FENESTRATION ASSOCIATION OF BC

SPECIFYING THE ENERGY PERFORMANCE OF GLAZING PRODUCTS IN BRITISH COLUMBIA

VERSION – MAY 2013

A Joint Task Group Project
with representatives from:

Association of Professional Engineers and Geoscientists of British Columbia

Architectural Institute of British Columbia

Ministry of Energy, Mines and Natural Gas

Fenestration Association of BC

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DEFINITIONS

Architect: a person who is a member of the Architectural Institute of British Columbia.

ASHRAE 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings, issued by ASHRAE (the American Society of Heating, Refrigerating and Air-Conditioning Engineers).

British Columbia Energy Efficiency Act (the Act): the provincial legislation that sets energy performance standards for devices that use, control or affect the use of energy. Energy performance standards are laid out in the *Energy Efficiency Standards Regulation*.

Designer: An architect, professional engineer or other person qualified to design and specify fenestration products.

Fenestration Product: The definition for fenestration products is to be consistent with the Energy Efficiency Act definition, which includes the following:

a. Windows, sliding glass doors and skylights
b. Glazing for doors, sidelites or transoms
c. Door slabs

Floor Area: Floor area requirements referenced in the Act assume gross floor area of all floors, including both commercial and residential floor areas in mixed-use buildings.

- *A six-storey building with 100 m^2 floor area/floor will total 600 m^2*
- *A three storey building with 300 m^2 commercial floor area on the ground level and 150 m^2 of residential floor area on each of the two upper storeys will also total 600 m^2*

Professional Engineer: a person registered under the Engineers and Geoscientists Act as a professional engineer.

Registered Professional: Either (a) a person who is registered or licensed to practice an architect under the Architect's Act, or (b) a person who is registered or licensed to practice as a professional engineer under the Engineers and Geoscientists Act.

Skylight: A fenestration product that is offset from the vertical by greater than 15°.

Glazing Manufacturer/Contractor: The party that assembles the final glazing product. For glazing products, assembly is defined as the installation of the glass into the frame components. Assembly can be completed in a factory or on site.

BACKGROUND

Since the introduction of the British Columbia Energy Efficiency Act ("the Act") in 2009 by the provincial government, the glazing industry, in combination with the engineering and architectural communities, is facing shared challenges with meeting the requirements of the Act. In particular, the following questions arise with respect to fenestration:

1. What projects fall under the jurisdiction of the Energy Efficiency Act, and when is ASHRAE 90.1 applicable?
2. Who is responsible for ensuring compliance with the Act?
3. How is enforcement managed?
4. What are the thermal performance requirements for different projects?
5. How can thermal modeling and testing of performance be incorporated pre-tender?
6. What are the labeling and documentation requirements?

Designers face a special challenge when specifying fenestration products and assemblies. Having to meet the requirements of the Act and building code-referenced standards such as ASHRAE 90.1, performance criteria must be considered along with other functional requirements such as aesthetics, constructability, building envelope and structural performance, as well as fire performance. In addition, commercial systems typically involve the integration of many proprietary products, including framing members, coatings on glass, spacer bars, sunshades systems anchorage assemblies, gaskets, couplers, deflection headers, seismic jambs etc. The component manufacturers cannot predict thermal performance of a glazed assembly as they can only be expected to know the performance of their own products.

As the party that assembles the final fenestration product, Glazing Manufacturers/Contractors are ultimately responsible for ensuring compliance with the Act. A conflict arises when the specified products, when combined, do not meet the requirements of the Act when required to do so; the Glazing Manufacturer/Contractor is challenged to comply with the Act, based on the Designer's non-compliant contract documents, and ultimately must to make up the difference. This is not entirely fair to the manufacturer/contractor; it is not professionally supportable for designers to place glazing contractors in this untenable position.

To bridge the gap between the designer as specifier and the Glazing Manufacturer/Contractor and to develop a consistent methodology to improve compliance with the Energy Efficiency Act, a special task group comprised of representatives from the glazing manufacturing industry, the architectural and building science engineering community and the Ministry of Energy and Mines collaborated to complete the following:

1. Develop standardized specifications or model specifications aimed at appropriately specifying glazing assemblies that comply with the Act.
2. Prepare model specifications and standardized design methodologies for common fenestration systems including the following:
    a. Aluminum-Framed Entrances and Storefront
    b. Glazed Aluminum Curtain Wall
    c. Combustible Windows
    d. Roof Windows and Skylights
    e. Glass and Glazing

This guide is issued by the Fenestration Association of British Columbia (FEN-BC), with the cooperation of the Architectural Institute of British Columbia and the Association of Professional Engineers and Geoscientists of British Columbia. It is generally for the use of designers, some of whom will be registered professionals.

INTRODUCTION

.1 Objective

The British Columbia Energy Efficiency Act ("the Act") applies to the manufacture and sale of doors, window and skylights, as well as a broad range of other products such as lighting products, televisions and water heaters.

It is applicable throughout the province, regardless of which building code is in effect. In general, the Act is complimentary to building code requirements, though its application is broader; it applies in situations where building codes are not applicable. For example, replacement windows in an existing building may not require a building permit, but the Act would still apply.

Though its application is broad, there are a number of exemptions to the Act for buildings that meet specific building code criteria. For example, compliance with ASHRAE 90.1 allows exemption from the requirements of the Act.

The objective of this guideline is to clarify intended compliance paths and describe the necessary steps to comply with the Act and building codes applicable in BC when specifying fenestration products.

Included in this guideline are supplements meant to assist with the selection and specification of fenestration products, including a number of model specifications formatted to the current National Master Specification Format. These model specifications, along with the procedures described within this document, are intended to establish a standardized level of practice among Designers who are involved in specifying commercial glazing products. There is also information, intended to help with the certification process, depending on the scope of work and type of project.

The use and acceptance of this guideline among industry and regulatory stakeholders will help to establish uniform applications of the Act. Ultimately, the Act is aimed at consumer protection and is intended to improve the energy efficiency of buildings, reduce consumption of fossil fuel, electricity and decrease production of greenhouse gasses.

.2 Intended Audience

This document is aimed at all stakeholders involved in designing, specifying, manufacturing, fabricating and installing fenestration products in British Columbia. The following provides a summary of each of the main stakeholders and their respective responsibilities:

i. Designer

The Designer is responsible for determining not only what energy performance compliance path governs (either building code or the Act) – but also whether the fenestration products conform to the energy requirements.

Since site-assembled and factory-assembled systems often use a variety of components, sometimes from many different suppliers, Designers should be aware of how each of these components affects energy performance. When writing specifications, Designers should pay particular attention to the products/materials they are specifying for:

- Frames
- Gaskets
- Spacer bars and sealants
- Setting blocks
- Glass and glazing (including low-emissivity coatings)
- Gas fills
- Anchors
- Couplers
- Deflection headers
- Seismic jambs

Testing and modeling of energy performance should be completed during the design phase, prior to tendering. Some level of collaboration between the Designer and the Suppliers and Manufacturers is expected, given the amount of detail required in order to test conformance.

ii. Supplier

Suppliers are responsible for providing up-to-date testing/performance data on their products to the Designer and other necessary parties. Though final testing of the system is up to the Designer, the design process should be a collaborative initiative between the Designer and product Suppliers. Suppliers should expect to invest some time to provide support to the Designer before tendering and project award occur, even if there is no guarantee that they will be awarded the contract as a result of the bidding process.

iii. Glazing Manufacturer/Contractor

The Glazing Manufacturer/Contractor is the party that assembles the final glazing product. For glazing products, assembly is defined as the installation of the glass into the frame components. The assembly process can take place in a factory, or on site.

Like Suppliers, Glazing Manufacturers/Contractors are responsible for providing up-to-date product data to Designers during the design phase. In addition to providing support to the Designer during the design phase, Glazing Manufacturers and Contractors are also responsible for ensuring the proper labeling of products. Compliant labeling can be either individual product labels or a site certificate summarizing all product U-values for a given project. The Glazing Contractor is also responsible for ensuring that fenestration products are built as-designed.

.3 Consequences of Non-Compliance

The Act was established as a consumer protection act, aimed at manufacturers. In the case of fenestration products, the Glazing Manufacturers/Contractors is responsible for complying with the Act, as they are the party responsible for the supply, fabrication, assembly and installation of fenestration products. Failure to comply with the Act is considered an offence under the British Columbia Offence Act.

2.0 COMPLIANCE PATHS

The following flow charts are intended to be a guide to determine (1) how the Act applies to a given project (or if the project has been designed to meet ASHRAE 90.1), and (2) what energy performance requirements govern.

Figure 1 starts with a very high level perspective of Figures 2 through 6. It maps project dependencies including the location of the project and whether it is new construction or renovation. Figures 2 through 6 provide further guidance on energy requirements based on the size and type of project. Figure 7 clarifies how the 600 m^2 floor area distinction (mentioned in Figure 6) is calculated, depending on whether the project is new construction or renovation. Energy performance requirements for glazing used in door assemblies (which are considered fenestration products under the Act) are provided in Table 1.

