



NUCOR CORPORATION - VULCRAFT/VERCO GROUP

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STEEL DECK PANELS

CSI DIVISION: 05 00 00 – METALS
CSI SECTION: 05 31 00 – STEEL DECK
05 31 13 – STEEL FLOOR DECKING
05 31 23 – STEEL ROOF DECKING

1.0 RECOGNITION

Vulcraft steel deck recognized in this report has been evaluated for use as a component of horizontal or sloped floor and roof systems supporting out of plane loads, in-plane diaphragm shears, and in-plane axial loads. Physical characteristic and structural performance properties comply with the intent of the provisions of the following codes and regulations:

- 2018, 2015 and 2012 International Building Code® (IBC)
- 2018, 2015 and 2012 International Residential Code® (IRC)

2.0 LIMITATIONS

Use of the steel deck recognized in this report is subject to the following limitations:

2.1 Sound Transmission Performance: Acoustic performance is beyond the scope of this report.

2.2 Fire-Resistance Ratings: Fire-resistance performance is beyond the scope of this report.

2.3 The steel deck shall be installed in accordance with the applicable code, the manufacturer's published installation instructions, and this report. Where there is a conflict, the most restrictive requirements shall govern.

2.4 The steel panels recognized in this report are produced by Vulcraft in Fort Payne, Alabama.

3.0 PRODUCT USE

3.1 General: It is permissible to use steel deck panels to resist out-of-plane loads, in plane diaphragm shear loads, and axial loads.

3.2 Design:

3.2.1 Out-of-Plane Strength: Out-of-plane strength of deck panels shall be determined using engineering mechanics and deck panel properties presented in this report.

Deflections resulting from out-of-plane load shall comply with Section 1604.3 of the IBC.

3.2.2 Reactions: The strength of steel deck panels to resist reaction loads at supports and locations of concentrated loads shall be determined based on the either web crippling strength or web shear strength. Web crippling strength shall be determined in accordance with AISI S100-16 Section G5 and the properties in this report. Deck panel web shear strength of deck panel webs shall be determined in accordance with AISI S100-16 Section G2.1 and the properties in this report. The strength of web-perforated deck panels shall be determined in accordance with the equations in this report.

3.2.3 In-Plane (Diaphragm) Shear Strength and Stiffness: The in-plane shear strength of steel roof deck, non-composite steel deck, or composite steel deck-slabs shall be determined in accordance with AISI S310-16 including the modifications and properties in this report.

3.2.4 Axial Strength: The axial strength or combined axial and bending strength of steel deck panels shall be determined in accordance with AISI S100-16 using the properties in this report.

3.2.5 Wall Bracing: The design for anchorage of structural walls and transfer of anchorage forces into the diaphragm shall be in accordance with Section 12.11.2 of ASCE/SEI 7, subject to the following limitations:

1. Transfer of anchorage forces into diaphragm shall be in the direction parallel to the flutes (ribs) of the steel deck.
2. When acting as the continuous ties or struts between diaphragm chords, anchorage forces shall be distributed into the diaphragm in the direction parallel to the flutes (ribs) of the steel deck.
3. Combined axial load and bending shall be considered in accordance with Section H1 of AISI S100-16 to determine the strength of steel deck (without concrete fill) used to resist wall anchorage forces or to resist continuous tie forces parallel to the flutes (ribs).



4. Power-actuated fasteners, self-drilling screws, or welded connections described in this report are permitted to provide positive means of attachment to satisfy the connection requirements in ASCE/SEI 7 Section 12.11.2.2.1.

3.2.6 Partial Panels, Openings, Holes or Penetrations through Steel Deck: The registered design professional may submit design calculations and opening details to the building official for approval based on the principles of engineering mechanics for openings, holes or penetrations. For lateral force resisting systems, the calculations shall consider the effects of partial panels, openings, holes, or penetrations on the overall strength and stiffness of the diaphragm.

3.2.7 Supporting Member Materials: Supporting members shall comply with the requirements of AISI S310-16.

3.2.8 Connections:

3.2.8.1 Self-Drilling Screws: Self-drilling screws may be used to attach steel deck panels to supporting members and to attach the sidelaps of steel deck panels to each other in accordance with AISI S100 and AISI S310 unless described in this report. The screws shall be manufactured in accordance with SAE J78 and shall be compliant with ASTM C1513.

3.2.8.2 Power Actuated Fasteners (PAF's): Power actuated fasteners may be used to attach steel deck panels to supporting members in accordance with this report. The fasteners shall be designed to attach steel deck panels to supporting members and shall be described in a current evaluation report issued by an approved and accredited evaluation service.

3.2.8.3 Welds: Welds may be used to attach steel deck panels to supporting members and to attach the sidelaps of steel deck panels to each other in accordance with AISI S100-16 and AISI S310-16. The minimum tensile strength of the weld filler shall be designated as a minimum of 60 ksi (413.7 MPa) and comply with the appropriate AWS standard.

3.2.8.4 Non-Piercing Button Punch: Non-piercing button punch may be used to attach the sidelaps of steel deck panels to each other in accordance with AISI S310-16.

