Energy Code
Performance Compliance
ABC 2014 - (9.36.5)
SCC Conference 2017

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Municipal affairs

The building discipline is responsible for establishing and interpreting the Alberta Building Code, standards and respective regulations under the Safety Codes Act.

Municipal Affairs works in partnership with the Safety Codes Council to develop and provide relevant information to the building industry, designers and authorities having jurisdiction.
Energy codes Presentations

Common Types:
- **Political** (with /against)
- **Promotional** (BE consultants, Manufacturer, etc.)
- **Regulatory** (compliance/enforcement)

- Our presentation approaches the **Regulatory requirements**.
Discussion Overview

- Intent and Introduction notes.
- Code Expectations (authority having jurisdiction / Designer)
- Energy Codes: now and the future/NZEr.
- Compliance Paths
- HOT2000 and ERS
- Recommended documentation.
- Pay attention / Errors in Hot2000/HVAC notes/Components that impact simulation.
- Calculators/ Software Demonstration.
- Common issues/questions.


Discussion Overview

**Intent: To Know**

- The basics of HOT\textsuperscript{2000}.
- Documents/parameters that need to be followed for simulation.
- What component impact simulation.
- Recommended Documents you may ask the applicant for.
- Calculators /Excel that help expedite Plan examinations.
- Your choice for the Risk Management.
- Ask for information but don’t Panic? why?
- You need to understand energy.
Performance Compliance (9.36.5)

Introduction notes

- In this presentation we will be focusing on compliance verification for performance Path “ABC 2014-9.36.5 compliance”.
- Detailed technical requirements and best practices are not part of this presentation.
- It is the local authority* responsibility to decide how to verify compliance.
Performance Compliance [9.36.5]

Introduction notes

- Are we there Yet? numbers
  Feedback from Municipalities.
  Input from Energy Advisors.

- Where are we heading? ERS/Tiers /Step codes/Net-zero.

- Why performance?

- HRV/R_{15}/EF 95/HWT/2.5 ACH, NRC.
## Performance Compliance (9.36.5)

### Reference NRCan

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>78-80</td>
<td>83</td>
<td>86 (Renewables)</td>
<td>100(R)</td>
</tr>
<tr>
<td>3.2</td>
<td>2.5/3.2</td>
<td>2.5 ACH</td>
<td>1.5 ACH</td>
<td>1.0 ACH</td>
</tr>
</tbody>
</table>

**ERS scale is between 0 and 100**

0 ~ very inefficient home

100 ~ no purchased energy required
Performance Compliance (9.36.5)

Net Zero NZE & NZEr

<table>
<thead>
<tr>
<th></th>
<th>2016</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Code</strong></td>
<td>80</td>
<td>83</td>
<td>86</td>
<td>90(80% <strong>better</strong>)</td>
</tr>
<tr>
<td><strong>Industry capacity</strong></td>
<td>86</td>
<td>90</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

**Net Zero Energy**

A home that **produces** as much energy as it **uses** on an annual basis (All energy used in a home, including that for heating, hot water, ventilation, air conditioning and all miscellaneous electrical consumption)
Performance Compliance (9.36.5)
Net Zero Ready

Maybe:
Smart framing principles
Thicker foundation walls
Heat pump (air/ground)

<table>
<thead>
<tr>
<th>Energy Consumption</th>
<th>42 GJ/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>7.1</td>
</tr>
<tr>
<td>Occupant Electrical Load</td>
<td>23.0</td>
</tr>
<tr>
<td>Water Heating</td>
<td>8.8</td>
</tr>
<tr>
<td>Ventilation</td>
<td>2.0</td>
</tr>
<tr>
<td>Space Cooling</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Net Zero Consumption

- Net Zero Ready
- ENERGY STAR®
- Building Code

Net Annual Energy When Renewables Installed

- 42 GJ
- 94 GJ
- 109 GJ
- 0 GJ
Performance Compliance [9.36.5]

Net Zero Energy ready
Efficient Building Envelope
RSI 9 (R51) Walls
RSI 8.5 (R48) Foundation Walls
RSI 15.9 (R90) Ceiling
Triple Glazed Windows (W, S, E)
Quad Glazed Windows (N)

http://www.becor.org/content/downloads/BECORpathNZEHMay10.pdf
Policy Objectives for Energy Codes

- Support the Pan-Canadian plan (federal and provincial governments) for clean growth and climate change to
  - Meet Canada’s greenhouse gas (GHG) emissions targets;
  - Transition to a low-carbon economy;
  - Develop net-zero ready national building code with the goal that P/Ts adopt it by 2030;
  - Harmonization of energy codes; and
  - Long-term reductions to the operating costs of houses and buildings.
Future of Energy Codes

The Canadian Commission on Building and Fire Codes is developing a “step” approach to energy codes.

