

ASHRAE 90.1 2004 Appendix G TABLE G3.1.1A - Baseline HVAC System Types

| Building Type | Fossil Fuel, Fossil/Electric Hybrid & Purchased Heat | Electric and Other |
|--|---|-------------------------------------|
| Residential | System 1 – PTAC | System 2 - PTHP |
| Nonresidential & 3 Floors or Less & <75,000 ft2 | System 3 – PSZ-AC | System 4 – PSZ-HP |
| Nonresidential & 4 or 5 Floors & <75,000 ft2 or 5 Floors or Less & 75,000 ft2 to 150,000 ft2 | System 5 - Packaged VAV w/ Reheat | System 6 - Packaged VAV w/PFP Boxes |
| Nonresidential & More than 5 Floors or >150,000 ft2 | System 7 - VAV w/ Reheat | System 8 - VAV w/PFP Boxes |

ASHRAE 90.1 2004 Appendix G TABLE G3.1.1B - Baseline System Descriptions

| System No. | System Type | Fan Control | Cooling Type | Heating Type |
|-----------------------------|--|--------------------|---------------------|------------------------------|
| 1. PTAC | Packaged terminal air conditioner | Constant Volume | Direct Expansion | Hot Water Fossil Fuel Boiler |
| 2. PTHP | Packaged terminal heat pump | Constant Volume | Direct Expansion | Electric Heat Pump |
| 3. PSZ-AC | Packaged rooftop air conditioner | Constant Volume | Direct Expansion | Fossil Fuel Furnace |
| 4. PSZ-HP | Packaged rooftop heat pump | Constant Volume | Direct Expansion | Electric Heat Pump |
| 5. Packaged VAV w/Reheat | Packaged rooftop variable air volume with reheat | VAV | Direct Expansion | Hot Water Fossil Fuel Boiler |
| 6. Packaged VAV w/PFP Boxes | Packaged rooftop variable air volume with reheat | VAV | Direct Expansion | Electric Resistance |
| 7. VAV w/Reheat | Packaged rooftop variable air volume with reheat | VAV | Chilled Water | Hot Water Fossil Fuel Boiler |
| 8. VAV w/PFP Boxes | Variable air volume with reheat | VAV | Chilled Water | Electric Resistance |

BC Hydro New Construction Program (NCP) - Baseline HVAC System Types (2004)

| Proposed Building Type | | Proposed Heating Energy Source | | |
|--|---------------------|--------------------------------|-------------------------|-----------------------------------|
| | | Fossil Fuel & Purchased Heat | Fossil/Electric Hybrid* | Electric and On-Site Renewables** |
| Residential | Heating and Cooling | System 1 | System 1a | System 2 |
| | Heating only | System 1b | System 1c | System 2a |
| Nonresidential & 3 Floors or Less & <75,000 ft2 | | System 3 | System 3a | System 4 |
| Nonresidential & 4 or 5 Floors & <75,000 ft2 or 5 Floors or Less & 75,000 ft2 to 150,000 ft2 | | System 5 | System 5a | System 6 |
| Nonresidential & More than 5 Floors or >150,000 ft2 | | System 7 | System 7a | System 8 |

* Fossil fuel based HVAC systems with heat pump pre-heat, or heat pump based HVAC systems with fossil fuel boost and/or back-up

** On-Site Renewables: Solar, Geo Thermal, Wind

Note: Baseline HVAC system types selection is based on the proposed building type and proposed building heating energy source (the first table)

