# Bethel Board of Education Special Meeting - HVAC Feasibility

Tuesday, June 28, 2022 7:30 PM
Board of Education Conference Room E, 1 School Street, PO Box 253, Bethel, CT 06801

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| 1. | **Call to Order** | **Speaker(s):** Policy 9326 |
| 1.A. | Roll Call for Quorum | |
| 1.B. | Pledge of Allegiance | |
| 2. | **BOARD REPORTS - PROGRESS TOWARDS DISTRICT INITIATIVES** | |
| 2.A. | HVAC Feasibility - Master Plan Study at Bethel High School | |
| 3. | **Adjourn** | |

# Bethel High School
# Mechanical Upgrades Study

June 3, 2022

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# Table of Contents

# I. PURPOSE

The purpose and goal of this engineering study is to provide a path to modernize the mechanical systems serving the Bethel High School to meet operational needs for the next 20 to 30 years. Particular attention based on the original RFP is to address AHX-1 deficiencies, add air conditioning to the non-air-conditioned classrooms, add air conditioning to the athletic facilities and provide a long-term replacement plan for all AHU's. Additionally, Kohler Ronan has identified miscellaneous items that were discovered during building investigations outside of the scope of the original RFP. Items discovered are noted within this report.

The HVAC systems serving the high school are the heart of the approximate 167,000 square foot building. The building was originally constructed in 1970, with a significant addition built in 1975 and 2007. Most of the mechanical rooftop units were replaced in 2007.

This report and its recommendations are based on:

1. Initial on-site kickoff meeting with the staff to discuss and review the current building deficiencies on March 25, 2022.
2. Site visits to visually review existing rooftop equipment conditions on April 4, 2022.
3. Additional site visits on April 12th, 13th, and 14th 2022 for further field investigation.
4. An incomplete set of original building design drawings from 1968.
5. Various design drawings from renovations dated 1998, 2002, and 2006.
6. Design drawings to replace RTU-9 and RTU-13 dated January 2022 along with pre-demo testing performed by Wing's Testing and Balancing Co. Replacement of these units is scheduled for second quarter 2022.
7. Various email correspondence during 2020 noting controls issues, airflow issues, and repair orders.
8. Commissioning report performed by Wing's Testing and Balancing Co. dated October 29, 2020
9. Review of the building management system.
10. Bethel High School McQuay Rooftop Unit Re-Commissioning Memo by Pelegrine Energy Group dated December 18, 2018.
11. Bethel High School Identification of Priority High School HVAC Updates Memo by Pelegrine Energy Group dated February 4, 2020.
12. Bethel High School Rooftop Unit Commissioning Check Memo by Pelegrine Energy Group dated August 13, 2020.
13. Bethel High School RTU-5 Rebalancing Report Memo by Pelegrine Energy Group dated October 18, 2020.
14. Bethel High School HVAC Improvement Options Memo by Pelegrine Energy Group dated March 29, 2021
15. Bethel High School HVAC Update Planning Memo by Pelegrine Energy Group dated July 14, 2021
16. A spreadsheet by Pelegrine Energy Group documenting mechanical equipment issues experienced in 2018 and 2019.
17. A spreadsheet by Pelegrine Energy Group documenting general mechanical equipment information, opinions of condition, and issues experienced in 2017.
18. A building operating schedule by Pelegrine Energy Group dated September 25, 2018.
19. Electrical Utility bills from January 2020 to January 2022.
20. A spreadsheet summarizing natural gas usage from January 2020 to January 2021.

# II. EXECUTIVE SUMMARY

The building boiler plant is nearly new and in proper operating condition. The air handling equipment and its associated DX cooling equipment is at the end of its expected lifespan or has exceeded it. The school has about 36 classrooms without cooling along with the gym, locker rooms, weight room, and wrestling room. Many exterior spaces are heated with perimeter radiation, unit ventilator or combination thereof. Select classrooms have been retrofitted with split air conditioning units but lack the means for mechanical ventilation air. All variable volume rooftop units supply conditioned air to their respective spaces via ducted VAV boxes. Air is typically distributed to the spaces via a combination of linear and square diffusers.

The building has been experiencing many HVAC related issues over the years. These deficiencies include:

1. Inability to maintain space temperature setpoint during hot summer days.
2. Rooftop units tripping on flame out.
3. Air handling and cooling equipment is unreliable requiring costly repairs and replacements.
4. Failure of ERU-2 energy wheel.
5. Visible areas of air infiltration through the building envelope.
6. History of damaged and leaking ductwork.
7. Insufficient airflow at the offices and classrooms served by AHX-1.
8. Insufficient airflow at the administration offices served by AHU-5
9. Noise complaints from unit ventilators.
10. Lack of ventilation air to some classrooms.
11. Exhaust fan failures and lack of bathroom exhaust.
12. Control issues and communication difficulties between the BMS.
13. Lack of maintenance performed on MAU-1

Kohler Ronan has determined the heating plant is sized appropriately with capacity to spare. Furthermore, the rooftop unit DX cooling sections are sized appropriately for their zones with the exception of AHX-1. However, the inability to maintain temperature in certain spaces is most likely due to the system's incapability to supply and distribute the proper amount of air to the rooms. Detailed analysis and recommendations addressing each of these deficiencies can be found later in this report.

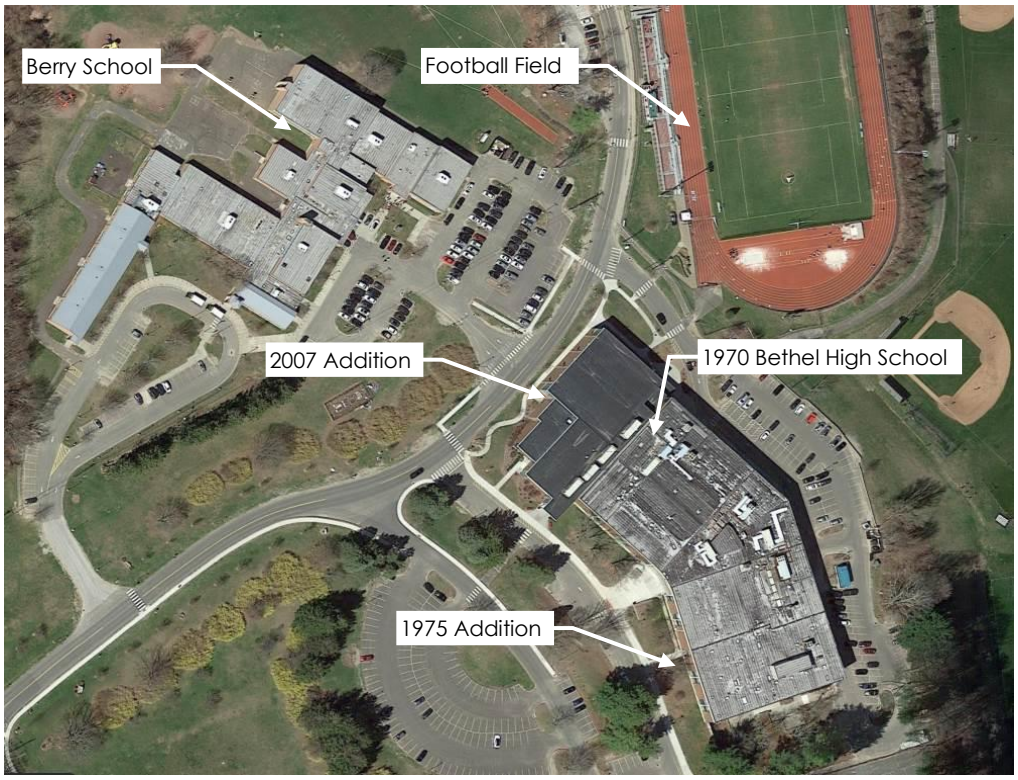
Further complicating efforts to address the deficiencies and improvements are lack of funds, available time at which the school is unoccupied to perform renovation work (ie. Summer recess or holiday breaks), the fire rating and classification of the building and the current supply chain/inflation concerns driving the cost of construction to be higher than normal.

Bethel has identified up to a maximum of $1,400,000 in funds that is compiled from grants and town funds that may be available for immediate upgrades. Based on limited initial project funds available, the school has identified priority 1 items for design such as adding cooling to classrooms that are currently heated only and replacement of unit ERU-2. To work within the budget, two alternatives would be designed as additional priority 1 and a priority 2 space if funds allow. A phased approach to these upgrades may be implemented in order to manage the timing and initial costs with annual budgets.

Adding air conditioning to all classrooms and addressing ERU-2 has cost ranging from $3.8M to $4.7M depending on the option selected. Replacement of AHX-1, adding air conditioning to the gym, locker rooms, weight room, and wrestling room has a budget around $2.64M. A full detail list of costs are summarized in Appendix B-Mechanical Upgrades Estimates.

## III. BUILDING INFORMATION & LAYOUT

Bethel High School is a three-story building originally constructed in 1970 with an addition built in 1975 and 2007 totaling approximately 167,000 total square feet. The building consists of a gymnasium, weight room, locker rooms, cafeteria, administrative offices, and a variety of classrooms on floors 1-3.



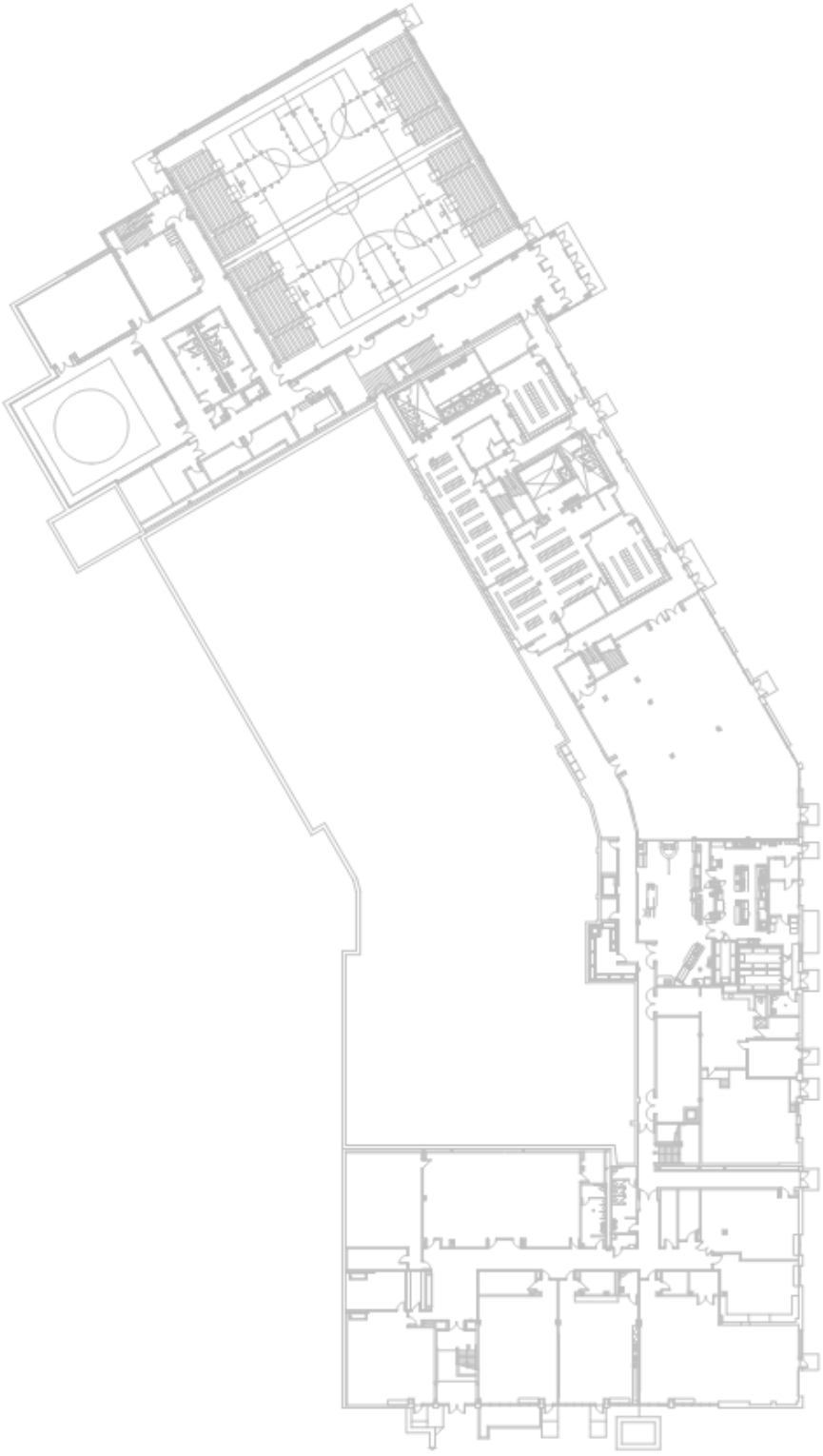

*Building Location & Surrounding Area*


*Southwest Elevation*

*Example of Rooftop Equipment*

*Boiler Plant*

## IV. BUILDING PLANS

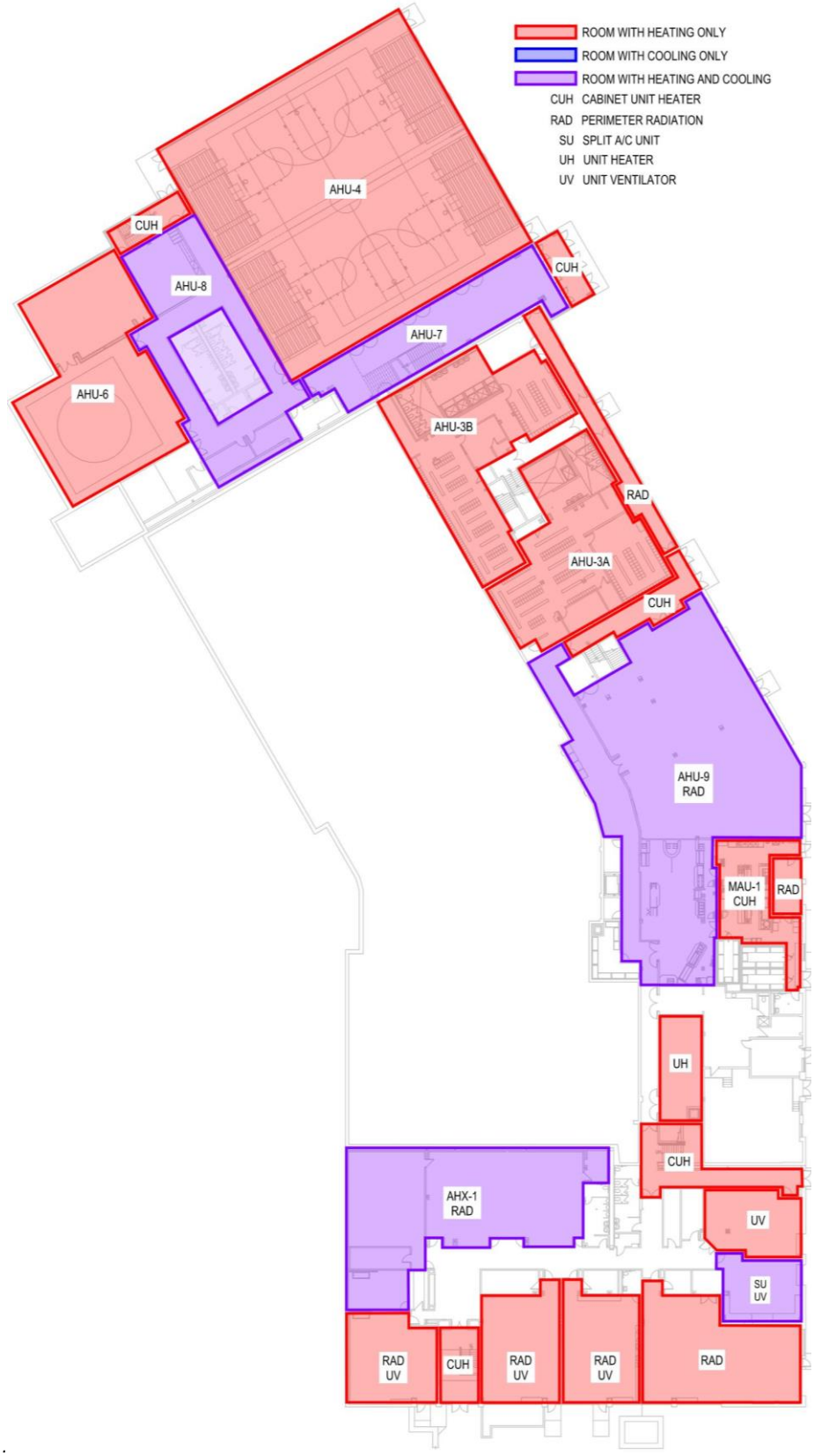


*1st Floor*

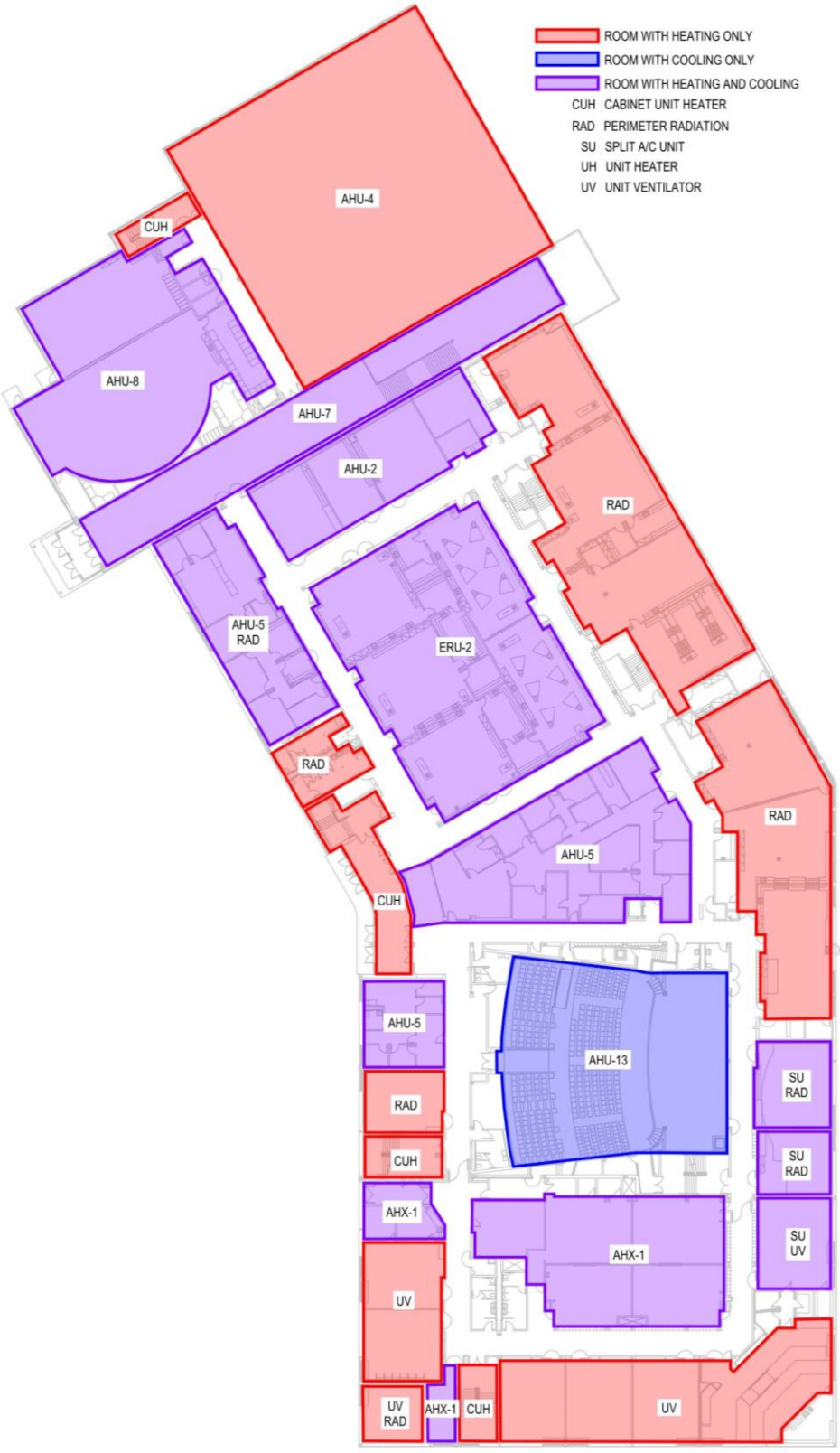
*2nd Floor*

*3rd Floor*

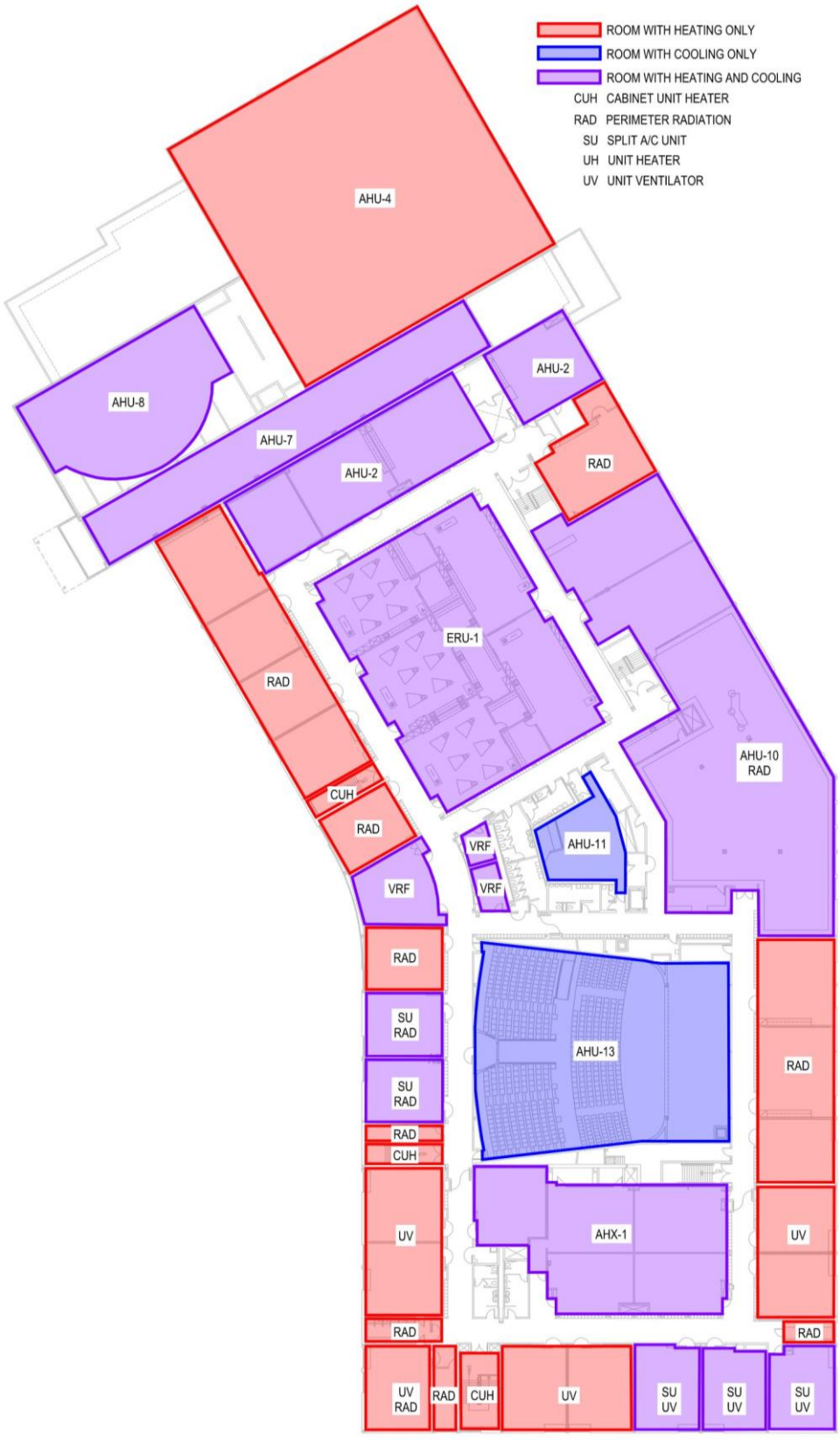
## V. EXISTING HVAC ZONING PLANS




*First Floor Existing Zoning*




*Second Floor Existing Zoning*




*Third Floor Existing Zoning*

# VI. MECHANICAL SYSTEM DEFICIENCIES & RECOMMENDATIONS

**Heating and Cooling Plants**

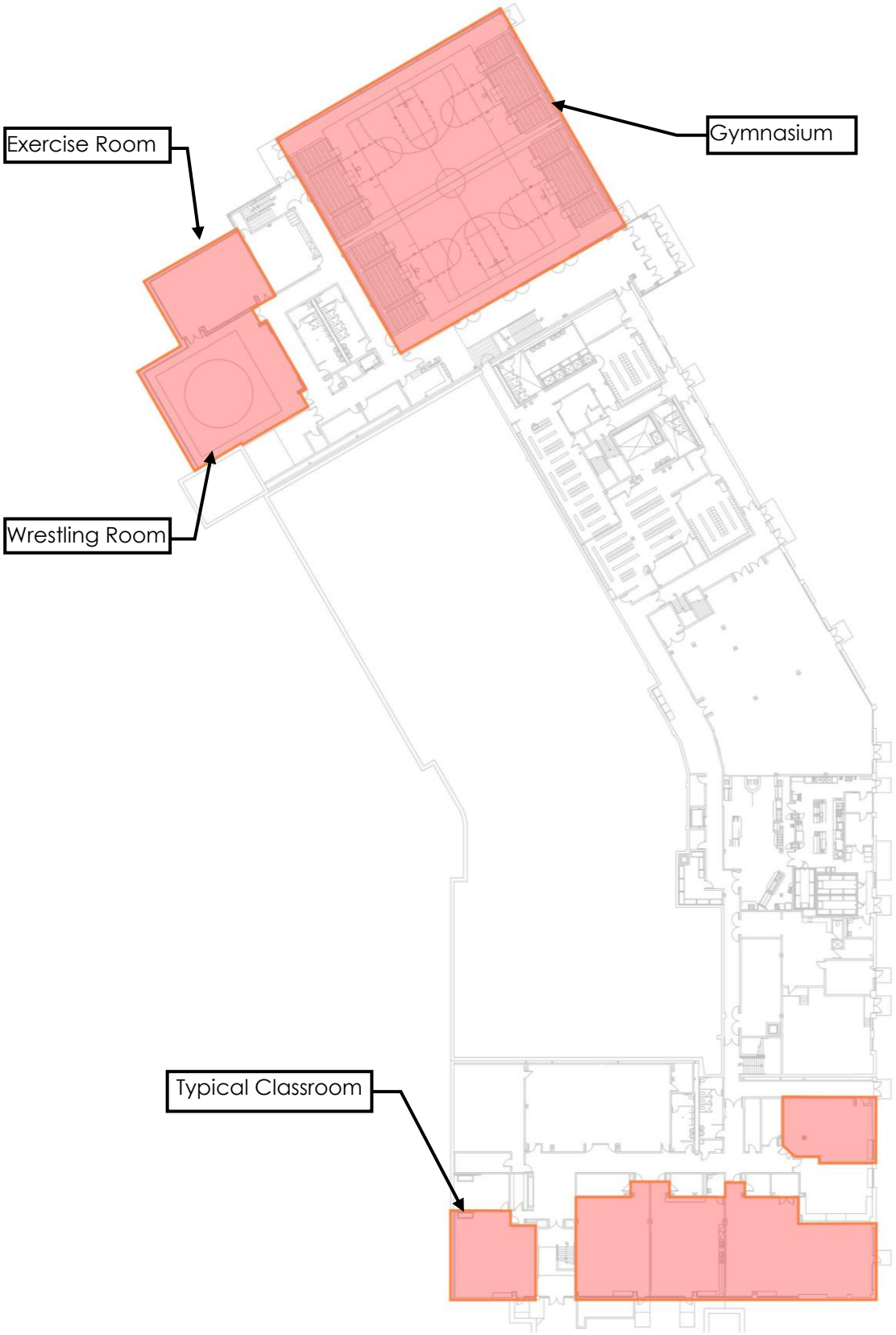
Bethel High School is heated by a gas fired condensing boiler plant producing hot water at the first-floor level. The boiler plant consists of (4) 3,840 MBh Patterson-Kelley boilers each furnished with a dedicated inline primary pump. The hot water plant is piped in a primary loop / secondary loop fashion with (3) secondary loops leaving the boiler room. The first secondary loop is served by Taco end suction lead/standby pumps sized for 80 gpm at 90 feet of head. The second secondary loop is served by Taco end suction lead/standby pumps sized for 140 gpm at 175 feet of head. Similarly, the third secondary loop is served by Taco end suction lead/standby pumps sized for 460 gpm at 130 feet of head. Hot water is distributed to air handling units AHX-1, ERU-1, and ERU-2 on the roof. Hot water is also circulated to indoor equipment such as MAU-1, AHU-3A, AHU-3B, perimeter radiation, duct mounted reheat coils, terminal box reheat coils, unit ventilators and unit heaters. A glycol feeder is connected to the building hot water loop maintaining a propylene glycol concentration of approximately 30%. The boiler plant equipment in good condition and appears to be only 2 or 3 years old. Building heat is also provided by gas fired packaged rooftop units AHU-2, 4, 5, 6, 7, 8, 9, 10, and 13.

Cooling is provided to portions of the building via packaged DX rooftop units AHU-2,5, 7, 8, 9, 10, and 13 as well as split DX units AHX-1, ERU-1 and ERU-2. Additional mini split units were installed as means to cool select rooms in the building. AHU-12 was removed from the roof under the 2007 renovation, and it's associated steel dunnage was abandoned in place. The maintenance staff noted that AHU-11 was inactive and abandoned in place.