- P/Ts are at different stages for building energy efficiency;
- The Commission and National Research Council will develop modules at different energy efficiency levels to allow P/Ts to choose the appropriate energy efficiency standard from a set of national standards;
- The modules will provide a path for P/Ts toward ultimate goal of “net-zero energy ready” by 2030 and harmonization across Canada.
Future of Energy Codes

Expected Compliance verification in the Future:

Energy Modeling by Energy Advisor

Air-Tightness Testing

No Prescriptive Energy Requirements
Compliance Paths

- **Three** compliance pathways for buildings
  - (Respect to Section 9.36 and NECB)
- Compliance can be achieved through
  - The prescriptive path
  - The prescriptive/Trade-off path
  - The performance path,

Expectations
Expectations

Co-ordination

Designers

Developers

Energy Advisors

Local Authorities

Trades

Alberta
Expectations of the designer

What are the responsibilities of the designer?

- Ensure all the appropriate information is provided within the submitted documents
  - (Reference Div. C, Subsection 2.2.8)
- Run Performance modeling (2 houses)
- Complementary Information to Support/validate modelling.
Expectations of the designer

- The effective thermal resistance values and respective areas of all opaque building envelope assemblies.
- The overall thermal transmittance (U-value), solar heat gain coefficient and respective areas of all fenestration and door components.
- The ratio of total vertical fenestration and door area to gross wall area, (Performance Modeling)
- The performance rating, energy source, and types of all equipment required for space-heating and -cooling and service water heating.
- The design basis for the ventilation rates, (Tables in 9.32, ASHRAE Standards, etc.)
- Where a test is used to determine the airtightness of a house, the measured airtightness of the building envelope in air changes per
- Any additional features used in the energy model calculations that account for a significant difference in house energy performance.
Expectations of the AHJ

What are the expectations of the AHJ?

- Request/Review the drawings/specifications.
- Request/Review (2) Models (proposed and reference)
- Assess code compliance.
- Provide a Letter of Review stating deficiencies – if any.
- Issue permits
- Perform site inspections
Performance path 9.36

HOT2000
HOT2000

What is HOT2000

- Software tested in accordance with ANSI/ASHRAE 140.
- Used to demonstrate compliance with Ener-Guide rating System (AKA ERS).
- Used to demonstrate compliance with NBC 2010 (ABC 2014) subsection 9.36.5.
- Recently updated (see next).
Structure of compliance software

- **Compliance shell**: Interface for input and files preparation.
- **Energy analysis engine**: Algorithms that calculate energy consumption based on compliance shell input.
Recently updated to accommodate Ener-Guide V15 where the reference house is built to NBC section 9.36. (NBC 9.36.5.), and also fixes bugs such as operation schedules for ventilation.
Why do we need to know the software?

- Professional involvement for homes is not required as per the code, so verification of compliance is on the BSCO shoulders.
- Similar to structural compliance for conventional lumber (joist, beams, etc.) we need to know the parameters.
- HOT2000 is tricky and values can differ if the parameters are not followed.
- It is an interesting software, fun to work with.
WOW! THANKS

I FEEL SOOOO MUCH BETTER NOW!
Using HOT2000 for ERS and NBC/ABC 9.36

- The modeler selects the mode in the program; For ERS choose ERS, For 9.36 chooses General.
- General means a user specified value.
- ERS means the program locked its own values for the reference house.

(remember that ERS creates its own reference model automatically using NBC 9.36 but not necessary 9.36.5 inputs)
HOT2000

Using HOT2000 for ERS and NBC/ABC 9.36
HOT\textsubscript{2000}

Using HOT\textsubscript{2000} for ERS Versus NBC/ABC

9.36

- **ERS** needs to follow:
  - ERS Guide for Hot 2000

- **NBC/ABC 2014 9.36.5** needs to follow:
  - NBC 9.36 guide for HOT\textsubscript{2000},
  - ABC 2014 /NBC.
HOT\textsuperscript{2000}

Software inputs:

- 2010 /2015 national Building code of Canada: \textit{e.g.} 9.32 ventilation rates
- Performance Path HOT\textsuperscript{2000} User Guide.
- Residential Mechanical Ventilation systems \texttt{CAN/CSA-F326-M91}
- Determining the Required Capacity of Residential Space Heating and Cooling Appliances \texttt{CAN/CSA-F280-M12}
- Etc.
**HOT2000**

