CENTRIA

STRUCTURAL STANDING SEAM ROOF SYSTEMS

SRS® DESIGN MANUAL

CENTRIA

INTRODUCTION

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DESIGN CONSIDERATIONS

DESIGN DETAILS

For panel details, please refer to the CENTRIA website and portal.
www.CENTRIA.com

Contact CENTRIA for a copy of SRS® Installation General Notes Sheets.

THE SYSTEM

CENTRIA's SRS® Structural Standing Seam Roof Systems are designed as true standing seam roof systems which offer high performance structural features while attaining aesthetic lines required in architectural systems (Fig. 1)

The SRS panels are attached to a variety of substrates with concealed anchor clips that minimize exposed panel securement fasteners. The anchor clips are designed and tested to allow for thermal movement in the installed roofing system. Where conditions permit, the panels can be designed to extend continuously from roof eave to fascia without flashing or elastomeric rib caps, all of which would detract from the aesthetics and weathertightness of the system.

The mechanically field-seamed, factory-caulked battens eliminate exposed fastening along the sidelaps. SRS 2 has an integral batten. SRS 3 battens are manufactured to the same length as the panels, which eliminates unnecessary batten endlaps.

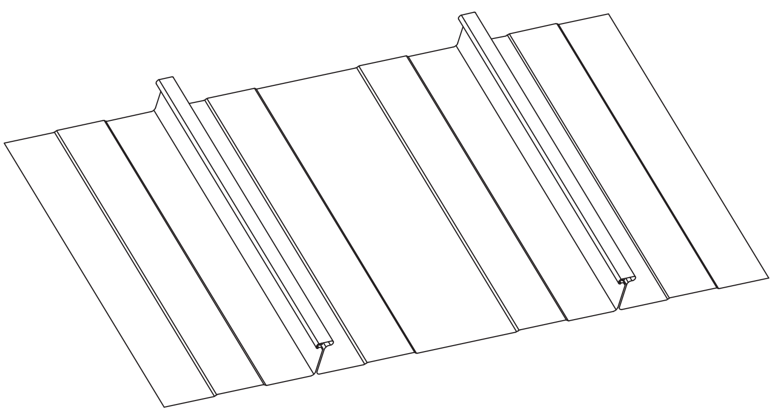
SRS Systems are thermally efficient and will achieve a "U" value as low as 0.077 BTU/Hr•Ft^2•˚F [.437w/m^2•˚C] when installed according to CENTRIA installation procedures.

The weathertightness of the systems has been proven and confirmed through independent testing and in the field. Contact CENTRIA for copies of test reports.

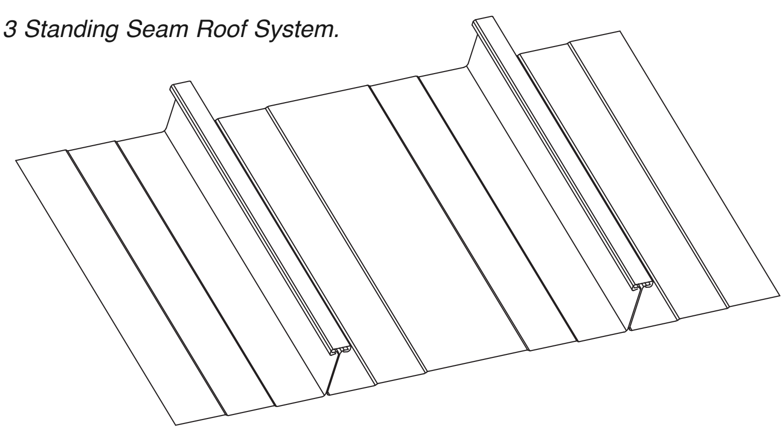
Simplicity of installation was a major objective in designing the systems. Factory applied batten sealant and proven details are examples of ways to prevent potential leak areas. SRS 2 is a handed system that requires the field modification of a standard panel to create a starter panel to accomodate installation in both directions. SRS 2 panels, with end laps, and notched and flared panel ends, require left-to-right installation. SRS 3 panels are non-directional, which enables them to be installed left to right, right to left, or from the middle of a roof in both directions.

SRS Systems are versatile, structural and architectural roofing products. They are designed as a weathertight low-slope system for roofing and siding in both new construction and retrofit, and provide a low maintenance, long-lasting roof for any type of building.

Figure 1. *SRS 2 Standing Seam Roof System.*



SRS 3 Standing Seam Roof System.



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PANELS

SRS Standing Seam Roof System panels, battens, flashings and closures are available with a substrate of Galvalume® or G-90 galvanized steel in 20 [.91], 22 [.76] and 24 [.60] gages. SRS 3 is available in 18 [1.19] gage with 20 [.91] gage or lighter battens. These substrates are available with Duragard, Duragard Plus or, Fluorofinish® (KYNAR 500 - 70%), coating systems. Panels coated with a metallic or mica finish must be oriented in the same direction to prevent the appearance of a color mismatch. SRS Standing Seam Roof System panels, battens, flashings, and closures are also available in stainless steel and aluminum.

Panels and battens are factory-formed and available in custom lengths up to 60' [18.288m] long. However, panels over 45' [13.716m] may require special transportation requirements at a higher cost. CENTRIA recommends that panels for standing seam roofing be fabricated in continuous lengths with no endlaps; endlaps require exposed fasteners in the pan of the panel which are a potential source of leaks due to panel thermal movement.

To accommodate continuous panel lengths longer than 60' [18.288m], CENTRIA will fabricate panels at the jobsite with a mobile roll-former. However, panel lengths may be restricted by jobsite space limitations.

The roofing installer must be qualified for long panel applications, roll-formed in the field. CENTRIA requires installer certification prior to material erection.

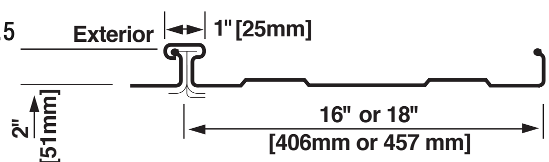
Figure 2.

PANELS AVAILABLE

SRS 2 System: 18” [457mm] (1.5) profile width; also available in 16” [406mm] (1.33) and 12” [305mm] (1.0) widths with standard planking ribs or optional pencil bead pan stiffeners for architectural versatility.

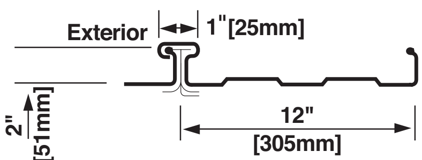
SRS 2 – 1.33 and 1.5

Planking Rib



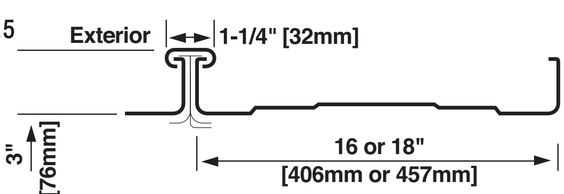
SRS 2 – 1.0

Planking Rib

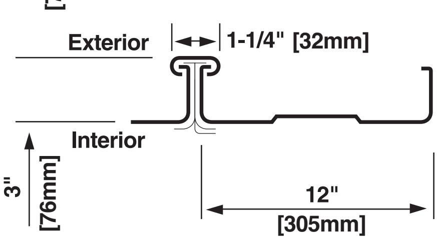


SRS 3 System: 18” [457mm] (1.5) profile width; also available in 16” [406mm] (1.33), and 12” [305mm] (1.0) widths for architectural versatility.

SRS 3 – 1.33 and 1.5



SRS 3 – 1.0



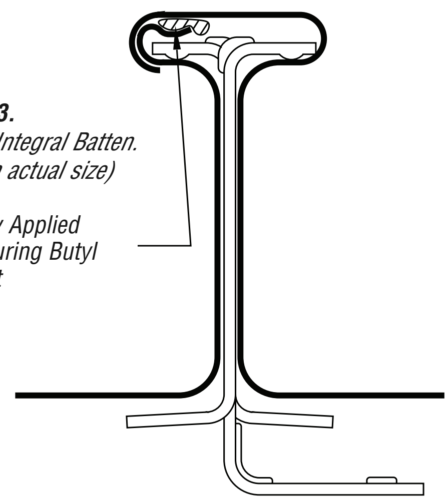


Figure 3.
SRS 2 Integral Batten.
(Shown actual size)

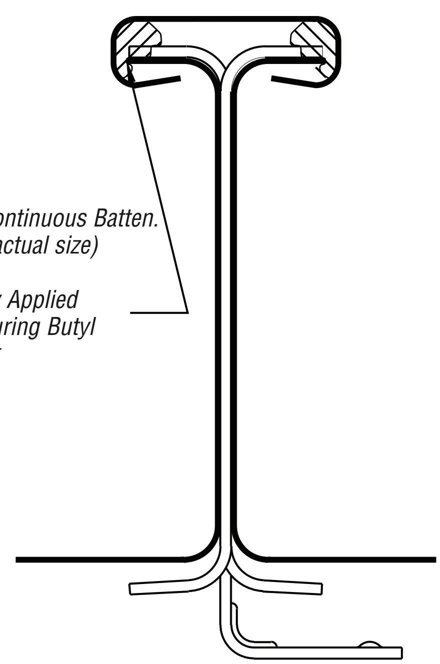
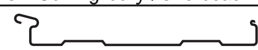
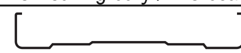


Figure 4.
SRS 3 Continuous Batten.
(Shown actual size)

SRS 2 and SRS 3 BASIC DIFFERENCES

The basic differences between SRS 2 and SRS 3 result from the integral batten and 1/4” [6mm] thick top flange on the SRS 2 panel. The SRS 2 panel has different sealant details at end lap, roof to fascia, and gable edge details. The integral batten will also affect erection direction and endlap notching. The SRS 2 1/4”[6mm] top flange thickness will require seal plugs at panel ends and transitions that fill the 1/4”[6mm] by 1”[25mm] flange area and remain weathertight. Crimping tools and seamers are different due to the flange dimensions and rib height.

Table 1. *SRS Systems Differences*

FEATURE	SRS 2	SRS 3
Rib Height	2” [51mm] Nominal	3” [76mm] Nominal
Batten	Integral	Separate
Shop Sealant	Non-Curing butyl/one bead	Non-curing butyl/two beads
Planking Ribs		
Pencil Ribs		Not available
Clips	2G1P, 2S1P, one piece 2G2P, 2S2P, two piece	3G1P, 3S1P, one piece 3G2P, 3S2P, two piece
Curving	No	Yes - See Page 4
Start Installation	 Create a starter panel by field modification of a standard panel for two direction installation	Left to right or right to left
Endlap Detail	Requires panel with notched and flared end	Requires panel with notched and flared end
Roof to Fascia Detail	Requires flange plugs in top flange and batten cap. Filler plates must be erected in sequence with panels	Must be erected in sequence with panels.
Gable Edge Details	See typical details	See typical details
Structural Capacity	See load/span tables	See load/span tables
Panel Description	Metal • 24 [.60], 22 [.76] and 20 [.91] gage, G-90, AZ50or AZ55 steel (18 [1.19] gage, SRS 3 only) 18 gage SRS3 panels must use 20 gage battens. • 22 [.76] and 24 [.60] gage stainless steel • 0.040 [1mm] aluminum	
	Coatings • See specifications	
	Panel Width • 12”, 16”, 18” [305, 406, 457mm]	Panel Width • 12”, 16”, 18” [305, 406, 457mm]
	Panel Length • Standard factory formed to 48’-0” [14.630m] • Custom factory formed to 60’-0” [18.288m] • Field-formed to 220’-0” [67.056m]	
	Clips • One-piece 14 [1.984] gage galvanized steel or one-piece 16 [1.587] gage stainless steel (SRS2) • One-piece 16 [1.587] gage galvanized steel or stainless steel (SRS3) • Two-piece 16 [1.587]gage galvanized steel or stainless steel web with galvanized steel base (SRS2 and SRS3) • Two piece clips required for curved panels, aluminum & stainless steel panels	
Minimum Slope	• 1/2:12 without endlaps • 1:12 with endlaps	
Minimum Convex Radius	N/A	• 24 [.60] gage steel 60’ [18.288m] • 22 [.76] and 20 [.91] gage steel 30’ [9.144m] • Stainless Steel 40’ [12.192m] • Aluminum 20’ [6.096m]