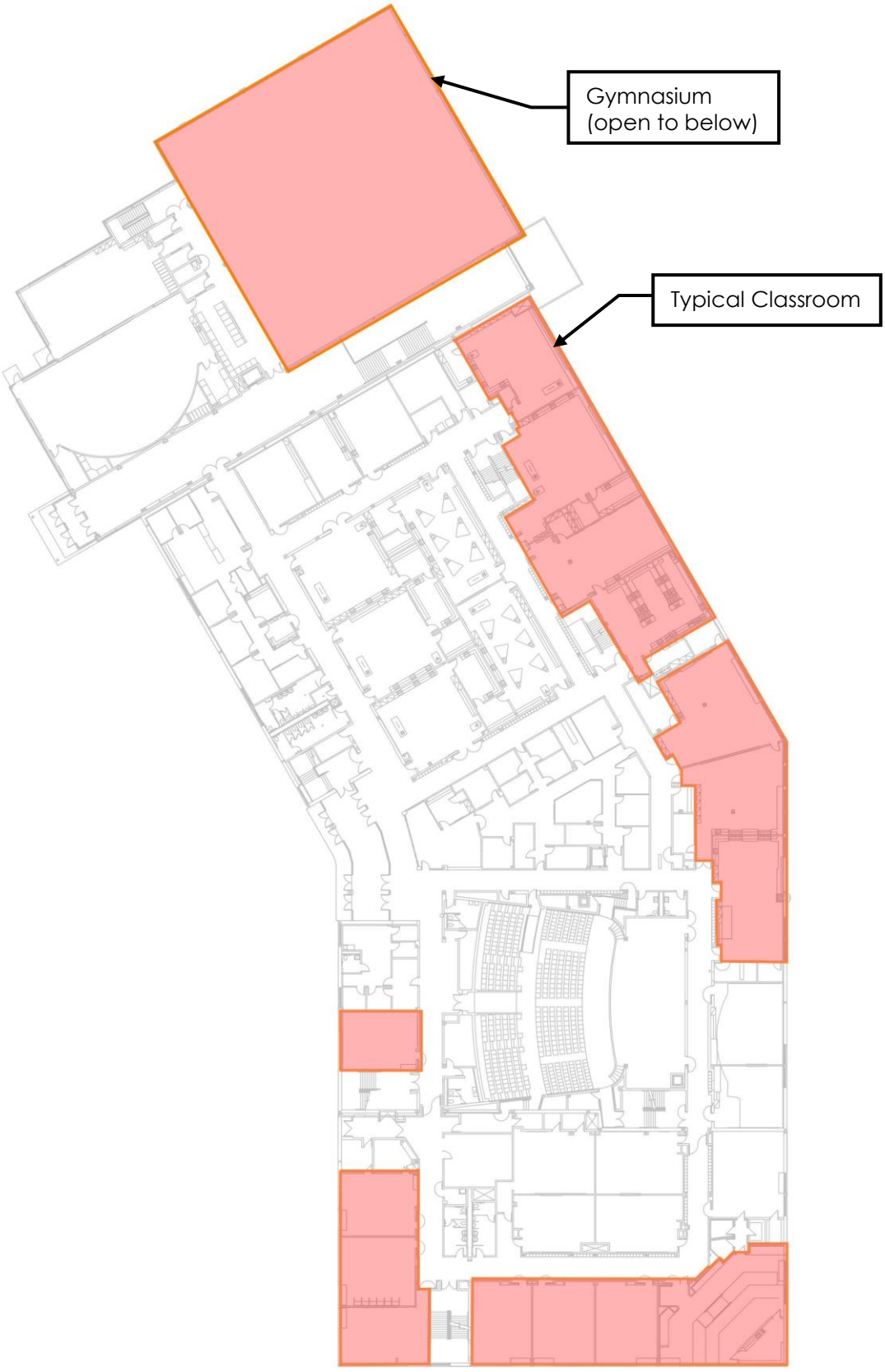
*Typical Hot Water Boiler*

*Typical Packaged RTU Condenser Section*

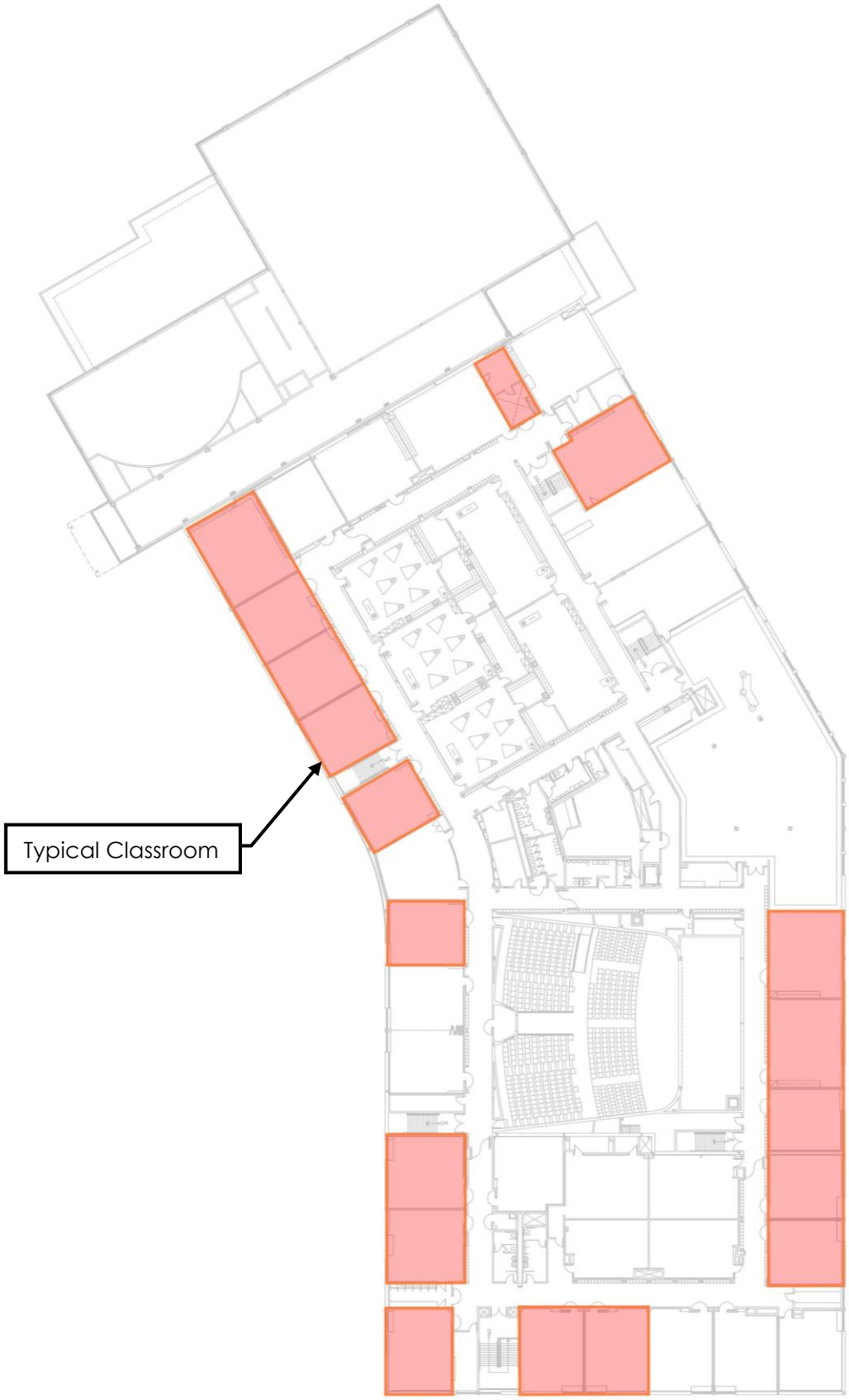
Currently, air conditioning is provided in the core of the 1975 building, cafeteria, auditorium, library, computer labs, office areas and approximately 12 perimeter classrooms. Rooms that are not cooled are being targeted for a new cooling system including 36 classrooms, the gymnasium, its nearby wrestling room and exercise room. Refer to the diagrams below for rooms requiring cooling.




*First Floor Rooms with No Air Conditioning*




*Second Floor Rooms with No Air Conditioning*




*Third Floor Rooms with No Air Conditioning*

**Air Handling Units**

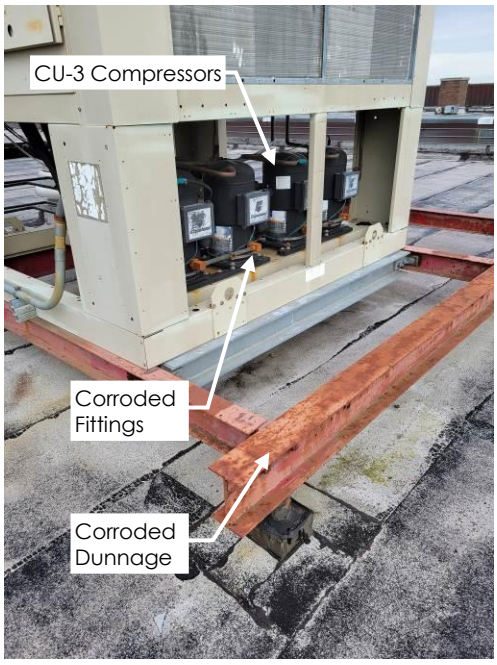
AHX-1 Description:
Unit AHX-1 is built up in multiple sections all housed within a rooftop penthouse. This air handling unit provides conditioned air to core classrooms on floors 1, 2, and 3 of the 1975 addition. It is sized for 38 tons of cooling, 449 MBh of heating, and 9,200 CFM. The unit is a variable air volume Trane Climate Changer consisting of a sheet metal mixing box, filter section, hot water coil, DX cooling coil, remote condensing unit, remote belt driven supply fan, and a remote belt driven return fan. Signs of repair and improvements were observed such as re-sealing of ductwork, a new motor on the supply fan, and both fans have been retrofitted with variable frequency drives. AHX-1 provides conditioned air to VAV boxes without reheat coils.

AHX-1 Analysis:
It was noted that AHX-1 was not delivering sufficient airflow. This was apparent as the fan drives were constantly operating at 100% in an attempt to satisfy the spaces. AHX-1 is original to the 1975 construction and although it is in fair condition for its age it is well past its expected lifespan. Additionally, the return air ductwork within the penthouse was damaged and air leakage was observed at the roof penetration access doors.

The rooftop condensing unit serving AHX-1, tagged as CU-3, is mounted on steel dunnage without external vibration isolation. The unit is comprised of 4 compressors which have damaged and missing refrigerant pipe insulation and mild corrosion at the pipe fittings. The condensing unit utilizes R-22 refrigerant which has been phased out. The unit was installed during the 2007 renovation and replaced an existing chilled water coil serving AHX-1.

After performing heating and cooling load calculations it appears that AHX-1 is undersized by approximately 400 CFM. to maintain 75°F on a design summer day. Upon a review of the controls, a majority of the AHX-1 spaces had a setpoint of 70°F – 73°F. In order to maintain a more comfortable 72°F average, this unit will need to increase in capacity from 38 to 45 tons, and 10,800 CFM of total supply air.


*Damaged CU-3 Insulation*




*CU-3 on Dunnage*

AHX-1 Recommendations:

Remove AHX-1 and its associated condensing unit entirely. Replace this unit in kind with a modular air handling unit sized for 10,800 CFM similar to a Trane Climate Changer matching the components of the existing AHX-1 including its remote condensing unit. Cooling capacity shall be increased to 45 tons. Existing steel dunnage supporting the condensing unit shall be cleaned, treated for corrosion, and painted. New ductwork shall connect to the existing duct risers at the floor of the penthouse.

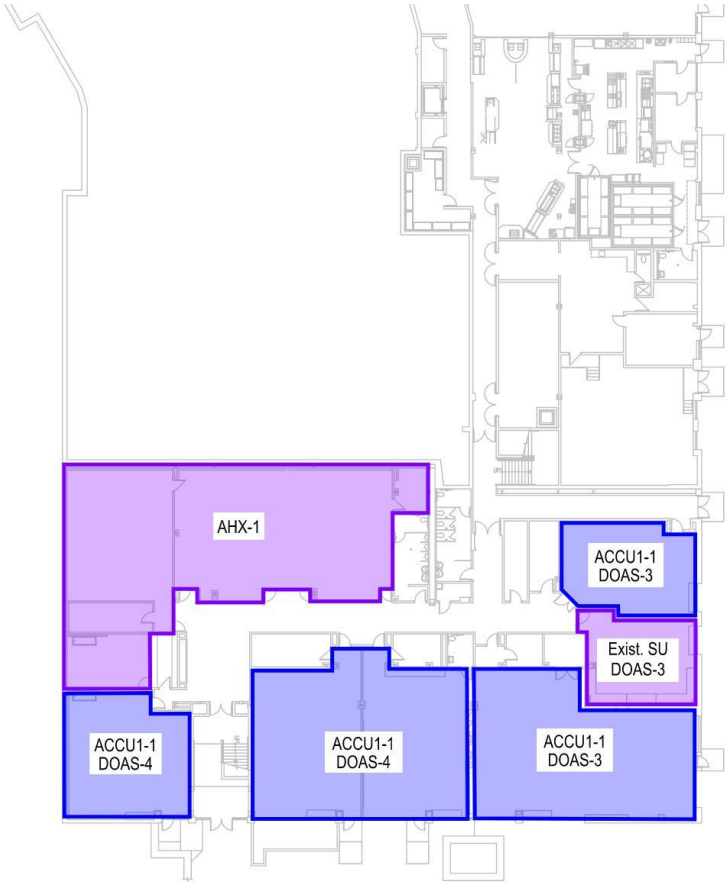
All existing ductwork serving AHX-1 shall be cleaned, pressure tested, sealed as needed, and reused. AHX-1 zoning shall not change. Refer to equipment pricing as this is not a priority item.

Option 1, Priority 1: All classrooms in the 1975 addition that are not served by AHX-1 or split AC units shall be cooled via 33”x33” ceiling cassette VRF units similar to Trane model TPLFY. Exterior classrooms shall be sized for approximately 2.5 tons of cooling each and interior classrooms shall be sized for approximately 2 ton of cooling each. The cassette units shall be connected to outdoor roof mounted VRF heat pump condensing units similar to Trane model TUHY with a total capacity of approximately 60 tons. Condensing units shall be mounted on 24” high rooftop equipment rails.

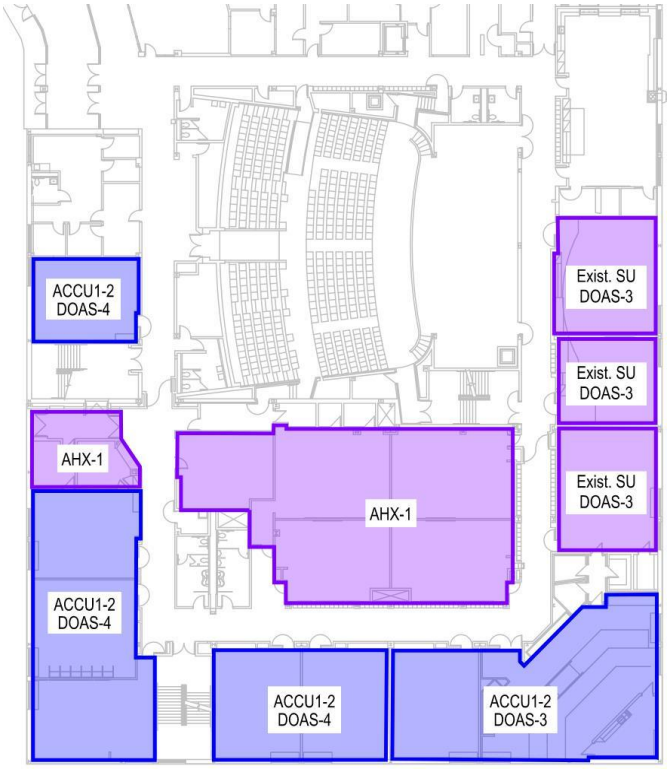
Ventilation to the perimeter classrooms shall be provided via (2) new rooftop dedicated outside air unit sized for approximately 6,250 CFM each similar to a Greenheck model RVE, tagged as DOAS-3 and DOAS-4 on the plans. The new units shall compose of filter sections, an energy recovery wheel, DX cooling coil, hot gas reheat coil, hot water reheat coil, supply air fan section and exhaust air fan section. New DOAS unit ductwork shall be routed on the roof to new risers located inside the building. Much of the existing exhaust ductwork can be retained with some modifications to serve as exhaust air back to the DOAS units. DOAS unit ventilation air shall distribute to all classrooms in the 1975 addition not served by AHX-1. All existing unit ventilators shall be removed and replaced with finned tube radiation. The new DOAS units and radiation shall be controlled via the BMS. The VRF system shall be controlled by factory controllers and monitored by the BMS.

Option 2, Priority 1: Remove AHX-1 and its associated condensing unit entirely. Replace this unit with a custom dedicated outside air unit sized for approximately 15,350 CFM similar to a Trane’s custom offering, tagged as DOAS-5 on the plans. The new unit shall be installed within the existing penthouse and shall include filter sections, an energy recovery wheel controlled via VFD, DX cooling coil, a hot water reheat coil, supply air fan section and exhaust air fan section. New ductwork shall connect to the existing duct risers at the floor of the penthouse. Additional ductwork shall route on the roof to new risers located inside the building. A remote condensing unit shall be installed on the existing condensing unit dunnage using new supplemental galvanized steel supports. Existing steel dunnage shall be cleaned, treated for corrosion, and painted.

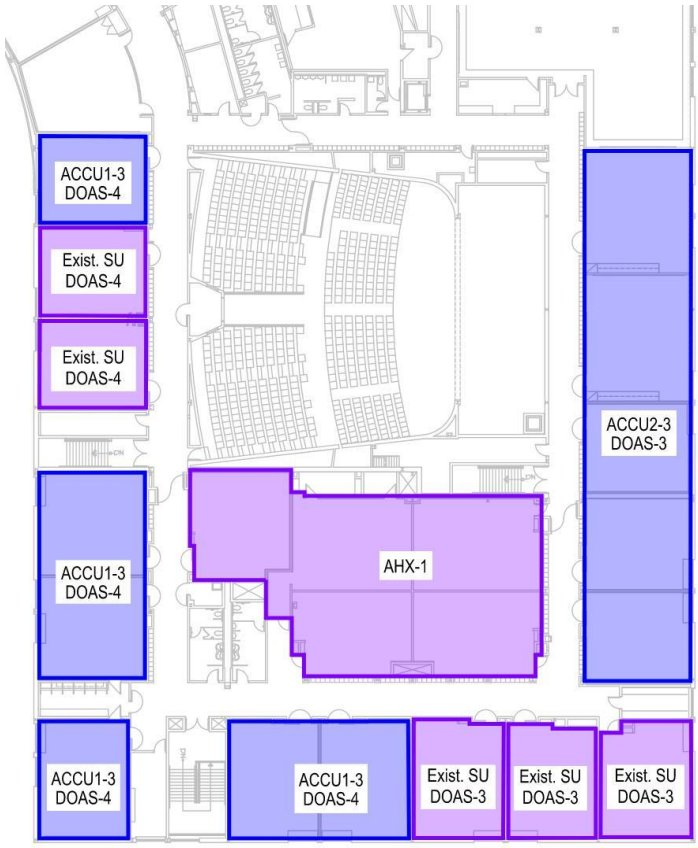
Existing ductwork through the building shall be cleaned, pressure tested, sealed as needed, and reused. New duct mains and risers shall be installed as necessary to provide ventilation to all rooms in the 1975 addition. Existing unit ventilators shall be removed and replaced with finned tube radiation. All classrooms in the 1975 addition shall be conditioned via 33”x33” ceiling cassette units similar to Trane model TPLFY. Exterior classrooms shall be sized for approximately 2.5 tons of cooling each and interior classrooms shall be sized for approximately 2 ton of cooling each. The cassette units shall be connected to outdoor roof mounted VRF heat pump condensing units similar to Trane model TUHY with a total capacity of approximately 86 tons. VRF condensing units shall be mounted on 24” high rooftop equipment rails. The new outside air unit, VRF system, and radiation shall be controlled via the building BMS. Option 2 is not a recommended option as it would be expensive, very disruptive, and difficult to achieve over a short summer break. It is shown for reference only and not being recommended.



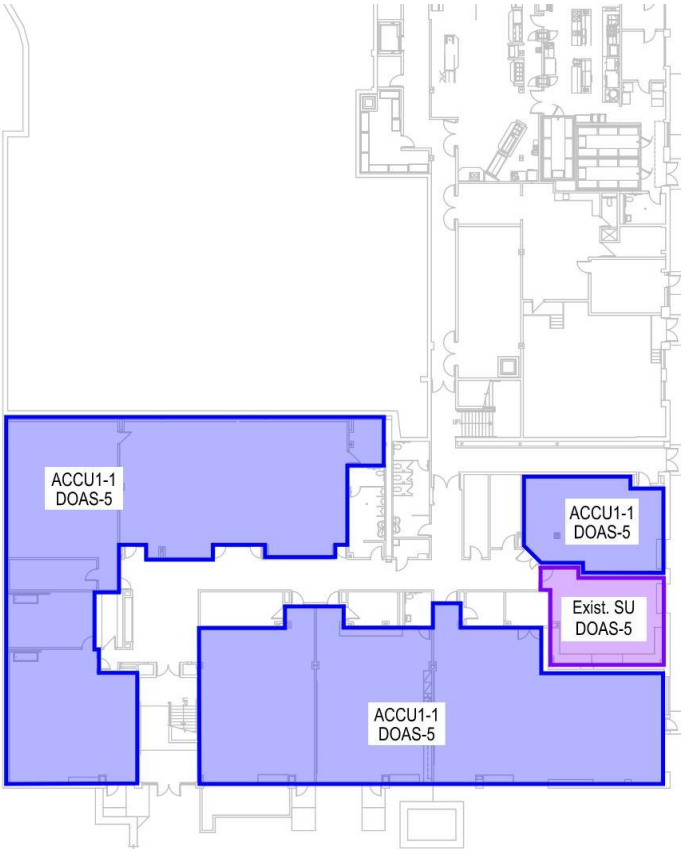

*Option 1 - VRF Classrooms - First Floor (AHX-1 for Reference Only)*



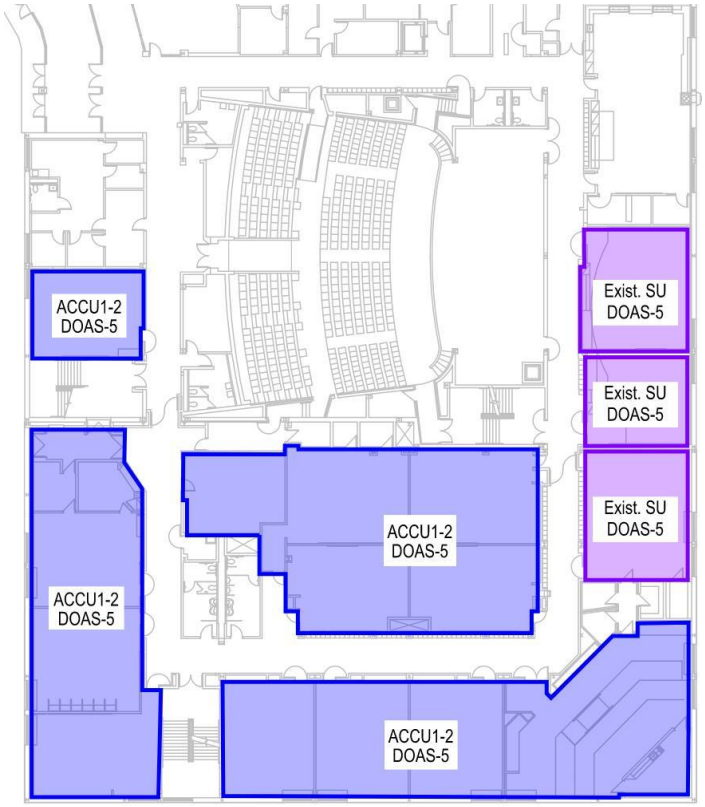

*Option 1 VRF Classrooms – Second Floor (AHX-1 for Reference Only)*



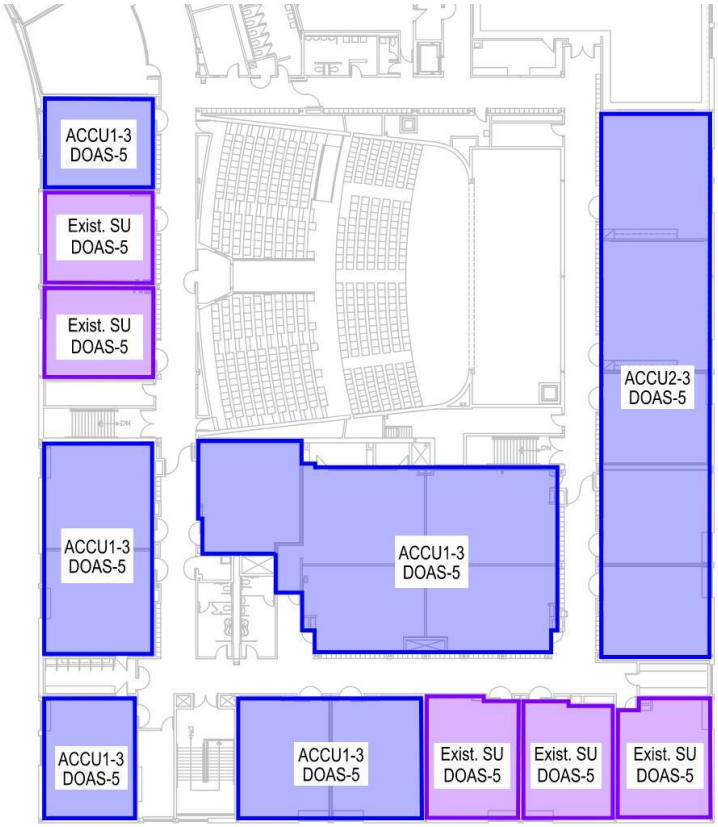

*Option 1 VRF Classrooms – Third Floor (AHX-1 for Reference Only)*




*Option 2 All VRF Classrooms – First Floor*




*Option 2 All VRF Classrooms – Second Floor*




*Option 2 All VRF Classrooms – Third Floor*

AHX-1 Penthouse Analysis:

The rooftop penthouse containing the components for AHX-1 has internal dimensions of approximately 44'-6"L x 17'-6"W x 8'-9"H. The penthouse is heated via a hot water unit heater. At the time of survey, the unit heater fan was running continuously without any hot water flowing through it. A hot water control valve serving this unit heater was not found.

The penthouse is cooled via a sidewall propeller exhaust fan and intake air damper. The damper appeared to be in good condition, but it is controlled via an antiquated actuator. The exhaust fan is corroded, in poor condition and appears to be inoperable. An abandoned suspended expansion tank was found in the penthouse which appears to be left over from the 2007 renovation. This is typical of items that were specified to be removed and were not as part of the renovation project.

*Penthouse Unit Heater*

*Penthouse Exhaust Fan*

*Penthouse Intake Damper*

*Abandoned Expansion Tank*

AHX-1 Penthouse Recommendations:

Provide a new DDC 2-way hot water control valve to serve the penthouse unit heater. Remove and replace the penthouse propeller exhaust fan with a new fan in kind sized for approximately 700 CFM. Remove and replace the penthouse make up air damper actuator with a new actuator.

Connect the penthouse fan and makeup damper to the building BMS and monitor penthouse temperature. Remove the abandoned expansion tank and any other abandoned appurtenances.

AHU-2 Description:

AHU-2 is installed on the original 1970 building roof and provides conditioned air to classrooms on the third floor, and teacher lounges and a classroom on the second floor. It is sized for 31 tons of cooling, 320 MBh of heating, 3,500 CFM of ventilation air, and 9,300 CFM of total supply air. The unit is a variable air volume McQuay model RPS030CLA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, DX cooling coil, integral condensing unit, belt driven supply fans, and belt driven return fans. This unit provides conditioned air to VAV boxes with reheat coils.

AHU-2 Analysis:

The unit was installed during the 2007 renovation and is in fair condition. Dirt and debris were seen inside the unit and on the cooling coil. Damaged cooling coil fins were observed as well as corrosion at the base of the coil. The unit contains 3 compressors which have damaged refrigerant insulation. Wiring splices were found in the supply fan section exposed to the airstream which should be contained in a junction box. AHU-2 does not have any reported issues with cooling, but it has been reported that AHU-2 spaces are subject to overheating. Since there are VAV boxes with reheat coils on this system, this can be avoided.

*AHU-2 Cooling Coil Damage*

*AHU-2 Cooling Coil Corrosion*

*AHU-2 Damaged Refrigerant Insulation*

*AHU-2 Cooling Coil Corrosion*

AHU-2 Recommendations:

Prior to the replacement of AHU-2 it is recommended that the controls be retro-commissioned to determine the cause of the occasional over heating concerns. Control sequence modifications shall be completed as required.

Option 1 (Recommended): Remove and replace AHU-2 in kind with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized to match the existing unit capacity. Provide a new adaptor curb and reconnect to the existing supply and return air main risers. All existing ductwork serving AHU-2 shall be cleaned, pressure tested and sealed as needed. All existing VAV boxes served by AHU-2 shall be inspected, cleaned, and reused. Two offices and one special education classroom on the second floor currently have no airflow and shall be furnished with new VAV boxes with hot water reheat coils fed from AHU-2.

Neighboring history and special education classrooms on the third floor that do not have cooling shall be outfitted with 33”x33” VRF ceiling cassette units similar to Trane model TPLFY. Cassette units serving the western bank of rooms on the third floor shall connect to outdoor roof mounted VRF heat pump condensing units sized for approximately 14 tons of cooling. VRF condensing units shall be similar to Trane Model TUHY mounted on 24” high equipment rails.

The history and special education classrooms served by VRF shall be ventilated via a dedicated rooftop outside air ventilator sized for approximately 2,600 CFM similar to a Greenheck model RVE tagged as DOAS-2 on the drawings. The new unit shall be installed on a new 18” high rooftop curb with supplemental structural framing. The rooftop ventilator shall include filter sections, an energy recovery wheel, DX cooling coil, hot gas reheat coil for dehumidification, a hot water reheat coil, supply air fan section and exhaust air fan section. Hot water piping shall be extended from nearby mains. The new AHU-2 and DOAS-2 shall be controlled via the BMS. The VRF system shall be controlled by factory controllers and monitored by the BMS

Option 2: Remove and replace AHU-2 with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized for 50 tons of cooling, 688 MBh of heating, 4,800 CFM of ventilation air, and 12,000 CFM of total supply air. Connect to existing supply and return air risers. Provide new roof mounted supply and return air mains to new roof penetration serving history and special education classrooms on the third floor that do not currently have cooling. Outfit these rooms with new VAV boxes complete with hot water reheat coils. Provide (1) VAV box per classroom. Extend hot water from nearby mains serving radiation. Existing VAV boxes shall be reused and shall have their reheat coils inspected and cleaned. Re-balance all existing

VAV boxes. All existing ductwork serving AHU-2 to remain shall be cleaned, pressure tested and sealed as needed. New AHU-2, VAV boxes, and reheat coils shall be controlled by the BMS.


*Option 1- AHU-2 & VRF (ACCU3-3) – Third Floor*

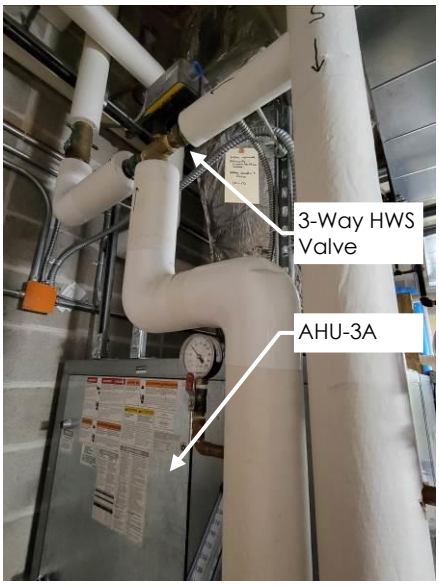

*Option 2 – Larger AHU-2 – Third Floor*

AHU-3A and AHU-3B Description:

Units AHU-3A and AHU-3B are installed in a small mechanical room on first floor and provides heating to the boy's locker rooms and girl's locker rooms respectively. Each unit is sized for 267 MBh of heating, 2,000 CFM of ventilation air, and 4,000 CFM of total supply air. The units are vertical constant air volume McQuay model CAH008GHAC indoor unit consisting of a mixing box, filter section, hot water heating coil and supply fan.

AHU-3A and AHU-3B Analysis:

The units were installed during the 2007 renovation and are in good condition. Dirt and debris were seen inside the units and on the heating coils. The unit dampers, gaskets, fans, and components all appear to be in good working order. Hot water is controlled via a 3-way control valve and no deficiencies to the piping, components, or insulation were found. These units have a ducted outside air connection sized for airside economizer and no insulation was seen on the outside air ductwork. Insulation is required by the energy code. It was also cold to the touch at the time of survey. Although no condensation or water damage was found, this ductwork should be insulated to eliminate potential condensation issues and to comply with the energy code. Breakout noise from AHU-3A and 3B is audible within the locker rooms.




*AHU-3A Heating Coil Piping*

*AHU-3A Dirty Heating Coil*

AHU-3A and AHU-3B Recommendations:

Although these units are in good operating condition, they do not cool nor dehumidify the locker rooms. Furthermore, they are not modular construction so adding a cooling coil to the existing units is not feasible. Both units shall be removed and replaced with new vertical modular air handling units similar to Trane Climate Changers, matching the current 4,000 CFM each. Each unit shall include a filter section, DX cooling coil, and vertical supply fan section. New duct mounted hot water reheat coils shall be installed in the supply air duct main above the ceiling of both locker rooms. All existing ductwork shall be cleaned and reused. The existing outside air ductwork shall be insulated with R-6 fiberglass duct wrap. The remote condensing units shall be mounted on the roof on 24" high equipment rails. The locker room inline exhaust fan (EF-1) shall be inspected and reused. The sidewall discharge louver associated with EF-1 shall be inspected and cleaned. The new air handlers and reheat coils shall be controlled by the BMS. Noise output of the new replacement units should be evaluated during the next phase of design. Duct silencers may be considered based on the new unit's published acoustical data.

AHU-4 Description:

AHU-4 is installed on the original 1970 building roof and provides heated air to the gymnasium. It is sized for 1,500 MBh of heating, 6,000 CFM of ventilation air, and 18,000 CFM of total supply air. The unit is a constant air volume McQuay model RAH077CYA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, belt driven supply fans, and belt driven return fans.

AHU-4 Analysis:

The unit was installed during the 2007 renovation and is in good condition. Dirt and debris were seen inside the unit and on the fan bearings. Light corrosion was observed on the heat exchanger condensate discharge. At the time of survey, the outside air damper and relief dampers were fully closed, and the unit was only recirculating air. The facilities staff noted this unit frequently shuts off on flameout. The gas pressure regulator is tagged with a 6 to 13 in. w.c. spring and the unit burner is tagged as requiring 8 in. w.c. minimum. Lastly, duct lining was not seen on the unit supply or return ductwork.

*AHU-4 Casing and Shut Relief Damper*

*AHU-4 Natural Gas Train*


*AHU-4 Debris on Fan Bearing*

*AHU-4 Corrosion on Condensate Discharge*

AHU-4 Recommendations:

Remove and replace AHU-4 in kind with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized to match the existing unit airflow and heating capacity. Provide a new adaptor curb and reconnect to the existing supply and return air main risers. The new unit shall be composed of a mixing box, filter section, DX cooling coil, hot gas reheat coil, integral condensing unit, indirect natural gas burner, belt driven supply fans, and belt driven return fans. The condensing unit section shall be sized for 70 tons of cooling. All existing ductwork serving AHU-4 shall be cleaned and sealed as needed. Internal lining should be added at least 15 feet downstream of the supply fan and 15 upstream of the return/relief air fan. New AHU-4 shall be controlled by the BMS.

Until this unit is replaced it is recommended to remove and clean the gas regulator orifice, inspect the internal condition of the gas piping, and verify the spring is adjusted to properly deliver the 8 in. w.c. minimum gas pressure.

AHU-5 Description:

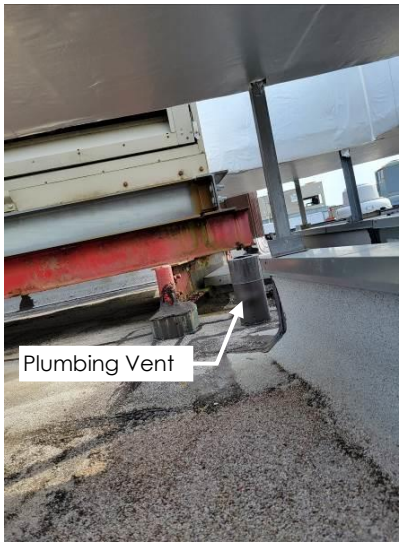
AHU-5 is installed on the original 1970 building roof and provides conditioned air to the Administration and Guidance offices on the second floor. It is sized for 250 MBh of heating, 24 tons of cooling, 2,500 CFM of ventilation air, and 7,400 CFM of total supply air. The unit is a variable air volume McQuay model RPS020CSA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, DX cooling coil, integral condensing unit, belt driven supply fans, and belt driven return fans. This unit provides conditioned air to VAV boxes with reheat coils.

