

BC CARPENTER APPRENTICESHIP PROGRAM

LEVEL 2

2018 (Harmonized)

Line I: Finishing Materials

Competency I-4: Install Exterior Finishes

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Version 2, New, November 2017

ISBN 978-0-7726-7153-0

Acknowledgments

The Industry Training Authority of British Columbia would like to acknowledge the Carpentry Articulation Committee and Open School BC, a division of the BC Ministry of Education, as well as the following individuals and organizations for their contributions in updating the BC Carpenter Apprenticeship Learning Guides:

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Symbol Legend



Electric shock: This icon is a reminder for potential electric shock.



Explosive: This icon is a reminder for a possibly explosive situation.



Flammable: This icon is a reminder for a potentially flammable situation.



Important: This icon highlights important information.



Poisonous: This icon is a reminder for a potentially toxic/poisonous situation.



Resources: The resource icon highlights any required or optional resources.



Safety gear: The safety gear icon is an important reminder to use protective equipment.



Self-Test: This icon reminds you to complete a self-test.

We want your feedback! Please go to the BC Trades Modules website (www.bctradesmodules.gov.bc.ca) to enter comments about specific sections that require correction or modification. All submissions will be reviewed and considered for inclusion in the next revision.

Program Outline

Line B – Documentation and Organizational Skills

B-1 Use Construction Drawings and Specifications

B-2 Interpret Building Codes and Bylaws

Line C – Tools and Equipment

C-2 Use Portable Power Tools

C-3 Use Stationary Power Tools

C-4 Use Oxy-Fuel Equipment

Line D – Survey Instruments and Equipment

D-2 Use Site-Layout Equipment

Line F – Site Layout

F-1 Lay Out Building Locations

Line G – Concrete Formwork

G-4 Build Slab-On-Grade Forms and Suspended Slab Forms

G-7 Place and Finish Concrete

Line H – Wood Frame Construction

H-2 Select Framing Materials

H-4 Build Wall Systems

H-5 Build Stair Systems

H-6 Build Roof Systems

Line I – Finishing Materials

I-1 Describe Roofing Materials

I-2 Install Doors and Hardware

I-3 Install Windows and Hardware

I-4 Install Exterior Finishes

Line J – Building Science

J-1 Control the Forces Acting on a Building

J-2 Control Heat and Sound Transmission

J-3 Control Air and Moisture Movement in Buildings

Competency I-4: Install Exterior Finishes

Creating a weathertight exterior envelope for a building requires the carpenter to have a good understanding of the materials used in exterior finishing. This Competency describes the materials and procedures used for the exteriors of residential and commercial buildings.

Learning Objectives

When you have completed the Learning Tasks in this Competency, you will be able to:

- describe building envelope requirements
- describe exterior finishing materials
- describe the application of exterior finishes
- install exterior finishing materials

Competencies

Written: “Install Exterior Finishes”

- You will be tested on your knowledge of exterior finish materials and the accessories and fasteners used with them.
- You will be tested on your knowledge of the terminology and methods of installation for various exterior finishing materials.

Practical: You will be required to install exterior siding materials including flashing to a wall with an envelope penetration. The materials are to be installed as per manufacturer’s specifications and *BC Building Code* requirements.

LEARNING TASK 1

Describe Building Envelope

The purpose of an exterior envelope is to protect building components from moisture damage. Moisture can be in a liquid, vapour or solid state. Rainwater and snow/ice melt are the typical liquid sources for which protection is required.

Rainwater penetration of exterior building envelopes is a major concern and was the leading cause in British Columbia's leaky condo crisis. Rainwater penetration may be from a direct source such as wind-driven rain hitting a wall. It can also be from the effects of gravity when water from higher up a wall runs down its surface. A third source is bounce. When rainwater hits a deck, the ground or a roof that's adjacent to a wall, it can splatter and bounce against the wall surface. An effective exterior needs to protect against all three types of liquid entry.

The exterior envelope (cladding) normally consists of three elements: a sheathing membrane, a capillary break and exterior cladding (Figure 1). The main protection against liquid entry is the exterior cladding, which must be designed and installed to shed water to the outside of the building. In most cases, exterior cladding must have a pleasing appearance, and this can present additional challenges.



Figure 1—Components of a rainscreen wall

First and Second Planes of Protection

It can be very difficult to achieve 100% protection against wind-driven rain. Cladding must last many years, and even when done well, it will suffer from mechanical damage, weather and lack of maintenance.

The exterior cladding deflects the water downward and keeps it from entering the interior. It's nearly impossible for cladding to prevent all leakage and moisture penetration. Because of this, a second plane of protection is normally required behind the exterior cladding. The second plane protects the building from the small amounts of water that might make it through the cladding.

The *BC Building Code (B.9.27.2.2(4))* states that a building of residential occupancy must have exterior walls covered with a "cladding assembly consisting of a first plane of protection and a second plane of protection." This refers to exterior cladding, such as bevel siding, as the first plane of protection, and some form of sheathing membrane (building paper or house wrap) as the second plane of protection.

The exception to this is when a face-sealed cladding is used, such as plywood sheets. When this method is used, joints must be supported and covered with battens, be ship-lapped or be sealed with other methods. Locked seamed sheet metal cladding is also considered face-sealed and doesn't require a second plane of protection. Although the *Building Code* does not require a second plane of protection for face-sealed walls, studies have shown this wall cladding system to be unreliable due to building movement, sealing failure at joints and poor building maintenance.

Capillary Break

Differential pressure and wicking can suck water into and through small openings. Providing a capillary break will reduce this and will allow for drainage of any water that makes it past the first plane of protection (siding).

This capillary break is known as *rainscreen*. It consists of a minimum 10-mm gap between the inside face of the cladding and the building wrap. The purpose of the gap is so that any water that makes its way through the exterior cladding can drain away or dry without compromising the second plane of protection and causing damage to the structure of the building.

When Is Rainscreen Required?

When is the capillary break required? Generally speaking: in relatively warm, moist climate zones. More specifically, according to *BC Building Code article B.9.27.2.2(5)*, the capillary break is needed where:

- The number of degree-days is less than 3400 and the moisture index is greater than 0.90.
- or
- The number of degree-days is 3400 or more and the moisture index is greater than 1.00.

The number of degree-days is the total number of days that the average temperature of an area is below 18°C, multiplied by the number of degrees below 18°C.

For example, if there are 100 days each year when the average temperature is 10°C, this results in 800 degree-days (100 days × (18°C – 10°C)). If there are another 50 days in which the average temperature is 5°C, this results in an additional 650 degree-days (50 days × (18°C – 5°C)). These degree-days are added together (along with all other degree-days for that region) to determine the annual total.

BC Building Code Div B, Appendix C gives climatic information for many different towns and cities in BC. (Contact the local regional or municipal building department for areas that are not listed.) For example, North Vancouver has 3000 degree-days and a moisture index of 2.07. According to the Code, a dwelling unit built in North Vancouver requires a rainscreen wall (capillary break).

Conversely, Kamloops has 3650 degree-days but a moisture index of only 0.23. Because the moisture index is less than 1.0, rainscreen is not required.

If there is any doubt as to whether rainscreen is required, check with the local building or development services department.

There are exceptions for the requirement to provide a rainscreen:

- Mass walls—a *mass wall* is a wall that is cast or poured in place, such as an insulated concrete form (ICF) wall. Mass walls can be exposed to moisture for prolonged periods of time before the moisture will work its way through.
- Walls that do not contain moisture-sensitive materials and any intersecting or supported floors also do not contain moisture-sensitive materials.
- Cladding that has a built-in capillary break and drainage, such as vinyl and some profiles of vertical metal siding.
- Exterior walls that are between two non-conditioned spaces, such as gable end walls.

Parts of a Cladding System

A cladding system will usually consist of an exterior finish (siding) over a moisture barrier (Figure 2). It may include a capillary break (rainscreen).

Exterior Finish

The exterior finish is the initial barrier to precipitation—it must be made from materials that are stable when they become wet. The siding materials must overlap to naturally shed the water from the surface. When possible, it's best to create a drip edge to reduce water intrusion by capillary action.

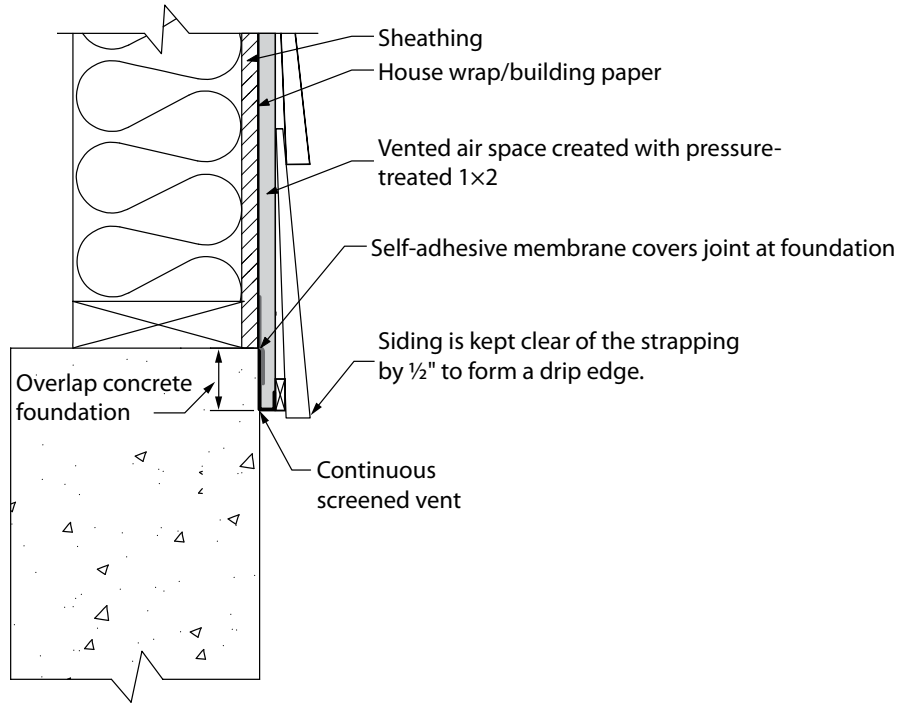


Figure 2—Rainscreen system

Detailed information on cladding types, installation, flashing, and trims will be covered in later Learning Tasks.

Rainscreen

Maintaining an effective capillary break cavity (drainage space) behind the exterior finish is the most important component of the rainscreen. Water that leaks through the exterior finish will collect in the drainage space, as will water vapour that may be coming from the inside of the building. This space is normally created by applying vertical strapping over the sheathing membrane and installing the exterior cladding to the outside of the strapping.

Although the Code doesn't require strapping to be treated, good building practice is to use pressure-treated strapping. 1x2 pressure-treated lumber is sometimes used, as is 10 mm x 38 mm CCA-treated plywood strips. The CCA plywood is becoming more popular with many builders because the treatment is CCA instead of ACQ, resulting in less likelihood of fastener corrosion due to electrolysis.

There are also a number of non-moisture-susceptible open mesh materials manufactured in large mats that can be used instead of strapping. These mats come in rolls and are fastened over the sheathing membrane to the sheathing. The cladding is applied over the mat and fastened through the mat to the sheathing and/or framing (Figure 3).

The cavities must allow for drainage at the bottom (Figure 4). Venting the capillary break cavity at the top and installing bug screens both top and bottom is not required by the Code but is considered good practice. Having ventilation at the top and bottom will allow for air circulation and help dry the drainage cavity, reducing the likelihood of mould and mildew forming.

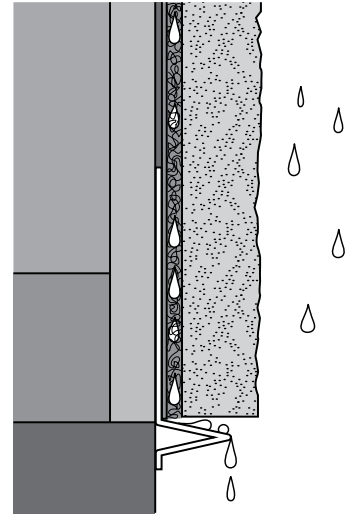


Figure 3—Stucco over mat drainage layer

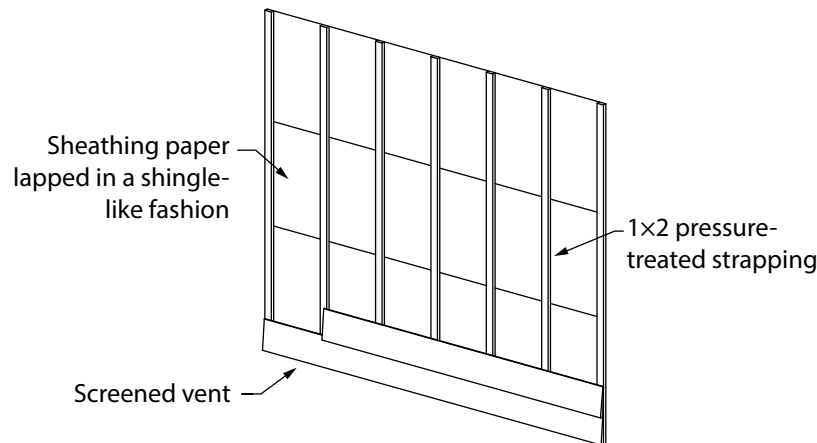


Figure 4—Ventilation space

The top of the wall can be vented just below the soffit space or at each floor level. Drip flashings are used to deflect the rainwater at floor levels. It's important that the rainscreen not vent into the soffit area as this can result in moisture entering the attic. It's also important that venting at the cavity bottom be designed to shed any rain bouncing off decks, roofs or sidewalks.

Drainage Cavity Compartments

Wind causes pressure differentials. One of the purposes of the drainage space is to equalize this pressure. However, if the drainage space continues around the corners of a building, a pressure differential will be created.

Drainage spaces should be constructed with compartments that allow the pressure to equalize without causing a differential. The compartments should not continue around the corners of the building (Figure 5 and Figure 6) or extend for more than one storey in height.

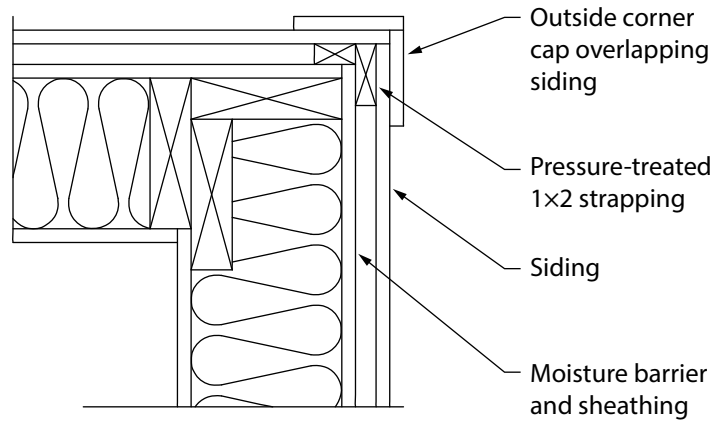


Figure 5—Sealing drainage compartments at outside corners

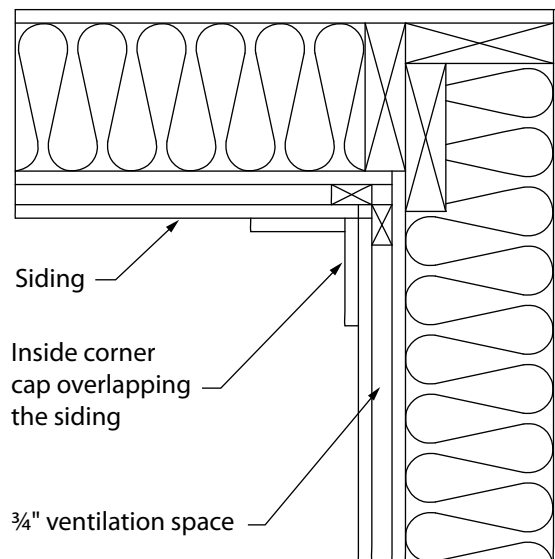


Figure 6—Sealing drainage compartments at inside corners

Moisture Barrier

The moisture barrier should be a water-shedding material. It consists of sheathing (building) paper, house wrap or peel and stick. The moisture barrier is referred to by the *Building Code* as a *sheathing membrane*. It's intended to work as a second plane of protection and intercept all rain and snow that makes it past the cladding. Care must be taken with all joints and penetrations (including windows and doors) to create a moisture-shedding barrier.

Sheathing Paper

Although the *Building Code* only requires one layer of 30-minute paper, most warranty providers require two layers of 30-minute sheathing paper or one layer of 60-minute paper. The building paper is applied over the exterior surface of the building. The layers are lapped in a shingle-like fashion, with top sheets overlapping lower sheets. All horizontal and vertical joints require a minimum 100-mm (4") overlap.

Building paper is not waterproof, but it provides adequate protection when a 10-mm drainage cavity has been provided. In areas where the drainage cavity is partially blocked, a section of waterproof membrane (peel and stick) may be required.

House Wrap

House wrap comes in larger rolls than sheathing paper and will cover large areas without joints. Joints in house wrap should be sealed with tape to create a continuous moisture barrier. House wrap is more resistant to tearing than building paper and provides a better air barrier.

House wrap is non-perforated, but it does have microscopic pores that resist bulk water and air penetration while allowing moisture vapour to pass through.

Self-Adhesive Membrane (SAM)

Self-adhesive waterproof membrane (peel and stick) is applied to areas where moisture leakage is anticipated. These membranes are overlapped to shed any water that may intrude through the exterior finish. They're installed around window and door openings and along the base of walls.

Rigid Insulation Board

Rigid insulation board may be used instead of sheathing paper. All joints must be sealed if it's a type subject to moisture deterioration. If not subject to moisture deterioration, then joints must be sealed, lapped, tongue-and-grooved or otherwise designed to drain water to the exterior.

Liquid Applied Barriers

Liquid applied barriers (LABs) are now available in Canada from a number of companies. LABs are rolled, sprayed or trowelled on, depending on the product. They create an approximately $\frac{3}{32}$ " membrane on the wall sheathing that is extremely tear resistant. Unlike building paper and house wrap, LABs are 100% waterproof. LABs are normally applied prior to window installation and are designed to go over plywood, OSB, exterior gypsum board, glass clad and other types of wall sheathing.

Used as part of an exterior insulation finishing system (EIFS), grooved rigid insulation is usually applied against the LAB to create a drainage cavity (Figure 7). It's expected that LABs will also become popular in low-rise residential construction.

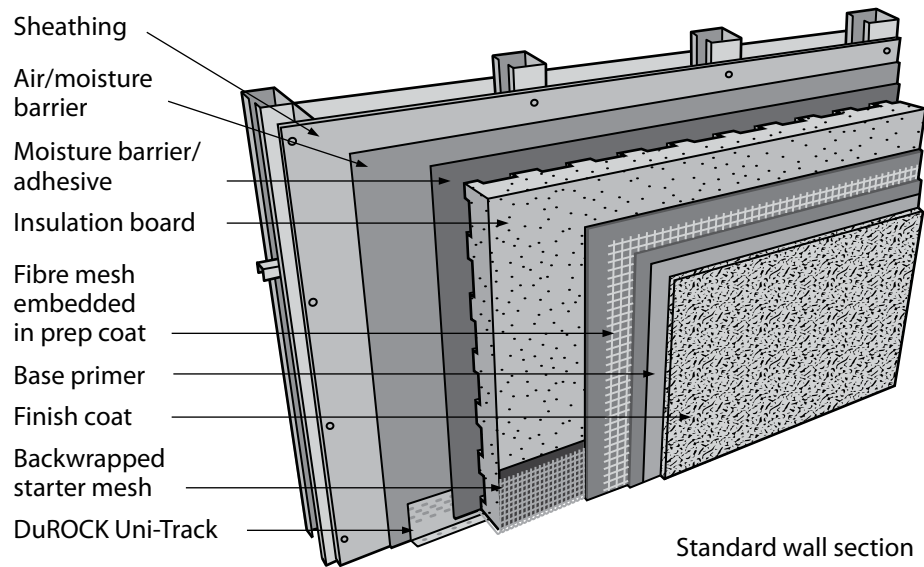


Figure 7—EIFS wall cladding showing grooved rigid insulation providing a drainage cavity

Best Practices

Further explanation of the *Building Code* requirements can be found at:

http://www.housing.gov.bc.ca/pub/bulletins/B_08_02_Capillary_Break_Rainscreen.pdf

A “best practices” guide, titled *Building Envelope Guide for Houses*, is available from BC Housing, Licensing and Consumer Services at:

<http://www.bchousing.org/research-centre/library>

As most residential buildings require a third-party warranty, it’s important to check with the warranty provider to find out if there are any rainscreen requirements in addition to the *Building Code* provisions.

Large commercial buildings and other buildings that fall under *Parts 3 and 4* of the *BC Building Code* are required to use *Part 5* of the Code to determine exterior envelope requirements.

National Energy Code

The *National Energy Code of Canada for Buildings (NEC)* applies to buildings that do not fall under *Part 9* of the *Building Code*. It sets minimum floor, wall, roof and window insulation values along with other energy-related requirements.

The *NEC* divides Canada into zones based on heating degree-days. Zone 4 is for areas with less than 3000 degree-days and includes Victoria, BC. The overall wall rating must be a minimum R-18 for Zone 4. Zone 8 is for areas with more than 7000 degree-days and includes Canada’s far north. The minimum overall wall insulation requirement for Zone 8 is R-31.

The insulation levels set by the *NEC* include all materials that make up wall assemblies (including siding) and also take thermal bridging of framing members into account. Many buildings that fall outside the scope of *Part 9* use exterior insulated finishing systems (EIFS) to achieve the needed R-value.

EIFS incorporate insulation and a waterproof exterior finish in an integrated composite system. Rigid lightweight insulation is covered by a thin synthetic stucco to form an airtight exterior barrier, adding to the overall R-value of the wall. Some manufacturers have designed EIFS walls with a built-in rainscreen.



Now complete Self-Test 1 and check your answers.

Self-Test 1

1. What is a sheathing membrane?

2. What are the three sources of rainwater penetration of cladding?

3. Why is face-sealed cladding unreliable?

4. Sketch a rainscreen and label its parts.

5. How is the wall sheathing paper installed?

6. What are the three components of a rainscreen?

7. Why are the vent spaces not continued around the corners of the building?

8. What type of strapping is normally used to make the vent space?

9. According to the *BC Building Code*, when is a capillary break required?

10. What do the acronyms EIFS and LAB stand for?

LEARNING TASK 2

Describe Exterior Finish Materials

The purpose of exterior wall coverings (cladding) is to protect buildings and occupants from weather. Wall coverings can be made of wood, vinyl, metal, synthetic stucco, cement stucco, cement-fibre, brick and other materials. Each material has advantages and disadvantages and its own method of installation. Engineered materials must meet both the *Building Code* as well as the manufacturers' installation requirements.

Wood Products

Wood products include boards, sheets, shakes and shingles. Western red cedar is the main species used for exterior cladding, as it's naturally weather-resistant and has the lowest coefficient of expansion due to moisture change of all of the wood species available in BC. Pressure-treated wood of different species is also used for exterior finishing.

Cedar from the heartwood of old-growth trees produces clear stock that is dark in colour and is relatively free of knots. Sapwood is not resistant to the weather and should not be used for exterior finishing.

Wood continually expands and contracts due to changes in moisture content. Seasonal changes in relative humidity can cause a dimensional change of up to 6 mm (¼") in the width of a siding board. Wood must be installed to allow for this movement.

Pressure-treated lumber is excellent for exterior use when appearance is not a prime concern. Some pressure-treated lumber has indentations every 13 mm (½") that leave the surface pock-marked and unattractive even after finishing.

Wood Shakes and Shingles

The main difference between shakes and shingles is that shingles are thinner than shakes. Shingles are 6–13 mm (¼–½") thick at the butt (thick) end, smooth on both sides and tapered. Shakes are thicker and can be split, resawn or tapersawn.

Whether split or sawn, cedar shakes and shingles can last for over a hundred years. Cedar was used for the roofing on early settlers' and explorers' cabins. Many of these cabins are still standing in the interior of British Columbia with the cedar roof still resisting the elements.

The shingle materials used for sidewall installation are the same as those used for roofing except that the exposure may be increased. For example, a 16" shingle used for a sidewall installation can have a maximum exposure of 7½". The maximum exposure for a 16" shingle used on a roof is only 5".

Split Shakes

Split shakes generally last longer than shingles because the split surface resists weather more effectively. Split shakes are not usually used for exterior wall finishes because the resulting finish is very rough.

Resawn Shakes

A resawn shake is a thick shake that is tapersawn into two shakes. Each shake will have a split surface and a smooth sawn surface. This type of shake lies flatter on a wall than a split shake.

Tapersawn Shakes

A tapersawn shake resembles a large shingle with both faces sawn instead of being split. Thickness at the butt will be at least 15 mm ($\frac{5}{8}$ ").

Cedar Shingles

Cedar shingle grades and uses:

- No. 1** No. 1 shingles are the best grade of shingles that can be used for roofs and sidewalls. These top-grade shingles are 100% heartwood, 100% clear and 100% edge-grain. A blue label identifies No. 1 shingles.
- No. 2** No. 2 shingles meet the *Building Code* for use as a roofing and sidewall shingle. Due to the flat grain, these shingles tend to warp and twist, giving an unlevel surface. The No. 2 grading requires that the shingles have no knots for 10" on 16" shingles, 11" on 18" shingles and 16" on 24" shingles. Flat grain and limited sapwood are permitted in this grade. A red label identifies No. 2 shingles.
- No. 3** No. 3 shingles are only allowed to be used as an under-course for sidewall applications. The number three grading requires that the shingles have no knots for 6" on 16" shingles, 6" on 18" shingles and 10" on 24" shingles. A black label identifies No. 3 shingles.

Fancy butt cedar shingles are No. 1 shingles that have their butt ends cut to a specific pattern. These shingles are often used to emulate the Victorian gable end look in modern residential buildings (Figure 1).



Figure 1—Fancy butt shingles

Machine Grooved Shakes and Shingles

Certigroove® Red cedar shakes and shingles are made from No. 1 cedar tapersawn shakes and shingles and have been machine-grooved to give a shake look. They're kiln-dried and have the two edges cut parallel. This product comes to the job in a cardboard carton that contains enough shakes/shingles to cover 100 square feet of wall area. These may be primed for painting or left clear for staining. This shake/shingle may be installed using a single- or double-course method.

Wood Siding

Wood siding is available in many sizes, types and finishes. It can be lumber siding applied vertically or horizontally, or panel-type siding installed vertically.

Lumber Siding

Lumber siding is overlapped or matched at its edges. Lumber siding can be plain boards, bevelled boards or edge matched boards.

Lapped Siding

Bevelled siding is made from taper cut boards. They are installed horizontally and lapped to shed water. Lapped bevel siding must overlap by at least 1" and matched siding must overlap by at least ½". Figure 2 shows lapped bevel wood siding.

Plain boards such as 1×8 or 1×10 also can be installed in a similar manner.

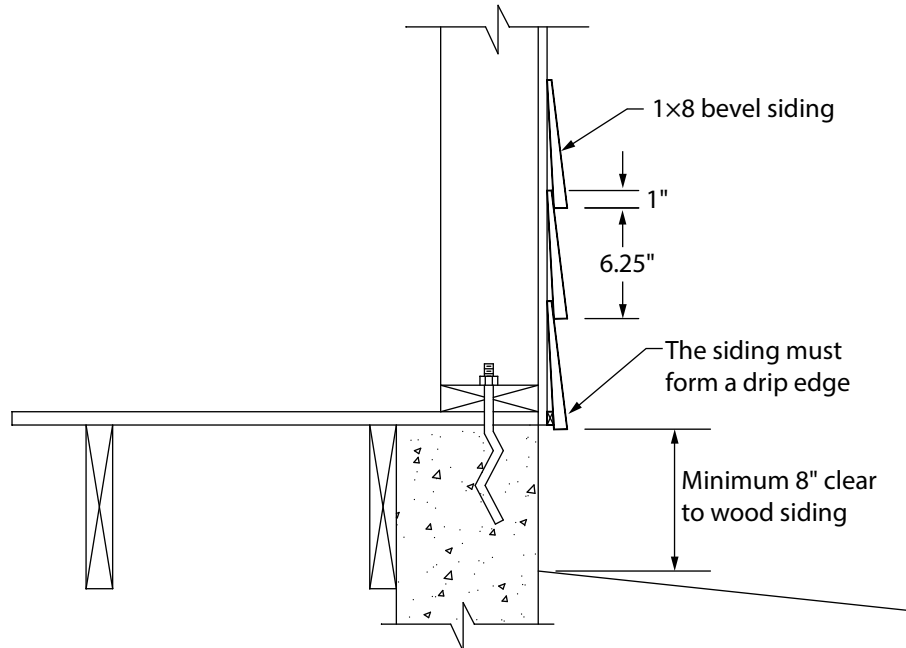


Figure 2—Lapped bevel siding

Board and Batten

Board and batten siding is shown in Figure 3. This type of siding can only be used vertically. Board and batten is usually created using rough-sawn lumber that is a full 1×8 or 1×10. The battens are usually at least 2" wide.

