



Aluminum

Design Guide / Installation Supplement

This aluminum panel design guide / installation guide supplement provides general information and guidance for AEP Span products manufactured out of aluminum. Refer to the standard AEP Span product installation guides for installation recommendations and refer to this supplement for additional considerations and information specific to aluminum.

ALUMINUM MATERIAL SUMMARY

Physical properties of AEP Span’s aluminum offering:

Alloy:	3003-H14 (3105-H26 alt.)
Yield (typ.):	17ksi
Tensile (typ.):	20ksi
Coefficient of Thermal Expansion:	0.000133” growth of 1” of material per each degree of temperature rise
Weight:	0.098lbs/in ³

- Properties obtained from The Aluminum Association’s *Aluminum Design Manual*.
- AEP Span aluminum alloys and product design in compliance to ASTM B209, *Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate*

Products manufactured out of aluminum have specific characteristics that provide both benefits and limitations for their use as single skin metal roof and wall panels.

Benefits:

- Highly corrosion resistant. Develops durable oxide layer.
- Lightweight. Weighs about 1/3 that of steel panels.

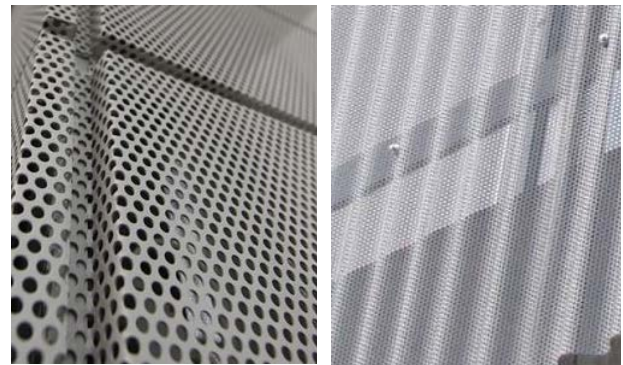
Limitations:

- Lower strength vs. steel.
- High thermal expansion. Panels will expand/contract in length twice the rate of steel.
- More expensive.

KEY ATTRIBUTES IN DETAIL

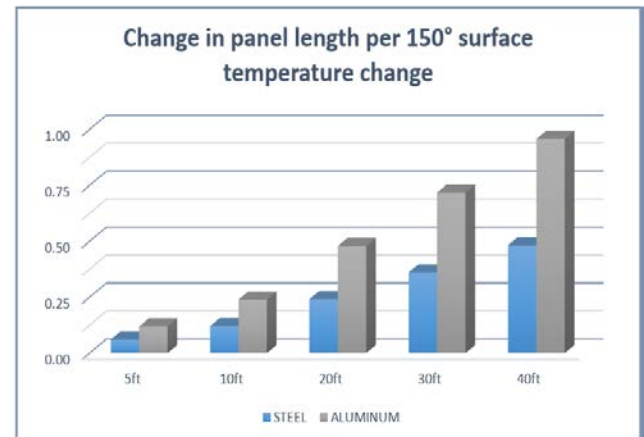
Corrosion Resistance:

Bare aluminum quickly develops a durable oxide film on the surface when exposed to air. This transparent, very thin oxide layer is nearly impervious to further corrosion. This drives the desire for utilizing aluminum in coastal (corrosive) environments as well as applications that produce many cut edges. Perforated panels are also very popular in aluminum due to the corrosion resistance around the punched holes. No red rust around perforation edges like what often occurs with steel panels.



Thermal Expansion / Contraction:

The thermal expansion/contraction of aluminum is double the rate of steel. A common rule of thumb for steel is to expect roughly 1/8” expansion for every 10ft of panel length. For aluminum, this equates to 1/4” per 10ft of panel length. Panel buckling/oil-canning, panel slotting around fastener shanks, and other installation concerns must be carefully evaluated.



Strength:

Roll forming aluminum alloys utilized for single skin metal roof and wall panels generally have a low yield strength. For reference, AEP Span offers 22ga (~0.030”) steel panels with a 50 ksi yield strength. Similar thickness .032” aluminum panels offered by AEP Span have a yield strength of 17 ksi – only 35% that of steel. Panel damage may occur if panels are not handled carefully or properly selected for final application. Since roll forming grades of aluminum alloys are lower strength and do not spring-back like steel under focused loads, they have a higher risk for permanent deformation.