AHU-5 Analysis:

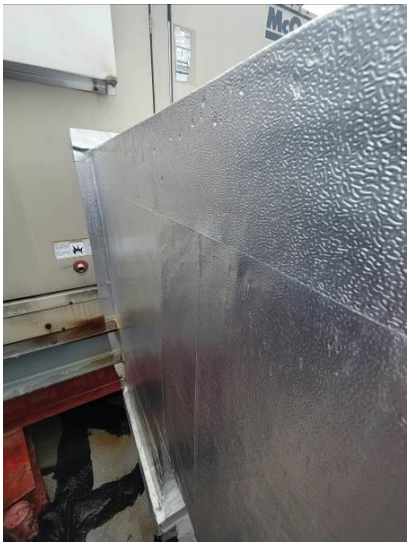
The unit was installed during the 2007 renovation and is in poor condition. Minor damage to the exterior duct insulation and refrigerant piping was observed. The cooling coil has damage to the fins and corrosion at the coil base. The return fan was out of balance with visible oscillation and excessive noise radiated from the supply fan possibly indicating a failing bearing. Excessive air leakage was observed at the unit module junctions. A plumbing vent was installed close to the outside air intake which does not comply with current code. The air balance report indicates this unit is providing less airflow than design. Lastly, the exterior ductwork was routed in such a way that it prevents access to the unit heating section.

*AHU-5 Damaged and Corroded DX Coil*

*AHU-5 Supply Fan*




*Plumbing Vent Near AHU-5 Intake*



*Exterior Ductwork Obstructing Access*

AHU-5 Recommendations:

Remove and replace AHU-5 with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized to match the existing unit airflow and capacity. New AHU-5 shall be relocated on the roof to avoid service conflict with the existing duct penetrations and to avoid existing plumbing vents. The unit shall be mounted on new steel dunnage at its new location.

Existing VAV boxes and ductwork serving the administrative and guidance offices shall be inspected, cleaned, and reused. Provide a new VAV box with reheat coil dedicated to the administrative office lobby. Extend hot water from nearby existing reheat coil piping. Re-balance all existing VAV boxes to original design airflows. All existing ductwork serving AHU-5 to remain shall be cleaned, pressure tested and sealed as needed. New AHU-5, VAV box, and reheat coil shall be controlled by the BMS.


*AHU-5 Proposed Correction – Second Floor*

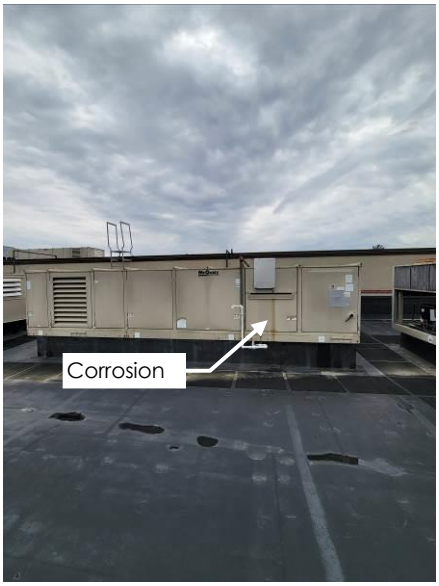
AHU-6 Description:

AHU-6 is installed on the original 1970 building roof and provides heated air to the Weight Room and Wrestling Room. It is a 100% outside air unit sized for 320 MBh of heating and 3,600 CFM of total supply air all of which is used for ventilation. The unit is a constant air volume McQuay model RDS800CYA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, belt driven supply fans, and belt driven return fans.

AHU-6 Analysis:

The unit was installed during the 2007 renovation and is in good condition. Heavy dirt and debris were observed on the return fan bearings. Mild corrosion was found on the unit casing as a result of the acidic burner condensate. The facilities staff noted this unit occasionally shuts off on flameout, although not as frequently as the neighboring AHU's.


*Debris on AHU-6 Fan Bearing*




*AHU-6 Overall*

AHU-6 Recommendations:

Remove and replace AHU-6 in kind with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model HAXX sized to match the existing unit airflow and 18 tons of cooling. Provide a new adaptor curb and reconnect to the existing supply and return air risers. If noise is a concern, consider installing duct mounted supply and return air silencers at this time. The new unit shall be composed of a mixing box, filter section, DX cooling coil, hot gas reheat coil, indirect natural gas burner, integral condensing unit, supply air fan, and exhaust air fan.

New VAV boxes shall be provided to serve the weight room and wrestling room as individual zones. Both VAV boxes shall be furnished with a hot water reheat coil. Hot water shall be extended to the new VAV boxes from nearby mains. Each room shall be outfitted with a thermostat and CO2 sensor for temperature and ventilation control. Existing supply air ductwork shall be modified as needed to accommodate the new VAV boxes. All existing ductwork serving AHU-6 shall be cleaned, pressure tested and sealed as needed. New AHU-6, VAV boxes, and reheat coils shall be controlled by the BMS.

Until this unit is replaced it is recommended to remove and clean the gas regulator orifice, inspect the internal condition of the gas piping, and verify the regulator spring is adjusted properly to deliver the minimum gas pressure noted on the unit burner.

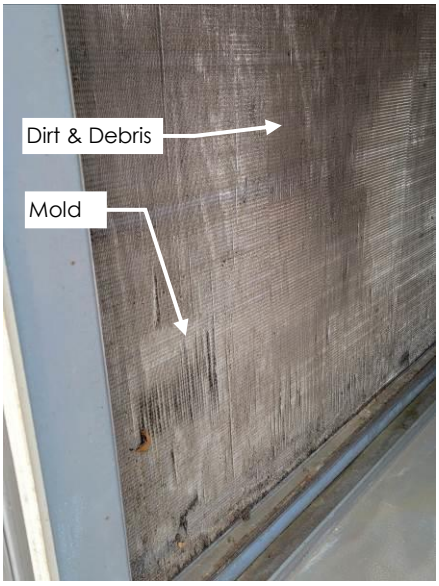

*AHU-6 Proposed Correction – First Floor*

AHU-7 Description:

AHU-7 is installed on the original 1970 building roof and provides conditioned air to the Main Lobby. It is sized for 650 MBh of heating, 32 tons of cooling, 4,720 CFM of ventilation air, and 9,000 CFM of total supply air. The unit is a constant air volume McQuay model RPS030CSA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, DX cooling coil, integral condensing unit, belt driven supply fans, and belt driven return fans.

AHU-7 Analysis:

The unit was installed during the 2007 renovation and is in fair condition. Minor damage to the cooling coil fins was observed along with clogging debris, mold growth, and corrosion at the base of the coil. The unit outside air dampers were closed at the time of survey and the unit was operating under a heavy negative pressure. The condensate drain off the gas fired heat exchanger is causing acidic damage to the unit casing. Mild damage to the condenser coil fins and fan guard corrosion was discovered. The facilities staff noted this unit frequently shuts off on flameout when in heating mode. Lastly, no duct lining or silencers was found on the supply or return air ductwork leading to audible noise transmission in the lobby below. In addition, condensate was found on the supply air ductwork in the lobby which appears to be a result of the absence of duct lining along with air infiltrating the lobby from frequent use of the building entrances.




*AHU-7 Cooling Coil*


*AHU-7 Cooling Coil Drain Pan*

*AHU-7 Heat Exchanger Condensate*

*AHU-7 Condenser Section*

AHU-7 Recommendations:

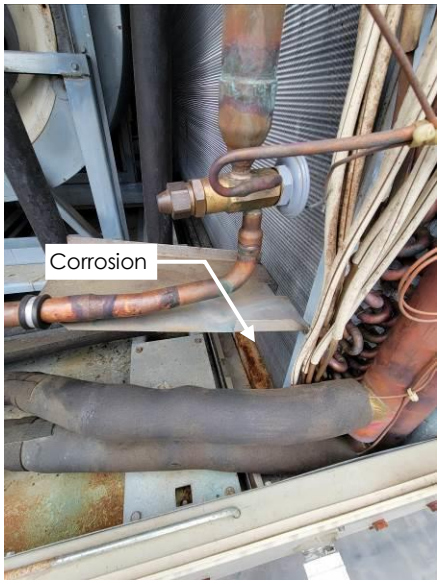
Remove and replace AHU-7 in kind with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized to match the existing unit airflow and capacity. The new unit shall be furnished with a hot gas reheat coil for dehumidification. Provide a new adaptor curb and reconnect to the existing supply and return air risers. If noise is a concern, consider installing duct mounted supply and return air silencers at this time. The new unit shall be composed of a mixing box, filter section, DX cooling coil, hot gas reheat coil, indirect natural gas burner, supply fans, and return fans. All existing ductwork serving AHU-7 shall be cleaned and sealed as needed. Internal duct lining is recommended at portions of supply air ductwork and return air ductwork near the building entrance. New AHU-7 shall be controlled by the BMS.

Until this unit is replaced it is recommended to remove and clean the gas regulator orifice, inspect the internal condition of the gas piping, and verify the regulator spring is adjusted properly to deliver the minimum gas pressure noted on the unit burner.

AHU-8 Description:
AHU-8 is installed on the original 1970 building roof and provides conditioned air to the athletic offices on the first floor as well as music classrooms on the second floor. It is sized for 320 MBh of heating, 24 tons of cooling, 3,000 CFM of ventilation air, and 11,400 CFM of total supply air. The unit is a variable air volume McQuay model RPS025CLA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, DX cooling coil, integral condensing unit, belt driven supply fans, and belt driven return fans. This unit provides conditioned air to VAV boxes with reheat coils.

AHU-8 Analysis:
The unit was installed during the 2007 renovation and is in fair condition. Minor damage to the cooling coil fins was observed. The coil had considerable amount of dirt on the as did the inside of the unit in general. Additionally, the cooling coil was found to have significant corrosion along the base. The outside air and relief air dampers appear to be operating correctly at the time of survey. The facilities staff noted this unit frequently shuts off on flameout when in heating mode. Lastly, no duct lining or silencers was found on the supply or return air ductwork. This appears to be contributing to the audible noise observed in the lobby below.

*AHU-8 Cooling Coil*




*AHU-8 Cooling Coil Corrosion*

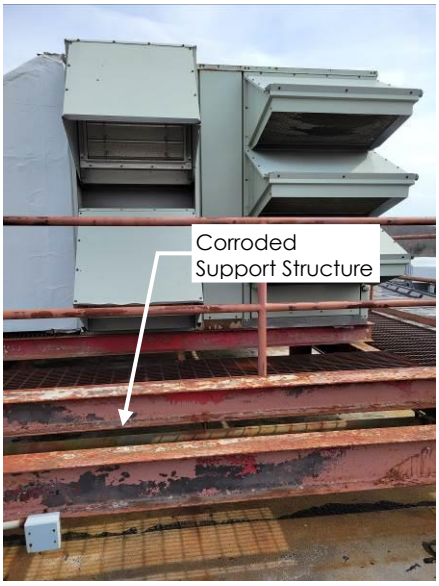
AHU-8 Recommendations:
Remove and replace AHU-8 in kind with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized to match the existing unit airflows and capacity. Provide a new adaptor curb and reconnect to the existing supply and return air risers. All existing ductwork serving AHU-8 shall be cleaned, pressure tested and sealed as needed. All existing VAV boxes served by AHU-8 shall be inspected, cleaned, and reused. New AHU-8 shall be controlled by the BMS. If noise is a concern, consider installing duct mounted supply and return air silencers.

Until this unit is replaced it is recommended to remove and clean the gas regulator orifice, inspect the internal condition of the gas piping, and verify the regulator spring is adjusted properly to deliver the minimum gas pressure noted on the unit burner.

AHU-9 Description:
AHU-9 is installed on the original 1970 building roof and provides conditioned air to the cafeteria on the first floor. It is sized for 40 tons of cooling, 3,450 CFM of ventilation air, and 14,770 CFM of total supply air. According to the air balance report dated 7/22/21, the supply airflow was reduced to 9,300 cfm under the 2007 renovation. The unit is a constant air volume Trane model TCH480A40A1A3LG1 packaged rooftop unit consisting of a mixing box, filter section, DX cooling

coil, integral condensing unit, belt driven supply fans, and belt driven return fans. The unit does not have a heating section however a duct mounted 399 MBh hot water reheat coil was added to the supply air main during the 2007 renovation.

AHU-9 Analysis:
The unit was installed in 1995 and is in poor condition. The unit is scheduled for replacement during second and third quarter of 2022, therefore a detailed investigation was not performed. However, the unit support structure and existing exterior ductwork was examined. The dunnage and associated service platform is constructed of painted carbon steel structural beams. The paint has weathered over time and the structural dunnage is in poor condition. The exterior ductwork appears to have minor holes in the fiberglass insulation which led to sagging and degradation from rain.




*AHU-9 Support Dunnage*


*AHU-9 Duct Insulation*

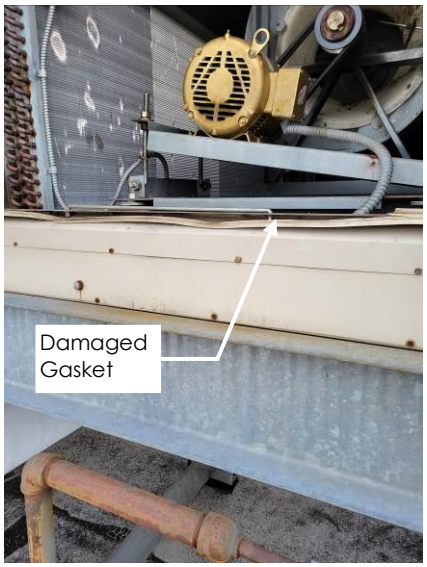
AHU-9 Recommendations:
Remove all abandoned and unused steel dunnage. Provide new galvanized steel supports as part of the new AHU-9 replacement. If this is not practical the existing steel dunnage should be stripped and painted with a rust inhibitive type paint. It is recommended to have the existing ductwork and reheat coil inspected, cleaned, pressure tested, and sealed as needed prior to final unit operation. It is also recommended to replace the insulation on any rooftop ductwork to be reused with a closed cell insulation such as polyisocyanurate or flexible elastomeric. New exterior duct insulation should be a minimum R-12 and shall be protected with a self-adhesive aluminum jacketing.

AHU-10 Description:
AHU-10 is installed on the original 1970 building roof and provides conditioned air to the Media Center and adjacent computer labs on the third floor. It is sized for 400 MBh of heating, 25 tons of cooling, 4,720 CFM of ventilation air, and 8,450 CFM of total supply air. The unit is a variable air volume McQuay model RPS020CSA packaged rooftop unit consisting of a mixing box, filter section, indirect natural gas burner, DX cooling coil, integral condensing unit, belt driven supply fans, and belt driven return fans.

AHU-10 Analysis:
The unit was installed during the 2007 renovation and is in poor condition. The cooling coil has excessive damage to the fins and corrosion at the coil base. Unit access door gaskets are ripped or dislodged from their mounting seam. The outside air damper was completely shut at the time of survey causing a high negative pressure inside the unit. The exterior roof mounted ductwork is

wrapped with fiberglass insulation which has holes and signs of water damage. Similarly, the refrigerant insulation is ripped, and corrosion was found at the compressor fittings.

*AHU-10 Damaged Cooling Coil*




*AHU-10 Damaged Door Gasket*

*AHU-10 Water Damaged Duct Insulation*

*AHU-10 Damaged and Corroding Compressor*

AHU-10 Recommendations:

Remove and replace AHU-10 in kind with a new variable air volume gas fired / DX packaged rooftop unit similar to a Trane model IPAK sized to match the existing unit airflows and capacity. Provide a new adaptor curb and reconnect to the existing supply and return air mains on the roof. All existing rooftop ductwork shall be reinsulated with a closed cell product such as polyisocyanurate or flexible elastomeric insulation. Exterior insulation shall be protected with a self-adhesive aluminum jacketing. A new supply air main shall be routed to the (2) computer labs adjacent to the media center. Each computer lab shall be furnished with a new VAV box. The existing supply air main serving the media center shall be furnished with a slip in retrofit VAV box. New space mounted thermostats and CO2 sensors shall be installed to control temperature and ventilation. All existing ductwork serving AHU-10 shall be cleaned, pressure tested and sealed as needed. New AHU-10 and VAV boxes shall be controlled by the BMS.


*AHU-10 Proposed Correction – Second Floor*

AHU-11 Description:
AHU-11 is installed on the original 1970 building roof and provides cooling to the Broadcast Studio. No documentation is available for this unit however it was determined to have 6 tons of cooling capacity. It is a Trane model TSC072A3R0A0HH100A100A6C0 packaged rooftop unit consisting of a mixing box, filter section DX cooling coil, integral condensing unit, and a supply air fan. The unit is designed for 208 / 230V – 3 phase power which is different than all the other 480V rooftop units.

AHU-12 was removed during the 2007 renovation with its ductwork capped at the roofline and dunnage abandoned in place. This unit used to serve the 1970 Choral Room behind the auditorium stage on the second floor. The Choral room was converted to two classrooms in 2007 with no cooling at the time but have since been furnished with mini split units.

AHU-11 Analysis:
AHU-11 was installed around 2002 and is in inoperable condition. The facilities staff noted this unit has not operated in years. The exterior ductwork serving this unit is not protected and has an excessive amount of corrosion as a result. Rust was observed around the unit base along with damaged condenser fins.

*AHU-11 Corroded Ductwork*


*Abandoned AHU-12 Dunnage and Ductwork*

AHU-11 Recommendations:
Remove and replace AHU-11 in kind with a new variable air volume DX heat pump packaged rooftop unit similar to a Trane Precedent sized for 5 tons of cooling, 400 CFM of ventilation air, and 2,000 CFM of supply air. Provide a new roof curb and reconnect to the existing supply and return sidewall duct penetrations. Damaged exterior ductwork shall be removed, replaced, and insulated with a closed cell R-12 insulation such as polyisocyanurate or flexible elastomeric and protected with a self-adhesive aluminum jacketing. All existing ductwork serving AHU-11 shall be cleaned and sealed as needed for reuse.

All abandoned dunnage serving the previous AHU-12 should be removed entirely.

AHU-13 Description:
AHU-13 is installed on the original 1970 building roof and provides conditioned air to the Auditorium on the second floor. It is sized for 75 tons of cooling and 23,900 CFM of total supply air. According to the air balance report dated 7/22/21, the unit was operating at 84% airflow and damaged ductwork with excessive leakage was since repaired. The unit is a Trane model SXHFC7540EC5C79D1001AELRT packaged rooftop unit consisting of a mixing box, filter section, DX cooling coil, integral condensing unit, belt driven supply fans, and belt driven return fans. The unit provides conditioned air to (5) duct mounted reheat coils.

AHU-13 Analysis:
The unit was installed in 1995 and is in poor condition. The unit is scheduled for replacement during second and third quarter of 2022, therefore a detailed investigation was not performed. However, the unit support structure and existing exterior ductwork was examined. The base rail and associated service platform is constructed of painted carbon steel structural beams. The paint has weathered over time and the structural dunnage is rusting. Additional dunnage from previous units remains adjacent to AHU-13, abandoned in place. The exterior supply air ductwork serving AHU-13 is in poor condition and has excessive air leakage at all seams.

*AHU-13 & Abandoned Dunnage*

*AHU-13 Example of Leaking Duct Seam*

AHU-13 Recommendations:
Remove all abandoned and unused steel dunnage. Provide new galvanized steel supports as part of the new AHU-13 replacement. If this is not practical the existing steel dunnage should be stripped and painted with a rust inhibitive type paint. It is recommended to have the existing ductwork, lining, and reheat coils inspected, cleaned, and sealed as needed prior to final unit operation.

ERU-1 and ERU-2 Description:
Units ERU-1 and ERU-2 are installed on the original 1970 building roof. ERU-1 provides 100% conditioned outside air to the science classrooms on the third floor and ERU-2 provides 100% conditioned outside air to the science classrooms on the second floor. Both units are nearly identical, each sized for 287 MBh of heating and 30 tons of cooling. The only difference between the units is ERU-1 is sized for 7,800 CFM and ERU-2 is sized for 7,600 CFM. Both units are constant air volume Venmar model 9318 modular rooftop units consisting of a filter section, hot water coil, DX cooling coil, energy recovery wheel, remote R22 condensing unit, belt driven supply fans, belt driven exhaust fans, and a bypass for unoccupied mode. Both units provide conditioned air to duct mounted reheat coils inside the building.

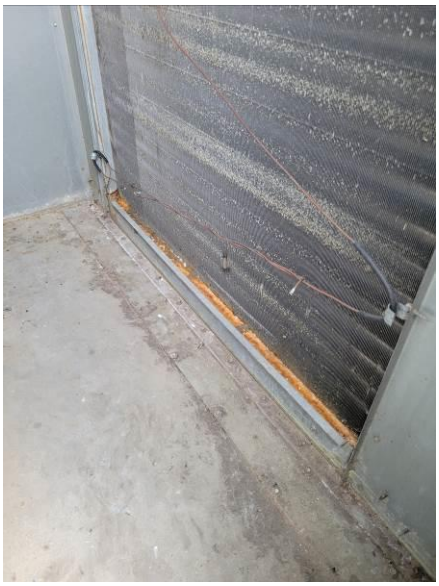
It was reported that ERU-2 was not providing proper airflow to the science classrooms on the second floor during our initial walkthrough. The explanation of no supply airflow while the fan was running seemed to point to clogged duct mounted hot water coils or a closed damper. During the initial kickoff meeting we identified the location of the ERU-2 duct risers along with their associated fire dampers using the 2006 design drawings. At that point we investigated the duct chase, opened the fire damper access door, and found the fire damper completely closed due to broken linkage. That was the cause of the airflow issue and facilities immediately called the service company to replace the linkage. Apparently, this flow issue was ongoing for some time but was a simple fix.

ERU-1 and ERU-2 Analysis:
ERU-1 was installed during the 2007 renovation and is in poor condition. The cooling coil has corrosion at its base and debris was seen on both coils. The hot water and refrigerant valves and hangers have excessive surface rust. Rust was also observed on the remote condensing unit frame, coil guard, and compressor fittings. Lastly, the hot water piping serving ERU-1 is supported by pipe clamps at the roof penetration that have rotted and are crumbling. The exhaust fan is furnished with a nearly new electric motor.

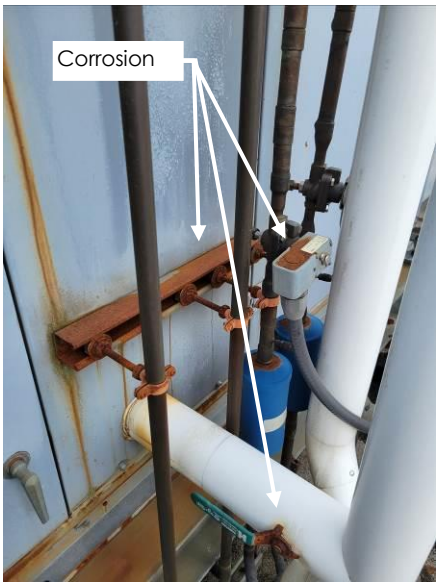
ERU-2 was installed during the 2007 renovation and is also in poor condition. Most notably, the energy wheel has failed completely and is currently dismantled. The unit is actively running with its bypass damper open recirculating air to lab spaces. Airflow from the science labs should not be circulated under occupied periods. These science rooms should be restricted in use until this unit is either repaired or replaced as to not recirculate any potential odors or limited hazards. The cooling coil has heavy corrosion at its drain pan locations and up the casing of the coil. An excessive amount of dirt and grime was observed on both the heating and cooling coils as well as corrosion of exterior valves and components.

ERU-1 and ERU-2 Recommendations:

It is recommended to remove and replace both ERU-1 and ERU-2 in kind with a new constant air volume hot water / DX packaged rooftop unit similar to a Semco model EPHC sized to match the existing unit airflows and capacity. Provide steel modifications based on unit size and reconnect to the existing supply and return air main risers for each unit. The new units shall be composed of a mixing box, filter section, DX cooling coil, hot gas reheat coil, hot water heating coil, supply air fans, and exhaust air fans. The cooling coil shall be connected to a new remote roof mounted condensing unit at the existing unit location. New supplemental steel dunnage shall be added to support the new condensing unit. All existing ductwork and reheat coils serving ERU-1 and ERU-2 shall be inspected, cleaned, pressure tested and sealed as needed. The cost to replace the failed energy wheel in ERU-2 is approximately $80,000 compared to an estimated $288,000 for full unit replacement. Repair of the wheel is not recommended.

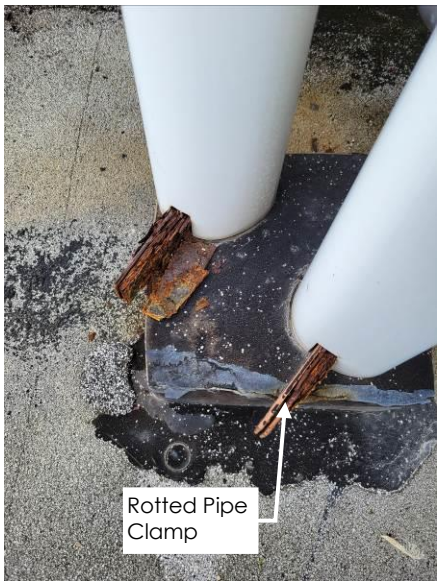


*ERU-1 Cooling Coil*




*ERU-1 Exterior Pipe Hanger and Valves*

*ERU-1 Compressors*




*ERU-1 Hot Water Penetration*


*ERU-2 Energy Wheel*

*ERU-2 Cooling Coil Corrosion*

MAU-1 Description:

Unit MAU-1 is installed above the ceiling of the kitchen and provides heated make up air for the kitchen hood exhaust. It is sized for 450 MBh of heating and 5,000 CFM of outside air. The unit is a constant air volume McQuay model CAH010GHAC suspended air handler consisting of a filter section, hot water coil, and a belt driven supply air fan. Access to this unit is difficult but not impossible.

MAU-1 Analysis:

MAU-1 was installed during the 2007 renovation and is in good condition. The duct insulation on the unit inlet is deteriorating and the inlet louver is completely obstructed with debris. Likewise, the hot water coil is coated, almost entirely with dirt. One filter was observed to be dislodged from its frame allowing the coil to become contaminated. The supply fan motor was running at the time of survey. However, a loose fan belt prevented the fan wheel from spinning. The unit is actively running in “hand” mode. The design drawings indicate a freeze pump serving the hot water coil however that freeze pump could not be located and may not exist. Glycol in the hot water system is likely protecting this coil from freezing.

Access to repair or replace major components for MAU-1 is blocked by adjacent wall framing and the kitchen equipment below. Routine maintenance items such as filter and belt replacement is very difficult with the current unit location.

*Clogged MAU-1 Heating Coil*

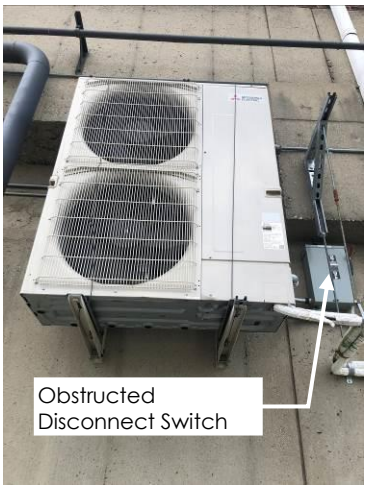
*MAU-1 Supply Fan with Loose Belt*

MAU-1 Recommendations:
MAU-1 is in good working condition and shall remain. However, this unit requires a thorough cleaning as well as a new, properly adjusted fan belt. The inlet ductwork, discharge ductwork, and outside air louver should be thoroughly cleaned as well. Service access is a challenge with the current unit arrangement. It is recommended to add a service platform above the kitchen hood in order to properly maintain this unit. Note upon discovery, facilities was notified and the service company was contacted to address the concerns of the dirty coil and belt but the other items still need attention.

Split AC Units Description:
Supplemental split air conditioning units have been installed in select rooms throughout the building in order to provide cooling for some rooms that are not served by a central air handling unit. Split units by Mitsubishi and Sanyo were found on the building roof and supported on some exterior walls. These split systems seem to date back to 2017 and range from good condition to nearly new. A Mitsubishi City Multi VRF system was found serving 3 offices on the third floor.

Split AC Units Analysis:
One condensing unit on the back of the building was noted to have damaged insulation and a pipe support that is obstructing its disconnect switch. Some roof mounted condensing units are mounted on wood blocking a few inches off the roof making them subject to snow entrainment. The Sanyo condensing units on the roof have missing casing sections with exposed control wiring that have been weathered at an accelerated rate. The indoor units are ductless wall mounted units or ductless ceiling cassettes. These indoor units provide cooling only and do not supply their spaces with ventilation air.

Split AC Units Recommendations:
Mount all rooftop condensing units on 24” high equipment rails to avoid snow infiltration. Relocate the pipe hanger on the wall mounted unit to avoid the unit’s disconnect switch.




*Wall Mounted Condensing Unit*

*Roof Mounted Condensing Unit On Wood Blocks*

*Example Indoor Ceiling Cassette Unit*

*Sanyo Condensing Unit With Water Damage*

Art, Culinary and Science Rooms Without Cooling

The art, culinary, and science rooms on the second floor are heated only with finned tube radiation and exhausted with rooftop fans. The fans did not appear to be running at the time of survey. The culinary room is furnished with a heat capture hood above commercial cooking equipment. This hood has a sidewall exhaust to the exterior of the building with no backdraft damper allowing a large amount of infiltration.

Recommendations:

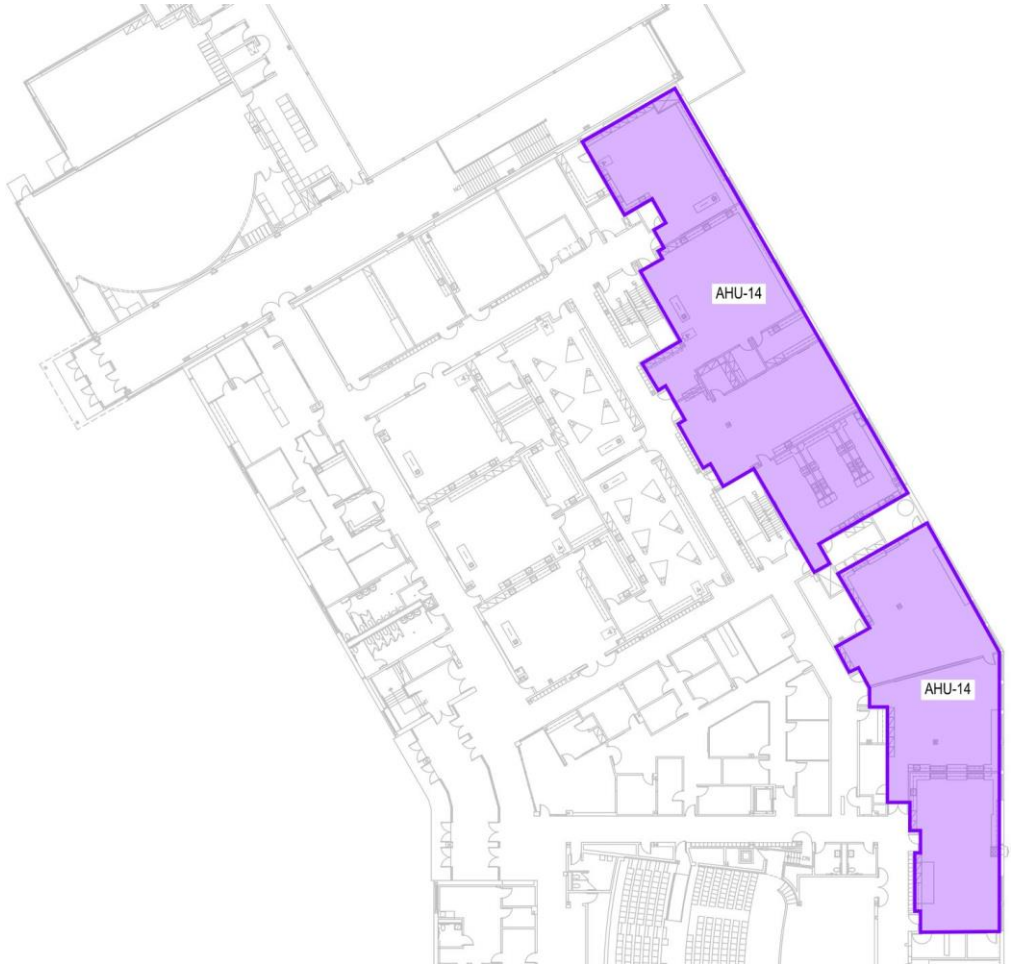
Option 1: Provide a new 100% outside air variable volume rooftop air handling unit sized for 560 MBh of heating, 40 tons of cooling, and 11,000 CFM total supply air, tagged as AHU-14 on the drawings. The unit shall be similar to a Trane Horizon and shall be composed of filter sections, an energy recovery wheel, DX cooling coil, indirect gas fired burner, a recirc damper for unoccupied mode, supply air fans, and exhaust air fans. The unit shall deliver 100% outside air to these classrooms without any recirculation. This unit shall be installed on new galvanized steel dunnage.

