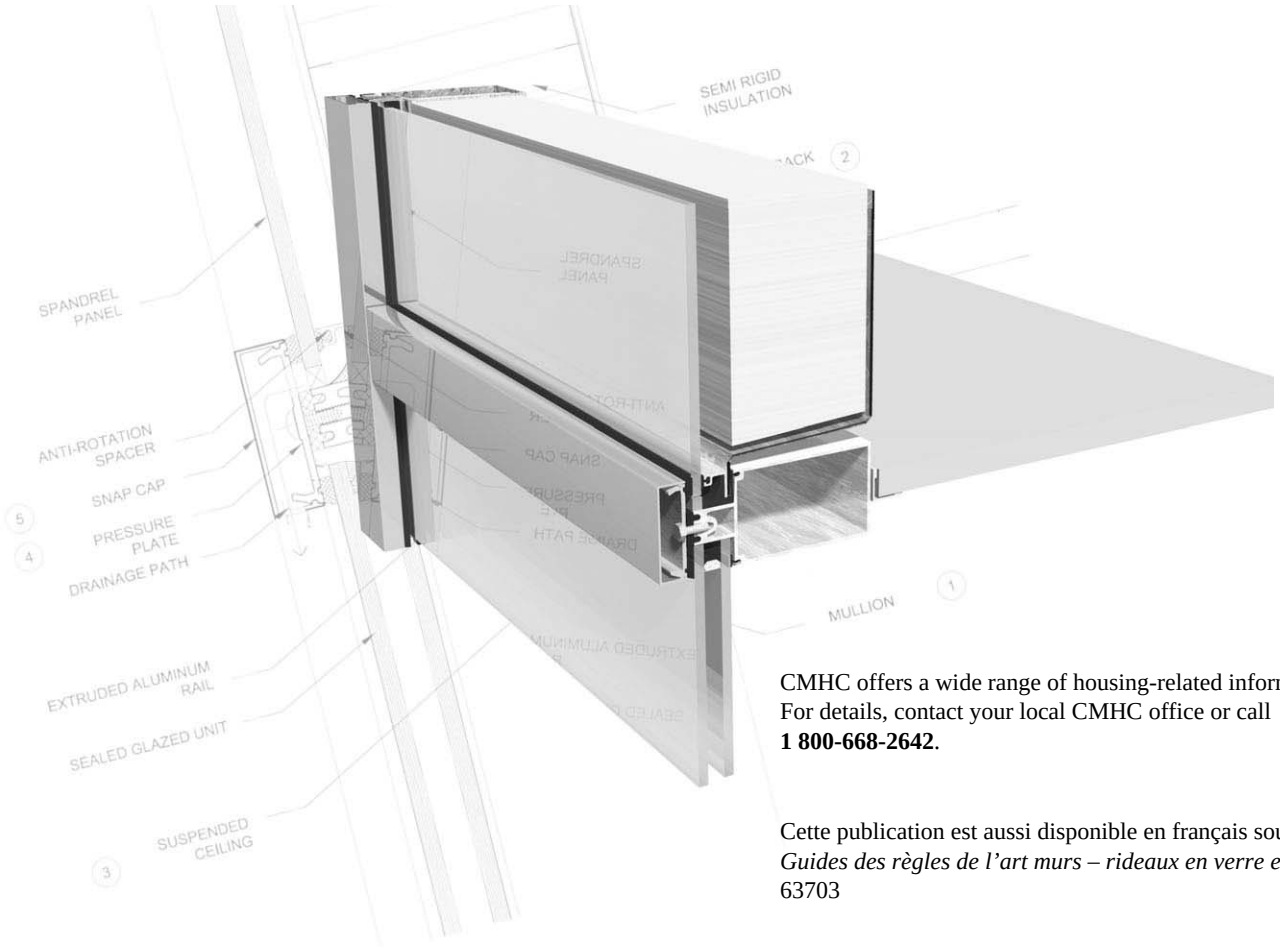


GLASS AND METAL CURTAIN WALLS

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FOREWORD

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This legislation is designed to aid in the improvement of housing and living conditions in Canada. As a result, the Corporation has interests in all aspects of housing and urban growth and development.

Under Part IX of this Act, the Government of Canada provides funds to CMHC to conduct research into the social, economic, and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research. CMHC therefore has a statutory responsibility to make information widely available that may be useful in the improvement of housing and living conditions.

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Chapter 1

INTRODUCTION

INTRODUCTION

This Guide on Glass and Metal Curtain Wall Technology is one of a series of CMHC technical publications that provides practical information on wall system design and performance for building designers, owners and managers.

All wall systems are required to resist many different forces in the provision of a suitable separation of indoor and outdoor environments. They are required to:

- have sufficient structural strength and rigidity
- resist the spread of fire
- be durable
- control odours
- control light
- control sound and vibration
- control heat flow
- control air flow
- control water vapour flow
- control exterior precipitation
- control solar radiation

While each of these requirements is important, history shows that deficiencies in the performance of walls relate to some requirements more frequently than others. Accordingly, these requirements have a greater potential for damage, either physical or financial. The rate of occurrence of defects in certain aspects of wall performance has generated the industry need for reference material such as the Best Practice Guide Series, and has also influenced the topics covered in this *Guide*.

The glass and metal curtain wall, in all its forms ranging from single-storey, storefront applications to towering skyscraper cladding, has become one of the most popular forms of building cladding. Owing to this popularity, the more general term “curtain wall”, while actually defining and encompassing a very broad spectrum of different wall types, has become the everyday reference to glass and metal curtain wall. The two terms will be used interchangeably in this *Guide*.

A modern curtain wall, by its nature, is a highly engineered product based on sophisticated industrial processes and concepts of mass production, standardization, precise tooling and machining. Unlike traditional walls, curtain walls are typically designed, manufactured and installed by one contractor. Much like the modern automobile with “no user serviceable parts”, the curtain wall is often treated as a “black box” and the design professionals actually participate little in the wall design. This lack of detailed design involvement leads to an increased reliance on the curtain wall suppliers for technical expertise and, too often, an inability on the part of the professionals to properly assess the suitability of particular designs proposed by suppliers. This *Guide* is intended to provide assistance to the professional in this regard.

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One of the major causes of defects in exterior wall systems is the failure to apply existing knowledge of envelope construction to new buildings and to the repair of existing buildings. The Best Practice Guide Series is intended to encourage state-of-the-art construction by providing detailed descriptions and CAD details of building features that can be adapted and developed by professionals to suit the particular conditions of their buildings.

The *Guide* is organized into nine chapters. Following this introductory chapter, there are eight additional chapters covering various topics, as summarized in the following paragraphs.

A glass and metal curtain wall, in its basic form, consists of a lightweight metal gridwork with some combination of transparent or opaque infill panels. The grid, of either tubular or open shaped pieces can be assembled as individual pieces in the field (stick) or as part of factory preassembled panels (unitized). In either case, the grid is typically attached at discrete points to the floor slab edges, hanging like a curtain down the building. Glass forms one of the most popular infills as vision panels or, when coated, opaque spandrel panels. A wide variety of other materials such as stone, steel, aluminum, composites and plastics are used as curtain wall panels. In Chapters 2 and 3 curtain wall systems and their components are described.

A curtain wall is a unique wall assembly with regards to the number, type and level of performance tests used for its assessment. Regardless of the sophistication of the product or the testing programme, curtain walls must meet the same basic performance criteria as all wall types. The lightweight, thin and non-absorbent nature of glass and metal imposes special constraints on the wall design to meet the basic performance criteria. For example, a metal and glass curtain wall must control water penetration by either a positive seal or by drainage, as it has no ability, like masonry or stone, to absorb and store water for re-evaporation. The modular gridwork layout of a curtain wall creates the potential for pressure-equalized rainscreen performance but this potential is only realized through careful detail design and construction. In Chapter 4 the basic performance aspects of curtain walls are discussed.

As mentioned above, curtain walls are subjected to a greater degree of performance testing than almost any other wall type. The selection of a proper test procedure, the establishment of rational test criteria and knowledgeable interpretation of the test results, are all critical to the usefulness and success of a test programme. In Chapter 5 the test methods used to evaluate wall performance are described.

Chapter 6 contains CAD details to illustrate special features of curtain wall and provide explanatory notes to outline the proper use of the details. An accompanying CD ROM contains AutoCAD files of the details in this chapter.

An adequate quality assurance programme is mandatory to a successful wall installation. Quality assurance impacts not only field installation but all aspects of the wall from design through fabrication, assembly and installation. The repetitive nature of a curtain wall can result in a very small issue being reproduced numerous times throughout a wall area to become a very large problem. A discussion of Quality Assurance along with Quality Control checklists is provided in Chapter 7.

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Following the “black box” analogy, performance specifications for curtain wall typically employ a “hands off” approach to curtain wall design. Regrettably, this lack of detail design involvement leads to a reliance on the technical expertise of suppliers with little opportunity for design professionals to properly match a client’s needs or specific site requirements to actual wall attributes. A greater understanding of curtain wall detail design can only strengthen curtain wall performance specifications. The CAD details of Chapter 6 are supplemented by an annotated master specification in Chapter 8.

Curtain walls, like all wall systems, do age and require maintenance before eventual renewal. While many of the wall components are inherently durable in most environments, building owners often overlook the large investment they have in renewable components such as sealants and insulating glass and budgets do not allow for timely replacement. Guidance regarding maintenance and renewal can assist design professionals in advising owners. Chapter 9 offers information related to the maintenance and renewal of curtain wall systems.

Finally, a reference section lists other useful publications and web sites along with a glossary of curtain wall terminology.

This Best Practice Guide is intended to be supplemented by the knowledge of the professional engineer or architect and, where prudent, the advice of a specialist consultant. The information contained in the *Guide* is intentionally generic, and must be considered in light of local codes and building practices, with proposed details modified to suit particular conditions. Products shown in this *Guide* are for illustrative purposes only and are not intended to promote any specific product over others available on the market.

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Chapter 2

METAL CURTAIN WALL ASSEMBLIES

2.1 BASIC DEFINITIONS

The term "curtain wall" was first used to describe the outer wall of medieval fortifications. Its use in a more contemporary sense is seen in Gothic cathedrals with their large expanses of lightly framed glass walls between load-bearing buttresses. Today the term curtain wall is defined in most literature to be any building wall of any material that is designed to resist lateral loads due to wind or earthquake and its own self weight. In other words, the curtain wall is a non-load-bearing wall.

The American Architectural Manufacturers Association, the most widely referenced industry source with respect to metal curtain walls, provides the following definitions in their Aluminum Curtain Wall Design Guide Manual:

Metal Curtain Wall – An exterior curtain wall which may consist entirely or principally of metal, or may be a combination of metal, glass and other surfacing materials supported by or within a metal framework.

Window Wall – A type of metal curtain wall installed between floors or between floor and roof and typically composed of vertical and horizontal framing members, containing operable sash or ventilators, fixed lights or opaque panels or any combination thereof.

From the above definitions it follows that a metal curtain wall is a particular type of curtain wall and a window wall is a subset of metal curtain wall. For purposes of this document window wall systems, as illustrated in Figure 2-7, are specifically excluded from consideration.

2.2 METAL CURTAIN WALL

A metal curtain wall can be classified in several different ways. One of the common means of identifying different walls is to classify them by type, erection system and glazing method. For example a wall can be described as a custom, unitized, two-sided, structurally glazed system. The following illustrates the categories for classification of a curtain wall in this manner.

WALL TYPE	→	ERECTION	→	GLAZING METHOD
STANDARD CUSTOM		STICK UNITIZED OTHER		EXTERIOR BATTEN STOP STRUCTURAL SILICONE GLAZING (SSG) OTHER

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2.3 ESSENTIAL TERMINOLOGY

To properly understand the specific features of a wall design that permit the classification of the wall, it is first essential to understand some basic terminology used in describing components and features of a wall. The following provides essential terminology in the nomenclature of curtain wall components.

