









MECHANICAL ASSESSMENT

MAINE EAST HIGH SCHOOL

This report section includes an overview of the existing mechanical cooling and heating systems serving Maine East High School. The sections will include: building cooling plant, building heating plant, mechanical ventilation systems, unit ventilators, roof top units and recommendations for replacement of these mechanical systems.

The system replacement recommendation(s) follow each equipment's existing conditions description. To determine the recommendations, our experience with similar systems and the ASHRAE median service life tables were utilized. Estimated equipment service life, according to the 2015 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Handbook, is defined as the economic life of a system or component, or the amount of time it remains in its original service application. The remaining service life values reported in this document are based off the ASHRAE Equipment Life Expectancy Chart, as well as the ASHRAE Preventative Maintenance Guidebook, which use median years to provide an indication of expected equipment service life. Many factors effect equipment service life and with any average, some systems may have lifetimes far from average. However, these median lifetimes provide a reasonable basis for establishing the remaining useful life of existing systems.



MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS MECHANICAL ASSESSMENT

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Equipment recommended for replacement is categorized into the following four groups:

- 1. 1 to 2 Years (2019 to 2020) Equipment in this category should be considered for replacement within the next couple of years.
- 2. 3 to 5 Years (2021 to 2023) Replacement of equipment in this category is less pressing than equipment listed in categories 1-2, but should still be considered for replacement within this timeframe.
- 3. 6 to 10 Years (2024 to 2028) Replacement of equipment in this category is not an immediate need, but is still recommended for replacement within this timeframe.

On the following pages are four (4) maps. The maps display an overview of all the mechanical ventilation systems at Maine East. These systems will be discussed in further detail throughout the report.





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MECHANICAL VENTILATION OVERVIEW

MAINE EAST HIGH SCHOOL

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS



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MECHANICAL VENTILATION OVERVIEW

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MECHANICAL VENTILATION OVERVIEW

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- (2017) Four-Pipe UVs With Condensing Unit



Third Floor Plan





MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

MECHANICAL VENTILATION OVERVIEW

MAINE EAST HIGH SCHOOL

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Science Wing Chiller Location & Zone

Lower Floor Plan

Science Wing Chiller



Space cooling for Maine East is provided by three (3) separate chilled water plants. The chillers are in three (3) separate mechanical rooms, and serve multiple two or four-pipe unit ventilators (UVs) as well as air handling units (AHUs) throughout the building.

SCIENCE WING CHILLED WATER PLANT

The first chilled water plant is equipped with one (1) 180-ton natural gas fired absorption chiller located in the basement boiler room and is commonly referred to as the "Science Wing Chiller." This plant serves the basement and all three floors of the Science Wing. The Science wing was pumps were also installed in 1999. The picture on the right shows the location of the chiller and the area it serves.

Water is circulated throughout the science wing by two (2) constant speed "Bell & Gossett" dual temperature pumps, also located in the boiler room. Each pump is rated for 15 HP, 75 ft. of head, and 438.5 GPM of flow. Hot water for the science wing dual temperature system is provided via one (1) "Bell & Gossett" steam-to-hot water shell and tube heat exchanger (HX located near the science wing chiller. Heat exchangers and the building heating plant will be discussed in further detail in the building heating section.

Heat rejection is provided by one (1) single cell "Marley" cooling tower, located on the industrial arts building roof. It is equipped with one (1) two-speed direct drive tower fan rated for 15 HP. Flow through the tower is provided by one (1) constant speed "Bell & Gossett" base-mounted condenser water pump rated for 25 HP, 80 ft. of head, and 762 GPM of flow.

Tag	Service	Location	Pump Motor HP	Pump Feet of Head	Supply GMP	Fluid Medium
P-1	Science Wing	Science Chiller Rm.	15	75	438.5	Hot Water & Chilled Water
P-2	Science Wing	Science Chiller Rm.	15	75	438.5	Hot Water & Chilled Water
P-3	Science Wing Cooling Tower	Science Chiller Rm.	25	80	762	Condenser Water

Table 1: Science Wing Pumps

It should be noted that a separate study evaluating the chilled water plants serving Maine East High School is currently underway. The study includes evaluation of the feasibility for interconnection of all (3) chilled water plants and the elimination of the center court chiller plant. For further details please reference this Maine East Chilled Water Study.

