

Chapter 8: Integrating Mechanical Systems with SIPs

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Introduction

For SIP installers, the job is not done once the panels are up. In order for a building to function properly as a system, special attention needs to be paid to how the electrician, plumber, and HVAC contractor interact with the SIP building envelope. In traditional wood frame construction, plumbing and electrical work typically precedes the tasks of insulating and air sealing. But with SIPs, each trade runs the risk of creating air leaks that could potentially cause moisture issues over the life of the building.

Scheduling a preconstruction meeting with subcontractors is an excellent way to inform them of the importance of maintaining an airtight building envelope. It also gives everyone a chance to discuss potential issues and correct them before the SIPs are installed. Opening the channel of communication during the design phase and considering the needs of the subtrades during panel installation will make for a smoother, more efficient build for all parties involved.

Definitions

Electrical chase:	Path for electrical wiring drilled through the foam core of a SIP by the SIP manufacturer
Manual J:	Calculation performed by HVAC professionals to size heating and cooling equipment
Blower door test:	Measurement of a home's air leakage conducted by a Home Energy Rater

Electrical

With a little planning and forethought, wiring SIP structures can be done as fast or faster than in a conventional wood frame structure. The SIP installer has the ability to ensure that electrical installation

goes smoothly. This starts by establishing an electrical plan with the building owner, architect and electrician during the design phase. During a preconstruction meeting, the exact location of fixtures needs to be determined so electrical chases can be appropriately specified.

Electrical Chases

SIP manufacturers typically cut electrical chases measuring between 1 inch and 1 ½ inches in diameter into the foam core at standard locations: at outlet and switch height for horizontal locations, and at regular intervals for vertical chases. Custom chases can be ordered at any location to meet the electrical requirements of the building, so it is important to establish fixture locations before ordering a SIP package.

Some SIP builders try to minimize the number of chases in the panel to maintain a solid core of insulation. In many cases, chases can be minimized by running wires behind dimensional lumber end plates for switches near doorways, running as many wires as possible through interior partitions or floor systems, and fabricating short chases onsite.

It is relatively easy for SIP installers or electricians experienced with SIP construction to create chases between 2 feet and 3 feet in length on the jobsite. A popular method of doing this is to use a hole saw to access the foam core and a long flexible drill bit to cut the chase. Save the section of the panel facing that was removed with the hole saw so that it can be used along with expanding foam to seal the void once all the wiring has been installed.

SIP Installation

When installing SIPs, it is crucial that crews maintain a continuous electrical chase between floor systems and wall systems, between intermediate floors, or from wall to roof systems. In each case, top and/or bottom plates will need to be drilled as panels are being installed in order to maintain the continuity of the electrical chase. Label the locations where plates have been drilled.

SIP installers may also install wiring in some hard-to-reach locations during SIP installation, such as wiring in the roof panels or at the roof ridge. This also allows the SIP installer to seal these locations during the installation phase as opposed to after all electrical has been installed.

When wires or conduit are placed during SIP installation, make sure the installation crew is aware of where wires and conduit are located so they do not damage wiring with SIP screws or other fasteners.

Plumbing

Like electrical work, plumbing in a SIP building should be examined during the design phase. Plumbing should never be placed in the core of a SIP. The easiest way to avoid doing so is to locate all plumbing in floors and interior partitions.

Where plumbing is required in an exterior wall, it is common to specify a thinner SIP for that section of wall and frame out a surface chase or “wet wall” to house the plumbing. Another commonly used option is to frame a short section of wall with conventional wood framing. Both of these options require some planning and need to be addressed during the preconstruction meeting so the SIP package and other materials can be ordered accordingly.

Every penetration through the SIP building envelope is a potential area for air leakage, so it is best practice to limit the number of penetrations by combining plumbing vents and/or specifying air admission valves. When cutting plumbing penetrations, the opening should be roughly 1 inch in diameter larger than the pipe that will be placed through it. This allows the penetration to be easily sealed with expanding foam.

HVAC

The work of the HVAC contractor is a key component in the long-term durability and occupant comfort of any home. As discussed in Chapter 4, a house functions as a system of interrelated parts that all affect each other. The airtightness of a SIP building enclosure affects the way HVAC systems are designed and specified. It is important to work with a qualified HVAC professional who will specify a system that fits the building’s performance characteristics.