Channel Siding

Channel siding is a matched edge siding. It can be used vertically or horizontally. The overlap is $\frac{1}{2}$ ", leaving a channel that is approximately $1\frac{1}{2}$ " wide. This siding can be used with the channel exposed or with the "V" groove exposed. Having the channel side exposed is most common. The channel side is usually referred to as the *face* of the board. The face is rough-cut and the back, or "V" groove side, is planed smooth. The "V" groove side is used to finish wooden soffits.



Figure 3—Board and batten siding

Drawbacks of Lumber Siding

The use of lumber siding is limited because:

- Obtaining quality lumber is difficult. Siding should be free of knots and made from heartwood cedar. Clear cedar siding can be purchased, but it's more expensive than most other sidings.
- Wood siding requires regular maintenance: paint or stain should be applied every two to five years.
- If lower quality siding is used, knots can fall out and the boards may check and split.
- Wood siding takes longer to install than most other exterior finishes.
- Wood is more susceptible to rot than many other types of siding.

Panel-type Wood Siding

Sheets of plywood, hardboard, OSB and waferboard can be used as an exterior finish. The face of the plywood has shallow grooves at 8" o.c. to give the appearance of vertical boards. Joints in the panels and the nailing can be hidden by the grooves.

This siding is more cost effective than lumber siding, is quick to install and will withstand weather if maintained regularly.

Low cost clapboard (horizontal lap) siding made from these materials is also available.

Vinyl and Aluminum Siding

Vinyl siding is popular because it's the most economical siding available. The material is inexpensive, lightweight and easily installed. Vinyl can be used for new construction or for renovation work.

The design of vinyl siding produces a capillary break and the bottom of each sheet has small drainage holes.

Vinyl siding is used more frequently than aluminum siding because it comes in more colours and profiles, is less expensive and does not dent.

Vinyl products are made with solid-coloured vinyl. This means that any damage from scratches or abrasions will be less visible.

Vinyl siding comes in 12-foot lengths.

Vinyl is more subject to dimensional changes due to temperature than aluminum. A 12' sheet of vinyl will change length by $\frac{3}{8}$ " from summer to winter.

Vinyl materials must never be butted up tight to mouldings or trim. Always leave a gap for expansion. Never nail the siding solidly to the building. Vinyl siding is hung on the nails. Each piece must be free to move from side to side.

The bottom of each course of vinyl siding can be unzipped for retrofitting wires and cables, such as antenna and phone lines. As vinyl siding can easily be damaged by heat and impact, this unzipping feature will allow damaged pieces to be easily replaced.

Aluminum siding is quite similar to vinyl siding, but it has lost its popularity due to cost and because it's easily dented and scratched. Aluminum siding may be encountered by carpenters when doing renovation work and should be handled carefully to avoid damaging it.

Stucco

There are two distinctly different types of stucco:

- synthetic (acrylic) stucco
- cement stucco

Synthetic stucco is a proprietary mix of additives, fibres and acrylics applied in two coats. The overall thickness is much less than cement stucco.

Cement stucco is made from sand, cement, lime and water and applied in three coats.

Synthetic Stucco

Synthetic stucco is used as the finish in the exterior insulation and finish system (EIFS) cladding (Figure 4). This type of cladding is mainly used on commercial buildings, but was used in the 1980s on lower priced housing. Installations were often awarded to the lowest bid and done by unqualified applicators with the result that its reputation suffered and class-action lawsuits followed.

The EIFS proprietary systems normally consist of a layer of rigid insulation applied to framing or sheathing with adhesive or mechanical fasteners. A layer of mesh is then fastened over the rigid insulation and a base coat containing Portland cement is applied. The base coat governs the strength and durability of the finished product. The thickness of the mesh regulates how strong the base coat will be. Standard-weight mesh is used for upper storeys, and high-impact or heavyweight mesh for the ground-level walls. Corners often get a special mesh. A thin layer of synthetic stucco is then towelled, rolled or sprayed over the base coat.

The total thickness of the stucco can be as thin as a 25-cent coin. The EIFS system has been susceptible to leaking around windows and doors due to poor flashing and faulty installation. Rot of framing members has been common when EIFS was installed with no provisions in the system for water drainage. To deal with this issue, many manufacturers of EIFS products have developed EIFS that include rainscreen drainage cavities.

EIFS is also available in a prefabricated panellized form (Figure 5).



Figure 4—Example of an EIFS



Figure 5—Example of a panellized EIFS

Cement Stucco

Cement stucco provides a hard, dense, water-resistant finish. It must be a minimum of 15 mm ($\frac{3}{8}$ ") thick over the exterior walls. The stucco is usually applied in three layers over metal lath or stucco wire.

Stucco Wire

Stucco wire is installed over sheathing paper. The wire has bumps (self-furring devices) in the wires that space the wire away from the wall. The space is needed for the stucco to bond around the wire. The bumps are placed against the wall surface to space the grid of wires away from the wall.



Figure 6—Expanded metal lath

Expanded Metal Lath

Expanded metal lath is made from sheets of steel that have been punched with slits. The sheets are pulled or expanded to form a dense surface of fine holes (Figure 6). Expanded metal lath is used for extra reinforcement at corners and for overhead situations. The stucco sticks to the smaller holes much better than to the 2" grid of the stucco wire (Figure 7).



Figure 7—Stucco over expanded metal lath

Stucco Mixes

Cement stucco is a concrete-like mixture made from sand, cement, lime and water. The sand must be clean, washed masonry sand. Do not use unwashed sand. The lime is used to make the mixture workable and to help it stick to vertical and overhead surfaces.

The proportions vary slightly, but a basic mixture of 1 part Portland normal cement, ¼ part lime and 3½ parts sand will give a strong stucco mix. Add only enough water to make a workable mixture.

Mix the stucco thoroughly before the water is added and continue mixing during the addition of water. Maintain a consistent mixture from one batch to another, especially for the finish coat.

Application

Cement stucco is applied in three coats:

1. The first is the *scratch coat*—made with plain washed sand and grey in colour. Scratching with a broom or rake roughens the surface (minimum 6 mm thick).
2. The second coat is called the *brown coat* and has about 10% more lime and sand than the scratch coat. It's used to level the surface of the wall (minimum 6 mm thick).
3. The third coat uses white sand and colouring. It's the finish texture coat and provides the final look to the stucco (minimum 3 mm thick).

Brick Veneer

A *veneer* is a thin layer of material on top of another material. Veneer plywood has thin layers of wood placed one on top of the other. Brick veneer construction is a thin layer of brick over other construction (i.e., brick siding).

Brick veneer is decorative only and carries no load. It forms the primary plane of protection/cladding. The brick veneer is supported on a ledge formed into the concrete foundation wall or a steel angle iron that is bolted to the foundation wall (Figure 8).

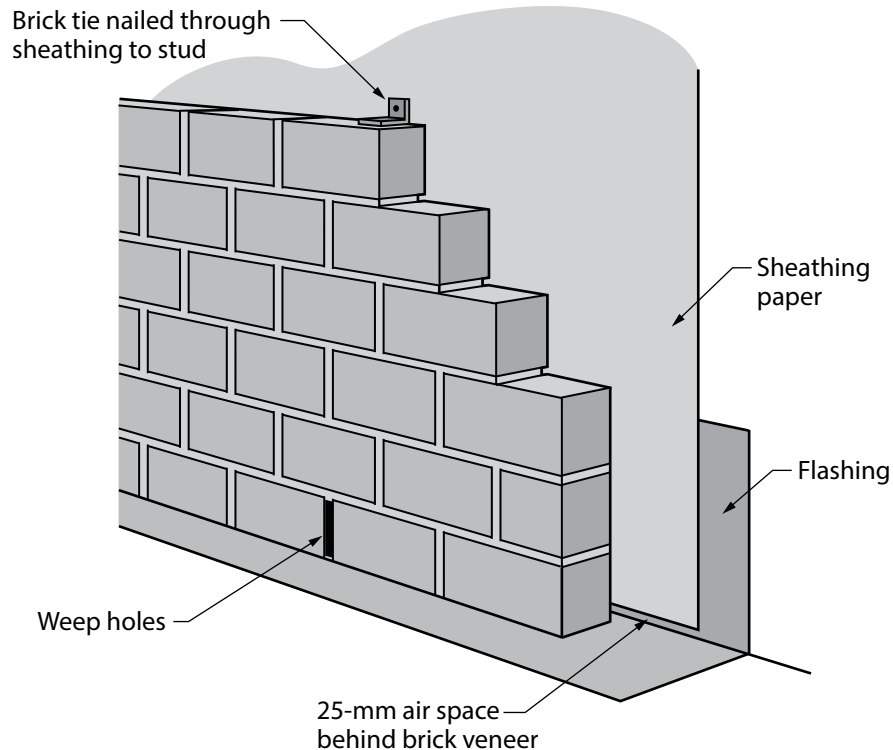


Figure 8—Brick veneer

A 25-mm air space is left behind the veneer to allow moisture to evaporate. If there is significant moisture, it will run down the back of the bricks and collect at the bottom. Flashing protects the building from the moisture and directs the water through the weep holes onto the ground.

As brick is porous, it will allow some moisture through. This makes the 25-mm air space and weep holes extremely important. Metal ties anchor the brick veneer to the wall framing.

Stone veneer can be installed in a similar manner to brick veneer. Brick and stone are listed as masonry veneer by the *BC Building Code*.

Cultured Stone

Cultured stone (Figure 9) is a concrete product that looks like real stone but is only a quarter the thickness. Wall sheathing is protected with two layers of a waterproof barrier, and then a metal lath is applied. The cultured stone is fixed to the lath with a bed of mortar.

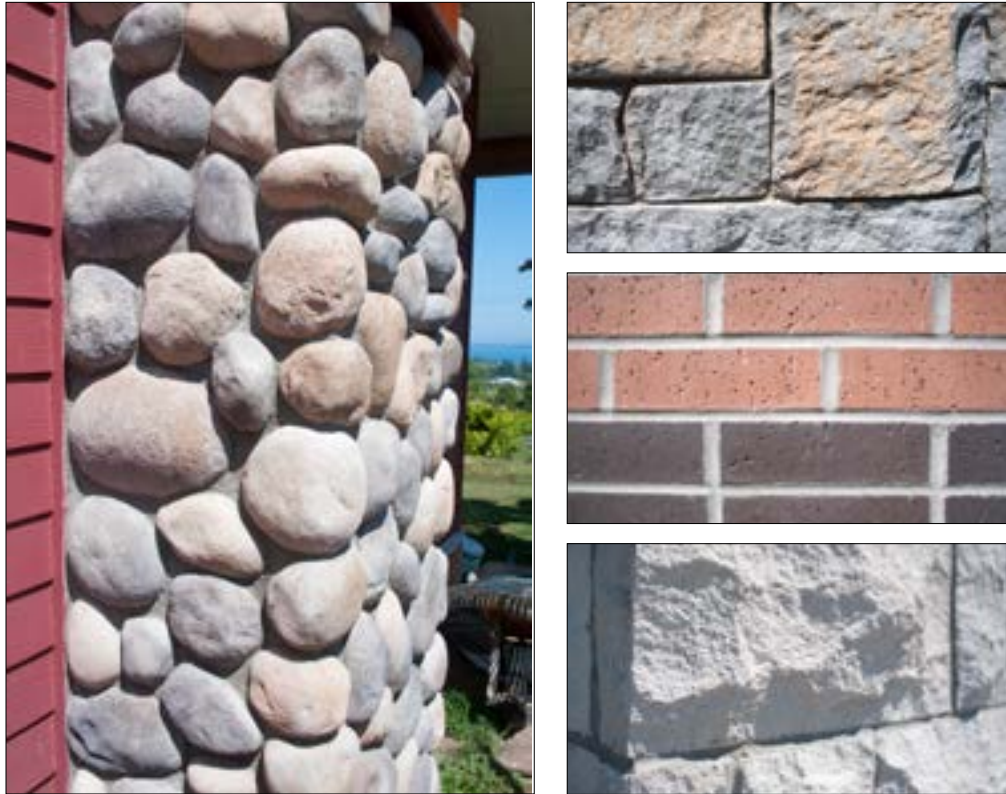


Figure 9—Examples of cultured stone veneer

Sheet Metal Finishes

Ribbed or crimped metal panels, similar to those used for roofing, are available for finishing the exterior walls of commercial and industrial buildings (Figure 10). Flat panels are also available. Steel is a very durable and economical metal siding.

Sheet metal siding materials come in various widths and profiles and can be ordered to specific lengths. The finishes are baked enamel or vinyl plastic. Aluminum, copper and stainless steel siding materials are available but not often used.



Figure 10—Sheet metal siding with fasteners

Fibre Cement Siding

Composite fibre cement siding comes in a range of colours, textures and sizes (Figure 11). These dense, easily nailed materials are usually paint-primed or finish-painted at the factory and require less maintenance than wood siding. Commonly used for both commercial and housing, these panels are attractive but require more time to install than vinyl siding.



Figure 11—An example of fibre cement panels (left) and textured lap siding (right)

The panels are made from combinations of sand, cement and cellulose fibres. The finish texture can resemble stucco, clapboard or cedar shingles. The product is durable and fire-resistant, repels insects and requires little maintenance.

The first North American manufacturer of fibre cement siding was James Hardie Building Products in the 1990s. Since then, several other companies have started producing fibre cement siding for the Canadian market.

Products now include lap siding, shingles, shakes, panels, vertical panels and a raised aggregate finish. Many fibre cement siding products are considered sustainable building products, as they contain up to 50% recycled products.

Asphalt Shingle Siding

Although asphalt shingles are mostly a thing of the past, the *BC Building Code* allows them to be used as siding. These are the same shingles that are used for roofing, and they are installed in the same manner as for roofs with slopes of 1 in 3 and greater. Like most other siding types, they require a rainscreen application for many British Columbia locations. This can be difficult to achieve with this type of product.

Overcladding

Overcladding is a process used to modernize older high-rise buildings. Many older high-rises, especially those built in the 1960s, are large energy consumers and are not considered aesthetically pleasing.

Overcladding often uses panellized metal cladding. The process adds insulation and usually incorporates a chase or plenum to allow for retrofitting services such as gas lines, Internet services and future telecommunications connections.

Exterior Finish Materials

Each type of exterior finish includes trim and accessories that are used to complete the installation. Flashing and caulking materials are often combined with trim to prevent the ingress of rainwater.

Exterior Casings

Door and windows may be trimmed with exterior casing. Casing helps to seal the connection between the exterior finish and the window or door. Decorative exterior casings are part of the architectural design of the building. Windows will most likely have to be replaced at least once over the lifespan of a building. Exterior cased windows offer several advantages when windows need replacement.

Exterior casing is made using brickmould, surfaced four sides (S4S) boards or surfaced one side and two edges (S1S2E) boards. Brickmould comes in several profiles. It's usually hemlock and kiln-dried (Figure 12). S4S boards (Figure 13) can be hemlock, fir or cedar, and S1S2E boards are usually cedar.

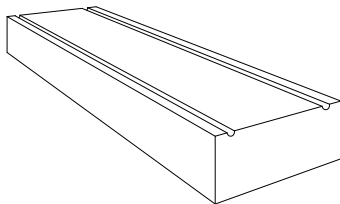


Figure 12—Brickmould

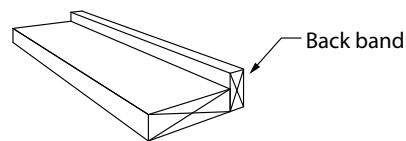


Figure 13—S4S moulding and back band

Brickmould dimensions are $2\frac{1}{4}'' \times 1\frac{1}{4}''$. It's installed on all three sides of a door to cap the door jamb and wall sheathing. The siding then butts into the edge of the brickmould. Brickmould is also used with windows.

S4S lumber is available in 2", 4", 6" and 8" widths and random lengths.

S1S2E is resawn lumber that is made from 2×4, 2×6, 2×8, or 2×10 S4S boards.

Water Table

Overlapping of the trim materials is very important to prevent rainwater from entering the building (Figure 14).

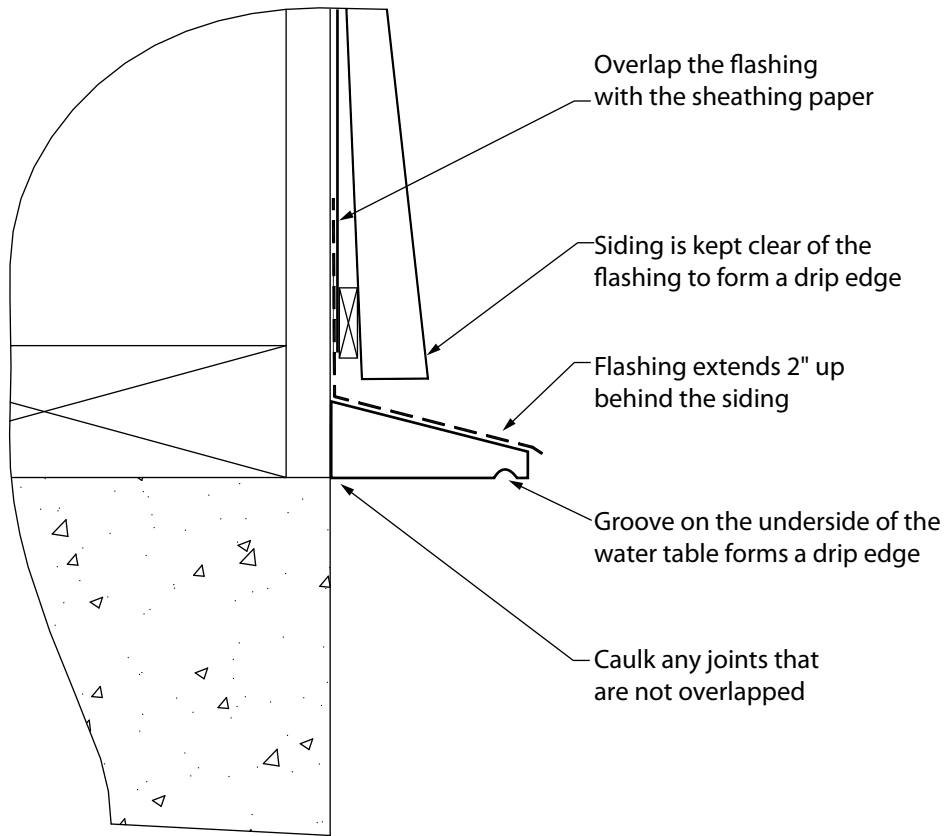


Figure 14—Weatherproofing the siding-to-foundation connection

A water table is used at the base of a wall to make a horizontal joint to the foundation or accent board. Figure 15 shows two typical uses.

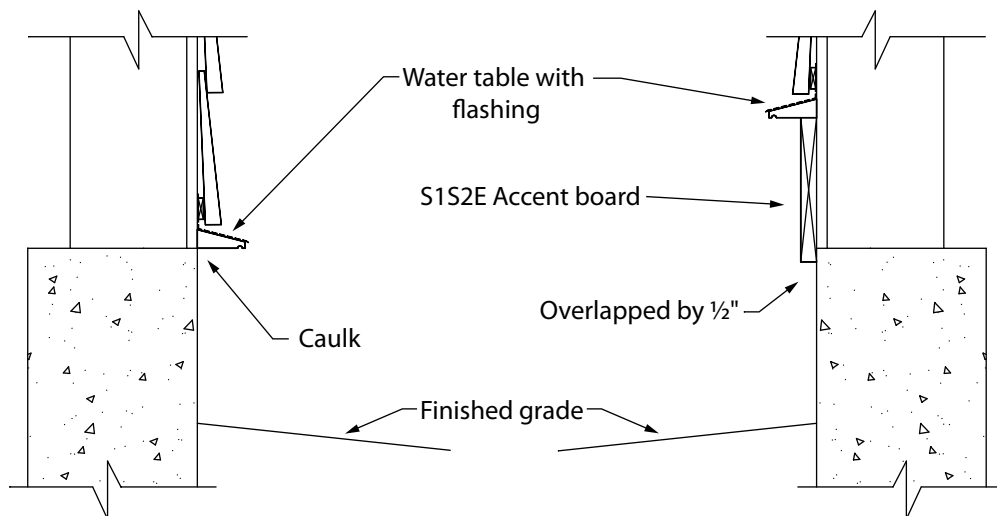


Figure 15—Water table uses

Drip Cap

A drip cap is the same shape as water table moulding, only smaller (Figure 16). A drip cap is used over doors and windows to form a sloping edge to deflect rainwater away from the building. Metal flashing often replaces the drip cap since flashing is needed on top of the drip cap in any case.

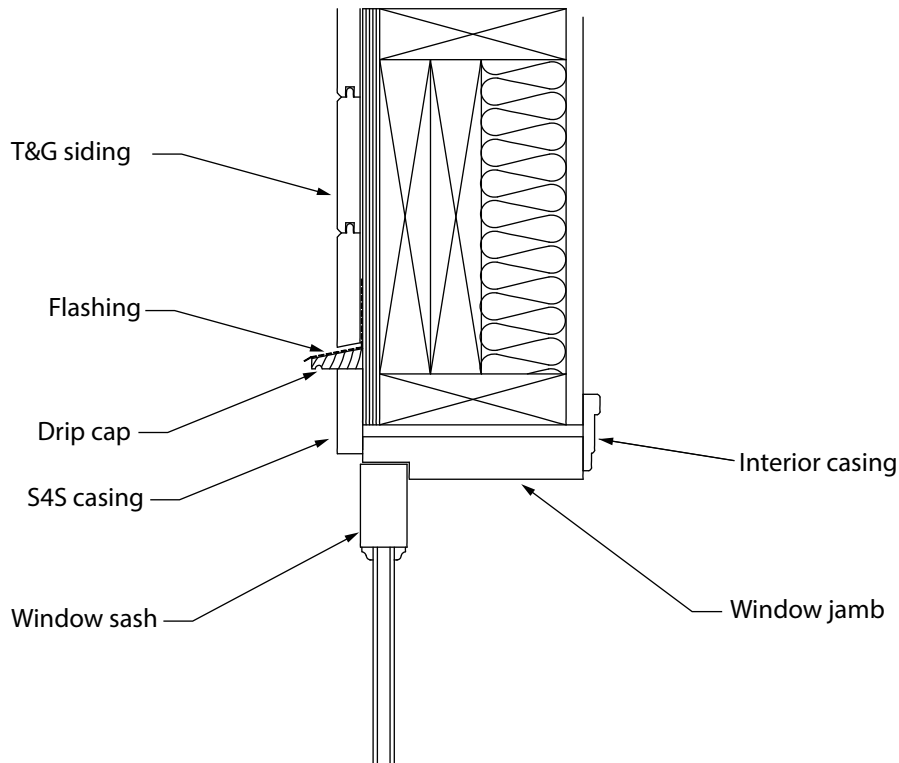


Figure 16—Drip cap over a window opening

Flashing

Flashing is required over exposed openings in exterior walls and at horizontal joints in the finish materials that are not overlapped by at least 25 mm (1").

Flashing may only be omitted over windows and doors that are protected by the roof projection. If the distance from the underside of the soffit to the window is more than $\frac{1}{4}$ of the projection, the window is considered unprotected and flashing must be installed.

For example, where the projection is 24" and the distance from the underside of the soffit to the window is 8½", flashing must be installed since 8½" is greater than 6" (24" \times $\frac{1}{4}$).

Flashing must extend up the wall at least 50 mm (2") behind the sheathing membrane and have at least a 6° slope toward the exterior to facilitate drainage. It must also lap over the door or window by 10 mm vertically and project past by at least 5 mm to form a drip edge (Figure 17).

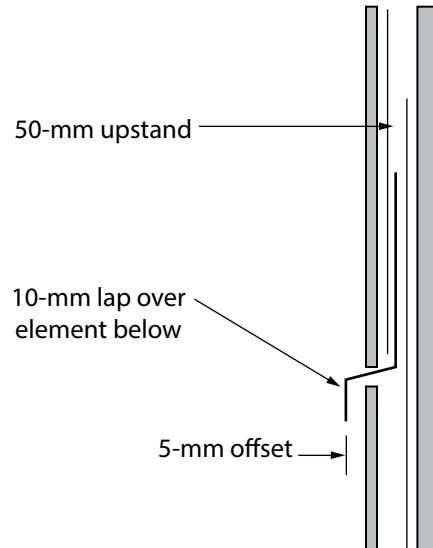


Figure 17—Flashing configuration

Window and door head flashings require minimum 25-mm high end dams. These are formed by folding and bending the flashing to create a waterproof joint (Figure 18).



Figure 18—End dams

Many types of wall penetrations, such as dryer vents and hose bibs, are not considered openings by the *Building Code* and are not required to be flashed. However, it's often a good idea to do so anyway.

Cornice and Trim Mouldings

There are many ways to finish the cornice of a building. Figure 19 shows a box cornice that's finished with aluminum fascia and soffit. J-trim is used to support the vented aluminum soffit material.

The use of a metal drip edge helps to protect the bottom edge of the roof construction. The lowest points on a roof are the most susceptible to leaks.

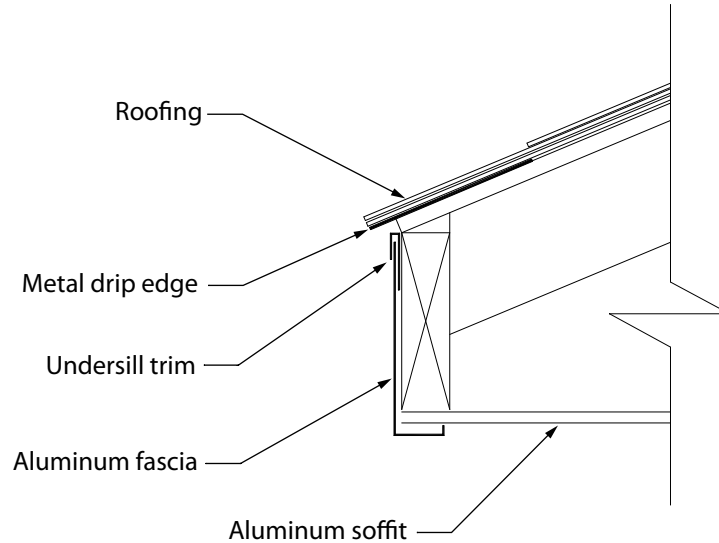


Figure 19—Aluminum finish of a box cornice

Screened vents are used with a wood soffit (Figure 20)

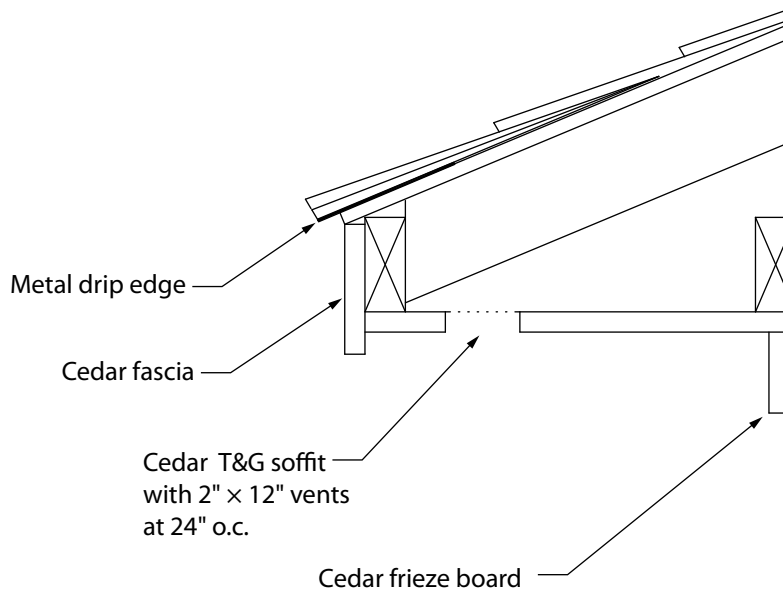


Figure 20—Box cornice finished in wood

The frieze is a moulding or a group of mouldings at the intersection of the soffit and the wall. The soffit space requires continuous ventilation, and provisions must be made to allow the soffit ventilation to connect to the attic ventilation.

Vinyl Trim

Vinyl siding is used extensively in residential building construction. The following are common trim pieces used with vinyl siding. Similar trim pieces are available in aluminum for use with aluminum soffits and siding.

A starter strip (Figure 21) is used to attach the bottom of the first siding board to the wall.

