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ESR-1780

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Reissued 11/2015
This report is subject to renewal 11/2017.

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
SECTION: 06 12 00—STRUCTURAL PANELS

REPORT HOLDER:

ENERCEPT, INC.

3100 NINTH AVENUE SE
WATERTOWN, SOUTH DAKOTA 57201

EVALUATION SUBJECT:

ENERCEPT STRUCTURAL INSULATED PANELS



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REPORT HOLDER:

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EVALUATION SUBJECT:
ENERCEPT STRUCTURAL INSULATED PANELS
1.0 EVALUATION SCOPE
1.1 Compliance with the following codes:

- 2009 and 2006 *International Building Code*® (IBC)
- 2009 and 2006 *International Residential Code*® (IRC)

Properties evaluated:

- Structural
- Thermal barrier

Fire-resistance-rated assemblies

1.2 Evaluation to the following green standards:

- 2013 California Green Building Standards Code (CALGreen), Title 24, Part 11
- 2012 and 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2012 and ICC 700-2008)

Properties evaluated:

- See Section 3.1

2.0 USES

Enercept Structural Insulated Panels are used as structural insulated load-bearing and nonload-bearing wall assemblies, roof assemblies and lintels of Type V construction.

When panels are installed under the IRC, an engineered design is required in accordance with IRC Section R301.1.3.

3.0 DESCRIPTION
3.1 General:

Enercept Structural Insulated Panels are prefabricated panels consisting of oriented strand board (OSB) facings adhered to an expanded polystyrene (EPS) foam plastic core.

The attributes of the panel system have been verified as conforming to the requirements of (i) 2013 CALGreen Section A4.404.3.3 and (ii) ICC 700-2012 Sections 601.5 and 11.601.5 and ICC 700-2008 Section 601.5. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.2 Materials:

3.2.1 Expanded Polystyrene Core: Core material is EPS foam plastic having thicknesses as noted in Table 2 of this report. The EPS core complies with the Type I requirements of ASTM C 578, has a nominal 1.0 pcf (16 kg/m³) density, and complies with IBC Section 2603 and the approved Enercept, Inc., quality control manual.

3.2.2 Facing: Facing material is ⁷/₁₆-inch-thick (11.1 mm) OSB sheathing in conformance with Exposure 1, 24/16 performance-rated panel requirements specified in United States Voluntary Product Standard PS-2 and the approved quality control manual.

3.2.3 Adhesive: The facing material is bonded to the EPS core material with a Type II, Class 2, laminating adhesive as specified in the ICC-ES approved quality control documentation. The adhesive complies with the ICC-ES Acceptance Criteria for Sandwich Panel Adhesives (AC05) and is recognized in current ICC-ES evaluation report [ESR-1023](#). The adhesive is also used to bond the lumber to the EPS in the thermal splines described in Section 3.2.4.

3.2.4 Splines: The splines (thermal splines) of the panels used as wall panels consist of two nominally 2-by-4 spruce-pine-fir standard-grade or better wood members factory-adhered to an EPS foam core that has a depth permitting the thermal spline depth to match the sandwich panel core thickness. Panel splines for panels installed as roof panels are No. 2 hem-fir solid-sawn lumber with a 2-inch nominal thickness with a depth to match the panel core thickness.

3.2.5 Thermal Barrier Gypsum Wallboard: Gypsum wallboard must be a minimum of ¹/₂ inch (12.7 mm) thick and must comply with ASTM C 36.

3.3 Panels:

3.3.1 Wall Panels: The panels used as wall panels consist of the OSB facings bonded to 5⁵/₈- or 7³/₈-inch-thick (143 or 187.3 mm) EPS cores. The panels are fabricated in 1- to 4-foot (305 to 1219 mm) widths. Refer to Table 1 for panel heights. The panels are manufactured

with full-length panel facings without intermediate joints. The core is recessed 3 inches (76 mm) from the top panel edge, $1\frac{1}{2}$ inches (38 mm) from the bottom, and $1\frac{11}{16}$ inches (42.9 mm) from each panel side. The recesses receive double nominally 2-inch plates at the top, and a single nominally 2-inch sill plate at the bottom; the plates are installed at the jobsite. Top and bottom plates must be spruce-pine-fir No. 2 or better, with the depth of the plates sized to match the EPS core thickness. A spline is factory-installed along one side of the panel and nailed to the sheathing with 8d common nails spaced at 6 inches (152 mm) on center, unless noted otherwise in this report for shear walls.

