Energy efficiency in housing and small buildings—performance path
### Section 9.36.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Compliance Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Part 9 - Prescriptive</td>
</tr>
<tr>
<td>- Houses, houses with secondary suites</td>
<td>X</td>
</tr>
<tr>
<td>- Buildings containing only dwelling units and common spaces ≤ 20% floor area</td>
<td></td>
</tr>
<tr>
<td>- <strong>Residential buildings</strong></td>
<td></td>
</tr>
<tr>
<td>- <strong>Mixed-use buildings</strong>, where all non-residential portions (except F2)</td>
<td></td>
</tr>
<tr>
<td>have a floor area ≤ 300 m²</td>
<td></td>
</tr>
<tr>
<td>- <strong>Non-residential buildings</strong> (except F2) having a floor area ≤ 300m²</td>
<td>X</td>
</tr>
<tr>
<td>- Any building where non-residential occupancies have a floor area &gt; 300m²</td>
<td></td>
</tr>
<tr>
<td>- Buildings containing F2 occupancies (any size)</td>
<td></td>
</tr>
</tbody>
</table>
Subsection structure

• General
  • 9.36.5.1. Scope and application
  • 9.36.5.2. Definitions
  • 9.36.5.3. Compliance

• Calculation
  • 9.36.5.4. Calculation methods
  • 9.36.5.5. Climatic data
  • 9.36.5.6. Building envelope calculations
  • 9.36.5.7. HVAC system calculations
  • 9.36.5.8. Service water heating system calculations
Subsection structure

• Proposed house
  • 9.36.5.9. General requirements for modeling
  • 9.36.5.10. Modeling building envelope
  • 9.36.5.11. Modeling HVAC
  • 9.36.5.12. Modeling service water heating

• Reference house
  • 9.36.5.13. General requirements for modeling
  • 9.36.5.14. Modeling building envelope
  • 6.36.5.15. Modeling HVAC
  • 9.36.5.16. Modeling Service Water Heating
Recall – Prescriptive approach

- Building envelope
- HVAC & service water heating
- No trade-off across building envelope and HVAC
Performance path concept

• Reference house modeled as proposed house using prescriptive path values (+ assumptions)

\[\text{= X is the benchmark}\]
Performance path concept

- Reference house modeled as proposed house using prescriptive path values (+ assumptions)
- Proposed house modeled against reference result
- If proposed house uses ≤ energy = OK
Application

- Houses
- Houses with secondary suites
- Buildings containing only dwelling units and common spaces ≤ 20% floor area

- Cannot be applied to non-residential occupancies or buildings
Calculations–general

• Provide
  • Guidance for calculation method (what included)
  • Temperature set-points
  • User-dependent load assumptions and exclusions

• Used for both proposed and reference houses

• Calculation method tested to ASHRAE 140, “Evaluation of Building Energy Analysis Computer Programs”
Software

• No specific software/calculation tool

• ERS and its software (HOT2000) is one tool
  • Addresses other issues (fuel source including renewables, plug loads)
Components addressed

- R-values of walls/floor/attic
- U-value windows and FWDR
- Solar heat gain
- Ventilation rate
- Heating and Service water equipment efficiency
- Airtightness
- Orientation

Non HRV values

Even window distribution of archetype house

Set according to # of bedrooms (9.32)
# Prescriptive, reference and proposed house

