

HVAC and Service Water Heating Requirements (9.36.3. & 9.36.4.)

While HVAC and service water heating requirements are in different parts of Section 9.36., they have been combined in this guide for simplicity.

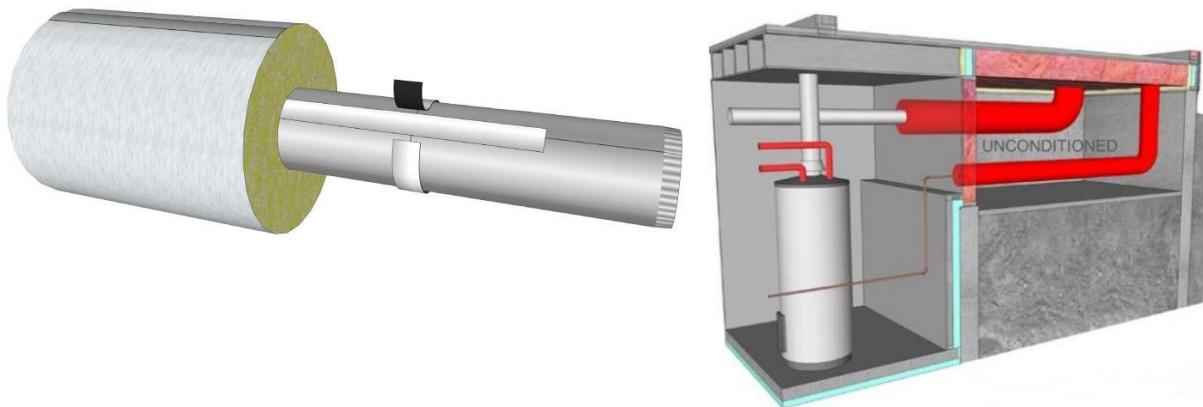
Scope and Application (9.36.3.1. & 9.36.4.1.)

This section applies to the efficiency of heating ventilation and air conditioning equipment and service water heating. The design and installation of HVAC and service water heating systems are covered in Sections 9.32. and 9.33. of the Code.

Equipment and Ducts (9.36.3.2.)

HVAC systems and ducts are required to be sized in accordance with “good practice,” such as described in the Thermal Environmental Comfort Association (TECA) reference material, CSA 280, and Sections 9.32. and 9.33. In addition, 9.36. requires that:

- Transverse and longitudinal joints in duct work must be sealed using an approved tape and sealant when outside the plane of insulation
- Ducts must be insulated to the same level as required for walls if they are outside of the envelope and carry conditioned air.
- When ducts, chases, pipes, or panels are placed within an exterior wall, the effective thermal resistance of the wall must be maintained between the duct and the exterior of the wall.
- Where mechanical ducts, plumbing pipes, conduits, etc. are placed within an insulated portion of a floor or a ceiling, the area between the duct, pipe etc. and the exterior shall have an effective insulation value of not less than RSI-2.78 (R15.8).



Sealing and Insulation Requirements for Ducts Outside the Building Envelope.

Air Intake and Outlet Dampers (9.36.3.3.)

In general, ducts are required to be equipped with a damper. The damper may be gravity operated, motorized or spring loaded. Where motorized dampers are used, they must remain in an open position if damper operation fails, such as during power outages. Examples of requirements are summarized below.

Requirements for Dampers

| Location | Damper |
|--|--------|
| Flue connected to water heater | No |
| Condensing furnace/boiler air intake/exhaust | No |
| Combustion air intake on fireplace or wood stove | No |
| Ventilation air intake | Yes |
| Clothes dryer vent | Yes |
| Combined supply and exhaust ventilators | Yes |
| Exhaust and supply fans | Yes |

Heat Recovery from Ventilation Systems (9.36.3.9.)

Where heat recovery ventilators are used, equipment must conform to the requirements of 9.36.3.9., including having a minimum sensible heat recovery efficiency of 60%.

Solar Thermal Systems for Space Heat and Service Water Heating (9.36.4.3.)

Solar thermal systems are not required in Section 9.36. However, if they are installed, the systems must comply with the following requirements:

- Installed in accordance with manufacturers requirements and procedures,
- Installed in accordance with other plumbing systems requirements of the Code, and
- The storage tank must be installed in conditioned space.