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS **BUILDING COOLING PLANTS**

BUILDING COOLING PLANTS

MAINE EAST HIGH SCHOOL

Center Court Chiller Location & Zone



Center Court Chiller



CENTER COURT CHILLED WATER PLANT

The second chilled water plant is equipped with one (1) "Trane" 250-ton steam driven absorption chiller, referred to as the "Center Court Chiller." The center court building was constructed in 1969, and the chiller was later installed in 1995. Heat rejection for the center court chiller is provided by one (1) two-speed "Marley" single-cell cooling tower located on the center-court building roof. This plant serves the center court classroom two-pipe unit ventilators, finned tube radiators, two (2) AHUs located in the center court basement, and one (1) AHU located in the attic above the Learning Resource Center (LRC). The picture on the right provides the location of the steam boiler plant, the chiller, as well as the chillers' zones of service.

There are six (6) total pumps located in the center court basement mechanical room and listed in the following table below. The first two (2) "Bell & Gossett" pumps were installed in approximately 1968 and serve hot water to the center court finned tube radiators. The next two (2) "Bell & Gossett" pumps were also installed in approximately 1968 and serve hot water and chilled water to the center court twopipe unit ventilators. The fifth "Baldor" pump circulates chilled water throughout the chiller and the sixth is a 15 HP condenser water pump which serves the center court cooling tower. Both the chilled water and condenser water pumps were installed in 1995.

Tag	Service	Location	Pump Motor HP	Pump Feet of Head	Supply GMP	Fluid Medium
P-FT1	Center Court FTRs	Center Court Mech. Rm.	3	57	62	Hot Water
P-FT1	Center Court FTRs	Center Court Mech. Rm.	3	57	62	Hot Water
P-UV1	Center Court UVs	Center Court Mech. Rm.	7.5	70	215	Hot Water & Chilled Water
P-UV1	Center Court UVs	Center Court Mech. Rm.	7.5	70	215	Hot Water & Chilled Water
P-CHW	Center Court Chiller	Center Court Mech. Rm.	15	-	-	Chilled Water
P-CW	Center Court CoolingTower	Center Court Mech. Rm.	15	-	-	Condenser Water

It should be noted that a separate study evaluating the chilled water plants serving Maine East High School is currently underway. The study includes evaluation of the feasibility for interconnection of all (3) chilled water plants and the elimination of the center court chiller plant. For further details please reference this Maine East Chilled Water Study.

1 TO 2 YEAR RECOMMENDATION

The four (4) "Bell & Gossett" pumps that serve the FTRs and UVs have been in operation since approximately 1968. They are in poor condition due to age and their reliability is diminishing. It is recommended to replace these pumps with a like for like replacement. Please reference the Pump Cost Estimates section for additional details.



MAINE EAST HIGH SCHOOL

Table 2: Center Court Pumps

*Note no pump tag name was found, so tags were assigned to each pump.



Main Chilled Water Plant & Zones

MAIN CHILLED WATER PLANT

The third and final chilled water plant is equipped with two (2) 400-ton natural gas fired absorption chillers, known as "The Main Chillers." They are in the chiller room on the 1st floor and were installed in 2003. The associated pumping and cooling tower equipment was also installed in 2003. Equipment served includes six (6) AHUs and classroom four-pipe UVs located throughout the building. Note the highlighted picture to the right for the chillers location and areas served by these chillers.

This system utilizes a "primary-secondary" chilled water loop. The "primary" chilled water loop utilizes two (2) constant flow "Bell & Gossett" pumps, one (1) for each chiller. These pumps circulate water through their respective chiller and are each rated for 10 HP, 25 ft. of head and 922 GPM.

Chilled water is circulated throughout the "secondary" loop, by two (2) variable flow "Bell & Gossett" pumps that are each rated for 25 HP, 70 ft. of head, and 1060 GPM of flow. The secondary loop supplies chilled water to the areas highlighted in the photo on the right. Heat rejection for the chillers is provided by two (2) "Evapco" cooling towers located on the roof. Flow through the towers is provided by two (2) constant flow "Bell & Gossett" condenser water pumps that are each rated for 40 HP, 60 ft. of head, and 950 GPM of flow.

Table	3:	Main	Chillers'	Pum	p
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Tag	Service	Location	Pump Motor HP	Pump Feet of Head	Supply GMP	Fluid Medium
P-CH1	Primary CHW Loop	Chill Rm.	10	25	922	Chilled Water
P-CH1	Primary CHW Loop	Chill Rm.	10	25	922	Chilled Water
P-1	Secondary CHW Loop	Chill Rm.	25	70	1060	Chilled Water
P-1	Secondary CHW Loop	Chill Rm.	25	70	1060	Chilled Water
P-CT1	Cooling Tower	Chill Rm.	40	60	950	Condenser Water

Main Chillers





It should be noted that a separate study evaluating the chilled water plants serving Maine East High School is currently underway. The study includes evaluation of the feasibility for interconnection of all (3) chilled water plants and the elimination of the center court chiller plant. For further details please reference this Maine East Chilled Water Study.