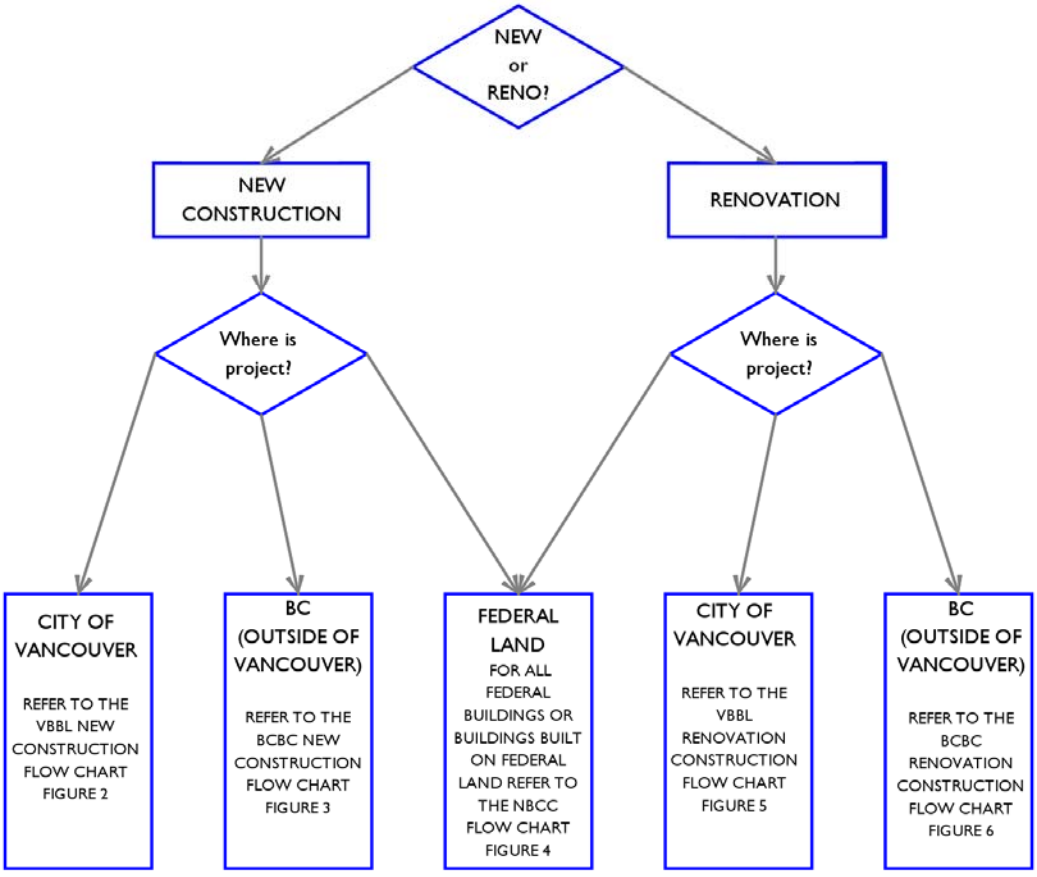

Figure 1: Compliance Path Options for New Construction vs. Renovation Projects

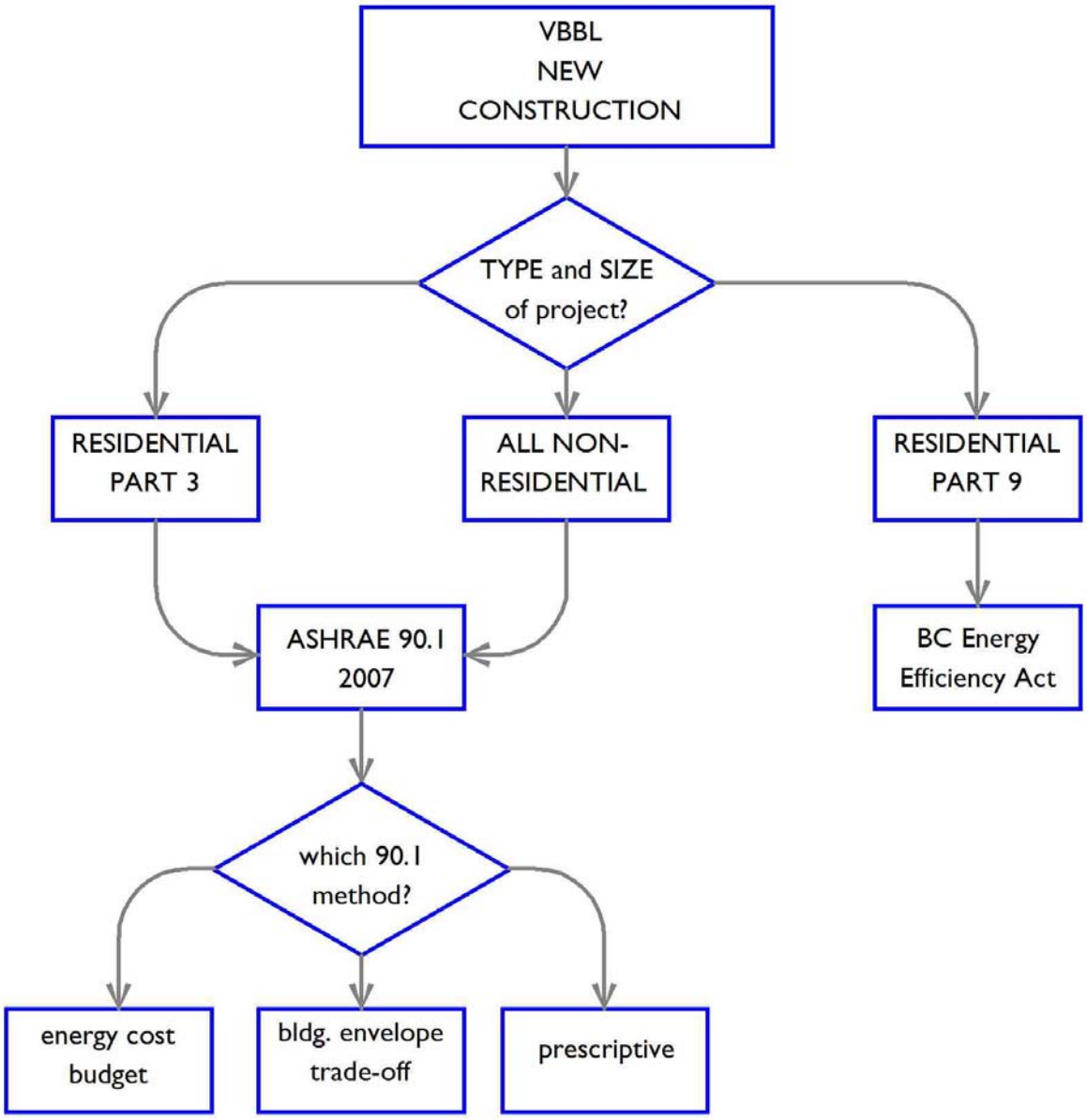

Figure 2: New Construction Projects in the City of Vancouver (Vancouver Building By-Law)

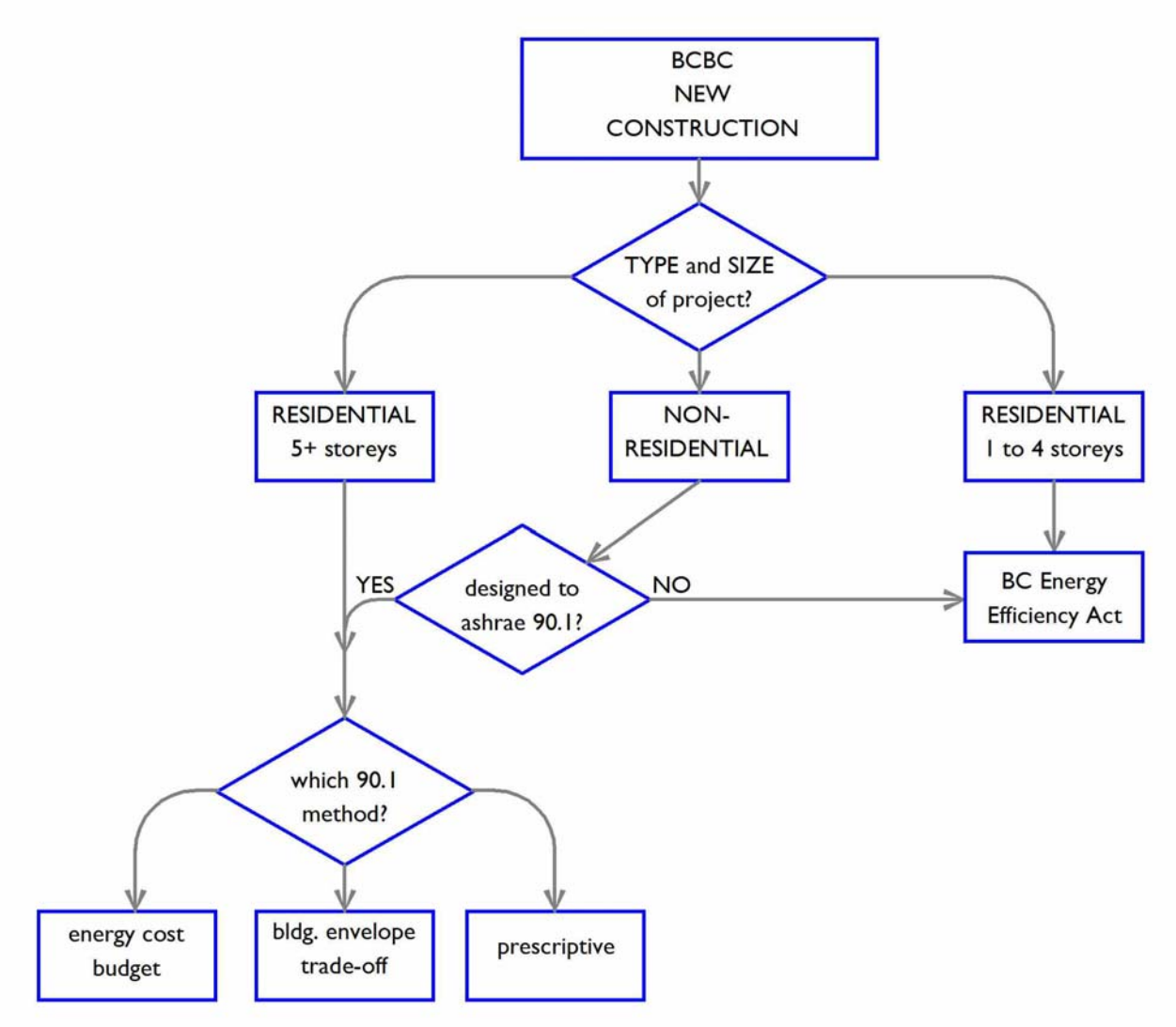

Figure 3: New Construction Projects in the Remainder of British Columbia (BC Building Code)

