# CONSTRUCT with evissa SIPs


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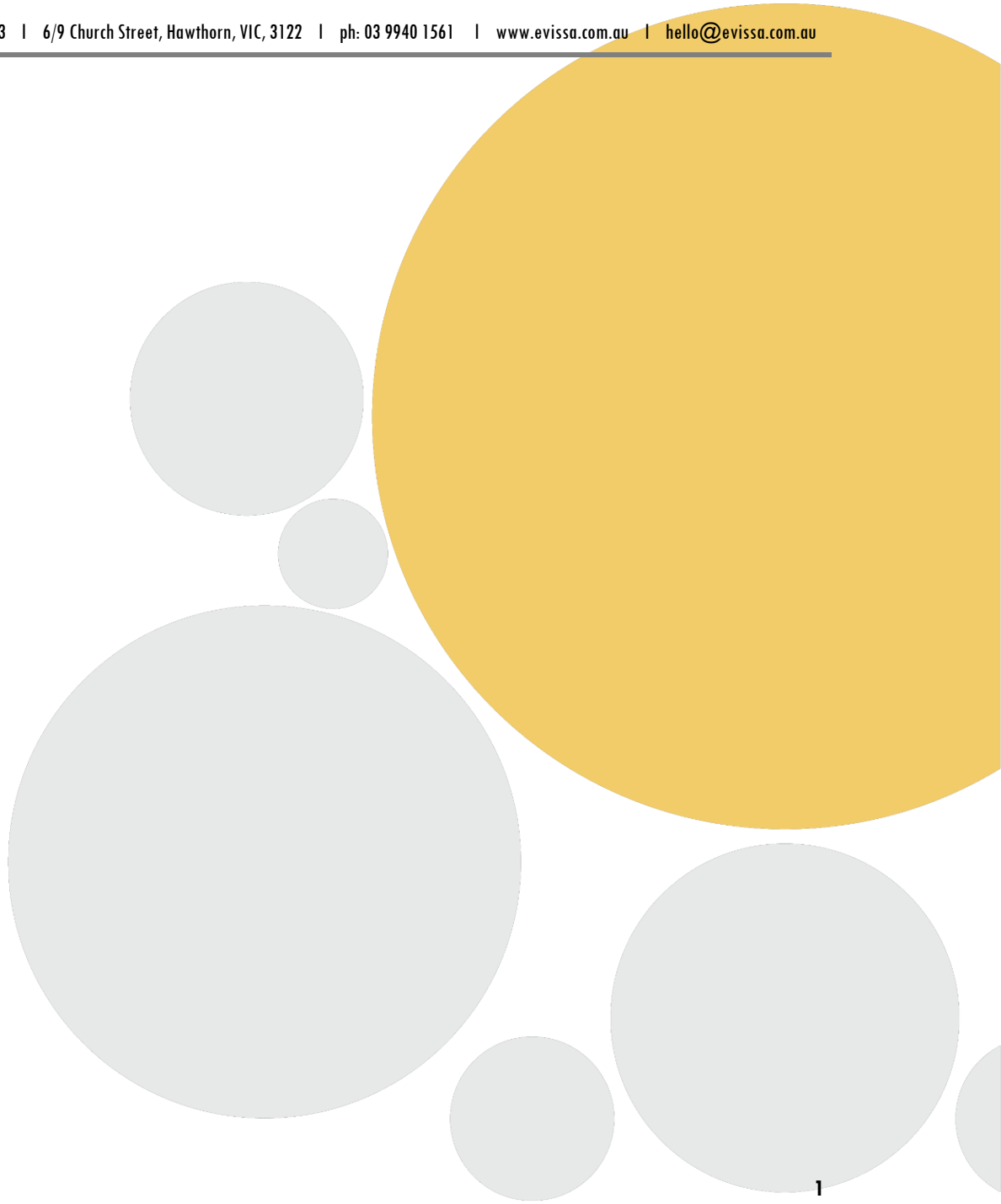

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***NOTE:***

*This document is to be utilized by building professionals experienced in residential and small scale commercial buildings. All details described in this manual are generic by their nature and do not depict specific project details. Evissa will not take responsibility for inadequate use of information contained in this manual and details and/or SIP specific drawings which are not prepared / issued by Evissa.*

**A chartered structural engineer will prepare all the SIP structural engineering drawings and certify all the computations for each specific project.**

## EVISSA SIPS OVERVIEW

SIPs are high-performance composite building panels used in floors, walls, and roofs for residential and light commercial buildings. These panels are fabricated in a factory and shipped to a construction site, where they can be quickly assembled to form a tight, energy-efficient building envelope. SIPs are a simple composite sandwich panel. ASTM International defines simple sandwich panels as "a three-layered construction formed by bonding a thin layer (facing) to each side of a thick layer (core)." The term "composite" refers to any material in which two or more distinct materials are combined, yet remain uniquely identifiable in the mix.

Composition of Evissa SIPS consists of two typical Oriented Strand Board (OSB) panels, glued with a high-performance adhesive, on an Expanded Polystyrene (EPS) board. Follows the same composition and manufacturing process as the one used extensively in North America.

