Interior B.C. Residential Construction Institute

2023 BC Step and Building Codes

Course Outline

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Introduction

2023 BC Step and Building Codes is a 16 hour course delivered over two consecutive days.

(This Course Does Not Qualify For Equivalent Training for "Step Code Status".)

This course is designed to provide content similar to **BC Energy Step Code Modules** of mandatory training for builders as required by BC Housing (as of Oct 2022).

Topics include:

BC Energy Step Code Overview and Requirements

Meeting the BC Energy Step Code by Design

Building Science for the BC Energy Step Code

Building Envelope Options for the BC Energy Step Code

Air Barriers for the BC Energy Step Code

Mechanical Systems for the BC Energy Step Code

Building Envelope Quality Assurance and Quality Control

BC Energy Step Code Project Management

Each participant at training session receives a set of 2 Manuals.

Manuals are for reference and illustrations for construction methods after completion of training.

Content of the manuals are referenced and section's reviewed during training.

Titles and content of Manuals as described in:

Building Envelope Solutions Pgs. 25-38

Building Envelope Pgs. 39 - 42

Introduction to the training, first provides background information, including the evolution of energy efficiency codes and related programs that have had a large impact on the overall energy consumption of homes.

It then defines what high-performance housing is, and what the major features and benefits are.

This section also introduces the business case for such housing.

Energy-Efficiency Requirements Described in Building Codes and Energy-Related Programs

Definition, Features, and Benefits of High-Performance Housing

Business Case

BC Energy Step Code Overview and Requirements

This module sets the groundwork for the overall design and compliance process and shares the motivation behind this evolution towards performance-based code. It is not intended to cover design principles for the BCESC since it is covered in Module 2.

Recognize the importance of building housing in BC that responds to climate change through energy efficiency, durability, and comfort, for a diverse range of occupants.

Present evidence projected climate conditions indicate a need for houses with improved home energy efficiency, durability, and occupant comfort.

Compare at a high level the energy use, durability, occupant comfort characteristics, and potential broader climate impacts of “business-as-usual” houses with those of a Step 3 or higher houses, including for a diverse range of Part 9 housing formats and users.

Design, construction & regulatory process

Overview, outlines the main strategies as well as performance targets that can be utilized in the design and construction of high-performance housing.

Their impacts on whole-house energy consumption are illustrated, and the considerations for cost optimization during the design and construction process are highlighted.

Step 1, 2, 3

- Basic understanding of the BC Energy Step Code
- Principles of performance- based codes
- Schedules for testing and demonstration of compliance

Step 4, 5

- improved integration of project team

Meeting the BC Energy Step Code by Design

This module provides an overview of how architectural and mechanical design choices can have a significant impact on certain building performance parameters, which can either help or hinder compliance as well as impact overall cost.

- **Explain to team members and clients the basic considerations for designing and building including considerations for future climate readiness, market expectations, potential cost implications, diverse building types, and future code readiness.**
- Understand how house size/ratio/orientation and window size/orientation can impact home energy performance and construction cost, including for a diverse range of Part 9 housing types.
- Compare mechanical systems that may become more common with Step 3 houses and beyond including their impact on energy use, and the home's characteristics that impact mechanical design
- **Assess qualitatively a building's likelihood of meeting various performance requirements of the BC Energy Step Code based on its design elements.**
- Identify key detailing and building form elements that can impact airtightness, thermal
- Performance, and mechanical system installation.

Design and Construction Strategies: Overview

Passive Heating, Lighting, and Cooling

Building Envelopes

Mechanical Ventilation

Electrical Energy Loads

Water-Heating Loads

Heating Systems

Solar Electric (Photovoltaic) and Solar Thermal Collectors

Whole-House Energy Consumption

Sustainable Materials and Products

Water Conservation

Storm-Water Management

Cost-Effectiveness Considerations

Integrated Design Process

- The Integrated Design Process, covers a step-by-step approach, utilizing building-as-a-system principles, to designing homes with optimized energy performance and long-term durability.

- It outlines how best practices can be used at the schematic design stage, which is followed by computer simulation and a design charrette process, to develop and optimize solutions.