3.3.2 Roof Panels: The panels used as roof panels are 4 feet (1219 mm) wide and consist of the OSB facings and EPS core. Refer to Table 2 for EPS core thicknesses and panel lengths. The panels are manufactured with full-length panel facings, without intermediate joints. The foam plastic core is recessed $1\frac{1}{2}$ inches (38 mm) along transverse panel edges, and $1\frac{11}{16}$ inch (17.5 mm) along both longitudinal panel edges. A solid-sawn lumber spline is factory-installed along one of the two longitudinal panel edges, and the panel facings are attached to the spline with 8d common nails spaced at 6 inches (152 mm) on center.

3.3.3 Lintels: The panels used as lintels are sandwich panels fabricated in a manner similar to the fabrication of the wall panels as described in Section 3.3.1. The lintels have an EPS core thickness of $5\frac{5}{8}$ inches (143 mm), and are $13\frac{3}{4}$ inches (349 mm) deep. The maximum span is 6 feet (1829 mm). A factory-installed, nominally 2-by-6 bottom plate is nailed to the lintel facings with 8d common nails spaced at 3 inches (152 mm) on center. A $9\frac{1}{4}$ -inch-long (235 mm) vertical thermal spline is factory-installed and nailed to the facings at both ends of the lintel. The lintel is fabricated without a joint in the OSB facing and EPS core. Refer to Figures 1 and 5.

3.3.4 Miscellaneous: All panels to be used as wall panels include a 1-inch-diameter (25.4 mm) horizontal void in the panel core, located 16 inches (406 mm) above the bottom of the panel, for electrical wiring. Vertical voids in the panel core are 1 inch in diameter and are factory-installed along one edge of wall panels, when panels are adjacent to exterior doors or countertop windows, for electrical outlets. An additional 1-inch diameter horizontal void is located in the panel core 44 inches (1118 mm) above the floor when panels are adjacent to countertops. Electrical, plumbing and mechanical systems are not a part of this report and require the specific approval of the code official.

4.0 DESIGN AND INSTALLATION

4.1 Design:

Allowable transverse, axial and racking shear loads for the standard wall and allowable transverse loads for curtain wall panels are as specified in Table 1. Allowable transverse loads for the roof panels are specified in Table 2. The lintels have an allowable gravity uniform load capacity of 340 pounds per lineal foot (4964 N/m). Structural calculations justifying adequacy of supports and load-transfer connections must be provided to the code official for approval.

4.2 Installation:

4.2.1 Wall Panels: Wall panels must be installed on wood floors, or concrete slabs on grade, with foundations that comply with the applicable code. Vertical edges of wall panels must be connected to the spline placed between adjacent panels with 8d common nails spaced at 6 inches

(152 mm) on center on both panel faces, unless noted otherwise in this report for shearwalls. Panel facings must be attached to the sill plate and top plate of wall panels with 8d common nails at 6 inches (152 mm) on center on both panel faces, except as noted in this report for shearwalls. Top plates must be fastened to each 2-by-4 member in the thermal spline with two 16d common nails. The factory-installed thermal splines must be located in the leading edge of the panels, and must be toe-nailed to the sill plate with two 16d nails prior to nailing to the adjacent panels. The entire thickness of axially loaded wall panels must be supported by structural elements. Refer to Figures 1 through 4 for typical installation details.

4.2.2 Lintels: Lintels at window and door openings must be installed with each end supported by the spline in adjacent wall panels as shown in Figure 5. The lintels must be nailed to the top plate with 8d common nails spaced at 3 inches (76 mm) on center. The top plate must be continuous across the lintel.

4.2.3 Roof Panels: Roof panels must have continuous spans between wall panels and support beams. Panels must have supports that provide the panel with a continuous minimum bearing length of 3 inches (76 mm). All connections must be designed based on applied loads. Adjacent roof panels must be connected with shared factory-installed, nominally 2-inch-wide, No. 2 hem-fir wood splines inserted into the tongue-and-groove panel edges. The panels must be attached to the splines with 8d common nails spaced at 6 inches (152 mm) on center on both panel faces and both sides of the joints. Nominally 2-inch-wide, hem-fir, solid-sawn lumber end plates with a depth to match the panel core thickness must be field-installed into the recessed ends of the panels. The panel facings must be attached to these end plates with 8d common nails spaced at 6 inches (152 mm) on center on both panel faces.