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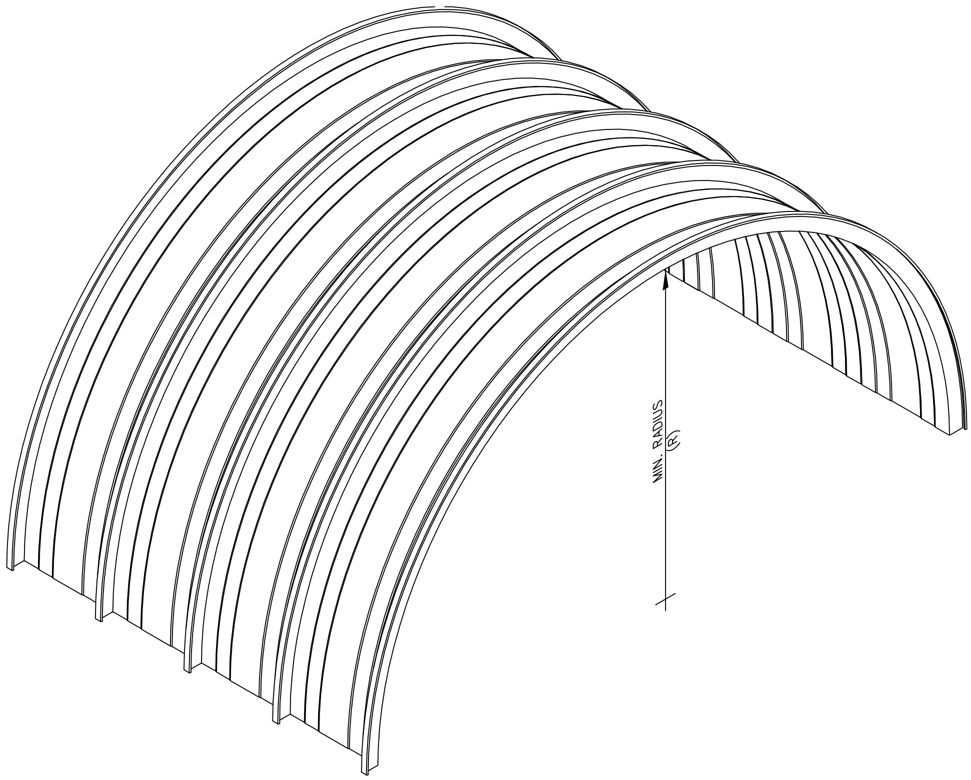
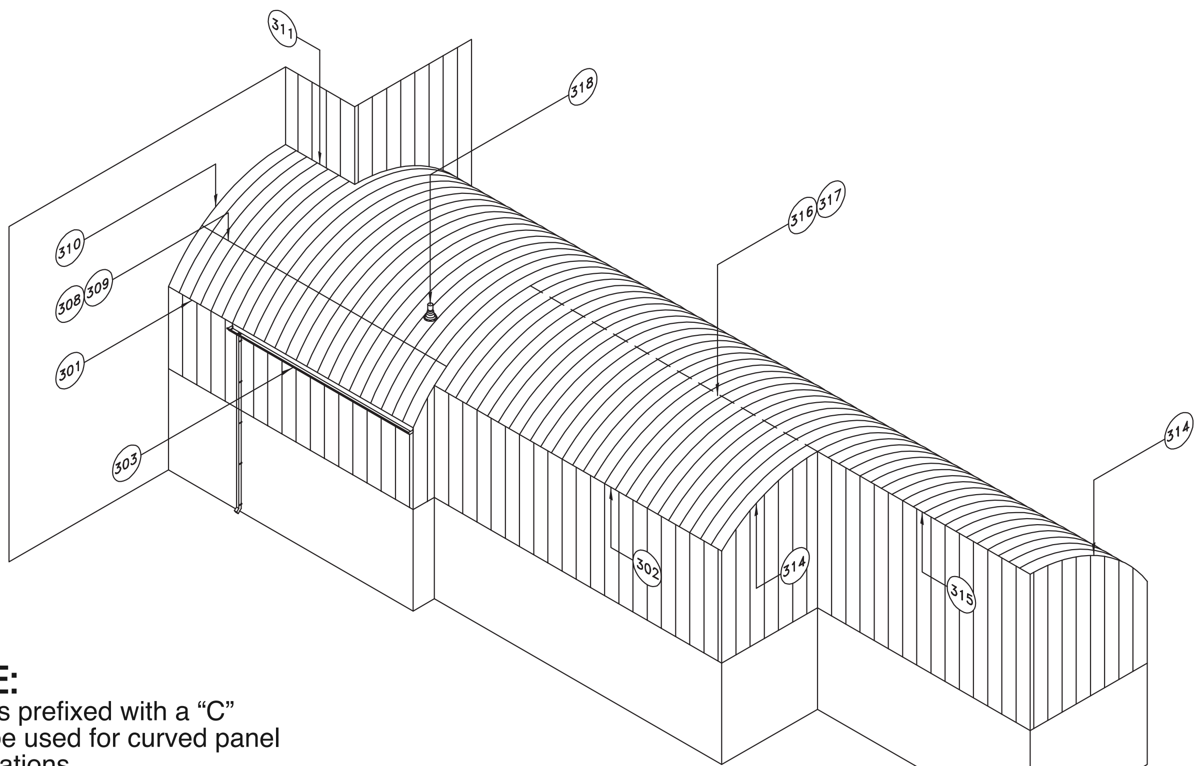
CURVING

Standing Seam Curved Roofing

CENTRIA SRS 3 structural standing seam curved roofing offers you advantages that can give your designs more freedom and flexibility. Walk down curves are available in 22 [.76] gage steel to a minimum radius of 200' [60.96m]. Roof panel curving is performed on-site or in the plant, using CENTRIA supplied equipment. Machine curves are available in radii as low as 20' [6.096m] in aluminum and 30' [9.144m] in steel. (Consult CENTRIA for the minimum radius available for each gage and for other substrates.) Panels are available in 12" [305mm], 16" [406mm] and 18" [457mm] widths. And, of course, SRS 3 curved roofing is available in CENTRIA's Colorstorm® palette, the industry's widest selection of colors.





NOTE:
Details prefixed with a "C" may be used for curved panel applications.

ACCESSORIES

ANCHOR CLIPS

CENTRIA concealed anchor clips are designed to allow minimal resistance to thermal movement of the roofing while at the same time securely attaching the system to the building structure. The standard one-piece clip ensures that the movement point is between the panels and the clip, thereby allowing the panel to move independent of the structural steel.

STANDARD SRS G-1P CLIP

Designed for one- or two-fastener attachment, standard concealed clips are manufactured from 16 [1.587] gage G-90 galvanized steel for SRS 3 and 14 [1.984] gage G-90 galvanized steel for SRS 2, conforming to ASTM A653 Grade 50. Seamed battens secure roof panels together over the extended top legs of the clip but allow free longitudinal thermal movement of the panels (Figs. 5,6,9). Clip standoff is a nominal 1/2” [13mm].

SRS S-1P CLIP

“S” series clips are similar to the “G” series clips except that they are manufactured from 16 [1.587] gage 300 series stainless steel for use in corrosive conditions or in stainless steel panel applications. Clip standoff is a nominal 1/2” [13mm]. (Figs. 5, 6.)

TWO-PIECE CLIPS

The purpose of the two-piece clip is for use with curved, aluminum, and/or stainless steel panels, or to satisfy the COE guide specification requirements. The top of this clip is similar to the one-piece clip. The SRS 2 clips have tabs that fit into the panel hem. A slight crimp on the hem is required on each side of the clip to assure its registration to the panel. Sliding occurs between the top and bottom clip elements, and the movement range is 3” [76mm]. This translates to approximate movements at the ends of a 200’ [60.96m] long steel panel or a 100’ [30.48m] long aluminum panel with a mid-length fixing point. The clip has a centering device to pre-locate the clip base in the center of the slot (Figs. 7, 8).

The clip standoff is a nominal 1/2” [13mm] which is the same as the one-piece clip. This allows the use of the one-piece clip as a mid-length fixing line clip where the panel may be fixed through the panel standing seams at predetermined and reinforced locations with a stainless steel bolt and washer attachment. Another method of fixing panels is to install fasteners through the pan of the panel. This method may be required when fixing point loads are high.

Two-piece clips are required when aluminum, stainless steel, and/or curved SRS is used. The top piece of the two-piece clip, which is in direct contact with the panel, is 16 [1.587] gage 302 stainless steel. The base clip, which is not in contact with the panel, is 16 [1.587] gage G-90 material and has an electro-deposited epoxy paint over all surfaces to act as an isolator against galvanic corrosion.

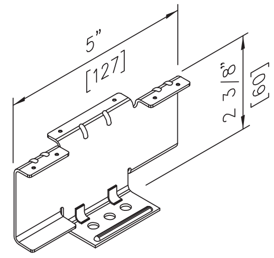


Figure 5. *SRS 2G-1P and 2S-1P Clip.*

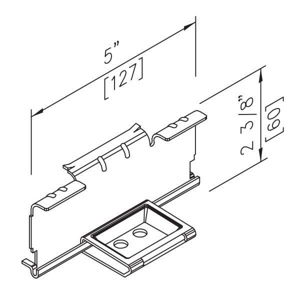


Figure 7. *SRS 2G-2P and 2S-2P Clip.*

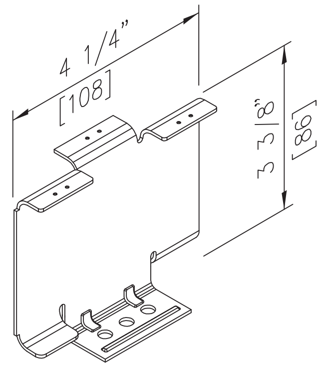


Figure 6. *SRS 3G-1P and 3S-1P Clip.*

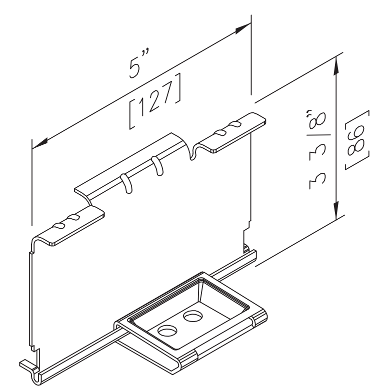


Figure 8. *SRS 3G-2P and 3S-2P Clip.*

Figure 9. SRS System Over Purlins

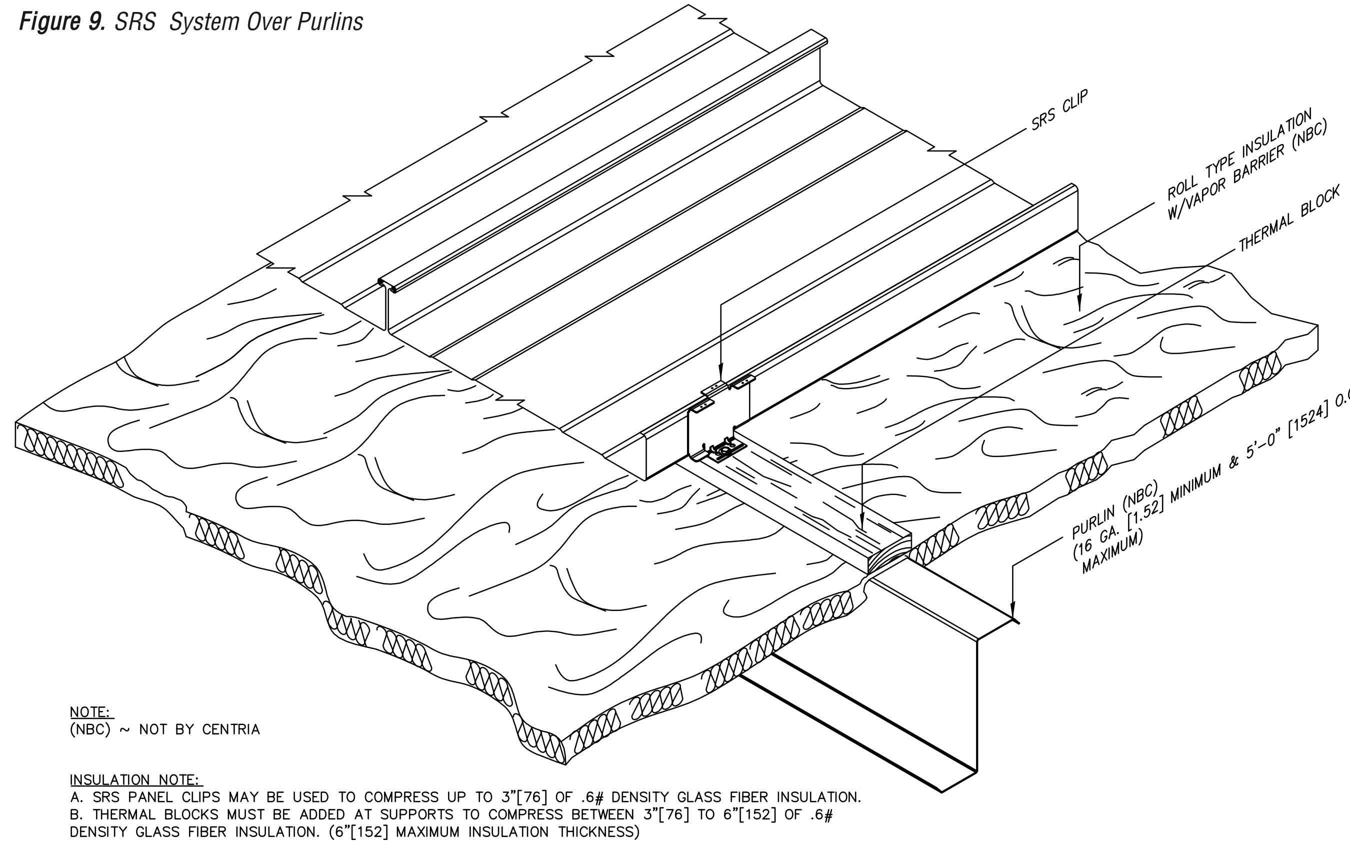
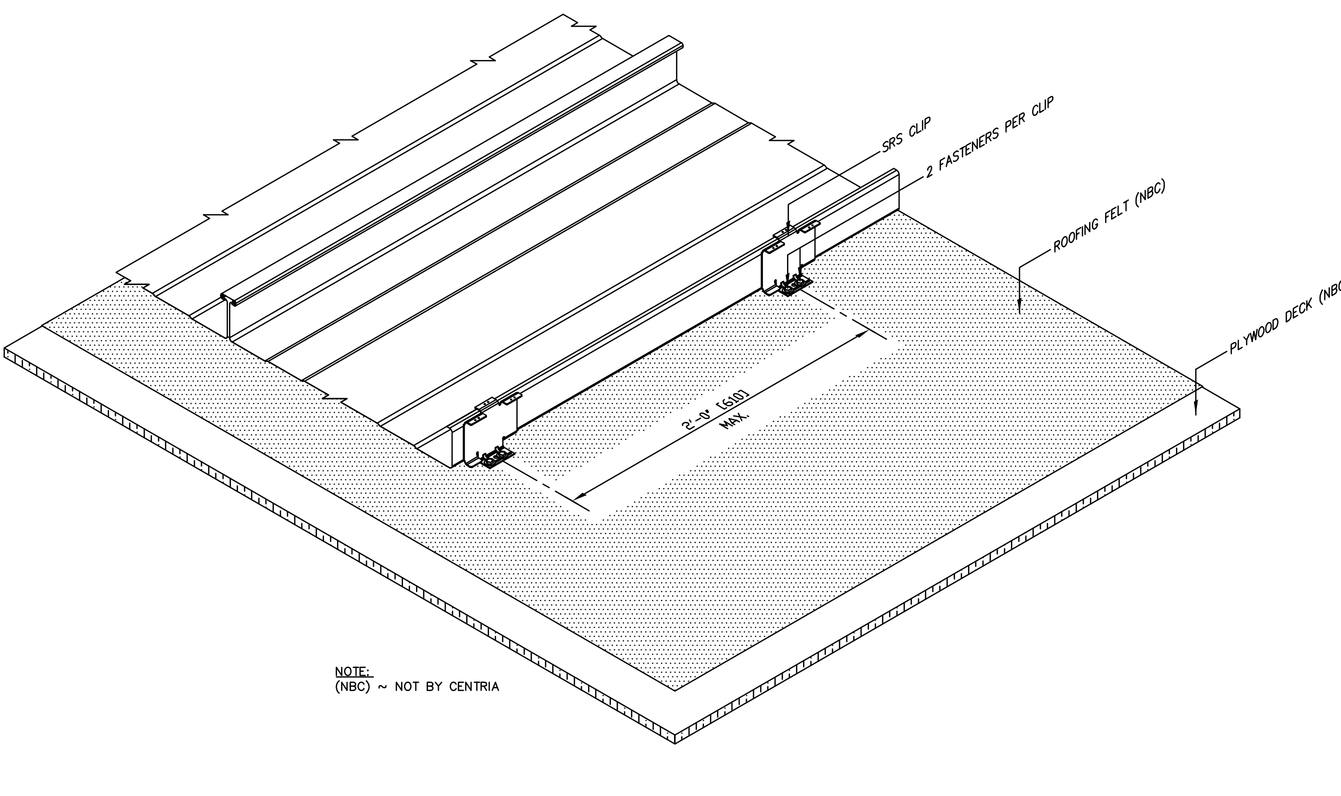