Step 1, 2, 3

- Schedules for testing and demonstration of compliance

Step 4, 5

- improved integration of project team

The Integrated Design Process

- Program Development
  - Setting Energy and Environmental Performance Goals
  - Building as a System.
- Site Analysis
- Schematic Design
  - Building Orientation and Form
  - Rules of Thumb for Schematic Design Stage
- Preliminary Energy Analysis
- Design Charrette
- Design Development
  - Determining Insulation and Airtightness Levels
  - Calculating Total Annual Electrical Energy Load
  - Estimating Photovoltaic Array Size

Energy modelling & metrics

Step 1, 2, 3

- Modelling tool outputs and how to integrate them into the design process
- Thermal energy demand intensity (TEDI), energy use intensity (EUI), mechanical energy intensity and power transfer limit (PTL) standards

Step 4, 5

- Advanced modelling tools

Building Science for the BC Energy Step Code

Building Science

Step 1, 2, 3

- Understanding of the "envelope first" building approach
- Impacts of building form and massing on energy performance

Step 4, 5

- Application of building science to determine insulation, glazing and airtightness requirements
- Reducing overall loads and simplified equipment
- Apply building science principles to help in the selection of durable building components, assemblies, and construction approaches in the diverse British Columbia climate and market.

This module builds on basic building science principles and applies them to the evolving/emerging enclosure design and construction practices required to meet the "envelope first" approach. This is not intended as a building science fundamentals course, but must still set the groundwork for the training completed in Module 4.

- Identify the key characteristics of typical building assemblies that impact the energy performance of the building.
- List the key enclosure selection criteria that affect the building construction cost and schedule.
- Use building science principles to guide the evolution of the design and construction of building enclosures with increased R- value in the "envelope first" approach, accounting for BC's five climate zones and diverse building types and occupancies.
- Assess and mitigate the potential impacts of solar heat gain on occupant comfort, including a basic understanding of the solar heat gain coefficient, low-e coatings, window operability, and influence of mechanical systems.
- Differentiate between enclosure elements and construction practices for achieving airtightness and those intended for vapour control.

- **Use industry resources to determine appropriate enclosure components and assemblies, mechanical components, and construction approaches that can be used to meet the current and future requirements of the BCESC and achieve best practices.**

- Find typical ranges of assembly R-values associated with wood- frame, below-grade concrete and wood-frame roof assemblies.
- Be mindful of prescriptive code items that still apply to building enclosures even if they are used as part of performance-based compliance and of design approaches that may require design professional involvement/sign-off during assembly selection.
- Consider the five key design and construction criteria of cost efficiency, constructability, air- tightness, moisture durability, and sustainability in selecting an appropriate enclosure assembly
- Assess the benefits of an exterior-insulated assembly compared to an interior-insulated assembly in terms of building science principle
- **Evaluate a window product based on key characteristics including NAFs rating, energy, durability, design option**

Building Science
Moisture and Climate
Wind Exposure
Sunlight
Humidity
Relative Humidity
Everyday Example of Relative Humidity
Water Movement – Diffusion1
Water Vapour Movement – Diffusion
Water Vapour Movement – Air Leakage
Water Vapour Movement – Air Leakage and Vapour Diffusion
Water Vapour Movement – Air Leakage
Capillary Suction
Water Movement – Capillary Suction
Preventing Water Damage – the 4 Ds
Meauring Moisture
Moisture Meters
Common Questions about Building Durability
Building Science Reasons for the Performance of Building Types:
Older Buildings
Building Science Reasons for the Performance of Building Types: Mid 1980s to 1998
Building Science Reasons for the Performance of Building Types: Current Practice Part A
Building Science Reasons for the Performance of Building Types: Current Practice Part B

Building Envelope Options for the BC Energy Step Code

Building envelope assemblies

Building Envelopes, covers the technical principles of energy-efficient and durable building envelopes including thermal insulation, considerations for air barriers and vapour barriers, and steps towards ensuring long-term durability.
It then includes a series of examples of highly energy-efficient and durable building assemblies for foundations, exterior above-grade walls, roofs, and exposed floors. It also covers the characteristics and installation of high-performance windows, doors, and skylights.

Step 1, 2, 3

- Elements of an effective building envelope
- Envelope quality control and assurance

Step 4, 5

- Minimizing thermal bridging
- Advanced framing, alternative envelope solutions (SIPs, box truss walls, etc.)