Examples of Common setting for ABC2014 9.36.5

- **Temperature**
  - Heating set point equal 21 degree Celsius
- **Base Load**
  - Sum of electric appliances, lighting, other electric must equal 20 kWh/day
- **Correct weather library**
  - Alberta, correct Zone.
- **Season**
  - May-October-July
- **Orientation**
  - ?
Reference House (General)

- Reference house is modeled to represent a hypothetical house built using the prescriptive path of ABC/NBC 9.36.2 through 9.36.4 (hereafter referred to as “the prescriptive path”).
- The equipment efficiencies and the thermal resistance of building envelope components are dictated by NBC 9.36.
- Needs to follow 9.36.5.13 to 9.36.5.16 (inputs)
HOT2000

• **Needs to follow 9.36.5.13 to 9.36.5.16 (inputs)**

For example:

**9.36.5.14. Modeling Building Envelope of Reference House**

5) The area and orientation of fenestration and doors of the reference house shall be modeled as being **equally distributed** on all sides of the house.

7) Windows and other glazed components in the reference house shall have a maximum overall thermal transmittance as required in **Table 9.36.2.7.A.** for the applicable heating degree-day category.
The proposed house is modeled to reflect the actual construction of the house under consideration.

The proposed house is modeled in a similar manner to houses participating in one of NRCan’s housing initiatives (EnerGuide Rating System\(^1\), ENERGY STAR\(^2\) for New Homes and R-2000).

*Future consideration for ERS.*
How to verify compliance for submitted reports:

For both reports (e.g.):

1. Check it has been modeled under general mode.
   - General and not ERS reference,
2. Check number of occupants
   - 2 adult, 2 children
3. Check absorptivity
   - 0.40
4. Check Daytime and night time set point
   - 21 degree Celsius
5. Fan Mode
   - Auto/Two Speed matching?
HOT2000

How to verify compliance for submitted reports:
For Reference House:
1. Check **Glazing equally distributed/ prescriptive U value** (U1.6- RSI 0.625) requirements or ER?
2. Check **prescriptive insulations** ; *Exposed Floor & Cantilevers (5.02) Rim Joist & wall(3.08) and ceiling(10.43) / RSI-Values.*
3. Check windows Airtightness A2 or better ; A3
4. Doors U1.6- RSI 0.625
5. Foundation walls (RSI 3.46)
6. AirLeakage 2.5 ACH
How to verify compliance for submitted reports:
For Reference House:
7. Ventilation data complies with 9.32.3.3 table (minimum + maximum/2) for the number of bedrooms. (9.36.5.11.(6))
8. Gas Furnace efficiency set to 92%.
9. Hotwater tank temperature set to 55° and right efficiency and sized as per 9.31.4.
10. Check House Energy Target.
How to verify compliance for submitted reports:

For Proposed House:

1. Check **Glazing U value** (user defined versus HOT 2000 calculated; inspection?)
2. Check **insulations**; Exposed Floor & Cantilevers, Rim Joist & wall and ceiling/ RSI-Values, (User defined or calculated), inspection/accuracy?
3. Check **Air Leakage input**, 2.5/3.2 ACH, based on that examine air barrier details/drawings.
How to verify compliance for submitted reports:
For Proposed House:
4. Ventilation rate same as reference house.
5. Check annual energy consumption.
   I would check that; from the Monthly estimated energy consumption by device. (exclude lights and appliances)
Performance path 9.36

Recommended documents
Performance path 9.36

Recommended documents:
A) 9.36 project Summary
Performance path 9.36

Recommended documents:
A) 9.36 project Summary

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Compliance Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Address:</td>
<td>Prescriptive</td>
</tr>
<tr>
<td>Applicant:</td>
<td>Trade off</td>
</tr>
<tr>
<td>Applicant Address:</td>
<td>Performance</td>
</tr>
</tbody>
</table>

In order to confirm compliance with Section 9.36 of the ABC 2014, the checklist below is to be completed and submitted as part of any application for a Single Family. Trade off and Performance paths will also require a complete set of calculations to process. Incomplete information will delay the application processing.

