

# ICC-ES Evaluation Report

**ESR-2126**

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**DIVISION: 06—WOOD AND PLASTICS**  
**Section: 06095—Nails**
**REPORT HOLDER:**
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**EVALUATION SUBJECT:**
**PASLODE POSITIVE PLACEMENT NAILS AND DUO-FAST METAL CONNECTOR FRAMING NAILS**
**1.0 EVALUATION SCOPE**
**Compliance with the following codes:**

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- Other Codes (See Section 8.0)

**Property evaluated:**

Structural

**2.0 USES**

Paslode Positive Placement Nails and Duo-Fast Metal Connector Framing Nails are used to fasten metal connectors to lumber.

**3.0 DESCRIPTION**

The nails are formed from steel wire and have hardened diamond-shaped points, smooth shanks and 0.285-inch-diameter (7.24 mm) round heads. Five nail sizes, with nominal lengths and shank diameters as shown in Tables 1 through 4, are recognized in this report. The nails are available without a coating (bright); with an electrogalvanized finish complying with ASTM B 633, Fe/Zn 5, SC1; or with a mechanically deposited zinc (galvanized) coating complying with ASTM B 695, Class 55. Nails having a 0.131-inch (3.4 mm) shank diameter have a minimum bending yield strength of 100,000 psi (689 MPa). Nails having a 0.148-inch (3.8 mm) or a 0.162-inch (4.1 mm) shank diameter have a minimum bending yield strength of 90,000 psi (620 MPa). The nails conform to the dimensional tolerances specified in ASTM F 1667. The nails are available in strips.

**4.0 DESIGN AND INSTALLATION**
**4.1 Design:**

**4.1.1 General:** Reference design values for the nails described in this report are given in Tables 1 through 4. These design values are based on normal load duration and dry conditions of use. Tabulated reference design values must be multiplied by all applicable adjustment factors in the applicable code to obtain adjusted design values for the nails. Design values for one species of wood are also applicable to other species having the same or higher specific gravity. Metal side plates or connectors must be designed in accordance with the applicable section of the code, or must be recognized in an ICC-ES evaluation report. For use of the nails in areas enforcing the IRC, an engineered design must be submitted in accordance with IRC Section R301.1.3, or compliance with the applicable evaluation report for the metal connector must be demonstrated.

**4.1.2 Lateral Loads:** Reference lateral design values,  $Z$ , for single shear, metal-side-plate connections are shown in Tables 1, 2 and 3. Table 1 provides reference lateral design values for the nails used with metal side plates having a dowel bearing strength,  $F_{es}$ , equal to 75,625 psi (521 MPa), based on an ultimate tensile strength,  $F_u$ , of 55,000 psi (379 MPa), and thicknesses ranging from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness] to No. 22 gage [0.0299 inch (0.8 mm) base-metal thickness]. Table 2 provides reference lateral design values for the nails used with metal side plates having a dowel bearing strength,  $F_{es}$ , equal to 61,875 psi (427 MPa), based on an ultimate tensile strength,  $F_u$ , of 45,000 psi (310 MPa), and thicknesses ranging from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness] to No. 22 gage [0.0299 inch (0.8 mm) base-metal thickness]. Table 3 provides reference lateral design values for the nails used with metal side plates having a dowel bearing strength,  $F_{es}$ , equal to 52,250 psi (360 MPa), based on an ultimate tensile strength,  $F_u$ , of 38,000 psi (262 MPa), and thicknesses ranging from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness] to No. 22 gage [0.0299 inch (0.8 mm) base-metal thickness].

**4.1.3 Withdrawal loads:** Reference withdrawal design values for single nails inserted into the side grain of wood are shown in Table 4.

**4.2 Installation:**

The nails must be installed using a nailing tool, as recommended by the nail manufacturer.