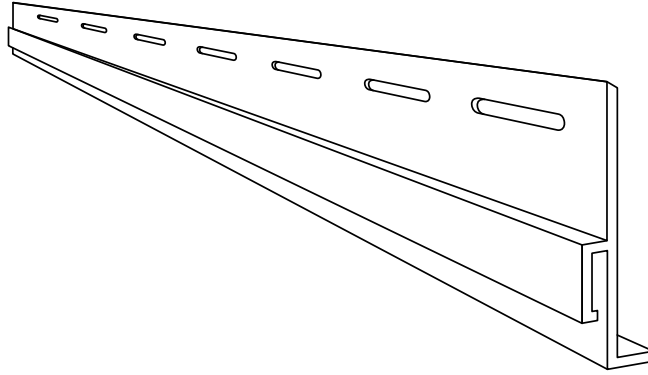


Figure 21—Starter strip

Undersill (Figure 22) is used to finish off cut edges of the vinyl siding at the underside of windows or soffits.

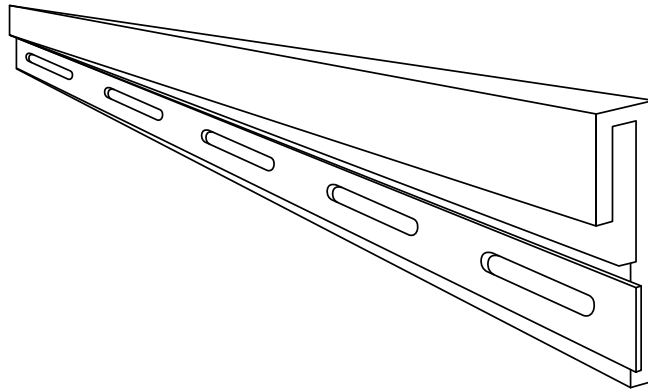


Figure 22—Undersill

J-trim (Figure 23) is used to finish the sides and tops of openings.

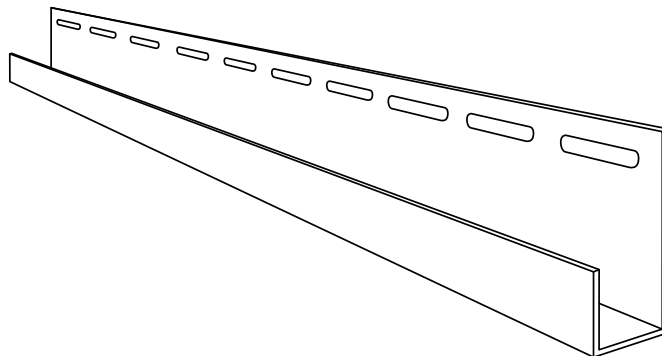


Figure 23—J-trim

F-trim is used for support and soffit (Figure 24).

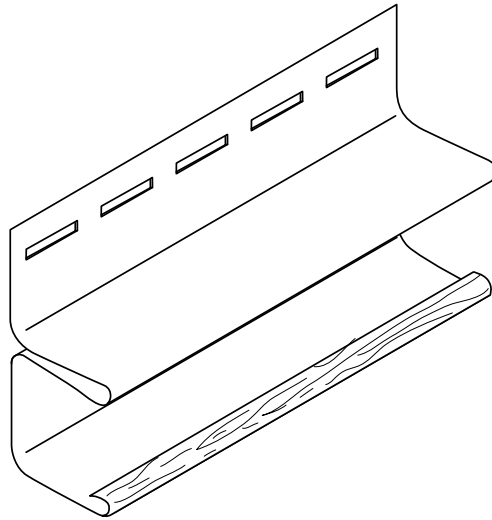
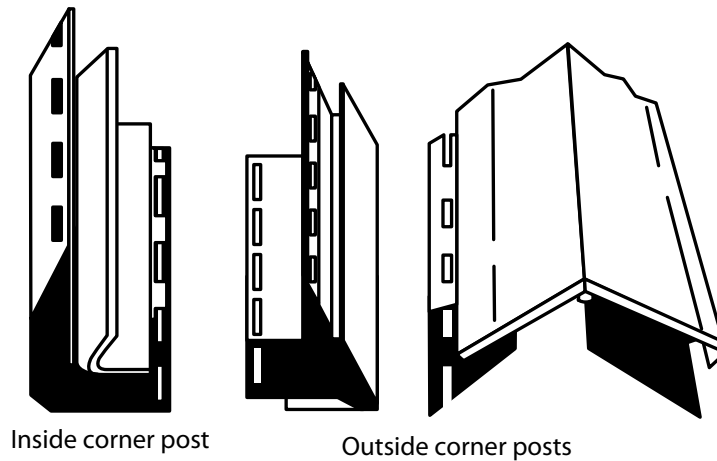


Figure 24—F-trim

Inside and outside corner posts (Figure 25) are placed at the corners to finish off the ends of the siding boards.



Inside corner post

Outside corner posts

Figure 25—Inside/outside corner post trim

Fasteners Used for Exterior Finishing

Most exterior finish materials are applied using nails. The nails are either hand-driven or set with a pneumatic nailing gun. Pneumatic nailing tools are dangerous and must be handled with care.

Lag Screws

Sheet metal siding is installed with lag screws. These fasteners are fitted with a neoprene washer to make them watertight. Lag screws come in various diameters and are finished in a colour that matches the siding.

Nails

Nails used for exterior work must be resistant to rusting. Galvanized, aluminum or stainless steel nails are used for exterior work. When fastening treated lumber, only hot-dipped galvanized, stainless steel or triple-coated zinc polymer nails should be used.

Galvanized—Hot-dipped: Designed for exterior use, a hot-dipped galvanized nail resists rust and corrosion. The thick coating of zinc produces a very rough surface, which increases the nail's holding power.

Electroplated—Designed for use where not exposed to weather, the electroplated nail also resists rust and corrosion. Its zinc coat is very thin and smooth and does not provide the holding power or corrosion resistance of hot-dipped nails.

Aluminum—Aluminum nails are used to attach aluminum soffit, fascia and trim pieces. Corrosion will occur if galvanized materials contact aluminum finishes. Galvanized nails should not be used to attach aluminum products for this reason. Aluminum nails are available in colours to match the materials being installed.

Common Nail—Common nails are the main type used for framing. They're made from wire and the head is usually three to four times the diameter of the shank. Hot-dipped galvanized common nails are only used to secure trim when a lot of holding power is needed.

Box Nail—A box nail is similar to a common nail but with a thinner shank (Figure 26). Hot-dipped galvanized box nails are used for attaching wood finish trim and siding. The box nail's thin shank is less likely to split the wood.



Figure 26—Box nail

Casing Nail—A casing nail has a conical head that is less easily seen than a box nail or a siding nail (Figure 27). Hot-dipped galvanized casing nails are used for attaching wood finish trim and siding. The casing nail doesn't hold as well as the box nail or the siding nail. The shank of the casing nail is thicker than that of a box nail or a siding nail. 1 $\frac{3}{4}$ " casing nails are used for installing double-course sidewall shakes.



Figure 27—Casing nail

Siding Nail—The siding nail is a special nail that was developed for the attachment of wood siding and finish trim pieces. The siding nail has a domed head that allows it to be driven and sunk flush without the use of a nailset (Figure 28). The head shape has better holding power than a casing nail.



Figure 28—Siding nail

Roofing Nail—Roofing nails are used to:

- fasten vinyl siding to sheathing
- install panel-type insulating sheathing
- apply sheathing paper
- install stucco wire and expanded metal lath

When used for installing siding, the large head on the roofing nail keeps the siding from coming off but still allows it to move with temperature changes (Figure 29). Roofing nails are available in hot-dipped and electroplated galvanization. Electroplated nails should only be used in drier climates.

The length should be long enough to penetrate the wall sheathing and at least 1" into the framing members.



Figure 29—Roofing nail

Waterproof Nail—Waterproof nails have various shank styles. Usually a twisted or grooved shank is used to provide improved holding power. It has a neoprene washer behind the head to make a watertight seal (Figure 30).



Figure 30—Roofing nails with neoprene washer

A waterproof nail is designed for attaching sheet metal roofing, but it can be used to attach sheet metal siding as well. The nail comes in both aluminum and galvanized steel. Use only aluminum nails with aluminum sheet metal products.

Air-driven Fasteners

Special nails in strips or coils are used in pneumatic nailing tools. These fasteners are made using various corrosion-resistant materials and finishes.

Many galvanized nails used with pneumatic fasteners are not hot-dipped. The rough surface of a hot-dipped nail will not work with the firing mechanisms of pneumatic tools. Most pneumatic-drive manufacturers have their own proprietary methods of nail construction.

Stanley Bostitch manufactures a nail designed for fastening pressure-treated lumber using their Thickcoat technology. They also offer many paper collated hot-dipped galvanized nails with smooth shanks and ringed shanks.

Stainless steel pneumatic fasteners are available for use where extreme resistance to corrosion is required.

Check with the local building inspector to determine which pneumatic fasteners are approved. Many pneumatic fasteners are not approved for exterior uses.

The coil nails shown in Figure 31 are available in a galvanized finish. The T-nails shown at the bottom of Figure 31 are used for attaching wood siding and trim materials. Brads can also be used for attaching trim materials if they are corrosion-resistant.



Pneumatic fasteners will also drive staples (Figure 32). They can be used for exterior finish if made from stainless steel.



Figure 31—Nails used in pneumatic nailing tools



Figure 32—Fasteners for pneumatic staplers

Staples

Staples for spring-driven hand-operated staplers and stapling hammers are designed for attaching insulation and air or vapour barriers to wood framing (Figure 33).



Figure 33—Spring-driven stapler (left) and stapling hammer (right)

Staples are not interchangeable from one stapler to another. Remember to use staples specified for your stapler.

Sheathing Paper Installation

The exteriors of buildings are normally covered with sheathing paper or house wrap before the cladding is applied. Apply sheathing paper in a shingle-like manner, overlapping horizontal and vertical joints by at least 4".

If the sheathing paper is ripped during installation or by the wind, replace the damaged sections or apply another layer of paper. Roofing nails hold sheathing paper in place better than staples. When working in a windy environment, using roofing nails can save replacing damaged sheathing paper.

House wraps often use proprietary fastening systems. For example, Tyvek uses DuPont Tyvek Wrap Cap nails for pneumatic- or hand-nailing.

Note: Building paper should be left exposed to the weather for as short a duration as possible. If it must be left exposed for an extended period, then an additional layer should be installed to protect the layer(s) underneath. House wrap should not be exposed to the weather for more than 120 days.

Exterior Sealants (Caulking)

The *Building Code* requires that caulking “be provided where required to prevent the entry of water into the structure.” This is a very broad statement, but it can be applied using logic and common sense. The Code goes on to say that caulking is required at joints between masonry, siding or stucco and the adjacent door and window frames or trim unless otherwise protected. Also required by Code is caulking at vertical joints between different cladding materials unless the joint is suitably lapped or flashed.

The caulking must be a type that remains pliable, as most building materials expand and contract with moisture and/or temperature. Wood trim that has not properly dried before installation may also have shrinkage as a factor.

Caulking must be able to resist the effects of weathering and be compatible with the material it's being applied to.

Caulking must not trap moisture. Be careful when applying caulk to the underside of materials. Any water that may get behind surfaces needs a path to drain out.

Types of Caulking

Acrylic caulking meeting the requirements of CGSB 19-GP-5M is allowed for low-traffic areas of infrequent wetting. It has elasticity for joints that move up to plus or minus 7.5%.

Elastomeric (rubber-based) one-component caulking meeting the requirements of CAN/CGSB 19.13-M is typically used for sealing window flanges to the building envelope.

Butyl-polyisobutylene polymer caulking meeting the requirements of CGSB 19-GP-14M is allowed for exterior use. It has good elasticity for joints that move up to plus or minus 5%. It offers good adhesion to metal, glass, concrete and wood surfaces.

Multicomponent (polyurethane) joint sealing caulking meeting the requirements of CAN/CGSB 19.24-M can be used for applications such as precast, tilt-up, concrete, masonry, exterior insulating and finishing systems (EIFS), metal curtain walls and perimeter joints around doors and windows. It can also be used in some water immersion applications. It's very elastic, allowing movements of plus or minus 25%.

Backer Rod

Caulking is not a surface coating—it needs to be applied into the joint being sealed. It must be applied such that it will remain elastic. This is usually achieved using backer rod. Backer rod is used to provide a backing for caulking (Figure 34). The rod should be installed so that it's tight-fitting and set back from the surface such that the finished caulking bead will be one quarter as deep as it is wide.

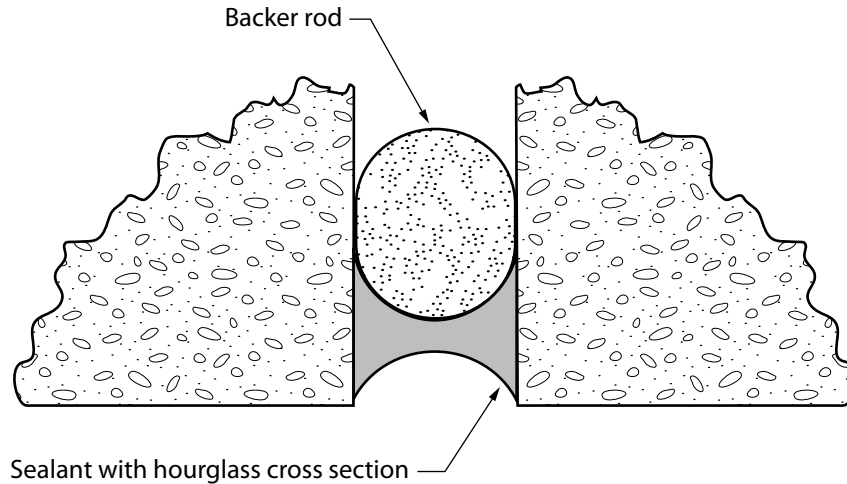


Figure 34—Backer rod used with caulking

The backer rod should be 20% thicker than the joint. Pushing the backer rod too deep into the joint wastes caulking and actually reduces its flexibility.

Most backer rods are close-celled plastic foam and come in lengths or in a coil. The material used as a backer rod must be compatible with the caulking applied to it. Check the manufacturer's specifications for the correct type of rod to use.

Backer rod may be plastic foam, expanded rubber or neoprene. Caulking sealants are tooled to form an hourglass cross section, which will allow expansion and compression as the members on either side of the joint move.

Where joint depth is too shallow for backer rod, a bond-breaker tape should be used to prevent three-side adhesion. This is done to maintain the elasticity of the caulking.

Applying Caulking

Before starting the caulking operation, check that the caulking gun is working properly and prepare the tips of the caulking tubes. Determine how wide a bead is needed and cut the tips off enough tubes to complete the job. Make sure the angle of the tip will suit the method of installation.

Make a test caulking of a mocked-up joint, complete with backer rod.

A scraper can be made from a waste plastic container. Using a plastic tool such as this is better than using your finger. The tool will maintain a uniform shape and allows your hands to remain clean.

The application of caulking should be done as follows:

1. Clean the surface of the area where the caulking is to be applied. Remove loose materials and debris.

2. Mask both sides of the joint with masking tape to provide a clean finish to the caulking.
3. Some types of caulking or types of installation require a primer to help the caulking adhere to the surface. Apply the primer after the masking is in place, as the primer can discolour the finish of the surfaces being caulked.
4. Insert the backer rod into the joint. Take care not to push it in too far. Use a bond-breaker tape instead of backer rod for shallow joints.
5. Caulk the joint in a manner that will provide full penetration of the caulking. Use a pushing motion or allow a small bead to build up ahead of the direction of movement of the caulking gun.
6. Tool the joint with the plastic tooling piece previously prepared. The tooling should make sure that the caulking is fully adhered to both sides of the joint and that the joint is completely filled with caulking. If too little caulking is in the joint, add some more.
7. Remove the masking tape before the caulking hardens, and clean up any excess caulking. DO NOT attempt to re-tool the joint, as it will spoil the finish.

Maintenance

Caulking is often the least durable building material and needs to be maintained. Because it's made to shrink and expand, it often does not hold paint well.

Joints in damp locations need to be cleaned with a cleaning agent that will resist mildew and prevent the adhesion of moss and algae growth.

Caulking must be inspected on a regular basis, usually no longer than five years. It may need to be removed and the joint recaulked to maintain a water-resistant joint. Recaulking is usually done with repainting or restoration of the exterior finish of the building.



Now complete Self-Test 2 and check your answers.

Self-Test 2

1. What is the main difference between shingles and shakes?

2. What is meant by the term *self-furring*?

3. What species of wood is preferred for wood siding?

4. List the benefits of vinyl siding.

5. What are the two types of stucco?

6. What is the purpose of the expanded metal lath used with stucco work?

7. What type of metal is used for sheet metal siding?

8. What grade of shingles is used for sidewall application?

9. What governs the strength of EIFS cladding?

10. What are the minimum thicknesses for the three cement stucco coats?

11. What is fibre cement board?

12. What is done to the bottom course of bricks to allow for drainage?

13. What is cultured stone?

14. Where is a "frieze" moulding found?

15. What does "S4S" stand for?

16. How is S1S2E made?

17. What is the difference between a drip cap and a water table?

18. What is always required at horizontal changes in the exterior finish if the materials do not overlap by at least 1"?

19. What is the purpose of a metal drip edge?

20. Where is brickmould used?

21. What type of nail is shown in Figure 1?



Figure 1

22. List four different types of corrosion-resistant fasteners.

23. What types and components of exterior finishes are installed using roofing nails?

24. What are box nails used for?

25. What should be checked before choosing pneumatic fasteners for applying exterior finishes?

26. Which two fasteners are used for applying sheet metal siding?

27. What type of nail should be used to install aluminum fascia boards?

28. How is a flashing end dam made?

29. What is bond-breaker tape used for?

LEARNING TASK 3

Plan Exterior Finish Installation

Normally installed from the bottom up, exterior wall coverings must be installed to allow for any shrinkage that may occur in building height. Most shrinkage occurs at floor joist level, where there are often two top plates, the rim joist and a bottom plate. In worst-case scenarios, there will be $\frac{3}{16}$ " shrinkage overall at these locations.

Some types of siding (such as shingles, shakes, bevel and fibre cement lapped boards) handle the shrinkage well. However, vinyl siding does not. One method to deal with this issue is to use a lumber "belly band" at floor joist level.

Installation of all types of siding must meet *Building Code* requirements. The installation of engineered siding such as vinyl, fibre cement board and exterior insulated finishing systems (EIFS) must also meet the manufacturer's installation requirements.

Siding that is adversely affected by moisture must have a ground clearance of at least 200 mm (8"). It must have at least 50 mm (2") clearance to the surface of a roof. Siding that is not adversely affected by moisture requires only 150 mm (6") ground clearance.

Safety

Most exterior cladding projects will require the use of ladders, ladder jacks and scaffolding, and can involve working over roof surfaces or near power lines. Fall protection may be required, and when working more than 25 feet above the ground, a fall protection plan will also be required.

If the ground level slopes, then scaffold location and set-up will have to be carefully planned. Both the *all around* and *tube and clamp* types of scaffolding work well for use on sloping ground compared to the normal *end-frame* type. Site-built wooden scaffolding is sometimes used, but it is time- and lumber-consuming to build.

Care should be taken not to overload or clutter scaffold working decks with tools and materials.

BC Building Code Requirements

Section 9.27 of the *BC Building Code* covers cladding (siding, trim and soffits) and the requirements for a rainscreen capillary break. Flashing and sealant requirements are also included in *Section 9.27*. *Section 9.28* covers stucco.

Although there are many requirements for wooden siding products, such as lumber, shakes, shingles and plywood siding, there is very little in the *Building Code* to cover non-wooden products such as vinyl siding. This is because vinyl and other non-wooden siding products have been tested and certified. The *Building Code* relies on the manufacturer to provide most of the requirements when using one of the products.

Some cladding types require a certain minimum thickness or spacing of sheathing for backing or as a nailer for attachment.

Gutter and downspout (eavestrough and rainwater leader) regulations fall under the Plumbing Code, which is *Part 7* of the *Building Code*.

Manufacturer and Architect's Specifications

The manufacturer's installation requirements must be followed to meet both *Building Code* and the product's warranty requirements. In addition to manufacturer's requirements, the architect may specify additional requirements in the drawings or specifications for the project. Before starting the installation, Code, manufacturer's requirements and the drawings/specifications need to be checked.

In addition to the requirements mentioned so far, the BC Housing, Licensing and Consumer Services warranty provider may also have installation requirements.

Delivery, Storage and Protection

Depending on the type of cladding, it may be delivered to the job site or picked up from the supplier by the carpenter. Some types of siding and soffits come packaged in cardboard and may need extra support and/or rain protection when being transported on roof racks.

Cladding material should be stored out of harm's way and in a manner that allows it to lie flat and stay clean. It may need to be protected from weather if boxed in cardboard or if a finish such as paint or stain needs to be applied before installation.

Once installed, lower areas may need to be covered by a sheet of polyethylene film to protect from mud splatter or concrete splatter during landscaping or exterior concrete flatwork (driveways and walkways).

Starting the First Course of Siding

When starting the first course of siding, a builder's level is used to set a level line that is chalked around the entire perimeter of the building.

If the foundation is sloped, the line is marked at the top of the highest portion of foundation. For each area where the foundation steps down, a new line is chalked by measuring down from the first line.

The height of the starting line is often at the top of the first course of horizontal siding. This height should allow the siding to overlap the foundation (Figure 1). It is a good practice to create a drip edge at this area such that water running down the siding doesn't continue to run down the foundation wall, and to reduce water intrusion by capillary action. If a vented air space is required behind the cladding (rainscreen), then a screened vented area is also required. All these factors require careful planning.

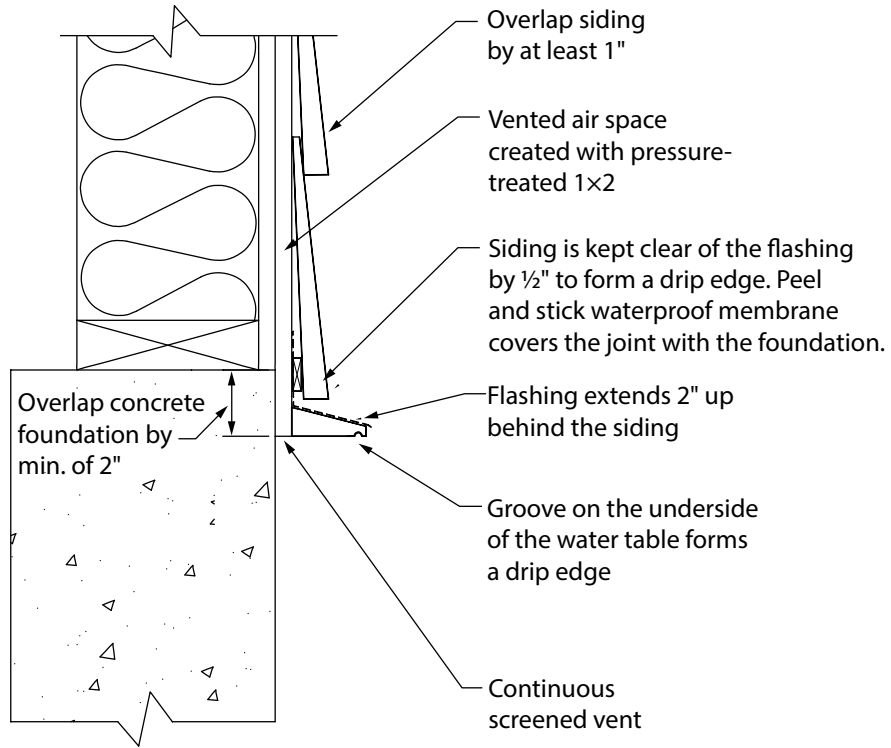


Figure 1—Drip edge and foundation overlap

It is also critical when applying horizontal siding to have the courses line up at all building corners. Working from a line chalked completely around the building helps to eliminate corner alignment problems.



Now complete Self-Test 3 and check your answers.

Self-Test 3

1. In relation to a building's height, where does most shrinkage occur?

2. What is one method of dealing with shrinkage issues when installing vinyl siding?

3. What are two disadvantages of using site-built scaffolding for installing exterior cladding?

4. In addition to the *BC Building Code*, where might exterior cladding requirements be found?

5. What should be done to protect the installed cladding from concrete or mud splatter?

- 6. Why should a line be chalked completely around the building for the starter course of horizontal siding?

- 7. Use the *Building Code* to determine the required nailing for horizontal vinyl siding.

LEARNING TASK 4

Calculate Exterior Finish Materials

The steps involved in calculating exterior finished claddings include:

- determining in square feet or square metres the amount of wall area to be covered
- subtracting an appropriate area for windows and doors (openings)
- calculating the coverage of the product being used
- allowing for wastage

Calculating quantities for exterior trims and accessories usually involves determining linear lengths for all trims. Associated materials such as nails, caulking, flashing, paper, wire and paint/stain will all have to be estimated based on rules of thumb developed with experience. Manufacturers of products such as caulking will list coverage based on bead size; however, it's a lot of work to estimate how many feet of bead is needed and it may not be worth the time it takes to do so.

Most measurements can be done by scaling the elevation drawings if the drawings match the actual construction. In many cases the location of foundation steps may not match, and if so, some adjustments may have to be made when doing the calculations.

Because of the high price of labour, many carpenters do not do detailed calculations, but instead do rough calculations and order more product than needed, hoping to return any extra or to use it on the next project. Another method is to purposely order a bit short and when just about out of product, calculate the small remaining area that needs finishing and place a second order.

Doing a detailed or a rough calculation, purposely ordering extra or ordering short, all depends on a variety of factors, including the cost of labour versus materials, how easy and affordable it is to place a second order, and how capable and experienced the person is who does the material take-off.

Product Coverage

The first step in determining the amount of cladding material to purchase is to calculate the area to be covered. Each face of the building can be divided into rectangles and triangles. For each of these shapes a simple area calculation is made. The next step is to do the same for the openings and deduct the opening areas from the total area for the building faces.

Once the cladding area has been calculated, the third step is to calculate product coverage. This will differ for each type of cladding and even for the manner in which it's installed. The fourth step is to add an amount for wastage. This amount may be very small or quite large depending on the cladding type and the building design. Wastage is also higher when there are many angled cuts for gable ends and walls projecting above a sloping roof.

Wood Shingles and Shakes

Wood shingles and shakes are sold by the square and packaged in bundles. A square is designed to cover 100 ft.² of roofing. Because the allowable exposure for wall coverage is about 50% greater than that for roofing, a square applied as wall cladding will cover significantly more than 100 ft.² If the shingles are installed in a decorative double-course application, the coverage will be closer to 100 ft.²

Since there is very little wastage when using shingles and shakes for wall cladding, adding 2% to 5% for wastage should be sufficient, depending on the building design.

Horizontal Lumber Siding

Two of the more common types of horizontal lumber sidings are channel and bevel (Figure 1).

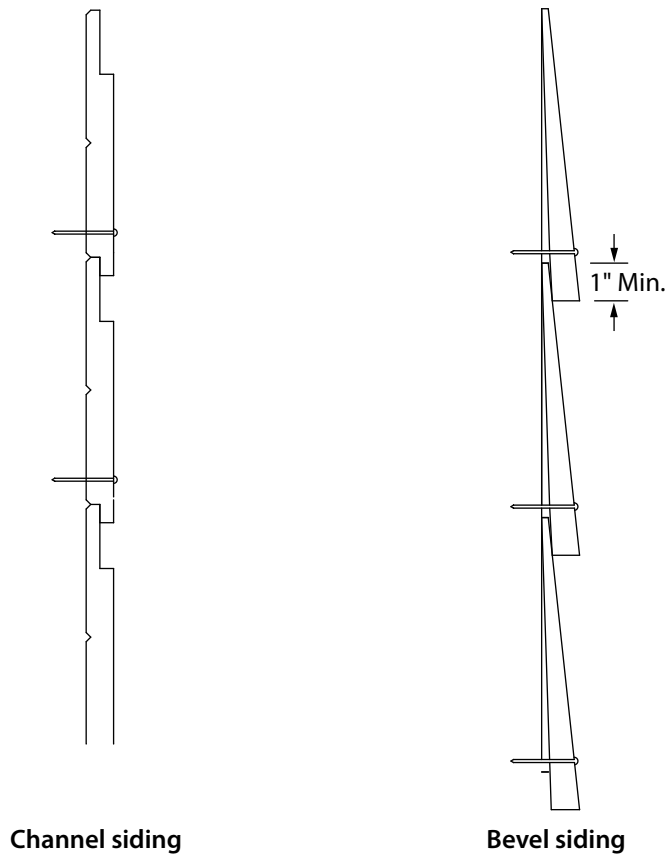


Figure 1—Two types of horizontal wood siding

The maximum exposure for a given siding is found by subtracting the required overlap from the actual width of the board. For example, 1×8 bevel siding has an actual width of 7¼", which means it has a maximum exposure of 6¼". Using this example, 28% must be added to make up for an 8" board only covering 6¼" ($8 / 6.25 = 1.28$). Typically about 5% would be added to the order for wastage.