4.2.4 Connections: Wall panels are connected to conventional floor-joist systems as shown in Figure 3, and to roof panels as shown in Figure 2. The wall panels' roof-to-wall and floor-to-wall details must be designed to apply the roof and floor loads to the entire wall panel width, including the sandwich panel facings.

4.2.5 Thermal Barrier: Gypsum wallboard is used as a thermal barrier in accordance with IBC Section 2603.4 and must be attached to all walls and ceilings of the building interior. When used in wall panels, the gypsum wallboard type, thickness and installation shall comply with Section 4.3.1 of this report, or minimum $\frac{1}{2}$ -inch-thick (12.7 mm) gypsum board must be fastened to the wall panel facings with $1\frac{1}{2}$ -inch (38 mm) buglehead wallboard screws spaced at 14 inches (356 mm) on center horizontally and 16 inches (406 mm) on center vertically. The gypsum wallboard must be fastened to the ceiling of the roof panels with screws identical to those used on the wall panels; the screws must be spaced at 12 inches (305 mm) on center each way.

4.2.6 Panel Cladding:

4.2.6.1 Roof Covering: The exterior (top) face of the Enercept roof panels must be protected by a roof covering complying with Chapter 15 of the IBC or Chapter 9 of the IRC, as applicable. Roofs with hot-asphalt or hot coal-tar pitch require mechanical attachment of a separate base sheet prior to roof covering application. Fasteners must have sufficient length to penetrate through the top facing of the panel. Underlayments and flashing must be installed in accordance with the applicable code or a current ICC-ES evaluation report.

4.2.6.2 Exterior Wall Covering: The exterior side of the standard and curtain wall panels, at the time of their erection and placement, must be provided with a weather-resistant exterior wall envelope, consisting of flashing, a water-resistive barrier, and an approved wall covering material. Where the wall covering is exterior plaster, the water-resistive barrier must be two layers of Grade D building paper in accordance with IBC Sections 2510 and 2512, or IRC Section R703.6.3, as applicable. Installation methods must be in accordance with the water-resistive barrier manufacturer's recommendations, subject to approval by the code official. The exterior wall covering materials and installation must comply with the requirements of the applicable code or a current evaluation report. Flashing material and installation must be in accordance with the applicable code.

4.2.6.3 Interior Finish: The thermal barrier required in Section 4.2.5 must be covered with an approved interior finish material complying with the requirements of the applicable code.

4.3 Fire-resistance-rated Assemblies:

4.3.1 One-hour, Limited Load Bearing, Fire-resistance-rated Wall Assembly: Enercept wall panels, as described in Section 3.3.1 with 5¹/₂-inch-thick (140 mm) cores, with two layers of 5⁸/₈-inch-thick (15.9 mm), Type X gypsum wallboard field-installed on both faces, are a one-hour fire-resistance-rated assembly. Splines used at longitudinal edges of the Enercept panels must be the Enercept thermal splines. Both layers of gypsum wallboard must be installed vertically. The vertical joints of the base layer of gypsum wallboard must be offset a minimum of 24 inches (406 mm) from the vertical joints of the Enercept panel. The base layer must be attached to the OSB facing with No. 6, 1⁵/₈-inch-long (41.3 mm), self-tapping, buglehead wallboard screws spaced 12 inches (305 mm) on center, horizontally and vertically. The face layer of gypsum wallboard must be installed with the board joints offset 24 inches (406 mm) from base-layer joints. The face layer must be attached with No. 6, 2-inch-long (51 mm), self-tapping, buglehead wallboard screws spaced 12 inches (305 mm) on center, vertically and horizontally, with the screws offset 6 inches (152 mm) from the screws in the base layer.

The maximum wall height must be 8 feet (2438 mm), and the maximum allowable axial load must be 1920 pounds per foot (28 kN/m), as noted in Table 1 of this report.