## 5.0 CONDITIONS OF USE

The Paslode Positive Placement Nails and the Duo-Fast Metal Connector Framing Nails described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation complies with this report, the manufacturer's published installation instructions and the applicable code. If there is a conflict between the installation instructions and this report, this report governs.
- 5.2 Drawings and design details verifying compliance with this report must be submitted to the code official for approval. The drawings and calculations must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

## 6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Nails and Spikes (AC116), dated October 2006.

## 7.0 IDENTIFICATION

The nails are identified by labels on the cartons bearing the manufacturer's brand name (Paslode or Duo-Fast), the product name, the nail length and diameter, and the evaluation report number (ESR-2126). The head of each nail is identified by one of the marks noted in Figure 1, depending on the nail size.

## 8.0 OTHER CODES

The Paslode Positive Placement Nails and Duo-Fast Metal Connector Framing Nails were evaluated for compliance with the 1997 *Uniform Building Code*<sup>TM</sup> (UBC). The nails comply with the UBC as described in this report, with the following revisions:

Revise Section 4.1.1 to read as follows:

**General:** Nominal design values for the nails described in this report are given in Tables 4 through 6. These design values are based on normal load duration and dry conditions of use. Tabulated reference design values must be multiplied by all applicable adjustment factors in the applicable code to obtain allowable design values for the nails. Design values for one species of wood are also applicable to other species having the same or higher specific gravity. Metal side plates or connectors must be designed in accordance with the applicable section of the code, or must be recognized in an ICC-ES evaluation report.

Revise Section 4.1.2 to read as follows:

**Lateral Loads:** Nominal lateral design values,  $Z$ , for single shear, metal-side-plate connections are shown in Tables 5 and 6. Table 5 provides nominal design loads for the nails used with metal side plates having a dowel bearing strength,  $F_{es}$ , equal to an ultimate tensile strength,  $F_u$ , of 30,000 psi (207 MPA), and thicknesses ranging from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness]. Table 6 provides nominal design loads for the nails used with metal side plates having a dowel bearing strength,  $F_{es}$ , equal to an ultimate tensile strength,  $F_{tu}$ , of 45,000 psi (310 MPa), and thicknesses ranging from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness] to No. 22 gage [0.0299 inch (0.8 mm) base-metal thickness].

**TABLE 1—REFERENCE LATERAL DESIGN VALUES, Z (pounds), FOR PASLODE POSITIVE PLACEMENT NAILS AND DUO-FAST METAL CONNECTOR NAILS FOR METAL SIDE PLATES HAVING  $F_{es} = 75,625$  psi (521 MPa)<sup>1,2,3</sup>**

BASE METAL THICKNESS (inches)	SPECIES OF MAIN MEMBER (Specific Gravity)								
	Southern Pine (0.55)			Douglas Fir - Larch (0.50)			Spruce - Pine - Fir (0.42)		
	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter
0.1345 (10 ga.)	134	158	182	125	146	169	108	126	146
0.1046 (12 ga.)	121	143	167	112	133	155	97	115	134
0.0747(14 ga.)	111	132	156	102	122	144	88	106	124
0.0598 (16 ga.)	107	128	152	99	118	141	85	102	121
0.0478 (18 ga.)	104	126	150	96	116	138	83	100	119
0.0359 (20 ga.)	103	124	149	95	115	137	82	98	118
0.0299 (22 ga.)	103	124	147	95	114	137	81	98	117

For SI: 1 pound = 4.4 N, 1 inch = 25.4 mm 1 psi = 6.89 kPa.

<sup>1</sup>Tabulated lateral design values must be multiplied by all applicable adjustment factors in the applicable code.

<sup>2</sup>Lateral design values are based on:  $F_{yb} = 100,000$  psi for 0.131-inch-diameter nails;  $F_{yb} = 90,000$  psi for 0.148- and 0.162-inch-diameter nails.

<sup>3</sup>Metal side plate dowel bearing strength,  $F_{es}$ , is based on an ultimate tensile strength,  $F_u$ , of 55,000 psi (379 MPa).