Figure 10. SRS System Over Plywood Deck



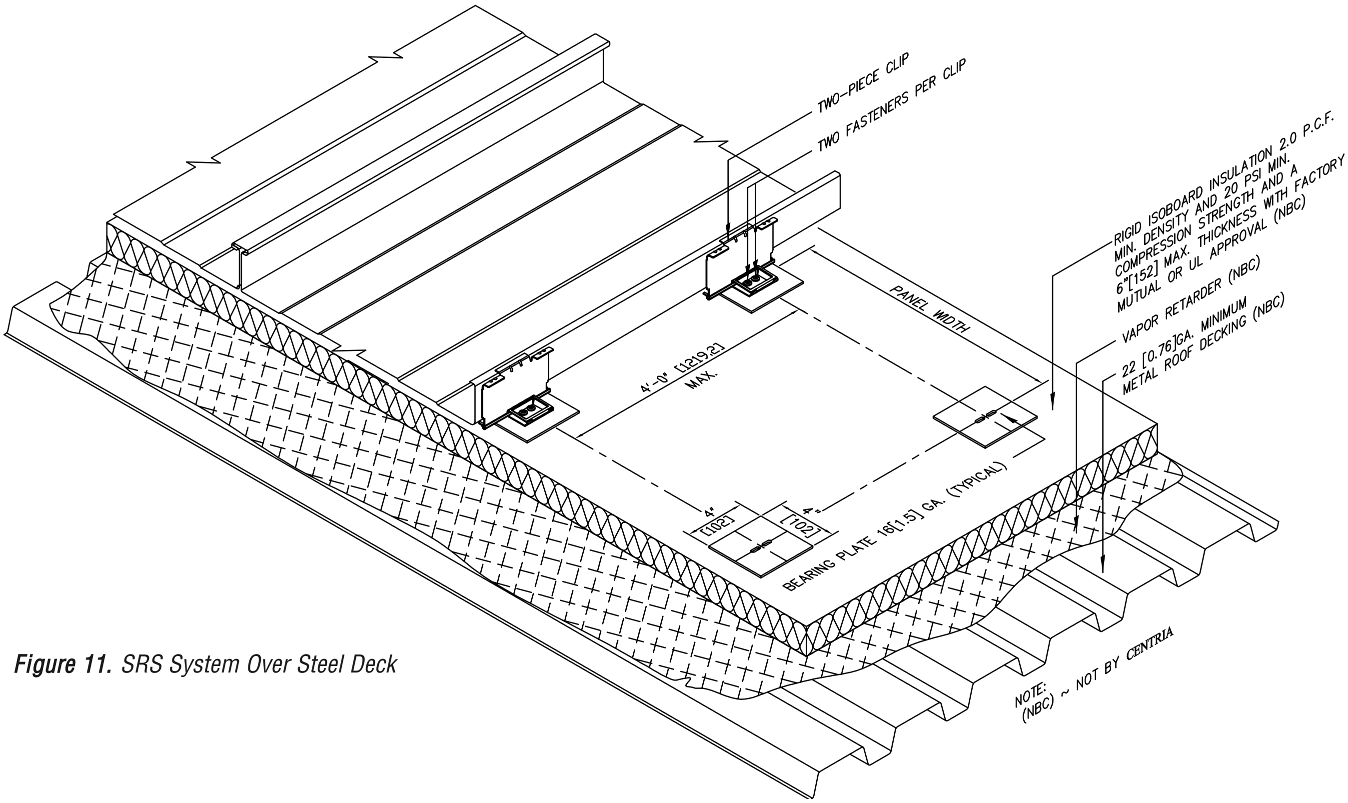


Figure 11. *SRS System Over Steel Deck*

STANDARD SRS GABLE CLIP

The field-modified gable clips are secured to the building frame or the wall cladding and spaced at the purlins. This design allows for a fixed flashing at the gable while at the same time allowing the panel flashing on the opposite side to move freely. It also ensures that there are no void areas at the eave of the building which would require trimming with special pieces (Fig. 12).

SRS SYSTEM OVER DECK

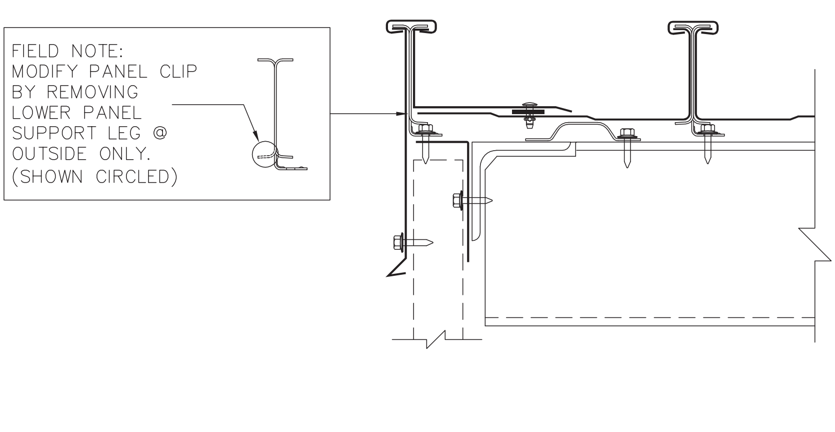
SRS panels may be designed to attach to metal decking. Two fasteners must be used with clips in this design. The maximum clip spacing is 4'-0" [1.219m] (Fig. 11).

CENTRIA SRS Systems do not provide for diaphragm action since the basis of the design is to allow thermal movement of the panels. The designer should ensure that diaphragms, bridging and bracing are incorporated into other building components.

NOTE TO SPECIFIER:

Quite often a structural deck will be used across the roof slope to span trusses (running perpendicular to roof slope) for diaphragm action. A common design error in this situation is designing the deck for uniform load. This assumption does not take into consideration the actual concentrated line load along individual deck cells due to SRS clip locations. The decking gage should be thoroughly evaluated for concentrated line loads and fastener withdrawal loads.

Figure 12. *Standard SRS Gable Clip Assembly.*



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EAVE FILLER PLATES

These components (Fig. 13) are factory fabricated from the same material as the panels and are used in designs which require unbroken panel lines at the eave. Fixing lines (see Page 23) must occur near the area of the filler plates. Typical step-by-step field assembly directions are provided on standard CENTRIA SRS installation general note sheets.

CLOSURE ASSEMBLY

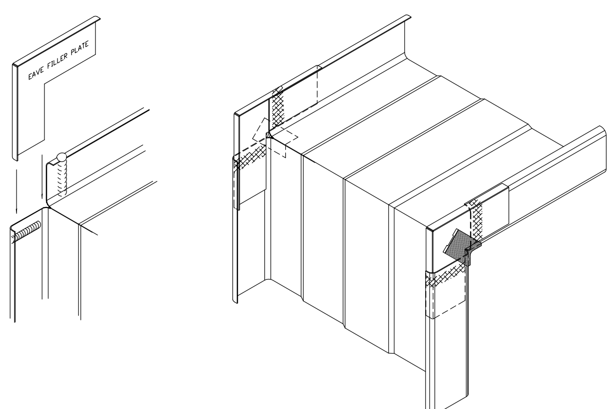
The standard ridge and hip closure system consists of a cross-linked closed-cell polyethylene composition foam closure. It is protected and supported by a formed metal channel closure manufactured of the same material as the roofing panels (Fig. 14).

The “U” shaped metal closure is designed for fastening to the pan of the panel. This attachment method makes the panels rigid and prevents transverse deflection. A major cause of roof leaks at ridge closures is construction and maintenance foot traffic near the closures. Without this attachment, a heavy concentrated load in the pan of the panel will sometimes cause permanent deformation of the panel and/or cause the closure and panel to separate.

CLOSURE INSTALLATION

The ridge closures are manufactured to fit one piece per panel and hip closures are field-cut from 12' [3.657m] lengths of metal and 4' [1.219m] lengths of composition closure strips.

Figure 13. *Filler Plates.*



Eave Filler Plate

Figure 14. *Closure Assembly.*

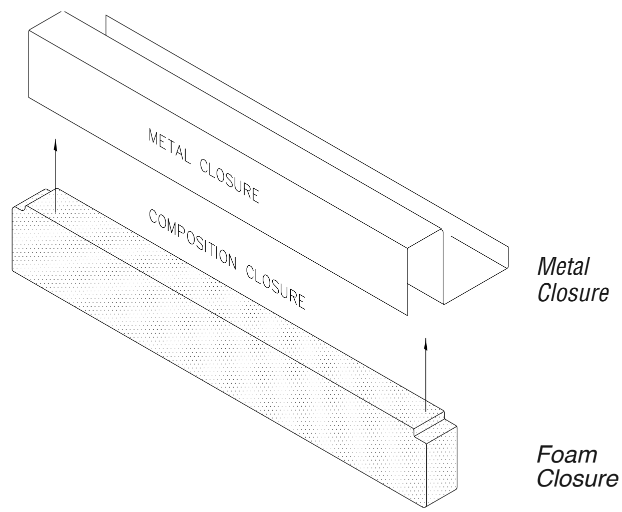
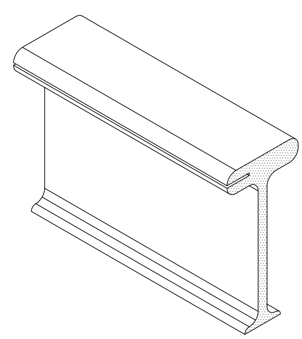


Figure 15. *SRS 2 Foam End Plug (QC-191).*



A foam end plug (Fig. 15) is used to visually close SRS 2 panel ends and complete marriage seals at floating or recessed seal planes.

The ridge cap or base flashing is fastened to the closure assembly with field-applied continuous tape mastic placed between the closure and the flashing. Field-applied tape mastic is also required between the panel and the bottom of the metal closure to seal the base of the metal and foam closure to the panel. Foot traffic will damage ridge flashing.
Do not walk on ridge caps.