<table>
<thead>
<tr>
<th></th>
<th>Prescriptive</th>
<th>Performance Reference House</th>
<th>Performance Proposed House</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDWR</td>
<td>Variable</td>
<td>17%-22%</td>
<td>Actual</td>
</tr>
<tr>
<td>R-Values Walls/floor/attic</td>
<td>Variable – depending on use of heat recovery ventilator</td>
<td>Fixed - no heat recovery ventilator</td>
<td>Actual</td>
</tr>
<tr>
<td>U-values Windows</td>
<td>Variable - ER ratings permitted</td>
<td>Fixed</td>
<td>Actual</td>
</tr>
<tr>
<td>Solar Heat Gain Coefficient</td>
<td>Not defined</td>
<td>Fixed (U value route, SHGC)</td>
<td>Actual (if SHGC not available – use same as reference house)</td>
</tr>
<tr>
<td>Orientation</td>
<td>Not defined</td>
<td>Neutral (even distribution)</td>
<td>Actual</td>
</tr>
<tr>
<td>Airtightness Criteria</td>
<td>Not defined; prescriptive details</td>
<td>Fixed (2.5 air changes/hr (ACH))</td>
<td>3.2 ACH, 2.5 ACH (with details), or as tested</td>
</tr>
<tr>
<td>Ventilation rate</td>
<td>Fixed (9.32)</td>
<td>Fixed - Minimum rate by bedroom</td>
<td>Actual - at least minimum rate by bedroom</td>
</tr>
<tr>
<td>Ventilation volume</td>
<td>Not defined</td>
<td>8 hrs operated 365 days</td>
<td>8 hrs operated 365 days</td>
</tr>
<tr>
<td>Heating efficiency</td>
<td>Fixed</td>
<td>Fixed (based on fuel/appliance type)</td>
<td>Actual</td>
</tr>
<tr>
<td>Service Hot Water</td>
<td>Fixed</td>
<td>Fixed (based on fuel type)</td>
<td>Actual</td>
</tr>
</tbody>
</table>
Fenestration and door to wall ratio

<table>
<thead>
<tr>
<th>Proposed house</th>
<th>Reference house</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 17%</td>
<td>17%</td>
</tr>
<tr>
<td>&gt; 22%</td>
<td>22%</td>
</tr>
<tr>
<td>Between 17 to 22%</td>
<td>Same as proposed</td>
</tr>
</tbody>
</table>

Graph showing fenestration and door to wall ratio comparison between a proposed house and a reference house.
Airtightness

- Reference 2.5 air changes/hour (ACH)
- Proposed house:
  - 3.2 ACH if built for non-energy objectives
  - 2.5 ACH if
    - built to above + higher performance, or
  - as tested

Yes, whole building air leakage test results can be used!
Proposed house

- Orientation of actual house can differ 22.5° from design
- Heat recovery limited to sensible heat
- Drain-water heat recovery permitted
Reference house

• HVAC and service water heating
  • Same equipment type and fuel as proposed house

• If proposed equipment not listed
  • HVAC: gas warm-air furnace at 92% AFUE
  • Service water heating: gas storage type
Summary

• All paths apply to houses and most MURBs

• Prescriptive path:
  • All residential buildings in Part 9 and some small non-residential bldgs.

• Performance:
  • Aligned with HOT2000 to avoid duplication with incentive programs
  • Blower door testing option for houses
Get involved with your codes!

www.nrc-cnrc.gc.ca/eng/solutions/advisory/codes_centre

Volunteer or observe on a committee  /volunteer.html

Request code changes  /code_change_request.html

Comment on proposed changes (public review)

Respond to information requests

Support research priorities
Canadian Codes Centre

Today's construction technologies and techniques differ vastly from those in use at the time the first National Building Code (NBC) was produced in 1941. To keep pace with changes, and ensure that the latest innovations and applications are applied safely in the construction industry, a new edition of the NBC is published approximately every five years.

NRC's Canadian Codes Centre (CCC) plays a vital role in this process by providing technical and administrative support to the Canadian Commission on Building and Fire Codes (CCBFC) and its related committees, which are responsible for the development of Canada's National Model Construction Codes. These codes are the following:

- National Building Code of Canada 2015
- National Fire Code of Canada 2015
- National Plumbing Code of Canada 2015
- Quebec Construction Code, Chapter I Building, and National Building Code of Canada 2010 (amended)
- National Energy Code of Canada for Buildings 2011 (NECB)
- National Building Code of Canada 2010 (NBC)
- National Fire Code of Canada 2010 (NFC)
Thank you!