### BUILDING ENVELOPE 9.36.2

<table>
<thead>
<tr>
<th>WALLS</th>
<th>Member size spacing O.C.</th>
<th>Interior Insulation</th>
<th>Exterior Sheathing</th>
<th>Exterior Insulation</th>
<th>Cladding</th>
<th>Effective R-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above Grade Assemblies</td>
<td>16” O.C.</td>
<td>R-20 FG</td>
<td>3/8” OSB</td>
<td>N/A</td>
<td>Vinyl</td>
<td>15.22</td>
</tr>
<tr>
<td>Below Grade Wall</td>
<td>16” O.C.</td>
<td>R-20 FG</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>11.87</td>
</tr>
<tr>
<td>Basement slab above Frost line</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heated Slab</td>
<td></td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rim-boards</td>
<td>1 1/8” OSB</td>
<td>4” ccSPF</td>
<td>3/8” OSB</td>
<td>N/A</td>
<td>Vinyl</td>
<td>23.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FLOORS / ROOF</th>
<th>Insulation Type</th>
<th>Insulation Depth</th>
<th>Effective R Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulated floor above garage</td>
<td>Closed Cell Foam</td>
<td>4”</td>
<td>26.12</td>
</tr>
<tr>
<td>Cantilever</td>
<td>Closed Cell Foam</td>
<td>4”</td>
<td>24.0</td>
</tr>
<tr>
<td>Roof</td>
<td>Fiberglass</td>
<td>20”</td>
<td>51.27</td>
</tr>
</tbody>
</table>

Air Barrier Type / Manufacturer: Interior - Impermeable, Exterior - Permeable

Sealed/Sandwiched Poly Joints

<table>
<thead>
<tr>
<th>FENESTRATIONS</th>
<th>Manufacturer</th>
<th>Energy Rating</th>
<th>U Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>Choose an item.</td>
<td>N/A</td>
<td>Metric U-1.5</td>
</tr>
<tr>
<td>Doors</td>
<td>Choose an item.</td>
<td>N/A</td>
<td>Metric U-1.5</td>
</tr>
<tr>
<td>OH Doors</td>
<td>Exempt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Alberta
Performance path 9.36

Recommended documents:
B) 9.36 Site Review checklist/Nominal R/U Values

SITE REVIEW Checklist with Nominal R-Values

Proposed House Requirements – This document is for code compliance NOT energy efficiency

NOTE: Blueprints, specs and actual construction MUST match these details

<table>
<thead>
<tr>
<th>ATTIC INSULATION – Flat Ceiling</th>
<th>R-40 Blow in - 16” thickness (Eff. R-42.2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATTIC INSULATION – Vault Scissor</td>
<td>N/A</td>
</tr>
<tr>
<td>ATTIC INSULATION – Vault Cathedral</td>
<td>R-28 Fiberglass Batt (Eff. R-29.1)</td>
</tr>
</tbody>
</table>

WALL Insulation Assembly Calculations (without Cladding)

<table>
<thead>
<tr>
<th>ABOVE GRADE WALL #1.</th>
<th>W-20-16 (R-20 @ 16”) Eff R-15.22+ Cladding</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABOVE GRADE WALL #2.</td>
<td>W-20-24 (R-20 @ 24”) Eff R-15.73 + Cladding</td>
</tr>
</tbody>
</table>

See Qualistat EMC-01 for Wall Calculations
See Qualistat EMC-03 for Bsmt Wall Calculations

<table>
<thead>
<tr>
<th>RIM JOINT INSULATION</th>
<th>RIM CC4 - 4” Closed Cell Spray Urethane Foam (Eff. R-23.8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXPOSED FLOOR (Cantilevers)</td>
<td>CAN’T CC4 - 4” Closed Cell Foam (Eff. R-24.0 + Flooring)</td>
</tr>
<tr>
<td>EXPOSED FLOOR (Bonus Room)</td>
<td>BONUS OC8 (8” Open Cell Foam) Eff R-29.13 + Flooring</td>
</tr>
<tr>
<td>FOUNDATION FROST WALLS Insulation</td>
<td>BW12-24 (R-12 24”x24”) Eff R-11.87</td>
</tr>
<tr>
<td>WALKOUT – SLAB ON GRADE Insulation</td>
<td>N/A</td>
</tr>
<tr>
<td>SLAB ON GRADE (no foundation)</td>
<td>N/A</td>
</tr>
<tr>
<td>HEAT TUBE (Underslab Radiant RI)</td>
<td>R-10 + Concrete Slab NO FINISHES (Eff R-11.1)</td>
</tr>
</tbody>
</table>

NOTE: Qualistat 9.36 Energy Drawings
- For Fenestration Calculations see EMC-00
- For Wall & Rim Calculations see EMC-01
- For Ceiling and Floor Calculations see EMC-02
- For Roof & Duct Calculations see EMC-03
- For BSMT Wall Calculations see EMC-04
- Vent Pipe Calculations see EMC-05
- Walkout BSMT Calculations see EMC-06
- Slab-On-Grade Calculations see EMC-07

