



## Information Bulletin

### Building and Safety Standards Branch

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### **HVAC and Service Hot Water Equipment Efficiency Requirements: Relating the BC Building Code and the Energy Efficiency Standards Regulation**

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Minimum efficiencies for equipment installed in housing and small buildings (Part 9) are now listed in Section 9.36 of the BC Building Code (BCBC) for various types of equipment (see Appendix). These requirements were adopted in April 2013 and became effective for projects applying for building permits after December 19, 2014. Buildings for which permits were applied for prior to this date are not required to comply with Section 9.36. As significant overlap exists with BC's Energy Efficiency Standards Regulation (EESR), manufacturers and other stakeholders within the supply chain should pay special attention to the products listed in the tables below. In cases where the EESR and the BCBC do not align the question arises: which requirements are to be followed? In short, the more stringent requirement should be used. Work is currently underway to harmonize these standards where appropriate.

#### **What is the difference between the EESR and the BCBC?**

The EESR: point of sale. Under the BC *Energy Efficiency Act*, the EESR sets out minimum energy performance standards for energy-using equipment and building components that are manufactured, offered for sale, leased, or otherwise disposed of in BC. In other words, regulated products that fall below the performance level listed are no longer allowed to be sold in the Province. The only exception is for products that were manufactured before the effective date of that regulation.

The BCBC: point of installation. Minimum energy performance standards set out in the BCBC are only applicable to installations in buildings that fall within the scope of the Code. It is the responsibility of the building owner to ensure that any work within the scope of the BCBC complies with the applicable requirements. Just because a product is available for sale and complies with the EESR does not mean that product automatically complies with the BCBC.

#### **Where standards differ, which applies?**

Technically, both the EESR and the BC Building Code apply at all times, even when they have different requirements. Since manufacturers and retailers of regulated products need to comply with the EESR, and building owners having regulated products installed need to comply with the BCBC, under no circumstances do differing standards in the EESR and BCBC result in a lower standard being applied.

Work is currently underway to harmonize these standards where appropriate, however it is important to ensure that both the EESR and the BC Building Code requirements have been satisfied when equipment is manufactured, offered for sale, and installed in a building.

In the case where standards set out in the EESR are equal to or more stringent than those in the BC Building Code, builders will generally only be able to buy equipment that meets the requirements of the BCBC. Some lower-efficiency products manufactured before the effective date set out in the EESR may be available for sale and it is the responsibility of the building owner to ensure that installing these products is compliant with the BCBC.

Space heating and water heating equipment for which EESR standards are equal to or more stringent than BCBC standards are listed in Table 1 below.

**Table 1: Products where EESR Standards match or exceed BCBC Standards**

| Product  | EESR Requirement <sup>1</sup>   | EESR Effective Date | BCBC Requirement                        |
|--|---|---------------------|---|
| <b>Electric water heaters, top-inlet, 50-270 litres (11-59 imp gal)</b>    | SL ≤ 25 + 0.20V<br>using CAN/CSA-191-04<br>& heat trap required at inlet and outlet & pipe insulation required    | Sept 1, 2010        | Same as EESR                            |
| <b>Electric water heaters, top-inlet, 271-454 litres (60-100 imp gal)</b>  | SL ≤ 0.472V – 48.5<br>using CAN/CSA-191-04<br>& heat trap required at inlet and outlet & pipe insulation required | Sept 1, 2010        | SL ≤ 0.472V – 38.5<br>using CAN/CSA-191 |
| <b>Electric water heaters, bottom-inlet, 50-270 litres (11-59 imp gal)</b> | SL ≤ 40 + 0.20V<br>using CAN/CSA-191-04<br>& heat trap required at outlet & pipe insulation required              | Sept 1, 2010        | Same as EESR                            |

|   |   |              |   |
|---|---|--------------|---|
| <b>Electric water heaters, bottom-inlet, 271-454 litres (60-100 imp gal)</b>                                  | SL ≤ 0.472V – 33.5<br>using CAN/CSA-191-04<br>& heat trap required at outlet & pipe insulation required | Sept 1, 2010 | Same as EESR  |
| <b>Gas or propane storage-type water heaters, 76-380 litres (20-100 US gal), input ≤75,000 BTU/hr (22 kW)</b> | EF ≥ 0.70-0.0005V<br>using CAN/CSA-P.3-04   | Sept 1, 2010 | EF ≥ 0.67-0.0005V<br>using CAN/CSA-P.3 & pipe insulation required |

In the case where standards set out in the EESR are less stringent than those in the BCBC, builders must be more vigilant to ensure that installed products are compliant with the Code.