3.2.8.5 PunchLok® II System: The PunchLok II system consists of PunchLok deck described in this report connected at sidelaps with the Vulcraft/Verco Group proprietary connection. Acoustical versions of the listed deck sections may also be used. The proprietary connection is referred to as the "Vulcraft/Verco Sidelap Connection 2" (VSC2), and is an interlocking connection between the male and female lips of the appropriate deck. A VSC2 connection is made in either direction relative to the female lip. A VSC2 connection is made when the sidelap material has been sheared and offset so the sheared surface of the steel deck panel male lip is visible. This punched portion measures 0.45 inch (11.4 mm) – 0.70 inch (17.8 mm) nominal width by 0.30 inch (7.6 mm)

nominal height. The PunchLok II system shall be installed in accordance with Vulcraft/Verco Group instructions. The resulting VSC2 connection is illustrated on page 8 of this report.

3.3 Installation:

Steel deck panel erection sequence and installation method is the responsibility of the contractor(s) performing installation of the steel deck panels. Installation shall be in accordance with this report, ANSI/SDI-RD1.0 and ANSI/SDI-NC1.0, and all welds shall comply with AWS D1.3. Where conflicts occur, the more restrictive shall govern. Additional installation information is available in the Steel Deck Institute (SDI MOC) Manual of Construction with Steel Deck and manufacturer's recommendations. Mechanical fasteners shall be installed in accordance with the manufacturer's current evaluation report issued by an approved and accredited evaluation service.

3.4 Inspections:

Special inspection is required in accordance with IBC Chapter 17.

3.4.1 Jobsite Welding: Periodic special inspection for welding shall be in accordance with IBC Section Chapter 17. Prior to proceeding, the welder shall demonstrate the ability to produce the prescribed weld to the special inspector's satisfaction. The inspector's duties include verification of materials, weld preparation, welding procedures, and welding processes.

3.4.2 Periodic Special Inspection: Periodic special inspections for weld, screw and power-actuated fastener connections are required where the steel deck systems are used in a seismic-force-resisting system in structures assigned to Seismic Design Category C, D, E or F; or a wind-force resisting system in areas described in IBC Chapter 17.



4.0 PRODUCT DESCRIPTION

The steel deck panels described in this report are cold-formed from steel sheets into panels with fluted sections having galvanized, phosphatized/painted, painted/painted, or mill finishes. Panel characteristics including profile designation, sidelap type, applicable sidelap fasteners and perforation for fluted profiles are described in the tables and figures that accompany this report.

The galvanized deck panels are formed from either ASTM A653 or A1063 steel, with a minimum G30 galvanized coating designation. The phosphatized/painted, painted/painted, or mill finished steel deck panels are formed from either ASTM A1008 or A1039 steel. Phosphatized/painted deck panels have a phosphatized (uncoated) top surface and primer painted bottom surface.

Painted/painted deck panels have primer painted top and bottom surfaces. Mill-finished deck panels have no coating on either top or bottom surfaces.

Vulcraft® and PunchLok® are registered trademarks of Nucor Corporation or its affiliates.

5.0 IDENTIFICATION

Each bundle of deck panels is identified with a visible label. The label includes the manufacturer's name (Vulcraft), production location (Alabama) and address, evaluation report number, deck type, steel specification, base metal thickness and gage, one of the IAPMO ES Marks of Conformity noted below, and evaluation report number (ER-0652).

6.0 SUBSTANTIATING DATA

Data in accordance with the IAPMO Uniform Evaluation Service Evaluation Criteria EC007, adopted April 2019, Evaluation Criteria for Steel Composite, Non-composite, and Roof Deck Construction.

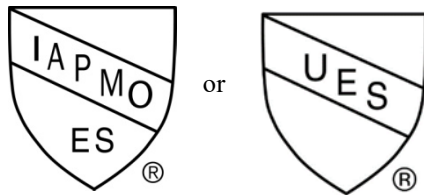
7.0 STATEMENT OF RECOGNITION

This evaluation report describes the results of research carried out by IAPMO Uniform Evaluation Service on Vulcraft steel deck panels to assess conformance to the codes shown in Section 1.0 of this report and serves as documentation of the product certification. Products are manufactured at locations noted in Section 2.4 of this report under a quality control program with periodic inspection under the supervision of IAPMO UES.

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IAPMO UES ER-0652

For additional information about this evaluation report please visit www.uniform-es.org or email at info@uniform-es.org



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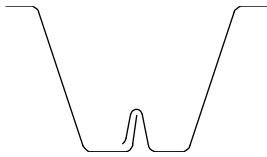
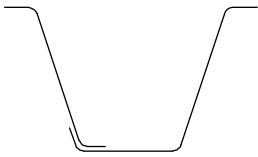
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PROFILE CHARACTERISTICS										
Profile Designation(s)	Sidlap Type		Sidlap Fastener			Embossed	Cellular	Acoustic		
	Inter-locking	Nestable	PunchLok II	Screws	Other ¹			Web Perforated	Fully Perforated	Perforated Bottom Pan
3NL-32		✓		✓	✓					
3NI-32	✓				✓					
3PLN-32	✓		✓							
3NLA-32		✓		✓	✓			✓		
3NIA-32	✓				✓			✓		
3PLNA-32	✓		✓					✓		

Notes

1. Other = Top arc seam sidlap welds or non-piercing button punch sidlap connections for interlocking profiles and arc spot or fillet welds for nestable profiles.

