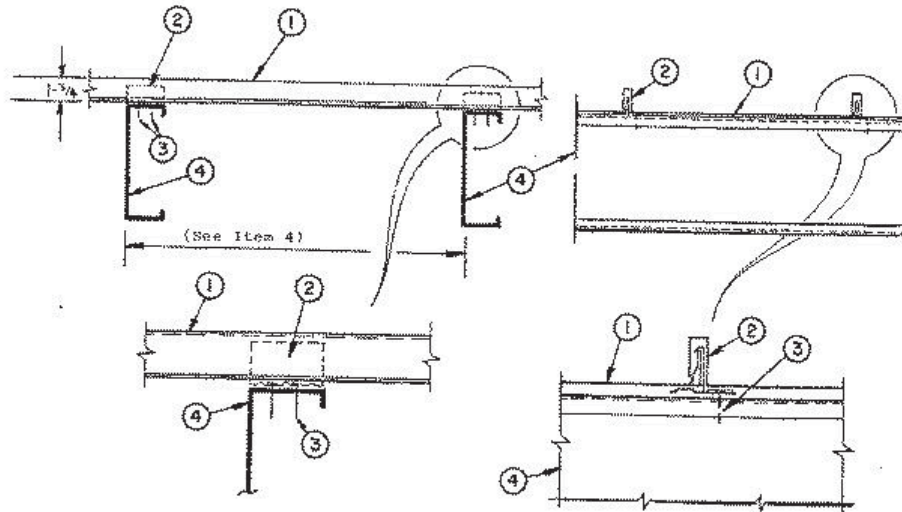
B. Nom 2 by 4 in wood when used on a top chord of a wood truss, No. 2 or better.

C. Light gauge structural steel framing with the member against the plywood to be a min No. 22 MSG coated steel.

Construction No. 445

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min coated steel. Max panel width 12 in., rib height 1-3/4 in. Panels continuous over two or more spans. No endlaps. A bead of sealant may be used at panel ends and side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* — (Panel Clips)** — One piece assembly, 3-1/2 in. wide by 1-7/8 in. high. Clip spacing to be 48 in. OC.

3. **Panel Fasteners — (Screws)** — Screws used to attach panel clips (Item 2) to purlins (Item 4) to be No. 10x1 in. long No. 3 self-drilling point, No. 2 Phillips Pancake head. Two screws per clip.

4. **Purlins** — No. 16 MSG min thickness steel (min yield 50 ksi).

Spacing —	For 22 MSG thickness panels - 60 in. OC.
	For 24 MSG thickness panels - 48 in. OC.

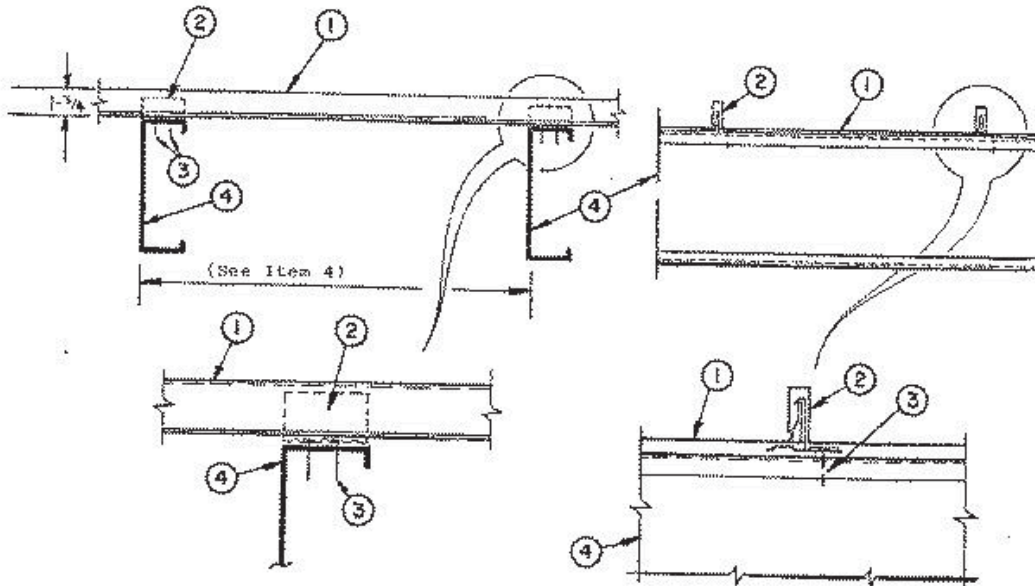
5. **Insulation — (Optional) (not shown)** — 3 in. thick vinyl faced blanket insulation. To be installed between metal panels (Item 1) and purlins (Item 4).

*Bearing the UL Classification Mark

Construction No. 446

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min coated steel. Max panel width 18 in., rib height 1-3/4 in. Panels continuous over two or more spans. No endlaps. A bead of sealant may be used at panel ends and side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* — (Panel Clips)** — One piece assembly, 3-1/2 in. wide by 1-7/8 in. high. Clip spacing to be 48 in. OC.

3. **Panel Fasteners — (Screws)** — Screws used to attach panel clips (Item 2) to purlins to be No. 10 by 1 in. long No. 3 self-drilling point, No. 2 Phillips Pancake head. Two screws per clip.

4. **Purlins** — No. 16 MSG min thickness steel (min yield 50 ksi) spaced 48 in. OC.

5. **Insulation — (Optional) (not shown)** — 3 in. thick vinyl faced blanket insulation. To be installed between metal panels (Item 1) and purlins (Item 4).

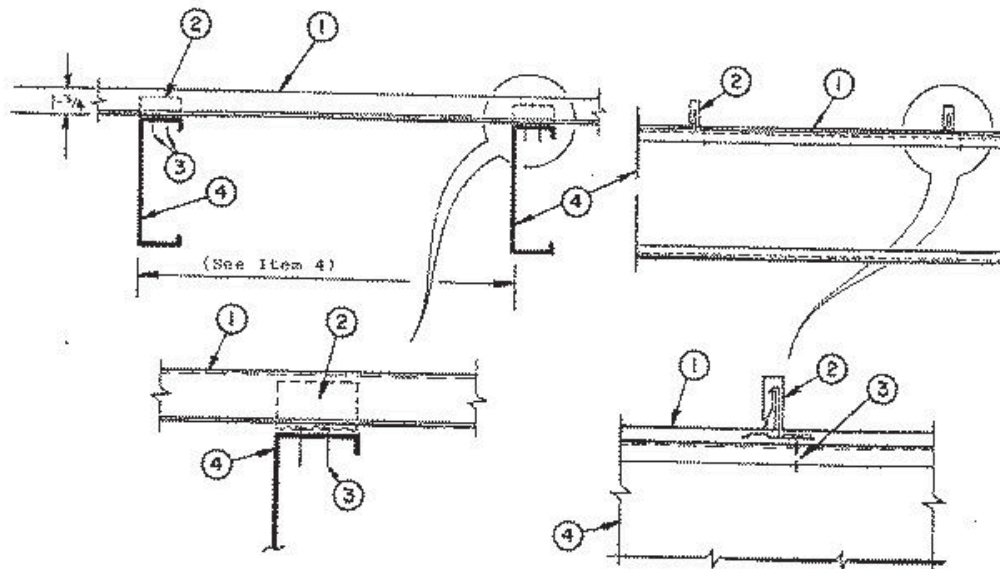
5A. **Insulation** — (Optional) (not shown) - 1/4 in. thick closed/microcellular polyethylene insulation with foil facing designated "Low-E Insulation™." To be installed between metal panels (Item 1) and purlins (Item 4).

*Bearing the UL Classification Mark

Construction No. 447

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — 0.032 in. thick aluminum or No. 24 MSG min thickness coated steel. Panels 10 in. wide, 1-3/4 in. high at the ribs. Panels continuous over two or more spans. No endlaps. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* — (Panel Clips)** — One piece assembly, 3-1/2 in. wide by 1-7/8 in. high. One panel clip located at each purlin intersection.

3. **Panel Fasteners — (Screws)** — Screws used to attach panel clips (Item 2) to purlins (Item 4) to be No. 10x1 in. long No. 3 self-drilling point. No. 2 Phillips Pancake head. Two screws per clip.

4. **Purlins** — No. 16 MSG min thickness steel (min yield 50 ksi).

Spacing —

For 0.032 in. thick aluminum panels	36 in. OC.
For 22 MSG thickness panels	60 in. OC.
For 24 MSG thickness panels	48 in. OC.

5. **Insulation — (Optional)—(Not shown)** — 3 in. thick vinyl faced blanket insulation. To be installed between metal panels (Item 1) and purlins (Item 4).

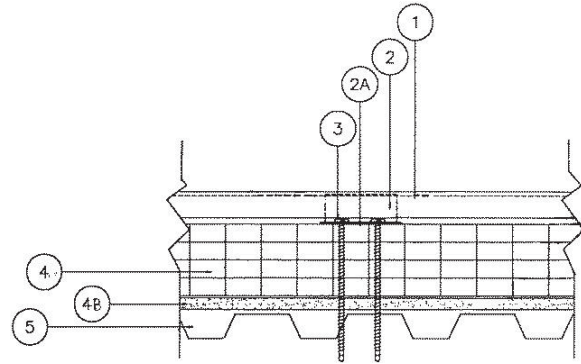
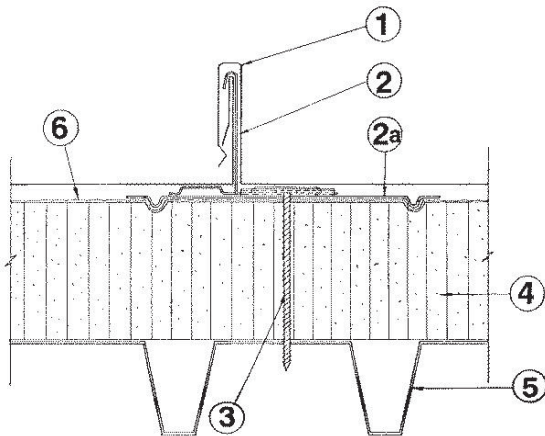
Refer to General Information, Roof Deck Constructions, for Items Not Evaluated.

*Bearing the UL Classification Mark

Construction No. 448

Uplift — Class 90

Fire Not Investigated



1. Metal Roof Deck Panels* — No. 24 MSG min coated steel. Max panel width 18 in., rib height 1-3/4 in. Panels continuous over three or more spans. Endlaps for panels to be overlapped 6 in. and to include back up plate (Item 2B). A bead of sealant may be used at panel ends and side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. Roof Deck Fasteners* — (Panel Clips) — One piece assembly, 3-1/2 in. wide by 1-7/8 in. high. Clip spacing to be 48 in. OC.

2A. Bearing Plate — (Optional) — To be used in lieu of plywood or OSB (Item 4A) with rigid insulation (Item 4). Bearing plates to be 16 MSG min coated steel. Located under each clip (Item 2) for support.

2B. Endlap Back-Up Plate — (Not shown) — No. 16 MSG min coated steel, width of back up plate to correspond to width of panel. Two 1 in. wide by 3/4 in. long tabs are used for sliding over end of panels.

3. Panel Fasteners — (Screws) — Screws used to attach the panel clips and bearing plates (Items 2 and 2A) through rigid insulation and into metal deck (Item 5). Screws to be No. 14 Truss head with No. 3 Phillips drive. Length to be a min of 1/2 in. longer than thickness of rigid insulation and metal deck. Two screws per clip. Fasteners used at endlaps to be one of the following: 14x1 in. Type AB self-tapper; 14x1-1/4 in. Hex washer head self-driller; 14x1 in. Type AB Phillips stainless steel self-tapper.

4. Rigid Insulation — (Optional) — Foamed plastic, max thickness 4 in. Density to be a min of 2 PCF.

4A. Plywood or OSB — (Optional) (Not Shown) — Min APA rated plywood, exposure sheathing span C-D 40/20, nom 1/2 in. thick, or Oriented Strand Board (OSB), nom 7/16 in. thick. 4x8 ft. Sheets to be installed on top of rigid insulation (Item 4) in lieu of bearing plates (Item 2A).

4B. Gypsum Board — (Optional) — Any 5/8 in. thick gypsum wallboard supplied in sheets 2x4 ft to 4x12 ft. Applied perpendicular to steel roof deck direction with adhesive. End joints to occur over crests of steel roof deck and be staggered 2 ft in adjacent rows. The total cumulative thickness of the rigid board (Item 4) and the gypsum may not exceed 4 in.

5. Metal Deck — No. 22 MSG min thickness coated steel. Min yield strength 33 KSI. Min depth 1-1/2 in. Max pitch 6 in.

6. Vapor Barrier — (Optional) — Installed on top of metal deck (Item 5) or on top of gypsum wallboard (Item 4B) if used. Min 6 mil plastic sheet.

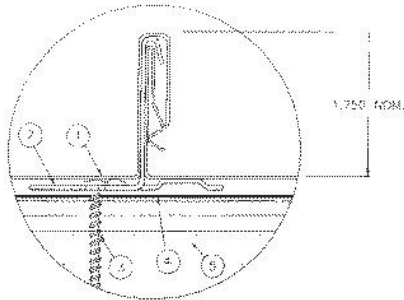
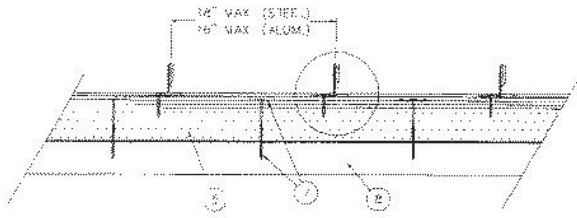
6A. Waterproof Membrane — (Optional) (Not shown) — Used to protect plywood or OSB (Item 4A). Installed under panels (Item 1).

7. Supports — (Not shown) — Used to support metal deck, spaced per deck manufacturer's specifications.

Construction No. 508A

Uplift — Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — (when used with nailable insulation) No. 24 MSG min thick coated steel panels, 18 in., 16 in., 12 in. or 10 in. wide or 0.032 in. min thick aluminum, 16 in., 12 in. or 10 in. wide; 1-3/4 in. high at female side rib. Panels continuous over three or more clips with no end laps. A bead of sealant may be used at panel side joints.

METAL ROOFING SYSTEMS INC. - "MRS System 2000"

2. **Roof Deck Fasteners* (Panel Clips)** — One piece assembly, 3-1/2 in. wide, 1-7/8 in. high. No. 18 MSG min thick coated steel. Clips spaced 36 in. OC max for steel panels and 18 in. OC max for aluminum panels. Fastened to nailable insulation (Item 5).

2A. **Roof Deck Fasteners* (Panel Clips)** — One piece assembly, 3-1/2 in. wide, 1-7/8 in. high. No. 18 MSG min thick coated steel. Clips spaced 36 in. OC max for steel panels. Fastened to structural cement-Fiber unit

3. **Fasteners (Screws)** — Fasteners used to attach panel clip (Item 2) to nailable insulation (Item 5), or structural cement-fiber units (Items 5A or 5D) to be No. 10-12 by 1 in. long pancake head, No. 2 Phillips drive, A-point, coated steel screws. Min two fasteners per clip.

4. **Underlayment** — Underlayment used over nailable insulation (Item 5) to be Type 30 organic felt. Sides overlapped min 2 in. End laps per manufacturer's instructions. Felt nailed to nailable insulation with 1 in. long galvanized steel roofing nails, located in side laps and between side lap per manufacturer's instructions. Nail spacing to be max 12 in. OC at the side lap and max 24 in. OC in interior rows.

5. **Nailable Insulation** — Consisting of 1 in. min. to 3-1/2 in. max thick Classified polyisocyanurate foamed plastic with a factory laminated 7/16 in. thick APA rated O.S.B. Density of foamed plastic to be 2 pcf.

5A. **Structural Cement-Fiber Unit (Substructure)** — (Not Shown) (used in lieu of Nailable Insulation (Item 5)) Consists of a minimum 5 in. thick composite structural cement-fiber units with foamed plastic core of a minimum 0.95 PCF density expanded polystyrene and 7/16 in OSB structural use panels on one face. All transverse butt joints are to occur over structural support. Unit will be designated as plank (tongue and groove) when used without truss tees (Item 5B). Unit will be designated as tile (rabbetted) when used with truss tees.