Building Envelopes

- Thermal Insulation
  - Materials
  - Strategies
  - The Law of Diminishing Returns
- Air Barriers
  - Materials
  - Performance
  - Quality Assurance
  - Indoor Air Quality
- Vapour Barriers
- Long-Term Durability of Highly Insulated Assemblies
  - Wetting and Drying Mechanisms
  - Measures to Improve Durability
  - Detailing of Wall Penetration
- Foundations
  - Durability Considerations
  - Conditioned Crawl Space
  - Thermal Insulation and Airtightness
- Exterior Above-Grade Walls
  - Cavity Insulation
  - Exterior Insulation
  - Combined Interior and Exterior Insulation
  - Other Considerations in Wall Design

- Roof Assemblies
    - Pitched-Roof Attic Assemblies
    - Open or Cathedral Ceilings
- Exposed Floors
- Windows, Glass Doors, and Skylights
    - Windows
    - Glass Doors
    - Skylights
- Exterior Doors

Building Envelope Options for the BC Energy Step Code

This module introduces builders to the different options they have to achieve higher performance levels when it comes to the building assemblies and their interfaces.

- **Compare and contrast the performance, cost, constructability, compatibility, and future-readiness parameters at play in the design and construction of modern enclosure assemblies that are used in buildings meeting the BC Energy Step Code.**
- Identify exterior wall assembly configurations that optimize cost, durability, thermal performance including reduced thermal bridging, and buildability in all climate zones in BC.
- Develop basic strategies for constructing wall assemblies that use exterior insulation that are durable and buildable.
- Manage key design and construction concerns for below-grade concrete assemblies with increased thermal performance including reduced thermal bridging, while using moisture control best practices.
- Manage key design and construction concerns for roof assemblies with increased thermal performance including reduced thermal bridging, and airtightness, while using moisture control and resilience best practices.
- Understand the typical correct sequence of exterior wall membrane installation that includes for airtightness and use of exterior insulation, and identify the parties in charge of each step in this sequence.
- Understand the typical correct sequence of exterior insulation installation, and identify the parties in charge of each step in this sequence.
- Understand the correct overall sequence of typical airtightness and insulation detailing, and identify the parties in charge of each step in this sequence.
- Align cost and construction priorities across the project team and with the owner/client, including for a diverse group of trades/subcontractors with a varying understanding of enclosure assemblies.

- **Plan the construction of enclosure assemblies, including aligning a diverse range of trades/**

subcontractors, managing supply chains, sequencing site work, and ensuring correct installation practices are used.

- List key planning considerations that contribute to the successful construction of a cost-effective building enclosure across a range of diverse housing types.
- Identify key building specification and drawing information that assist in enclosure assembly selection and construction, including key product information, detailing accessories, assembly thickness constraints, and window specifications.
- Determine core competencies needed by team members in the enclosure construction process and implement ways to train those considering diverse backgrounds and learning styles, especially indigenous persons and those from equity seeking groups.
- Summarize the factors that can lead to improper installation and poor quality control in building enclosure construction, and how they can be addressed during design and early stage construction.

Insulation (Building envelope & mechanical)

Step 1, 2, 3

- Envelope insulation requirements (defined by model, climate zone, etc.)
- Temperature bearing systems required for insulation (heating and cooling)

Step 4, 5

- Thermal bridge-free design, consideration of slab edges, balconies, etc.
- Heavier and fatter walls, smaller windows, passive design, and shading

- Thermal Insulation
  - Materials
  - Strategies
  - The Law of Diminishing Returns

Compare and contrast the performance, cost, constructability, compatibility, and future-readiness parameters at play in the design and construction of modern enclosure assemblies that are used in buildings meeting the BC Energy Step Code.

- Identify exterior wall assembly configurations that optimize cost, durability, thermal performance including reduced thermal bridging, and buildability in all climate zones in BC.
- Develop basic strategies for constructing wall assemblies that use exterior insulation that are durable and buildable.
- Manage key design and construction concerns for below-grade concrete assemblies with increased thermal performance including reduced thermal bridging, while using moisture control best practices.
- Manage key design and construction concerns for roof assemblies with increased thermal performance including reduced thermal bridging, and airtightness, while using moisture control and resilience best practices.
- Understand the typical correct sequence of exterior wall membrane installation that includes for airtightness and use of exterior insulation, and identify the parties in charge of each step in this sequence.
- Understand the typical correct sequence of exterior insulation installation, and identify the parties in charge of each step in this sequence.
- Understand the correct overall sequence of typical airtightness and insulation detailing, and identify the parties in charge of each step in this sequence.