SIDELAP TYPES	
Interlocking (PunchLok II, Other)	Nestable (Screwed Sidlap)
	



PERFORATED PROFILES

Perforated Web Reduction Factor

The perforated web reduction factor, q_s , is calculated as follows:

$$q_s = 1 - (1 - k) \left(\frac{W_p}{h_w} \right) \quad [\text{Eq. W-1}]$$

$$p_o = 0.9069 \left(\frac{d_p^2}{c_p^2} \right) \quad [\text{Eq. W-2}]$$

$$\begin{aligned} k &= 1 - 2.175p_o \text{ for } p_o < 0.20 \\ k &= 0.9 + p_o^2 - 1.875p_o \text{ for } 0.20 \leq p_o \leq 0.58 \end{aligned} \quad [\text{Eq. W-3}]$$

Where:

q_s = Perforated web reduction factor

k = Ratio of stiffness

W_p = Width of perforated band in web, in.

h_w = Flat dimension of web measured in plane of web, in.

p_o = Percentage of open area

d_p = Diameter of perforation hole, in.

c_p = Perforation hole center-to-center spacing, in.

Shear Strength of Profiles with Perforated Webs

The vertical shear strength for profiles with perforated webs shall be calculated as follows:

$$V_{np} = q_s n_w V_n \sin\theta \quad [\text{Eq. W-4}]$$

Where:

V_{np} = Vertical shear strength of profile with perforated web, kip/ft

n_w = Number of webs per foot

V_n = The nominal shear strength of solid web calculated in accordance with AISI S100-16 Sec. G2.1, kips

θ = Angle between plane of web and plane of bearing surface, deg

Web-Crippling Strength of Profiles with Perforated Webs

The web-crippling strength of a perforated web shall be calculated in accordance with AISI S100-16 Sec. G5 with the following modifications:

$$P_n = Ct^2 F_y \cdot \sin\theta \cdot \left(1 - C_R \sqrt{\frac{R}{t}} \right) \left(1 + C_N \sqrt{\frac{N}{t}} \right) \left(1 - C_h \sqrt{\frac{h_w}{q_s t}} \right) \quad [\text{AISI S100-16 Eq. G5-1}]$$

(Modified)

All variables are as defined in AISI S100-16 Section G5



DIAPHRAGM SHEAR STRENGTH AND STIFFNESS

Diaphragm shear strength and stiffness shall be calculated per AISI S310-16 with the following modifications:

D1 Diaphragm Shear Strength per Unit Length Controlled by Connection Strength, S_{nf}

The nominal shear strength [resistance] per unit length of a diaphragm controlled by connection strength, S_{nf} , shall be the smallest of S_{ni} , S_{nc} , S_{ne} , and S_{np} .

$$S_{np} = \text{minimum} \left(n_d P_{nf} \frac{12}{w_t} \right) \quad [\text{Eq. D1-4}]$$

Where

S_{np} = Nominal shear strength [resistance] per unit length of diaphragm controlled by connections along the edge perpendicular to the panel span and located at exterior support, kip/ft

n_d = Number of support connections at any given bottom flute along a panel end perpendicular to the panel span and located at exterior support

w_t = Greatest tributary width to any given bottom flute with support connections along the edge perpendicular to the panel span and located at exterior support, in.

All other variables are as defined in AISI S310-16 Section D1

D2.1 Fluted Panel

The nominal diaphragm shear strength [resistance] per unit length, S_{nb} , for either acoustic or non-acoustic fluted panels shall be the smallest of S_{no} , and S_{ni} .

$$S_{no} = \alpha \frac{7890}{L_v^2} \left(\frac{I_{xg}^3 t^3 d}{s} \right)^{0.25} \quad [\text{Eq. D2.1-1}]$$

$$S_{ni} = P_n \frac{d - e}{D_d} \left(\frac{12}{d} \right) \quad [\text{Eq. D2.1-2}]$$

Where

α = 1.00 for panels fastened to support at every bottom flute at exterior supports

0.75 for panels not fastened to support at every bottom flute at exterior supports

S_{no} = Nominal diaphragm shear strength [resistance] per unit length controlled by panel out-of-plane buckling, kip/ft

S_{ni} = Nominal diaphragm shear strength [resistance] per unit length controlled by exterior support local web buckling, kip/ft

d = Panel corrugation pitch, in.

e = One-half the bottom flat width of panel measured between points of intercept, in.

D_d = Depth of panel, in.

$$P_n = 4.36t^2 F_y \cdot \sin\theta \cdot \left(1 - 0.04 \sqrt{\frac{R}{t}} \right) \left(1 + 0.25 \sqrt{\frac{N_e}{t}} \right) \left(1 - 0.025 \sqrt{\frac{h_w}{q_s t}} \right) \quad [\text{Eq. D2.1-3}]$$

Where

t = Base steel thickness of panel, in.

F_y = Design yield stress, ksi

θ = Angle between plane of web and plane of bearing surface, deg.

R = Inside bend radius, in.

