



23 0500 – Existing Building HVAC Systems Description

Designer Note: Equipment data noted below is based on a combination of sources: HMS asset lists provided by HMS on 10/27/2016, a spreadsheet provided by Siemens controls on 9/21/2016, and various Project documents pertaining to specific buildings and equipment. When utilizing existing building HVAC systems to serve areas of renovation or new work, the design Engineer must confirm which systems serve that area and that the heating, cooling and airside capacity is sufficient to support the design.

1. Armenise Building

- a. Heating: MATEP Steam to PRV station; Steam HW converters (D-HHC-0001, 0002) located in D1 basement. HW pumps (H-HWP-0001, 0002 & H-HWP-0003, 0004) located in D1 basement, 0001, 0002 are equipped with VFD's, 003/0004 do not have VFD's. Steam converter control valves are DDC with pneumatic actuation.
- b. Cooling: MATEP fed Chilled water coils: CHW pumps (DCHWP0001, 0002) located in D2 basement & serve AC-1, AC-2 & MUA-2 in link plus D2 FCU's - 775 GPM, 25 HP, Single VFD w/ switch, CHW deny valve is DDC w/ pneumatic actuator
- c. Process Condenser Water: (2) pumps on starters (?). Bypass valve, emergency city water supply controlled by pneumatic actuation by pressure.
- d. Controls: Siemens BACnet
- e. AHUs:
 - i. D-HAC-0013: AC-1; Installed 2012; Lab space ventilation, 100% OA; 20,000 CFM, 55F SAT, 7.6" TSP Design.
 - ii. D-HAC-0006: AC-2 / RAF-1; Installed 2012; Amphitheatre conditioned supply air with return air through RAF-1; 7,500 CFM, 55F SAT, 6.1" TSP Design.
 - iii. D-MUA-0001: MA-1; Installed 2012; Fume hood make up air, 100% OA, heating only; 12,000 CFM 55F SAT, 8.35" TSP Design
 - iv. D-HAC-0012: AHU-10; Installed 2004; 6th Floor Walker Labs make up air, 100% OA; 7,500 CFM, 55F SAT, 6.0" TSP Design.
 - v. D-HAC-0011: AC-3; Installed ???; Lab make up air, 100% OA; 7,500 CFM, 65F LAT (RESET?).
 - vi. D-HAC-0004: AC-4; Installed ???; Fourth Floor Lab make up air, 100% OA; 6,150 CFM, 68F LAT (RESET?).
 - vii. D-HAC-0005: AC-5; Installed ???; Fifth Floor Lab make up air, 100% OA; 6,880 CFM, 65F LAT (RESET?).
 - viii. DHAC-0009: Installed 1971; 4th Floor Link; 1,800 CFM.
 - ix. DHAC-0010: Installed 2014; 4th Floor Link; 1,835 CFM.



