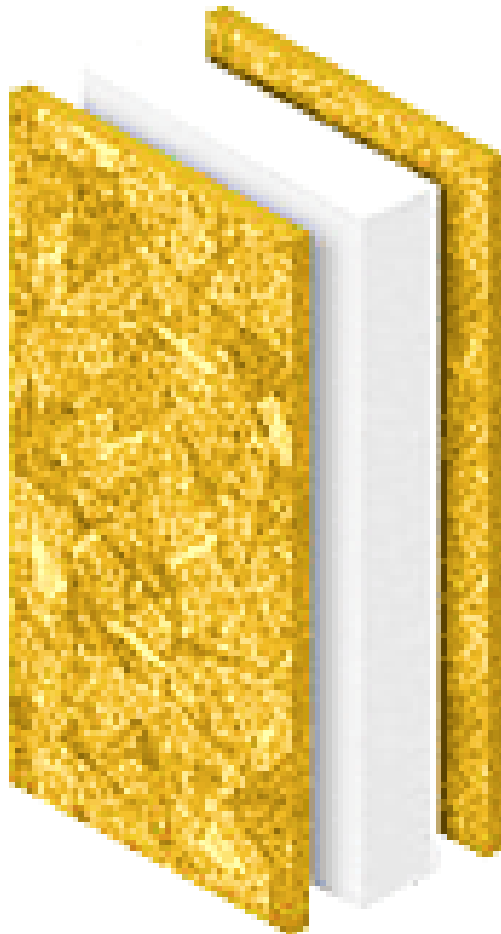




Construction Manual



Panel Fastening

Enersip wall panels are joined together using splines and plates. Panels are fastened together by nails or staples. Nails and staples can be substituted with screws of equal strength at an equivalent frequency. Screw fasteners require a minimum of 1" penetration into the support. Together with all fastening techniques adhesive must be used.

Splines

All joints of two panels must be splined. In most cases two panels are joined together by two OSB or plywood splines. 2X "wood splines are provided for the areas of higher than usual point load. Failure to install splines as specified will violate the structural integrity of a wall. During installation panel joints must be sealed with foam sealant. Wall elements are shipped with spline channels pre-routed, however, if modifications are done on site, then new spline channels must be made by using a router with a 5/8" diameter and 2" long bit for OSB splines. In the case of 2X "splines, the foam must be cut to suit. Please follow the gluing and fastening instructions as provided by the construction details on the blueprints and this construction manual.

Foundation & Floor Deck

The foundation walls must be true and square. If there is a discrepancy it must be rectified. It is imperative the floor deck be built carefully in order to accommodate a pre-cut structure. **The floor deck must be square and leveled.** An uneven floor deck will result in the uneven support of panels which in turn will affect the structural integrity of the building. An uneven floor deck will affect the overall length of walls by preventing them to join parallel but rather in an "A" or "V" shape. Having a true, square and level foundation and floor deck can save you hours of erection time.

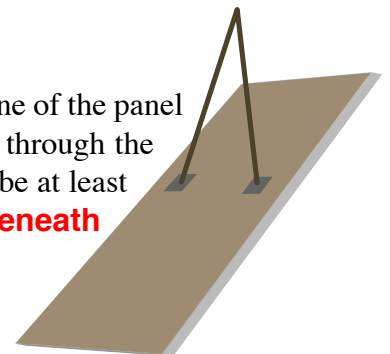
Wall Length Adjustments

All walls supplied by Enersip are precisely pre-cut to fit the floor plan. Due to a possible error in the size of a floor deck, it may be necessary to adjust the length of a wall. The adjustment can be made at the joint of two panels using the following procedure:

1. If the wall is too long, cut off a slice of the panel to meet the required adjustment (this will require the re-routing of spline channels).
2. If the wall is too short, a maximum of a 4" extension can be made by using the supplied "adjustment splines" (7" wide) and foam. The width of splines must be adjusted to the required length (+3" for channel depth).

Panel Lifting Procedures

Roof panels will require a crane. Two holes must be drilled just above the center line of the panel and in a 1/4 of the width of the panel from each side. Eye bolts must be inserted through the holes and secured on the bottom with a wide washer and nut. The eye bolts must be at least 1/2" in diameter. Please note that **under no circumstances can anyone be beneath the panel while being lifted.**



Load & Span Limits

Load and span limits for Enersip panels and other building components must be followed strictly. Engineering and load tables are provided by Enersip. Homes supplied by Enersip are engineered to satisfy all structural requirements. **No change or customizing shall be done without consulting Enersip or a structural engineer, failure to do so will void all warranties.**

Adhesives & Sealants

Adhesives used with Enersip panels must be wood-to-wood bonding adhesives which are safe to use in conjunction with expanding polystyrene foam insulation EPS, Enersip will recommend the proper sealants to use, and in most cases supply it as part of the panel cost. Apply the adhesive in a 1/4" x 1/8" bead to wood surfaces only. This size of an application bead will result in the optimum coating when the panel plates and splines are installed in accordance with GSH recommendations.

Expanding foam sealant is required when sealing joints in contact with the EPS foam insulation. Apply the sealant in a 3/8" bead where shown in the GSH details. When properly applied, the expanding foam sealant will augment the overall tightness of the structure.

Thermal Barriers

All interior surfaces of Enersip panels must be finished with a thermal barrier as per code. A fifteen minute thermal barrier can be obtained with 1/2" gypsum board or equivalent. Hourly fire rated systems can be achieved using high performance thermal barriers such as type X and C gypsum board or spray applied fire proofing or equivalent. When Enersip panels are applied for special uses such as buildings with automation sprinklers, or designs not requiring thermal barriers, consult your local code. Approved thermal barriers must be applied according to the manufacturer's application specifications. Consult GSH for these assemblies.

Vapor Barriers

Vapor retarder requirements may be mandated by building codes. GSH recommends the use of vapor retarders (ie, 6 mil polyethylene) on all panel applications where inner and outer surfaces of the wall are interconnected with lumber (built in posts) or material other than EPS foam

Storage – Protection

When Enersip panels are stored they must be fully supported and protected from the weather elements. Store panels on a flat surface with supports placed at least 4' on center. Cover stored panels with tarps or similar protective wraps. When panels are used as roof elements, roofing must be immediately applied or panels must be protected with a temporary cover. Wall panels should have a code approved weather-proof cladding applied immediately. If wall cladding application is delayed (more than three weeks, or if there is an anticipated exposure to precipitation) apply temporary breathable weather-proof cladding.

Staples or 8d Nails

Enersip panels typically uses 8d nails at 6” on center for the connection of splines and plates as shown in the Details Booklet. Many contractors prefer to use staples as the typical fastener for their projects. Staples maybe used instead of 8d nails provided they meet the following criteria:

Minimum Staple Length = 1- 1/2”

14 gauge - 6” on center.

16 gauge - 4” on center.

Chisel point staples are preferred

The suggested size and spacing for the staples is an equivalent to the typical 8d nails. Each project should be reviewed to make sure that the minimum nailing patterns satisfy design conditions. High diaphragm loads may require more fasteners depending on the diaphragm design loads. Consult your shop drawings and contact Enersip Homes if you have any questions.

Nail Withdrawl Capacities In OSB

With the use of Structural Insulated Panels there are numerous instances where the attachment of finishing materials such as shingles, siding, drywall etc... is required. The application of these materials is typically accomplished through the use of conventional nail products. Data pertaining to the pullout resistance of nails in OSB to date is not readily available.

The following is a summary of the average ultimate values by panel Manufactures achieved for various nail fasteners placed into 7/16” OSB.

AVERAGE DIRECT WITHDRAWAL (PULLOUT) – lbs.	
NAIL SIZE & DESCRIPTION	AVG. ULTIMATE PULLOUT
4d ring shank-drywall nail.....	133
6d smooth galvanized	59
Roofing Nail-smooth galvanized.....	51
8d smooth coated sinker	150
8d smooth galvanized spiral shank.....	112
8d galvanized ring shank	77
8d smooth galvanized	65
8d bright box.....	107
10d galvanized ring shank	164
16d smooth galvanized	63
16d bright box.....	90

This data has been compiled to provide manufacturers, designers and engineers with values for assessment of fastener requirements. These values are average ultimate capacities and an appropriate factor of safety should be applied to determine design values.

Through the utilization of Enersip Panel applications of ancillary materials such as cabinets, sidings, etc. are needed to finish a structure. In many of these attachment applications screws are the preferred fasteners. Data on the pullout and lateral withdrawal capacities of screws into OSB to date have not been readily accessible.

To help clarify the performance of screws placed in OSB a major manufacturer of OSB took it upon itself to generate data on various screws placed into OSB that was exposed to different environments. Fifteen repetitions of both direct and lateral withdrawal of each screw type in each of three environmental conditions were conducted. The following charts summarize the lowest ultimate average value achieved for a particular screw type when placed into three different thickness of OSB.

Average Lateral Withdrawal (Shear) - Ids.

Screw Size	7/16" OSB	5/8" OSB	3/4" OSB
#6 Deck Screw	198	273	295
#8 Deck Screw	118	197	224
#10 Deck Screw	143	260	301
#12 Deck Screw	436	581	561
#14 Deck Screw	466	630	797

Average Direct Withdrawal (Pullout) - Ids.

Screw Size	7/16" OSB	5/8" OSB	3/4" OSB
#6 Deck Screw	198	273	295
#8 Deck Screw	118	197	224
#10 Deck Screw	143	260	301
#12 Deck Screw	436	581	561
#14 Deck Screw	466	630	797

The above charts are reporting Ultimate values. Appropriate safety factors should be applied to obtain design values.

If there are any questions regarding the above information, please contact your Enersip Homes Inc. System representative or the OSB Manufacture.

Attachement of Exterior Claddings to Panels

Enersip Panels is used in both commercial and residential applications. Through the years panels have had nearly every type of exterior cladding applied to the face of our panels. The advent of new exterior claddings in the market place always brings the question of how this product should be applied to the panel.

Most exterior claddings currently available in the market place make reference that their product should be attached to the framing members of the structure. Enersip Panels do not incorporate framing members and therefore do not meet their written recommendations. However, a review of the requirements for attachment typically calls out for the cladding to be attached with 8d nail 16" or 24" on center depending on the framing spacing.

Using these values one can compare the pullout values for 8d nails into standard framing and compare that to the fastener pullout values listed above. This comparison shows that all claddings with the requirements of fastening to framing members can be matched by applying 8d ring shanked nails 12" o.c. into Enersip Structural Panels. This would include the attachment of standard sidings such as hardboard, cedar, redwood, composites and cementitious sidings.

This type of comparison is also valid for the application of laths for stucco as well as brick tie placement. Typically these products are applied by simply increasing the number of fasteners 25%. Whereas, a manufacturer calls out for fasteners 16" o.c. the fasteners would be placed in a panel application at a rate of 12" o.c. This will allow the panel application to meet or exceed the pull out values designed by the manufacturer. It should be noted that the fastener placement can be maintained at manufacturer's recommendations provide a nail is replaced with a screw. In all cases the fastener should be corrosion resistant.

Wiring Enersip Panels

The Structural Insulated Panels manufactured by Enersip Homes is both simple and easy for electricians to wire. It does require a small amount of advance planning. 1-1/2" wiring chases are provided for quick access to panel interiors as described in the wiring detail drawings. Added chases @ 16" and 45" off the finished floor as well as vertically 4' on center can be requested at a minimum charge.

Wiring chases can be added in the field with the approval of the chase location by a Enersip representative or structural engineer. These chases are cut vertically on the inside walls for the wire to be set into panel than foamed for sealing the panel.

Mechanical Ventilation of Enersip Structures

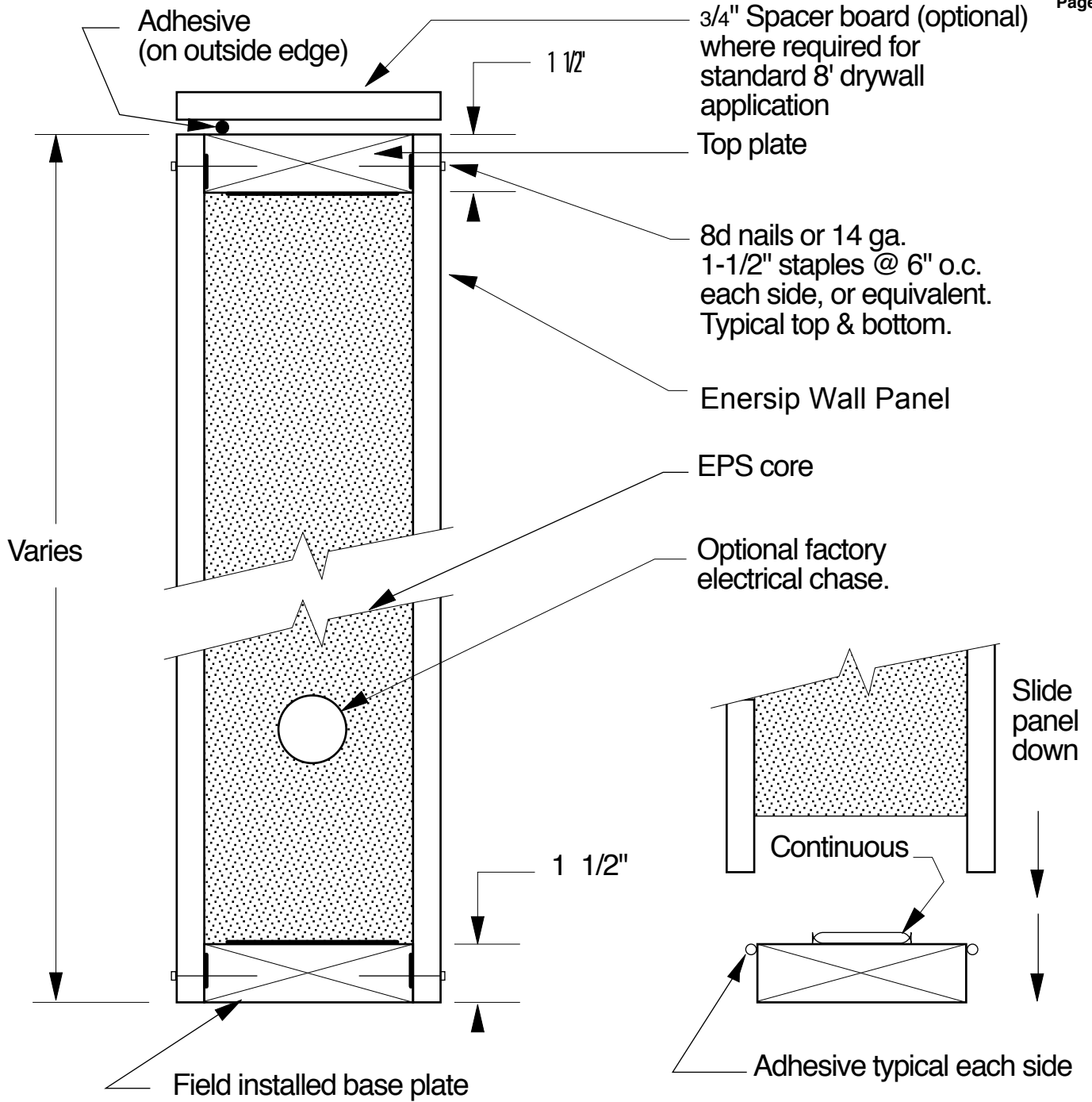
As we have insulated and sealed homes to achieve greater levels of comfort and energy independence Enersip panels have proven themselves to be the most cost effective and stable method of construction. Although this simplified process of super insulation has shown positive impacts on the quality, comfort and energy savings of structures, it has also created the need for controlled ventilation.

Many of today's indoor airborne pollutants can be effectively controlled, actually increasing the comfort and livability of a structure. Mechanical ventilation has been proven effective in mitigating fumes from combustion appliances, radon, formaldehyde and even pollutants such as excess humidity and tobacco smoke.


Established levels of humidity levels are governed by region, but a rough rule of thumb is 50% relative humidity on the interior of a building will be low enough to inhibit mold or mildew based pollutants and high enough to inhibit low humidity pollutants like dust mites. In order to remove the contaminated air, an exhaust is essential. Typically, that exhausted air is the replaced with fresh air from outside the structure. Several methods of accomplishing this are available.

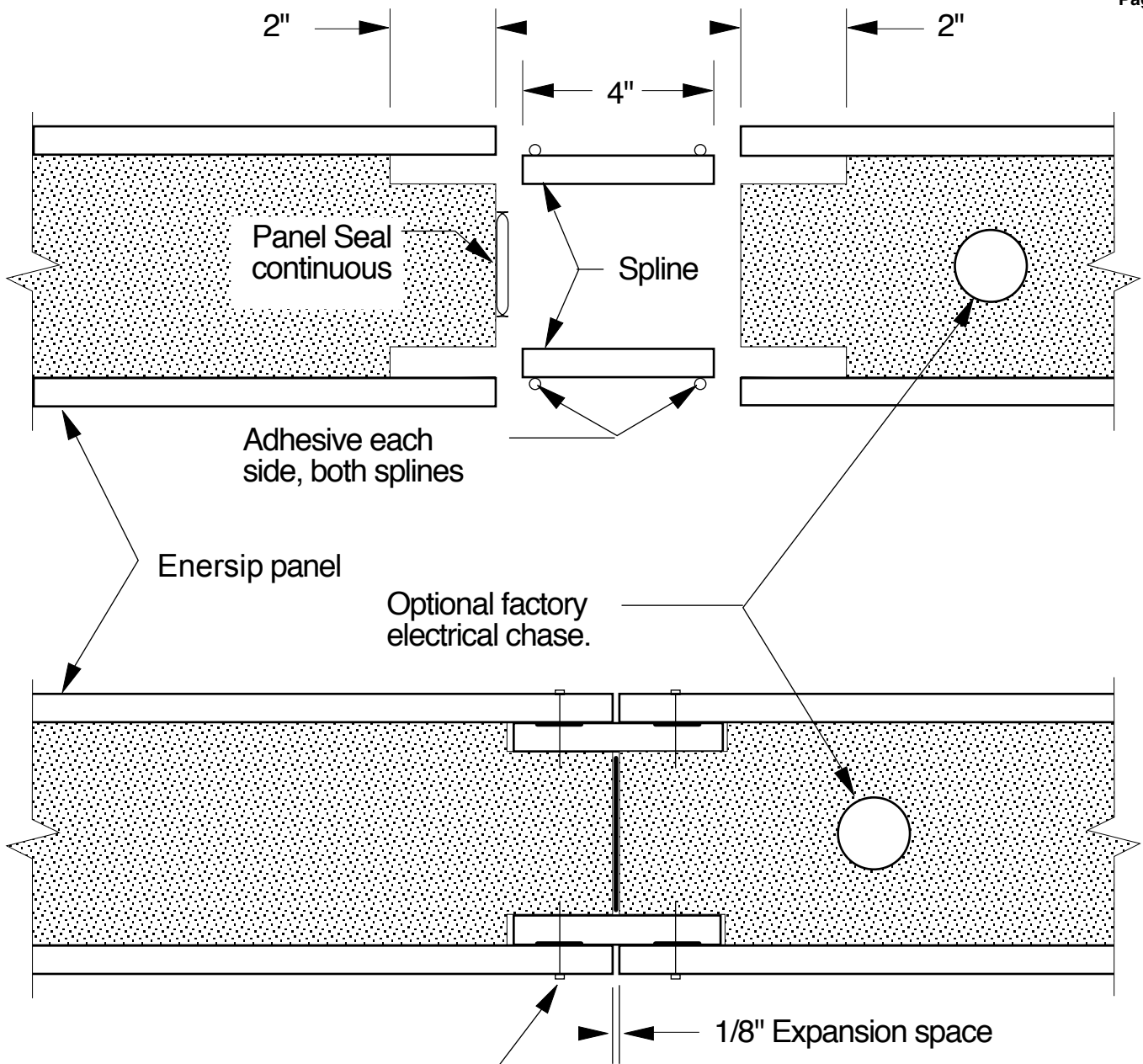
- 1.)** Air to air heat exchangers - These small units generally draws air from source areas like kitchens and bathrooms where excess humidity is created. Moisture laden warm air is carried through ducts to the unit where it transfers the heat through a core, similar in function to the radiator of a car, while carrying the moisture out of the structure. Thus, the exhaust air tempers or pre-heats the cold unconditioned but fresh air that is coming in from outside. These units are also known as HRV's or Heat Recovery Ventilators.
- 2.)** Exhaust only systems - These come in many shapes and sizes from simple one-room units to multiple duct whole house exhausts. These units typically exhaust the stale air and rely upon natural infiltration to replace the exhausted air. They can create a negative pressure on the structure.
- 3.)** Ventilating windows - These windows use a small grille to both exhaust and replace air in a house. They are manually operated and can be used in selected or every window in a home.
- 4.)** Air Cleaners - These units run the gamut from inexpensive tabletop versions to very sophisticated whole house systems. They are used to remove particulate pollutants but generally are not designed for the removal of gaseous pollutants. Typically these are not recommended for either humidity or radon control.

Whatever your choice in mechanical ventilation, your design professional should be deeply involved in any indoor air quality maintenance design.



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	Plate Connections	AM-001
	ENERSIP Panel Building System	

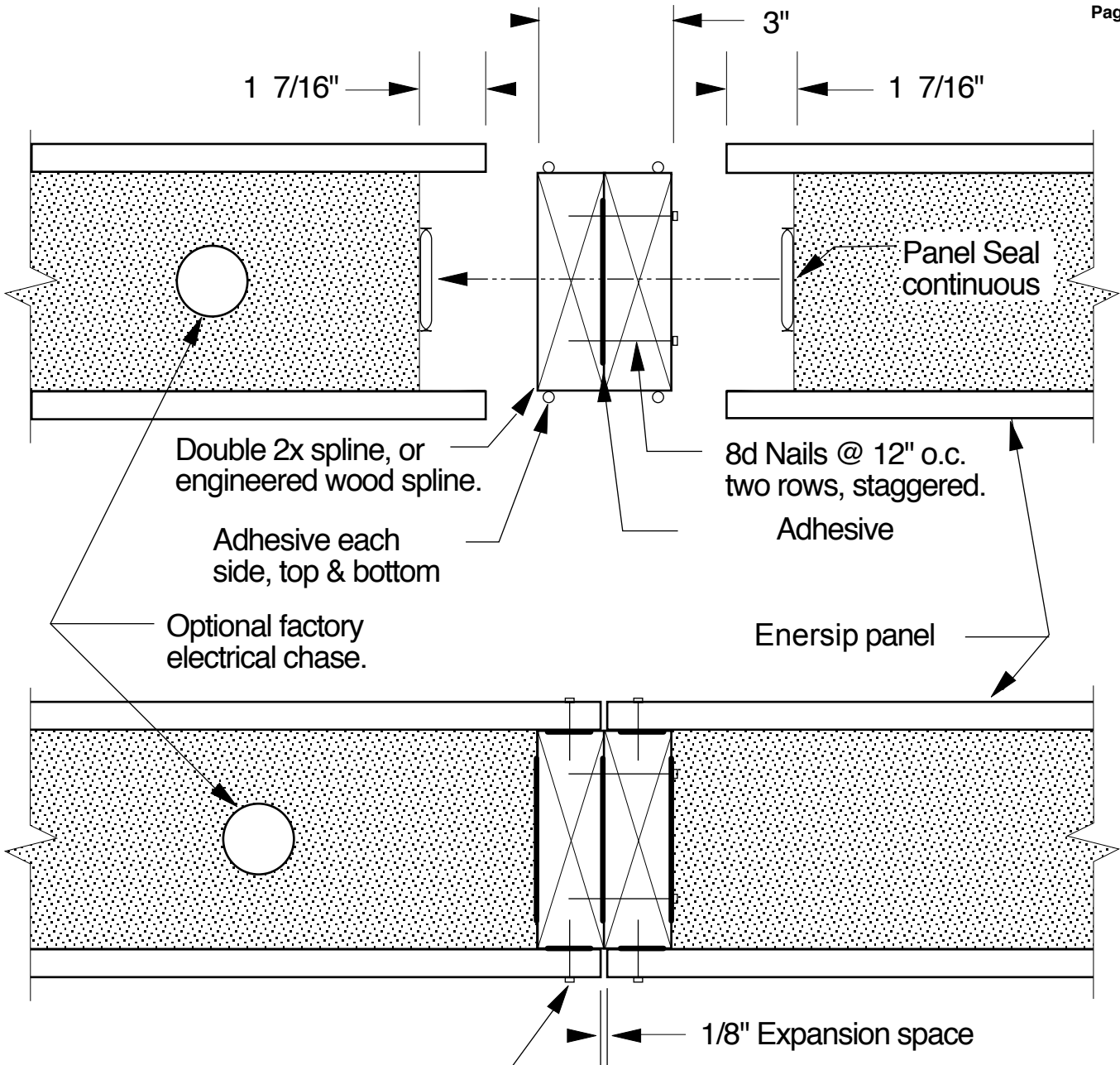


Fasten with 8d nails or 14 ga. 1-1/2" staples @ 6" o.c. both sides of panel joint or equivalent. Typical each side of panel.