1 TO 2 YEAR RECOMMENDATION

Based on conversations with maintenance staff the two (2) 3-way condenser water valves serving these chillers do not function properly. Please reference the Cost Estimates section for additional details.

BUILDING COOLING PLANTS

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MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS **BUILDING HEATING PLANT**

Bolier Plant Location



Lower Floor Plan

"Brvan" Steam Boiler







Heating for the building is provided by one (1) steam boiler plant that consists of two (2) "Bryan" natural gas fired steam boilers located in the building's basement boiler room, note the picture on the right for location. Both boilers are equipped with "Gordon-Piatt Winfield" Burners that are each rated for a maximum firing rate of 21,000 MBH and a total minimum firing rate of 5,250 MBH. The boilers were installed in 2003 and serve the entire building's heating equipment, excluding areas served by gas-fired rooftop units (RTUs) which will be discussed in further detail within the mechanical ventilation section. The boilers provide steam to the center court steam absorption chiller, a domestic hot water heater, five (5) AHUs, unit heaters, and seven (7) steam-to-hot water heat exchangers. The heat exchangers provide heating hot water to the school's unit ventilators, air handling units, and unit heaters.

Steam is supplied to seven (7) heat exchangers that provide heating hot water to UVs, AHUs and cabinet heaters located throughout the building. The following table displays additional information regarding the heat exchangers.

Тад	Area Served	Location	Age
*LRC-HX1	LRC AHU	LRC Attic	1968
*LRC-HX2	LRC Fin Tube Radiators	LRC Attic	1968
*CC-HX1	Center Court UVs	Center Court Mech Rm.	1968
*CC-HX2	Center Court Fin Tube Radiators	Center Court Mech Rm.	1968
*SW-HX	Science Wing UVs	Boiler Room	1999
HX-1	Remainder of UVs and AHUs	Attic	2002
HX-1	Remainder of UVs and AHUs	Attic	2002

No alterations are recommended for the boiler equipment and heat exchangers within the scope of this report.

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Table 4: Heat Exchanger Datails

*Note no tag name was found, so tags were assigned to the associated HX.

AHU-S11 Zone



Lower Floor Plan

Ventilation for Maine East High School is provided by twenty-four (24) air handling units (AHUs), eighteen (18) roof top units (RTUs), and unit ventilators (UVs) located in most classrooms. Air is exhausted by exhaust fans located throughout the building.

AIR HANDLING UNITS

AHU-S11 is a variable volume air handling unit installed in 2014. The unit is equipped with a direct expansion (DX) cooling coil with an associated remote outdoor condensing unit for cooling and a steam coil for heating. This AHU serves the highlighted portion of the basement classrooms pictured right. AHU-S11 has a separate supply and return fan, and each are equipped with a variable frequency drive (VFD) for variable operation. Although, AHU-S11 was installed in 2014 the existing return fan was retrofitted for use with the new AHU. It was reported that this return fan has been in operation since approximately the 1950s. AHU-S11 operates utilizing demand controlled ventilation with CO2 sensors that respond based on the ventilation load needed in any given spaces. The following table provides a summary of AHU-S11.

Table	5:	AHL	J-S11
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Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-S11	North Basement Area	Basement	8,000	7.5	DX	Steam

1 TO 2 YEAR RECOMMENDATION

No alterations are recommended for AHU-S11; however, it is recommended to replace the associated return fan as it is significantly aged beyond its ASHRAE median service life of 25 years. Please reference the Exhaust/Return Fan Cost Estimates section for related pricing information.



MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

MECHANICAL VENTILATION SYSTEMS

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AH-1 to AH-5 serves the basement and floors one through three of the highlighted zone on the right, minus the zone of AHU-S11 discussed on the previous page. These units are all constant volume multi-zone units located in the fourth-floor attic and were installed in 2002. AH-2 utilizes a direct expansion (DX) cooling coil equipped with a remote outdoor condensing unit. The remaining (4) AHUs are equipped with chilled water coils and are supplied chilled water via the main chilled water plant. All (5) units have pre-heat and re-heat coils that are served hot water via the two (2) HXs located in the same attic space. In addition, each AHU is equipped with a supply and return fan. The table below provides a summary of the AHUs described above.

