R-2000 HOME PROGRAM TECHNICAL REQUIREMENTS

(Effective January, 1996) - changed in 1999
(Including Revisions for Hot2000 V7)

1. PURPOSE

1.1 The R-2000 Home Program Technical Requirements provide the basis for the design and construction of new residential buildings which will be more efficient in the use of energy, improve the level of indoor air quality and address the environmental responsibility aspects of house construction and operation. This can be done through the use of such features as higher envelope insulation, air tightness, orientation, heating, cooling and ventilation as well as the selection of materials and components for use in the home.

1.2 The Requirements are intended to allow flexibility in the selection of thermal resistance values, lighting equipment, appliances (when they are supplied by the builder), cooling, ventilation and heat recovery equipment, and heating equipment for both space and domestic hot water to meet a total home annual energy consumption target for a particular location.

1.3 The Ventilation Systems and Equipment along with the Indoor Air Quality sections of these Technical Requirements are intended to ensure acceptable levels of air quality, adequate venting of combustion products, and control of indoor humidity levels for safety and health.

1.4 The Requirements provide a method by which achievement of the annual energy target can be assessed at the design stage through the evaluation of plans and specifications.

1.5 The Environmental Requirements and Indoor Air Quality Requirements are intended to allow flexibility in the selection of products and components used in the building to promote improved levels of indoor air quality and so the building has a reduced impact on the environment during the construction process and while in operation.

2. SCOPE

2.1 These Requirements apply to ground related low rise housing as per Part 9 of the *National Building Code of Canada* ("N.B.C.") (except as noted in 2.5) to be constructed under the R-2000 Home Program by Registered Builders.

2.2 All houses constructed to these Requirements must comply with local and provincial code(s) or in the absence of such code(s) legislation, to the requirements of the current edition of the *National Building Code of Canada*.

2.3 These requirements are in addition to the requirements of local, provincial or National Building Codes and Standards.

2.4 Recognizing that the R-2000 Home Program is designed to encourage innovation and creativity, these R-2000 Technical Requirements may be amended if changes are identified in advance and agreed to by Canadian Home Builders' Association ("CHBA") and Natural Resources Canada ("NRCan").

2.5 The minimum standard of performance for a multiple unit building with common heated areas, ventilation system or heating system will be agreed upon (between CHBA, NRCan and the Builder) prior to construction.

2.6 CHBA has the responsibility for ensuring equivalency and the authority to accept equivalent methods.

3. MINIMUM ENVELOPE REQUIREMENTS

3.1 In order to maintain thermal comfort, and prevent condensation problems, insulation levels shall not be less than the following nominal values;

Degree Day Zone	Exterior Above Grade Walls		Exterior Below Grade Walls		Insulated Ceiling and Attics	
	RSI	R	RSI	R	RSI	R
Up to 3500	2.8	16	1.8	10	4.7	27
3501 - 6000	3.6	20	1.8	10	5.6	32
6001 - 8000	4.2	24	2.8	16	6.4	36
8001 and over	4.7	27	3.6	20	7.1	40

3.2 Windows shall be at least double glazed with a minimum air space thickness of 12.5mm (0.5 inch) between panes. Metal window frames must be thermally broken except in warm areas where the January 2 1/2% Design Temperature is not less than -12 degrees Celsius.

3.3 Either the Normalized Leakage Area (NLA) of the building envelope shall be no greater than 0.7 cm^2/m^2 (1 sq in/100 ft^2) area of the building envelope or the air change rate at 50 Pa shall be no greater than 1.5 ACH. Either shall be determined according to CAN/CGSB2-149.10-M86 "Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method" or by equivalent methods as approved by CHBA. Additional stipulations on test procedure in 3.4 and 3.5 will supersede these Requirements.

3.4 A dwelling unit shall be tested individually without fan depressurization of any adjacent heated space. Envelope area will include that of building components separating a dwelling unit from other dwelling units, heated space and/or the outdoors.

3.5 Wood stoves and fireplace flues may be sealed for the airtightness test. Temporary sealing of sumps during air tightness tests is not allowed.

4. VENTILATION SYSTEMS AND EQUIPMENT

4.1 Mechanical ventilation systems shall be designed by an HRAI registered Ventilation Installer or Ventilation Designer. Mechanical ventilation systems shall be installed by an HRAI registered Ventilation Installer in accordance with CAN/CSA-F326-M91, Residential Mechanical Ventilation Systems.