Service Water Heating Piping (9.36.4.4.)

Pipe insulation is required for the first 2 m (6.5 ft) of the storage tank inlet and outlet. The insulation must be at least 12mm (0.5”) thick. In cases where piping is located outside the building enclosure or within unconditioned space, the insulation must be installed to a thermal resistance not less than the effective resistance requirements of the exterior above grade wall. In homes with recirculating hot water systems, all piping must be insulated.

Service Water Heating Controls (9.36.4.5.)

Service water heating systems are required to be equipped with controls to permit adjustment of the temperature settings.

Space Heat and Service Water Heating Equipment Efficiency (9.36.3.10.) & (9.36.4.2.)

Equipment efficiency requirements are defined for a range of equipment and fuel options in Table 9.36.3.10..

Notes to Table 9.36.3.10.:

(1) 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_c = in cooling mode and COP_h = in heating mode)
- E_c = combustion efficiency, in %
- 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

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

(3) Includes propane.

(4) See the exception stated in Sentence (3).

(5) See Sentence (2).

(6) CSA B415.1 does not apply to stoves with an oven whose volume is greater than 0.028 m³ and automatically fuelled appliances.

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

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 ⁽¹⁾ |
|---|---------------------------------|--|--|
| Air-Cooled Unitary Air Conditioners and Heat Pumps – Electrically Operated | | | |
| Split system | ≤ 19 | CSA C656 | SEER = 14.5 EER = 11.5 HSPF = 7.1 (region 5 in standard) |
| Single-package system | ≤ 19 | 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 | | | |
| Ground-source and water-source heat pumps open loop closed loop | < 40 | CAN/CSA-C13256-1 | COP _c ≥ 4.75, COP _h ≥ 3.6 COP _c ≥ 3.93, COP _h ≥ 3.1 |
| Water-to-water heat pumps open loop closed loop | < 40 | CAN/CSA-C13256-2 | COP _c ≥ 5.60, COP _h ≥ 3.4 COP _c ≥ 4.21, COP _h ≥ 2.8 |
| Internal water-loop heat pumps | < 5 ≥ 5 and ≤ 40 | CAN/CSA-C13256-1 | COP _c ≥ 3.28, COP _h ≥ 4.2 COP _c ≥ 3.52, COP _h ≥ 4.2 |
| Water-cooled air conditioners – all types | < 19 | ANSI/AHRI 210/240 or CTI STD-201RS | 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 _h = 3.1 |

Table 9.36.3.10. (Continued)

| Component or Equipment | Heating or Cooling Capacity, kW | Standard | Minimum Performance ⁽¹⁾ |
|---|--|---|--|
| Room Air Conditioners and Room Air Conditioner Heat Pumps | | | |
| Room air conditioners with reverse cycle with louvered sides without louvered sides | < 10.55 | ANSI/AHAM RAC-1 | EER = 8.5 EER = 8.0 |
| Room air conditioners without reverse cycle and with louvered sides | < 1.8 | 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 |
| Room air conditioner heat pumps with louvered sides | < 5.9 ≥ 5.9 | | EER = 9.9 EER = 9.5 |
| 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 |
| Room air conditioner heat pumps without louvered sides | < 4.1 ≥ 4.1 | | EER = 9.2 EER = 8.8 |
| Room air conditioner, casement only | All capacities | EER = 9.5 | |
| Room air conditioner, casement slider | All capacities | EER = 9.5 | |
| Boilers | | | |
| Electric <i>boilers</i> | ≤ 88 | — | Must be equipped with automatic water temperature control ⁽²⁾ |
| Gas-fired <i>boilers</i> ⁽³⁾ | ≤ 88 | CSA P.2 | AFUE ≥ 90% |
| | > 88 and ≤ 117.23 | AHRI BTS | E _t ≥ 83% |
| Oil-fired <i>boilers</i> | ≤ 88 | CSA B212 or ANSI/ASHRAE 103 | AFUE ≥ 85% |
| Warm-Air Furnaces, Combination Warm-Air Furnace/Air-conditioning Units, Duct Furnaces and Unit Heaters | | | |
| Gas-fired warm-air <i>furnaces</i> ⁽³⁾ | ≤ 65.9 | CSA P.2 | AFUE ≥ 92% |
| | > 65.9 and ≤ 117.23 | CAN/CSA-P8 | E _t ≥ 78.5% |
| Gas-fired duct <i>furnaces</i> ⁽³⁾ | ≤ 117.23 | ANSI Z83.8/CSA 2.6 | E _t ≥ 81% |
| Gas-fired <i>unit heaters</i> ⁽³⁾ | ≤ 117.23 | CAN/CSA-P.11 | E _t ≥ 82% |
| Oil-fired warm-air <i>furnaces</i> | ≤ 66 | CSA B212 | AFUE ≥ 85% |
| Oil-fired duct <i>furnaces</i> and <i>unit heaters</i> | — | UL 731 | E _c ≥ 80% |
| Combined space- and water-heating systems (combos) | ≤ 87.9 if <i>boiler</i> -based ≤ 73.2 if based on <i>service water heater</i> | CAN/CSA-P.9 ⁽⁴⁾ | TPF = 0.65 |
| Integrated mechanical systems | — | CSA P.10 | OTPF = 0.78 |
| Other | | | |
| Gas-fired fireplaces and stoves ⁽³⁾ | — | — | ⁽⁵⁾ |
| Solid-fuel-burning space-heating equipment | — | EPA 40 CFR, Part 60, Subpart AAA or CSA B415.1 ⁽⁶⁾ | See standard ⁽⁷⁾ |
| Dehumidifiers | ≤ 87.5 L/day | CAN/CSA-C749 | See standard ⁽⁷⁾ |



