# Ichabod Crane Central School District

## HVAC Assessment

## August 28th, 2021

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**Supporting Documents**

- NYS Building Code:
    1. Mechanical Code of New York State 2020
        - Section 403 Mechanical Ventilation
        - Table 403.3 Required Outdoor Ventilation Air
- ASHRAE Documents:
    1. One Page Guidance for Reopening Schools
    2. Core Recommendations for Reducing Airborne Infectious Aerosol Exposure
    3. In-Room Air Cleaner Guidance for Reducing Covid-19 In Air In Your Space/Room

## Summary:

The purpose of this document is to inventory the school building HVAC systems and to determine how to maximize the existing systems efficiency with regard to filtration and ventilation. HVAC equipment plays a critical role in creating a healthy and safe indoor environment. The information within this document will provide District's staff, students and residents a better understanding of the mechanical systems in place and their capabilities. This document will identify compliance/non-compliance with the existing mechanical standards. In addition, ventilation and filtration enhancements will also be listed within the inventory, should they be applicable.

The inventory was completed with the help of the Ichabod Crane Maintenance Department, the mechanical engineers of CSarch, the construction managers of Turner Construction as well as The District's Health and Safety Specialist. Review of the equipment capabilities included representatives from Otto Building Services and Camfil USA, Inc.

After a thorough review of the inventory, recommendations were developed for each school building. In some instances the recommendations were categorized into short-term and long-term initiatives. Short-term initiatives included lower cost, high impact enhancements. Long-term initiatives are major replacements which would require engineered designs, SED approval and most likely voter authority.

There was some discussion about air conditioning during the development of this document. While those involved in the discussions recognized temperature and humidity control during the hotter months may provide additional comfort, the main focus of the group was to make recommendations to maximize the efficiency of the current HVAC systems, and make recommendations for upgrades to prevent the spread of respiratory illnesses where applicable. The information gathered regarding air conditioning and dehumidification within the schools will be utilized in a separate assessment document. This document will be shared with the facilities committee, the Board and the District's engineers. The District's engineers will be completing it's Building Condition Survey document within the year. The Building Condition Survey can be used to quantify and estimate the extent of the air conditioning needs.

Guidance for creating this document was taken from the reference standards that govern any HVAC equipment that is installed in the district facilities. The standards, as well as other supporting documents were listed. (See Supporting Documents above).

The information compiled in this document has been gathered through visual inspections conducted by the District with the assistance of the District's A/E firm of record. At the time of the survey, no intrusive actions were taken. This document reports the current physical condition, as observed at the time of the visual inspections with no consideration given to the programmatic suitability or the educational needs of the buildings individually or as a whole. The Survey was conducted on the following school facilities, which are owned by The Kinderhook Central School District:

## Primary School Inventory

The original building was constructed in 1965 with two small additions completed in 1970 and one small addition in 2016. The total square footage of the building is 57,925. The Primary School is a single story steel frame building with CMU/brick exterior walls. The foundation and footings are cast concrete. The roof structure is steel beams with structural panel decking. The interior walls are CMU blocks and the floor is concrete slab on grade.

The HVAC system in the primary school relies predominantly on individual units (unit ventilators) in the classrooms. Office spaces are served by two roof top units with mechanical cooling. The current equipment was installed in 2009, which included ducted exhaust for all occupied spaces..

The following is a list of the HVAC equipment that services the Primary School:

Classrooms:

**Unit Ventilators**: AFF-HermanNelson (McQuay- 2016 addition)
Installation Date: 2009
Modulation: Face & Bypass
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Office Areas: (including rooms 201, 202, 116 &117)

**Roof Top Unit with DX Cooling**: Aaon
Installation Date: 2009
Modulation: 3-way valve, with heat recovery
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Cafetorium

**Cabinet Heaters:- wall model**: AFF-HermanNelson
Installation Date: 2009
Modulation: Face & Bypass
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

## Middle School Inventory

The original building was constructed in 1972 with a single small addition (computer lab) built in 1998. The building area is currently 112,250 square feet. The Middle School is a single story steel frame building with CMU/brick exterior walls. The foundation and footings are cast concrete. The roof structure is steel beams with steel panel decking. The interior walls are CMU block and movable partitions. The floor is a structural concrete slab over either a basement or crawl space.