2. Building C

- a. Heating: MATEP Steam PRV; There are (2) 250 GPM hot water pumps located in the basement which provide year round hot water to the terminal units located throughout the building through a 4-pipe distribution system. Pumps are redundant where if one fails the other provides standby duty.
- b. Cooling: MATEP fed Chilled water coils; There are (2) 1,175 GPM chilled water pumps located in the basement which provide year round chilled water to the terminal units located throughout the building through a 4-pipe distribution system. Pump set is redundant where if one fails the other provides standby duty.
- c. Controls: Siemens
- d. AHUs:
 - i. AC-1: Installed 1988; Lab Ventilation: 100% OA, Single fan, preheat, CHW coil, humidifier. Provides ventilation to all C1 lab and non-lab spaces not served by other dedicated units; 25,000 CFM / 100% OA
 - ii. MUA-1: Installed 1988; Fume Hood Make Up Air: 100% OA, Single fan, preheat, CHW coil, humidifier. Provides make up air ducted directly to hoods in C1. Supply air does not enter the spaces; 23,000 CFM / 100%OA.
 - iii. AC-2: Installed 2012; Lab Ventilation: 100% OA, 4 fan array with VFD's, 100% OA, CHW coil, steam preheat, humidifier. Provides ventilation to all C2 lab and non-lab spaces not served by other units scheduled below; 25,000 CFM / 100% OA.
 - iv. MUA-2: Installed 2012; Fume Hood MUA: 100% OA, 3 fan array with VFD's, 100% OA, steam preheat, humidifier. Provides make up air ducted directly to hoods in C2. Supply air does not enter the spaces; 23,000 CFM / 100%OA
 - v. AC-3: Installed 1988; 114 Lecture Hall: Recirculating air handler, CHW coil, no heating coil, no humidification. Serves Lecture hall 114; 2,640 CFM SA / 528 CFM OA.
 - vi. AC-3: Installed 1988; 114 Lecture Hall: Recirculating air handler, CHW coil, no heating coil, no humidification. Serves Lecture hall 114; CV / Draw Through; 2,640 CFM SA / 528 CFM OA.
 - vii. AC-6: Installed 2001; Lab 672 ICCB Fume Hoods & Ventilation: 100% MUA, VFD, Steam F&B preheat, Steam humidification, Chilled water coil, Steam reheat, Sized for future expansion. Running at 2,800 CFM; 4,000 CFM / 100% OA.
 - viii. MUA-7: Installed 2002; Hood MUA, Room 609 Clardy: 100% MUA, VFD, STM Face & bypass preheat, Steam humidifier, CHW, STM Reheat; 4,000 CFM / 100% OA.
 - ix. AHU-1: Installed 1991; Lab 123 - Hogle Generator: 100% RA (no OA intake), CHW W/ Electric preheat & Electric humidification; 1,500 CFM / 100%RA.

3. Countway Library

- a. Heating: MATEP Steam PRV; There are (2) 600 GPM hot water pumps serving all connected hot water loads in the building (HW reheat coils & radiant panels). The pumps are redundant and operate in a lead/lag/standby sequence. Both pumps located in basement. No VFD's.



- b. Cooling: MATEP Chilled water; There are (2) 900 GPM chilled water pumps serving all connected chilled water loads (AHU's & FCU's). The pumps are redundant and operate in a lead/lag/standby sequence. Both pumps located in basement and are equipped with VFD's.
- c. Controls: Siemens
- d. AHU's:
 - i. AHU-1: Installed 1998; Supply Air to Building: Recirculating Unit, Single fan, CHW coil, humidifier. Provides supply air to VAV's on all floors; 55,000 CFM / 18,000 CFM OA / 50F LAT / 8.0" TSP, 4.0" ESP.
 - ii. AHU-2: Installed 1998; Supply Air to Building: Recirculating Unit, Single fan, steam preheat coil, CHW coil, humidifier. Provides supply air to VAV's on all floors; 55,000 CFM / 18,000 CFM OA / 50F LAT / 8.0" TSP, 4.0" ESP
 - iii. AHU-3: Installed 1998; Rare Books Unit: Recirculating Unit, Single fan, steam preheat coil, CHW coil, HW reheat coil, humidifier. Provides supply air to rare books area in Lower Level 2; 14,900 CFM / 3,000 CFM OA / 50F LAT / 7.16" TSP, 3.0" ESP.
 - iv. AHU-4: Installed 1998; Rare Books Unit: Recirculating Unit, Single fan, steam preheat coil, CHW coil, HW reheat coil, humidifier. Provides supply air to rare books area in Lower Level 2; 14,900 CFM / 3,000 CFM OA / 50F LAT / 7.16" TSP, 3.0" ESP
 - v. AHU-5: Installed 1998; Supply Air to 6th Floor: Recirculating Unit, Single fan, steam preheat coil, CHW coil. Provides supply air to portion of 6th Floor; 7,000 CFM / 1,400 CFM OA / 53 F SAT / 5.44" TSP, 3.0" ESP.