PANNED END PANELS

Additional protection against leakage will be provided by field-bending the ends of the panels upward using the CENTRIA Pan End Tool. Diagonally field-cut panels at a hip condition must also have panned ends. Other than hip and valley conditions and openings, no field-cutting or trimming of the panel is required. **Any CENTRIA SRS roof system with a slope of less than 3:12 must have panned panel ends (Fig. 16).**

ALUMINUM (3004 H34) SUBSTRATE

1. Aluminum SRS will continue to be evaluated by the CENTRIA Design and Development Department on a project basis.
2. Panel runs are restricted to 50’ [15.24m] from the fixing points. Panels should be fixed at midpoint for all panels, and must be fixed at midpoint for panels over 50’ [15.24m] up to 100’ [30.48m].
3. Minimize end laps.
4. The installer must have experience in Aluminum Standing Seam Roofs.
5. The project details must be reviewed by the CENTRIA Design and Development Department prior to shipment of material.
6. The product is available 12” [305mm] or 16” [406mm] wide, .040” [1mm] thick only. SRS Panels are available in non-clad, painted aluminum only.
7. Two-piece clips are required: 2S2P (SRS 2) or 3S2P (SRS 3).
8. UL580 Class 90 certification is available.
9. Contact the CENTRIA Design and Development Department for loading information.

Figure 16. *Panned End Panel Assembly.*

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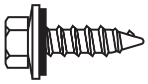
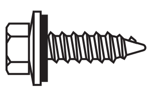
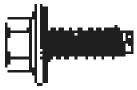
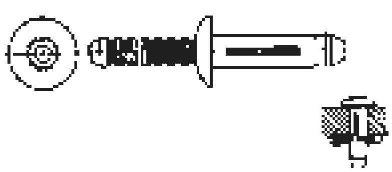
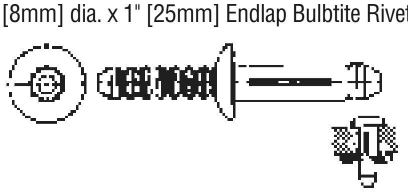
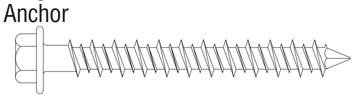
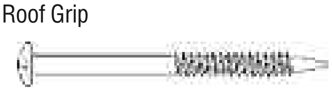
FASTENERS

The fasteners to be used in any standing seam roofing application must be properly sized and spaced to meet or exceed the specified design loading with an adequate safety factor. Standing seam roofing systems eliminate many of the fasteners typically used in a corrugated or ribbed metal roofing system. Fasteners which secure the anchor clips to the structure have become a more critical component in the system as fewer fasteners are required. Refer to the Design Considerations Section for more detailed information on fasteners.

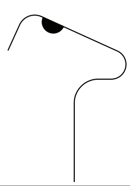
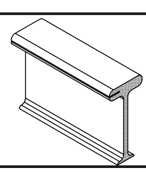
Table 2. *Fasteners.*

FASTENER TYPE AND DESCRIPTION	
ITEM	**DESCRIPTION AND USE**
#14-10 Hex Head Type "A" Screw 	Length from 3/4" [19mm] to 6" [152mm] assembled with 15 mm O.D. 20 [.91] gage sealing washer. Zinc-plated carbon steel or 300 Series stainless steel when exposed. Used to attach clips, flashings, and panels to purlins no thicker than 16 [1.587] gage, plywood, or, flashings to panels.
1/4-14 Hex Head Type "AB" Screw — Self Tappinig 	Length from 3/4" [19mm] to 1-3/4" [44mm] assembled with 15 mm O.D. 20 [.91] gage sealing washer. Zinc-plated carbon steel or 300 Series stainless steel when exposed. Used to attach clips, flashings, and panels to 14 [1.984], 12 [2.778] and 10 [3.572]gage purlins.
1/4-14 Hex Head, Type "B" Screw —Self Tapping 	Length from 1" [25mm] to 6" [152mm] assembled with 15 mm O.D. 20 [.91] gage sealing washer. Zinc-plated carbon steel or 300 Series stainless steel when exposed. Used to attach clips, flashings and panels to purlins thicker than 10 [3.572]gage.
3/16" [5mm] dia. x 3/4" [19mm] Flashing Rivet 	RV6604-6-4W Series Sealing Blind Rivet, standard dome head, aluminum rivet and mandrel, with a weathertight EPDM washer under the head. Used to attach closures to panels, exposed flashings, and gutter systems. Grip range .062" [2mm] to .250" [6mm]; 7/16" [11mm] head diameter.
5/16" [8mm] dia. x 1" [25mm] Endlap Bulbtite Rivet 	RV6605-9-6W Series Sealing Blind Rivet, large flange head, aluminum rivet and mandrel, with a weathertight EPDM washer under the head. Used to attach panel endlaps. Grip range .042" [1mm] to .375" [10mm]; 3/4" [19mm] head diameter.
#10 dia. Hex Washer Head, Dual Threaded, Milled Point Wood Screw 	1-1/2" [38mm] long assembled with 1/2" [13mm] diameter 20 [.91] gage galvanized sealing washer. Zinc-plated carbon steel. For attaching flashings to wood structures. Not for plywood attachment.
1/4" [6mm] dia. Slotted Hex Washer Head Concrete Screw Anchor 	Length from 1-1/4" [32mm] to 5" [127mm]. Masonry embedment from 1" [25mm] minimum to 1-3/4" [44mm] maximum. Used to attach subgirts and flashings to concrete and cement block.
#14 Roof Grip 	Length for 1-1/2" [38mm] to 8" [203mm]. Used to attach clips through bearing plates and rigid insulation into steel deck.

SEALANTS

Top quality sealants are essential for the CENTRIA standing seam roofing system. It is vital that the various sealants be applied per the construction details as they are an integral part of the CENTRIA SRS roofing system. The sealants as recommended by CENTRIA designate the standard of quality necessary for maximum performance for the roof system. All of the sealants used in the standing seam roof system are asbestos-free and have a service temperature range of at least -40 to +180 degrees Fahrenheit [-40 to +82 Celcius].

Table 3. *Sealants.*

SEALANT TYPE AND DESCRIPTION	
ITEM	**DESCRIPTION AND USE**
NON-CURING BUTYL SEALANT — SRS 3 BATTEN 	Two 1/4" [6mm] diameter beads are factory applied into the corners of the battens during the manufacturing process. It is a non-skinning, non-drying, non-hardening, non-oxidizing sealant designed for metal-to-metal concealed joints. 3/16” [5mm] x 7/8” [22mm] webbed mastic may be field applied in place of the factory sealant.
NON-CURING BUTYL SEALANT — SRS 2 BATTEN 	1/4” [6mm] diameter bead is factory applied and connects with mating edge when seamed. 3/32” [2.38mm] x 1/2” [13mm] butyl tape may be applied in place of the factory sealant. Butyl tape must be used for field roll-formed panels.
FIELD APPLIED SEALANTS	Polyurethane sealant is a one-component, curing joint sealant used at exposed conditions when movement is limited. Non-Curing Butyl Sealant — Blend of butyl rubber and polyisobutylene to provide a flexible seal with minimum shrinkage. Not for use in exposed conditions.
FIELD APPLIED TAPES WEBBED MASTIC (7/8" [22mm] X 3/16" [5mm])  SEALANT TAPE (1/2" [13mm] X 3/32" [2.38mm]) 	Sealant Tape and Webbed Mastic are extruded polymeric butyl tape sealants, identical in composition. Both are field-applied, non-skinning, and designed to retain aggressive tack while not being easily displaced under compression. Typically, sealant tape is used to seal flashing and siding sidelap joints and webbed mastic is used to seal SRS system panel endlaps, closures, and panel-to-gutter connections. Do not use webbed mastic to seal moving joints.
FOAM TAPE	Norton V748 Tape, 1/4” [6mm] x 1” [25mm] with PSA one side and mylar one side for floating details. Norton V778 1/4” [6mm] x 1” [25mm] with PSA one side. 4”[102mm] long pieces used at SRS2 End Laps.
FLANGE PLUG 	QC-191 Foam End Plug is used to close off SRS 2 Panel Ends. Material furnished in rolls and field cut to length as required.

TOOLS

SRS Roofing Systems utilize standard hand tools which are normally required for installing metal roofing and siding. In addition, the following tools are available from CENTRIA to ensure weathertightness of the system.

HAND-CRIMPING TOOL

The Hand-Crimping Tool is used to close the batten over the panel at ***All*** anchor clips, and to temporarily hold the batten in place until it is seamed. This tool is also used to seam short soffit and fascia panels (Fig. 17). Red SRS 3 crimping tools are different from blue SRS 2 crimping tools due to different rib sizes.

Figure 17. *Hand Crimping Tool: SRS 2 — Blue, SRS 3 — Red.*

Figure 18. *Pan End Tool.*

PAN-END TOOL

The CENTRIA Pan-End Tool is used to field-bend the flat bottom of the panel upward at ridge, peak, hip and headwall locations at slopes less than 3:12. This provides additional protection against leakage during wind-driven rainstorms (Fig. 18). Note: The panel is not cut to perform this operation. This tool is used on both SRS 3 and SRS 2 panels.

SEAMING MACHINES

The CENTRIA Seaming Machines mechanically seam the battens to the panels and clips. This process locks the panels together and ensures positive, weathertight sidelaps that can be obtained only through the use of a mechanical seamer. The seamers are designed to seam both painted and unpainted metals and battens without causing damage to the panels or battens (Fig. 19). A different seamer is used for SRS 2 panels.

Figure 19. *Seaming Machine.*

SRS 2 and SRS 3

CORROSION PREVENTION

Potential corrosion problems can be eliminated by building design and proper material handling and storage.

Water staining on unpainted metal panels is the result of minor surface corrosion due to moisture trapped within the panel bundles or ponding water on the roof of the building. Ponding water can be eliminated by designing sufficient slope into the roofing system. Moisture in the bundles can be eliminated by using proper storage procedures. Water staining due to improper storage and erection can affect the integrity of both the metal and coating.

Condensation on the underside of the panels must also be avoided through proper use of thermal blocks and vapor barriers. Thermal blocks limit conductive heat transfer in the roof assembly. Vapor barriers prevent moisture from escaping the “building envelope”. Heating a building in the winter season will drive moisture into the insulation or cause it to condense on the relatively cold roof panels.

Standard untreated framing lumber and plywood are recommended by CENTRIA, and will not affect the SRS panels. Clips and panels should not come into contact with treated wood, redwood or red cedar. Many preservatives used in treated lumbers contain acid, copper chromate and other forms of copper in various solutions, all of which are highly corrosive to unpainted metal. Salts used in fire retardant treated wood will also corrode unpainted metal roofing (Table 4).

CAUTION ON UNCOATED METAL— Copper, tin or lead will cause extreme galvanic corrosion of aluminum-coated or aluminum zinc alloy-coated panels when metal-to-metal contact occurs. These other metals will corrode and galvanic action will occur if rainwater carries particles of the metals onto the aluminum-coated panels and flashings.

Table 4. *Corrosion Potential Between Materials.*

CORROSION POTENTIAL BETWEEN COMMON FLASHING MATERIALS AND SELECTED CONSTRUCTION MATERIALS

CONSTRUCTION MATERIALS / FLASHING MATERIALS	Copper	Aluminum	Stainless steel	Galvanized steel	Zinc	Lead	Brass	Bronze	Monel	Uncurred Mortar or Cement	Iron/Steel
Copper		●	●	◑	●	◑	◑	◑	◑	○	●
Aluminum			○	○	○	◑	●	●	○	●	◑
Stainless steel				◑	●	◑	●	●	●	○	◑
Galvanized steel					○	○	◑	◑	◑	○	◑
Zinc alloy						○	●	●	●	○	●
Lead							◑	◑	◑	●	○

● Galvanic action will occur, hence direct contact should be avoided.
◑ Galvanic action may occur under certain circumstances and/or over a period of time.
○ Galvanic action is insignificant, metals may come into direct contact under normal circumstances.

GENERAL NOTE: Galvanic corrosion is apt to occur when water runoff from one material comes in contact with a potentially reactive material.

DESIGN CONSIDERATIONS

BUILDING DESIGN CODES

The design architect or engineer must find the design uplift pressure (negative) and any snow load pressure (positive) for the specific conditions of the project to determine the appropriate panel and support spacing selection. Local building code authorities should be consulted and meteorology reports reviewed to indicate any unusual local climate extremes.CENTRIA recommends that recognized building codes be reviewed and used prior to the building design. Following is a listing of commonly used building design codes:

1 International Building Code (IBC), International Code Council (ICC).

2 BOCA National Building Code (BOCA), Building Officials and Code Administrators International, Inc. (BOCA).

3 Uniform Building Code (UBC) International Conference of Building Officials (ICBO).

4 Standard Building Code (SBC), Southern Building Code Congress International, Inc. (SBCCI).

Chapters 6 and 7 of ASCE-7, the American Society of Civil Engineers "Minimum Design Loads for Buildings and Other Structures", are also widely recognized standards for determining wind and snow loads for buildings.

CENTRIA believes that taking wind uplift design pressures into consideration is critical for proper building design .

STRUCTURAL

The structural performance of the SRS System is based on the "Cold-Formed Steel Design Manual". This AISI Design Code is used to calculate the structural properties for all CENTRIA exterior panels.

In order to conform to the AISI code, testing is required to confirm and determine the structural performance of the panels. Standing seam roof panels, including CENTRIA's SRS panels, do not fall within the limitations set forth in section B1 of the AISI specification. Generally, calculated strength of profiles containing broad and relatively flat areas of the profile section are unconservative or invalid due to loss of profile when loaded.

Positive loads for SRS panels are calculated by use of the proper material design procedure. When crosswise panel deflection is restricted by the roof purlins under a positive loading condition, the design formula has been found to be valid.