Windows, skylights & doors

Step 1, 2, 3

- Role of fenestration in heat loss calculations
- Labels, standards, shading coefficients, and U-values

Step 4, 5

- Thermal bridge-free installation strategies
- Smaller and heavier windows, passive design, and shading

- Windows, Glass Doors, and Skylights
  - Windows
  - Glass Doors
  - Skylights

Exterior Doors

Evaluate a window product based on key characteristics including NAFs rating, energy, durability, design option

- Assess and mitigate the potential impacts of solar heat gain on occupant comfort, including a basic understanding of the solar heat gain coefficient, low-e coatings, window operability, and influence of mechanical systems.
- Understand how house size/ratio/orientation and window size/orientation can impact home energy performance and construction cost, including for a diverse range of Part 9 housing types.

Understand Types of Window

Describe Types of Windows by Frame Attachment Detail

Types of Windows in Terms of Wall Type

Describe Alternate Types of Windows in Terms of Frame Materials

Describe Alternate Types of Doors Prepare Wall for Window and Door Installation

Install Windows and Doors in Rough Openings

Install Sill and Jamb Flashing Papers

Install Windows and Doors for Rainscreen and Non-rainscreen Windows

Windows, skylights & doors – Cont.

WINDOWS

Water Leakage Through and Around Windows
Window Terminology
Fixed Window
Operable Windows
Casement
Awning
Top Hung or Bottom Hung or Hopper
Double or Single Hung
Horizontal Slider
Tilt and Turn
Punched Window
Strip Windows
Composite Windows
Water Penetration through Windows
Resisting Water Penetration in Windows
Condensation
Water and Glazed Units
Air Barrier
Vapour Barrier
Factors Affecting Durabiity of Seals
Water Penetration Control Systems in Windows
Face Sealed Windows
Concealed Barrier Windows
Rainscreen Windows

WINDOW STANDARDS

Window Standards Extracted from the BCBC
A-9.7.2.1 (1) Window Standard

HOW IS THE CAN/CSA -A440-1-98 STANDARD APPLIED?

Lab Tests versus Field Tests
Test Methods
Features that Prevent Rain Penetration
Sealing between the Glazing and Window Frame
Water Penetration Between Opening Sash and Window Frame
Leakage Through Window Frames
Aluminum Windows
Wood Windows
Vinyl Windows
Subsill Flashings
Window Selection
Window Installation
Polyethylene Air/Vapour Barrier Window Installation Sequence
ADA Window Installation Sequence
HWAB Window Installation Sequence
EABA Window Installation Sequence
Window Maintenance

DOORS

Door Installation
Air Sealing Door Frame to Polyethylene Air/Vapour Barrier Installation Sequence
Air Sealing Door Frame to Air Barrier (ADA) Installation Sequence
Exterior View Door Frame Installation Sequence (ADA and Polyethylene Air Barrier)
House Wrap Air Barrier Door Installation Sequence
Exterior Air Barrier Approach Installation Sequence

Air Barriers for the BC Energy Step Code

Airtightness

Step 1, 2, 3

- Design and construction of an airtight building envelope to achieve 3.5 ACH
- Conducting blower door testing
- Detection and control of air leakages and managing envelope penetrations

Step 4, 5

- How to design and build an airtight envelope to achieve <1.5 ACH

- Air Barriers
  - Materials
  - Performance
  - Quality Assurance
  - Indoor Air Quality

Air Barriers for the BC Energy Step Code

This module discusses the different options that builders have when selecting an air barrier approach, and the important planning steps associated with a successful air barrier.

- **Select an appropriate air barrier approach for a given roof, wall, floor, and party- wall assembly based on performance, cost- effectiveness, and constructability, bearing in mind current and future BCESC requirements.**
- Appreciate the importance of the building air barrier as a way of significantly improving energy efficiency with minimal construction cost implications.
- Understand how airtightness impacts energy performance from code minimum to current practices to best practice.
- Describe the four attributes of a correctly installed building air barrier: air impermeability, durability, continuity, and stiffness.
- Compare the design and construction sequence considerations of typical interior and exterior air barrier systems, including key details for implementing them successfully.
- Assess cost trade-offs of different air barrier approaches including materials, installation techniques, sequencing, and effectiveness.
- **Apply knowledge of the correct design and installation practices for a given air barrier**

approach to properly manage the planning, installation, and testing of the building's complete air barrier.