Table 9.36.4.2.
Service Water Heating Equipment Performance Standards
 Forming Part of Sentences 9.36.4.2.(1) and (2)

| Component | Input ⁽¹⁾ | Standard | Performance Requirement ⁽²⁾ |
|--|---|---|--|
| Storage-Type Service Water Heaters | | | |
| Electric | ≤ 12 kW (50 L to 270 L capacity) | CAN/CSA-C191 | SL ≤ 35 + 0.20V (top inlet) |
| | ≤ 12 kW (> 270 L and ≤ 454 L capacity) | | SL ≤ 40 + 0.20V (bottom inlet) |
| | | | SL ≤ (0.472V) – 38.5 (top inlet) |
| >12 kW (> 75 L capacity) | ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G | SL ≤ (0.472V) – 33.5 (bottom inlet) | |
| Heat pump water heaters | ≤ 24 A and ≤ 250 V | CAN/CSA-C745 | S = 0.30 + 27/V _m |
| Gas-fired ⁽³⁾ | < 22 kW | CAN/CSA-P.3 | EF ≥ 0.67 – 0.0005V |
| | ≥ 22 kW | ANSI Z21.10.3/CSA 4.3 | E _t ≥ 80% and standby loss ≤ rated input ⁽⁴⁾ /(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 _t ≥ 78% and standby loss ≤ (rated input ⁽⁴⁾ /800) + 16.57·√V |
| Tankless Service Water Heaters | | | |
| Gas-fired | ≤ 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 _t ≥ 80% |
| Oil-fired | ≤ 61.5 kW ⁽⁵⁾ | DOE 10 CFR, Part 430, Subpart B, Appendix E | EF ≥ 0.59 – 0.0019V _m |
| | Other | ANSI Z21.10.3/CSA 4.3 and DOE 10 CFR, Part 431, Subpart G | E _t ≥ 80% |
| Electric | — | — | ⁽⁶⁾ |
| Combined space- and water-heating systems (combos) | ≤ 87.9 kW if <i>boiler-based</i> ≤ 73.2 kW if based on <i>service water heater</i> | CAN/CSA-P.9 | TPF = 0.65 |
| Integrated mechanical systems | — | CSA P.10 | OTPF = 0.78 |
| Pool Heaters | | | |
| Gas-fired ⁽³⁾ | < 117.2 kW | ANSI Z21.56/CSA 4.7 or CSA P.6 | E _t ≥ 82% |
| Oil-fired | — | CSA B140.12 | E _t ≥ 75% |

Notes to Table 9.36.4.2.:

(1) 1 kW = 3412 Btu/h

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

EF = energy factor, in %/h

E_t = 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_m = measured storage volume, in US gallons

(3) Includes propane.

(4) Rated input is measured in watts.

(5) Consistent with the U.S. Congress "National Appliance Energy Conservation Act of 1987."

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