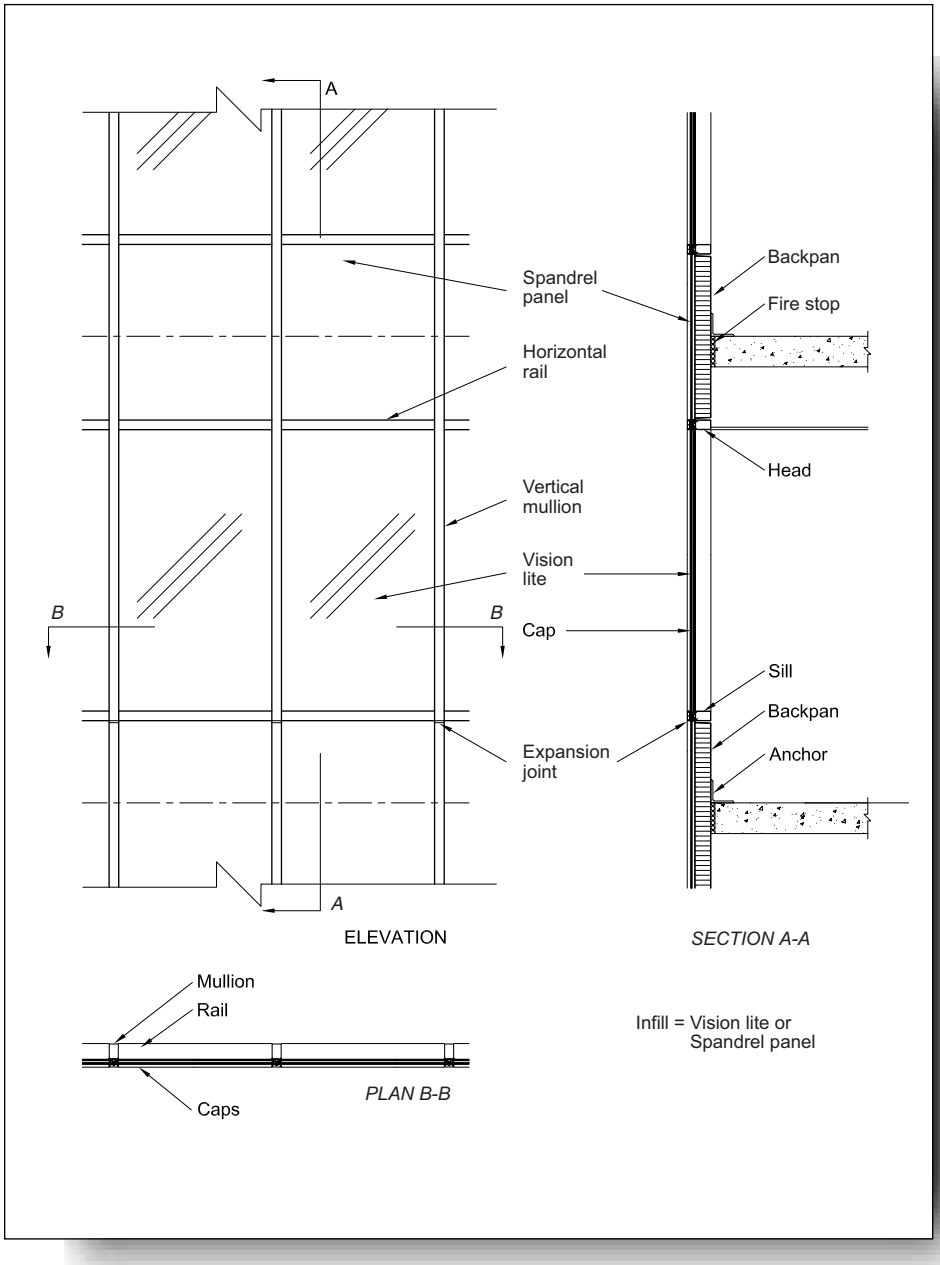


Figure 2.1: *Essential terminology*

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The following sections describe the alternatives for classification of a wall within each category.

2.3.1 WALL TYPES

This category for wall classification includes two generic options. A comparison between these two wall types is provided below.

WALL TYPE	CHARACTERISTICS AND FEATURES
STANDARD	• Details and components designed and standardized by manufacturer • Manufacturers sell through a dealer network • Manufacturers stock in standard lengths typically 6.5 to 8.2 m (20 to 27 ft.) in length • Standard finishes although custom finishes available • Typical frame width 50 mm (2 inches) or 63.5 mm (2 ½ inches) , frame depth 75 to 150 mm (3 to 6 inches) • Manufacturers catalogue information readily available • “Standard” designation applies only to components not to potential arrangement of components
CUSTOM	• Details and components designed specifically for a single project or group of projects • Materials generally not available on open market but restricted to single supplier or installer • Minimum size of project required to justify custom extrusions • Allows optimum use of material and flexibility to meet architectural requirements • Component dimensions and cross sections often architecturally distinct

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2.3.2 ERECTION

This category for wall classification includes the two most common erection techniques, as well as a third grouping used to mention others that may be encountered on older buildings but are no longer common, nor promoted, for new construction.

ERECTION	CHARACTERISTICS AND FEATURES
STICK	• Likely most common wall system especially on low-rise construction and in smaller population centres • Each component of wall is installed piece by piece in the field. Installed with one- or two-storey mullion lengths and horizontal rails equal in length to width of the infill panels • Field labour intensive and dependent • Often utilize standard system • Minimum requirements for assembly facilities and shipping • Normally short lead time to arrive on-site, but longer erection/close-in time on-site • Difficult to accommodate in-plane movements due to sway or seismic events
UNITIZED	• Most common to large high-rise buildings although found on buildings as low as four stories. System has grown in popularity since 1980 • Large factory assembled framed units complete with spandrel panels and often with vision lites installed. Panels typically one-storey high by width of infill panels • Panels designed for sequential installation with interlocking split vertical mullions and nesting horizontal rails at expansion joint • Significant fabrication facility and shipping requirement. More shop labour dependant and less field dependant than stick system • Normally longer lead time to arrive on-site, but rapid erection with minimum time to close in building once on-site • Design potential to accommodate in-plane movements due to sway and seismic events

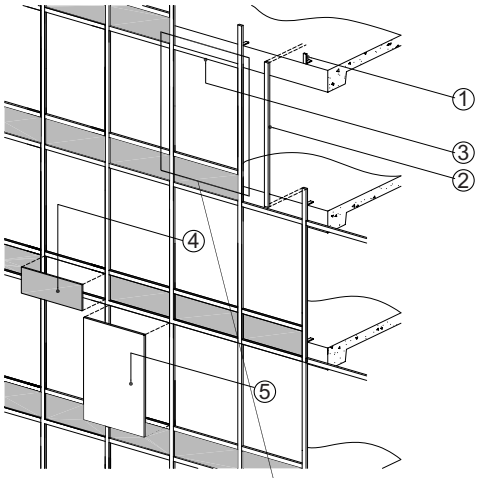
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OTHER	**Mullion and panel** • Consists of gridwork similar to stick system and prefabricated framed panels installed between. Popular through the 1970s but rarely used today • Combines features of stick and unitized wall systems **Large panel** • Typically consists of steel truss type frame one storey in height by 10 to 15 m (33 to 50 feet) in length. Frame supports all of wall elements • Not as popular due to handling issues. Used on smaller specialized projects **Window wall** • Consists of wall system spanning between floor slabs with slab edge cover. Almost entirely restricted to residential applications • Framing lightweight residential type inside stop glazed. Can utilize either stick or unitized framing. Often use older technology with inherent reliability problems

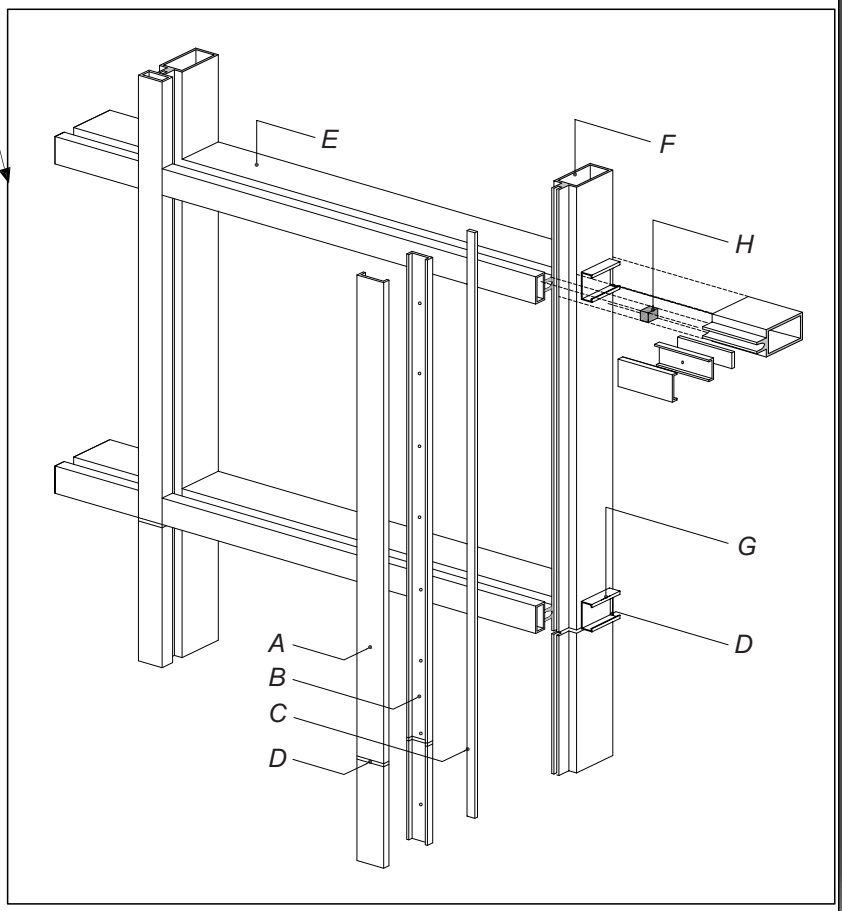
The following sections illustrate the general erection techniques for the above assemblies of curtain wall. However, the remainder of this *Guide* will focus only on stick and unitized systems which represent the vast majority of curtain wall designs today.

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STICK SYSTEM - GENERAL



1. Anchor
2. Vertical mullion—interlocks vertically
3. Rail installed on shear blocks
4. Spandrel backpan and panel
5. Vision lite

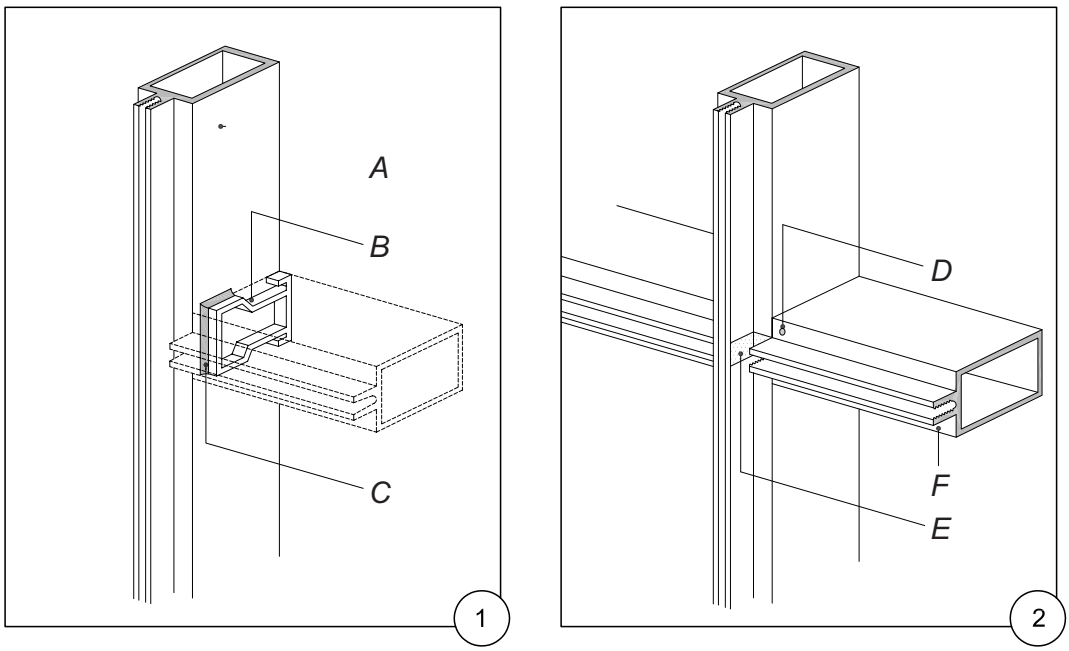


A Snap cap
B Pressure plate
C Thermal break
D Expansion joint
E Horizon rail
F Vertical mullion
G Shear mullion
H Corner block

