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Energy efficiency in housing and small buildings: heating, ventilating and air-conditioning and service water heating Mihailovic, Mihailo

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NRC Canadian Codes Centre

Energy Efficiency in Housing and Small Buildings

Heating, Ventilating and Air- Conditioning and Service Water Heating

Mihailo Mihailovic

March 2013



National Research
Council Canada

Conseil national
de recherches Canada

Canada

Introduction

- Presentation is part of a series of four
- Model code developed by Canadian Commission on Building and Fire Codes
- National Building Code of Canada 2010 (NBC) must be adopted by provincial/territorial authorities to become law

Outline

- Heating, Ventilating and Air-conditioning (HVAC) requirements
 - Subsection structure
 - Equipment efficiency
 - Ducts and pipes
 - Heat recovery from air over interior pools
- Service Water Heating requirements
 - Subsection structure
 - Equipment efficiency
 - Pipe insulation
 - Controls
- Solar

HVAC – subsection structure

- 9.36.3. HVAC Requirements
 - 9.36.3.1. Scope and Application
 - 9.36.3.2. Equipment and Ducts
 - 9.36.3.3. Air Intake and Outlet Dampers
 - 9.36.3.4. Piping for Heating and Cooling Systems
 - 9.36.3.5. Equipment for Heating and Air-conditioning Systems
 - 9.36.3.6. Temperature Controls
 - 9.36.3.7. Humidification
 - 9.36.3.8. Heat Recovery from Dehumidification in Spaces with an Indoor Swimming Pool or Tub
 - 9.36.3.9. Heat Recovery from Ventilation Systems
 - 9.36.3.10. Equipment Efficiency
 - 9.36.3.11. Solar Thermal Systems

HVAC – equipment efficiency

- List of equipment developed based on:
 - Model National Energy Code of Canada for Houses 1997
 - National Energy Code of Canada for Buildings 2011
 - Additional equipment (identified in committee meetings)
- Performance based on validation requirements, market analysis and industry practice
- Minimum equipment efficiencies
 - Standards and performance referenced for other technology
 - Requirements for air-conditioners, where installed
- *Energy Efficiency Regulations* absolute floor for performance

HVAC – equipment efficiency

- 9.36.3.10. Equipment Efficiency Table

Table 9.36.3.10.
HVAC Equipment Performance Requirements
 Forming Part of Sentences 9.36.3.9.(2) and 9.36.3.10.(1)

Air-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated			
Component or Equipment	Heating or Cooling Capacity, kW	Standard	Minimum Performance ⁽¹⁾
Split system	≤ 19	CAN/CSA-C656	SEER = 14.5 EER = 11.5 HSPF = 7.1 (region 5 in standard)
Single-package system	≤ 19	CAN/CSA-C656 (including General Instruction No. 2)	SEER = 14 EER = 11 HSPF = 7.0 (region 5 in standard)
All systems	> 19	CAN/CSA-C746	See Level 2 in standard
Water-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated			
Component or Equipment	Heating or Cooling Capacity, kW	Standard	Minimum Performance ⁽¹⁾
Ground-source and water-source heat pumps	< 40	CAN/CSA-C13256-1	
open loop			COP _c ≥ 4.75, COP _h ≥ 3.6
closed loop			COP _c ≥ 3.93, COP _h ≥ 3.1
Water-to-water heat pumps			