The HVAC system in the middle school relies predominantly on individual units. Unit ventilators, cabinet heaters or air handler units serve classrooms. PTAC units serve office spaces. The current equipment varies in age. All original equipment has been upgraded (new coils, controls and increased ventilation) during a 1997 capital project. Occupied spaces within the building interior (no operable windows) are air conditioned using the chilled water.

The following is a list of the HVAC equipment that services the Middle School:

Classrooms: (Wings)
**Unit Ventilators**: Daikin
Installation Date: 2021
Modulation: 3-way valves
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Small Instructional Spaces: (Wing cores, library offices)
**AHU (air handler unit) with Chilled Water Cooling**: Daikin
Installation Date: 2021
Modulation: 3-way valves
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Classrooms: (Band, Chorus, Art & Technology)
**Cabinet Heaters**:
Installation Date: 1997
Modulation: 2-way valves
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Office Areas: (including rooms 419, 420, 421, 422 & 423)

**PTAC (Packaged Thermal Air Conditioning)Units**: Nesbitt
Installation Date: 1997
Modulation: 2-way valve
Current level of Filtration: Merv 4
Maximum Level of Filtration: Merv 4
Required Ventilation: 15 CFM per occupant
Current Ventilation: 15 CFM per occupant
Maximum Ventilation: 15 CFM per occupant

Cafeteria, Library, LGI

**AHU (air handler unit) with Chilled Water Cooling**:
Installation Date: 1972
Modulation: 2-way valve
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

## High School Inventory

The original building was constructed in 1956 with additions completed in 1965, 1980, 1991, 1998 and 2021. The building area is currently 125,924 square feet. The High School is a single story steel frame building. The exterior walls are a combination of CMU/brick veneer and steel stud/brick veneer. The foundation and footings are cast concrete. The roof structure of the original building is stamped steel joists with tectum panel decking. Later additions have roof structures consisting of steel beams with steel decking. The interior walls are a combination of CMU block and heavy gauge steel studs with wire lath and plaster finish. The floor is a concrete slab on grade with a very small basement boiler room and minimal crawl space areas.

The HVAC system in the high school relies predominantly on individual units (unit ventilators) in the classrooms. Office spaces are served by rooftop units with mechanical cooling. The current equipment was installed or upgraded over the years, please refer to the inventory list for specifics.

The following is a list of the HVAC equipment that services the High School:

Classrooms: (100 & 200 wings)

**Unit Ventilators**:
Installation Date: 2001
Modulation: Face and Bypass
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Classrooms: (300 wing)

**Cabinet Heaters**:
Installation Date: 1997
Modulation: 3-way valves
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Classrooms: (Science wing & Technology)

**RTUs (roof top unit)**:
Installation Date: 2021
Modulation: 3-way valves
Current level of Filtration: N/A
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Main Office:

**AHU (air handler unit) with mechanical cooling**: Carrier
Installation Date: 1991
**Fin Tube Radiation** (heat)
Modulation: 2-way valve
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per occupant
Current Ventilation: 30 CFM per occupant
Maximum Ventilation: Dependent on occupancy and outside air temperature

Guidance Office:

**RTU (Roof top Unit) with mechanical cooling**: Carrier
Installation Date: 2021
Modulation: 3-way valve
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per occupant
Current Ventilation: 30 CFM per occupant
Maximum Ventilation: Dependent on occupancy and outside air temperature

Library:

**RTU (roof top unit) with Dx Cooling**:
Installation Date: 1991
Modulation: 3-way valve (Modified in 2021)
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Music Suite:

**RTU (roof top unit) with Dx Cooling**:
Installation Date: 1992
Modulation: 2-way valve
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Auditorium:

**RTU (roof top unit) with Dx Cooling**:
Installation Date: 2005
Modulation: 3-way valve (Modified in 2021)
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

Cafeteria:

**AHU (air handler unit) with Dx Cooling**:
Installation Date: 2011
Modulation: 2-way valve
Current level of Filtration: Merv 8
Maximum Level of Filtration: Merv 13
Required Ventilation: 15 CFM per student
Current Ventilation: 60 CFM per student
Maximum Ventilation: Dependent on occupancy and outside air temperature

## Recommendations

General Statement: The consulting team who has helped The District develop this document and the protocols to create the healthiest environment possible has focused on three components: System Operation Verification, Ventilation and Filtration. These three factors have the most significant impact on the health of the building occupants.