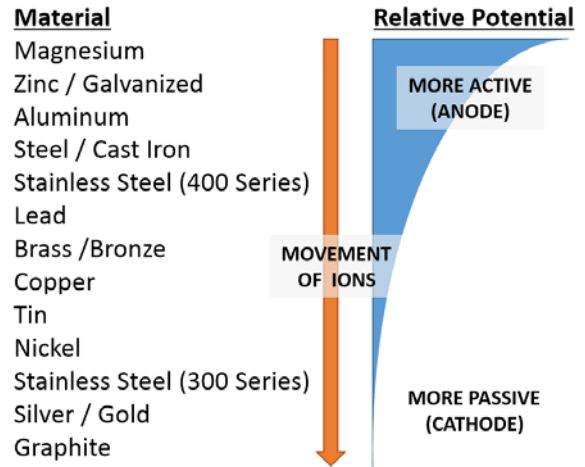
CORROSION

As with all metals, aluminum can also be impacted by the effects of corrosion. Aluminum itself is highly corrosion resistant, but contact with dissimilar metals may create a corrosion risk.

The risk and extent of corrosion is based on many factors, including (but not limited to):

- Difference in galvanic potential between the two materials.
- Properties of the electrolyte (moisture), including:
 - Temperature
 - PH
 - Flow/movement
 - Conductivity
- Barriers that exist – films, paints, oxides.
- Area difference between the dissimilar metals.
- Amount of material contact or separation.
- Amount of oxygen present.
- Temperature.
- Physical or environmental cycling.

The following chart shows the relative galvanic potential of various materials.



Fastener compatibility:

The table below provides basic guidance regarding fastener materials recommended for the attachment of aluminum panels. Please note that the table does not evaluate the fastener’s corrosion compatibility with various underlying substrates, just compatibility with the aluminum panel. Compatibility listed in table also applies for small accessories (panel clips, clamps, etc.) in direct contact with the aluminum panels.

Fastener	Fastener + Panel Environmental Exposure				
	Dry	Light/ Sporadic Moisture	Humid/ Wet	Coastal	Corrosive Industrial
1. 300 Series (Austenitic) Stainless	E	E	VG	VG	VG
2. Zinc Plated with Inert/Organic Coating	VG	G	P	P	P
3. Zinc Plated	G	P	P	P	P
4. 400 Series (Martensitic) Stainless	VG	VG	G	P	P
5. Heavy Zinc Capped Steel	E	E	VG	G	G
6. Hot Dip Galvanized	E	E	VG	G	G
7. Aluminum	E	E	E	E	E

E: Excellent VG: Very good G: Good P: Poor

1. 300 Series: Excellent fastener for all-around usage. Developed chromium oxide layer is non-reactive.

2. Zinc with Inert Coating: The common premium construction sheet metal fasteners. May be acceptable in non-corrosive environments. AEP Span recommends utilizing a 300 series stainless fastener instead.
3. Zinc Plated: Not recommended.
4. 400 Series: Relatively poor corrosion resistance compared to 300 Series SST. Not recommended.
5. Heavy Zinc Capped: Reasonable for some exposed fastener applications.
6. Hot Dipped Galv.: Good resistance. Fastener usage not common for metal roof & wall installations.
7. Aluminum: Excellent match. Commonly bolted or riveted connections. Self-drilling fasteners are not available.

Concealed fasteners and clips:

Clips and fasteners shielded from moisture and outside of coastal (1000ft or farther from salt-water/marine environments) or industrial exposure are generally acceptable with standard G90 galvanized clips and high quality zinc-plated fasteners with organic (inert) coatings. The risk of galvanic corrosion is low when dissimilar materials are not in the presence of moisture.

Applications where the panel clips and clip fasteners are exposed to the elements – high condensation, coastal fog, industrial exposure, etc. generally require the use of stainless steel clips and clip fasteners to avoid accelerated corrosion rates.

IBC language:

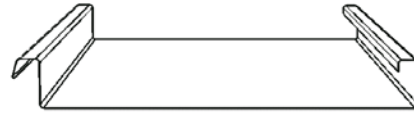
Per 2018 IBC, Section 1507.4.4:

3. *Stainless steel fasteners are acceptable for all types of metal roofs.*
4. *Aluminum fasteners are acceptable for aluminum roofs attached to aluminum supports.*

Other fastener materials may be acceptable however are not explicitly mentioned within IBC.

Corrosion concerns are not just limited to the interaction of the panels, clips, and fasteners; other roof & wall connections and nearby components are also at risk for contributing to galvanic corrosion. These include items such as gutters, valleys, and curbs where dissimilar materials may be used to direct water runoff from aluminum panels.

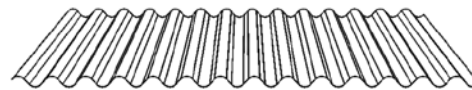
Panel Types & Corrosion:



Concealed Fastened Applications (Standing Seam, etc.)