Vertical Lumber Siding

Vertical lumber siding types include board and batten and channel (Figure 2).

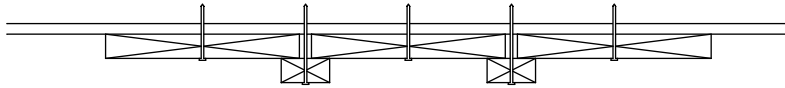


Figure 2—Plan view of board and batten

Because the boards for board and batten are spaced slightly apart, a 1×8 board will cover 8" even if only 7¼" wide. Once the total linear footage of the boards is calculated, the same number and lengths of battens will be needed. Wastage will be greatly affected by the available lengths versus the needed lengths. For example, if the wall height was 9'3" and only 12' boards were available, there would be a large amount of waste, but if 10' boards were available, the wastage would be much smaller.

Exposure calculations for vertical channel siding are similar to those for horizontal channel.

Wood Panel Cladding

Wood panels used for siding are installed vertically. Typically, the panels are sheets of grooved plywood measuring 48" wide by 104" tall. Unless windows are quite large, no reductions are made for the wall openings when calculating wall area. Although square footage can be used, it is often better to make calculations based on the width of the panels, by doing an actual panel count for each wall.

Sheet Metal Panel Cladding

Sheet metal roofing panels are also used as wall cladding. Coverage may be 24" or 36" wide per sheet. Panels are custom ordered for length. As with wood panels, an actual sheet count is done for each wall.

Vinyl and Aluminum Siding

Vinyl and aluminum siding is sold by the coverage area. Normally wastage is about 5% depending on building design. Although it is sold by the box, it is often possible to purchase a partial box. Siding pieces are normally 12' long.

Fibre Cement Siding

Fibre cement siding amounts are calculated in the same method as used for wood bevel siding. Because this is an engineered manufactured product, coverage will be specified by the manufacturer in their product literature. The wastage is normally 5%, depending on building design. Boards are normally 12' long.

Stucco Cladding

Because stucco is trowelled on, the total wall area less the opening area is used. Wastage is minimal or can be significant, depending on the person doing the application. Exterior insulation finish system (EIFS) type stucco should have the calculations done using the methods shown in the manufacturer's product literature.

Brick Veneer Cladding

Bricks come in various sizes. The number of bricks required to cover one square foot can be calculated using the dimensions of the brick's exposed face plus the mortar thickness. This is usually done by the brick manufacturer. For the common red brick with a $\frac{3}{8}$ " thick mortar joint, it takes 6.3 bricks to cover 1 ft.², or 630 bricks to cover 100 ft.² Because bricks are small, there is very little wastage.

Trims and Accessories

Lengths for exterior window and door casings, fascias, corner capping, belly bands and other trims can be calculated by scaling the elevation drawings. Full-length boards may be desired for some of these trims, but it may be acceptable to splice some of the other trims.

Accessories, such as nails, caulking, flashing, paper, wire and paint/stain are often unique to each type of exterior cladding. Trying to estimate how many nails to buy per 100 ft.² of vinyl siding may be more work than it's worth. There are Internet sites that will give an estimated number, and some sites will convert that number into weight, which is how nails are usually sold.

Many manufacturers of engineered products offer helpful guidelines. Most carpenters estimate high for accessories and then use the leftovers on the next project. It is worthwhile for carpenters to keep records, so that they can estimate more accurately for future projects. Learning from experience will be greatly enhanced when records are kept.

Some accessories come in fixed lengths. For example most flashing is sold in 10-foot lengths. When calculating drip flashing for over windows and doors, there may be a lot of wastage due to the desirability of using full-length pieces. Additional length must be added for window or door casing and end dams when calculating the length for these pieces of drip flashing.



Now complete Self-Test 4 and check your answers.

Self-Test 4

Use the Ladysmith Vacation Cabin drawings to answer the following for only the east wall. Round measurements up to the nearest foot. Check that plans are to scale before scaling drawings.

1. Find the square footage of the wall (do not deduct for the belly band).

2. Find the total square footage for the openings.

3. What is the wall area minus the opening area (total siding area)?

LEARNING TASK 5

Install Exterior Finishes

This Learning Task covers the installation of:

- wood shingles and shakes
- wood lumber and panel siding
- vinyl siding
- metal siding
- fibre cement siding
- stucco
- brick veneer

Wood Shingles and Shakes

Wood shingles and shakes provide a very weatherproof finish for the outside of buildings. The installation is similar to applying shingles to a roof, with some modifications. Western red cedar is the most popular species of wood used to make shingles and shakes.

Shakes used for sidewall applications are machine grooved and have matching edges. The edges are resawn so that they're perfectly square to the butts. This allows them to fit together, giving a uniform appearance.

Nailing

Shingles and shakes are blind nailed or face nailed.

Blind Nailing

In single-course applications, shingles and shakes are blind nailed. They're nailed with two nails placed $\frac{3}{4}$ " in from the sides and 1" above the butt of the subsequent course (Figure 1).

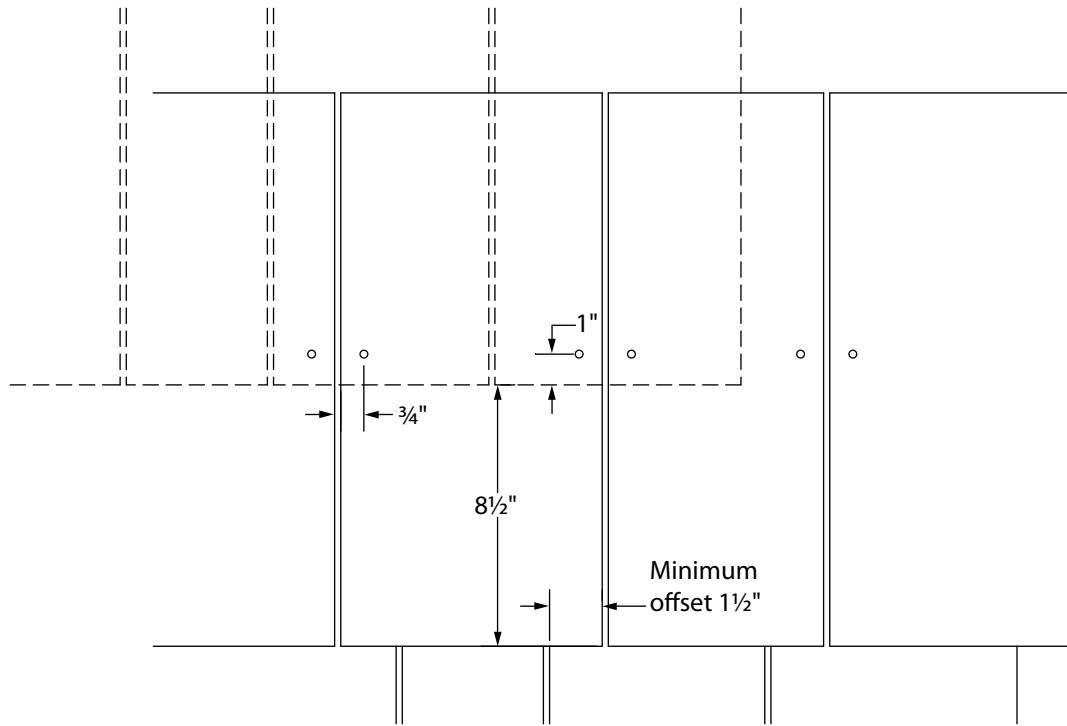


Figure 1—Nailing of shingles in single-course application

Hot-dipped galvanized box nails are used. The nails are usually 1 3/4" long, extending 1" into the supports.

Face Nailing

Shingles and shakes are face nailed when they're installed in a double-course. In a double-course application, two courses are installed at the same time. The nails in the top course attach both layers of shingles (Figure 2).

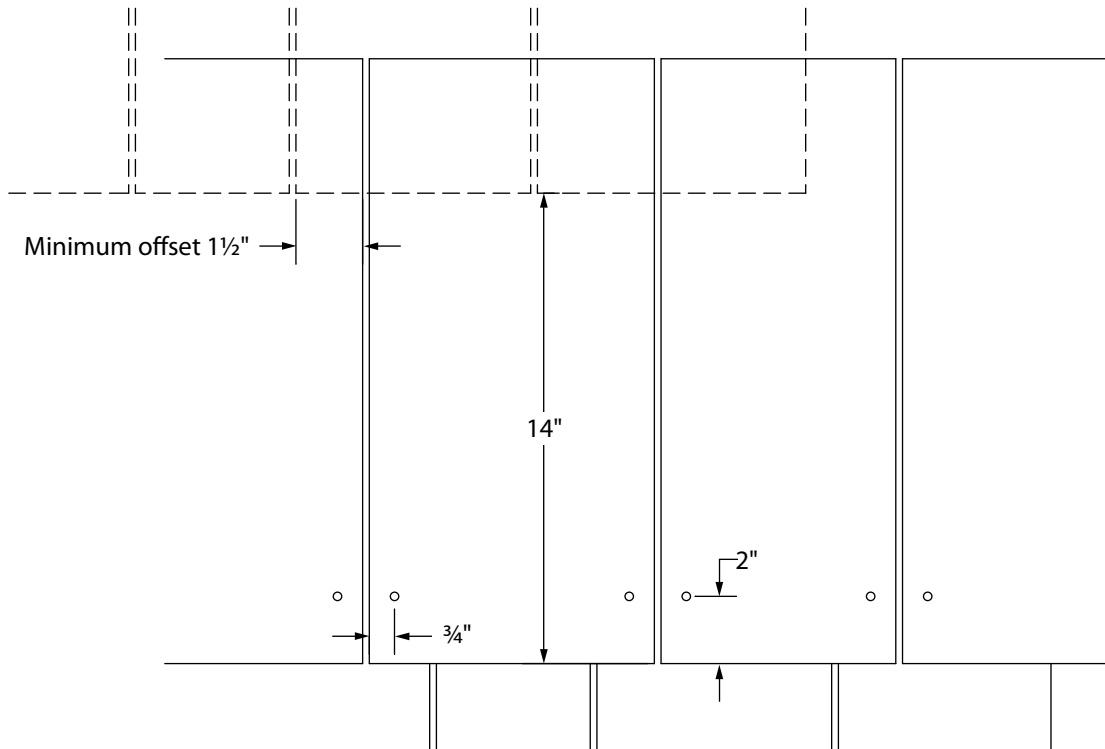


Figure 2—Nailing of shingles in double-course application

Hot-dipped galvanized casing nails are used. The nails are usually 1 3/4" long, extending 1" into the supports.

Exposure

The exposure of wood shingles used for sidewall applications is shown in the table in (Figure 3).

Shake or Shingle Length in Inches	Maximum Exposure	
	Single-course	Double-course
16"	7 1/2"	12"
18"	8 1/2"	14"
24"	11 1/2"	16"

Figure 3—Maximum exposure for wood shingles and machine-grooved shakes

Single-course Installation

Shakes and shingles installed in single-courses are simply overlapped. For 18" shingles, the maximum exposure is 8 1/2", this allows the next course to overlap by 9 1/2". The next course over will overlap the first course by 1", effectively covering the wall with three layers of shingles.

Shakes and shingles must have their joints offset so the sides overlapp by at least 1 1/2" (Figure 1).

Shakes and shingles should not be butted tightly together. Dry shingles butted tightly together will buckle when they absorb moisture from the surrounding air. If the shingles are not fully dried at the time of installation, they can be butted closer together. This is because they will leave a gap of $\frac{1}{8}$ – $\frac{1}{4}$ " once they dry (depending upon what their moisture content was at the time of installation).

Double-course Installation

Double-course installation is used with machine-grooved sidewall shakes. These shakes are actually kiln-dried shingles that have been edge-trimmed and matched.

They're applied over an under-course of #3 shingles. Joints in the outer layer are offset sideways from the under-course by a minimum of $1\frac{1}{2}$ ", and the face shingle in one course must be offset from the next course by $1\frac{1}{2}$ " as well (Figure 2).

The outer course of a double-course installation is dropped $\frac{3}{8}$ " below the under-course to create a drip edge. The drip edge reduces the possibility of capillary action between the two courses.

Use a piece of shiplap as a temporary ledger to set the shingles on to construct the drip edge. The shiplap is tacked onto the wall surface, the under-course is placed on the upper edge and the finish course is placed on the lower edge of the rabbet. This keeps the course straight and the overlap uniform.

Flashings

As with other sidings, all exposed openings must be suitably flashed.

Step Flashing

Vertical joints between shingle siding and other surfaces can be made using step flashing. In step flashing, pieces of flashing are placed under each course of shingles. Step flashing creates a very weatherproof connection. Cap the step flashing with a counter flashing or trim.

Caulking

A weakness in a shingle wall finish is how the shingles are finished against window and door frames. Butting the shingles into the side of a wooden moulding leaves a gap as the shingles dry. Caulking this gap seals the opening for a short time, but as the wooden shingle expands and shrinks (due to changes in moisture content), the caulking will fail and leaks will be likely.

Sealing the joint between the edge of shingles and other surfaces should be done with step flashing or with an overlapping moulding against the windows and doors.

Corners

Outside corners of shingle siding are made by alternately overlapping the shingles (Figure 4), or by applying corner boards.

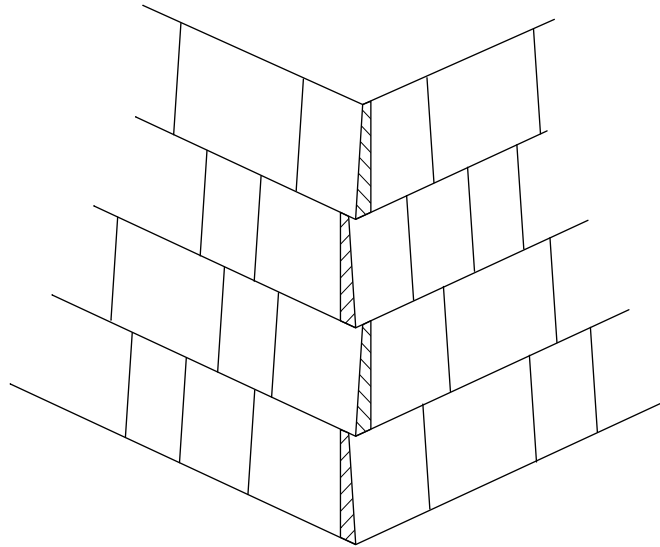


Figure 4—Alternate overlap

Wood Lumber and Panel Siding

There are two basic types of wood siding: lumber siding and panel-type wood siding. Lumber siding can be installed vertically or horizontally. Panel-type siding is installed with the sheets vertical only.

Lumber Siding

Lumber siding is exposed to the weather and is usually made from wood species that are resistant to moisture. Western red cedar is the most common material used for wood siding in BC. The boards can be rough, resawn or planed smooth.

Board and batten siding (Figure 5) is usually made with rough boards a full one inch thick. Board and batten is always installed vertically. The siding on the left of (Figure 6) is channel siding, which is smooth on one side and rough on the other. Channel siding may be installed with either the smooth or the rough surface exposed. Channel siding can be installed vertically or horizontally.

Nailing

Lumber siding is nailed in place with either dome head siding nails or casing nails. In either case, the nails must be resistant to moisture. They're usually hot-dipped galvanized or stainless steel.

Wood expands and contracts with changes in moisture content. The siding on the exterior of a building absorbs moisture during wet weather and loses moisture during dry weather. The siding boards must be able to move during these changes or they'll crack and split. Use only one nail at each support when fastening lumber siding.

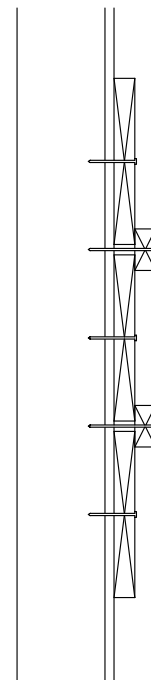


Figure 5—Plan view of board and batten

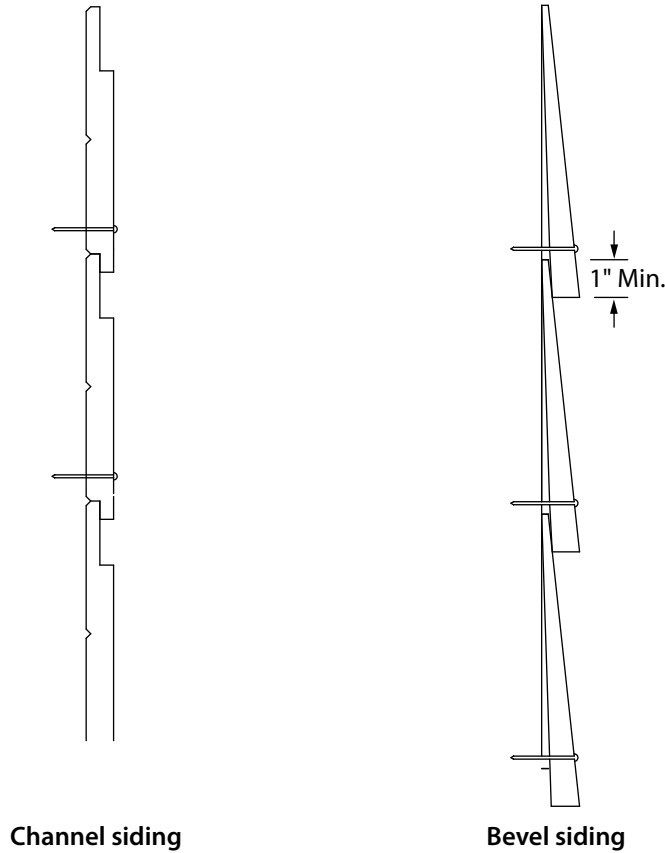


Figure 6—Nailing of wood siding

Exposure

Overlap bevel siding a minimum of 1". When the siding is matched, such as channel siding, the overlap is reduced to $\frac{3}{8}$ ". Vertical battens must overlap the adjacent board by at least $\frac{1}{2}$ ".

The maximum exposure for a given siding is found by subtracting the required overlap from the actual width of the board. For example, 1×8 bevel siding has an actual width of 7¼", which means it has a maximum exposure of 6¼".

Horizontal Installation

Horizontal siding is applied starting from the bottom of the wall. Use a builder's level to set a level line around the perimeter of the building.

Bevel Siding

Exposure

Bevel siding (Figure 6, right image) is simply overlapped. This allows the exposure to be adjusted to suit the wall surface being covered.

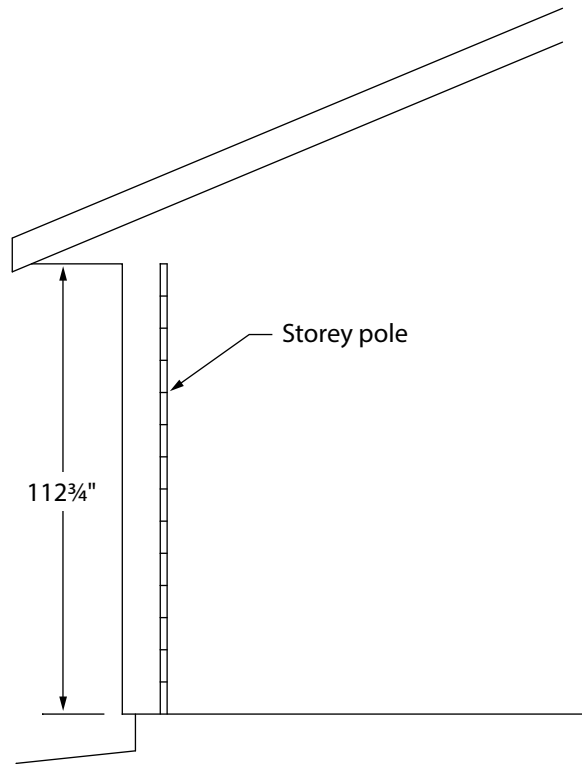


Figure 7—Measuring the height

The exposure for each course of siding is calculated to allow the last board to have the same exposure as all other boards.

To calculate equal exposures, measure the vertical distance from the level line at the bottom to the soffit at the top. Divide this height by the maximum exposure of the siding to determine the number of courses required. Round the number of courses up to the nearest whole number, and then divide that number into the distance to be covered to find the actual exposure of each board.

Examples:

If the distance to be covered is 112.75" and 1×10 bevel siding is used, the actual exposure will be:

$$\text{Maximum exposure: } 9\frac{1}{4}" - 1" = 8\frac{1}{4}"$$

$$\text{Number of courses: } 112.75" \div 8\frac{1}{4}" = 13.67 \text{ (round up to 14)}$$

$$\text{Actual exposure: } 112.75" \div 14 = 8.05" \text{ (approx. } 8\frac{1}{16}"\text{)}$$

The exposure can be adjusted to allow for the height of windowsills or transitions in different siding materials, but in all cases the minimum overlap of 1" must be maintained.

Once the exposure is established, use the dimension to lay out a storey pole (Figure 7). The top end of the storey pole is held against the soffit and the marks indicate the position of each course of siding. Use the storey pole to check how each course will line up at windows, doors and other features.

Starter Strip

The first board of bevel siding is tipped out from the building by the same amount as the board above it. A thin strip of wood, the starter strip, is used to space the first board the correct distance from the wall.

To find the thickness of the starter strip, overlap two siding boards the same amount as they will be installed, and measure the space behind the board at top (Figure 8). This distance will vary depending upon the thickness of the narrow edge of the bevel siding.

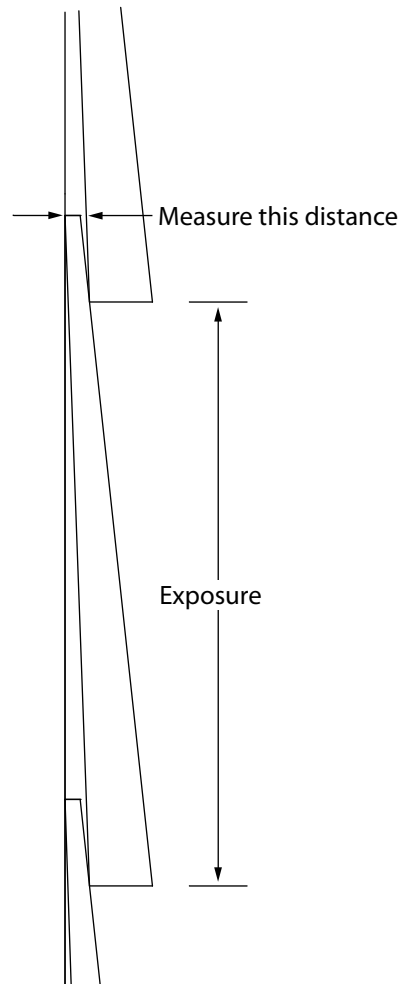


Figure 8—Finding the thickness of the starter strip

If rough lumber is applied as bevel siding, the starting spacer will be quite thick.

Chalk Lines

Use the storey pole to lay out locations for each course and snap a chalk line on the building paper or house wrap at the top of every third course. The intermediate courses are positioned with a block cut to the actual exposure distance.

Joints

A scarf joint (Figure 9) is used to join lumber siding. The joint should be made over the vertical supports unless the wall sheathing is at least $\frac{1}{2}$ " thick and directly supports the siding. A bead of caulking is used to seal the end grain of the scarf as well as where the siding butts into brickmould at doors or into exterior casing around windows.

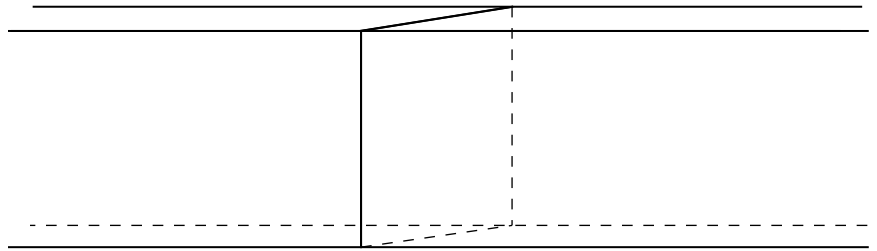


Figure 9—Scarf joint

Corners

The outside corners of horizontal bevel siding are usually mitred or covered with battens (also referred to as corner boards) (Figure 10). At inside corners, the siding is butted into a square wooden post (Figure 11).

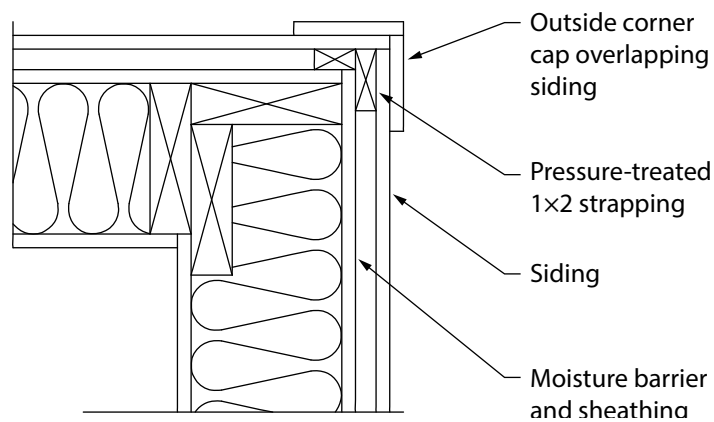


Figure 10—Outside corner boards with a rainscreen—covered with battens

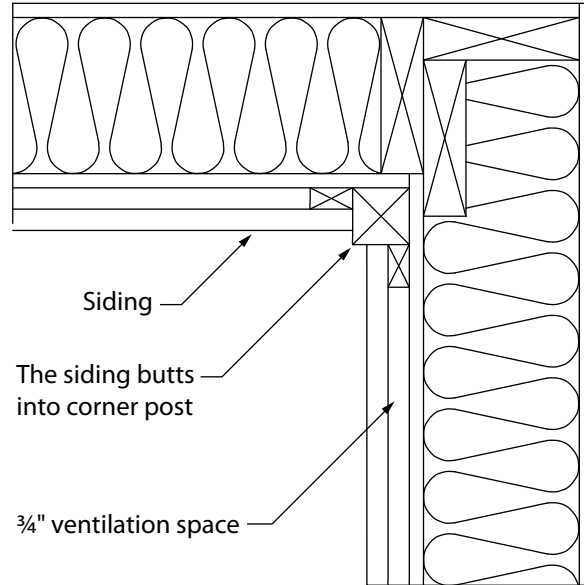


Figure 11—Inside corner post with a rainscreen

Lapping the siding with corner boards provides better deflection of the rainwater than making mitre joints at the corner.

Vertical Installation

A water table or band moulding is often used when installing vertical lumber siding (Figure 12). The water table is set level using a builder’s level. The flashing over the water table must extend up under the sheathing paper and the siding by at least 50 mm (2”).

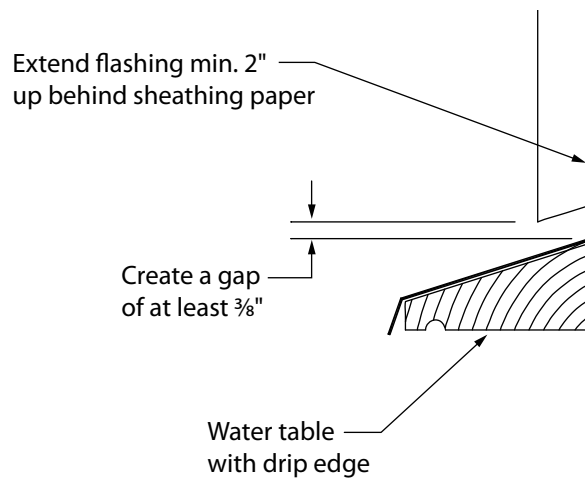


Figure 12—Flashing and water table at base of vertical siding

Keeping the siding clear of the flashing allows the wood siding to dry out after a rain. All wood siding should be “back primed” prior to installing. The exposed ends of the vertical boards should get at least two coats of finish. The bottom edge of the boards is cut at an angle to create a drip edge.

Solid blocking between the studs at maximum 24" o.c. is required for vertical wood siding attachment. The blocking can be omitted if the wall sheathing is a minimum of ½" thick. Joints in individual boards are made with a scarf joint with the upper board overlapping the lower board.

1×3 or larger furring spaced at a maximum 24" o.c. may be used instead of blocking to support vertical lumber siding.

Corners

Vertical siding is overlapped at outside corners and butted at inside corners. It's difficult to compartmentalize the corners when furring (strapping) is used with rainscreen for vertical siding. The end spacer requires tightly fitting blocks between each row of strapping to effectively block air passage (Figure 13).