Space heating and water heating products for which recent<sup>ii</sup> EESR standards are less stringent than BCBC standards are listed in Table 2 below.

**Table 2: Products where BCBC Standards exceed recent EESR Standards**

| <b>Product</b>   | <b>EESR Requirement<sup>iii</sup></b>   | <b>EESR Effective Date</b> | <b>BCBC Requirement</b>   |
|--|---|----------------------------|---|
| <b>Gas-fired warm-air furnaces, input ≤ 220,000 BTU/h (≤ 66 kW)</b>                      | AFUE ≥ 90% <sup>iv</sup><br>using CAN/CSA-P.2-07  | Dec 31, 2009               | AFUE ≥ 92%<br>using CAN/CSA-P.2   |
| <b>Gas or propane boilers, input ≥ 300,000 BTU/h (88kW) and ≤ 400,000 BTU/h (117 kW)</b> | Combustion efficiency ≥ 80%<br>using ANSI Z21.13-2004/CSA 4.9-2004<br>or<br>GAMA BTS-2000 | Jan 1, 2007                | E <sub>t</sub> ≥ 83%<br>using AHRI BTS  |
| <b>Gas- or propane-fired fireplaces or stoves</b>  | Must be tested using CAN/CSA P.4.1-02   | Jan 1, 2007                | Must be a) direct-vent (sealed), and b) pilot-on-demand, interrupted or intermittent ignition systems without a standing pilot light. |



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*Note: Information provided relates specifically to the prescriptive compliance path within Section 9.36. If the code user chooses the alternate performance compliance path, the building is examined as a system, using computer modelling. In that case, the BCBC would accommodate equipment with higher or lower efficiencies than those listed within this bulletin provided the overall performance of the building was achieved. (Ex. lower efficiency equipment could be installed but would need to be offset by more insulation, better windows, etc.)*

**Table 3: Other space and water heating equipment covered by the BCBC for which no recent EESR Standards exist include:**

|   |
|---|
| Electric water heaters, input > 41,000 BTU/h (12 kW), capacity > 75 litres (16.5 imp gal)                             |
| Heat pump water heaters, $\leq 24$ A and $\leq 250$ V   |
| Gas-fired water heaters, input $\geq 75,000$ BTU/h (22 kW)  |
| Oil-fired water heaters   |
| Gas-fired tankless water heater, input $\leq 250,000$ BTU/h (73 kW)   |
| Gas-fired pool heaters, input < 400,000 BTU/h (117 kW)  |
| Oil-fired pool heaters  |
| Combined space- and water-heating systems (combos), boiler-based, input $\leq 300,000$ BTU/h (88 kW)                  |
| Combined space- and water-heating systems (combos), based on service water heater, input $\leq 250,000$ BTU/h (73 kW) |
| Integrated mechanical systems   |
| Electric Boilers, input $\leq 300,000$ BTU/hr (88 kW)   |
| Gas-Fired Boilers, input $\leq 300,000$ BTU/hr (88 kW)  |
| Oil-Fired Boilers, input $\leq 300,000$ BTU/hr (88 kW)  |
| Various Air-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated                                    |
| Various Water-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated                                  |
| Various Direct-Expansion Ground-Source Heat Pumps – Electrically Operated   |
| Various Room Air Conditioners and Room Air Conditioner Heat Pumps   |
| Gas and Propane-Fired Unit Heaters  |
| Gas-fired warm-air furnaces, input > 225,000 BTU/h (66 kW) and $\leq 400,000$ BTU/h (117 kW)                          |
| Gas-Fired duct furnaces, input $\leq 400,000$ BTU/h (117 kW)  |
| Oil-fired warm-air furnaces, input $\leq 225,000$ BTU/h (66 kW)   |
| Oil-fired duct furnaces and unit heaters  |
| Solid-fuel-burning space-heating equipment  |
| Dehumidifiers   |

See the appendix to this bulletin for BCBC Tables 9.36.3.10 and 9.36.4.2 related to HVAC and service hot water equipment.

The BC Energy Efficiency Standards Regulation can be found at [http://www.bclaws.ca/civix/document/id/complete/statreg/389\\_93](http://www.bclaws.ca/civix/document/id/complete/statreg/389_93).

<sup>i</sup> SL is standby loss. V is tank volume in litres. EF is Energy Factor.

<sup>ii</sup> Standards with effective dates in the last decade.