- List the key factors that contribute to the successful installation of a complete air barrier system.
- Manage the key wood-frame construction practices that can interfere with achieving a successful air barrier, including coordination and education for all trades interacting with the enclosure.
- Coordinate qualitative and quantitative testing at the appropriate times, and use results to track quality control of the air barrier.

VAPOUR BARRIERS AND AIR BARRIERS
CONDENSATION
AIR BARRIERS
AIR BARRIERS: POLYETHYLENE AIR/VAPOUR BARRIER
Polyethylene Air/Vapour Barrier: Exterior Wall/Slab
Polyethylene Air/Vapour Barrier: Wall Hood.
Polyethylene Air/Vapour Barrier: Window Installation
Polyethylene Air/Vapour Barrier: Electrical Outlets
Polyethylene Air/Vapour Barrier: Rim Joist
Polyethylene Air/Vapour Barrier: Direct Vent Glass Flue
Polyethylene Air/Vapour Barrier: Plumbing Wall Penetration
Polyethylene Air/Vapour Barrier: Door
Polyethylene Air/Vapour Barrier: Exterior Hood at Rim Joist
Polyethylene Air/Vapour Barrier: Partition Wall at Ceiling
Polyethylene Air/Vapour Barrier: Plumbing Stack Penetration
Polyethylene Air/Vapour Barrier: Conventional Recessed Light
Polyethylene Air/Vapour Barrier: Corridor Pressurization Fan
Polyethylene Air/Vapour Barrier: Ceiling Electrical Box.
Polyethylene Air/Vapour Barrier: Bathroom Fan
AIRTIGHT DRYWALL AIR BARRIER (ADA)
Airtight Drywall Air Barrier (ADA): Exterior Wall/Slab
Airtight Drywall Air Barrier (ADA): Exterior Hood
Airtight Drywall Air Barrier (ADA): Window
Airtight Drywall Air Barrier (ADA): Electrical Outlet Boxes
Airtight Drywall Air Barrier (ADA): Rim Joist

Airtight Drywall Air Barrier (ADA): Direct Vent Flue
Airtight Drywall Air Barrier (ADA): Wall Plumbing Penetration
Airtight Drywall Air Barrier (ADA): Door
Airtight Drywall Air Barrier (ADA): Partition Wall at Ceiling Beneath Attic
Airtight Drywall Air Barrier (ADA): Partition Wall at Ceiling
Airtight Drywall Air Barrier (ADA): Recessed Light
Airtight Drywall Air Barrier (ADA): Corridor Pressurization Fan
Airtight Drywall Air Barrier (ADA): Bathroom Fan

AIR BARRIERS: HOUSE WRAP AIR BARRIER

House Wrap Air Barrier (HWAB): Exterior Wall/Slab
House Wrap Air Barrier (HWAB): Exterior Hood
House Wrap Air Barrier (HWAB): Window
House Wrap Air Barrier (HWAB): Exterior Door
House Wrap Air Barrier (HWAB): Rim Joist
House Wrap Air Barrier (HWAB): Direct Vent Flue
House Wrap Air Barrier (HWAB): Wall Ceiling Connection

AIR BARRIERS: EXTERIOR AIR BARRIER APPROACH

Exterior Air Barrier Approach: Slab/Wall Connection
Exterior Air Barrier Approach: Exterior Hood
Exterior Air Barrier Approach: Window
Exterior Air Barrier Approach: Intermediate Floor Joist
Exterior Air Barrier Approach: Door
Exterior Air Barrier Approach: Direct Vent Flue
Exterior Air Barrier Approach: Wall/Ceiling Connection

AIR TIGHTNESS TESTING

Mechanical Systems for the BC Energy Step Code

Mechanical systems & equipment (heating, cooling, and ventilation)

Space Heating, Ventilation, and Water Heating, provides an overview of space heating, mechanical ventilation, and domestic hot water systems that are best for use in high-performance housing.