Concealed fastened panels are those with no attachment fasteners exposed to the environment.

For these applications, standard, high quality zinc-plated fasteners with organic (inert) coatings are generally acceptable for use within panel assemblies. For applications where the underside of panels are exposed to persistent moisture, in coastal climates, or polluted/industrial environments it is recommended that 300 series stainless steel clips and fasteners be utilized.



Exposed Fastened Applications (Corrugated roofing/siding)

For most exposed fastener applications with aluminum panels, the usage of stainless steel fasteners is strongly encouraged to reduce risk of galvanic corrosion.

NOTE: The corrosion information presented above is for general guidance only. Designing for corrosion resistance can be complex and some applications may require a specialist to perform a detailed corrosion analysis.

ADDITIONAL CONSIDERATIONS

Aluminum Hail Resistance

Aluminum roofing products have much less resistance to hail damage and are not recommended for areas with a notable risk of hail. The low yield strength of aluminum provides little resiliency to hail impact.

Fire Resistance

The requirements and approvals for AEP Span steel roof and wall panels also applies to products produced out of aluminum. Fire resistant assemblies exist for applications

governed by IBC, IRC, UL, IWUIC, among others. Contact AEP Span for any clarification.

Installation Substrates

Ideally, aluminum panels are best installed over rigid, or semi-rigid substrates and not over open framing to reduce the risk of product damage. Areas with foot traffic should be installed over solid or closely spaced sheathing to reduce risk of cosmetic damage to product; Installations over spaced framing concentrates loads over framing locations which may buckle ribs, or otherwise telegraph substrate read-through to the panel surface. For exposed fastened aluminum roof panels over sensitive spaces, the usage of ice & water shield underlayment is recommended to act as a secondary barrier for water infiltration through compromised fastener attachment holes.







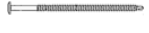

Panel thickness

AEP Span offers several products in both .032 and .040 aluminum. AEP recommends the usage of .040" aluminum to increase durability of finished product. Products subject to foot traffic, or higher loads should utilize .040" aluminum. Heavily corrugated (rigid) products like Nu-Wave Corrugated® and HR-36® are generally acceptable in .032" in numerous applications, especially if located in project areas not subject to excessive loads.

FASTENERS

The following is a list of available stainless steel fasteners for use with AEP Span aluminum panel installations








Concealed-fastener panel installations (standing seam panels, etc.):

Stainless Steel Fasteners: Concealed Fastener Panels			
300 Series Stainless			
Panel Laps			
Lap Fastener		Size: #12 Head: HWH Drive: 5/16" Hex	1": SFS #1123164
Alternate Lap Fast.		Size: 1/4" Head: HWH Drive: 5/16" Hex	1-1/8": SFS #1133512
Steel Substrates			
Into Light Structural .035"-.098"		Size: #14 Head: HWH Drive: 5/16" Hex	1-1/8": SFS #1141971
Into Med. Structural .060"-.157"		Size: #12 Head: HWH Drive: 5/16" Hex	1-1/4": SFS #1134304
Into Heavy Structural .157"-.550"		Size: #12 Head: HWH Drive: 5/16" Hex	1-9/16": SFS #770786
Pan Head		Size: #10 Head: Truss Drive: Torx T20	1": SFS #1193547
Long Length Low Head		Size: #14 Head: Truss Drive: #3 PH	2": SFS #791373 3": SFS #791376 4": SFS #791379 5": SFS #791381 etc., (12" max.)
Wood Substrates			
Into Lumber/ Ply. / OSB		Size: #10 Head: Pancake Drive: #2 SQ	1": SFS #1545891 2": SFS #1545895

Exposed-fastener panel installations (corrugated, through-fastened panels.):