**FACING - OSB – Oriented Strand Board – APA approved – AS 1604.1 - 2012**
*Adhesive* - *ISOGRIP SP 3030D – approved ASHLAND INC*
**CORE - EPS – Expanded Polystyrene – AS 1366.3-1992**
*Adhesive* - *ISOGRIP SP 3030D – approved ASHLAND INC*
**FACING - OSB – Oriented Strand Board – APA approved – AS 1604.1 - 2012**

### SIPs STRUCTURE

Structural integrity of the building is achieved through the OSB skin. SIPs use less timber than typical framing. The panels are held together by OSB SPLINES / TIMBER STUDS MgP10, LVL, SPF / I-JOIST SPLINES / BOTTOM & TOP TIMBER PLATES. Timber elements should be sighted and use rectilinear pieces with a deflection error of 1mm for every 1m length. Structural capacity of the product is assessed against: NCC and current AS – see references page 23.

| EVISSA SIP PANEL THICKNESS USING MGP10 & LVL SIZES | 115mm | 165mm | 215mm | 265mm | 315mm |
|---|---|---|---|---|---|
| MgP10 or LVL TIMBER SPLINE WIDTH | 90x45mm | 140x45mm | 190x45mm | 240x45mm | 290x45mm |
| EVISSA SIP PANEL THICKNESS USING SPF SIZES | 110mm | 165mm | 210mm | 260mm | 310mm |
| SPF TIMBER SPLINE WIDTH | 86x38mm | 140x38mm | 186x38mm | 238x38mm | 286x38mm |

## CONSTRUCT WITH EVISSA SIPS

The construction of a SIP home or commercial building begins with the construction documents. Once the construction documents are in the hands of our SIP manufacturer, they are converted to SIP shop drawings that give the dimensions of each individual panel. The shop drawings are reviewed by Evissa designer and / or structural engineer. Once the shop drawings are finalized, the SIPs are fabricated and shipped to the jobsite for installation.

On-site modification can easily be done using a few additional SIP specific tools, however major cuts through the panel should be avoided to ensure structural integrity of the panel is maintained. Thick panels can be cut using a beam saw or a beam cutting attachment to a circular saw. The foam core can then be recessed for splines or dimensional lumber using a hot wire foam scoop or specialized angle grinder attachment.

If panels are damaged, a structural engineer needs to assess the damage to determine what is cosmetic and what is structural. If the damage is only cosmetic, then the damaging source must be determined and fixed, whether it is from inside or outside. If the damage is structural, then the source of the problem must be identified and a structural solution to the problem must be found. That can be done by either a site modification of the panels or replacement of the panels, depending on the extent of the damage. If panels are damaged, Evissa should be notified.

### CLADDING

Builders should consult the cladding manufacturer's installation instructions for how to attach their product to SIPs. Because SIPs use very little solid lumber, an increased fastening schedule is often required when attaching exterior cladding. If the siding manufacturer does not offer recommendations for attaching their product to SIPs, an engineer can calculate the appropriate fastener frequency by obtaining fastener pullout capacities from the SIP manufacturer. It is also important that proper moisture management procedures be followed when applying any type of cladding to SIPs. Exterior cladding shall include a primary and secondary weather resistive system, e.g., drainage plane. Moisture barriers are required, common building paper, non-perforated house wrap.

**RECESSED LIGHTS**

Recessed lights should never be embedded in structural insulated panels. To install recessed lights, an interior soffit must be constructed.

**AIR MOVEMENT**

All joints are to be sealed in such a way to ensure no air infiltration or exfiltration. A building having the entire external envelope made from SIPs (walls / roof / floor) could reach airtightness levels as low as 1 ach@50Pa pressure. This can be easily tested by undertaking a blower door test. Out of practice, a continuous external SIP envelope is easy to seal. The only areas highly vulnerable to air movement are floor to wall and wall to roof connection which would require taping in order to achieve low levels of air transfer throughout the building.

**VOIDS**

All voids must be filled with nominated Evissa sealants/panel adhesives to ensure against air movement and moisture intrusion into the building envelope.

**VAPOR TRANSMISSION**

Vapor permeability for all SIP panel joints must meet local building codes and/or environmental requirements.

**VENTILATION SYSTEM**

A HVAC or HRV system must be designed to: provide proper ventilation due to the inherent air-tightness of the structure and be properly sized to account for the inherent energy efficiency of the structure.

**THERMAL BRIDGES**

The level of insulation in a SIPs building are quite high which makes the thermal bridging an important aspect for a low energy building. The heat transfer would occur only through the thermal highways created by different thermal resistances and use of mixed materials, hence a continuous SIP envelop throughout the whole building would enable the materials to transfer heat/cold in an even matter. At the opposite end mainstream buildings, which rely on high levels of energy, leak air throughout the whole envelope and thermal bridging becomes a less stringent aspect, as there's a potential for the external envelope to release and take air transfer throughout.

## INSTALLATION PROCESS

### GENERAL DO'S

**DO –** Provide adequate bracing of panels during instillation.

**DO –** Study the installation drawings before setting panels.

**DO –** Set wall plates carefully. Panel skins provide the strength for walls so panel skins must be fully supported. The panel slips over the wall plate, so remember to set your plates a 12.5mm in from the building edge, and leave room where plates meet for the skin to slide by.

**DO –** Set panels in order. Mark out your wall plates to show where panel edges fall. When setting walls and roofs, it's a good idea to start in corners or valleys and work out - that way, you won't "box yourself into a corner." At wall corners, one panel "stops short" and the other "flies by" – be sure you know which is which, or one wall will be too long and the other too short.

**DO –** Always follow the manufacturer's recommended joint sealing techniques. Seal joints as you work. Panel joints must be thoroughly sealed to ensure there is no air infiltration from the outside or exfiltration from the inside. Be sure to follow the manufacturer's recommendations for sealing joints properly.

**DO –** Install standard deterrents to resist termites and carpenter ants such as insect clips and flashing.

**DO –** Install proper flashing and sealants around all rough openings and penetrations as required.

**DO –** Use high-quality roofing and cladding. High performance light weight roof covers are suitable for use on a SIP roof. Popular siding materials such as steel or tile, vinyl, wood, brick, or fiber-cement are also fine for SIP houses.

