

Support Fastening

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A variety of fastening systems may be used to connect steel deck to the supporting members. The type of fastening system used depends on the required diaphragm shear capacity, uplift capacity and the thickness of the supporting steel members. These fastening systems include arc spot welds, arc seam welds, self-drilling screws and power-actuated fasteners, (PAF).

The strength of each fastener type is mathematically derived from specified standards and testing. The shear strength for arc spot and arc seam welds is derived from the equations in Section E2.6 of AISI S100-2007. The strength for self-drilling screws and PAF is determined in accordance with the *Steel Deck Institute Diaphragm Design Manual DDM-03*. The strengths for these fasteners are listed in the Weld and Shear capacities (see *Figure 1.11.10* and *Figure 1.11.11*). The pull-out and pull-over capacity for fasteners are in accordance with Sections E4.4.1 and E4.4.2 of AISI S100-2007. The pull-out for PAF's should be obtained from the manufacturer's data for the selected fastener.

Fastener Selection

To ensure quality fastening to supports, the fastener, weld, screw, or PAF must be compatible with the thickness of the steel support member. Arc spot and arc seam welds do not have a mandatory minimum support member thickness. Experience has shown that a support thickness as thin as 10 gage is reasonable. Welders with light gage welding experience can weld steel deck to thinner gage supports. Self-drilling screws are suitable

for use with supporting members from 0.0385 inches gage to 1/2", depending on thread pitch and drill point configuration. The fastener manufacturer should be consulted to determine which screw is appropriate. PAFs are selected based on a range of support thickness for a given fastener. Follow the PAF manufacturer's support thickness recommendations. The fastener selection chart (see *Figure 1.11.1*) provides a quick and easy guide to help select the appropriate fastening system for the support member thickness.

Minimum Fastener Edge Distance

The minimum edge distance for fasteners used with ASC Steel Deck has been verified through full-scale diaphragm shear testing. The minimum edge distance for self-drilling screws and PAFs is 1/2". The minimum edge distance for arc spot and arc seam welds is 3/4". Edge distance is measured from the center of the fastener or the center of the radius of an arc spot or seam weld.

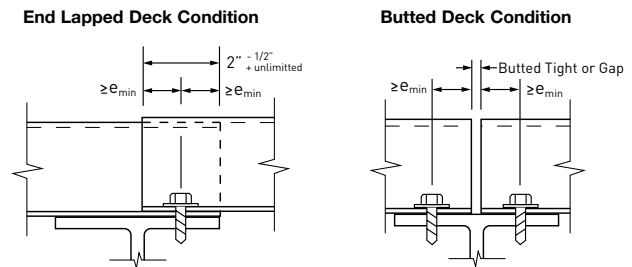
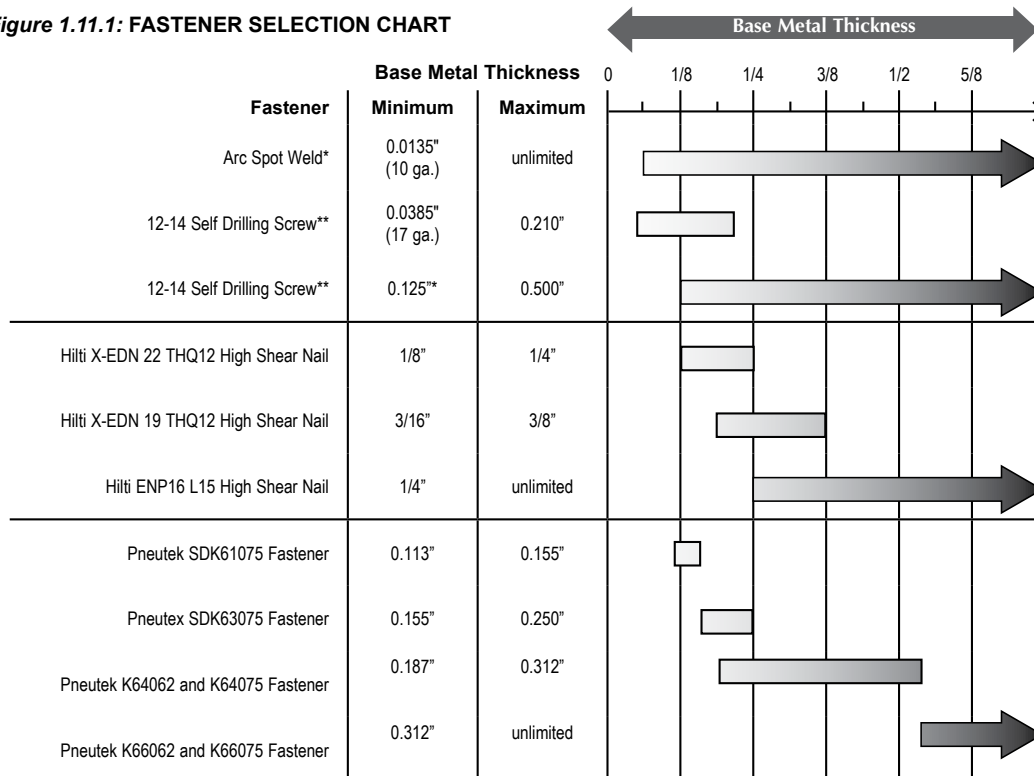