Stainless Steel Fasteners: Exposed Fastener Panels

300 Series Stainless

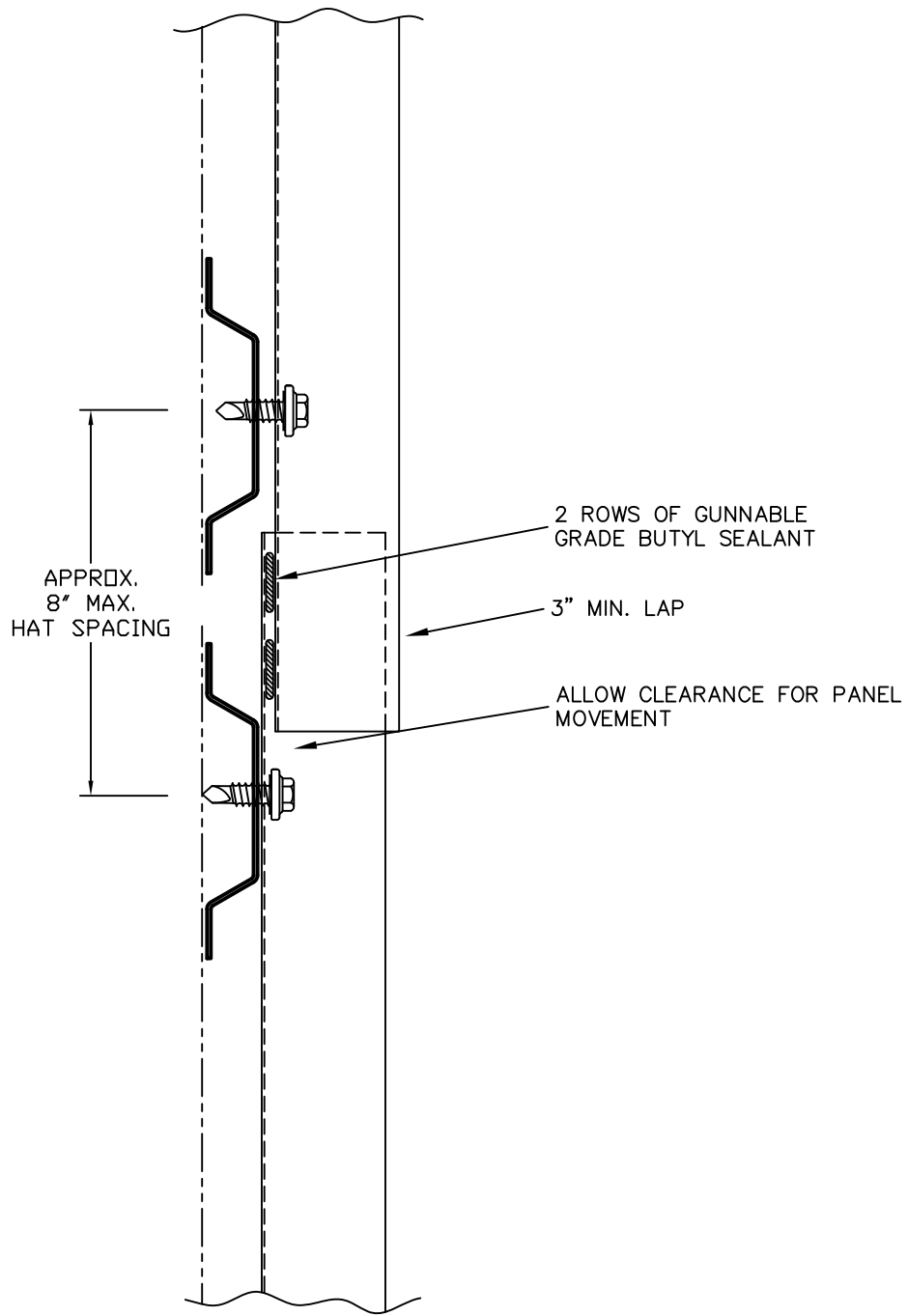
Panel Laps			
Lap Fastener		Size: #12 Head: HWH Drive: 5/16" Hex	1": SFS #1123164
Alternate Lap Fast.		Size: 1/4" Head: HWH Drive: 5/16" Hex	1-1/8": SFS #1133512
Steel Substrates			
Into Light Structural .035"-.098"		Size: #14 Head: HWH Drive: 5/16" Hex	1-1/8": SFS #1141978
Into Med. Structural .060"-.157"		Size: #12 Head: HWH Drive: 5/16" Hex	1-1/4": SFS #1122767
Into Heavy Structural .157"-.550"		Size: #12 Head: HWH Drive: 5/16" Hex	1-9/16": SFS #770785
Wood Substrates			
Into Lumber/ Ply. / OSB		Size: #9 Head: HWH Drive: 1/4" Hex	1": SFS #790755 1-1/2": SFS #790905 2": SFS #1411486
Alternate Wood Fast.	 Requires pre-drilled pilot holes	Size: #14 Head: HWH Drive: 3/8" Hex	1": #790396 1-1/2": #790443 2": #790470 etc., (8" max.)

SUMMARY

This aluminum panel design guide / installation guide supplement provides general information and considerations regarding AEP Span's aluminum product offering. Please refer to the AEP Span website for products currently available in aluminum and applicable product options and limitations. Also refer to the standard AEP Span product installation guides for installation recommendations and refer to this supplement for additional considerations and information specific to aluminum.