Step 1, 2, 3

- Metering, monitoring and controls
- Mechanical ventilation in homes, MURBs and ICIs
- Heat pumps, heat recovery/recycling, low temperature hydronic solutions, solar, etc.
- Commissioning

Step 4, 5

- Simple systems (design, layout, and equipment) to minimize run lengths
- Renewable energy solutions
- Whole building commissioning, M&V
- Basic building science and the importance of air barrier integrity

Space Heating, Ventilation, and Water Heating

- General Considerations
- Heating Systems
- Natural-Gas Forced-Air Heating
  - Natural-Gas Hydronic Heating
  - Combined Heat and Power
  - Electric Baseboards
  - Heat Pumps
- Ventilation Systems
- Domestic Water-Heating Systems
  - Gas
  - Electric
  - Solar
  - Drain-Water Heat-Recovery Systems

Mechanical Systems for the BC Energy Step Code

This module discusses correct design and construction steps for heating, cooling and ventilation systems used in BCESC homes.

Use knowledge of the basic characteristics of correctly designed and installed code compliant mechanical systems used in BCESC homes when communicating with mechanical designers and mechanical trades.

- Compare strategies for improving energy efficiency and reducing emissions of mechanical systems both in the overall building design and in system selection, including for up-front and lifetime costing.
- Set expectations for deliverables from the energy modeller and mechanical contractor regarding right-sizing, design and installation, quality assurance, and verification/commissioning.
- Assess basic mechanical installations for overall quality and communicate with designers/ installers on areas of concern.
- Evaluate basic code-compliant mechanical systems design and installation approaches and use industry resources to guide selection of appropriate heating/cooling/ventilation systems likely to be used in homes complying with Step 3 and beyond.
- Compare cost implications of the installation and operation of typical mechanical systems as part of selection and evaluation process, including maintenance and lifecycle implications.
- Manage the sequencing and coordination of the mechanical system installation and verification on site to account for the BCESC compliance process including for airtightness testing, inspections, commissioning, and compliance reports.
- Assess modern and emerging mechanical systems for suitability and integration with homes built to BCESC Step 3 and beyond, especially relating to increased airtightness, the need for responsive systems, and future GHGI considerations.
- Consider throughout design and construction the diverse range of occupants such as Indigenous persons, elderly, and those from equity seeking groups, who will be using the mechanical system to control interior conditions to meet their needs.

- Ventilation System Options
- Exhaust Ventilation Systems
- Basic Exhaust Ventilation System
- Central Exhaust Ventilation System
- Supply Ventilation System
- Balance Ventilation Systems
- Basic Balanced Ventilation System
- Recirculating Central Ventilation System
- Heat Recovery Ventilation Systems
- Energy Recovery Ventilation Systems
- Ventilation System Construction
- Minimum Requirements for a Distributed Ventilation System

Electrical systems & equipment

Photovoltaic Systems, provides a discussion of design considerations and information related to the use of photovoltaic (PV) systems in high-performance housing.

It also describes the basic requirements for making a project PV ready for the future.

Step 1, 2, 3

Ventilation equipment, lighting, appliances, electric HVAC equipment (fans, pumps, etc.)

Metering / submetering, monitoring and controls

Building commissioning

Step 4, 5

Renewable energy solutions

Whole building commissioning, M&V

Basic building science and the importance of air barrier integrity

Photovoltaic Systems

Typical Conversion Efficiencies

Grid-Connected Systems

Building-Integrated Systems

Making a Project PV Ready

Building Envelope Quality Assurance and Quality Control

Supply chain

Step 1, 2, 3

Sourcing new/unfamiliar products and services required for compliance
(energy model, blower door, commissioning, etc.)

Step 4, 5

New forms of procurement to assure accountability
New forms of delivery methods that foster collaboration, use of digital tools and prefabrication
New / certified products and materials, labels, and standards

Building Envelope Quality Assurance and Quality Control

This module focuses firstly on building envelope details that are more commonly associated with performance issues, and secondly on the quality assurance and control of the air barrier, and on diagnosis and repair of the air barrier with the assistance of air tightness testing

Use basic quality assurance and quality control tools like mockups and airtightness testing to achieve airtight durable enclosures.

Plan the correct sequencing for typical detail installation relating primarily to air barrier and insulation, without compromising other control functions and durability.

Identify key building enclosure QA/QC items from construction documents and plan for ways to address them including modifying details and using mockups.

Understand the scheduling, preparation, and testing process for airtightness testing at mid- construction and for final compliance, for both detached and attached homes.

