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# ICC-ES Report

## ESR-1735

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**DIVISION: 05 00 00—METALS**

**SECTION: 05 31 00—STEEL DECKING**

**SECTION: 05 31 13—STEEL FLOOR DECKING**

**SECTION: 05 31 23—STEEL ROOF DECKING**

**REPORT HOLDER:**

**VERCO DECKING, INC.**

**4340 NORTH 42<sup>ND</sup> AVENUE  
PHOENIX, ARIZONA 85019**

**EVALUATION SUBJECT:**

**VERCO STEEL DECK PANELS: HSB, PBL, N AND PLN ROOF DECK PANELS; B, BR, PLB, N, PLN, W2, PLW2, W3 and PLW3 FORMLOK DECK PANELS; PLB, HSB, PLN, AND N ACOUSTICAL ROOF DECK PANELS; 9/16-INCH (SHALLOW) VERCOR, 15/16-INCH (DEEP) VERCOR, AND 15/16-INCH (DEEP) VERCOR VENTLOK DECK PANELS; PLB-CD, HSB-CD, PLN-CD AND N-24CD CELLULAR ROOF DECK PANELS; AND PLB-CD, BCD, PLN-CD, NCD, PLW2-CD, W2CD, PLW3-CD and W3CD FORMLOK CELLULAR DECK PANELS**



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# ICC-ES Evaluation Report

**ESR-1735**

Reissued April 2015

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**DIVISION: 05 00 00—METALS**  
**Section: 05 31 00—Steel Decking**  
**Section: 05 31 13—Steel Floor Decking**  
**Section: 05 31 23—Steel Roof Decking**

**REPORT HOLDER:**

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 602-272-1347  
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**EVALUATION SUBJECT:**
**VERCO STEEL DECK PANELS:**

- **HSB, PLB, N and PLN ROOF DECK PANELS**
- **B, BR, PLB, N, PLN, W2, PLW2, W3 and PLW3 FORMLOK DECK PANELS**
- **PLB, HSB, PLN, AND N ACOUSTICAL ROOF DECK PANELS**
- **9/16-INCH (SHALLOW) VERCOR, 1<sup>5</sup>/16-INCH (DEEP) VERCOR, AND 1<sup>5</sup>/16-INCH (DEEP) VERCOR VENTLOK DECK PANELS**
- **PLB-CD, HSB-CD, PLN-CD AND N-24CD CELLULAR ROOF DECK PANELS; AND PLB-CD, BCD, PLN-CD, NCD, PLW2-CD, W2CD, PLW3-CD and W3CD FORMLOK CELLULAR DECK PANELS**

**1.0 EVALUATION SCOPE**
**Compliance with the following code:**

 2006 *International Building Code*® (IBC)

**Properties evaluated**

- Structural

**2.0 USES**

Verco steel deck panels are used in floor and roof systems to resist the code-required appropriate floor and roof loads.

**3.0 DESCRIPTION**
**3.1 General:**

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 dimensions and profiles are as shown in the tables and figures that accompany this report.

The galvanized deck panels are formed from ASTM A653 steel, with a minimum G30 galvanization coating

designation. The phosphatized/painted and painted/painted and mill-finished steel deck panels are formed from ASTM A1008 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.

A “PL” prefix — for example, PLB — indicates deck intended for installations where side seam (sidelap) connections are made with the Verco PunchLok tool. A suffix number indicates the deck panel cover width — for example, N-24 indicates a deck panel cover width of 24 inches (610 mm). The “SS” suffix indicates deck panels provided with extended female lips intended for installations where side seam connections are made with self-drilling, self-tapping screws. The “CD” suffix indicates cellular deck panels composed of fluted top sections, factory resistance-welded to flat bottom sections.

**3.2 Roof Deck Panels:**

Type PLB, HSB, PLN, and N roof deck panels are available as galvanized, painted/painted, or mill-finished. Galvanized deck panels are formed from SS Designation, Grade 40 (minimum) steel. Painted/painted and mill-finished steel decks are formed from SS Designation Grade 45 (minimum) steel. The deck panels are available in thicknesses ranging from No. 22 to No. 16 gage [design base-metal thickness from 0.0299 inch (0.759 mm) to 0.0598 inch (1.52 mm)].