<sup>iii</sup> AFUE is Annual Fuel Use Efficiency. E<sub>t</sub> is thermal efficiency.

<sup>iv</sup> Exception in the EESR: Gas furnaces with an integrated cooling component that are out-door gas furnaces and use single-phase electric current must only meet an AFUE  $\geq 78\%$ .

**Appendix:**

**Table 9.36.3.10.**  
**HVAC Equipment Performance Requirements**

Forming Part of Sentences 9.36.3.9.(2) and 9.36.3.10.(1)

| Component or Equipment   | Heating or Cooling Capacity, kW | Standard   | Minimum Performance <sup>(1)</sup>              |
|--|---------------------------------|--|---|
| Air-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated   |                                 |  |   |
| Split system   | ≤ 19                            | CAN/CSA-C656                                       | SEER = 14.5                                     |
|  |                                 |  | EER = 11.5                                      |
|  |                                 |  | HSPF = 7.1<br>(region 5 in standard)            |
| Single-package system  | ≤ 19                            | CAN/CSA-C656 (including General Instruction No. 2) | SEER = 14                                       |
|  |                                 |  | EER = 11  |
|  |                                 |  | HSPF = 7.0<br>(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 |                                 |  |   |
| Ground-source and water-source heat pumps                                    |                                 |  |   |
| Open loop  | < 40                            | CAN/CSA-C13256-1                                   | COP <sub>c</sub> ≥ 4.75, COP <sub>h</sub> ≥ 3.6 |
| Closed loop  |                                 |  | COP <sub>c</sub> ≥ 3.93, COP <sub>h</sub> ≥ 3.1 |
| Water-to-water heat pumps  |                                 |  |   |
| Open loop  | < 40                            | CAN/CSA-C13256-2                                   | COP <sub>c</sub> ≥ 5.60, COP <sub>h</sub> ≥ 3.4 |
| Closed loop  |                                 |  | COP <sub>c</sub> ≥ 4.21, COP <sub>h</sub> ≥ 2.8 |

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| Component or Equipment  | Heating or Cooling Capacity, kW | Standard                     | Minimum Performance <sup>(1)</sup>              |
|---|---------------------------------|------------------------------|---|
| Internal water-loop heat pumps                                      | < 5                             | CAN/CSA-C13256-1             | COP <sub>c</sub> ≥ 3.28, COP <sub>h</sub> ≥ 4.2 |
|   | ≥ 5 and ≤ 40                    |                              | COP <sub>c</sub> ≥ 3.52, COP <sub>h</sub> ≥ 4.2 |
| Water-cooled air conditioners – all types                           | < 19                            | ANSI/AHRI 210/240 or CTI 201 | COP = 3.54, ICOP = 3.60                         |
| Direct-Expansion Ground-Source Heat Pumps – Electrically Operated   |                                 |                              |   |
| Direct-expansion ground-source heat pumps                           | ≤ 21                            | CSA C748                     | EER = 13.0                                      |
|   |                                 |                              | COP <sub>h</sub> = 3.1                          |
| Room Air Conditioners and Room Air Conditioner Heat Pumps           |                                 |                              |   |
| Room air conditioners with reverse cycle                            |                                 |                              |   |
| with louvered sides   | < 10.55                         | ANSI/AHAM RAC-1              | EER = 8.5                                       |
| without louvered sides  |                                 |                              | EER = 8.0                                       |
| Room air conditioners without reverse cycle and with louvered sides | < 1.8                           | CAN/CSA-C368.1               | EER = 10.7                                      |
|   | ≥ 1.8 and < 2.3                 |                              | EER = 10.7                                      |
|   | ≥ 2.3 and < 4.1                 |                              | EER = 10.8                                      |
|   | ≥ 4.1 and < 5.9                 |                              | EER = 10.7                                      |
|   | ≥ 5.9                           |                              | EER = 9.4                                       |
| Room air conditioner heat pumps with louvered sides                 | < 5.9                           |                              | EER = 9.9                                       |
|   | ≥ 5.9                           |                              | EER = 9.5                                       |