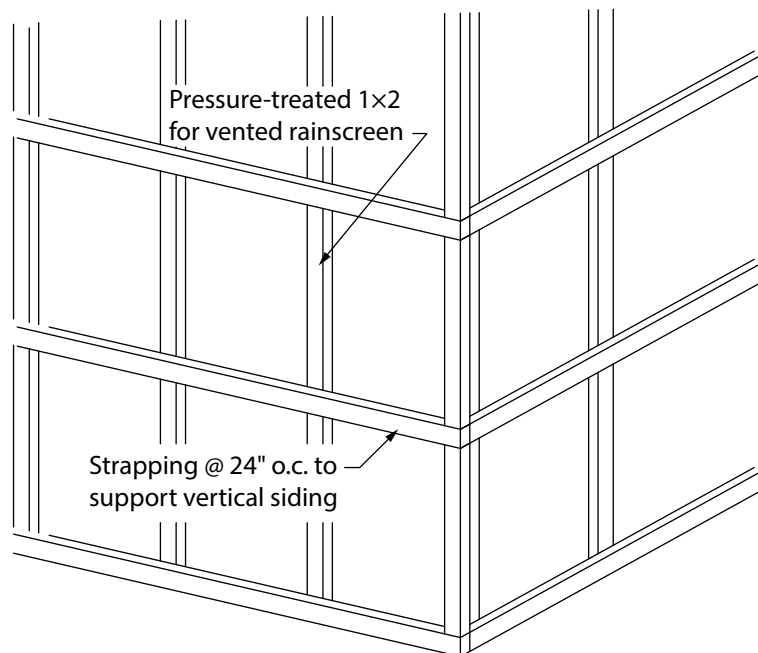


Figure 13—Furring (strapping) over rainscreen

Wood Panels

Plywood panels can be used as exterior wall sheathing and exterior finish simultaneously. The material is provided with a shiplap edge, which hides the joint and makes installation easier. Battens can also be used to cover the joints.

Wood panels range from plain sheets to grooved panels with a variety of finishes. They have appearances such as a natural raised wood grain or stucco. Some wood panels are covered with resin-impregnated kraft paper laminated to the surface to provide a smooth, moisture-resistant finish suitable for painting (Figure 14).

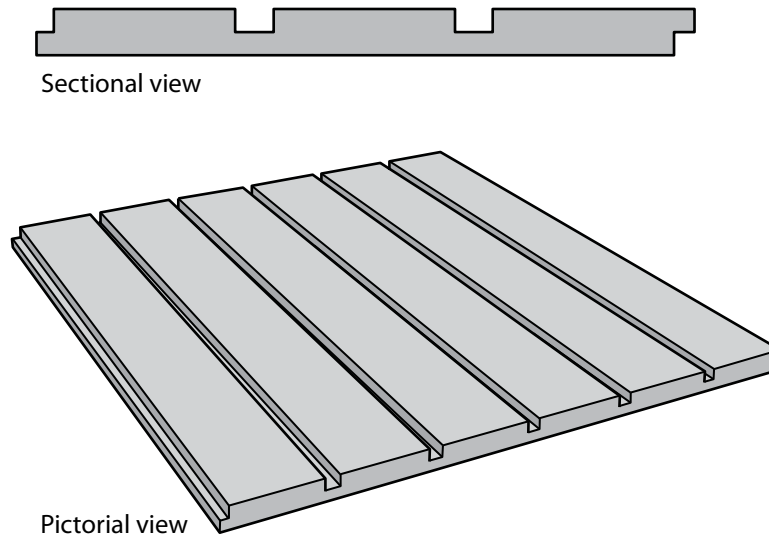


Figure 14—Shiplapped plywood panel siding

When using panel-type exterior siding, the windows are often installed in the walls while the wall is lying on the subfloor. Flashing and sheathing paper are applied over the wall studs and the panelling is fitted around the window and door openings. The windows are caulked, and the joint is covered with an exterior casing. These walls are very heavy and must be lifted with wall jacks.

The other, slower method is to frame the walls, apply diagonal metal cross-strapping, lift the walls, then install windows, flashing, sheathing paper, panel siding and caulking. This method works well for slab-on-grade one-storey buildings.

Vinyl Siding

As with wood siding, vinyl can be purchased in a wide range of sizes and styles. Vinyl siding never needs to be painted since the material is coloured all the way through. Vinyl has the added benefits of being very light and easy to handle. It can be installed horizontally or vertically and comes with a range of moulding, strips and trim pieces that simplify application.

Basic Installation Rules

Vinyl siding can be crosscut with a mitre saw or a portable circular saw. Use a plywood blade and install it backwards on the saw.

Feed the saw slowly into the vinyl. Use a cutting jig, as shown in Figure 15, when cutting with a portable circular saw.



Figure 15—Cross cut jig for siding or soffit

Use a knife or tinsnips to rip vinyl siding. If cutting with a knife, use a straightedge and make multiple light cuts. Position the straightedge so it protects the siding should the knife slip.

Install vinyl siding with at least 6 mm clearance where it fits into accessories (12 mm if installed in cold weather). This allows for the fact that the material expands about 10 mm for every 2400 mm in length with a 50°C change in temperature.

Notch and overlap all siding and accessory pieces, except where the manufacturer states otherwise.

Always place nails in the middle of the slots provided (Figure 16). Never face nail through the siding itself.

Use nails with a minimum head diameter of 8 mm ($\frac{5}{16}$ ") and anchor them at least 20 mm into solid framing or sheathing. Siding and accessories should hang from the nails. Do not drive the nails tightly home—the interlocking design provides enough strength to secure the material to the wall.

Once the lower horizontal siding course is nailed, snap in the course above. When nailing, lift the top panel gently so that the locks just touch (Figure 17).

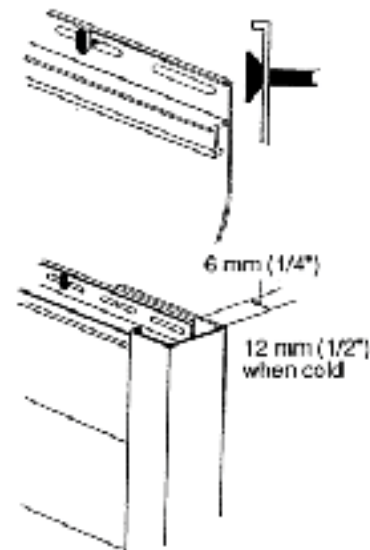


Figure 16—Nailing technique and expansion allowance for vinyl siding

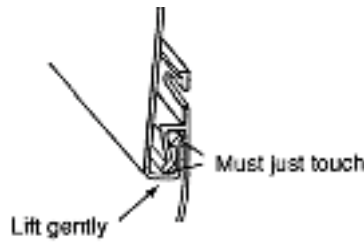


Figure 17—Touching locks

Caulking

It's necessary to caulk all areas where water penetration is possible (pipes, wires, J-channels on sides of windows and doors). Use a compatible caulking (i.e., not an oil base caulking).

Installation

Because vinyl siding is installed as a system, it is important to install as per the manufacturer's instructions. Usually the trim pieces are installed first.

Vinyl trims include J-channel, F-channel, H-channel, inside and outside corner post, single and dual undersill cap, window surround and others.

The first step in installing any horizontal siding is to determine at what height you will start the first course of siding. Use a chalk line to mark the starter strip level on the building. Courses should normally line up on all sides of the building. Then install the inside and outside corner posts plumb (Figure 19 and Figure 20). These should extend down below the starter strip by $\frac{3}{4}$ ". A $\frac{1}{4}$ " space should be left between the corner post and soffits.

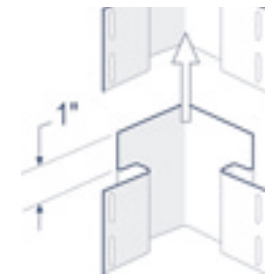


Figure 18—Backside view of splicing outside corner post

Stagger the nails, and, if more than one piece is required vertically, place the joint at the top, out of the line of sight. Lap the upper piece over the lower piece by cutting away 1" of the nailing flange of the lower piece (Figure 18). Overlap $\frac{3}{4}$ ", allowing $\frac{1}{4}$ " for expansion. This will allow water to flow over the joint, reducing the chance of water infiltration.

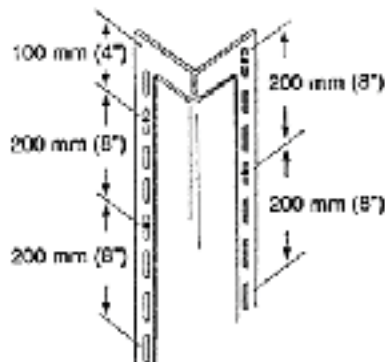


Figure 19—Outside corner posts for vinyl siding



Figure 20—Inside corner post—starter strip is kept back to provide expansion room

Nail the starter strip between the corner posts, butted with a gap of at least 6 mm (Figure 21). Install this material so that the siding hangs over the foundation by about 12 mm. Place nails at 200–250 mm o.c.

The next step is to trim around windows, doors, foundation steps and other openings.

Place J-channel on the sides of all doors and windows so that it extends 25 mm past the top and bottom of all frames (Figure 22). The top horizontal J-channel is cut long enough to make a tab to fold over the vertical J-channels (Figure 22). Loosely nail every 8–12" in the centre of slots and provide a 3/4" lap tab when joining two J-channels.

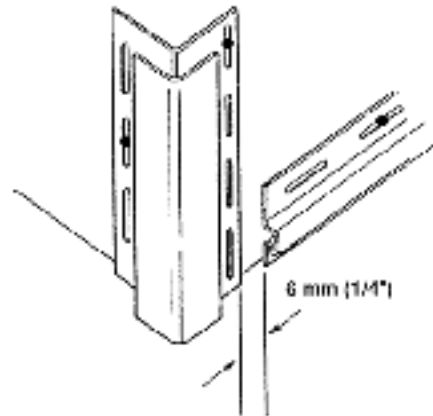


Figure 21—Starter strip at outside corner post

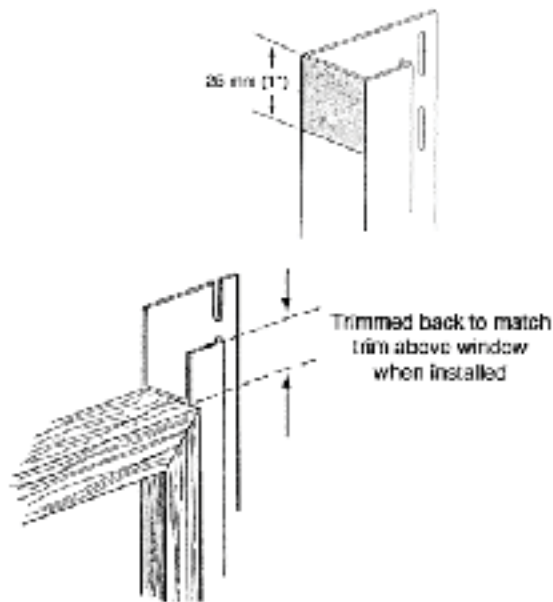


Figure 22—J-channel

Place undersill trim above and below all openings so that it extends as far as the outer edge of the J-channel face (Figure 23).

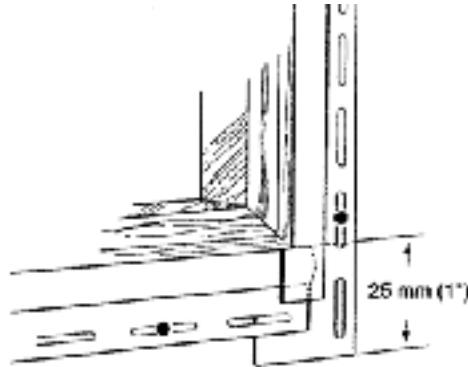


Figure 23—Undersill trim meets J-channel

Fur out the undersill trim to preserve the proper angle (Figure 24 and Figure 25). Use it in an inverted position above windows and doors where trims butt against frames.



Figure 24—Inverted furring strip above window



Figure 25—Furring below sill

Wherever J-channel and sill trims meet the opening frame, caulk them (Figure 26). Where drip caps are required, nail them above the window or door, extended on either side, flush with the exposed leg of the J-channel. Cut a tab at either end of the drip cap and bend it over the J-channels (Figure 27).

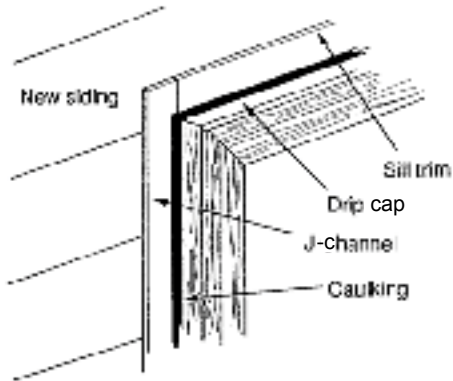


Figure 26—Caulking at frame

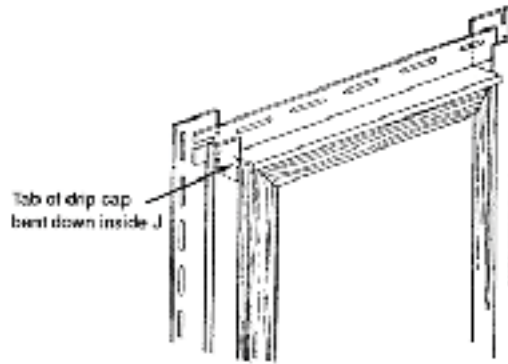


Figure 27—Drip cap installation

Now install the wall panels. Engage the first panel in the starter strip and place nails at either end of the middle slot of the panel to fix it. Nail the whole panel every 400 mm for normal installation or every 200 mm in windy areas (Figure 28).

When panels must be joined, overlap them by half the length of the factory notch as shown in Figure 29. Do not nail closer than 150 mm to the ends of the panels. Try to overlap panels in a direction that makes the lap less visible to normal travel directions.

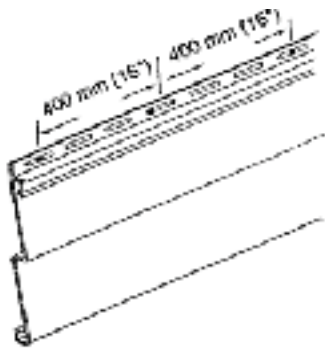


Figure 28—Nailing vinyl siding

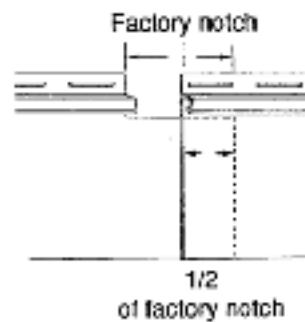


Figure 29—Overlapping siding

If panels must be cut under windows or soffits, the manufacturer supplies a tool to punch “ear” holes along the top edge. These ears hook into the undersill trim and hold the siding securely (Figure 30).

Vertical Vinyl Siding

The installation of vertical vinyl siding is similar to that of horizontal material. There are a few minor differences, which are covered in the manufacturer’s installation guide.

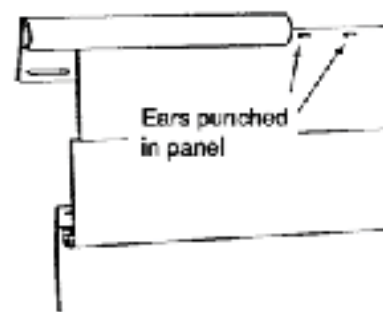


Figure 30—“Ears”

Metal Siding

Aluminum Siding

Aluminum siding is similar to vinyl in appearance, accessories, types of design and application. The baked-on enamel finish is available in a range of colours.

Aluminum nails must be used to fasten aluminum siding and accessories. Aluminum will react with other metals, which can cause it to corrode. Aluminum also reacts with concrete so contact must be avoided to prevent corrosion.

Corner Caps

Corner posts, similar to those for vinyl siding, are available. Corners can also be finished with corner caps. The caps give the siding the look of mitred bevel siding.

Aluminum siding must be kept 12–20 mm back from the corners when corner caps are being used. It's important that courses on each side of the corner are in line (Figure 31).

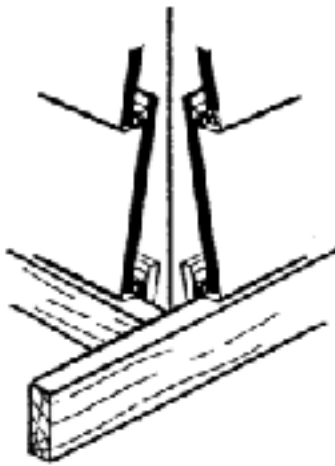


Figure 31—Checking alignment

Framing Shrinkage

Shrinkage of the floor framing can cause any siding to buckle and bulge. In severe cases, the shrinkage can cause the lock between boards of aluminum siding to disengage. Using engineered floor systems reduces shrinkage problems.

Cutting Aluminum Siding

Use a mitre saw or portable circular saw to cut aluminum siding. Use a plywood blade installed backwards. Cut the siding slowly and carefully so that it does not chatter. If using a portable circular saw, use a cutting jig (Figure 32).



Figure 32—Crosscut jig for siding or soffit

Make lengthwise cuts with a utility knife. Score the cut and then bend back and forth until it breaks along the scored line.

Sheet Metal

Ribbed or crimped metal panels, similar to those used for roofing, are available for finishing the exterior walls of commercial and industrial buildings. This material has a long life and is easy to apply.

Sheet materials are sold in various widths and thicknesses. The panels are ordered in specific lengths. Finishes are porcelain-baked enamel or vinyl plastic. Most metal exterior walls are made from galvanized steel, but aluminum and stainless steel are also available.

Sheet metal siding is fastened to studs or strapping with sheet metal screws and neoprene washers (Figure 33).

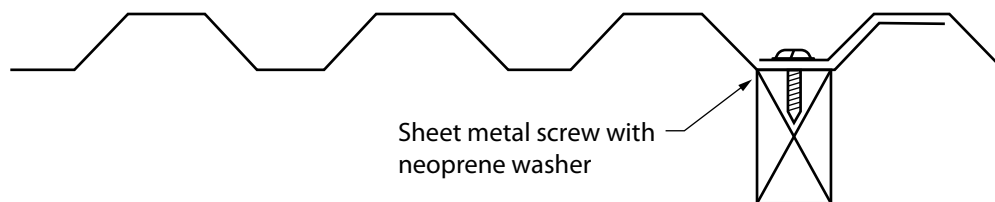


Figure 33—Sheet metal siding with fasteners

Fibre Cement Siding

Fibre cement siding is available in both horizontal lap and vertical panel configurations. Shakes and shingles are also available.

Fibre cement siding needs to be kept dry prior to installation. Store siding under shelter in a garage or outside under tarps. Keep the pile raised off the ground on pallets or by other means. Never install wet fibre cement siding.

Never use uncoated aluminum flashing or other uncoated metals in contact with fibre cement.

Cutting

Siding boards come in 12-foot lengths and must be cut to fit. All cuts should be sealed with primer or paint.

Caution: Fibre cement siding contains crystalline silica, which has been known to cause lung damage—use proper respiratory protection. Wear a P1 or P2 respirator when cutting cement siding using a circular saw. Never cut indoors. A dust-reducing circular saw hooked up to vacuum with a HEPA filter is highly recommended.

For minimal dust and a clean cut, use a polycrystalline diamond-tipped blade when cutting fibre cement siding. These blades stay sharp considerably longer than carbide-tipped blades. Do not cut wood with a polycrystalline diamond-tipped blade. A carbide-tipped blade should be used for cutting trim pieces.

Due to the expense of polycrystalline diamond-tipped blades, it's best to use a portable circular saw with 7¼" blades rather than the more expensive 10" blades of a mitre saw. Furthermore, the fine dust can damage the saw. Once a saw has been used to cut fibre cement siding, it should not be used for fine finishing work.

A carbide-tipped scoring tool can also be used to cut cement siding. The surface is scratched and then the board is snapped off. The cut is rough and should not be used to butt into finish trim.

When using a circular saw or shears, cut with the siding face-down. When using a power mitre, cut with the siding face-up.

Nibbler and Power Shears

The preferred tool for cutting fibre cement siding is either a nibbler or guillotine power shears. The nibbler cuts a narrow slot out of the siding while the power shear slices the siding in half.

These tools cut slower than a portable circular saw, but no dust is produced. This greatly reduces the health hazards from working with this material.

Holes

Cut holes for electrical outlets using a jigsaw equipped with a polycrystalline diamond-tipped blade or a carbide-tipped blade. Use a hammer and a large nail set to make the starting hole for the saw. Masonry bits work best when drilling.

Nails and Fasteners

Nails should be double hot-dipped galvanized or stainless steel. Cement siding can be face nailed or blind nailed. Never angle nails.

Pneumatic fastening with a siding or roofing nail gun is recommended. Do not use a framing gun. Set the air pressure to 80–85 psi such that the backside of the head of the nail is flush to the siding and the nail is not countersunk. Using an adapter to position the height of the nail speeds up application and results in a better job (Figure 34).

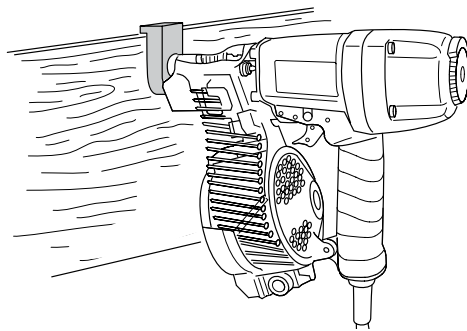


Figure 34—Using an adapter to position the nail

If hand nailing, predrilling may need to be done when nailing near the ends of the boards.

Face Nailing

2" siding nails are used for face nailing. Face nailing is required for vertical panels and some trims. Face nailing for lapped siding is usually only used at joints and at locations where the siding boards are butted into a finished surface, such as butting into a masonry chimney. Predrilling for face nailing will prevent accidental breakout of the edge of the siding. Colour-matched nails are available for face nailing.

Blind Nailing

Galvanized roofing nails with a $\frac{3}{8}$ " diameter head are used when blind nailing. The large head gives extra support to the siding board. The nail is placed as close to the exposure line as possible (Figure 35). The lower edge of the siding is not nailed. The siding is stiff enough to allow the blind nailing to hold the board in place.

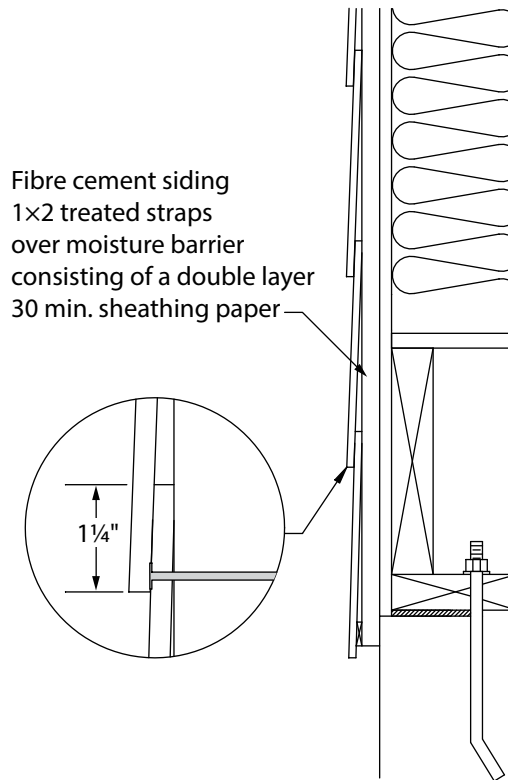


Figure 35—Nailing and head lap

The siding shown in Figure 35 is installed over a rainscreen. Rainscreens are required if the building is in a moist climate.

Screw Fasteners

Fibre cement siding can also be installed with screw-type fasteners. Screws must be non-corrosive and designed for use with fibre cement. Heads should be bugle shaped with a diameter of at least $\frac{3}{8}$ ".

For fastening to insulated concrete form walls (ICF), consult the ICF manufacturer for requirements based on the weight of the fibre cement product.

Installing Fibre Cement Lap Siding

Fibre cement lap siding is installed in the same manner as bevelled cedar siding. The boards are lapped and nailed in place. The cement siding is butt joined, not scarf joined. For outside corners, the siding butts into corner boards, rather than being mitred.

Exposure

Fibre cement siding boards come in various widths from $5\frac{1}{4}$ " to 12". The siding boards are installed with a simple overlap without a notch or other connecting device. This allows the exposure to be adjusted by varying the overlap.

The minimum head lap is $1\frac{1}{4}$ " (shown in Figure 35) but is often increased up to $1\frac{3}{4}$ ".

Calculating the Exposure

In most cases, the exposure is adjusted so that the width of the final board at the underside of the soffit has the same exposure as all other boards. There are four steps in calculating the exposure:

1. Measure the total height to be covered with siding. Remember to allow a 2" cover over the top of the foundation wall.
2. Determine the maximum exposure by subtracting $1\frac{1}{4}$ " from the width of the siding.
3. Find the number of courses by dividing the total height by the maximum exposure. (Round up to the next whole number.)
4. Find the exposure by dividing the number of courses into the total height. Round to the nearest $\frac{1}{16}$ ".

Example:

Find the exposure for siding a wall when using $8\frac{1}{4}$ " wide siding on a wall that measures $98\frac{1}{2}$ " from the concrete to the soffit.

1. $98\frac{1}{2}" + 2" = 100\frac{1}{2}"$
2. $8\frac{1}{4}" - 1\frac{1}{4}" = 7"$
3. $100\frac{1}{2}" \div 7" = 14.36$ courses. (Round up to 15 courses.)
4. $100\frac{1}{2}" \div 15 = 6.7"$ (Round to $6\frac{11}{16}"$.)

The head lap in this example is $1\frac{1}{16}"$ ($8\frac{1}{4}" - 6\frac{11}{16}"$).

This example is appropriate for a simple building. For larger, more complex buildings, many factors have to be considered: slope of the finished grade, different soffit elevations, other types of finishes used, etc.

Windowsill Height

When calculating exposure, consider the location of the bottom of any windows. It's best to avoid a thin strip of siding under the window if possible.

Corners

The corners of horizontal cement siding are usually covered with battens or corner boards (with the siding butting into them) (Figure 36 and Figure 37). A 1/8" gap is provided for caulking.

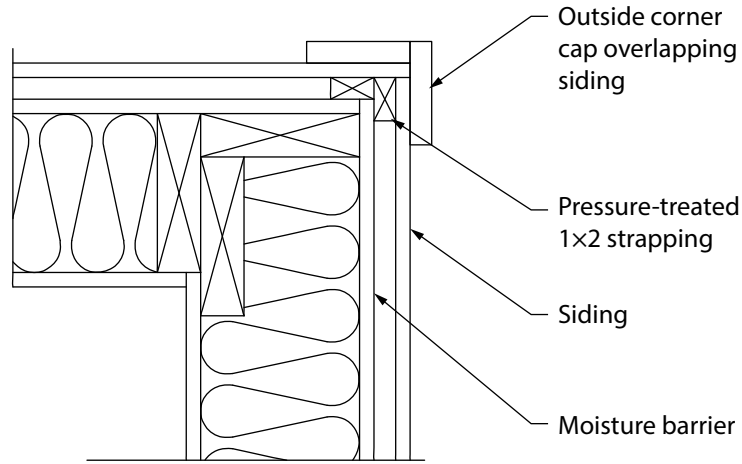


Figure 36—Outside corner boards with a rainscreen

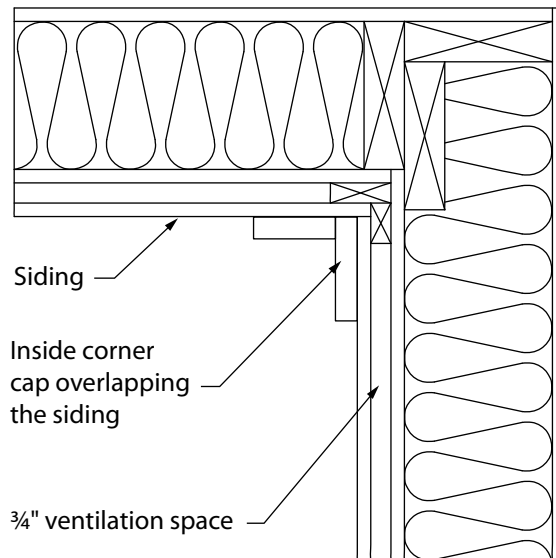


Figure 37—Inside corner boards with a rainscreen

Flashings

As with other sidings, all exposed openings must be suitably flashed.

Butted joints of lapped siding are back-flashed with coated metal or other fibre cement compatible material (Figure 38). Flashing should extend at least 3" on both sides of the joint and 2" above. The bottom of the back flashing stops 1/4" short of the siding boards.

Mid-wall joints are installed tight and caulking is not required. Try to use factory ends for these joints.