**3.3 FORMLOK Deck Panels:**

Type PLB, B, BR, PLN, N, PLW2, W2, PLW3, and W3 FORMLOK Deck Panels are available as galvanized, phosphatized/painted, or mill-finished. The deck panels are formed from SS Designation, Grade 50 (minimum) steel. The deck panels have web embossments as shown in Figure 3. The deck panels are available in thicknesses ranging from No. 22 to No. 16 gage [design base-metal thickness from 0.0290 inch (0.737 mm) to 0.0598 inch (1.52 mm)]. FORMLOK deck panels are for use with or without concrete fill.

**3.4 Acoustical Deck Panels:**

PLB, HSB, PLN, and N roof deck panels are also available as acoustical deck panels. See Figure 4 for web perforation patterns. Data in Tables 19 through 28 also apply to the acoustical versions. Acoustical deck panels are limited to non-fire- resistance-rated assemblies.

**3.5 Acoustical Cellular Deck Panels:**

PLB-CD, HSB-CD, PLN-CD and N-24CD roof deck panels and PLB-CD, BCD, PLN-CD, NCD, PLW2-CD, W2CD, PLW3-CD and W3CD FORMLOK deck panels are available with acoustical perforations in the flat bottom plate. Perforations are  $\frac{5}{32}$  inch (4mm) in diameter on  $\frac{7}{16}$ -inch (11.1 mm) staggered centers. The nominal center-to-center widths of the perforated bands, which are centered under the top flanges of the fluted top sections, are: PLB-CD, HSB-CD and BCD—3.5 inches (90 mm); PLN-CD, N-24CD and NCD—5.5 inches (140 mm); PLW2-CD, W2CD, PLW3-CD and W3CD—6.6 inches (167 mm).

### 3.6 $\frac{9}{16}$ -inch (Shallow) Vercor Deck Panels:

These deck panels are available as galvanized, painted/painted, or mill-finished. The deck panels are formed from ASTM A653 SS Designation, Grade 50 Class 1 steel (minimum) or ASTM A1008 SS Designation, Grade 50 steel (minimum). The deck panels are available in thicknesses ranging from No. 22 to No. 26 gage [design base-metal thickness from 0.0299 inch (0.759 mm) to 0.0179 inch (0.455 mm)].

### 3.7 $1\frac{5}{16}$ -inch (Deep) Vercor and $1\frac{5}{16}$ -inch (Deep) Vercor Ventlok Deck Panels:

These deck panels are available as galvanized, painted/painted, or mill-finished. The deck panels are formed from SS Designation, Grade 80 steel. The deck panels are available in thicknesses ranging from No. 20 to No. 26 gage [design base-metal thickness from 0.0374 inch (0.950 mm) to 0.0195 inch (0.495 mm)].

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

**4.1.1 Section Properties:** Deck panel section properties are provided in Tables 1 and 2.

**4.1.2 Support Reaction:** Support reactions must not exceed the allowable reactions based on web crippling of the bare deck panels provided in Table 3.

1.

### 4.2 Installation:

**5.0 General:** Deck panels must be installed at locations in accordance with the plans and specifications approved by the code official. **CONDITIONS OF USE**

The Vercor steel deck panels described in this report comply with, or are suitable alternatives to what is

specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

**5.1** The base metal thickness of the deck panels delivered to the jobsite must be at least 95 percent of the base (design) metal thickness noted in Tables 1 and 2.

**5.2** Vertical load design of deck panels, without concrete fill, must be based on section properties shown in Tables 1 and 2 and reaction loads shown in Table 3.

5.3 When the steel deck panels are used as roof decks, the panels must be covered with an approved code-complying roof covering.

5.4 Special inspections must be provided in accordance with Chapter 17 of the IBC.

5.5 Calculations and details demonstrating that the loads applied to the deck panels comply with this report must be submitted to the code official for approval. Calculations and drawings must be prepared, signed and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.6 The cellular deck panels are manufactured in Antioch, California under a quality program with regular ongoing inspections by ICC-ES. All other deck panels are manufactured in Phoenix, Arizona; Fontana, California; and Antioch, California under a quality program with annual inspections by ICC-ES.

## 6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Steel Deck Roof and Floor Systems (AC43), dated October 2010 (editorially revised September 2013).

## 7.0 IDENTIFICATION

Each bundle of deck panels is marked with the Vercor Decking, Inc., name, the deck panel type, the minimum base-metal thickness (uncoated), the minimum specified yield strength, and the evaluation report number (ICC-ES ESR-1735P). The cellular deck panel labeling also includes the manufacturing location (Antioch, California).