**TABLE 2—REFERENCE LATERAL DESIGN VALUES, Z (pounds), FOR PASLODE POSITIVE PLACEMENT NAILS AND DUO-FAST METAL CONNECTOR NAILS FOR METAL SIDE PLATES HAVING  $F_{es} = 61,875$  psi (427 MPa)<sup>1,2,3</sup>**

BASE METAL THICKNESS (inches)	SPECIES OF MAIN MEMBER (Specific Gravity)								
	Southern Pine (0.55)			Douglas Fir - Larch (0.50)			Spruce - Pine - Fir (0.42)		
	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter
0.1345 (10 ga.)	126	148	172	117	138	160	102	120	139
0.1046 (12 ga.)	115	137	161	107	127	149	93	110	129
0.0747(14 ga.)	107	129	152	99	119	141	86	103	122
0.0598 (16 ga.)	104	126	150	96	116	138	83	100	119
0.0478 (18 ga.)	103	124	148	95	115	137	82	99	118
0.0359 (20 ga.)	102	123	147	94	114	136	81	98	117
0.0299 (22 ga.)	102	123	136	94	113	136	80	97	117

For SI: 1 pound = 4.4 N, 1 inch = 25.4 mm 1 psi = 6.89 kPa.

<sup>1</sup>Tabulated lateral design values must be multiplied by all applicable adjustment factors in the applicable code.

<sup>2</sup>Lateral design values are based on:  $F_{yb} = 100,000$  psi for 0.131-inch-diameter nails;  $F_{yb} = 90,000$  psi for 0.148- and 0.162-inch-diameter nails.

<sup>3</sup>Metal side plate dowel bearing strength,  $F_{es}$ , is based on an ultimate tensile strength,  $F_u$ , of 45,000 psi (310 MPa).

**TABLE 3—REFERENCE LATERAL DESIGN VALUES, Z (pounds), FOR PASLODE POSITIVE PLACEMENT NAILS AND DUO-FAST METAL CONNECTOR NAILS FOR METAL SIDE PLATES HAVING  $F_{es} = 52,250$  psi (360 Mpa)<sup>1,2,3</sup>**

BASE METAL THICKNESS (inches)	SPECIES OF MAIN MEMBER (Specific Gravity)								
	Southern Pine (0.55)			Douglas Fir - Larch (0.50)			Spruce - Pine - Fir (0.42)		
	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter	0.131 inch nail diameter	0.148 inch nail diameter	0.162 inch nail diameter
0.1345 (10 ga.)	120	142	165	123	132	154	97	115	134
0.1046 (12 ga.)	111	133	156	103	123	145	90	107	126
0.0747(14 ga.)	105	126	149	97	116	138	84	101	120
0.0598 (16 ga.)	103	124	147	95	114	136	82	99	118
0.0478 (18 ga.)	101	123	147	94	113	135	81	98	117
0.0359 (20 ga.)	101	122	138	93	113	135	80	97	116
0.0299 (22 ga.)	93	105	115	93	105	115	80	97	115

For SI: 1 pound = 4.4 N, 1 inch = 25.4 mm 1 psi = 6.89 kPa.

<sup>1</sup>Tabulated lateral design values must be multiplied by all applicable adjustment factors in the applicable code.

<sup>2</sup>Lateral design values are based on:  $F_{yb} = 100,000$  psi for 0.131-inch-diameter nails;  $F_{yb} = 90,000$  psi for 0.148- and 0.162-inch-diameter nails.

<sup>3</sup>Metal side plate dowel bearing strength,  $F_{es}$ , is based on an ultimate tensile strength,  $F_u$ , of 38,000 psi (262 MPa).

**TABLE 4—REFERENCE WITHDRAWAL DESIGN LOADS,  $W^1$  (pounds per inch)**

WOOD SPECIES	SPECIFIC GRAVITY	NAIL DIAMETER		
		0.131 inch	0.148 inch	0.162 inch
Spruce-pine-fir	0.42	21	23	26
Douglas fir-larch	0.50	32	36	40
Southern pine	0.55	41	46	50

For **SI**: 1 inch = 25.4 mm, 1 pound per inch = 0.175 N/mm.

<sup>1</sup>Tabulated withdrawal design values are in pounds per inch of penetration into side grain of main member.

<sup>2</sup>Tabulated withdrawal design values must be multiplied by all applicable adjustment factors in the applicable code.