5B. **Truss Tee** — (Optional) (Not Shown) Minimum size to be 5-6-17-2. Maximum spacing to be 48-1/4 in. OC. Tees to be welded to structural support (Item 6) with a 3/4 in. fillet weld on both sides of tee.

5C. **Tectum Grout** — (Optional) (Not Shown) Used with truss tee (Item 5B) and tile (rabbetted) type substructure (Item 5A). Grout to fill void between substructure tiles around and above truss tee.

5D. **Structural Cement-Fiber Unit (Substructure)** — (Not Shown) (May be used in lieu of Item 5A) Consists of a minimum 5 in. thick composite structural cement-fiber units with foamed plastic core of a minimum 1.5 PCF density expanded polystyrene 7/16 in OSB structural use panels on one face. All transverse butt joints are to occur over structural support. Unit will be designated as plank (tongue and groove) when used without truss tees (Item 5B). Unit will be designated as tile (rabbetted) when used with truss tees.

6. **Supports (Purlins)** — (Not shown) — Purlins used for liner panel (Item 8) support to be cold formed steel sections. As alternatives, structural steel components (hot rolled beams, channels, open web joists, etc.) may be used. Min gauge and yield to depend on design considerations for uplift loading with max spacing to be 6 ft OC. As alternatives, structural steel components (hot rolled beams, channels, open web joists, etc.) may be used. Size and spacing of structural components to depend on design considerations.

7. **Fasteners (Screws)** — Fasteners used to attach nailable insulation (Item 5) to liner panel (Item 8) to be No. 11-13, No. 3 Phillips drive, truss head, painted steel screws. Length to depend on overall thickness of deck and to penetrate steel deck 1/2 in. min.

A 2 in. diameter formed pressure plate fabricated from No. 22 MSG coated steel to be used with each screw. Fasteners located in three rows along the 8 ft length of the nailable insulation beginning 6 in. from the 8 ft edges with a row down the center and spaced 21 in. OC beginning 6 in. from the 4 ft edges. A total of 15 fasteners used for each 4 by 8 ft board.

Fasteners used to attach Structural Cement Fiber Units (Items 5A or 5D) to structural support (Item 6) to be minimum 6 in. long, No. 14 screw with 5/8 in. diameter head. Fasteners are spaced a maximum of 12 in. OC at each joist along butt end. Pre-drilling with a 3/16 in. bit for steel up to 1/8 in. thick or with a 7/32 in. bit for steel greater than 1/8 in. thick when required.

8. **Liner Panel (Steel Deck)** — (Optional when structural cement fiber units (items 5A or 5B) are used) No. 22 MSG min thick coated steel. Min depth 1-1/2 in., max pitch 6 in. fabricated to various profiles. Min yield strength 33,000 psi. Fastened to supports (Item 6) with fastener type and spacing per liner panel manufacturers instructions for uplift loading.

9. **Gypsum Board** — (Optional) (Not shown) — Max thick 5/8 in. supplied in 4 by 8 ft sheets. Butt joints located over crests of metal roof deck panel (Item 1). Fastened to panel with same fasteners used for nailable insulation (Item 5).

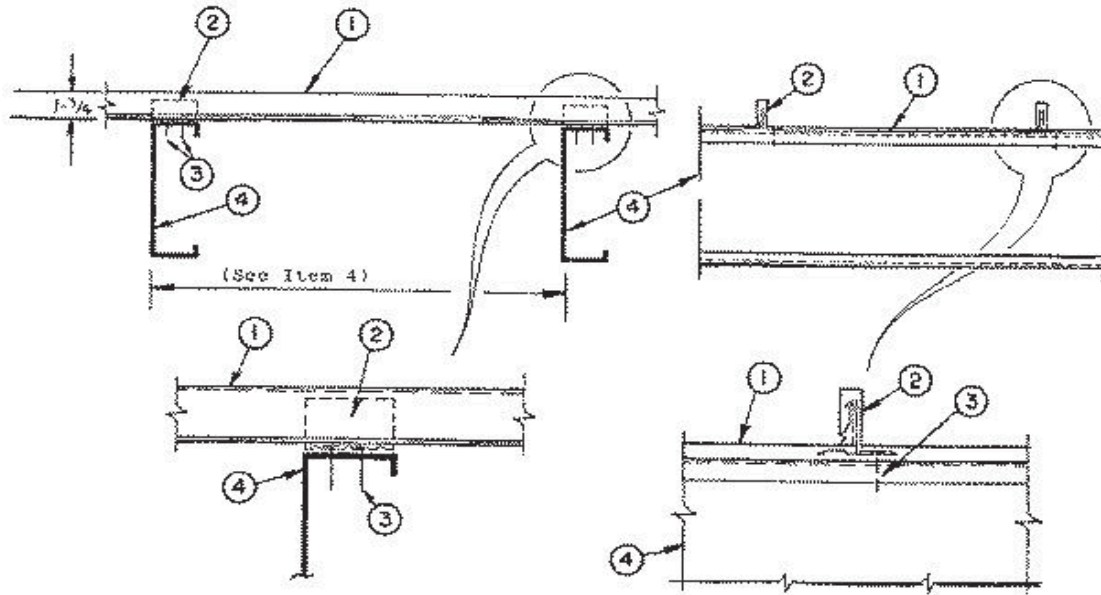
Refer to General Information, Roof Deck Construction (Roofing Materials and Systems Directory) for items not evaluated.

*Bearing the UL Classification Mark

Construction No. 543

Uplift – Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG (minimum) thickness coated steel. Maximum panel width 18 inches by 1-3/4 inches high at the ribs. Panels continuous over two or more spans with no end laps. A bead of sealant may be used at the panel side joint.

METAL ROOFING SYSTEMS INC. — "MRS System 2000"

2. **Roof Deck Fasteners*—(Panel Clips)** — One piece assembly, 3-1/2 inches wide, 1-7/8 inches high. Minimum thickness No. 18 MSG. One clip located at each purlin intersection.

3. **Fasteners (screws)** — Fasteners used to attach panel clips (Item No. 2) to purlins to be No 10-16 by 1 inch long plated steel pancake head No. 2 Phillips drive with a No. 3 self-drilling point. Two screws per clip.

4. **Purlins** — No. 16 MSG minimum thickness steel with a minimum yield strength of 50,000 psi. Purlin spacing as follows:
a) 48 inch purlin spacing for class 90 rating for No. 24 MSG panels in all widths.
b) 60 inch purlin spacing for class 90 rating for No. 22 MSG 12 inch wide panels only.
c) 60 inch purlin spacing for class 60 rating for No. 22 MSG panels in all widths.

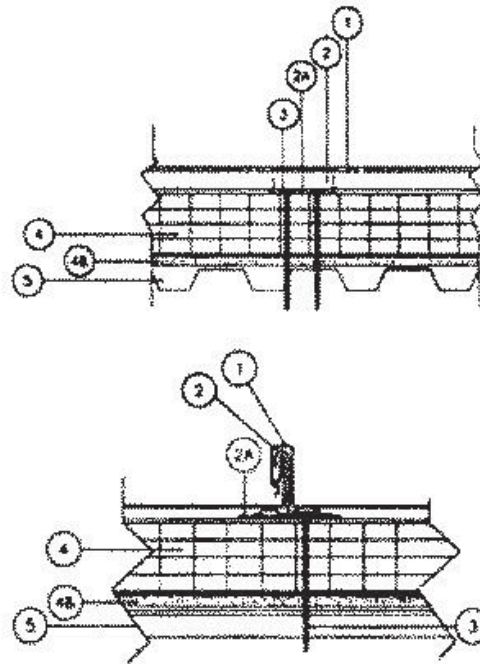
5. **Insulation** — (optional)-Any compressible blanket insulation, 3 inches max. thickness when located between panels (Item No. 1) and purlin (Item No. 4).

*Bearing the UL Classification Mark

Construction No. 544

Uplift – Class 90

Fire Not Investigated



1. **Metal Roof Deck Panels*** — No. 24 MSG min. Coated steel. Max. panel width 18 inches and rib height 1-3/4 inches. Panels continuous over two or more spans. Endlap for panels to be overlapped 6 in. A bead of sealant may be used at panel ends and side joints.

METAL ROOFING SYSTEMS INC. — "MRS System 2000"

2. **Roof Deck Fasteners*—(Panel Clips)** — One piece assembly, 3-1/2 inches wide, 1-7/8 inches high. Minimum thickness No. 18 MSG. One clip to be used at each purlin. Maximum clip spacing to be 48 inches O.C. Clips to interface with bearing plates (Item No. 2A).

2A. **Bearing Plate** — -No. 24 MSG minimum gauge coated steel, 5 inches wide by 3-7/8 inches long (50,000 psi minimum yield strength).

3. **Panel Fasteners (screws)** — Fasteners used to attach panel clips (Item No. 2) and bearing plates (Item No. 2A) through rigid board insulation (Item No. 4), light gauge steel deck (Item No. 5) and into purlins (Item No.7) to be No. 14 self-tapper. Two screws per clip to be used. Length to be a minimum of 1/2 inch longer than the combined thickness of the liner panel (Item No. 5), rigid insulation (Item No. 4), gypsum wall board (Item No. 4B) and plywood or oriented strand board (Item No. 4A).

4. **Foamed Plastic-(rigid insulation)** — Minimum thickness 1 inch, maximum thickness 6 inches. Density to be a minimum of 2 pcf.

4A. **Plywood or OSB** — (optional)—(not shown)-Minimum APA rated plywood or Oriented Strand Board (OSB), nominal thickness 1/2 inch. To be installed over Rigid Board (Item No. 4) in lieu of bearing plates (Item No. 2A).

4B. **Gypsum Wallboard** — (optional)—(Any 5/8 inch thick gypsum wallboard supplied in sheets 2x4 to 4x12 foot. Applied with adhesive perpendicular to steel liner panel (Item No. 5). End joints to occur over crests of steel liner panel (Item No. 5) and be staggered 2 foot in adjacent rows. The total cumulative thickness of the rigid board (Item No. 4), plywood/OSB (Item No. 4A) and gypsum board (Item No. 4B) may not exceed 6 inches.

5. **Liner Panel** — (optional)-No. 29 MSG minimum steel. Minimum yield strength 80,000 psi, minimum depth 9/16 inches, maximum pitch 2.6667 inches O.C.

6. **Underlayment** — (optional) (Not Shown) —Any suitable membrane to protect substructure (Item 4A).

7. **Supports (Purlins)** — (not shown)-No. 16 MSG minimum thickness coated steel with a minimum yield strength of 50,000 psi. Or minimum "H" series open-web joists. Maximum spacing "48" O.C.

*Bearing the UL Classification Mark



American Test Lab, Inc.
1656 Calvert Road, Brevard, N. C. 28712
Phone (828) 884-3700 Fax (828) 884-3710
Web www.atlnc.com E-Mail atli@citcom.net

ATLNC # 0521.01-12

Report Date: 6/21/12

Test Date: 05/21/12

ATLNC Certification # 08-0227.14

FL Organizational # TST 1555

Test Requested By: Metal Roofing Systems
7687 Mikron Drive
Stanley, NC 28164
Phone 704-820-3110

Test Standards: ASTM E 1592-05

Test Conditions: 70-75 degrees F

Description of product tested:

Specimen A, 24 gauge (.026") Galvalume Metal Roof Panels over 3-1/2" x 8" x 16 ga. (.061") Z purlins as shown in MRS System 2000 dwg 1 - 4. The edge and the ends of the panels were attached to the purlins with self drilling screws.

Specimen B, 24 gauge (.026") Galvalume Metal Roof Panels over 3-1/2" x 8" x .061" Z purlins as shown in MRS System 2000 dwg 1 - 4. The edge and the ends of the panels were attached to the purlins with self drilling screws.

Configuration: Specimens Mounted vertically in steel test chamber
Specimen A, (2) 5' purlin spans, 4 panels wide
Specimen B, (4) 1' purlin spans, 4.5 panels wide

Description of Units:

Specimens A, B

Panel Construction- 24 ga (.026") Galvalume steel roof panels 16" wide with 1-3/4" interlocking standing seams per MRS System 2000 dwg 1 - 4. Specimen A -138" long, Specimen B - 72" long

Purlin Construction- 3-1/2" x 8" x 16 ga (.061") Z purlins

Purlin Spacing- Specimen A 2 spans 60" OC with 8" overhang.
Specimen B 4 spans 12" OC with 12" over hang

Screws and Method of Attachment-

Purlins- 18 ga clips attached to purlins with 2 self drilling screws as shown in drawing.

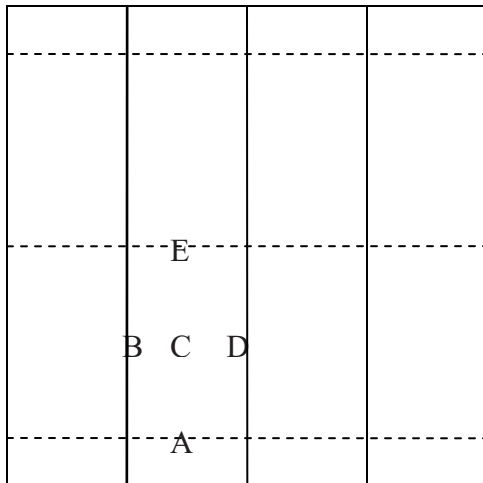
Panel Standing Seams- Overlaps were 16” OC and panels were attached with 18 ga clips at each purlin as shown in drawing.

Purlin Attachment- Each purlin was attached to the chamber.

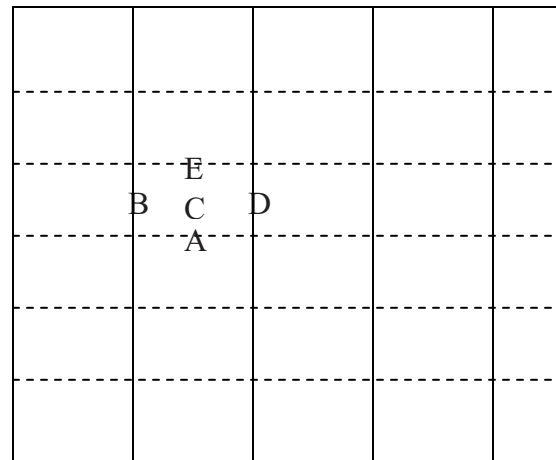
Test Specimens

Indicator Locations

Specimen A



Specimen B



*Drawings not to scale.

Specimen A

Deflections in inches

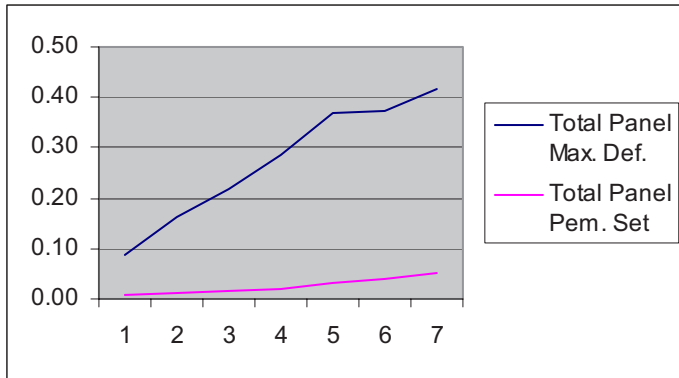
Pressure Increments psf Positive	Time (sec)	End Purlin Between Ribs (A)	Perm. Set	Mid-Span Rib (B)	Perm. Set	Mid-Span (C)	Perm. Set
*RZ 5.6	60						
8	60	.05"	.08"	.01"	.00"	.09"	.01"
12	60	.09"	.08"	.03"	.00"	.16"	.01"
16	60	.11"	.08"	.04"	.00"	.22"	.01"
24	60	.12"	.10"	.06"	.01"	.28"	.02"
28	60	.14"	.10"	.09"	.01"	.37"	.03"
32	60	.14"	.11"	.09"	.01"	.37"	.04"
36	60	.15"	.10"	.11"	.02"	.48"	.05"

Deflections in inches

Pressure Increments	Time (sec)	Mid Span Rib (D)	Perm Set	End Span Purlin mid panel (E)	Perm. Set	Total Panel Deflection	Total Panel Perm. Set
*RZ 5.6	60						
8	60	.02"	.01"	.01"	.01"	.09"	.01"
12	60	.05"	.02"	.03"	.01"	.16"	.01"
16	60	.08"	.03"	.03"	.01"	.22"	.01"
24	60	.11"	.04"	.04"	.02"	.28"	.02"
28	60	.15"	.03"	.06"	.02"	.37"	.03"
32	60	.15"	.05"	.06"	.02"	.37"	.04"
36	60	.18"	.07"	.07"	.02"	.42"	.05"

***Note:** RZ (Reference Zero pressure) is to compensate for vertical test position.
Note: C indicator reading is used as Total Panel Deflection and Permanent Set.