BC Hydro New Construction Program (NCP) - Baseline System Descriptions

| System No. | System Type | Fan Control | Cooling Type | Heating Type | Ventilation Type | DWH System Type |
|----------------------------------|--|-----------------|------------------|--|---|---|
| 1. PTAC | Packaged terminal air conditioner with hydronic heating coil (high t-re) | Constant Volume | Direct Expansion | Hot Water Fossil Fuel Boiler | Fossil Fuel Rooftop Make Up Air Unit | Hot Water Fossil Fuel Boiler |
| 1a. PTAC-GBHP | Packaged terminal air conditioner with hydronic heating coil (high t-re) | Constant Volume | Direct Expansion | Heat Pump with Fossil Fuel Back-up / Boost, Fossil Fuel Boiler with Heat Pump Pre-Heating, or Electric Resistance*** | Heat Pump with Fossil Fuel Back-up / Boost, Fossil Fuel Boiler with Heat Pump Pre-Heating, or Fossil Fuel Rooftop Make Up Air Unit*** | Heat Pump with Fossil Fuel Back-up / Boost, Fossil Fuel Boiler with Heat Pump Pre-Heating, or Fossil Fuel Boiler*** |
| 1b. HBB | Hydronic Baseboards (high t-re) | - | - | Hot Water Fossil Fuel Boiler | Fossil Fuel Rooftop Make Up Air Unit | Hot Water Fossil Fuel Boiler |
| 1c. EBB-GB | Electric Baseboards with gas ventilation and DWH | - | - | Electric Resistance | Fossil Fuel Rooftop Make Up Air Unit | Hot Water Fossil Fuel Boiler |
| 2. PTHP | Packaged terminal heat pump | Constant Volume | Direct Expansion | Electric Heat Pump | Electric Heat Pump | Electric Heat Pump |
| 2a. EEB-HP | Electric Baseboards with electric ventilation and DWH | - | - | Electric Resistance | Electric Resistance | Electric Resistance |
| 3. PSZ-AC | Packaged rooftop air conditioner | Constant Volume | Direct Expansion | Fossil Fuel Furnace | Fossil Fuel Furnace | Same Type as Proposed |
| 3a. PSZ-HPGB | Packaged rooftop air conditioner with heat pump and gas boost/back-up | Constant Volume | Direct Expansion | Electric Heat Pump with Fossil Fuel Boost/Back-up | Electric Heat Pump with Fossil Fuel Boost/Back-up | Same Type as Proposed |
| 4. PSZ-HP | Packaged rooftop heat pump | Constant Volume | Direct Expansion | Electric Heat Pump | Electric Heat Pump | Same Type as Proposed |
| 5. Packaged VAV w/Reheat | Packaged rooftop variable air volume with reheat | VAV | Direct Expansion | Hot Water Fossil Fuel Boiler | Hot Water Fossil Fuel Boiler | Hot Water Fossil Fuel Boiler |
| 5a. Packaged VAV w/Reheat - HPGB | Packaged rooftop variable air volume with heat pump/gas boost/back-up high t-re heating and reheating system | VAV | Direct Expansion | Electric Heat Pump with Fossil Fuel Boost/Back-up | Electric Heat Pump with Fossil Fuel Boost/Back-up | Same Type as Proposed |
| 6. Packaged VAV w/PFP Boxes | Packaged rooftop variable air volume with reheat | VAV | Direct Expansion | Electric Resistance**** | Electric Resistance**** | Same Type as Proposed |
| 7. VAV w/Reheat | Packaged rooftop variable air volume with reheat | VAV | Chilled Water | Hot Water Fossil Fuel Boiler | Hot Water Fossil Fuel Boiler | Hot Water Fossil Fuel Boiler |
| 7a. VAV w/Reheat - HPGB | Variable air volume with central heat pump/gas boost-back-up high t-re heating and reheating system | VAV | Chilled Water | Electric Heat Pump with Fossil Fuel Boost/Back-up | Electric Heat Pump with Fossil Fuel Boost/Back-up | Same Type as Proposed |
| 8. VAV w/PFP Boxes | Variable air volume with reheat | VAV | Chilled Water | Electric Resistance**** | Electric Resistance**** | Same Type as Proposed |

*** Baseline system selection depends on the proposed system type. Example: If GSHP system with gas boiler back-up is proposed heating plant for space heating, ventilation and DWH, the baseline heating plant will be a central heat pump (usually air to water) based system with gas boiler back-up with minimum efficiency levels as per ASHRAE 90.1 prescriptive requirements.

**** If proposed heating system is a heat pump systems with electric resistance back-up, the baseline system will be a central heat pump (usually air to water) with electric resistance back-up.

