PRESENTED BY: Andy Christie RBO, City of Kimberley

New BC Energy and Zero Carbon Step Code Handbook for Building Officials

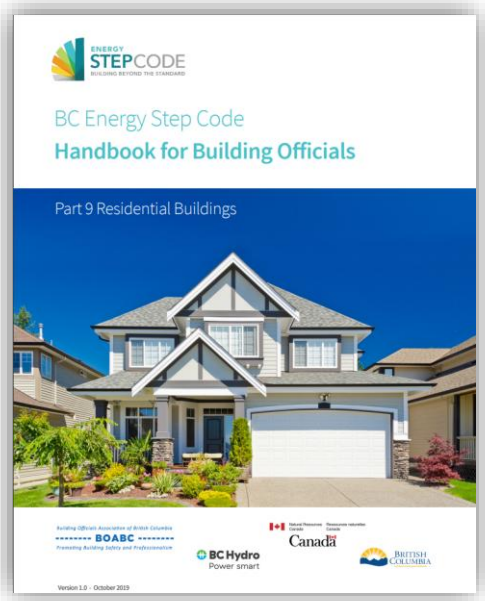
ENERGY STEPCODE
BUILDING BEYOND THE STANDARD

ZERO CARBON STEPCODE

Community Energy Association | Accelerating bold action by local governments and Indigenous communities related to climate and energy.

What Are We Reviewing Today?

- **Energy Step Code** – Provincial Updates (May 2023/2024) captured in new Handbook
- **Zero Carbon Step Code** – New Addition to the BC Building Code in May 2023 revision captured in handbook
- Local Bylaw Requirements
- New updated Forms, Graphics and General Layout
- New handbook twice as large
- Addition of Building Science terms and cooling requirements
- Lots of examples of Do's and Don'ts



Chapter 1 - Overview of the Step Codes

- One centralized Glossary of terms in Handbook
- Clearly defined prescriptive and performance objectives for both ESC and ZCSC
- Addition of ZCSC requirements into all areas of the Handbook
- Far greater detail regarding Compliance options/examples pathways
- All text speaks to ‘required’ objectives and metrics as opposed to voluntary measures previously

New Overview of Energy and Zero Carbon Step Codes

Figure 1.1 As of May 2023, Step 3 of the ESC is the minimum requirement across BC. Steps 1 and 2 (not shown) no longer apply.

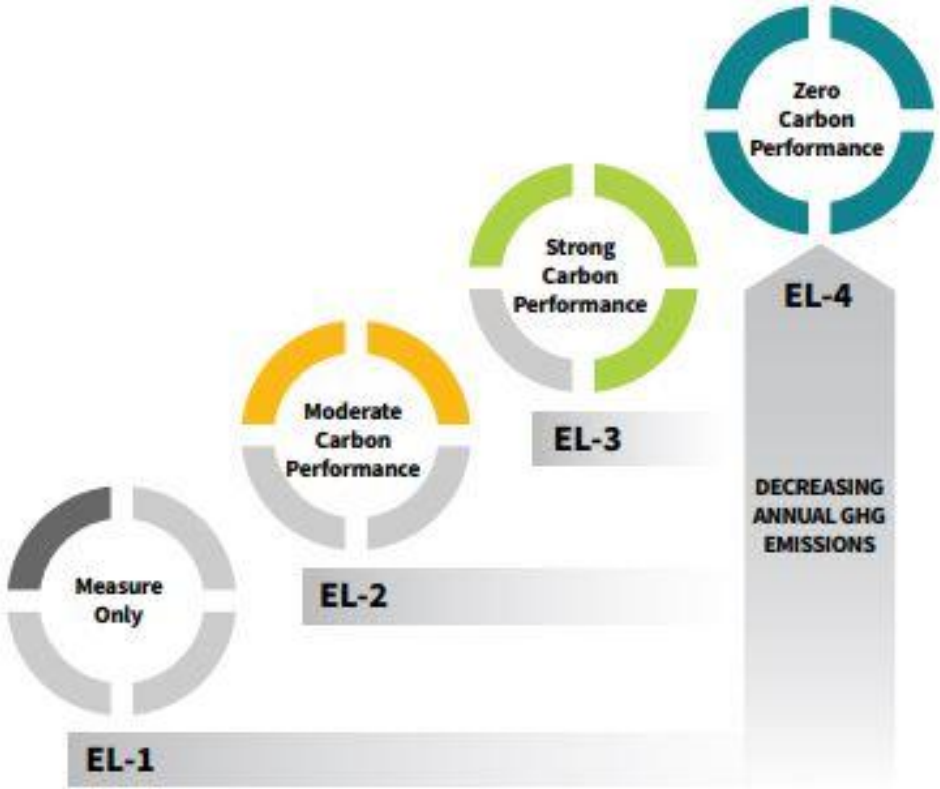


Figure 1.2 As of March 2025, Emission Level 1 (EL-1) of the ZCSC is the minimum requirement across BC.

Energy Step Code Provisions

1. The ESC requires a reduction in the annual building energy use based on whole-building energy modelling.
2. The ESC is concerned with reducing the amount of energy used, regardless of the energy source.
3. The ESC considers only the operational energy use in buildings, not the on-site energy production capability.

- Also speaks to AHJ's adopting Bylaws for prescriptive options and exceeding Code minimums for the performance pathway of the ESC.
- Reference to BC Information Bulletin B23-01

ENERGY STEPCODE
BUILDING BEYOND THE STANDARD

Zero Carbon Step Code Provisions

1. The ZCSC is distinct from the ESC, but it has a ***performance pathway*** that uses results from the ESC energy modelling. The ZCSC also has a ***prescriptive pathway*** that doesn't use energy modelling results.
2. The ZCSC is concerned with reducing emissions based on the amount of energy and type of energy source (e.g., electricity or combustion fuel) used by the building systems.
3. The ZCSC considers only operational emissions from energy-using equipment, not the embodied emissions associated with building materials or construction.

- Speaks to both performance and prescriptive options for AHJ's to achieve compliance.
- Higher levels of the ZCSC can be adopted by local AHJ's through Bylaw.