**DO –** Flash all penetrations. Most windows will eventually leak some water at the window sill; install flashing under and around windows and doors to direct water away from the wall structure.

**DO –** Provide adequate ventilation to maintain indoor air quality. A properly selected ventilation system will let you have fresh air when, how, and where you need it.

**DO –** Provide a mechanical ventilation system. Passive air infiltration will not be enough to keep good indoor air quality levels. In cold climates, use a heat recovery ventilator; you'll save energy, and the incoming air will be tempered for comfort. In hot, humid climates, an energy recovery ventilator is best: these systems take humidity out of the incoming air and transfer it to the exhaust stream, reducing the load on your air conditioner and improving your comfort.

**DO –** Control indoor humidity. High humidity levels can be unhealthy and can damage your building. Set your ventilation system to keep indoor humidity around 50 percent. Install exhaust fans in kitchens, bathrooms, and laundry rooms to expel moist air as needed. Moisture intrusion through slabs, crawlspaces, and basements can be significant, so make sure your foundation has good drainage and provides for control of moisture vapor.

**GENERAL DON'Ts**

**DON'T –** Cut wall panel skins horizontally for installation of electrical wiring.

**DON'T –** Cut roof or floor panel skins without contacting your supplier.

**DON'T –** Be afraid to field-trim panels for an exact fit. Contact your supplier when in doubt.

**DON'T –** Install panel skins in direct contact with concrete. Provide a cavity break between panel skins and concrete.

**DON'T –** Install recessed lights inside the panels.

**DON'T –** Install plumbing in interior walls. All services and duct work to run at the inside face of the panel.

**DON'T –** Install or use unvented combustion equipment. "Vent-free" gas logs, fireplaces, or heaters are not appropriate for an airtight SIP house.

**THE ACTUAL JOB INSTALLATION SEQUENCE WILL VARY DEPENDING ON WHERE THE EVISSA SIPS ARE BEING USED AND THE INDIVIDUAL LAYOUT OF DESIGN. BELOW IS A TYPICAL SEQUENCE:**

### FOUNDATIONS AND BOTTOM PLATES

Foundations and floor slab constructed in traditional way. A well-laid concrete slab provides a great base for Evissa SIPS. A damp proof membrane protects the softwood bottom plates.

### ERECTION OF GROUND FLOOR EVISSA PANELS

The SIPs are lifted onto the base plate and nailed in place. Adjoining panels are splined together. The ground floor external and internal walls are quickly fixed into position.

### FIRST FLOOR JOISTS

The ceiling joists are nailed to the panels using joist hangers. In this example, engineered I-Joists have been used. Timber beam lintels can be used to create door and window openings. Floor boards are screwed in place and run through over the top of the panels.

### FIRST FLOOR, GABLE ENDS AND TRUSSES

Once the first-floor joists and floor boards are fixed, any first floor external and internal walls, gable ends and roof trusses can be positioned and fixed. In this example attic trusses are being used to accommodate further rooms in the roof space. Window and door openings are pre-cut into the panel at the factory.

### ROOF PANELS

Roof SIPs are fixed over the trusses. Depending on the size and span, roof panels can be supported by the gable ends, purlins or trusses. Alternatively, roofs can be finished in traditional ways, using tiles hung on battens over a breather membrane Evissa panels consist of high performance rigid EPS core sandwiched and adhered between two layers of oriented strand board (OSB).

### FINISHES

SIP panels can be cladded externally in a number of ways. These include, timber planks on battens over a breather membrane, hanging tiles, a skin of brickwork or with render. Internally, vapor check plasterboard can be fitted to battens, creating a void for services, or fixed directly to the panels.

## DELIVERY & STORAGE

### SITE ACCESSIBILITY

Panels are typically delivered to site with a conventional truck. Once the delivery truck leaves the major freeway there are many additional items to consider such as: driveways / bridges / sharp turns / hills / trees / overhead wires / buried lines or tile / excavation trenches. If the truck cannot get into the site, be prepared to unload onto a smaller delivery vehicle and then shuttle the panels into the jobsite. If this is required then additional trucking time should be allocated. Any potential concerns related to shipping or access to the jobsite should be considered ahead.

### STACKING

Never allow OSB skins to rest directly on ground or concrete surfaces. Lay panels flat on stacking stick, no closer than 10cm off the ground. Give the panels plenty of support, and don't let them sag.

- For 2,440mm panels use two stacking sticks
- For 3,660mm to 4,880mm panels use three stacking sticks
- For longer panels space stacking sticks at ~2,000mm centers.

### MATERIAL HANDLING EQUIPMENT

Arrangements will need to be in place prior to the SIPS arriving on the site. Each installation will require specific site considerations for unloading. There will also be requirements for the tools & equipment needed for installation, which could include rigging and lifting tools required for larger panels. Unloaded panels take up lots of room on site and need to be planned for carefully. Room for sorting panels is often necessary because the first panel required may not always be where you expect it to be.

Unloading of the shipping truck will require that the following items be considered prior to the arrival of the truck at the site.