4.2 Heat Recovery Ventilators (HRV) permitted for use shall be certified by the Home Ventilating Institute (HVI).

5. COMBUSTION EQUIPMENT

5.1 All gas, propane, and oil-fired space and water heating equipment shall have direct vent (sealed) or induced or forced draft venting systems. Induced draft or forced draft vented systems shall be capable of positive shut-down in the case of venting failure.

5.1.1 The following mechanically vented induced draft (power vented) gas and propane appliances will not be subject to a pressure decrease limit in accordance with CSA F326:

- furnaces without standing pilot lights
- domestic hot water heaters without standing pilot lights
- clothes driers without standing pilot lights, and
- fireplaces with non-openable doors and without standing pilot lights.

5.2 All wood burning appliances including, fireplaces, woodstoves and pellet stoves must be certified as meeting the requirements of either:

1) CSA B415.1-M92 Performance Testing of Stoves, Inserts and Low to Medium Burn Rate Factory Built Fireplaces, or

2) The United States Environmental Protection Agency (EPA) wood burning appliance standards (1990), CFR Part 60.

5.3 Gas and propane fireplaces must be either:

1) Direct-vent (sealed); either top-, or rear-vented
2) Power-venting.

5.4 Fireplaces and chimneys on exterior walls shall be constructed to maintain continuity of the house air barrier and shall be insulated with non-combustible insulation. Air cooled chimneys are not permitted.

5.5 Where ducts that supply combustion air to combustion appliances pass through conditioned space they must be insulated with a minimum of RSI 0.4 (R-2) and have a vapour barrier to avoid condensation on the duct.

5.6 No unvented combustion appliance shall be installed unless specific provision is made to exhaust the products of combustion to the outside.

5.7 Electric domestic water heaters shall either have factory-installed insulation with a minimum RSI of 1.8 (R-10) or have a standby loss of 80 watts or less for a 270 L (60 gal.) tank measured in accordance with CSA C191 Series M1983.

5.8 Gas-fired domestic water heaters shall have a standby loss of 3.5% or less measured in accordance with CGA CAN-4.1-77 Gas Fired Automatic Storage Type Water Heaters with Inputs Less than 75000 BTU.

6. ENERGY PERFORMANCE TARGETS

6.1 The annual energy consumption target for an R-2000 Home is determined from the following equation:

Annual Energy Target: $Q_s + Q_w$

where :
Q_s = space heating energy consumption target
Q_w = domestic hot water energy consumption target

6.1.1 The annual space heating energy consumption target is calculated using the equation:

$$Q_s = S*(60*DD/6000)*(35 + V/2.5)$$

where :

S = 4.5 megajoules (MJ) for fuel-fired space heating systems
S = 1.0 kilowatt hours (kWh) or 3.6 megajoules (MJ) for electric space heating systems.

DD = Celsius heating degree days for the locality.

V = Interior heated volume, including basement, in cubic metres.

6.1.2 The annual domestic hot water heating energy consumption target is calculated using the equation:

$Q_w = 4745*W * (55-T_w)/(55-9.5)$
where:
T_w = local water mains temperature
W = 1.72 kilowatt hours (kWh) or 6.19 megajoules (MJ) for fuel-fired DHW systems
W = 1.075 kilowatt hours (kWh) or 3.87 megajoules (MJ) for electric DHW systems.

6.1.3 Reserved for future inclusion of the annual space cooling energy target.

6.1.4 Reserved for future inclusion of the annual lighting energy target.

6.1.5 Reserved for future inclusion of the annual appliance energy target.

6.2 The current authorized version of the HOT-2000 computer analysis program is used as the basis for determining compliance with the annual energy target. All HOT-2000 computer analysis are to be done in accordance with "HOT-2000 Design Approval Procedures and Guidelines".

7. LIGHTS AND APPLIANCES

7.1 Builders including appliances with the sale of a home shall offer the home owner the option of selection of appliances in the upper 33% of the Energuide rating for that appliance category.

7.2 An energy credit will be allowed for builder installed, high efficiency lamps (40 lumens/watt minimum). The credit will be given for each lamp, up to a total of 4, installed in any combination of the following rooms: bathrooms, bedrooms, hallways, kitchen, utility room, or other finished rooms.