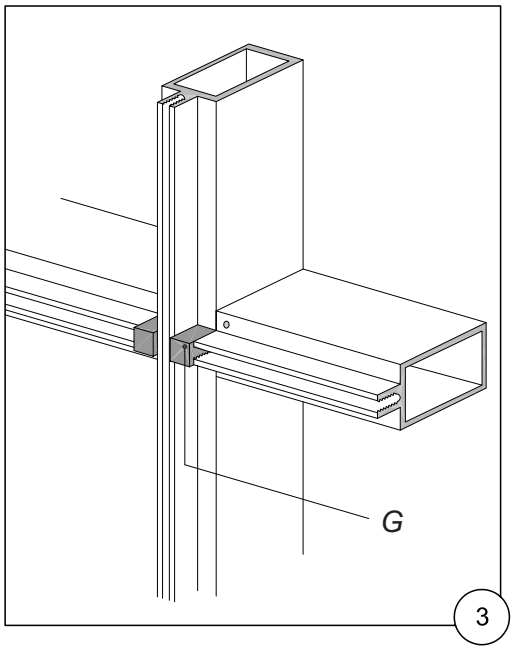
Figure 2.2: *Stick system - general*

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STICK SYSTEM - JOINERY



Typical horizontal / vertical connection

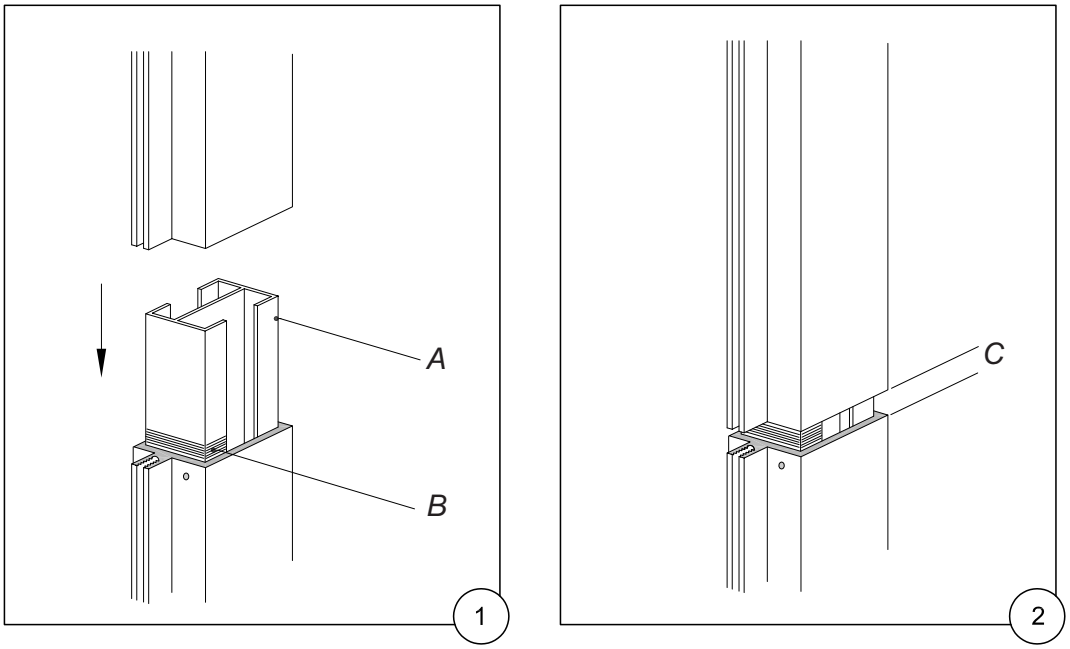


A	Vertical mullion
B	Shear block or spigot (several different designs available)
C	Joinery sealant or tape
D	Fixing screw
E	Bedding sealant for corner block
F	Horizontal rail
G	Corner block (typically neoprene rubber)
*	Outer surface of corner block extends to the same plane as top of thermal break.

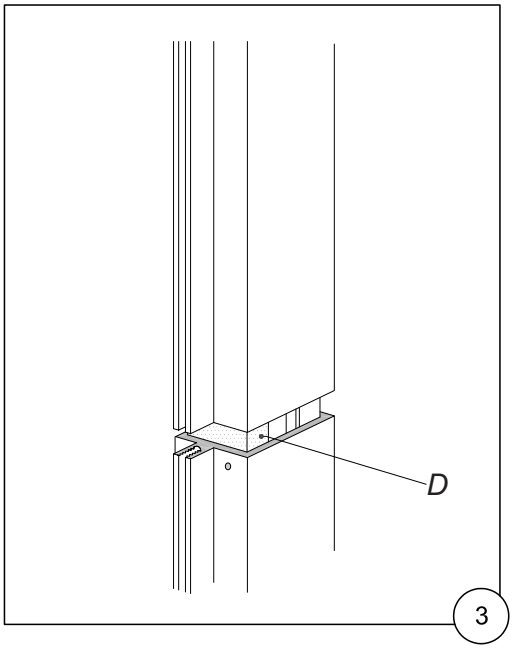
Figure 2.3: *Stick system — joinery — typical horizontal/vertical connection*

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STICK SYSTEM - JOINERY



Typical expansion joint assembly



A Mullion sleeve or spigot

B Bond breaker

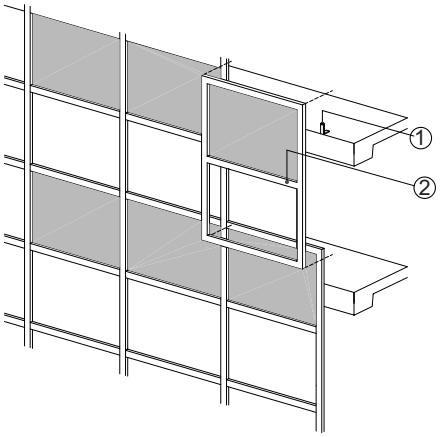
C Expansion / tolerance joint

D Sealant applied to completed assembly

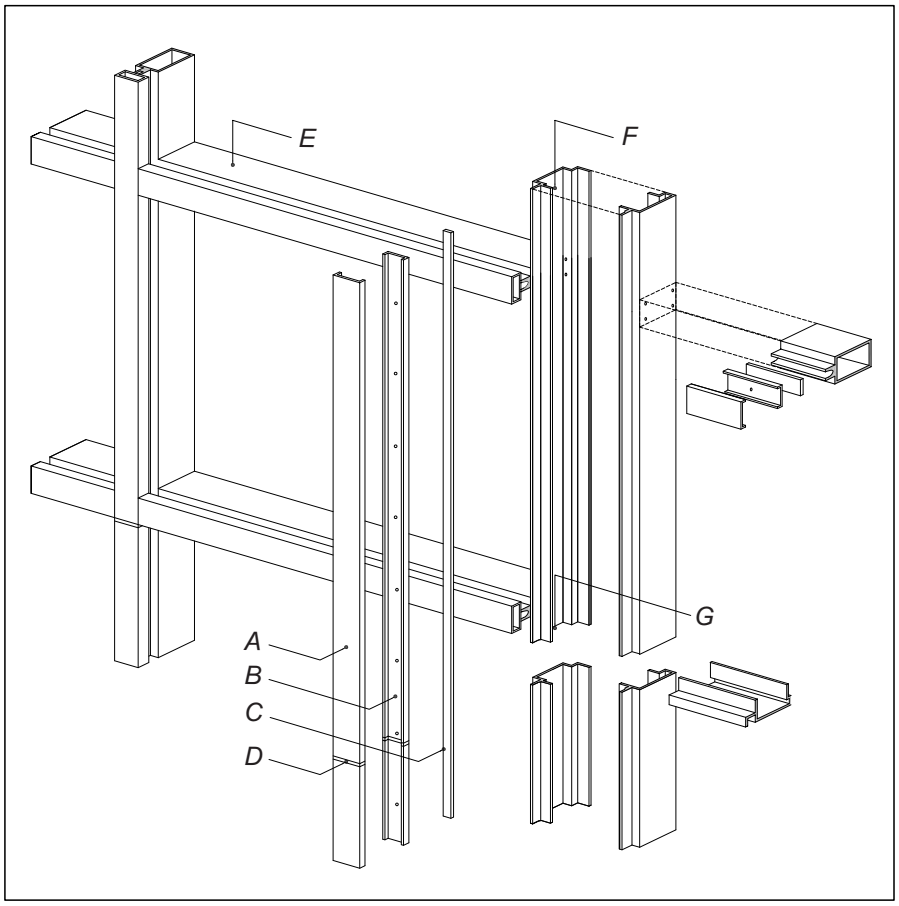
Figure 2.4: *Stick system — joinery — typical expansion joint assembly*

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UNITIZED SYSTEM - GENERAL



1. Anchor
2. Prefabricated, pre-glazed frame



A Snap cap

B Pressure plate
(May be in two pieces)

C Thermal break

D Expansion joint

E Horizontal rail

F Split mullion

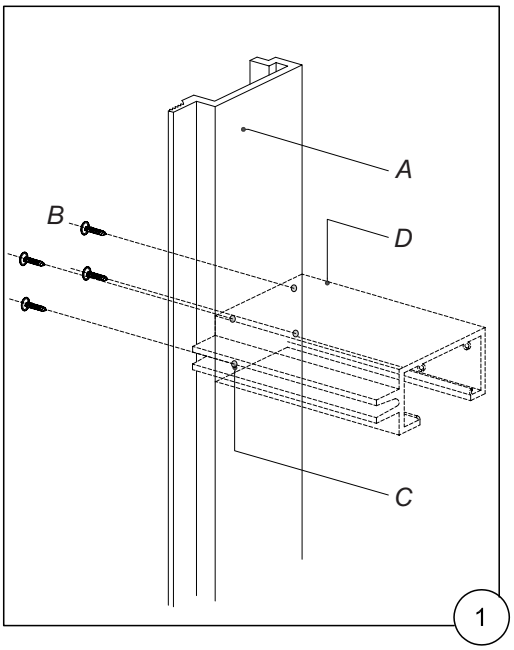
G Mullion sleeve*

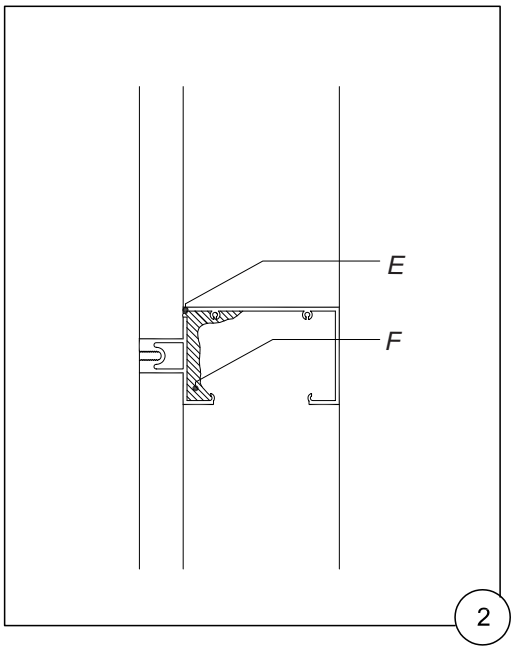
* Connection at expansion or stack joint varies widely with different designers

Figure 2.5: *Unitized system — general*

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UNITIZED SYSTEM JOINERY





A	Split mullion
B	Rail fixing
C	Predrilled holes
D	Horizontal rail, often open section, incorporating screw lots
E	Sealant continuity hole
F	Sealant applied inside horizontal*