Positive Side Graph



Observations: Deflections increased as pressure increased. No fastener failure occurred.

Deflections in inches

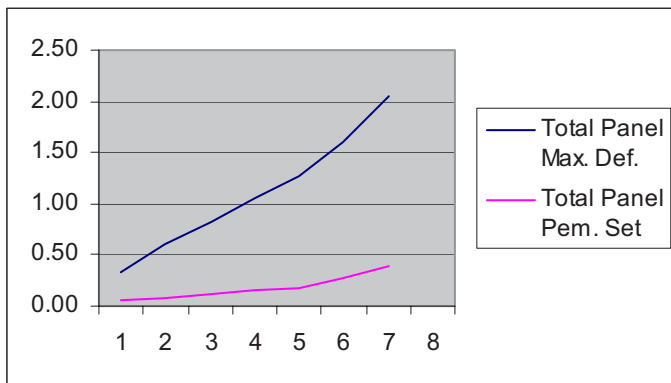
Pressure Increments psf Negative	Time (sec)	End Purlin Between Ribs (A)	Perm. Set	Mid-Span (B)	Perm. Set	Mid-Span (C)	Perm. Set
*RZ 5.6	60						
8	60	.03"	.01"	.12"	.05"	.33"	.05"
16	60	.06"	.01"	.17"	.09"	.61"	.08"
24	60	.07"	.02"	.32"	.12"	.83"	.11"
32	60	.10"	.02"	.42"	.17"	1.05"	.15"
40	60	.12"	.03"	.56"	.20"	1.26"	.18"
48	60	.13"	.04"	.87"	.27"	1.61"	.28"
56	60	.17"	.07"	1.30"	.33"	2.05"	.40"

Pressure Increments psf Negative	Time (sec)	Mid Span (D)	Perm Set	End Span Purlin mid panel (E)	Perm. Set	Total Panel Deflection	Total Panel Perm. Set
*RZ 5.6	60						
8	60	.11"	.03"	.40"	.06"	.33"	.05"
16	60	.19"	.05"	.73"	.16"	.61"	.08"
24	60	.28"	.07"	.10"	.17"	.83"	.11"
32	60	.39"	.14"	1.23"	.23"	1.05"	.15"
40	60	.56"	.16"	1.5"	.31"	1.26"	.18"
48	60	.75"	.19"	1.95"	.46"	1.61"	.28"
56	60	1.07"	.27"	2.48"	.53"	2.05"	.40"

*Note: RZ (Reference Zero pressure) is to compensate for vertical test position.

Note: C indicator reading is used as Total Panel Deflection and Permanent Set.

Negative Side Graph



Observations- Deflections increased as pressure increased. Fastener failure occurred at approximately 57 to 58 psf. The panel disengaged from the clips.

Specimen B

Deflections in inches

Pressure Increments psf Positive	Time (sec)	Purlin Mid Panel (A)	Perm. Set	Mid-Span (B)	Perm. Set	Mid-Span (C)	Perm. Set
*RZ 5.6	60						
12	60	.02	.01	.03	.02	.01	0
24	60	.03	.01	.04	.02	.03	0
36	60	.03	.01	.05	.03	.04	0
48	60	.03	.01	.06	.03	.05	0
60	60	.03	.01	.07	.03	.06	0
72	60	.03	.01	.07	.03	.07	0
84	60	.03	.00	.08	.03	.08	.0
96	60	.03	.00	.08	.03	.10	.0

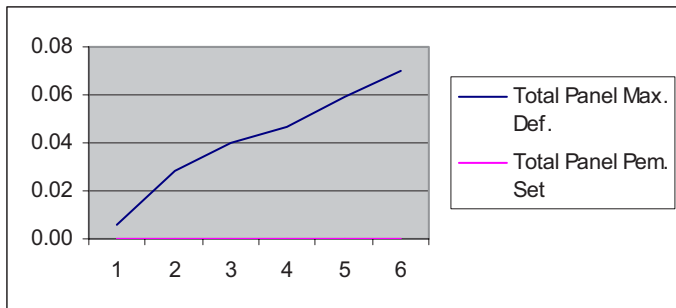
Deflections in inches

Pressure Increments psf Positive	Time (sec)	Mid Span (D)	Perm Set	Purlin mid panel (E)	Perm. Set	Total Panel Deflection	Total Panel Perm. Set
RZ 5.6	60						
12	60	.03	.02	.02	.01	.01	0
24	60	.04	.02	.03	.01	.03	0
36	60	.05	.03	.04	.01	.04	0
48	60	.06	.03	.05	.02	.05	0
60	60	.07	.03	.05	.02	.06	0
72	60	.07	.03	.06	.02	.07	0
84	60	.08	.03	.06	.02	.08	.0
96	60	.08	.03	.06	.03	.10	.0

***Note:** RZ (Reference Zero pressure) is to compensate for vertical test position.
 Note: C indicator reading is used as Total Panel Deflection and Permanent Set.

Observations- Deflections increased as pressure increased. No fastener failure occurred.

Positive Side Graph



Deflections in inches

Pressure Increments psf Negative	Time (sec)	Purlin Mid Panel (A)	Perm. Set	Mid-Span (B)	Perm. Set	Mid-Span (C)	Perm. Set
RZ 5.6	60						
21	60	.16	.04	.06	.01	.15	.06
42	60	.26	.05	.08	0	.25	.25
63	60	.36	.08	.10	0	.34	.09
84	60	.44	.07	.11	0	.41	.09
105	60	.51	.08	.11	.01	.48	.09
126	60	.56	.08	.12	.01	.53	.09
147	60	.65	.10	.13	.02	.59	.09
168	60	.70	.11	.13	.03	.67	.09
189	60	.78	.11	.15	.03	.72	.09
210	60	.90	.12	.20	.03	.84	.10

Deflections in inches

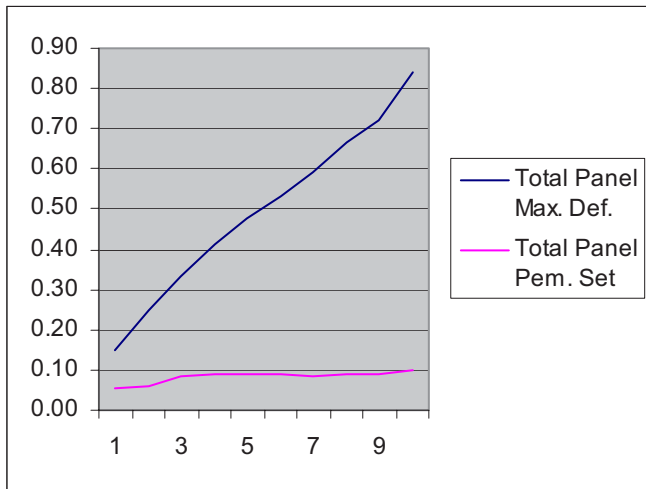
Pressure Increments psf Negative	Time (sec)	Mid Span (D)	Perm Set	Purlin Mid Panel (E)	Perm. Set	Total Panel Deflection	Total Panel Perm. Set
RZ 5.6	60						
21	60	.10	.05	.17	.09	.15	.06
42	60	.14	.06	.32	.15	.25	.25
63	60	.18	.07	.41	.17	.34	.09
84	60	.22	.08	.49	.18	.41	.09
105	60	.24	.08	.56	.19	.48	.09
126	60	.28	.09	.61	.19	.53	.09
147	60	.32	.09	.68	.20	.59	.09
168	60	.35	.11	.74	.20	.67	.09
189	60	.38	.12	.80	.20	.72	.09
210	60	.43	.13	.92	.21	.84	.10

***Note:** RZ (Reference Zero pressure) is to compensate for vertical test position.

Note: C indicator reading is used as Total Panel Deflection and Permanent Set.

Observations- Deflections increased as pressure increased. No fastener failure occurred.

Negative Side Graph



Note: 2 mil polyethylene film was used for the ASTM 1592 test, it is the opinion of the undersigned that it had no influence on the results of the test.

Observers-

Keith Owen / ATL
Eddie Lance, Josh Thomas / ATL
Jeremiah Buechner / Metal Roofing Systems
Andy Sigmon / Metal Roofing Systems
Brian Thompson / Metal Roofing Systems
David W. Johnson, P.E

Keith Owen, Lab Manager
American Test Lab, Inc.

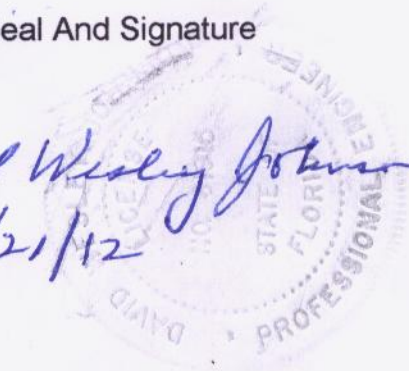
Keith Owen
6/21/12

All Tests Witnessed and Certified by:

David Johnson P. E.
1656 Calvert Rd.
Brevard, NC 28712
Florida P.E. # 00061915

Engineer Seal And Signature

David Wesley Johnson
6/21/12



Certificate of Independence: The witnessing engineer has no equity interest in American Test Lab of North Carolina, Metal Roofing System or their parts vendors. Witnessing engineer is in complete compliance of Florida Statue 9B-72, Section 72.110

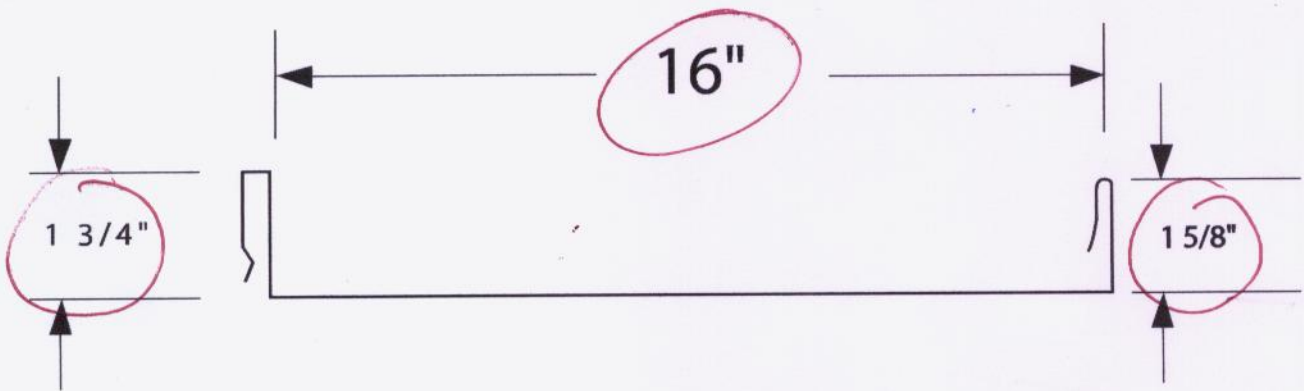
Disclaimer:

ATL and its staff have no equity interest in any product tested or installed. This test report was prepared by American Test Lab, North (ATL) for the exclusive use of the above named client; it does not constitute certification of this product. The results are for that particular specimen tested and does not imply the quality of similar or identical products manufactured or installed from specifications identical to the tested product. ATL is a testing lab and assumes that all information provided by the client is accurate and does not guarantee or warranty any product tested or installed. This report may not be reproduced except in full, and only under expressed permission from American Test Lab or Metal Roofing System. Reproduced reports in hard copy must be labeled "Copy".

**AMERICAN TEST LAB
NORTH**

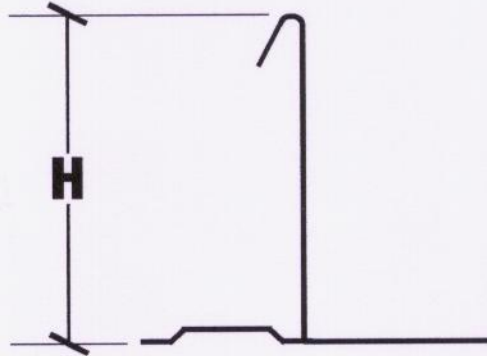
DATE 6/21/12
REPORT NO. ATLNC 0521.0112

Keith Owen
ATL INSPECTOR



24 GA. SYSTEM 2000 SSMR PANEL

H = 1-7/8"
W = 2-1/4"



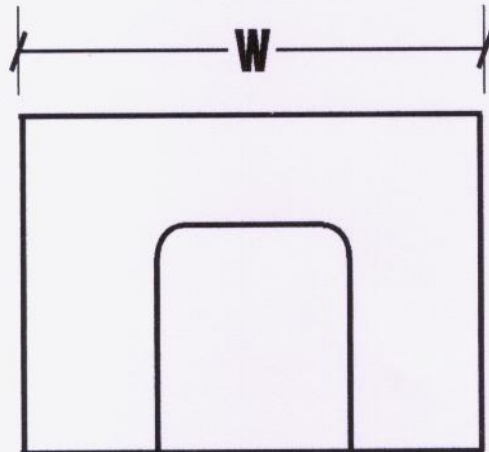
**AMERICAN TEST LAB
NORTH**

DATE 6/21/12
REPORT NO. ATLNC 0521.01-12

Keith Owen
ATL INSPECTOR

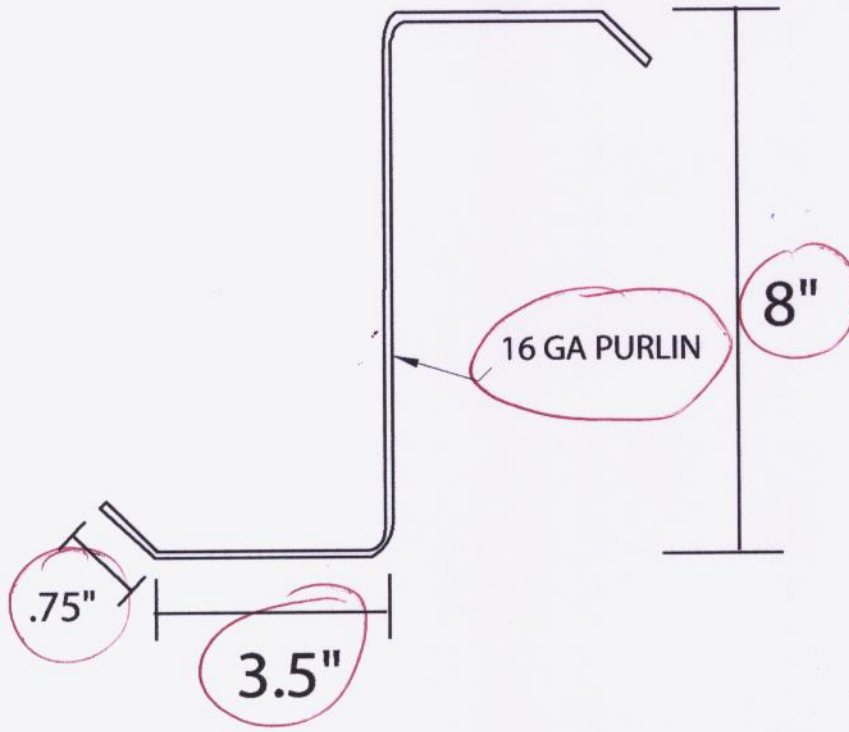
CLIP SIDE VIEW

H = 1-7/8"
W = 2-1/4"