Assess the suitability of qualitative and quantitative testing techniques in the construction process for BCESC homes, including challenges with diverse housing types.

Coordinate QA/QC measures for enclosure detailing and airtightness control, including enlisting the correct parties responsible and tracking items from design through to completion.

Use checklists to manage QA/QC of key enclosure items related to BCESC compliance steps from design to completion, including avoiding costly errors and need for repairs through effective quality assurance.

Effectively communicate to trades the key QA/QC items related to BCESC compliance, and identify and mitigate potential conflict and bias that might arise between team members especially relating to differing cultural backgrounds.

Identify desirable qualifications and responsibilities for an onsite QA/QC supervisor to support all aspects of BCESC compliance, including insulation, airtightness, and mechanical systems.

Enlist appropriate personnel, tools, and techniques for repairing incomplete enclosure items and improving building airtightness

Integrate key quality assurance and quality control language relating to BCESC compliance into contract agreements with designers and trades, including performance-based contractual obligations.

BC Energy Step Code Project Management

BC Energy Step Code Project Management

This module presents ways in which the builder can manage the project, in cooperation with the rest of the project team and the trades, to achieve the expected performance levels.

Recognize the design and construction factors contributing to the success or failure of a building project in meeting its goals such as meeting BCESC requirements, staying on budget and on schedule, and maintaining working relationships with team members and clients.

Integrate broad project management and QA/QC tools that help lower the risk of failing to meet project goals

Role of the Building Professional

Role of the General Contractor

Quality Assurance Protocols for Construction

QUALITY ASSURANCE

What is Quality Assurance? What is Quality? Why Quality?

Develop a Quality Assurance Program Structure, Training , Manual of Instructions

PROJECT DESIGN

Setting up the Project Team, Establishing Project Timelines, Identify Design Parameters, Establishing Materials of Construction

PROJECT CONSTRUCTION

Construction Meeting Format, Successful Control Methods, Construction Materials Control

Consultant Reviews, Quality Assurance Review, Communication Techniques, Warranty Obligations

Project Facts Sheet and Checklists, End of Construction.

Maintenance, General Notes.

Commissioning Meeting

Building Envelope Solutions

Module 2 BUILDING SCIENCE

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Current Practice Part B.....

Building Envelope Solutions

Module 4 CONDENSATION CONTROLS IN ASSEMBLIES

Building Envelope Solutions

Module 5 RAIN PENETRATION CONTROL FOR WALL ASSEMBLIES

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Building Envelope Solutions

Module 6 SHEATHING, SHEATHING MEMBRANES, CLADDINGS, SEALANTS AND FLASHINGS

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Building Envelope Solutions

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Building Envelope Solutions

Module 9 NEW CONSTRUCTION OF THE BUILDING ENVELOPE — ROLES, RESPONSIBILITIES AND QUALITY ASSURANCE

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Building Envelope Solutions

Module 11 REGULATORY REQUIREMENTS AND STANDARDS

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Building Envelope - manual contents

MODULE D Understand Building Science

MODULE E Understand Applied Building Science

E1: Understand Moisture Load
- LEARNING TASK 1: Understand Moisture Load
- LEARNING TASK 2: Describe Measures of Moisture Load
- LEARNING TASK 3: Describe Weather Exposure
- LEARNING TASK 4: Identify Moisture Indices for Various BC Communities

E2: Understand Methods for Controlling Forces Causing Water Leakage
- LEARNING TASK 1: Describe Methods for Controlling Water Leakage Caused by Gravity
- LEARNING TASK 2: Describe Methods for Controlling Water Leakage Caused by Momentum
- LEARNING TASK 3: Describe Methods for Controlling Water Leakage Caused by Capillarity/Surface Tension
- LEARNING TASK 4: Describe Methods for Controlling Water Leakage Caused by Air Pressure Differences

E3: Understand Methods for Controlling Capillary Action
- LEARNING TASK 1: Describe methods for controlling capillary action
- LEARNING TASK 2: Explain the Term, “Surfactants”