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| | - Identical system with ASHRAE 90.1 2004 Appendix G TABLE G3.1.1B |
| | - BC Hydro New Construction Program specific baseline system |

Special Case No.1:

The proposed building type: Heated/cooled MURB with gas fired distributed heat pump system and gas fired ventilation (MAU) and DWH systems.

The BC Hydro NC Program baseline: 2-pipe changeover fan coil system with electric resistance duct heaters as a main heating source when outside air temperature is above 5°C (during shoulder and summer seasons and during summer if supplemental heating is required in certain spaces). When outside air temperature is below 5°C, the system changes over to gas fired boiler hot water system (this will happen only during typical winter months when cooling is not required). In this fan coil system two pipes deliver, either hot water (during typical winter season), or chilled water (during shoulder and summer seasons). Gas fired ventilation (MAU) and DHW systems.

Special Case No.2:

The proposed building type: 100,000 s.f heated/cooled warehouse-type retail store with constant volume rooftop units.

The BC Hydro NC Program baseline: System 3, or System 3a when proposed design involves rooftop heat pumps.

Special Case No.3:

The proposed building type: Retail component takes the first 3 floors of an office or residential high-rise building. Proposed retail design: fan coil, distributed heat pump or VRF system.

The BC Hydro NC Program baseline: The retail component baseline (always treated separately from the rest of the building) will be a 2-pipe fan coil system with electric resistance duct heaters (in case of all electric proposed retail design), or 2-pipe changeover fan-coil system explained in the Special Case No.1. If retail building component (3 floors or less & <75,000 ft2) has a podium type structure, with sufficient exposed roof surface, the retail baseline system will default to System 3 or 3a (depending on the proposed heating energy source).

Special Case No.4:

The proposed building type: 100,000 s.f. heated/cooled high school with gas fired distributed heat pump system, gas fired DOAS and DWH.

The BC Hydro NC Program baseline: 2-pipe changeover fan-coil system explained in the Special Case No.1 and gas fired DOAS and DWH. In case of all electric proposed space heating/cooling design, 2-pipe fan coil system with electric resistance duct heaters. Heated and cooled elementary schools (3 floors or less & <75,000 ft2) will default to System 3 or 3a (depending on the proposed heating energy source).

ASHRAE 90.1 2007 Appendix G TABLE G3.1.1A - Baseline HVAC System Types

| Building Type | Fossil Fuel, Fossil/Electric Hybrid & Purchased Heat | Electric and Other |
|--|---|-------------------------------------|
| Residential | System 1 – PTAC | System 2 - PTHP |
| Nonresidential & 3 Floors or Less & <25,000 ft ² | System 3 – PSZ-AC | System 4 – PSZ-HP |
| Nonresidential & 4 or 5 Floors & <25,000 ft ² or 5 Floors or Less & 25,000 ft ² to 150,000 ft ² | System 5 - Packaged VAV w/ Reheat | System 6 - Packaged VAV w/PFP Boxes |
| Nonresidential & More than 5 Floors or >150,000 ft ² | System 7 - VAV w/ Reheat | System 8 - VAV w/PFP Boxes |

ASHRAE 90.1 2007 Appendix G TABLE G3.1.1B - Baseline System Descriptions

| System No. | System Type | Fan Control | Cooling Type | Heating Type |
|-----------------------------|--|--------------------|---------------------|------------------------------|
| 1. PTAC | Packaged terminal air conditioner | Constant Volume | Direct Expansion | Hot Water Fossil Fuel Boiler |
| 2. PTHP | Packaged terminal heat pump | Constant Volume | Direct Expansion | Electric Heat Pump |
| 3. PSZ-AC | Packaged rooftop air conditioner | Constant Volume | Direct Expansion | Fossil Fuel Furnace |
| 4. PSZ-HP | Packaged rooftop heat pump | Constant Volume | Direct Expansion | Electric Heat Pump |
| 5. Packaged VAV w/Reheat | Packaged rooftop variable air volume with reheat | VAV | Direct Expansion | Hot Water Fossil Fuel Boiler |
| 6. Packaged VAV w/PFP Boxes | Packaged rooftop variable air volume with reheat | VAV | Direct Expansion | Electric Resistance |
| 7. VAV w/Reheat | Packaged rooftop variable air volume with reheat | VAV | Chilled Water | Hot Water Fossil Fuel Boiler |
| 8. VAV w/PFP Boxes | Variable air volume with reheat | VAV | Chilled Water | Electric Resistance |