CLIP FRONT VIEW

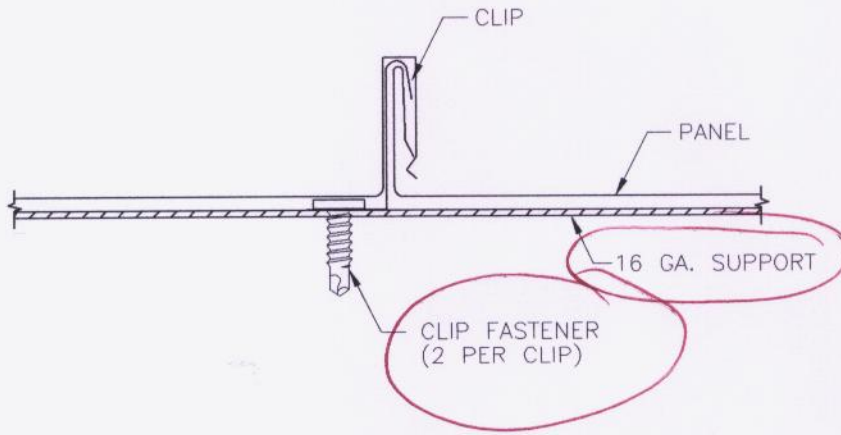
SYSTEM 2000 CLIP



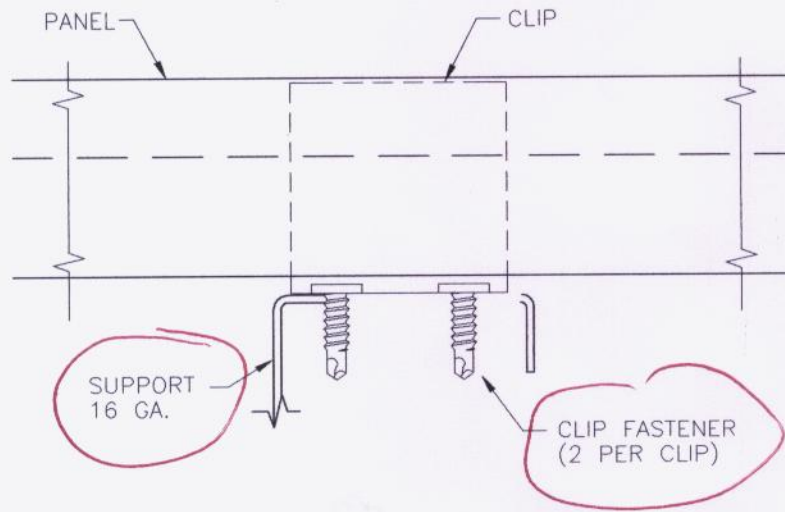
**AMERICAN TEST LAB
NORTH**

DATE 6/21/12
REPORT NO. ATLNC 0521.01-12

Kurt Owen
ATL INSPECTOR



CLIP SECTION VIEW



AMERICAN TEST LAB CLIP SIDE VIEW

NORTH

DATE 6/21/12

REPORT NO. ATLNC 052601-12

Keith Owen

ATL INSPECTOR

Attachment Clips

Roof Panel Clips

THE STRUCTURAL INTEGRITY OF THE SUPPORTING STRUCTURE AND/OR SUBSTRATE'S CAPACITY TO RECEIVE IMPARTED LOADS BY THE METAL ROOFING SYSTEM IS NOT ANALYZED BY METAL ROOFING SYSTEMS, INC. AND IS THE RESPONSIBILITY OF THE OWNER, OWNER'S REPRESENTATIVE, OR DESIGN PROFESSIONAL, WHICHEVER IS APPLICABLE.

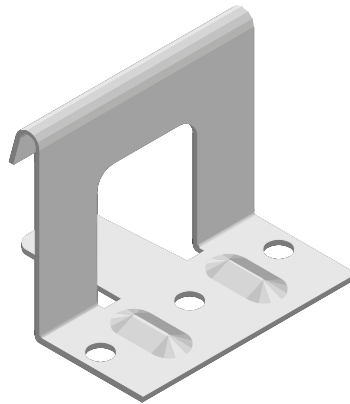
IMPORTANT NOTE:

ALL FLASHING AND TRIM TO BE FORMED PER "MRS" APPROVED SHOP DRAWINGS IN ORDER TO VALIDATE WEATHERTIGHT WARRANTY.

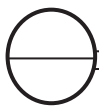
1 -7/8" Snaplock Clip

Base, 2-1/4in. wide with groove tongue. Height
1-7/8 in. 18 ga Galvanized Steel

H = 1-7/8"
W = 2-1/4"



Fasteners



Roof Fastener Usage

#10 Type A: Pancake Head
2/2 Quadrex Drive
Metal to wood



#10 Self-Drill: Pancake Head
2/2 Quadrex Drive
Metal to metal
Min projection: 3/8" of threads
below substrate



Head Height: .080 – .068
Head Dia: .447 – .423
Thread Major Dia: .194 – .188
Thread Minor Dia: .133 – .126

Strength (lbs ult.):	Carbon	Stainless
Tensile:	1825	1653
Torsional:	48 in-lbs	50 in-lbs
Shear:	1535	1587

#10 Type A, Pull-out (lbs ult.):

SPF wood:
1" penetration: 821

#10 Self Drill, Pull-out (lbs ult.):

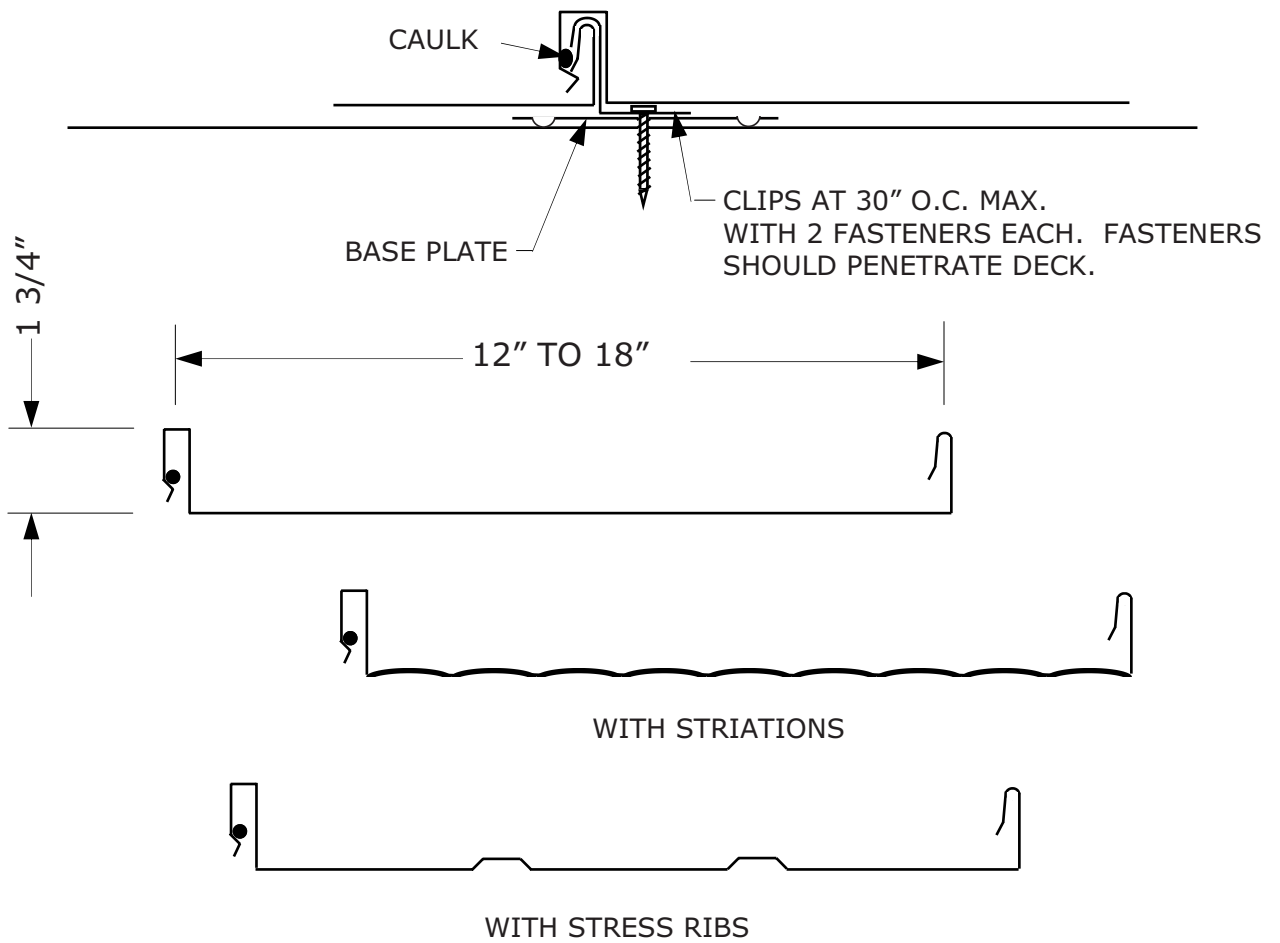
12 ga (.105): 1782
14 ga (.075): 1072
16 ga (.060): 782

Typical Details

UL-90 CLIP



H = 1-15/16"
W = 2-1/4"



7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: CLIP AND PANEL PROFILE

SYSTEM: **MRS System 2000**

DATE:

SCALE: NONE

REV:

DRAWING NO.

1

EAVE FLASHING. SEE
DETAIL BELOW FOR
CAULKING PATTERN

12-14 X 3/4" FASTENER

#10-13 X 1"
FASTEN 12" O,C.

HANGERS 30" O.C.

FIELD NOTCH 1" AND HEM
UNDER DRIP.

BEAD OF CONTINOUS SEALANT ON DRIP



METAL ROOFING
Systems, Inc

7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: LOCKING EAVE FLASHING

SYSTEM: **MRS System 2000**

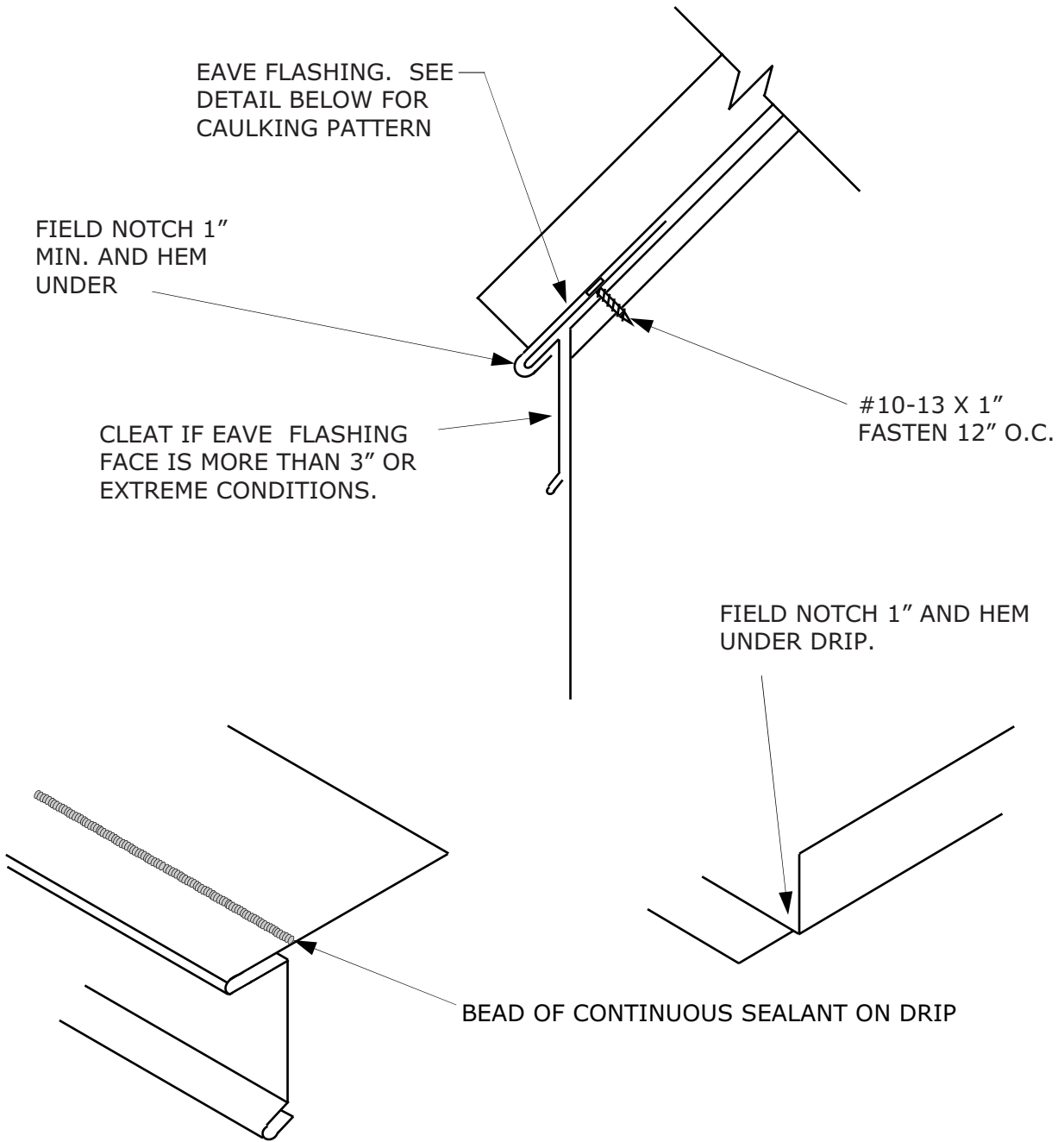
DATE:

SCALE: NONE

REV:

DRAWING
NO.

2



METAL ROOFING
Systems, Inc

7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: LOCKING EAVE FLASHING

SYSTEM: **MRS System 2000**

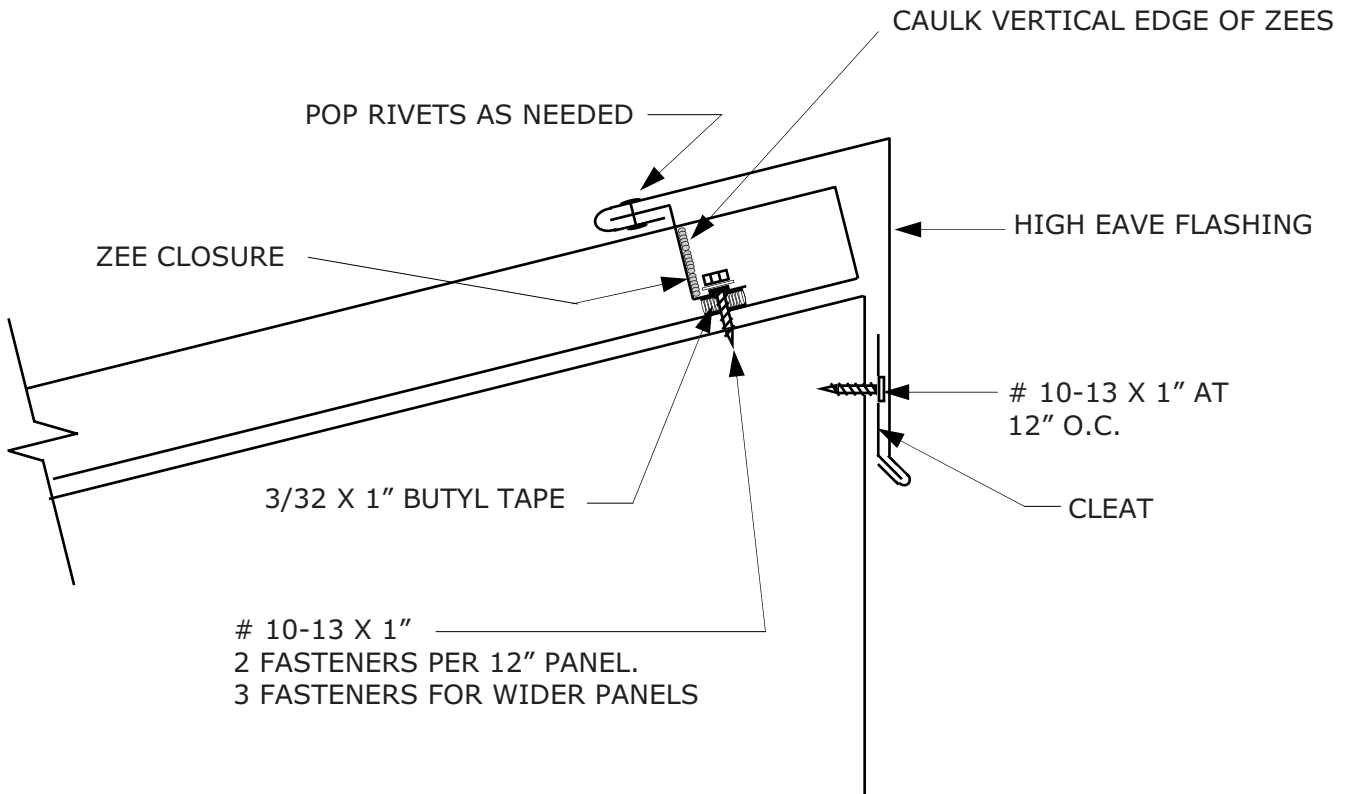
DATE:

SCALE: NONE

REV:

DRAWING
NO.