E4: Understand methods for controlling air-borne moisture
- LEARNING TASK 1: Describe Methods for Controlling Air-borne Moisture
- LEARNING TASK 2: Describe Methods for Controlling Openings
- LEARNING TASK 3: List Essential Features of an Air Barrier
- LEARNING TASK 4: Identify the Role of Other Occupations in Controlling Air-borne Moisture
- LEARNING TASK 5: Describe Key Features of R-2000 Technology, as they apply to the importance of air barriers in walls
- LEARNING TASK 6: Describe Alternate Techniques for Creating Air Barriers in Walls

E5: Understand Methods for Controlling Vapour
- LEARNING TASK 1: Describe Methods for Controlling Vapour
- LEARNING TASK 2: Explain Vapour Permeability
- LEARNING TASK 3: Identify the Role of Other Occupations in Controlling Vapour

E6: Understand Methods for Controlling Condensation and Drying
- LEARNING TASK 1: Outline Methods for Preventing/Limiting Condensation
- LEARNING TASK 2: Describe Methods for Removing Moisture/Drying Walls

MODULE F Describe walls

F1: Understand elements and functions of walls
LEARNING TASK 1: Describe the Functions of a Wall
LEARNING TASK 2: Identify the Elements of a Wall and Functions of Each Element

F2: Understand Types of Walls
LEARNING TASK 1: Describe main types of walls in terms of mechanism and capacity for controlling water ingress
LEARNING TASK 2: Describe wall types by materials and structure
LEARNING TASK 3: Describe Wall Types by Location of Insulation

F3: Understand Critical Parts of Walls
LEARNING TASK 1: Identify Critical Wall Interfaces With Other Components
LEARNING TASK 2: Identify Critical Material Interfaces

MODULE G Understand Relevant Regulatory Requirements

G1: Understand Relevant Regulatory Requirements Under Part 9 of the Current Building Code
LEARNING TASK 1: Identify Requirements Pertaining to Air Flow Control
LEARNING TASK 2: Identify Requirements Pertaining to Control of Water Ingress
LEARNING TASK 3: Identify Requirements Pertaining to Control of Capillary Action
LEARNING TASK 4: Identify Requirements Pertaining to Vapour Diffusion
LEARNING TASK 5: Identify New Part 9 Requirements of the National Building Code
LEARNING TASK 6: Identify Relevant Regulatory Requirements of the Homeowner Protection Office and Warrantors 7

G2: Understand Relevant New Regulatory Requirements Under Part 5 of the Building Code
LEARNING TASK 1: Identify Requirements Pertaining to Moisture Control in Walls of Buildings Governed by Part 5 Requirements

MODULE J Install Windows and Doors

J1: Understand Types of Window
LEARNING TASK 1: Describe Types of Windows by Frame Attachment Detail
LEARNING TASK 2: Describe Types of Windows in Terms of Wall Type
LEARNING TASK 3: Describe Alternate Types of Windows in Terms of Frame Materials
LEARNING TASK 4: Describe Alternate Types of Doors

J2: Prepare Wall for Window and Door Installation and Install Windows and Doors in Rough Openings
LEARNING TASK 1: Install Sill and Jamb Flashing Papers
LEARNING TASK 2: Install Windows and Doors for Rainscreen and Non-rainscreen Windows

MODULE L Apply Self-adhered Membranes

L3: Apply Self-adhered Membrane

LEARNING TASK 1: Apply Self-adhered Membranes in Typical Locations (e.g., inside and outside corners)

LEARNING TASK 2: Apply Self-adhered Membranes as an Air and Vapour Barrier in Exterior Insulated Walls

MODULE M Install Strapping

M1: Understand Strapping Requirements

LEARNING TASK 1: Explain the Purpose of Strapping

LEARNING TASK 2: Identify Building Code Requirements for Strapping

LEARNING TASK 3: Describe Material Requirements for Strapping

M2: Install Strapping

LEARNING TASK 1: Describe Strapping Attachment Guidelines

LEARNING TASK 2: Install Strapping

LEARNING TASK 3: Install Screening for Insects on Rainscreen Walls

MODULE N Apply Sealants

N1: Understand Materials, Purpose and Proper Use of Sealants

LEARNING TASK 1: Explain Sealants, Their Function and Requirements

LEARNING TASK 2: Describe Typical Locations and Applications of Sealants

LEARNING TASK 3: Describe Joint Design

LEARNING TASK 4: Identify Material Compatibility Issues6

LEARNING TASK 5: Describe Safety Requirements

N2: Apply Sealants

LEARNING TASK 1: Apply sealants