4.3.2 One-hour, Limited Load Bearing, Fire-resistive Roof-ceiling Assembly: Enercept roof panels, as described in Section 3.3.2 with a 7³/₈-inch-thick (187 mm) core, with two layers of 5⁸/₈-inch-thick (15.9 mm), Type X gypsum wallboard field-installed on the interior (bottom) face, are an unrestrained one-hour, limited-load, fire-resistive roof-ceiling assembly. Based on the tested conditions and the 78 psf (3.74 kN/m²) allowable transverse load shown in Table 2 for the roof panels with a 12-foot (3658 mm) span, the total transverse load must not exceed 36 percent of the allowable transverse loads of Table 2. Splines used at longitudinal edges of the Enercept panels must be solid-sawn lumber splines. Both layers of gypsum wallboard must be installed with the long dimension of the wallboard parallel to the long dimension of the Enercept panels. The longitudinal joints of the base layer of gypsum wallboard must be offset a minimum of 24 inches (610 mm) from the longitudinal joints of the Enercept panel. The base layer must be attached to the OSB facing with No. 6, 1⁵/₈-inch-long (41.3 mm), self-tapping, buglehead wallboard screws spaced 12 inches (305 mm) on center, horizontally and vertically. The face layer of gypsum wallboard must be installed with the board

joints offset 24 inches (610 mm) from the base-layer joints. The face layer must be attached with No. 6, 2-inch-long (51 mm), self-tapping, buglehead wallboard screws spaced 12 inches (305 mm) on center, vertically and horizontally, with the screws offset 6 inches (152 mm) from the screws in the base layer.

4.4 Special Inspection:

Periodic special inspections shall be as required by IBC Section 1707.3.

5.0 CONDITIONS OF USE

The Enercept Structural Insulated Panels 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** Enercept Structural Insulated Panels are fabricated, identified and erected in accordance with this report and the manufacturer's published installation instructions. If there are any conflicts between the manufacturer's published installation instructions and this report, the more restrictive governs.
- 5.2** The panels must be separated from the building interior by a thermal barrier as required in Section 4.2.5 of this report.
- 5.3** Design loads to be resisted by the panels must be determined in accordance with the applicable code, and must not exceed the allowable panel loads noted in this report.
- 5.4** Construction documents, including engineering calculations and drawings providing floor plans, window details, door details, and connector details, must be submitted to the code official when application is made for a permit, verifying compliance with this report and the applicable code. The design calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.5** Special inspection shall be as required in Section 4.4.
- 5.6** Use of the foam plastic in areas subject to damage from termites must be in accordance with IBC Section 2603.8 and IRC Section R320.5.
- 5.7** The panels must be installed such that the panel facings are protected against decay and termites in accordance with IBC Sections 2304.11.2.2 and 2304.11.2.6, or IRC Sections R319 and R320, as applicable.
- 5.8** Use of the panels is limited to Type V construction.
- 5.9** For use of the panels under the IRC, the panels are limited to an engineered design under IRC Section R301.1.3, engineered in accordance with the provisions in this evaluation report.
- 5.10** When used as shear walls under the IBC and IRC, the panels must be limited to Seismic Design Category A, B or C.
- 5.11** The panels and their attachments must be subject to inspection by the code official prior to covering with an approved water-resistive barrier or approved roof covering.
- 5.12** For installation of the roof panels, justification must be submitted to the code official demonstrating that Enercept Structural Insulated Panels with the uninsulated roof covering comply as a Class A, B or C roof assembly, as required by IBC Section 2603.6, with the classification complying with minimum classification requirements of the building.

5.13 The panels are fabricated in Watertown, South Dakota, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with ICC-ES Acceptance Criteria for Sandwich Panels (AC04), dated October 2011.
- 6.2 Test reports in accordance with ASTM E 119.

7.0 IDENTIFICATION

Each Enercept Structural Insulated Panel shall be identified by a stamp or label on the panel bearing the product panel number, the name and address of the manufacturer (Enercept, Inc.), the evaluation report number (ESR-1780). In addition, panels to be used as wall panels have the panel core voids evident at the longitudinal panels edge.

TABLE 1—STANDARD WALL PANEL AND CURTAIN WALL PANEL ALLOWABLE LOADS¹

PANEL HEIGHT (feet)	ALLOWABLE LOADS			
	Axial Load ^{2,8} (pounds per lineal foot)	Transverse Load ² (pounds per square foot)	Racking Shear Load ³ (pounds per lineal foot)	
8	1,920	50	181 ^{4,5}	292 ^{6,7}
10	1,920	40	-	-
12	1,920	33	-	-
14	—	29	-	-
16	—	23	-	-

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.6 N/m, 1 psf = 0.0479 kPa.