New exterior roof mounted ductwork shall extend to new vertical duct risers installed through the third floor in order to distribute conditioned air to the second-floor classrooms. Each classroom shall be outfitted with new VAV boxes complete with hot water reheat coils. Provide (1) VAV box and thermostat per classroom. Extend hot water from nearby mains serving radiation. Remove the exhaust fans and exhaust ductwork serving these classrooms. All exhaust shall be ducted back to the new rooftop air handling unit, sized to maintain a negative cfm offset in relation to the new supply VAV boxes. Existing perimeter radiation shall remain. New AHU-14, VAV boxes, and

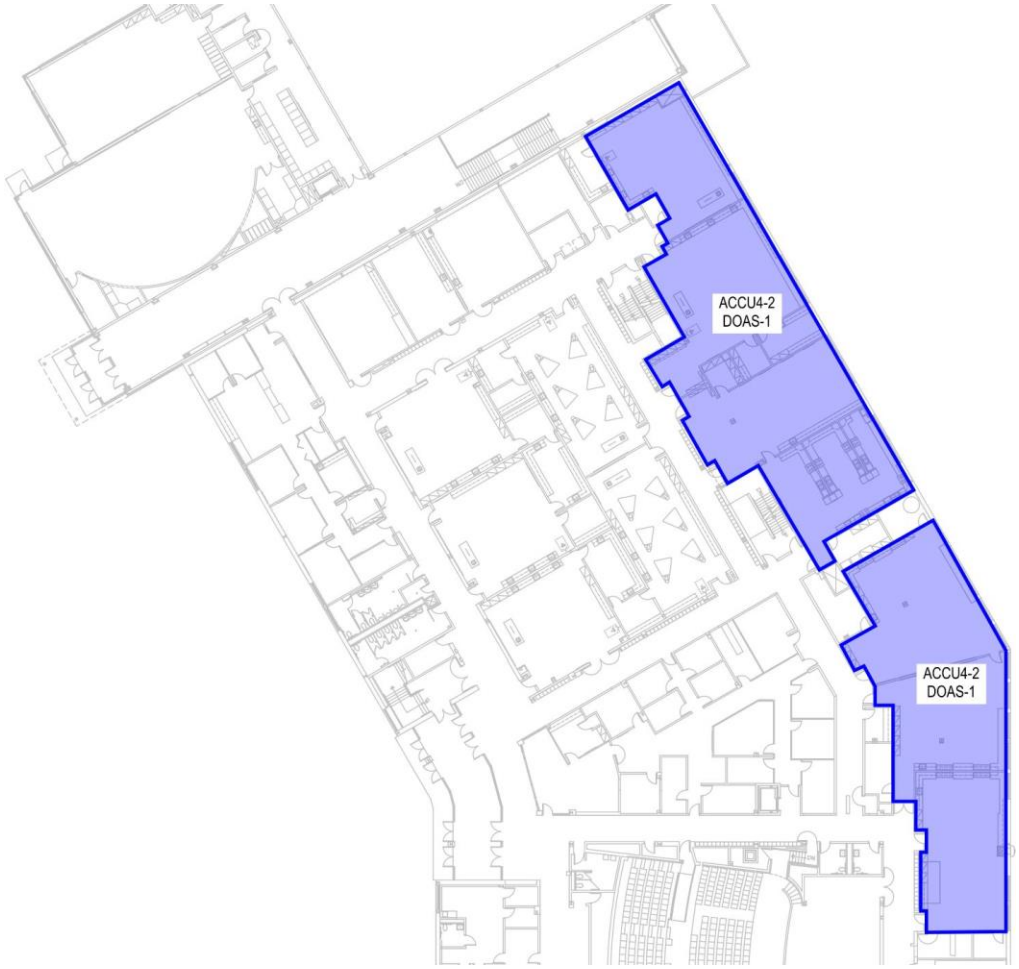
reheat coils shall be controlled via the BMS. Option 1 is not recommended due to the first cost, disruption to the areas of concern and the limited time in which to perform the work over the summer periods.

Option 2: The art, culinary, and science classrooms on the second floor shall be outfitted with 33”x33” VRF ceiling cassette units similar to Trane model TPLFY. Cassette units serving these classrooms shall connect to outdoor roof mounted VRF heat pump condensing units sized for approximately 24 tons of cooling. VRF condensing units shall be similar to Trane Model TUHY and shall be mounted on 24” high equipment rails.

The classrooms shall be ventilated via a dedicated rooftop outside air ventilator sized for approximately 4,500 CFM similar to a Greenheck model RVE, tagged as DOAS-1 on the drawings. The new unit shall be installed on new galvanized steel dunnage. The rooftop ventilator shall include filter sections, an energy recovery wheel, a DX cooling coil, hot gas reheat coil for dehumidification, a hot water reheat coil, supply air fan section and exhaust air fan section. Hot water piping shall be extended to the unit from nearby mains. Provide new exterior roof mounted duct mains extending to new duct risers through the third floor. New supply and exhaust ductwork shall distribute inside the building to feed the classrooms on the second floor. The existing exhaust system serving the art rooms shall be removed completely. Ventilation air shall be controlled via (1) VAV box per classroom and a space mounted CO2 sensor. Existing finned tube radiation shall remain. New DOAS-1 and associated VAV boxes shall be controlled by the BMS. The VRF system shall be controlled by a factory controller and monitored by the BMS.




*Art, Culinary and Science Option 1 – Second Floor*




*Art, Culinary and Science Option 1 – Second Floor*

Building Exhaust Fans

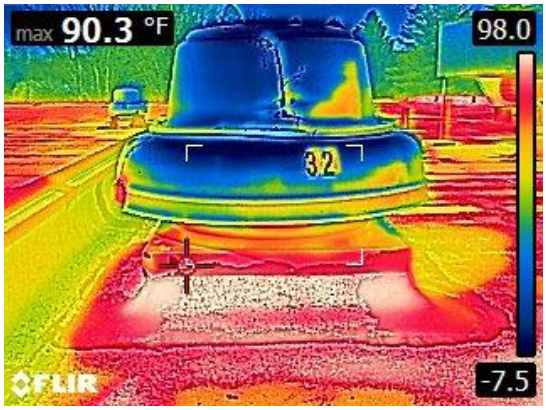
Approximately 40 rooftop exhaust fans were discovered. Of them, approximately 12 were installed during the 2007 renovation and were in proper working order. The fans original to 1970 and 1975 are in poor condition, have exterior damage, and most were not running at the time of survey. These older fans can be identified by their dull aluminum fan shrouds. A general overview of the rooftop fans showed that warm building air was exfiltrating out of the fans that were inoperable. This was further confirmed with a thermal imaging camera noting 80°F to 90°F air exfiltrating from the inoperable fans on a 50°F day. It is apparent that some fans either do not have an isolation damper or the damper is no longer holding a seal. Most of the old fans are fed from the existing motor control centers and we believe are controlled by time clocks although all could not be confirmed. Upon reviewing the controls system, approximately 5 fans were found on the BMS.

Fans demolished during the 2007 renovation had existing abandoned curbs with sheet metal caps. However, not all abandoned fans were removed, and some were left in place on the roof, disconnected. Much of the interior ductwork was also abandoned in place during the 2007 renovation.

Recommendations:

It is not in the scope of this report to thoroughly investigate every exhaust fan on a case-by-case basis. It is recommended to have these fans traced out and investigated further to confirm which fans from 1970 and 1975 construction should be active and which fans are abandoned in place. Once determined, said fans should be replaced in kind with new fans, new motor starters and new motorized isolation dampers. All new fans and dampers should be controlled by the BMS. Fans installed under the 2007 renovation shall remain as is. A similar investigation should take

place for the exhaust fans inside the building. At a minimum the fans serving the toilets should be changed as this is an area of biggest complaint for odors. Fans that provide ventilation to unconditioned classrooms also need to be addressed.




*EF-32 Thermal Image with Leakage*


*EF-32 Reference Image with Notable Damage*


*EF-41 Thermal Image without Leakage*

*EF-41 Reference Image*

*Example of Abandoned Fan*

*Example of Capped Fan Curb*

# VII. BUILDING AND HVAC DISTRIBUTION EVALUATION

**General:**

Over to the past 5 years or so there has been an effort to address operating deficiencies within the existing systems. It is recommended that these efforts continue in order to keep equipment and systems not yet scheduled for replacement or renovations operating as efficiently as possible.

Not all areas of the building can be addressed due to budget limitations. That being said, the areas that are not renovated should have the temperature control operations confirmed in order to provide proper controllability to the remaining areas without cooling until future budgets allow for additional renovations.

Many of the original duct systems were abandoned in place during the 2007 renovation. It is recommended that these be removed as time allows or under a scheduled renovation.

During the 2007 renovation the school was changed from a 2B to a 2A classification. This required the creation of fire rated ceilings in certain areas as well extensive spray on fire proofing. This classification makes renovation more costly due to the repair of fire proofing and fire dampers required throughout the building.

Noted miscellaneous grilles are missing throughout the spaces. New grilles should be installed. These areas not specifically noted in the report but can be replaced at Bethels convenience.

Most of the electrical closets with transformers have transfer ducts to the corridors without exhaust and these rooms are hot. It is recommended to add exhaust to these rooms.

The 1970 and 1975 portions of the school utilize natural ventilation in classrooms without unit ventilators. The use of natural ventilation requires operable openings to be sized for 4% of the room's floor area or greater. The existing classroom operable windows are not large enough to achieve this criteria in itself. It appears that exhaust fans were provided under the original building designs to draw ventilation air through the operable windows. Most of these fans are currently inoperable and in some cases the distribution has deficiencies, such as grilles located above the ceiling, which hinder the system from operating as intended. Furthermore, the use of natural ventilation, although allowable by code, results in a large amount of untreated outside air entering a conditioned or non-conditioned space which could result in poor indoor air quality and lack of temperature and humidity control. Therefore, natural ventilation should not be considered for new design options. Instead, mechanical ventilation with outside air treatment shall be utilized to comply with the International Mechanical Code.

The existing corridors do not currently have any means of ventilation. The 2015 International Mechanical Code requires corridors to be ventilated at rate of 0.06 cfm per square foot of floor area. It is recommended to add ventilation to the corridors under the next phase of design to comply with this code requirement.

It has been reported that there are issues with the natural gas system serving the units on the roof. Mainly, several units at times will lockout via internal safeties which require a manual reset. There has been several attempts to try and correct this by the equipment manufacturer and several service companies. The initial issues with regulator vents and regulator spring adjustments have improved the situation but have not completely solved the issue. This is further compounded by the fact that the trips are not solely contingent on load or weather conditions as units have tripped with minimal heating demand.

The gas company supplies high pressure gas to building. Gas pressure is regulated down to 2 psi after the gas meter to feed two main loads. One set of regulators feeds the boilers and kitchen. The other has a single regulator that serves the rooftop equipment and science classrooms. We first thought the piping was potentially undersized. After review of the existing

gas loads with respect to the piping that was ruled out. The gas piping appears to be sized adequately based on the current loads served. At the time of this report there was no conclusive evidence as to the cause of the problem other than a few recommendations identified under each respective unit recommendations.

**1970 Wing**

First Floor:

Noted mold above the ceiling in the kitchen area above the walk in coolers. It appears to be from condensation caused by the refrigeration piping. This should be remediated, and the insulation and surfaces should be replaced.

The kitchen make-up air louver should be cleaned. The unit was addressed but the louver is partially plugged with debris.

Old EF-22 serves the maintenance shop. This fan was left as part of the 2007 renovation but no longer used. The make-up duct that served the fan has been removed. The fan is located above the kitchen coolers and exhausts through a sidewall louver above the kitchen make up air louver. Separation of exhaust and make up air does not comply with the mechanical code for minimal separation distance. This is not an issue if the systems do not operate simultaneously.

Reheat coils exist that serve the spaces controlled by the Mitsubishi City Multi VRF system which are on the DDC system. The ductwork that these are installed in does not connect to any system as the unit was removed in the 2007 renovation.

Second Floor:

Classroom 228 has the active ducted exhaust pushed above the ceiling and the ceiling tile is set below. This is part of the ventilation system and should be in the classroom, not above the ceiling. Note this classroom is not air conditioned and this condition should be corrected under the proposed scope.

Third Floor:

Classroom 307 has an open-ended exhaust duct above the ceiling with no grille in the classroom. As with classroom 335 it is part of the ventilation system and would be corrected under option 1.

Classroom 309, 310, 312 and 315 have abandoned exhaust ducts or a capped roof curb duct above the ceiling wrapped in plastic. The capped duct is part of the ventilation serving 312 and needs to be active as there are no exhaust grilles for ventilation in the ceiling. Classroom 309, 310 and 315 is served by AHU-2 so this is not an issue other than capping the ducts. These ducts are to be removed or properly capped. Room 312 would be addressed under one of the air conditioning options.

The small boy's bathroom plan west of the TV Studio has the exhaust duct located above the ceiling with no exhaust in the toilet. Exhaust shall be added if the bathroom is to remain in use.

Bathrooms plan east and south of the TV Studio appear to be abandoned. The associated exhaust system was not active. No further action is recommended at this time but when they are renovated, the ventilation system should be upgraded.

Electrical room plan west of 312 has a transfer duct for make-up air. The corridor side has the grill removed and has an open-ended duct above ceiling. The duct needs to be extended to the ceiling as the space above a corridor ceiling cannot be used as a plenum.

Duct mounted reheat coils on the plan west side of the auditorium are dirty and should be cleaned. These coils are served by AHU-13. All the coils on this system should be inspected and

cleaned as well. Access doors should be added for proper service and cleaning where access is not available.

Nurses' area finned tube radiation has pneumatic control valves. It is not clear if they function, but the valves should be replaced with electronic valves connected to the BMS.

**1975 Wing:**

General:

The spaces served by AHX-1 used to be plenum return according to the 2007 renovation drawings. At some point a ducted return was implemented but many of the spaces still have the open return to the ceiling plenum above. Within this plenum is uninsulated supply duct. When there was a plenum ceiling this was acceptable as the temperature differentials allowed for this condition. Since the ceiling cavity is no longer a plenum this supply ductwork should be insulated.

Also noted in some of these areas is the presence of PVC roof drain piping which would not have been allowed within a plenum space. As long as the ceiling cavities are not being used as plenums this is no longer an issue. The PVC piping appears to have replaced the original cast iron as a repair.

First Floor:

Many on the cabinet unit heaters at the entrances are original and damaged. It is recommended that the operation be confirmed, and units repaired or replaced as needed. Units are controlled from local return air or wall thermostats.

Room 105 VAV box has a poor inlet connection. Flexible ductwork is utilized throughout the AHX-1 system. Although flex duct is not an issue, the reliability of VAV operation is contingent upon maintaining 3 diameters of straight duct length at the inlet. This should be corrected.

There is excessive supply air duct leakage in the first-floor main corridor and a duct restriction in the AHX-1 supply main outside of classroom 102. The main duct is an acoustically lined 26x14 and there is a reduction in the duct to 24x10 for no apparent reason. This reduction acts as a restriction and should be corrected. Accessible ductwork should be sealed. Unlined ductwork should be insulated.

Health Classroom 105 has the ducted return pushed above the ceiling and ceiling tile set below. this is part of the ventilation system and should be in the classroom ceiling not above it. Please note, this classroom is not air conditioned and this grille should be corrected under the proposed scope.

Classroom 102 has an open louver above the ceiling. The louver feeds a unit ventilator on the floor above. Open portions of louver shall be blanked off with insulated sheet metal panels. This classroom also has no exhaust to remove ventilation air brought in by the unit ventilator. However, a grille exists above the ceiling. This should be addressed under the proposed scope.

Classroom 101 has a grille in the ceiling with plastic laid on top, most likely to prevent down drafts. An exhaust source for ventilation air removal introduced by the unit ventilator could not be found. This should be addressed under the proposed scope.

The ROTC room has several concerns. First, EF-10 needs service as it has no fan belt. The fan is controlled by the BMS. Second, this room has historically experienced cold complaints. The exhaust louver is not completely covered with a sheet metal plenum and is open above the ceiling. There was a piece of insulation stuck to it at one point, which has fallen off. A more permanent insulated enclosure is needed. Third, the radiation located on the plan northeast side is completely blocked by cabinets which is reducing the effectiveness of convection and capacity.

Lastly, there are abandoned exhaust systems which may be retained for future ventilation air and exhaust.

Second Floor:

Offices plan west of room 226 on the exterior are controlled by a common VAV box that also serves interior classroom 226. The control is located in classroom 226. There is no apparent heating for the exterior room and no complaints have been noted but it is not typical to have exterior and interior rooms on the same zone. If there are no temperature complaints, then no further action required at this time.

Room 224 has a portion of the space served by a VAV box off AHX-1 with the remainder only heated and ventilated with a unit ventilator and finned tube radiation. Both systems operate together and a cooling setpoint cannot be maintained. This VAV box used to be in an enclosed work room which was demolished as apparent by the unfinished radiation cover where the old wall was. This area should be addressed under Option 1 or Option 2.

Third Floor:

Classroom 304 has the active ducted exhaust pushed above the ceiling and ceiling tile set below. This is part of the ventilation system and should be in the classroom ceiling, not above it. This condition should be corrected under the proposed scope.

Noted finned tube radiation was installed above the ceiling of classroom 337. Functionality could not be determined, but it was most likely added to curb roof loss. Typically, this is not required with an insulated roof above. This needs to be further evaluated as it is reported by SNE that it is not under BMS control.

Classrooms 324 through 333 have abandoned roof mounted relief penthouses with the old pneumatic dampers closed. These were most likely part of the original relief air strategy with the unit ventilators as there is no exhaust in these rooms. Most of these room still have the relief grille in the ceiling but some have been removed. One item to note is the 2006 drawings indicate fire dampers at all of these grilles as existing to remain. We did not notice these in the field and the ceiling is not clipped or appear to be a fire rated ceiling.

**2007 Wing:**

Second Floor:

Repair AHU-8 supply air duct insulation that has fallen off the corridor.

There are numerous eggcrate type grilles in the ceiling of the instrument storage which is part of the corridor serving the band and music areas. These grilles were not part of the original design and it is not clear why they were added. They communicate the corridor with the ceiling cavity above. Open grilles to the ceiling cavity are not allowed in a school's egress corridor. If ventilation is the concern, then a ducted solution is necessary.

# VIII. BUILDING MANAGEMENT SYSTEM EVALUATION

A central Building Management System (BMS) controls and monitors all major pieces of HVAC equipment in the building. The BMS is a direct digital control (DDC) system which has been modified throughout the building's life as necessary and is connected to the Town wide controls server located at the Town Hall. The BMS is manufactured by Schneider Electric with SNE Building Systems as the sole source vendor. Controllers are vintage but parts and components are still available. Controllers shall be updated as renovated work is performed. The system currently utilizes a LonWorks communication protocol. A BACnet communications protocol is currently being implemented as renovations and equipment replacements are being completed. Within the last few years, air handling unit factory controllers were removed and replaced with Schneider Electric controllers to improve controllability.

The BMS also controls perimeter radiation control valves, unit ventilators, VAV boxes, reheat coil control valves, the VRF system, and exhaust fans EF-1, 7, 8, 9, and 10. Exhaust fans on BMS control were part of the 2007 renovation.

As part of the BMS investigation the following discoveries were made:

1. The local building controls system server is located in the first floor IT room.
2. At the time of survey, AHU-10 was in a fan failure alarm. The BMS was not receiving a fan status which then leads to no control of the heating, cooling, and dampers.
3. Unit AHX-1 and all other AHU's appear to utilizes a dry bulb economizer set at 54°F in lieu of an enthalpy economizer. With replacement units an enthalpy-based economizer should be employed.
4. The VRF system serves the AV room and associated offices and operates as a heat pump without simultaneous heating and cooling. The AV room contains radiation which is not under control of the BMS.
5. Three abandoned reheat coils that served the offices and AV room now conditioned by the VRF system are on the BMS. A coil leaving temperature sensor noted approximately 80°F in the duct with the valve fully closed, further confirming no airflow through this abandoned system. These should be valved off. These spaces do not have any outside air for ventilation.
6. Rooftop units are programmed with a linear outdoor temperature reset schedule.
7. ERU-1 is programmed to recirculate air when space humidity rises above 60%. These Science rooms should never recirculate air when in occupied mode.
8. The ERU-1 and ERU-2 economizer outside air temperature values are noted to enable when above 60° and below 45°F. This sequence is backwards, and the economizer programming should be confirmed as this may be a graphical error. Stoppage of wheel in economizer mode should be confirmed.
9. ERU-1 and 2 do not have any upstream or downstream temperature readings. It is recommended these be installed for monitoring of unit conditions.
10. AHU-11 is not in service but is mislabeled as AHU-13 on the graphics.
11. VAV boxes with reheat coils do not have leaving air temperature readings. This is not required but these readings are useful for troubleshooting and operations.
12. Reheat coil 13-2 appears to have a failed leaving air temperature sensor as the hot water valve is open but is reading nearly the same temperature as AHU-13 leaving air.
13. AHU-5 is operating at 100% fan speed. The static pressure setpoint is set to 2" but the unit is only maintaining 1.09" of static. See section on AHU-5 for additional comments.
14. The radiation in the health suite does not have BMS control.
15. The radiation in room 106 does not have BMS control.
16. Cabinet unit heaters, suspended unit heaters, and convectors do not have BMS control. Control operation should be confirmed.
17. AHU-7 is retrofitted with variable frequency drives but the unit operates in a constant volume fashion.
18. The BMS provides a hot water header temperature setpoint to the boilers. The boilers autorotate, cascade, and modulate using packaged controls to satisfy the header temperature setpoint.

# IX. ELECTRICAL

The Bethel High School electric service originates from a Eversource overhead utility distribution system on Whittlesey Drive to a pad mounted 1000kVA utility transformer in the east parking lot. The service conductors enter the east side of the building and terminate into a 2500 Amp, 277/480 Volt 3 phase, 4 wire service disconnect CT combination unit, located in Switch Gear D006 on the Lower Level. The service is metered at the service disconnect CT combination unit via Eversource Meter#08103588.

The building main distribution switchboard, located in Switch Gear D006, is a 2500 amp, 277/480 volt 3 phase, 4 wire switchboard. The switchboards contain (9) positions with bolt on circuit breakers energizing an existing distribution switchboard, motor starters, IT loads, receptacle/lighting panelboards and elevator. The existing switchboard, located in Switch Gear D006, is a 1200 amp, 277/480 volt 4 phase, 4 wire switchboard. The existing switchboard contains (13) positions with bolt on circuit breakers energizing several lighting/ receptacle panelboards, PDU, Liebert units, mechanical panelboards and kitchen panelboard. Additionally, the main distribution switchboard contains an in-line standby automatic transfer switch, used to energize the entire facility, that connects to an exterior pad mounted standby generator in the east parking lot. The electrical distribution from the Switch Gear D006 room to other mechanical and electrical rooms throughout the building is in 480-volt three phase. Once the feeders reach the remote electrical and mechanical rooms, a local step-down transformer is provided for 120/208-volt 3 phase, 4 wire distribution.

In preparation for the mechanical air handling unit replacement options, the following electrical revisions shall be provided:

1. Electrical contractor shall meter existing panelboard “PP-7” located on Storage Room D239 on third floor. The metering information shall identify the electrical load for the existing stage lighting panelboard energized by panelboard “PP-7”. The metering of “PP-7” shall be performed while the auditorium is being used. Once the load is identified, electrical contractor shall disconnect and remove existing panelboard “PP-7” located in Storage Room D239. Provide one two section 600 amp, 480/277 volt, three phase, 4 wire, 84 pole surface panelboard in existing panelboard “PP-7” location. The new panelboard shall energize air handling unit replacement options and the existing stage lighting panelboard.
2. Electrical contractor shall meter existing “MOTOR CONTROL 4” located in Storage Room D239 on the third floor. The metering information shall identify the electrical load for existing studio lighting panelboard and studio audio panelboard energized by panelboard “MOTOR CONTROL 4”. The metering of “MOTOR CONTROL 4” shall be performed while the auditorium is being used. Once the load is identified, electrical contractor shall disconnect and remove existing “MOTOR CONTROL 4” located in Storage Room D239. Provide (1) two section 225 amp, 84 pole, 480/277 volt, three phase, 4 wire surface panelboard in existing “MOTOR CONTROL 4” location. The new panelboard shall energize air handling unit replacement options and the existing auditorium panelboards.
3. Electrical contractor shall disconnect and remove existing “MOTOR CONTROL 3” located in Storage Room D203. Provide (1) 100 amp, 42 pole, 480/277 volt, three phase, 4 wire surface panelboard in existing “MOTOR CONTROL 3” location. The new panelboard shall energize air handling unit replacement options.
4. Electrical contractor shall meter existing panelboard “MP2C” located in Storage Room C203 on the third floor. The metering information shall identify the existing mechanical equipment load for the panelboard. The metering of “MP2C” shall be performed while the building is occupied and mechanical units are being used. Once the load is identified and mechanical options outside of option one priority one are selected, electrical contractor shall provide one (1) two section 1000amp, 480/277 volt, three phase, 4 wire, 84 pole panelboard in existing panelboard “MP2C” location. Additionally, electrical contractor shall provide one (1) 1000A 3 pole circuit breaker in switchboard “MSB-1”, located in Switch Gear room D006, re-use existing conduit/wire (with new 2/0 ground wire) previously utilized by existing panelboard “MP2C” and provide 4 # 600kcmil + #2/0G in 4” conduit from Switch Gear room D006 to

Storage Room C203. The new panelboard shall energize air handling unit replacement options and the existing stage lighting panelboard.

**Electrical Revisions for Air Handling Units**

AHX-1

In support of replacing AHX-1, the electrical contractor shall disconnect and remove associated branch circuit conduit and wire back to existing panelboard. The AHX-1 equipment located on the roof shall be energized by panelboard “PP-7” while the local VRF equipment is energized by panelboard “RP-7” on second floor and panelboard “RP-E” on first floor. The new equipment located within AHX-1 penthouse shall be energized by existing to remain panelboard “PP-2P” located within the penthouse.

AHU-2

In support of replacing AHU-2, the electrical contractor shall disconnect and remove associated branch circuit conduit and wire back to existing panelboard “MP2C”. The rooftop equipment for both options shall be energized by new panelboard “MP2C” while the local VRF equipment in option 1 is energized by panelboard RP-8 on third floor and panelboard “RP-7” on first floor.

AHU- 3A and AHU-3B

In support of replacing AHU-3A and AHU-3B, the electrical contractor shall disconnect and extend existing branch circuit conduit and wire from existing AHU-3A and AHU-3B to new AHU-3A and AHU-3B. The rooftop equipment shall be energized by new panelboard “MP2C”.

AHU-4

In support of replacing AHU-4, the electrical contractor shall disconnect and remove associated branch circuit conduit and wire back to existing panelboard “MP2C”. The new rooftop equipment shall be energized by new panelboard “MP2C”.

AHU-5, AHU-7, AHU-8, AHU-10, AHU-11, ERU-1, ERU-2 and Building Exhaust Fans

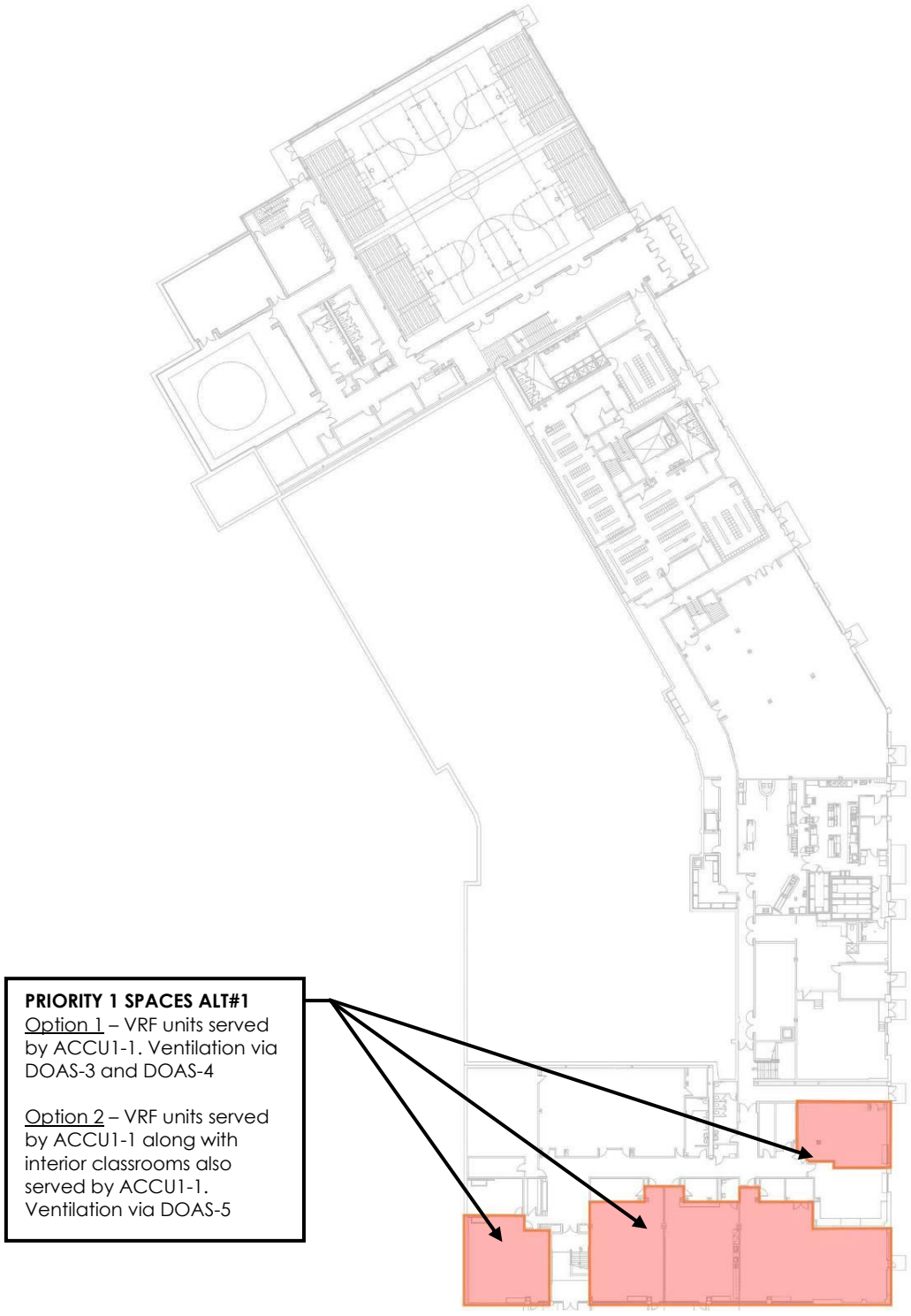
All equipment identified in this section shall be replaced in kind. The electrical contractor shall disconnect and extend existing branch circuiting energizing equipment to new location.

AHU-6

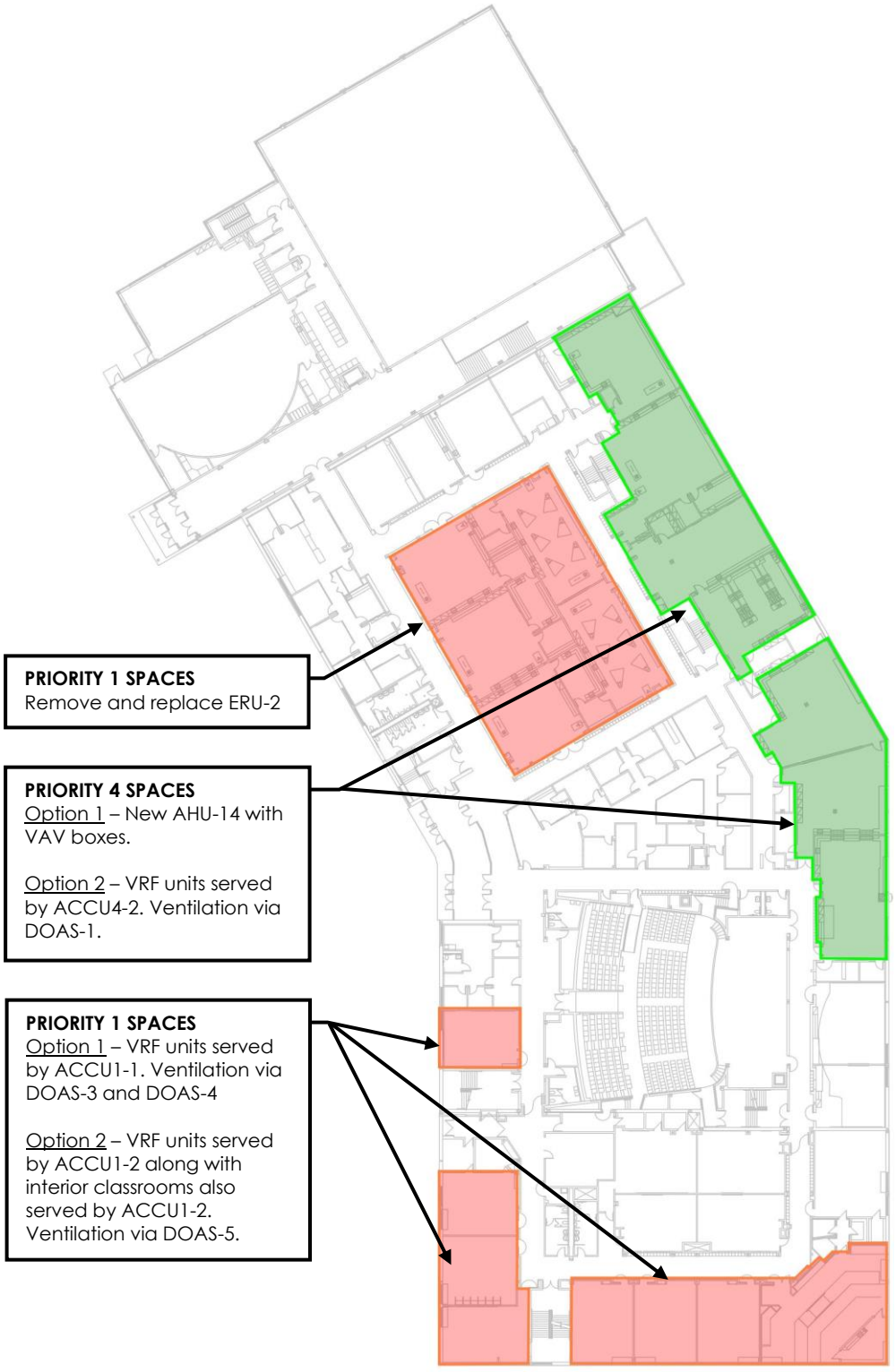
In support of replacing AHU-6, the electrical contractor shall disconnect and remove associated branch circuit conduit and wire back to existing panelboard “MP2C”. The new rooftop equipment shall be energized by new panelboard “MP2C”.