ZERO CARBON STEPCODE

Compliance Pathway for ESC

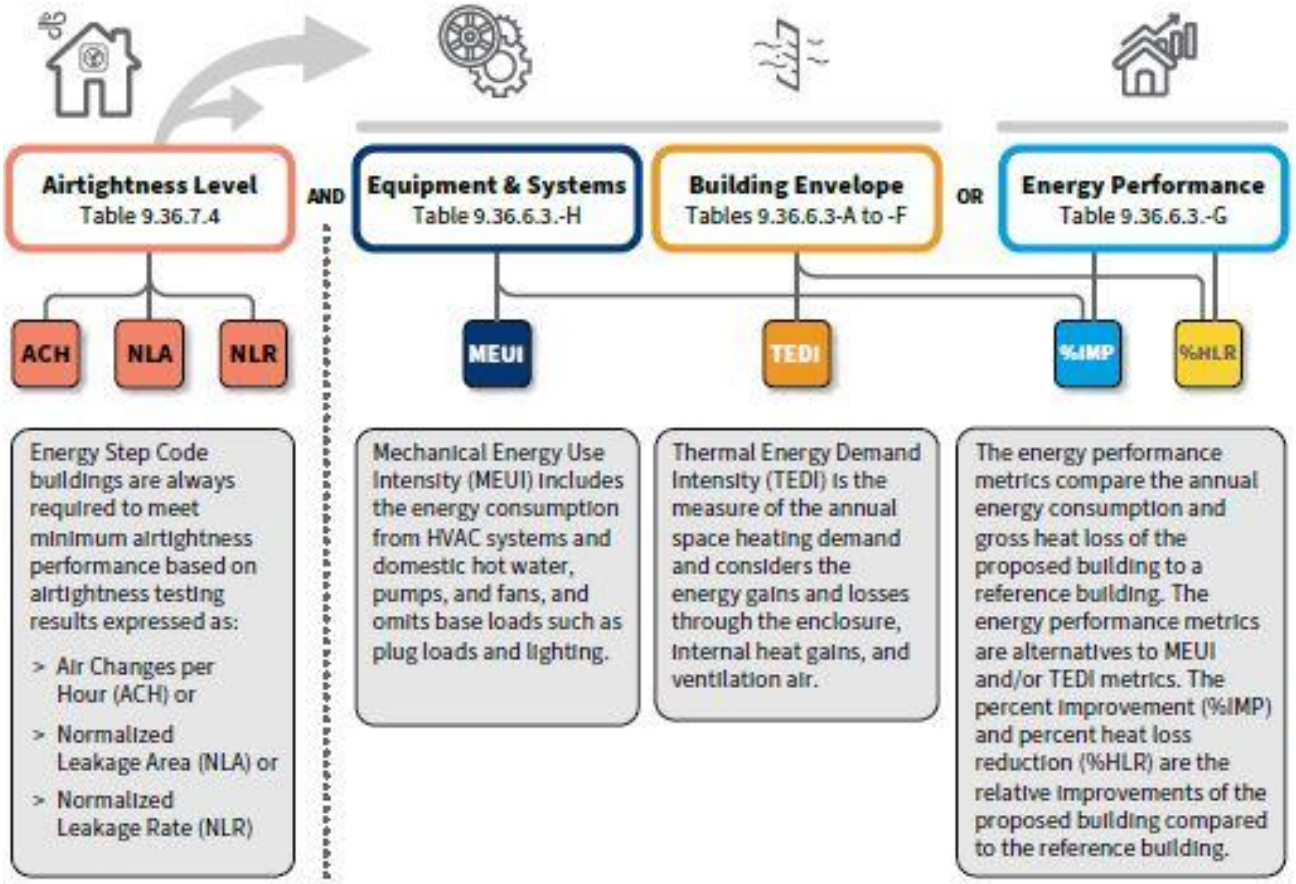
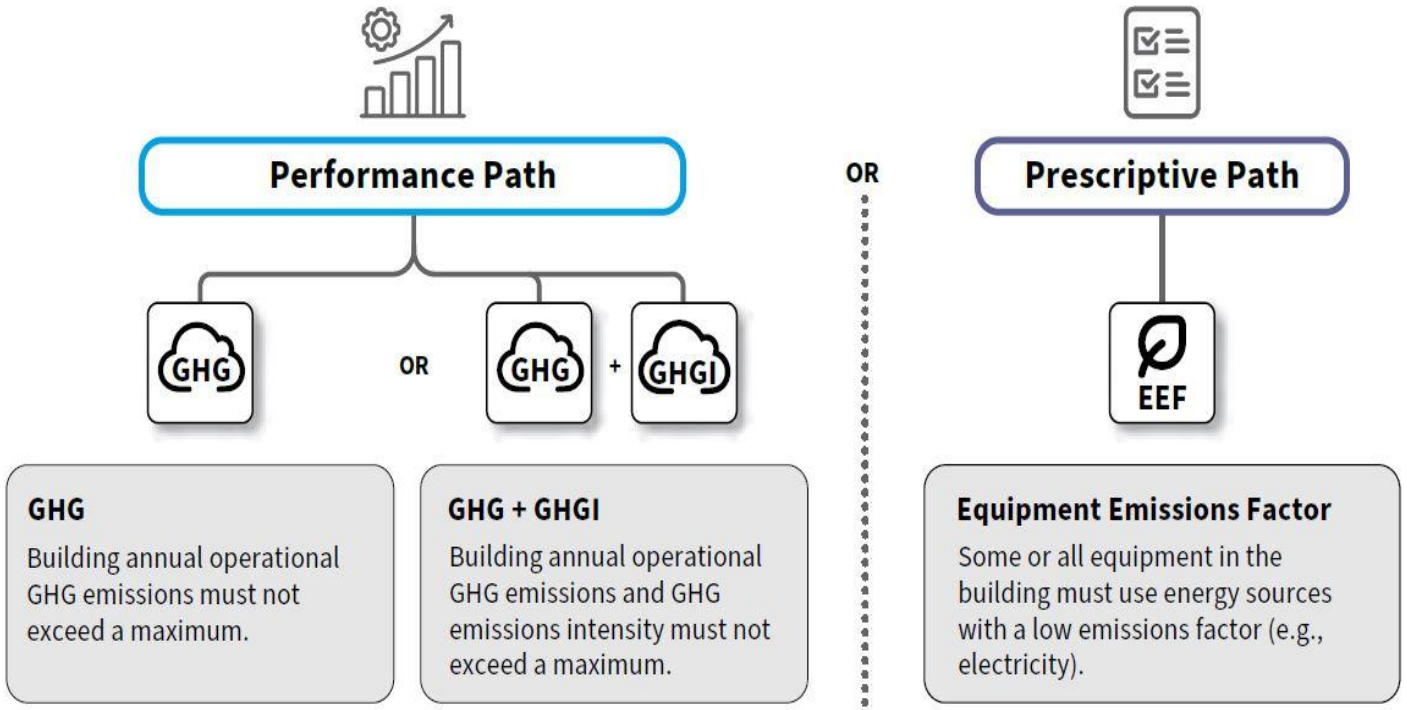


Figure 1.6 Summary of compliance pathways and key performance metrics of the ESC.