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| Component or Equipment   | Heating or Cooling Capacity, kW | Standard                    | Minimum Performance <sup>(1)</sup>                                       |
|--|---------------------------------|-----------------------------|--|
| Room air conditioners without louvered sides and without reverse cycle | < 1.8                           |                             | EER = 9.9  |
|  | ≥ 1.8 and < 2.3                 |                             | EER = 9.9  |
|  | ≥ 2.3 and < 4.1                 |                             | EER = 9.4  |
|  | ≥ 4.1 and < 5.9                 |                             | EER = 9.4  |
|  | ≥ 5.9                           |                             | EER = 9.4  |
| Room air conditioner heat pumps without louvered sides                 | < 4.1                           |                             | EER = 9.2  |
|  | ≥ 4.1                           |                             | EER = 8.8  |
| Room air conditioner, casement only                                    | All capacities                  |                             | EER = 9.5  |
| Room air conditioner, casement slider                                  | All capacities                  |                             | EER = 9.5  |
| <b>Boilers</b>   |                                 |                             |  |
| Electric <i>boilers</i>  | ≤ 88                            | —                           | Must be equipped with automatic water temperature control <sup>(2)</sup> |
| Gas-fired <i>boilers</i> <sup>(3)</sup>                                | ≤ 88                            | CAN/CSA-P.2                 | AFUE ≥ 90%   |
|  | > 88 and ≤ 117.23               | AHRI BTS                    | E <sub>t</sub> ≥ 83%   |
| Oil-fired <i>boilers</i>   | ≤ 88                            | CSA B212 or ANSI/ASHRAE 103 | AFUE ≥ 85%   |

| Component or Equipment   | Heating or Cooling Capacity, kW         | Standard  | Minimum Performance <sup>(1)</sup> |
|--|---|---|------------------------------------|
| Warm-Air Furnaces, Combination Warm-Air Furnace/Air-conditioning Units, Duct Furnaces and Unit Heaters |   |   |                                    |
| Gas-fired warm-air furnaces <sup>(3)</sup>   | ≤ 65.9                                  | CAN/CSA-P.2   | AFUE ≥ 92%                         |
|  | > 65.9 and ≤ 117.23                     | CAN/CSA-P.8   | E <sub>t</sub> ≥ 78.5%             |
| Gas-fired duct furnaces <sup>(3)</sup>   | ≤ 117.23                                | ANSI Z83.8/CSA 2.6  | E <sub>t</sub> ≥ 81%               |
| Gas-fired unit heaters <sup>(3)</sup>  | ≤ 117.23                                | CAN/CSA-P.11  | E <sub>t</sub> ≥ 82%               |
| Oil-fired warm-air furnaces  | ≤ 66                                    | CSA B212  | AFUE ≥ 85%                         |
| Oil-fired duct furnaces and unit heaters   | —                                       | UL 731  | E <sub>c</sub> ≥ 80%               |
| Combined space- and water-heating systems (combos)   | ≤ 87.9 if boiler-based                  | CAN/CSA-P.9 <sup>(4)</sup>                                    | TPF = 0.65                         |
|  | ≤ 73.2 if based on service water heater |   |                                    |
| Integrated mechanical systems  | —                                       | CSA P.10  | OTPF = 0.78                        |
| Other  |   |   |                                    |
| Gas-fired fireplaces and stoves <sup>(3)</sup>   | —                                       | —   | <sup>(5)</sup>                     |
| Solid-fuel-burning space-heating equipment   | —                                       | EPA 40 CFR, Part 60, Subpart AAA or CSA B415.1 <sup>(6)</sup> | See standard <sup>(7)</sup>        |
| Dehumidifiers  | ≤ 87.5 L/day                            | CAN/CSA-C749  | See standard <sup>(7)</sup>        |

**Notes to Table 9.36.3.10.:**

<sup>(1)</sup> The symbols and abbreviations that appear in this column have the following meanings:

AFUE = annual fuel utilization efficiency

COP = coefficient of performance, in W/W (COP<sub>c</sub> = in cooling mode and COP<sub>h</sub> = in heating mode)

E<sub>c</sub> = combustion efficiency, in %



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EER = energy efficiency ratio, in (Btu/h)/W (no metric equivalent)

$E_t$  = thermal efficiency

FE = fireplace efficiency

HSPF = heating season performance factor, in watt-hours

ICOP = integrated coefficient of performance, in W/W

OTPF = overall thermal performance factor

SEER = seasonal energy efficiency ratio, in (Btu/h)/W (no metric equivalent)

TPF = thermal performance factor

<sup>(2)</sup> No standard addresses the performance efficiency of electric *boilers*; however, their efficiency typically approaches 100%.

<sup>(3)</sup> Includes propane.

<sup>(4)</sup> See the exception stated in Sentence (3).

<sup>(5)</sup> See Sentence (2).

<sup>(6)</sup> CSA B415.1 does not apply to *stoves* with an oven whose volume is greater than 0.028 m<sup>3</sup> and automatically fuelled *appliances*.