* Closed section horizontals may use butyl tape seals

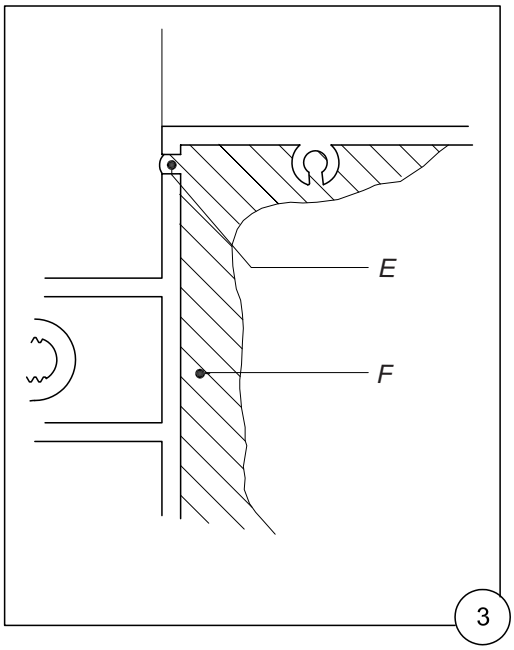
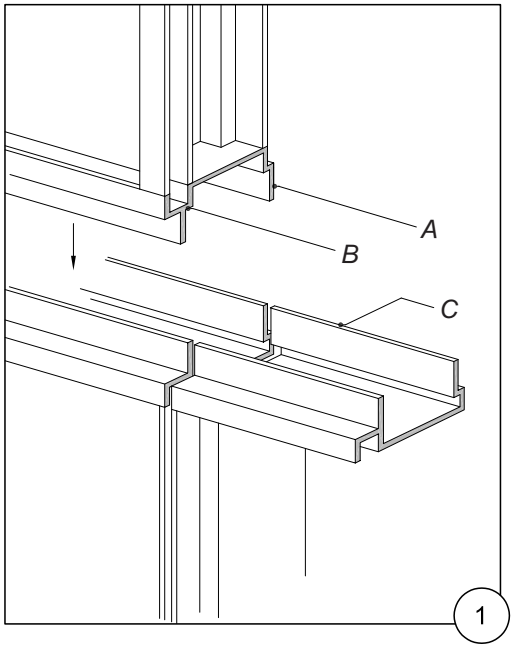
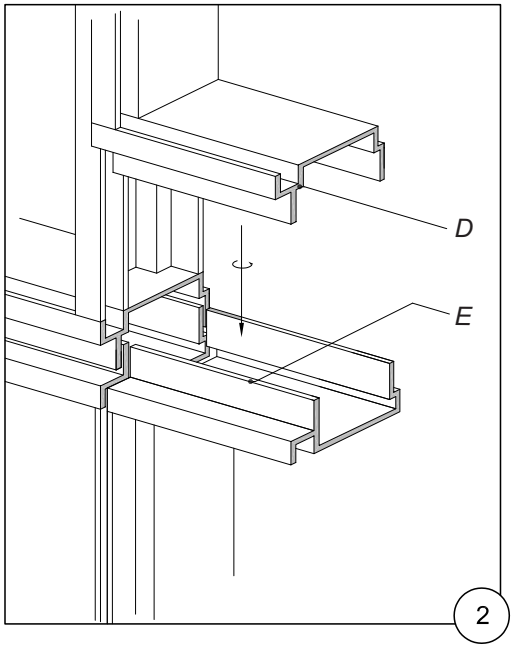


Figure 2.6: *Unitized system — joinery — typical expansion joint assembly*

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UNITIZED SYSTEM - GENERAL





Four-way stack joint concept

A	Frame lowered into position onto installed frames
B	Mullion interlock
C	Interlocking rail
D	Mullion interlock is engaged—frame is rotated and lowered into position
E	Airseal gasket

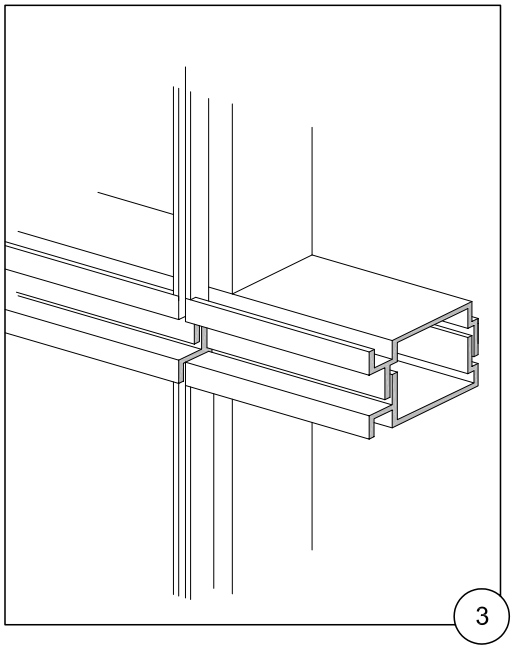


Figure 2.7: *Unitized system — general — four-way stack joint concept*

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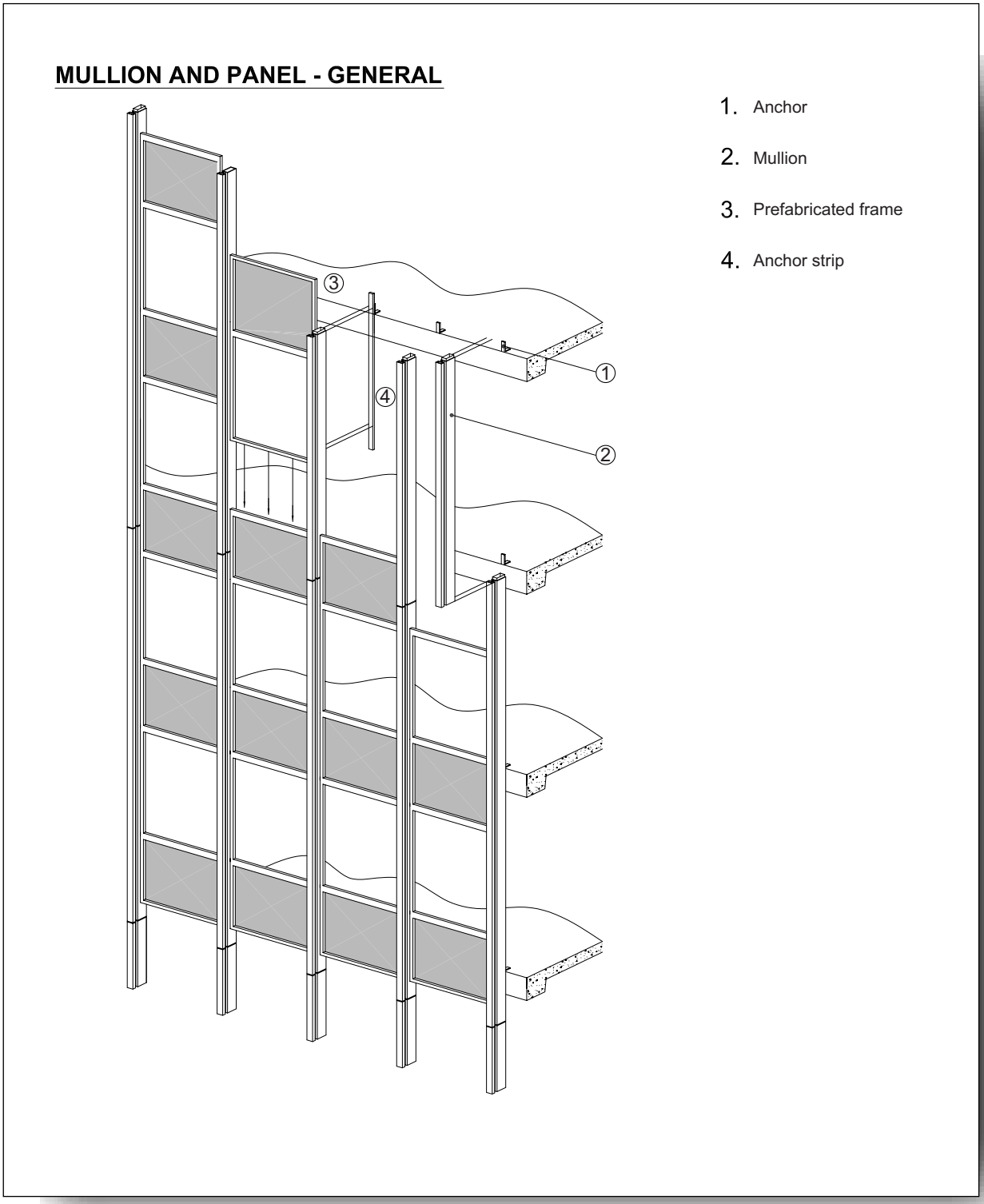


Figure 2.8: *Mullion and panel — general*

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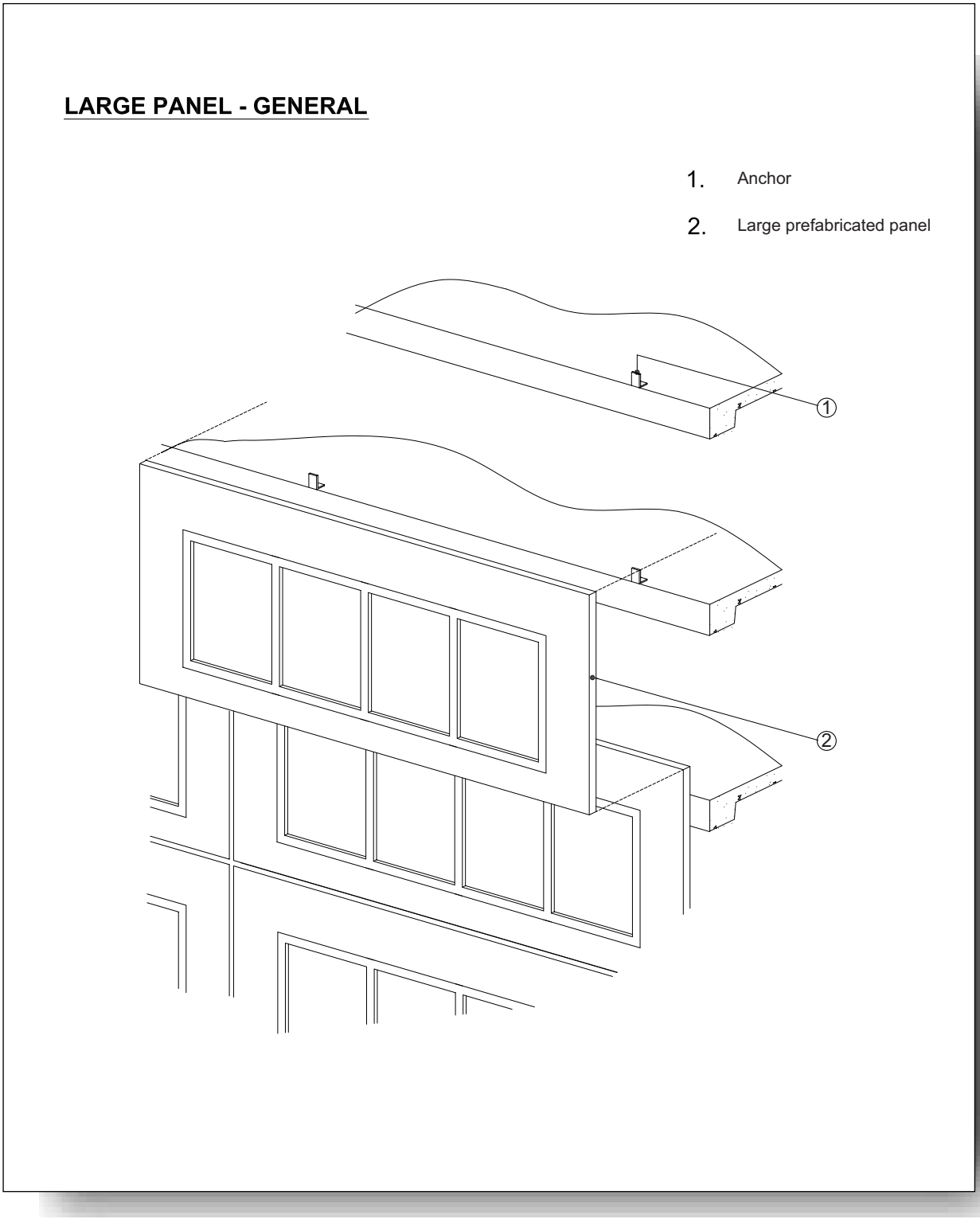