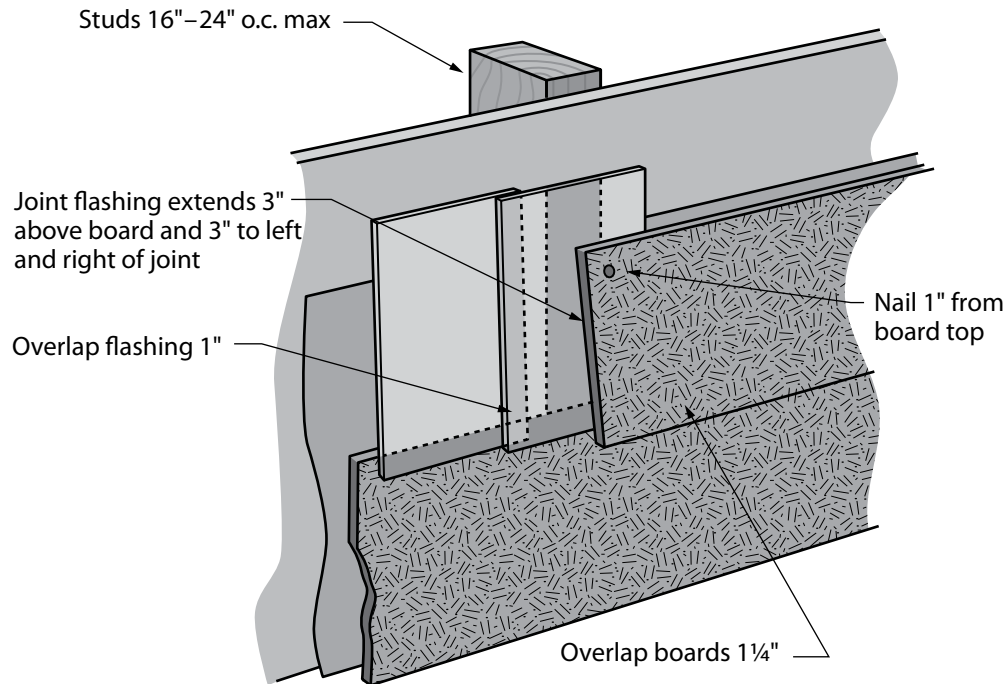


Figure 38—Back flashing a butt joint

Caulking

Caulking must be compatible with fibre cement products and should be paintable. Exterior acrylic and urethane are normally used. Caulking is used between fibre cement siding and dissimilar materials, such as wood or brick. Caulking is also used between the siding and trim boards (Figure 39). A $\frac{1}{8}$ " gap is left and filled with caulking (smaller gaps are difficult to fill).

Caulking is also required at end joints around windows and doors and around penetrations such as dryer ducts, hose bibs, electrical outlets, light fixtures and cables.

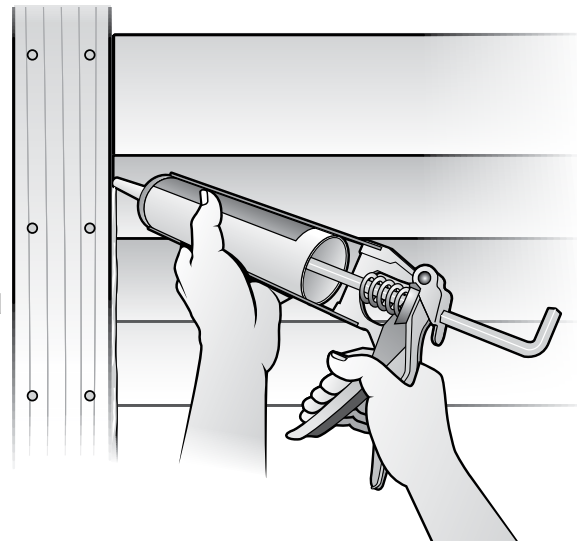


Figure 39—Caulking the $\frac{1}{8}$ " wide joint at a trim board

Caulking must be of the type that stays flexible. Use a product that's marked with a phrase similar to "permanently flexible".

Do not caulk where drainage is expected to occur, such as at flashing locations (Figure 40).

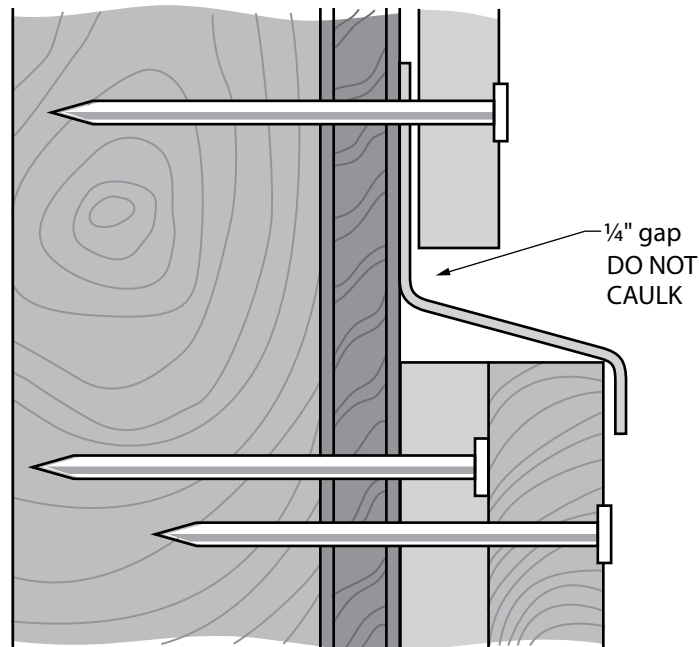


Figure 40—Allowing for drainage

Painting

Fibre cement siding is available either unfinished, primed or coloured. Unfinished siding should be painted within 90 days of installation. Primed siding should be painted within 180 days.

Painting can be done prior to installation, but do not paint the back of the siding as it needs to breathe. Use only latex products on fibre cement products, never oil-based paint or stain. Two coats are normally required.

Factory-painted fibre cement siding won't require painting other than to seal cut edges. It comes with a protective film on the face side. Do not remove the film until after each board has been nailed.

Fibre cement siding is usually warranted for 50 years if properly painted and maintained.

Stucco

Acrylic stucco and cement stucco are two distinctly different types of stucco finish. Both systems are able to provide an excellent exterior finish if installed correctly and if used in appropriate locations.

Exterior Insulation Finish System

Exterior insulation finish system (EIFS) is not ideal for areas where wind-driven rain is prevalent. It uses an acrylic stucco finish on top of expanded polystyrene rigid insulation. The acrylic finish provides a watertight seal to vertical wall surfaces, but leaks can occur at the transitions if there are any horizontal or sloping surfaces.

EIFS can be used with a drainage rainscreen to allow leaked rainwater a path to the exterior, making it a better option in wet, temperate climates.

The smooth, flat surfaces and striking colours that are available with EIFS make it architecturally pleasing. It's best suited for areas partially protected from weather.

Application

Application is as per the manufacturer's specifications. The EIFS Council of Canada has developed an EIFS Quality Assurance Program to certify installers and provide third-party warranty assurance. ULC S716 EIFS was created to set a national standard for this type of cladding.

Most EIFS installations include the following (Figure 41):

- Expanded polystyrene insulation board is applied to the wall surfaces using adhesive and/or special fasteners for holding foam insulation. These fasteners have very large heads to spread the support for the insulation.
- A fibreglass mesh is applied over the insulation to provide reinforcement of the stucco.
- A base coat of stucco is applied in a layer approximately $\frac{1}{8}$ " thick to encase the mesh and to level the surface of the insulation.
- A thin finish texture coat of stucco is coloured and applied in a thin layer over the base coat.

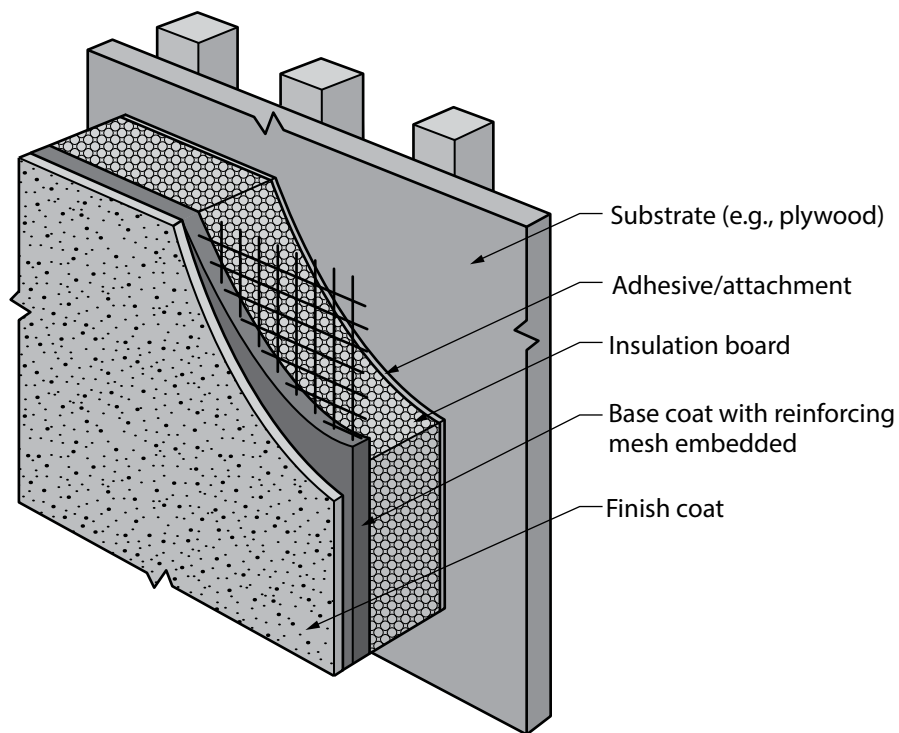


Figure 41—Typical construction of an Exterior Insulated Finish System (EIFS)

Cement Stucco

Cement stucco provides a hard, dense, water-resistant coat of cemented material at least 15 mm thick over exterior sheathing. Stucco is applied in three layers over metal lath or stucco wire.

Metal Lath

Expanded metal lath is used for horizontal surfaces, existing concrete walls (Figure 42), and sometimes to reinforce corners (Figure 43).

Stucco Wire

Stucco wire is used for vertical surfaces and must be installed with the self-furring devices against the wall sheathing.



Figure 42—Stucco over metal lath

Nailing

Lath and wire must be attached with roofing nails or staples. The maximum spacing of the nails for vertical surfaces is:

- 6" o.c. vertically and 16" o.c. horizontally
- or
- 4" o.c. vertically and 24" o.c. horizontally

In no cases shall there be fewer than 20 nails per square metre of lath or wire.



Figure 43—Expanded metal lath reinforcing the corner

Overlap

Horizontal and vertical joints must overlap by at least 2" and these joints must be staggered like wall sheathing and occur over framing members.

Corner Reinforcement

Expanded metal lath corner reinforcements are used at exterior and interior corners. The lower edge of the stucco is also reinforced with a galvanized metal strip.

Expansion and Control Joints

Stucco will expand and contract with temperature changes. These stresses cause the stucco to crack. The control joints are placed at horizontal intervals of approximately 12 feet.

Expansion joints are placed at each floor level. They allow for the shrinkage and settling of the building.

Window and Door Flashing

The weight of the stucco will apply loads onto the flashings over windows and doors. This load will deflect the flashing. The flashing must be kept clear of the top of the window by $\frac{3}{8}$ " to allow for this deflection.

Aluminum reacts with stucco and will corrode. It should not be used for flashing under or around stucco unless factory coated.

Stucco Mixes

Cement stucco is a mixture of Portland cement, lime, aggregates and water. Masonry cement contains lime—if it's used in place of Portland cement, then lime does not have to be added to the mixture.

Lime makes the mixture workable and helps it to set quickly. Like concrete, the stucco should be cured in a moist environment. The moisture is applied as a fine spray of water. Stucco should not be applied when the weather is too warm.

The stucco should be mixed thoroughly before and after adding the water. The mixed stucco must be applied within three hours of adding the water.

Portland cement and/or masonry cement are used to make the stucco base coat. The resulting stucco colour is grey. The brown coat (the second coat applied) has 10% more lime and sand to make it slightly weaker so it won't crack the base coat when it shrinks. The finish coat is made using white cement, lime, white sand and up to 6% pigment (colour) by weight.

Application

The traditional method of stucco application is done with a trowel and hawk. A *hawk* is a flat tray with a handle on the bottom. The stucco is scooped onto the hawk and spread over the wall surface using the trowel. This is a very labour-intensive process. Another method of application uses an air stream to project the stucco onto the wall surface, similar to Gunnite concrete application. Finish coats are applied using a trowel.

Thickness of the coats:

- The base coat must be at least 6 mm ($\frac{1}{4}$ ") thick, measured from the face of the lath or substrate. If lath is used, the total thickness of the base coat will be $\frac{1}{2}$ ".
- The second coat must also be 6 mm ($\frac{1}{4}$ ") thick.
- The finish coat may be as thin as 3 mm ($\frac{1}{8}$ "). The overall thickness of the stucco must be at least 15 mm ($\frac{3}{8}$ "), measured from the face of the lath or substrate. Additional stucco used to texture the wall is not included in the stucco's required thickness.

Stone Dash

The finish coat may be omitted and a coating of small stones used as the finish. This "stone dash" finish is applied using a scoop to throw small pebbles at the wall. The pebbles are selected for colour and are uniform in size, usually with a diameter less than $\frac{3}{8}$ ".

The stones must be embedded into the second coat before it has had a chance to harden. A drop sheet or tarp is used to catch the stones that are not embedded.

Brick Veneer

Brick veneer refers to bricks that are applied in a thin layer. This layer is usually 2–4" thick, but may be as thick as 8" in certain situations.

Brick exteriors will last almost indefinitely. Over very long periods of time, the bricks themselves will deteriorate and fall apart. If the bricks are frequently subjected to freeze/thaw cycles, premature deterioration may occur. A coating of clear sealer will help prevent this.

Brick veneer is covered by *BC Building Code Section B-9.20*.

Support

Masonry construction is heavy and must be suitably supported. The width of the footing supporting the foundation wall is increased by 65 mm for each storey of masonry veneer to support the extra weight.

The best support is a corbel or ledge in the foundation wall (Figure 44 and Figure 45).

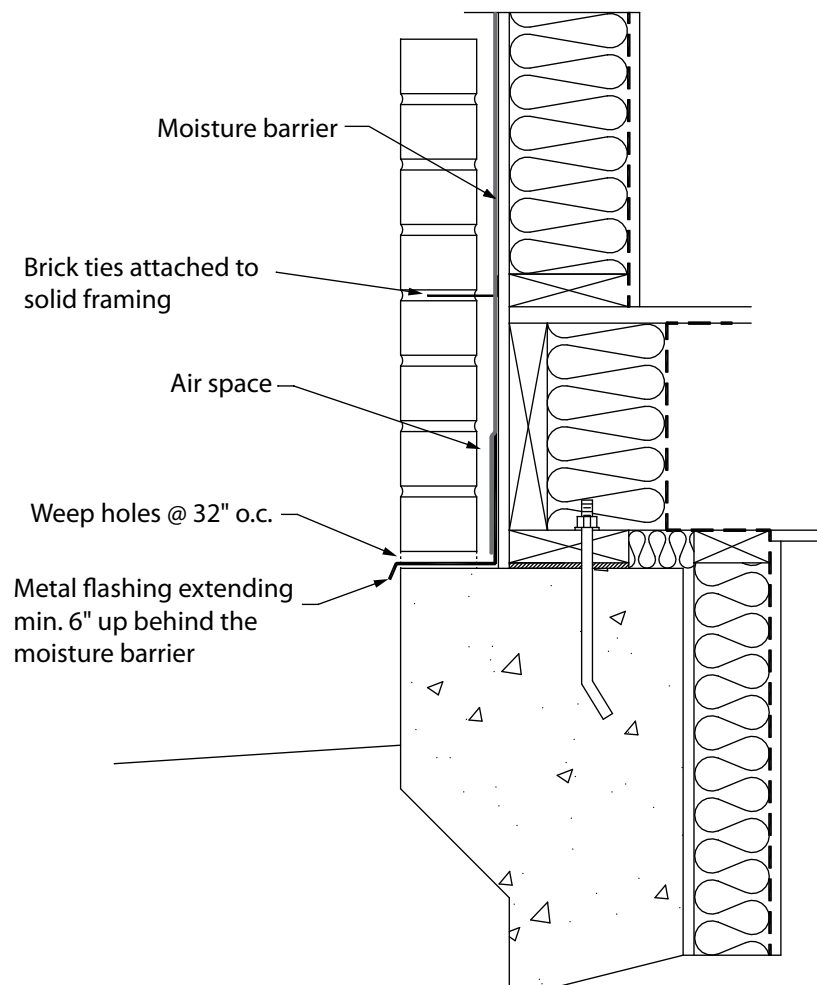


Figure 44—Masonry veneer supported on a corbel in the foundation wall

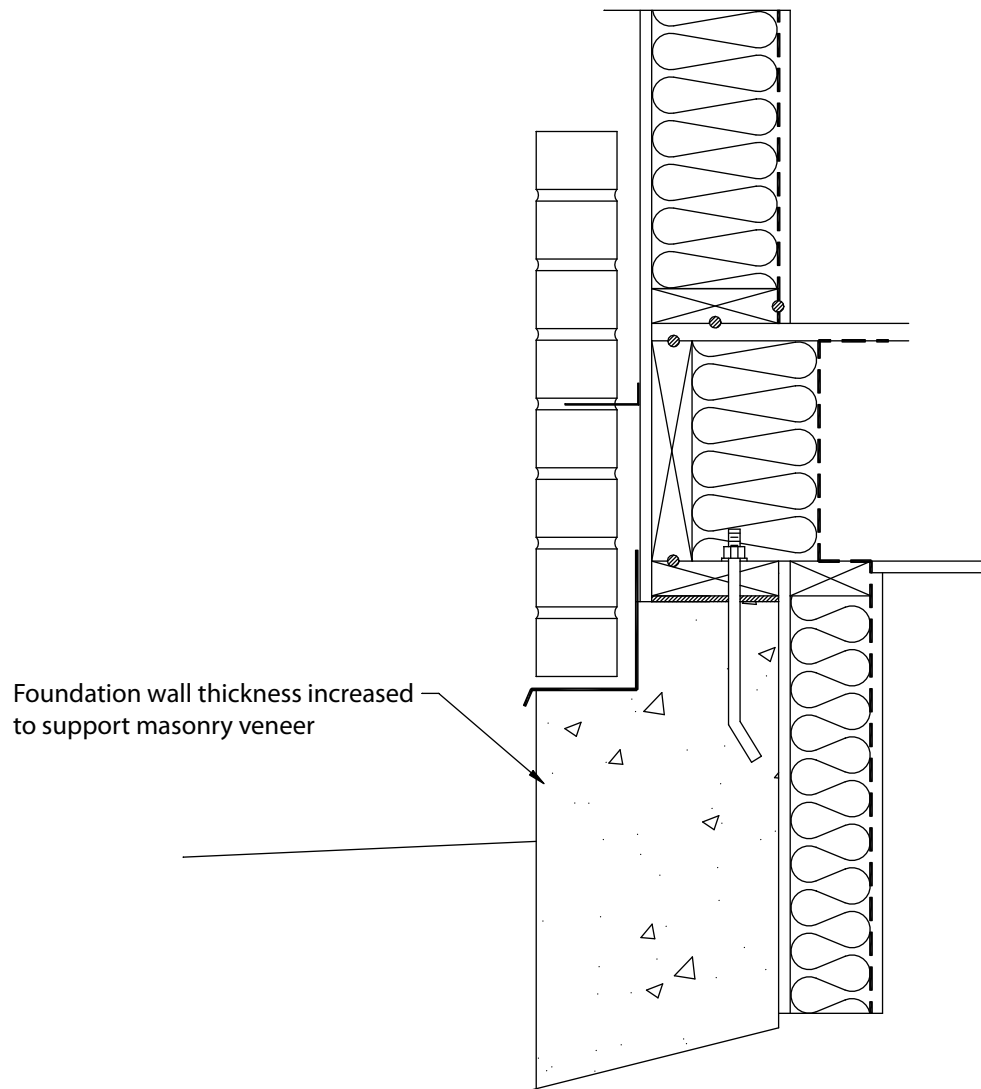


Figure 45—Masonry veneer supported on a ledge in the foundation wall

Another acceptable method is to bolt a steel ledger to the foundation and support the brick veneer on the ledger.

Lintels

Metal angle iron supports are used to span over openings. The allowable span is specified in the *Building Code*. The minimum end bearing for the angle iron is $3\frac{1}{2}$ ". *BCBC Table B-9.20.5.2* specifies the design the size of angle iron for masonry veneer lintels.

Brick Ties

Metal brick ties are used to attach the veneer wall to the wood framing. The spacing of the ties is dependent on the spacing of the wall studs. For studs 24" o.c., the vertical spacing is 500 mm, and for studs 16" o.c., the vertical spacing is 600 mm.

The fasteners used to attach the brick ties to the framing must be $\frac{1}{8}$ " in diameter and be screws or spiral nails. They must penetrate solid framing at least $2\frac{1}{2}$ ".

Brick ties must be at least 0.76 mm thick and at least 22 mm wide.

Shrinkage

Masonry construction does not settle or shrink, but woodframe construction will. When masonry is applied as a veneer over a wood frame, a gap should be left at the top of the masonry to allow for the building to settle. The amount of the gap should be $\frac{3}{8}$ " per floor of masonry construction.

Flashing

Flashing under the bottom course of the masonry veneer must extend behind the moisture barrier (sheathing paper) at least 6". This base flashing must continue out under the masonry and form a drip edge that projects beyond the support below.

If panel-type rigid insulation or insulating sheathing is used, the base flashing must extend 6" behind the insulation or sheathing.

Flashing must be provided over any unprotected openings in the masonry veneer. Non-coated aluminum flashing should not contact masonry, concrete or mortar.

Weep Holes

Weep holes are provided to allow any water that accumulates behind the veneer to escape. They must be spaced no more than 32" apart and be clear of mortar.

Install Exterior Finish Materials

Exterior finish materials include mouldings and trim. This material is used to create friezes, foundation skirts, cap corners, frame windows and doors, and finish and cap columns. Other types of trim can be used to frame and secure wall panels and cap panel joints.

Trim material includes lumber, strand board, PVC, vinyl, metal, fibre cement and other materials.

Wood Trim

Smooth lumber (S4S), rough-sawn lumber or resawn lumber (S1S2E) can be used for finishing trim. Combed-face lumber is lumber that has gone through a planer equipped with serrated knives to texture the boards. It looks as though a comb has been dragged across the board. Combed-faced lumber was primarily manufactured for fascia use but is now used for many types of trim.

Rough and resawn materials are better for trim than smooth lumber because they hold paint better, hide nail heads better and have a nicer appearance.

Wooden trim is typically nailed with galvanized casing nails. Double rows of nails should be spaced no more than 24" o.c. and should penetrate the substrate at least the same amount as the thickness of the trim material. A single row of staggered nails 12" o.c. can also be used.

Scarf joints should be used to minimize water infiltration. Caulking may be required at joints and between trim and siding.

Another wood trim product is SmartSide Trim®. This product and others like it use a high-quality primed or prefinished strand board (similar to OSB) to make a 4/4 or 5/4 fascia covering. It's available with a textured wood-grain finish. When installing engineered products such as SmartSide Trim®, always follow the manufacturer's installation procedures.

Fibre Cement Trim

Fibre cement trim boards are applied similar to wood trim. Fibre cement products include plank materials. Available in smooth or textured, planks come in 4–16" widths and thicknesses from $\frac{5}{8}$ " to 1 $\frac{1}{4}$ ". Some trims have rabbeted edges for lapping siding pieces (Figure 46). Always follow the manufacturer's installation procedures.

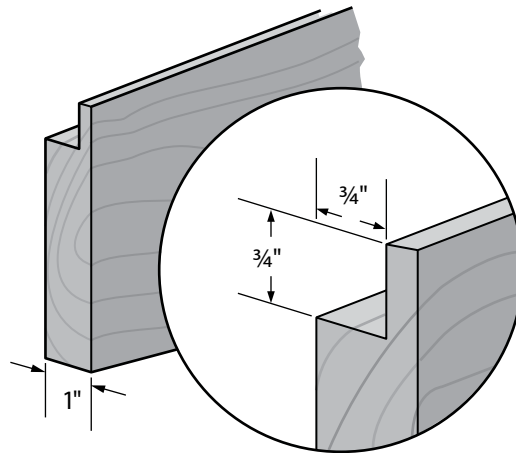


Figure 46—Trim piece with rabbeted edge

Corner pieces include one-piece outside corners, with or without a siding recess notch, and inside corner post (Figure 46 and Figure 47). Both outside and inside corners can also be made as two-piece units (Figure 48).

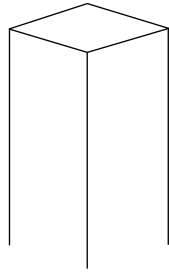


Figure 47—One-piece inside corner post trim

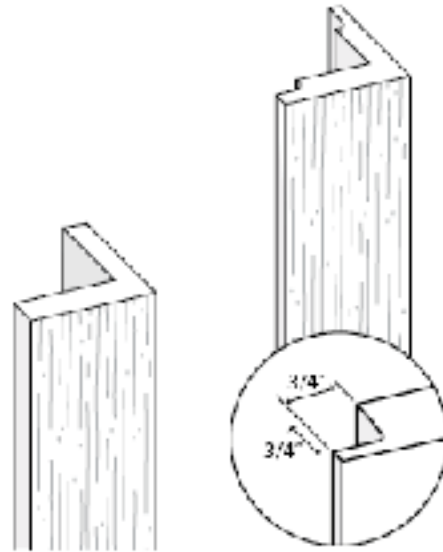


Figure 48—One-piece outside corner trim

Double board

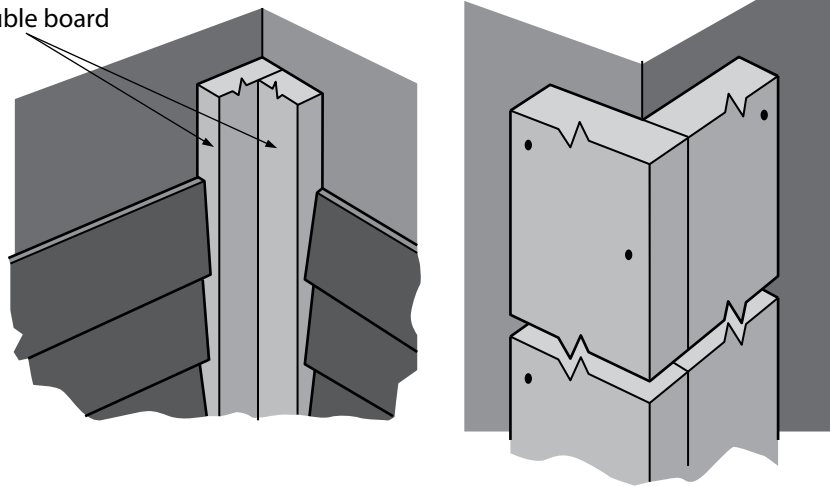


Figure 49—Two-piece corner posts

Follow the manufacturer's nailing instructions. Typically, trim 4" wide or less gets a single staggered row of nails and trim more than 4" wide gets a double course of nails (Figure 50).

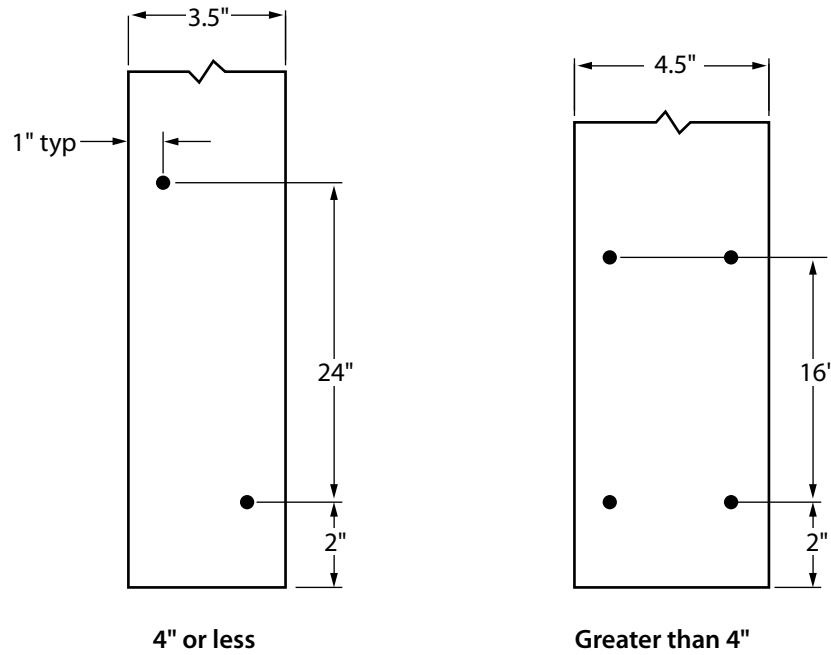


Figure 50—Typical nailing pattern for fibre cement trim

Tabs can be installed for the blind nailing of most trims including corners and band boards (Figure 51).