Figure 1.11.2: END LAP AND BUTTED DECK

Figure 1.11.1: FASTENER SELECTION CHART



*Below 10 gage is not recommended due to the difficulty of producing a good quality weld.

**Correct drill point must be selected for the base material thickness.

Support Fastening

Power-Actuated Fasteners, PAF

Power-actuated fasteners, PAFs, are an excellent fastening system. Commonly referred to as high shear nails or pins, they can be used to achieve mid to high range shear diaphragms capacities depending on the fastener selected and the support thickness. The benefits of using PAFs is that they can be installed without skilled qualified welders, are efficient to install, do not pose a jobsite fire risk and do not leave any burn marks associated with welding. This makes PAFs an attractive option for architecturally exposed steel deck.

A drawback of PAFs systems is that it may be difficult for the design engineer to select the fastener size when designing with open-web steel joists because the thickness of the top chord maybe unknown. Good practice would be to design the diaphragm with the minimum expected substrate steel thickness and indicate a range of acceptable fasteners based on the thickness of the supporting steel member. The inspection process on the jobsite should be tasked with ensuring that the correct fastener is used based on the substrate thickness.

Pneutek

Pneutek's PAF system uses a pneumatic actuated tool. This system does not use a powder charge to drive the fastener. Contact Pneutek for fastener installation instructions and for additional technical support relating to their fastening systems.

www.pneutek.com 800-431-8665

Pneutek Fasteners

SDK61075, SDK63075, K64062, K66075, K66056, K66062, K66075

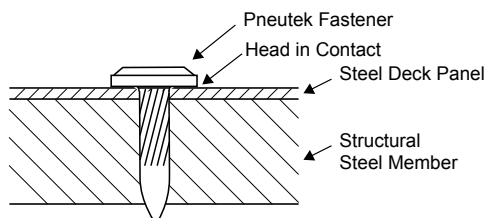


Figure 1.11.3: PNEUTEK K64062

Hilti, Inc.

Hilti, Inc.'s PAF system includes powder fired tools to install their high shear nails (HSN) and ENP fasteners. The operator of the powder-fired tools must have OSHA compliant safety training. Contact Hilti, Inc. for fastener installation instructions and for additional technical support relating to their fastening systems.