Figure 20. *SRS Panels — Positive Load. Calculated properties are accurate.*

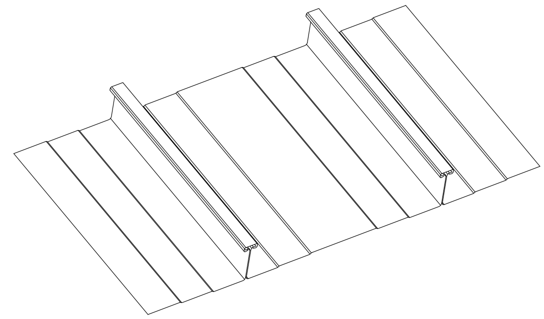
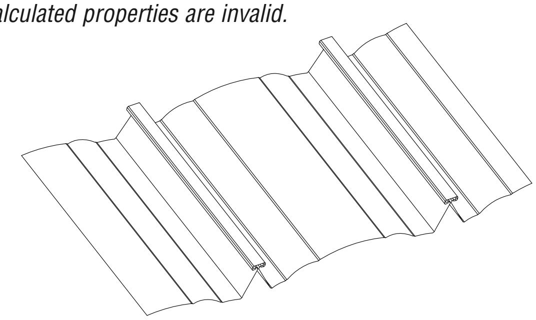


Figure 21. *SRS Panels — Negative Load. Calculated properties are invalid.*



Negative loading must be determined by testing. "Loss of profile" occurs during negative loading when the panel is basically unrestrained (Fig. 21). The AISI Code, Section F1 "Tests for Determining Structural Performance" states that the structural performance shall be established from tests because the capacity and deflection of the element cannot be determined in accordance with the code. Standing seam roofing must be designed to resist the uplift wind pressures required by the modern building codes. CENTRIA uses the ASTM E1592, "Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference" to meet the AISI requirements (Fig. 22).

The uplift test procedures used by CENTRIA are similar to those followed by the Factory Mutual Research Corporation. The test results and procedures are verified by a professional engineer.

The Underwriters Laboratories UL 580 test procedure is intended to provide only a basis for design and for jurisdictive authorities to ***make a determination on appropriate roof assemblies. The UL 580 test is not intended to quantify the performance of a roof assembly in actual field conditions***. The purpose of the test is to evaluate the comparative resistance of roof assemblies to positive and negative pressures.

PANEL GAGE SELECTION

In designing for economy, the most efficient use of the SRS Systems will result from utilizing the lightest panel gage permitting the maximum allowable span while meeting all of the durability and strength requirements. Purlin sizing, spacing and selection can then be determined.

Extra care should be taken by the installer to prevent construction traffic damage. Foot traffic near the purlins will not damage panels which have the battens installed, crimped and seamed.

DRILL SIZES FOR SELF-TAPPING FASTENERS

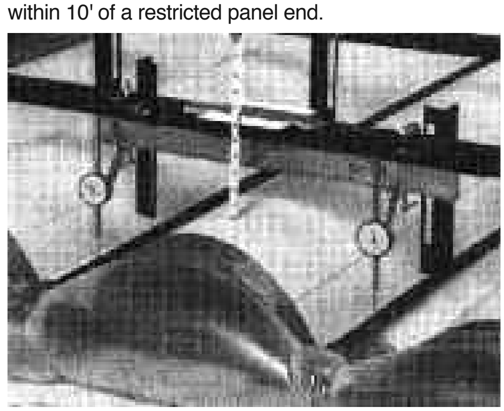
The use of recommended drill sizes for pilot holes of self-tapping fasteners is critical. See CENTRIA General Notes Sheets.

Figure 22. *CENTRIA Uplift Test Procedures.*

A minimum of five panels are tested. The purlin spacing can be adjusted to any span condition. Air pressure applied to the assembly is indicated by manometers.

Dial gages record panel rib deflection and can indicate a concealed clip failure. A rule is used to measure pan deflection.

None of the panel ends have fasteners which can limit pan deflection. Full pan deflection can occur within 10' of a restricted panel end.



Approximately 100 psf [4.78kPa] load shown. Pan deflection as much as 8" [203mm] will occur on an 18" [457mm] panel. Note that the vertical legs are approaching a horizontal position. This test procedure is the only method to determine the clip strength under load.

CENTRIA

DESIGN CONSIDERATIONS

SRS 2 — ALLOWABLE LOADS (English)

Table 5. *SRS 2 Panel Maximum Uplift Loads (English) With One-Piece Clip.***

SRS 2 — RECOMMENDED MAXIMUM UPLIFT LOADS (PSF)									
Panel Profile	Gage	Thickness (inches)	Weight (lb/ft²)	Span Length (ft)					
				2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
SRS 2-1.5	20	0.036	2.10	104*	97	89	82	74	67*
	22	0.030	1.75	81*	75	69	62	56	50*
	24	0.024	1.40	59*	54	49	43	38	33*
SRS 2-1.33	20	0.036	2.17	123*	113	102	92	82	72*
	22	0.030	1.80	84*	78	71	66	58	52*
	24	0.024	1.45	65*	60	55	49	44	39*

All tabulated loads are based on a minimum triple span configuration.

* Tested in accordance with COE Guidespec and ASTM 1592. These recommended loads are based on applying a safety factor of 1.65 at ultimate failure, load or 1.3 at yield failure, whichever is lower, as required by the Corps of Engineers standard specification.

No increase in allowable stress due to wind is permitted.

** For loads with two-piece clips and for higher allowable loads with deflection limiters, contact CENTRIA Design & Development Department.

Table 6. *SRS 2 Panel Maximum Positive Loads (English).*

SRS 2 — RECOMMENDED MAXIMUM POSITIVE LOADS (PSF)									
Panel Profile	Gage	Thickness (inches)	Weight (lb/ft²)	Span Length (ft)					
				2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
SRS 2-1.5	20	0.036	2.10	150*	150*	150*	135	107	87
	22	0.030	1.75	150*	150*	140	108	85	69
	24	0.024	1.40	150*	137	101	77	61	50
SRS 2-1.33	20	0.036	2.17	150*	150*	150*	150*	121	98
	22	0.030	1.80	150*	150*	150*	121	96	78
	24	0.024	1.45	150*	150*	115	88	69	56

* Contact CENTRIA Design and Development Department for positive loads in excess of 150 psf.

All tabulated loads are based on triple span configurations. Dead load of the panel is based on the weight of painted material. Deflections will not be greater than 1/180 of the span length. The above loads and spans are based on calculations according to the AISI Specification for the Design of Cold-Formed Steel Structural Members with a base material yield strength of 37 ksi. For higher load capacities via 50 ksi material, contact CENTRIA Design and Development Department.

Table 7. *SRS 2 Panel Section Properties (English).*

SRS 2 — PANEL SECTION PROPERTIES						
Panel Profile	Gage	Thickness (inches)	+Ic	+Sc	-It	-St
SRS 2-1.5	20	0.036	0.244	0.145	0.160	0.117
	22	0.030	0.203	0.121	0.121	0.093
	24	0.024	0.163	0.097	0.084	0.067
SRS 2-1.33	20	0.036	0.269	0.163	0.180	0.132
	22	0.030	0.224	0.136	0.136	0.105
	24	0.024	0.179	0.109	0.095	0.076

Ic & Sc = Weather Side in Compression — Positive Pressure

It & St = Weather Side in Tension — Negative Pressure (values based on testing)

I = Moment of Inertia Inches^4/ft width of panel

S = Section Modulus Inches^3/ft width of panel

Per AISI Cold-Formed Steel Design Manual/37 ksi yield

SRS 2 — ALLOWABLE LOADS (Metric)

Table 8. *SRS 2 Panel Maximum Uplift Loads (Metric) With One-Piece Clip.***

SRS 2 — RECOMMENDED MAXIMUM UPLIFT LOADS (KPA)									
Panel Profile	Gage	Thickness (mm)	Weight (kg/m²)	Span Length (mm)					
				750	900	1050	1200	1350	1500
SRS 2-1.5	20	0.91	10.25	4.98*	4.64	4.26	3.93	3.54	3.21*
	22	0.76	8.29	3.88*	3.59	3.30	2.97	2.68	2.39*
	24	0.60	6.83	2.82*	2.59	2.35	2.06	1.82	1.58*
SRS 2-1.33	20	0.91	10.59	5.93*	5.44	4.96	4.47	3.99	3.50*
	22	0.76	8.78	4.05*	3.75	3.45	3.14	2.84	2.54*
	24	0.60	7.07	3.11*	2.87	2.64	2.40	2.17	1.93*

All tabulated loads are based on triple span configuration.

* Tested in accordance with COE Guidespec and ASTM 1592. These recommended loads are based on applying a safety factor of 1.65 at ultimate failure load or 1.3 of yield failure, whichever is lower, as required by the Corps of Engineers standard specification.

No increase in allowable stress due to wind is permitted.

** For loads with two-piece clips and for higher allowable loads with deflection limiters, contact CENTRIA Design and Development Department.

Table 9. *SRS 2 Panel Maximum Positive Loads (Metric).*

SRS 2 — RECOMMENDED MAXIMUM POSITIVE LOADS (KPA)									
Panel Profile	Gage	Thickness (mm)	Weight (kg/m²)	Span Length (mm)					
				750	900	1050	1200	1350	1500
SRS 2-1.5	20	0.91	10.25	7.18*	7.18*	7.18*	6.46	5.12	4.16
	22	0.76	8.29	7.18*	7.18*	6.70	5.17	4.07	3.30
	24	0.60	6.83	7.18*	6.56	4.84	3.69	2.92	2.39
SRS 2-1.33	20	0.91	10.59	7.18*	7.18*	7.18*	7.18*	5.79	4.69
	22	0.76	8.78	7.18*	7.18*	7.18*	5.79	4.60	3.73
	24	0.60	7.07	7.18*	7.18*	5.50	4.21	3.30	2.68

*Contact CENTRIA Design and Development Department for positive loads in excess of 7.18 kPa.

All tabulated loads are based on triple span configurations. Dead load of the panel is based on the weight of painted material. Deflections will not be greater than 1/180 of the span length. The above loads and spans are based on calculations according to the AISI Specification for the Design of Cold-Formed Steel Structural Members with a base material yield strength of 255 mPa. For higher load capacities via 345 mPa material, contact CENTRIA Design and Development Department.

Table 10. SRS 2 Panel Section Properties (Metric).

SRS 2 — PANEL SECTION PROPERTIES						
Panel Profile	Gage	Thickness (mm)	+Ic	+Sc	-It	-St
SRS 2-1.5	20	0.91	333	7.79	219	6.29
	22	0.76	277	6.50	165	5.00
	24	0.60	223	5.21	115	3.60
SRS 2-1.33	20	0.91	367	8.76	246	7.10
	22	0.76	306	7.31	186	5.64
	24	0.60	245	5.86	130	4.09

Ic & Sc = Weather Side in Compression — Positive Pressure

It & St = Weather Side in Tension—Negative Pressure (values based on testing)

I = Moment of Inertia in mm^4 x 10^3/meter Width of Panel

Per AISI Cold-Formed Steel Design Manual/37 ksi yield

S = Section Modulus in mm^3 x 10^3/meter Width of Panel

SRS 3 — ALLOWABLE LOADS (English)

Table 11. *SRS 3 Panel Maximum Uplift Loads (English).*

SRS 3 — RECOMMENDED MAXIMUM UPLIFT LOADS (PSF)									
Panel Profile	Gage	Thickness (inches)	Weight (lb/ft²)	Span Length (ft)					
				2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
SRS 3-1.5	20	0.036	2.31	92 / 142	84 / 135	77 / 128	69 / 121	62 / 114	54 / 107
	22	0.030	1.96	92* / 142*	84 / 135	77 / 128	69 / 121	62 / 114	54* / 107*
	24	0.024	1.59	63* / 148*	59 / 139	54 / 130	50 / 122	45 / 113	41* / 104*
SRS 3-1.0	20	0.036	2.68	167 / 290	160* / 286*	— / —	— / —	— / —	— / —
	22	0.030	2.26	92 / 142	84 / 135	77 / 128	69 / 121	62 / 114	54 / 107
	24	0.024	1.84	63 / 148	59 / 139	54 / 130	50 / 122	45 / 113	41 / 104

All tabulated loads are based on a minimum triple span configuration.

*Tested in accordance with COE Guidespec and ASTM 1592. These recommended loads are based on applying a safety factor of 1.65 at ultimate failure load or 1.3 at yield failure, whichever is lower, as required by the Corps of Engineers standard specification.

No increase in allowable stress due to wind is permitted.

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Top value represents the recommended maximum uplift load.

Lower value represents the higher recommended maximum uplift load achieved through the use of deflection limiters. (See Detail 58).

Table 12. *SRS 3 Panel Maximum Positive Loads (English).*

SRS 3 — RECOMMENDED MAXIMUM POSITIVE LOADS (PSF)									
Panel Profile	Gage	Thickness (inches)	Weight (lb/ft²)	Span Length (ft)					
				2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
SRS 3-1.5	20	0.036	2.31	150*	150*	150*	132	104	84
	22	0.030	1.96	150*	150*	142	109	86	70
	24	0.024	1.59	150*	150*	112	86	68	55
SRS 3-1.0	20	0.036	2.68	150*	150*	150*	150*	150*	133
	22	0.030	2.26	150*	150*	150*	150*	135	110
	24	0.024	1.84	150*	150*	150*	134	106	86

* Contact CENTRIA Design and Development Department for positive loads in excess of 150 psf.