4. Goldenson Building

- a. Heating: MATEP Steam PRV; HW converter (B-HHC-0001) located in B1 basement. HW pumps (B-HWP-0001, 0002 & H-HWP-0003, 0004) located in B1 basement and are not equipped with VFD's. Steam converter control valve is DDC with pneumatic actuation.
- b. Cooling: MATEP Chilled Water; Building served by (2) CHW pumps w/ VFD's, BCHQP-0001,0002, 1,000 GPM, 100 FT head, 40 HP, CHW deny valve is DDC, based on history of design documentation the pumps were installed in 1986.
- c. Controls: Siemens



d. AHUs

- i. B-HAC-0001: Amphitheater, recirculating unit with mixing dampers, no RAF, preheat, CHW, 1 Fan with VFD, DDC; SAT Reset based on return air temp; Air is preheated to 50F by duct mounted coil prior to entering unit.
- ii. B-HAC-0004, AHU-4: Link Ventilation, 100% OA, preheat, CHW, (2) Fans, VFD; SAT Reset based on OA; Air is preheated to 50F by duct mounted coil prior to entering unit.
- iii. B-MUA-0010: Preheat coils for B-HAC-0001 & B-HAC-0004;
- iv. B-MUA-0001: North B2 MUA, 100% OA, heating only, 2 fans w/ VFD; 9,000 CFM, SAT Reset based on OA, 2.87" TSP.
- v. B-MUA-0002; South B2 MUA, 100% OA, heating only, 2 fans w/ VFD; 8,500 CFM, SAT Reset based on OA, 2.87" TSP.
- vi. B-MUA-0003: North B1 MUA, 100% OA, heating only, 2 fans w/ VFD; 6,700 CFM, SAT Reset based on OA, 3.05" TSP;
- vii. B-MUA-0004: South B1 MUA, 100% OA, heating only, 2 fans w/ VFD; 7,300 CFM, SAT Reset based on OA, 3.3" TSP.
- viii. B-AHU-0001, SF-1: North B2 Ventilation, 100% OA, preheat, CHW, (2) Fans, VFD; 6,300 CFM, SAT Reset based on OA.
- ix. B-HAC-0002, SF-2: North B2 Ventilation, 100% OA, preheat, CHW, (2) Fans, VFD; 5,200 CFM, SAT Reset based on OA.
- x. B-HAC-0010, SF-3: South B2 Ventilation, 100% OA, preheat, CHW, Reheat, 1 Fan, no VFD; 5,000 CFM, SAT set point = 55F.
- xi. B-HAC-0005, SF-5; North B1 Ventilation, 100% OA, preheat, CHW, (2) Fans, VFD; 6,300 CFM, SAT = 70F.
- xii. B-HAC-0006, SF-6: South B1 Ventilation, 100% OA, preheat, CHW, (2) Fans, VFD; 9,400 CFM, SAT = 68F.
- xiii. B-HAC-0008: Micro Lab 117 - Recirculating unit, no preheat, mixing box, DX cooling with adjacent water cooled condenser; Constant Volume.

5. Gordon Hall

- a. Heating: MATEP Steam PRV; Hot water provided to fan coil units and VAV reheat coils by heat exchanger A-HHC-001 and HW pumps A-HWP-0001,0002 located in basement MER 003U.