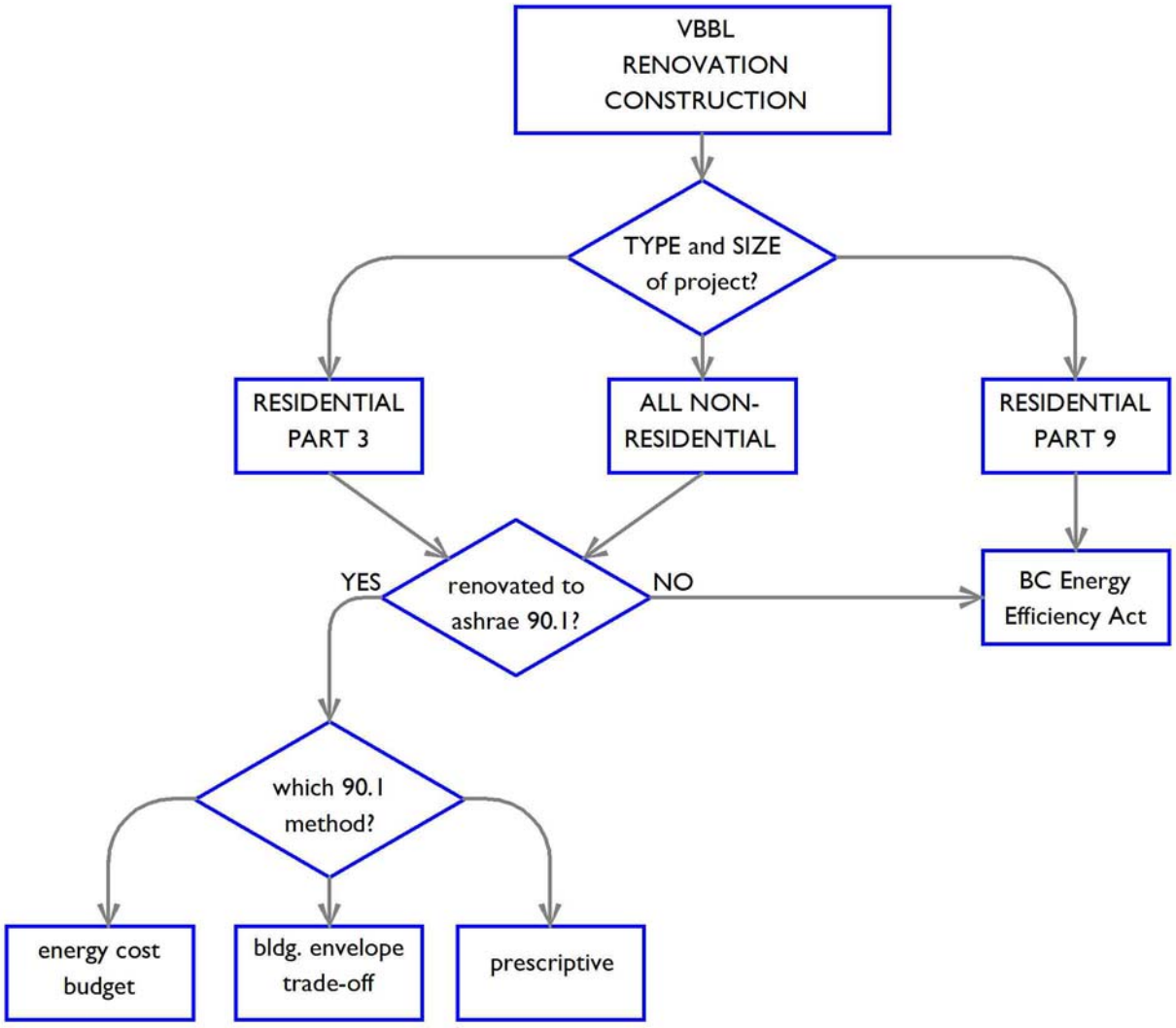

Figure 4: New Construction and Renovation Projects on Federal Lands (National Building Code)

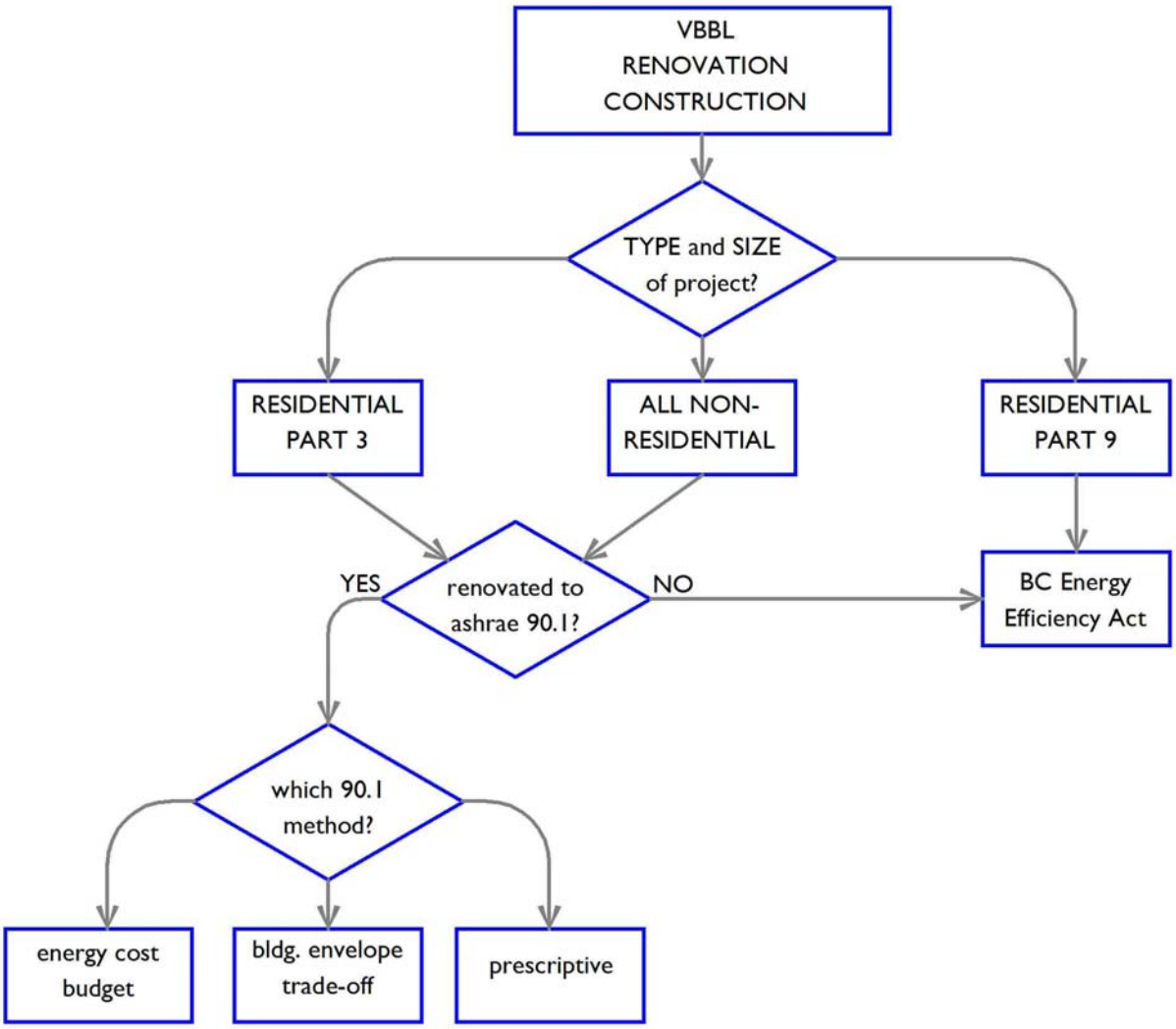

Figure 5: Renovation Projects in the City of Vancouver (Vancouver Building By-Law)