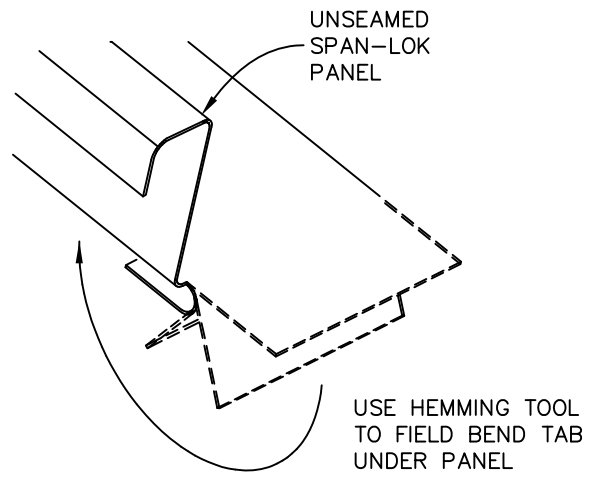
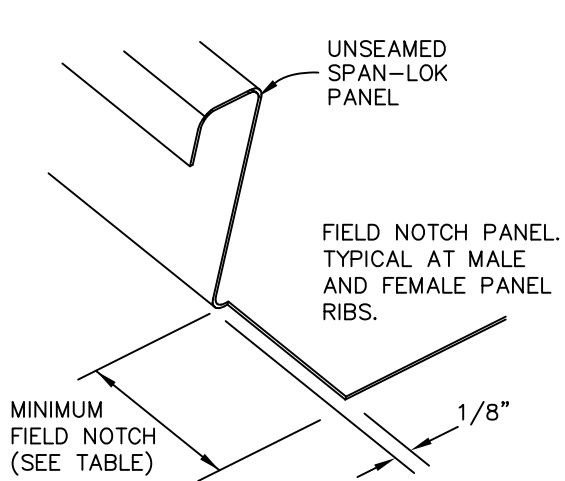
SUPPLEMENTAL ALUMINUM INSTALLATION DETAILS

The following pages contain supplemental installation details that focus on a few key aluminum installation areas, most notably around the topic of thermal expansion. Refer to AEP Span's standard installation guides for all other available details.

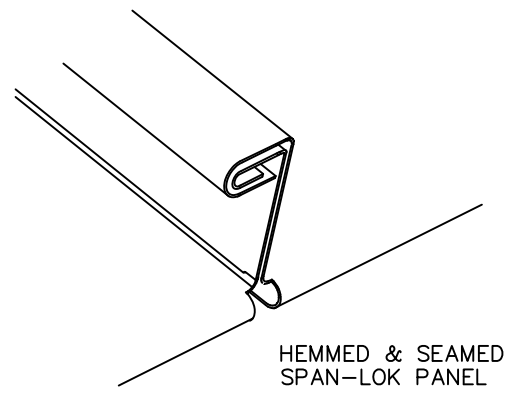
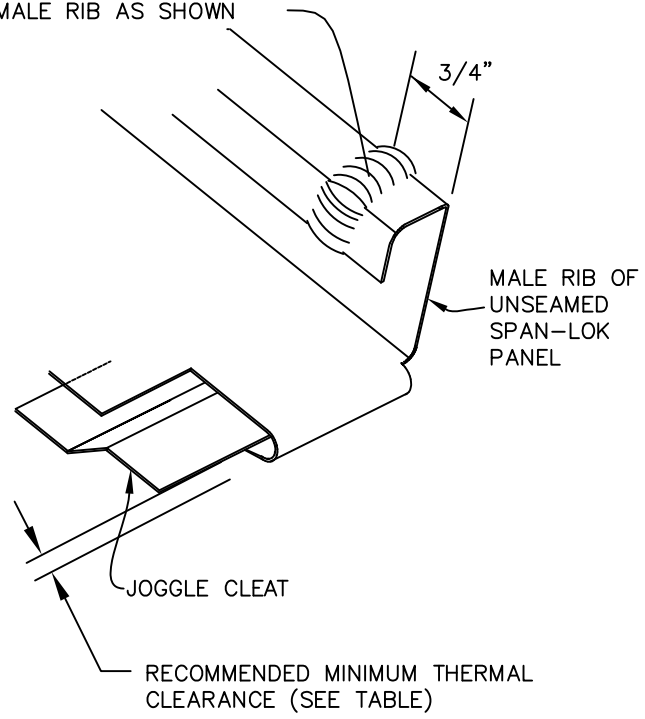