3



METAL ROOFING
Systems, Inc

7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: HI— EAVE FLASHING

SYSTEM: **MRS System 2000**

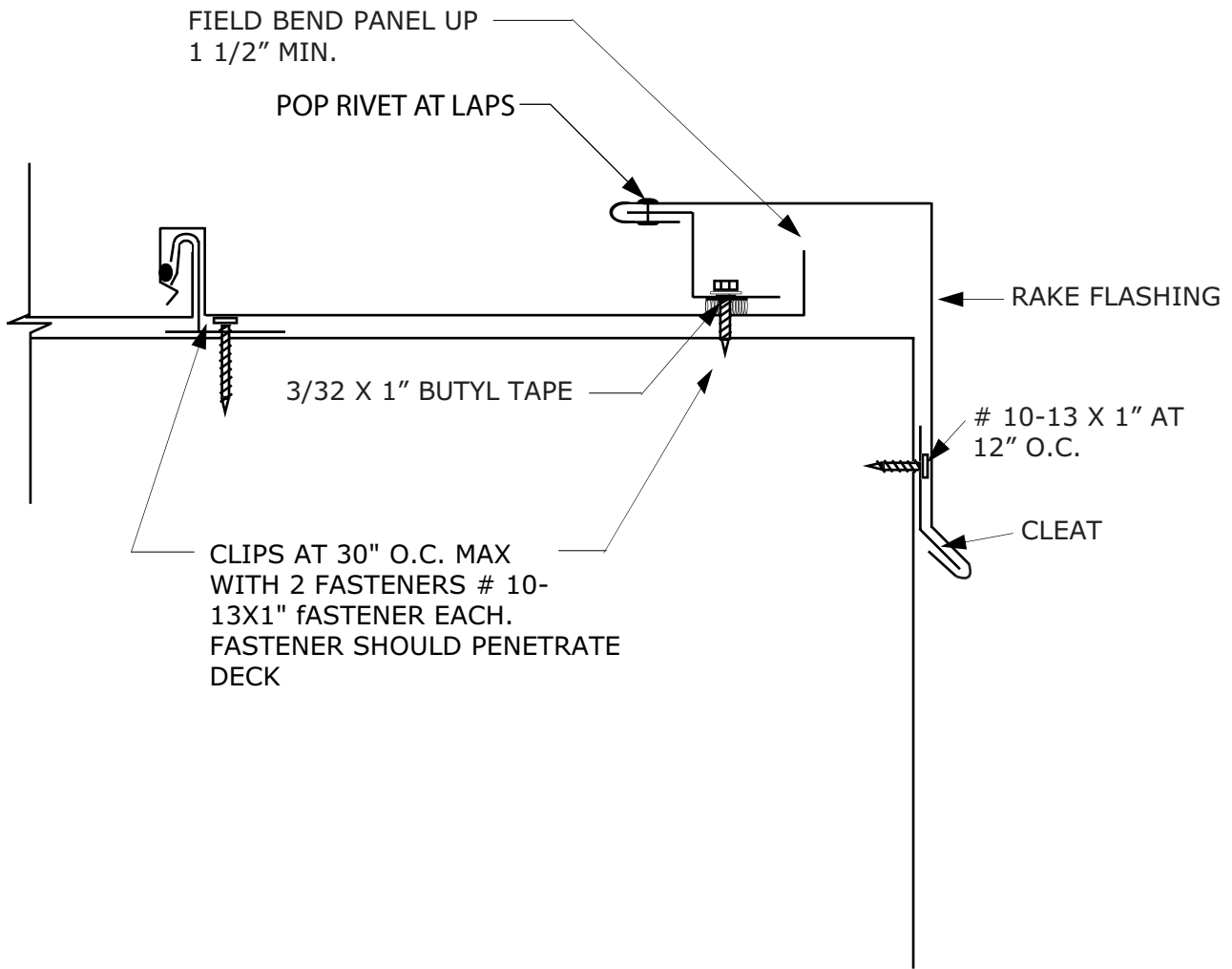
DATE:


SCALE: NONE

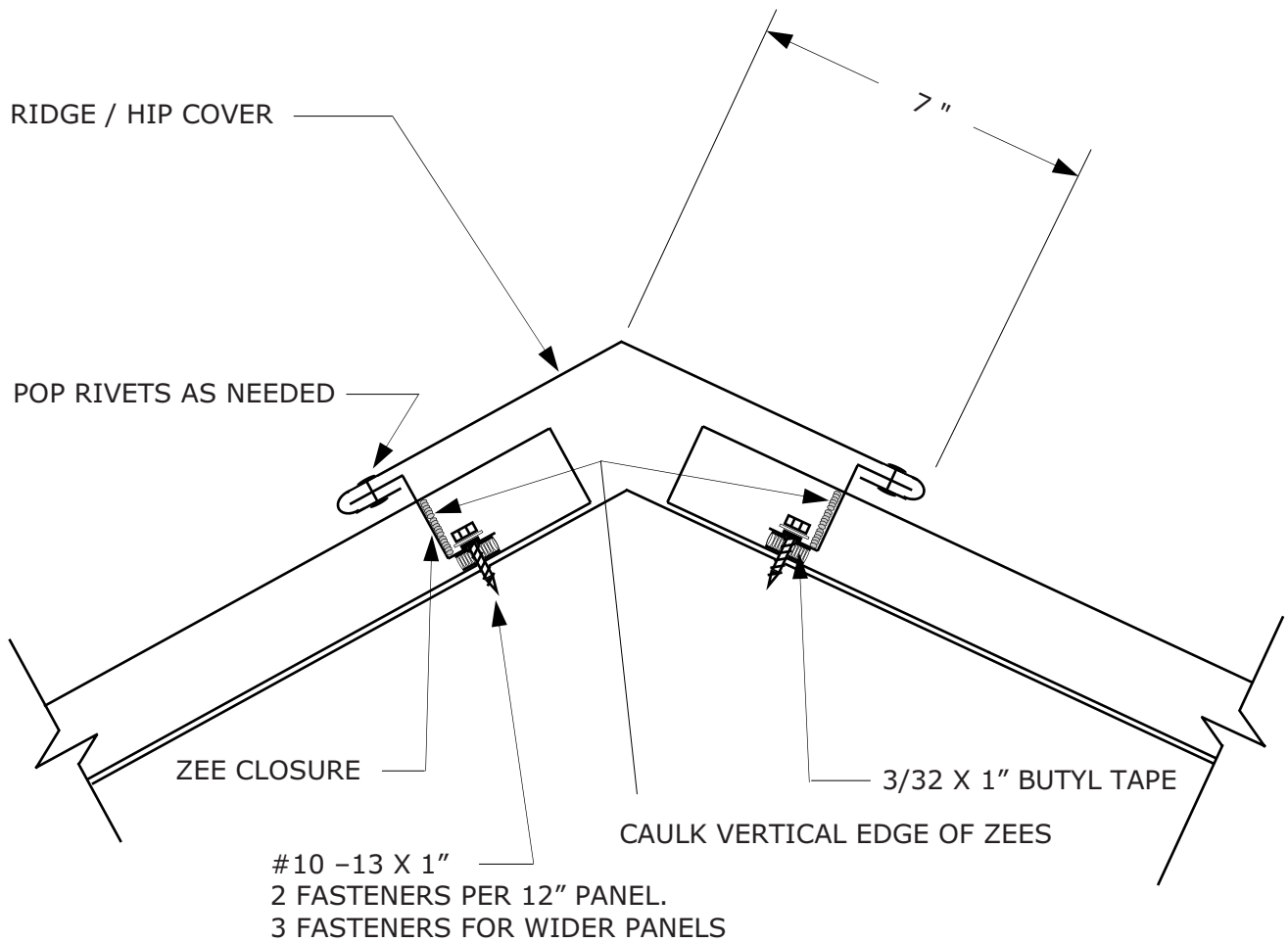
REV:

DRAWING
NO.

4



 METAL ROOFING Systems, Inc	7670 Mikron Drive Stanley, NC 28164 704-820-3110		SUBJECT: RAKE — GABLE FLASHING		DRAWING NO 5
			SYSTEM: MRS System 2000		
	DATE:	SCALE: NONE	REV:		



7670 Mikron Drive
 Stanley, NC 28164
 704-820-3110

SUBJECT: RIDGE / HIP COVER

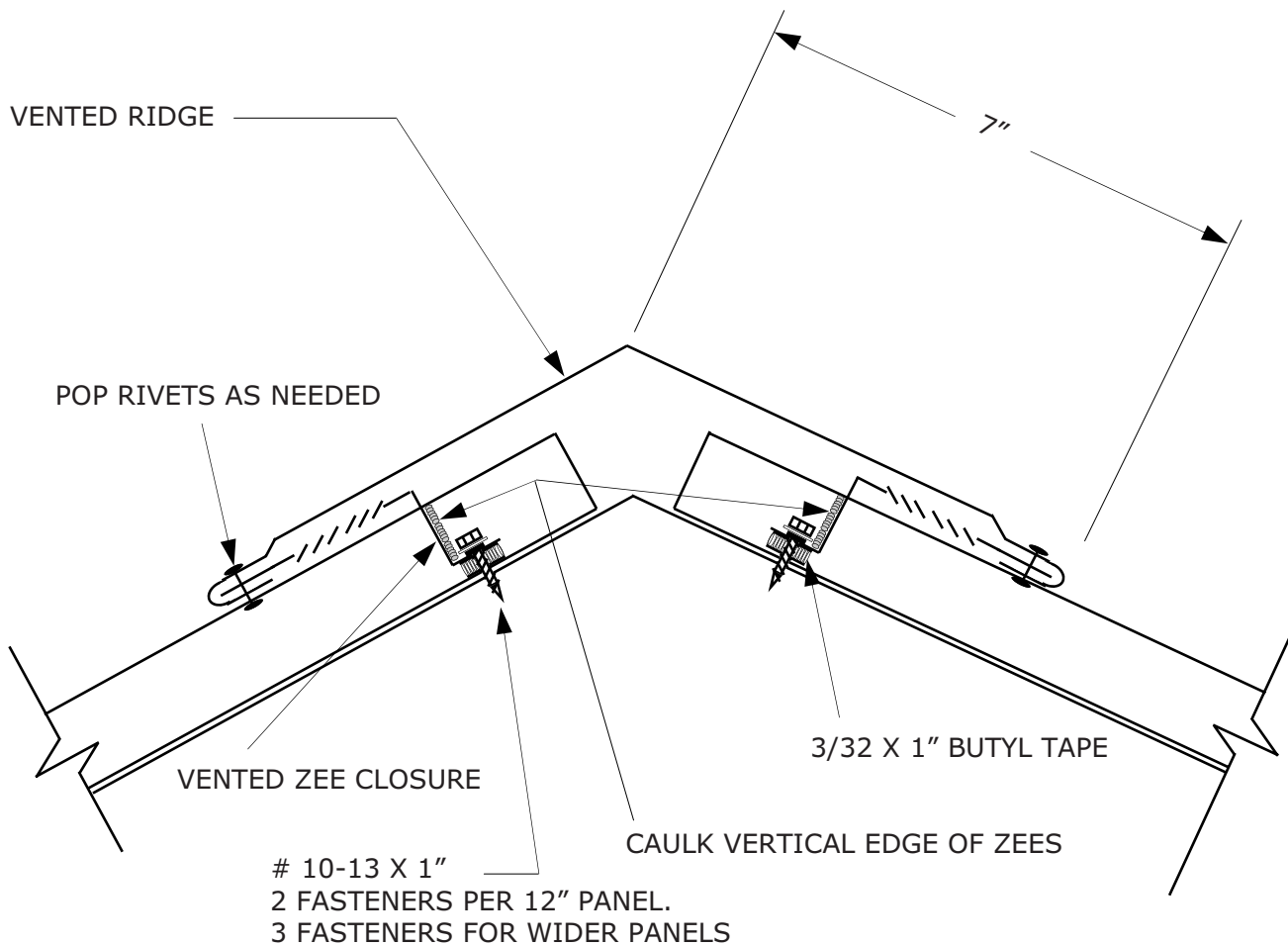
SYSTEM: **MRS System 2000**

DATE:

SCALE: NONE

REV:

DRAWING
 NO.
6



METAL ROOFING
Systems, Inc

7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: VENTED RIDGE

SYSTEM: **MRS System 2000**

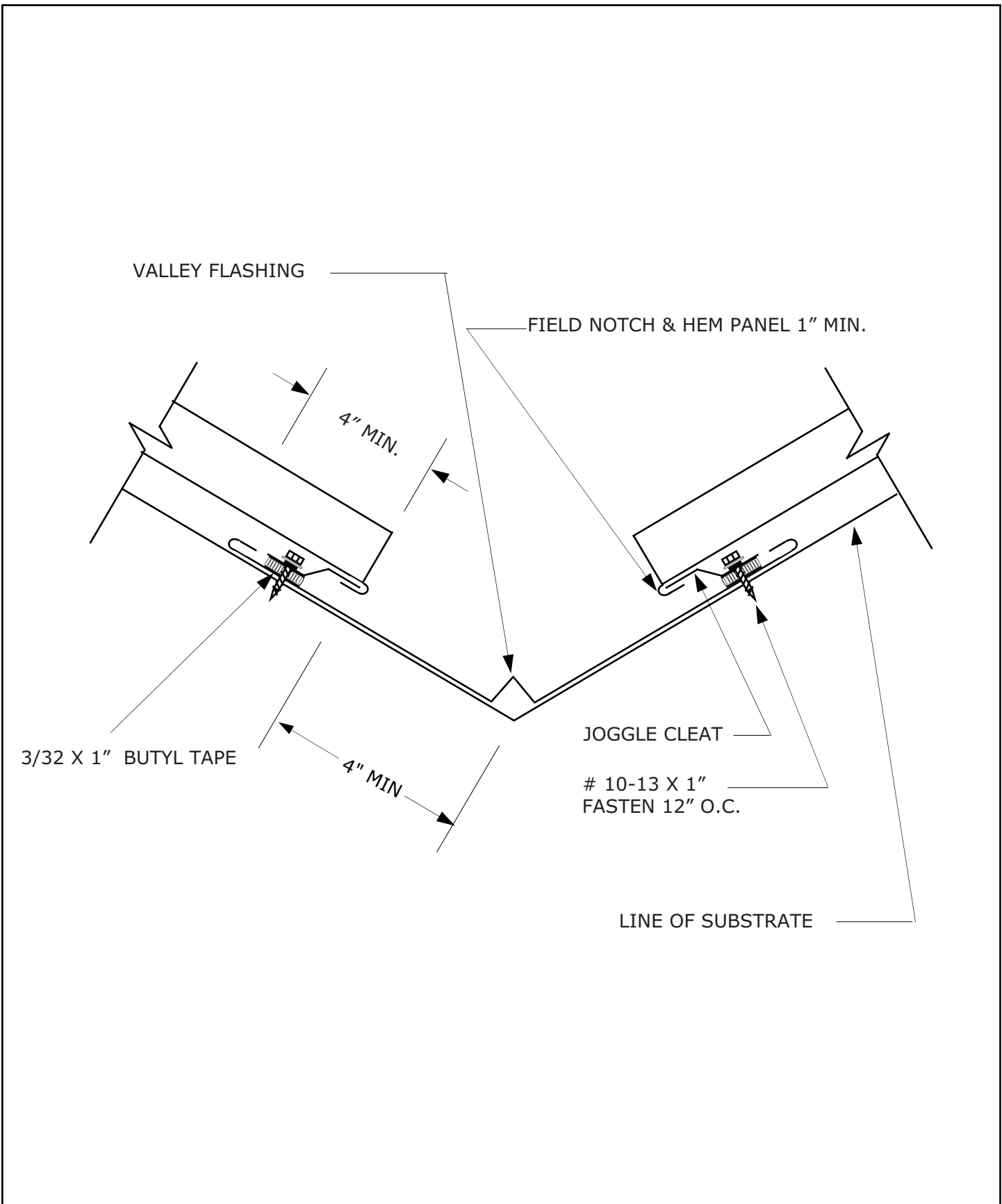
DATE:

SCALE: NONE

REV:

DRAWING
NO.