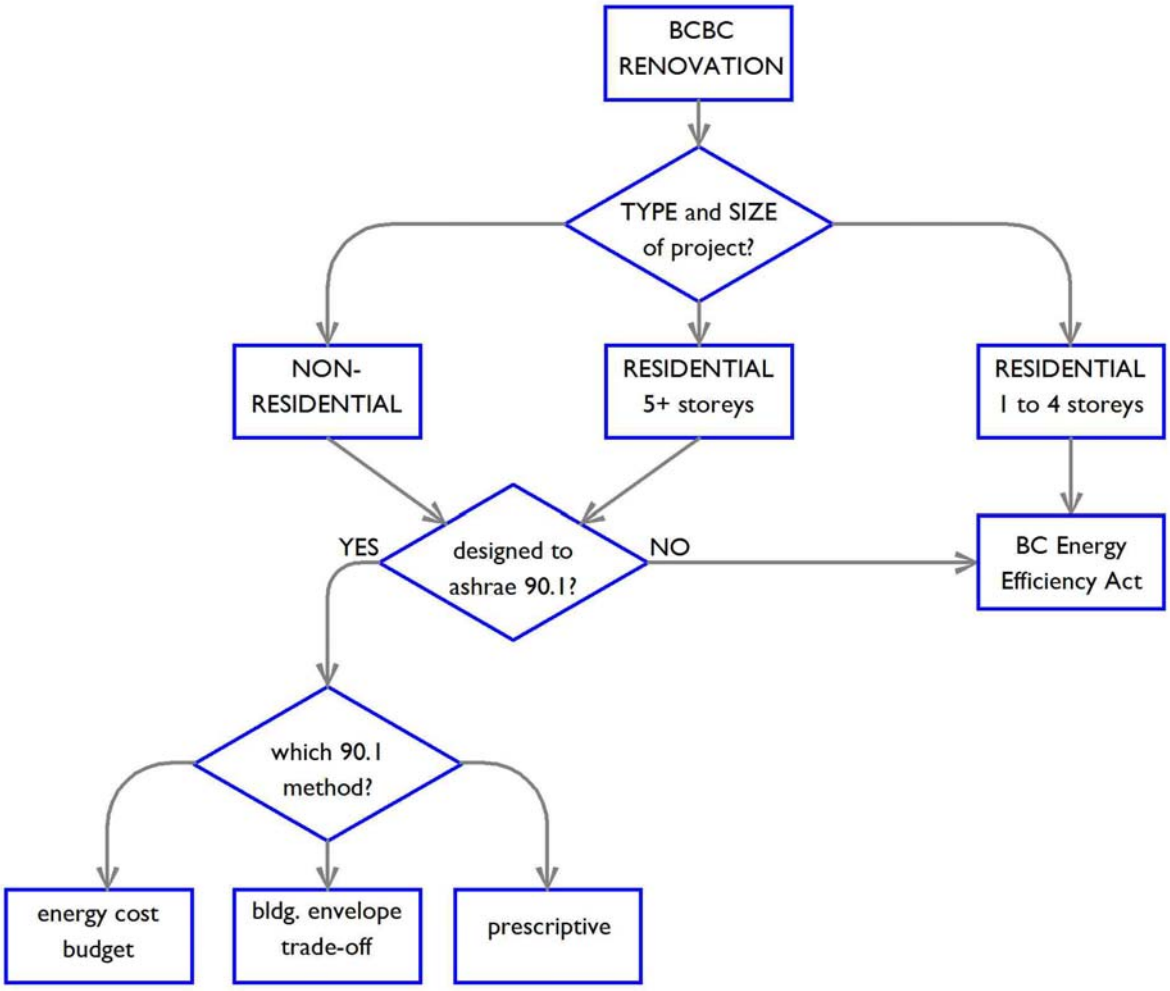

Figure 6: Renovation Projects in the Remainder of British Columbia (BC Building Code)

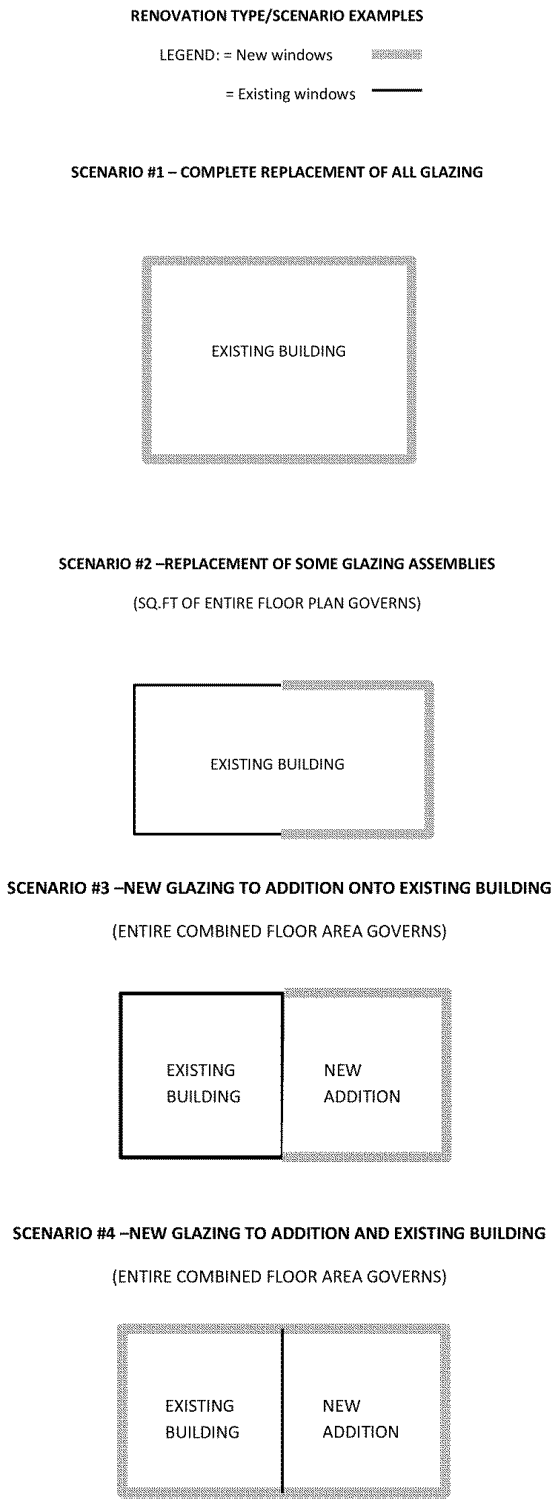

Figure 7: Explanation of Floor Area Requirements for the BC Energy Efficiency Act Compliance Path in Figure 6

Table 1: BC Energy Efficiency Act Door Criteria

Door Product	Prescriptive Criteria	Exceptions
Glazing for installation in manufactured door slabs, sidelites and transom lites (item 41, schedule 1 in the Act)	▪ Multiple-glazed, with at least one low-e coating in between lites ▪ 90 % argon gas fill, with a compatible edge sealant system ▪ Spacer bars other than non-thermally broken aluminum box spacer bars	▪ Glazing installed in pre-hung door assemblies with a maximum U-value of 2.0 W/(m^2K), tested with *NFRC 100-2004 Procedure for Determining Fenestration Product U-Factors* ▪ Decorative glazing that has stained glass panels, iron inserts or blinds, contained in a sealed insulating glass unit ▪ Door products installed in unheated or unconditioned buildings ▪ Products installed in designated heritage buildings ▪ Glazing replacements in an existing sash or frame if the U-value of the replacement is equal to, or less than, the U-value of the original glazing ▪ Products installed in buildings that are compliant with ASHRAE 90.1 (2004, 2007 or 2010) Energy Standard for Buildings ▪ Products shipped or sold out of province
Door Slabs that are foam filled (typically steel and fiberglass skinned doors) (item 42, schedule 1 in the Act)	▪ Door panels must be insulated with products rated to a thermal resistance greatr than , or equal to, 0.875 m^2K/W (RSI) ▪ Thermal performance to be tested as per *ASTM C518-4, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*	▪ Solid wood door slabs ▪ Door slabs in pre-hung door assemblies with a maximum U-value of 2.0 W/(m^2K), tested with *NFRC 100-2004 Procedure for Determining Fenestration Product U-Factors* ▪ Door products installed in unheated or unconditioned buildings ▪ Door slabs installed in designated heritage buildings ▪ Glazing replacements in an existing sash or frame if the U-value of the replacement is equal to, or less than, the U-value of the original glazing ▪ Products installed in buildings that are compliant with ASHRAE 90.1 (2004, 2007 or 2010) Energy Standard for Buildings ▪ Products shipped or sold out of province

3.0 SYSTEM SELECTION[1]

Product selection requires some knowledge of the design features, strengths, and limitations of each kind of system, matched to the needs of the project.

.1 Testing

Many of the standard glazing systems have been subjected to rigorous testing during the course of their development and have also been proven in use. There is little reason to specify further testing of such products. However, the specifier should review the test and performance data closely to ensure that it applies to the specific project requirements. In particular, close attention must be paid to the date of testing, sample sizes used, and individual framing components tested.

When performance criteria can be quantified, manufacturers should be consulted to determine whether their products can meet those criteria. Copies of relevant test results, the manufacturer's published literature, and any available thermal performance data should be requested to substantiate the representations of sales representatives. When it is not possible to quantify performance criteria, or when suitably tested products are not available, the design features of the products may be described in a prescriptive manner, by specifying product materials, glazing assemblies, coatings etc.

.2 Selection Chart

The following chart provides an overview of the four main glazing systems considered in this guideline. Model specifications, with sample energy requirement clauses, are included in *Appendix A* for italicized specification sections.