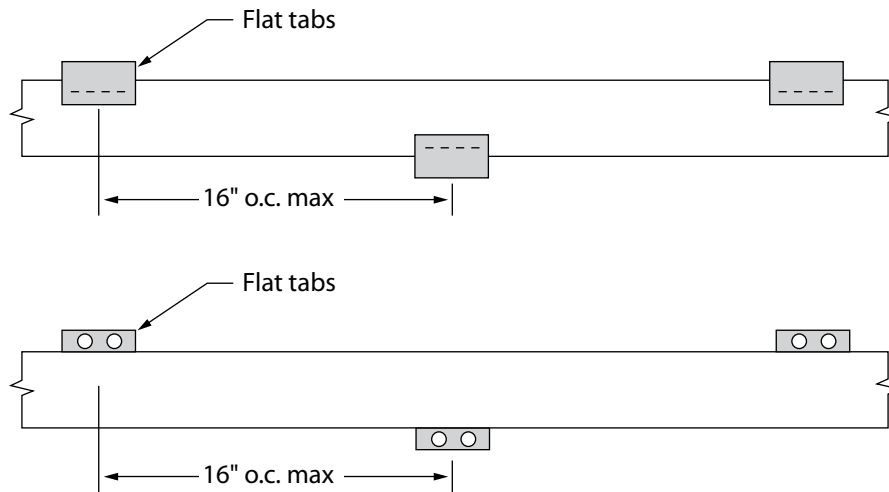


Figure 51—Tabs for blind nailing

Complete sets of trim are available for encasing various size posts (Figure 52).

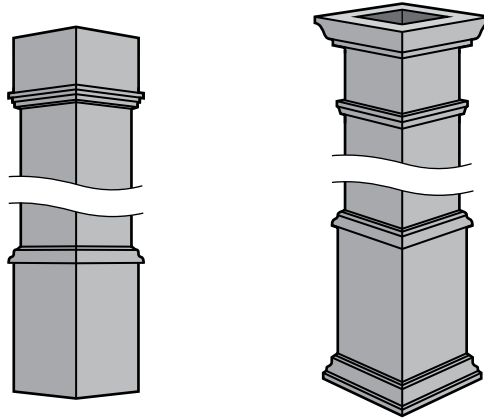


Figure 52—Fibre cement column trim examples

Fibre Cement Panel Trims

Many commercial cladding applications use large fibre cement panels as a cladding system (Figure 53). These panels are often each trimmed and capped with metal trim as part of the fastening process. Typically, the bottom trim is fastened to the wall first and then corner trims are installed. The wall face is then divided into a grid of panel areas following the architect's plan and backer trim is installed to fit between each panel.

Panels are cut to fit in each of the grids and the caps are snapped into place, securing the panels. In some cases, the panels are also screwed to the wall for centre support.



Figure 53—Example of a finished commercial fibre cement panel cladding

Vinyl Trims

Vinyl siding is installed as a system. The trim pieces are described in a previous Learning Task.

Install Fascia, Soffits and Continuous Venting

Soffits finish the underside of roof projections. Attics need ventilation and soffits are the usual location to provide this *Building Code* requirement.

The fascia extends below the rough fascia to cover the soffit trim or edges. Similarly, roofing materials extend far enough to cover the fascia.

Fascia and soffits are made from metal, vinyl, lumber, strand board, fibre cement, PVC or other materials.

Fascia Systems

Fascia can be finished with many different materials. Each has its own look, and some such as metal and vinyl have the advantage of being maintenance-free.

Most engineered wood and fibre cement fascia require a drip edge flashing to keep water from building up behind the fascia board (Figure 54).

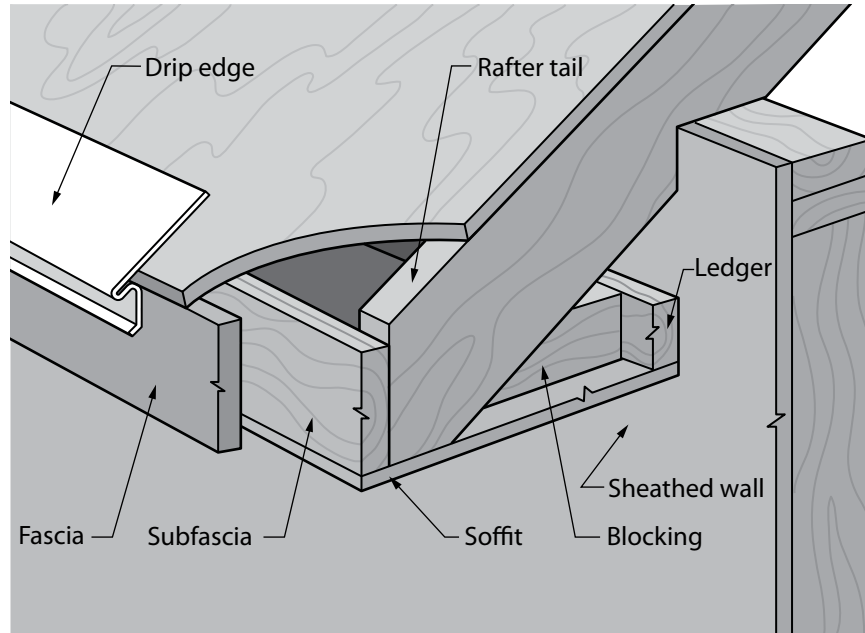


Figure 54—Drip edge flashing (roofing not shown)

Metal and Vinyl Fascia Systems

Prefabricated metal and vinyl fascia systems are very popular in new and retrofit construction. These materials are attractive, easy to install and usually do not need to be painted. Fascia systems fit right over the wood rough fascia and into channels that are stapled in place (Figure 55).

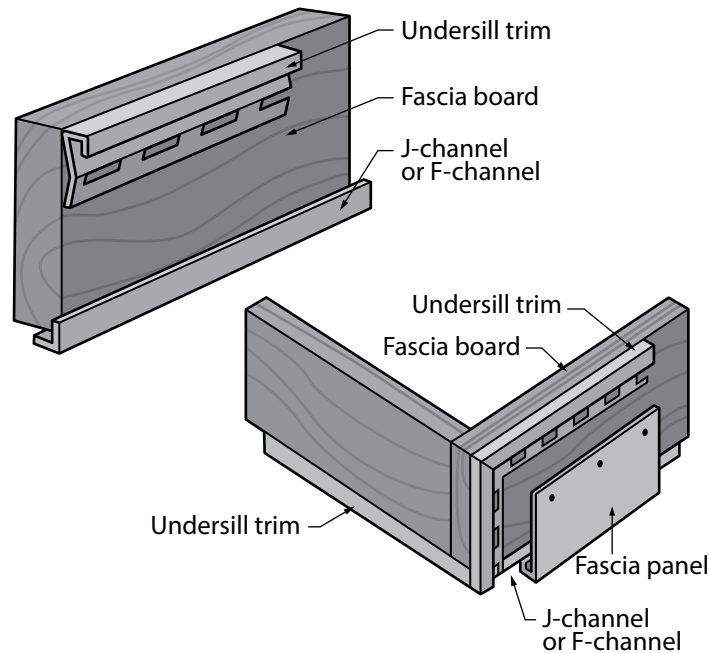


Figure 55—Fascia covers and trim

These systems are widely used to match the cornice appearance to the exterior wall finish. They incorporate some of the same trims used for wall finishes (Figure 56).

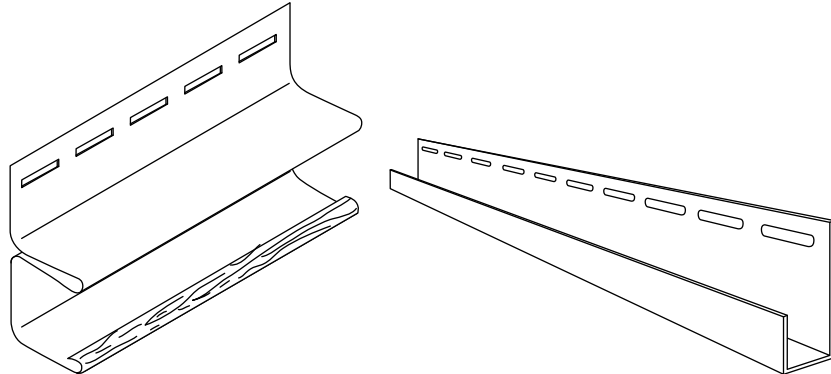


Figure 56—F- and J-channel

Installing Metal and Vinyl Fascia

Install undersill trim along the top of the wooden rough fascia (Figure 57). Cut vinyl or aluminum fascia material to width. Punch ears along the top edge of the fascia panel to fit into the undersill trim. Hook the specially designed bottom edge over the bottom of the rough fascia or over a J-channel.

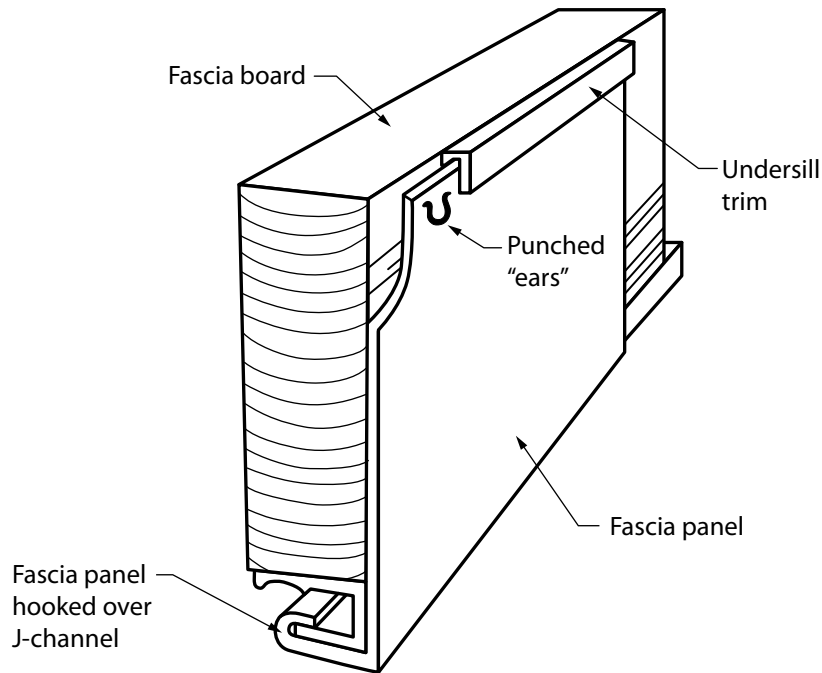


Figure 57—Detail of fascia panel

Wooden Fascia

Smooth lumber (S4S), rough-sawn lumber or resawn lumber (S1S2E) can be used for finishing fascia. The roofing material must project far enough to cover the fascia. For this reason, fascia is usually installed before the roofing material.

Installing Wooden Fascia

Wooden fascia is typically nailed with galvanized casing nails. Double rows of nails should be spaced no more than 24" o.c. and should penetrate the substrate at least the thickness of the fascia material.

When installing engineered products such as SmartSide, always follow the manufacturer's installation procedures.

Fibre Cement Fascia

Fibre cement products include fascia materials. Available smooth or textured, it comes in 4 to 16" widths and thicknesses from $\frac{5}{8}$ " to $\frac{5}{4}$ ".

Fibre cement fascia and PVC fascia are applied similar to wooden fascia material. Always follow the manufacturer's installation procedures.

Gutter Fascia

Gutters can be used as fascia by applying an extra deep gutter to the rafter tails. Gutter installation is covered in a later in Learning Task.

Soffit Systems

Soffits can be made from metal, vinyl, wood, fibre cement or other materials. Metal and vinyl are the most common due to their light weight and ease of installation.

Soffit systems are widely used to match the cornice appearance to the exterior wall finish. They incorporate some of the same trims used for wall finishes and are available plain or vented (Figure 58).



Figure 58—Vented soffit

Metal and Vinyl Soffit Installation

Nail all trims at 300 mm o.c. To allow for expansion, notch J-channel 40 mm and overlap it by half this amount as shown in Figure 59. The terms *trim* and *channel* are interchangeable in reference to metal and vinyl materials.

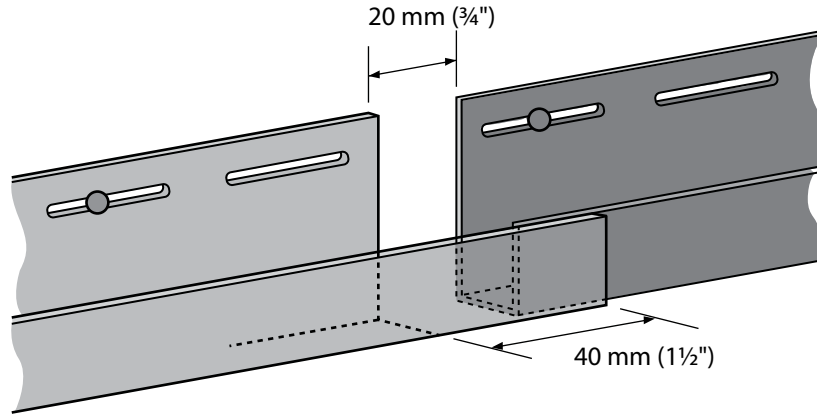


Figure 59—Notched and overlapped J-channel

A 38 mm × 38 mm ledger is nailed to the wall to support J-channel. F-channel is nailed directly to the wall (Figure 60).

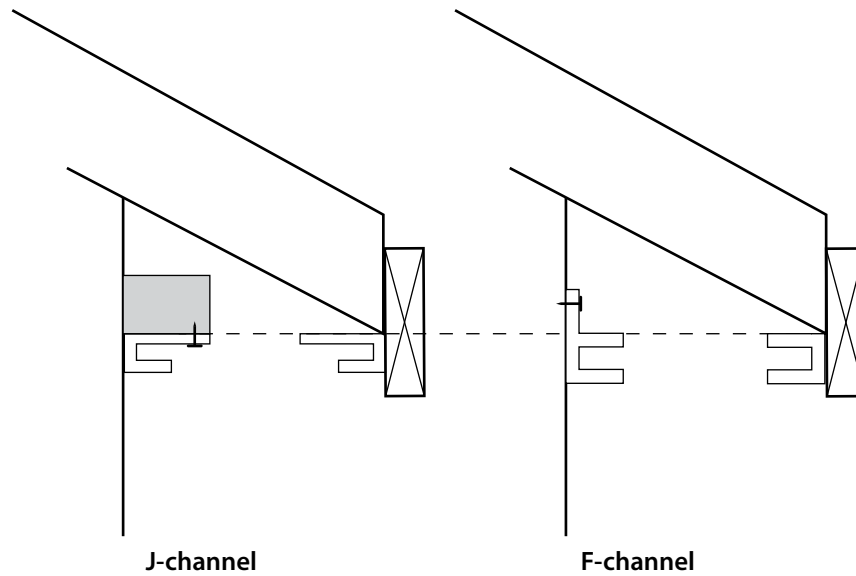


Figure 60—J- and F-channel at wall side

Another method is to apply the siding undersill trim cap trim slightly lower than the 38 mm × 38 mm ledger to leave a channel for the soffit (Figure 61).

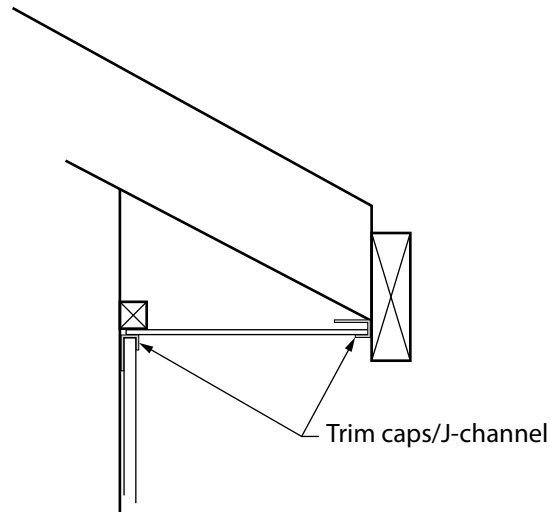


Figure 61—Soffit supported by siding trim or J-channel

If a wooden fascia is to be exposed, J-channel can be attached to lookouts or F-channel can be installed against the finished fascia. J-channels can also be screwed through the channel against both the wall and fascia boards.

Soffit panels are cut 12 mm shorter than the distance between the inside of the channels. Lock the panels together as they are installed and, where possible, nail or screw them to wooden supports. Panels longer than 600 mm must be nailed to an intermediate support. Finish the ends of each soffit-run by trimming with J- or F-channel.

Where two soffit sections meet at a corner, use two J- or F-channels properly supported back-to-back. There are two methods of making the joint, either as a butt joint or as a mitre joint (Figure 62 and Figure 63).

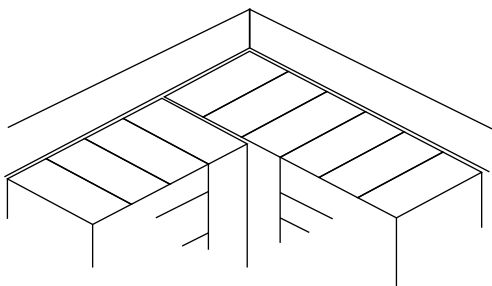


Figure 62—Square corner

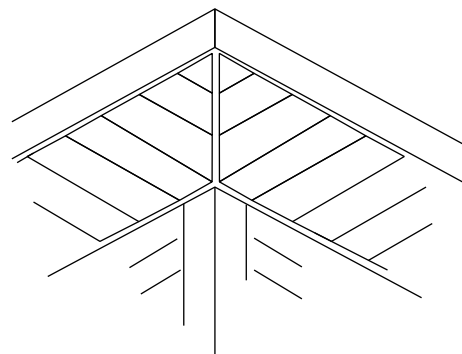


Figure 63—Mitred corner

Wood Soffit Installation

Wood channel siding or plywood is sometimes used for soffits. A strip is left open and backed with screen mesh to allow for venting. Wood soffits can be applied horizontally to lookouts or at an angle to the underside of the rafter tails as shown in Figure 64. It's typically held up with galvanized casing nails.

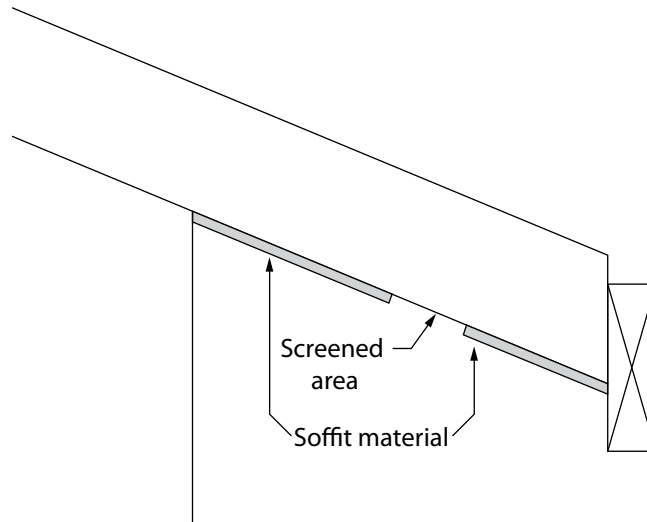


Figure 64—Soffit material applied directly to rafter tails

A frieze board is often used to trim the siding and soffit junction when wooden soffits are applied horizontally (Figure 65).

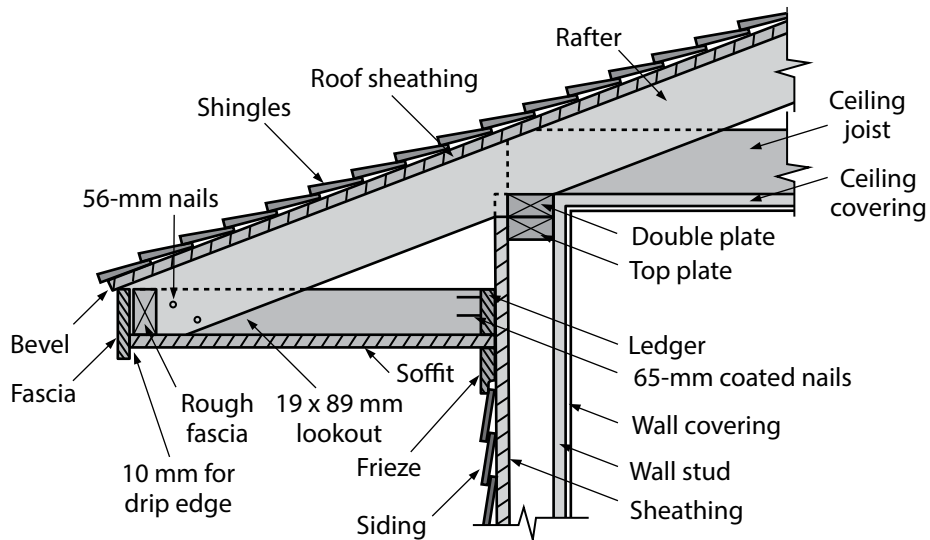


Figure 65—Soffit supported by lookout and frieze board

Fibre Cement Soffit Systems

Several manufacturers produce a fibre cement soffit material. It's typically ¼" thick, which is thinner than fibre cement siding and lighter in weight.

Fibre cement soffits should be supported in both directions no farther apart than 24" o.c. Joints are butt joints and can be left as-is, trimmed with PVC caps or covered with battens (Figure 66). As with any engineered product, always follow the manufacturer's installation procedures.

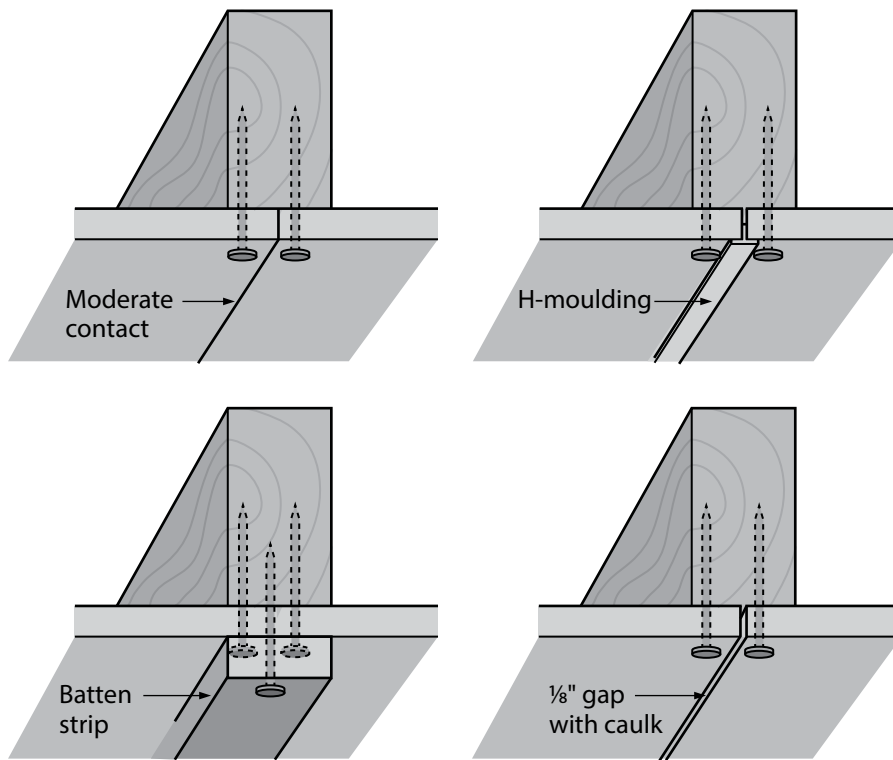


Figure 66—Fibre cement soffit joints

Fibre cement soffit material comes in smooth, textured and beaded finishes. Vented materials have holes or slots that allow air passage but are too small for flies, wasps or other similar-size insects (Figure 67).

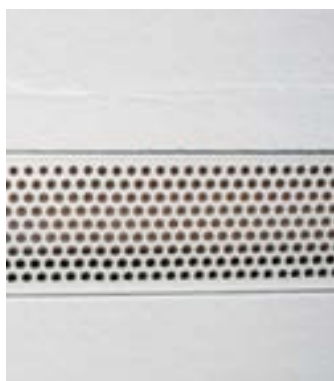


Figure 67—Vented soffit vent

Continuous Ventilation

The *Building Code* requires roof spaces to be vented when there is insulation between the ceiling and the underside of the roof sheathing. The unobstructed vent space must be no less than $\frac{1}{300}$ of the ceiling area, except if the roof slope is less than 1:6 or if roof joists are used to frame the roof, in which case the vent space cannot be less than $\frac{1}{150}$.

Vents can be roof-type, eave-type, gable-end-type or any combination and must be uniformly distributed on opposite sides of the building. At least 25% of the required ventilation is to be near the bottom of the space and 25% at the top.

When roof joists are used, each joist space must be vented unless 38-mm thick purlins are used on top of the roof joists.

Installing vented soffits is one of the best ways of providing continuous ventilation at the bottom of the roof space. High heeled trusses are normally used along with insulation stops to keep insulation from blocking ventilation over exterior walls (Figure 68).

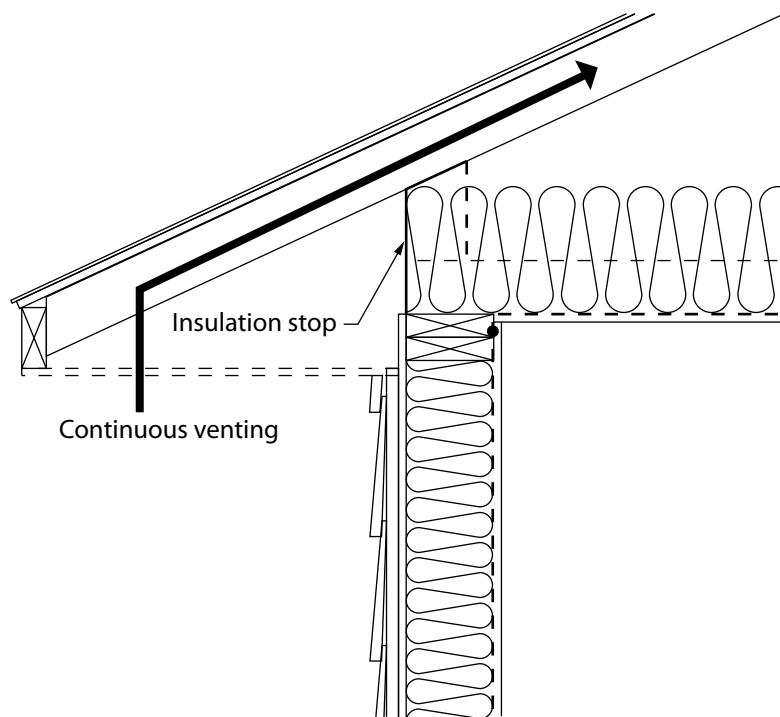


Figure 68—Vented soffit, raised heeled trusses and insulation stops for continuous ventilation at the bottom of the roof space

Install Gutters and Rainwater Leaders

There are many types of gutters and rainwater disposal systems. The *Building Code* does not require gutters, but it's wise to install them, as water falling off a roof will splash against the exterior cladding.

Rainwater that lands on sloped roofs can be collected using gutters (also known as *eavestroughs*). Flat and semi-flat roofs use roof rains or scuppers instead of gutters. If gutters, roof leaders or scuppers are installed, the *Building Code* requires rainwater leaders (downspouts) to direct the rainwater away from the building in a manner that will prevent soil erosion.

The two types of gutter systems are *attached gutters* and *hidden gutters*. Attached gutters are usually metal or vinyl, and hidden gutters are framed into the eaves of the roof and made watertight using roofing materials.

Gutters drain down vertical pipes known as *rainwater leaders*. The *Building Code* defines leader as “a pipe that is installed to carry storm water from a roof to a storm building drain or storm building sewer or other place of disposal.”

Leaders drain into sloped horizontal pipes at the foundation level, and these are called *storm building drains*. The pipe the storm building drains to the storm sewer, ditch or dry well, is known as the *storm building sewer*. *BC Building Code Division B – Part 7* (Plumbing Code) governs sizes for gutters, leaders, storm building drains and storm building sewer pipes.

Although the Plumbing Code covers rainwater collection and disposal, most residential work of this type is done by tradespeople other than plumbers.

