HVAC SYSTEMS

NARRATIVE REPORT

The following is the HVAC system narrative, which defines the scope of work and capacities of the HVAC system as well as the Basis of Design. The HVAC systems shall be designed and constructed for LEED for Schools where indicated on this narrative.

1. CODES

   All work installed under Division 230000 shall comply with the Town of Winthrop Building Code and all state, IBC 2009 Appendix 115AA - Stretch Energy Code, county, and federal codes, laws, statutes, and authorities having jurisdiction.

2. DESIGN INTENT

   The work of Division 230000 is described within the narrative report. The HVAC project scope of work shall consist of providing new HVAC equipment and systems as described here within. All new work shall consist of furnishing all materials, equipment, labor, transportation, facilities, and all operations and adjustments required for the complete and operating installation of the Heating, Ventilating and Air Conditioning work and all items incidental thereto, including commissioning and testing.

3. BASIS OF DESIGN: (MASS CODE)

   Project weather and Code temperature values are listed herein based on weather data values as determined from ASHRAE weather data tables and the International Energy Conservation Code.

   Outside: Winter 5 deg. F, Summer 91 deg. F DB 74 deg. F WB

   Inside: 70 deg. F +/- 2 deg F for heating, 75 deg. F +/- 2 deg F (55% RH) for cooling for areas with air conditioning. 78 deg. F +/- 2 deg F (55% RH) for cooling for areas with displacement ventilation. Unoccupied temperature setback will be provided.

   Generally outside air is provided at the rate of 15 cfm/person in all classrooms and large group spaces, and 15 cfm/person for the combination auditorium, gymnasium and cafeteria. In all cases ASHRAE guide 62.1-2007 and the International Mechanical Code will be met as a minimum. All occupied areas will be designed to maintain 850 PPM carbon dioxide maximum.

4. SYSTEM DESCRIPTION

   A. Central Heating Plants: LEED for Schools Credit EP2 & EC1

      Heating for the entire building will be through the use of a high efficiency gas-fired condensing boiler plant.

      The boiler plant shall be provided with (3) 1500 MBH input boilers and (2) end suction base mounted pumps with a capacity of 450 gpm each will be located in the mechanical room. In addition to new boilers and pumps, new hot water accessories including air separators and expansion tanks shall be provided.
The boiler plant will supply heating hot water to heating equipment and systems located throughout the building through a two-pipe fiberglass insulated schedule 40 black steel piping system. The boiler plants shall supply a maximum hot water temperature of 160 deg F on a design heating day and the hot water supply water temperature will be adjusted downward based on an outside temperature reset schedule to improve the overall operating efficiency of the power plants. Primary and standby end suction base mounted pumps will be provided with variable frequency drives for variable volume flow through the water distribution system for improved energy efficiency.

Combustion air for each boiler will be directly ducted to each boiler through a galvanized ductwork distribution system. Venting from each boiler shall be through separate double wall aluminized stainless steel (AL29-4C) vent system and shall discharge approximately 12 feet above the roof level. Final venting height will be depending on the location of building intake air locations and adjacent roofs.

B. Central Cooling Plant: **LEED for Schools Credit EP2 & EC1**

A high efficiency central chilled water cooling plant consisting of a 20 ton outdoor, high-efficiency, air cooled chilled, primary and standby chilled water pumps with VFDs, each with a capacity of 50 gpm, accessories, controls and steel and copper piping distribution system shall be provided to serve chilled water cooling HVAC equipment located throughout the building. The chilled water system will consist of a 35% propylene glycol solution. A glycol make-up feed unit system shall be provided.

D. Classroom Heating and Ventilation (General Classrooms, Art & Music, SPED, Vocational & Technology Classrooms):

**LEED of Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1**

Rooftop air handling units with supply and return fan with VFDs, energy recovery wheels, gas fired heating section with modulating capacity control, DX cooling system and MERV 13 filtration will be provided to serve a new displacement ventilation system. Supply air will be provided to the space through a galvanized steel supply duct distribution system and shall be connected to wall mounted displacement ventilation diffusers located within the classrooms. Return air will be drawn back to the units by ceiling return air registers located within the classroom and will be routed back to the rooftop unit by a galvanized sheetmetal return air ductwork distribution system. Supplemental hot water fin tube radiation heating will be provided along exterior walls.

It is estimated that the following rooftop air handling equipment will be required to serve these Classroom areas:

(4) Four air handling units with a capacity of 11000 CFM (40 Tons Cooling, 480 MBH Heating).