[1] This section has been borrowed from the Glazing Specifications Manual

Product	Typical Application	Performance
Storefront *08 41 13 Aluminum Framed Entrances*	• Typically used on ground level not exposed directly to wind-driven rain • Overhang required to protect from wind-driven rain. This system may have limited internal water management capacity • As its name implies, this system is intended for store front entry applications where an awning or recessed overhang is present • Ease of installation and glass replacement make these systems ideal for store front entry ways	• Can be thermally broken • Typically not intended to be exposed to water. Weather-resistant versions incorporate limited internal water drainage into the sub-sill • Spans are usually limited to 10 ft. • Some systems can be reinforced to increase spans
Curtain Wall *08 44 13 Glazed Aluminum Curtain Walls*	• Typically used in high-rise and commercial applications. • "Off-the-shelf" systems are available but larger projects often rely on custom extrusions to suit specific architectural requirements. • Stick built systems can be erected on site from stock materials allowing for shorter lead times and capacity to handle varied site conditions (however, access can be an issue at higher levels). • Unitized or factory built frames are expected to have higher reliability given the higher degree of quality control attainable in a factory setting. Installation of the unitized frames requires less time on site than stick frame systems. • Glazing units can be secured by pressure plate or structural silicone.	• These systems are internally drained and thermally broken. Rain screen designs and can achieve the highest levels of air, water, and thermal performance • Very long spans can be achieved with customizable extrusions, the ability to add structural reinforcing, and the use of specialized connectors
Combustible Windows *08 50 10 Combustible Windows*	• Typically used in residential applications, intended to be installed as punched or strip windows • Framing materials typically consist of wood, vinyl and fiberglass • Can often be used in non-combustible construction, provided the design incorporates adequate fire considerations (as per the applicable building code)	• Combustible window systems are available in all forms from relatively low-performance face sealed residential systems, to high-performance rainscreen systems that can rival and even exceed the air, water and thermal performance of many curtain wall systems • A thorough understanding of the water, air and thermal management principals and test reports is required to assess

	• Used in buildings requiring fenestration with very high thermal and condensation resistance • Continuation of the air and moisture barrier at the rough opening can be achieved with self-adhered membrane	performance • Windows are reliant on sub-sill waterproof flashing to divert internal water drainage to the exterior • Typically are capable of achieving good (to excellent) thermal performance
Aluminum Window Wall 08 51 13 Aluminum Windows	• Products are usually wet/dry glazed with butyl tape to the exterior and gasket and glazing stop to the interior. • Typically used in residential high-rise applications. • Floor-to-floor spans with attachments to top and under-side of slab allow for optimized construction sequencing.	• These systems can achieve high air, water, and thermal performance ratings similar to curtain wall, but are heavily reliant on the water-tightness and drainage capacity of the sub-sill and slab bypass membranes • Hybrid framing elements allow for quasi-slab bypass elements, however, thermal performance is not as high as with curtain wall
Structural Glazing (Total Vision Glazing) 08 44 26 Structural Glazing	• Typically employs glass to act as structural framing elements • Also can include the use of decorative stainless steel elements such as point support bolt type fittings and/or steel cable • Often reserved for main building entrances of feature areas • Typically more costly than traditional framing systems	• Typically single-glazed • Assemblies are usually face sealed by means of structural silicone. However such joints are robust and more reliable than other face sealed cladding assemblies • Not intended for fully exposed locations (it is recommended to protect glazing with overhangs) • May not be as thermally efficient if structural steel support framing is required for deflection control
Overhead Glazing T-Bar Systems *08 60 00 Roof Windows and Skylights*	• Use of this system should be limited to small exterior canopy assemblies, in areas with lower wind loading • The system should not be used over heated spaces. • Double glazed (insulated glazing units) should not be used with this type of framing. • Glass must be laminated.	• Poor water penetration resistance • Limited thermal efficiency • Use of roll bead alone to secure glass does not meet structural requirements of the code for uplift, seismic or freeze/thaw loading. • Supplemental mechanical fastening or adhesives are required for seismic and uplift resistance.
Unitized Skylights *08 60 00 Roof Windows and Skylights*	• Small prefabricated skylights that generally sit on a curb raised above the main roof level • Glazing is typically glass, polycarbonate, composite or fiberglass	• Combustible window systems are available in all forms from relatively low-performance face sealed residential systems, to high-performance rainscreen systems that can rival and even exceed the air, water and thermal performance of many curtain wall systems • A thorough understanding of the water, air and thermal

		management principals and test reports is required to assess performance • Unitized skylight performance is reliant on effective sub-sill waterproof flashing to divert internal water drainage to the exterior and good roof design so that drainage is not restricted
Overhead Glazing Pressure Plate Systems *08 60 00 Roof Windows and Skylights*	• Should be used where over an interior heated space. • Glass must be laminated. • If double glazing (insulated glazing units) is used the inside, downward facing pane must be laminated.	• Systems must include integral, internal purlin-to-rafter drainage gutters to keep IGUs out of the plane of the internal drainage water, and allow pressure equalization and drainage of the internal gutters • Interior condensation gutters on the rafters and purlins drained to condensation pan at the sill are recommended if interior condensation is expected (and on all high-humidity buildings) • Performance levels similar to that of a curtain wall system should be attainable. • Air infiltration performance can vary greatly • Internal drainage requires careful detailing
Overhead Glazing Structural Glazed *08 60 00 Roof Windows and Skylights* 08 44 26 Structural Glazing	• Glass must be laminated. • Glass is typically single glazed. • Can provide a clean look with hidden joints creating the appearance of large continuous sheets of glass	• Systems must include integral, internal purlin-to-rafter drainage gutters to keep IGUs out of the plane of the internal drainage water, and allow pressure equalization and drainage of the internal gutters • Interior condensation gutters on the rafters and purlins drained to condensation pan at the sill are recommended if interior condensation is expected (and on all high-humidity buildings) • Performance levels can be similar to that of a curtain wall system • Air infiltration performance can vary greatly • Internal drainage requires careful detailing

4.0 MODEL SPECIFICATIONS

The following model specifications are provided with this guideline (refer to *Appendix A*).

1. Section 08 41 13 – Aluminum-Framed Entrances and Storefront
2. Section 08 44 13 – Glazed Aluminum Curtain Wall
3. Section 08 50 10 – Combustible Windows
4. Section 08 60 00 – Roof Windows and Skylights
5. Section 08 80 00 – Glass and Glazing

For the purposes of this guideline the model specifications have been pared down to only include clauses relevant to conformance with the Act, including energy performance requirements, as well as label and certificate requirements during fabrication and installation. These clauses may need to be modified to suit specific projects. Products specified in bid documents should have already been selected and analyzed by an initial design process to verify conformance with the applicable energy performance requirements.

5.0 SPECIFYING U-VALUES

.1 Theory

A U-value is a measure of thermal transmittance and includes the combined effects of conduction, convection and radiation. It is the mathematical inverse of the R-value which is a measure of resistance to heat flow. This U-value has units of power per area per temperature difference (e.g. $W/m^2/^oK$ = Watts per meter square per degree Kelvin or $BTU/ft^2/hr/^oF$). More heat will pass through a material with a high U-value than a material with a low U-value. A house with windows that are rated with a high U-value will cost more to heat than if the windows had a lower U-value.

Conduction is heat transfer through a material through collision of the molecules within the material. Molecules in hot material vibrate more quickly and energetically than in cold material. In a window system, conduction occurs through the solid parts of the assembly such as through the framing members or the glass. More dense materials will be better at conducting heat. The use of thermal breaks in the framing system or thermally insulating spacer bars will reduce conduction through a window system.

Convection is the transfer of heat through the movement of a fluid (either gas or liquid). In a window system this occurs within the interstitial space of the insulated glazing unit. Convective heat transfer also occurs at the outer surfaces of insulated glazing units by means of air movement at thin surface air films.

Radiation is the transfer of heat through space and does not rely on a solid or fluid medium. In a window system, the use of tinted glass or special coatings on the glass surface can be used to reduce the transmission of electromagnetic radiation through the window.

.2 Compliance Paths for the Act

There are two steps to achieving compliance with the Act: testing or computer simulation, and verification. Testing establishes the thermal performance of the fenestration product, based on the product test size. This can be accomplished through physical testing at an accredited facility, or it can be completed via computer simulation by an appropriately qualified Architect or Professional Engineer. Verification takes place during the fabrication and installation of the fenestration, to confirm that the products installed are consistent with those tested/simulated.

The Act recognizes three streams for testing and verifying fenestration products. These options are summarized in Table 2.

Table 2: Compliance Paths for the Energy Efficiency Act for Fenestration Products

	Standard	Testing/Modeling	Certification/Verification
Standards Council of Canada (SCC)	CSA A440.2-04	SCC-Accredited Laboratories (QAI, Intertek)	Certification Organizations: • CSA International • Quality Assurance International (QAI) • Intertek
National Fenestration Rating Council	NFRC 100-2004	NFRC Accredited Labs	NFRC-Accredited Inspection Agency: • National Accreditation and Management Institute Inc. (NAMI) • Keystone Certifications Inc. • American Architectural Manufacturers Association (AAMA) • Window and Door Manufacturers Association (WDMA)
Architect, Professional Engineer (project-specific)	CSA A440.2-04 NFRC 100-2004	Trained Registered Professional (using component modeling, refer to Section 5.2.i)	Trained Registered Professional (the registered professional should submit a Schedule S as confirmation of window performance to the registered professional of record)

i. Standards Council of Canada (SCC) Accredited Labs and Certification Organizations and National Fenestration Rating Council (NFRC) Accredited Labs and Certification Organizations

The SCC and NFRC compliance paths determine product U-values based on product test sizes. These test-size U-values are acceptable for achieving compliance with the Act.

SCC-accredited laboratories conduct the computer simulations of the fenestration products to determine the U-values and other performance characteristics of the product, such as solar heat gain coefficient (SHGC) and visible light transmittance. SCC-accredited certification organizations also certify that products sold and installed meet the performances calculated by the labs. This is a third-party verification process. Temporary and permanent labeling is required.