N_e = Bearing Length at end of panel support, in.

h_w = Flat dimension of web measured in plane of web, in.

q_s = Perforated web reduction factor

D5.1.1 Stiffness of Fluted Panels

For spacing of fasteners connecting panels along longitudinal edges parallel to the deck flutes greater than the interior side-lap seam fastener spacing:

$$d_e \leq \frac{S_s}{S_f} d_s \quad [\text{Eq. G}]$$

Where:

d_e = Spacing of parallel edge fasteners

d_s = Spacing of sidelap fasteners

S_s = Sidelap connection flexibility (in/kip)

S_f = Structural support connection flexibility (in/k)

PROPRIETARY FASTENERS

PunchLok II System

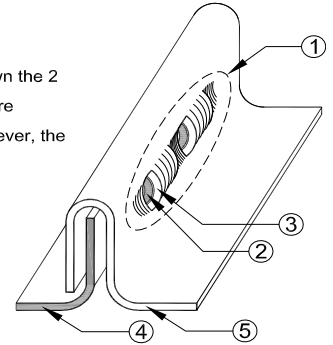
The nominal shear strength [resistance] for PunchLok II System (VSC2) connection shall be determined in accordance with Eq. PL-1:

$$P_{ns} = 137.42 \cdot t - 2.01 \quad [\text{Eq. PL-1}]$$

The flexibility of PunchLok II System (VSC2) connection shall be determined in accordance with Eq. PL-2:

$$S_s = \frac{0.012}{1000 \cdot t^2} \quad [\text{Eq. PL-2}]$$

- ① PunchLok® II system connection - as shown the 2 deformations of male and female sheets are projecting through the female sheet. However, the VSC2 may be made in either direction
- ② Sheared surface of male leg.
- ③ Sheared surface of female leg.
- ④ Male leg / sheet.
- ⑤ Female leg / sheet.



Simpson Strong-Tie

The nominal shear strength [resistance] for the Simpson XL Screw shall be determined in accordance with Eq. S-1:

$$P_{nf} = 78 \cdot t \cdot (t_{\text{support}})^{0.15} \leq P_{nvs} \quad [\text{Eq. S-1}]$$

The nominal shear strength [resistance] for the Simpson XM Screw shall be determined in accordance with Eq. S-2a or S-2b:

$$\text{For } t_{\text{support}} \leq 0.1875 \text{ in} \quad P_{nf} = 240 \cdot (t)^{1.5} \leq P_{nvs} \quad [\text{Eq. S-2a}]$$

$$\text{For } t_{\text{support}} > 0.1875 \text{ in} \quad P_{nf} = 53 \cdot t \leq P_{nvs} \quad [\text{Eq. S-2b}]$$

The nominal shear strength [resistance] for the Simpson X1S1016 or XQ1S1016 shall be determined in accordance with Eq. S-3:

$$P_{ns} = 20 \cdot t \leq 1.625 \quad [\text{Eq. S-3}]$$

The nominal shear strength [resistance] for the Simpson XU34B1016 shall be determined in accordance with Eq. S-4:

$$P_{ns} = 25.2 \cdot t \leq 1.735 \quad [\text{Eq. S-4}]$$

Where:

t = Base steel thickness of panel (in.)

t_{support} = Thickness of support (in.)

S_s = Sidelap connection flexibility (in/kip)

S_f = Structural support connection flexibility (in/k)

P_{nf} = Nominal shear strength [resistance] of a support connection (kips)

P_{ns} = Nominal shear strength [resistance] of a side-lap connection per fastener (kips)

P_{nvs} = Nominal shear strength [resistance] of screw (see page 11)



PROPRIETARY FASTENERS (Continued)

Hilti

The nominal shear strength [resistance] for the Hilti X-ENP-19 L15 PAF shall be determined in accordance with Eq. H-1:

$$P_{nf} = 56 \cdot t \cdot (1 - t) \leq P_{nvp} \quad [\text{Eq. H-1}]$$

The nominal shear strength [resistance] for the Hilti X-HSN24 PAF shall be determined in accordance with Eq. H-2:

$$P_{nf} = 52 \cdot t \cdot (1 - t) \leq P_{nvp} \quad [\text{Eq. H-2}]$$

The flexibility of the Hilti X-ENP-19 L15 and X-HSN24 PAF shall be determined in accordance with Eq. H-3:

$$S_f = \frac{1.25}{1000\sqrt{t}} \quad [\text{Eq. H-3}]$$

The nominal tension strength [resistance] for the Hilti X-HSN 24 controlled by pull-out shall be determined in accordance with Eq. H-4:

$$P_{not} = 8 \cdot t_{\text{support}} + 0.088 \leq 1.875 \quad \Omega = 2.50 \text{ (ASD)} \quad \phi = 0.65 \text{ (LRFD)} \quad \phi = 0.55 \text{ (LSD)} \quad [\text{Eq. H-4}]$$

The nominal tension strength [resistance] for the X-ENP-19 L15 controlled by pull-out shall be determined in accordance with Eq. H-5:

$$P_{not} = 2.625 \quad \Omega = 2.50 \text{ (ASD)} \quad \phi = 0.65 \text{ (LRFD)} \quad \phi = 0.55 \text{ (LSD)} \quad [\text{Eq. H-5}]$$

Where:

t = Base steel thickness of panel (in.)

t_{support} = Thickness of support (in.)