Note: Spline to be minimum thickness equal to the panel skins.

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	Spline Connection Surface Spline	AM-002
	ENERSIP Panel Building System	



Double 2x spline, or
engineered wood spline.
Adhesive each
side, top & bottom
Optional factory
electrical chase.

8d Nails @ 12" o.c.
two rows, staggered.
Adhesive
Enersip panel


Panel Seal
continuous

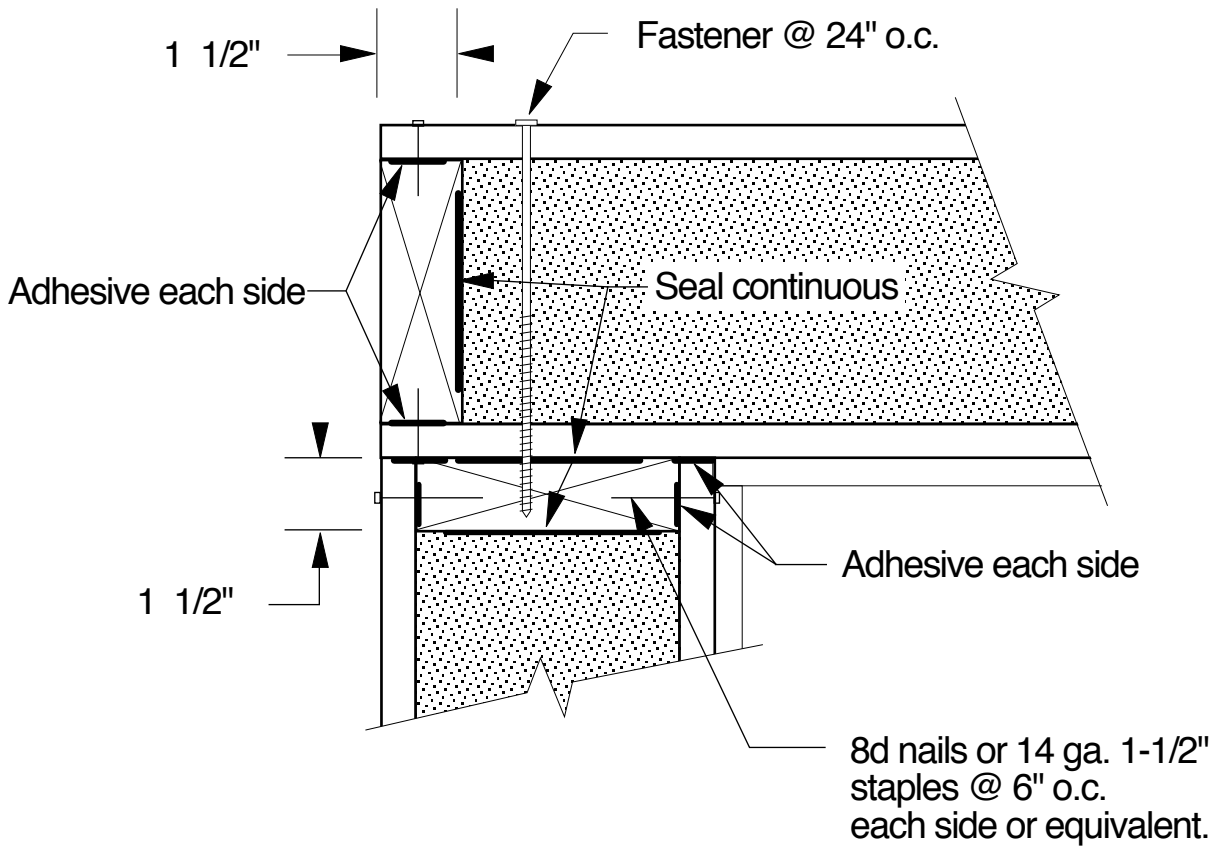
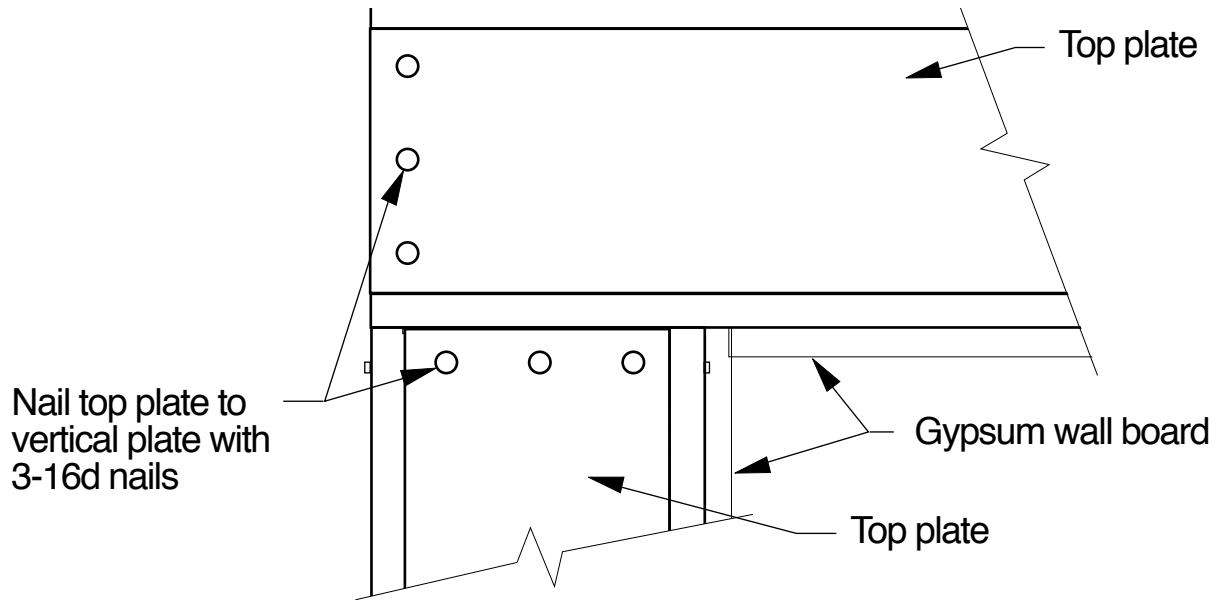
1/8" Expansion space


Fasten with 8d nails or
14 ga. 1-1/2" staples @ 6" o.c.
both sides of panel joint or equivalent.
Typical each side of panel.

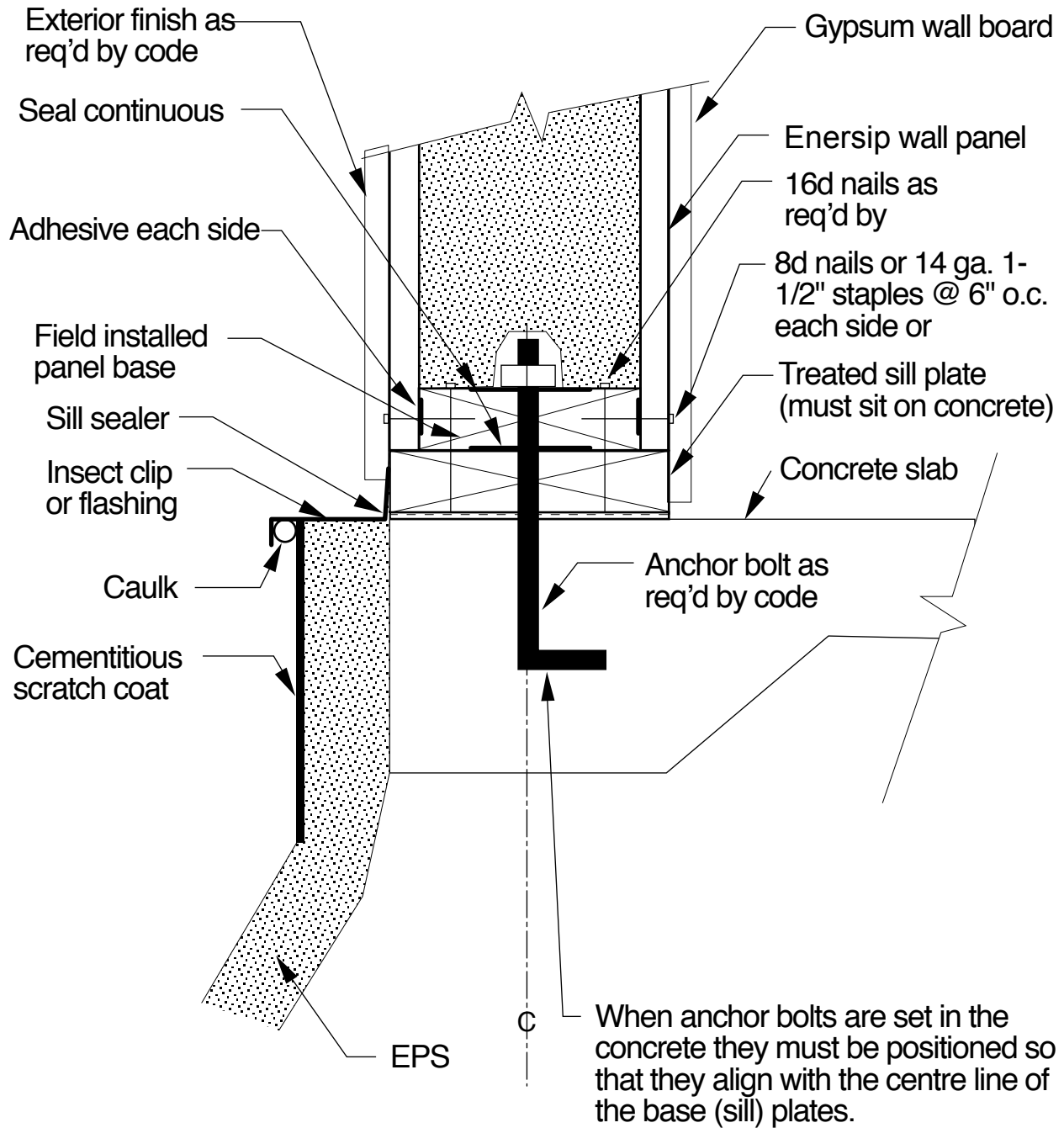
Note: Vapor retarder on warm side of panel should be utilized with 2x splines.

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	<p>Spline Connection Double x2</p>	<p>AM-002a</p>
	<p>ENERSIP Panel Building System</p>	

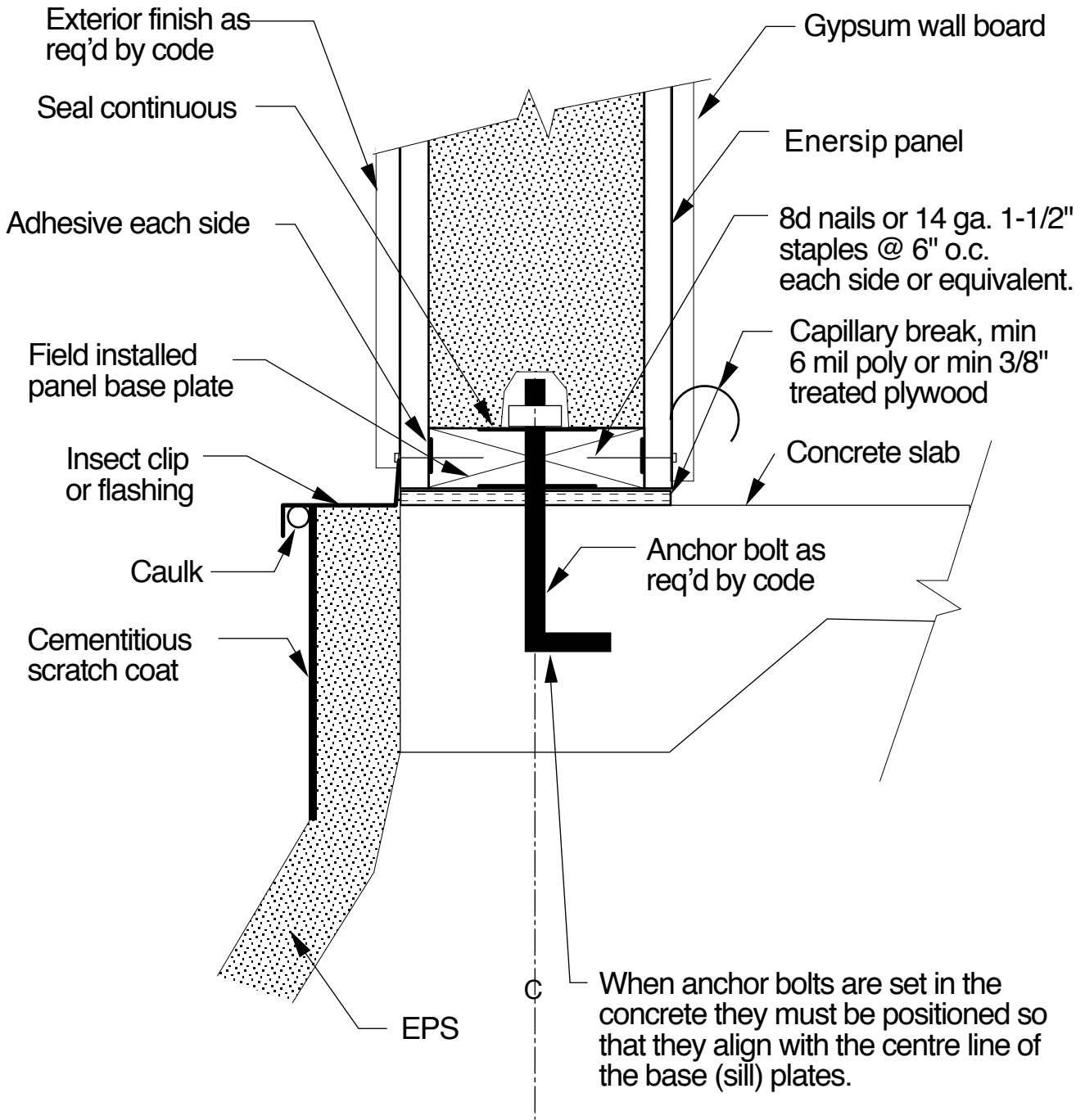


	Corner Connection	AM-003
	ENERSIP Panel Building System	




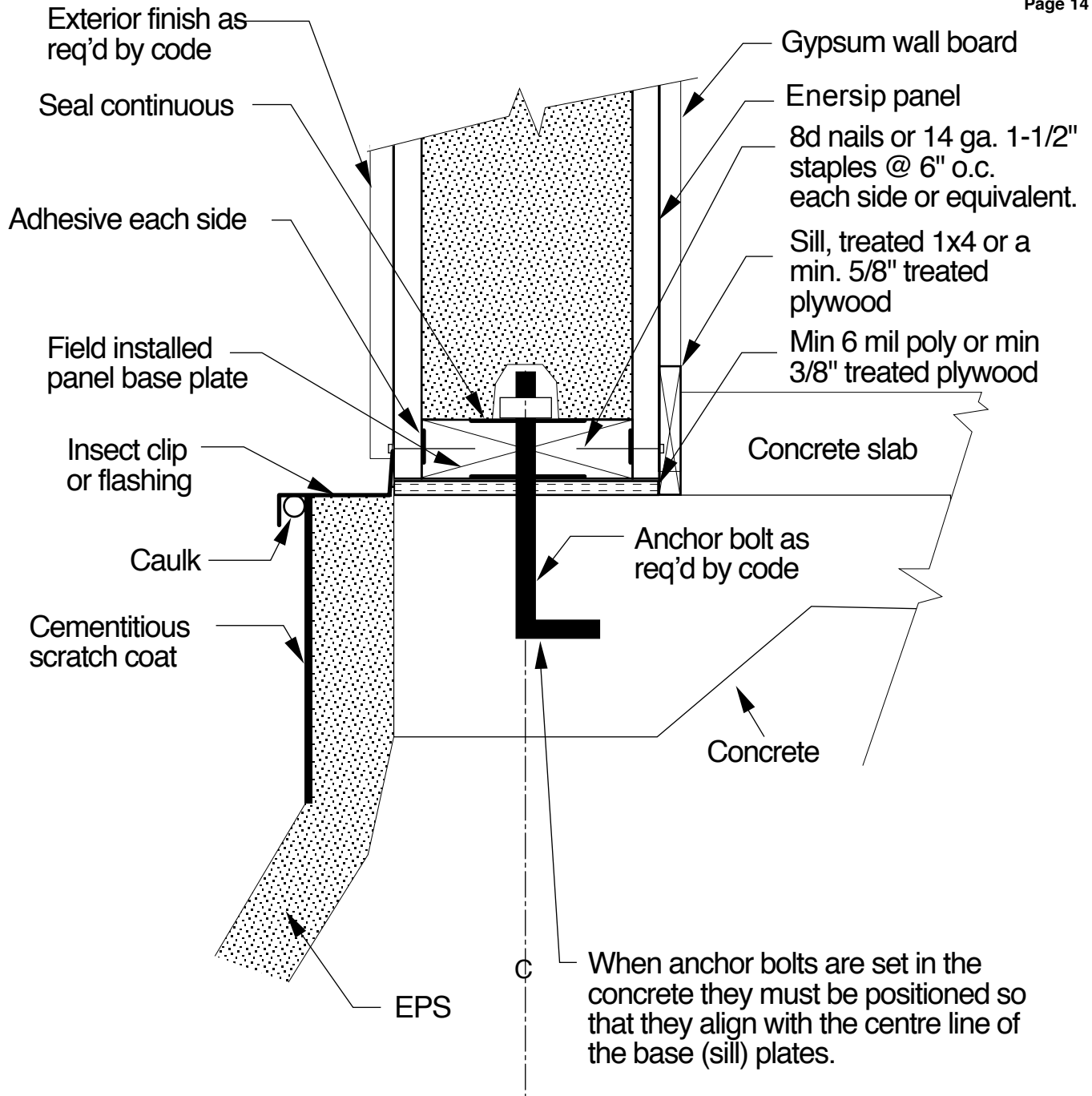
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	Slab Foundation Framing AM-004
	ENERSIP Panel Building System




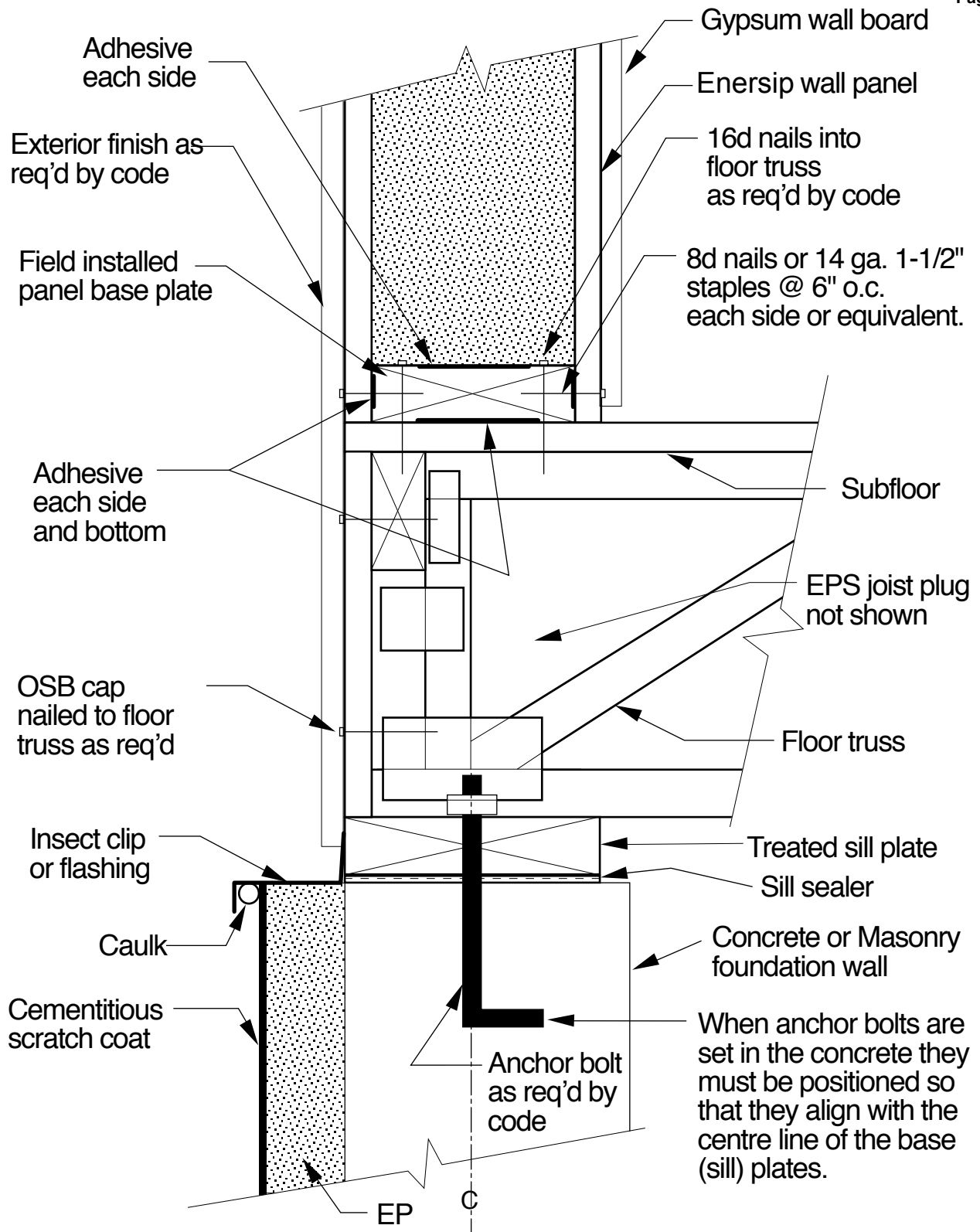
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	Slab Foundation Framing AM-004a
	ENERSIP Panel Building System