Similar to the SCC, the NFRC also accredits labs and certification organizations (Inspection Agencies). The simulation techniques to determine U-value and other properties are very similar to SCC labs. NFRC requires a further guarded hot box test of a physical sample to confirm the

simulation results. One of four inspection agencies is required to certify products on an ongoing basis. Permanent and temporary labeling is required as per their procedures.

ii. Professional Engineer or Architect Determination of U-Value and Verification

The third option for verifying energy efficiency of fenestration products is component modeling. The modeling can be completed by an Architect or Professional Engineer licensed to practice in British Columbia. This compliance path should be selected when the test size configurations for a specific project will not meet the U-value requirements. In this case, the Act allows simulation of the actual size of each fenestration product, to calculate an overall average U-value for the project.

The Act currently accepts component modeling simulation following one of these two standards, which are nearly identical:

- CSA A440.2-04: Energy Performance of Windows and Other Fenestration Systems
- NFRC 100-04: Procedure for Determining Fenestration Product U-Factors

General Procedure

Both the CSA and the NFRC standards utilize an area-weighted procedure for determining the overall U-value for a given fenestration product. The procedure breaks the fenestration product into three components: frame components (sill, head, jamb, mullion, etc); edge-of-glass areas (2.5”, or 63.5 mm, of glass adjacent to the frame); and the centre of glass (the net glass area, once the edge-of-glass areas are subtracted). Figure 8 below shows an example of the area distributions for a sample fenestration product.

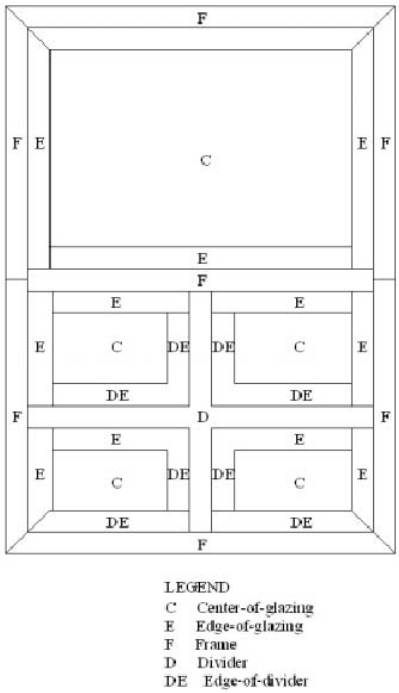

Figure 8: Area Distributions for a Sample Fenestration Product
(image borrowed from NFRC 100-04)

U-values are computed for each component using approved software programs (NFRC provides a list of pre-approved two-dimensional heat transfer programs; CSA A440.2 requires computations to be completed using VISION and FRAME). Boundary conditions, and other requirements for model properties, are specified in each of the standards. Once U-values for each component have been computed, the U-values can be weighted for each product configuration, based on the area distribution conventions, to obtain the overall product U-Value. Under the Act, component modeling must be completed for every product configuration used in a given project. Both NFRC and CSA specify model sizes for different products; however, actual 'project specific' dimensions should be used when confirming compliance with Act.

Once an area-weighted U-value has been calculated for every product configuration in a given project (using project-specific dimensions), all U-values are then averaged together to form one project-wide U-value; compliance with the Act is based on this project-wide U-value. Under this method, it is possible to have individual products configurations that do not meet the maximum U-value requirements; however, if those non-compliant configurations do not account for a large portion of the glazing on the project (and the remaining product configurations meet and/or exceed target U-values), the project may still meet the requirements of the Act.

.3 Establishing Equivalency

Some Glazing Manufacturers/Contractors may have NFRC certificates for their different products. These NFRC certificates certify a product's energy performance, assuming model product dimensions (model dimensions vary for different product types, and may be found in NFRC 100-04).

Manufacturers who would like their products considered for a specific project may apply for equivalency to the design professional. In addition to NFRC test certificates, manufacturers should also supply relevant product information on other components of the proposed fenestration system, including (but not limited to) gaskets, spacer bars and glazing units. Evaluating equivalency using NFRC test certificates and other product test data should be completed by a professional proficient in interpreting test certificates.

.4 ASHRAE 90.1 Compliance Paths

Depending on the location and type of project (new construction or renovation), *ASHRAE 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings* may govern for a project. Alternatively, Designers may choose to design a project to the ASHRAE 90.1 standard, as buildings designed to the ASHRAE 90.1 standard are exempt from the fenestration requirements in the Act. There are currently two standards of ASHRAE 90.1 that are in use for projects in British Columbia: *ASHRAE 90.1-2004* (for projects located outside the City of Vancouver, where the BC Building Code is applicable) and *ASHRAE 90.1-2007* (for projects located within the City of Vancouver). The Designer should check to verify which edition of the standard applies.

Within the ASHRAE 90.1 standard, there are three compliance path options available. Each path has its benefits, depending on the type of work being undertaken. The following is meant to provide a brief description of the three compliance paths. For more information on the application of these compliance paths, refer to the standard.

ASHRAE 90.1 does not require fenestration to be "verified" during installation. The standard only requires that products be tested and/or designed by a Designer.

i. Prescriptive Path

The Prescriptive Path is the simplest path to use, but also the least flexible. Tables in the standard lay out required thermal performance requirements for wall, floor and roof assemblies, as well as fenestration products (based on ASHRAE-defined climate zones). Under the prescriptive path, each assembly or component of the building envelope must meet their

respective requirements. Note that the requirements for the prescriptive path vary slightly between the 2004 and 2007 editions.

ii. Building Envelope Trade-Off Path

The Building Envelope Trade-Off Path gives the Designer slightly more flexibility over the prescriptive path; however this option requires more calculations and simulations to comply. In this method, Designers are allowed to make trade-offs between different elements of the building enclosure; a discrete element could possibly not meet its prescriptive requirements, yet as long as another element exceeds its prescriptive requirements, the overall design could meet the standard. Trade-offs can only be made between elements in the building enclosure; trade-offs cannot be made with the HVAC or lighting systems.

iii. Energy Cost Budget Path

The Energy Cost Budget Path looks at energy costs for a building as a whole. Through energy modeling, energy demands from the building envelope, HVAC system, lighting and internal equipment are analyzed. This method allows for trade-offs to be made between all building systems, not just within the building enclosure.

APPENDIX A: MODEL SPECIFICATIONS

Part 1 GENERAL

1.1 SUMMARY

Briefly describe section content. Mention any special requirements, such as matching existing work or incorporating non standard materials.

1.2 SECTION INCLUDES

List significant generic types of products, work, or requirements to be included under this section.

1.3 ITEMS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

List appropriate items.

1.4 ITEMS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

List appropriate items.

1.5 RELATED SECTIONS

List sections that have specific requirements directly related to the work of this section.

1.6 REFERENCES

All Referenced Standards are latest editions, unless noted otherwise:

Only list documents referenced in this section. This article does not require compliance with standards, but lists the full description of standards referenced elsewhere in this specification. Reference documents may include (but are not limited to) building codes, structural design standards, product evaluation standards, recommended practice manuals, test method standards and energy standards.

[Select Energy Standard that the project is designed to]

.1 Energy Standards

.1 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA)

or

.2 ASHRAE 90.1-2004 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located outside of the City of Vancouver]

or

.3 ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located in the City of Vancouver]

or

.4 ASHRAE 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings [for projects where higher than minimum standards are desirable]

1.7 SUBMITTALS

List documents required to establish conformance with design and performance criteria.

[While the Designer is responsible for specifying fenestration products that meet the requirements of the Act, the Glazing Manufacturer/Contractor is responsible for coordinating testing]

.1 Energy Conformance (for BCEEA-governed projects)

.1 Supply documentation sufficient to confirm conformance with the British Columbia Energy Efficiency Act, using one of the following testing agencies or persons:

.1 A person or organization accredited by the Standards Council of Canada

.2 National Fenestration Rating Council-accredited Inspection Agency

.3 Architect or Professional Engineer, authorized to practice in British Columbia.

1.8 QUALITY ASSURANCE

List quality assurance standards and requirements for the work.

1.9 DELIVERY, STORAGE AND HANDLING

Describe protocol for the delivery, storage and handling of materials related to this specification.

1.10 SITE CONDITIONS

Describe requirements for field-glazed framing.

1.11 SCHEDULING/COORDINATION

Describe relevant scheduling/coordination requirements.

1.12 WARRANTIES

Describe relevant warranty requirements for glazing and fenestration products.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Describe system design features. Be specific when writing a prescriptive specification.

2.2 PERFORMANCE REQUIREMENTS

Describe relevant performance requirements.

2.3 STRUCTURAL DESIGN REQUIREMENTS

Describe relevant values and design information that will affect the design of the glazing system.

2.4 ENERGY PERFORMANCE

[The following items are options for the specification writer to select. This information is provided to guide the Contractor, in the event that an alternate product is to be proposed. Select one.]

[For BCEEA projects with floor area ≤ 600 m^2]:

.1 Overall project U-Value averaged over all fenestration products within the scope of work to be no more than 2.0 W/m^2K.

or

[For BC EEA project with floor area > 600 m^2]:

.2 Overall project U-Value averaged over all fenestration products within the scope of work to be no more than 2.57 W/m^2K.

or

[For ASHRAE 90.1 projects:]

.3 Energy performance requirements to be determined using one of the following compliance paths:

.1 Prescriptive Path

.2 Building Enclosure Trade-off Path

.3 Energy Cost Budget Path

2.5 OTHER REQUIREMENTS

Specify additional requirements here, such as sound control, modifications to suit fire, egress, or other code provisions or equivalencies.

2.6 MATERIALS

Describe specific features of materials used in the fabrication of the fenestration/glazing products. Information could relate to:

- *Hardware*
- *Anchors and fasteners*
- *Sealants*
- *Air, vapour barrier membranes*
- *Glazing materials (gaskets, weather stripping, setting blocks, thermal breaks)*
- *Glass and glazing*
- *Spacer bar*
- *Seismic jambs and headers*

These items may also be called up in their own specification sections.