- New Airtightness Level (e.g. AL - 1) measurements (NLA/NLR)
- % Improvement/% Heat Loss Reduction vs % < Ref House
- Heated Floor Area vs Conditioned Space
- Inclusion of Cooling requirements
- ‘Air Barrier System’, CSA F280
- Exclusion of on-site energy production
- Heat Pump Switchover temperature
- Examples of Compliance options

Compliance Pathways for ZCSC (New)



- Descriptions of **Emission Levels** (EL-1 through EL-4)(measured in $kgCO_2e$)
- **Energy Source Emissions Factor** ($kgCO_2e/kWh$) for each type of energy
- Renewable Natural Gas not recognized
- Decorative/backup Fireplace and outdoor appliances & on-site energy production excluded

ZCSC Pathways in the BCBC

Performance

- Maximum operating GHG emissions for each Emission Level
- Total quantity of GHG Emissions/yr (GHG)
- Total quantity of GHG Emissions/m^2 (GHG Intensity)
- Compliance options (GHG or combination of GHG/GHGI)

Prescriptive (No Bylaw Req'd)

- Which type of equipment requires low emissions factor energy source
- Energy source <= 0.011kgCO_{2e}/kWh
- Space heating, water heating and appliances

BCBC 9.37 & 10.3 – Greenhouse Gas Emissions

Performance / Measured | **Prescriptive**

GHG Emission Level	GHG Emission Compliance Options					
	Maximum GHG Emissions by House, Expressed in kg CO_{2e}/year	or	Maximum GHG Emissions by House[1]		or	Reduction of GHG Emissions by Energy Source of Building Systems[2]
			Maximum GHGI of the House, Expressed in $kgCO_{2e}/m^2$/year	Maximum GHG Emissions by House, Expressed in $kgCO_{2e}$/year		
EL-1	measure only		measure only			N/A
EL-2	1050	or	6.0	2400	or	Energy sources supplying heating systems have an emissions factor ≤ 0.011 $kgCO_{2e}$/kWh
EL-3	440		2.5	800		Energy sources supplying heating and service water heating systems have an emissions factor ≤ 0.011 $kgCO_{2e}$/kWh
EL-4	265		1.5	500		Energy sources supplying all building systems, including equipment and appliances, have an emissions factor ≤ 0.011 $kgCO_{2e}$/kWh

PART 9
BUILDINGS

This data is already available on energy compliance forms

GHG Emission Level	Maximum GHGI of the *Building*, Expressed in $kgCO_{2e}/m^2$/year			
	Residential Major Occupancy		*Business and Personal Service* and *Mercantile Major Occupancies*	
	Hotels and Motels	Other *Residential Occupancies*	Offices	Other *Business and Personal Service* and *Mercantile Occupancies*
EL-1	measure only			
EL-2	9.0	7.0	5.0	6.0
EL-3	4.0	3.0	3.0	3.0
EL-4	2.0	1.8	1.5	2.0