Figure 2.9: *Large panel — general*

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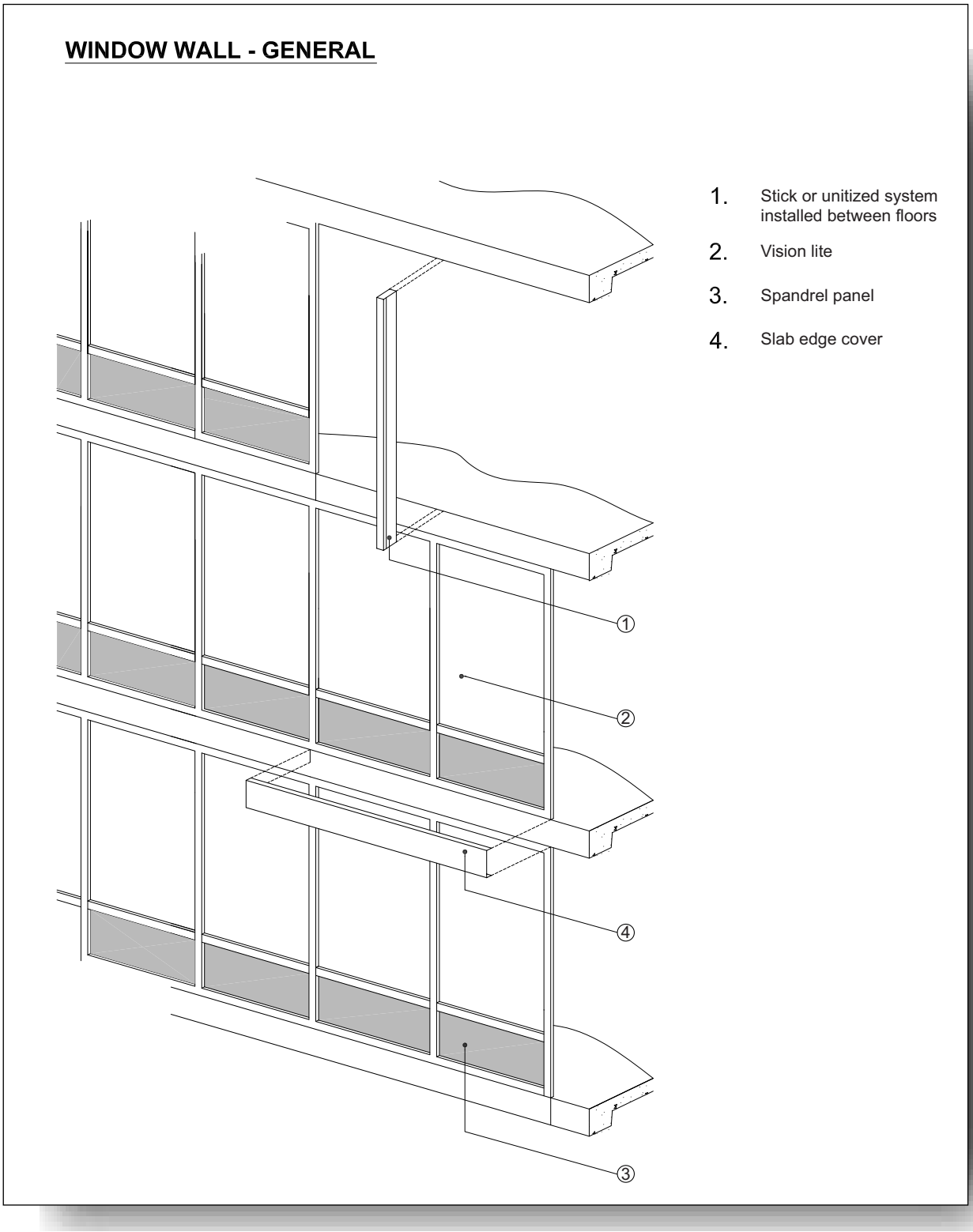
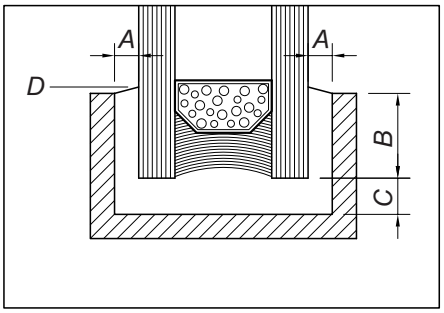


Figure 2.10: *Window wall — general*

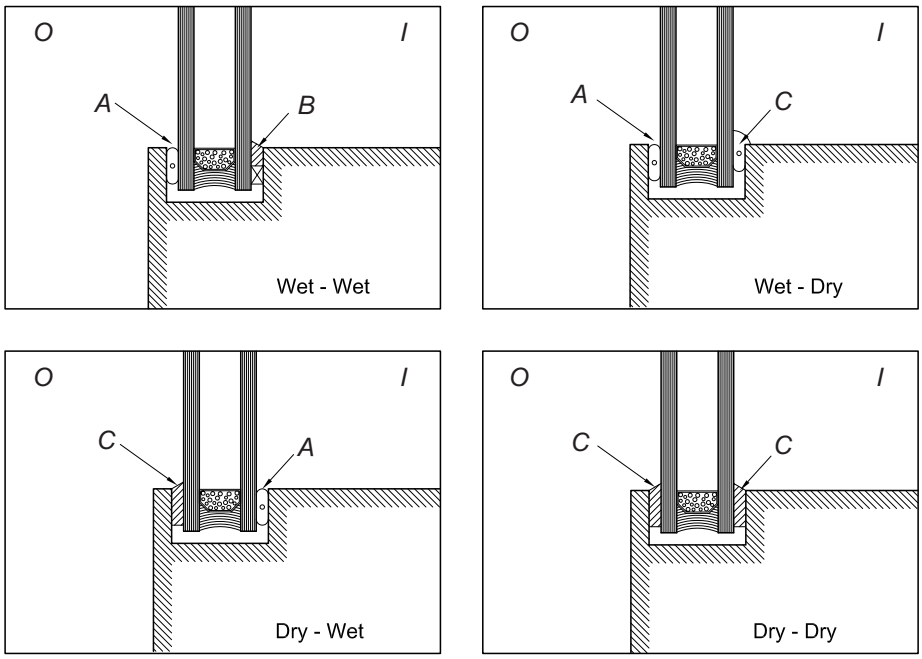
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The classification of a wall within the Glazing Method category is based on specific details of how infill panels are attached within the openings of a framing grid. Before discussing the various methods of glazing (attaching an infill panel) it is important to review the terminology that will be used to distinguish between components used in the different glazing methods.

GLAZING METHOD - ESSENTIAL TERMINOLOGY



A Face clearance
B Bite
C Edge clearance
D Sight line



SEAL COMBINATIONS

A - Shimmed glazing tape
B - Gunnable sealant on spacer
C - Rubber gaskets

O - Outside
I - Inside

Figure 2.11: *Glazing method — essential terminology*

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2.3.3 GLAZING METHOD

This category for wall classification includes the three most common methods, as well as a fourth grouping used to mention other methods that may be encountered on older buildings but are no longer common, nor promoted, for new construction.

GLAZING METHOD	CHARACTERISTICS AND FEATURES
EXTERIOR BATTEN	• Most commonly used form of glazing method relies on exterior metal batten to hold infill panel against framing member • Batten or pressure plate fixed to framing with cap screws that apply pressure to gaskets or tapes at edge of infill to create seal. Used with either tubular or split mullion • Glass installed from exterior • Exterior gasket is mainly a water intrusion barrier. It is not waterproof • Interior seal (gasket/tape) provides air barrier continuity between frame and sealed unit/backpan • Other gaskets between antirotation spacers provide separation and movement capability

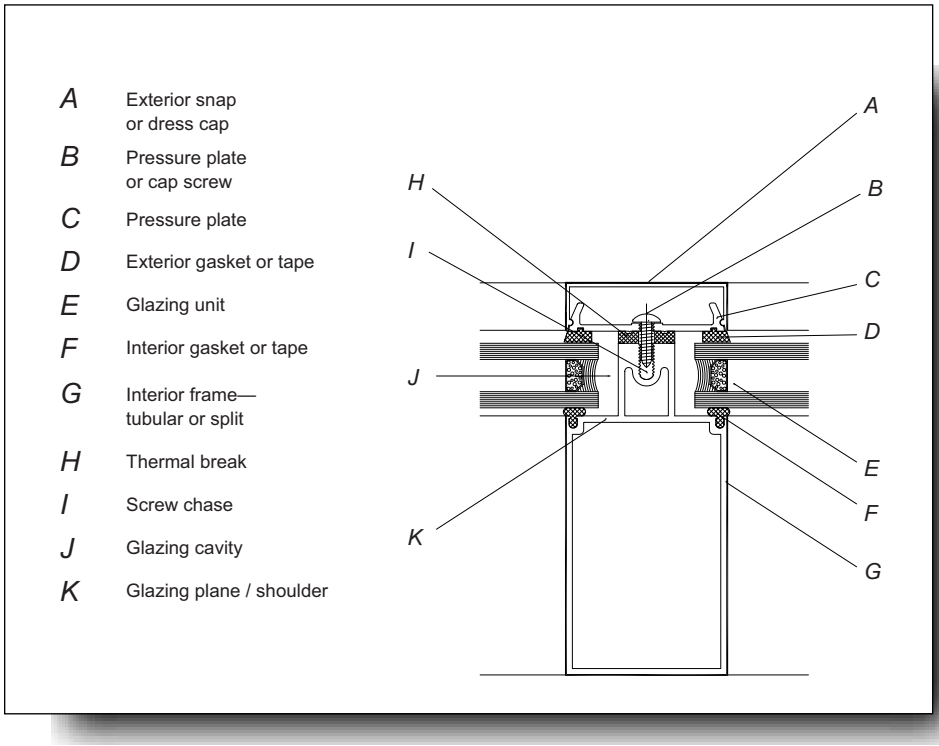


Figure 2.12: *Glazing method — exterior batten*

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GLAZING METHOD	CHARACTERISTICS AND FEATURES
STOP	• Interior or exterior removable glazing stop or bead used to force edge of infill against fixed stop. Most common is interior stop • Seal is created with tapes or gaskets compressed by stop. Common method used in window wall assemblies, at operable sash and in some contemporary systems • Glass installed from side of removable stop

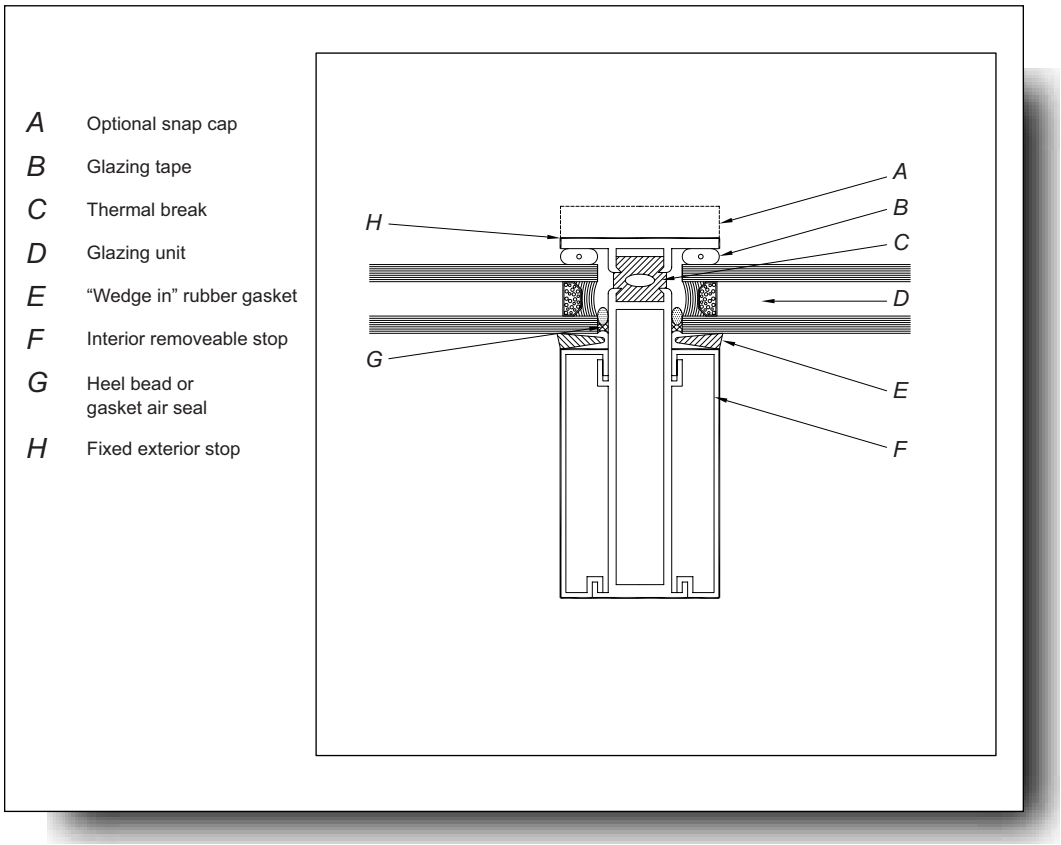


Figure 2.13: *Glazing method — stop*

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GLAZING METHOD	CHARACTERISTICS AND FEATURES
STRUCTURAL SILICONE (SSG)	**2-Sided Structural Silicone (2SSG)** • Two edges of infill are adhered to framing with structural silicone sealant and two edges are mechanically fixed usually with pressure plates. Can be field installed **4-Sided Structural Silicone (4SSG)** • Four edges of infill are adhered to framing with structural silicone sealant. Must be shop installed (for quality control) • Dead load of infill is supported on metal fin and setting block