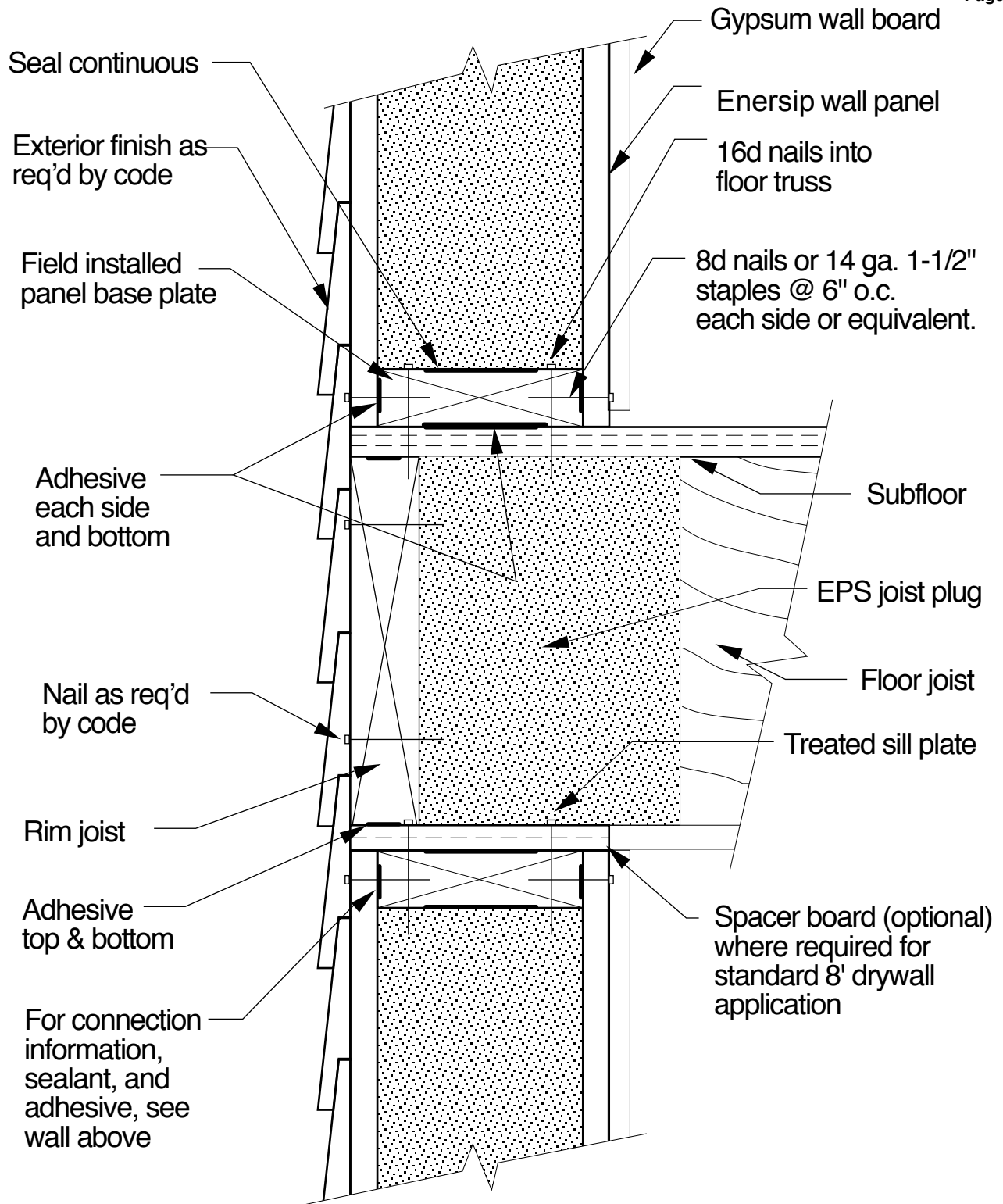
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	Slab Foundation Framing AM-004b
	ENERSIP Panel Building System




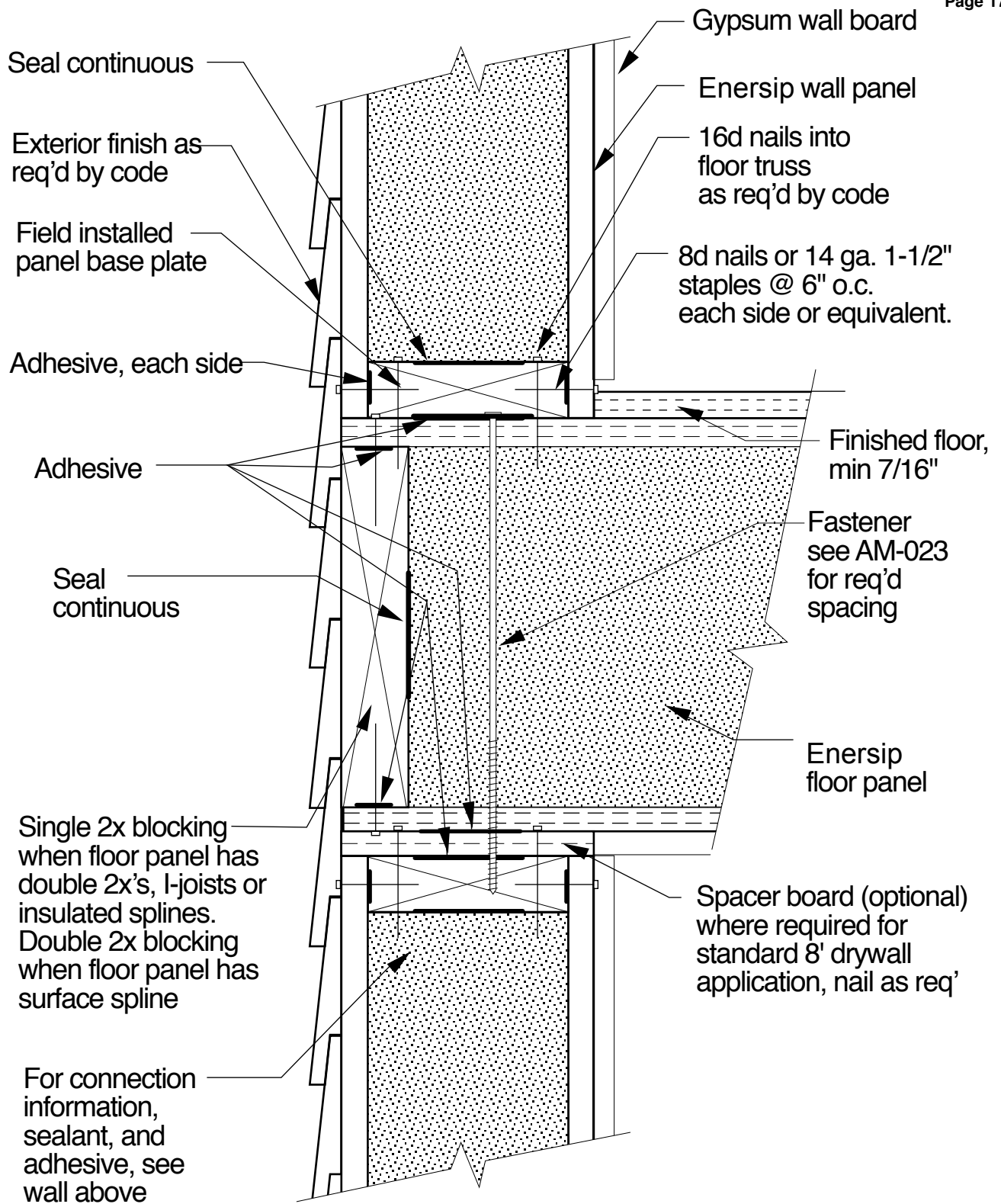
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	Foundation Framing – Truss	AM-005
	ENERSIP Panel Building System	



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	Floor Joist Bearing on Wall Panel	AM-006
	ENERSIP Panel Building System	

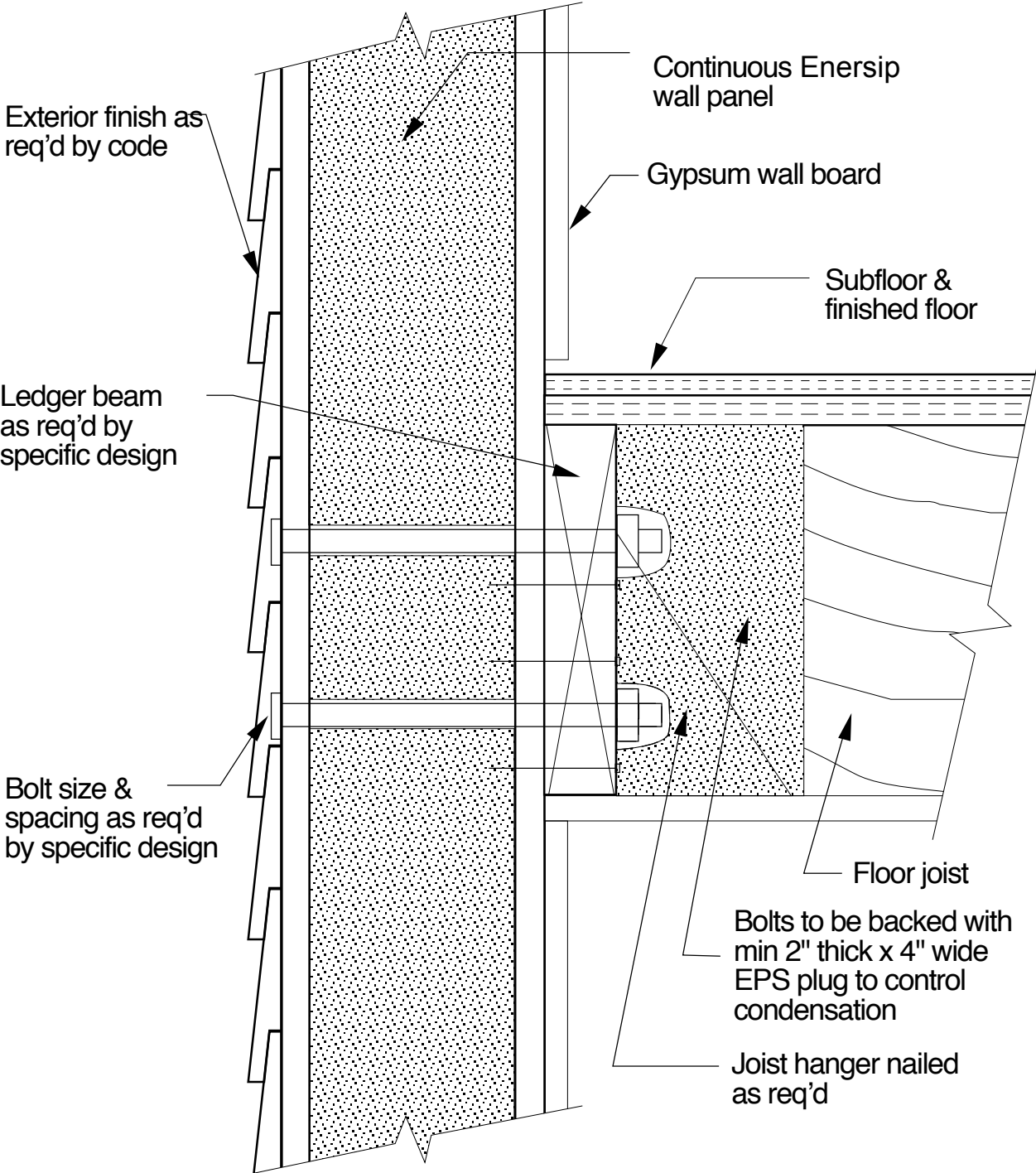


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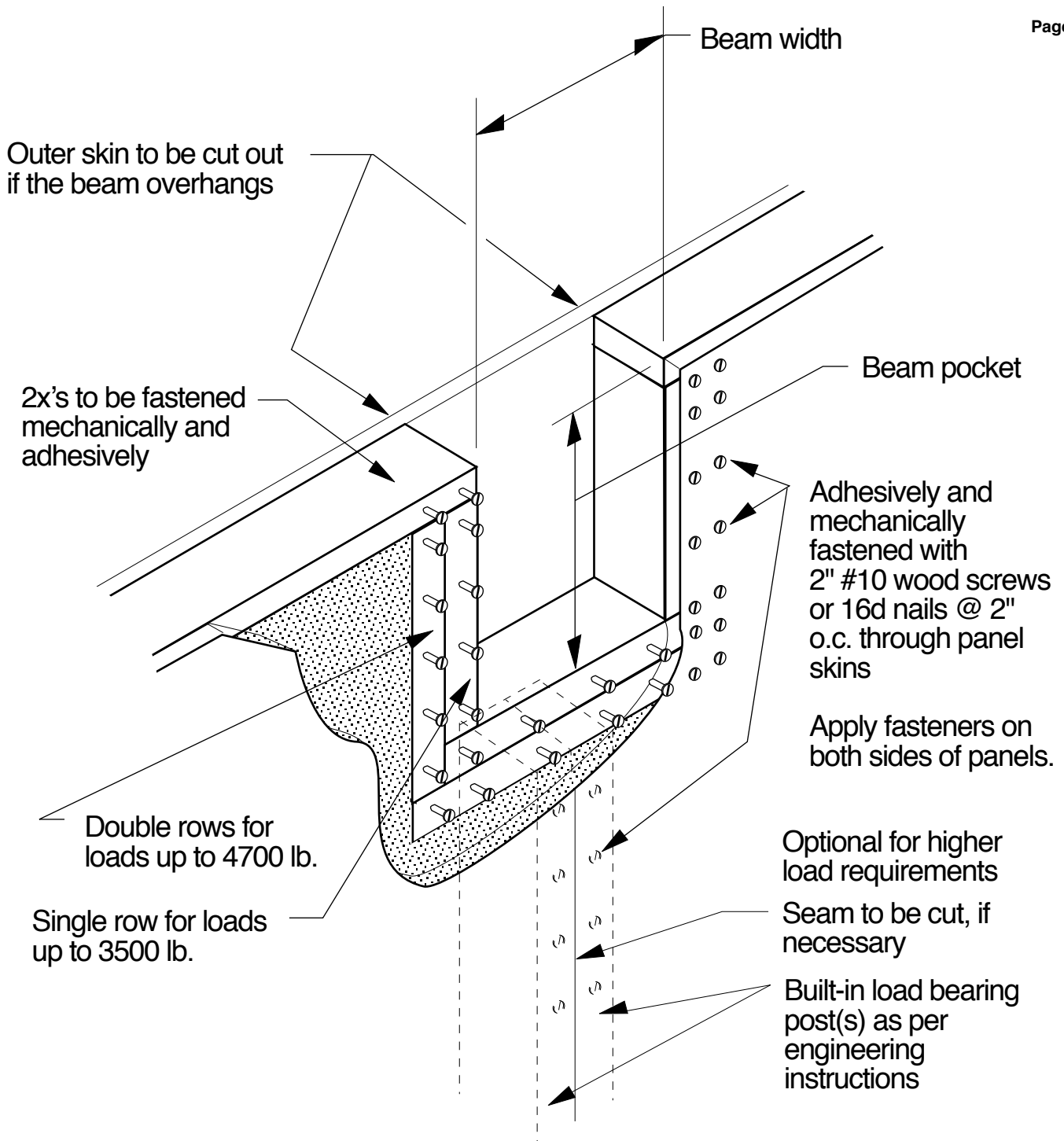
Floor Panel on Wall Panel AM-006a

ENERSIP
Panel Building System




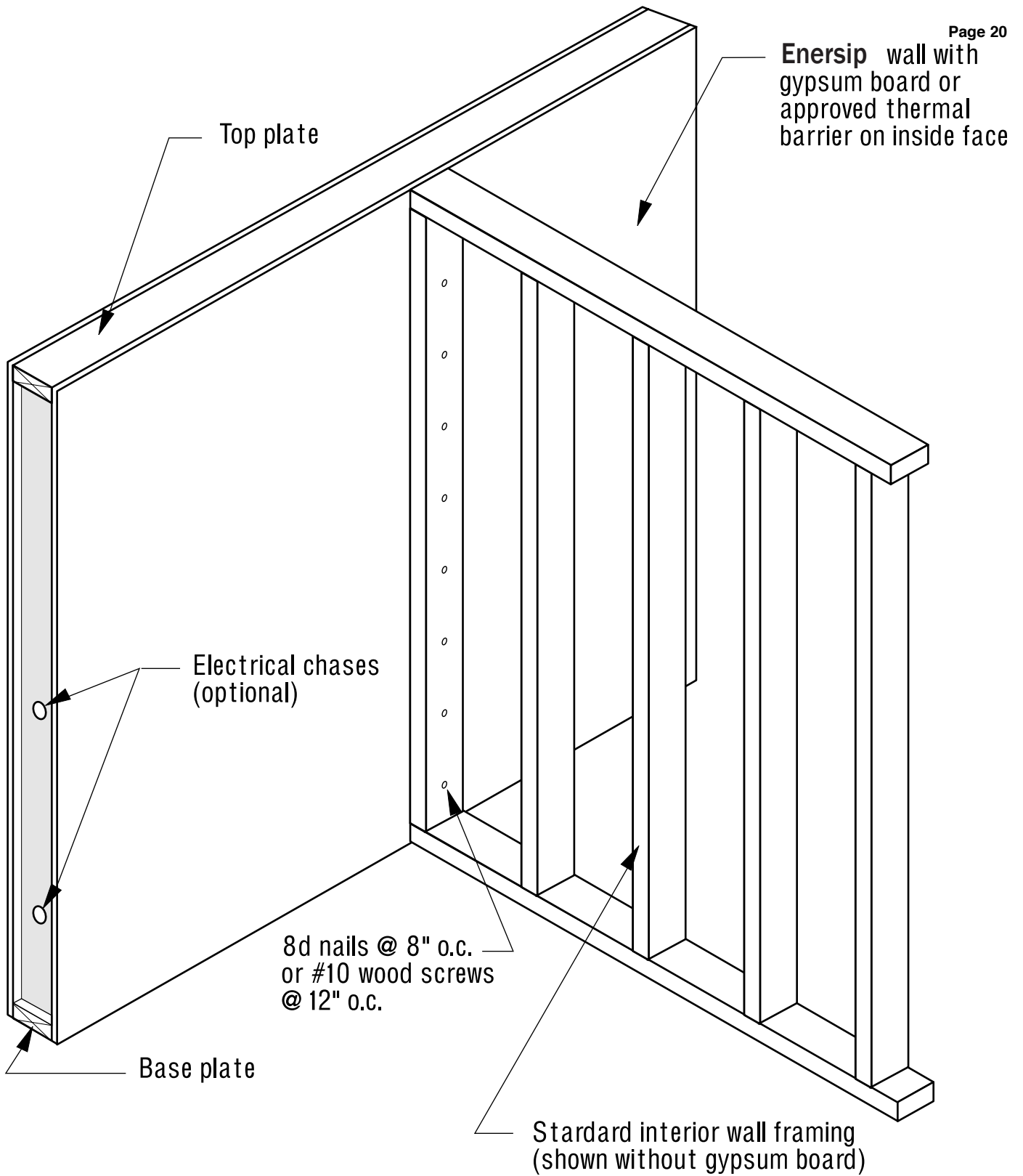
Rev: 950809

	Floor Joist Hanger and Ledger Beam	AM-007
	ENERSIP Panel Building System	



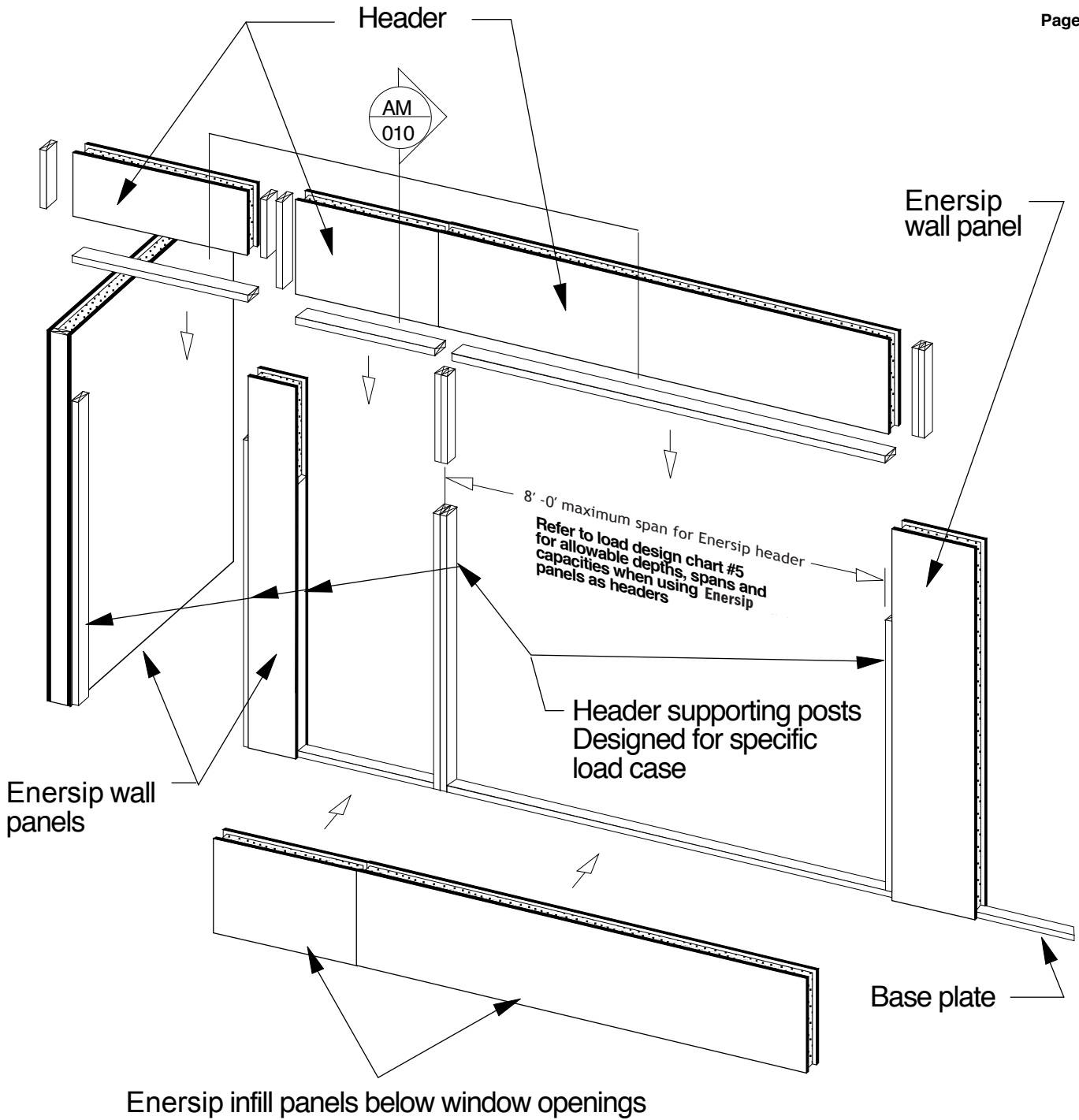
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	Beam Pocket at Top of Wall AM-007a
	ENERSIP Panel Building System



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	Interior Wall Connection	AM-008
	ENERSIP Panel Building System	

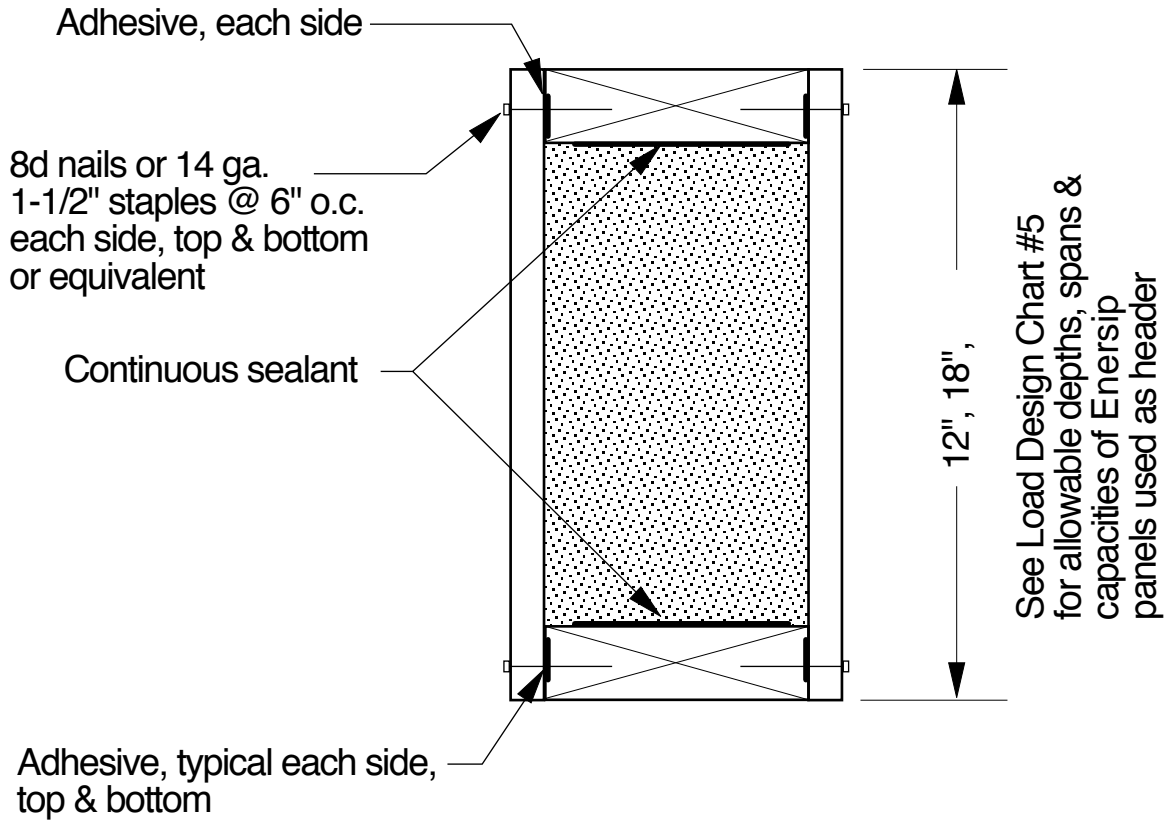


Notes:


- Diagram represents headers in a wall assembly.
- Headers may be any type – see also detail AM-010.
- Minimum dimensions are not required between openings, but supporting posts must extend to floor level.
- Bottom plate of headers must extend to the outside of any post.