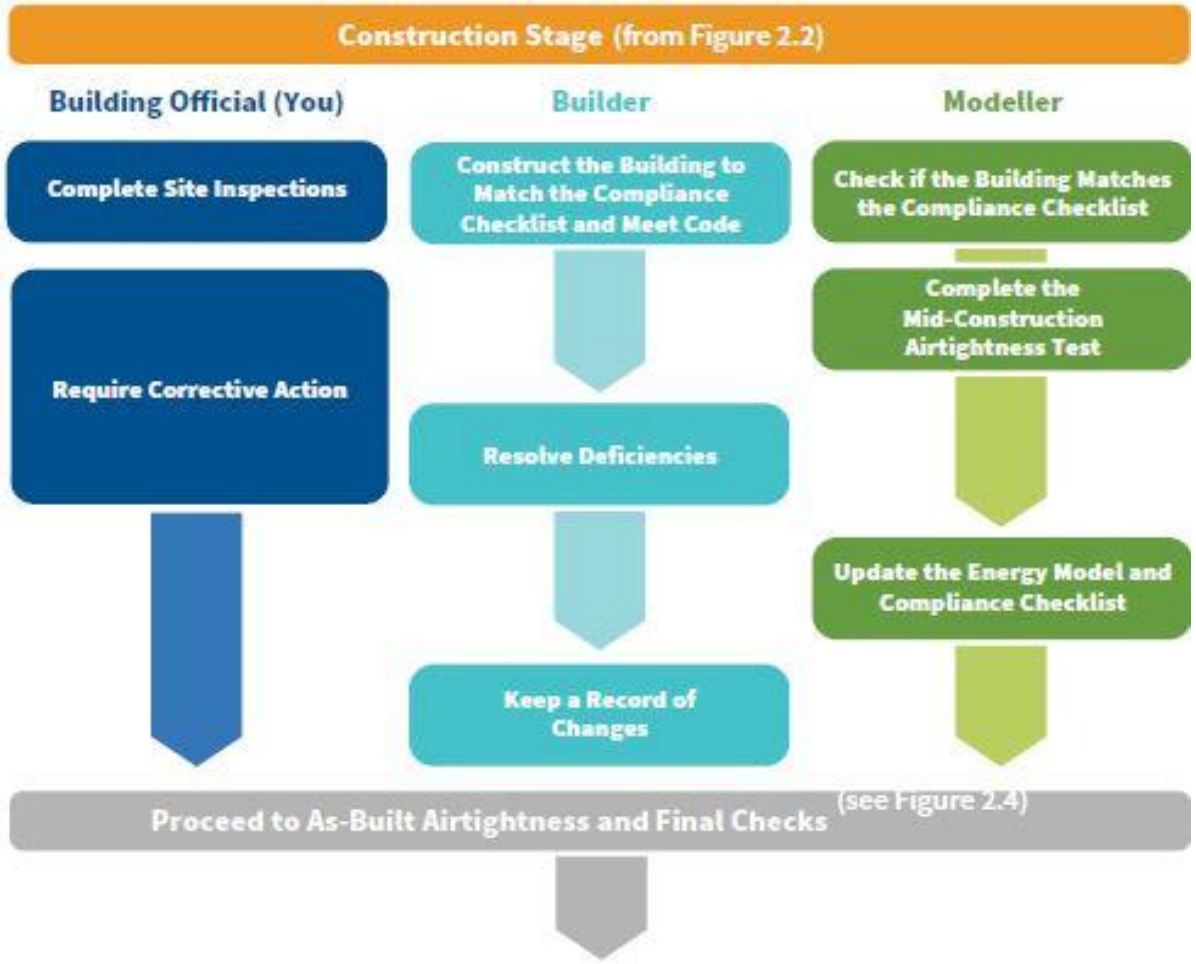
PART 3
BUILDINGS

no prescriptive option available

Chapter 2: Step Code Compliance Process and Roles

- Greatly expanded section detailing the roles and responsibilities for the Building Official, Builder and Energy Modeler. Included checklists
- Step Code Checklist details expanded to match current forms (Pre-construction, Mid-construction, As-Built Construction)
- Single Flowchart replaced with construction stages flowcharts (Project Start, Construction Stage, As-Built Airtightness and Final Checks)
- Helpful Step Code Compliance ‘Do’s and Don’ts’ with as-built compliance
- Appendix checklists clearly show how to read both Step Code Compliance Checklists and CSA F280 reports.

Flow Chart Example



Construction Stage Example

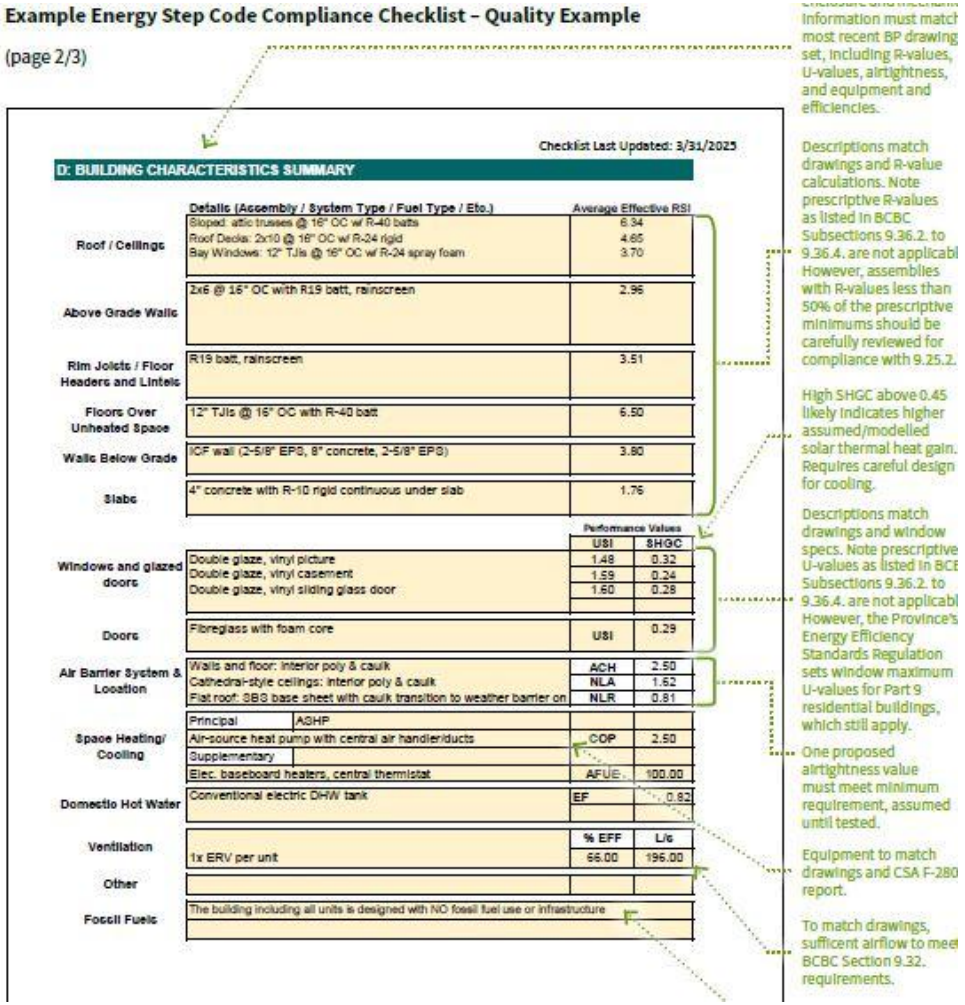
- 3 different flow charts to make each stage of construction clearer to understand.
- Roles and responsibilities for Building Official, Builder and Energy Modeler clearly defined.
- Suggestions for application submission acceptance and on-site inspection requirements.