S_f = Structural support connection flexibility (in/k)

P_{nf} = Nominal shear strength [resistance] of a support connection (kips)

P_{ns} = Nominal shear strength [resistance] of a side-lap connection per fastener (kips)

P_{nvp} = Nominal shear strength [resistance] of PAF (see page 11)

P_{not} = Nominal tensile strength [resistance] of a support connection per fastener controlled by pull-out (kips)

ϕ = Resistance Factor

Ω = Safety Factor



PROPRIETARY FASTENERS (Continued)

Pneutek

The nominal shear strength [resistance] for the Pneutek SDK61 PAF shall be determined in accordance with Eq. P-1a and P-1b:

For substrate thickness equal to 0.113"

$$P_{nf} = 0.735 \cdot t \cdot F_u(1 - 0.016 \cdot t \cdot F_u) \leq P_{nvp} \quad [\text{Eq. P-1a}]$$

For substrate thickness equal to 0.155"

$$P_{nf} = 0.788 \cdot t \cdot F_u(1 - 0.028 \cdot t \cdot F_u) \leq P_{nvp} \quad [\text{Eq. P-1b}]$$

For substrate thickness between 0.113" and 0.155", P_{nf} shall be determined by interpolation.

The nominal shear strength [resistance] for the Pneutek SDK63, K64 and K66 PAF shall be determined in accordance with Eq. P-2:

$$P_{nf} = 1.264 \cdot t \cdot F_u(1 - 0.053 \cdot t \cdot F_u) \leq P_{nvp} \quad [\text{Eq. P-2}]$$

The flexibility of the Pneutek SDK61 PAF shall be determined in accordance with Eq. P-3:

$$S_f = \frac{3}{1000\sqrt{t}} \quad [\text{Eq. P-3}]$$

The flexibility of the Pneutek SDK63, K64 and K66 PAF shall be determined in accordance with Eq. P-4a and P-4b:

For substrate thickness less than 0.25"

$$S_f = \frac{3}{1000\sqrt{t}} \quad [\text{Eq. P-4a}]$$

For substrate thickness equal to or greater than 0.25"

$$S_f = \frac{1}{1000\sqrt{t}} \quad [\text{Eq. P-4b}]$$

The nominal tension strength [resistance] for the Pneutek SDK61, SDK63, K64 and K66 PAF controlled by pull-out shall be determined in accordance with Eq. P-5:

$$P_{not} = 18.37 \cdot t_{support} \leq 4.811 \quad \Omega = 2.45 \text{ (ASD)} \quad \phi = 0.65 \text{ (LRFD)} \quad \phi = 0.55 \text{ (LSD)} \quad [\text{Eq. P-5}]$$

Where:

P_{not} = Nominal tensile strength [resistance] of a support connection per fastener controlled by pull-out (kips)

P_{nf} = Nominal shear strength [resistance] of a support connection per fastener (kips)

t = Base steel thickness of panel (in.)

F_u = Ultimate strength of sheet steel (ksi)

P_{nvp} = Nominal shear strength [resistance] of PAF (see page 11)

$t_{support}$ = Thickness of support (in.)

S_f = Structural support connection flexibility (in/k)

ϕ = Resistance Factor

Ω = Safety Factor

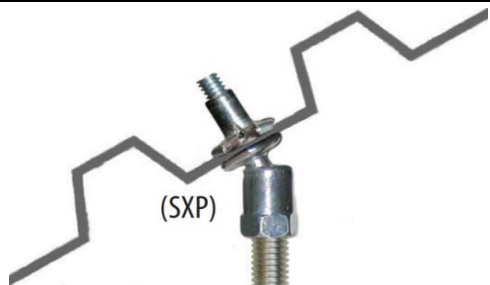


PROPRIETARY SUPPORT FASTENER PROPERTIES								
Specified Properties	Hilti		Pneutek				Simpson Strong-Tie	
	X-HSN 24	X-ENP-19	SDK61	SDK63	K64	K66	XM Screw	XL Screw
Minimum Substrate Thickness (in)	0.125	0.250	0.113	0.155	0.187	0.281	0.125	0.125
Maximum Substrate Thickness (in)	0.375	∞	0.155	0.250	0.312	∞	0.610	0.610
Minimum Spacing ^{1,2}	1"	1"	1"	1"	1"	1"	11/16"	11/16"
Minimum Edge Distance ^{1,2}	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	3/8"	3/8"
Shank Diameter (in)	0.157	0.177	0.144	0.173	0.181	0.199	0.216	0.216
Head or Washer Diameter (in)	0.474	0.591	0.500	0.500	0.500	0.500	0.483	0.625
Tensile Strength based on Material strength (kip)	5.033	6.397	3.909	5.641	6.175	7.465	4.985	4.985
Nominal Shear Strength of Screw, P _{nvs} (kip)	-	-	-	-	-	-	3.110	3.110
Nominal Shear Strength of PAF, P _{nvp} (kip)	3.020	3.838	2.345	3.385	3.705	4.479	-	-

Notes:

1. Minimum spacing and edge distance for Screws are determined in accordance with AISI S100-16 Section J4.1 and J4.2 respectively.
2. Minimum spacing and edge distance for PAF's are determined in accordance with AISI S100-16 Table J5.1-1