### System Operations Verification

**Recommendation:** Verify the functionality of all HVAC equipment.

**Response:** The Maintenance Department employees, along with HVAC Balancing Technicians and commissioning agents have examined the HVAC equipment to verify the operational functionality of every component (dampers, valves, economizers, etc.). Building automation programming, which controls the HVAC equipment was also reviewed and the sequence of operations was verified as part of the process. This thorough review is in addition to the periodic maintenance that is completed by district staff.

### Ventilation

**Recommendation:** Increase ventilation above the requirements by code, to the extent possible.

**Response:** The HVAC equipment is required to meet ventilation standards that are set forth by the Building Codes of New York State. These standards are updated through changes in the Building Code upon recommendation by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE). The current code requirement is to provide 15 cubic feet per minute (cfm) per occupant in each occupied space within the buildings. To quantify that requirement, the district uses a standard of 30 cfm occupants per classroom. Occupancy in larger spaces (assembly spaces in particular) is determined by the occupancy rating of the space.

The district has exceeded the current standard throughout the pandemic. Over the past year the rate of outside air was increased two-fold to 30 cfm per occupant (figuring 30 occupants for each standard classroom), even though many classrooms had roughly half the students occupying the spaces due to social distancing. In most instances, the reduction of students in the classrooms pushed the supply of fresh air close to 60 cfm per student.

The Center for Disease Control (CDC) has published numerous guidance documents specific to HVAC equipment to assist with ensuring the safety of the building occupants. The recommendations, which the district has adopted, is to reduce recirculated air as much as possible. To that end, the district's building automation systems are being programmed to allow for 100% outside air when the outside air temperature is above 55 degrees. The outside air will be reduced progressively as the outside air temperature decreases, with the lowest setting at 20% (equivalent to 30 cfm per occupant for a typical classroom). It was discussed that this reset schedule may need to be adjusted on the coldest mornings to allow the rooms to reach their targeted setpoint.
HVAC equipment for assembly spaces will have a similar reset schedule although the percentage of outside air to reach 30 cfm per occupant may vary.

The district will also be extending the time that the HVAC systems are running. This "extended schedule" will begin an hour before staff and students arrive and will continue for 2 hours after the majority of the staff and students have left for the day. The purpose of the extended schedule is to introduce "fresh", outside air into the building.

## Filtration

**Recommendation:** Increase the Minimum Efficiency Rating Value (MERV) of the HVAC equipment to 13, wherever possible. Investigate possible modifications or replacement of HVAC equipment that does not allow for a higher MERV rating.

**Response:** The District is fortunate that a majority of the HVAC equipment can accept, and operate with a filter that has a MERV 13 rating. The district has ordered the higher efficiency filter media and is ready to install the filters when they arrive. The increase in the efficiency of the filter media will create a slightly higher pressure drop in the units which can easily be overcome with the existing fan motors. It was discussed that higher filtration requires more frequent filter changes. The district's current filter change schedule exceeds the manufacturer's recommendations for filter changes.

The HVAC Equipment Inventory revealed that several units in the middle school will not be able to accept a MERV 13 filter. In situations where the district cannot achieve the recommendation, a HEPA air filtering unit, of appropriate capacity for the room, will be provided to help enhance air filtration. The middle school rooms where a HEPA unit will be installed are Rooms 414, 419, 420, 421, 422 and 423.

The HVAC units in the middle school that do not allow for higher filtration can not be effectively modified. A replacement for the current HVAC system would be a large project; one that may require a referendum. The project would require a formal design by a licensed professional, submission to NYSED, and subsequent SED approval prior to the commencement of work. This potential scope of work will be evaluated during the Building Condition Survey