**EXPOSED
FASTENER PANEL
(ALUMINUM)**

FLOATING END LAP



APPLY 3/8" BEAD OF NON-SKINNING BUTYL SEALANT ON BOTH SIDES OF MALE RIB AS SHOWN

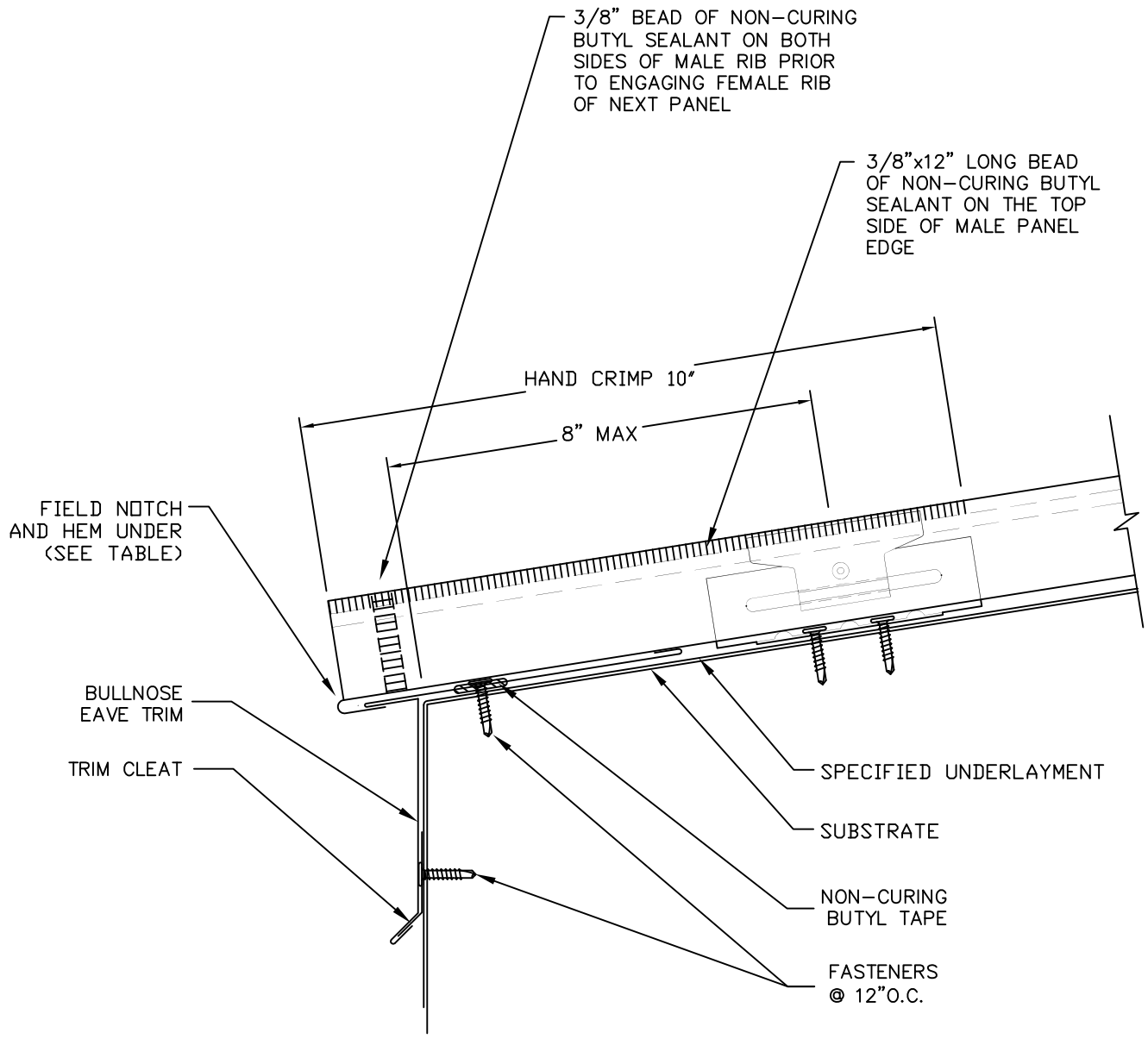


40'	1"	1-3/4"
30'	3/4"	1-1/2"
20'	1/2"	1-1/4"
10'	1/4"	1"
PANEL LENGTH	MINIMUM GAP	NOTCH DIM.



