



# Mechanical Compliance Certificate

## 2009 IECC

### Section 1: Project Information

Project Type: **New Construction**

Project Title : Danforth on High

Construction Site:  
81 Danforth Street  
Portland, ME 04101

Owner/Agent:  
Danforth on High, LP  
309 Cumberland Ave.  
Portland, ME 04101

Designer/Contractor:  
Archetype Architects PA  
48 Union Wharf  
Portland, ME 04101

### Section 2: General Information

Building Location (for weather data): **Portland, Maine**  
Climate Zone: **6a**

### Section 3: Mechanical Systems List

#### Quantity System Type & Description

- |   |  |
|---|--|
| 2 | Plant 1: Heating: Hot Water Boiler, Capacity 399 kBtu/h, Gas, Efficiency: 92.00 % Et   |
| 1 | Water Heater 1: Gas Storage Water Heater, Capacity: 119 gallons, Input Rating: 125 Btu/h w/ Circulation Pump, Efficiency: 92.00 % Et |

### Section 4: Requirements Checklist

#### Requirements Specific To: Plant 1 :

- 1. Equipment minimum efficiency: Boiler Thermal Efficiency 75% Et 80% Ec
- 2. Two-pipe changeover heating/cooling controls must have:
  - a) 15 degrees F deadband where boiler and chiller can not operate,
  - b) allow operation in either heating or cooling for at least 4 hrs. and
  - c) prevent difference between heating and cooling set points greater than 30 degrees F

*Exception(s):*

  - Air/evap condenser and extensive outside-air filtration
- 3. Newly purchased heating equipment meets the efficiency requirements  
- used equipment must meet 80% Et @ maximum capacity
- 4. Systems with multiple boilers have automatic controls capable of sequencing boiler operation
- 5. Hydronic heating systems comprised of a single boiler and >500 kBtu/h input design capacity include either a multistaged or modulating burner

#### Requirements Specific To: Water Heater 1 :

- 1. Water heating equipment meets minimum efficiency requirements: Gas Storage Water Heater efficiency: 80.00 % Et (166 SL, kBtu/h)
- 2. All piping in circulating system insulated
- 3. Hot water storage temperature controls that allow setpoint of 90°F for non-dwelling units and 110°F for dwelling units.
- 4. Automatic time control of heat tapes and recirculating systems present
- 5. Controls will shut off operation of circulating pump between water heater/boiler and storage tanks within 5 minutes after end of heating cycle

#### Generic Requirements: Must be met by all systems to which the requirement is applicable:

- 1. Plant equipment and system capacity no greater than needed to meet loads  

*Exception(s):*

  - Standby equipment automatically off when primary system is operating

- Multiple units controlled to sequence operation as a function of load
- 2. Minimum one temperature control device per system
- 3. Minimum one humidity control device per installed humidification/dehumidification system
- 4. Load calculations per ASHRAE/ACCA Standard 183.
- 5. Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup  
*Exception(s):*
  - Continuously operating zones
  - 2 kW demand or less, submit calculations
- 6. Outside-air source for ventilation; system capable of reducing OSA to required minimum
- 7. Hot water pipe insulation: 1.5 in. for pipes ≤1.5 in. and 2 in. for pipes >1.5 in.  
Chilled water/refrigerant/brine pipe insulation: 1.5 in. for pipes ≤1.5 in. and 1.5 in. for pipes >1.5 in.  
Steam pipe insulation: 1.5 in. for pipes ≤1.5 in. and 3 in. for pipes >1.5 in.  
*Exception(s):*
  - Piping within HVAC equipment.
  - Fluid temperatures between 55 and 105°F.
  - Fluid not heated or cooled with renewable energy.
  - Piping within room fan-coil (with AHRI440 rating) and unit ventilators (with AHRI840 rating).
  - Runouts <4 ft in length.
- 8. Operation and maintenance manual provided to building owner
- 9. Hot water distribution systems ≥ 300 kBtu/h must have one of the following:
  - a) controls that reset supply water temperature by 25% of supply/return delta T
  - b) mechanical or electrical adjustable-speed pump drive(s)
  - c) two-way valves at all heating coils
  - d) multiple-stage pumps
  - e) other system controls that reduce pump flow by at least 50% based on load  
- calculations required*Exception(s):*
  - Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems.
  - Hydronic systems that use variable flow to reduce pumping energy.
- 10. Demand control ventilation (DCV) present for high design occupancy areas (>40 person/1000 ft<sup>2</sup> in spaces >500 ft<sup>2</sup>) and served by systems with any one of 1) an air-side economizer, 2) automatic modulating control of the outdoor air damper, or 3) a design outdoor airflow greater than 3000 cfm.  
*Exception(s):*
  - Systems with heat recovery.
  - Multiple-zone systems without DDC of individual zones communicating with a central control panel.
  - Systems with a design outdoor airflow less than 1200 cfm.
  - Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.
- 11. Automatic controls for freeze protection systems present
- 12. Exhaust air heat recovery included for systems 5,000 cfm or greater with more than 70% outside air fraction or specifically exempted  
*Exception(s):*
  - Hazardous exhaust systems, commercial kitchen and clothes dryer exhaust systems that the International Mechanical Code prohibits the use of energy recovery systems.
  - Systems serving spaces that are heated and not cooled to less than 60°F.
  - Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
  - Heating systems in climates with less than 3600 HDD.
  - Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64°F.
  - Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
  - Laboratory fume hood exhaust systems that have either a variable air volume system capable of reducing exhaust and makeup air volume to 50 percent or less of design values or, a separate make up air supply meeting the following makeup air requirements:
    - a) at least 75 percent of exhaust flow rate, b) heated to no more than 2°F below room setpoint temperature, c) cooled to no lower than 3°F above room setpoint temperature, d) no humidification added, e) no simultaneous heating and cooling.