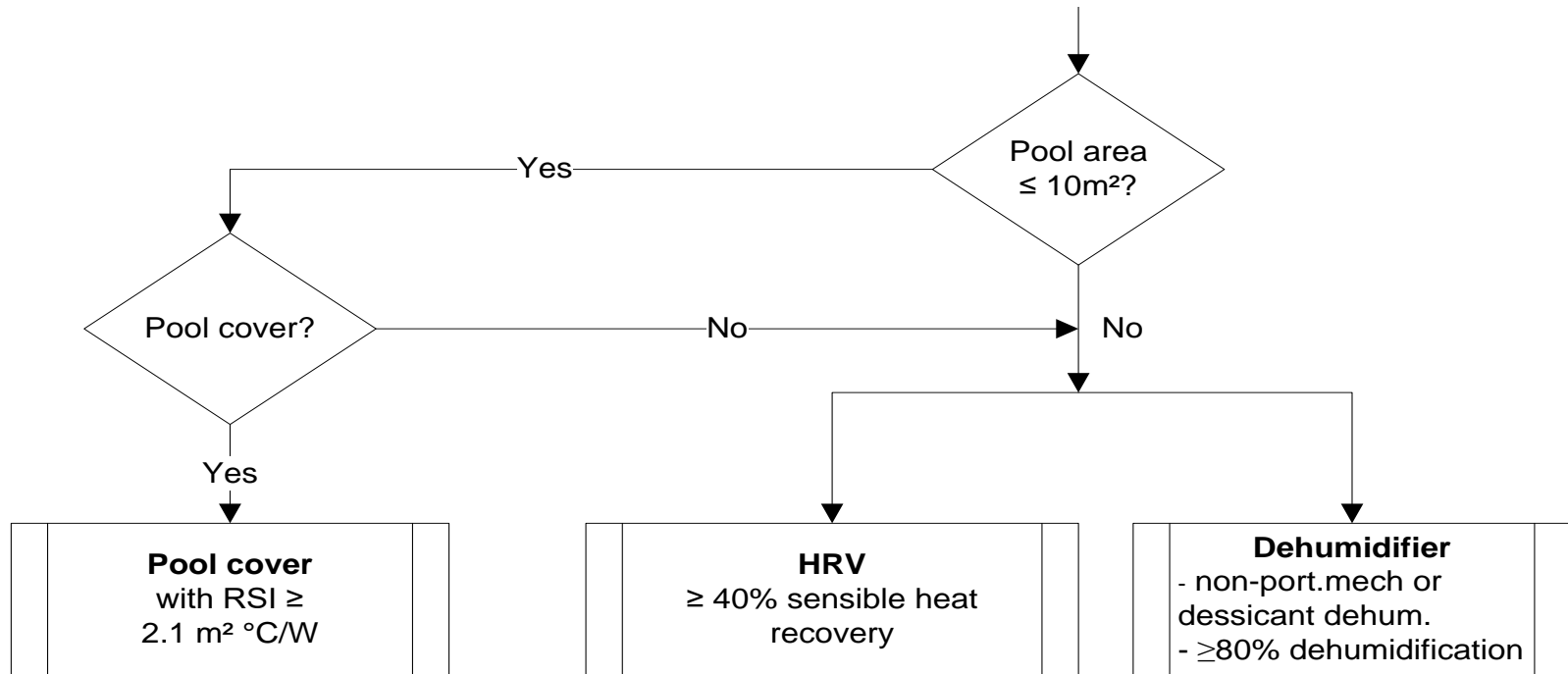
HVAC – ducts and pipes

- Prescriptive HVAC requirements
 - Proper sizing of system and ducts with Sections 9.32 and 9.33
 - Outside ducts and piping insulated to above-grade wall RSI value
 - Heat recovery ventilators (HRV) not required, but
 - Where installed, minimum sensible heat recovery efficiency required
 - 60% in mild locations (when tested at 0°C)
 - 55% in cold locations (when tested at 0°C and -25°C)
 - Dampers required (some exemptions), thermostats
 - Controls to prevent simultaneous heating and cooling
 - Specific heat pump controls for supplementary heating
 - Piping installed as per Section 9.33.8.

HVAC – ducts and pipes

- Duct insulation solution
 - Addresses construction types having low profiles
 - Insulated duct installed under floor over shallow foundation
 - Due to transportation limitations
 - Increase side insulation to compensate for bottom insulation
 - Performance expected to be close to equal

HVAC – heat recovery from air over interior pools



HVAC – gas and propane fireplaces/stoves

- Performance requirements currently not listed
- Testing standard being updated
- Applies to decorative appliances
- Code lists prescriptive requirements
 - Direct-vented
 - No standing pilot lights
- To be revisited when standard available

Service water heating – subsection structure

- 9.36.4. Service Water Heating Systems
 - 9.36.4.1. Scope and Application
 - 9.36.4.2. Equipment Efficiency
 - 9.36.4.3. Solar Domestic Hot Water Systems
 - 9.36.4.4. Piping
 - 9.36.4.5. Controls
 - 9.36.4.6. Indoor Swimming Pool Equipment Controls

Service water heating – equipment efficiency

- Minimum equipment efficiencies
 - Electric, gas, oil
 - Tankless/storage tank type
 - Pool heaters included
 - Combo systems (water and heating)
- Storage tanks need to be insulated

Service water heating – pipe insulation and controls

- Insulate outlet and inlet piping within two meters of storage or heating vessel
- Pipe insulation for
 - Piping located outside or in unconditioned spaces
 - Recirculation piping: 12 mm diameter insulation
- Controls for
 - Storage tank temperature
 - Pool heater shut down

Solar thermal technology

- Applies to HVAC and service water heating
 - Solar space heating technology
 - Solar water heating technology
- Requirement (separate Article)
 - Conform to manufacturer's design and installation procedures, or
 - Installation according to National Plumbing Code of Canada 2010
 - Exception: all storage tanks must be installed in conditioned space
- Related standards not listed under equipment efficiency



Questions?

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Thank you



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