SPAN-LOK HP
(ALUMINUM)

EAVE HEM

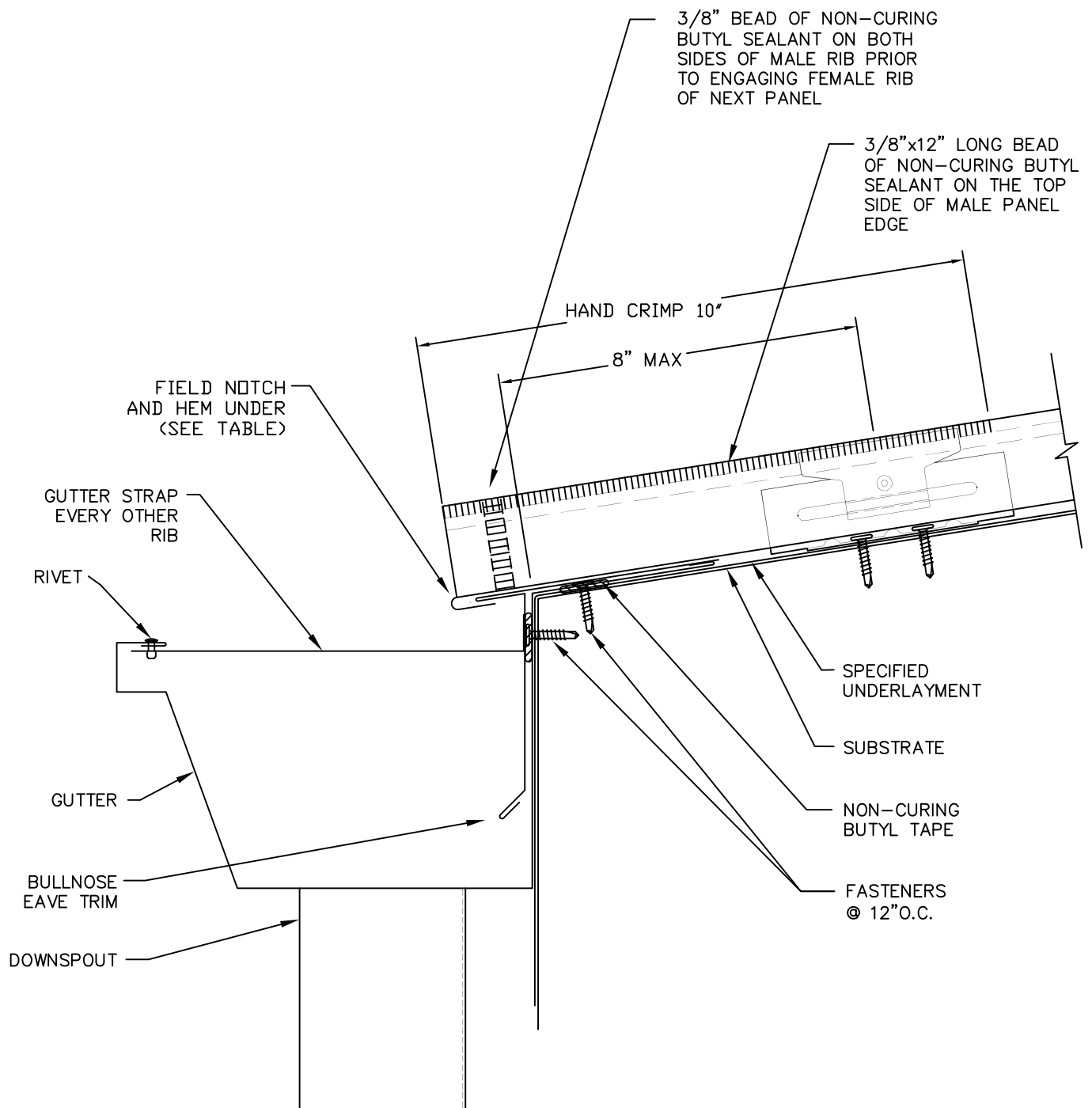


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SPAN-LOK HP
(ALUMINUM)