## Section 5: Compliance Statement

*Compliance Statement:* The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2009 IECC requirements in COMcheck Version 3.9.1 and to comply with the mandatory requirements in the Requirements Checklist.

KURT MAGNUSSON P.E  
Name - Title

  
Signature

8/3/12  
Date

### Section 6: Post Construction Compliance Statement

- HVAC record drawings of the actual installation, system capacities, calibration information, and performance data for each equipment provided to the owner.
- HVAC O&M documents for all mechanical equipment and system provided to the owner by the mechanical contractor.
- Written HVAC balancing and operations report provided to the owner.

The above post construction requirements have been completed.

\_\_\_\_\_  
Principal Mechanical Designer-Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



# Mechanical Requirements Description

## 2009 IECC

The following list provides more detailed descriptions of the requirements in Section 4 of the Mechanical Compliance Certificate.

### Requirements Specific To: Plant 1 :

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency:  
Boiler Thermal Efficiency 75% Et 80% Ec
2. Two-pipe changeover heating/cooling controls must:
  - a) allow a deadband between changeover from one mode (heating/cooling) to the other of at least 15 degrees F outside temperatures
  - b) allow operation in one mode (heating/cooling) for at least 4 hours before changing over to the other mode
  - c) allow heating and cooling supply temperatures at the changeover point to be no more than 30 degrees F apart.Exception(s):
  - An economizer is not required due to unusual outside air filtration requirements. Section 403.3 of the Mechanical Code for New York State sets minimum outside air ventilation requirements and requirements for filtration or purification if the outside air does not meet minimum air-quality requirements. Economizers are not required for systems having air- or evaporatively cooled condensers (i.e., those that cannot use water economizers) when the outside air pollutants can be classified as "unusual."
3. The specified heating equipment is covered by Federal minimum efficiency requirements. New equipment of this type can be assumed to meet or exceed ASHRAE 90.1 Code requirements for equipment efficiency. Used equipment must meet 80% Et @ maximum capacity.
4. Systems with multiple boilers have automatic controls capable of sequencing the operation of the boilers.
5. Hydronic heating systems comprised of a single boiler and >500 kBtu/h input design capacity include either a multistaged or modulating burner.

### Requirements Specific To: Water Heater 1 :

1. Water heating equipment used solely for heating potable water, pool heaters, and hot water storage tanks must meet the following minimum efficiency: Gas Storage Water Heater efficiency: 80.00 % Et (166 SL, kBtu/h)
2. Insulation must be provided for recirculating system piping, including the supply and return piping of a circulating tank type water heater.
3. Service water-heating equipment shall be provided with controls to allow a setpoint of 110°F for equipment serving dwelling units and 90°F for equipment serving non-dwelling units. Lavatory outlet temperatures shall be limited to 110°F.
4. Systems designed to maintain usage temperatures in hot water pipes, such as recirculating hot water systems or heat trace, must be equipped with automatic time switches or other controls that can be set to switch off the temperature maintenance system during extended periods when hot water is not required.
5. When used to maintain storage tank water temperature, recirculating pumps must be equipped with controls limiting operation to the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle.