## X. PRIORITY PHASING

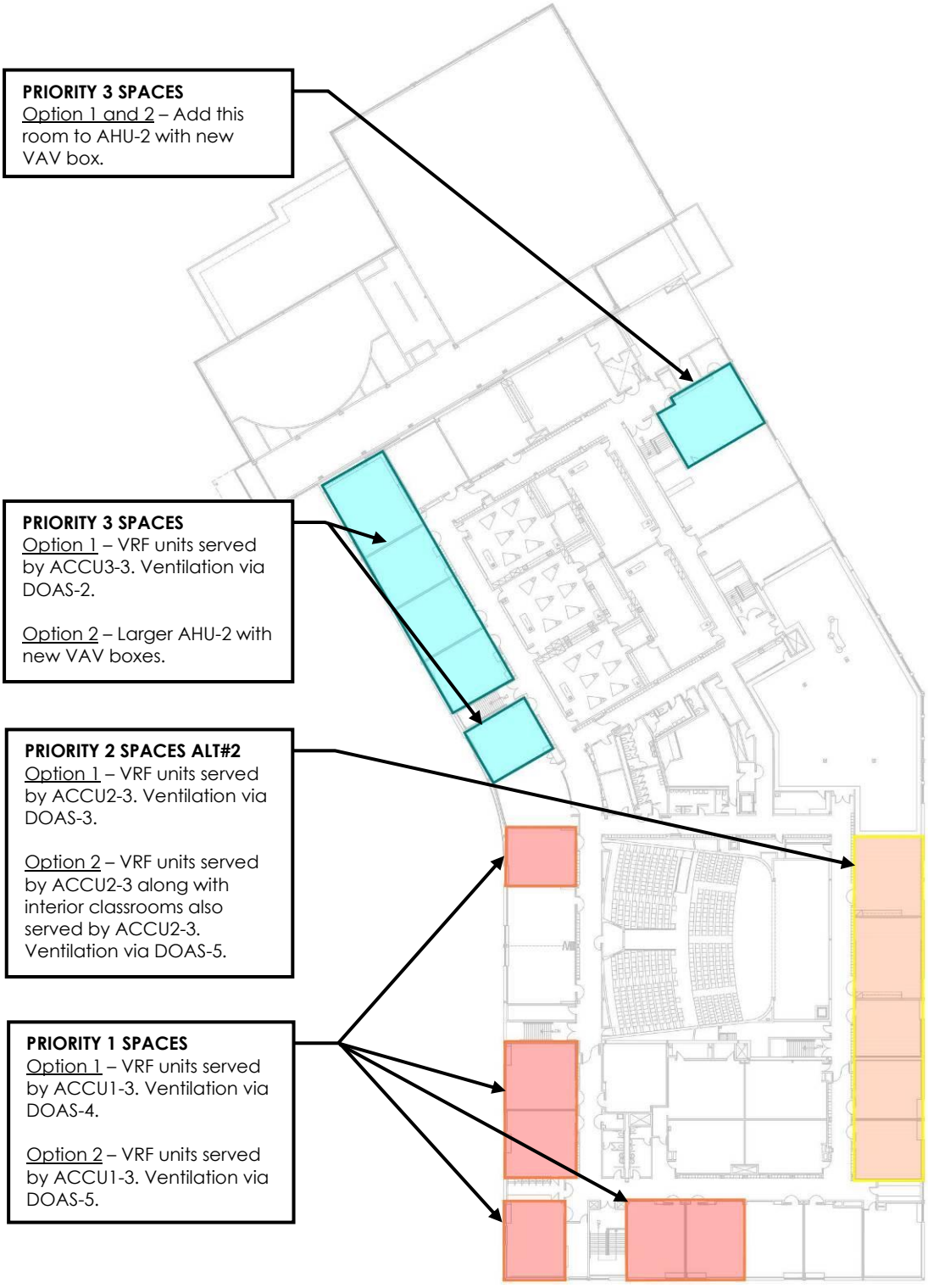
Regardless of design option, the school would like to prioritize replacement of ERU-2 and add cooling to required classrooms under priority one prior to other mechanical work. Construction shall be limited to timeframes outside the normal school schedule. Therefore, a phased approach to demolition and construction must be taken into consideration in order to minimize building downtime and to remain within annual budgetary parameters. Refer to diagrams below for order of space priority




*First Floor Priority Cooling*




*Second Floor Priority Cooling*




*Third Floor Priority Cooling*

# XI. APPENDIX A – HEATING AND COOLING LOADS

The calculations below were performed by Kohler Ronan which serve as a basis for verifying the heating and cooling capacities of the plants as well as sizing of both system options. The calculations are based on the following assumptions:

- Original building plans.
- Inspection of the existing glazing
- Credit for window blinds are included in order to reduce heat gains from the envelope.
- Neutral building construction with average infiltration is included.
- Lighting loads are based on florescent light fixtures typical for school building of this vintage.
- Quantity of people is based on approximate seat counts with diversity assumed.
- Ventilation air is based on ASHRAE recommendations for schools.

# System Checksums

By Kohler Ronan

**AHX-1 Option 1** — **VAV w/Baseboard Skin Heating**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 88 / 73 / 98

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 26,073 | 26,073 | 5 |
| Glass Solar | 9,106 | 0 | 9,106 | 2 |
| Glass/Door Cond | 909 | 0 | 909 | 0 |
| Wall Cond | 2,349 | 1,021 | 3,370 | 1 |
| Partition/Door | -421 | | -421 | 0 |
| Floor | -233 | | -233 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 299 | | 299 | 0 |
| *Sub Total ==>* | 12,009 | 27,094 | 39,103 | 7 |
| **Internal Loads** | | | | |
| Lights | 42,430 | 10,608 | 53,038 | 10 |
| People | 177,700 | 0 | 177,700 | 33 |
| Misc | 40,137 | 0 | 40,137 | 8 |
| *Sub Total ==>* | 260,267 | 10,608 | 270,875 | 51 |
| **Ceiling Load** | 3,594 | -3,594 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 229,054 | 43 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -5,606 | -5,606 | -1 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -23,702 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 275,871 | 4,799 | 533,426 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 17
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 10,566 | 5 |
| Glass/Door Cond | 775 | 0 |
| Wall Cond | 2,854 | 1 |
| Partition/Door | -421 | 0 |
| Floor | -233.13 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 116 | 0 |
| *Sub Total ==>* | 13,658 | 7 |
| **Internal Loads** | | |
| Lights | 42,430 | 21 |
| People | 103,460 | 51 |
| Misc | 40,137 | 20 |
| *Sub Total ==>* | 186,027 | 91 |
| **Ceiling Load** | 4,092 | 2 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 203,777 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -20,285 | 7.39 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -3,877 | -3,877 | 1.41 |
| Wall Cond | -2,957 | -4,257 | 1.55 |
| Partition/Door | -18,285 | -18,285 | 6.66 |
| Floor | -10,128 | -10,128 | 3.69 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -526 | -526 | 0.19 |
| *Sub Total ==>* | -35,773 | -57,358 | 20.89 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -12,217 | 0 | 0.00 |
| **Ventilation Load** | 0 | -226,552 | 82.52 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 9,368 | -3.41 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -47,990 | -274,542 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.0 | 0.0 |
| **Ra Plenum** | 72.9 | 0.0 |
| **Return** | 72.9 | 0.0 |
| **Ret/OA** | 81.0 | 0.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 10,753 | 3,226 |
| **Terminal** | 10,753 | 3,226 |
| **Main Fan** | 10,753 | 3,226 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 5,734 | 3,226 |
| **AHU Vent** | 5,734 | 3,226 |
| **Infil** | 7 | 7 |
| **MinStop/Rh** | 3,226 | 3,226 |
| **Return** | 10,761 | 3,233 |
| **Exhaust** | 5,741 | 0 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 53.3 | 100.0 |
| **cfm/ft²** | 0.83 | 0.25 |
| **cfm/ton** | 241.90 | |
| **ft²/ton** | 291.32 | |
| **Btu/hr·ft²** | 41.19 | -27.43 |
| **No. People** | 418 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 44.5 | 533.4 | 332.2 | 10,631 | 81.0 | 68.3 | 83.5 | 53.0 | 52.2 | 56.8 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 44.5 | 533.4 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 12,950 | | |
| **Part** | 1,381 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 3,800 | | |
| **Roof** | 3,800 | 0 | 0 |
| **Wall** | 877 | 125 | 14 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Aux Htg** | -48.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -294.0 | 5,734 | 7.0 | 53.0 |
| **Reheat** | -61.1 | 3,226 | 53.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -403.2 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 09:19 AM on 06/02/2022
Alternative - 2 System Checksums Report Page 13 of 17

# System Checksums

By Kohler Ronan

**AHU-2 Option 1** — **Variable Volume Reheat (30% Min Flow Default)**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 20,490 | 20,490 | 8 |
| Glass Solar | 0 | 0 | 0 | 0 |
| Glass/Door Cond | 0 | 0 | 0 | 0 |
| Wall Cond | 1,652 | 426 | 2,079 | 1 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | | 0 | 0 |
| *Sub Total ==>* | 1,652 | 20,916 | 22,568 | 9 |
| **Internal Loads** | | | | |
| Lights | 20,082 | 5,020 | 25,102 | 9 |
| People | 74,850 | 0 | 74,850 | 28 |
| Misc | 10,751 | 0 | 10,751 | 4 |
| *Sub Total ==>* | 105,683 | 5,020 | 110,703 | 42 |
| **Ceiling Load** | 4,518 | -4,518 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 137,970 | 52 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -11,098 | -11,098 | -4 |
| **Sup. Fan Heat** | | | 2,647 | 1 |
| **Ret. Fan Heat** | | 2,647 | 2,647 | 1 |
| **Duct Heat Pkup** | | -9,900 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 111,853 | 3,067 | 265,437 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 18
OADB: 83

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 0 | 0 |
| Glass/Door Cond | 0 | 0 |
| Wall Cond | 2,670 | 3 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 0 | 0 |
| *Sub Total ==>* | 2,670 | 3 |
| **Internal Loads** | | |
| Lights | 20,082 | 24 |
| People | 44,500 | 53 |
| Misc | 10,751 | 13 |
| *Sub Total ==>* | 75,333 | 90 |
| **Ceiling Load** | 5,569 | 7 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 83,571 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -21,248 | 8.71 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | 0 | 0 | 0.00 |
| Wall Cond | -4,322 | -5,469 | 2.24 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | 0 | 0.00 |
| *Sub Total ==>* | -4,322 | -26,717 | 10.95 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -8,640 | 0 | 0.00 |
| **Ventilation Load** | 0 | -194,784 | 79.84 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 13,755 | -5.64 |
| **OA Preheat Diff.** | | -36,212 | 14.84 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -12,962 | -243,957 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.5 | 74.2 |
| **Ra Plenum** | 74.3 | 65.6 |
| **Return** | 74.9 | 65.6 |
| **Ret/OA** | 83.9 | 7.0 |
| **Fn MtrTD** | 0.1 | 0.0 |
| **Fn BldTD** | 0.1 | 0.0 |
| **Fn Frict** | 0.4 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 4,580 | 2,790 |
| **Terminal** | 4,580 | 2,790 |
| **Main Fan** | 4,580 | 2,790 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 3,500 | 2,790 |
| **AHU Vent** | 3,500 | 2,790 |
| **Infil** | 0 | 0 |
| **MinStop/Rh** | 2,790 | 2,790 |
| **Return** | 4,580 | 2,790 |
| **Exhaust** | 3,500 | 2,790 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 76.4 | 100.0 |
| **cfm/ft²** | 0.75 | 0.46 |
| **cfm/ton** | 207.04 | |
| **ft²/ton** | 277.08 | |
| **Btu/hr·ft²** | 43.31 | -39.80 |
| **No. People** | 185 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 22.1 | 265.4 | 152.9 | 4,466 | 83.9 | 71.2 | 95.5 | 53.0 | 52.9 | 59.9 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 22.1 | 265.4 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 6,129 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 3,629 | 0 | 0 |
| **Wall** | 980 | 0 | 0 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -65.5 | 2,790 | 53.0 | 74.2 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -178.4 | 3,500 | 7.0 | 53.0 |
| **Reheat** | -52.6 | 2,790 | 53.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -244.0 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-2 Option 2** — **VAV w/Baseboard Heating**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 16
Outside Air: OADB/WB/HR: 87 / 73 / 97

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 68,455 | 68,455 | 14 |
| Glass Solar | 24,087 | 0 | 24,087 | 5 |
| Glass/Door Cond | 2,449 | 0 | 2,449 | 1 |
| Wall Cond | 7,602 | 2,378 | 9,980 | 2 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 840 | | 840 | 0 |
| *Sub Total ==>* | 34,979 | 70,834 | 105,813 | 22 |
| **Internal Loads** | | | | |
| Lights | 41,611 | 10,403 | 52,014 | 11 |
| People | 142,800 | 0 | 142,800 | 29 |
| Misc | 12,799 | 0 | 12,799 | 3 |
| *Sub Total ==>* | 197,210 | 10,403 | 207,613 | 43 |
| **Ceiling Load** | 15,325 | -15,325 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 184,824 | 38 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -22,521 | -22,521 | -5 |
| **Sup. Fan Heat** | | | 6,020 | 1 |
| **Ret. Fan Heat** | | 6,032 | 6,032 | 1 |
| **Duct Heat Pkup** | | -22,648 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 247,514 | 26,775 | 487,781 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 17
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 23,786 | 13 |
| Glass/Door Cond | 2,181 | 1 |
| Wall Cond | 8,391 | 4 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 326 | 0 |
| *Sub Total ==>* | 34,684 | 19 |
| **Internal Loads** | | |
| Lights | 41,611 | 22 |
| People | 82,250 | 44 |
| Misc | 12,799 | 7 |
| *Sub Total ==>* | 136,660 | 73 |
| **Ceiling Load** | 15,754 | 8 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 187,098 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -56,157 | 16.03 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -10,905 | -10,905 | 3.11 |
| Wall Cond | -10,314 | -13,385 | 3.82 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -1,480 | -1,480 | 0.42 |
| *Sub Total ==>* | -22,698 | -81,926 | 23.39 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -31,967 | 0 | 0.00 |
| **Ventilation Load** | 0 | -214,724 | 61.31 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 27,262 | -7.78 |
| **OA Preheat Diff.** | | -80,838 | 23.08 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -54,664 | -350,227 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.5 | 70.0 |
| **Ra Plenum** | 75.8 | 62.1 |
| **Return** | 76.3 | 62.1 |
| **Ret/OA** | 81.4 | 7.0 |
| **Fn MtrTD** | 0.1 | 0.0 |
| **Fn BldTD** | 0.1 | 0.0 |
| **Fn Frict** | 0.4 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 10,192 | 3,058 |
| **Terminal** | 10,192 | 3,058 |
| **Main Fan** | 10,192 | 3,058 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 4,634 | 3,058 |
| **AHU Vent** | 4,634 | 3,058 |
| **Infil** | 21 | 21 |
| **MinStop/Rh** | 3,058 | 3,058 |
| **Return** | 10,213 | 3,079 |
| **Exhaust** | 4,655 | 3,079 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 45.5 | 100.0 |
| **cfm/ft²** | 0.80 | 0.24 |
| **cfm/ton** | 250.73 | |
| **ft²/ton** | 312.44 | |
| **Btu/hr·ft²** | 38.41 | -27.58 |
| **No. People** | 336 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB/WB/HR °F | Enter DB/WB/HR °F | Enter DB/WB/HR gr/lb | Leave DB/WB/HR °F | Leave DB/WB/HR °F | Leave DB/WB/HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 40.7 | 487.8 | 321.5 | 10,158 | 81.4 | 67.7 | 79.7 | 53.0 | 52.1 | 56.6 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 40.7 | 487.8 | | | | | | | | |

## AREAS

| | Gross Total ft² | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 12,700 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 10,200 | 0 | 0 |
| **Wall** | 2,790 | 351 | 13 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -112.6 | 0 | 0.0 | 0.0 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -237.6 | 4,634 | 7.0 | 53.0 |
| **Reheat** | -57.9 | 3,058 | 53.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -350.2 | | | |

Project Name:
Dataset Name: BHS.TRC

# System Checksums

By Kohler Ronan

**AHU-3A** — **Single Zone**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 0 | 0 | 0 |
| Glass Solar | 0 | 0 | 0 | 0 |
| Glass/Door Cond | 0 | 0 | 0 | 0 |
| Wall Cond | 0 | 0 | 0 | 0 |
| Partition/Door | -520 | | -520 | 0 |
| Floor | -941 | | -941 | -1 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | | 0 | 0 |
| *Sub Total ==>* | -1,461 | 0 | -1,461 | -1 |
| **Internal Loads** | | | | |
| Lights | 10,485 | 2,621 | 13,106 | 8 |
| People | 0 | 0 | 0 | 0 |
| Misc | 0 | 0 | 0 | 0 |
| *Sub Total ==>* | 10,485 | 2,621 | 13,106 | 8 |
| **Ceiling Load** | -1,162 | 1,162 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 91,968 | 55 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 60,853 | | 60,853 | 36 |
| **Exhaust Heat** | | 2,541 | 2,541 | 2 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -8,866 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 68,714 | -2,541 | 167,007 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 0 | 0 |
| Glass/Door Cond | 0 | 0 |
| Wall Cond | 0 | 0 |
| Partition/Door | -520 | -1 |
| Floor | -941.11 | -1 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 0 | 0 |
| *Sub Total ==>* | -1,461 | -2 |
| **Internal Loads** | | |
| Lights | 10,485 | 15 |
| People | 0 | 0 |
| Misc | 0 | 0 |
| *Sub Total ==>* | 10,485 | 15 |
| **Ceiling Load** | -1,162 | -2 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 60,853 | 89 |
| ***Grand Total ==>*** | 68,714 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | 0 | 0.00 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | 0 | 0 | 0.00 |
| Wall Cond | 0 | 0 | 0.00 |
| Partition/Door | -3,946 | -3,946 | 2.62 |
| Floor | -7,142 | -7,142 | 4.74 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | 0 | 0.00 |
| *Sub Total ==>* | -11,089 | -11,089 | 7.36 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | 0 | 0 | 0.00 |
| **Ventilation Load** | 0 | -139,645 | 92.64 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -11,089 | -150,734 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 56.5 | 72.5 |
| **Ra Plenum** | 70.9 | 70.0 |
| **Return** | 70.9 | 70.0 |
| **Ret/OA** | 78.6 | 38.5 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 4,000 | 4,000 |
| **Terminal** | 4,000 | 4,000 |
| **Main Fan** | 4,000 | 4,000 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 2,000 | 2,000 |
| **AHU Vent** | 2,000 | 2,000 |
| **Infil** | 0 | 0 |
| **MinStop/Rh** | 0 | 0 |
| **Return** | 4,000 | 4,000 |
| **Exhaust** | 2,000 | 2,000 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 50.0 | 50.0 |
| **cfm/ft²** | 1.25 | 1.25 |
| **cfm/ton** | 287.41 | |
| **ft²/ton** | 229.93 | |
| **Btu/hr·ft²** | 52.19 | -47.10 |
| **No. People** | 35 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB/WB/HR °F | Enter DB/WB/HR °F | Enter DB/WB/HR gr/lb | Leave DB/WB/HR °F | Leave DB/WB/HR °F | Leave DB/WB/HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 13.9 | 167.0 | 106.9 | 4,000 | 78.6 | 67.0 | 81.2 | 54.5 | 53.5 | 60.0 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 13.9 | 167.0 | | | | | | | | |

## AREAS

| | Gross Total ft² | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 3,200 | | |
| **Part** | 270 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 2,432 | | |
| **Roof** | 0 | 0 | 0 |
| **Wall** | 0 | 0 | 0 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -150.7 | 4,000 | 38.5 | 72.5 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -70.9 | 4,000 | 38.5 | 54.5 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -150.7 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-3B** — **Single Zone**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 0 | 0 | 0 |
| Glass Solar | 0 | 0 | 0 | 0 |
| Glass/Door Cond | 0 | 0 | 0 | 0 |
| Wall Cond | 0 | 0 | 0 | 0 |
| Partition/Door | -1,498 | | -1,498 | -1 |
| Floor | -709 | | -709 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | | 0 | 0 |
| *Sub Total* ==> | -2,207 | 0 | -2,207 | -1 |
| **Internal Loads** | | | | |
| Lights | 9,829 | 2,457 | 12,287 | 7 |
| People | 0 | 0 | 0 | 0 |
| Misc | 0 | 0 | 0 | 0 |
| *Sub Total* ==> | 9,829 | 2,457 | 12,287 | 7 |
| **Ceiling Load** | -1,132 | 1,132 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 91,782 | 55 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 62,223 | | 62,223 | 37 |
| **Exhaust Heat** | | 2,639 | 2,639 | 2 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -8,866 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 68,714 | -2,639 | 166,724 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 0 | 0 |
| Glass/Door Cond | 0 | 0 |
| Wall Cond | 0 | 0 |
| Partition/Door | -1,498 | -2 |
| Floor | -708.54 | -1 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 0 | 0 |
| *Sub Total* ==> | -2,207 | -3 |
| **Internal Loads** | | |
| Lights | 9,829 | 14 |
| People | 0 | 0 |
| Misc | 0 | 0 |
| *Sub Total* ==> | 9,829 | 14 |
| **Ceiling Load** | -1,132 | -2 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 62,223 | 91 |
| ***Grand Total* ==>** | 68,714 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | 0 | 0.00 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | 0 | 0 | 0.00 |
| Wall Cond | 0 | 0 | 0.00 |
| Partition/Door | -11,368 | -11,368 | 7.27 |
| Floor | -5,377 | -5,377 | 3.44 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | 0 | 0.00 |
| *Sub Total* ==> | -16,746 | -16,746 | 10.71 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | 0 | 0 | 0.00 |
| **Ventilation Load** | 0 | -139,645 | 89.29 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -16,746 | -156,391 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 56.5 | 73.8 |
| **Ra Plenum** | 70.8 | 70.0 |
| **Return** | 70.8 | 70.0 |
| **Ret/OA** | 78.6 | 38.5 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 4,000 | 4,000 |
| **Terminal** | 4,000 | 4,000 |
| **Main Fan** | 4,000 | 4,000 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 2,000 | 2,000 |
| **AHU Vent** | 2,000 | 2,000 |
| **Infil** | 0 | 0 |
| **MinStop/Rh** | 0 | 0 |
| **Return** | 4,000 | 4,000 |
| **Exhaust** | 2,000 | 2,000 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 50.0 | 50.0 |
| **cfm/ft²** | 1.33 | 1.33 |
| **cfm/ton** | 287.90 | |
| **ft²/ton** | 215.93 | |
| **Btu/hr·ft²** | 55.57 | -52.13 |
| **No. People** | 35 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 13.9 | 166.7 | 106.8 | 4,000 | 78.6 | 67.0 | 81.3 | 54.5 | 53.6 | 60.1 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 13.9 | 166.7 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 3,000 | | |
| **Part** | 779 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 1,831 | | |
| **Roof** | 0 | 0 | 0 |
| **Wall** | 0 | 0 | 0 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -156.4 | 4,000 | 38.5 | 73.8 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -70.9 | 4,000 | 38.5 | 54.5 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -156.4 | | | |

Project Name:
Dataset Name: BHS 2.TRC

TRACE® 700 v6.3.4 calculated at 05:58 PM on 06/06/2022
Alternative - 2 System Checksums Report Page 7 of 17

# System Checksums

By Kohler Ronan

**AHU-4** — **Single Zone Variable Air Volume**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 88 / 73 / 98

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 68,138 | 68,138 | 9 |
| Glass Solar | 11,375 | 0 | 11,375 | 1 |
| Glass/Door Cond | 3,492 | 0 | 3,492 | 0 |
| Wall Cond | 12,895 | 3,408 | 16,303 | 2 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | -1,678 | | -1,678 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 1,048 | | 1,048 | 0 |
| *Sub Total* ==> | 27,131 | 71,547 | 98,678 | 12 |
| **Internal Loads** | | | | |
| Lights | 34,321 | 8,580 | 42,901 | 5 |
| People | 412,500 | 0 | 412,500 | 52 |
| Misc | 1,365 | 0 | 1,365 | 0 |
| *Sub Total* ==> | 448,186 | 8,580 | 456,767 | 57 |
| **Ceiling Load** | 5,702 | -5,702 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 238,250 | 30 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -15,112 | -15,112 | -2 |
| **Sup. Fan Heat** | | | 10,626 | 1 |
| **Ret. Fan Heat** | | 10,642 | 10,642 | 1 |
| **Duct Heat Pkup** | | -39,977 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total*** ==> | 481,019 | 29,978 | 799,850 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 9
OADB: 73

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 36,142 | 10 |
| Glass/Door Cond | -409 | 0 |
| Wall Cond | 9,405 | 3 |
| Partition/Door | 0 | 0 |
| Floor | -1,677.89 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 6 | 0 |
| *Sub Total* ==> | 43,466 | 12 |
| **Internal Loads** | | |
| Lights | 34,321 | 10 |
| People | 281,250 | 79 |
| Misc | 1,365 | 0 |
| *Sub Total* ==> | 316,936 | 89 |
| **Ceiling Load** | -3,730 | -1 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total*** ==> | 356,673 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -58,707 | 12.14 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -16,107 | -16,107 | 3.33 |
| Wall Cond | -28,694 | -35,877 | 7.42 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | -27,919 | -27,919 | 5.77 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -1,853 | -1,853 | 0.38 |
| *Sub Total* ==> | -74,573 | -140,463 | 29.05 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -23,084 | 0 | 0.00 |
| **Ventilation Load** | 0 | -385,904 | 79.80 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 42,806 | -8.85 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total*** ==> | -97,657 | -483,561 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.5 | 85.9 |
| **Ra Plenum** | 74.7 | 63.1 |
| **Return** | 75.3 | 63.1 |
| **Ret/OA** | 79.5 | 7.0 |
| **Fn MtrTD** | 0.1 | 0.0 |
| **Fn BldTD** | 0.1 | 0.0 |
| **Fn Frict** | 0.4 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 18,317 | 5,495 |
| **Terminal** | 18,317 | 5,495 |
| **Main Fan** | 18,317 | 5,495 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 6,000 | 5,495 |
| **AHU Vent** | 6,000 | 5,495 |
| **Infil** | 26 | 26 |
| **MinStop/Rh** | 5,495 | 5,495 |
| **Return** | 18,343 | 5,521 |
| **Exhaust** | 6,026 | 5,521 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 32.8 | 100.0 |
| **cfm/ft²** | 1.75 | 0.52 |
| **cfm/ton** | 274.80 | |
| **ft²/ton** | 157.15 | |
| **Btu/hr·ft²** | 76.36 | -46.16 |
| **No. People** | 1,250 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter gr/lb | Leave DB °F | Leave WB °F | Leave gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 66.7 | 799.9 | 530.1 | 17,931 | 79.5 | 66.4 | 76.2 | 53.0 | 51.7 | 55.0 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 66.7 | 799.9 | | | | | | | | |

## AREAS

| | Gross Total ft² | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 10,475 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 10,475 | | |
| **Roof** | 10,475 | 0 | 0 |
| **Wall** | 6,925 | 440 | 6 |
| **Ext Door** | 196 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -483.6 | 5,495 | 7.0 | 85.9 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -483.6 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 09:19 AM on 06/02/2022
Alternative - 2 System Checksums Report Page 8 of 17

# System Checksums

By Kohler Ronan

**AHU-5**

**Variable Volume Reheat (30% Min Flow Default)**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 87 / 73 / 100

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 0 | 0 | 0 |
| Glass Solar | 11,887 | 0 | 11,887 | 4 |
| Glass/Door Cond | 847 | 0 | 847 | 0 |
| Wall Cond | 2,353 | 1,058 | 3,410 | 1 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 356 | | 356 | 0 |
| *Sub Total* ==> | 15,443 | 1,058 | 16,501 | 6 |
| **Internal Loads** | | | | |
| Lights | 26,539 | 6,635 | 33,174 | 12 |
| People | 22,500 | 0 | 22,500 | 8 |
| Misc | 15,017 | 0 | 15,017 | 5 |
| *Sub Total* ==> | 64,057 | 6,635 | 70,692 | 26 |
| **Ceiling Load** | 1,345 | -1,345 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 118,929 | 43 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 68,811 | | 68,811 | 25 |
| **Exhaust Heat** | | -1,456 | -1,456 | -1 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -8,201 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 149,655 | -3,310 | 273,476 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 9 / 16
OADB: 77

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 15,216 | 11 |
| Glass/Door Cond | 170 | 0 |
| Wall Cond | 2,864 | 2 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 37 | 0 |
| *Sub Total* ==> | 18,287 | 13 |
| **Internal Loads** | | |
| Lights | 26,539 | 19 |
| People | 12,500 | 9 |
| Misc | 15,017 | 11 |
| *Sub Total* ==> | 54,057 | 39 |
| **Ceiling Load** | 1,329 | 1 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 65,750 | 47 |
| **Exhaust Heat** | | |
| **Sup. Fan Heat** | | |
| **Ret. Fan Heat** | | |
| **Duct Heat Pkup** | | |
| **Underflr Sup Ht Pkup** | | |
| **Supply Air Leakage** | | |
| ***Grand Total* ==>** | 139,423 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | 0 | 0.00 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -3,883 | -3,883 | 1.44 |
| Wall Cond | -2,606 | -3,787 | 1.41 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -523 | -523 | 0.19 |
| *Sub Total* ==> | -7,012 | -8,192 | 3.05 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -281 | 0 | 0.00 |
| **Ventilation Load** | 0 | -174,556 | 64.95 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 304 | -0.11 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | -86,295 | 32.11 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -7,293 | -268,739 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.0 | 70.9 |
| **Ra Plenum** | 72.5 | 69.9 |
| **Return** | 72.5 | 69.9 |
| **Ret/OA** | 77.4 | 48.6 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 7,400 | 7,400 |
| **Terminal** | 7,400 | 7,400 |
| **Main Fan** | 7,400 | 7,400 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 2,500 | 2,500 |
| **AHU Vent** | 2,500 | 2,500 |
| **Infil** | 7 | 7 |
| **MinStop/Rh** | 2,220 | 7,400 |
| **Return** | 7,407 | 7,407 |
| **Exhaust** | 2,507 | 2,507 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 33.8 | 33.8 |
| **cfm/ft²** | 0.91 | 0.91 |
| **cfm/ton** | 324.71 | |
| **ft²/ton** | 355.42 | |
| **Btu/hr·ft²** | 33.76 | -33.18 |
| **No. People** | 50 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 22.8 | 273.5 | 185.9 | 7,400 | 77.4 | 64.5 | 71.0 | 54.0 | 52.1 | 55.3 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 22.8 | 273.5 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 8,100 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 0 | 0 | 0 |
| **Wall** | 793 | 125 | 16 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -138.5 | 7,400 | 54.0 | 70.9 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -130.2 | 2,500 | 7.0 | 54.0 |
| **Reheat** | -131.2 | 7,400 | 54.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -268.7 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-6** — **Rooftop Multizone**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 0 | 0 | 0 |
| Glass Solar | 0 | 0 | 0 | 0 |
| Glass/Door Cond | 0 | 0 | 0 | 0 |
| Wall Cond | 784 | 497 | 1,281 | 1 |
| Partition/Door | -2,470 | | -2,470 | -1 |
| Floor | -1,380 | | -1,380 | -1 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 12,691 | | 12,691 | 6 |
| *Sub Total* ==> | 9,626 | 497 | 10,123 | 5 |
| **Internal Loads** | | | | |
| Lights | 11,681 | 2,920 | 14,601 | 7 |
| People | 26,400 | 0 | 26,400 | 12 |
| Misc | 4,096 | 0 | 4,096 | 2 |
| *Sub Total* ==> | 42,176 | 2,920 | 45,096 | 21 |
| **Ceiling Load** | 703 | -703 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 137,358 | 63 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 26,573 | | 26,573 | 12 |
| **Exhaust Heat** | | -2,714 | -2,714 | -1 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | 0 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 79,078 | 0 | 216,436 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 16
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 0 | 0 |
| Glass/Door Cond | 0 | 0 |
| Wall Cond | 1,139 | 2 |
| Partition/Door | -2,470 | -4 |
| Floor | -1,379.55 | -2 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 5,454 | 9 |
| *Sub Total* ==> | 2,743 | 4 |
| **Internal Loads** | | |
| Lights | 11,681 | 18 |
| People | 18,000 | 28 |
| Misc | 4,096 | 6 |
| *Sub Total* ==> | 33,776 | 53 |
| **Ceiling Load** | 746 | 1 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 26,573 | 42 |
| ***Grand Total* ==>** | 63,838 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | 0 | 0.00 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | 0 | 0 | 0.00 |
| Wall Cond | -1,191 | -1,956 | 0.62 |
| Partition/Door | -18,745 | -18,745 | 5.93 |
| Floor | -10,470 | -10,470 | 3.31 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -23,224 | -23,224 | 7.35 |
| *Sub Total* ==> | -53,630 | -54,395 | 17.22 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -157 | 0 | 0.00 |
| **Ventilation Load** | 0 | -251,361 | 79.57 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | -10,740 | -10,740 | 3.40 |
| **Exhaust Heat** | | 607 | -0.19 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -64,528 | -315,889 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 56.0 | 86.2 |
| **Ra Plenum** | 72.6 | 69.9 |
| **Return** | 72.6 | 69.9 |
| **Ret/OA** | 86.4 | 7.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 3,600 | 3,600 |
| **Terminal** | 3,600 | 3,600 |
| **Main Fan** | 3,600 | 3,600 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 3,600 | 3,600 |
| **AHU Vent** | 3,600 | 3,600 |
| **Infil** | 333 | 333 |
| **MinStop/Rh** | 0 | 0 |
| **Return** | 3,933 | 3,933 |
| **Exhaust** | 3,933 | 3,933 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 100.0 | 100.0 |
| **cfm/ft²** | 1.01 | 1.01 |
| **cfm/ton** | 199.60 | |
| **ft²/ton** | 197.66 | |
| **Btu/hr·ft²** | 60.71 | -88.61 |
| **No. People** | 80 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 18.0 | 216.4 | 120.7 | 3,600 | 86.4 | 73.2 | 102.8 | 56.0 | 55.5 | 65.6 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 18.0 | 216.4 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 3,565 | | |
| **Part** | 1,285 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 3,565 | | |
| **Roof** | 0 | 0 | 0 |
| **Wall** | 345 | 0 | 0 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -120.4 | 3,600 | 56.0 | 86.2 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -195.5 | 3,600 | 7.0 | 56.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -315.9 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-7** — **Single Zone**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 23,960 | 23,960 | 7 |
| Glass Solar | 6,102 | 0 | 6,102 | 2 |
| Glass/Door Cond | 757 | 0 | 757 | 0 |
| Wall Cond | 1,448 | 1,271 | 2,718 | 1 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | -1,490 | | -1,490 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 210 | | 210 | 0 |
| *Sub Total ==>* | 7,026 | 25,230 | 32,256 | 9 |
| **Internal Loads** | | | | |
| Lights | 12,614 | 3,154 | 15,768 | 4 |
| People | 16,000 | 0 | 16,000 | 5 |
| Misc | 0 | 0 | 0 | 0 |
| *Sub Total ==>* | 28,614 | 3,154 | 31,768 | 9 |
| **Ceiling Load** | 917 | -917 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 196,384 | 56 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 95,334 | | 95,334 | 27 |
| **Exhaust Heat** | | -3,938 | -3,938 | -1 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -19,949 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 131,892 | 3,579 | 351,804 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: Sum of
OADB: Peaks