Example Checklists

- ☐ **Air Barrier**
  - ☐ Primary materials comprising the air barrier system (e.g., sheathing membrane, vapour barrier) are present but are not continuous or sealed with accessories (e.g., tape, sealant).
  - ☐ Air barrier materials are not installed according to the manufacturer's instructions (e.g., membrane wrinkles and creases, use of primer, incompatible materials), or do not meet the applicable Article in BCBC Subsection 9.25.3. Air Barrier Systems, including managing below-grade soil gas ingress.
- ☐ **Fenestration U-value**
  - ☐ Documentation of fenestration energy performance (e.g., window label or engineered shop drawings) shows a U-value greater than noted in the Compliance Checklist.
  - ☐ The energy and window performance ratings labels are inconsistent or missing, or all show the same values even for different window sizes. Windows must meet code requirements for energy performance, air-water-structural performance testing, and product certification.
  - ☐ Window size is larger than shown in the building permit drawings, or new fenestrations are present that are not shown in the building permit application. Checking window sizes may seem cumbersome, but it is a common discrepancy. You can also request the window shop drawings be submitted for further verification.
- ☐ **Mechanical Heating/Cooling**
  - ☐ Products/documentation of mechanical equipment type, capacity, energy efficiency, and intended operation do not match the building drawings or the Compliance Checklist (see also **CSA F280 Mechanical Heating and Cooling Sizing** on page 58).
- ☐ **Domestic Hot Water**
  - ☐ Product/documentation of the domestic hot water (DHW) equipment type, capacity, and energy efficiency does not match the building drawings or the Compliance Checklist.
  - ☐ If applicable, drain water heat recovery is missing or does not match the stated efficiency.
- ☐ **Ventilation**
  - ☐ Product/documentation of the ventilation equipment type, capacity, and operation does not match the building drawings or the Compliance Checklist.

- Helpful checklists to guide the Building Official through all the stages of construction.
- Offers typical items to view and ensure compliance to submitted Pre-Construction Energy Forms.
- Provides guidance for witnessed non-compliance

Checklist Form Examples (Appendix Section)



Example Energy Step Code Compliance Checklist – Quality Example

(page 2/3)

Checklist Last Updated: 3/31/2025

D: BUILDING CHARACTERISTICS SUMMARY

	Details (Assembly / System Type / Fuel Type / Eto.)	Average Effective RSI
Roof / Ceilings	Sloped: attic trusses @ 16" OC w/ R-40 batts	6.34
	Roof Decks: 2x10 @ 16" OC w/ R-24 rigid	4.65
	Bay Windows: 12" TJIs @ 16" OC w/ R-24 spray foam	3.70
Above Grade Walls	2x6 @ 16" OC with R19 batt, rainscreen	2.96
Rim Joists / Floor Headers and Lintels	R19 batt, rainscreen	3.51
Floors Over Unheated Space	12" TJIs @ 16" OC with R-40 batt	6.50
Walls Below Grade	ICF wall (2-5/8" EPS, 8" concrete, 2-5/8" EPS)	3.80
Slabs	4" concrete with R-10 rigid continuous under slab	1.76

		Performance Values	
		USI	SHGC
Windows and glazed doors	Double glaze, vinyl picture	1.48	0.32
	Double glaze, vinyl casement	1.59	0.24
	Double glaze, vinyl sliding glass door	1.60	0.28
Doors	Fibreglass with foam core	USI	0.29
Air Barrier System & Location	Walls and floor: interior poly & caulk	ACH	2.50
	Cathedral-style ceilings: interior poly & caulk	NLA	1.62
	Flat roof: SBS base sheet with caulk transition to weather barrier on	NLR	0.81
Space Heating/ Cooling	Principal: ASHP		
	Air-source heat pump with central air handler/ducts	COP	2.50
	Supplementary		
	Elec. baseboard heaters, central thermistat	AFUE	100.00
Domestic Hot Water	Conventional electric DHW tank	EF	0.92
Ventilation	1x ERV per unit	% EFF	L/s
		66.00	196.00
Other			
Fossil Fuels	The building including all units is designed with NO fossil fuel use or infrastructure		

Information must match most recent BP drawing set, including R-values, U-values, airtightness, and equipment and efficiencies.

Descriptions match drawings and R-value calculations. Note prescriptive R-values as listed in BCBC Subsections 9.36.2. to 9.36.4. are not applicabl However, assemblies with R-values less than 50% of the prescriptive minimums should be carefully reviewed for compliance with 9.25.2.

High SHGC above 0.45 likely indicates higher assumed/modelled solar thermal heat gain. Requires careful design for cooling.

Descriptions match drawings and window specs. Note prescriptive U-values as listed in BCE Subsections 9.36.2. to 9.36.4. are not applicabl However, the Province's Energy Efficiency Standards Regulation sets window maximum U-values for Part 9 residential buildings, which still apply.

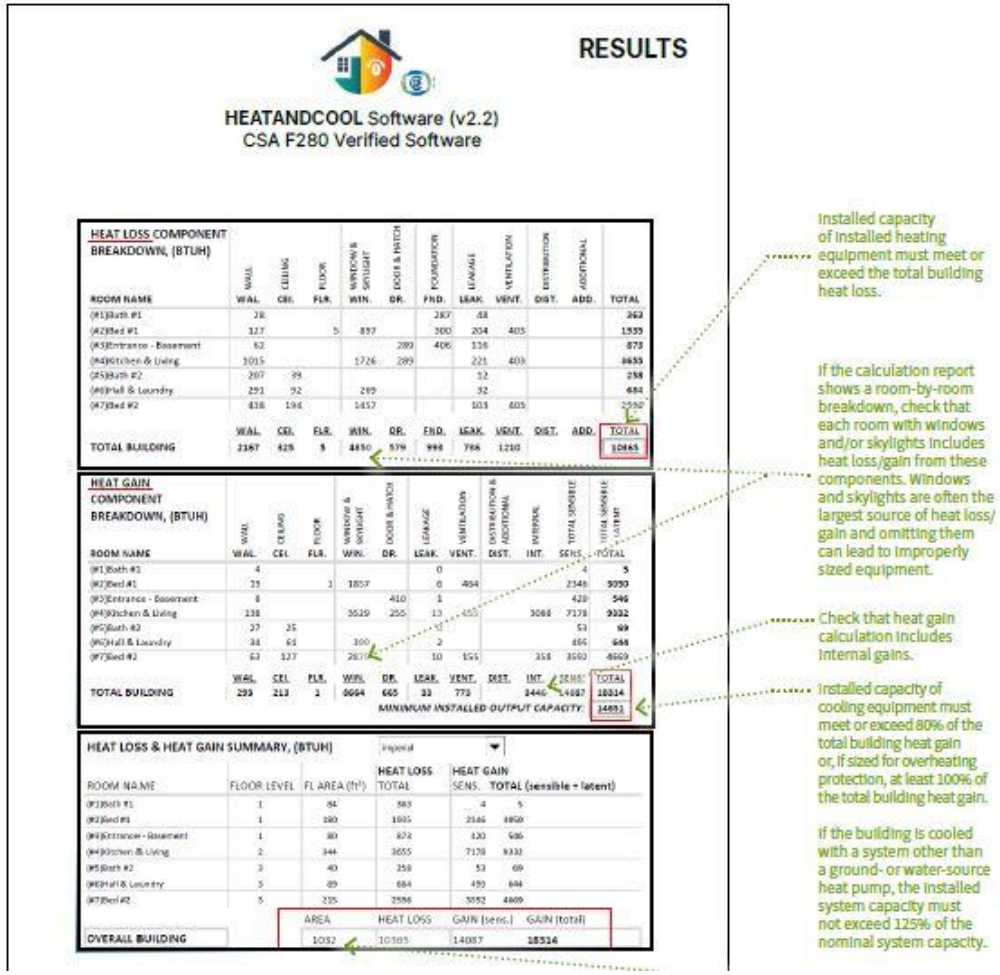
One proposed airtightness value must meet minimum requirement, assumed until tested.