7



7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: FLOATING VALLEY

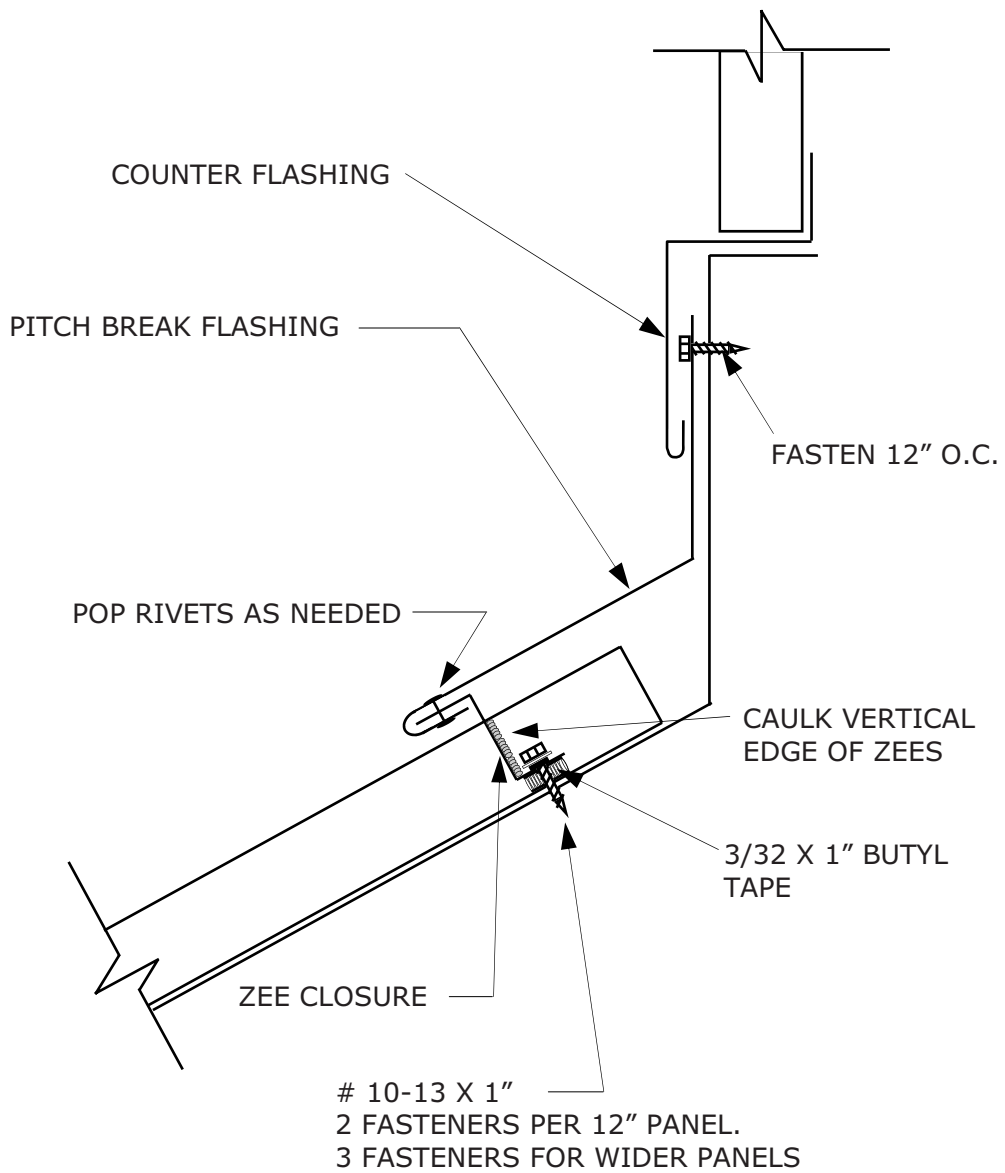
SYSTEM: **MRS System 2000**

DATE:

SCALE: NONE

REV:

DRAWING
NO.
8



METAL ROOFING
Systems, Inc

7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: HEADWALL FLASHING

SYSTEM: **MRS System 2000**

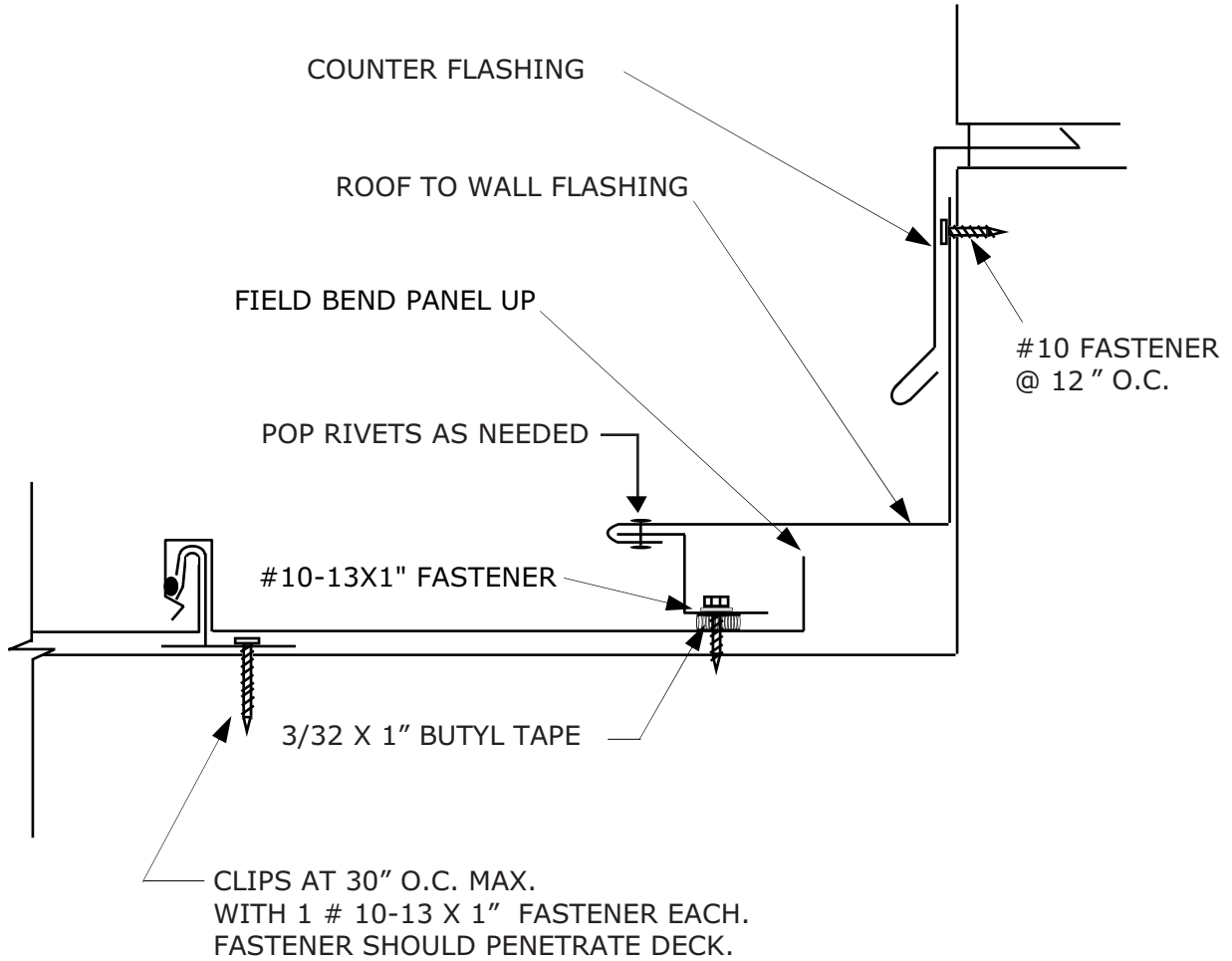
DATE:

SCALE: NONE

REV:

DRAWING NO.

9



METAL ROOFING
Systems, Inc

7670 Mikron Drive
Stanley, NC 28164
704-820-3110

SUBJECT: SIDEWALL FLASHING

SYSTEM: **MRS System 2000**

DATE:

SCALE: NONE

REV:

DRAWING
NO
10

Sealants



WeatherMaster Metal Roof Sealant

Titebond® WeatherMaster™ Metal Roof Sealant is specifically formulated to outperform all other sealant technologies, including silicones, tri-polymers, and polyurethanes. This superior polymer formula provides a waterproof seal against water, wind, dust and dirt. It offers exceptional adhesion to Kynar™ coated metal materials, along with standard metal, aluminum, steel, galvanized bonderized surfaces, plastics and glass. The product is ideal for use on a wide variety of metal roof, trim, architectural metal siding, aluminum, galvanized steel, galvanized gutters, flashing and downspouts. It also provides unbeatable adhesion to wood, brass and other common building substrates.

Titebond WeatherMaster Metal Roof Sealant is available in over 50 colors, all of which match today's popular metal roof and metal siding colors, regardless of the material or manufacturer. If touch-ups are necessary, it is paintable in one hour after application. It extrudes in extreme weather conditions (down to zero degrees Fahrenheit) and is UV-resistant, making it the ideal choice for exterior applications. It will expand and contract with the change of weather and temperature and will not crack. This sealant contains no solvents or isocyanates and is VOC-compliant.

Meets or exceeds the requirements of:

Passes ASTM C920, Type S, Grade NS, Class 50, Use NT, M, T, G and A

ASTM C510, ASTM C639, ASTM C661, ASTM C679, ASTM C717, ASTM C719, ASTM C793, ASTM C794, ASTM C1183, ASTM C1193, ASTM C1246, ASTM D412, ASTM D624 and ASTM G155.

Passes Federal Specification TT-S-00230C, Type II, Class A

Passes CAN/CGSB-19 13-M87, Classification MCG-2-25-A-N, No.81026

AAMA 808.3-92 Exterior Perimeter and AAMA 802.3-92 Type II Back-Bedding Compound and

USDA approved for use in meat and poultry areas



Product Features

- Outperforms VOC solvent, silicone, tripolymer and polyurethane sealants
- Adheres to Kynar™ coated metals
- Applies easily in extreme weather conditions
- Excellent adhesion to most common building materials
- Permanently flexible and watertight seal
- UV-resistant / non-yellowing
- VOC-compliant

Physical Properties

Type: Advanced polymer (reactive) **Calculated VOC (less water):** 9 g/L (<2% wt.)
State : Medium-viscosity caulk **Weight/gallon :** 13.85 lbs.
Color : Over 50 colors **Flashpoint :** > 200°F.
Solids : 99% **Freeze/thaw stability :** Stable
Viscosity : 500,000 **Storage life :** More than 12 months in tightly closed containers @ 75°F (24°C)

Coverage (maximum): Approximate length of bead according to bead diameter:

Container	1/4" bead	3/8" bead	1/2" bead
10.1 oz. Cartridge	31 ft.	13.5 ft.	7.5 ft.
20 oz. Sausage Pack	61 ft.	27 ft.	15 ft.

Application Guidelines

Application Temperature Above 0°F.

Service Temperature Range -75°F. to 300°F.

Method of Application Cartridge/caulking gun, bulk/sausage gun

Tooling Time For a 1/4" bead, approximately 20-40 minutes, depending on temperature and humidity.

Working Surfaces Surfaces must be clean down to the original substrate and free from any material that may deter adhesion. It is the sole responsibility of the user to thoroughly test any proposed use with all substrates to determine project suitability. To ensure neat sealant lines, mask areas adjacent to joints. Remove masking tape immediately once bead is tooled.

Cleanup Clean tools with isopropyl alcohol before it dries. Scrape dried excess. Follow solvent vendor's precautions.

Limitations

Air, caulk and surface temperature should be above 0°F (-18°C). WeatherMaster Metal Roof sealant may be painted anytime after one hour with exterior water-based paint. For other types of paints, a compatibility test is recommended. If joint depth exceeds 5/16", use backing material. Not designed for continuous submersion or use below the waterline. For questions, please call our Help Line 1-800-347-4583 or visit us at titebond.com.

Caution Statements

CAUTION: EYE AND SKIN IRRITANT. Do not swallow. Do not allow eye contact or prolonged skin contact. **First Aid:** If swallowed, do not induce vomiting; contact physician. If eye contact occurs, flush with water for 15 minutes. Wash skin contact areas with soap and water. If irritation from eye or skin contact areas persists, contact physician. Product releases methanol during cure. For additional information, refer to Material Safety Data Sheet. **KEEP OUT OF THE REACH OF CHILDREN.**

Tacky Tape[®]

SM5227

Metal Building Sealant

TECHNICAL DATA

PRODUCT DESCRIPTION:

Tacky Tape[®] is a 100% solids, asbestos-free butyl tape sealant that is a highly rubbery, tacky, reinforced compound designed for sealing metal lap joints in the metal building industry. It is easy to apply and compress during installation. It exhibits excellent application and performance characteristics over a wide temperature range and will not become brittle, crack or flow during service. It is available in various sizes supplied in ready-to-use rolls and pre-cut endlap pads for standing seam roof (SSR) applications. It is also available in double and triple bead rolls and endlap pads.

TYPICAL USES:

Tacky Tape[®] is designed to seal and prevent the entry of dust, air and moisture and assure a weather tight seal in metal building details.

- Metal rib and end joints
- Standing seam roof endlaps
- Sealing roof curbs roof jacks and skylights
- Sealing polyethylene sheeting
- Sealing air conditioning equipment
- Window and door flanges

ADVANTAGES:

- Excellent for sealing Galvalume, Galvalume Plus, Zinalume and KNAR 500
- Adheres to oily Galvalume
- Will not corrode Galvalume, Galvalume Plus and KYNAR 500
- Meets ASTM and Federal Standards
- Non-staining
- Permanently flexible
- Resistant to ultraviolet and infrared radiations, precipitation atmospheric hydrocarbon contamination and extremes in temperature

APPLICATION:

Optimally, a clean dry uncontaminated surface is desired to obtain intimate adhesion, but realistically there are field situations that prevent complete control of surface conditions. Obviously, excessive oil, caked-on dirt, free standing water and ice or snow

must be removed before sealant tape is applied. This sealant tape can be applied in cold temperatures. Temperatures below 40°F (4.44°C) often promote the formation of condensation and frost substrates. These should be removed before the sealant tape is applied in order to achieve optimum performance. Remove condensation and other moisture with a clean dry cloth and isopropyl (IPA) alcohol. Follow this with a dry cloth wipe.