ITW BUILDEX SAMMYS X-PRESS SWIVEL HEAD [®] CONNECTION ¹⁻⁹					
Part Number	Model Number (Threaded Rod Size)	Deck Gage	Connection Strength (lbs)		Part Image
			ASD P_{not}/Ω	LRFD ϕP_{not}	
8294922 8272957	SXP 20 (3/8") SXP 2.0 (1/2)	22	200	320	 <p>(SXP)</p>
		20	240	390	
		19	280	460	
		18	320	520	
16	400	660			
14	500	820			

¹ P_{not} = Nominal pullout strength of SAMMYS X-Press Swivel Head[®] Connector

² Sammy X-press may be installed in any flat portion of the bottom flange, web or top flange as shown in figure below.

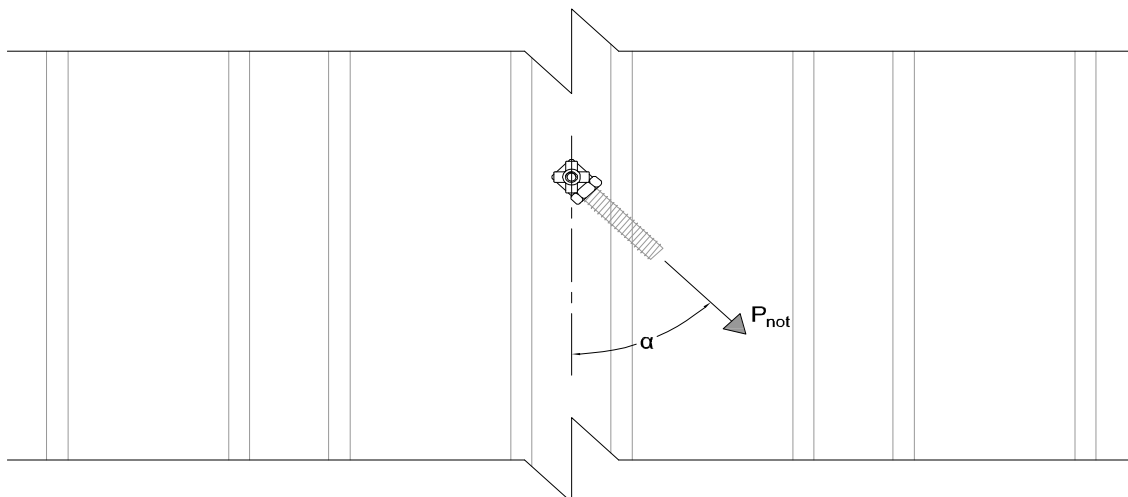
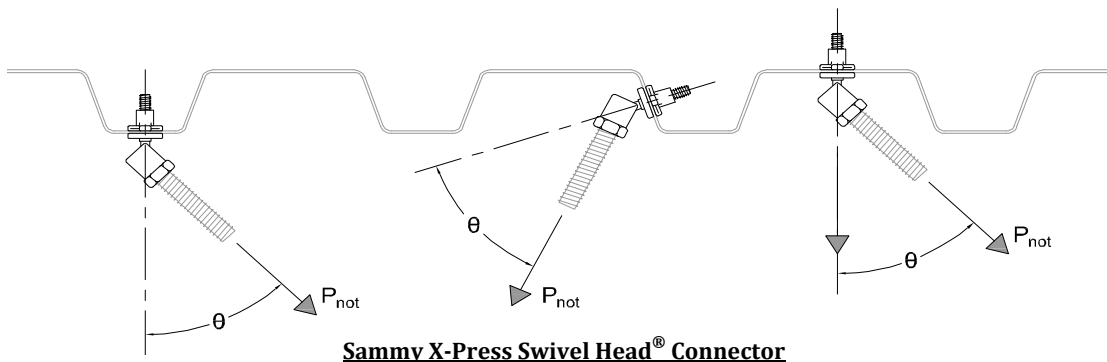
³ The load may be applied at any angle, θ , from 0 to 90 degrees, $0 \leq \theta \leq 90$, relative to the axis of the base of the Sammy X-press as shown below.

⁴ The load may be applied at any angle, α , from 0 to 360 degrees, $0 \leq \alpha \leq 360$, relative to the ribs of the steel deck as shown below.

⁵ The allowable strength, P_n/Ω , shall be equal to or greater than the governing nominal load or load combination for Allowable Stress Design (ASD) as stipulated in the IBC or ASCE/SEI 7.

⁶ The factored strength, ϕP_n , shall be equal to or greater than the governing factored load or factored load combination for Load and Resistance Factor Design as stipulated in the IBC or ASCE/SEI 7.

⁷ Safety and resistance factors included in the table are ASD: $\Omega = 2.5$ and LRFD $\phi = 0.65$ respectively.