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 9,500 | 7 |
| Glass/Door Cond | 673 | 1 |
| Wall Cond | 1,699 | 1 |
| Partition/Door | 0 | 0 |
| Floor | -1,489.83 | -1 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 73 | 0 |
| *Sub Total ==>* | 10,454 | 8 |
| **Internal Loads** | | |
| Lights | 12,614 | 10 |
| People | 9,800 | 8 |
| Misc | 0 | 0 |
| *Sub Total ==>* | 22,414 | 17 |
| **Ceiling Load** | 1,467 | 1 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 95,334 | 74 |
| ***Grand Total ==>*** | 129,670 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -23,379 | 6.48 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -3,666 | -3,666 | 1.02 |
| Wall Cond | -2,426 | -4,520 | 1.25 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | -11,307 | -11,307 | 3.13 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -352 | -352 | 0.10 |
| *Sub Total ==>* | -17,750 | -43,223 | 11.98 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -2,775 | 0 | 0.00 |
| **Ventilation Load** | 0 | -329,562 | 91.32 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 11,910 | -3.30 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -20,524 | -360,875 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 59.0 | 72.1 |
| **Ra Plenum** | 72.8 | 67.7 |
| **Return** | 72.8 | 67.7 |
| **Ret/OA** | 79.9 | 35.9 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 9,000 | 9,000 |
| **Terminal** | 9,000 | 9,000 |
| **Main Fan** | 9,000 | 9,000 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 4,720 | 4,720 |
| **AHU Vent** | 4,720 | 4,720 |
| **Infil** | 5 | 5 |
| **MinStop/Rh** | 0 | 0 |
| **Return** | 9,005 | 9,005 |
| **Exhaust** | 4,725 | 4,725 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 52.4 | 52.4 |
| **cfm/ft²** | 2.34 | 2.34 |
| **cfm/ton** | 306.99 | |
| **ft²/ton** | 131.32 | |
| **Btu/hr·ft²** | 91.38 | -93.73 |
| **No. People** | 40 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 29.3 | 351.8 | 224.4 | 9,000 | 79.9 | 68.2 | 85.3 | 57.0 | 56.0 | 65.9 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 29.3 | 351.8 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 3,850 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 3,850 | | |
| **Roof** | 3,850 | 0 | 0 |
| **Wall** | 895 | 84 | 9 |
| **Ext Door** | 84 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -360.9 | 9,000 | 35.9 | 72.1 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -210.7 | 9,000 | 35.9 | 57.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -360.9 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-8**

**Variable Volume Reheat (30% Min Flow Default)**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 17
Outside Air: OADB/WB/HR: 85 / 72 / 100

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 31,257 | 31,257 | 11 |
| Glass Solar | 42,977 | 0 | 42,977 | 15 |
| Glass/Door Cond | 2,941 | 0 | 2,941 | 1 |
| Wall Cond | 7,714 | 3,383 | 11,096 | 4 |
| Partition/Door | -669 | | -669 | 0 |
| Floor | -1,027 | | -1,027 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 1,253 | | 1,253 | 0 |
| *Sub Total* ==> | 53,189 | 34,639 | 87,828 | 31 |
| **Internal Loads** | | | | |
| Lights | 23,509 | 5,877 | 29,386 | 10 |
| People | 53,580 | 0 | 53,580 | 19 |
| Misc | 3,754 | 0 | 3,754 | 1 |
| *Sub Total* ==> | 80,843 | 5,877 | 86,720 | 30 |
| **Ceiling Load** | 6,595 | -6,595 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 122,895 | 43 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -9,744 | -9,744 | -3 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -13,775 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 140,627 | 10,403 | 287,700 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 17
OADB: 85

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 42,977 | 37 |
| Glass/Door Cond | 2,941 | 3 |
| Wall Cond | 7,714 | 7 |
| Partition/Door | -669 | -1 |
| Floor | -1,027.41 | -1 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 440 | 0 |
| *Sub Total* ==> | 52,376 | 45 |
| **Internal Loads** | | |
| Lights | 23,509 | 20 |
| People | 30,850 | 26 |
| Misc | 3,754 | 3 |
| *Sub Total* ==> | 58,113 | 50 |
| **Ceiling Load** | 6,595 | 6 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total* ==>** | 117,085 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -25,563 | 10.36 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -15,857 | -15,857 | 6.43 |
| Wall Cond | -9,545 | -13,529 | 5.48 |
| Partition/Door | -5,074 | -5,074 | 2.06 |
| Floor | -7,797 | -7,797 | 3.16 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -2,136 | -2,136 | 0.87 |
| *Sub Total* ==> | -40,409 | -69,956 | 28.35 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -14,653 | 0 | 0.00 |
| **Ventilation Load** | 0 | -136,154 | 55.19 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 14,148 | -5.73 |
| **OA Preheat Diff.** | | -53,531 | 21.70 |
| **RA Preheat Diff.** | | -1,222 | 0.50 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -55,062 | -246,715 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.0 | 94.2 |
| **Ra Plenum** | 74.9 | 63.6 |
| **Return** | 74.9 | 63.6 |
| **Ret/OA** | 79.8 | 9.9 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 6,214 | 2,054 |
| **Terminal** | 6,214 | 2,054 |
| **Main Fan** | 6,214 | 2,054 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 3,000 | 1,950 |
| **AHU Vent** | 3,000 | 1,950 |
| **Infil** | 31 | 31 |
| **MinStop/Rh** | 2,054 | 2,054 |
| **Return** | 6,245 | 2,085 |
| **Exhaust** | 3,031 | 1,981 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 48.3 | 94.9 |
| **cfm/ft²** | 0.87 | 0.29 |
| **cfm/ton** | 259.20 | |
| **ft²/ton** | 299.27 | |
| **Btu/hr·ft²** | 40.10 | -34.39 |
| **No. People** | 126 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 24.0 | 287.7 | 184.5 | 6,214 | 79.8 | 67.2 | 80.7 | 53.0 | 52.2 | 57.1 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 24.0 | 287.7 | | | | | | | | |

## AREAS

| | Gross Total ft² | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 7,175 | | |
| **Part** | 348 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 2,655 | | |
| **Roof** | 4,520 | 0 | 0 |
| **Wall** | 2,976 | 510 | 17 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -93.8 | 2,054 | 53.0 | 94.2 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -152.9 | 3,000 | 7.0 | 53.0 |
| **Reheat** | -38.7 | 2,054 | 53.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -246.7 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-10**

**Variable Volume Reheat (30% Min Flow Default)**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 47,047 | 47,047 | 16 |
| Glass Solar | 20,950 | 0 | 20,950 | 7 |
| Glass/Door Cond | 4,270 | 0 | 4,270 | 1 |
| Wall Cond | 2,001 | 960 | 2,961 | 1 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 1,801 | | 1,801 | 1 |
| *Sub Total* ==> | 29,023 | 48,006 | 77,029 | 25 |
| **Internal Loads** | | | | |
| Lights | 28,745 | 7,186 | 35,931 | 12 |
| People | 67,500 | 0 | 67,500 | 22 |
| Misc | 17,065 | 0 | 17,065 | 6 |
| *Sub Total* ==> | 113,310 | 7,186 | 120,496 | 40 |
| **Ceiling Load** | 11,259 | -11,259 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 116,418 | 39 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -11,637 | -11,637 | -4 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -14,402 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 153,591 | 17,895 | 302,307 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 9
OADB: 73

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 56,985 | 36 |
| Glass/Door Cond | -268 | 0 |
| Wall Cond | 2,937 | 2 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 39 | 0 |
| *Sub Total* ==> | 59,693 | 37 |
| **Internal Loads** | | |
| Lights | 28,745 | 18 |
| People | 37,500 | 24 |
| Misc | 17,065 | 11 |
| *Sub Total* ==> | 83,310 | 52 |
| **Ceiling Load** | -1,150 | -1 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 17,354 | 11 |
| ***Grand Total* ==>** | 159,206 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -47,565 | 20.72 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -20,476 | -20,476 | 8.92 |
| Wall Cond | -4,024 | -5,930 | 2.58 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -2,758 | -2,758 | 1.20 |
| *Sub Total* ==> | -27,258 | -76,730 | 33.42 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -24,413 | 0 | 0.00 |
| **Ventilation Load** | 0 | -177,000 | 77.10 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 25,059 | -10.92 |
| **OA Preheat Diff.** | | -905 | 0.39 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -51,671 | -229,576 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.0 | 88.4 |
| **Ra Plenum** | 76.1 | 61.2 |
| **Return** | 76.1 | 61.2 |
| **Ret/OA** | 80.1 | 7.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 8,450 | 2,535 |
| **Terminal** | 8,450 | 2,535 |
| **Main Fan** | 8,450 | 2,535 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 2,553 | 2,535 |
| **AHU Vent** | 2,553 | 2,535 |
| **Infil** | 40 | 40 |
| **MinStop/Rh** | 2,535 | 2,535 |
| **Return** | 8,490 | 2,575 |
| **Exhaust** | 2,592 | 2,575 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 30.2 | 100.0 |
| **cfm/ft²** | 0.96 | 0.29 |
| **cfm/ton** | 335.42 | |
| **ft²/ton** | 348.24 | |
| **Btu/hr·ft²** | 34.46 | -26.17 |
| **No. People** | 150 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 25.2 | 302.3 | 195.4 | 6,498 | 80.1 | 66.6 | 76.9 | 53.0 | 51.2 | 53.6 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 25.2 | 302.3 | | | | | | | | |

## AREAS

| | Gross Total ft² | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 8,773 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 8,773 | 0 | 0 |
| **Wall** | 1,759 | 658 | 37 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -99.4 | 2,535 | 53.0 | 88.4 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -130.1 | 2,553 | 7.0 | 53.0 |
| **Reheat** | -47.8 | 2,535 | 53.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -229.6 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-11**

**Single Zone Variable Air Volume**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 15
Outside Air: OADB/WB/HR: 87 / 73 / 100

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 5,908 | 5,908 | 12 |
| Glass Solar | 0 | 0 | 0 | 0 |
| Glass/Door Cond | 0 | 0 | 0 | 0 |
| Wall Cond | 0 | 0 | 0 | 0 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | | 0 | 0 |
| *Sub Total* ==> | 0 | 5,908 | 5,908 | 12 |
| **Internal Loads** | | | | |
| Lights | 4,500 | 1,125 | 5,625 | 12 |
| People | 9,000 | 0 | 9,000 | 19 |
| Misc | 10,239 | 0 | 10,239 | 21 |
| *Sub Total* ==> | 23,739 | 1,125 | 24,864 | 52 |
| **Ceiling Load** | 818 | -818 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 18,618 | 39 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | -1,389 | -1,389 | -3 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -4,433 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 24,557 | 393 | 48,001 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 16
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 0 | 0 |
| Glass/Door Cond | 0 | 0 |
| Wall Cond | 0 | 0 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 0 | 0 |
| *Sub Total* ==> | 0 | 0 |
| **Internal Loads** | | |
| Lights | 4,500 | 12 |
| People | 5,000 | 13 |
| Misc | 10,239 | 27 |
| *Sub Total* ==> | 19,739 | 52 |
| **Ceiling Load** | 868 | 2 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 17,076 | 45 |
| **Exhaust Heat** | | |
| **OA Preheat Diff.** | | |
| **RA Preheat Diff.** | | |
| **Additional Reheat** | | |
| **Underflr Sup Ht Pkup** | | |
| **Supply Air Leakage** | | |
| ***Grand Total* ==>** | 37,682 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -4,767 | 15.67 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | 0 | 0 | 0.00 |
| Wall Cond | 0 | 0 | 0.00 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | -4,767 | 15.67 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -1,344 | 0 | 0.00 |
| **Ventilation Load** | 0 | -27,929 | 91.83 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 2,282 | -7.50 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -1,344 | -30,414 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.0 | 72.0 |
| **Ra Plenum** | 75.1 | 64.9 |
| **Return** | 75.1 | 64.9 |
| **Ret/OA** | 77.5 | 26.3 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 2,000 | 600 |
| **Terminal** | 2,000 | 600 |
| **Main Fan** | 2,000 | 600 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 400 | 400 |
| **AHU Vent** | 400 | 400 |
| **Infil** | 0 | 0 |
| **MinStop/Rh** | 600 | 600 |
| **Return** | 2,000 | 600 |
| **Exhaust** | 400 | 400 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 20.0 | 66.7 |
| **cfm/ft²** | 2.43 | 0.73 |
| **cfm/ton** | 499.99 | |
| **ft²/ton** | 206.00 | |
| **Btu/hr·ft²** | 58.25 | -36.91 |
| **No. People** | 20 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 4.0 | 48.0 | 32.0 | 2,000 | 77.5 | 63.5 | 66.0 | 53.0 | 53.0 | 60.2 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 4.0 | 48.0 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 824 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 824 | 0 | 0 |
| **Wall** | 0 | 0 | 0 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -30.4 | 600 | 26.3 | 72.0 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -30.4 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# System Checksums

By Kohler Ronan

**AHU-14 Option 1** — **Variable Volume Reheat (30% Min Flow Default)**

## COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 14
Outside Air: OADB/WB/HR: 86 / 73 / 103

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 0 | 0 | 0 |
| Glass Solar | 26,654 | 0 | 26,654 | 6 |
| Glass/Door Cond | 5,693 | 0 | 5,693 | 1 |
| Wall Cond | 3,990 | 1,652 | 5,642 | 1 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 2,321 | | 2,321 | 0 |
| *Sub Total* ==> | 38,659 | 1,652 | 40,310 | 8 |
| **Internal Loads** | | | | |
| Lights | 39,318 | 9,829 | 49,147 | 10 |
| People | 62,700 | 0 | 62,700 | 13 |
| Misc | 13,652 | 0 | 13,652 | 3 |
| *Sub Total* ==> | 115,670 | 9,829 | 125,499 | 26 |
| **Ceiling Load** | -3,084 | 3,084 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 303,675 | 64 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | 6,240 | 6,240 | 1 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | -15,272 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total* ==>** | 151,245 | 5,533 | 475,724 | 100.00 |

## CLG SPACE PEAK

Mo/Hr: 7 / 9
OADB: 73

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 80,421 | 39 |
| Glass/Door Cond | -358 | 0 |
| Wall Cond | 6,288 | 3 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 52 | 0 |
| *Sub Total* ==> | 86,403 | 42 |
| **Internal Loads** | | |
| Lights | 39,318 | 19 |
| People | 42,750 | 21 |
| Misc | 13,652 | 7 |
| *Sub Total* ==> | 95,720 | 46 |
| **Ceiling Load** | -2,865 | -1 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 27,993 | 14 |
| ***Grand Total* ==>** | 207,251 | 100.00 |

## HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | 0 | 0.00 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -27,302 | -27,302 | 4.11 |
| Wall Cond | -8,115 | -11,366 | 1.71 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -3,677 | -3,677 | 0.55 |
| *Sub Total* ==> | -39,095 | -42,345 | 6.38 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -1,644 | 0 | 0.00 |
| **Ventilation Load** | 0 | -230,414 | 34.72 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 1,607 | -0.24 |
| **OA Preheat Diff.** | | -392,557 | 59.15 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total* ==>** | -40,739 | -663,710 | 100.00 |

## TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 55.0 | 81.1 |
| **Ra Plenum** | 71.2 | 69.6 |
| **Return** | 71.2 | 69.6 |
| **Ret/OA** | 86.4 | 7.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

## AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 11,000 | 3,300 |
| **Terminal** | 11,000 | 3,300 |
| **Main Fan** | 11,000 | 3,300 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 11,000 | 3,300 |
| **AHU Vent** | 11,000 | 3,300 |
| **Infil** | 53 | 53 |
| **MinStop/Rh** | 3,300 | 3,300 |
| **Return** | 11,053 | 3,353 |
| **Exhaust** | 11,053 | 3,353 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

## ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 100.0 | 100.0 |
| **cfm/ft²** | 0.92 | 0.28 |
| **cfm/ton** | 277.47 | |
| **ft²/ton** | 302.70 | |
| **Btu/hr·ft²** | 39.64 | -55.31 |
| **No. People** | 190 | |

## COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 39.6 | 475.7 | 260.5 | 6,890 | 86.4 | 73.2 | 102.8 | 53.0 | 52.3 | 57.6 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 39.6 | 475.7 | | | | | | | | |

## AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 12,000 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 0 | 0 | 0 |
| **Wall** | 2,886 | 878 | 30 |
| **Ext Door** | 0 | 0 | 0 |

## HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -102.9 | 3,300 | 53.0 | 81.1 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | -560.8 | 11,000 | 7.0 | 53.0 |
| **Reheat** | -62.2 | 3,300 | 53.0 | 70.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -663.7 | | | |

Project Name:
Dataset Name: BHS 2.TRC

# Room Checksums

By Kohler Ronan

## Third Floor East Rm - VRF

### COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 16
Outside Air: OADB/WB/HR: 87 / 73 / 97

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 5,661 | 5,661 | 22 |
| Glass Solar | 1,888 | 0 | 1,888 | 7 |
| Glass/Door Cond | 591 | 0 | 591 | 2 |
| Wall Cond | 308 | 72 | 380 | 2 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 225 | | 225 | 1 |
| *Sub Total ==>* | 3,012 | 5,733 | 8,745 | 35 |
| **Internal Loads** | | | | |
| Lights | 3,014 | 754 | 3,768 | 15 |
| People | 11,700 | 0 | 11,700 | 46 |
| Misc | 1,024 | 0 | 1,024 | 4 |
| *Sub Total ==>* | 15,738 | 754 | 16,492 | 65 |
| **Ceiling Load** | 4,434 | -4,434 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 0 | 0 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | 0 | 0 | 0 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | 0 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 23,185 | 2,052 | 25,237 | 100.00 |

### CLG SPACE PEAK

Mo/Hr: 7 / 9
OADB: 73

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 7,415 | 38 |
| Glass/Door Cond | -23 | 0 |
| Wall Cond | 512 | 3 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 7 | 0 |
| *Sub Total ==>* | 7,911 | 41 |
| **Internal Loads** | | |
| Lights | 3,014 | 16 |
| People | 6,500 | 33 |
| Misc | 1,024 | 5 |
| *Sub Total ==>* | 10,538 | 54 |
| **Ceiling Load** | 955 | 5 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 19,405 | 100.00 |

### HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -4,758 | 68.48 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -2,631 | -2,631 | 37.86 |
| Wall Cond | -672 | -942 | 13.56 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -357 | -357 | 5.14 |
| *Sub Total ==>* | -3,659 | -8,687 | 125.03 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -3,289 | 0 | 0.00 |
| **Ventilation Load** | 0 | 0 | 0.00 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **System Plenum Heat** | | 1,739 | -25.03 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -6,948 | -6,948 | 100.00 |

### TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 50.9 | 77.6 |
| **Ra Plenum** | 87.2 | 58.7 |
| **Return** | 72.0 | 70.0 |
| **Ret/OA** | 72.0 | 70.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

### AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 826 | 826 |
| **Terminal** | 826 | 826 |
| **Main Fan** | 826 | 826 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 0 | 0 |
| **AHU Vent** | 0 | 0 |
| **Infil** | 5 | 5 |
| **MinStop/Rh** | 83 | 83 |
| **Return** | 831 | 831 |
| **Exhaust** | 5 | 5 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

### ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 0.0 | 0.0 |
| **cfm/ft²** | 0.90 | 0.90 |
| **cfm/ton** | 392.80 | |
| **ft²/ton** | 437.45 | |
| **Btu/hr·ft²** | 27.43 | -7.55 |
| **No. People** | 26.0 | 28.3/1000 ft² |

### COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 2.1 | 25.2 | 19.9 | 826 | 72.0 | 60.1 | 58.6 | 50.9 | 49.0 | 48.5 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 2.1 | 25.2 | | | | | | | | |

### AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 920 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 920 | 0 | 0 |
| **Wall** | 261 | 85 | 32 |
| **Ext Door** | 0 | 0 | 0 |

### HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -7.0 | 826 | 70.0 | 77.6 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -7.0 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 03:53 PM on 06/02/2022
Alternative - 2 System Checksums Report Page 25 of 29

# Room Checksums

By Kohler Ronan

## Third Floor South Rm - VRF

### COOLING COIL PEAK

Peaked at Time: Mo/Hr: 9 / 14
Outside Air: OADB/WB/HR: 76 / 65 / 73

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 2,138 | 2,138 | 10 |
| Glass Solar | 4,317 | 0 | 4,317 | 20 |
| Glass/Door Cond | 48 | 0 | 48 | 0 |
| Wall Cond | 1,171 | 285 | 1,456 | 7 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 38 | | 38 | 0 |
| *Sub Total ==>* | 5,574 | 2,423 | 7,997 | 38 |
| **Internal Loads** | | | | |
| Lights | 2,785 | 696 | 3,481 | 17 |
| People | 8,580 | 0 | 8,580 | 41 |
| Misc | 1,024 | 0 | 1,024 | 5 |
| *Sub Total ==>* | 12,389 | 696 | 13,085 | 62 |
| **Ceiling Load** | 3,084 | -3,084 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 0 | 0 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | 0 | 0 | 0 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | 0 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 21,047 | 35 | 21,082 | 100.00 |

### CLG SPACE PEAK

Mo/Hr: 9 / 14
OADB: 76

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 4,317 | 24 |
| Glass/Door Cond | 48 | 0 |
| Wall Cond | 1,171 | 6 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 11 | 0 |
| *Sub Total ==>* | 5,547 | 30 |
| **Internal Loads** | | |
| Lights | 2,785 | 15 |
| People | 5,850 | 32 |
| Misc | 1,024 | 6 |
| *Sub Total ==>* | 9,659 | 53 |
| **Ceiling Load** | 3,084 | 17 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 18,291 | 100.00 |

### HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -4,007 | 57.43 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -1,315 | -1,315 | 18.85 |
| Wall Cond | -1,211 | -1,483 | 21.25 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -178 | -178 | 2.56 |
| *Sub Total ==>* | -2,705 | -6,983 | 100.09 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -4,272 | 0 | 0.00 |
| **Ventilation Load** | 0 | 0 | 0.00 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **System Plenum Heat** | | 6 | -0.09 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -6,977 | -6,977 | 100.00 |

### TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 54.5 | 76.7 |
| **Ra Plenum** | 83.5 | 54.1 |
| **Return** | 72.0 | 70.0 |
| **Ret/OA** | 72.0 | 70.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

### AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 937 | 937 |
| **Terminal** | 937 | 937 |
| **Main Fan** | 937 | 937 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 0 | 0 |
| **AHU Vent** | 0 | 0 |
| **Infil** | 3 | 3 |
| **MinStop/Rh** | 94 | 94 |
| **Return** | 940 | 940 |
| **Exhaust** | 3 | 3 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

### ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 0.0 | 0.0 |
| **cfm/ft²** | 1.10 | 1.10 |
| **cfm/ton** | 533.61 | |
| **ft²/ton** | 483.82 | |
| **Btu/hr·ft²** | 24.80 | -8.21 |
| **No. People** | 26.0 | 30.6/1000 ft² |

### COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 1.8 | 21.1 | 18.3 | 937 | 72.0 | 60.1 | 58.6 | 54.5 | 52.1 | 54.3 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 1.8 | 21.1 | | | | | | | | |

### AREAS

| | Gross Total ft² | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 850 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 850 | 0 | 0 |
| **Wall** | 320 | 42 | 13 |
| **Ext Door** | 0 | 0 | 0 |

### HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -7.0 | 937 | 70.0 | 76.7 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -7.0 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 03:53 PM on 06/02/2022
Alternative - 2 System Checksums Report Page 27 of 29

# Room Checksums

By Kohler Ronan

## Third Floor West Rm - VRF

### COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 17
Outside Air: OADB/WB/HR: 86 / 72 / 95

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 5,549 | 5,549 | 20 |
| Glass Solar | 4,297 | 0 | 4,297 | 15 |
| Glass/Door Cond | 263 | 0 | 263 | 1 |
| Wall Cond | 1,379 | 373 | 1,752 | 6 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 105 | | 105 | 0 |
| *Sub Total* ==> | 6,044 | 5,922 | 11,966 | 42 |
| **Internal Loads** | | | | |
| Lights | 2,949 | 737 | 3,686 | 13 |
| People | 11,700 | 0 | 11,700 | 41 |
| Misc | 1,024 | 0 | 1,024 | 4 |
| *Sub Total* ==> | 15,673 | 737 | 16,410 | 58 |
| **Ceiling Load** | 4,365 | -4,365 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 0 | 0 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | 0 | 0 | 0 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | 0 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 26,082 | 2,294 | 28,376 | 100.00 |

### CLG SPACE PEAK

Mo/Hr: 7 / 17
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 4,297 | 21 |
| Glass/Door Cond | 263 | 1 |
| Wall Cond | 1,379 | 7 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 39 | 0 |
| *Sub Total* ==> | 5,979 | 29 |
| **Internal Loads** | | |
| Lights | 2,949 | 14 |
| People | 6,500 | 31 |
| Misc | 1,024 | 5 |
| *Sub Total* ==> | 10,473 | 50 |
| **Ceiling Load** | 4,365 | 21 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 20,817 | 100.00 |

### HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -4,655 | 78.74 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -1,315 | -1,315 | 22.25 |
| Wall Cond | -1,200 | -1,538 | 26.01 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -178 | -178 | 3.02 |
| *Sub Total* ==> | -2,694 | -7,686 | 130.02 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -3,218 | 0 | 0.00 |
| **Ventilation Load** | 0 | 0 | 0.00 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **System Plenum Heat** | | 1,775 | -30.02 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -5,911 | -5,911 | 100.00 |

### TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 51.6 | 75.8 |
| **Ra Plenum** | 87.3 | 58.7 |
| **Return** | 72.0 | 70.0 |
| **Ret/OA** | 72.0 | 70.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

### AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 913 | 913 |
| **Terminal** | 913 | 913 |
| **Main Fan** | 913 | 913 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 0 | 0 |
| **AHU Vent** | 0 | 0 |
| **Infil** | 3 | 3 |
| **MinStop/Rh** | 91 | 91 |
| **Return** | 916 | 916 |
| **Exhaust** | 3 | 3 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

### ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 0.0 | 0.0 |
| **cfm/ft²** | 1.01 | 1.01 |
| **cfm/ton** | 386.26 | |
| **ft²/ton** | 380.60 | |
| **Btu/hr·ft²** | 31.53 | -6.57 |
| **No. People** | 26.0 | 28.9/1000 ft² |

### COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter HR gr/lb | Leave DB °F | Leave WB °F | Leave HR gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 2.4 | 28.4 | 23.1 | 913 | 72.0 | 60.1 | 58.6 | 51.6 | 48.8 | 46.8 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 2.4 | 28.4 | | | | | | | | |

### AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 900 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 900 | 0 | 0 |
| **Wall** | 327 | 42 | 13 |
| **Ext Door** | 0 | 0 | 0 |

### HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -5.9 | 913 | 70.0 | 75.8 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -5.9 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 03:53 PM on 06/02/2022
Alternative - 2 System Checksums Report Page 29 of 29

# Room Checksums

By Kohler Ronan

## Third Floor SW Corner Rm - VRF

### COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 17
Outside Air: OADB/WB/HR: 86 / 72 / 95

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 4,198 | 4,198 | 13 |
| Glass Solar | 9,577 | 0 | 9,577 | 30 |
| Glass/Door Cond | 526 | 0 | 526 | 2 |
| Wall Cond | 1,608 | 363 | 1,970 | 6 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 209 | | 209 | 1 |
| *Sub Total* ==> | 11,919 | 4,561 | 16,480 | 51 |
| **Internal Loads** | | | | |
| Lights | 2,457 | 614 | 3,072 | 10 |
| People | 11,700 | 0 | 11,700 | 36 |
| Misc | 1,024 | 0 | 1,024 | 3 |
| *Sub Total* ==> | 15,181 | 614 | 15,796 | 49 |
| **Ceiling Load** | 4,943 | -4,943 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 0 | 0 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | 0 | 0 | 0 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | 0 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 32,043 | 232 | 32,276 | 100.00 |

### CLG SPACE PEAK

Mo/Hr: 7 / 17
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 9,577 | 36 |
| Glass/Door Cond | 526 | 2 |
| Wall Cond | 1,608 | 6 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 79 | 0 |
| *Sub Total* ==> | 11,789 | 44 |
| **Internal Loads** | | |
| Lights | 2,457 | 9 |
| People | 6,500 | 24 |
| Misc | 1,024 | 4 |
| *Sub Total* ==> | 9,981 | 37 |
| **Ceiling Load** | 4,943 | 19 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 26,713 | 100.00 |

### HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -3,535 | 41.20 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | -2,631 | -2,631 | 30.66 |
| Wall Cond | -1,824 | -2,317 | 27.00 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | -357 | -357 | 4.16 |
| *Sub Total* ==> | -4,811 | -8,839 | 103.01 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total* ==> | 0 | 0 | 0.00 |
| **Ceiling Load** | -3,769 | 0 | 0.00 |
| **Ventilation Load** | 0 | 0 | 0.00 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **System Plenum Heat** | | 258 | -3.01 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -8,581 | -8,581 | 100.00 |

### TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 53.1 | 76.1 |
| **Ra Plenum** | 92.8 | 54.1 |
| **Return** | 72.0 | 70.0 |
| **Ret/OA** | 72.0 | 70.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

### AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 1,268 | 1,268 |
| **Terminal** | 1,268 | 1,268 |
| **Main Fan** | 1,268 | 1,268 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 0 | 0 |
| **AHU Vent** | 0 | 0 |
| **Infil** | 5 | 5 |
| **MinStop/Rh** | 127 | 127 |
| **Return** | 1,273 | 1,273 |
| **Exhaust** | 5 | 5 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

### ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 0.0 | 0.0 |
| **cfm/ft²** | 1.69 | 1.69 |
| **cfm/ton** | 471.40 | |
| **ft²/ton** | 278.85 | |
| **Btu/hr·ft²** | 43.03 | -11.44 |
| **No. People** | 26.0 | 34.7/1000 ft² |

### COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter gr/lb | Leave DB °F | Leave WB °F | Leave gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 2.7 | 32.3 | 27.0 | 1,268 | 72.0 | 60.1 | 58.6 | 53.1 | 51.0 | 52.3 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 2.7 | 32.3 | | | | | | | | |

### AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 750 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 750 | 0 | 0 |
| **Wall** | 522 | 85 | 16 |
| **Ext Door** | 0 | 0 | 0 |

### HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -8.6 | 1,268 | 70.0 | 76.1 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -8.6 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 03:53 PM on 06/02/2022
Alternative - 2 System Checksums Report Page 28 of 29

# Room Checksums

By Kohler Ronan

## Third Floor Internal Rm - VRF

### COOLING COIL PEAK

Peaked at Time: Mo/Hr: 7 / 17
Outside Air: OADB/WB/HR: 86 / 72 / 95

| | Space Sens. + Lat. Btu/h | Plenum Sens. + Lat Btu/h | Net Total Btu/h | Percent Of Total (%) |
|---|---|---|---|---|
| **Envelope Loads** | | | | |
| Skylite Solar | 0 | 0 | 0 | 0 |
| Skylite Cond | 0 | 0 | 0 | 0 |
| Roof Cond | 0 | 5,116 | 5,116 | 24 |
| Glass Solar | 0 | 0 | 0 | 0 |
| Glass/Door Cond | 0 | 0 | 0 | 0 |
| Wall Cond | 0 | 0 | 0 | 0 |
| Partition/Door | 0 | | 0 | 0 |
| Floor | 0 | | 0 | 0 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | | 0 | 0 |
| *Sub Total ==>* | 0 | 5,116 | 5,116 | 24 |
| **Internal Loads** | | | | |
| Lights | 2,949 | 737 | 3,686 | 17 |
| People | 11,700 | 0 | 11,700 | 54 |
| Misc | 1,024 | 0 | 1,024 | 5 |
| *Sub Total ==>* | 15,673 | 737 | 16,410 | 76 |
| **Ceiling Load** | 5,931 | -5,931 | 0 | 0 |
| **Ventilation Load** | 0 | 0 | 0 | 0 |
| **Adj Air Trans Heat** | 0 | | 0 | 0 |
| **Dehumid. Ov Sizing** | | | 0 | 0 |
| **Ov/Undr Sizing** | 0 | | 0 | 0 |
| **Exhaust Heat** | | 0 | 0 | 0 |
| **Sup. Fan Heat** | | | 0 | 0 |
| **Ret. Fan Heat** | | 0 | 0 | 0 |
| **Duct Heat Pkup** | | 0 | 0 | 0 |
| **Underflr Sup Ht Pkup** | | | 0 | 0 |
| **Supply Air Leakage** | | 0 | 0 | 0 |
| ***Grand Total ==>*** | 21,604 | -78 | 21,526 | 100.00 |