- b. Cooling: MATEP Chilled water; Chilled water provided to AHU's and fan coil units by CHW pumps A-CWP-0001,0002 located in basement MER 004. Pumps in good condition. (1) VFD installed to serve both pumps. 570 GPM, 60 FT, 20 HP. Deny valve is DDC. Controls are DDC.
- c. Controls: Siemens, DDC
- d. AHUs
 - i. A-HAC-0010 / AHU-10: Installed 2007; Basement & First Floor VAV terminals, supply & return fans with mixing box and economizer control; VAV
 - ii. AHU-2: Installed 1984; Suite 111 air handling system with supply & return fans and mixing box, cooling only (no heating coil); 4,000 CFM; VAV..
 - iii. AHU-3: Installed in 1978; Suite 213 air handling system with supply fan and mixing box, cooling only (no heating coil); CV Draw through; 4,000 CFM; CV draw through.
 - iv. AHU-7: Installed 1984; Suite 206 air handling system with supply fan and cooling only (no heating coil); 1,450 CFM; CV draw through.
 - v. AHU-8: Installed 1984; Suite 206 air handling system with supply fan and cooling only (no heating coil); 1,450 CFM; CV draw through
 - vi. AHU-13: Replaced in 2014?? (confirm); Suite 210 air handling system with supply fan and mixing box, cooling only (no heating coil); CFM unknown; VAV.
 - vii. HAC-0005: Installed in 1998; 100% ventilation air to spaces served by FCU's, steam PH, CHW coil; 2,000 CFM. CV draw-through.
 - viii. HAC-0006: Installed 1988; 100% ventilation air to spaces served by FCU's (Deans suite, conf rm and 3rd floor offices), steam PH, CHW coil; CV draw through.
 - ix. HAC-0001: Installed in 2001; Atrium skylight air handling system with supply fan and cooling only (no heating coil), mixing box; CV draw through.
 - x. HAC-0002: Installed in 2001; Atrium skylight air handling system with supply fan and cooling only (no heating coil), mixing box; CV draw through.

6. Harvard Institutes of Medicine (HIM)

- a. Heating: MATEP Steam PRV; Hot water provided to fan coil units and VAV reheat coils by heat exchanger and 2 redundant pumps. 2 additional pumps dedicated to vivarium reheat loop.



- b. Cooling: MATEP Chilled water fed to fan coil units by 2 redundant pumps; AHU coils fed by 2 redundant pumps.
- c. Process cooling tower (80 tons??): serves process condenser water closed loop, 2 redundant pumps.
- d. Controls: JCI BAS with Phoenix Lab Controls (original vintage).
- e. AHUs
 - i. AHU-1-4 and EAHU-1-4: two tunnels (A&B sides) per supply and exhaust unit @ 45,000 cfm each (90,000 cfm / unit); 100% outside air AHU's with glycol heat recovery loop, LP steam preheat and humidifier, chilled water cooling.
 - ii. AHU-5&6: Serves Vivarium; 37,500 cfm each with glycol heat recovery loop, steam preheat and humidifier, chilled water cooling.

7. Laboratory for Human Reproduction and Reproductive Biology (LHRRB)

- a. Heating: MATEP steam to PRV station; There are (2) 200 GPM hot water pumps located in the basement which provide year round hot water to the terminal units located throughout the building through a 4-pipe distribution system. Pumps are redundant where if one fails the other provides standby duty.
- b. Cooling: MATEP Chilled water; There is (1) 780 GPM chilled water pump serving AC units. and (1) 488 GPM CHW pump providing year round chilled water to the terminal units located throughout the building through a 4-pipe distribution system. Both pumps located in basement and are equipped with VFD's.
- c. Process Cooling Loop: Two (2) 83 ton process condenser water closed-loop cooling towers located on the roof (one replaced in 2012). (2) Redundant pumps; Plate and frame heat exchanger (90 tons, Installed 2016) utilizes chilled water for backup/redundancy.
- d. AHUs
 - i. AC-1: Installed 1996; Lab Ventilation: 100% OA, Single fan, preheat w F&B, CHW coil, humidifier. Provides ventilation to all labs on floors 1 through 5; CV / Draw Through; 16,000 CFM / 100% OA / 55F LAT / 3.5" TSP, 1.25"ESP.
 - ii. AC-3: Installed 1996; Lab Ventilation: 100% OA, Single fan, preheat w F&B, CHW coil, humidifier. Provides ventilation to all labs on floors 1 through 5; CV / Draw Through; 16,000 CFM / 100% OA.
 - iii. HV-1 / MAU-1: Installed 1996; Lab MUA: 100% OA, Single fan, preheat w F&B, humidifier. Provides ventilation to all labs on floors 1 through 5; CV / Draw Through; 12,000 CFM / 100% OA / 60F LAT (heating only) / 2.5" TSP.