DEFINITION OF SECTION PROPERTY SYMBOLS

Symbol	Definition	Units
A_g	Gross area of cross-section	in ² /ft
A_n	Net area of cross-section	in ² /ft
c_p	Perforation hole center-to-center spacing	in.
d_p	Perforation hole diameter	in.
h_w	Flat dimension of web measured in plane of web	in.
I_{d+}	Positive effective moment of inertia for deflection due to uniform loads, $I_{d+}=(2I_{e+}+I_x)/3$	in ⁴ /ft
I_{d-}	Negative effective moment of inertia for deflection due to uniform loads, $I_{d-}=(2I_{e-}+I_x)/3$	in ⁴ /ft
I_{e+}	Positive effective moment of inertia	in ⁴ /ft
I_{e-}	Negative effective moment of inertia	in ⁴ /ft
I_{xg}	Moment of inertia of fully effective section	in ⁴ /ft
M_{n+}	Nominal positive flexural strength of deck or panel	k-ft/ft
M_{n-}	Nominal negative flexural strength of deck or panel	k-ft/ft
M_{nxt+}	Nominal positive flexural strength with respect to centroidal axes in considering tension yielding	k-ft/ft
M_{nxt-}	Nominal negative flexural strength with respect to centroidal axes in considering tension yielding	k-ft/ft
q_s	Perforated web reduction factor	-
R	Inside bend radius	in.
r	Radius of gyration of full unreduced section	in.
S_{e+}	Positive effective section modulus	in ³ /ft
S_{e-}	Negative effective section modulus	in ³ /ft
S_{ft+}	Positive section modulus of full unreduced section	in ³ /ft
S_{ft-}	Negative section modulus of full unreduced section	in ³ /ft
T_n	Nominal tensile axial strength of panel	k/ft
t	Base steel thickness of panel	in.
V_n	Nominal vertical shear strength of panel	k/ft
w_{bf}	Flat width of bottom flange	in.
w_{dd}	Weight of section	psf
W_p	Width of perforated band in web	in.
w_{tf}	Flat width of top flange	in.
y_b	Distance from extreme bottom fiber to neutral axis of gross section	in.
y_t	Distance from extreme top fiber to neutral axis of gross section	in.
θ	Angle between plane of web and plane of bearing surface	deg.



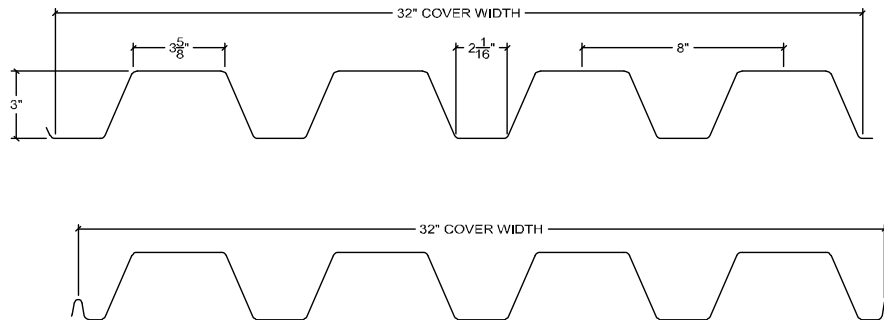
Nestable Profiles

3NL-32

Interlocking Profiles

3NI-32,

3PLN-32



Gage	t in.	w _{dd} psf	A _g in ² /ft	I _{xg} in ⁴ /ft	S _{ft+} in ³ /ft	S _{ft-} in ³ /ft	y _b in.	y _t in.	r in.	h _w in.	θ deg.
22	0.0295	1.8	0.537	0.750	0.450	0.562	1.665	1.335	1.182	2.925	68.2
20	0.0358	2.2	0.652	0.911	0.546	0.681	1.668	1.338	1.181	2.919	68.3
19	0.0418	2.6	0.762	1.065	0.638	0.794	1.670	1.341	1.182	2.913	68.3
18	0.0474	2.9	0.864	1.208	0.722	0.899	1.673	1.344	1.182	2.907	68.4
16	0.0598	3.7	1.091	1.526	0.909	1.130	1.679	1.351	1.183	2.894	68.6

GRADE 50: F _y = 50 ksi, F _u = 65 ksi												
Gage	I _{e+} in ⁴ /ft	I _{e-} in ⁴ /ft	I _{d+} in ⁴ /ft	I _{d-} in ⁴ /ft	S _{e+} in ³ /ft	S _{e-} in ³ /ft	M _{n+} k-ft/ft	M _{n-} k-ft/ft	M _{nxt+} k-ft/ft	M _{nxt-} k-ft/ft	V _n k/ft	T _n k/ft
22	0.589	0.698	0.643	0.715	0.345	0.372	1.438	1.550	1.875	2.342	3.481	26.85
20	0.754	0.874	0.806	0.886	0.448	0.476	1.867	1.983	2.275	2.838	6.017	32.60
19	0.915	1.046	0.965	1.052	0.554	0.579	2.308	2.413	2.658	3.308	8.203	38.10
18	1.080	1.196	1.123	1.200	0.660	0.675	2.750	2.813	3.008	3.746	10.556	43.20
16	1.455	1.523	1.479	1.524	0.869	0.885	3.621	3.688	3.788	4.708	14.502	54.55