EAVE, BULLNOSE

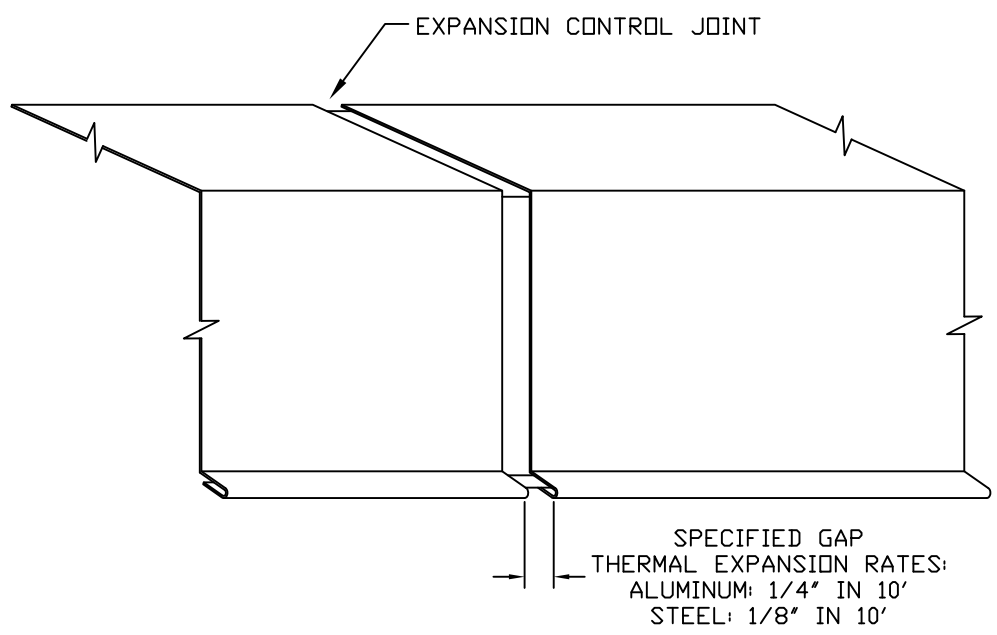
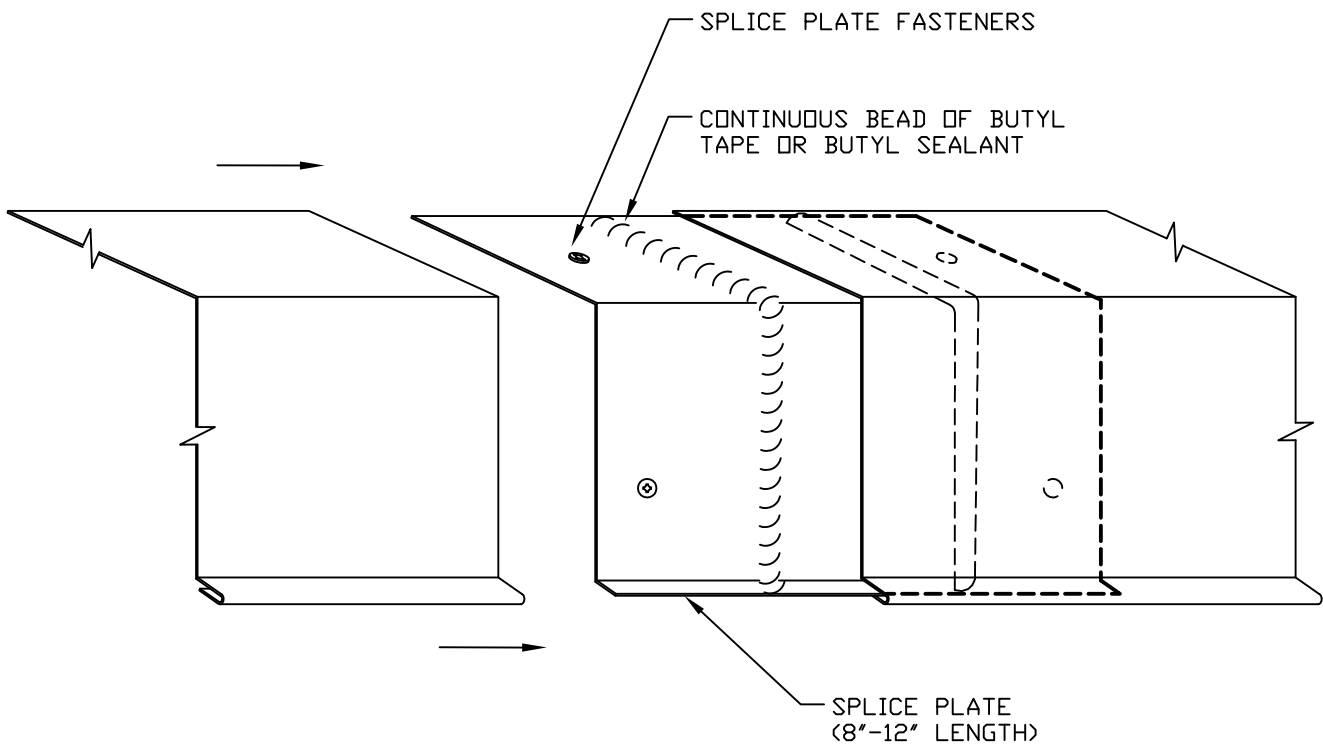


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PANEL LENGTH	MINIMUM GAP	NOTCH DIM.



SPAN-LOK HP
(ALUMINUM)

**EAVE, BULLNOSE
W/ GUTTER**



COMPLETED ASSEMBLY



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FLASHINGS

FLASHING LAPS
TYP.

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