¹The panel core thickness is either 5⁵/₈ or 7³/₈ inches.

²Combined axial and transverse loading must satisfy the following relationship: $P_{actual}/P_{allowable} + W_{actual}/W_{allowable} \# 1.0$.

³Design consideration shall be given to uplift forces on the shear wall.

⁴The racking shear load is based on a maximum shearwall height-to-length ratio of 2:1.

⁵The OSB facing material on each face of the panels shall be attached to the connection posts (vertical splines) and the top and bottom plates with 8d common nails spaced at a maximum of 6 inches on center.

⁶The racking shear load is based on a maximum shearwall height-to-length ratio of 1:1.

⁷The OSB facing material on each face of the panels shall be attached to the connection posts (vertical splines) and the top and bottom plates with 8d common nails spaced at a maximum of 3 inches on center.

⁸Panels were tested without connection posts/splines installed.

TABLE 2—ROOF PANEL ALLOWABLE TRANSVERSE LOADS (psf)^{1,2,3,4}

PANEL SPAN (feet)	PANEL CORE THICKNESS (inches)							
	5 ⁵ / ₈		7 ³ / ₈		9 ³ / ₈		11 ³ / ₈	
	L/180	L/240	L/180	L/240	L/180	L/240	L/180	L/240
8	86	86	117	117	143	143	174	174
10	69	62	94	91	120	120	140	140
12	55	43	78	65	101	91	116	116
14	40	30	59	47	79	68	98	89
16	29	22	45	36	60	52	75	68
18	22	—	35	27	47	40	59	54
20	—	—	27	21	38	32	47	43
22	—	—	22	—	31	26	39	35
24	—	—	—	—	26	21	33	29

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 psf = 0.0479 kPa.

¹Each end of the roof panels shall be continuously supported with supports that provide a minimum bearing length of 3 inches.

²5⁵/₈-inch-thick core roof panels, subject to concentrated roof maintenance live loads and a total uniform dead load of 14 psf, must be limited to a maximum span of 12 feet.

³7³/₈-inch-thick core roof panels, subject to concentrated roof maintenance live loads and a total uniform dead load of 14 psf, must be limited to a maximum span of 16 feet.

⁴9³/₈-inch-thick core roof panels, subject to concentrated roof maintenance live loads and a total uniform dead load of 14 psf, must be limited to a maximum span of 20 feet.