Equipment to match drawings and CSA F-280 report.

To match drawings, sufficent airflow to mee BCBC Section 9.32. requirements.

- Example Energy Step Code Compliance Checklist.
- How to read the checklist to ensure compliance with BCBC 9.36.6.
- Examples of ‘poor’ submissions and when to reject the checklist submission or ask for revisions/corrections.

CSA F280 Form Example (Appendix Section)



RESULTS

HEATANDCOOL Software (v2.2)
CSA F280 Verified Software

HEAT LOSS COMPONENT BREAKDOWN, (BTUH)

ROOM NAME	WALL WAL.	CEILING CEI.	FLOOR FLR.	WINDOW & SKYLIGHT WIN.	DOOR & HATCH DR.	FOUNDATION FND.	LEAKAGE LEAK.	VENTILATION VENT.	DISTRIBUTION DIST.	ADDITIONAL ADD.	TOTAL
(#1)Bath #1	28					287	68				382
(#2)Bed #1	127		5	897		300	204	405			1938
(#3)Entrance - Basement	62				289	406	116				873
(#4)Kitchen & Living	1015			1726	289		221	403			3655
(#5)Bath #2	207	99					52				358
(#6)Hall & Laundry	291	92		289			92				684
(#7)Bed #2	438	194		1457			103	405			2592
	WAL.	CEI.	FLR.	WIN.	DR.	FND.	LEAK.	VENT.	DIST.	ADD.	TOTAL
TOTAL BUILDING	2167	425	5	4850	579	993	756	1210			10985

HEAT GAIN COMPONENT BREAKDOWN, (BTUH)

ROOM NAME	WALL WAL.	CEILING CEI.	FLOOR FLR.	WINDOW & SKYLIGHT WIN.	DOOR & HATCH DR.	LEAKAGE LEAK.	VENTILATION VENT.	DISTRIBUTION & ADDITIONAL DIST.	INTERNAL INT.	TOTAL SENSIBLE SENS.	TOTAL (sensible + latent) TOTAL
(#1)Bath #1	4					0				4	5
(#2)Bed #1	23		1	1857		0	464			2348	3050
(#3)Entrance - Basement	8				410	1				420	546
(#4)Kitchen & Living	138			3529	255	13	455		3088	7178	9332
(#5)Bath #2	27	25				1				53	69
(#6)Hall & Laundry	34	61		300		2				696	648
(#7)Bed #2	63	127		2871		10	556		358	3660	4669
	WAL.	CEI.	FLR.	WIN.	DR.	LEAK.	VENT.	DIST.	INT.	SENS.	TOTAL
TOTAL BUILDING	299	213	1	9664	665	33	773		3446	14087	18314
MINIMUM INSTALLED OUTPUT CAPACITY:											14651

HEAT LOSS & HEAT GAIN SUMMARY, (BTUH)

ROOM NAME	FLOOR LEVEL	FL AREA (ft²)	HEAT LOSS TOTAL	HEAT GAIN SENS.	HEAT GAIN TOTAL (sensible + latent)
(#1)Bath #1	1	84	383	4	5
(#2)Bed #1	1	180	1935	2348	3050
(#3)Entrance - Basement	1	80	873	420	546
(#4)Kitchen & Living	2	344	3655	7178	9332
(#5)Bath #2	2	40	358	53	69
(#6)Hall & Laundry	2	89	684	499	648
(#7)Bed #2	2	235	2592	3660	4669
	AREA		HEAT LOSS	GAIN (sens.)	GAIN (total)
OVERALL BUILDING	1032		10985	14087	18314

Installed capacity of installed heating equipment must meet or exceed the total building heat loss.

If the calculation report shows a room-by-room breakdown, check that each room with windows and/or skylights includes heat loss/gain from these components. Windows and skylights are often the largest source of heat loss/gain and omitting them can lead to improperly sized equipment.

Check that heat gain calculation includes internal gains.

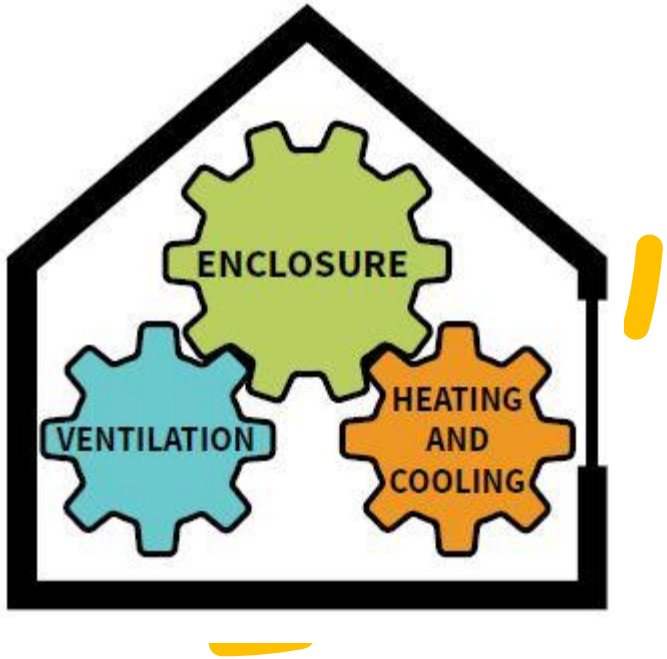
Installed capacity of cooling equipment must meet or exceed 80% of the total building heat gain or, if sized for overheating protection, at least 100% of the total building heat gain.