www.us.hilti.com 800-879-8000

Hilti Inc. Fasteners

X-ENP-19 L15, X-EDN-19 THQ12, X-EDNK-22 THQ12

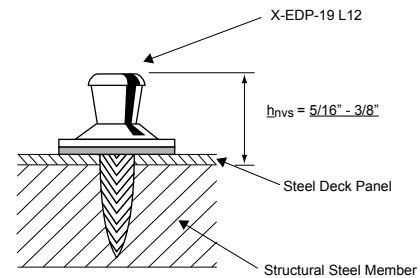


Figure 1.11.4: HILTI X-ENP-19

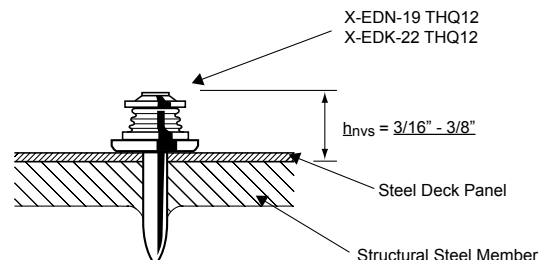


Figure 1.11.5: HILTI X-EDN-19

Support Fastening

Arc Spot and Arc Seam Welds

Traditionally, arc spot welds and arc seam welds are used to attach the steel deck to supports. The arc welds have high shear capacity leading to diaphragms with high shear capacities and low diaphragm flexibilities. Significant drawbacks of welded connections include cost of the required skilled labor and lengthy time to install. Additionally, welding cannot be performed in the rain or if standing water is present on the deck. Welding often results in burn marks visible from the underside of the deck and supporting members. Jobsite safety is of great concern as welding also creates a fire risk. Many specifications require the weld to receive touch-up paint after slagging the welds.

Arc spot and seam welds for ASC Steel Decks are specified based on the effective diameter or length and width. This is approximately the diameter or width and length of a weld at the interface between the deck and supporting member. The effective weld size is less than the visible weld size and is verified through the development of weld qualifications and procedures. See AISI S100-2007 Section E2 for more information regarding weld design. Weld inspection, procedures and qualifications should be in accordance with AWS D1.3.

Arc spot welds in deck less than 0.028 inches thick require weld washers in accordance with AWS D1.3. Weld washers are not recommended for thicker decks.

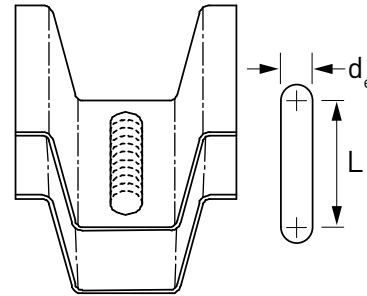
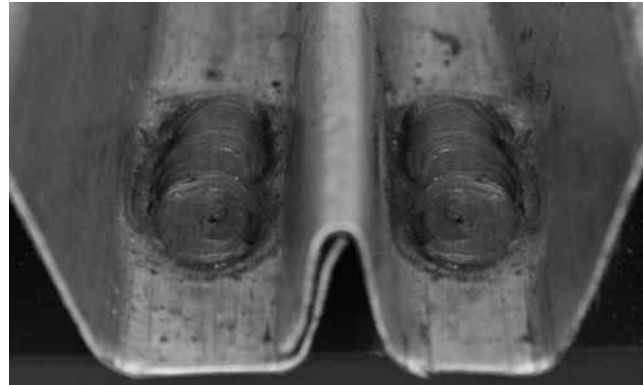


Figure 1.11.7: ARC SEAM WELD
(weld to support)