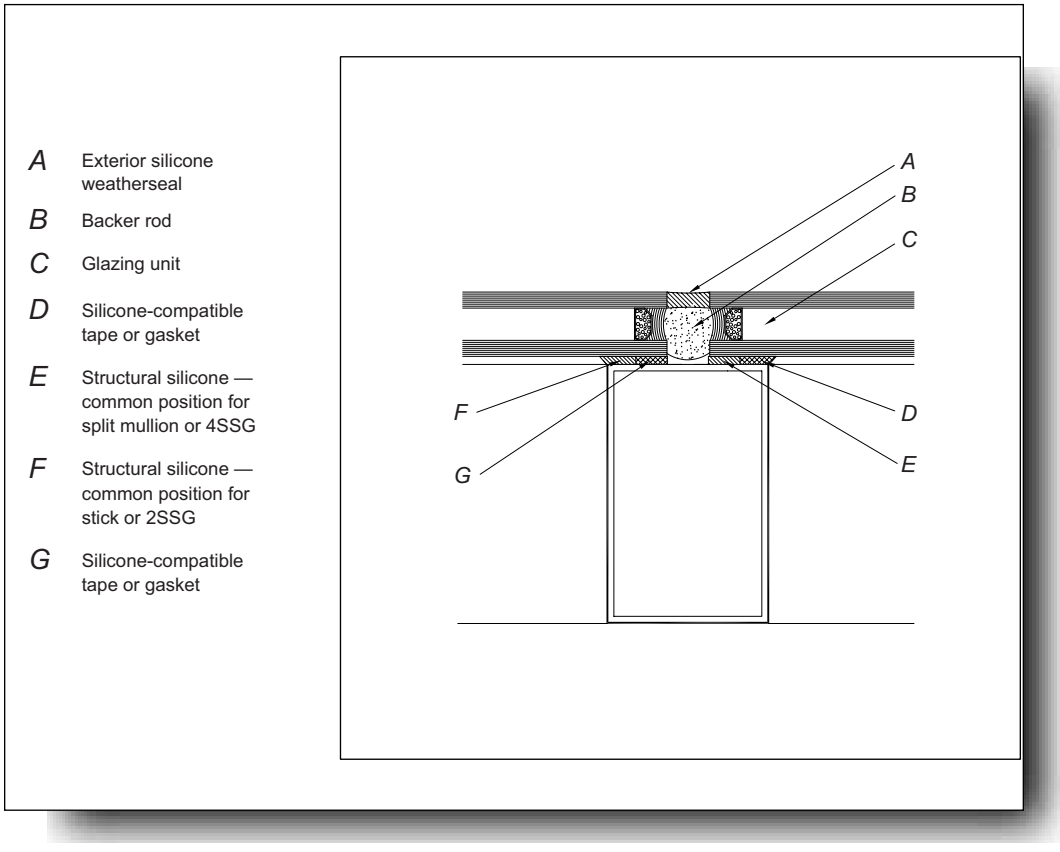


Figure 2.14: *Glazing method — structural silicone (SSG)*

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GLAZING METHOD	CHARACTERISTICS AND FEATURES
OTHER	**Channel glazing** • Channel or pocket glazing is modeled off of window sash assembly • Infill panel is maneuvered into oversized channel and fixed in position with wedge in type gaskets • Often used to accommodate unique geometry at building corners and/or to "hide" framing system from exterior at adjacent construction (e.g. framing behind stone sill or jamb)

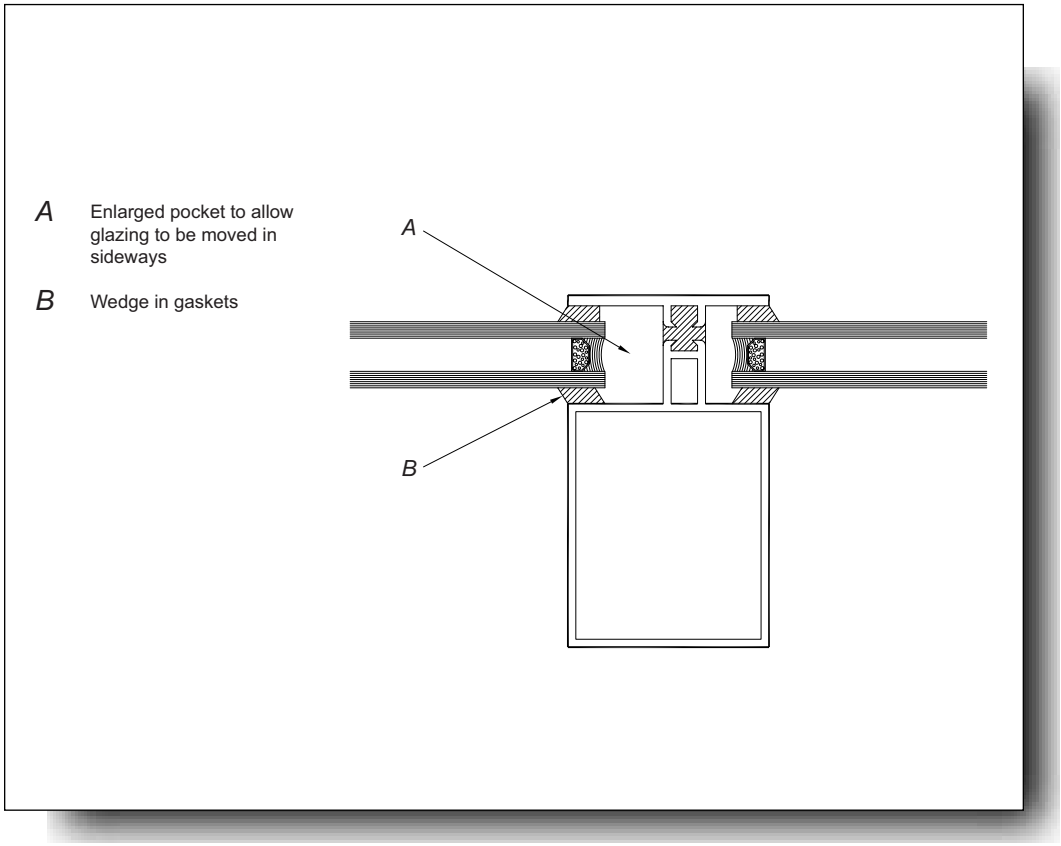


Figure 2.15: *Glazing method — channel glazing*

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GLAZING METHOD	CHARACTERISTICS AND FEATURES
OTHER	**Structural gasket** • Introduced in 1950s by automotive industry and used in many buildings up to late 1960s • Consists of preformed rubber seal with recess where locking strip is inserted • Locking strip exerts pressure on rubber creating seal • Fallen into disuse due to style change and performance problems

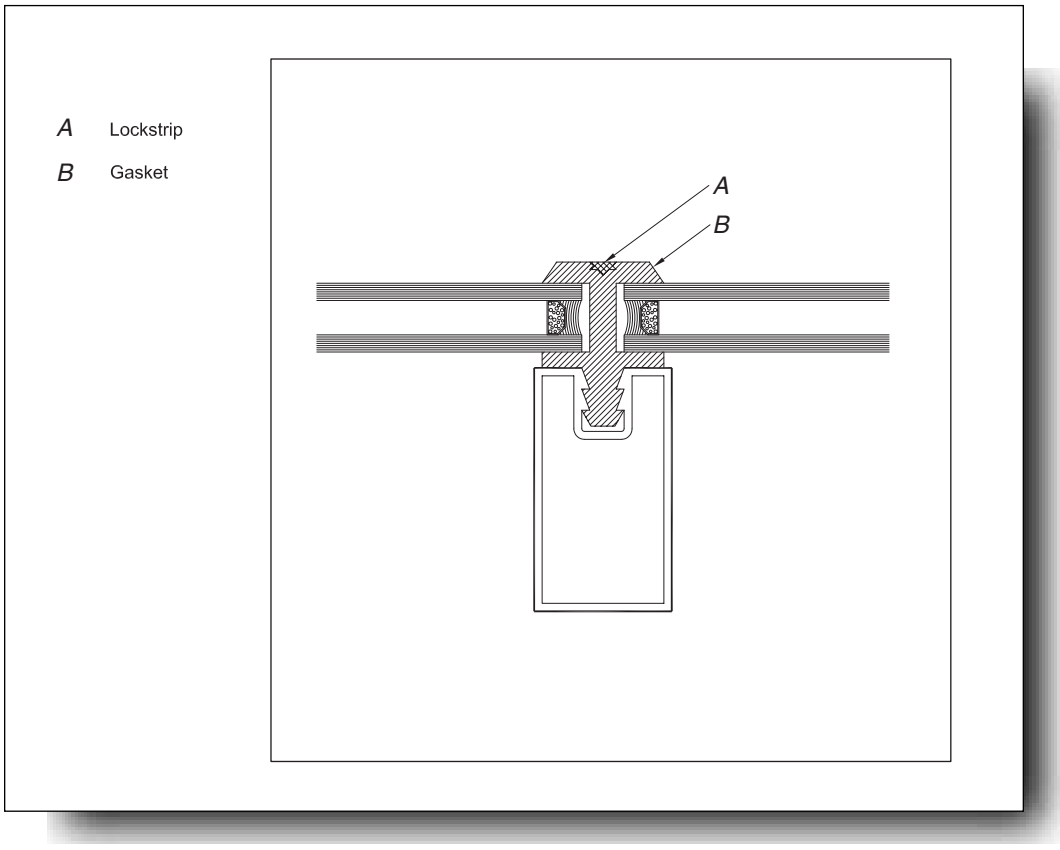


Figure 2.16: *Glazing method — structural gasket*

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2.3.4 SELECTION CRITERIA

There are a large number of factors that influence the design and selection of a particular curtain wall system. These factors range from whim to practical reality, from budget constraints to Code compliance.