7.3 An energy credit will be allowed for direct ducted ventilation system and/or electronically commutated motors (ECM) used for the furnace fan.

8. INDOOR AIR QUALITY

8.1 At least two of the following options, which refer to materials used only inside the air barrier or air/vapour barrier, shall be selected.

If all of the options are selected, then the house can be assumed to operate at 75% of the CSA F326 ventilation capacity for design evaluations under clause 6.2:

i) Carpeting; carpeting (except as noted) shall be labelled under the Canadian Carpet Institute’s Green Label Program and shall cover no more than 50% of the interior floor area. The interior floor area includes the basement floor area. The following floor coverings are exempt: wool or cotton area rugs, and carpeting that has latex-free backing. These (exempt) floor coverings shall not be glued to the floor and cannot have underpads.

ii) Air filtration; a medium efficiency air filter with a minimum 10% ASHRAE average dust spot efficiency shall be installed where air circulating heating, cooling or heat recovery ventilation systems are used.

iii) Paints and Varnishes; all liquid coatings used indoors except on wood floors, are to be water based, interior

type or meet or exceed Environment Canada Environmental Choice standards. Prefinished items are allowed.

iv) Flooring Adhesives; all finish flooring adhesives to be either water dispersion, low toxicity formulations or pre-adhesive types.

v) Kitchen cabinets and bathroom vanities; cabinets and vanities shall be solid wood or if made from manufactured wood products shall be made from formaldehyde-free fibre board; or particleboard meeting the E-1 European standard of the HUD Standard, 24 CFR Part 3280.308; or have all exposed surfaces sealed with an Environmental Choice approved sealer or a low toxicity sealer.

vi) Wood flooring; all liquid coatings used on wood flooring shall meet or exceed Environment Canada Environmental Choice standards (for paints) or be prefinished.

vii) Vinyl flooring; all vinyl flooring shall be either linoleum or synthetic vinyl tile. Sheet vinyl flooring shall not be used.

viii) Particleboard Underlayment; all particleboard flooring underlayment shall meet the E-1 European standard or the ANSI A208.1-1993 Table B standard; or have all surfaces sealed with an Environmental Choice approved sealer or a low toxicity sealer; or be prefinished.

9. ENVIRONMENTAL FEATURES/ECO-MANAGEMENT

9.1 Water Conservation

Where the following fixtures are installed, they shall meet the following criteria:

toilets:	water saver or ultra-low flush units; 13.25 litres/flush or less
showers:	low flow shower heads; 9.8 litres/min (2.15 imp. GPM) or less when tested at (80 psi) 550.8 kPa.
faucets:	lavatory and kitchen faucets 8.3 litres/min (1.84 imp. GPM) or less when tested at(60 psi) 413.1 kPa.

9.2 Materials Conservation

The dwelling unit shall incorporate a minimum of one of the following materials conservation features. The product must be

present in the entire application for which it is used.

Insulation:

(As a minimum use entirely in either the attic, the main walls or in the basement walls.)

#1 Fibre Glass Insulation
- meets or exceeds the requirements of the Environmental Choice Program for raw material from recycled glass

#2 Cellulose Insulation
- product is manufactured from 100% recycled paper

#3 Mineral Fibre Insulation
- a minimum of 50% of the raw material is recycled

#4 Insulation Made from Plastic
- meets or exceeds the requirements of the Environmental Choice Program for ozone layer impact, global warming impact and recycled content

Roofing:

(Use over the entire roof.)

#5 Roofing System
- system contains compatible recycled materials (eg. metal, paper, wood fibres, plastic or rubber)

Sheathing/Drywall:

(Material conservation product must replace equivalent ¨conventional¨ product throughout the house.)

#6 Fibreboard
- product is made from recycled newsprint and/or wood fibres

#7 Siding
- manufactured from factory and sawmill waste

#8 Drywall
- product contains recycled gypsum and/or newsprint

Interior:

(Must replace equivalent ¨conventional¨ product for entire

floor.)

#9 Steel Studs
- a minimum of 23% of the raw material is recycled steel

#10 Studs and trims
- manufactured from sawmill cut-offs and waste
- urea-formaldehyde free

Exterior:

(Must replace equivalent ¨conventional¨ backfill in its entirety.)

#11 Foundation and/or under slab drainage
- mixture of post consumer glass and crushed rock or stone