**TABLE 5—NOMINAL LATERAL DESIGN VALUES,  $Z^{1,2}$  (pounds), FOR PASLODE POSITIVE PLACEMENT NAILS FOR METAL SIDE PLATES<sup>3</sup> HAVING  $F_{es} = 30,000$  psi (UBC)**

NAIL SIZE (inches) <sup>4</sup>	SPECIES OF MAIN MEMBER (Specific Gravity)		
	Southern Pine (0.55)	Douglas Fir-Larch (0.50)	Spruce-Pine-Fir (0.42)
1 <sup>1</sup> / <sub>2</sub> × 0.131	89	83	72
2 <sup>1</sup> / <sub>2</sub> × 0.131	97	90	78
1 <sup>1</sup> / <sub>2</sub> × 0.148	95	88	77
2 <sup>1</sup> / <sub>2</sub> × 0.148	118	109	95
2 <sup>1</sup> / <sub>2</sub> × 0.162	141	131	113

For **SI**: 1 pound = 4.4 N, 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

<sup>1</sup>Tabulated lateral design values must be multiplied by all applicable adjustment factors in the applicable code.

<sup>2</sup>Lateral design values for 1<sup>1</sup>/<sub>2</sub>-inch-long nails have been adjusted for the penetration depth factor,  $C_D$ .

<sup>3</sup>Metal side plate thickness ranges from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness] to No. 22 gage [0.0299 inch (0.8 mm) base-metal thickness].

<sup>4</sup>Lateral design values are based on:  $F_{yb} = 100,000$  psi for 0.131-inch-diameter nails;  $F_{yb} = 90,000$  psi for 0.148- and 0.162-inch-diameter nails.

**TABLE 6—NOMINAL LATERAL DESIGN VALUES,  $Z^{1,2}$  (pounds), FOR PASLODE POSITIVE PLACEMENT NAILS FOR METAL SIDE PLATES<sup>3</sup> HAVING  $F_{es} = 45,000$  psi (UBC)**

NAIL SIZE (inches) <sup>4</sup>	SPECIES OF MAIN MEMBER (Specific Gravity)		
	Southern Pine (0.55)	Douglas Fir-Larch (0.50)	Spruce-Pine-Fir (0.42)
1 <sup>1</sup> / <sub>2</sub> × 0.131	93	86	74
2 <sup>1</sup> / <sub>2</sub> × 0.131	100	92	80
1 <sup>1</sup> / <sub>2</sub> × 0.148	99	92	79
2 <sup>1</sup> / <sub>2</sub> × 0.148	121	112	96
2 <sup>1</sup> / <sub>2</sub> × 0.162	145	134	115

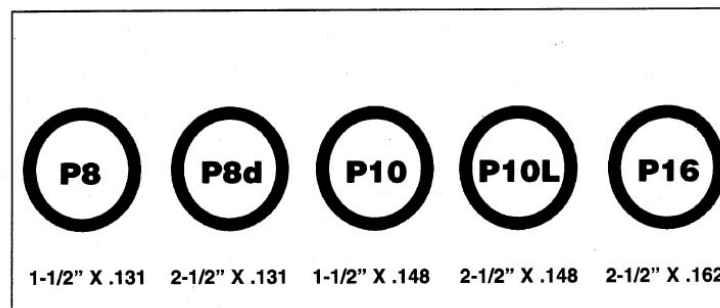
For **SI**: 1 pound = 4.4 N, 1 inch = 25.4 mm, 1 psi = 6.89 kPa.

<sup>1</sup>Tabulated lateral design values must be multiplied by all applicable adjustment factors in the applicable code.

<sup>2</sup>Lateral design values for 1<sup>1</sup>/<sub>2</sub>-inch-long nails have been adjusted for the penetration depth factor,  $C_D$ .

<sup>3</sup>Metal side plate thickness ranges from No. 10 gage [0.1345 inch (3.4 mm) base-metal thickness] to No. 22 gage [0.0299 inch (0.8 mm) base-metal thickness].

<sup>4</sup>Lateral design values are based on:  $F_{yb} = 100,000$  psi for 0.131-inch-diameter nails;  $F_{yb} = 90,000$  psi for 0.148- and 0.162-inch-diameter nails.



**FIGURE 1—NAIL HEAD MARKINGS**