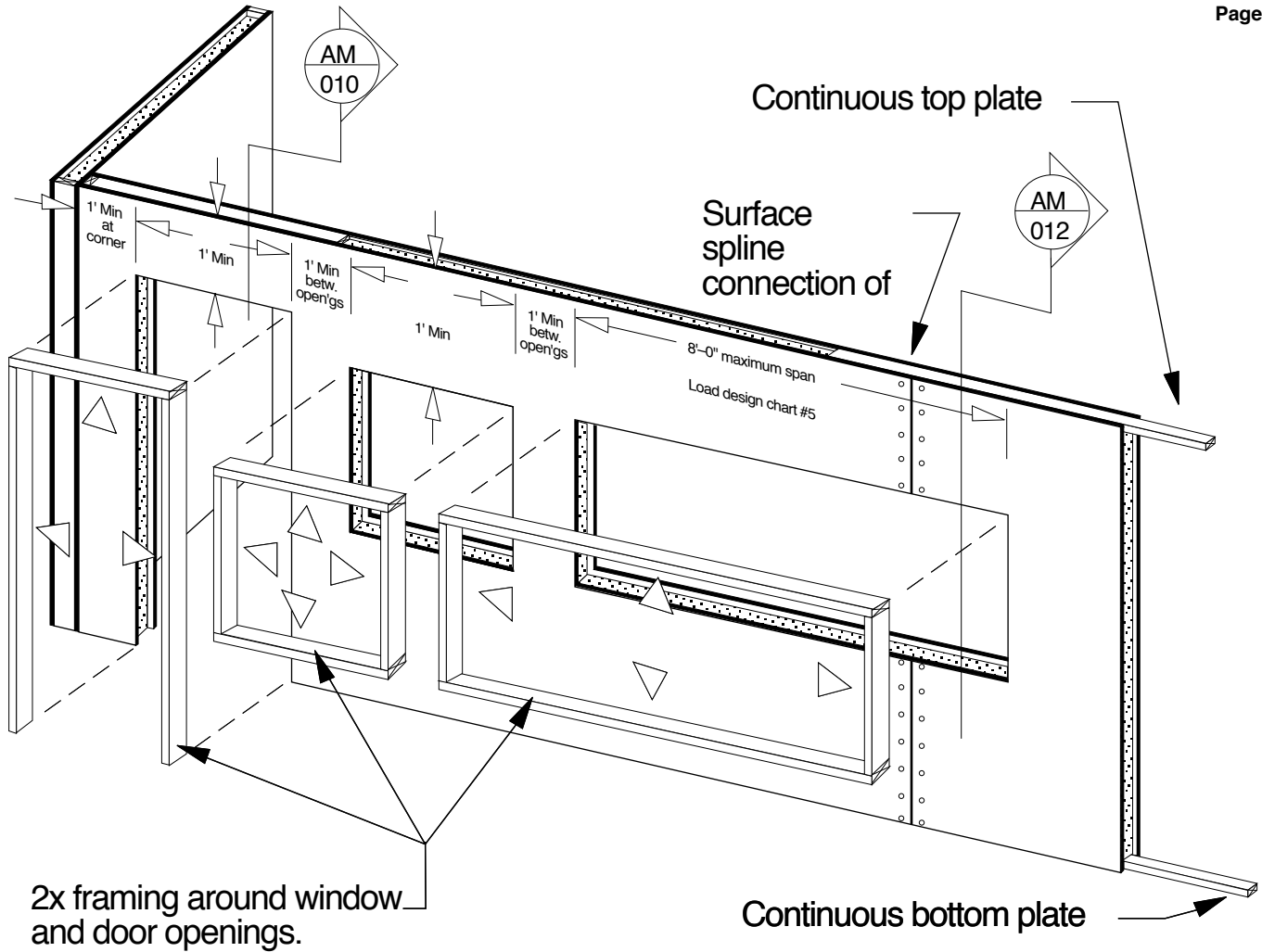
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	<p>Headers</p>	<p>AM-009</p>
	<p>ENERSIP Panel Building System</p>	



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	Header Sections	AM-010
	ENERSIP Panel Building System	




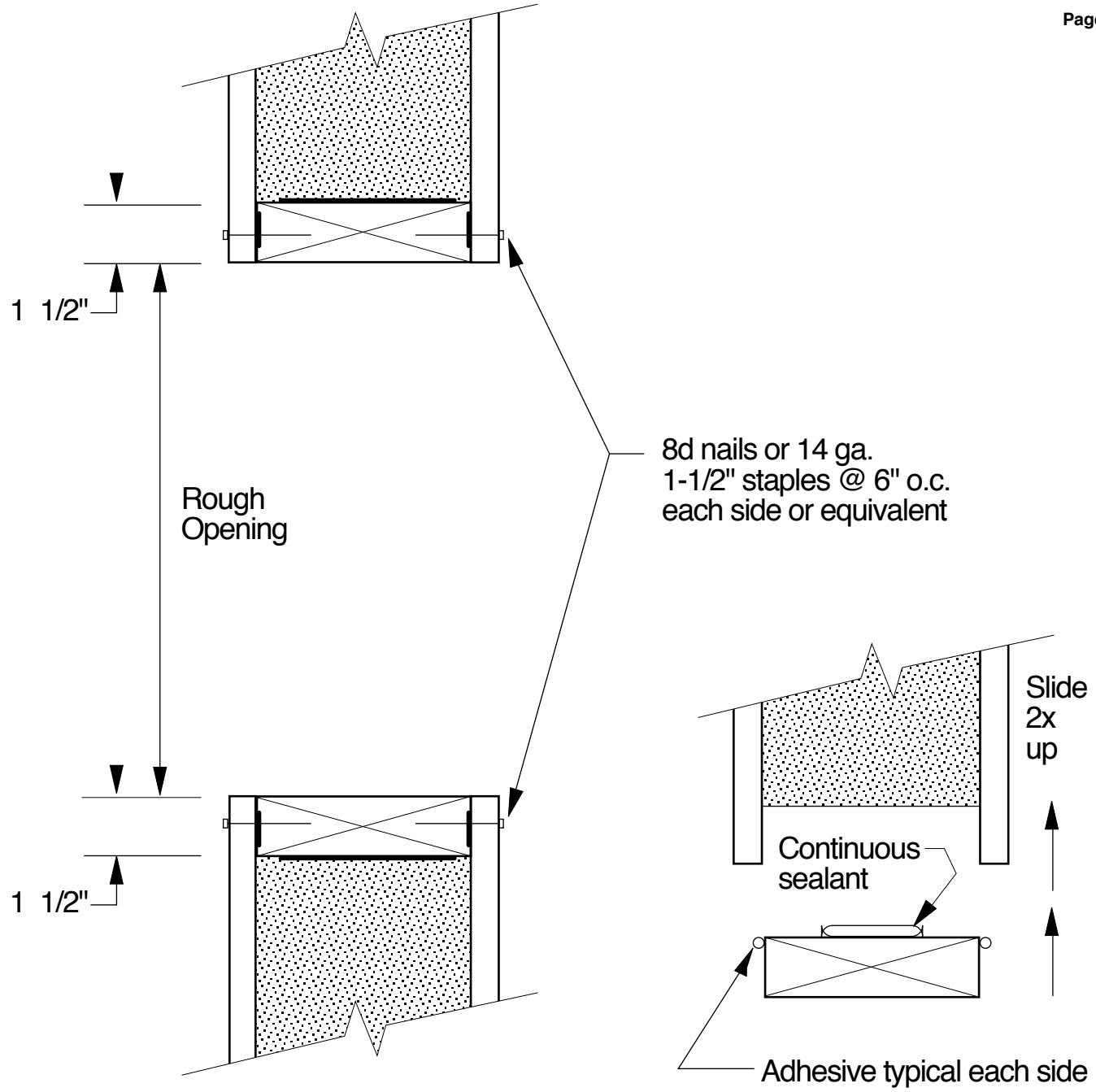
△₁ represents installation sequence. Refer to AM-012 for fitting of 2x's to OSB panels.

Notes:

- Diagram represents field/shop cut openings in a monolithic wall assembly.
- Splines may occur above and below openings.
- Minimum panel dimension of 1' must be maintained over openings.
- See Design Chart #5 for allowable loads.


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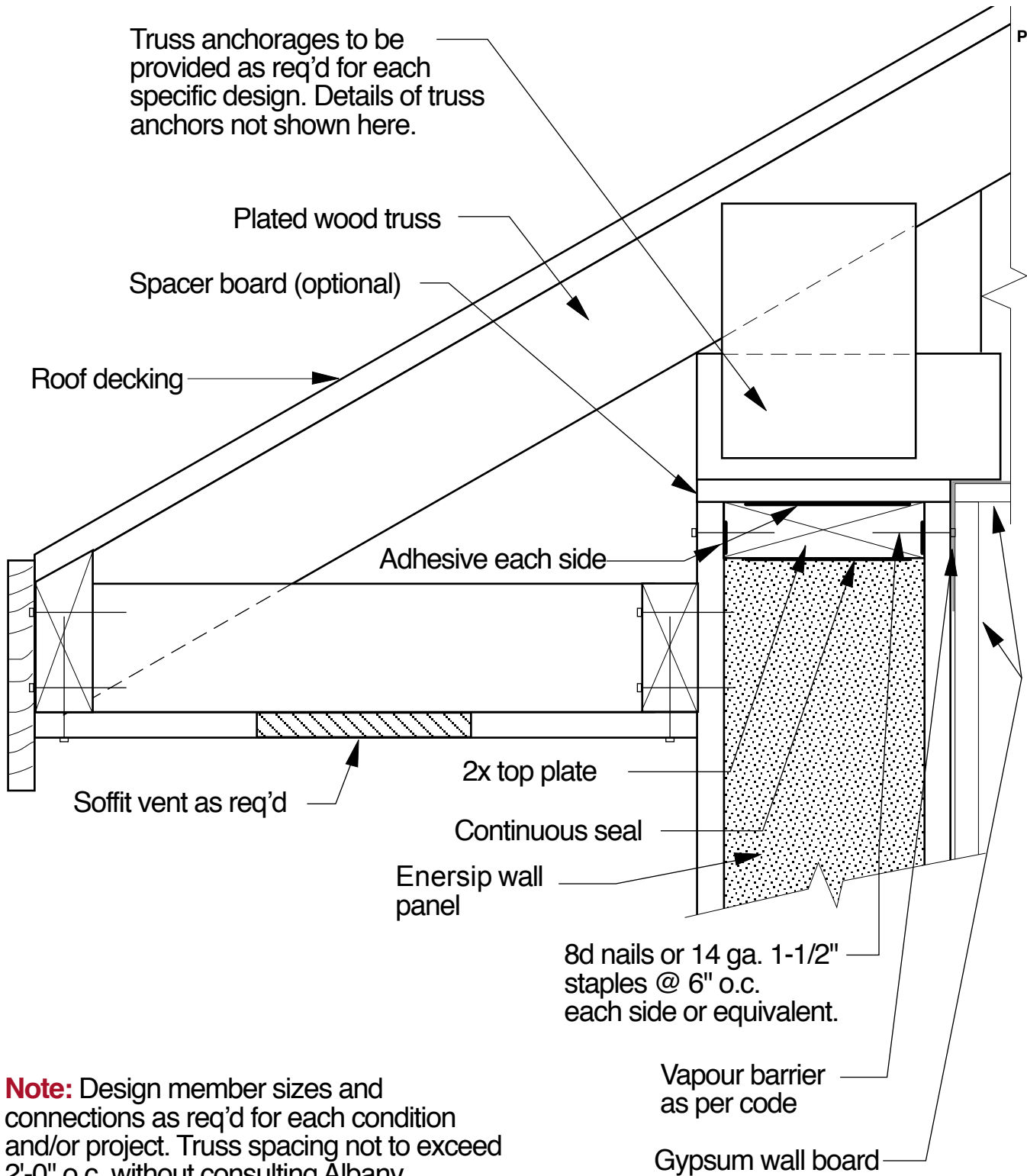
	<p>Panel used as Header (surface spline condition)</p>	<p>AM-011</p>
	<p>ENERSIP Panel Building System</p>	



Note: This detail is applicable for horizontal or vertical panels


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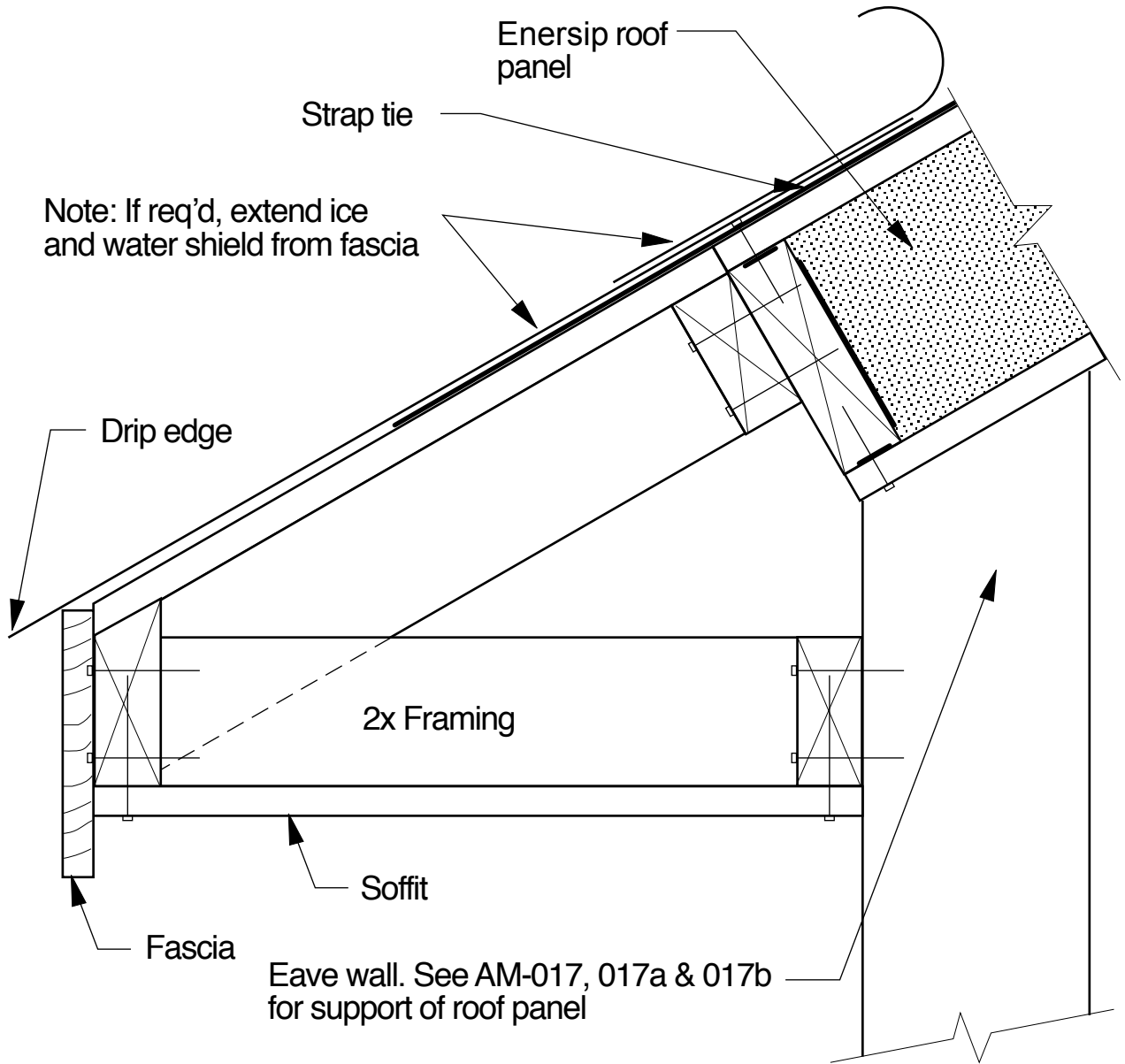
	Openings in Panels AM-012
	ENERSIP Panel Building System



Note: Design member sizes and connections as req'd for each condition and/or project. Truss spacing not to exceed 2'-0" o.c. without consulting Albany Manufacturing for specific project load requirements.


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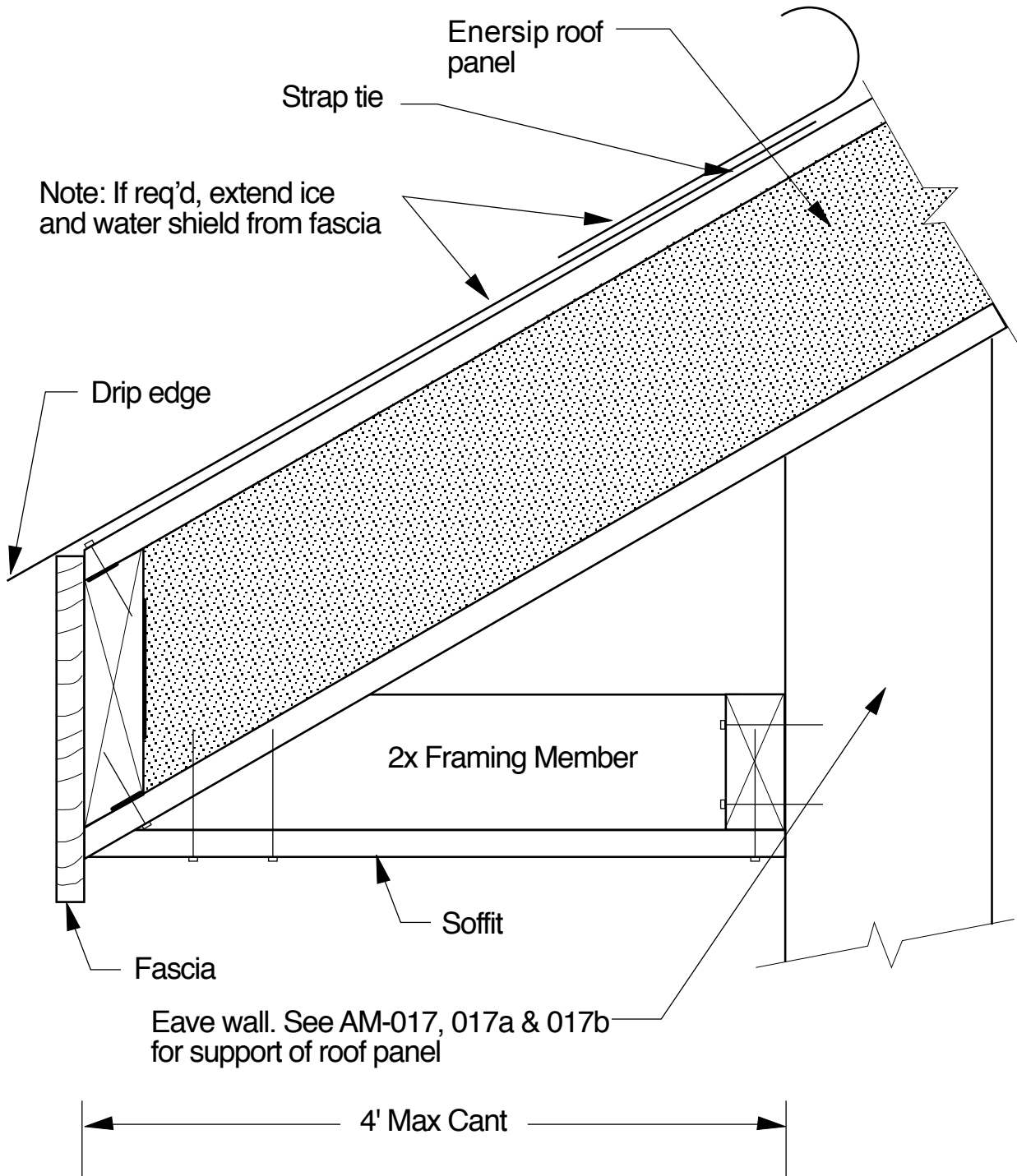
	Truss Bearing on Wall Panel AM-013
	ENERSIP Panel Building System



Note: Design member sizes and connections as req'd for each condition and/or project


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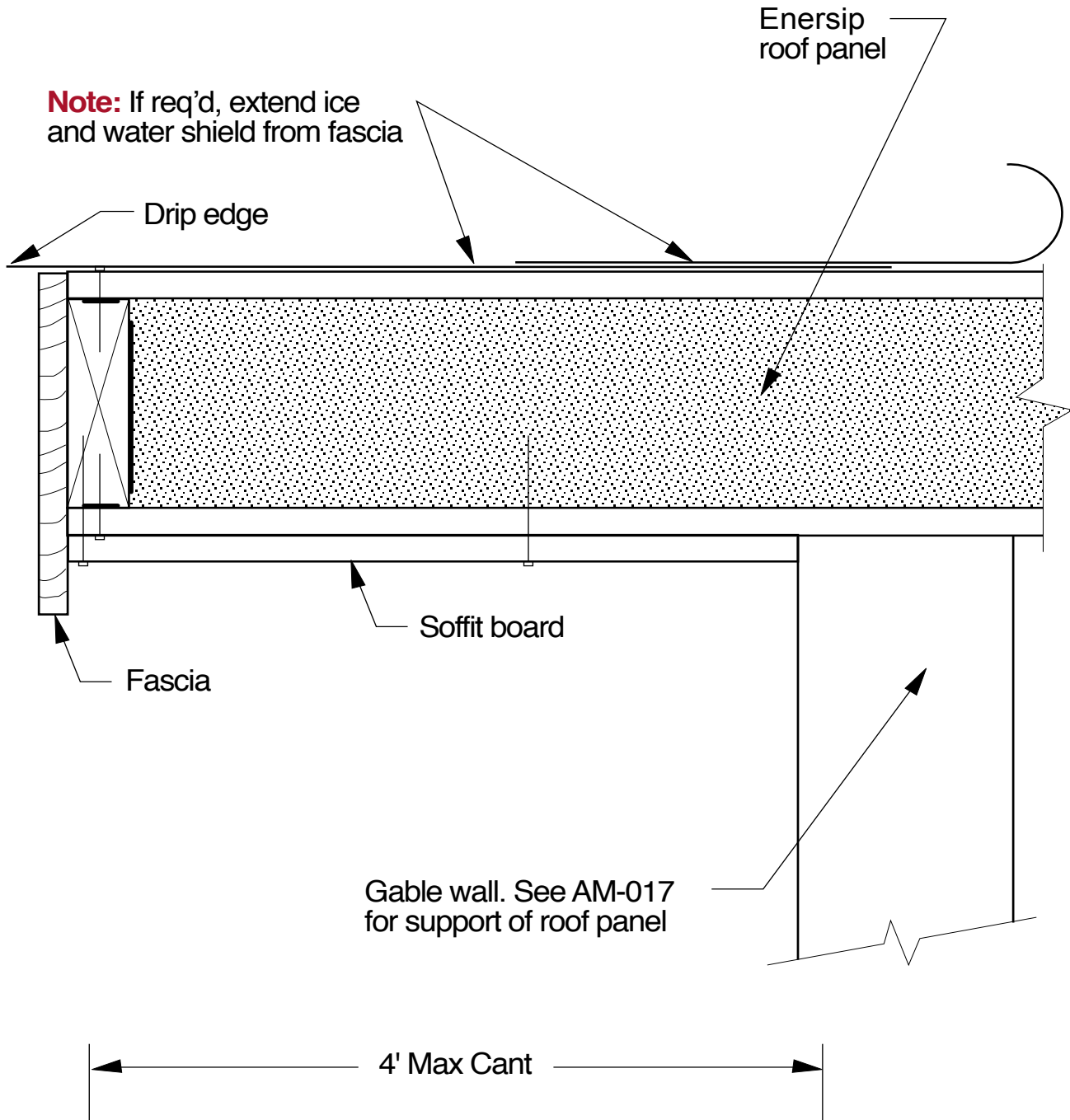
	<p>Roof Eave Built Up – Ladder Framed AM-014</p>
	<p>ENERSIP Panel Building System</p>