If the building is cooled with a system other than a ground- or water-source heat pump, the installed system capacity must not exceed 125% of the nominal system capacity.

- Example CSA F280 Form submission explaining how to interpret the data.
- What to look for in compliant submissions and what to reject in ‘poor’ submissions

Chapter 3: High Performance Step Code-Compliant Buildings

"Focusses more on what design approaches, construction practices and technology can make a building energy efficient, low emissions, comfortable, durable and buildable"



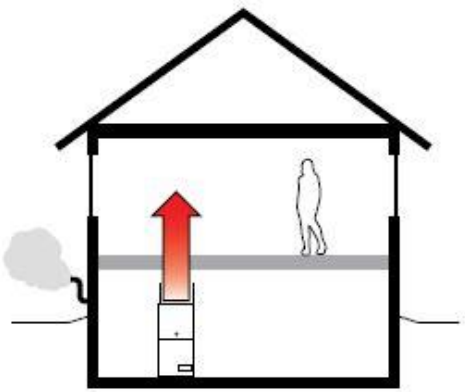
New Contents

- Expanded information of high-performance construction techniques
- Re-enforcing ‘Air Barrier Systems’ vs Air Barriers. Location of air barrier system mentioned. Air Barrier System detailing options/examples (interior/exterior)
- Discussing solutions for overheating/cooling
- “Achieving a High Step or Emission Level Does Not Mean Achieving a High-Performance Building”
- Caution on use of aerosolized sealants vs air barrier systems
- CSA F280 Section in detail
- Greatly expanded Mechanical system solutions and examples
- Heat pumps and switchover temperature description

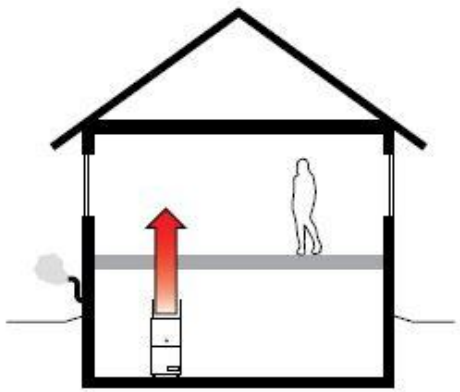
High Performance Progression

Low-Performance Building — **Energy Efficiency Progression** — High-Performance Building

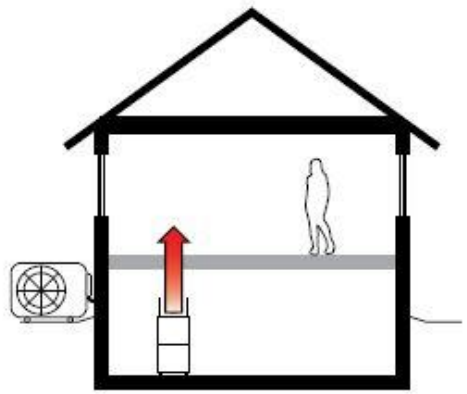
Potentially lower thermal performance and more air leaky, with standard efficiency equipment.



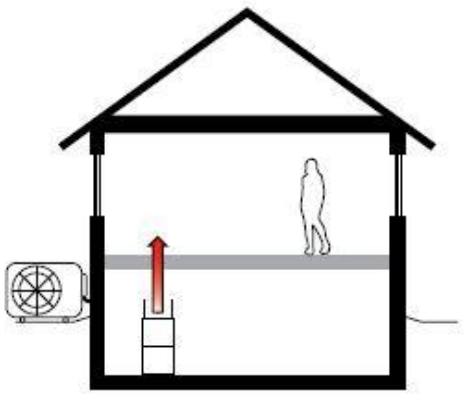
Improved airtightness, higher thermal performance, and more efficient mechanical systems.



Excellent airtightness, higher thermal performance, and smaller, more energy-efficient mechanical systems.



Excellent airtightness, high thermal performance, and small energy-efficient mechanical systems.