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-1	8 Zones: 238, 336/337, 338, Cor. 3, 137, 237, 234, 236	Basement	9,500	10	Chilled Water	Hot Water
AH-2	6 Zones: 124A, AD.W, AD.C, AD.NE, AD.SE, Store	Attic	6,000	7.5	DX	Hot Water
AH-3	12 Zones: 331, Cor. 2, 330A, 230, 231, 332, 135, 234A, 335, 235, 131, COR 1 & 334	Attic	12,400	20	Chilled Water	Hot Water
AH-4	11 Zones: 330B, 230A, 122, Cor. 2, 328, 222, 324, 326, 226, 129 & 229 & 329, 224	Attic	12,400	20	Chilled Water	Hot Water
AH-5	9 Zones: 119, 319, 219, 323, 123, 223, 321, 121, 221 & Cor. 3	Attic	12,400	20	Chilled Water	Hot Water

6 TO 10 YEAR RECOMMENDATION

Multi-zone systems are energy intensive because simultaneous heating and cooling occurs at each air handler to serve "hot deck" and "cold deck" ducts, which mix to space appropriate temperatures at local mixing boxes. This type of operation is less efficient than only heating or only cooling a space. In addition, these units are constant flow which is significantly less efficient when compared to variable volume.

It is recommended to install variable frequency drives (VFDs) on the supply/return fans. The supply fans would serve new Terminal boxes equipped with hot water reheat coils. This recommendation is not pressing since these units were installed in 2002; however, it would result in long term energy savings. Additionally, fan motor life is extended because a fan motor with a VFD can "soft-start." A "soft-start" increases motor life because it allows the motor to slowly ramp up which reduces initial start-up shock when compared to a traditional motor start. Please reference the AHU Cost Estimates section for pricing details.



MECHANICAL VENTILATION SYSTEMS

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Table 6: AHUs 1-5



AH-6 serves the auditorium and basement dressing rooms with variable air volume supply and is equipped with a separately mounted variable volume return fan. This unit is equipped with a steam heating coil and chilled water cooling coil. It is located in the mechanical space above the auditorium. AH-7 is also a variable volume AHU that is equipped with a separately mounted variable volume return fan. AH-7 serves the cafeteria and dance studio and is equipped with a chilled water coil and steam heating coil. Both units are provided chilled water via the main chilled water plant and were installed in 2002.

Table 7: AH-6 & AH-7

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-6	Auditorium and Dressing Rooms	2nd Floor Auditorium	54,000	60	Chilled Water	Steam
AH-7	Cafeteria and Dance Studio	2nd Floor Fan Room	29,000	30	Chilled Water	Steam

No alterations are recommended for this equipment within the scope of this report.

AH-7: Cafeteria and Dance Studio Zone



MECHANICAL VENTILATION SYSTEMS

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AHU-S1: Faculty Dining Zone



First Floor Plan



MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

AHU-S1 is a constant volume AHU equipped with a DX cooling coil and an associated roof mounted condensing unit. Heating is provided by duct mounted steam coils. AHU-S1 delivers conditioned air to the faculty dining area; note the graphic on the right for AHU-S1's zone. AHU-S2 is a constant volume AHU that utilizes steam heating coils. AHU-S2 serves the multi-purpose room and is not equipped with any cooling equipment. AHU-S2 is equipped with a separate mounted return fan that recently had its motor replaced. Both units were installed in 1951 and are furnished with pneumatic controls. The following table below summarizes AHUs S1 and S2.

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-S1	Faculty Dining	2nd Floor Fan Equipment Room	13,620	5	DX	Steam
AHU-S2	Multi-Purpose Room	2nd Floor Fan Equipment Room	19,700	5	None	Steam

1 TO 2 YEAR RECOMMENDATION Faculty Dining AHU-S1 and Multi-Purpose AHU-S2 have been in operation since 1951. These AHUs are substantially aged, and have surpassed their ASHRAE median service life of thirty (30) years. Additionally, constant volume, systems are considerably less energy efficient than today's technology.

It is recommended to upgrade the AHUs referenced above with new AHUs that are variable volume supply/return and equipped with chilled water coils, either steam or hot water coils, and direct digital control (DDC) capabilities. Further investigation would be required to determine if steam or hot water coils are more cost effective. A variable volume system upgrade operates based on the demand of the spaces; when demand is low, the supply fan reduces its speed, which results in significant energy savings both from the perspective of fan energy as well as heating and cooling energy. DDC technologies offer precise unit control, and constant unit monitoring to notify of issues or recommended preventative maintenance procedures. Implementing DDC can provide increased system efficiencies and optimal comfort control. Additionally, fan motor life is extended when equipped with a VFD. Please reference the AHU Cost Estimates section for pricing details.