All tabulated loads are based on triple span configurations. Dead load of the panel is based on the weight of painted material. Deflections will not be greater than 1/180 of the span length. The above loads and spans are based on calculations according to the AISI Specification for the Design of Cold-Formed Steel Structural Members with a base material yield strength of 37 ksi. For higher load capacities via 50 ksi material, contact CENTRIA Design and Development Department.

Table 13. *SRS 3 Panel Section Properties (English).*

SRS 3 — PANEL SECTION PROPERTIES						
Panel Profile	Gage	Thickness (inches)	+Ic	+Sc	-It*	-St*
SRS 3-1.5	20	0.036	0.330	0.147	0.198	0.114
	22	0.030	0.275	0.123	0.154	0.094
	24	0.024	0.218	0.098	0.116	0.074
SRS 3-1.0	20	0.036	0.495	0.227	0.321	0.180
	22	0.030	0.413	0.189	0.252	0.148
	24	0.024	0.330	0.151	0.188	0.116

Ic & Sc = Weather Side in Compression — Positive Pressure
It & St = Weather Side in Tension — Negative Pressure (values base on testing)
I = Moment of Inertia Inches^4/ft Width of Panel
S = Section Modulus Inches^3/ft Width of Panel
Per AISI Cold-Formed Steel Design Manual/37 ksi yield.
* Testing required to calculate uplift capacities.

SRS 3 — ALLOWABLE LOADS (Metric)

Table 14. *SRS 3 Panel Maximum Uplift Loads (Metric).*

SRS 3 — RECOMMENDED MAXIMUM UPLIFT LOADS (KPA)									
Panel Profile	Gage	Thickness (mm)	Weight (kg/m²)	Span Length (mm)					
				750	900	1050	1200	1350	1500
SRS 3-1.5	20	0.91	11.27	4.40 / 6.79	4.02 / 6.46	3.69 / 6.12	3.30 / 5.79	2.97 / 5.45	2.59 / 5.12
	22	0.76	9.56	4.40* / 6.79*	4.05 / 6.46	3.69* / 6.12	3.34 / 5.79	2.98 / 5.45	2.63* / 5.12*
	24	0.60	7.76	3.01 / 7.08*	2.80 / 6.66	2.59 / 6.24	2.38 / 5.81	2.17 / 5.39	1.96* / 4.97*
SRS 3-1.0	20	0.91	13.08	8.74 / —	7.09* / —	— / —	— / —	— / —	— / —
	22	0.76	11.03	4.40 / 6.79	4.05 / 6.46	3.69 / 6.12	3.34 / 5.79	2.98 / 5.45	2.63 / 5.12
	24	0.60	8.98	3.01 / 7.08	2.80 / 6.66	2.59 / 6.24	2.38 / 5.81	2.17 / 5.39	1.96 / 4.97

All tabulated loads are based on triple span configuration.

*Tested in accordance with COE Guidespec and ASTM 1592. These recommended loads are based on applying a safety factor of 1.65 at ultimate failure load or 1.3 of yield failure, whichever is lower, as required by the Corps of Engineers standard specification.

No increase in allowable stress due to wind permitted.

4.64 / 6.79

Top value represents the recommended maximum uplift load.

Lower value represents the higher recommended maximum uplift load achieved through the use of deflection limiters. (See Detail 58).

Table 15. *SRS 3 Panel Maximum Positive Loads (Metric).*

SRS 3 — RECOMMENDED MAXIMUM POSITIVE LOADS (KPA)									
Panel Profile	Gage	Thickness (mm)	Weight (kg/m²)	Span Length (mm)					
				750	900	1050	1200	1350	1500
SRS 3-1.5	20	0.91	11.27	7.18*	7.18*	7.18*	6.32	4.98	4.02
	22	0.76	9.56	7.18*	7.18*	6.78	5.22	4.12	3.35
	24	0.60	7.76	7.18*	7.18*	5.36	4.12	3.26	2.63
SRS 3-1.0	20	0.91	13.08	7.18*	7.18*	7.18*	7.18*	7.18*	6.34
	22	0.76	11.03	7.18*	7.18*	7.18*	7.18*	6.46	5.27
	24	0.60	8.98	7.18*	7.18*	7.18*	6.42	5.08	4.12

*Contact CENTRIA Design and Development Department for positive loads in excess of 7.18 kPa.

All tabulated loads are based on triple span configurations. Dead load of the panel is based on the weight of painted material. Deflections will not be greater than 1/180 of the span length. The above loads and spans are based on calculations according to the AISI Specification for the Design of Cold-Formed Steel Structural Members with a base material yield strength of 255 mPA. For higher load capacities via 255 mPA material, contact CENTRIA Design and Development Department.

Table 16. *SRS 3 Panel Section Properties (Metric).*

SRS 3 — PANEL SECTION PROPERTIES						
Panel Profile	Gage	Thickness (inches)	+Ic	+Sc	-It*	-St*
SRS 3-1.5	20	0.91	451	7.90	265	6.13
	22	0.76	376	6.61	210	5.05
	24	0.60	298	5.27	158	3.98
SRS 3-1.0	20	0.91	676	12.20	438	9.68
	22	0.76	564	10.16	344	7.96
	24	0.60	451	8.12	256	6.24

Ic & Sc = Weather Side in Compression — Positive Pressure
It & St = Weather Side in Tension — Negative Pressure (values based on testing)
I = Moment of Inertia in $mm^4 \times 10^3$/meter Width of Panel
S = Section Modulus in $mm^3 \times 10^3$/meter Width of Panel

Per AISI Cold-Formed Steel Design Manual.

* Testing required to calculate uplift capacities.

DESIGN CONSIDERATIONS

Aluminum

SRS 3 — ALLOWABLE LOADS (English)

Table 17. *SRS 3 Panel Maximum Uplift Loads (English).*

SRS 3 — RECOMMENDED MAXIMUM UPLIFT LOADS (PSF)									
Panel Profile	Gage	Thickness (inches)	Weight (lb/ft²)	Span Length (ft)					
				2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
SRS 3-1.5		0.040	0.75	52*	48	45	42	38	35*
SRS 3-1.33		0.040	0.78	52	48	45	42	38	35
SRS 3-1.0		0.040	0.85	107*	98	89	81	72	63*

All tabulated loads are based on a minimum triple span configuration.

*Tested in accordance with COE Guidespec and ASTM 1592. Test includes at least one fixed end to simulate actual building conditions.These recommended loads are based on applying a safety factor of 1.65 at ultimate failure load or 1.3 at yield failure, whichever is lower, as required by the Corps of Engineers standard specification.

No increase in allowable stress due to wind is permitted.

Aluminum panel tests are based on 3004-H34 aluminum with a minimum yield strength of 24 KSI.

Aluminum

SRS 3 — ALLOWABLE LOADS (Metric)

Table 18. *SRS 3 Panel Maximum Uplift Loads (Metric).*

SRS 3 — RECOMMENDED MAXIMUM UPLIFT LOADS (KPA)									
Panel Profile	Gage	Thickness (mm)	Weight (kg/m²)	Span Length (mm)					
				2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
SRS 3-1.5		1.016	3.66	2.53*	2.37	2.21	2.05	1.88	1.72*
SRS 3-1.33		1.016	3.81	2.53	2.37	2.21	2.05	1.88	1.72
SRS 3-1.0		1.016	4.15	5.19*	4.77	4.36	3.94	3.53	3.11*

All tabulated loads are based on a minimum triple span configuration.

*Tested in accordance with COE Guidespec and ASTM 1592. Test includes at least one fixed end to simulate actual building conditions.These recommended loads are based on applying a safety factor of 1.65 at ultimate failure load or 1.3 at yield failure, whichever is lower, as required by the Corps of Engineers standard specification.

No increase in allowable stress due to wind is permitted.

Aluminum panel tests are based on 3004-H34 aluminum with a minimum yield strength of 165 MPA..

PRODUCT DESCRIPTION

Table 19.

UNDERWRITERS LABORATORIES CLASS 90 COMPONENT REQUIREMENTS*			
	Open Purlins	Steel Deck	Plywood Deck
Classification No.	SRS 2 – 493, SRS 3 – 314	SRS 2 – 493A, SRS 3 – 314A	SRS 2 — Construction No. 493B SRS 3 — Construction No. 314B
Panels and Battens Minimum Thickness Metal	SRS-1.0, SRS-1.33, SRS-1.5 24 [.60] Gage Galvanized or Stainless	SRS-1.0, SRS-1.33, SRS-1.5 24 [.60] Gage Galvanized or Stainless	SRS-1.0, SRS-1.33, SRS-1.5 24 [.60] Gage Galvanized or Stainless
Clips** Galvanized or Stainless	G-1, G-2, S-1, S-2 Min. 16 [1.587] Gage	G-1, G-2, S-1, S-2 Min . 16 [1.587] Gage	G-1, G-2, S-1, S-2 Min . 16 [1.587] Gage
Clip Spacing	5'-0" [1.524m] Max.	4'-0" [1.219m] Max.	2'-0" [.6096m] Max.
Screws Per Clip	1 per clip SRS 3 2 per clip SRS 2 1/4-14 Type "B" with 5/8" [16mm] O.D. Washer	Two #14-10 Type "A" with 5/8" [16mm] O.D. Washer	Two #14-10 Type "A" with 5/8" [16mm] O.D. Washer
Bearing Plate Required 4"x4"x16 gage [102mmx102mmx1.587gage]	N/A	Yes	N/A
Substrate -Thickness	Purlins-16 [1.587] Gage Min.	Deck-22 [.76] Gage Min.	1/2" [13mm] Min.
Insulation Type Maximum Thickness	Fiberglass 6" [152mm]	Foamed Plastic 6" [152mm]	N/A
Endlap Fasteners Fixed Endlap (Panels Attached to Purlin)	1/4-14 Type "B" with 5/8" [16mm] O.D. Washer	5/16" [8mm] Diameter Rivet #RV6605-9-6W	5/16" [8mm] Diameter Rivet #RV6605-9-6W
5/16" [8mm] Diameter Rivet (Clip Only Attached to Purlin)	Floating Endlap #RV6605-9-6W	5/16" [8mm] Diameter Rivet #RV6605-9-6W	5/16" [8mm] Diameter Rivet #RV6605-9-6W

* Unless otherwise noted, all information applies to both SRS 2 and SRS 3. Aluminum panel ratings are available, consult CENTRIA.
** Since UL testing and printing of the current UL manual, C-1 and C-2 clip designations have been changed. Reference Page 5.

UNDERWRITERS LABORATORIES WIND UPLIFT CLASSIFICATION PER UL® 580

CENTRIA panels have been tested by UL® and have a Class 90 Rating for all of the system components as listed in Table 19.

Comparison of ASTM E1592 and UL® 90 (Test 580)

ASTM E1592 Test Significance (Fig. 24)

- Complies with AISI Cold-Formed Steel Design manual for determining structural performance
- Quantifies multiple span conditions
- Used to develop negative load tables
- Simulates field conditions
- Permits variable purlin spacing
- Provides accurate loading capacities of panel components of a standing seam roof system
- Test is run to ultimate failure

UL 580 CLASS 90 TEST SIGNIFICANCE (FIG. 23)

- Provides a comparative index of all types of roof assemblies with respect to uplift resistance
- Not intended to quantify load/span tables
- Not intended to quantify roof performance in actual field conditions
- End restraints limit full pan deflection
- Intended to represent field installations within restraints of the test frame
- Evaluates systems on pass/fail basis
- Test is run to 105 psf [5.03kPa]

FACTORY MUTUAL WIND STORM CLASSIFICATION

22 [.76] gage SRS 3-1.5, is tested and approved for FM 1-90 wind storm classification. Panel must be installed over minimum 16 [1.587] gage open framing or minimum 22 [.76] gage steel deck. Maximum clip spacing of 4'-0" [1.219m].

20 [.91] gage SRS 3-1.0, is tested and approved for FM 1-180 wind storm classification. Panel must be installed over minimum 14 [1.984] gage purlins. Maximum clip spacing of 4'-0" [1.219m-0].

DESIGN CONSIDERATIONS

FIRE RESISTANCE

Complete descriptions of the entire assemblies are shown in the U.L.Fire Resistance Directory. CENTRIA roofing is basically a covering in these assemblies and the fire resistance is determined by all of the components. See SRS2 and SRS3 UL listings below. It is the building designer's responsibility to determine and specifiy all of the compnents to be used in a particular construction. CENTRIA requires metal decking to be a minimum of 22 [.76] gage when metal decking is used in the construction. Rigid foam board insulation must have Factory Mutual or UL Labels to be used without a 15 - minute fire barrier.

FIRE RESISTANCE

PER UL 263 "FIRE TESTS OF BUILDING CONSTRUCTIONS AND MATERIALS"
METAL ROOF DECK PANELS (CETW)
CENTRIA SRS Roofing Panels are classified by Underwriters Laboratories

Ratings are as follows:

1/2 hour	P814
3/4 hour	P224, P701
1 hour	P224, P225, P227, P230, P250, P508, P510,P512, P516, P701, P711, P715, P717,P803, P814, P815, P819, P821
1 1/2 hour	P225, P227, P230, P250, P510, P701, P711, P715, P717, P803, P815, P819, P821
2 hour	P237, P701, P711, P715, P717, P815, P819,P821
3 hour	P719, P723, P815

SYSTEM WEATHERTIGHTNESS TESTING

The side joints of SRS Systems have been tested by an independent testing laboratory to determine weather-tightness. The air infiltration rate is obtained in accordance with ASTM E-1680. Per ASTM E-1646, water penetration of the panel system is measured. The side joints have also been tested for up to 8" [203mm] of ponded water.