- iv. AC-4: 6th Floor Lab Ventilation: 100% OA, Single fan, preheat, w F&B CHW coil, humidifier. Provides ventilation to all of the 6th Floor; CFM unknown.
 - e. Backup process water plate and frame heat exchanger: utilizes MATEP chilled water as heat rejection source from process loop. Manual changeover valves.
8. New Research Building (NRB)
- a. Heating: MATEP steam fed to PRV station; heat exchangers serve 3 separate pumped loops throughout the building (2 pumps serve Lab VAV reheat loop, 2 pumps serve perimeter radiation, and 2 pumps serve Vivarium Vav reheat loop).
 - b. Cooling: Chiller Plant located in sub-basement consists of (2) 2,000 ton and (1) 600 ton centrifugal chillers. (2) 1200 gpm and (3) 4,000 gpm pumps distribute to AHU coils and FCU's. (5) 873 ton Roof mounted cooling towers.
 - i. Plate and Frame heat exchanger utilizes winterized cooling towers that bypass chillers for free cooling of chilled water loop.
 - c. Process cooling: 150 ton closed loop process chiller and (2) pumps distributes 85 degree condenser water to all floors.
 - d. Controls: Siemens BAS with Phoenix Lab Controls
 - e. AHUs
 - i. AHU-1: located in 4th floor MER, service to Vivarium, 80,000 cfm.
 - ii. AHU-2: located in 4th Floor MER; service to Vivarium; 48,000 cfm.
 - iii. AHU-3: located in 4th Floor MER; Service to Lab floors; 105,000 cfm.
 - iv. AHU-4: located in 4th Floor MER; Service to Lab floors; 105,000 cfm.
 - v. AHU-5: located in Penthouse; Service to Lab floors; 90,000 cfm.
 - vi. AHU-6: located in Penthouse; Service to Lab floors; 90,000 cfm.
 - vii. AHU-7: located in Penthouse; Service to Lab floors; 95,000 cfm.
 - viii. AHU-8: located in Penthouse; Service to Lab floors; 75,000 cfm.
 - ix. AHU-9: located in Penthouse; Service to Lab floors; 75,000 cfm.
 - x. AHU-10. Capacity XX CFM: Mixed air unit. Electronic actuation. Chilled water coil. Reheat (LPS). Supply fans (2) on VFD's.
 - xi. AHU-11. Capacity XX CFM: Mixed air unit. Electronic actuation. Chilled water coil. Reheat (LPS). Supply and Return fans on VFD's.
 - xii. AHU-12. Capacity XX CFM: Mixed air unit. Electronic actuation. Chilled water coil. Reheat (LPS). Supply and Return fans on VFD's.
 - xiii. AHU-14. Capacity XX CFM: Return air unit. Electronic actuation. Chilled water coil. No heat.
 - xiv. AHU-15. Capacity XX CFM: Return air unit. Electronic actuation. Chilled water coil. No heat.
 - xv.



f. Exhaust AHUs

- i. EAHU-1: located in Penthouse; service to Vivarium; 80,000 cfm.
- ii. EAHU-2: located in Penthouse; service to Vivarium; 48,000 cfm.
- iii. EAHU-3: located in Penthouse; Service to Lab floors; 105,000 cfm.
- iv. EAHU-4: located in Penthouse; Service to Lab floors; 105,000 cfm.
- v. EAHU-5: located in Penthouse; Service to Lab floors; 90,000 cfm.
- vi. EAHU-6: located in Penthouse; Service to Lab floors; 90,000 cfm.
- vii. EAHU-7: located in Penthouse; Service to Lab floors; 95,000 cfm.
- viii. EAHU-8: located in Penthouse; Service to Lab floors; 75,000 cfm.
- ix. EAHU-9: located in Penthouse; Service to Lab floors; 75,000 cfm.