Metal Gutters

Metal gutters are either galvanized steel or aluminum. Both are coated with a baked enamel finish and are available in many colours. Steel gutters are only suitable in areas free from salt spray and ocean breezes.

Gutter material is available in 10- and 16-foot lengths or it can be manufactured at the job site in continuous lengths. The width of the gutter is measured horizontally from the fascia to the outside of the gutter: 5- and 6-inch widths are common.

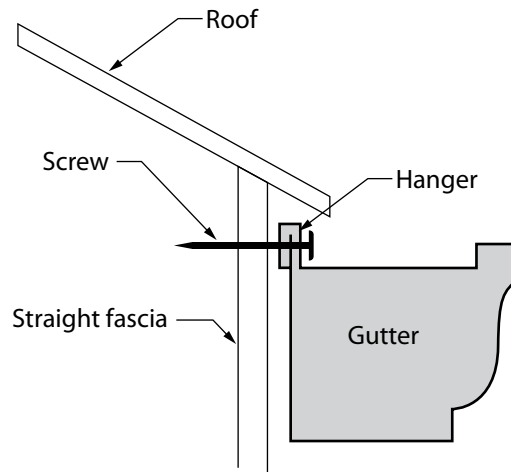
Installation

Gutters attach to finish fascia or rafter tails using hangers. The hangers support the gutter and help it hold its shape. Ladders can damage gutters so extra hangers should be added where ladder placement is expected.

Gutters should slope slightly down to where the leaders are located. The amount of slope is a factor for governing the required gutter size. The Plumbing Code recognizes gutter slopes from $\frac{1}{200}$ to $\frac{1}{25}$ ($\frac{1}{16}$ – $\frac{1}{2}$ " per foot).

Snow sliding off roofs can tear gutters off buildings. This is especially true for metal roofs. Gutters should be placed low enough to let the sliding snow pass over the gutter.

Installing wide fascias provides extra room to allow for slope requirements and sliding snow. The gutters shown in Figure 69 are not low enough to be installed on a metal roof.



Standard attachment

Figure 69—Gutter hanger

Continuous Gutter

Most new construction uses continuous gutters that are manufactured on-site by the installer. The overall lengths are measured and one continuous piece of gutter material is made for each run.

Outside and inside corners are made with a mitre joint that is sealed with caulking. The end of the gutter is finished with an end cap where the gutter butts into a wall or chimney, or where the gutter terminates at the end of a run.

Holes for the leaders (downspouts) are punched into the bottom of the continuous lengths where needed. Downspout fittings are placed into the punched holes and sealed with caulking. These fittings are equipped with leaf protectors.

All attached gutters are fastened to the building with hangers spaced at 24" o.c. The long lengths are assembled on the ground and lifted into place. They're fastened to the finished fascia board with 2" screws.

Sectional Gutter

The installation of a sectional gutter is similar to a continuous one. Each section is fitted with hangers and fittings before installing. The joints, corners and end caps are sealed on the inside with a special gutter caulking. Sheet metal screws are used to hold the joints together.

Vinyl Gutters

The principles of slope, drainage and the look of the finished assembly are much the same in all attached gutter systems (Figure 70). Some vinyl manufacturers recommend a minimum slope. Advantages of vinyl include durability, light weight, low maintenance, ease of cutting and shaping, and the snap-together installation method.

Vinyl gutters come in several profiles. Most vinyl systems hang from brackets screwed to the fascia at about 600 mm o.c., and all joints are sealed with fast-setting cement (adhesive) or other methods. As with other systems, the location of the downspouts is determined first, and then the sections of gutter are attached between the drops.



Figure 70—Examples of a vinyl gutter. Two elbows offset the downspouts to the wall.

Vinyl gutter systems often include a leaf guard. This is a useful feature for dealing with leaves and other debris, which cause problems by congesting and plugging the system.

Hidden Gutters

The construction of hidden gutters is done as part of the roof framing (Figure 71). A trough is made at the edge of the roof and sealed with a roofing membrane. Many types of roofing membranes are available, including neoprene, built-up asphalt and torch-on.

Framing the trough is done by attaching a wide fascia board to the rafter tails at a right angle to the slope of the roof. The top of the fascia board is extended above the roof surface, creating a natural trough. The inside of the trough is finished with the roofing membrane.

The downspout connections are sealed into the inside of the trough using the roofing membrane.

A major drawback of the hidden gutter system is that if leaks occur, serious roof damage can result before the leak is noticed. During construction, be careful to protect the membrane from damage from other construction activities.

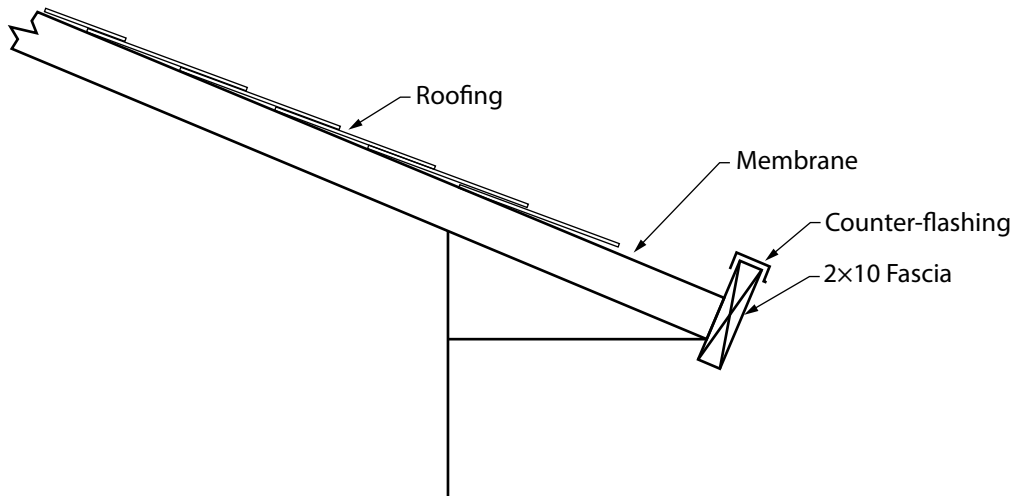


Figure 71—Hidden gutter

Downspouts

Downspouts (leaders) match the material used for the gutters. They're available in many sizes: $2\frac{1}{2}'' \times 2\frac{1}{2}''$, $2'' \times 3''$ rectangular and 2" round are common. Elbows and other fittings are made in matching colours and materials.

Installing Downspouts

The normal installation is to use a pair of elbows to offset the downspout from the roof edge to the wall. Place the seams in the downspout to the back, away from view, and use the straps to cover the joins in the downspout.

Each section of downspout is fitted into the next, creating an overlap to prevent leaks. Before attaching the downspout to the wall, double-check to ensure that it's plumb.

Connect each fitting and section of downspout to the others using sheet metal screws.

Scuppers

Flat and low-slope roofs are normally trimmed along their perimeter with a curb. Small openings are made in the curb and a rectangular rainwater collection box is placed in these areas to drain rainwater down a leader.

Roof Drains

Flat roofs can have drains located in the interior portions of the roof. The leaders then pass internally through the building. These drains are referred to as *roof drains* (Figure 72). The internal leaders must be constructed by a plumber due to their location within the building.



Figure 72—Roof drain

Termination of Storm Building Sewer Pipes

Rainwater and snowmelt eventually have to be disposed of somewhere. It must be away from the building and in an area where it won't interfere with a sanitary sewage disposal field (septic field) or where it could contaminate a water source (well).

Ideally, the storm building sewer pipe should be connected to a community storm sewer. When this option isn't available, a ditch or dry well will do. The *Building Code* allows leaders to be connected to splash blocks, but this is not a good option for areas of high rainfall.

Storm Sewer

If a storm sewer is available, connect the rainwater leader to it downstream from the building's perimeter drain. This connection will usually require inspection. Do not run rainwater leaders into the perimeter drain.

Dry Well

If no storm sewer or roadside drainage ditch is available, then the rainwater leaders should direct the runoff to a dry well. A dry well is only suitable if the ground is well-draining. It consists of a large perforated concrete or plastic tank inside a 4' diameter by 6' deep hole in the ground that is filled with drainrock or large rock (Figure 73).

The natural groundwater level must be below the bottom of the dry well. The hole is covered with a filter cloth and backfilled over. It serves as a temporary storage for roof and perimeter drain runoff until the water can seep into the ground.

The *Building Code* requires that dry wells be located at least 5 m (16') from the building and that they drain away from the building.

Do not connect rainwater leaders to the septic system.

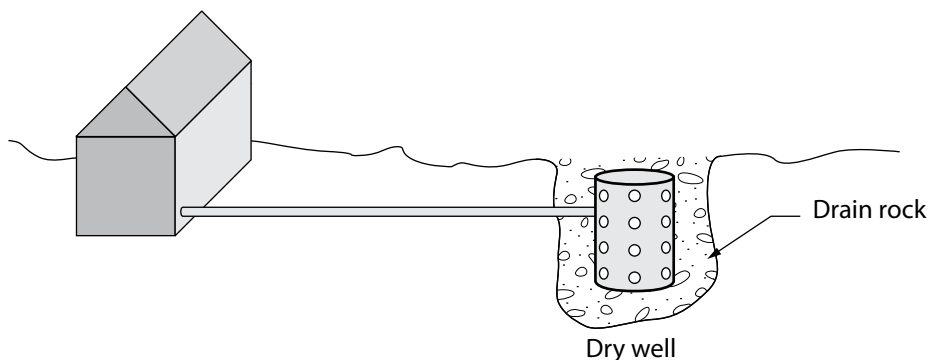


Figure 73—Dry well

Splash Blocks

An alternate method of disposing of rainwater in drier climates is to let it run out onto the surface of the ground away from the foundation. Splash blocks are precast concrete blocks that direct water away from the building and prevent erosion.

Sizing Gutters, Leaders and Pipes

Sizes for gutters and the pipes connected to them are dictated by *BC Building Code Division B Part 7* (Plumbing Code). Sizes are based on the roof area, slope and rainfall intensity.

Gutters, Roof Drains and Leaders

The first step when determining sizing is to calculate in square metres the horizontal area of the roof (roof area on flat) that’s being drained. Then add half the area of the largest adjacent wall above the roof. Multiply the total by the 15-minute rainfall amount for the geographic area. The 15-minute rainfall amount can be found in *Division B Appendix C* of the *Building Code*. This calculation gives the hydraulic load in litres.

The hydraulic load and gutter slope dictate the gutter size using *BCBC Table 7.4.10.10*. Leader size is base only on hydraulic load and *BCBC Table 7.4.10.11* is used.

Table 7.4.10.10. Maximum Permitted Hydraulic Load Drained to a Roof Gutter Forming Part of Article 7.4.10.10.					
Size of Gutter, Inches	Area of Gutter, cm ²	Maximum Hydraulic Load, L			
		Slope			
		1 in 200	1 in 100	1 in 50	1 in 25
3	22.8	406	559	812	1140
4	40.5	838	1190	1700	2410
5	63.3	1470	2080	2950	4170
6	91.2	2260	3200	4520	6530
7	124.1	3250	4600	6500	9190
8	162.1	4700	6600	9400	13 200
10	253.4	8480	12 000	17 000	23 600

Table 7.4.10.11.
Maximum Permitted Hydraulic Load Drained to a Leader
 Forming Part of Article 7.4.10.11.

Circular Leader		Non-Circular Leader	
Size of Leader, inches	Maximum Hydraulic Load, L	Area of Leader, cm²	Maximum Hydraulic Load, L
2	1700	20.3	1520
2½	3070	31.6	2770
3	5000	45.6	4500
4	10 800	81.1	9700
5	19 500	126.6	17 600
6	31 800	182.4	28 700
8	68 300	324.3	61 500

Storm Building Sewer Pipes

By adding the hydraulic loads together for the different roofs being drained, a total hydraulic load is found. Using *BCBC Table 7.4.10.9*, the total hydraulic load, and pipe slope, the required pipe sizes can be found for the storm building drain and storm building sewer.

Table 7.4.10.9.
Maximum Permitted Hydraulic Load Drained to a Storm Building Drain or Sewer or a Combined Building Sewer
 Forming Part of Article 7.4.10.9.

Size of Drain or Sewer, inches	Maximum Hydraulic Load, L						
	Slope						
	1 in 400	1 in 200	1 in 133	1 in 100	1 in 68	1 in 50	1 in 25
3	—	—	—	—	2390	2770	3910
4	—	—	—	4220	5160	5970	8430
5	—	—	6760	7650	9350	10 800	15 300
6	—	—	10 700	12 400	15 200	17 600	24 900
8	—	18 900	23 200	26 700	32 800	37 800	53 600
10	—	34 300	41 900	48 500	59 400	68 600	97 000
12	37 400	55 900	68 300	78 700	96 500	112 000	158 000
15	71 400	101 000	124 000	143 000	175 000	202 000	287 000

Example

Location is Fort St. John. The roof sizes and pipe slopes are shown in Figure 74. The gutter is sloped at 1/200 (1/16" per foot).

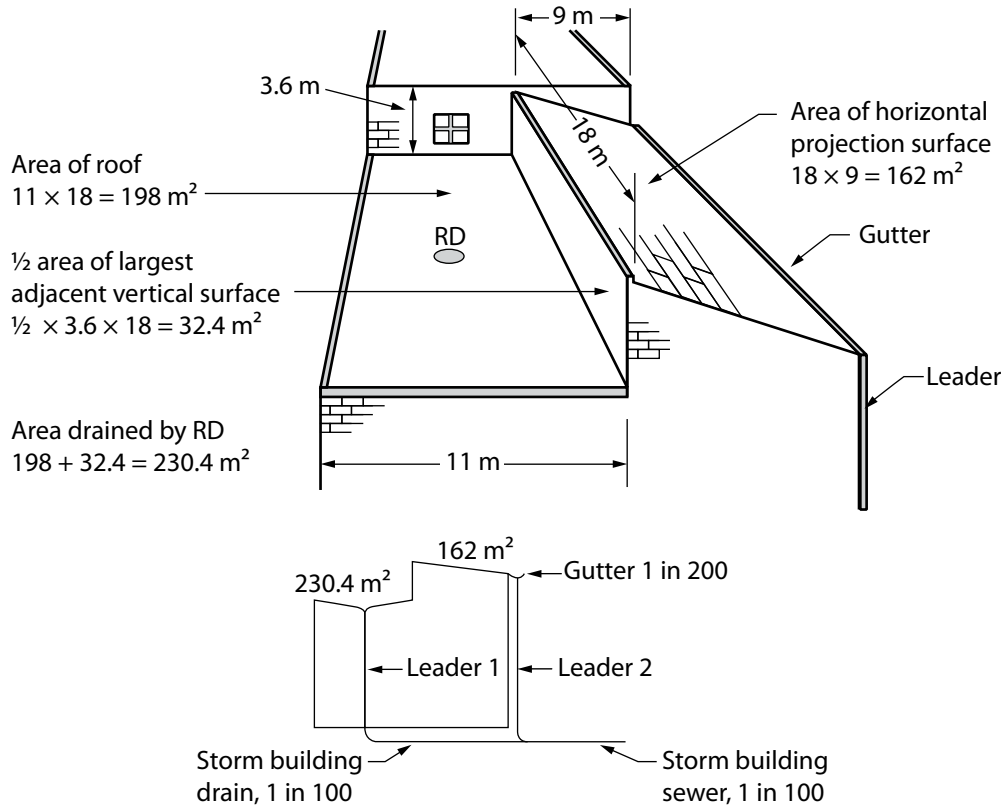


Figure 74—Fort St. John roof example

Area drained by gutter: $9 \text{ m} \times 18 \text{ m} = 162 \text{ m}^2$

Area drained by roof drain: $(11 \text{ m} \times 18 \text{ m}) + (\frac{1}{2} \times 3.6 \text{ m} \times 18 \text{ m}) = 230.4 \text{ m}^2$

Local 15-min. rainfall for Fort St. John: 15 mm

Hydraulic load for gutter and leader: $162 \text{ m}^2 \times 15 = 2430$ litres

Hydraulic load for roof drain: $230.4 \text{ m}^2 \times 15 = 3456$ litres

Combined hydraulic load for sewer: $2430 + 3456 = 5886$ litres

Drain sizes using *BCBC Tables 7.4.10.9, 7.4.10.10 and 7.4.10.11*

Gutter: 7" (5" if sloped at 1/50)

Gutter leader: 2.5" round or 2" square

Roof drain leader: 3"

Storm building drain: 4" (3" if sloped 1/68)

Storm building sewer: 5" (4" if sloped 1/50)

It's often more economical to add extra leaders, which will decrease the hydraulic load on gutters and roof rains and therefore reduce size requirements.



Now complete Self-Test 5 and check your answers.

Self-Test 5

1. Describe single-course application of sidewall shingles. (Include nail types, nail location, exposure and side lap.)

2. Describe double-course application of sidewall shingles. (Include nail types, nail location, exposure and side lap.)

3. Why is caulking not suitable for use with cedar shingles?

4. How is the drip edge formed when applying double-course shingles?

5. How long are the nails used to apply cedar shingles?

6. How is horizontal bevel siding joined at inside corners?

7. How many courses are needed to cover a height of 123 inches if 1×8 bevel siding is used?

8. What is the maximum exposure for the bevel siding in the previous question?

9. What type of joint is used to make horizontal joints between boards of bevel siding?

10. How is vertical siding finished at outside and inside corners?

11. How is lumber siding nailed in place?

12. How is a storey pole used to set horizontal siding to the correct height?

13. How is the thickness of the starter strip for horizontal bevel siding determined?

14. What is done to compartmentalize the rainscreen when using vertical siding?

15. Describe how the undersill trim is used.

16. How is the top of a window flashed if it's exposed to the weather?

17. Describe the nailing of vinyl siding.

18. What type of blade is used when cutting vinyl siding?

19. List three places where J-channel trim is used.

20. What types of nails are used with aluminum siding?

21. How is metal sheet siding applied to the walls of buildings?

22. How can buckling of aluminum siding at the floor system be prevented?

23. How is aluminum siding finished at outside corners?

24. What other type of siding is aluminum siding similar to?

25. What is the minimum head lap for fibre cement siding?

26. What is the maximum exposure for 9¼" fibre cement siding that is installed on a wall measuring 103½" from the soffit to the top of the concrete wall?

27. How is fibre cement siding cut?

28. What is the specific safety hazard associated with fibre cement products?

29. How are outside and inside corners built?

30. What are the finishing requirements for fibre cement siding?

31. Where can leaks occur in the exterior insulation finish system?

32. What type of stucco is used in the EIFS?

33. What two types of cement are used in the base coat of cement stucco?

34. What materials are used in the finish coat for cement stucco?

35. What is the diameter of the stones used in a "stone dash" finish?

36. What is the minimum thickness of the base coat for cement stucco?

37. Describe the EIFS.

38. What type of flashing must not be used with cement stucco?

39. What is the maximum spacing of the brick ties for a wall that has studs at 16" o.c.?

40. What is the purpose of a weep hole?

41. What is the difference between a corbel and a ledger?

42. What is done to the support for the foundation wall if the wall supports masonry construction?

43. How is the base flashing installed with the moisture barrier?

44. What type of flashing material must not come in contact with mortar?

45. What is combed-face wood?

46. What is SmartSide Trim®?

47. Why is textured wood used for trim?

48. What's the advantage of a scarf joint compared to a butt joint?

49. How far from the edge should fibre cement trim be nailed?

50. How can fibre cement trim be blind nailed?

51. How is undersill trim used when installing finish fascia covers?

52. What is used to join the soffit at the corner of the building?

53. How much is J-channel notched to allow for expansion?

54. What is the maximum spacing of nails for attaching trims used with soffits and fascias?

55. If the inside measurement from one J-channel to the other is 530 mm, how long should the soffit panel be cut?

56. What must be done to soffit panels longer than 600 mm?

57. If a roof is framed with trusses and the ceiling area is 1500 square feet, what is the minimum required soffit vent area?

58. How far apart are the hangers spaced when attaching metal or vinyl gutter systems?

59. Describe how a hidden gutter is constructed.

60. What are the three ways of disposing of rainwater?

61. When installing downspouts, how is an offset used?

62. What lengths of sectional aluminum gutter are available?

63. How are the outside and inside corners made when using continuous gutter?

64. What is a roof drain?

65. What is a scupper?

66. How is the hydraulic load for a gutter calculated?

Answer Key

Self-Test 1

1. a moisture barrier made from building paper or house wrap that provides the second plane of protection. (i.e., a water-shedding material)
2. direct contact from wind-driven rain, gravity running water running down a surface and bounce from rain hitting a surface
3. poor attention to sealing details at joints, building settlement, lack of maintenance
4. Figure 2
5. overlapped like shingles, with a min. 4" overlap both horizontal and vertical
6. moisture barrier, 10-mm capillary break, exterior cladding
7. Pressure may not be equal around the corner due to wind.
8. 10 mm × 38 mm CCA-treated plywood strips
9. The number of degree-days is less than 3400 and the moisture index is greater than 0.90; or the number of degree-days is 3400 or more, and the moisture index is greater than 1.00.
10. EIFS exterior insulated finish system; LAB liquid applied barrier

Self-Test 2

1. Thickness at the butt: $\frac{1}{4}$ – $\frac{1}{2}$ " is a shingle and $\frac{5}{8}$ " or more is a shake.
2. stands out from the wall surface by its own design
3. old growth edge-grain western red cedar
4. lightweight; inexpensive; easy to install and repair; provides a capillary break and drainage; allows for future hidden phone, internet and antenna wires to be hidden
5. cement stucco, synthetic stucco
6. to give extra reinforcement at corners and for overhead situations for bonding stucco to the building
7. steel and sometimes other metals
8. No. 1 & no. 2—no. 3 can be used for the under (starter) course.
9. the thickness of the mesh layer
10. 6 mm each for the first two coats and 3 mm for the finish coat
11. a siding material made from sand, cement and cellulose
12. Weep holes are created by leaving out the mortar between some of the bricks.

13. an imitation stone that is only $\frac{1}{4}$ the thickness of real stone
14. at the intersection of the soffit and the wall
15. surfaced four sides
16. An S4S board is resawn into two boards.
17. A drip cap is smaller and used over doors and windows.
18. flashing
19. to keep water from running down the surface below or running back (used for flashings and for the lower edge of roofs)
20. around doors for casing and sometimes around windows
21. galvanized casing nail
22. galvanized, stainless steel, triple-coated zinc polymer, aluminum
23. vinyl siding, stucco wire, rigid insulation, sheathing paper
24. for attaching wood finish trim and siding
25. whether it's approved by the local building inspection department
26. lag screws and waterproof nails (with washers)
27. aluminum nails
28. by folding and bending to create a 25-mm high waterproof end dam
29. in joints too shallow for backer rod—to prevent three-sided adhesion and maintain elasticity

Self-Test 3

1. at each floor level
2. using a lumber belly band at each floor level
3. slow to build and uses a lot of lumber
4. manufacturer, the project's plans and specifications and/or the warranty provider
5. The lower few feet of the siding should be covered by a sheet of polyethylene film.
6. so that the siding will line up at each corner
7. 1.5" min. length nail into framing not farther apart than 24" o.c., or into sheathing at 16" o.c. max. spacing

Self-Test 4

1. $22 \times 9 = 198$ (rectangle), $22 \times 11 / 2 = 121$ (triangle), $198 + 121 = 319$ (total)
2. $3 \times 7 = 21$ (door), $6 \times 4 = 24$ (window), $21 + 24 = 45$ (total)
3. $319 - 45 = 274 \text{ ft.}^2$
4. 22' needed for the belly band, 4' for the door and 7' for the window.
4—10' lengths are needed.
5. 2—18' pieces of 2x8 for fascias (2—20' would give a margin for error)
2—10' pieces of 5/4 by 4" for corners
22' of 5/4 by 10" for belly band

Self-Test 5

1. In single-course applications, shingles and shakes are blind nailed. They are nailed with two nails placed $\frac{3}{4}$ " in from the sides and 1" above the butt of the next course.
2. In double-course applications, shingles and shakes are face nailed. Two courses are installed at the same time. The nails in the top course attach both layers of shingles. Hot-dipped galvanized casing nails are used. The nails are usually $1\frac{3}{4}$ " long, extending 1" into the supports.
3. Since wooden shingles expand and shrink due to changes in moisture content, the caulking may fail and leaks will be likely.
4. The outer course of a double-course installation is dropped $\frac{3}{8}$ " below the under-course to create a drip edge.
5. The nails are usually $1\frac{3}{4}$ " long, extending 1" into the supports.
6. At inside corners, the siding is butted into a square wooden post.
7. 20
8. $6\frac{1}{4}$ "
9. scarf joint
10. Vertical siding is overlapped at outside corners.
11. Lumber siding is nailed in place with either dome head siding nails or casing nails.
12. The top end of the storey pole is held against the soffit and the marks indicate the position of each course of siding.
13. Overlap two siding boards the same amount as they will be installed, and measure the space behind the board at top.

14. It's difficult to compartmentalize the corners when furring (strapping) is used with a rainscreen for vertical siding. The end spacer must have tightly fitting blocks between each row of strapping to effectively block air passage.
15. Fur out the undersill trim to preserve the proper angle. Use it in an inverted position above windows and doors where trims butt against frames.
16. The flashing must be kept clear of the top of the window by $\frac{3}{8}$ " to allow for deflection.
17. Vinyl siding should hang from the nails. Do not drive the nails tightly home.
18. use a plywood blade and install it backwards on the saw
19. on the sides of all doors and windows
20. Aluminum nails must be used to fasten aluminum siding.
21. Sheet metal siding is fastened to studs or strapping with sheet metal screws and neoprene washers.
22. using engineered floor systems
23. corner caps
24. vinyl
25. The minimum head lap is $1\frac{1}{4}$ " but it is often increased up to $1\frac{3}{4}$ ".
26. 7.54" ($7\frac{9}{16}$ ")
27. The preferred tool for cutting fibre cement siding is either a nibbler or guillotine power shears.
28. Fibre cement dust contains crystalline silica, which has been known to cause lung damage. Proper respiratory protection is required.
29. Usually covered with battens or corner boards (with the siding butting into them)
30. Unfinished siding should be painted within 90 days of installation, primed siding should be painted within 180 days.
31. Leaks can occur at the transitions if there are any horizontal or sloping surfaces.
32. Acrylic stucco finish on top of expanded polystyrene rigid insulation.
33. Portland cement and/or masonry cement
34. The finish coat is made using white cement, lime, white sand and up to 6% pigment (colour) by weight.
35. less than $\frac{3}{8}$ "

36. The base coat must be at least 6 mm ($\frac{1}{4}$ ") thick, measured from the face of the lath or substrate. If lath is used, the total thickness of the base coat will be $\frac{1}{2}$ ".
37. EIFS uses an acrylic stucco finish on top of expanded polystyrene rigid insulation.
38. aluminum
39. 600 mm
40. Weep holes allow any water that accumulates behind the veneer to escape.
41. A corbel is built out at the top of a wall and a ledger is a recess into the full width of a wall.
42. A corbel or ledger is created.
43. Flashing under the bottom course of the masonry veneer must extend behind the moisture barrier (sheathing paper) at least 6". This base flashing must continue out under the masonry and form a drip edge that projects beyond the support below.
44. non-coated aluminum flashing
45. wood planed with a serrated blade to give a finish that looks as though a comb has been dragged along it
46. textured and primed strand board trim
47. to hold paint better, to hide nails and for better appearance
48. It's better at preventing water infiltration.
49. 8–12"
50. for expansion and contraction movement
51. Install undersill trim along the top of the wooden rough fascia. Cut vinyl or aluminum fascia material to width. Punch ears along the top edge of the fascia panel to fit into the undersill trim.
52. Use two J- or F-channels properly supported back-to-back. There are two methods of making the joint, either as a butt joint or as a mitre joint.
53. 40 mm (overlapped by 20 mm)
54. 300 mm o.c.
55. 518 mm
56. Panels longer than 600 mm must be nailed to an intermediate support.
57. 5 ft.²
58. 24"

59. Framing the trough is done by attaching a wide fascia board to the rafter tails at a right angle to the slope of the roof. The top of the fascia board is extended above the roof surface, creating a natural trough. The inside of the trough is finished with a roofing membrane.
60. • connecting to a storm sewer
• ditch
• dry well
• splash blocks (dry climates only)
61. Two are used to offset the leader from the gutter to the building wall.
62. 10- and 16-foot lengths
63. with a mitred joint sealed with caulking
64. a drain located in a flat roof
65. a rainwater collection box located at the edge of a flat or low-sloped roof
66. By calculating the horizontal area of the roof that is being drained in square metres. Then add half the area of the largest adjacent wall. Multiply the total by the 15-minute rainfall amount for the geographic area. This gives the total volume in litres.



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ISBN 978-0-7726-7153-0



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