A light film of lubricant used in roll forming is usually present on unpainted surfaces, such as Galvalume and should not adversely affect the sealant tape performance. If excess lubricant is present wiping with a clean cloth should minimize it.

Position tape sealant on required seal area with release backing paper on top. The tape sealant should be positioned on the “wet”, or entry sides of the fasteners to prevent passage of dynamic weather elements. Using a smooth even hand motion; press the tape to the surface to make intimate contact without distorting the tape sealant. Avoid lapping the tape by butt joining tapes at transition points. Remove release-backing paper prior to mating adjoining surface and fastening. IF SEALANT TAPE IS IN DIRECT CONTACT WITH ANY OTHER SEALANT OR ELASTOMER, A COMPATIBILITY TEST MUST BE CONDUCTED PRIOR TO USE.

SM5227 is compatible with the following Schnee-Morehead products:

- Acryl-R SM5430 Non-Skinning SSR Sealant
- ACRYL-R SM5504 Narrow Joint Sealant
- ACRYL-R SM5522 Acrylic Sealant
- Permathane SM7100 and SM7108 Polyurethane Sealants

LIMITATIONS:

Not recommended for:

- For applications requiring continuous water submersion, consult Schnee-Morehead field sales representative.
- Joints that are not mechanically fixed.
- Do not apply sealant to wet or frost bearing surfaces. See application paragraph

TYPICAL PROPERTIES		
Property	Typical Values	Test Method
Specific Gravity:	1.47	ASTM D 792
Density:	13.54 Lbs./Gal. 1.62 Kg/Liter	SM Lab Test
Percent Solids:	100%	SM Lab Test
Peel Adhesion PIW (N/mm ²) / % Cohesive Separation		AAMA 800
Galvalume	16 (2.8) / 100	1/16" (0.158cm) thick
Anodized Aluminum	16 (2.8) / 100	
Mill Finish Aluminum	16 (2.8) / 100	
Polyvinylidene Fluoride	17 (2.8) / 100	
PVC Plastisol	17 (2.8) / 100	
Polyester	16 (2.8) / 100	
Siliconized Polyester	16 (2.8) / 100	
Tensile Adhesive Strength PSI (kPa) % Cohesive Separation	20 (138) 95	ASTM C 907
Yield Strength PSI (kPa)	8 (55)	ASTM C 908
% Elongation	>1000	ASTM C 908
Sag	None	AAMA 800
Vehicle Migration	Pass, <1/8" (<3.175mm)	AAMA 800
Water Resistance	No Effects	AAMA 800
Hardness (Shore 00)	50-60	AAMA 800
Crazing to Acrylic plastics	None	MIL-S-11030C
Cone Penetration (0.1mm) @77°F (25°C) @120°F (48.8°C) @0°F (-17.7°C)	85-100 125-135 45-55	ASTM D 217 300 g cone (5 Sec)
Application Temperature Range	-5°F to 120°F (-20°C to 49°C)	SM Lab Test
Service Temperature Range	-40°F to 200°F (-40°C to 93°C)	SM Lab Test
Color	Gray	Visual SM Test
Weatherability QUV, 340A lamp 1000 Hrs	Excellent, no cracking, chalking, wash-off or flow (sag)	SM Lab Test
6" Static Water Pressure	Pass – No Leakage	ASTM Proposed Test Method
Water Penetration	Pass – No leakage	ASTM E 1646
Air Leakage At 1.57 PSF	0.051 CFM/FT ² 0.068 CFM/FT ²	ASTM E 1680
At 6.24 PSF	0.1024 CFM/FT ² 0.1365 CFM/FT ²	
Shelf Life	18 months when stored at or below 100°F (38°C)	

SPECIFICATION COMPLIANCE:

AAMA 804.3
AAMA 807.3
Federal Specification TT-C-1796A, Type II, Class B
USDA Acceptable
UL Approval for SM5227 has been granted on sizes
up to and including 3/4" width x 1/4" thick

- Galvalume and Galvalume Plus are registered trade marks of BIEC International
- Zincalume is a registered trademark of BHP Steel
- KYNAR 500 is a registered trademark of Elf Atochem North America, Inc.
- Tacky Tape and Acryl-R are registered trademarks of Schnee-Morehead, Inc.

Refer to Material Safety Data Sheet (MSDS) for further information

For medical emergency only,
call Chem Trec 1-800-424-9300

EXCLUSION OF WARRANTIES: AS TO THE HEREIN DESCRIBED MATERIALS, SCHNEE-MOREHEAD®, INC. MAKES NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SINCE THE USE OF THE HEREIN DESCRIBED MATERIALS INVOLVES MANY VARIABLES IN METHODS OF APPLICATION, HANDLING AND/OR USE, THE USER IN ACCEPTING AND USING THESE MATERIALS ASSUMES ALL RESPONSIBILITY FOR THE END RESULT. THE PURCHASE OF THIS SCHNEE-MOREHEAD®, INC. PRODUCT IS SUBJECT TO THE TERMS AND CONDITIONS OF AN "AS IS" SALE, AND IF THE PRODUCT IS PROVED TO BE DEFECTIVE, THE EXCLUSIVE REMEDY, AT SCHNEE-MOREHEAD®, INC.'S OPTION, SHALL BE TO REPLACE THE DEFECTIVE SCHNEE-MOREHEAD®, INC. PRODUCT. SCHNEE-MOREHEAD®, INC. SHALL NOT OTHERWISE BE LIABLE FOR LOSS OF DAMAGES, WHETHER DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL, REGARDLESS OF THE LEGAL THEORY ASSERTED, INCLUDING NEGLIGENCE, WARRANTY OR STRICT LIABILITY.

Complete technical information is available from Schnee-Morehead® Inc. For technical assistance, customer service and general information, call **1-800-878-7876, 1-800-TRUSTSM**

SCHNEE-MOREHEAD®, INC.

An ITW Company
111 N. Nursery Road
Irving, TX 75060

972-438-9111 Fax: 972-554-3939

www.trustsm.com

Warranty



20-Year Watertightness Limited Warranty

Building Owner : _____ MRS Work Order Number _____

Building/Job Name: _____ Date Roof Completed _____

Building Location: _____ Contract Amount (MRS Materials): _____

Metal Roofing Systems, Inc. (hereinafter referred to as "MRS") and the Roofing Contractor/Installer whose signature appears below (hereinafter referred to as "Roofer") severally warrant [Roofer only for any matter arising during the first two years after completion of installation of the subject roof on the above referenced Building and MRS only for any matter first arising after the second anniversary of successful completion of installation of the subject roof but arising not later than the twentieth anniversary of such completion] to the above named Building Owner (hereinafter referred to as "Owner") that subject to each and every term(s), condition(s), limitation(s), allocation(s) of warranty, and responsibility(ies) stated herein, Roofer's workmanship on the above named building will be adequate to prevent leaks for 20 years commencing with the date of completion of Installation of the Roofing System. This warranty will be fully satisfied by repair of the Roof, and any such repairs shall carry a warranty against leaks for any then remaining balance of the original 20-year warranty period.

MRS'S AND ROOFER'S AGGREGATE TOTAL CUMULATIVE LIABILITY UNDER THIS 20 YEAR WATERTIGHTNESS LIMITED WARRANTY IS LIMITED TO THE AMOUNT OF THE OWNER'S ORIGINAL PAYMENT MADE TO THEM FOR MATERIALS FURNISHED BY MRS ONLY AND FOR THE INSTALLATION OF THOSE MATERIALS ONLY, NEITHER MRS NOR ROOFER MAKES ANY OTHER WARRANTY WHATSOEVER, EXPRESS OR IMPLIED, ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE WHICH EXCEED OR DIFFER FROM THE WARRANTIES HEREIN EXPRESSED ARE DISCLAIMED BY EACH AND ALL OF SAID PARTIES AND EXCLUDED FROM THIS 20 YEAR WATERTIGHTNESS LIMITED WARRANTY. MRS DOES NOT IN ANY WAY WARRANT THE MERCHANTABILITY OF THE GOODS SOLD HEREBY. NO WARRANTIES EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

IN NO EVENT SHALL ANY ONE OR MORE OF MRS AND ROOFER HAVE ANY LIABILITY FOR ANY COMMERCIAL LOSS, CLAIMS FOR LABOR, OR CONSEQUENTIAL DAMAGES OF ANY OTHER TYPE WHETHER OWNER'S CLAIM BE BASED IN CONTRACT, TORT, WARRANTY, STRICT LIABILITY, OR OTHERWISE, IT IS EXPRESSLY AGREED THAT OWNER'S REMEDIES EXPRESSED IN THIS 20 YEAR WATERTIGHTNESS LIMITED WARRANTY ARE OWNER'S EXCLUSIVE REMEDIES.

TERMS, CONDITIONS, LIMITATIONS

1. Owner shall provide MRS and Roofer with written notice within thirty days of the discovery of any leak(s) in the Roof. Failure of the Owner to do so shall automatically relieve both MRS and Roofer of any and all responsibility and/or liability under the 20 year Watertightness Limited Warranty.
2. In the event a roof repair is necessary during the first two-year period or any extension thereof, the Roofer's responsibility [which shall be in lieu of any and all MRS liability during this period and any such extensions] shall be extended for a two-year period from the date of the last such repair. In any such case, MRS will be responsible only for the balance remaining after the end of such a period and any and all extension(s) of the original twenty-year period from the date of completion or installation of the Roofing System.
3. Following MRS's inspection, MRS determines that the leak(s) in the Roof are caused by defects in MRS materials or in the workmanship of the Roofer, Roof repair obligations shall then arise in accordance herewith, but Owner's remedies and MRS's liability shall in any event be limited to repair of the Roof, subject to the cost limitations set forth above. Otherwise, neither MRS nor Roofer shall have any liability. The Roofer's two year liability (which is in lieu of any and all MRS liability for such period) shall be extended an additional two years from date of last repair, should such repairs be necessary during the first two years of the Roofer's liability or during any extension thereof.

4. Neither MRS nor Roofer shall have any liability or responsibility under or in connection with either this 20-Year Watertightness Limited Warranty or the Roof if any one or more of the following shall occur:
 - a) Deterioration caused by marine(salt water) atmosphere or by regular spray of either salt or fresh water.
 - b) Corrosion caused by heavy fallout or exposure to corrosive chemicals, ash or fumes from any chemical plant, foundry, planting works, kiln, fertilizer manufacturing, paper plant, and the like.
 - c) Deterioration caused by any corrosive substance or any condensate of any condensate or any harmful substance contained, generated or released inside the building.
 - d) Damage caused by worker(s) on the roof.
 - e) Any other cause beyond MRS's control.
 - f) Damage to the Roof caused by natural disasters, including but not limited to, lightning, or any strong gale, hurricane, tornado, or earthquake.
 - g) Failure by any contractor or subcontractor to follow MRS's recommended installation instructions for the layout design and installation of the Roof.
 - h) If, after installation of the Roof by Roofer, there are any alterations, such as, but not limited to, structures, fixtures, or utilities being place upon or attached to the roof without prior written authorization from MRS, or
 - i) If there is any failure by the Owner or lessee or other occupant or user to use reasonable care in maintaining the Roof, or
 - j) If Owner fails to comply with every term and/or condition stated in this 20-Year Watertightness Limited Warranty, or
 - k) If any panels or other parts are installed in a manner that does not permit drainage of water from all surfaces.
 - l) MRS shall not have any liability or responsibility with leakage caused by ridge vents.
 - m) MRS shall not have any liability or responsibility with failure of gutters and gutter accessories.
 - n) Failure of roofing installation and the materials supplied by MRS for the flashing and metal roofing due to reaction of dissimilar metals will not be the responsibility of MRS, nor will MRS be held liable for any claims due to failures caused by dissimilar metals.
5. MRS shall not have any liability or responsibility under or in connection with either this 20-Year Watertightness Limited Warranty or the Roof in the event of a failure by any contractor or subcontractor to use approved installation details for roof curbs, roof jacks, sealants, sub framing, and flashing furnished by MRS, [or to substitute therefore only products approved in writing in advance by MRS as equal (if provided by the contractor)].
6. During the term of this Warranty, MRS, its Sales Representative and employees, shall have free access to the roof during regular business hours
7. MRS shall not have any obligation under this 20-Year Watertightness Limited Warranty until final drawings of the completed roof are submitted by MRS to the Roofer and accepted in writing by MRS. Such drawings must show the exact number, size and location of all roof penetrations and rooftop equipment. Photos of the roof showing these items must accompany the drawings.
8. MRS shall not have any obligation under this 20-Year Watertightness Limited Warranty until all invoices for installation, supplies and services have been paid in full to each of MRS and Roofer and each material supplier.
9. Neither MRS nor Roofer shall be responsible for any consequential damages or loss to the building its contents or other materials.
10. Neither MRS nor Roofer's failure at any time to enforce any of the terms or conditions stated herein shall be construed to be a waiver of such provision or of the right to exercise any right in the future.
11. This 20-Year Watertightness Limited Warranty supercedes and is in lieu of any and all other warranties (whether express or implied) that are either in addition to or in conflict with the term(s) and condition(s) stated herein. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE WHICH EXCEED OR DIFFER FROM THE WARRANTIES HEREIN EXPRESSED ARE DISCLAIMED BY EACH AND ALL OF SAID PARTIES AND EXCLUDED FROM THIS 20-YEAR WATERTIGHTNESS LIMITED WARRANTY.
12. If the subject roof is covered by products of more than one roofing products manufacturer, this 20-Year Watertightness Limited Warranty applies only to those portions of such roof which are covered solely by MRS manufactured products.
13. Notwithstanding any other provision of this 20-Year Watertightness Limited Warranty, MRS shall not have any liability or responsibility at any time for or as a consequence of any condensation or underside corrosion which is or was caused at any time in part or wholly by any condensation resulting from either or both of the following:
 - a) The use of an inadequate vapor barrier where the insulation is installed immediately beneath the roof panels. An adequate vapor barrier is defined as one which has a perm rating of .05 or less with sealed joints and perimeter.

- b) Inadequate ventilation of the attic space between a roof panel and insulation.
- 14. Roofing installation must be supervised by an authorized MRS installer or an individual that has been factory trained in the installation of MRS roofing products.
- 15. MRS roof panels must be made of a material which carries a 20-year durability warranty from manufacturer, such as a 20-year warranty Kynar 500 painted panel.

WARRANTY RESPONSIBILITY:

ROOFER:

- First through second Year, plus any applicable extension period(s) as describe hereinabove.

MRS:

- The thereafter remaining balance of the first 20 years from date of completion of installation of the subject Roof.

This 20-Year Watertightness Limited Warranty is tendered for the sole benefit of the original purchaser as named below is not transferable or assignable. It becomes valid only when signed by each of Roofer, Owner, and MRS.

EXCEPT ONLY AS EXPRESSLY PROVIDED HEREIN, MRS MAKES NO REPRESENTATION(S) OR WARRANTY(IES) OR MERCHANTABILITY AND WARRANT(IES) OF FITNESS FOR ANY PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED WITH RESPECT TO THE GOODS AND OR SERVICES COVERED HEREBY, NOR DOES MRS MAKE ANY WARRANTY OR RESUME ANY RESPONSIBILITY WITH THE RESPECT TO THE VALIDITY OF ANY PATENT(S), DESIGN(S), COPYRIGHT(S), OR TRADEMARK(S) WHICH MAY COVER ANY OF SUCH GOODS. THE CONDITIONS OF LIABILITY, RIGHTS, OBLIGATIONS AND REMEDIES OF THE PARTIES RELATING TO CLAIMS ARISING FROM ANY DEFECTIVE GOODS AND/OR WORKMANSHIP SHALL BE GOVERNED EXCLUSIVELY BY THE TERMS HEREOF. THIS 20-YEAR WATERTIGHTNESS LIMITED WARRANTY MAY NOT BE CHANGED ORALLY.

This 20-Year Watertightness Limited Warranty shall be governed by and construed and enforced in accordance with the laws of the State of North Carolina.