- Panels may come in large, mixed piles to maximize the trucking load for shipping efficiency
- A single panel can weigh 90 to 360 kg for sizes from 1,220mm by 2,440mm to 1,220mm by 6,100mm
- Manpower: Crew of 4 to 5 is best
- Crane or forklift selection will depend on the site terrain and the working distance
- Crane bars or fork extensions
- Lifting plates
- Scaffolding
- Extension ladders
- Wood blocking to support panels on site and protective cover materials for rain protection of SIP package prior to installation start

## INSTALLATION TOOLS AND EQUIPMENT

### PERSONAL TOOLS

01. Tool belt
02. Hammer
03. Tape measure
04. Utility knife
05. Pry bar
06. Nail puller
07. Wood chisels
08. Plumb bob
09. Awl
10. Chalk line and chalk
11. Dry string lines
12. 1,200m level
13. Hand saw
14. Adjustable wrench
15. Framing square
16. Framing square gauges
17. Linesmen pliers or equal
18. Lumber crayon & pencil

### CONTRACTOR SUPPLIED TOOLS

01. Electric drills
02. Cordless drills
03. Drill bits & augers
04. Power circular saws
05. Chain saw
06. Reciprocating saw
07. Saw blades for each saw
08. Power cords
09. Sledge hammers
10. Portable router and bits
11. Air compressor & hoses
12. Pneumatic nail or staple guns
13. Nails or staples
14. Clamps
15. Ratchet straps
16. Scaffolding, planks & ladders
17. Caulking guns
18. Builders level or transit

### PANEL SPECIFIC TOOLS & ACCESSORIES

01. Foam scoop – to provide recesses on the edges of panels where required
02. Portable hot wire assembly – used to remove long sections of foam
03. Chain saw guides
04. Evissa SIPS Screws
05. Evissa SIPS Sealant
06. Evissa SIPS 2-Part Polyurethane Foam Sealant
07. Evissa SIPS Seal Tape
08. Evissa SIPS Roof Edge Sealant

**SAFETY EQUIPMENT** - Safety cannot be over-emphasized on any construction project. Regular daily safety meetings at the start of each day can help avoid many of the injuries that occur on any jobsite. Safety equipment will be state or area specific and all rules and guidelines must be followed.

01. Written fall protection plan
02. MSDS (Material Safety Data Sheets) reports
03. Hardhats as required when there is any overhead work
04. Eye protection glasses
05. Hearing protection
06. Safety harnesses
07. Any other PSE (Personal Safety Equipment) required such as gloves, boots.

## FIXINGS / FASTENERS / ADHESIVES / FOAMS / TAPES

1. Treated timber bottom plate – MGP10 treated pine Bottom plates
2. SILKA expanding foam
3. LOCTITE Liquid PU adhesive MADE BY HENKEL
4. Sill gasket between foundation and bottom plate used as moisture proof and sealant. Plascourse 500um Polyethylene Damp-course.
5. Specific Evissa project construction drawings should be followed for all flashing and all window and external extrusions.
6. PEF backing rod - joint backing material as required – SIKA.
7. Anchor bolt (Dyna Bolt) : fasten treated timber bottom plate to foundation. Bottom plate fixing and spacing in accordance with AS 1684.2 & AS 1684.4 or engineer's specification.
8. PU glue: Used as sealant between spline and SIPs panel. Expanding foam to ensure spline and SIP panel are firmly installed and fill up big gaps.
9. Coil nail fasten on each side of SIP panel - 75 x 3.15mm. Paslode 75 x 3.06mm Bright D Head Impulse Nail
10. SIPs screw: long, connect wall to wall, roof to beam. Zenith 14g x 200mm, 16g x 225mm, 16g x 250mm, Galvanized Bugle screw used as specified by the structural engineer and as required through the thickness of the SIP.
11. White glue: structural adhesive used to glue OSB floor sheathing to floor joist.
12. Galvanized metal hangers and connectors (if details require).
13. Seal tape used on all SIP joints to improve airtightness
14. Hold down corner nailing pattern at each end (mm): 75 cts / 150 cts – or otherwise specified by the structural engineer.
15. Hold down continuous strap under the bottom plate and on both sides of panel for increased bracing capacity, to be determined by structural engineer.
16. Hold down 2 X steel straps fixed on one side of the panel and to the timber joist.

## WEATHER PROTECTION

All Evissa SIPs panels should be protected from the weather and comply with NCC weatherproofing clause H2P2, by adopting the following typical construction strategies.

**Evissa SIPs for walls (outside to inside layers):**

**Cladding:** Cladding system approved by Evissa and meet the NCC requirements, weathertightness and durability standards.
**Flashing Tape:** For all window and external extrusions specific Evissa project construction drawings should be followed
**Building Sealant:** Sill gasket between foundation and bottom plate used as moisture proof and sealant. Plascourse 500um Polyethylene Damp-course.
**Battens:** Locally sourced timber battens MGP 8 or aluminium top hat sections
**Install a breathable Membrane:** PROClima breathable membranes or similar
**Evissa SIPs for Walls:** various thicknesses - 115mm / 165mm / 215mm
**Wet Areas:** Install Scyon boards to all wet areas and apply waterproofing membrane as per AS 3740-2010
**Coating & Linings:** Paint, plaster or install internal linings as per - approved Evissa details, NCC requirements and durability standards.
**SIPs Walls on Boundaries:** Create a Fire-resistant wall system by adding non-combustible materials / layers as part of the system. The boundary system will be checked for compliance by the buildings surveyor.