Note: Design member sizes and connections as req'd for each condition and/or project


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	Roof Eave Plumb Cut – Cant Panel AM-014a
	ENERSIP Panel Building System

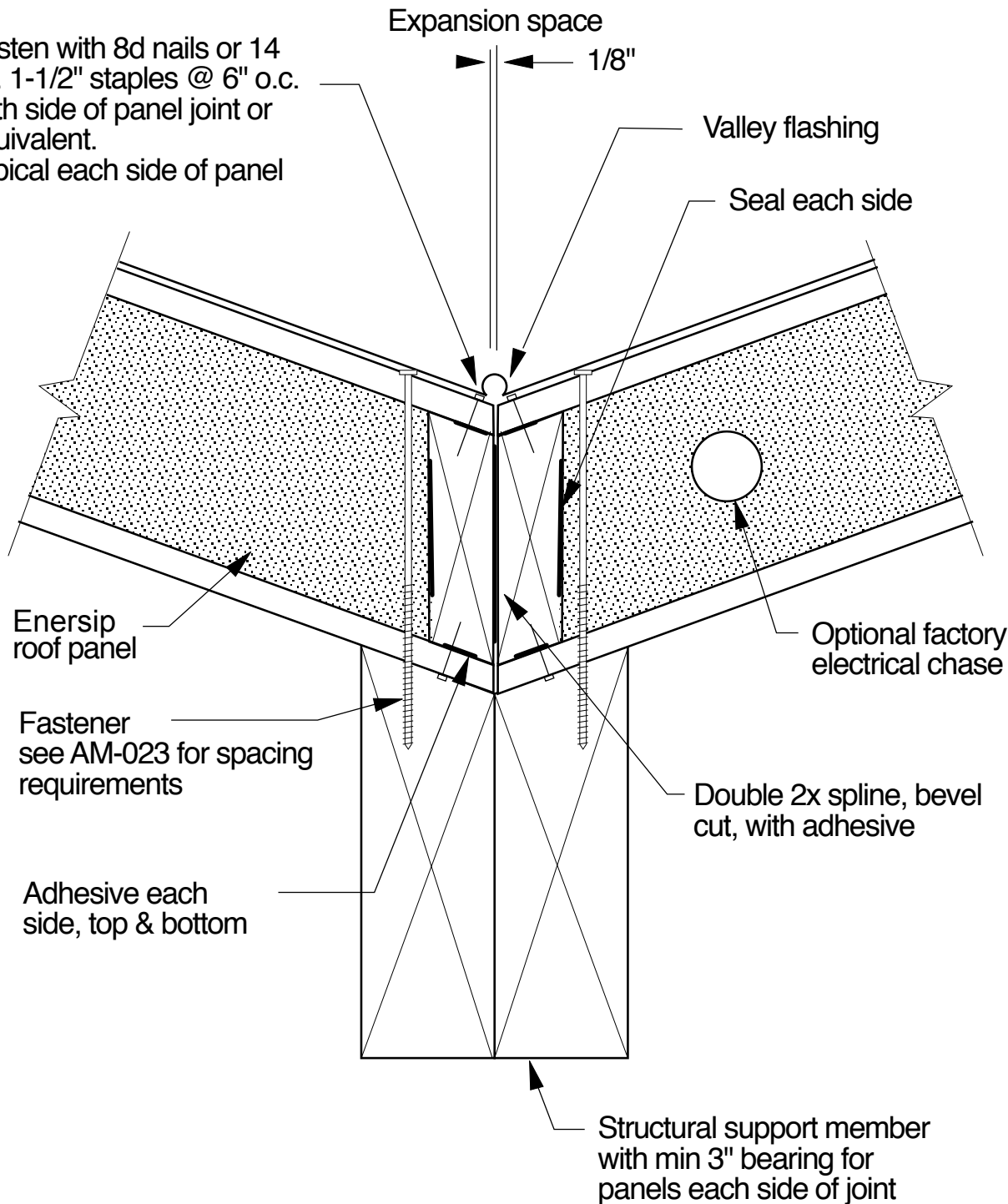


Note: Design member sizes and connections as req'd for each condition and/or project


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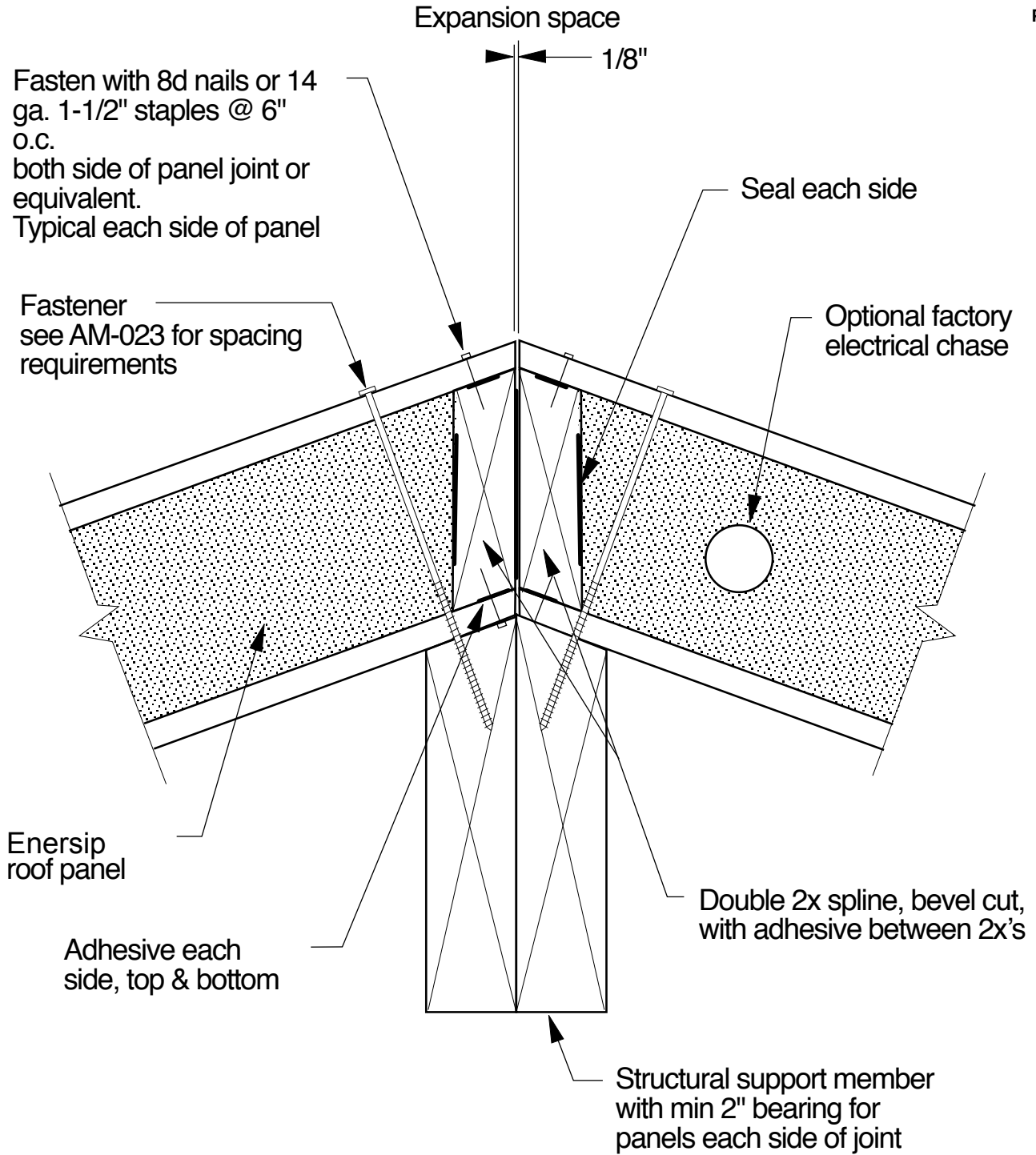
	Roof Gable Square Cut – Cant Panel AM-014b
	ENERSIP Panel Building System

Fasten with 8d nails or 14 ga. 1-1/2" staples @ 6" o.c. both side of panel joint or equivalent. Typical each side of panel



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	Roof Valley – Plumb Cut AM-015
	ENERSIP Panel Building System



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Roof Ridge – Plumb Cut **AM-016**

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Fasten with 8d nails or 14 ga. 1-1/2" staples @ 6" o.c. both side of panel joint or equivalent.
Typical each side of panel

Fastener
see AM-023 for spacing requirements

Ridge filler piece

Seal each side

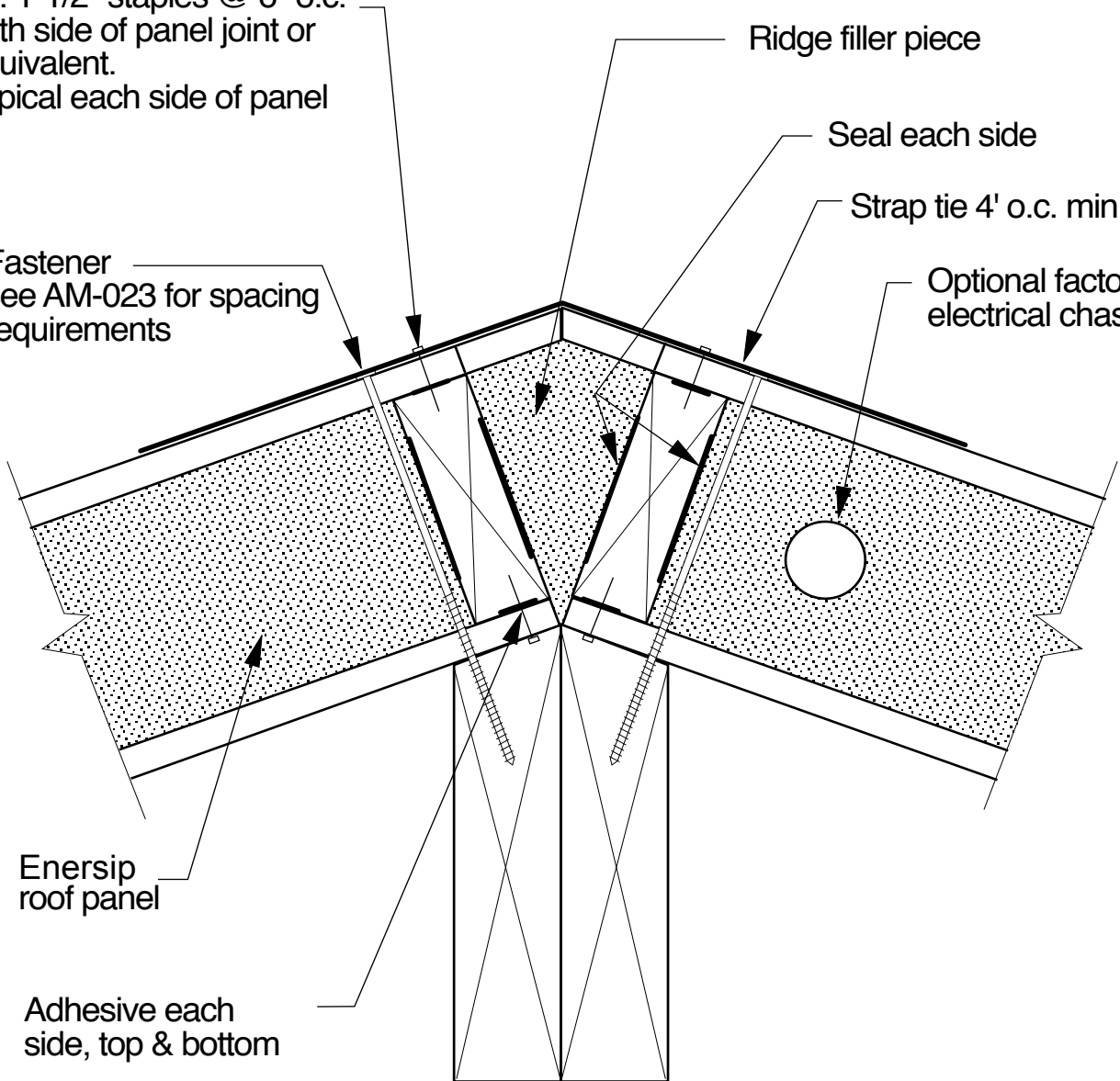
Strap tie 4' o.c. min

Optional factory electrical chase

Energip roof panel

Adhesive each side, top & bottom

Structural support member with min 2" bearing for panels each side of joint

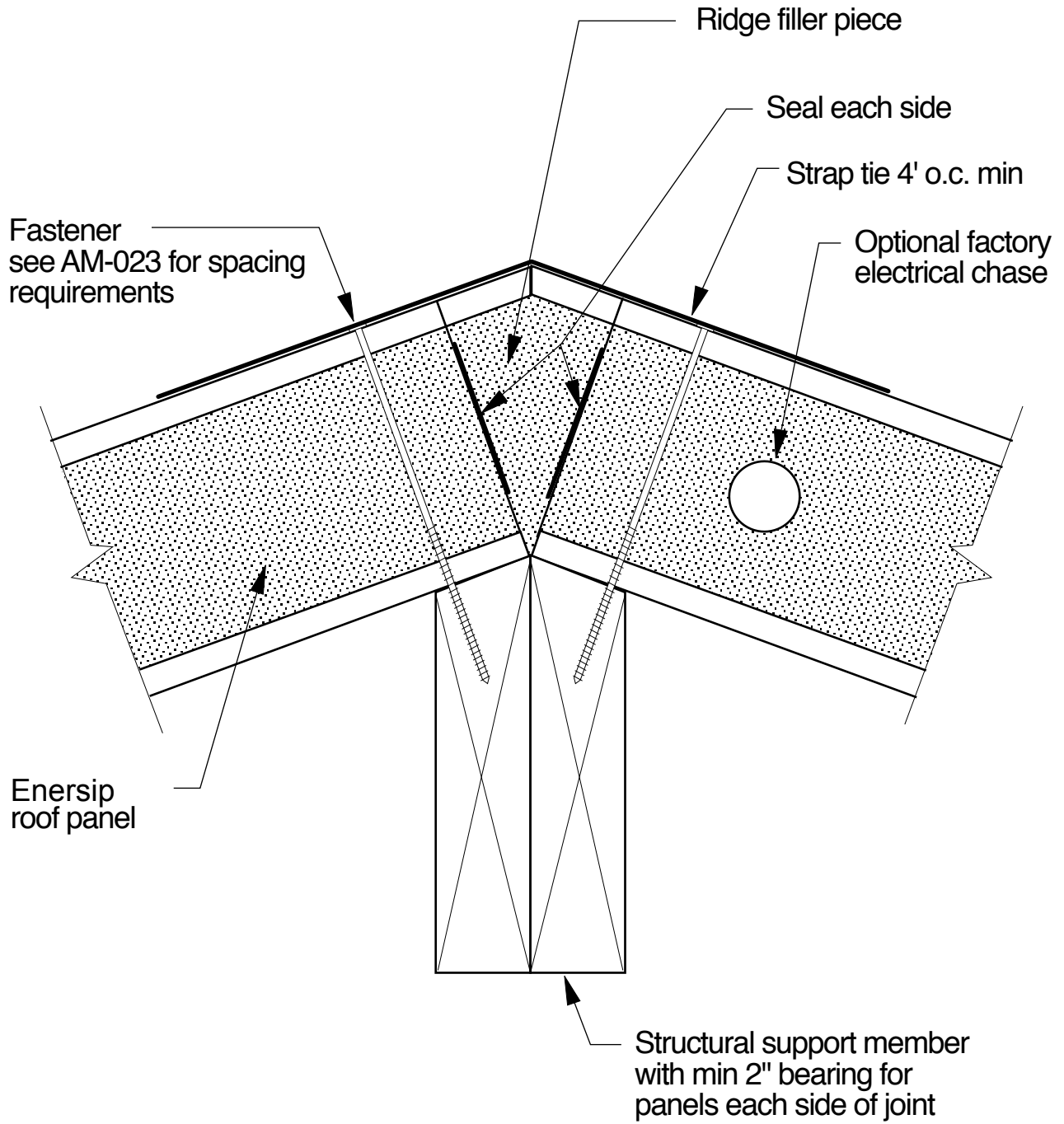


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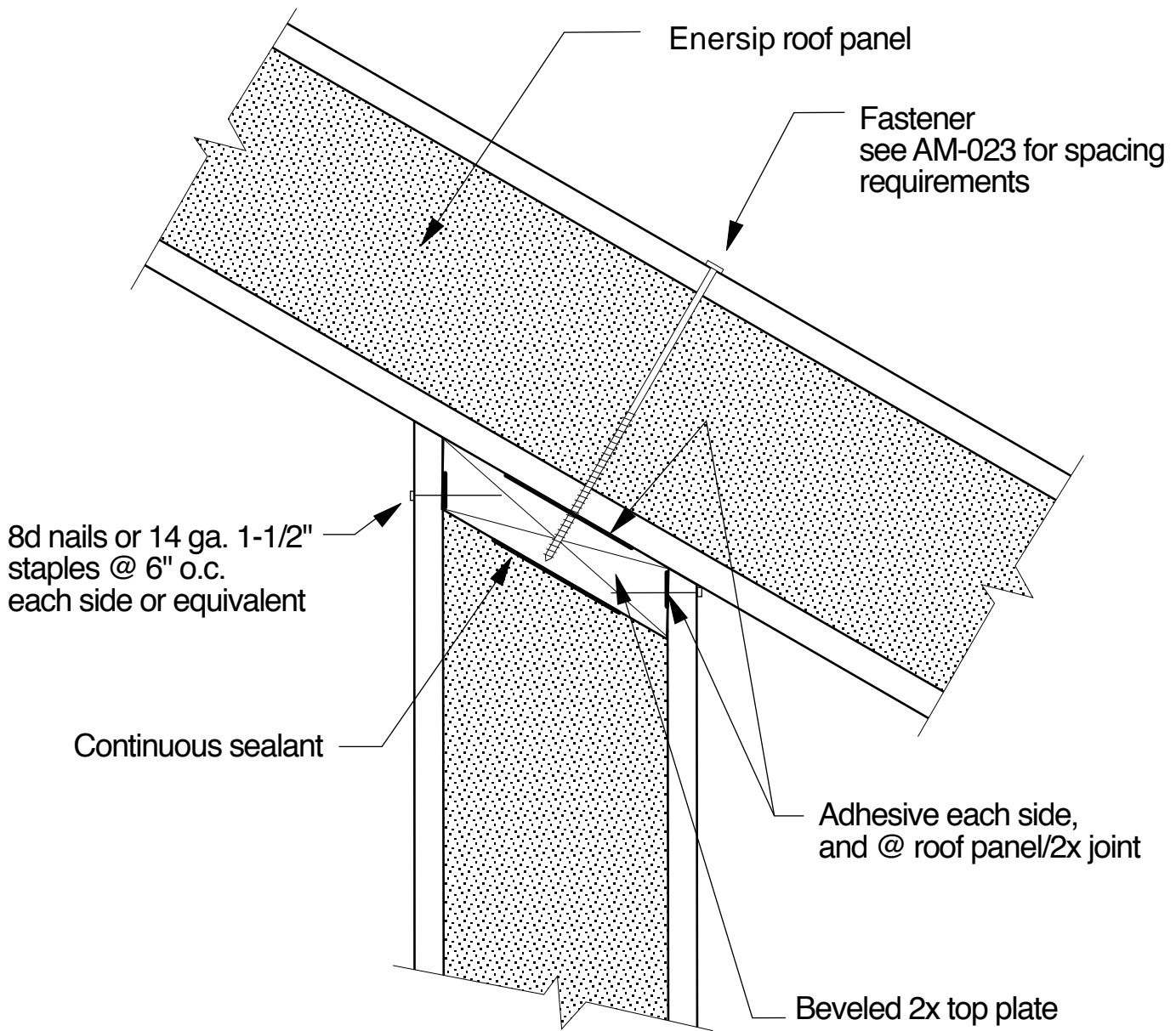
Roof Ridge – Square Cut **AM-016a**

ENERSIP
Panel Building System




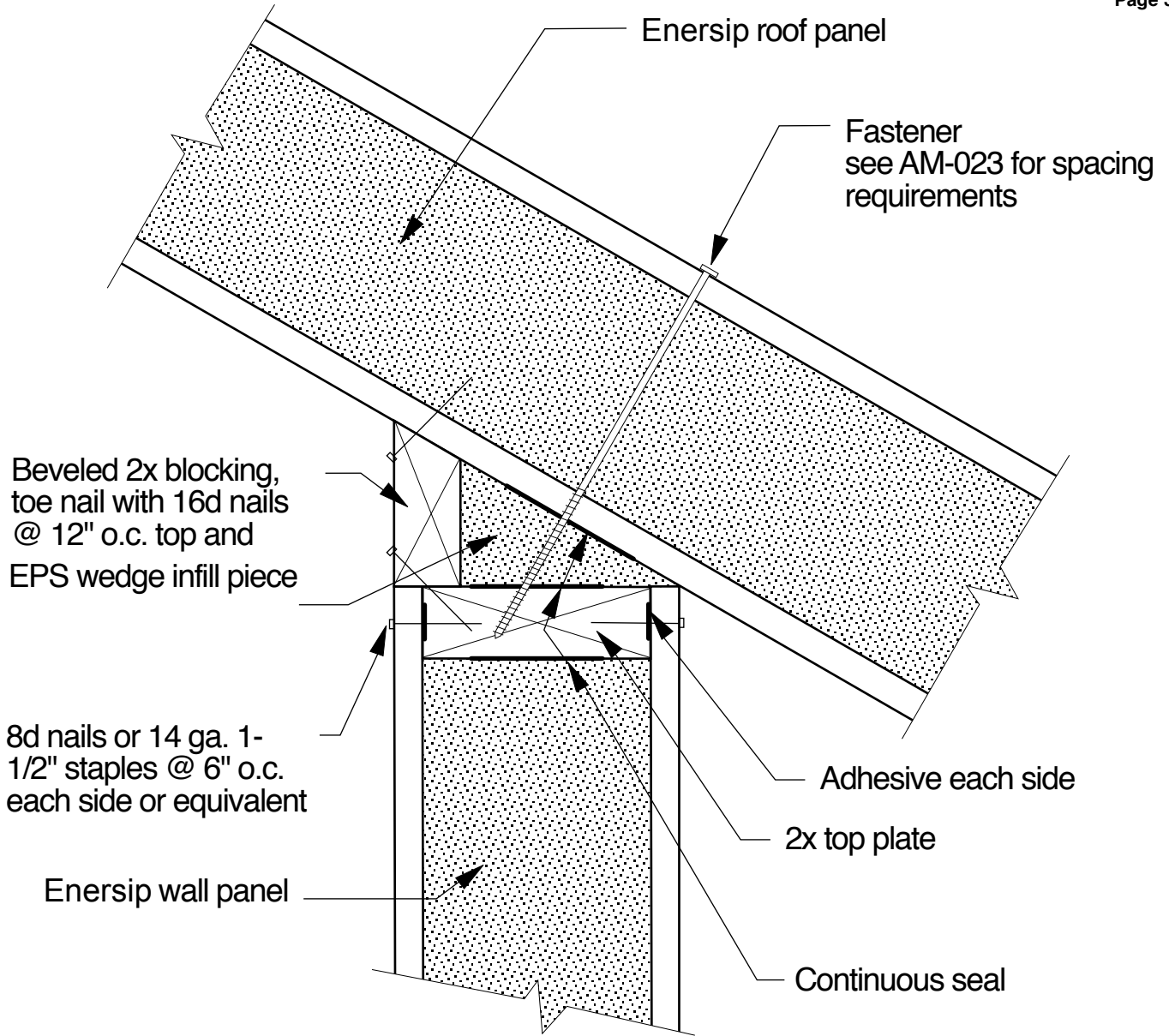
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	Roof Ridge – Square Cut AM-016b
	ENERSIP Panel Building System