### Generic Requirements: Must be met by all systems to which the requirement is applicable:

1. All equipment and systems must be sized to be no greater than needed to meet calculated loads. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.  
Exception(s):
  - The equipment and/or system capacity may be greater than calculated loads for standby purposes. Standby equipment must be automatically controlled to be off when the primary equipment and/or system is operating.
  - Multiple units of the same equipment type whose combined capacities exceed the calculated load are allowed if they are provided with controls to sequence operation of the units as the load increases or decreases.
2. Each heating or cooling system serving a single zone must have its own temperature control device.
3. Each humidification system must have its own humidity control device.
4. Design heating and cooling loads for the building must be determined using procedures in the ASHRAE Handbook of Fundamentals or an approved equivalent calculation procedure.
5. The system or zone control must be a programmable thermostat or other automatic control meeting the following criteria:
  - a) capable of setting back temperature to 55°F during heating and setting up to 85°F during cooling,
  - b) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedules,
  - c) have an accessible 2-hour occupant override,
  - d) have a battery back-up capable of maintaining programmed settings for at least 10 hours without power.Exception(s):
  - A setback or shutoff control is not required on thermostats that control systems serving areas that operate continuously.

- A setback or shutoff control is not required on systems with total energy demand of 2 kW (6,826 Btu/h) or less.
6. The system must supply outside ventilation air as required by Chapter 4 of the International Mechanical Code. If the ventilation system is designed to supply outdoor-air quantities exceeding minimum required levels, the system must be capable of reducing outdoor-air flow to the minimum required levels.
  7. All pipes serving space-conditioning systems must be insulated as follows:
    - Hot water piping for heating systems:
      - 1 1/2 in. for pipes  $\leq$  1 1/2-in. nominal diameter,
      - 2 in. for pipes  $>$  1 1/2-in. nominal diameter.
    - Chilled water, refrigerant, and brine piping systems:
      - 1 1/2 in. insulation for pipes  $\leq$  1 1/2-in. nominal diameter,
      - 1 1/2 in. insulation for pipes  $>$  1 1/2-in. nominal diameter.
    - Steam piping:
      - 1 1/2 in. insulation for pipes  $\leq$  1 1/2-in. nominal diameter,
      - 3 in. insulation for pipes  $>$  1 1/2-in. nominal diameter.
- Exception(s):
- Pipe insulation is not required for factory-installed piping within HVAC equipment.
  - Pipe insulation is not required for piping that conveys fluids having a design operating temperature range between 55°F and 105°F.
  - Pipe insulation is not required for piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
  - Piping within room fan-coil (with AHRI440 rating) and unit ventilators (with AHRI840 rating).
  - Pipe insulation is not required for runout piping not exceeding 4 ft in length and 1 in. in diameter between the control valve and HVAC coil.
8. Operation and maintenance documentation must be provided to the owner that includes at least the following information:
    - a) equipment capacity (input and output) and required maintenance actions
    - b) equipment operation and maintenance manuals
    - c) HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions; desired or field-determined set points must be permanently recorded on control drawings, at control devices, or, for digital control systems, in programming comments
    - d) complete narrative of how each system is intended to operate.
  9. Hot water space-heating systems with a capacity exceeding 300 kBtu/h supplying heated water to comfort conditioning systems must include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.
 

Exception(s):

    - Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems.
    - Hydronic systems that use variable flow to reduce pumping energy.
  10. Demand control ventilation (DCV) required for high design occupancy areas ( $>$ 40 person/1000 ft<sup>2</sup> in spaces  $>$ 500 ft<sup>2</sup>) and served by systems with any one of 1) an air-side economizer, 2) automatic modulating control of the outdoor air damper, or 3) a design outdoor airflow greater than 3000 cfm.
 

Exception(s):

    - Systems with heat recovery.
    - Multiple-zone systems without DDC of individual zones communicating with a central control panel.
    - Systems with a design outdoor airflow less than 1200 cfm.
    - Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.
  11. All freeze protection systems, including self-regulating heat tracing, must include automatic controls capable of shutting off the systems when outside air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing. Snow- and ice-melting systems must include automatic controls capable of shutting off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.
  12. Individual fan systems with a design supply air capacity of 5000 cfm or greater and minimum outside air supply of 70 percent or greater of the supply air capacity must have an energy recovery system with at least a 50 percent effectiveness. Where cooling with outdoor air is required there is a means to bypass or control the energy recovery system to permit cooling with outdoor air.
 

Exception(s):

    - Hazardous exhaust systems, commercial kitchen and clothes dryer exhaust systems that the International Mechanical Code prohibits the use of energy recovery systems.
    - Systems serving spaces that are heated and not cooled to less than 60°F.
    - Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
    - Heating systems in climates with less than 3600 HDD.
    - Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64°F.

- Systems requiring dehumidification that employ energy recovery in series with the cooling coil..
- Laboratory fume hood exhaust systems that have either a variable air volume system capable of reducing exhaust and makeup air volume to 50 percent or less of design values or, a separate make up air supply meeting the following makeup air requirements: a) at least 75 percent of exhaust flow rate, b) heated to no more than 2°F below room setpoint temperature, c) cooled to no lower than 3°F above room setpoint temperature, d) no humidification added, e) no simultaneous heating and cooling.