**Evissa SIPs for roofs (outside to inside layers):**

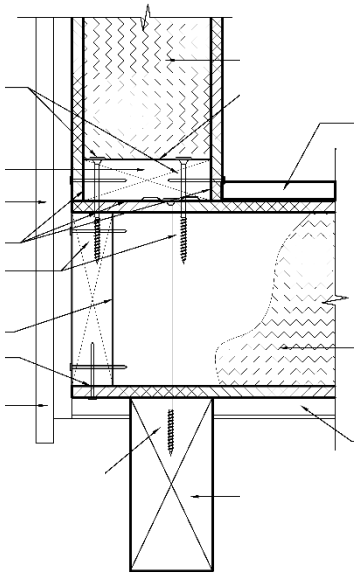
**Roof cover:** Metal roof cover approved by Evissa and meet the NCC requirements, weathertightness and durability standards.
**Flashing Tape:** For all skylights and external extrusions specific Evissa project construction drawings should be followed
**Battens:** Locally sourced timber battens MGP 8 or aluminium top hat sections
**Install a breathable Membrane:** PROClima breathable membranes or similar
**Evissa SIPs for Roofs:** various thicknesses - 165mm / 215mm / 265mm
**Coating & Linings:** Paint, plaster or install internal linings as per - approved Evissa details, NCC requirements and durability standards.

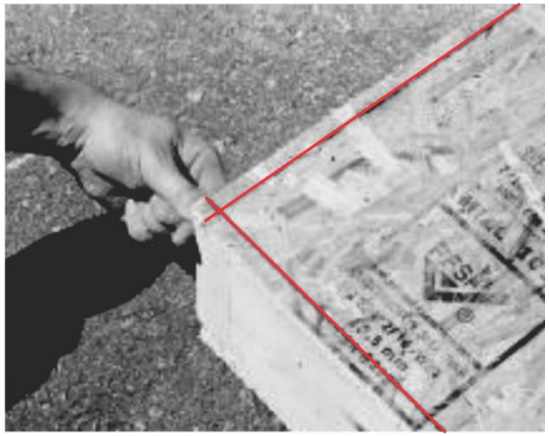
**Evissa SIPs for suspended floor (outside to inside layers):**

**Termite Protection:** as per NCC requirements, weathertightness and durability standards.
**Flashing Tape:** For all external extrusions specific Evissa project construction drawings should be followed
**Wet Areas SIPs Set-Down:** Utilise one size down Evissa SIPs for floor and install Scyon boards to all wet areas and waterproofing membrane as per AS 3740-2010
**Floor battens:** Locally sourced timber battens MGP 8 or hardwood battens to all non-wet areas.
**Floor Finish:** Lightweight floor finish (Timber floor boards, Tiles) as per approved Evissa details, NCC requirements and durability standards.

## ASSEMBLY PROCESS

### BOTTOM PLATE ATTACHED TO LIGHT WEIGHT SUB-FLOOR SHEATHING





1. Check sub-floor dimensions against Evissa SIPS shop drawings to determine start point. Use the 3-4-5 squaring method to ensure the sub-floor is square.
2. Measure in 11.5mm at the selected start point.
3. From this start point, you will need to snap a chalk line around the entire perimeter of the sub-floor to set the bottom plate
4. The line should end up 11.5mm minimum in from the edge of the sub-floor sheathing around the entire perimeter.

*To achieve design structural performance of the Evissa SIPS system both OSB skins must be fully supported.*

5. Apply one 15mm bead of construction adhesive along the inside perimeter of the snapped chalk line where the bottom plate will be set.
6. Lay the bottom plate into position on top of construction adhesive and nail or screw down to the sub-floor sheathing as per Evissa SIPS shop drawings. Make sure fasteners penetrate the sub-floor sheathing into floor joists for a strong connection.
7. Continue this procedure around entire perimeter. At corners, refer to Evissa SIPS shop drawings to ensure correct placement of bottom plate. One bottom plate will always run through to the end of the sill plate or sub-floor, while the other bottom plate coming into the corner will be stopped back 11.5mm to allow the inside OSB wall sheathing to carry through.

*When installing bottom plates over treated sill plates on concrete foundation walls or slab, the same procedures will apply.*

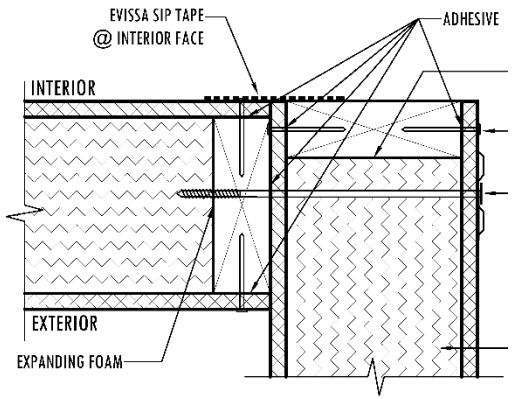
**PREPARATION FOR PANEL INSTALLATION (electrical cables running through the panel are covered in this installation process).**

Before tilting panels over the bottom plate check the bottom of panels for vertical wiring chases. Be sure to measure in corresponding distance along bottom plate.

Drill a 4mm diameter hole through the plate and sub-floor sheathing. Clear all drilling debris. Mark these positions on the sub-floor sheathing for later reference.

Apply a consistent (unbroken) 10mm bead of Evissa SIPS approved sealant along both inside corner edges of bottom plate.

**CORNER PANEL INSTALLATION (electrical cables running through the panel are covered in this installation process).**




Before setting wall panels in place, clear any debris that may have lodged in spline grooves or recessed areas of the panels. Also, check OSB skins for damage and repair these areas. Report any serious damage to your Evissa team for repair instructions. Once the bottom plates have all been set in place, wall panel installation can begin. It is imperative to start in a corner and work out in either direction. The corner you decide to start in may be determined by many factors, such as crane access or job site conditions. Regardless, it is important that the first corner is set accurately and that both wall panels at the corner are plumb and square. Both corner panels have 2x let-in timber ends in their edges.

Fasten bottom edge of first panel to bottom plate using nails on both sides of panel spaced as per approved Evissa SIPS shop drawings.

Before placing adjacent panel to form the corner, apply a 10mm bead of Evissa SIPS approved sealant along the OSB interior surface of the panel that will contact the edge plate of the adjoining panel.