9. Seeley G Mudd

- a. Heating: MATEP steam fed to PRV station; There are (2) 415 GPM Glycol HW pumps located in the basement which provide year round hot water to AHU-1,2 and MUA 4&5. Pumps are redundant where if one fails the other provides standby duty.
- b. Cooling: MATEP chilled water; There is a new 370 CHW pump serving AHU's and (1) 450 GPM CHW pump providing year round chilled water to the terminal units located throughout the building through a 4-pipe distribution system. Both pumps located in basement and are equipped with VFD's.
- c. Controls: Siemens
- d. AHUs
 - i. AHU-1: Installed 2012; Lab Ventilation: 100% OA, Plenum fans, HW preheat, CHW coil, humidifier. Provides ventilation to most spaces; CV / Draw Through; 30,000 CFM / 100% OA / 55F LAT / 6.0" TSP, 3.00"ESP.
 - ii. AHU-2: Installed 2013; Lab Ventilation: 100% OA, Plenum fans, HW preheat, CHW coil, humidifier. Provides ventilation to most spaces; CV / Draw Through; 30,000 CFM / 100% OA / 55F LAT / 6.0" TSP, 3.00"ESP.
 - iii. AHU-4: Make up Air: 100% OA, Cent Fan, Preheat, CHW coil, Steam Humidifier; CV Draw Thru. DDC w/ pneumatics
 - iv. AHU-5: Make up Air: 100% OA, Cent Fan, Preheat, CHW coil, Steam Humidifier; CV Draw Thru. DDC w/ pneumatics
 - v. MA-6: Make up Air: 100% OA, Cent Fan, Preheat, CHW coil, Steam Humidifier; CV Draw Thru. DDC w/ pneumatics
 - vi. AHU-8: Make up Air: 100% OA, Cent Fan, Preheat, CHW coil, reheat coil, Steam Humidifier; CV / Draw Through.



- vii. AHU-9: Lab 606 Ventilation: 100% OA, Plenum fans, HW preheat, CHW coil, reheat coil, humidifier. Provides ventilation to Lab 606; CV / Draw Through preheat / Blow through CHW & Reheat.

10. Tosteson Medical Education Center (TMEC)

- a. Heating: MATEP steam fed to PRV station; Hot water is delivered to VAV reheat coils using a shell and tube heat exchanger (HX-2) and pump P-7, with DDC control valves. Hot water is delivered to radiation systems using a shell and tube heat exchanger (HX-1) and pump P-5, with pneumatic control valves. Neither of these pumps are equipped with VFD's. The two systems maintain minimum flow in the system using a differential pressure bypass control.
- b. Cooling: MATEP Chilled Water; There is (1) chilled water pump with VFD located in the link basement delivering chilled water from the MATEP supply & return mains to AHU chilled water coils in the building, return valve has pneumatic actuator. CWP-0001, 0002 (175 GPM, 40 FT, 5 HP) are located in basement #027A and provide CHW to fan coil units, return valve is DDC. In 2009 A fourth pump (65 GPM, 50 FT) was installed in room #004 to serve the supplemental CHW coils in Fourth Floor Gross Anatomy suite.
- c. Controls: Siemens
- d. AHUs:
 - i. AC-1 (HAC-0007): Installed 1991; Supply air to VAV Terminals serving Southern half of building. Including 50% of 4th Floor Gross Anatomy; VAV; 90,000 CFM / Supply TSP = 7.3" / Return TSP = 3.5".
 - ii. AC-2 (HAC-0008): Installed 1991; Supply air to VAV Terminals serving Northern half of building. Including 50% of 4th Floor Gross Anatomy and the basement Morgue; VAV; 90,000 CFM / Supply TSP = 7.3" / Return TSP = 3.5".
 - iii. AC-3 (HAC-0009): Installed 1991; Serves core atrium area. Also capable of 100% outside air and exhaust for smoke control. Refer to color coded drawings for areas served; CV; 30,000 CFM / Supply TSP = 3.5" / Return TSP = 1.5".
 - iv. HAC-0001 (AHU-1): Installed 2013; 100% OA ventilation for spaces served by FCU's; VAV; 3,600 CFM, TSP= 5.75".
 - v. HAC-0002 (AHU-2): Installed 2013; 100% OA ventilation for spaces served by FCU's; 3,300 CFM, TSP= 5.75".
 - vi. HAC-0003: Installed 2011??; 100% OA ventilation for spaces served by FCU's. Refer to AHU zoning plans for area covered; VAV; 6,000 CFM.