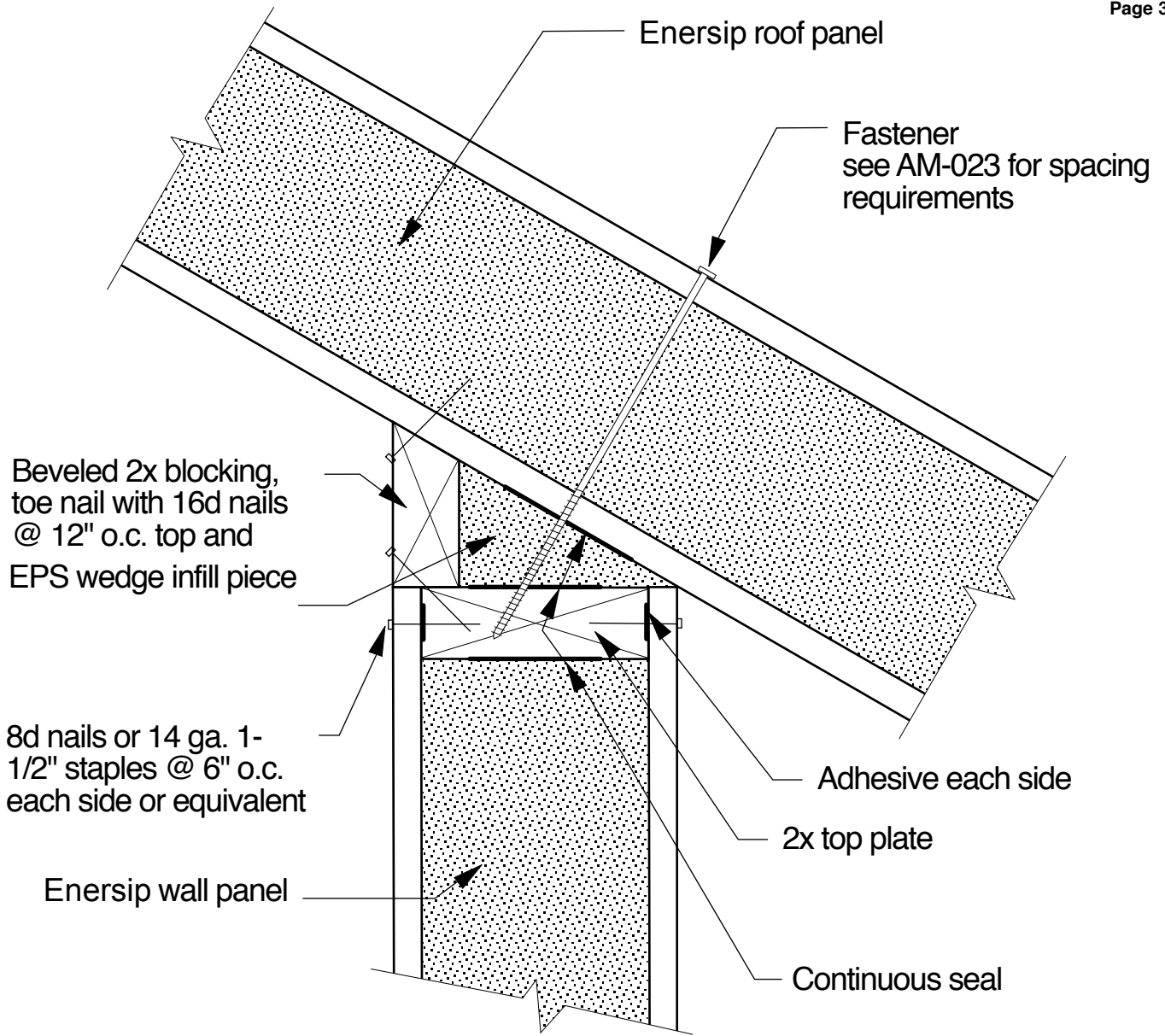
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	Mitered Roof Join	AM-017
	ENERSIP Panel Building System	




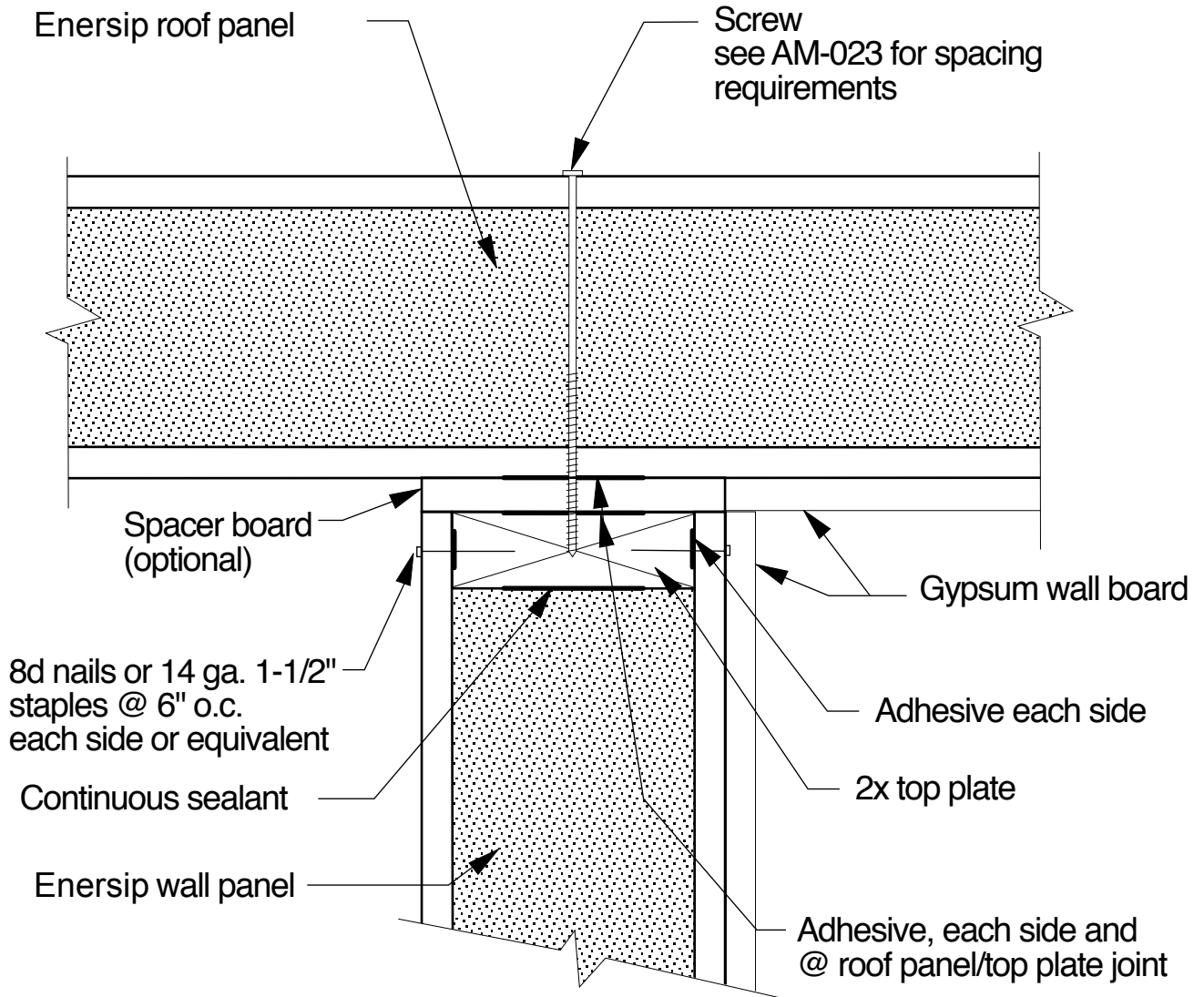
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	Beveled 2x Blocking AM-017a
	ENERSIP Panel Building System




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	Beveled 2x Blocking AM-017a
	ENERSIP Panel Building System

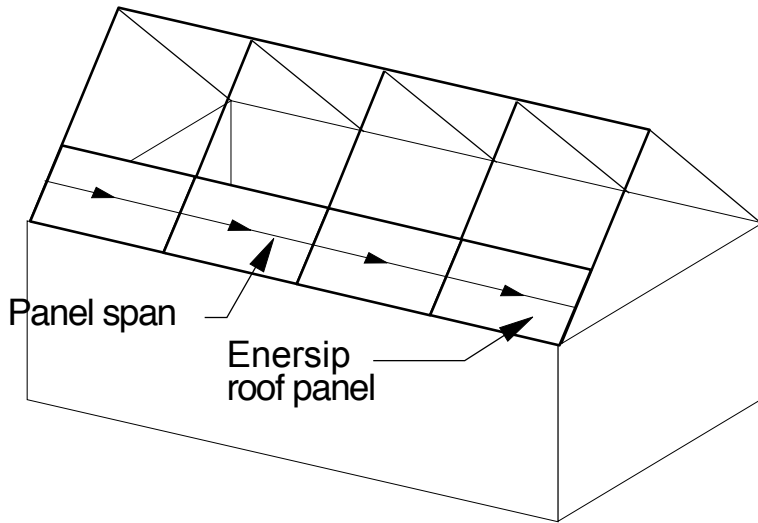


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	Gable End	AM-017c
	ENERSIP Panel Building System	

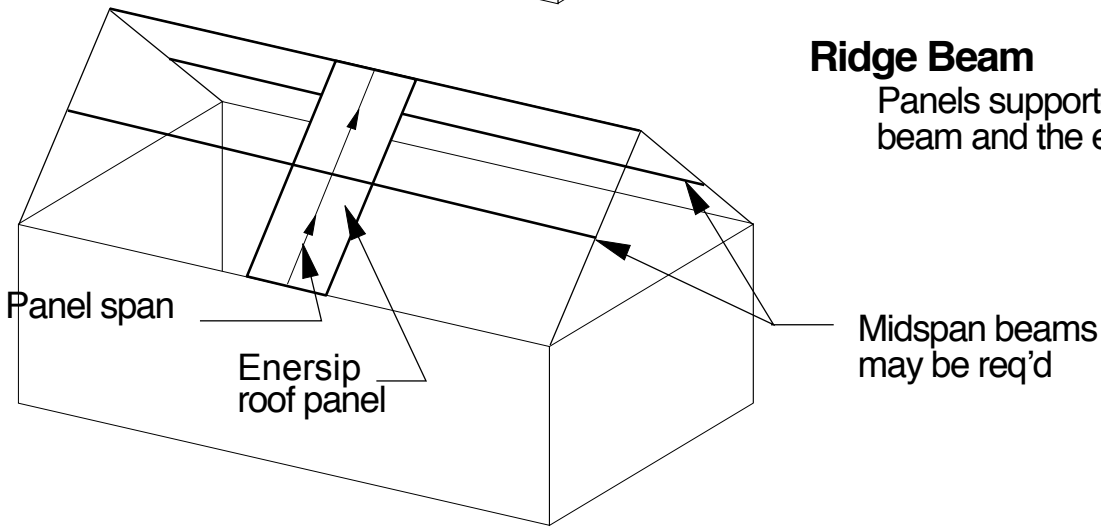
Rafter System

Panels supported by rafters spanning from the ridge beam to the eave walls.



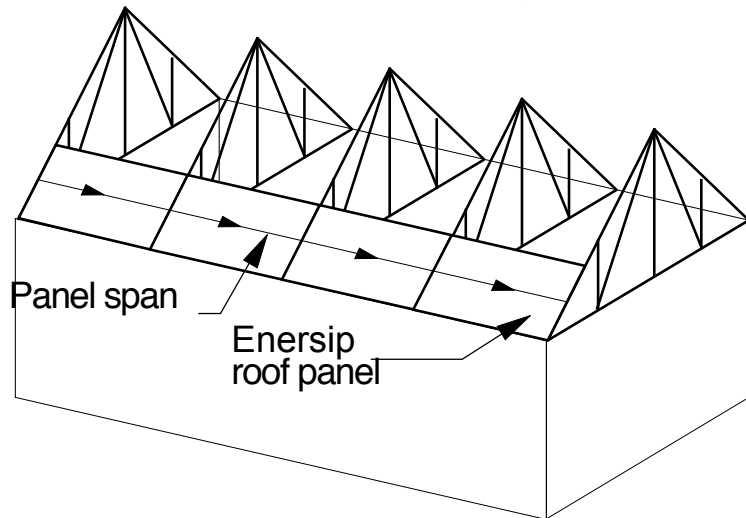
Ridge Beam

Panels supported by the ridge beam and the eave walls.




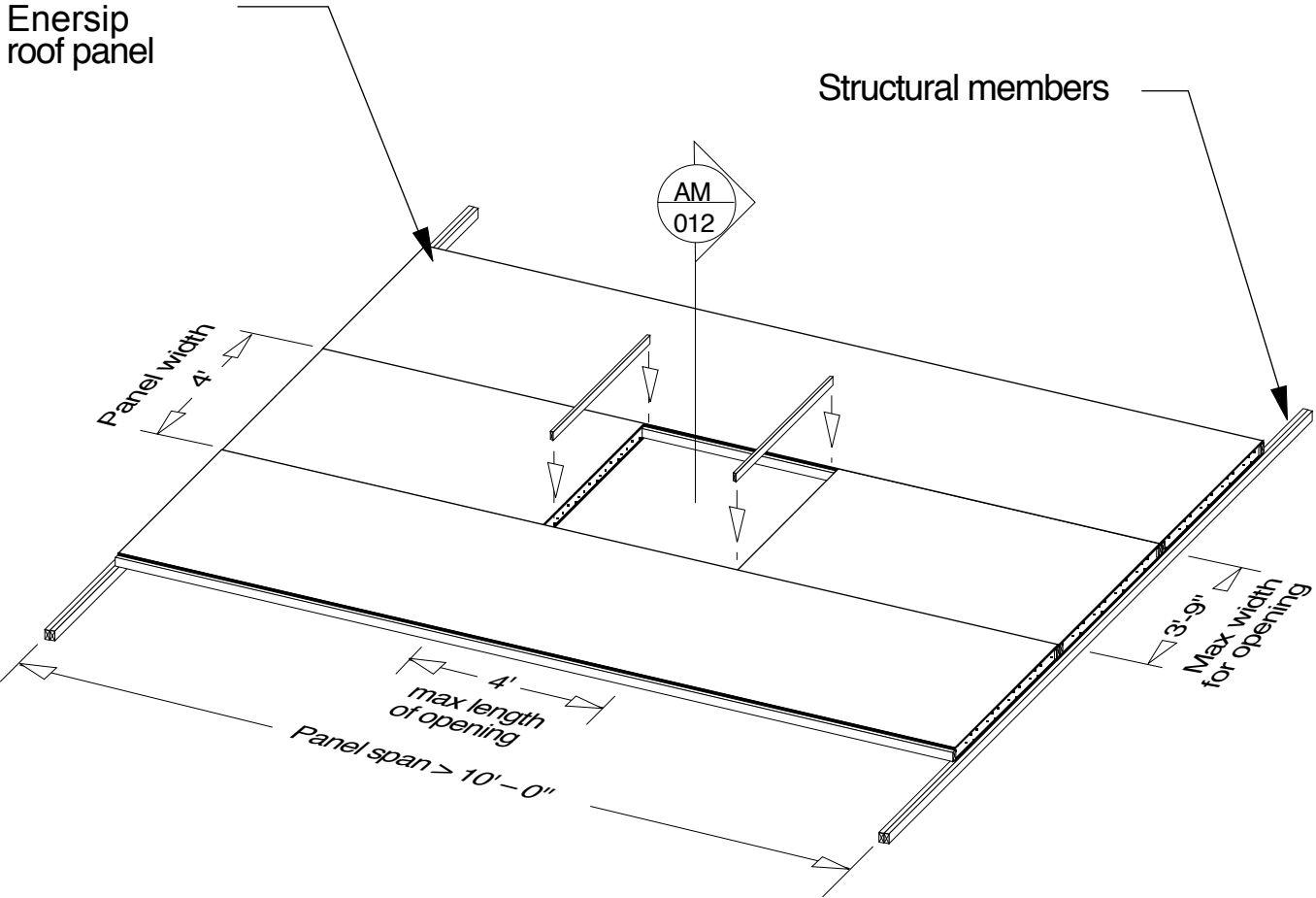
Truss

Panels supported by roof trusses.



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	Roof Framing Options AM-018
	ENERSIP Panel Building System

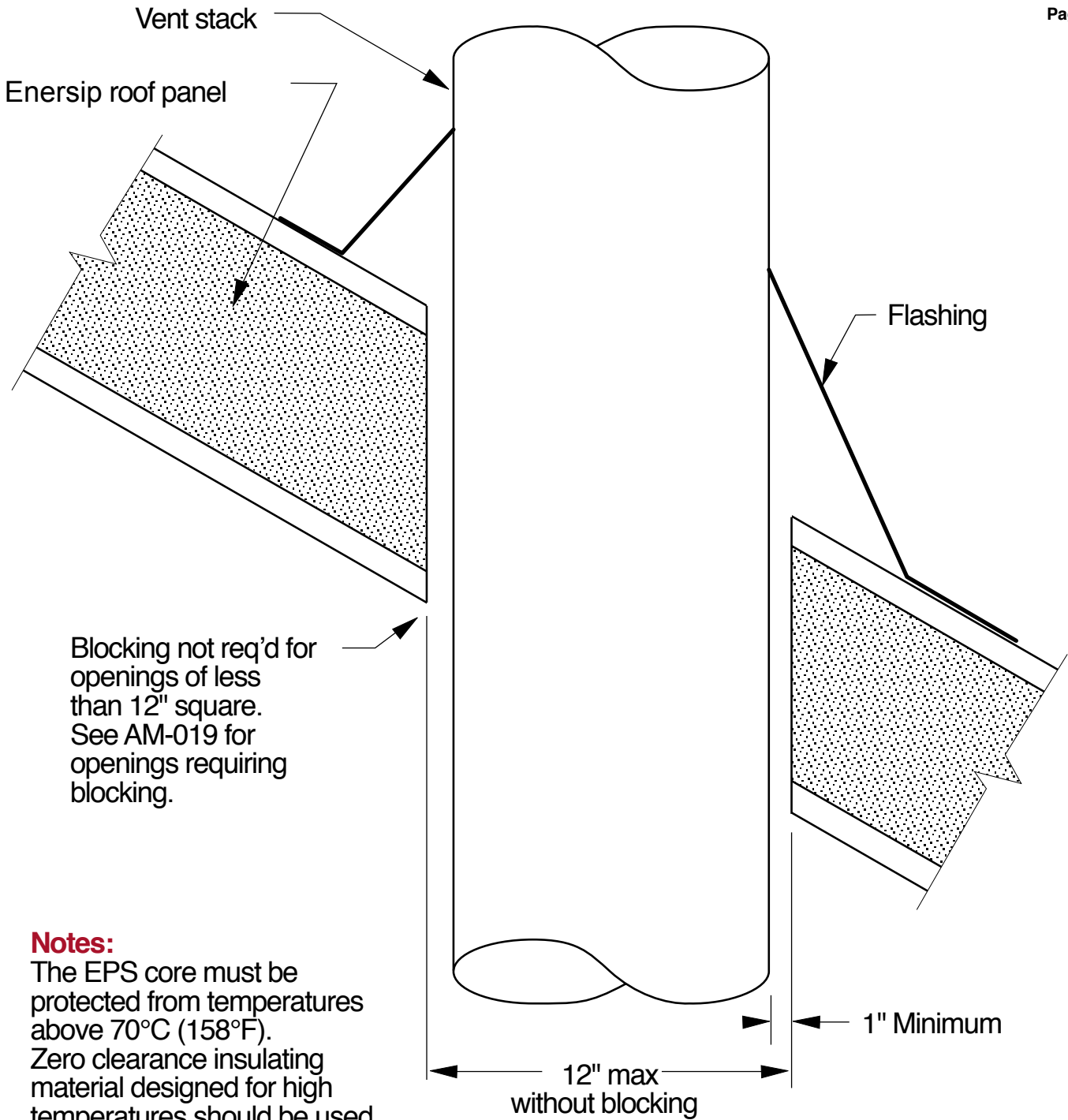


Notes:

- For bigger openings than shown above or for openings that cut through splines, additional framing must be provided to support panel edges.
- The additional framing should be located under the panels and framed into the main structural members.


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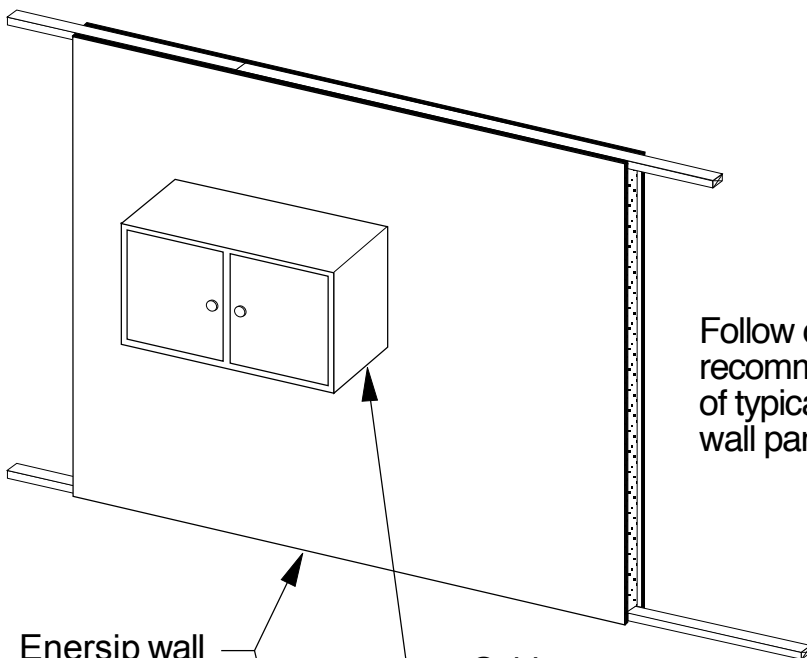
	Roof Openings	AM-019
	ENERSIP Panel Building System	



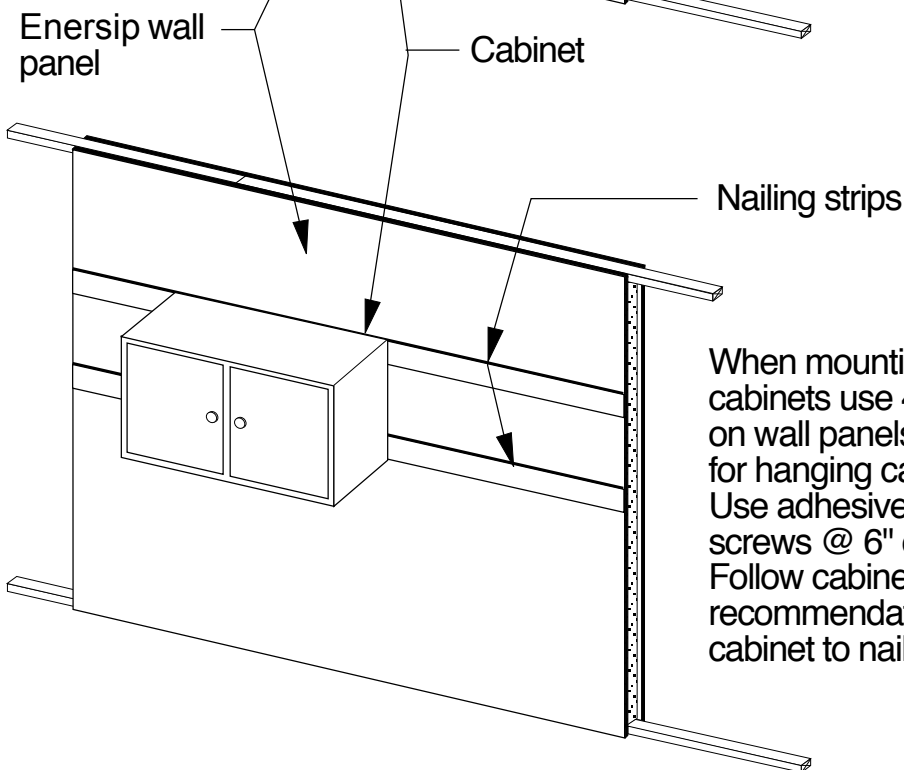
Recessed lights cannot be used in Enersip panels.