Detailed Window calculations and PG ratings available on manufacturer schedule.
**Performance path 9.36**

**Recommended documents:**
C) General Details used for calculating 9.36 performance report

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**General Details used for Calculating 9.36 performance Energy Model report**

<table>
<thead>
<tr>
<th>Defaults</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basement Temperatures:</strong></td>
<td>19°F/21°C</td>
</tr>
<tr>
<td><strong>Floors above Bsmt Temperatures:</strong></td>
<td>25°C</td>
</tr>
<tr>
<td><strong>Cooling set point:</strong></td>
<td>25°C</td>
</tr>
<tr>
<td><strong>Service Water:</strong></td>
<td>275 L/day (49.41 Imp Gallons)</td>
</tr>
<tr>
<td><strong>Ventilation fan wattage:</strong></td>
<td>2.32 W/Ls</td>
</tr>
<tr>
<td><strong>Furnace fan wattage:</strong></td>
<td>2.50 W/Ls</td>
</tr>
<tr>
<td><strong>Ventilation amount:</strong></td>
<td>Calculated per 9.32 ft³ per bedroom unless otherwise noted – up to 5 bedrooms – over 5 bedrooms, F-326 calculations are used</td>
</tr>
<tr>
<td><strong>Ventilation Time:</strong></td>
<td>8 Hours / 480 min/day</td>
</tr>
<tr>
<td><strong>Furnace Allowable Rise:</strong></td>
<td>5.5°F</td>
</tr>
<tr>
<td><strong>Multiple furnaces/DHW:</strong></td>
<td>Listed as single unit with calculated combined total</td>
</tr>
<tr>
<td><strong>Heat Recovery (HRV):</strong></td>
<td>Not used in Reference Model – Where used in Proposed only sensible heat efficiency is calculated</td>
</tr>
<tr>
<td><strong>Appliances:</strong></td>
<td>Electric Range / Electric Dryer</td>
</tr>
<tr>
<td><strong>Default DHW:</strong></td>
<td>≥ 07% - 0005/VEF for Natural Gas (for Tankless use .67)</td>
</tr>
<tr>
<td><strong>Default AFUE Furnace:</strong></td>
<td>90% AFUE for Natural Gas</td>
</tr>
<tr>
<td><strong>Default Boiler:</strong></td>
<td>90% AFUE for Natural Gas (≥ 88 kW or 300,256 BTU/h)</td>
</tr>
<tr>
<td><strong>Default A/C:</strong></td>
<td>14.5 SEER for Split Systems</td>
</tr>
<tr>
<td><strong>Window Air tightness:</strong></td>
<td>A-3</td>
</tr>
<tr>
<td><strong>Windows - Reference House:</strong></td>
<td>Metric U-Value (not Energy Rating) with SHGC = 0.26</td>
</tr>
<tr>
<td><strong>Windows - Proposed House:</strong></td>
<td>Metric U-Value (not Energy Rating) with SHGC as per manufacturer</td>
</tr>
<tr>
<td><strong>Exposed Floors:</strong></td>
<td>Credit of .16 RSI (R-91) added to enclosed space, i.e., Bonus room floor and common walls</td>
</tr>
<tr>
<td><strong>Floor Header:</strong></td>
<td>Refers to Exterior Rim Joint</td>
</tr>
<tr>
<td><strong>Hot 2000 FDWR Report:</strong></td>
<td>Does not include dogs in the calculation</td>
</tr>
<tr>
<td><strong>Climatic Data:</strong></td>
<td>Natural Resources Canada CWEC (Canadian Weather Year for Energy Calculations) and CWEEDS (Canadian Weather Energy and Engineering Data Sets)</td>
</tr>
<tr>
<td><strong>Orientation:</strong></td>
<td>9.36.5.10 (8) states that orientation of the foundation of the proposed house as constructed shall be within 22.5° of the orientation used in the energy model calculations – we use all 8-actual direction facing for each wall face in the Hot 2000 Models</td>
</tr>
<tr>
<td><strong>Reference House Electric Service Water:</strong></td>
<td>SL ≤ 35 + 0.20V (top inlet)</td>
</tr>
<tr>
<td>Service Water ≤ 35kW</td>
<td>SL ≤ 40 + 0.20V (bottom inlet)</td>
</tr>
</tbody>
</table>
Performance path 9.36

Recommended documents:

D) Calculations

- FDWR windows calculations.
- Ventilation Calculations based on 9.32.
- DHW (NG versus Electric).
- RSI-Value calculations.
- Vent Pipe Calculations.
- Walkout Basement calculations.
- Slab on grade.
Performance path 9.36