<sup>(7)</sup> Minimum performance values are omitted from the Table in cases where the referenced standard itself contains such requirements.

**Table 9.36.4.2.**  
**Service Water Heating Equipment Performance Standards**

Forming Part of Sentences 9.36.4.2.(1) and (2)

| Component                          | Input <sup>(1)</sup>                                      | Standard  | Performance Requirement <sup>(2)</sup>   |
|------------------------------------|---|---|--|
| Storage-Type Service Water Heaters |   |   |  |
| Electric                           | ≤ 12 kW (50 L to 270 L capacity)                          | CAN/CSA-C191  | SL ≤ 25 + 0.20V (top inlet)  |
|                                    |   |   | SL ≤ 40 + 0.20V (bottom inlet)   |
|                                    | ≤ 12 kW (> 270 L and ≤ 454 L capacity)                    |   | SL ≤ (0.472V) – 38.5 (top inlet)   |
|                                    |   |   | SL ≤ (0.472V) – 33.5 (bottom inlet)  |
| >12 kW (> 75 L capacity)           | ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G | S = 0.30 + 27/V <sub>m</sub>                              |  |
| Heat pump water heaters            | ≤ 24 A and ≤ 250 V  | CAN/CSA-C745  | EF ≥ 2.0   |
| Gas-fired <sup>(3)</sup>           | < 22 kW   | CAN/CSA-P.3   | EF ≥ 0.67 – 0.0005V  |
|                                    | ≥ 22 kW   | ANSI Z21.10.3/CSA 4.3                                     | E <sub>t</sub> ≥ 80% and standby loss ≤ rated input <sup>(4)</sup> /(800 + 16.57·√V) |
| Oil-fired                          | ≤ 30.5 kW   | CAN/CSA-B211  | EF ≥ 0.59 – 0.0005V  |
|                                    | > 30.5 kW   | ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G | E <sub>t</sub> ≥ 78% and standby loss ≤ rated input <sup>(4)</sup> /(800 + 16.57·√V) |

| Component  | Input <sup>(1)</sup>                              | Standard  | Performance Requirement <sup>(2)</sup> |
|--|---|---|--|
| Tankless Service Water Heaters                     |   |   |  |
| Gas-fired <sup>(3)</sup>                           | ≤ 73.2 kW   | CAN/CSA-P.7   | EF ≥ 0.8                               |
|  | > 73.2 kW   | ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G | E <sub>t</sub> ≥ 80%                   |
| Oil-fired  | ≤ 61.5 kW <sup>(5)</sup>                          | DOE 10 CFR, Part 430, Subpart B, Appendix E               | EF ≥ 0.59 – 0.0019V <sub>m</sub>       |
|  | Other   | ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G | E <sub>t</sub> ≥ 80%                   |
| Electric   | —   | —   | <sup>(6)</sup>                         |
| Combined space- and water-heating systems (combos) | ≤ 87.9 kW if <i>boiler-based</i>                  | CAN/CSA-P.9   | TPF = 0.65                             |
|  | ≤ 73.2 kW if based on <i>service water heater</i> |   |  |
| Integrated mechanical systems                      | —   | CSA P.10  | OTPF = 0.78                            |
| Pool Heaters                                       |   |   |  |
| Gas-fired <sup>(3)</sup>                           | < 117.2 kW  | ANSI Z21.56/CSA 4.7 or CSA P.6                            | E <sub>t</sub> ≥ 82%                   |
| Oil-fired  | —   | CSA B140.12   | E <sub>t</sub> ≥ 75%                   |



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#### Notes to Table 9.36.4.2.:

<sup>(1)</sup> 1 kW = 3,412 Btu/h

<sup>(2)</sup> The symbols and abbreviations used in this column have the following meanings:

EF = energy factor, in %/h

E<sub>t</sub> = thermal efficiency with 38.9°C water temperature difference

OTPF = overall thermal performance factor

S = standby loss, in %/h (percentage heat content of stored water per hour)

SL = standby loss, in W

TPF = thermal performance factor

V = storage volume, in L, as specified by the manufacturer

V<sub>m</sub> = measured storage volume, in US gallons

<sup>(3)</sup> Includes propane.

<sup>(4)</sup> Rated input is measured in watts.

<sup>(5)</sup> Consistent with the US Congress National Appliance Energy Conservation Act of 1987.

<sup>(6)</sup> No standard addresses the performance efficiency of electric tankless *service water heaters*; however, their efficiency typically approaches 100%.