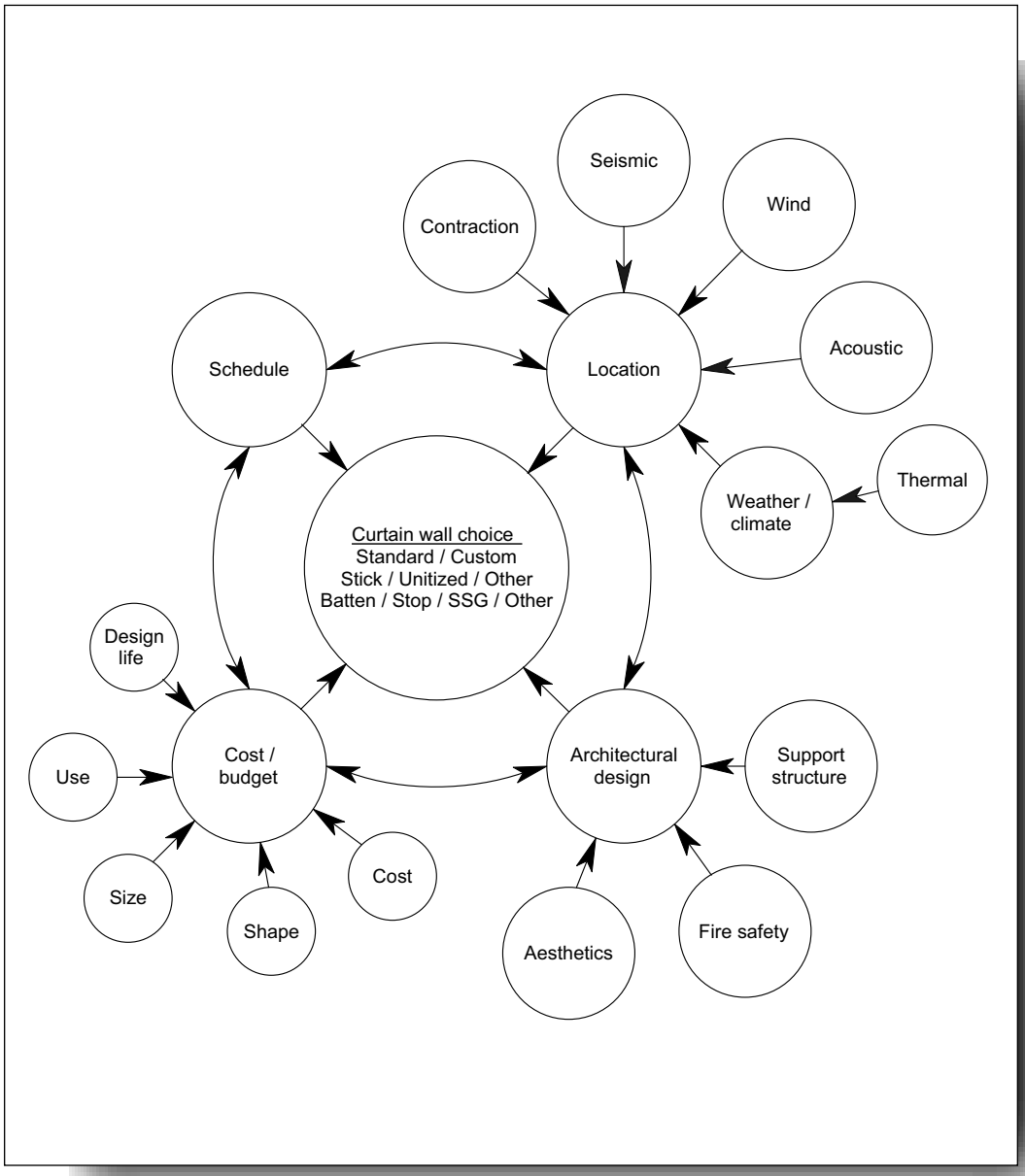


Figure 2.17: *Factors that influence the design and slection of a particular curtain wall system*

Inherent in all of the above are issues of quality and durability.

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Given the large number of factors and the interaction of these factors it is very difficult to provide all encompassing guidelines for curtain wall selection. Curtain wall designers are inventive and can adapt systems to accommodate many conditions. However, some guidelines can be provided to assist the professional in selecting a curtain wall type and system once the architectural aesthetic is resolved. The following describes considerations for choosing a wall system from within the wall type and erection categories. The glazing method is most often influenced by architectural concerns.

Choosing a Wall Type — Standard or Custom?

The use of a standard or off-the-shelf type of curtain wall does not imply a restriction to a standard overall design. It only implies the use of standardized components and details. These elements can be arranged in many different ways to produce very unique assemblies. Nonetheless, custom walls might still be the best choice in some situations. The following outlines considerations for choosing between a standard or custom wall type.

Type	Factor	Applicability
Standard or Custom?	Architectural Design	Architectural demands for non-typical sections or unusual arrangements may mandate **custom** extrusions to achieve the proper effect.
	Cost/Budget *Size*	The greater the project size the greater the potential that **custom** extrusions that exactly meet the site conditions will be more economical.
	Cost/Budget *Cost*	Unless there are size-related savings or special requirements custom projects will generally be more expensive than **standard** assemblies.
	Schedule	**Standard** walls can generally go into production faster and arrive on-site sooner. However, early arrival on-site does not ensure an earlier close-in of the building.
	Location *Contractor*	Smaller projects in smaller centres will have less access to custom materials thus favouring **standard** products.
	Location *Weather*	While standard products are available to meet most Canadian conditions, coupling severe exterior and severe interior conditions may require the development of a **custom** system.

Adequate quality and durability can be achieved with either standard or custom walls. Standard walls have the advantage of a product history. Custom assemblies may require greater testing and analysis to evaluate potential durability issues.

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Choosing Erection Type — Stick or Unitized?

While there are five or six different generic curtain wall systems, stick and unitized systems form the great majority of systems installed in Canada and North America. Given market pressures and contractor capability stick systems are typically used extensively in lower rise, smaller buildings in both smaller and larger centres. As the building size increases, in either height or footprint, the use of unitized systems to clad these buildings also increases. Most very large or very tall curtain wall clad buildings, constructed in Canada since the mid-1980s, have been clad with unitized systems. The following outlines considerations for choosing between a stick or unitized wall.

Erection	Factor	Applicability
Stick or Unitized?	Architectural Design	Most architectural designs can be executed in either system. Very long spans, especially near ground floor areas, are often more suited to stick systems. 4SSG systems must be pre-glazed unitized systems, making available shop facilities essential.
	Cost/Budget *Size*	The greater the project size, the greater the potential economy in unitized systems. Very small projects are almost exclusively completed using stick systems.
	Cost/Budget *Shape*	Very complex facades with little repetition, varying module size and spans make unitized systems less economical.
	Schedule	Advantages of one system over another depends on particular schedule demands. Standard stick systems can be fabricated and to the field quickly but take longer to close-in. Unitized systems take longer to arrive on-site due to plant assembly but close-in the building quickly once on-site.
	Location *Contractor*	Unitized systems require greater investment in plant and equipment and hence contractors are generally larger and located near major centres.
	Location *Seismic*	Stick systems, due to the sleeving of vertical mullions and the racking induced by lateral movements, are less able to accommodate seismic movements. Properly designed **unitized** systems can typically better accommodate seismic events.

As history has shown, adequate quality and durability can be achieved with either stick or unitized systems. However, due to the inherent quality control achievable in the factory assembly of the unitized system the potential for a higher quality project is increased using a unitized system. This potential is not always realized due to poor joint design to control air and water. Stick systems have problems mainly at the expansion joint where unitized systems add the vertical mullion joint which often compounds the expansion joint problem through the service life of the building.

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Chapter 3

COMPONENTS AND MATERIALS

3.1 OVERVIEW

Unlike many other wall assemblies metal curtain walls are assembled from a relatively short list of components. The primary materials are aluminum, steel and glass, along with secondary materials such as sealants, rubbers and insulation products. All of these materials and components are assembled to very close tolerance into a highly engineered product.

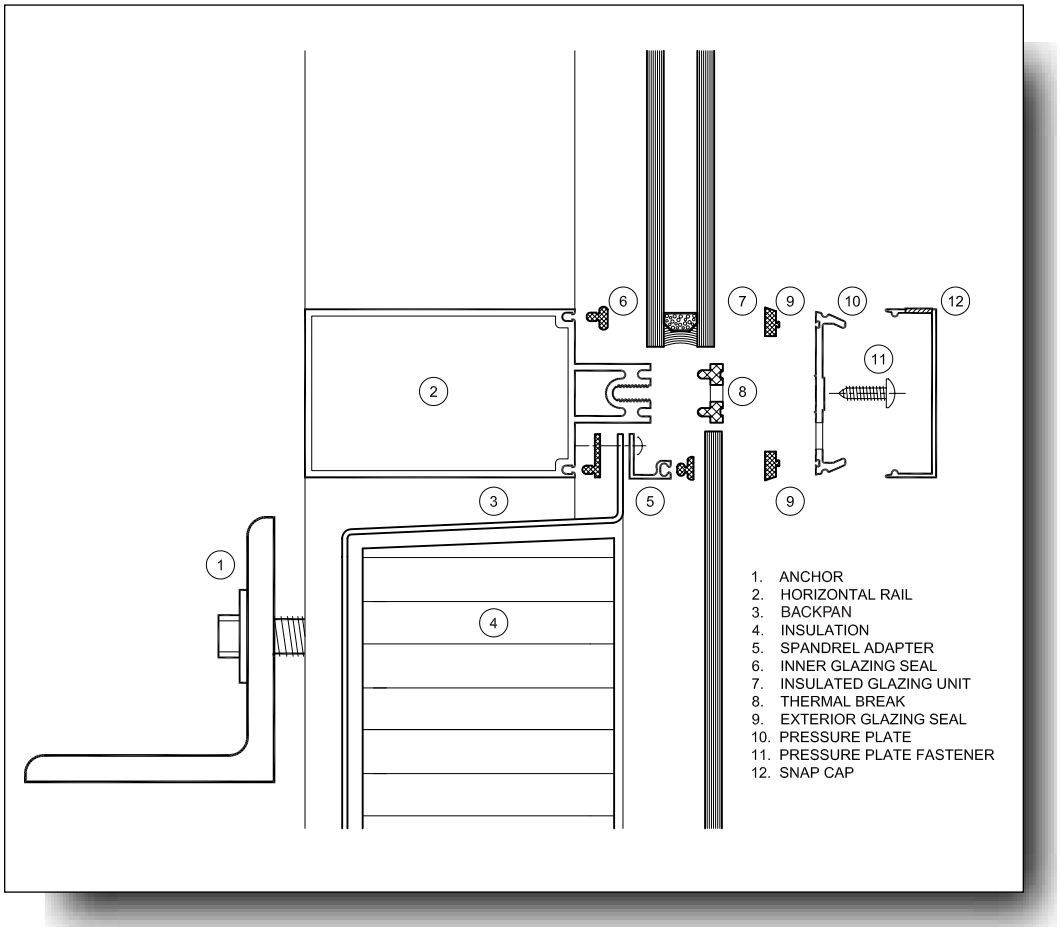


Figure 3.1: *Components and materials*

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3.2 ANCHORS

Curtain wall anchors connect the wall to the building and can be broadly grouped as both gravity and lateral load anchors (fixed) or as just lateral load anchors (slotted). Aside from their primary load carrying function anchors must be designed to allow for adjustment to site conditions and, in the case of lateral load anchors, allow adequate vertical movement but no out-of-plane movement.

Curtain wall anchors come in many sizes, shapes and configurations. Each manufacturer has its own favourite anchoring system representative of an ideal combination of material fabrication and field installation cost. However, every anchor has essentially two basic components: an embedded part, cast in or drilled into the floor slab edge; and a mounting lug assembly that fixes to the embed and to the framing.

3.2.1 Concrete Embed

Concrete embeds come in a variety of designs and, aside from a few proprietary anchor systems, there is little standardization across the industry. There is no best type of embed for all conditions. Top edge of slab anchors are the most common (A, B). Anchors cast into pockets are more expensive but when grouted over, simplify floor finishes (B). Slab edge anchors require careful control of slab edge tolerances. Underslab anchors are usually only used at special conditions (D).Given the interior location of the embed, the use of galvanizing is an excessive practice in most instances.

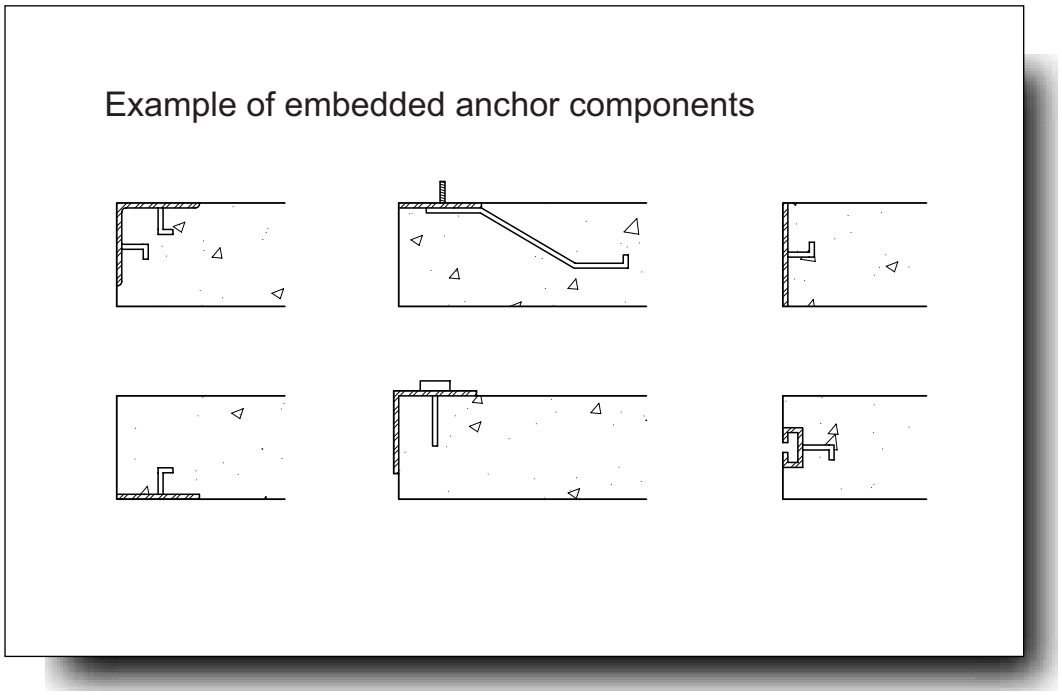


Figure 3.2: *Examples of embedded anchor components*

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Critical Path

The design and layout of cast-in embed type anchors are often in the critical path of a building's construction. The anchors must be installed long before the curtain wall is fabricated or even completely designed. Therefore some conservatism must be built into the anchors and decisions on module spacing or special elements must be made early.