PANEL	AIR (ASTM E 1680)	WATER (ASTM E 1646)
SRS 2	0 cfm/ft^2@ 4 psf [0 L/s/m^2@ 191Pa]	"no leakage" @ 6.4 psf [307Pa]
SRS 3	0.036 cfm/ft^2 @4 psf [0.18288 L/s/m^2 @191Pa]	"no leakage" @ 9.2 psf [441Pa]

Fig 23. UL®90 (580) — Test Chamber and Panel Layout.

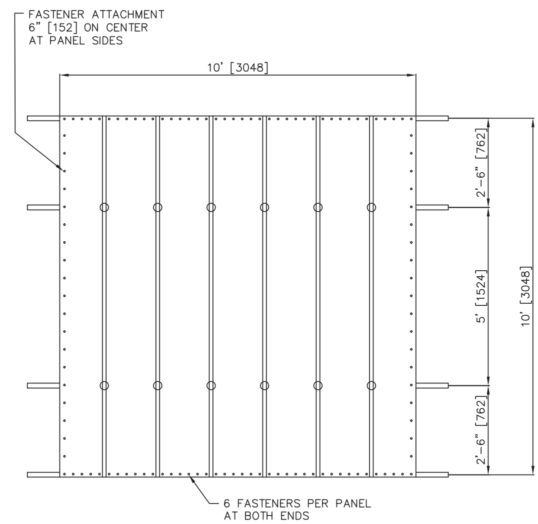
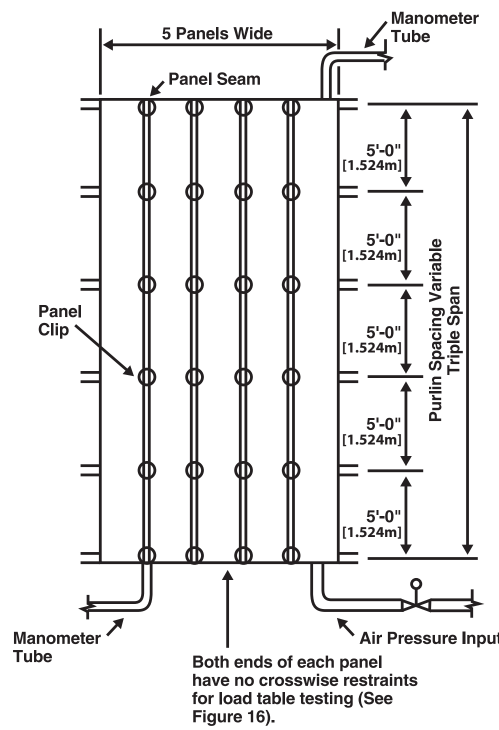


Fig. 24. ASTM E1592—Test Chamber and Panel Layout.



MINIMUM SLOPE

CENTRIA recommends a minimum roof slope of 1/2:12 per foot for roofs without endlaps and 1:12 per foot for roofs with endlaps. SRS Systems, when properly installed, will not have ponding of water on the panels. Purlin misalignment on low slope roofs could be within standard AISC steel erection tolerances but still require adjustment to assure proper panel drainage before roof installation can begin.

PURLIN DESIGN CONSIDERATIONS

I. Purlin Erection Tolerances
On many structures, it is general practice to specify that framing tolerances be in accordance with AISC code of standard practice. However, since SRS panels have non-ribbed flats which in most cases are 18” [457mm] wide, this specified tolerance is generally not sufficient to insure SRS panel flatness due to the fact that purlin misalignment often induces rippling and/or oil canning in wide flat products.

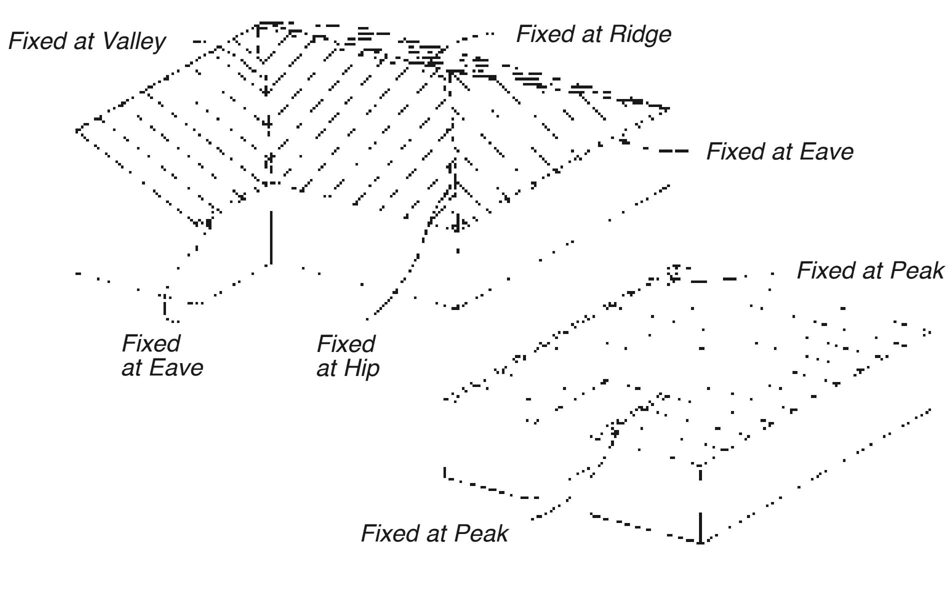
A. The following purlin erection tolerances are recommended.
   1. Maximum out-of-plane deviation should be limited to ± 3/16” [5mm] from the control with a maximum deviation of 1/8” [3mm] between adjacent clip locations or L/500,whichever is less
   2. Before panels are installed to the sub-framing system, it is imperative that purlin erection tolerances be checked. If any discrepancies exist, then all panel erection should be haulted until the proper purlin tolerances are established. Purlins which are out of tolerance can lead to restricted thermal movement of the panels.

II. Panel Fixing Lines
A. Thermal movement is an important factor in the proper design of both SRS 2 and SRS 3, and is particularly significant due to the fact that panel lengths are usually very long - sometimes ranging in lengths exceeding 150 ft.[45.72m] As a result, both SRS 2 and SRS 3 have been designed with the use of special clips which allow the roof to expand and contract freely to prevent any buildup of internal thermal stresses and/or forces. This requires fixing the roof system at one or more adjacent locations to prevent the panels from shifting down the roof under repeated thermal cycling (Fig. 25).

B. Fixing line requirements can vary from job to job based on sheet lengths, panel color, perimeter details, substrate type, etc. However, as a general rule, fixing points should be in a straight line perpendicular to the panel length.Other general recommendations as they relate to fixing line locations are as follows:
   1. Fixing lines should be at gutter and valley details because of the high performance weather tight ness typically required at these details.
   2. Panels which meet the following length limita tions do not require the use of a floating ridge and hip cap detail. The minimal linear expansion in the sheet is relieved by slight distortion and rotation of the one-piece ridge or hip cap and closure assemblies.
      A) Steel panels 30’-0” [9.144m] long or less
      B) Aluminum panels 15”-0” [4.572m] long or less
      C) Stainless steel panels 20’-0” [6.096m] long or less
   3. Establish fixing lines at the eaves and use a floating hip and ridge cap for the following conditions (unbalanced design):
      A) Steel panels under 75’-0” [22.86] long
      B) Aluminum panels under 40’-0” [12.192m] long
      C) Stainless steel panels under 50’-0” [15.24m] long
   4. Establish fixing lines at mid-length of sheet and use floating eave, ridge and hip details to mini mize total movement at panel ends for the following conditions (balanced design)
      A) Steel panels over 75’-0” [22.86m] long
      B) Aluminum panels over 40’-0” [12.192m] long
      C) Stainless steel panels over 50’-0” [15.24m] long

When utilizing mid-span or balanced design, two rows of adjacent fixing lines are required for sheet lengths from 75’ [22.86m] to 150’ [45.72m] and three rows for sheet lengths over 150’ [45.72m].

Figure 25. *Fixing Lines.*



Note:
Although a floating detail may not be required under the above conditions, one panel end must remain free to float. Do not fix both ends of the panel.

III. Purlin "Rollover" Due to Wind and Gravity Loads

The ability of a roof purlin to resist loads perpendicular to its strong axis is dependent upon the stability of the purlin. Likewise, the tested performance of the SRS roof system is contingent upon the stability of the roof purlin under load. Flanges of purlins tend to deflect or buckle laterally under load if not supported in their weak axis direction. Gravity loading due to snow loading causes the top flange to be in compression at the center of the span which must be braced against rotation if the flange compressive stresses are exceeded by that permitted by AISI codes. This typically is not a problem for exposed or direct fastened profiles due to the stability offered by the profiles. However, since SRS panels are clipped to the purlins without direct fastening methods — **which is essential for thermal expansion capabilities** — this lateral restraint is not present. The same problem exists on purlin bottom flanges under wind-uplift loading which reverses the above condition. Generally, all purlin systems require secondary bracing to develop their load capacity when designed to support standing seam roofing. Without lateral bracing, the load carrying capacity of these members is greatly reduced due to lateral buckling type failures. Purlin framing should be reviewed by a qualified structural engineer.

IV Purlin "Rollover" Due to Lateral Loads

In addition to the loads perpendicular to the surface resulting from dead, wind, and/or snow loading, purlins must be designed and braced properly to resist the in-plane forces induced by temperature loading and the lateral force component from panel weights and/or snow loads which increases as the roof pitch becomes greater. The combination of these loads can be significant on roof pitches exceeding 3:12" and roof sheets fixed at one end only. This requires the purlins,especially at the fixing lines of the roof, to be adequately braced against rollover as a result of these forces. Supports designed to handle the load component parallel to the roof slope as a result of thermal, dead, and/or live load must be provided at all fixing lines. For "open purlin" designs, the fixing line purlin must be designed to withstand this load. For "continuous deck" applications, supports such as wood blocking or zee struts must be provided to accomodate this load.

A. Temperature Loading — This lateral loading results from the developed forces required to overcome the frictional resistance of the SRS clips to the move ment of the roof panels. Tests indicate that this force can exceed 30 lb. [13.608kg] per clip for one-piece clips, and 10 lb. [4.536kg] for two-piece clips, especially on SRS 3 panels. Therefore, the total lateral force developed at the fixing point location is equal to the slip resistance per clip times the number of floating connection points supported by the fixed point connection. For design purposes, 5 lb.[2.268kg] per clip for two-piece clips and 20 lb. [9.072kg] per clip for one-piece clips are used when calculating these forces due to the unlikelihood that all clips will be at their maximum resistance at the same time.

B. Dead Loading — This lateral force results from the parallel component of the dead load force which increases with roof pitch. For example, a panel which weighs 2 lb. [.9072kg] per sq. ft., exerts a lateral force of approximately .17 lb. [.0771kg] per sq. ft. on a 1:12 pitched roof while the same panel exerts a .5 lb. [.2268kg] per sq. ft. force on a 3:12 pitched roof.

C. Snow Loading — This lateral force results from the parallel component of the snow load force which again increases with roof pitch. For a 30 lb. [13.608 kg] per sq. ft. snow load, this force translates to a 7.25 lb. [3.2885kg] per sq. ft. lateral force on a 3:12 pitched roof.

V. Serviceability Considerations

Serviceability criterion defines the functional performance of the structure, rather than control the safety of the structure. Therefore, this criterion is often not found in building codes and is left to the designer or building owner to determine.

For roof purlins, the primary serviceability considera-tion is vertical deflection. Large purlin deflections can lead to rotational problems with the purlins, and can cause ponding problems. The concern for maintaining drainage on the overall roof can be eliminated by using an appropriate roof slope. For standing seam panels, the minimum should be 1/2:12 per ft for roofs without end laps and 1:12 per ft for roofs with end laps. In no case should purlin deflections exceed L/180 and may need to be more stringent if ponding is a potential problem.

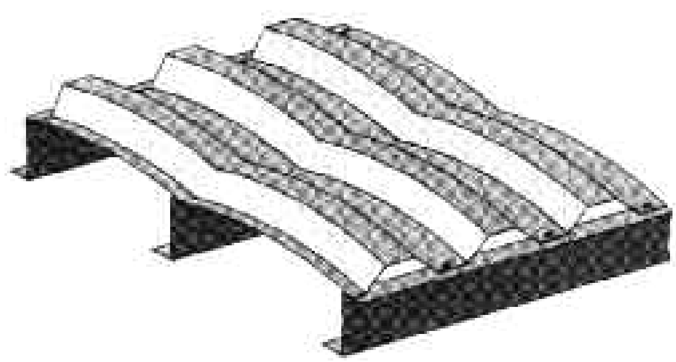
THERMAL MOVEMENT

The CENTRIA SRS Roof System has been designed to accommodate thermal movement. Structural integrity and weathertightness are not compromised by the movement if a project is properly designed and detailed. Ribbed and corrugated metal roofs transfer metal expansion to linear panel deflection between exposed structural fasteners. This situation occurs as a series of relatively equal minor distortions between the roof purlins and induces a tension reaction on the fasteners (Fig. 26).