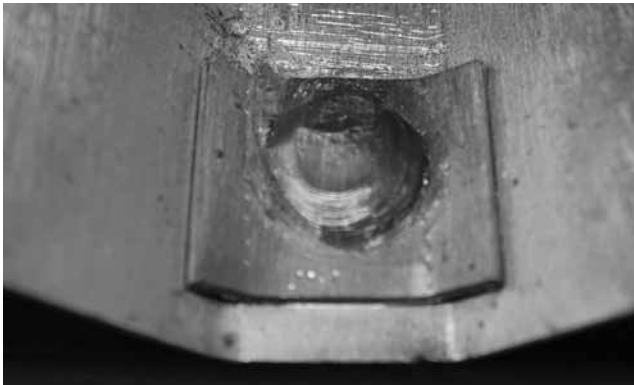


Figure 1.11.6: WELD WASHER

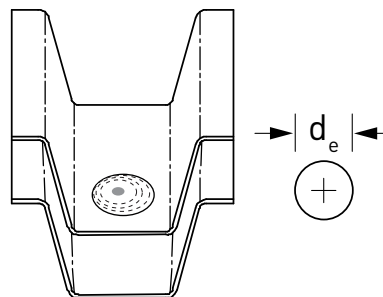
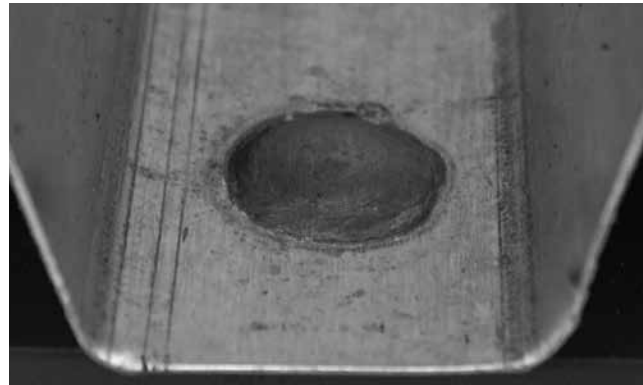


Figure 1.11.8: ARC SPOT WELD
(weld to support)

Support Fastening

Self-Drilling Screws

Self-drilling screws are an excellent option for attaching deck to thin-gage metal supporting members. Although diaphragms that are attached with screws tend to have a lower shear capacity than other support fastening systems, screws install quickly with lower skilled labor and do not leave any burn marks on the deck or supporting members. This makes them an attractive option for architecturally exposed steel deck. Self drilling screws may not be practical on heavier structural steel support members because it can be time consuming to drill through the steel deck panel into the supporting member. When installed, the driven screw penetrates both the steel deck panel and the supporting member; as a result, the screw points are visible from the underside of the roof structure.

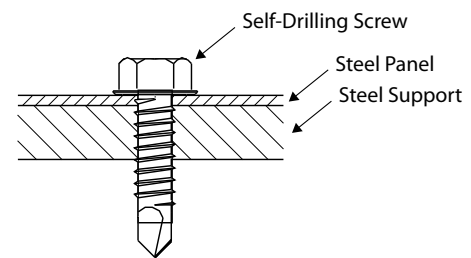


Figure 1.11.9: #12-24R1-1/4 SCREW



Support Fastening

Figure 1.11.10

Nominal Strength		WELDING CAPACITIES		
		Arc Spot (puddle) Weld (1/2 in effective diameter)		Arc Seam Weld (3/8 in x 1 in effective width & length)
Deck Panel	Gage	Shear (lbs)	Tensile (lbs)	Shear (lbs)
			IBC	
B, DGB, N, DGN	22	2116	2048	3098
	20	2955	2442	3751
	18	4710	3207	5075
	16	5810	3956	6452
2W, DG2W, 3W, DG3W	22	2002	1988	3001
	21	2532	2252	3434
	20	2820	2383	3652
	19	3950	2837	4425
	18	4635	3156	4985
	16	5738	3907	6359
Deep Deck	20	2595	2048	3161
	18	4011	2717	4314
	16	4965	338/	5503
	14	6193	4188	7143
BF, DGBF, NF, DGNF	20/20	6886	4689	7881
	20/18	7835	5335	9217
	20/16	8836	6082	10714
	18/20	7912	5387	9328
	18/18	8836	6075	10701
	18/16	8836	6958	12238
	16/20	8836	6148	10714
	16/18	8836	6958	12238
	16/16	8836	7867	13817
2WF, DG2WF, 3WF, DG3WF	20/20	6807	4635	7773
	20/18	7759	5283	9106
	20/16	8836	6017	10600
	18/20	7844	5341	9229
	18/18	8836	6017	10600
	18/16	8836	6898	12134
	16/20	8836	6089	10600
	16/18	8836	6898	10600
	16/16	8836	7805	13710
Cellular Deep Deck	20/20	5815	3932	6624
	20/18	6714	4540	7780
	20/16	7647	5171	9173
	18/20	6714	4540	7780
	18/18	7647	5171	9173
	18/16	8767	5928	10501
	16/20	7647	5171	9173
	16/18	8767	5928	10501
	16/16	8836	6708	11865