- vii. HAC-0004: Installed 2011??; Amphitheater. Recirculating system with supply fan, return fan and mixing box with economizer dampers & exhaust; VAV; 6,230 CFM, 4.0" TSP.
- viii. MUA-0001: Installed 1991; Booster fan provides fresh air to basement AHU's; VAV with controllable pitch blades; CFM unknown.

11. Vanderbilt Hall

- a. Heating: MATEP steam fed to PRV station. (4) steam to hot water Hex's.
- b. Cooling: MATEP Chilled Water; Chilled Water System: Pneumatic Control and actuation. (2) Deny valves. (2) Pumps on VFD's. (2) Pumps on starters
 - i. IT Department Chilled Water System: Pneumatic control and actuation. DP sensors. (2) Pumps on staged VFD's; CHW deny vlv pneumatic control, dp sensor, (2) staged pumps on VFDs.
- c. Building uses a two pipe changeover System that serves FCU and AHU coils through the same piping distribution loop.
- d. Controls: Siemens
- e. AHUs:
 - i. AHU-1. Capacity XX CFM: Mixed air unit. Preheat (HW) electronic control. Chilled water pneumatic control. Supply and return fans on starters.
 - ii. AHU-2. Capacity XX CFM: Mixed air unit. Preheat (HW) pneumatic control. Chilled water pneumatic control. Supply and return fans on starters.
 - iii. AHU-3. Capacity XX CFM: Mixed air unit. Preheat (HW) pneumatic control. Chilled water pneumatic control. Supply and return fans vanes on pneumatic control.
 - iv. AHU-5. Capacity XX CFM: 100% outside air unit. Bypass damper electronic control. DX cooling 2 stages. Reheat (LPS). Fan on VFD.

12. Warren Alpert Building (WAB)

- a. Heating: MATEP steam to PRV station; serves (3) shell and tube heat exchangers;
 - i. HX-1 Radiation: (2) Steam supply valves pneumatic control. (2) Pumps on starters. Bypass valve electronic actuation;
 - ii. HX-2 Animal: (2) Steam supply valves pneumatic control. (2) Pumps on starters. Bypass valve pneumatic actuation.
 - iii. HX-3 Lab Reheat: (2) Steam supply valves pneumatic control. (2) Pumps on starters. Bypass valve pneumatic actuation.
- b.



- c. Primary Cooling: MATEP chilled water with two redundant pumps located in basement serving FCU coils and AHU coils. Change-over piping arrangement for parallel local chiller plant.
 - d. Chiller Plant: Used during peak season; Four (4) 400 ton Rooftop Air cooled chillers (1600 tons total). Three (3) chilled water pumps in penthouse.
 - e. Process Cooling loop: Also serves Mudd, and C-building; One (1) 50 ton process condenser water closed loop cooling tower with two redundant pumps; Tower replaced in 2014. Plate and frame heat exchanger (2014) of same capacity utilizes chilled water for backup/redundancy.
 - f. Controls: Siemen BACnet.
 - g. AHUs: AHUs: 100% outside air AHU's with glycol heat recovery, steam preheat and humidifiers, chilled water cooling coils.
 - i. AHU-1-4 and EAHU-1-4: Renovated in 2016, serve Labs 4 supply and exhaust units in penthouse; 70,000 cfm each.
 - ii. AHU-5&6 and EAHU-5&6: serves vivarium; Renovated in 2017, 2supply units in basement, 2 exhaust units in penthouse; 23,000 cfm each.
 - iii. EAHU-1-6 exhaust fans replaced with fanwall (Huntair) in 2016. Each fan has VFD. Each unit has a harmonic filter.
 - h. Vivarium in basement (served by AHU-5&6 and EAHU-5&6)
 - i. Heat Recovery System: AHU/EAHU pumped glycol heat recovery system; (2) Pumps on starters. Mixing valve pneumatic control.
13. 158 Longwood Avenue: No information available.
14. 160-164 Longwood Avenue: Local Chillers, Local Boilers, Energy Recovery Unit, No further information available.
15. 180 Longwood Avenue:
- a. Heating: MATEP fed Steam PRV;
 - i. HX-1: Steam HEX. Pneumatic actuation. Outside air temperature controlled. Pumps on VFD's.
 - ii. HX- 2/3 ARC: High pressure steam HEX. Pneumatic actuation. Line TE controlled with reset by outside air temperature. Pumps staged on starters. DP sensor and bypass valve regulate pressure