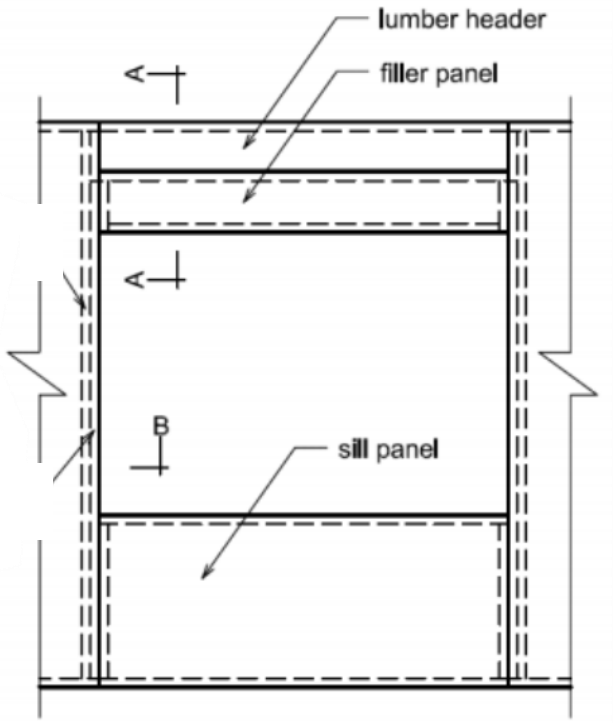
Tilt panel into position over the bottom plate, being careful not to disturb the sealant bead. Before fastening the panel in place, use a level on the interior surface and end of the panel to ensure that it is vertically plumb. Install the adjacent panel to form the corner.

## INSTALLING SUBSEQUENT WALL PANELS

Before installing successive panels into position, remember to apply Evissa SIPS approved sealant along both inside corner edges of the bottom plate and the panel to panel spline connection. Install panels in numerical order.

Follow the Evissa SIPS shop drawings included with the Evissa SIPS building system. Once panels are set in position, check for plumb. Both the interior and exterior surface of panel at spline connections must be fastened as per approved Evissa SIPS shop drawings. If necessary, use ratchet straps to pull the panels together while tapping gently with a sledgehammer as a means of moving panels into position. Always use blocks when tapping along the edge to avoid damaging the OSB skins or exposed splines.

Always make sure to properly brace wall panels while installing them. This will make them safer to work around, and in the event of high winds, will ensure they don't fall over causing considerable damage, expense and lost productivity.

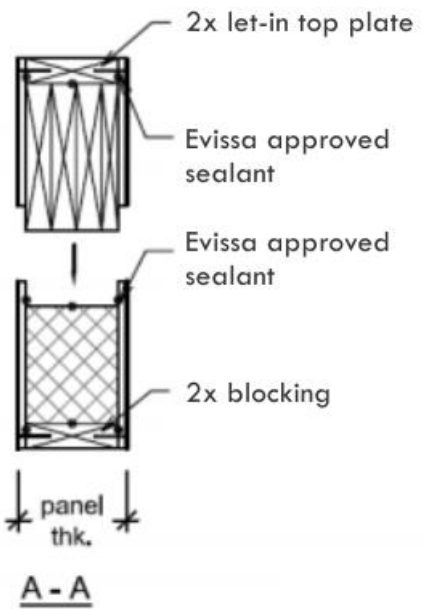


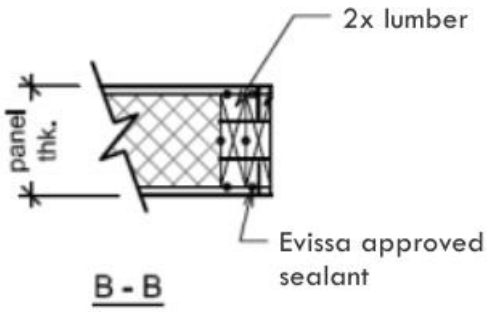

Typically, window openings will require 2xlet-in blocking all the way around the edge of the opening. Panels are factory pre-cut and recessed for all window and door openings.

For Ready to Assemble packages the let-in lumber is preinstalled into the window or door assembly components. The panels and/or headers that create the window or door openings are not pre-assembled in the factory. They must be assembled as per the approved Evissa SIPS shop drawings.

The panel edges must be recessed 11.5mm for the 2 x blocking. This blocking acts both as a nail base for securing windows and interior/exterior trim. If the foam insulation was not factory recessed around the edges of the rough opening, use a foam scoop. Install the blocking by nailing through the OSB skin with nails as per approved Evissa SIPS shop drawings. Headers are required over door and window openings with full-height structural framing spanning from the bottom plate to the top plate.

Refer to approved Evissa SIPS shop drawings for project-specific requirements. A qualified designer must review structural requirements for compliance with local building codes.




Unless a window opening has been cut from the centre portion of a panel, the rough opening will usually consist of two side panels, a lower panel and an upper panel. Install panel adjacent to the window opening as detailed. Apply adhesive as per approved Evissa SIPS details.

Install the panel below the window opening as detailed and pull into preceding wall panel. Position next the panel on the opposite side of window opening before installing header panel.

Lift the header above wall height and lower it down into the pockets making sure to align the header evenly with the adjacent wall panels. Nail both interior and exterior edges at all connections and along bottom plate.

**TOP PLATE INSTALLATION (electrical cables running through the panel are covered in this installation process).**

Check top surface of panel core for vertical wiring chases. Mark these positions on the interior OSB panel surface for later drilling reference. Insert the top plate into the recess on the top of wall panels allowing a minimum offset so that the top plate overlaps into adjacent panels by half the panel width. Fasten top plate to panels using nails as per approved drawings.