BC Hydro New Construction Program (NCP) - Baseline HVAC System Types (2007)

| Proposed Building Type | | Proposed Heating Energy Source | | |
|--|---------------------|--------------------------------|-------------------------|-----------------------------------|
| | | Fossil Fuel & Purchased Heat | Fossil/Electric Hybrid* | Electric and On-Site Renewables** |
| Residential | Heating and Cooling | System 1 | System 1a | System 2 |
| | Heating only | System 1b | System 1c | System 2a |
| Nonresidential & 3 Floors or Less & <25,000 ft2 | | System 3 | System 3a | System 4 |
| Nonresidential & 4 or 5 Floors & <25,000 ft2 or 5 Floors or Less & 25,000 ft2 to 150,000 ft2 | | System 5 | System 5a | System 6 |
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* Fossil fuel based HVAC systems with heat pump pre-heat, or heat pump based HVAC systems with fossil fuel boost and/or back-up

** On-Site Renewables: Solar, Geo Thermal, Wind

Note: Baseline HVAC system types selection is based on the proposed building type and proposed building heating energy source (the first table)

BC Hydro New Construction Program (NCP) - Baseline System Descriptions

| System No. | System Type | Fan Control | Cooling Type | Heating Type | Ventilation Type | DWH System Type |
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| 1. PTAC | Packaged terminal air conditioner with hydronic heating coil (high t-re) | Constant Volume | Direct Expansion | Hot Water Fossil Fuel Boiler | Fossil Fuel Rooftop Make Up Air Unit | Hot Water Fossil Fuel Boiler |
| 1a. PTAC-GBHP | Packaged terminal air conditioner with hydronic heating coil (high t-re) | Constant Volume | Direct Expansion | Heat Pump with Fossil Fuel Back-up / Boost, Fossil Fuel Boiler with Heat Pump Pre-Heating, or Electric Resistance*** | Heat Pump with Fossil Fuel Back-up / Boost, Fossil Fuel Boiler with Heat Pump Pre-Heating, or Fossil Fuel Rooftop Make Up Air Unit*** | Heat Pump with Fossil Fuel Back-up / Boost, Fossil Fuel Boiler with Heat Pump Pre-Heating, or Fossil Fuel Boiler*** |
| 1b. HBB | Hydronic Baseboards (high t-re) | - | - | Hot Water Fossil Fuel Boiler | Fossil Fuel Rooftop Make Up Air Unit | Hot Water Fossil Fuel Boiler |
| 1c. EBB-GB | Electric Baseboards with gas ventilation and DWH | - | - | Electric Resistance | Fossil Fuel Rooftop Make Up Air Unit | Hot Water Fossil Fuel Boiler |
| 2. PTHP | Packaged terminal heat pump | Constant Volume | Direct Expansion | Electric Heat Pump | Electric Heat Pump | Electric Heat Pump |
| 2a. EEB-HP | Electric Baseboards with electric ventilation and DWH | - | - | Electric Resistance | Electric Resistance | Electric Resistance |
| 3. PSZ-AC | Packaged rooftop air conditioner | Constant Volume | Direct Expansion | Fossil Fuel Furnace | Fossil Fuel Furnace | Same Type as Proposed |
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Special Case No.4:

The proposed building type: 100,000 s.f. heated/cooled high school with gas fired distributed heat pump system, gas fired DOAS and DWH.

The BC Hydro NC Program baseline: 2-pipe changeover fan-coil system explained in the Special Case No.1 and gas fired DOAS and DWH. In case of all electric proposed space heating/cooling design, 2-pipe fan coil system with electric resistance duct heaters. Heated and cooled elementary schools (3 floors or less & <25,000 ft2) will default to System 3 or 3a (depending on the proposed heating energy source).