First Floor Plan





MECHANICAL VENTILATION SYSTEMS

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Table 8: AHU-S1 & AHU-S2

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS MECHANICAL VENTILATION SYSTEMS

AH-S7: Learning Resource Center Zone

Lower Floor Plan

AH-S7 is a constant volume multi-zone AHU that serves the entire Learning Resource Center (LRC) occupying the basement through third floor (pictured right). AHU-S7 is equipped with a chilled cooling coil and hot water heating coil. AH-S7 is located on the 4th floor attic. S7 was installed in 1968 and utilizes an "Andover" pneumatic control system which is in a limited operating state due to its age and condition. AHU-S7 is served chilled water from the center-court chiller. AHU S-38 also installed in 1968 once served the basement pool area, but is no longer in operation. The following table summarizes the AHUs described above:

Table	9:	AHU	S-7	&	٩HU	S-38
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Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AH-S7	Basement to 3rd Floor of LRC	Upper Attic	40,370	25	Chilled Water	Hot Water
AH-S38	Basement Pool Area (No Longer Operating)	Upper Attic	9,400	5	None	Hot Water

1 TO 2 YEAR RECOMMENDATION

AHU-S7 has been in operation since 1968. This AHU is reportedly limited in use due to its aged pneumatic control system and has condensation leaking issues. According to ASHRAE, the median service life of an AHU of this type is thirty (30) years. This unit is well past its useful life and because of its aged characteristics, and poor controllability, this unit falls in the 1 to 2-year recommendation for replacement category.

It is recommended to upgrade this AHU with a new variable volume AHU that is equipped with chilled water coils, hot water coils and DDC. With the transition to variable flow, and new unit technologies of DDC capabilities, considerable energy savings, reliability and comfort improvements would be achieved. Please reference the AHU Cost Estimates section for pricing details.



MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

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AHUs SC & SE: Center Court AHUs - 1st Floor







Second Floor Plan



There are three (3) constant volume AHUs located in the basement fan room of the center court building. All units were installed in 1968. AHU-SC and AHU-SE are equipped with chilled water coils and AHU-SD is equipped with an associated remote condensing unit located on the center court roof. All three (3) units are equipped with heating hot water coils. The center court chilled water plant provides chilled water to these units and the two (2) center court heat exchangers provide hot water to their coils. All three (3) AHUs are equipped with pneumatic controls and each have separate return fans. AHU-SE serves only the exercise room, while multi-zone unit AHU-SC serves various office spaces. Multi-zone unit AHU-SD serves the TV studio, and computer labs located on the first and second floors of the center court building. Further details on the center-court AHUs are provided in the table below and graphics on the right.

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SC	Psychologist and Rms. C112 to C117	Basement Fan Equipment Rm.	2,480	2	Chilled Water	Hot Water
AHU-SD	TV Studio & Computer Lab	Basement Fan Equipment Rm.	6,635	5	DX	Hot Water
AHU-SE	Exercise Room	Basement Fan Equipment Rm.	1,650	1	Chilled Water	Hot Water

1 TO 2 YEAR RECOMMENDATION

1 to 2 years.

It is recommended to upgrade each of these AHUs with new variable volume AHUs that are equipped with chilled water coils, hot water coils and DDC interconnectivity. With the transition to variable flow, and DDC capabilities, considerable energy savings, reliability and comfort improvements would be achieved. Please reference the AHU Cost Estimates section for pricing details.

MECHANICAL VENTILATION SYSTEMS

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Table 10: AHU-SC, AHU-SD, AHU-SE

The three (3) center court AHUs have been in operation since 1968. The ASHRAE tables display a median service life for AHUs of this type to be thirty (30) years. Due to their diminishing reliability due to age, these units are recommended for replacement within the next

AHUs SH & SJ: Pool Units



AHU-SG is a constant volume heating only AHU that resides below the pool. This unit is equipped with a hot water heating coil, and provides 4,765 CFM of 100% outdoor air to the pool locker rooms. The pool area is served by two (2) constant volume AHUs (AHU-SH and AHU-SJ) that are each equipped with hot water coils. These AHUs provide 17,090 CFM of ventilated air to the pool area and utilize face and bypass dampers. All three (3) of these units utilize pneumatic controls and were installed in 1968. The following table below provides a summary of the pool equipment.