Air Barrier System Detailing

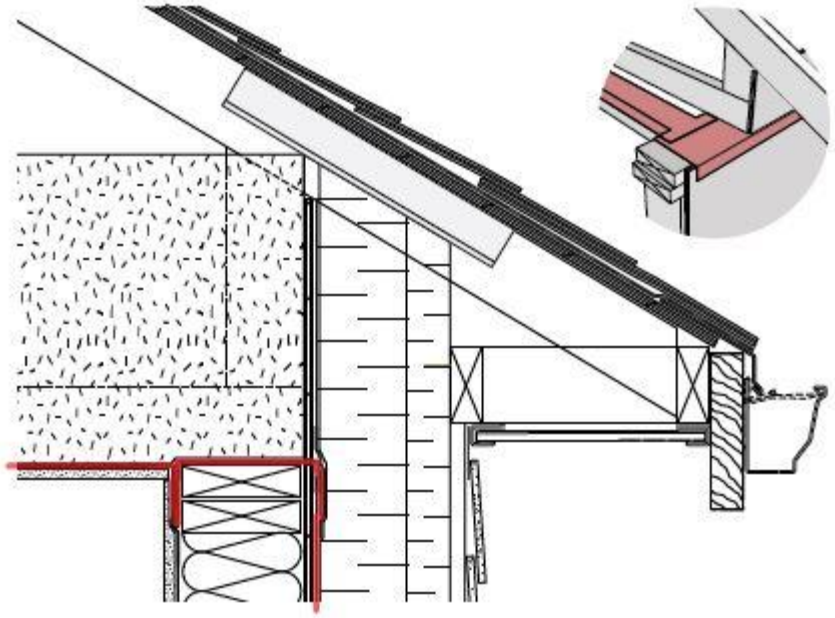
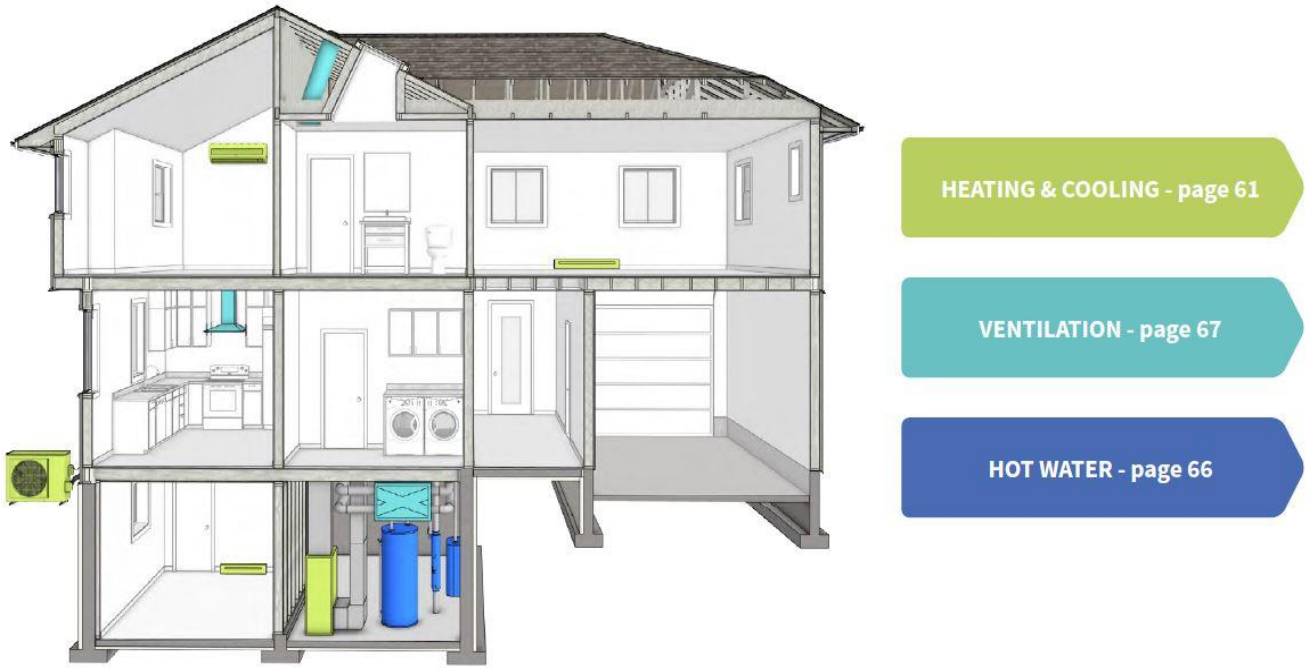


Figure 3.14 Roof-to-wall exterior air barrier redline detail (annotations not shown).

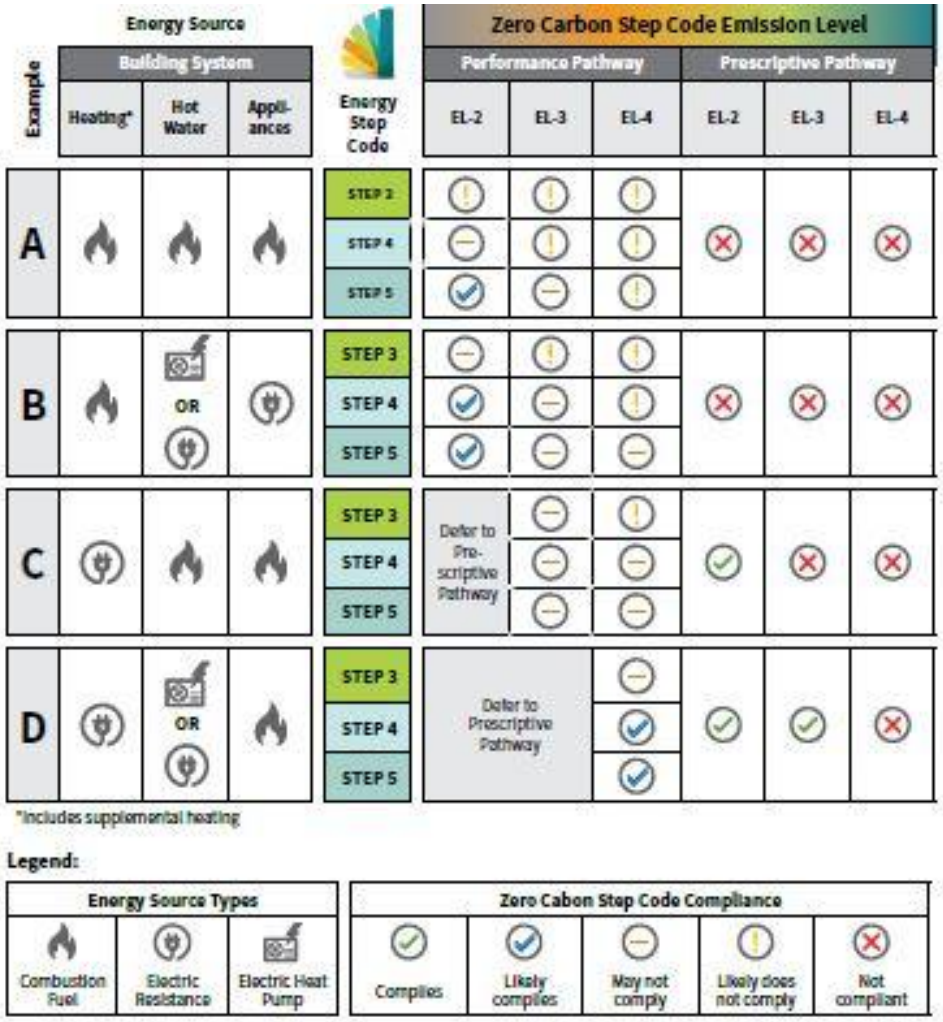
- Great details and descriptions for all transitions, penetrations and openings.
- Red-line drawings
- Interior and exterior air barrier system details

Mechanical Equipment and Systems



- ZCSC Considerations
- Cooling Requirements
- New Heat Pump detailing and switchover temps
- CSA F280 Reports
- Reminder: “CSA F280 Sizing Does Not Include Distribution Design, Installation Methods, or Commissioning”

Mechanical Systems and ZCSC



Tables with examples for mechanical system design/energy source to produce less GHG emissions and to achieve ZCSC Step Compliance.

QUESTIONS?