Calculations

- FDWR windows calculations (Reference):
  Total Area of proposed windows: 31.4 m²
  Total Area of opaque (walls): 198.8 m²
  Percentage: 15.7%

  Use 17% For less than 17%
  Use 22% Above 22%
  Use actual between if 17% - 22%

Then 17% of 198.8 = 33.796
Equally distributed windows: 33.796/4 = 8.5 m² each side
**Performance path 9.36**

**Calculations**

- FDWR windows calculations (Reference):

![Excel Spreadsheet Image]
Performance path 9.36

Calculations

-Ventilation Calculations based on 9.32.

Table 9.32.3.3. Normal Operating Exhaust Capacity of Principal Ventilation Fan Forming Part of Sentence 9.32.3.3.(2)

<table>
<thead>
<tr>
<th>Number of Bedrooms in Dwelling Unit</th>
<th>Normal Operating Exhaust Capacity of Principal Ventilation Fan, L/s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>More than 5</td>
<td>System must comply with Clause 9.32.3.1.(1)(a)</td>
</tr>
</tbody>
</table>

Average as per 9.36.5.

(Minimum + Maximum) / 2

<table>
<thead>
<tr>
<th># bedrooms</th>
<th>Average CFM</th>
<th>L/S average</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>75</td>
<td>32</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>37.5</td>
</tr>
</tbody>
</table>
Performance path 9.36

-DHW (NG versus Electric).

Natural gas

For appliances less than 22 kW

\[ EF \geq 0.67 - 0.0005V \]

E.g.

50 US Gallons = 189.27 liters

\[ EF = 0.67 - (0.0005 * 189.27) = 0.575 \] (the min to be used) - use for reference.
Performance path 9.36

Calculations

-DHW (NG versus Electric).

Electric

CSA C191 & ABC

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>hot water set point</td>
<td>131</td>
</tr>
<tr>
<td>Entering water temperature</td>
<td>50.5</td>
</tr>
<tr>
<td>Hot water Use (US Gallons/day)</td>
<td>59.44</td>
</tr>
<tr>
<td>Ambient air temperature</td>
<td>70</td>
</tr>
</tbody>
</table>

ABC 2014

\[
\leq 12 \text{ kW (50 L to 270 L capacity)}
\]

\[
SL \leq (0.472V) - 38.5 \text{ (top inlet)}
\]

\[
SL \leq (0.472V) - 33.5 \text{ (bottom inlet)}
\]
Recommended documents:

E) Airtightness Details

- Which ACH was input in the proposed House? 2.5/3.2? **More attention is needed for 2.5 ACH**

- Windows (air barrier wall/air barrier window).
- Interior wall to ceiling.
- Exterior wall to ceiling.
- Poly Joints.
- Part walls (straight or offset ceiling).
- Rim Joist (foundation, upper wall)/Cantilevers.
- Bonus rooms.
- Exhaust Fan/ Pot lights/ Ceiling outlet/Attic Access
Performance path 9.36

Recommended documents:

E) Airtightness Details - examples;

Thanks to Darrell Paul - EA
Performance path 9.36

Pay attention to;

General

Temperature and set points (19/21/25 °C) 9.36.5.4
Service water load 225L/day 9.36.5.8.(6)
Service water delivery temperature 55 °C 9.36.5.8.(5).

Ventilation time; 480 min/day.
Furnace allowable rise; 5.5 °C.
HVAC notes;

**Ventilation Fans Power,**

**Proposed**

HRV; use HRV specification (9.36.5.11(14)).

**Reference**

Use \( W = (PVFR) \frac{L}{S} \times 2.32 \frac{W}{L/S} \)

**Circulation Fans Power**

Two Speed (Guide for Hot2000)

**ABC 2014 / CFP (High Speed)** = **Output Capacities** \( \times 0.0251 \frac{L/s}{W} \times 2.30 \frac{W}{L/s} \)

Add Auxiliary capacity : 208 W as per 9.36.5.15(16) to High speed Power- **Reference**

Add Actual Auxiliary power to **Proposed**.

**Low Speed** = \( \frac{1}{3} \times \text{[High Speed]} \)

Designed: Default values may be acceptable as long as they match in both Proposed and Reference.