Table 11: AHU-SG, AHU-SH, AHU-SJ

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SG	Pool Locker Rooms	Under Pool Bleachers	4,765	3	None	HW
AHU-SH	Pool	Pool Equipment Room	9,550	5	None	HW
AHU-SJ	Pool	Pool Equipment Room	7,540	3	None	HW

1 TO 2 YEAR RECOMMENDATION

The pool units, AHU SH and SJ, are incapable of providing any dehumidification to the pool area since they do not have any means of cooling. These AHUs are also significantly aged and have far exceeded the ASHRAE median equipment service life of thirty (30) years.

It is recommended to replace units AHU-SH and AHU-SJ with new pool dehumidification units capable of variable flow operation, and equipped with DDC controls. The advantages of a new pool dehumidification unit include providing cool dry air during the summer and warm dry air during the winter. These new pool units would eliminate excess humidity in the pool air and improve occupant comfort.

For pool locker room AHU-SG, it is recommended to upgrade this unit to a variable volume AHU equipped with a hot water coil, cooling capabilities, and DDC controls. This new unit would provide ample comfort improvements and long-term energy efficiency benefits. Please reference the AHU Cost Estimates section for pricing details.



MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

MECHANICAL VENTILATION SYSTEMS

MAINE EAST HIGH SCHOOL

AHU-SK & SL: Kitchen Area and Back of Lounge Zones



First Floor Plan

The back of house kitchen areas are served by two (2) constant volume AHUs that were installed in 1968. The picture on the right displays the spaces served by each AHU. AHU-SK is equipped with a direct expansion (DX) cooling coil with an associated remote outdoor condensing unit. AHU-SL is heating only. Both units have hot water heating coils, pneumatic controls and are located in the mechanical room adjacent to the chiller room. The following table below summarizes AHUs SK and SL.

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium	
AHU-SK	Kitchen/Serving Lines	P.E. Equipment Room	3,850	3	DX	HW	
AHU-SL	Security/Back of Lounge	P.E. Equipment Room	10,000	5	None	HW	

1 TO 2 YEAR RECOMMENDATION AHU-SK and AHU-SL have been operating since 1968. The ASHRAE tables display a median service life for AHUs of these types to be thirty (30) years. These units have exceeded their ASHRAE defined median equipment service life and are recommended for replacement due to their age and their diminishing reliability.

It is recommended to upgrade each of these AHUs with new variable volume AHUs equipped with chilled water coils, hot water coils and DDC capabilities. The benefits of variable flow, and modern unit technologies would provide considerable energy savings, equipment reliability and comfort improvements. Please reference the AHU Cost Estimates section for pricing details.



MECHANICAL VENTILATION SYSTEMS

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Table 12: AHU-SK & AHU-SL



AHUs SM, SN, SO, & SP Zone



First Floor Plan

The girl's gymnasium is provided ventilation via four (4) constant volume AHUs (AHU-SM, AHU-SN, AHU-SO, and AHU-SP) installed in 1968. These AHUs supply 100% outdoor air to the girl's gymnasium and are equipped with hot water heating only. Note the two (2) gymnasium AHUs pictured right. Examine the table below for a summary of the girl's gymnasium units.

Table 13: AHU-SM, AHU-SN, AHU-SO &	AH

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-SM	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW
AHU-SN	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW
AHU-SO	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW
AHU-SP	Girl's Gymnasium	Girl's Gymnasium	4,000	1.5	None	HW

1 TO 2 YEAR RECOMMENDATION

The girl's gymnasium AHUs have been in operation since 1968, and supply constant volume air with heating only. According to ASHRAE, the median service life of a packaged medium-duty air handling unit is 25 years. These units have exceeded their ASHRAE median equipment service life and are ceiling hung making them difficult to service.

It is recommended to update these units with more accessible, variable speed, packaged roof top units equipped with hot water or gas heating and cooling capabilities. Further investigation would be required to determine if steam or hot water coils are more cost effective. With the conversion to variable flow, roof-mounted, and cooling capable packaged RTUs, long-term savings and immediate comfort improvements would be achieved. Please reference the AHU Cost Estimates section for pricing details.



ELÄRA

AHUs SM, SN, SO, & SP: Girl's Gymnasium

MECHANICAL VENTILATION SYSTEMS

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IU-SP

AHU-S4: Boy's Locker Room



The basement boy's locker room is served by one (1) constant volume mixed air AHU that utilizes a steam heating coil. The unit has been in operation since 1968 and utilizes face and bypass dampers and provides heating only.