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	Roof Penetration AM-019a
	ENERSIP Panel Building System




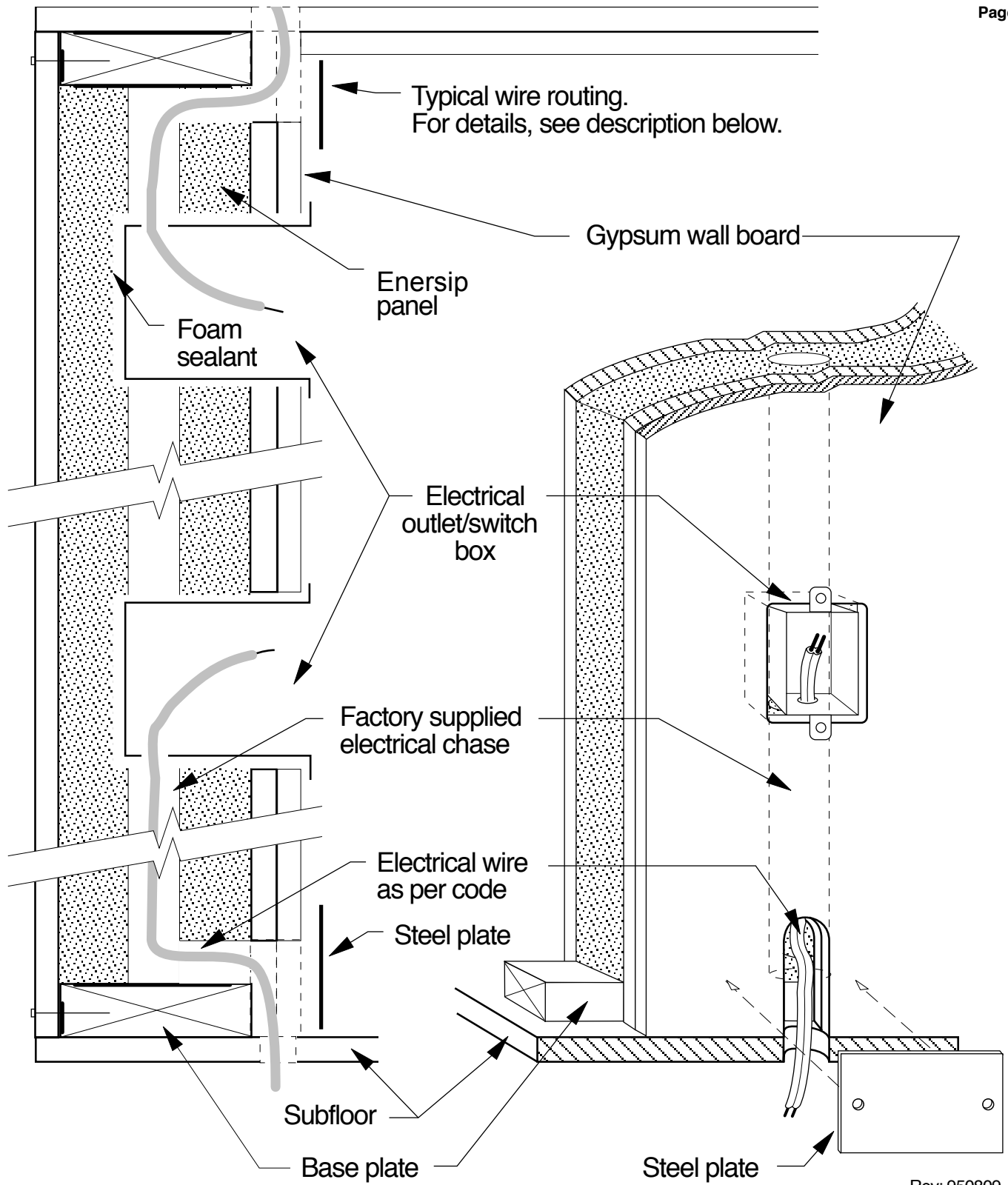
Follow cabinet manufacturer's recommendations for fastening of typical cabinet loadings to wall panels.



When mounting heavily loaded cabinets use 4" wide strips of OSB on wall panels as reinforcement for hanging cabinets. Use adhesive and 2 rows of #8 screws @ 6" o.c. Follow cabinet manufacturer's recommendations and fasten cabinet to nailing strips.

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	Cabinet Attachment AM-020
	ENERSIP Panel Building System

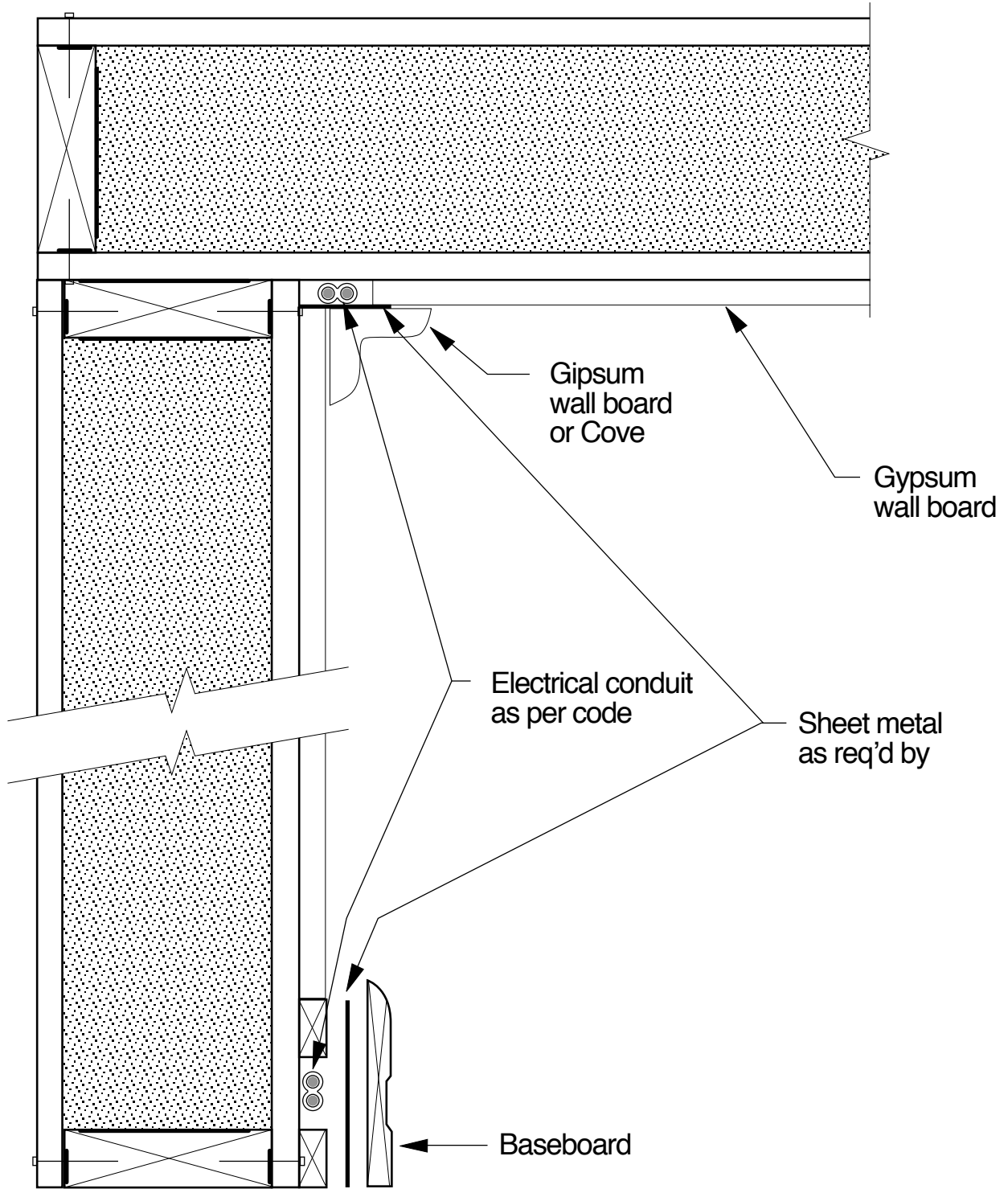


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Wiring Installation using optional Factory Chases **AM-021**

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Panel Building System



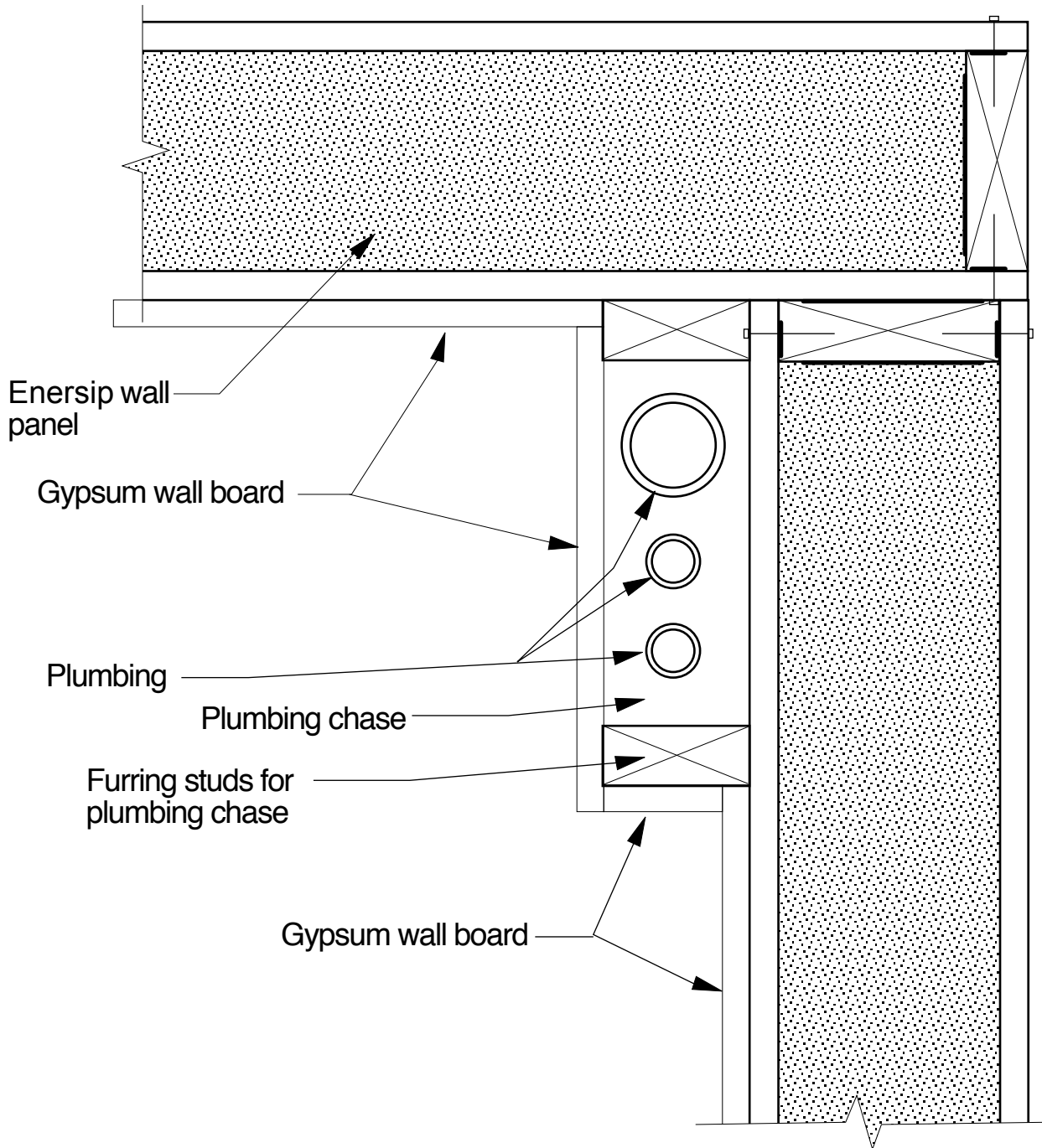
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**Wiring on the surface
baseboard & cove**


AM-021a

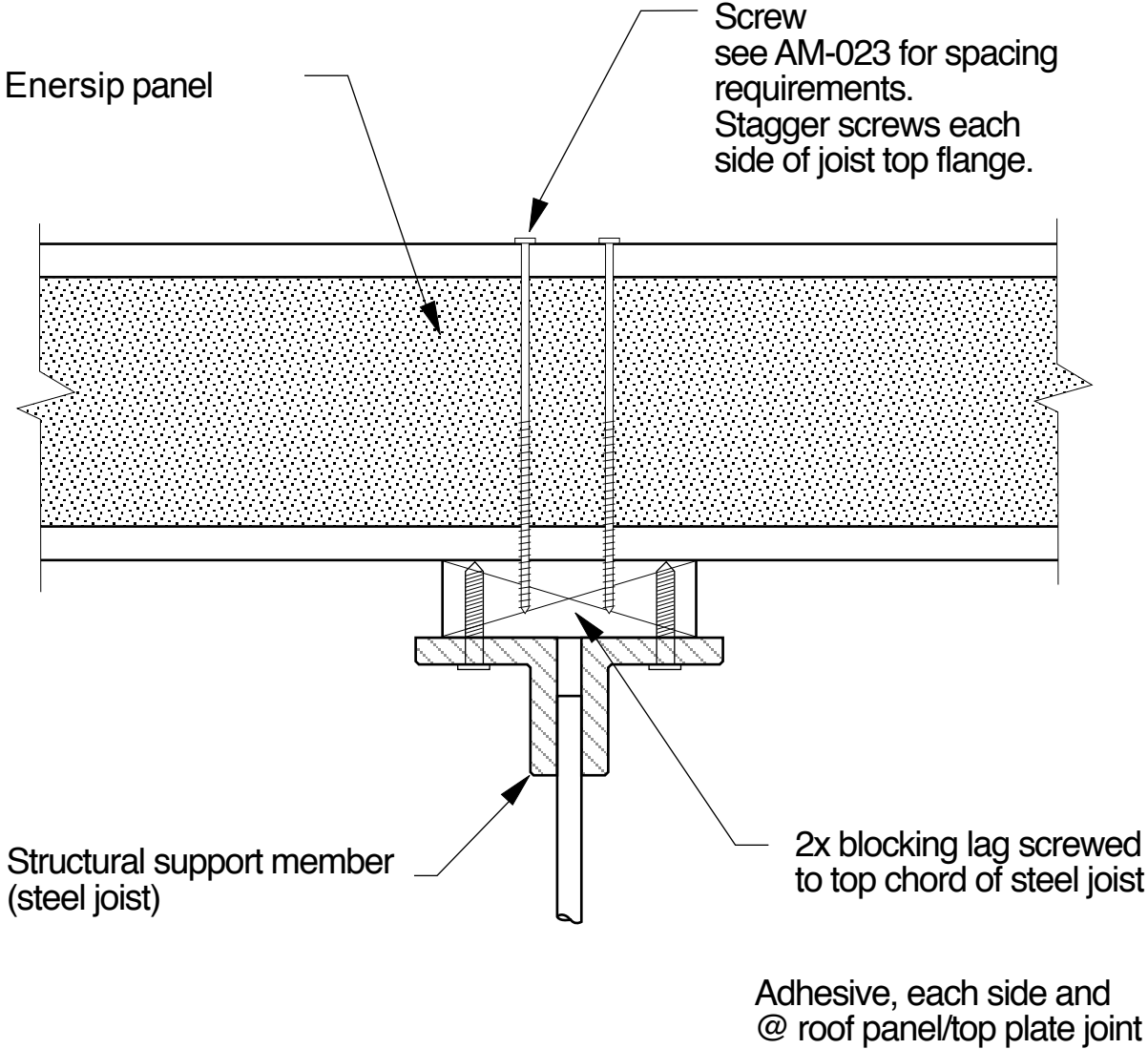
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NOTE: Precut interior wall studs to match Enersip panel wall height.

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	Wall Chase	AM-021b
	ENERSIP Panel Building System	



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	Continuous Panel at Steel Joist	AM-022
	ENERSIP Panel Building System	

Pattern 1 Panels up to 16 feet long.

Panels 16' or less in length require 4 screws per support for one & two span setups as shown in Diagrams 1 & 2 below.



Diagram 1: Single span setup
(2 points of attachment)

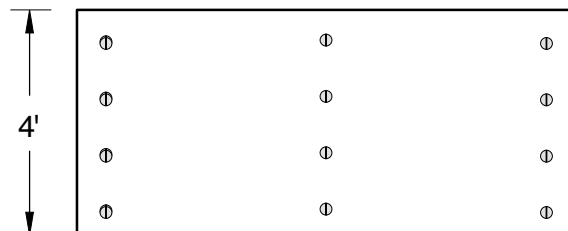


Diagram 2: Two span setup
(3 points of attachment)

Pattern 2 Panels 16 - 24 feet long.

Panels greater than 16' in length require 6 screws per support for one & two span setups as shown in Diagrams 3 & 4 below.



Diagram 3: Single span setup
(2 points of attachment)

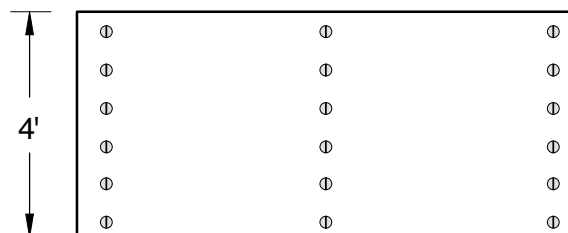


Diagram 4: Two span setup
(3 points of attachment)

Pattern 3 Panels with 3 or more spans.

Panels at any length with 3 or more spans require 4 screws per support as shown in Diagram 5 below.

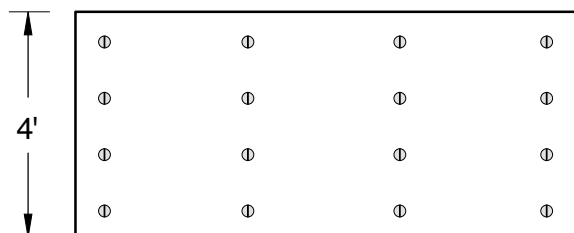



Diagram 5: 3 spans or greater
(Multiple points of attachment)

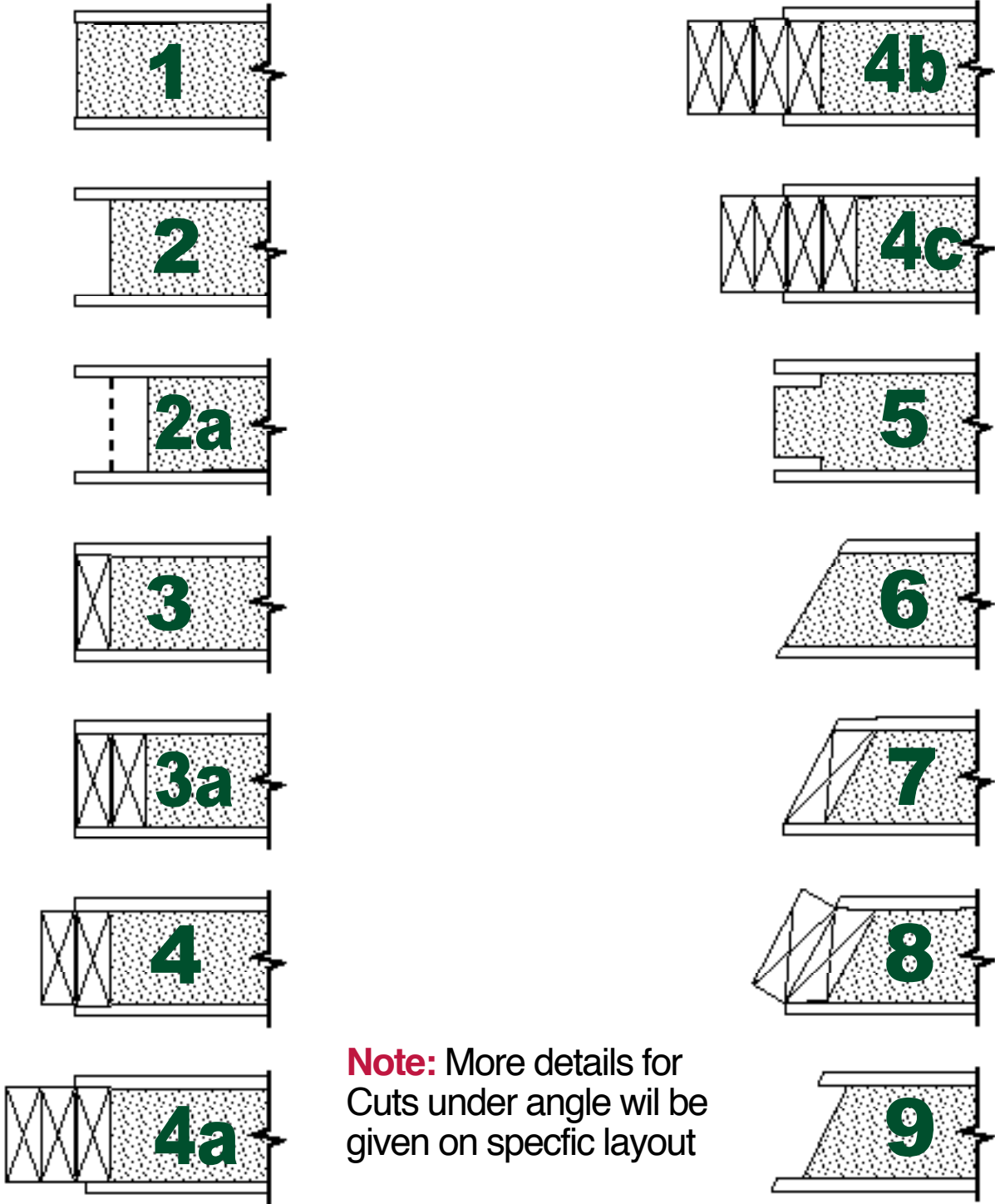
Notes:

1. Perimeter attachment of roof panels require a minimum of 1 fastener per 2 linear feet of panel.
2. The recommendations shown are based on 90 psf of uplift resistance with a minimum screw penetration of 1 inch.
3. The bottom of the screw head must remain flush with the top skin.
4. Attachment recommendations are for uplift only. Requirements for diaphragm or other bracing by others.