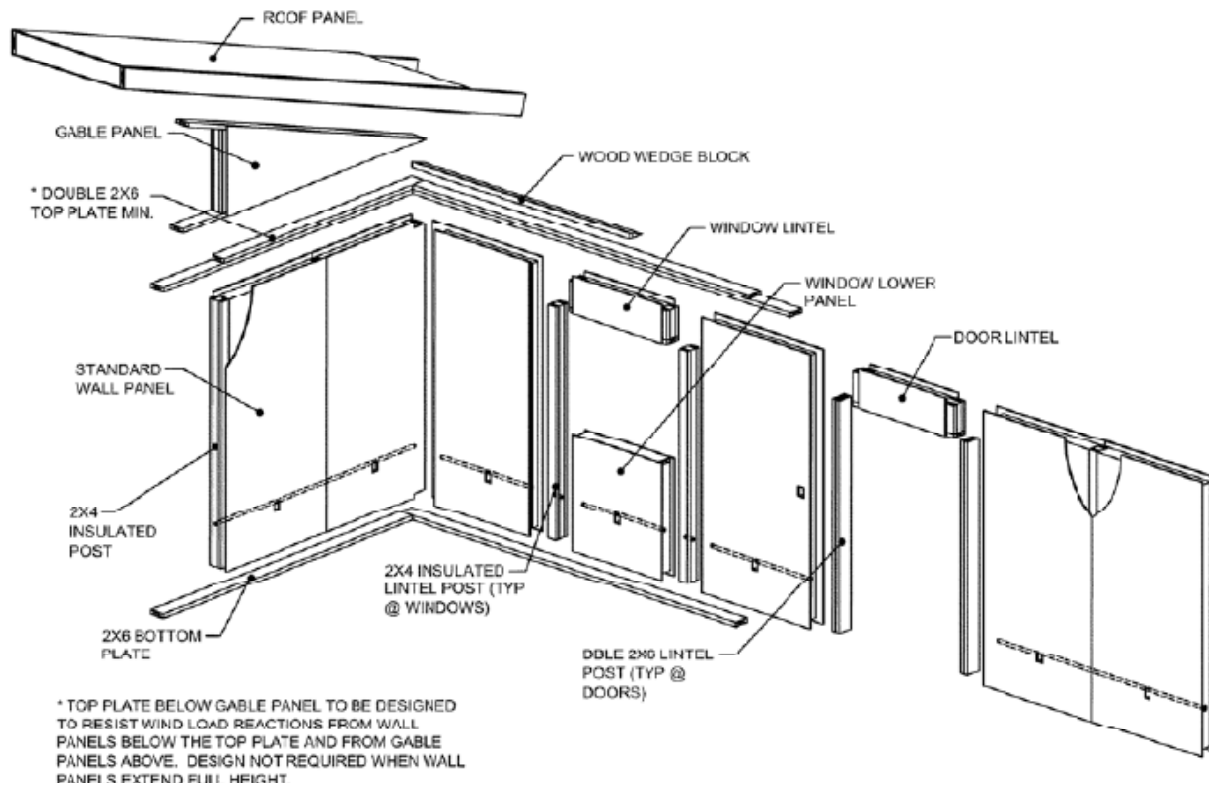


FIGURE 1—ENERCEPT BUILDING SYSTEM

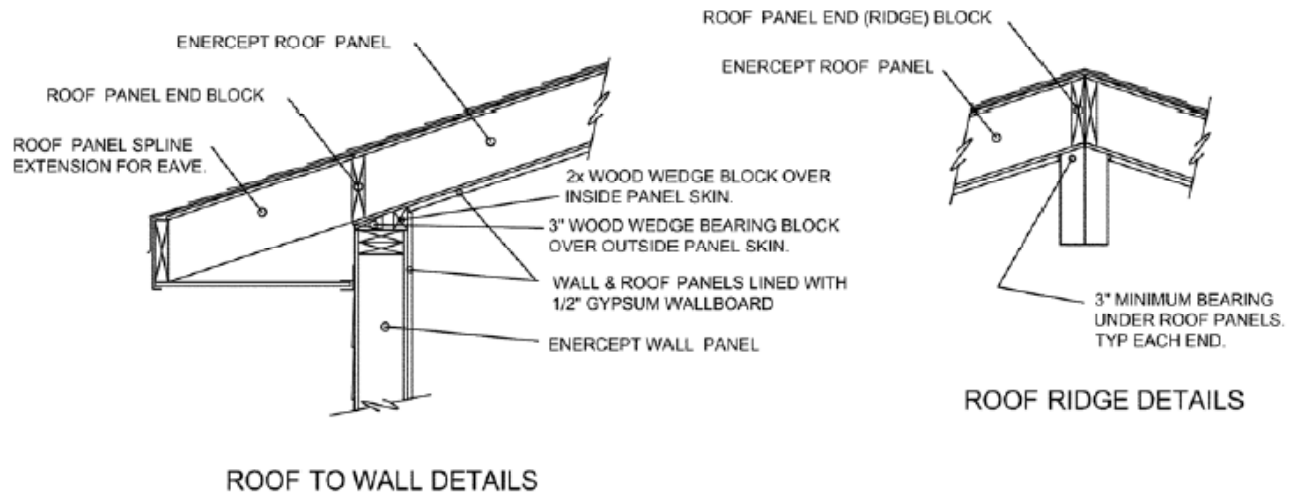


FIGURE 2—TYPICAL WALL AND ROOF PANEL CONSTRUCTION

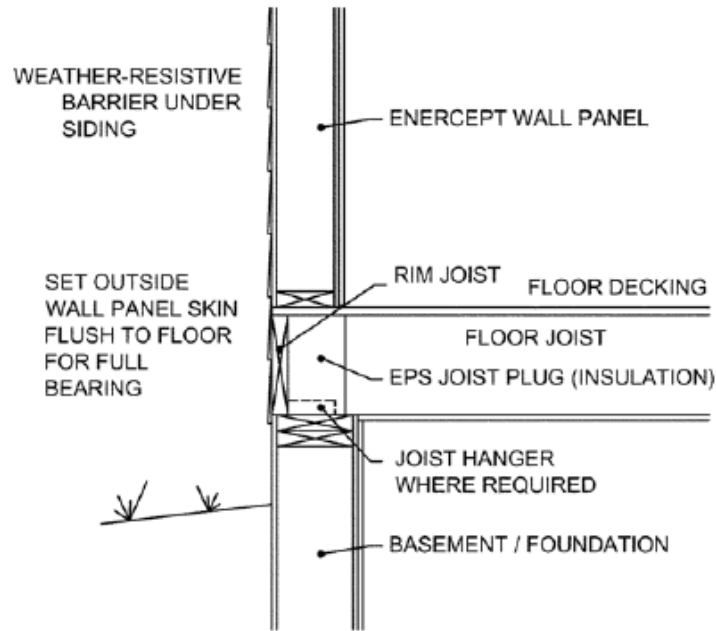