Тад	Area Served	Location	Supply CFM	Supply Fan HP	Cooling Medium	Heating Medium
AHU-S4	Boy's Locker Room	Boy's Locker Room	3,000	1	None	Steam

1 TO 2 YEAR RECOMMENDATION twenty-five (25) years.

reference this project.



MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

MECHANICAL VENTILATION SYSTEMS

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Table 14: Boy's Locker Room: AHU-S4

AHU-S4 was installed in 1968 and is in poor condition. The ASHRAE median service-life for a medium sized indoor AHU of this type is

It should be noted that a separate project to replace this AHU is scheduled to take place in summer of 2018. For further details please



First Floor Plan

Fieldhouse Unit Heaters





The fieldhouse is heated by eleven (11) ceiling suspended steam unit heaters and there are six (6) ceiling mounted louvers that allow for fresh air infiltration. There is no means of cooling for the fieldhouse. Based on our observations, there appears to be a lack of adequate ventilation for this space given how many people may occupy it.

1 TO 2 YEAR RECOMMENDATION

It is recommended to equip the fieldhouse with either two (2) or four (4) variable volume packaged rooftop units that utilize DX cooling and gas heating. Immense comfort and ventilation improvements would be satisfied with this upgrade. Please reference the Roof Top Unit Cost Estimates section for pricing details.

MECHANICAL VENTILATION SYSTEMS

MAINE EAST HIGH SCHOOL

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS MECHANICAL VENTILATION SYSTEMS

MISCELLANEOUS AHUS:

- this space. This AHU is aged beyond it's median service life.
- and serves the basement level boy's locker room. Elara is currently in the process of designing a replacement for this unit. Please refer to this project for further information.
- 3. Foyer AHU This AHU is located in a closet adjacent to the foyer room on the south side of the building. This unit is equipped with a steam heating coil and a return fan. It is believed that this unit is from the 1960s.

1 TO 2 YEAR RECOMMENDATIONS

Due to the aged condition of the Copy Room AHU, it is recommended to replace it with a unit equipped with a DX cooling coil with an associated condensing unit and either steam, electric or hot water heating coil. Further evaluation would be required to determine which type of heating is most cost effective.

Due to the aged condition of the Foyer AHU, it is recommended to replace it with a unit equipped with chilled water coils or DX cooling and steam heating coils; further evaluation would be required to determine which type of cooling is most cost effective. This upgrade would provide an increase in reliability and occupant comfort as this unit currently does not provide cooling. Please refer to the AHU Cost Estimates section for pricing details.

1. Copy Room AHU



2. Boys' Team Sports Lower Level Locker







MAINE EAST HIGH SCHOOL

1. Copy Room AHU – This AHU is hung from the copy room ceiling and is thought to be from the 60s. It utilizes a DX cooling coil with an associated condensing unit on the roof to provide cooling only to

2. Boys' Team Sports Lower Level Locker Room AHU – This AHU is in the first-floor fan storage room adjacent to the fieldhouse and is believed to be from 1960s. It is equipped with a steam heating coil

3. Foyer AHU





Lower Floor Plan

UNIT VENTILATORS

Many of the classrooms are served by two-pipe or four-pipe unit ventilator (UV) systems. The capacity of the UV varies depending on the size of the space served. The two-pipe UVs have one (1) supply pipe and one (1) return pipe and can only provide heating or cooling depending on the season. This type of two-pipe system is also referred to as a dual temperature system.

A four-pipe UV system has two (2) sets of supply and return pipes, two (2) supply/return pipes for heating, and two (2) supply/return pipes for cooling, for a total of four (4) pipes. This type of system is more flexible than the two-pipe system because it can provide heating or cooling regardless of season so long as the heating and cooling plants are running to provide hot and chilled water to their respective pipes. All UVs are served hot water via steam-to-hot water heat exchangers. The maps provided on the right and below indicate the locations where unit ventilators are utilized as well as the system type, and year of installation.

There are three (3) main varieties of UVs at Maine East. The first, and the oldest, are the Center Court UVs. These UVs are original to the Center Court addition from 1968 and are served chilled water from the Center Court chiller and steam from the main boiler plant that is converted to hot water via a HX located in the basement chiller room of the Center Court. These UVs utilize a two-pipe delivery system; therefore, this system lacks flexibility due to its ability to only provide either heating or cooling depending on the season. Examine the green highlighted zones in the following pictures for a view of the Center-Court UV zones.