2.7 FABRICATION

Describe general fabrication protocol.

2.8 FINISHES

Describe finishes/coatings required for glazing and fenestration products.

2.9 REFERENCE PRODUCTS

Reference Products can be used to identify products which possess physical characteristics (appearance, operation) relevant to the specifier.

2.10 ACCEPTED PRODUCTS

Accepted Products can be used to name products known to possess the design and performance features desired. Suppliers of other products wishing to be considered as equal to the named product(s) must demonstrate that they possess comparable design and performance features.

Before naming products, consult manufacturers to determine whether products can meet the design, performance, finish, and appearance criteria.

.1 (Name product) as manufactured by (name manufacturer).

.2 (Name product) as manufactured by (name manufacturer).

.3 Or pre-approved alternative. Approval of alternates to be confirmed in advance of tender closing by Addendum only.

Part 3 EXECUTION

3.1 GENERAL

Describe requirements relating to execution including inspection, preparation, installation, erection tolerances and field quality control and assurance.

3.2 ENERGY CERTIFICATE [BCEEA projects only]

.1 Site certificates to be supplied in accordance with the British Columbia Energy Efficiency Act.

.2 Certificates to include the following information:

.1 The test-size U-value for each fenestration product provided on site (in W/m^2K).

.2 The name of the person or agency acting as verifier for the fenestration products.

.3 Certificates are to be posted in plain view at the project site for a period of at least 120 days after the last manufactured fenestration product is installed in the building.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

Briefly describe section content. Mention any special requirements, such as matching existing work or incorporating non standard materials.

1.2 SECTION INCLUDES

List significant generic types of products, work, or requirements to be included under this section.

1.3 ITEMS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

List appropriate items.

1.4 ITEMS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

List appropriate items.

1.5 RELATED SECTIONS

List sections that have specific requirements directly related to the work of this section.

1.6 REFERENCES

All Referenced Standards are latest editions, unless noted otherwise:

Only list documents referenced in this section. This article does not require compliance with standards, but lists the full description of standards referenced elsewhere in this specification. Reference documents may include (but are not limited to) building codes, structural design standards, product evaluation standards, recommended practice manuals, test method standards and energy standards.

[Select Energy Standard that the project is designed to]

.1 Energy Standards

.1 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA)

or

.2 ASHRAE 90.1-2004 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located outside of the City of Vancouver]

or

.3 ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located in the City of Vancouver]

or

.4 ASHRAE 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings [for projects where higher than minimum standards are desirable]

1.7 DESIGN RESPONSIBILITY

Describe the scope of design services required by the glazing contractor.

1.8 SUBMITTALS

List all documents required to establish conformance with design and performance criteria.

[While the Designer is responsible for specifying fenestration products that meet the requirements of the Act, the Glazing Manufacturer/Contractor is responsible for coordinating testing]

.1 Energy Conformance (for BCEEA projects)

.1 Supply documentation sufficient to prove conformance with the British Columbia Energy Efficiency Act, using one of the following testing agencies or persons:

.1 A person or organization accredited by the Standards Council of Canada

.2 National Fenestration Rating Council accredited Inspection Agency

.3 Architect or Professional Engineer, authorized to practice in British Columbia.

1.9 QUALITY ASSURANCE

List quality assurance standards and requirements for the work.

1.10 DELIVERY, STORAGE AND HANDLING

Describe protocol for the delivery, storage and handling of materials related to this specification.

1.11 SITE CONDITIONS

Describe requirements for field-glazed framing.

1.12 SCHEDULING/COORDINATION

Describe relevant scheduling/coordination requirements.

1.13 WARRANTIES

Describe relevant warranty requirements for glazing and fenestration products.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Describe system design features. Be specific when writing a prescriptive specification.

2.2 PERFORMANCE REQUIREMENTS

Describe relevant performance requirements.

2.3 STRUCTURAL DESIGN REQUIREMENTS

Describe relevant values and design information that will affect the design of the glazing system.

2.4 ENERGY PERFORMANCE

[The following items are options for the specification writer to select. This information is provided to guide the Contractor, in the event that an alternate product is to be proposed. Select one.]

[For BCEEA projects with area ≤ 600 m^2]:

.1 Overall project U-Value averaged over all fenestration products within the scope of work to be no more than 2.0 W/m^2K.

or

[For BCEEA project with area > 600 m^2]:

.2 Overall project U-Value averaged over all fenestration products within the scope of work to be no more than 2.57 W/m^2K.

or

[For ASHRAE 90.1 projects:]

.3 Energy performance requirements to be determined using one of the following compliance paths:

.1 Prescriptive Path

.2 Building Enclosure Trade-off Path

.3 Energy Cost Budget Path

2.5 OTHER REQUIREMENTS

Specify additional requirements here, such as sound control, modifications to suit fire, egress, or other code provisions or equivalencies.

2.6 MATERIALS

Describe specific features of materials used in the fabrication of the fenestration/glazing products. Information could relate to:

- *Frame materials/finishes*
- *Hardware*
- *Anchors and fasteners*
- *Sealants*
- *Air barrier*
- *Glazing materials (gaskets, weather stripping, setting blocks)*
- *Glass and glazing*

These items may also be called up in their own specification sections.

2.7 FABRICATION

Describe general fabrication protocol.

2.8 FINISHES

Describe finishes/coatings required for glazing and fenestration products.

2.9 REFERENCE PRODUCTS

Reference Products can be used to identify products that possess physical characteristics (appearance, operation) relevant to the specifier.

2.10 ACCEPTED PRODUCTS

Accepted Products can be used to name products known to possess the design and performance features desired. Suppliers of other products wishing to be considered as equal to the named product(s) must demonstrate that they possess comparable design and performance features.

Before naming products, consult manufacturers to determine whether products can meet the design, performance, finish, and appearance criteria.

.1 (Name product) as manufactured by (name manufacturer).

.2 (Name product) as manufactured by (name manufacturer).

.3 Or pre-approved alternative. Approval of alternates to be confirmed in advance of tender closing by Addendum only.

Part 3 EXECUTION

3.1 GENERAL

Describe requirements relating to execution including inspection, preparation, installation, erection tolerances and field quality control and assurance.

3.2 ENERGY CERTIFICATE [BCEEA projects only]

.1 Site certificates to be supplied in accordance with the British Columbia Energy Efficiency Act.

.2 Certificates to include the following information:

.1 The test-size U-value for each fenestration product provided on site (in W/m^2K).

.2 The name of the person or agency acting as verifier for the fenestration products.

.3 Certificates are to be posted in plain view at the project site for a period of at least 120 days after the last manufactured fenestration product is installed in the building.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

Briefly describe section content. Mention any special requirements, such as matching existing work or incorporating non standard materials.

1.2 SECTION INCLUDES

List significant generic types of products, work, or requirements to be included under this section.

1.3 ITEMS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

List appropriate items.

1.4 ITEMS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

List appropriate items.

1.5 RELATED SECTIONS

List sections that have specific requirements directly related to the work of this section.

1.6 REFERENCES

All Referenced Standards are latest editions, unless noted otherwise:

Only list documents referenced in this section. This article does not require compliance with standards, but lists the full description of standards referenced elsewhere in this specification. Reference documents may include (but are not limited to) building codes, structural design standards, product evaluation standards, recommended practice manuals, test method standards and energy standards.

[Select Energy Standard that the project is designed to]

.1 Energy Standards

.1 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA)

or

.2 ASHRAE 90.1-2004 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located outside of the City of Vancouver]

or

.3 ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located in the City of Vancouver]

or

.4 ASHRAE 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings [for projects where higher than minimum standards are desirable]

1.7 SUBMITTALS

List all documents required to establish conformance with design and performance criteria.

[While the Designer is responsible for specifying fenestration products that meet the requirements of the Act, the Glazing Manufacturer/Contractor is responsible for coordinating testing]

.1 Energy Conformance (for BCEEA projects)

.1 Supply documentation sufficient to prove conformance with the British Columbia Energy Efficiency Act, using one of the following verification agencies or persons:

.1 A person or organization accredited by the Standards Council of Canada

.2 National Fenestration Rating Council Accredited Certification Agency.

.3 Professional architect or engineer, authorized to practice in British Columbia.

1.8 QUALITY ASSURANCE

List quality assurance standards and requirements for the work.

1.9 DELIVERY, STORAGE AND HANDLING

Describe protocol for the delivery, storage and handling of materials related to this specification.

1.10 SITE CONDITIONS

Describe requirements for field-glazed framing.

1.11 SCHEDULING/COORDINATION

Describe relevant scheduling/coordination requirements.

1.12 WARRANTIES

Describe relevant warranty requirements for glazing and fenestration products.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Describe system design features. Be specific when writing a prescriptive specification.

2.2 PERFORMANCE REQUIREMENTS

Describe relevant performance requirements.

2.3 STRUCTURAL DESIGN REQUIREMENTS

Describe relevant values and design information that will affect the design of the glazing system.

2.4 ENERGY PERFORMANCE

[The following items are options for the specification writer to select. This information is provided to guide the Contractor, in the event that an alternate product is to be proposed. Select one.]

[For BCEEA projects:]

.1 Overall project U-Value averaged over all fenestration products within the scope of work to be no more than 2.0 W/m^2K.

or

[For ASHRAE 90.1 projects:]

.2 Energy performance requirements to be determined using one of the following compliance paths:

.1 Prescriptive Path

.2 Building Enclosure Trade-off Path

.3 Energy Cost Budget Path

2.5 OTHER REQUIREMENTS

Specify additional requirements here, such as sound control, modifications to suit fire, egress, or other code provisions or equivalencies.