TABLE 1 - SECTION PROPERTIES AND ALLOWABLE MOMENTS

DECK TYPE	GAGE	BASE METAL THICKNESS (in.)	I <sub>d</sub> FOR DEFLECTION <sup>1</sup> (in. <sup>4</sup> /ft)	POSITIVE MOMENT <sup>2</sup>		NEGATIVE MOMENT <sup>2</sup>	
				+S (in. <sup>3</sup> /ft)	+M (in.-kips/ft)	-S (in. <sup>3</sup> /ft)	-M (in.-kips/ft)
9/16" (SHALLOW) VERCOR <sup>3</sup>	26	0.0179	0.013	0.042	1.3	0.044	1.3
	24	0.0239	0.017	0.059	1.8	0.059	1.8
	22	0.0299	0.023	0.074	2.2	0.074	2.2
1-5/16" (DEEP) VERCOR <sup>4</sup>	26	0.0195	0.073	0.099	3.6	0.103	3.7
	24	0.0254	0.098	0.138	5.0	0.140	5.0
	22	0.0314	0.123	0.175	6.3	0.174	6.3
	20	0.0374	0.143	0.207	7.4	0.206	7.4
PLB, HSB, PLB & B FORMLOK, PLB & HSB ACOUSTICAL <sup>5,6</sup>	22	0.0299	0.175	0.187	4.3	0.198	4.5
	20	0.0359	0.216	0.235	5.3	0.248	5.6
	18	0.0478	0.302	0.322	7.3	0.335	7.6
	16	0.0598	0.377	0.411	9.4	0.417	9.5
PLN, N & N FORMLOK, and PLN & N ACOUSTICAL <sup>5,7</sup>	22	0.0299	0.737	0.361	8.2	0.446	10.1
	20	0.0359	0.917	0.466	10.6	0.548	12.5
	18	0.0478	1.283	0.664	15.1	0.737	16.8
PLW2 & W2 FORMLOK <sup>5</sup>	16	0.0598	1.655	0.851	19.4	0.914	20.8
	22	0.030	0.340	0.283	6.4	0.287	6.5
	21	0.033	0.382	0.321	7.3	0.328	7.5
	20	0.036	0.423	0.361	8.2	0.370	8.4
	19	0.042	0.508	0.442	10.1	0.453	10.3
	18	0.047	0.555	0.510	11.6	0.511	11.6
PLW3 & W3 FORMLOK <sup>5</sup>	16	0.059	0.694	0.639	14.5	0.639	14.5
	22	0.029	0.718	0.418	9.5	0.444	10.1
	21	0.033	0.837	0.495	11.3	0.531	12.1
	20	0.035	0.896	0.534	12.2	0.564	12.8
	19	0.042	1.075	0.674	15.3	0.683	15.5
	18	0.047	1.203	0.767	17.5	0.767	17.5
	16	0.059	1.509	0.960	21.8	0.960	21.8

<sup>1</sup> Value based on lesser value of I<sub>d</sub>'s for normal position and inverted position.

<sup>2</sup> S (+ or -) is the effective section modulus. M (+ or -) is the ASD allowable moment,  $M=M_n/\Omega_b$ , where  $\Omega_b=1.67$  and  $M_n$  is nominal flexural strength.

<sup>3</sup> Values based on yield strength of 50,000 psi.

<sup>4</sup> Values based on yield strength of 60,000 psi (specified strength of 80,000 psi).

<sup>5</sup> Values based on yield strength of 38,000 psi.

<sup>6</sup> Multiply tabulated section properties by a factor of 0.97 to obtain acoustical deck section properties.

<sup>7</sup> Multiply tabulated section properties by a factor of 0.93 to obtain acoustical deck section properties.