The second variety of UVs are in the basement through third floors of the Science Wing. These are two-pipe UVs that were installed in 1999 and are served chilled water via the Science Wing chilled water plant and hot water via a steam-to-hot water HX. The Science Wing UV zones can be viewed in the following pictures in the blue highlighted areas.

The final variety, and newest UVs, are four-pipe UVs installed in 2002. These UVs are served chilled water from the Main Chiller Plant and hot water via steam-to-hot water heat exchangers. The service zone for these UVs is indicated in purple and can be viewed on the following pages.



E PROTECTION CONDITIONS MECHANICAL VENTILATION SYSTEMS MAINE EAST HIGH SCHOOL

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS MECHANICAL VENTILATION SYSTEMS

1 TO 2 YEAR RECOMMENDATION

The Two-Pipe Center Court UVs were installed in 1968 and are original to the center court building. The ASHRAE median service life for a unit ventilator is thirty (30) years. The UVs have exceeded the median service life by twenty (20) years. It is recommended to replace them due to their aged condition.

There are two options for UV replacement: Option 1 is to replace the UVs with vertical air change UVs. This would provide increased comfort control, reliability and efficiency. Option 2 is to install a variable flow, dedicated outdoor air supply (DOAS) unit on the roof that serves local fan coil units equipped with hot water heating and chilled water cooling coils. This system provides optimum temperature control and yields long term energy savings due to its variable volume supply. Please reference the UV Cost Estimates for pricing details.

6 TO 10 YEAR RECOMMENDATIONS

The Two-Pipe Science Wing UVs are from 1997 and the Four-Pipe UVs served by the Main Chillers were installed in 2002. Both UV systems still have approximately (10) years of remaining service life, however they are recommended for replacement within 6 to 10 years.

There are two options for UV replacement: Option 1 is to replace the UVs with vertical air change UVs. This would provide increased comfort control, reliability and efficiency. Option 2 is to install a variable flow, dedicated outdoor air supply (DOAS) unit on the roof that serves local fan coil units with hot water heating and chilled water cooling coils. This system provides optimum temperature control and yields considerable energy savings due to its variable volume supply. Please reference the UV Cost Estimates for pricing details.

First Floor Unit Ventilators





Second Floor Plan



MAINE EAST HIGH SCHOOL







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ROOF TOP UNITS (RTUs) The figure to the right provides roof locations of the RTUs that serve Maine East High School. The table on the following page summarizes information for the RTUs including: year installed, reference tag, make, roof location, areas served, heating and cooling type, and tonnage. The graphics following the aforementioned tables highlight the areas served by each RTU.

ROOF TOP UNITS

MAINE EAST HIGH SCHOOL

MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION CONDITIONS

Year Installed	Reference Tag	Make	Location	Area Served	Heating	Cooling	Tonnage
2002	2	Trane	W	Rm. 185 - Auto Shop	Duct Mounted HW Reheat	DX	13
2009	3	Carrier	W	Offices, Kitchen/Living	Natural Gas	DX	20
2002	4	Trane	W	Rm. 180 - Wood Shop	Duct Mounted HW Reheat	DX	13
2002	5	Trane	W	Weight Room	Duct Mounted HW Reheat	DX	10
2002	6	Trane	Н	Rm 175 & Nearby Offices	Duct Mounted HW Reheat	DX	8
2002	7	Trane	Н	Rm. 177	Duct Mounted HW Reheat	DX	9
1995	9	Trane	Н	Office Near Xerox Rm.	Natural Gas	DX	3
1984	10	Carrier	Н	Rm. 174 & Offices	None	DX	10
2002	11	Trane	Н	Rm. 169 - Food Lab	Natural Gas	DX	8
2002	12	Trane	Н	Rm. 171	Natural Gas	DX	8
2002	13	Trane	К	Rm. 155, 157	Natural Gas	DX	5
2002	14	Trane	К	Rm. 161	Natural Gas	DX	8
2002	15	Trane	К	Bookstore	Natural Gas	DX	5
1994	17	York	0	Band Room 154	Natural Gas	DX	8
1995	18	Carrier	0	Choral Rm. 254	Natural Gas	DX	9
2005	19	Lennox	0	Choral Rm. 258	Natural Gas	DX	21
2008	23	Carrier	Н	Rm's. C208, C215, C216, C217	Natural Gas	DX	6
1994	20	York	0	Band Rm. 158	Natural Gas	DX	9



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ROOF TOP UNITS

MAINE EAST HIGH SCHOOL

Roof Top Unit Details