A cap plate is required on lower panels where there is a second floor. Apply a 10mm continuous bead of construction adhesive on top of the top plate. Place the cap plate on the top plate making sure both edges of cap plate are flush with the outside wall panel skin. Drill 4mm holes through plate into the vertical electric chases in wall panel at previously marked locations.

For multi-story buildings follow structural engineering drawings available for each project. The same assembly process (as above) will be applied for the upper-floors and roof panels.

## TEST / REPORTS / SPECIFICATIONS / PRODUCER STATEMENTS

### FORMALDEHYDE EMISSIONS AND EXEMPTIONS - *Information under this section is referenced back to SIPA – www.sips.org*

Recent news reports have highlighted concerns over the health effects of formaldehyde and its classification as a carcinogen. This fact sheet from addresses the concerns related to structural wood panels and explains why plywood and OSB manufactured to U.S. Product Standards PS 1 and PS 2 have such low emission levels that they are exempt from the leading formaldehyde emission standards and regulations.

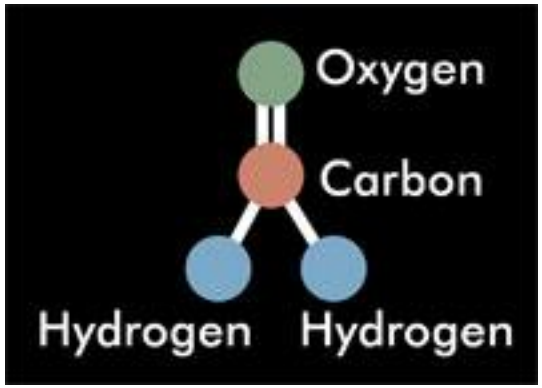
**Formaldehyde Regulations and Structural Wood Products**

Structural wood products such as plywood and oriented strand board (OSB) are manufactured to meet stringent product standards, including *Voluntary Product Standard PS 1-07 for Structural Plywood and Voluntary Product Standard PS 2, Performance Standard for Wood-Based Structural-Use Panels*. Because wood products produced under these standards are designed for construction applications governed by building codes, they are manufactured only with moisture-resistant adhesives that meet Exterior or Exposure 1 bond classifications. These adhesives, phenol formaldehyde and diphenylmethane diisocyanate (MDI), are chemically reacted into stable bonds during pressing. The final products have such low formaldehyde emission levels that they easily meet or are exempt from the world's leading formaldehyde emission standards and regulations:

1. **U.S. HUD Manufactured Housing Standard.** This standard specifies a 0.20 ppm emission limit for (non-structural) plywood using the ASTM E1333 method. Because of its extremely low formaldehyde emission levels, phenolic-bonded structural plywood is exempt from the testing and certification requirements of the standard. While there is no specific limit stated for OSB, it has been well accepted that the stated exemption for panels that use phenolic adhesives is applicable to OSB products meeting *Voluntary Product Standard PS 2*.

2. **California Air Resources Board (CARB) Air Toxic Control Measure for Composite Wood Products.** This regulation, developed by a division of the California EPA and scheduled to take effect January 1- 2009, is considered the most stringent formaldehyde emissions regulation in the United States. In recognition of the different formaldehyde emission levels of different types of wood products, this regulation explicitly exempts "structural plywood," "structural panels," "structural composite lumber," "oriented strand board," "glued laminated timber," and "prefabricated wood I-joists."

## WHAT IS FORMALDEHYDE?




Formaldehyde is a simple chemical made of hydrogen, oxygen, and carbon. It occurs naturally, and is the product of many natural processes. It is made by our bodies and is in the air. Plants and animals also produce formaldehyde. It is in many fruits and vegetables, and is a byproduct of cooking certain vegetables, such as brussel - sprouts and cabbage. This chemical break down quickly and is metabolized to simple carbon dioxide. Our bodies readily break down the low levels to which we are exposed every day. Formaldehyde is also a product from combustion associated with the burning of kerosene and natural gas; automobile emissions; and cigarettes. It is an important industrial chemical used in the manufacture of numerous consumer products, including permanent press fabrics and even toothpaste.

## HOW MUCH FORMALDEHYDE IS IN WOOD?

All wood species, and therefore all wood products, contain and emit small amounts of formaldehyde. Because formaldehyde occurs naturally in wood, there is no such thing as “formaldehyde-free” wood. An oak tree, for example, emits 0.009 parts per million (ppm) of formaldehyde. By itself, this is a very low quantity, but densely wooded areas can have much higher concentrations. It follows that any wood cut from that oak tree also contains small amounts of formaldehyde, as do all wood products.

## EXPANDED POLYSTYRENE FLAME RETARDANTS - *info under this section is provided by the EPS Industry Alliance - www.epsindustry.org*

Flame retardants (FRs) play a crucial role in protecting homes, hospitals, schools and other buildings from the life- threatening consequences of fire. In 2010, 482,000 building fires occurred in the U.S. injuring 15,420 civilians and resulting in $9.7 billion in property damage.

In order to reduce the risk of fires and meet building and consumer protection codes, FRs are incorporated into many building and commercial products to accomplish one or more of the following functions:

- Raise the ignition temperature;
- Reduce the rate of burning;
- Reduce flame spread; or
- Reduce smoke generation.

### EPS Fire Resistance

The primary flame retardant currently used in EPS foam insulation is HBCD. Hexabromocyclododecane (HBCD) is an additive flame retardant that promotes increased fire resistance in EPS building and construction applications. This allows EPS foam insulation to meet the stringent fire safety requirements governed by the International Code Council and National Building Code of Canada, providing increased protection to buildings and building occupants. HBCD has also been used as a flame retardant in solid plastics such as high impact polystyrene and in carpets, upholstery and other textiles.