TABLE 2 - SECTION PROPERTIES, ALLOWABLE MOMENTS, AND ALLOWABLE SHEARS<sup>7,8</sup>

DECK TYPE	GAGE <sup>3</sup>	DESIGN BASE METAL THICKNESS (in.) <sup>3</sup>	I <sub>d</sub> FOR DEFLECTIONS <sup>7</sup>		POSITIVE MOMENT <sup>4,7</sup>		NEGATIVE MOMENT <sup>4,7</sup>		ALLOWABLE VERTICAL SHEAR <sup>5,7</sup>	
			SIMPLE SPAN (in. <sup>4</sup> /ft)	MULTIPLE SPAN (in. <sup>4</sup> /ft)	+S (in. <sup>3</sup> /ft)	+M (in.-kips/ft)	-S (in. <sup>3</sup> /ft)	-M (in.-kips/ft)	END V (lb/ft)	INTERIOR V (lb/ft)
BCD <sup>1,2</sup>	20/20	0.0359/0.0359	0.392	0.392	0.284	6.5	0.393	8.9	339	521
	20/18	0.0359/0.0478	0.428	0.430	0.292	6.6	0.413	9.4	318	395
	20/16	0.0359/0.0598	0.458	0.477	0.298	6.8	0.431	9.8	305	338
	18/20	0.0478/0.0359	0.510	0.510	0.430	9.8	0.472	10.7	368	607
	18/18	0.0478/0.0478	0.559	0.559	0.441	10.0	0.539	12.3	516	692
	18/16	0.0478/0.0598	0.600	0.600	0.450	10.3	0.562	12.8	489	571
	16/18	0.0598/0.0478	0.677	0.677	0.610	13.9	0.665	15.1	548	781
	16/16	0.0598/0.0598	0.729	0.729	0.622	14.2	0.693	15.8	716	874
NCD <sup>1,2</sup>	20/20	0.0359/0.0359	1.694	1.694	0.565	12.9	0.801	18.2	559	894
	20/18	0.0359/0.0478	1.855	1.912	0.562	12.8	0.985	22.4	521	704
	20/16	0.0359/0.0598	1.967	2.159	0.597	13.6	1.027	23.4	499	594
	18/20	0.0478/0.0359	2.209	2.209	0.847	19.3	0.969	22.1	608	1054
	18/18	0.0478/0.0478	2.421	2.421	0.868	19.8	1.183	26.9	850	1225
	18/16	0.0478/0.0598	2.599	2.626	0.885	20.1	1.335	30.4	805	1024
	16/18	0.0598/0.0478	2.965	2.965	1.194	27.2	1.345	30.6	906	1374
	16/16	0.0598/0.0598	3.193	3.193	1.218	27.6	1.606	36.5	1180	1578
W2CD <sup>1,2</sup>	20/20	0.036/0.0359	0.673	0.673	0.406	9.2	0.430	9.9	403	592
	20/18	0.036/0.0478	0.722	0.722	0.414	9.4	0.446	10.2	376	463
	20/16	0.036/0.0598	0.762	0.762	0.420	9.6	0.460	10.5	358	404
	18/20	0.047/0.0359	0.843	0.843	0.571	13.0	0.555	12.6	439	698
	18/18	0.047/0.0478	0.906	0.906	0.582	13.3	0.574	13.1	595	779
	18/16	0.047/0.0598	0.958	0.958	0.592	13.5	0.592	13.5	561	658
	16/18	0.059/0.0478	1.093	1.093	0.744	16.9	0.713	16.2	653	905
	16/16	0.059/0.0598	1.158	1.158	0.756	17.2	0.735	16.7	830	1013
W3CD <sup>1,2</sup>	20/20	0.036/0.0359	1.460	1.460	0.632	14.4	0.626	14.3	571	849
	20/18	0.036/0.0478	1.548	1.548	0.643	14.6	0.651	14.8	530	660
	20/16	0.036/0.0598	1.620	1.620	0.644	14.7	0.671	15.3	503	572
	18/20	0.047/0.0359	1.793	1.793	0.863	19.6	0.810	18.4	624	1007
	18/18	0.047/0.0478	1.920	1.920	0.880	20.0	0.836	19.0	843	1117
	18/16	0.047/0.0598	2.027	2.027	0.894	20.4	0.863	19.6	792	938
	16/18	0.059/0.0478	2.310	2.310	1.091	24.8	1.038	23.6	929	1305
	16/16	0.059/0.0598	2.440	2.440	1.109	25.2	1.070	24.4	1177	1452

Notes:

- 1.) "BCD" refers to PLB-CD & HSB-CD roof decks and PLB-CD & BCD FORMLOK composite decks.  
 "NCD" refers to PLN-CD & N24-CD roof decks and PLN-CD & NCD FORMLOK composite decks.  
 "W2CD" refers to PLW2-CD & W2-CD FORMLOK composite decks.  
 "W3CD" refers to PLW3-CD & W3-CD FORMLOK composite decks.
- 2.) "AC" suffix indicates acoustical version.
- 3.) The first number is the gage or thicknesses of the top fluted section and the second number is the gage or thickness of the flat bottom sheet.
- 4.) S (+or-) is the effective section modulus. M (+or-) is the ASD allowable moment where  $M = M_n / \Omega_b$ , where  $\Omega_b = 1.67$  and  $M_n$  is the nominal flexural strength.
- 5.) Vertical shear is the ASD allowable vertical shear strength based on horizontal shear strength of resistance welds, where  $V = V_n / \Omega$ , with  $\Omega = 2.35$ .
  - "END" shear strength values are applicable adjacent to supports where deck is not continuous.
  - "INTERIOR" shear strength values are applicable adjacent to supports where deck is continuous.
- 6.) Reactions must be compared to the allowable reactions due to web crippling as shown in Table 3 (based on the gage of the fluted top section of the cellular deck).
- 7.) Multiply tabulated section properties by the following factors to obtain cellular acoustical deck section properties:

DECK TYPE	I <sub>d</sub>	POSITIVE MOMENT	NEGATIVE MOMENT	VERTICAL SHEAR	
				END	INTERIOR
BCD AC & NCD AC	0.92	0.99	0.86	1.03	1.19
W2CD AC & W3CD AC	0.95	0.95	0.95	1.03	1.17

- 8.) Values based on yield stress of 38,000 psi.

TABLE 3 - ALLOWABLE REACTIONS BASED ON WEB CRIPPLING (pounds per foot of deck width)<sup>2,3,4</sup>

	GAGE	END REACTION		INTERIOR REACTION			GAGE	END REACTION			INTERIOR REACTION			
		LENGTH OF BEARING						LENGTH OF BEARING						
		1½"	2"	1½"	2"			2"	3"	4"	3"	4"		
9/16" (SHALLOW) VERCOR	26	488	541	661	723	B <sup>1</sup>	22	710	818	884	1185	1270		
	24	824	909	1155	1258		20	990	1135	1223	1665	1779		
	22	1236	1358	1773	1922		18	1662	1893	2028	2829	3004		
		2"	3"	4"	3"		4"	16	2492	2824	3010	4278	4519	
1-5/16" (DEEP) VERCOR	26	499	579	647	838	N <sup>1</sup>	22	497	572	636	988	1065		
	24	813	939	1045	1382		1521	20	700	802	889	1385	1490	
	22	1200	1380	1532	2055		2254	18	1190	1355	1495	2345	2513	
	20	1653	1893	2095	2845		3111	16	1799	2038	2239	3533	3775	
W2 <sup>1</sup>	22	313	361	400	602	650	W3 <sup>1</sup>	22	275	316	352	558	602	
	21	374	429	476	718	774		21	351	403	447	709	764	
	20	438	503	557	843	907		20	392	449	498	791	851	
	19	582	664	734	1119	1201		19	551	629	695	1106	1188	
	18	715	814	898	1374	1473		18	679	773	853	1360	1458	
	16	1082	1226	1348	2081	2224		16	1034	1172	1288	2061	2203	

<sup>1</sup> "B"- PLB, HSB, PLB & HSB Acoustical, and PLB & B Formlok;

"N" - PLN, N, PLN & N Acoustical, and PLN & N Formlok;

"W2" - PLW2 & W2 Formlok

W3" - PLW3 & W3 Formlok

<sup>2</sup> Allowable reactions based on web crippling =  $P_n \times \text{number of webs per foot} / \Omega_w$ , where  $P_n$  is the normal web crippling strength and  $\Omega_w = 1.70$  for end reactions and 1.75 for interior reactions (one flange loading; fastened to supports).

<sup>3</sup> The allowable values are reactions (or concentrated loads) applied to bare deck and to composite decks during the construction phase only, prior to the concrete achieving the minimum specified compressive strength.

<sup>4</sup> Reactions for cellular deck shall be compared to allowable reactions based on the fluted top section. The allowable reactions may be multiplied by 1.05 for W3CD-FORMLOK with a 20 gage fluted top section.