2.6 MATERIALS

Describe specific features of materials used in the fabrication of the fenestration/glazing products. Information could relate to:

- *Frame materials/finishes*
- *Hardware*
- *Anchors and fasteners*
- *Sealants*
- *Air barrier*
- *Glazing materials (gaskets, weather stripping, setting blocks)*
- *Glass and glazing*

These items may also be called up in their own specification sections.

2.7 FINISHES

Describe finishes/coatings required for glazing and fenestration products.

2.8 ACCEPTED PRODUCTS

Accepted Products can be used to name products known to possess the design and performance features desired. Suppliers of other products wishing to be considered as equal to the named product(s) must demonstrate that they possess comparable design and performance features.

Before naming products, consult manufacturers to determine whether products can meet the design, performance, finish, and appearance criteria.

.1 (Name product) as manufactured by (name manufacturer).

.2 (Name product) as manufactured by (name manufacturer).

.3 Or pre-approved alternative. Approval of alternates to be confirmed in advance of tender closing by Addendum only.

Part 3 EXECUTION

3.1 GENERAL

Describe requirements relating to execution including inspection, preparation, installation, erection tolerances and field quality control and assurance.

3.2 ENERGY CERTIFICATE [BCEEA projects only]

.1 Site certificates to be supplied in accordance with the British Columbia Energy Efficiency Act.

.2 Certificates to include the following information:

.1 The test-size U-value for each fenestration product provided on site (in W/m^2K).

.2 The name of the person or agency acting as verifier for the fenestration products.

.3 Certificates are to be posted in plain view at the project site for a period of at least 120 days after the last manufactured fenestration product is installed in the building.

Part 1 GENERAL

1.1 SUMMARY

Briefly describe section content. Mention any special requirements, such as matching existing work or incorporating non standard materials.

1.2 SECTION INCLUDES

List significant generic types of products, work, or requirements to be included under this section.

1.3 ITEMS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

List appropriate items.

1.4 ITEMS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

List appropriate items.

1.5 RELATED SECTIONS

List sections that have specific requirements directly related to the work of this section.

1.6 REFERENCES

All Referenced Standards are latest editions, unless noted otherwise.

Only list documents referenced in this section. This article does not require compliance with standards, but lists the full description of standards referenced elsewhere in this specification. Reference documents may include (but are not limited to) building codes, structural design standards, product evaluation standards, recommended practice manuals, test method standards and energy standards.

[Select Energy Standard that the project is designed to]

.1 Energy Standards

.1 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA)

or

.2 ASHRAE 90.1-2004 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located outside of the City of Vancouver]

or

.3 ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located in the City of Vancouver]

or

.4 ASHRAE 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings [for projects where higher than minimum standards are desirable]

1.7 DESIGN RESPONSIBILITY

Describe the scope of design services required from the glazing contractor.

1.8 SUBMITTALS

List all documents required to establish conformance with design and performance criteria.
[While the Designer is responsible for specifying fenestration products that meet the requirements of the Act, the Glazing Manufacturer/Contractor is responsible for coordinating testing]

.1 Energy Conformance (for BCEEA projects)

.1 Supply documentation sufficient to prove conformance with the British Columbia Energy Efficiency Act, using one of the following testing agencies or persons:

.1 A person or organization accredited by the Standards Council of Canada

.2 National Fenestration Rating Council accredited Inspection Agency

.3 Architect or Professional Engineer, authorized to practice in British Columbia.

1.9 QUALITY ASSURANCE

List quality assurance standards and requirements for the work.

1.10 DELIVERY, STORAGE AND HANDLING

Describe protocol for the delivery, storage and handling of materials related to this specification.

1.11 SITE CONDITIONS

Describe requirements for field-glazed framing.

1.12 SCHEDULING/COORDINATION

Describe relevant scheduling/coordination requirements.

1.13 WARRANTIES

Describe relevant warranty requirements for glazing and fenestration products.

Part 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Describe system design features. Be specific when writing a prescriptive specification.

2.2 PERFORMANCE REQUIREMENTS (MINIMUM)

Describe relevant performance requirements.

2.3 STRUCTURAL DESIGN REQUIREMENTS

Describe relevant values and design information that will affect the design of the glazing system.

2.4 ENERGY PERFORMANCE

[The following items are options for the specification writer to select. This information is provided to guide the Contractor, in the event that an alternate product is to be proposed. Select one.]

[For BC EEA projects:]

.1 Overall project U-Value averaged over all roof and skylight fenestration products within the scope of work to be no more than 3.10 W/m^2K.

or

[For ASHRAE 90.1 projects:]

.2 Energy performance requirements to be determined using one of the following compliance paths:

.1 Prescriptive Path

.2 Building Enclosure Trade-off Path

.3 Energy Cost Budget Path

2.5 OTHER REQUIREMENTS

Specify additional requirements here, such as sound control, modifications to suit fire, egress, or other code provisions or equivalencies.

2.6 MATERIALS

Describe specific features of materials used in the fabrication of the fenestration/glazing products. Information could relate to:

- *Frame materials/finishes*
- *Hardware*
- *Anchors and fasteners*
- *Sealants*
- *Air barrier*
- *Glazing materials (gaskets, weather stripping, setting blocks)*
- *Glass and glazing*

These items may also be called up in their own specification sections.

2.7 FABRICATION

Describe general fabrication protocol.

2.8 FINISHES

Describe finishes/coatings required for glazing and fenestration products.

2.9 REFERENCE PRODUCTS

Reference Products can be used to identify products that possess physical characteristics (appearance, operation) relevant to the specifier.

2.10 ACCEPTED PRODUCTS

Accepted Products can be used to name products known to possess the design and performance features desired. Suppliers of other products wishing to be considered as equal to the named product(s) must demonstrate that they possess comparable design and performance features.

Before naming products, consult manufacturers to determine whether products can meet the design, performance, finish, and appearance criteria.

.1 (Name product) as manufactured by (name manufacturer).

.2 (Name product) as manufactured by (name manufacturer).

.3 Or pre-approved alternative. Approval of alternates to be confirmed in advance of tender closing by Addendum only.

Part 3 EXECUTION

3.1 GENERAL

Describe requirements relating to execution including inspection, preparation, installation, erection tolerances and field quality control and assurance.

1.2 ENERGY CERTIFICATE [BCEEA projects only]

.1 Site certificates to be supplied in accordance with the British Columbia Energy Efficiency Act.

.2 Certificates to include the following information:

.1 The test-size U-value for each fenestration product provided on site (in W/m^2K).

.2 The name of the person or agency acting as verifier for the fenestration products.

.3 Certificates are to be posted in plain view at the project site for a period of at least 120 days after the last manufactured fenestration product is installed in the building.

END OF SECTION

Part 1 GENERAL

1.1 SUMMARY

Briefly describe section content. Mention any special requirements, such as matching existing work or incorporating non-standard materials.

1.2 SCOPE OF WORK

Use this paragraph to specify all glass and glazing work under this section.

1.3 SECTION INCLUDES

List significant generic types of products, work, or requirements to be included under this section.

1.4 ITEMS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

List appropriate items.

1.5 ITEMS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

List appropriate items.

1.6 RELATED SECTIONS

List sections that have specific requirements directly related to the work of this section.

1.7 REFERENCES

All Referenced Standards are latest editions, unless noted otherwise:

Only list documents referenced in this section. This article does not require compliance with standards, but lists the full description of standards referenced elsewhere in this specification. Reference documents may include (but are not limited to) building codes, structural design standards, product evaluation standards, recommended practice manuals, test method standards and energy standards.

[Select Energy Standard that the project is designed to]

.1 Energy Standards

.1 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA)

or

.2 ASHRAE 90.1-2004 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located outside of the City of Vancouver]

or

.3 ASHRAE 90.1-2007 – Energy Standard for Buildings Except Low-Rise Residential Buildings [minimum for projects located in the City of Vancouver]

or

.4 ASHRAE 90.1-2010 – Energy Standard for Buildings Except Low-Rise Residential Buildings [for projects where higher than minimum standards are desirable]

1.8 SUBMITTALS

List all documents required to establish conformance with design and performance criteria.

1.9 QUALITY ASSURANCE

List quality assurance standards and requirements for the work.

1.10 DELIVERY, STORAGE AND HANDLING

Describe protocol for the delivery, storage and handling of materials related to this specification.

1.11 SITE CONDITIONS

Describe requirements for field-glazed framing.

1.12 SCHEDULING/COORDINATION

Describe relevant scheduling/coordination requirements.

1.13 WARRANTIES

Describe relevant warranty requirements for glazing and fenestration products.

Part 2 MATERIALS

2.1 STRUCTURAL DESIGN REQUIREMENTS

Describe relevant values and design information that will affect the design of the glazing system.

2.2 OTHER REQUIREMENTS: (SPECIFY)

Specify additional requirements here, such as sound control, modifications to suit fire, egress, or other code provisions or equivalencies.

2.3 GLASS PRODUCTS

Specify glass and glazing products.

2.4 GLAZING SCHEDULE

Describe products to be used for every application. This information can be provided in other places, such as a window or door schedule.

2.5 GLAZING MATERIALS (PERFORMANCE TESTED SYSTEMS)

Specify glazing materials and accessories including (but not limited to): exterior and interior gaskets, glazing tapes, sealants, adhesives and setting blocks.

Part 3 EXECUTION

3.1 GENERAL

Describe requirements relating to execution including inspection, preparation, installation, erection tolerances and field quality control and assurance.

END OF SECTION