Thermal contraction on this type of roofing will elongate fastener holes in the panels by approximately 1/8" [3mm] in extreme situations, but a properly installed fastener with a 5/8" [16mm] diameter sealing washer should prevent any chance of leakage at these points.

Standing seam metal roofs eliminate approximately 70% of the typically required fasteners. Because the linear thermal panel movement is cumulative, the force of this movement is sufficient to buckle and tear metal and shear fasteners if long length panel movement is restricted. With proper design of SRS Systems, these potential failure areas are not experienced (Table 20).

Figure 26. Expansion/Deflection for Ribbed Roofing.



All materials will expand and contract with temperature changes. The coefficient of expansion for three comparative metals are as follows:

Carbon and Galvanized Steel --.00065 [.00117]
Stainless Steel — .00099 [.00178]
Aluminum — .00128 [.00231]

An unpainted or light-colored roofing panel on an un-insulated building will exhibit the least amount of thermal movement; a minimum 100 degree Fahrenheit [38 degree Celcius] temperature differential should therefore be figured.

*Inches per inch per 100 degree Fahrenheit.

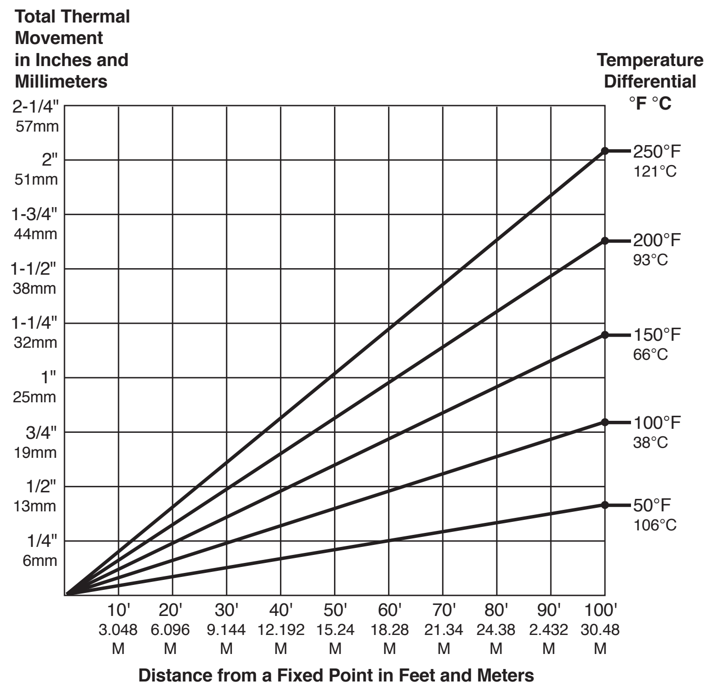
*[Millimeters per millimeter per 38 degree Celcius]

The greatest amount of thermal movement will occur with a dark-colored panel on an insulated building. The exposed metal temperature in this condition can reach 180 degrees Fahrenheit [82 degrees Celcius] while the insulated structure remains relatively cool. The lowest expected temperature during the winter should be used to calculate the total temperature differential .

Ample clearance must be provided in the details for thermal panel movement. Refer to the Design Details Section for more specific applications.

Lateral thermal movement in the panels is absorbed by slight uniform transverse deflection in the flat pan of the panel. A 200 degree Fahrenheit [93 degree Celcius] temperature differential will induce a deflection of 0.024" [.61mm], or the thickness of 24 [.60] gage steel (Fig. 27).

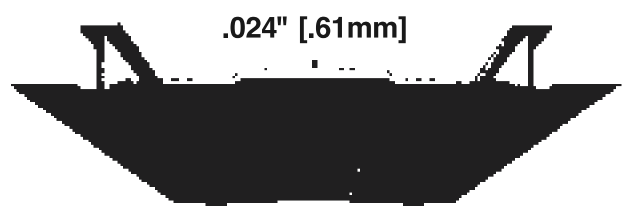
Table 20. Linear Thermal Expansion for Steel Panels.



STEEL PANELS

Thermal expansion testing has been conducted on SRS Systems by an independent testing laboratory. The results of the testing confirmed that the thermal panel movement was not impeded by the one-piece clip design. Contact CENTRIA Design and Develop-ment Department for copies of the test report.

Figure 27. Thermal Transverse Deflection.



In addition to the thermal panel movement test, CENTRIA has conducted thermal cycle testing to determine the wear on the panels and clips caused by repeated thermal cycles (Fig. 28).

This assembly was cycled 100,000 times to simulate up to five cycles per day for 50 years. The panel assembly was then dismantled and the clips and panels were checked with a micrometer at the contact points. The total loss of material at these areas was 0.005" [.127mm] maximum. For copies of the test reports, contact CENTRIA Design and Development Department.

CENTRIA

DESIGN CONSIDERATIONS

The design of SRS Systems allows adjacent panels to move relative to each other if this condition is encountered. No longitudinal slip joints between panels are required for the SRS Systems.

Figure 28. *Thermal Cycle Test.*

THERMAL INSULATION

Standard glass fiber blanket insulation with a 0.6 pcf [9.61kg/m^3] density and moisture-resistant laminate facing provides an economical, fire-resistant insulation system. The insulation, including facings and adhesives, should have a flame spread rating of 25 or less with a smoke developed rating of 50 or less when tested in accordance with ASTM E-84.

Insulation up to 3" [76mm] thick may be used with or without a thermal spacer between the clip and purlin. However, overall installed insulation values are much lower due to compression of the insulation over purlins (Table 21). Thickness may be increased to 6" [152mm] provided that a continuous thermal spacer is used. Continuous thermal spacers are construction grade wood with nominal dimensions of 1" x 3" [25x76mm]. Pressure-treated wood is not recommended. Composite metal and foam plastic thermal spacers are available.

If additional thermal performance is required, a drop basket insulation system suspended from the purlins can be used.

Rigid foam board insulation that is 2" [51mm] thick will provide a "U" value of approximately 0.077 BTU/Hr•Ft^2•˚F [.437 w/m^2•˚C]. Consult insurance authorities and building codes concerning approved application of this insulation. Rigid board foam insulation must have a minimum density of 2.0 PCF, a minimum compressive strength of 20 PSI and a 6"[152mm] maximum thickness with a factory mutual or UL approval.

Thermal breaks are required between the roofing system and the structural framing when insulation is placed between purlins. As in metal sash systems, the exterior metal must be isolated from interior metal by using a "thermal break" to prevent "through-metal conductance". Ignoring the need for thermal isolation may result in frost lines or condensation inside the building.

ROOF SPACE VENTILATION

When reroofing an existing building with an SRS System or if a new building design has an "attic space" between the ceiling and the new roof, adequate ventilation is required to prevent condensation. The total net vent area should equal 1/300 of the building roof area at the eave line (1/150 in humid climates). Wall louvers or perforated soffits spaced uniformly are recommended to allow for maximum air movement.

Example:

Roof Area at Eave = 10,000 square feet [929.03m^2].

Vent area required 10,000/300 = 33-1/3 square feet [3.1m^2] of net free area of wall louvers or perforated soffit and 33-1/3 square feet [3.1m^2] of the net free area is required at the high point of the roof.

Table 21. *Typical "U" Values.*

0.6 PCF [9.61kg/m^3] DENSITY FIBERGLASS*				RIGID FOAMBOARD** POLYISOCYANURATE	
NOMINAL THICKNESS	INSULATION "R" VALUE	INSTALLED "R" VALUE WITHOUT THERMAL SPACER	INSTALLED "R" VALUE WITH THERMAL SPACER	NOMINAL THICKNESS	INSULATION "R" VALUE
3" [76mm]	R10 [1.76]	R7.5 [1.32]	R9.8 [1.73]	1-1/2" [38mm]	R9.8 [1.72]
4" [102mm]	R13 [2.29]	R8.7 [1.53]	R12.0 [2.11]	2" [51mm]	R13 [2.29]
6" [152mm]	R19 [3.34]	R11.0 [1.94]	R15.3 [2.69]	4" [102mm]	R26 [4.58]

**Tests conducted by the North American Insulation Manufacturers Association (NAIMA).*
*** Must have Factory Mutual or UL Labels to be used without a 15-minute fire barrier.*
R-Value to be verified by insulation manufacturer.

MOISTURE CONTROL

The space inside a building contains air with different properties from that of the air outside. This microclimate of different temperature and relative humidity is created by the HVAC system and contained by one or more elements of the roof, wall and floor that together are referred to as the building envelope. As is the natural order of things, differences held in check by this envelope attempt to lessen over time. Differences in temperature result in heat loss or gain. Likewise, differences in vapor pressure, or the weight of the water contained in air, are diminished by mechanisms of moisture-laden air movement or vapor diffusion.

The need for proper envelope design to limit heat transfer, air filtration and vapor migration is as important as the design of the building foundation. The result of poor design and installation can be considerable. Gaps or poor design of the air and/or vapor barrier can result in significant amounts of water being absorbed by the insulation or other hygroscopic materials in the roof construction through condensate collection to be relieved some time later into the conditioned space as a drip or a waterfall. In cases as this, it is rare that sufficient forensic evidence is available to distinguish this condensate seepage from a roof rainwater leak. Nevertheless, the results are the same — callbacks and claims.

CENTRIA's position on roof installations using our material is simple. The proper design, specification and installation of air and vapor control materials in commercial buildings is the responsibility of the owner and design professional for the project. Although not implicitly outlined in most model building and energy codes, CENTRIA requires evidence of their proper address to limit damage to and provide warranty for any installed system incorporating our roof and wall products. Improper attention to design and installation of either the air barrier or the vapor barrier may result in condensate formation and leakage, loss of insulation values, corrosion of the support system and/or CENTRIA product, and mold growth. such damage is generally not caused in any direct way by the roof cladding, and CENTRIA shall deny any such claims as not relevant.

ROOF DRAINAGE SYSTEMS

The design of the Roof Drainage System is an essential factor in the total roofing system design. Gutter and downspout sizing tables can be found in the SMACNA Architectural Sheet Metal Manual.

CENTRIA standard downspouts are 4"x 4" [102x102mm] square, and should be spaced to drain a maximum of 50 feet [15.24m] of gutter. Smaller downspouts should be avoided as they are more susceptible to blockage by debris or ice. Decreasing the downspout spacing or increasing the size to 4" x 6" [102x152mm] will increase the conductor capacity. The standard CENTRIA eave gutter design is based on SMACNA rectangular type gutter “Style F”.

The front edge of the gutter is lower than the back edge so that any overflow will spill over the front of the gutter. Typically, level gutters are preferred for aesthetics and simplicity in design. Gutters require expansion joints spaced at a maximum of 50'-0" [15.24m].

Built-in eave gutters are less visible than standard exposed gutters. Designers specifying this type of gutter should be aware that leaks which may develop will result in water flow directly into the building. Frozen downspouts below exterior soffits will also cause these gutters to overflow. The front of the gutter must be a minimum of 1" [25mm] lower than the back edge of the gutter.

Valley gutters should be designed with overflow scuppers at the ends of the gutter. The bottom of the scupper should be approximately 2" [51mm] lower than the top of the gutter.

Built-in eave gutters or valley gutters should have membrane liners or be fabricated from 20 [.91] gage minimum stainless steel. To insure watertightness, stainless steel must be shop-welded to the longest practical shipping length and water-tested prior to shipping; field-assembled valley gutters without liners are prone to leak at the fastener locations and end joints.

SNOW COUNTRY PRECAUTIONS

This section is intended to provide the building designer with recommended designs, details and precautions in regard to metal roofing and snow. The following information is based on past experience and is not intended to be used as a complete reference for metal roofing and drainage designs for snow conditions. The designer should consider local conditions, building shape and other such factors in the final building design.

Metal roofing, particularly standing seam, will shed snow from moderately to steeply sloped roofs. In heavy snow areas, steep sloped roofs (8:12 slopes and steeper) are designed to shed snow to prevent roof overloading. This snow typically slides from the roof in one large mass that can cause injury or property damage at building entrances, pedestrian walkways and vehicle parking areas. Gabled ends or large dormers should be designed above building entrances and other areas (HVAC units at grade, loading docks, lower roofs, etc.) where sliding snow could cause injury or damage.

Snow will easily slide on standing seam roofs with slopes steeper than 1-1/2:12. Snowguards are recommended to prevent ice and snow movement.

DESIGN CONSIDERATIONS

DESIGNER NOTE: Snowguards are intended to keep snow and ice in place until the snow and ice melts or evaporates. Snowguards CANNOT restrain the forces produced when snow moves down a roof.

CENTRIA recommends use of the S-5! Color-Gard™ snow retention system for use in conjunction with SRS 2 and SRS 3 roof systems. Use S-5-T clamps by S-5! for connection of the snow retention system to the seams of SRS 2 and SRS 3. S-5-T clamps are structurally tested, do not penetrate the roof panel, and do not restrict thermal movement of the panel.

On buildings with eave gutters, the front face of the gutter must not intersect the roof plane, or gutter damage will occur from sliding snow. Also refer to the AIA Architectural Graphic Standards, “Roof Specialities, Gutter and Downspout Accessories” for recommended gutter clearances for sliding ice and snow.

Snow and ice guards are recommended to prevent further damage (See Details on Page 63).

Webbed mastic must be installed over the SRS panel legs before installing battens for distance of 5' [1.524m] from the bottom of all panels at valleys, eaves, gutters and curb areas for all projects in snow country. This additional sealant is required to prevent ponding water penetration should ice damming occur at the eaves and valleys.

NOTES

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