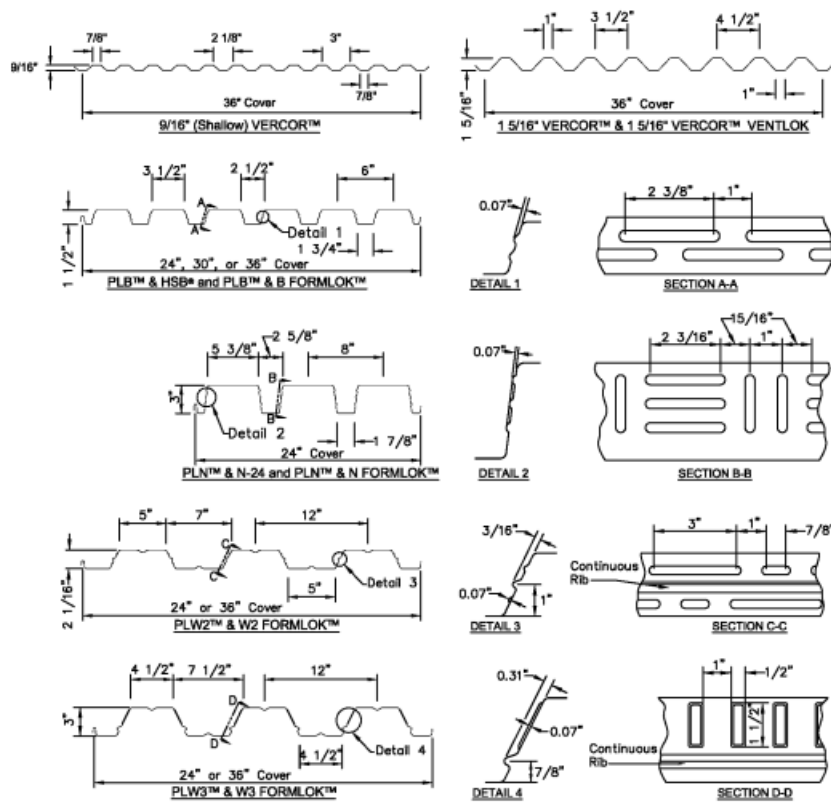


FIGURE 1 - DECK PROFILES

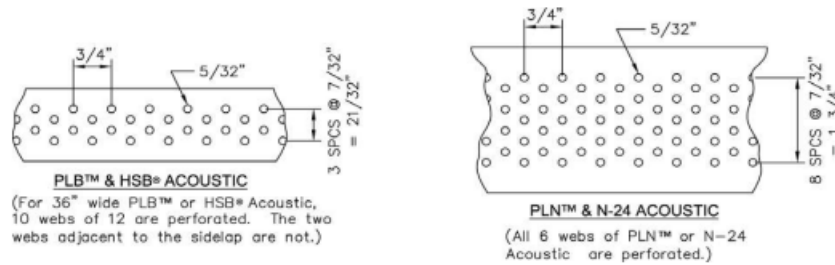


FIGURE 2 - ACOUSTICAL DECKS

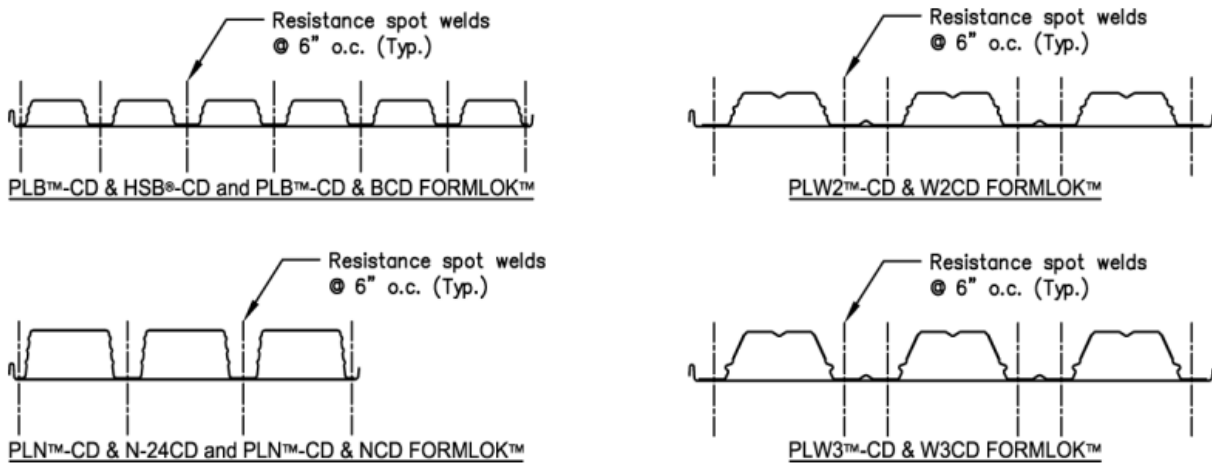


FIGURE 3 - CELLULAR DECK PROFILES