FIGURE 3—TYPICAL WALL-TO-FLOOR DETAILS

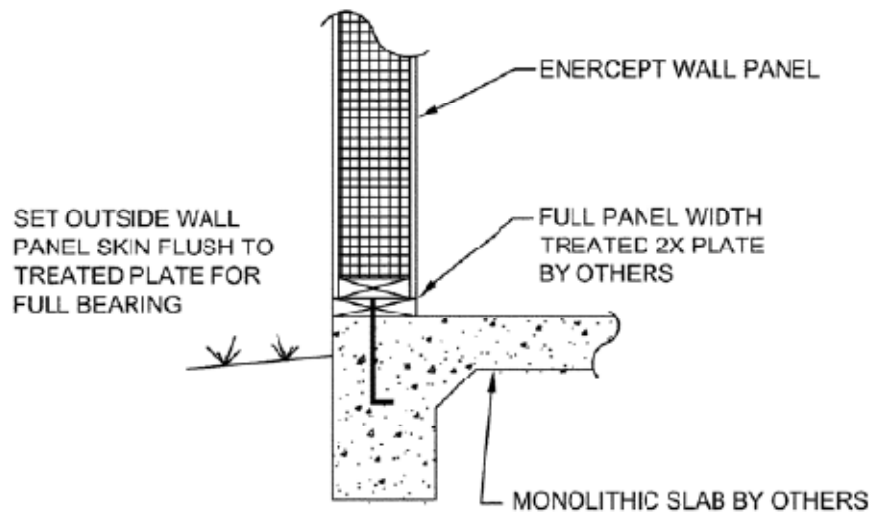


FIGURE 4—TYPICAL WALL TO MONOLITHIC SLAB

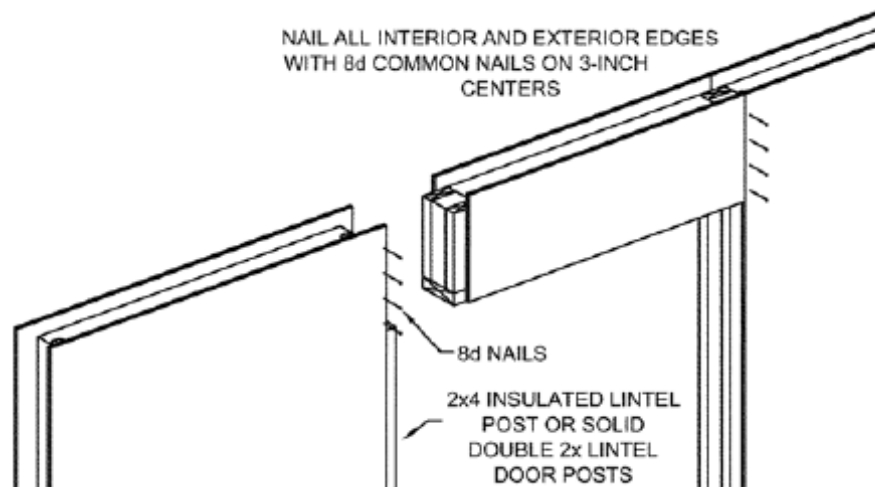


FIGURE 5—TYPICAL LINTEL INSTALLATION