**Displacement Ventilation:**

The displacement ventilation system for the classroom wings are intended to provide a maximum cooling temperature during peak cooling periods of approximately 78°F, however, the ventilation air provided will be extremely dry which will be the result of utilizing refrigeration equipment and hot gas reheat to reduce vapor pressure to an extremely low condition of approximately 50 grains of moisture per pound of air and reheating the air to a supply temperature of approximately 68°F which will be distributed
to each space. The extremely dry condition of the supply air provides the perception of a condition that is cooler than is actually occurring due to the evaporation of moisture to the adjacent air from the occupants of the space.

Considering maximum cooling requirements occur primarily during the months of July and August when the majority of the academic areas are not in use, it would suggest maintaining slightly higher temperatures may not present a discomfit, however, will relate to a substantial operating cost savings and a reduced installation cost.

An additional major benefit of utilizing dry air within the building will be the overall reduction of vapor pressure typically present in outside ventilation air during summer months. This reduction in vapor pressure will dramatically reduce the amount of moisture entering the building and the potential of condensation resulting in moisture, and a direct relationship with the formation of mold.

Classrooms Requiring Full Air Conditioning:

Classrooms that require full air conditioning will be provided with supplemental cooling equipment, including high efficiency variable refrigerant AC systems or active chilled beam induction units.

E. Gymnasium:

**LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1**

The gymnasium will be served by a rooftop air handling unit with supply and return fan with VFDs, energy recovery wheel, gas fired heating section with modulating capacity control, DX cooling system MERV 13 filtration, and carbon dioxide controls which will reduce outside air as allowed maintaining a maximum of 850 PPM will be provided to serve a displacement ventilation system. Supply air will be provided to the space through a galvanized steel supply duct distribution system and shall be connected to wall mounted displacement ventilation diffusers located within the gymnasium. As levels of carbon dioxide drop, generally relating to a reduction in population, the variable frequency drive located in the rooftop unit will modulate to reduce air flow and ventilation while always maintaining a maximum of 850 ppm. Return air will be drawn back to the units by ceiling return air registers located within the gymnasium and will be routed back to the rooftop unit by a galvanized sheetmetal return air ductwork distribution system. Supplemental hot water fin tube radiation heating will be provided along exterior walls.

It is estimated that the Gymnasium will be served by (2) two rooftop air handling units. One rooftop unit will have a capacity of 6500 CFM (27.5 Tons Cooling, 300 MBH Heating), and the other unit will have a capacity of 5000 CFM (18 Tons Cooling, 240 MBH Heating).

F. Locker Rooms:

**LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1**

The Boys and Girls locker rooms, team rooms and adjacent office areas will be provided with new roof-mounted air handling units of the 100% outside air design with energy recovery. There will be (2) units, with one unit serving the Middle School locker room areas and the other unit serving the High School locker room areas, each unit will be approximately 2500 CFM and will include a supply and exhaust fan with VFDs, 300 MBH gas fired heating section with modulating capacity control, and MERV 13 filtration. Supply
Air ventilation will be provided to each space through new galvanized supply duct which will travel throughout each locker room area to a series of ceiling mounted supply registers. New exhaust air ductwork and air distribution devices shall be installed and shall be routed from the locker and team rooms to the new air handling units.

G. Auditorium and Stage:

*LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1*

The auditorium and stage will be provided with a new roof-mounted air handling unit of the recirculation design capable of providing 100% outside air variable volume displacement ventilation air distribution to the Auditorium and Stage areas. The units will be approximately 9,000 CFM and will include supply and return fans with VFDs, 400 MBH gas fired heating section with modulating capacity control, 40 ton DX cooling system and MERV 13 filtration.

Supply air ventilation to the auditorium will be provided to the space through the galvanized steel supply duct distribution system that will connect to displacement diffuser. In addition, carbon dioxide controls will be installed which will monitor the overall level of carbon dioxide at a threshold level of 850 ppm. As levels drop generally relating to a reduction in population the air handling unit outside air damper will modulate to reduce air flow and ventilation while always maintaining a maximum of 850 ppm. Return air will be drawn back to the units by return air registers located high on walls within the space or near the ceiling of the space.

I. Administration and Guidance Areas:

*LEED for Schools Credit EO2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1*

Spatial heating and air-conditioning for the Administration area and Guidance offices will be served by horizontal ceiling concealed type ducted 4-pipe heating and cooling active chilled beam induction units with hot water and chilled water for the induction unit system provided by the individual hot water and chilled water central recirculation piping system communicating with the boiler and chilled water power plants.