This will **auto** calculate circulation fans Power.
HOT2000

Error in hot 2000
Different Calculated energy consumption
HOT2000 Windows area percentage

What Component does Impact the simulation in hot 2000?
Envelope.
HRV.
Airtightness.
High Efficient equipment/Appliances.
Rim Joists.
Solar Gain/Thermal Gain.
HOT2000

Calculators
Software Demonstration
Common Questions
For 9.36 and 9.36.5 (modelling)
HOT2000

**Windows FDWR**

Actual window/door size or RO opening?

Use the RO opening to account for less RSI value around windows/doors (gaps).

Also this will **add more to the FDWR** –making the model worse-more stringent.

**Match NRCan – 9.36 Hot 2000 Guide**

**ABC 2014**

8) **Joints** and junctions between walls and other building envelope **components** shall be insulated in a manner that provides an effective thermal resistance that is no less than the lower of the minimum values required for the respective adjoining components.
Exterior doors with glass inserts

RSI/U value from manufacturer (overall unit U-value) or model the door and add window(glass) in HOT2000?

Both may be accepted by the Local authorities, except that when using the manufacturer’s RSI/U value and enter it as a door, you ignore the SHGC, more stringent.

Attached Garage wall (to home) reported RSI is 2.83, although calculated RSI in drawings shows RSI 2.67.

**HOT2000** does add this value automatically based on:

9.36.2.4 (4)

4) Where a component of the building envelope is protected by an enclosed unconditioned space, such as a sun porch, enclosed veranda, vestibule or attached garage, the required effective thermal resistance of the building envelope component between the building and the unconditioned enclosure is permitted to be reduced by 0.16 (m²·K)/W.

![HOT2000 software interface](image)
Energy code Compliance section 9.36 -General

Frost walls RSI

The model/DWG shows modeled 2 x 4 R-20 nominal insulation, you visited a site for inspection you found 2x6 with R-20 when the model clearly states a worse value, the local authorities may accept a higher value.
**Thicker Material**

The model/DWG shows 3/8” OSB and site shows 7/16” or model shows ½” OSB while site shows 5/8” which means that the model is being modeled by thinner material, so worse than what on site?

When the model/DWG clearly states a worse value, the local authorities may accept a higher value.
Energy code Compliance section 9.36 - General

Attached Garage Exterior walls and ceiling RSI.

What are the RSI requirements for attached garage under section 9.36?

Garage walls studs needs to be filled with fiber glass insulation (e.g. R-12) according to the thickness of the studs (2x4, 2x6) or equivalent and Ceiling need to have a value of RSI 6.0 (R-34) or better.

Remember that this insulation is required for HIRF and not for energy efficiency.
Energy code Compliance
section 9.36 - General

What other options available to calculate RSI values?

Appendix A-9.36.2
Additional configurations and assembly types are listed in EnergyStar tables.

<table>
<thead>
<tr>
<th>Cavity Insulation Component (Nominal Thermal Resistance)</th>
<th>Framing Configuration¹ (on-centre spacing)</th>
<th>Effective Thermal Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>304 mm (12&quot;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>406 mm (16&quot;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>488 mm (19.2&quot;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>610 mm (24&quot;)</td>
<td></td>
</tr>
<tr>
<td>RSI 2.99 R 17</td>
<td>RSI</td>
<td></td>
</tr>
<tr>
<td>3.17 R 18</td>
<td>2.18</td>
<td>2.22</td>
</tr>
<tr>
<td></td>
<td>2.22</td>
<td>2.26</td>
</tr>
<tr>
<td>3.34 R 19</td>
<td>2.25</td>
<td>2.29</td>
</tr>
<tr>
<td></td>
<td>2.29</td>
<td>2.33</td>
</tr>
<tr>
<td>3.52 R 20</td>
<td>2.32</td>
<td>2.36</td>
</tr>
<tr>
<td></td>
<td>2.36</td>
<td>2.41</td>
</tr>
<tr>
<td></td>
<td>2.38</td>
<td>2.43</td>
</tr>
<tr>
<td></td>
<td>2.43</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.53</td>
</tr>
</tbody>
</table>

¹Walls Above Grade - Lumber Studs
²Walls Above and Not in Contact with Ground

Stud dimensional lumber - 38 mm x 140 mm (2"x6") with RSI=1.19 m²K/W

Table WA-2
Energy code Compliance section 9.36 -General

Can interior finishing be included in RSI calculations? (NRCan)

Carpet, tiles, GB, any interior finish may be included in RSI calculations, except if a conditioned space exists behind the interior finish (rare).
Energy code Compliance
section 9.36.5 (Modeling)

Continuous Insulation in Modelling

Illustrated Guide quote

9.36.2.5. Continuity of Insulation
“The reason for requiring continuous insulation across entire assemblies is to ensure that the required assemblies in NBC Articles 9.36.2.6, and 9.36.2.8, perform consistently. As well, the requirements reflect assumptions made when considering the whole house energy performance in the performance path.”
Energy code Compliance section (9.36)/(9.36.5)

Electric Furnaces

**Prescriptive:**
Electric furnaces are very efficient and meet the intent of the functional statements and objectives (table 9.36.3.10).