### EPS Flame Retardant Advancement

In response to ongoing questions about the ecological safety of HBCD, the chemical industry has announced the development of an innovative flame retardant (FR) that is a suitable alternative for use in expanded polystyrene (EPS) foam. The process to transition to the new FR is currently underway but will take time to be fully implemented. The new flame retardant is a polymeric compound, designed to deliver ease of substitution in existing EPS production technologies without compromising fire safety performance at similar load levels. The announcement is just the beginning of a

transition process that will proceed with great care to assure that this new flame retardant performs just as well or better than HBCD in accordance with ASTM C578 and CAN S701 physical properties and U.S./Canadian building code fire safety requirements. This process is the result of ongoing collaboration among key stakeholders and government agencies to identify and implement alternative flame retardants that meet the following criteria:

Provide equal flame retardancy;

Result in equal performance and physical properties;

Maintain cost-effectiveness; and

Offer compatibility with existing manufacturing processes.

Any transition from an established product composition must proceed in a structured fashion to ensure the necessary approvals are in place. The chemical industry reports that a preliminary scientific review indicates the new FR will meet the health and environmental criteria for new chemicals. While production facilities to manufacture the new FR are being established, it will take several years to reach production levels that adequately satisfy historical market demands. The EPS industry is currently developing a test program to ensure the new fire retardant complies with U.S. and Canadian building code fire performance requirements for EPS building applications. Once commercial quantities become available to the EPS molder community, in-house testing and quality control measures will continue to be verified via independent, third-party certification programs.

**Scientific Inventory**

HBCD is just one of over 550 compounds currently being evaluated by the U.S. Environmental Protection Agency, Environment Canada and the European Union. This has spurred increased interest from the research community to investigate further, resulting in hundreds of studies on a variety of flame retardants, including HBCD. EPS-IA evaluated more than ten (10) different studies on HBCD published between 2008–2011 in which several consistent themes and conclusions prevail.

**HBCD Exposure Pathways Are Undetermined**

Although trace amounts of flame retardants have been found in remote geographic regions, human tissue and consumer food products, the source of these flame retardants remains unclear. While the discovery of even small amounts of HBCD in the environment does raise questions as to how to prevent any further exposure, the science indicates that the concentrations are well below thresholds that would present a health risk.

**HBCD Detection Levels Miniscule**

Environment Canada completed a thorough risk assessment and found that HBCD is not entering the environment in a quantity or under conditions that constitute a risk to human health. This determination is further supported by the European Chemicals Agency's conclusion that HBCD presents no risk to consumers or the general public.

**EPS Insulation Not Linked to HBCD Levels**

Recent studies have supported the fact that EPS insulation is not a significant source of HBCD. Specifically, the study found high correlation between detectable levels of HBCD and the number of televisions and electronic devices present in the test areas suggesting that in-place EPS insulation is not a source of HBCD in the indoor environment. Because the scientific community has not yet been able to identify verifiable exposure pathways to explain the appearance of HBCD in remote geographical locations, it is prudent to embark on the transition to the new FR. This move is another step along the EPS industry's path to increase energy efficiency and promote environmental stewardship.

**Regulatory Action**

The EPS Industry Alliance has been and will continue to work closely with the U.S. EPA and Environment Canada in their efforts to develop guidelines and regulations regarding HBCD. Although the U.S. EPA has not yet initiated any formal regulatory action for HBCD use in EPS, it has released a Chemical Action Plan to evaluate HBCD and then determine its course of action for any future regulation of this chemical. As part of that process, a Design for Environment (DfE) task group has been formed to examine next generation flame retardants that would serve as suitable replacements for HBCD in polystyrene foam insulation and the EPA has issued a Significant New Use Rule for HBCD use in textiles. EPS- IA is likewise engaged with the Canadian government's Risk Assessment and Risk Management plan for HBCD. Key information and industry input have been provided to Health Canada and Environment Canada to ensure adequate time is provided for a smooth transition to an alternative flame retardant.

## REPLACEING EPS INSULATING CORE WITH NEOPOR GPS

Neopor Graphite Polystyrene (GPS) is highly efficient, rigid foam insulation used in various construction applications. It provides up to 20% more energy savings than traditional white expanded polystyrene (EPS) insulation. Neopor is patented and manufactured by BASF, the world's largest chemical company. BASF integrates high-purity graphite particles into polystyrene beads, giving the insulation a reflective property which increases the energy efficiency of the material.

Imagine that heat is a person walking on a path. A path which takes many twists and turns along the way will take longer than a straight path to the destination. Neopor, when insulating, creates a twisted path for the heat which slows it's transfer when compared with the EPS making it more energy efficient.

In addition, Neopor features a higher permeability rating. Products with higher permeability ratings allow water vapor to pass through the wall, protecting against moisture damage.

Insulation is key to reducing carbon emissions and global warming potential from buildings by saving energy consumption. On the other hand, all insulation materials take energy to manufacture and transport something the industry refers to as embodied energy.
The amount of embodied energy depends to a great extent on the blowing agent in insulation material. Neopor GPS is a non-HFC foam insulation which uses a polymeric flame retardant (polymer FR) with about 1.1% by mass added. Polymer-FR is a brominated styrene-butadiene copolymer (CAS No 1195978-93-8) which is a synthetic rubber, not oil and ozone or weather resistant. The pentane assists in the expansion process and is released partly during and shortly after production (ageing process).

## REFERENCES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