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	<p>Panel Fastening Patterns AM-023</p>
	<p>ENERSIP Panel Building System</p>

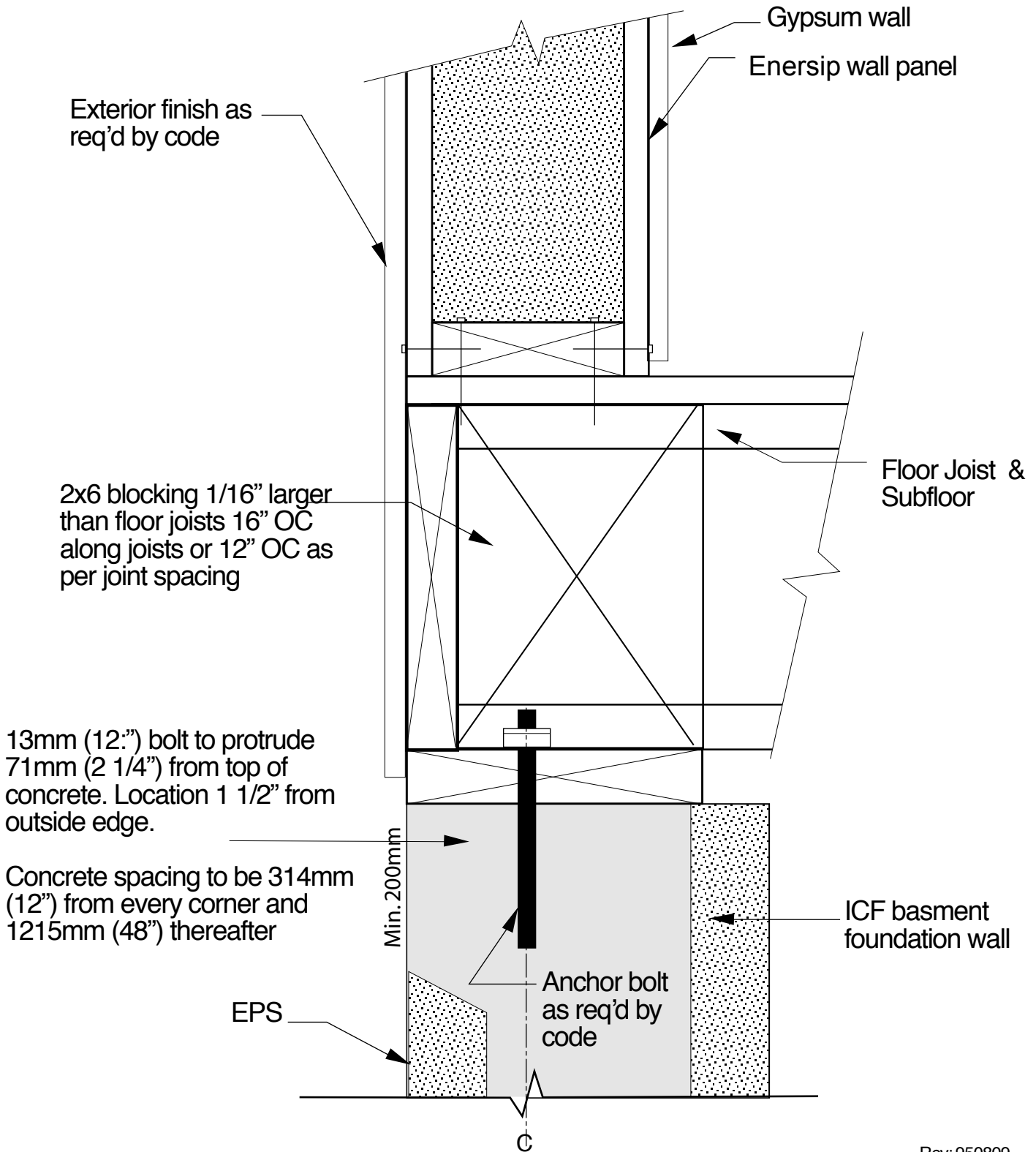
Key for finishing end of panels




Note: More details for Cuts under angle will be given on specific layout

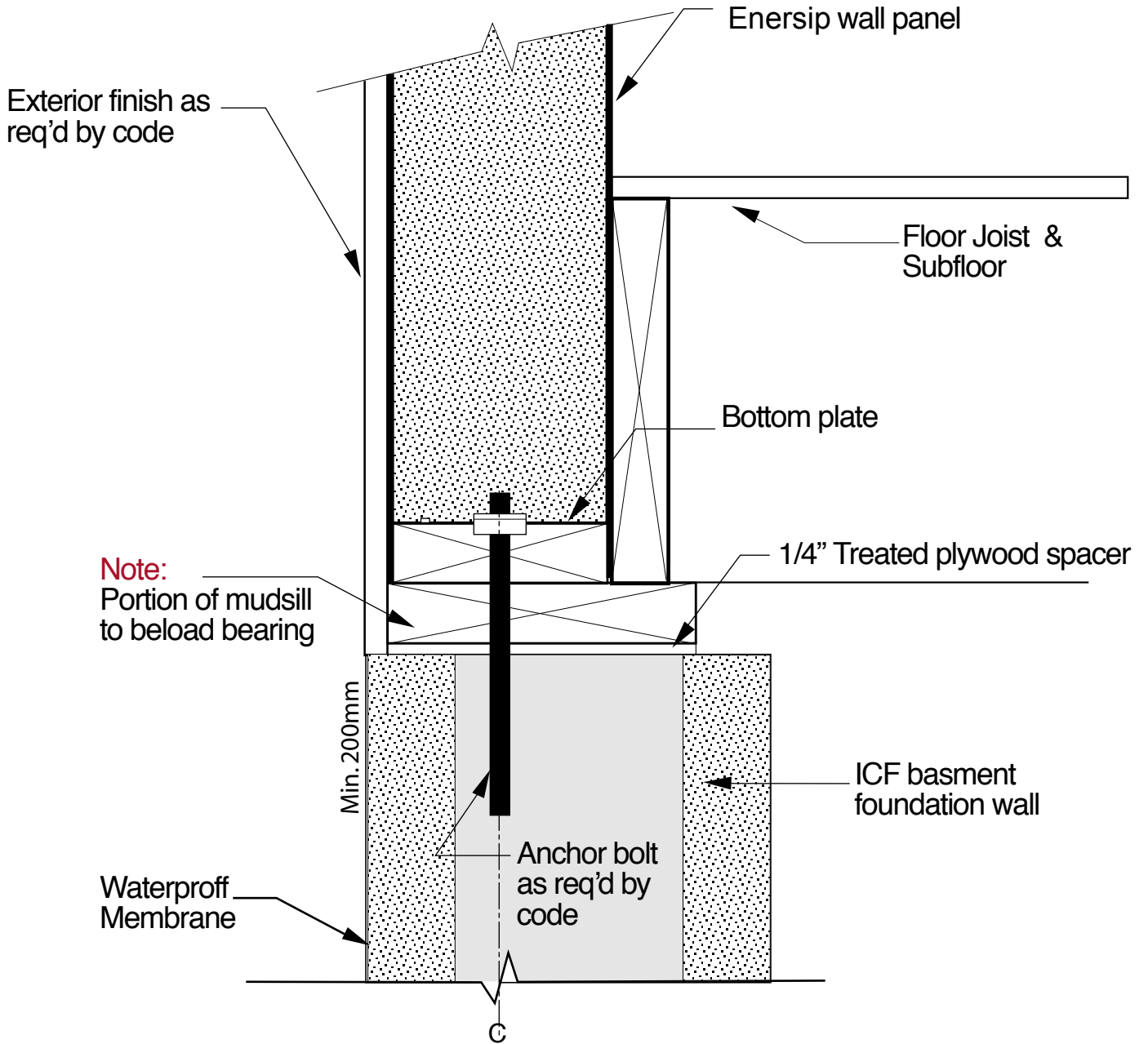
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	Panel Connections	AM-024
	ENERSIP Panel Building System	




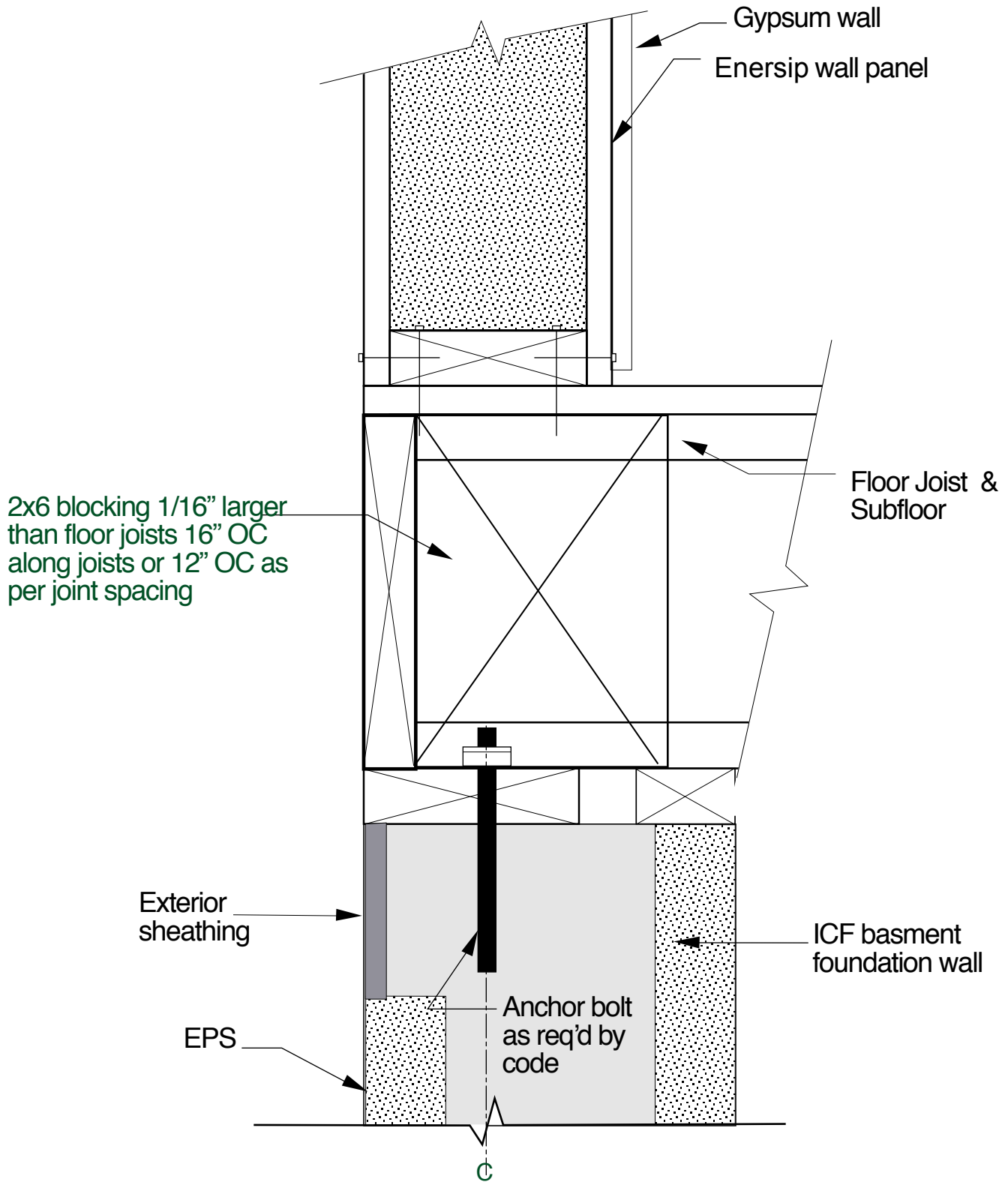
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	ICF Basement & SIP Wall Assembly	AM-025
	ENERSIP Panel Building System	




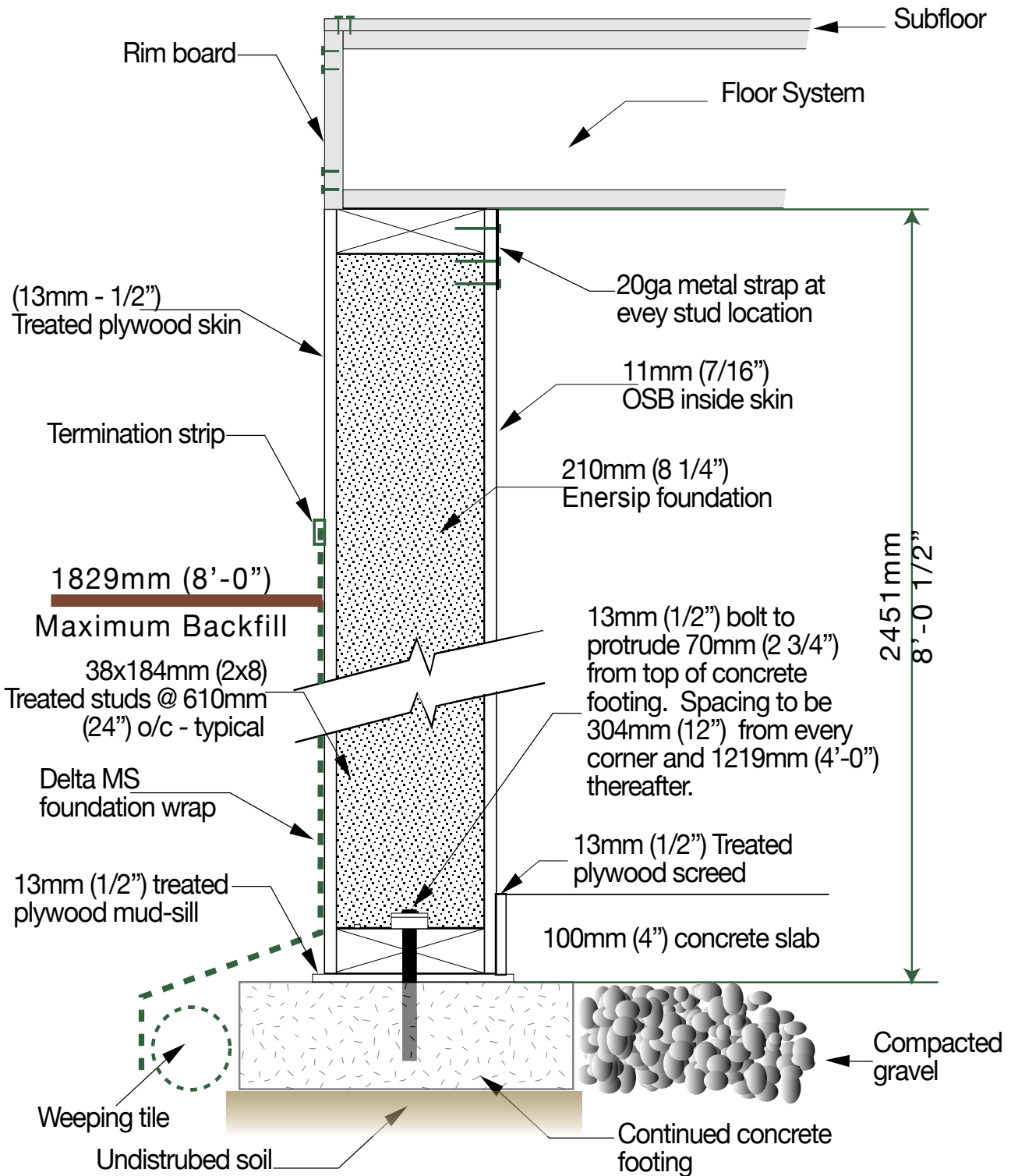
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	ICF Basement & SIP Wall Assembly	AM-025a
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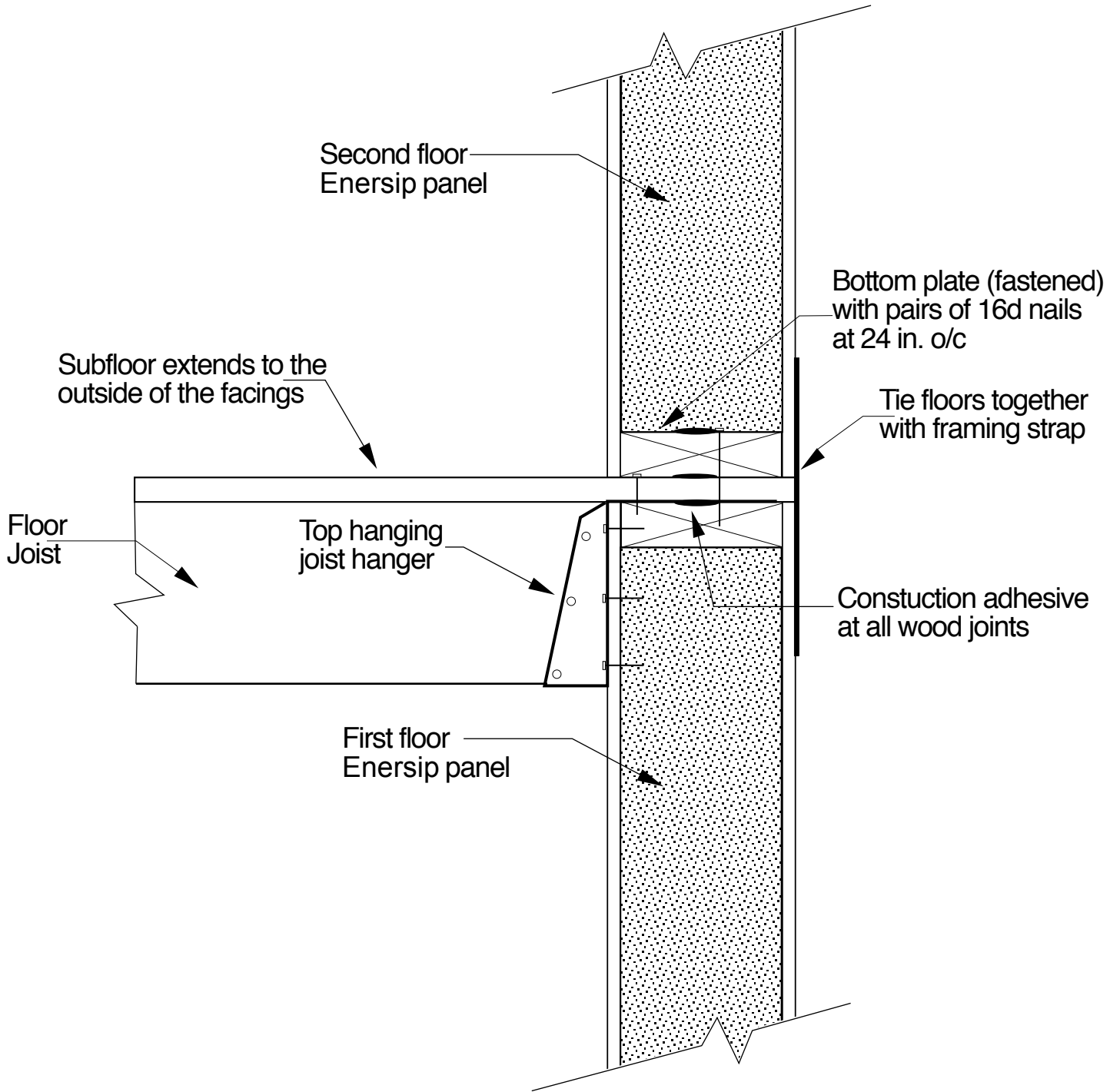
	ICF Basement & SIP Wall Assembly	AM-025b
	ENERSIP Panel Building System	




NOTE: Customers may be required to hire a local engineer to meet local building code requirements. Cost to be assumed by customer

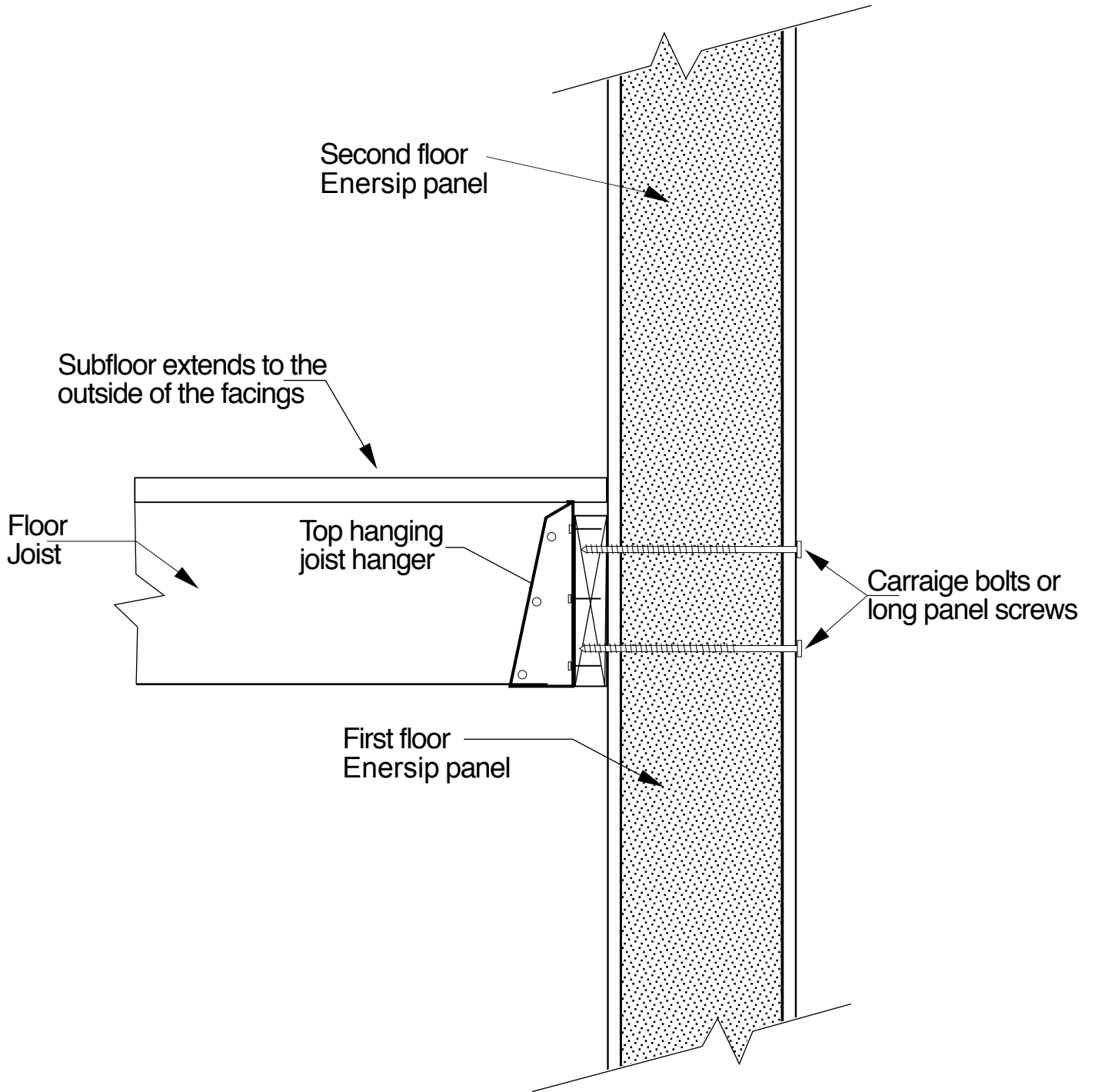
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	Foundation/Basement Wall	AM-026
	ENERSIP Panel Building System	




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	2n Floor Panel Connection	AM-027
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	2n Floor Panel Connection	AM-027a
	ENERSIP Panel Building System	



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Contact Information

Box 182 Dominion City, Manitoba R0A 0H0

Tel: 1.877.ENERSIP or 204.427.3405 Cell: 204.712.5206 Fax: 204.427.3643

Email: jwaldner@enersip.com - www.enersip.com