**Illustrated Guide:**
Where the table does not have the type of equipment used in the proposed house design, the default for the reference house is set as a 92% gas warm-air furnace.
HOT2000

Framing Percentage

Three options:

- **Actual** % area of framing if known (Manual input-user defined).
  - Commonly required for tall walls (P.Eng)
- Framing Percentage listed in **table A-9.36.2.4.(1)**
  - Commonly requested by Local authorities (more stringent)
- **Hot 2000 assembly/RSI builder** (automatically).
  - ERS/NRCan.
Energy code Compliance section 9.36 - General

Tall wall RSI calculations?

Appendix note 1 Table 9.36.2.4 (1)
If the actual % areas of framing and cavity are known, those should be used rather than the ones in this Table.

8” on center wall
Double top plate
Single bottom plate
3 row of blocking

Calculations:
12’ x 19’ = 228 Sq.Ft
Framing 50.9 sq.ft
Solid 22 %, Cavity 78%
### Energy code Compliance section (9.36)/(9.36.5)

#### Framing Percentage

Example of 12 feet **solid wall** (no openings):

<table>
<thead>
<tr>
<th>Stud Spacing</th>
<th>Appendix ABC₁⁴</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Framing</td>
<td>Cavity</td>
</tr>
<tr>
<td>406 mm- 16''</td>
<td>23</td>
<td>77</td>
</tr>
<tr>
<td>610 mm- 24''</td>
<td>20</td>
<td>80</td>
</tr>
</tbody>
</table>

E.g. Kitchen walls transition from 24'' to 16''

If the actual % areas of framing and cavity are known, those should be used rather than the ones in this Table.
**Energy code Compliance section (9.36)/(9.36.5)**

**Spray Foam Insulation**

**ITR versus LTTR**
- **ITR**: Initial Thermal Resistance.
- **LTTR**: Long Term thermal Resistance (180 days/ ULC-S770 closed cell)

**ABC 2014/ A9.36.2.4.(1)D**

This LTTR value shall be input as the design thermal resistance value for the purpose of energy Calculations in Section 9.36

---

**Properties of Cured Foam**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Test Method</th>
<th>Value Metric (Imperial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Density</td>
<td>ASTM D 1622</td>
<td>38.2 kg/m³ (2.4 lb/ft³)</td>
</tr>
<tr>
<td>Initial Thermal Resistance at 50 mm</td>
<td>ASTM C 518</td>
<td>2.4 (m²·K)/W (R14 at 2&quot;)</td>
</tr>
<tr>
<td>Colour</td>
<td>Platinum</td>
<td></td>
</tr>
<tr>
<td>Long Term Thermal Resistance at 50 mm</td>
<td></td>
<td>2.02 (m²·K)/W (R12 at 2&quot;)</td>
</tr>
<tr>
<td>Long Term Thermal Resistance at 25 mm</td>
<td></td>
<td>1.0 (m²·K)/W (R8 at 1&quot;)</td>
</tr>
<tr>
<td>Long Term Thermal Resistance at 75 mm</td>
<td></td>
<td>3.1 (m²·K)/W (R18 at 3&quot;)</td>
</tr>
<tr>
<td>Conditioned Thermal Resistance at 50 mm</td>
<td>ASTM C 518</td>
<td>2.3 (m²·K)/W (R13 at 2&quot;)</td>
</tr>
<tr>
<td>Air Permeance at 35 mm</td>
<td>ASTM E 2178</td>
<td>0.0005 L/s·m²</td>
</tr>
</tbody>
</table>
Basement wall shows (in the report) RSI 3.34 in the reference home, while ABC 2014 calls for RSI 3.46. The report only shows the interior walls insulation, it doesn't show the foundation wall RSI value.
Energy Efficiency compliance documentation for modular housing?

- **ABC 2014** requires factory-constructed building to be certified in accordance with **CSA A277**.
- Manufacturer of a factory constructed building is subject to quality assurance program (certification agency).
- It is unnecessary for the manufacturer to meet the same energy efficiency documentation as site-constructed builders.
- **BA Letter to modular Housing association.**
Thank you

Questions
E-mail: Safety.services@gov.ab.ca
Phone: 1.866.421.6929