Roofing Contractor/Installer: _____

Owner: _____

By: _____

Title: _____

Date: _____

Metal Roofing Systems, Inc.: _____

Date: _____



30-Year Limited COOLR "Paint" Warranty AZ50 Galvalume®, G90 Galvanized, or Aluminum

EXCLUSIVE WARRANTY

This Warranty (collectively, the "Warranty") is issued by Metal Roofing Systems, Inc. (hereinafter referred to as "MRS"), to the customer identified in this Certificate (hereinafter referred to as "Customer") and applies to the finish on AZ50 Galvalume®, G90 Galvanized, or Aluminum flat sheet and coil products (hereinafter referred to as the "Product") with PVDF based coating consisting of KYNAR 500® or Hylar 5000® resin (hereinafter referred to as the "Coating") if erected anywhere within the Continental United States including Alaska, Hawaii and Canada.

1. Subject to the provisions contained herein, MRS warrants that during the Thirty (30) Year Warranty Period, MRS COOLR stock Coatings will not chip, crack, peel, flake or check (except for such slight crazing or cracking as may occur on tightly roll-formed edges or break bends at the time of roll forming or other fabrication of pre-painted sheet or coil and which is accepted in the industry as standard). Subject to the provisions contained herein, MRS warrants that for twenty-five (25) years, when installed vertically or not more than eighty-six (86°) from the vertical, the Coating will not chalk in excess of ASTM D-4214-89 method D659 number eight (8) rating, or change color more than Five (5.0) Hunter AE units as determined by ASTM method D-2244-2. Color change will be measured on an exposed painted surface that has been cleaned of surface soils and chalk, and the corresponding values measured on the original or unexposed surface. It is understood that fading or color change may not be uniform, if the surfaces are not equally exposed to the sun and elements.
2. This Warranty does not apply to circumstances beyond MRS control, including:
 - a. Fire or other casualty or physical damage;
 - b. Unusual harmful fumes, foreign substances in the atmosphere or standing water;
 - c. Improper treatment of or defects in the metal or in the fabrication;
 - d. Intermittent or continual submersion in water or any other liquid or solid material;
 - e. Damage from wind, deliberate damage, improper handling by erectors; and
 - f. Mishandled Products, e.g., ANY PRODUCT WHICH HAS BEEN ABUSED, ALTERED, MODIFIED, USED IN A MANNER NOT ORIGINALLY INTENDED, OR STORED CONTRARY TO OUR INSTRUCTIONS.
 - g. Stored or installed in a way that allows for poor air circulation, contact with animals or animal waste.
 - h. Embossing that fractures or severely stretches the film (i.e. film is diminished at the point of emboss by greater than 0.2 mils).
3. This Warranty does not cover damage or deterioration resulting from moisture contamination or entrapment or any other contamination detrimental to the coating, which occurs prior to installation of the Products, including, without limitation, contamination occurring during shipment of the Product to the jobsite or during storage at the jobsite. This Warranty does not cover failure due to corrosion of substrate. Other MRS warranties address corrosion issues.
4. All Warranty work will be performed by MRS, or any company, dealer, contractor, applicator, or distributor selected by MRS. Since there may be a color variance between the replacement or repainted Product and the originally installed Product due to normal weathering (i.e. exposure to sunlight and extremes of temperature and weather) of the originally installed Products, this condition shall not be indicative of a defect.
5. NOT WITHSTANDING ANYTHING TO THE CONTRARY CONTAINED HEREIN, MRS LIABILITY SHALL NOT EXCEED THE LESSER OF THE FOLLOWING: (I) THE CUSTOMER'S LIABILITY DIRECTLY ATTRIBUTABLE TO A BREACH OF THIS WARRANTY, OR (II) THE REFINISHING OR REPLACEMENT OF THE FAILED COATED MATERIAL, OR AT MRS OPTION, REFUND OF THE PURCHASE PRICE WHICH SHALL NOT EXCEED AN AMOUNT EQUAL TO ONE HUNDRED PERCENT (100%) OF THE AMOUNTS PAID TO MRS BY THE CUSTOMER FOR THE PURCHASE OF THE DEFECTIVE PRODUCT. MRS SHALL NOT BE LIABLE FOR INJURY TO PROPERTY OTHER THAN THE FLAT SHEET AND/OR COIL PRODUCTS COATED WITH FLUOROCARBON PAINT SYSTEMS, IN THE CONDITION AND AS PURCHASED BY CUSTOMER FROM MRS. MRS, IN ALL INSTANCES, SHALL HAVE THE SOLE AND EXCLUSIVE RIGHT TO DETERMINE WHETHER OR NOT REFINISHING OR REPLACEMENT OF THE FAILED AREAS IS REQUIRED, AND TO FULFILL ITS OBLIGATION UNDER THE WARRANTY, MRS RESERVES THE RIGHT TO NEGOTIATE AND APPROVE ANY FINAL CONTRACT LET FOR REFINISHING AND REPLACEMENT AS THE CASE MAY BE.

6. This Warranty applies only to products manufactured by the customer within six (6) months from shipment thereof by Metal Roofing Systems, Inc.
7. Claims under this Warranty must be presented by the customer to MRS in writing during the warranty period and within thirty (30) days after Customer becomes aware that any warranted condition has occurred. Time is of the essence and failure to give notice within the specified time shall discharge MRS from any obligations under this Warranty. MRS must be given a reasonable opportunity to do an on-site inspection to determine if there is a coating failure.
8. The laws of the State of Ohio shall exclusively govern the rights and duties of the parties to this Warranty. Any controversy or claim arising out of or related to this Warranty, or the breach thereof shall be brought before a court of competent jurisdiction in Cleveland, Ohio under the substantive and procedural laws of the State of Ohio.
9. Customer acknowledges that MRS is not the manufacturer or applicator of the coating warranted herein and agrees that all issues arising from or related to the exceptions set forth herein shall be determined finally and conclusively as to Customer, by the original manufacturer.
10. Due to pigment limitations, Regal Red, Matte Black and US Antique Black are covered by a number eight (8) rating for chalk and five (5) AE units for fade for a period of ten (10) years from installation. Copper and other metallic colors have no rating available for color change.
11. This Warranty applies solely to MRS "inventoried stock" colors. Custom matched colors and non-inventoried items may have different Warranty terms, or not be warranted.
12. For this Warranty to apply, the Customer must retain certain records. In order for MRS to process a claim, we will need to be told the original coil or skid tag number.
13. THIS WARRANTY IS GIVEN AS THE SOLE AND EXCLUSIVE WARRANTY AND EXCLUSIVE REMEDY BY OR AGAINST MRS, AND NO OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR PURPOSES, ARE MADE, AND ANY SUCH OTHER WARRANTIES ARE EXPRESSLY DISCLAIMED. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION CONTAINED IN THIS INSTRUMENT. CUSTOMER WAIVES THE BENEFIT OF ANY RULE THAT THE DISCLAIMERS OF WARRANTY SHALL BE CONSTRUED AGAINST THE SELLER, AND AGREES THAT THE DISCLAIMERS IN THIS INSTRUMENT SHALL BE CONSTRUED LIBERALLY IN FAVOR OF MRS. MRS SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. MRS HEREBY DISCLAIMS ALL LIABILITIES FOR DAMAGES BASED ON THEORIES OF NEGLIGENCE AND STRICT PRODUCT LIABILITY. THIS WARRANTY IS EXTENDED TO CUSTOMER ALONE AND NO OTHERS, IS NON-TRANSFERABLE AND NON-ASSIGNABLE, AND MAY NOT BE ENLARGED IN ITS SCOPE BY ANY REPRESENTATIVE, SALES PERSON, AGENT OR OTHER EMPLOYEE OF MRS. THE CUSTOMER SHALL NOT PERMIT ANYONE TO CLAIM OR IMPLY THAT THIS WARRANTY EXTENDS OR CAN BE "PASSED THROUGH" TO ANYONE OTHER THAN THE CUSTOMER. THIS PROVISION IS A MATERIAL TERM OF THIS WARRANTY AND ITS VIOLATION OR BREACH BY CUSTOMER OR ANY OF CUSTOMER'S AGENTS OR REPRESENTATIVES, SHALL VOID AND CANCEL THIS WARRANTY FOR ALL PURPOSES.

THE LIABILITY OF SELLER MRS SHALL NOT EXTEND TO PERSONAL INJURY, PROPERTY DAMAGE, LOSS OF PROFIT, DELAY OR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FAILURE OF ANY PRODUCT OR COATING TO CONFORM WITH THE PROVISIONS OF THIS LIMITED WARRANTY.

MRS SHALL NOT IN ANY EVENT BE LIABLE TO THE CUSTOMER OR ANY OTHER PERSON OR ENTITY FOR ANY ACTIONS, CLAIMS, CAUSES OF ACTION, DAMAGES, EXPENSES AND/OR LIABILITIES ARISING FROM OR RELATED TO THE DESIGN, USE OR FAILURE OF THE PRODUCT OR COATING, FOR THE INTERRUPTION OF THE CUSTOMER'S OPERATIONS OR BUSINESS, FOR THE COST OF LABOR EXPENDED BY OTHERS ON ANY DEFECTIVE PRODUCT OR COATING OR FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES WHATSOEVER OR LOSS OF PROFIT OR OTHER FINANCIAL LOSS ARISING OUT OF THE USE OR FAILURE OF THE PRODUCT OR COATING, EVEN IF MRS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH ACTIONS, CLAIMS, CAUSES OF ACTION, DAMAGES, EXPENSE, LOSS AND/OR LIABILITIES, WHETHER ARISING FROM BREACH OF CONTRACT BREACH OF WARRANTY, TORT, INCLUDING NEGLIGENCE, STRICT LIABILITY OR OTHERWISE TO ANYONE BY REASON OF THE FACT THAT SUCH PRODUCT OR COATING SHALL HAVE BEEN DEFECTIVE.

The customer named below, whose signature appears on this warranty, shall be named as Purchaser

Purchaser

Signature

Print Name

Job Name

Product Color/Material/Type

Purchase Order Number

Invoice Number

Date

Metal Roofing Systems

Signature

Print Name

Title

Date



7670 Mikron Drive
Stanley, NC 28614

Finish



METAL ROOFING
Systems, Inc

30
YEAR
WARRANTY

SEE REVERSE SIDE FOR MATERIAL AVAILABILITY



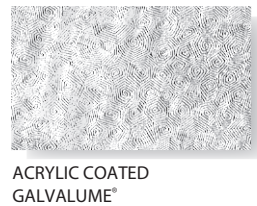
ENVIRONMENTALLY SMART COLORS - DESIGNED ENERGY EFFICIENT

TERRA COTTA	AGED COPPER	BONE WHITE	SANDSTONE	SURREY BEIGE
COLONIAL RED	PATINA GREEN	REGAL WHITE	ASH GRAY	SIERRA TAN
REGAL RED	HEMLOCK GREEN	STONE WHITE	DOVE GRAY	MEDIUM BRONZE
BURGUNDY	HARTFORD GREEN	SLATE BLUE	SLATE GRAY	MANSARD BROWN
MATTE BLACK	EVERGREEN	REGAL BLUE	CHARCOAL GRAY	DARK BRONZE

METALLIC COLORS

*SILVER	*COPPER	*CHAMPAGNE	*PRE-WEATHERED GALVALUME®

NON-PAINTED



*** CONTACT YOUR REPRESENTATIVE FOR EXACT COLOR CHIP SAMPLE**



LOCATIONS

7687 Mikron Drive
Stanley, NC 28164
P: 704.820.3110
F: 704.820.0113

370 Allied Drive
Conway, SC 29526
P: 843.347.6673
F: 843.347.6693

3214 Hanover Drive
Johnson City, TN 37604
P: 423.434.0535
F: 423.434.0537



*Available at a slight price premium. Colors shown are matched as accurately as possible, but may vary slightly from finished product. These rich and vibrant colors are produced with either Kynar 500® or Hylar 5000® resins, which provide superior color retention, and allow us to offer non-prorated coating warranties for most applications. Coating warranty varies for Regal Red, Matte Black, Copper, Silver, Champagne, and Pre-Weathered Galvalume. Metallics are warranted for chip, crack, and peel only. Please contact your representative for more information.

www.metalroofingsystems.biz

Faster. Smarter. Better. Period.

STOCK AVAILABILITY MATRIX

						GALVALUME	ALUMINUM				
						24 ga.	.032	.040	.050	.063	
			ISR	EMI	3yr.	SRI					
Aged Copper	★	L	0.47	0.85	0.46	53	●	●			
Ash Gray	★	L	0.39	0.84	0.39	41	●				
Bone White	★	L	0.47	0.83	N/A	58	●	●	●	●	
Burgundy	★		0.25	0.85	0.23	23	●				
Champagne Metallic	★	L	0.37	0.80	0.35	37	●				
Charcoal Gray	★		0.29	0.84	0.28	28	●				
Colonial Red	★	L	0.30	0.85	0.29	30	●	●	●	●	
Copper Metallic	★	L	0.49	0.86	0.47	56	●	●			
Dark Bronze	★		0.26	0.84	0.25	24	●	●	●	●	
Dove Gray	★	L	0.49	0.86	N/A	56	●				
Evergreen	★		0.27	0.86	0.26	26	●	●	●	●	
Hartford Green	★		0.26	0.85	0.25	24	●	●	●	●	
Hemlock Green	★	L	0.29	0.86	0.29	29	●				
Mansard Brown	★		0.27	0.86	0.25	26	●	●	●	●	
Matte Black	★		0.29	0.83	0.27	27	●	●	●	●	
Medium Bronze	★	L	0.30	0.87	0.28	31	●	●	●	●	
Patina Green	★		0.28	0.87	0.28	28	●				
Pre-weathered Galvalume*	★		0.30	0.79	0.28	27	●				
Regal Blue	★		0.26	0.85	0.25	24	●				
Regal Red	★	L	0.42	0.83	0.41	45	●	●		●	
Regal White	★	L	0.67	0.86	0.67	81	●	●	●	●	
Sandstone	★	L	0.54	0.86	0.53	63	●	●	●	●	
Sierra Tan	★	L	0.35	0.86	0.34	37	●	●	●	●	
Silver Metallic	★	L	0.59	0.79	0.60	67	●	●	●	●	
Slate Blue	★		0.29	0.85	0.28	28	●				
Slate Gray	★	L	0.33	0.84	0.33	33	●	●	●	●	
Stone White	★	L	0.60	0.86	0.56	71	●	●	●	●	
Surrey Beige	★	L	0.42	0.85	0.41	46	●				
Terra Cotta	★	L	0.35	0.86	0.35	37	●	●	●		
Acrylic Coated Galvalume*	★	L	0.67	0.14	0.55	56	●				

*** IF DESIRED COLOR IS NOT LISTED ON MATRIX PLEASE CONTACT METAL ROOFING SYSTEMS FOR AVAILABILITY**

NOTES
<ul style="list-style-type: none"> All metal is painted with a .20 mil primer and .70 -90 mil Top Coat of 70% Kynar 500 or Hylar 5000. The reverse side has a .20 primer and .30 - .40 backer coating. 22 gauge steel available upon request. For low slope roofing to meet Energy Star requirements the ISR must be \geq 0.65. After 3 years, the solar reflectance must be \geq0.50. For steep slope roofing to meet Energy Star requirements the ISR must be \geq 0.25. After 3 years, the solar reflectance must be \geq0.15. For low slope roofing to meet LEED 2009 requirements the SRI must be \geq 78. For steep slope roofing to meet LEED 2009 requirements the SRI for 100% of the roof must be \geq 29. Low slope is defined as \leq2:12. Steep slope is defined as $>$2:12.

KEY	
●	Stocked Item
★	Energy Star Compliant
L	LEED 2009 Compliant
ISR	Initial Solar Reflectance
EMI	Emissivity
SRI	Solar Reflectance Index



METAL ROOFING
Systems, Inc



Oil canning is an aesthetic issue and is an inherent part of light gauge cold formed metal products. By using coil that has been processed properly, designing for thermal movement, following stringent specifications for installation and proper handling most oil canning can be eliminated. Oil canning is not grounds for coil/panel rejection.

Galvalume® is a registered trademark of BIEC. Hylar 5000 is a registered trademark of Solvay Solexis, Inc. Kynar 500 is a registered trademark of Atofina, Inc.