3.2.2 Mounting Lug Assembly

The design of the mounting lug assembly is based, in part, on the installation philosophy of the contractor. In Canada, the predominant approach to wall installation is to install the wall as quickly as possible in a temporary position and then adjust and shift components to achieve the proper final position of the wall. The other approach is to spend more time on the initial setting and fixing of the mounting lug, so that framing can be installed with little or no adjustment. This approach is common in Europe and the Far East and is gaining popularity in Canada. Notwithstanding developing philosophies there are a few common lug configurations.

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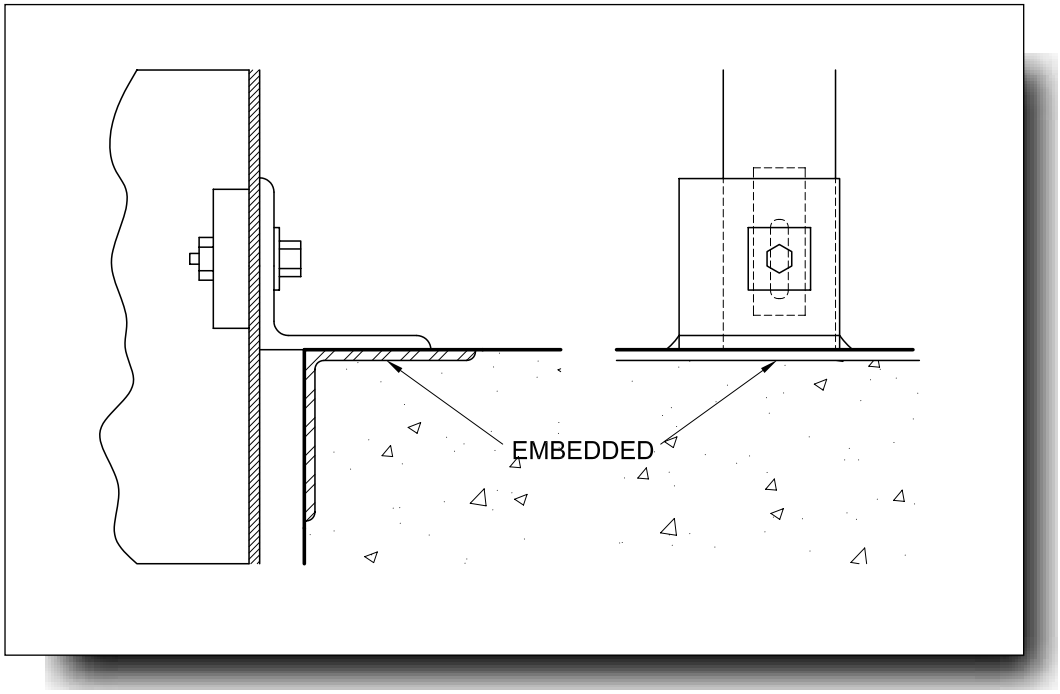


Figure 3.3: *Common anchor in many stick-erected curtain wall systems*

The relatively simple anchor shown above is common in many stick-erected curtain wall systems and has a long record of proven performance. The anchor consists of a cut steel angle welded to the mounting surface of the embed. The angle is roughly positioned and tacked in place during initial layout. The angle has a cut hole in the vertical leg that allows some vertical and lateral movement of the anchor bolt. The anchor bolt is set through an anchor block internal to the mullion tube and through the cut hole in the angle. A rectangular steel washer plate on the anchor bolt is welded in position to fix the bolt and framing position. Welding and locking of the anchor bolt nut are the final activities in the fixing of the anchor. Welds require final inspection as they are a structural element and painting is recommended as minimal corrosion protection.

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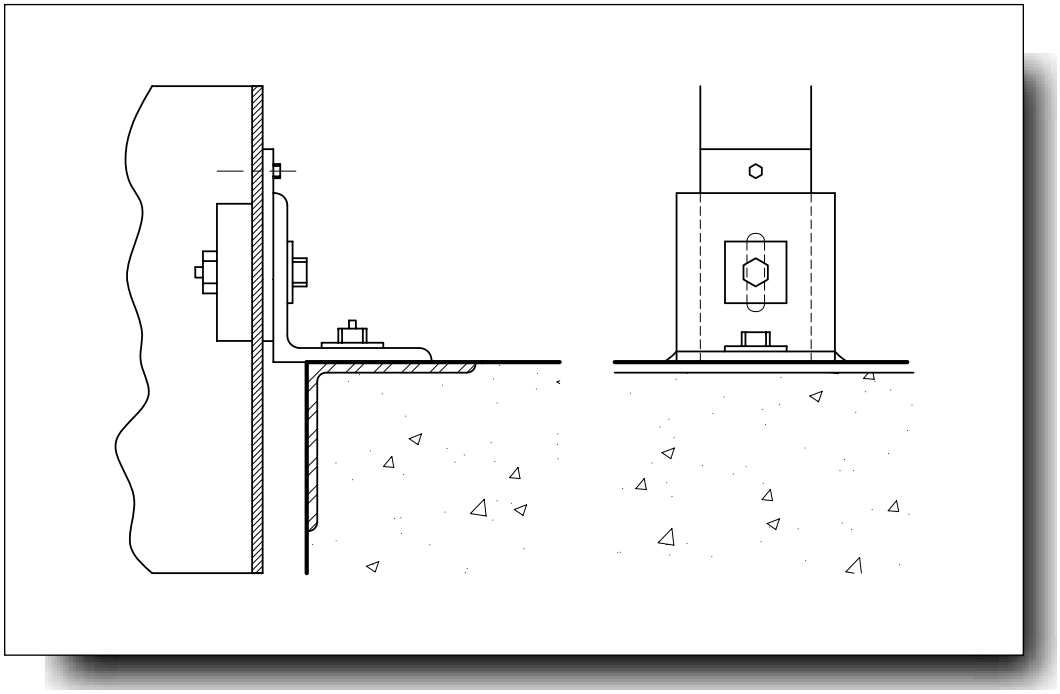


Figure 3.4: *More sophisticated anchor*

The slightly more sophisticated anchor shown above is most commonly found in unitized wall systems. It eliminates field welding through the use of a pre-welded threaded stud on the embed, extruded aluminum mounting lugs and a separate dead load fixing screw.

Aside from typical slab edge anchors, a curtain wall that extends to grade often requires internal anchoring to the structure. These anchors are often cut from aluminum extrusions or may be built-up plate/angle assemblies. Such anchorage must satisfy the same constraints as slab edge anchors. In addition, given the termination of the system, air seal closures require special attention.

Regardless of the actual anchor design, there is a need to account for certain clearances and tolerances associated with the anchor. When reviewing a shop drawing, it is worthwhile to check that the following clearances and tolerances have been incorporated.

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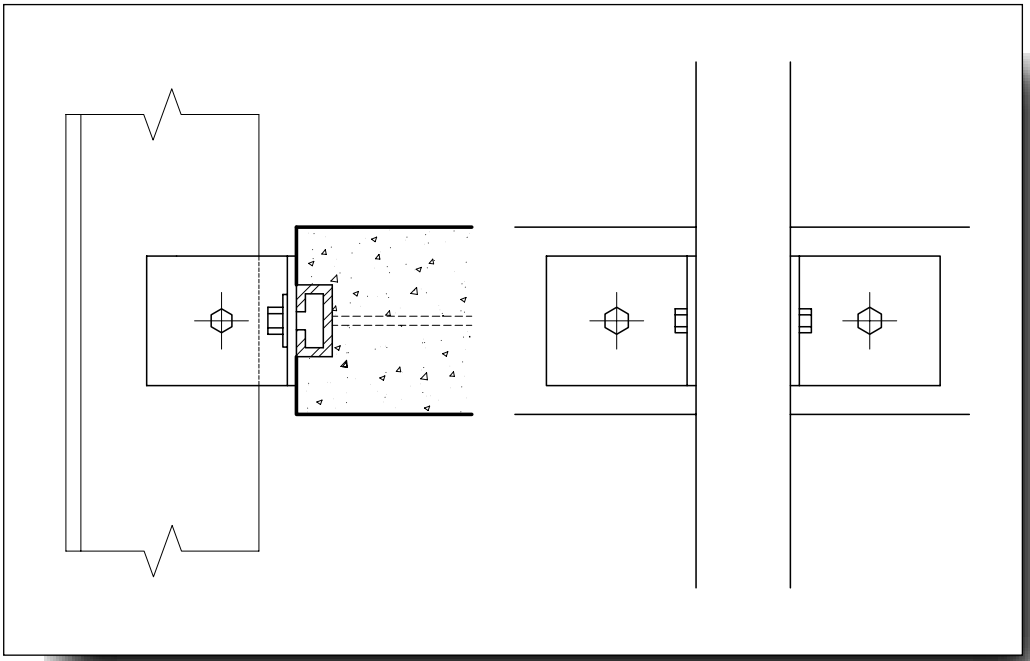
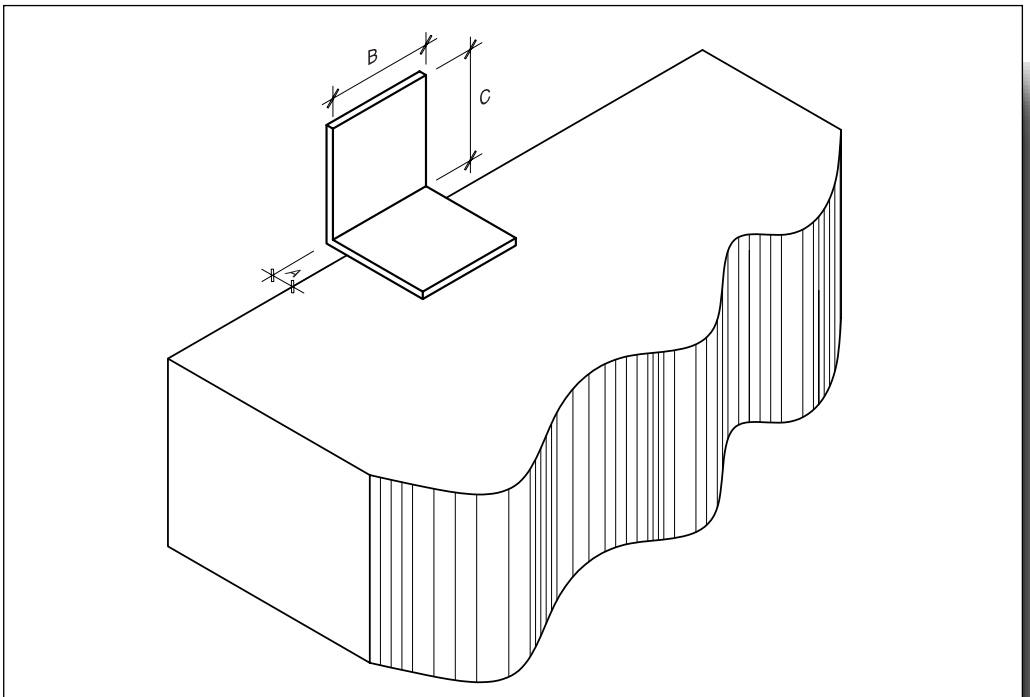


Figure 3.5: *Slab edge anchor*



Clearance @ A typical 25-50 mm (1 to 2 inches)
Tolerance @ A typically ±25 mm* (1 inch)
Tolerance @ B typically ±12 mm (1/2 inch)
Tolerance @ C typically ±12 mm (1/2 inch)
*Increasing A to 75 mm (3 inches) may require added gusset.

Figure 3.6: *Anchor clearances and tolerances*

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