GRADE 80: F _y = 60 ksi, F _u = 62 ksi												
Gage	I _{e+} in ⁴ /ft	I _{e-} in ⁴ /ft	I _{d+} in ⁴ /ft	I _{d-} in ⁴ /ft	S _{e+} in ³ /ft	S _{e-} in ³ /ft	M _{n+} k-ft/ft	M _{n-} k-ft/ft	M _{nxt+} k-ft/ft	M _{nxt-} k-ft/ft	V _n k/ft	T _n k/ft
22	0.578	0.686	0.635	0.707	0.335	0.346	1.675	1.730	2.250	2.810	3.481	32.22
20	0.735	0.859	0.794	0.876	0.434	0.463	2.170	2.315	2.730	3.405	6.238	39.12
19	0.893	1.028	0.950	1.040	0.536	0.563	2.680	2.815	3.190	3.970	8.986	45.72
18	1.050	1.189	1.103	1.195	0.637	0.659	3.185	3.295	3.610	4.495	11.563	51.84

R	w _{tf}	w _{bf}
in.	in.	in.
0.188	3.328	1.746



ACOUSTIC

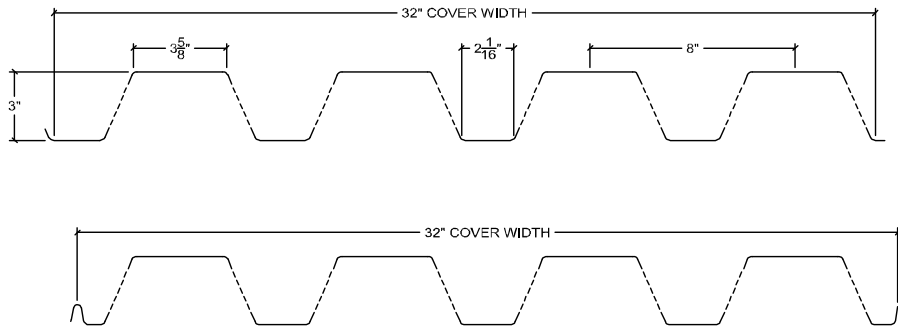
Nestable Profiles

3NLA-32

Interlocking Profiles

3NIA-32,

3PLNA-32



Gage	t in.	w _{dd} psf	A _g in ² /ft	A _n in ² /ft	I _{xg} in ⁴ /ft	S _{ft+} in ³ /ft	S _{ft-} in ³ /ft	y _b in.	y _t in.	r in.	h _w in.	θ deg.
22	0.0295	1.7	0.537	0.454	0.713	0.428	0.534	1.665	1.335	1.253	2.925	68.2
20	0.0358	2.1	0.652	0.552	0.865	0.519	0.646	1.668	1.338	1.252	2.919	68.3
19	0.0418	2.4	0.762	0.644	1.012	0.606	0.755	1.670	1.341	1.254	2.913	68.3
18	0.0474	2.8	0.864	0.731	1.148	0.686	0.854	1.673	1.344	1.253	2.907	68.4
16	0.0598	3.5	1.091	0.923	1.450	0.864	1.073	1.679	1.351	1.253	2.894	68.6

GRADE 50: F _y = 50 ksi, F _u = 65 ksi												
Gage	I _{e+} in ⁴ /ft	I _{e-} in ⁴ /ft	I _{d+} in ⁴ /ft	I _{d-} in ⁴ /ft	S _{e+} in ³ /ft	S _{e-} in ³ /ft	M _{n+} k-ft/ft	M _{n-} k-ft/ft	M _{nxt+} k-ft/ft	M _{nxt-} k-ft/ft	V _n k/ft	T _n k/ft
22	0.560	0.663	0.611	0.680	0.328	0.353	1.367	1.471	1.783	2.225	2.611	22.70
20	0.716	0.830	0.766	0.842	0.426	0.452	1.775	1.883	2.163	2.692	4.513	27.60
19	0.869	0.994	0.917	1.000	0.526	0.550	2.192	2.292	2.525	3.146	6.152	32.20
18	1.026	1.136	1.067	1.140	0.627	0.641	2.613	2.671	2.858	3.558	7.917	36.55
16	1.382	1.447	1.405	1.448	0.826	0.841	3.442	3.504	3.600	4.471	10.877	46.15

GRADE 80: F _y = 60 ksi, F _u = 62 ksi												
Gage	I _{e+} in ⁴ /ft	I _{e-} in ⁴ /ft	I _{d+} in ⁴ /ft	I _{d-} in ⁴ /ft	S _{e+} in ³ /ft	S _{e-} in ³ /ft	M _{n+} k-ft/ft	M _{n-} k-ft/ft	M _{nxt+} k-ft/ft	M _{nxt-} k-ft/ft	V _n k/ft	T _n k/ft
22	0.549	0.652	0.604	0.672	0.318	0.329	1.590	1.645	2.140	2.670	2.611	27.24
20	0.698	0.816	0.754	0.832	0.412	0.440	2.060	2.200	2.595	3.230	4.679	33.12
19	0.848	0.977	0.903	0.989	0.509	0.535	2.545	2.675	3.030	3.775	6.740	38.64
18	0.998	1.130	1.048	1.136	0.605	0.626	3.025	3.130	3.430	4.270	8.672	43.86

R	w _{tf}	w _{bf}
in.	in.	in.
0.188	3.328	1.746

d _p	c _p	W _p
in.	in.	in.
0.156	0.375	2.031