HVAC Sizing

For residential buildings, the HVAC professional should perform a Manual J, a calculation method developed by Air Conditioning Contractors of America (ACCA) to determine the appropriate size of the heating or cooling system. This calculation takes into consideration the building size, orientation, insulation levels, windows, air infiltration and local climate characteristics. The completed Manual J calculation will let the builder know what type of equipment to specify and include in their bid for the project. Smaller units can often be used on SIP homes, adding to the cost savings of SIP construction.

Although most reputable HVAC contractors are using this calculation method, there are still contractors that specify equipment using rules of thumb based on the square feet of conditioned space. Since SIP homes are much more airtight than older wood-framed homes, such estimates result in oversized equipment. Oversized systems will heat or cool the conditioned space to the desired temperature in a very short amount of time, but this short cycling reduces both the lifespan and energy efficiency of the equipment.

In cooling situations, oversized air conditioning units cannot adequately dehumidify the conditioned space because they never reach a steady operating state. This can cause a number of problems, including mold, rot, poor indoor air quality, and uncomfortable living conditions for occupants. It is also a serious liability risk to the builder because excess moisture can infiltrate SIP joints.

When conducting a Manual J calculation, make sure the HVAC professional has the proper information about the building, including the R-values of the SIPs that will be used. When doing a preconstruction

estimate, assume 1 air change per hour at 50 pascals (ACH50) as the rate of air infiltration. This rate is easily achievable with a complete SIP building enclosure that is properly installed and sealed.

Ducts

Another benefit of SIP construction is that all ductwork is located inside the conditioned space. Ductwork that is inside conditioned space does not have to be insulated, and any duct leakage spills into the home instead of into an unconditioned attic. The airtightness of SIP homes also allows duct runs to be shortened in some situations, adding to the overall cost savings of SIP construction.

Ventilation

Controlled ventilation systems provide fresh air for building occupants and exhaust polluted air to the outside. There is no such thing as building a house too airtight. Issues only arise when irresponsible builders or HVAC contractors fail to provide adequate ventilation in airtight homes.

There are a number of ventilation systems compatible with SIP homes. Systems typically involve incorporating fresh air through the central air handling unit and providing exhaust-only systems in kitchens and bathrooms. Heat recovery ventilators, energy recovery ventilators, automated fan cyclers, and fans equipped with humidistats are all popular options for SIP homes. Ventilation systems vary greatly by climate zone so make sure to discuss ventilation with a qualified HVAC professional.

Testing the Envelope

The exact amount of air infiltration through the building enclosure in a single family home is measured by a blower door test. The test is performed by a certified Home Energy Rater (HERS Rater) as a necessary part of calculating a home's Home Energy Rating (HERS Index) or qualifying for ENERGY STAR. The HERS rater places a calibrated fan system over the home's door and measures the amount of air that passes through the fan to maintain the pressure difference of 50 pascals between the inside and outside of the home.

The test results indicate how much air is leaking through the building enclosure, expressed in cubic feet per minute at 50 pascals (CFM50) or air changes per hour at 50 pascals (ACH50).

Blower door testing can be combined with a smoke stick or fog machine to visibly identify where leaks are in the building envelope. The test should be conducted after electrical and plumbing contractors have completed their work so any unsealed penetrations can be identified and sealed.

Combustion Appliances

Natural gas or propane combustion appliances for hot water heating and space heating need to be sealed combustion, power vented, or direct vented if they are to be placed inside the conditioned space of a SIP home. Combustion ranges should only be used with a range hood that vents directly to the outside. If not vented, combustion appliances pose an air quality risk to occupants and a fire risk if large enough pressure differences occur.

Woodstoves, wood burning fireplaces and natural gas fireplaces also require special considerations in SIP homes. Refer to the *Builder's Guide to Structural Insulated Panels (SIPs)* for more information.

Summary

As discussed in previous chapters, the performance and durability of a SIP building enclosure depends on proper air sealing. This needs to be communicated to any electrical and plumbing subcontractors who may be unfamiliar with SIP construction. It is best to discuss this at a preconstruction meeting, where the electrical and plumbing design of the home is reviewed. Examining the electrical and plumbing plans before ordering a SIP package allows the SIP installer to order custom electrical chases if needed and design for a wet wall or section of wood-framed wall if plumbing must be placed in the exterior walls.

HVAC is equally important to the energy efficiency, durability, and indoor air quality in a SIP home. SIP builders should work with a qualified HVAC contractor that will consider the reduced air infiltration and insulating abilities of a SIP building enclosure when specifying an HVAC system. HVAC contractors can also provide assistance in determining a climate-specific ventilation strategy to provide fresh air for building occupants.