### CLG SPACE PEAK

Mo/Hr: 7 / 17
OADB: 86

| | Space Sensible Btu/h | Percent Of Total (%) |
|---|---|---|
| **Envelope Loads** | | |
| Skylite Solar | 0 | 0 |
| Skylite Cond | 0 | 0 |
| Roof Cond | 0 | 0 |
| Glass Solar | 0 | 0 |
| Glass/Door Cond | 0 | 0 |
| Wall Cond | 0 | 0 |
| Partition/Door | 0 | 0 |
| Floor | 0.00 | 0 |
| Adjacent Floor | 0.00 | 0.00 |
| Infiltration | 0 | 0 |
| *Sub Total ==>* | 0 | 0 |
| **Internal Loads** | | |
| Lights | 2,949 | 18 |
| People | 6,500 | 40 |
| Misc | 1,024 | 6 |
| *Sub Total ==>* | 10,473 | 64 |
| **Ceiling Load** | 5,931 | 36 |
| **Ventilation Load** | 0 | 0 |
| **Adj Air Trans Heat** | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 |
| ***Grand Total ==>*** | 16,404 | 100.00 |

### HEATING COIL PEAK

Mo/Hr: Heating Design
OADB: 7

| | Space Peak Space Sens Btu/h | Coil Peak Tot Sens Btu/h | Percent Of Total (%) |
|---|---|---|---|
| **Envelope Loads** | | | |
| Skylite Solar | 0 | 0 | 0.00 |
| Skylite Cond | 0 | 0 | 0.00 |
| Roof Cond | 0 | -4,242 | 93.79 |
| Glass Solar | 0 | 0 | 0.00 |
| Glass/Door Cond | 0 | 0 | 0.00 |
| Wall Cond | 0 | 0 | 0.00 |
| Partition/Door | 0 | 0 | 0.00 |
| Floor | 0 | 0 | 0.00 |
| Adjacent Floor | 0.00 | 0.00 | 0.00 |
| Infiltration | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | -4,242 | 93.79 |
| **Internal Loads** | | | |
| Lights | 0 | 0 | 0.00 |
| People | 0 | 0 | 0.00 |
| Misc | 0 | 0 | 0.00 |
| *Sub Total ==>* | 0 | 0 | 0.00 |
| **Ceiling Load** | -4,523 | 0 | 0.00 |
| **Ventilation Load** | 0 | 0 | 0.00 |
| **Adj Air Trans Heat** | 0 | 0 | 0 |
| **Ov/Undr Sizing** | 0 | 0 | 0.00 |
| **Exhaust Heat** | | 0 | 0.00 |
| **OA Preheat Diff.** | | 0 | 0.00 |
| **RA Preheat Diff.** | | 0 | 0.00 |
| **Additional Reheat** | | 0 | 0.00 |
| **System Plenum Heat** | | -281 | 6.21 |
| **Underflr Sup Ht Pkup** | | 0 | 0.00 |
| **Supply Air Leakage** | | 0 | 0.00 |
| ***Grand Total ==>*** | -4,523 | -4,523 | 100.00 |

### TEMPERATURES

| | Cooling | Heating |
|---|---|---|
| **SADB** | 49.4 | 76.2 |
| **Ra Plenum** | 92.8 | 54.1 |
| **Return** | 72.0 | 70.0 |
| **Ret/OA** | 72.0 | 70.0 |
| **Fn MtrTD** | 0.0 | 0.0 |
| **Fn BldTD** | 0.0 | 0.0 |
| **Fn Frict** | 0.0 | 0.0 |

### AIRFLOWS

| | Cooling | Heating |
|---|---|---|
| **Diffuser** | 650 | 650 |
| **Terminal** | 650 | 650 |
| **Main Fan** | 650 | 650 |
| **Sec Fan** | 0 | 0 |
| **Nom Vent** | 0 | 0 |
| **AHU Vent** | 0 | 0 |
| **Infil** | 0 | 0 |
| **MinStop/Rh** | 65 | 65 |
| **Return** | 650 | 650 |
| **Exhaust** | 0 | 0 |
| **Rm Exh** | 0 | 0 |
| **Auxiliary** | 0 | 0 |
| **Leakage Dwn** | 0 | 0 |
| **Leakage Ups** | 0 | 0 |

### ENGINEERING CKS

| | Cooling | Heating |
|---|---|---|
| **% OA** | 0.0 | 0.0 |
| **cfm/ft²** | 0.72 | 0.72 |
| **cfm/ton** | 362.35 | |
| **ft²/ton** | 501.73 | |
| **Btu/hr·ft²** | 23.92 | -5.03 |
| **No. People** | 26.0 | 28.9/1000 ft² |

### COOLING COIL SELECTION

| | Total Capacity ton | Total Capacity MBh | Sens Cap. MBh | Coil Airflow cfm | Enter DB °F | Enter WB °F | Enter gr/lb | Leave DB °F | Leave WB °F | Leave gr/lb |
|---|---|---|---|---|---|---|---|---|---|---|
| **Main Clg** | 1.8 | 21.5 | 16.3 | 650 | 72.0 | 60.1 | 58.6 | 49.4 | 47.9 | 47.4 |
| **Aux Clg** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0.0 | 0.0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ***Total*** | 1.8 | 21.5 | | | | | | | | |

### AREAS

| | Gross Total | Glass ft² | Glass (%) |
|---|---|---|---|
| **Floor** | 900 | | |
| **Part** | 0 | | |
| **Int Door** | 0 | | |
| **ExFlr** | 0 | | |
| **Roof** | 900 | 0 | 0 |
| **Wall** | 0 | 0 | 0 |
| **Ext Door** | 0 | 0 | 0 |

### HEATING COIL SELECTION

| | Capacity MBh | Coil Airflow cfm | Ent °F | Lvg °F |
|---|---|---|---|---|
| **Main Htg** | -4.5 | 650 | 70.0 | 76.2 |
| **Aux Htg** | 0.0 | 0 | 0.0 | 0.0 |
| **Preheat** | 0.0 | 0 | 0.0 | 0.0 |
| **Humidif** | 0.0 | 0 | 0.0 | 0.0 |
| **Opt Vent** | 0.0 | 0 | 0.0 | 0.0 |
| ***Total*** | -4.5 | | | |

Project Name:
Dataset Name: BHS.TRC

TRACE® 700 v6.3.4 calculated at 03:53 PM on 06/02/2022
Alternative - 2 System Checksums Report Page 26 of 29

# XII. APPENDIX B – MECHANICAL UPGRADES ESTIMATES

**Option 1**

| FLR/Roof | Equip Tags | Quantities | UM | Price | Totals | Notes |
|---|---|---|---|---|---|---|
| **Option 1 / Priority 1** | | | | | | |
| Roof | ERU-2 | 1 | EA | $ 288,000 | **$ 288,000** | Remove and Replace |
| Roof | DOAS-4 | 1 | EA | $ 385,656 | **$ 385,656** | DOAS 4 Flrs 1,2,3. See Equip Matrix for details |
| Floor 1(Alt 1) | ACCU1-1 14T | 1 | EA | $ 30,131 | **$ 30,131** | New roof top equipment |
| | VRF-A | 2 | EA | $ 3,000 | **$ 6,000** | |
| | VRF-B | | | | | |
| | VRF-C | 6 | EA | $ 2,500 | **$ 15,000** | |
| | VRF Refrig Piping | 9 | EA | $ 4,500 | **$ 40,500** | |
| | Electrical | 9 | EA | $ 2,500 | **$ 22,500** | New Circuits/Panels |
| | ACCU1-1 Electrical | 1 | EA | $ 17,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 21,000 | **$ 21,000** | |
| | **Floor 1 Subtotal** | | | | **$ 195,131** | |
| Floor 2 | ACCU1-2 18T | 1 | EA | $ 45,162 | **$ 45,162** | New roof top equipment |
| | VRF-A | 6 | EA | $ 3,000 | **$ 18,000** | |
| | VRF-B | 0 | | | | |
| | VRF-C | 2 | EA | $ 2,500 | **$ 5,000** | |
| | VRF Refrig Piping | 9 | EA | $ 4,500 | **$ 40,500** | |
| | Electrical | 9 | EA | $ 2,500 | **$ 22,500** | New Circuits/Panels |
| | ACCU1-2 Electrical | 1 | EA | $ 17,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 21,000 | **$ 21,000** | |
| | **Floor 2 Subtotal** | | | | **$ 212,162** | |
| Floor 3 | ACCU1-3 14T | 1 | EA | $ 30,131 | **$ 30,131** | New roof top equipment |
| | VRF-A | 5 | EA | $ 3,000 | **$ 15,000** | |
| | VRF-B | 0 | | | | |
| | VRF-C | 2 | EA | $ 2,500 | **$ 5,000** | |
| | VRF Refrig Piping | 8 | EA | $ 4,500 | **$ 36,000** | |
| | Electrical | 8 | EA | $ 2,500 | **$ 20,000** | New Circuits/Panels |
| | ACCU1-3 Electrical | 1 | EA | $ 17,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 19,000 | **$ 19,000** | |
| | **Floor 3 Subtotal** | | | | **$ 185,131** | |
| **Option 1 / Priority 1 Subtotal** | | | | | **$ 1,266,079** | |
| | Soft Costs | | | | | |
| | Design | 10% | | | **$ 126,608** | |
| | Contingency | 10% | | | **$ 126,608** | |
| | Escalation | 7.5% | | | **$ 94,956** | |
| **Option 1 / Priority 1 Total** | | | | | **$ 1,614,251** | |
| **Priority 2** | | | | | | |
| Roof | DOAS-3 | 1 | EA | $ 385,656 | **$ 385,656** | New roof top equipment. See Equip Matrix for details |
| Floor 3 | ACCU2-3 14T | 1 | EA | $ 30,131 | **$ 30,131** | New roof top equipment |
| | VRF-A | 5 | EA | $ 3,000 | **$ 15,000** | |
| | VRF-B | 0 | | | | |
| | VRF-C | 0 | | | | |
| | VRF Refrig Piping | 6 | EA | $ 4,500 | **$ 27,000** | |
| | Electrical | 6 | EA | $ 2,500 | **$ 15,000** | New Circuits/Panels |
| | ACCU2-3 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 15,000 | **$ 15,000** | |
| **Option 1 / Priority 2 Subtotal** | | | | | **$ 547,787** | |
| | Soft Costs | | | | | |
| | Design | 10% | | | **$ 54,779** | |
| | Contingency | 10% | | | **$ 54,779** | |
| | Escalation | 7.5% | | | **$ 41,084** | |
| **Option 1 / Priority 2 Total** | | | | | **$ 698,428** | |
| **Priority 3** | | | | | | |
| Roof | DOAS-2 | 1 | EA | $ 259,500 | **$ 259,500** | New roof top equipment. See Equip Matrix for details |
| Floor 3 | ACCU3-3 14T | 1 | EA | $ 30,131 | **$ 30,131** | New roof top equipment |
| | VRF-A | 5 | EA | $ 3,000 | **$ 15,000** | |
| | VRF Refrig Piping | 6 | EA | $ 4,500 | **$ 27,000** | |
| | VAV @ Rm C205 | 2 | EA | $ 4,500 | **$ 9,000** | |
| | Electrical | 14 | EA | $ 2,500 | **$ 35,000** | New Circuits/Panels |
| | ACCU3-3 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Duct Work | 1 | allow | $ 10,000 | **$ 10,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 31,000 | **$ 31,000** | |
| **Option 1 / Priority 3 Subtotal** | | | | | **$ 476,631** | |
| | Soft Costs | **27.5%** | | | | |
| | Design | 10% | | | **$ 47,663** | |
| | Contingency | 10% | | | **$ 47,663** | |
| | Escalation | 7.5% | | | **$ 35,747** | |
| **Option 1 / Priority 3 Total** | | | | | **$ 607,704** | |
| **Priority 4** | | | | | | |
| Roof | AHU-14 | 1 | EA | $ 666,750 | **$ 666,750** | New roof top equipment. See Equip Matrix for details |
| Floor 2 | VAV Boxes | 10 | EA | $ 4,000 | **$ 40,000** | |
| | Electrical | 11 | EA | $ 2,500 | **$ 27,500** | New Circuits/Panels |
| | Duct Work | | | | | Included in AHU-14 Cost |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | | | | Included in AHU-14 Cost |
| | Temp Controls | 1 | allow | $ 18,000 | **$ 18,000** | |
| **Option 1 / Priority 4 Subtotal** | | | | | **$ 772,250** | |
| | Soft Costs | **27.5%** | | | | |
| | Design | 10% | | | **$ 77,225** | |
| | Contingency | 10% | | | **$ 47,663** | |
| | Escalation | 7.5% | | | **$ 35,747** | |
| **Option 1 / Priority 4 Total** | | | | | **$ 932,885** | |
| **OPTION 1 TOTAL** | | | | | **$ 3,853,268** | |

**Option 2**

| FLR/Roof | Equip Tags | Quantities | UM | Price | Totals | Notes |
|---|---|---|---|---|---|---|
| **Option 2 / Priority 1** | | | | | | |
| Roof | DOAS-5 | 1 | EA | $ 761,969 | **$ 761,969** | Remove and Replace Mod Dunnage |
| Floor 1 | ACCU1-1 20T | 1 | EA | $ 30,131 | **$ 30,131** | New roof top equipment |
| | VRF-A | 3 | EA | $ 3,000 | **$ 9,000** | |
| | VRF-B | 2 | EA | $ 2,750 | **$ 5,500** | |
| | VRF-C | 6 | EA | $ 2,500 | **$ 15,000** | |
| | VRF Refrig Piping | 12 | EA | $ 4,500 | **$ 54,000** | |
| | Electrical | 12 | EA | $ 2,500 | **$ 30,000** | New Circuits/Panels |
| | ACCU1-1 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 27,000 | **$ 27,000** | |
| | **Floor 1 Subtotal** | | | | **$ 230,631** | |
| Floor 2 | ACCU1-2 28T | 1 | EA | $ 57,162 | **$ 57,162** | New roof top equipment |
| | VRF-A | 7 | EA | $ 3,000 | **$ 21,000** | |
| | VRF-B | 5 | EA | $ 2,750 | **$ 13,750** | |
| | VRF-C | 4 | EA | $ 2,500 | **$ 10,000** | |
| | VRF Refrig Piping | 17 | EA | $ 4,500 | **$ 76,500** | |
| | Electrical | 17 | EA | $ 2,500 | **$ 42,500** | New Circuits/Panels |
| | ACCU1-2 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 37,000 | **$ 37,000** | |
| | **Floor 2 Subtotal** | | | | **$ 317,912** | |
| Floor 3 Alt 2 | ACCU1-3 14T | 1 | EA | $ 30,131 | **$ 30,131** | New roof top equipment |
| | VRF-A | 5 | EA | $ 3,000 | **$ 15,000** | |
| | VRF-B | 0 | | | | |
| | VRF-C | 2 | EA | $ 2,500 | **$ 5,000** | |
| | VRF Refrig Piping | 8 | EA | $ 4,500 | **$ 36,000** | |
| | Electrical | 8 | EA | $ 2,500 | **$ 20,000** | New Circuits/Panels |
| | ACCU1-3 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 19,000 | **$ 19,000** | |
| | **Floor 3 Subtotal** | | | | **$ 185,131** | |
| **Option 2 / Priority 1 Subtotal** | | | | | **$ 2,229,315** | |
| | Soft Costs | | | | | |
| | Design | 10% | | | **$ 222,931** | |
| | Contingency | 10% | | | **$ 222,931** | |
| | Escalation | 7.5% | | | **$ 167,199** | |
| **Option 2 / Priority 1 Total** | | | | | **$ 2,842,376** | |
| **Priority 2** | | | | | | |
| Floor 3 | ACCU2-3 24T | 1 | EA | $ 52,428 | **$ 52,428** | New roof top equipment |
| | VRF-A | 5 | EA | $ 3,000 | **$ 15,000** | |
| | VRF-B | 5 | EA | $ 2,750 | **$ 13,750** | |
| | VRF-C | 0 | | | | |
| | VRF Refrig Piping | 11 | EA | $ 4,500 | **$ 49,500** | |
| | Electrical | 11 | EA | $ 2,500 | **$ 27,500** | New Circuits/Panels |
| | ACCU2-3 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 25,000 | **$ 25,000** | |
| **Option 2 / Priority 2 Subtotal** | | | | | **$ 243,178** | |
| | Soft Costs | | | | | |
| | Design | 10% | | | **$ 24,318** | |
| | Contingency | 10% | | | **$ 24,318** | |
| | Escalation | 7.5% | | | **$ 18,238** | |
| **Option 2 / Priority 2 Total** | | | | | **$ 310,052** | |
| **Priority 3** | | | | | | |
| Floor 3 | AHU-2 | 1 | EA | $ 242,469 | **$ 242,469** | Remove and Replace |
| | VAVs | 6 | EA | $ 2,000 | **$ 12,000** | |
| | VAV Piping | 7 | EA | $ 4,500 | **$ 31,500** | |
| | Duct | | | | | Included in AHU-2 Cost |
| | Electrical | 14 | EA | $ 2,500 | **$ 35,000** | New Circuits/Panels |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 30,000 | **$ 30,000** | |
| | Temp Controls | 1 | allow | $ 19,000 | **$ 19,000** | |
| **Option 2 / Priority 3 Subtotal** | | | | | **$ 389,969** | |
| | Soft Costs | | | | | |
| | Design | 10% | | | **$ 38,997** | |
| | Contingency | 10% | | | **$ 38,997** | |
| | Escalation | 7.5% | | | **$ 29,248** | |
| **Option 2 / Priority 3 Total** | | | | | **$ 497,210** | |
| **Priority 4** | | | | | | |
| Roof | DOAS-1 | 1 | EA | $ 346,188 | **$ 346,188** | New roof top equipment. See Equip Matrix for details |
| Floor 2 | ACCU4-2 24T | 1 | EA | $ 52,428 | **$ 52,428** | |
| | VRF-A | 2 | EA | $ 4,000 | **$ 8,000** | |
| | VRF-B | 4 | EA | $ 2,750 | **$ 11,000** | |
| | VRF-C | 6 | EA | $ 2,500 | **$ 15,000** | |
| | Electrical | 13 | EA | $ 2,500 | **$ 32,500** | New Circuits/Panels |
| | ACCU4-2 Electrical | 1 | EA | $ 20,000 | **$ 20,000** | |
| | Roof LVL Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Interiors Work | 1 | allow | $ 20,000 | **$ 20,000** | |
| | Temp Controls | 1 | allow | $ 10,000 | **$ 10,000** | |
| **Option 2 / Priority 4 Subtotal** | | | | | **$ 535,116** | |
| | Soft Costs | | | | | |
| | Design | 10% | | | **$ 53,512** | |
| | Contingency | 10% | | | **$ 53,512** | |
| | Escalation | 7.5% | | | **$ 40,134** | |
| **Option 2 / Priority 4 Total** | | | | | **$ 682,272** | |
| **OPTION 2 TOTAL** | | | | | **$ 4,331,911** | |

**Discrectionary Equipment Replacement**

| Equip Tag | Tons | CFM | Quant | UM | Equip Price | Status | Remove | Set Unit | Dunnage/Struct | Duct Mods/New Duct | Elec Reconnect/ New | Temprature Controls | Piping Reconnect/ New | Curb Mods/New | Roofing | Interiors | SubTotal | Contractors OH&P | Installed Price | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AHU-3A Interior + CU on Roof | 14 | 4,000 | 1 | EA | $34,208 | R&R | $2,500 | $1,600 | $5,000 | $2,500 | $1,500 | $20,000 | $1,500 | N/A | N/A | N/A | $68,808 | $17,202 | $86,010 | Remove and Replace.Roof level work only. Includes mark-ups |
| AHU-3B Interion + CU on Roof | 14 | 4,000 | 1 | EA | $34,208 | R&R | $2,500 | $1,600 | $5,000 | $2,500 | $1,500 | $20,000 | $1,500 | N/A | N/A | N/A | $68,808 | $17,202 | $86,010 | Remove and Replace.Roof level work only. Includes mark-ups |
| AHU-4 | 70 | 18,000 | 1 | EA | $200,849 | R&R | $7,500 | $14,900 | N/A | $5,000 | $100,000 | $45,000 | $2,500 | $5,500 | N/A | N/A | $381,249 | $95,312 | $476,561 | Remove and Replace. Panel Upgrade. |
| AHU-5 | 25 | 7,400 | 1 | EA | $118,206 | New | N/A | $14,900 | $15,000 | $148,000 | $15,000 | $18,500 | $12,500 | $15,000 | $7,500 | $44,400 | $409,006 | $102,252 | $511,258 | New Location. Dunnage, roof mods and connections |
| AHU-6 | 15 | 3,600 | 1 | EA | $83,582 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $15,000 | $2,500 | $5,500 | N/A | N/A | $137,482 | $34,371 | $171,853 | Remove and Replace, separate installs |
| AHU-7 | 30 | 9,000 | 1 | EA | $128,992 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $22,500 | $2,500 | $5,500 | N/A | N/A | $190,392 | $47,598 | $237,990 | Remove and Replace, separate installs |
| AHU-8 | 25 | 11,400 | 1 | EA | $120,277 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $28,500 | $2,500 | $5,500 | N/A | N/A | $187,677 | $46,919 | $234,596 | Remove and Replace, separate installs |
| AHU-10 | 25 | 8,450 | 1 | EA | $118,206 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $21,125 | $2,500 | $5,500 | N/A | N/A | $178,231 | $44,558 | $222,789 | Remove and Replace |
| AHU-11 | 5 | 2,000 | 1 | EA | $16,674 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $12,000 | $2,500 | $5,500 | N/A | N/A | $67,574 | $16,894 | $84,468 | Remove and Replace |
| ERU-1 | 30 | 7,800 | 1 | EA | $172,000 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $19,500 | $2,500 | $5,500 | N/A | N/A | $230,400 | $57,600 | $288,000 | Remove and Replace |
| AHX-1 | 50 | 10,800 | 1 | EA | $107,487 | R&R | $7,500 | $14,900 | N/A | $5,000 | $20,000 | $27,000 | $2,500 | $5,500 | N/A | N/A | $189,887 | $47,472 | $237,359 | Included in Option 1, Priority 1 |
| | 271 | 83,450 | 11 | | $1,134,689 | | $65,000 | $137,300 | $25,000 | $193,000 | $159,000 | $249,125 | $35,500 | $59,000 | $7,500 | $44,400 | $2,109,514 | $527,379 | $2,636,893 | |

**Equipment Included in Options 1&2**

| Equip Tag | Tons | CFM | Quant | UM | Equip Price | Status | Remove | Set Unit | Dunnage/Struct | Duct Mods/New Duct | Elec Reconnect/ New | Temprature Controls | Piping Reconnect/ New | Curb Mods/New | Roofing | Interiors | SubTotal | Contractors OH&P | Installed Price | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AHU-2 Opt 1 | 30 | 9,300 | 1 | EA | $128,029 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $23,250 | $2,500 | $5,500 | N/A | N/A | $190,179 | $47,545 | $237,724 | Included in Option 2, Priority 3 |
| AHU-2 Opt 2 | 50 | 12,000 | 1 | EA | $161,646 | R&R | $7,500 | $14,900 | N/A | $5,000 | $20,000 | $30,000 | $2,500 | $5,500 | N/A | N/A | $247,046 | $61,762 | $308,808 | Included in Option 2, Priority 3 |
| AHU-14 Opt 1 | 40 | 11,000 | 1 | EA | $140,000 | New | N/A | $14,900 | $15,000 | $220,000 | $15,000 | $27,500 | $12,500 | $15,000 | $7,500 | $66,000 | $533,400 | $133,350 | $666,750 | Included in Option 1, Priority 4 |
| DOAS-1 Opt 2 | 16 | 4,500 | 1 | EA | $68,800 | New | N/A | $14,900 | $15,000 | $90,000 | $15,000 | $11,250 | $12,500 | $15,000 | $7,500 | $27,000 | $276,950 | $69,238 | $346,188 | New Location. Dunnage, roof mods and connections |
| DOAS-2 Opt 1 | 12 | 2,600 | 1 | EA | $50,100 | New | N/A | $14,900 | $15,000 | $52,000 | $15,000 | $10,000 | $12,500 | $15,000 | $7,500 | $15,600 | $207,600 | $51,900 | $259,500 | New Location. Dunnage, roof mods and connections |
| DOAS-3 Opt 1 | 28 | 6,250 | 1 | EA | $66,750 | New | N/A | $14,900 | $15,000 | $93,750 | $30,000 | $15,625 | $12,500 | $15,000 | $7,500 | $37,500 | $308,525 | $77,131 | $385,656 | New Location. Dunnage, roof mods and connections |
| DOAS-4 Opt 1 | 28 | 6,250 | 1 | EA | $66,750 | New | N/A | $14,900 | $15,000 | $93,750 | $30,000 | $15,625 | $12,500 | $15,000 | $7,500 | $37,500 | $308,525 | $77,131 | $385,656 | New Location. Dunnage, roof mods and connections |
| DOAS-5 Opt 2 | 50 | 15,350 | 1 | EA | $215,000 | New | N/A | $14,900 | $15,000 | $184,200 | $15,000 | $38,375 | $12,500 | $15,000 | $7,500 | $92,100 | $609,575 | $152,394 | $761,969 | Included in Option 2, Priority 1 |
| ERU-2 | 30 | 7,800 | 1 | EA | $172,000 | R&R | $7,500 | $14,900 | N/A | $5,000 | $3,500 | $19,500 | $2,500 | $5,500 | N/A | N/A | $230,400 | $57,600 | $288,000 | Remove and Replace |

# XIII. APPENDIX D – DRAWINGS

Below is a compilation of drawings created by the design team to further describe and illustrate the required work. Both 11x17 and full size drawings are included for convenience. The drawings consist of:

Mechanical:

- M1.1: First Floor Plan Option 1 - Mechanical
- M1.2: First Floor Plan Option 2 - Mechanical
- M2.1: Second Floor Plan Option 1 - Mechanical
- M2.2: Second Floor Plan Option 2 - Mechanical
- M3.1: Third Floor Plan Option 1 - Mechanical
- M3.2: Third Floor Plan Option 2 - Mechanical
- M4.1: Roof Plan Option 1 - Mechanical
- M4.2: Roof Plan Option 2 – Mechanical

Structural:

- S1.1: Schematic Roof Dunnage Part Plan For Proposed RTU's (Option 1, Area A & B)
- S1.2: Schematic Roof Dunnage Part Plan For Proposed RTU's (Option 1, Area C)
- S1.3: Schematic Roof Dunnage Part Plan For Proposed RTU's (Option 1, Area D)
- S2.1: Schematic Roof Dunnage Part Plan For Proposed RTU's (Option 2, Area A & B)
- S2.2: Schematic Roof Dunnage Part Plan For Proposed RTU's (Option 2, Area C)
- S2.3: Schematic Roof Dunnage Part Plan For Proposed RTU's (Option 2, Area D)

# Glossary of Acronyms and Terms Related to HVAC

| Acronym / Term | Meaning |
|---|---|
| ACCU | Air Cooled Condensing Unit |
| AHU | Air Handling Unit. Some have air conditioning, some do not. |
| AHX | Active Heat Extractor, which is a type of AHU with air conditioning. |
| BMS | Building Management Systems (BMS) control and monitor the large energy consuming systems within a building, such as HVAC, lighting, fire and security systems. |
| BTU | The British thermal unit is a unit of heat; it is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. |
| CFM | Cubic Feet Per Minute, which is a measurement of airflow volume |
| DOAS | Dedicated Outdoor Air System, which is used for ventilation. |
| Dunnage | Roof dunnage provides structurally sound support and security for large and expensive items that are placed on rooftops. These structural supports are often made of steel and tied into cross beams or roof trusses. The equipment is then placed on top of the supports. |
| DX | Direct Expansion Cooling |
| ERU | Energy Recovery Unit |
| HVAC | Heating, Ventilation, and Air Conditioning |
| MAU | Makeup Air Unit, which is used to replace large volumes of air that is vented out. |
| MBH | Thousand BTU's per hour |
| RTU | Roof Top Unit |
| Taco | short for Taco Comfort Solutions, which is a brand of equipment |
| VFD | A variable frequency drive (VFD) is a type of motor controller that drives an electric motor by varying the frequency and voltage of its power supply. |
| VRF | Variable Refrigerant Flow (VRF) HVAC systems consist of outdoor units connected to multiple indoor units via refrigerant piping to provide cooling and heating to individual zones. |

# Bethel High School

Bethel High School Mechanical Upgrades Study
Board of Education Presentation
June 28, 2022 Meeting

KOHLER RONAN, LLC
CONSULTING ENGINEERS

# Kohler Ronan LLC

Engineering consultancy firm focused on delivering Mechanical, Electrical, Plumbing, Fire Protection, IT/AV/S and Commissioning solutions.

70 plus staff between CT and NYC offices.