(2) Two rooftop units will be provided; one unit will serve the Middle School administration area and the other unit will serve the High School administration area. Each of the rooftop units will be approximately 1,500 CFM and will include supply and return fans with VFDs, 150 MBH gas fired heating section with modulating capacity control, MERV 13 filtration, 6.25 ton capacity DX cooling section, and exhaust air energy recovery wheel. Supply air ventilation will be provided to each space that will satisfy building code requirements based on population.

J. Drama/Music Classrooms

*LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1*

The Drama/Music classroom areas will be served by a roof mounted recirculation design air handling unit capable of providing 100% outside air (economizer). The unit will be approximately 2,500 CFM and will include supply and return fan with VFDs, 200 MBH gas fired heating section with modulating capacity control, MERV 13 filtration, 10 ton DX cooling section, and exhaust air energy recovery wheel. Supply air ventilation will be provided to each space which will satisfy building code requirements based on population. It is proposed that spatial heating and air-conditioning for in this area will be provided by a displacement air ventilation system with variable air volume boxes with
temperature and CO2 controls. Perimeter hot water radiation heating equipment shall be provided for supplemental and night setback heating operation.

K. Media Center/Computer Lab  
*LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1*

The Media Center and adjacent office and Computer Lab spaces will be provided with roof mounted air handling units of a recirculation design capable of providing 100% outside air (economizer) and variable air volume operation displacement ventilation air distribution to the Media Center. Each of the units will be approximately 4,600 CFM and will include supply and return fan with VFDs, 200 MBH gas fired heating section with modulating capacity control, MERV 13 filtration, 15 ton capacity DX cooling section, and exhaust air energy recovery wheel. Supply air ventilation will be provided to each space which will satisfy building code requirements based on population. It is proposed that spatial heating and air-conditioning for zones will be provided by a displacement air ventilation system with CO2 demand ventilation controls. Hot water radiant panel heating will be provided for supplemental and night setback heating operation. The radiant heating panels will be connected to the central hot water heating recirculation piping system communicating with the boiler power plants.

L. Cafeteria and Staff Lunch Areas  
*LEED for Schools Credit EP2, EC1, EC5, IEQP1, IEQC1, 2, 3.1, 3.2, 5, 6.2 & 7.1*

The Cafeteria areas will be served by a roof mounted recirculation design air handling unit capable of providing 100% outside air (economizer). The unit will be approximately 6,500 CFM and will include supply and return fan with VFDs, 450 MBH gas fired heating section with modulating capacity control, MERV 13 filtration, 22 ton DX cooling section, and exhaust air energy recovery wheel. Supply air ventilation will be provided to each space which will satisfy building code requirements based on population. It is proposed that spatial heating and air-conditioning for in this area will be provided by a displacement air ventilation system with variable air volume boxes with temperature and CO2 controls. Perimeter hot water radiation heating equipment shall be provided for supplemental and night setback heating operation.

M. Kitchen  
*LEED for Schools Credit EP2*

The kitchen areas shall be provided with new kitchen exhaust air fan and make-up air rooftop unit with gas fired heating. The kitchen will be heated by a roof mounted heating and ventilation air handling units with gas fired heating.

A variable volume kitchen exhaust hood control system consisting of kitchen exhaust stack temperature and smoke density sensors, supply and exhaust fan variable speed drives and associated controller will be provided by the kitchen equipment vendor. This system installation shall be field installed and coordinated with the ATC and Electrical contractors.

N. Lobby, Corridor, and Entry Way Heating

New hot water convectors, cabinet unit heaters and fin tube radiation heating equipment shall be installed to provide heating to these areas. Corridors shall be ventilated from adjacent air handling unit systems.
O. Custodial Support Areas

Custodial support areas will be heated and ventilated by an indoor hot water heating and ventilation unit. Storage areas will be heated by hot water radiation heating equipment. Horizontal type unit heaters will heat areas adjacent to the loading dock. All custodial closets will be exhausted by exhaust air fan systems.

P. Utility Areas:

Utility areas will be provided with exhaust air fan systems for ventilation, and will typically be heated with horizontal type ceiling suspended unit heaters.

The main electric rooms and IDF rooms will be air conditioned by high efficiency ductless AC cooling units.

Q. Testing, Adjusting, Balancing & Commissioning:

All new HVAC systems shall be tested, adjusted, balanced and commissioned as part of the project scope.

R. Automatic Temperature Controls – Building Energy Management System

A new DDC (direct digital control) automatic temperature control and building energy management system shall be installed to control and monitor building HVAC systems. Energy metering shall be installed to monitor the energy usage of building HVAC systems and utilities (fuel, gas, water).