Calculated in accordance with section E of the *AISI Cold Formed Steel Design Manual 2004 supplement to the 2001 & 2007 NASPEC*

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Figure 1.11.11

Nominal Strength

MECHANICAL FASTENER CAPACITIES

		Nominal Shear Strength (lbs)							
Deck Panel	Gage	Screws	Hilti			Pneutek			
		#12 Self Drill	X-ENP-19 L15	X-EDN 19 THQ 12	X-EDNK22 THQ12	K64062 K64075	K63062 K63075	SDK63075	SDK61075
B, DGB, N, DGN	22	1150	1624	1604	1508	1841	1735	1728	1546
	20	1381	1938	1914	1800	2258	2216	1977	1833
	18	1839	2549	2517	2367	3132	3009	2417	2378
	16	2301	3149	3109	2924	4076	3686	2812	2896
2W, DG2W, 3W, DG3W	22	1116	1577	1557	1464	1780	1655	1689	1502
	21	1270	1787	1765	1659	2055	1993	1860	1695
	20	1347	1891	1868	1756	2195	2149	1941	1790
	19	1616	2253	2225	2092	2698	2642	2210	2116
	18	1808	2508	2477	2329	3071	2960	2389	2342
	16	2270	3109	3070	2887	4011	3644	2787	2862
Deep Deck	20	1206	1891	1868	1756	2195	2149	1941	1790
	18	1619	2508	2477	2329	3071	2960	2389	2342
	16	2032	3109	3070	2887	4011	3644	2787	2862
	14	2583	3885	3836	3608	5363	4440	3265	3506
BF, DGBF, NF, DGNF	20/20	2766	3737	3690	3470	5092	4294	3176	3386
	20/18	3190	4258	4204	3953	6071	4800	3485	3804
	20/16	3651	4810	4750	4466	7201	5314	3801	4229
	18/20	3224	4300	4246	3992	6154	4840	3509	3837
	18/18	3647	4806	4745	4462	7191	5310	3799	4225
	18/16	4109	5342	5275	4960	8383	5793	4099	4619
	16/20	3686	4851	4790	4504	7288	5351	3824	4259
	16/18	4109	5342	5275	4960	8383	5793	4099	4619
	16/16	4571	5862	5789	5444	9639	6251	4385	4982
2WF, DG2WF, 3WF, DG3WF	20/20	2732	3694	3648	3430	5014	4250	3150	3350
	20/18	3155	4215	4163	3914	5989	4760	3460	3770
	20/16	3617	4769	4710	4429	7114	5277	3778	4198
	18/20	3193	4262	4209	3958	6081	4804	3487	3807
	18/18	3617	4769	4710	4429	7114	5277	3778	4198
	18/16	4078	5307	5240	4928	8302	5762	4079	4594
	16/20	3655	4815	4754	4471	7211	5318	3804	4232
	16/18	4078	5307	5240	4928	8302	5762	4079	4594
	16/16	4540	5828	5755	5412	9553	6221	4367	4958
Cellular Deep Deck	20/20	2411	3646	3600	3385	4928	4202	3121	3311
	20/18	2824	4215	4163	3914	5989	4760	3460	3770
	20/16	3238	4769	4710	4429	7114	5277	3778	4198
	18/20	2824	4215	4163	3914	5989	4760	3460	3770
	18/18	3238	4769	4710	4429	7114	5277	3778	4198
	18/16	3651	5307	5240	4928	8302	5762	4079	4594
	16/20	3238	4769	4710	4429	7114	5277	3778	4198
	16/18	3651	5307	5240	4928	8302	5762	4079	4594
	16/16	4064	5828	5755	5412	9553	6221	4367	4958

Calculated in accordance with the *Steel Deck Institute Diaphragm Design Manual*