# Outline of Meeting Discussion

- Review of scope of services
- Discussions
- Existing conditions
- Findings
- Building options
- Building priorities

# Scope of Services

Phase I – Feasibility and Master Plan (Complete)

- Meetings to further understand the project
- Conducted multiple field visits for site assessment
- Interview facilities staff
- Review of existing documentation
- Analyze 2 years of utility bills for capacity
- Analyze existing conditions to prepare for options
- Conduct load calculations for equipment sizing
- Prepared multiple options for review
- Present report to the committee
- Prioritized options based on available funding

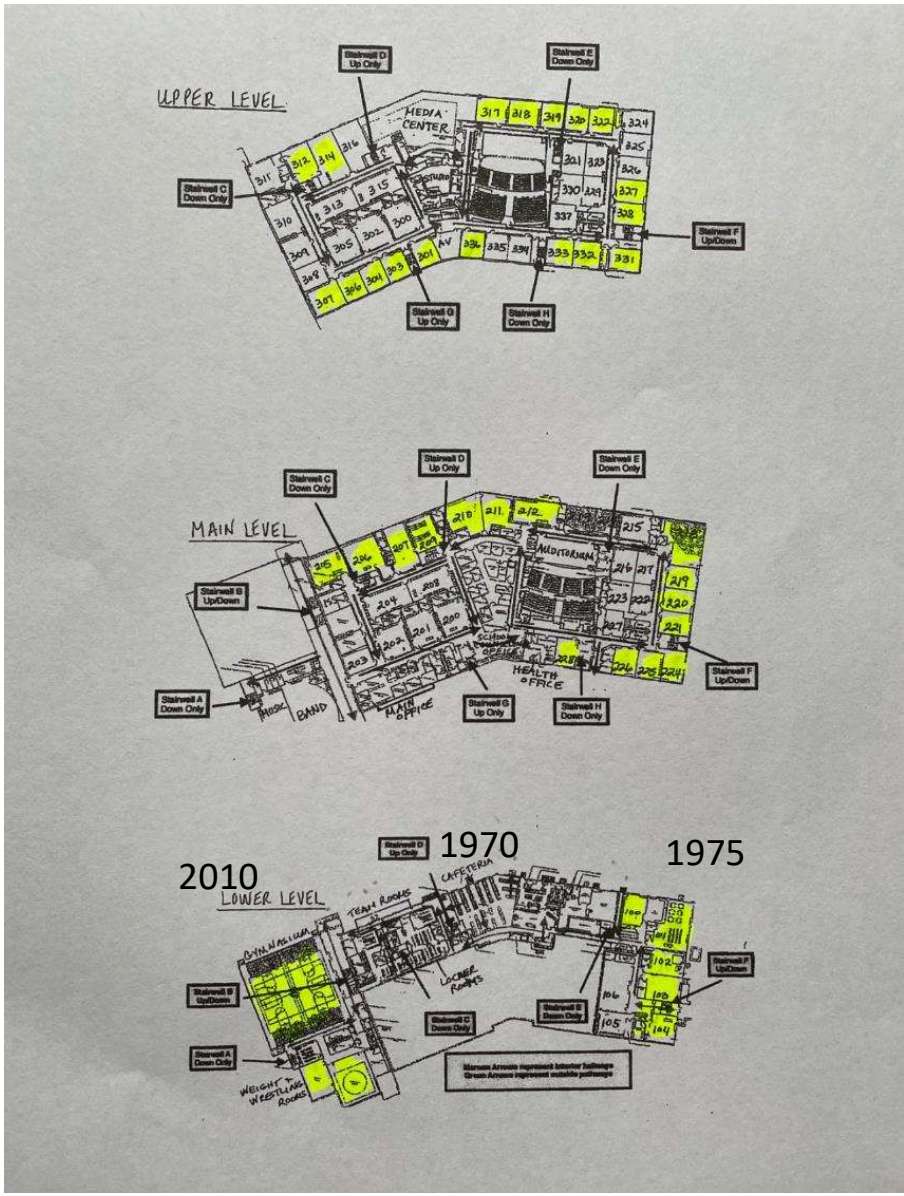
# Scope of Services

Phase II – Design and Construction Administration (Pending)

- Prepare design development and construction documents of selected priorities
- Update initial cost estimates
- Assist in bidding
- Perform basic construction administration
- Commission installed systems (CxA TBD)
- Prepare final punch list

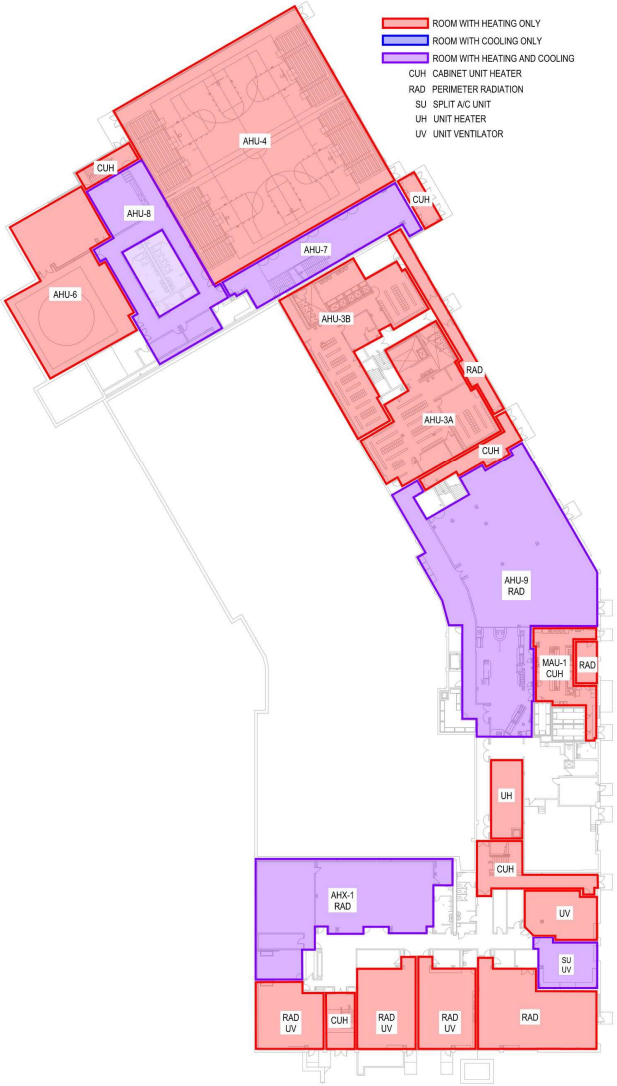
# Discussions
# What We Heard (Goals)

- Address areas without Air Conditioning
  - Classroom A/C
  - Athletic Facility A/C
- Gas service concerns
- Failed energy recovery
- Full building generator
- Dehumidification concerns
- Boilers recently replaced
- AHX-1 service issues
- Classroom units noisy
- Long term replacement
- Inadequate toilet exhaust
- Maintenance concerns
- Controls issues

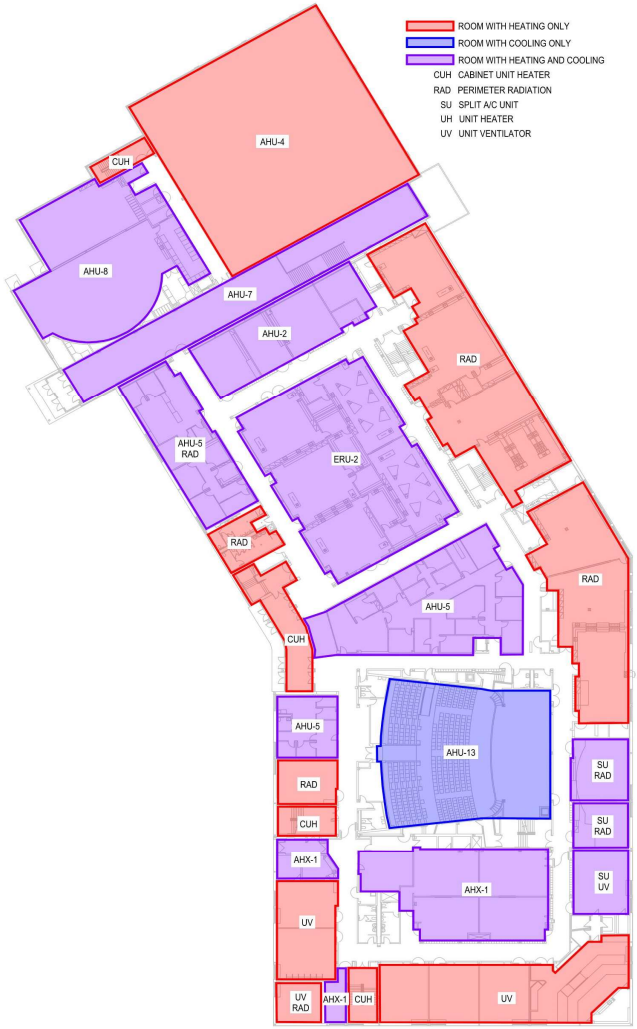


# Existing Conditions

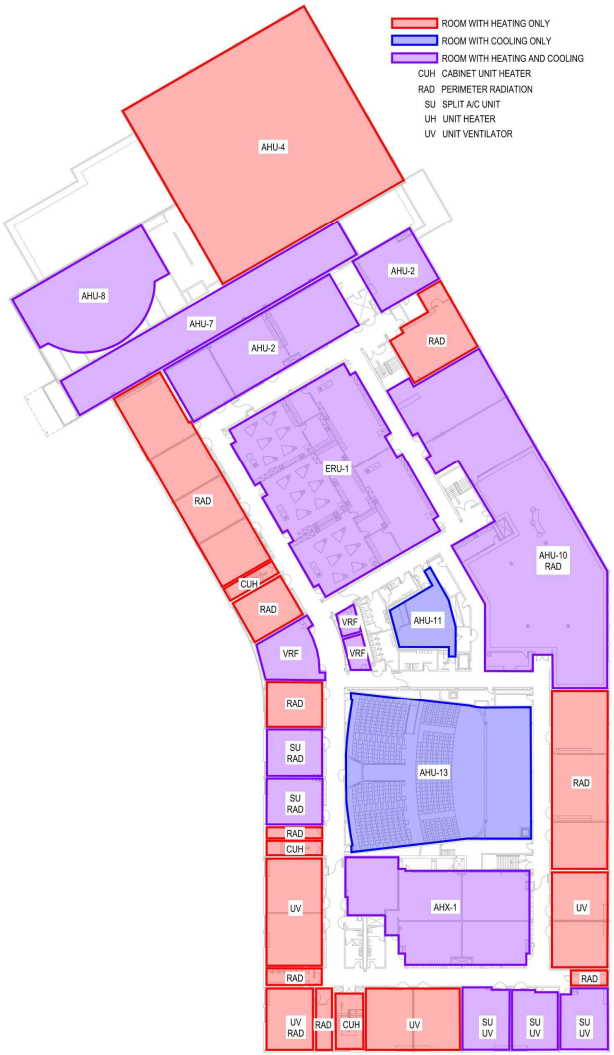
- Original 1970 building with additions in 1975 and 2007. Overall building has 3 floors
- Partially air conditioned by packaged rooftop units, rooftop split units, indoor air handler (AHU) with remote condensing units and miscellaneous mini-splits.
- Central boiler serves radiation, terminal units, unit ventilators, some rooftop units and indoor AHUs.
- Ventilation is provided by rooftop units, AHU's and unit ventilators.
- Over 40 misc. exhaust fans in various conditions
- Major addition/renovation in 2007 changed building classification from 2B to 2A. Designation made renovation challenging.
- Building DDC controls system
- Zoning for building consists of…..




First Floor Zoning




Second Floor Zoning




Third Floor Zoning

KOHLER RONAN

# Findings

- AHX-1
  - Installed in 1975.
  - Refurbished in 2007 and miscellaneous times after.
  - Located in rooftop penthouse.
  - Serves mostly interior classrooms of the 1975 wing.
  - Old unit but still has service life.
  - Original plenum return converted to ducted but many open grilles exist to ceiling cavity.
  - Supply and return ductwork in old plenum spaces not insulated.
- Issues:
  - Lack of capacity due to adjacent non-air-conditioned spaces.
  - Duct leakage.
  - Slightly undersized to achieve desired 72°F space temperatures.
- Recommendations:
  - Replace unit when budget allows.
  - Address misc. issues identified such as insulation and duct sealing.
  - Option 2 replacement recommended when Variable Refrigerant Flow (VRF) is installed in adjacent classrooms.

# Findings

- Classroom Air Conditioning
  - Units have either unit ventilators only, radiation only or combination of both.
  - Exhaust fans with ducts to classrooms are inconsistent. Some grilles capped above ceilings or not connected to duct.
  - Abandoned rooftop relief penthouses.
  - Unit ventilators are noisy. Do not comply with ANSI classroom sound standards.

- Issues:
  - Noise.
  - No air conditioning.
  - Lack of ventilation in some non-air-conditioned and air-conditioned spaces (mini-splits).
  - Tight conditions.

- Recommendations:
  - Option 1/Priority 1 and 2 with VRF and Dedicated Outside Air System (DOAS)

# Findings

- Athletic Area Air Conditioning
  - Heating and ventilating units only.

- Issues:
  - No air conditioning

- Recommendations:
  - Add air conditions
  - To be discussed in priorities

- Long Term Replacement of Units
  - Update or replace as funds allow
  - To be discussed in the priority section

# Findings (Miscellaneous)

Highlights:

- Lots of abandoned ducts from the 2007 renovation that were supposed to be removed.
- Direct opens to the exterior.  I.e., open louvers.
- Mold on ceiling tiles in kitchen area.
- No means of ventilation in corridors throughout.
- Natural gas issues to rooftop units.
- Plugged outside air louver to kitchen make up unit.
- Abandoned equipment on roof and above ceilings.
- Dead systems with controlled heating coils.
- Misc. exhaust ductwork capped above ceiling with plastic
- Some pneumatic control valves on radiation (nurses' area).
- Exhaust grilles located above ceilings, not in space served.
- Some plenum areas with PVC drain piping.
- Inoperable exhaust fans.
- AHU-8 open grilles in egress corridor.
- Windows too small for natural ventilation without operable exhaust.
- Fire proofing throughout

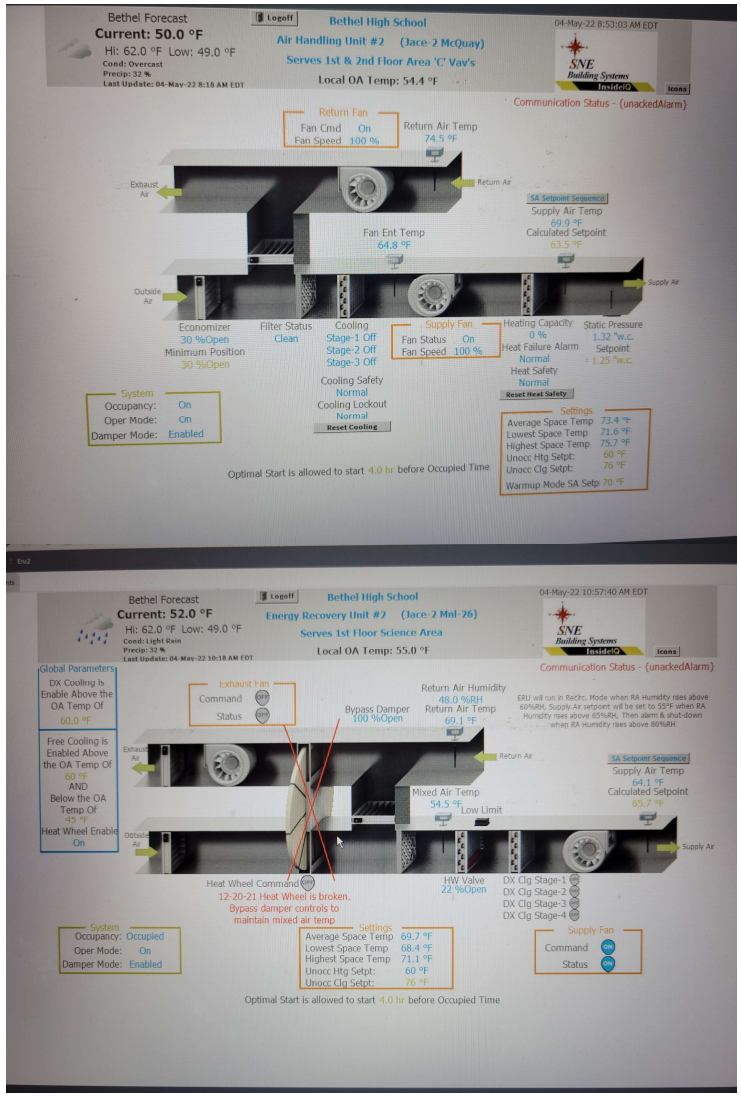

# Findings (Controls)

Highlights:

- Schneider Electric controls.
- Handles most of the major equipment
- Control conversions.
- Many variations in unit operations and sequences.
- Does not control:
  - Original exhaust fans (majority of fans)
  - Cabinet and unit heaters
  - Some radiation

Recommendations:

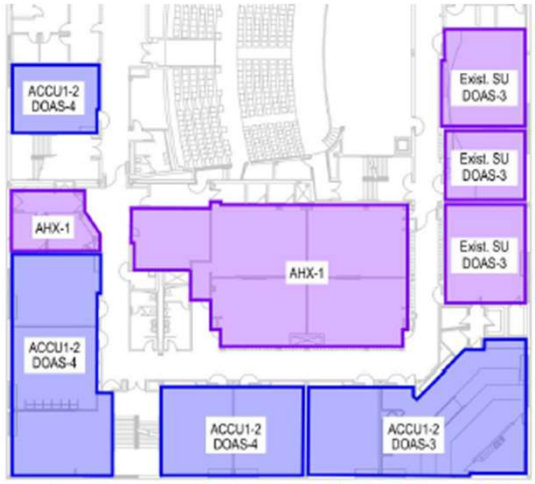
- Add all equipment not currently controlled by DDC system as they are replaced.
- Retro-commission all the controls
- Review and update all control sequences
- Update controllers as work proceeds



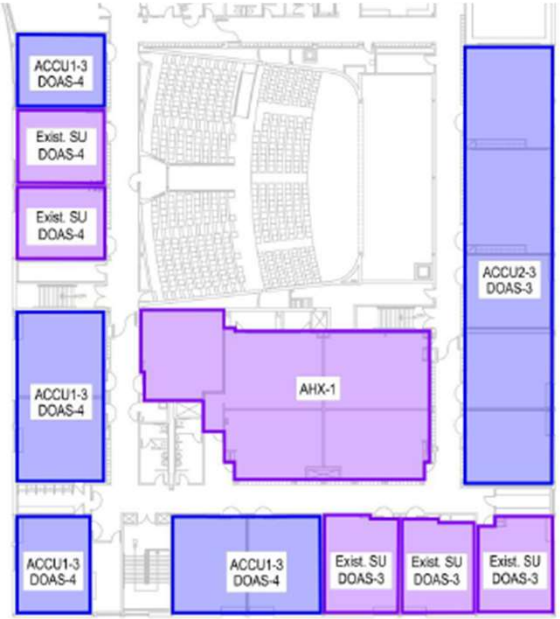
# Building Options (AHX-1)

Option 1:  Leave AHX-1 and provide DOAS and VRF to unconditioned classrooms


*Option 1 -  VRF Classrooms - First Floor (AHX-1 for Reference Only)*



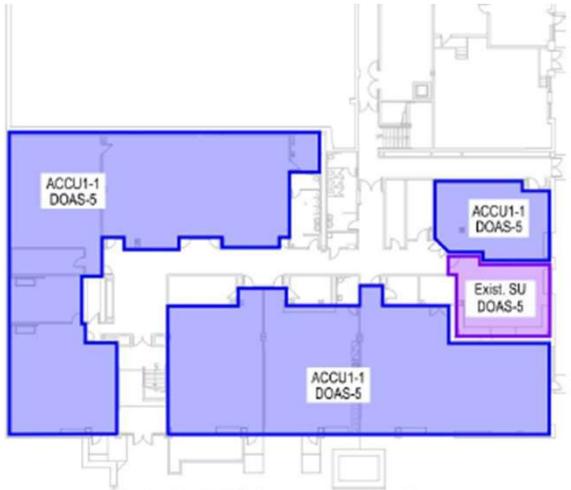

*Option 1  VRF Classrooms – Second Floor (AHX-1 for Reference Only)*



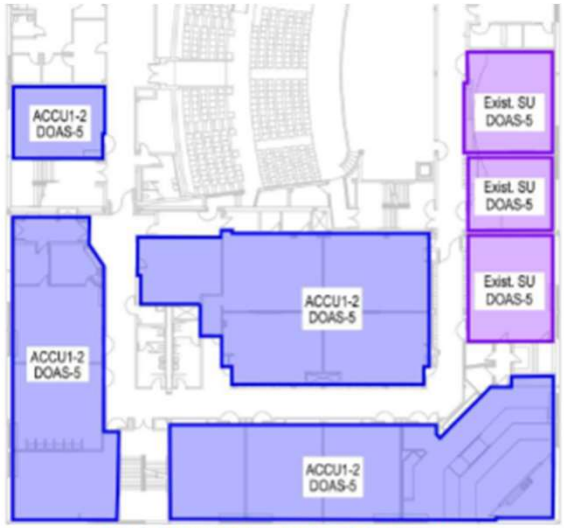

*Option 1  VRF Classrooms – Third Floor (AHX-1 for Reference Only)*

# Building Options (AHX-1)

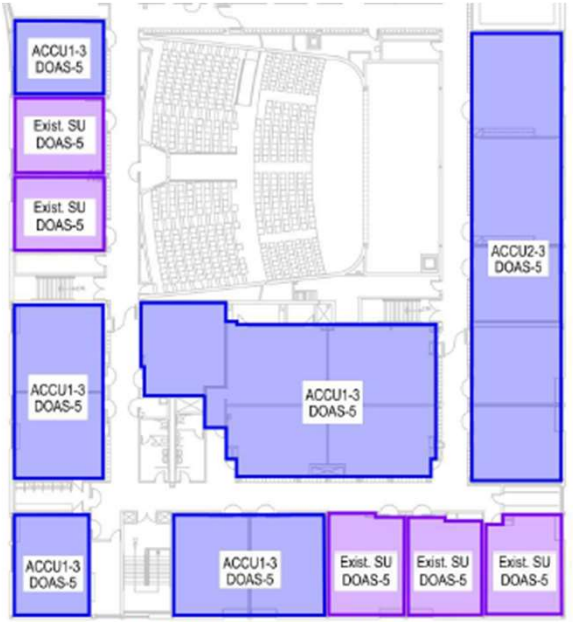
Option 2:  Replace AHX-1 with DOAS unit to serve entire 1975 wing.  Costly and not recommended as this is very disruptive.




*Option 2 All VRF Classrooms – First Floor*




*Option 2 All VRF Classrooms – Second Floor*




*Option 2 All VRF Classrooms – Third Floor*

# Building Options (AHU-2)

Option 1: Replace AHU-2 in kind. Add DOAS and VRF to remaining spaces


*Option 1- AHU-2 & VRF (ACCU3-3) – Third Floor*

Option 2: Increase size of AHU-2 and add new VAV zones


*Option 2 – Larger AHU-2 – Third Floor*

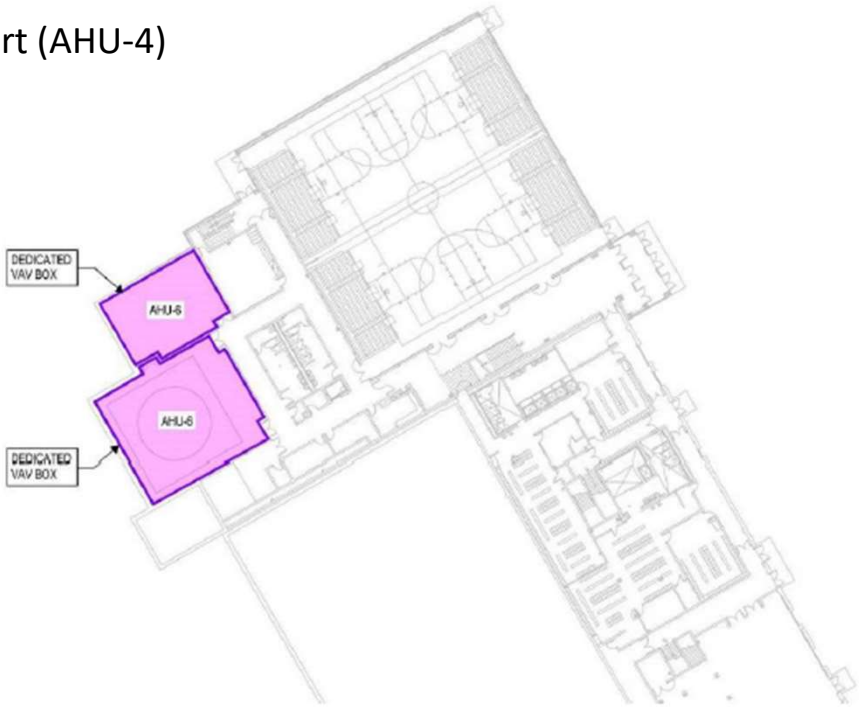
# Building Options (AHU-5)

Replace and AHU-5 in new location.
Upgrade unit for proper airflow.


*AHU-5 Proposed Correction – Second Floor*

# Building Options (AHU-6)

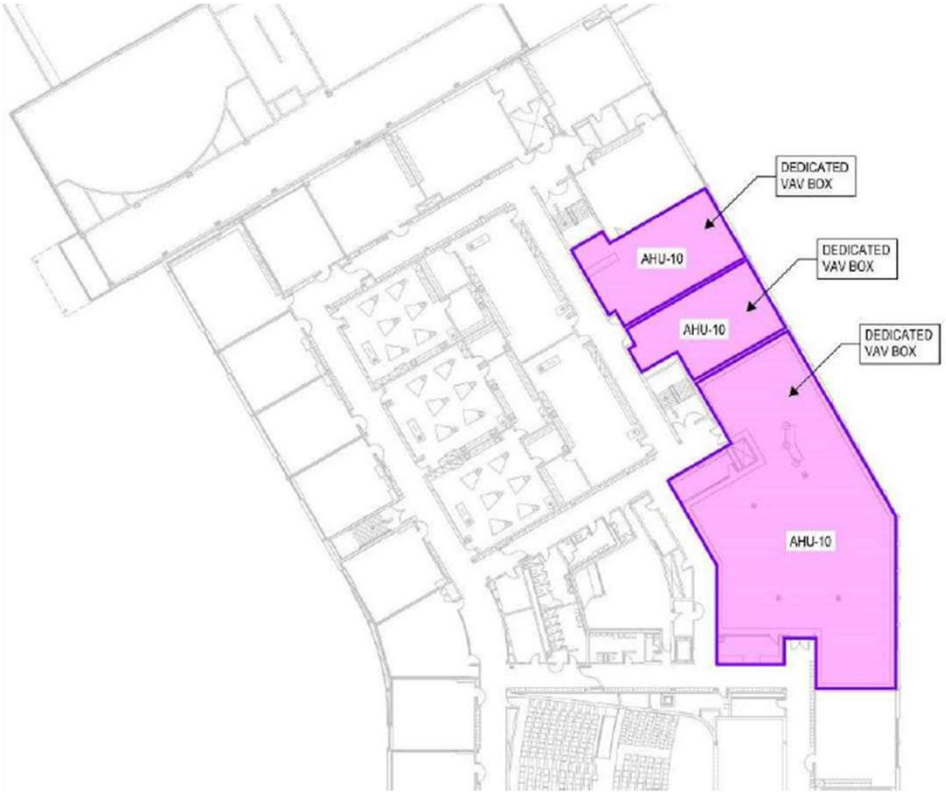
Replace AHU-6 in kind with additional cooling section.
Add VAV boxes to spaces.
Requires electric upgrades to support (AHU-4)




*AHU-6 Proposed Correction – First Floor*

# Building Options (AHU-10)

Replace AHU-10 in kind with VAV Rooftop Unit.
Add VAV boxes to spaces.




*AHU-10 Proposed Correction – Second Floor*

# Building Options (Art, Culinary and Science)

New 100% Outside Air Rooftop VAV Unit
(Not recommended)

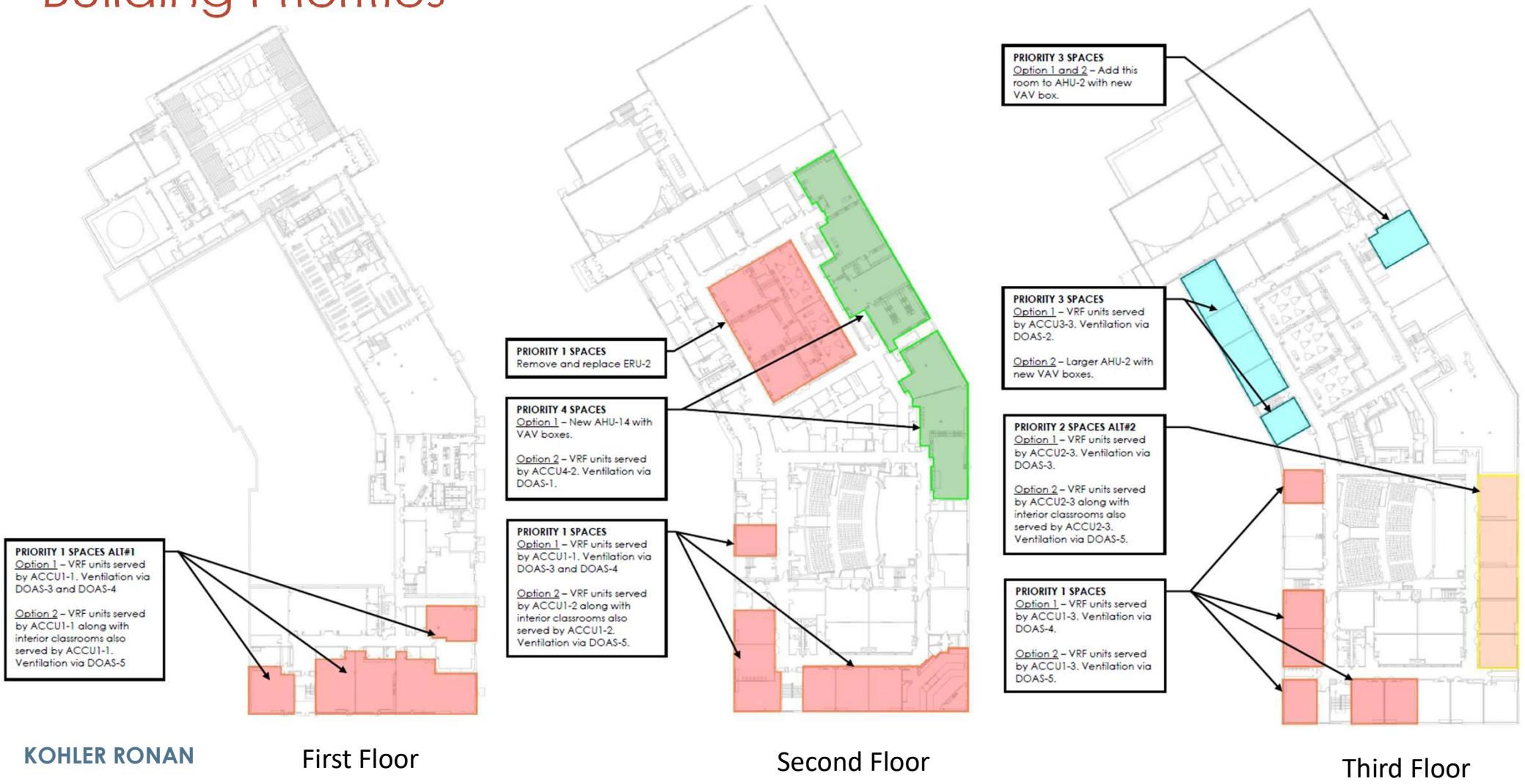

*Art, Culinary and Science Option 1 – Second Floor*

# Building Options (Art, Culinary and Science)

DOAS with VRF
(Recommended option)


*Art, Culinary and Science Option 1 – Second Floor*

# Building Priorities




KOHLER RONAN

First Floor

Second Floor

Third Floor

# Building Priorities

- Budget
  - Adding A/C to all classrooms and replacing ERU-2 ranges from $3.8M to $4.7M
  - Complete system upgrades range from $6.44M to $7.34M
- Constraints
  - $1.4 million initial grant.
  - $1.1 million available inclusive of design fees due to other obligations.
- Anticipated budget for Option 1/Priority 1 spaces
  - $1,365,460
  - Includes ERU-2, DOAS-4 and VRF for 14 classrooms on 2nd and 3rd floors in 1970 and 1975 building.
- Budget with Base and Alternate 1
  - $1,614,251
  - Includes 5 classrooms on first floor of 1975 wing.
- Budget with Base and Alternate 2
  - $2,063,888
  - Includes DOAS-3 and VRF for 5 classrooms on 3rd floor of 1970/1975 wing.
  - Adds ventilation air to classrooms served by mini splits.
- Total budget of base and alternates
  - $2,312,679
- Alternate Funding Options?

| Unit | Serves | Type | Manufacture | Flow CFM | Year | AGE | Condition | Expected Service Life Years | Expected Remaining Life Years | Estimated Reaplcement Cost | Priority | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAU-1 | Kitchen | Draw thru | McQuay | 5,000 | 2007 | 15 | Good | 25-35 | 10-15 | NA | LOW | Unit location difficult to service but serviceable |
| AHU-2 | CR's | Packaged RTU | McQuay | 9,300 | 2007 | 15 | Fair | 15-25 | 5-10 | $238,000-$309,000 | 6 | Two options to consider: Direct replacement or expanded service |
| AHU-3A | Boys Locker | Draw thru | McQuay | 4,000 | 2007 | 15 | Good | 25-35 | 10-15 | $86,010 | LOW | No work required unless AC wanted |
| AHU-3B | Girls Locker | Draw thru | McQuay | 4,000 | 2007 | 15 | Good | 25-35 | 10-15 | $86,010 | LOW | No work required unless AC wanted |
| AHU-4 | Gym | Packaged RTU | McQuay | 18,000 | 2007 | 15 | Good | 15-25 | 5-10 | $476,561 | 2 | **Cost includes electrical upgrades to support other unit replacements such as AHU-6 and 2. Do this unit first.** |
| AHU-5 | Admin | Packaged RTU | McQuay | 7,400 | 2007 | 15 | Poor | 15-25 | 3-5 | $511,258 | 4 | Unit has fan capacity and distribution issues. Ducts block access doors |
| AHU-6 | Wrestling | Packaged RTU | McQuay | 3,600 | 2007 | 15 | Good | 15-25 | 5-10 | $171,853 | 3 | No AC but unit in good condition |
| AHU-7 | Lobby | Packaged RTU | McQuay | 9,000 | 2007 | 15 | Fair | 15-25 | 5-10 | $237,990 | 7 | Service unit, clean coils and drain pan, condensation of gas burner. Noise concerns to corridor below |
| AHU-8 | Music | Packaged RTU | McQuay | 11,400 | 2007 | 15 | Fair | 15-25 | 5-10 | $234,596 | 7 | Service unit, clean coils and drain pan, some rusting internal. Noise concerns to corridor below |
| AHU-9 | Café | Packaged RTU | Trane | 16,000 | 1995 | 27 | Poor | 15-25 | 0 | NA | NOW | Currently being replaced |
| AHU-10 | Media Ctr | Packaged RTU | McQuay | 8,450 | 2007 | 15 | Fair | 15-25 | 5-10 | $222,789 | 8 | Service unit, clean coils and drain pan, some rusting internal. Duct insulation. Poor condition in report should be fair |
| AHU-11 | Studio | Packaged RTU | Trane | NA | 2007 | 15 | Poor | 15-25 | 5-10 | $84,468 | LOW | Reported unit does not function. Low priority to space utilization |
| AHU-13 | Auditorium | Packaged RTU | Trane | 24,000 | 1995 | 27 | Poor | 15-25 | 0 | NA | NOW | Currently being replaced |
| AHX-1 | Core CR's | Split draw thru | Trane | 9,200 | 1975 | 47 | Fair | 30-40 | 5-10 | $237,359 | 5 | Unit has been refurbished multiple times but should be replaced. Does provide AC but has distribution concerns. Depends on option selected. |
| ACCU-3 | AHX-1 | Packaged ACCU | McQuay | NA | 2007 | 15 | Fair | 15-25 | 5-10 | incl with AHX-1 | 5 | Replace with AHX-1 |
| ERU-1 | Science Lab | Packaged HRV | Venmar | 7,600 | 2007 | 15 | Fair | 20-25 | 5-10 | $288,000 | 8 | Report indicated poor but unit is fair condition and serviceable. Wheel life is less than unit life |
| ERU-2 | Science Lab | Packaged HRV | Venmar | 7,600 | 2007 | 15 | Poor | 20-25 | 0 | $288,000 | 1 | Energy recovery wheel failed. $85K to replace |
| ACCU-1 | ERU-1 | Packaged ACCU | McQuay | NA | 2007 | 15 | Fair | 15-25 | 5-10 | Incl with ERU-1 | 8 | Replace when ERU-1 replaced |
| ACCU-2 | ERU-2 | Packaged ACCU | McQuay | NA | 2007 | 15 | Fair | 15-25 | 5-10 | Incl with ERU-2 | 1 | Replace with ERU-2 |

| | |
|---|---|
| Good | Serviceable condition. No major work required |
| Fair | Minor issues but in serviceable condition |
| Poor | Has issues to address and should be considered for replacement |

# Building Priorities

- Cost Concerns
    - Prioritized on budget
    - Short window for work summers or breaks
    - Occupied school
    - Escalation
    - Equipment lead times
    - Phasing
    - Immediate needs
    - Some opportunities for economies of scale with alternates
    - ACM concerns (Floor tiles, caulking)
    - Fire proofing
    - Fire ratings


# Thank You