- b. Cooling: MATEP fed Chilled water coils. AHU Chilled Water: Pneumatic actuation. Pumps on VFD's with staged control; FCU Chilled Water: Pneumatic actuation. DP. Pumps on VFD's.
- c. Controls: Siemens
- d. AHUs:
 - i. AHU-1. Capacity XX CFM: 100% Outside air unit, McQuay packaged unit. Preheat (LPS) control not on graphic. Mechanical cooling 2 staged compressors.
 - ii. AHU-2. Capacity XX CFM: 100% Outside air unit. Pneumatic actuation. Preheat (LPS) face and bypass. Chilled water coil. Fan on starter (?).
 - iii. AHU-4. Vivarium; Capacity XX CFM: Mixed air unit. Electronic actuation. Preheat (LPS). Chilled water coil. Humidifier is shut down and said not to be used.
- e. Special: Data Center served by two (2) 10 ton DX Liebert Units.
- f. New Emergency generator and Fuel storage system (Installed 2016).

16. 641 Huntington Avenue

- a. Heating: Steam Boiler System: Electronic actuation. 2 city water feed valves. 2 condensate pumps on starters. Hot Water System: DP sensor. (2) Pumps on VFD's.
- b. Cooling: MATEP chilled water: Electronic actuation. Outside air temperature enabled. DP control with bypass valve. (2) Pumps on VFD's.
- c. Controls: Siemens.
- d. AHUs: No information available.

17. School of Dental Medicine

- a. Heating
 - i. HX-1: Steam HEX. Pneumatic control. Bypass valve. (2) Staged pumps on starters.
 - ii. 2nd Floor Radiation: Electronic mixing valve. (2) staged pumps on starters.
 - iii. HX-3: Steam HEX. Pneumatic control and actuation. Steam supply valves two position. Isolation valves. (2) pumps on starters
- b. Cooling: MATEP chilled water; (2) pumps on VFDS; Deny valve; pneumatic control.
- c. Controls: Siemens.



d. AHUs:

- i. AHU-1. Capacity XX CFM: Mixed air unit. Pneumatic control. Preheat (LPS). Chilled water coil. Supply and return fans on VFD's.
- ii. AHU-2. Capacity XX CFM: Mixed air unit. Pneumatic control. No heat. Chilled water coil. Supply and return fans on VFD's.
- iii. Malony AHU. Capacity XX CFM: Mixed air unit. Preheat (HW) electronic. Chilled water control not shown. Unit temperature controlled. Fan on starter.

18. Research and Education Building (REB)

- a. Heating: MATEP steam fed PRV; There are (2) 175 GPM hot water pumps serving all connected hot water loads in the building (HW radiation, radiant panels, reheat coils). The pumps are redundant and operate in a lead/lag/standby sequence. Both pumps located in basement and are equipped with VFD's.
- b. Cooling: MATEP Chilled water; There are (2) 600 GPM chilled water pumps serving all connected chilled water loads (AHU's & FCU's). The pumps are redundant and operate in a lead/lag/standby sequence. Both pumps located in basement and are equipped with VFD's.
- c. Controls: Siemens with Phoenix Lab Controls.
- d. AHUs
 - i. AHU-1: Installed 2004; Lab Ventilation: 100% OA, Single fan, heat recovery / preheat coil, CHW coil, and humidifier. Provides ventilation to all labs on floors 3 through 5; CV / Draw Through; 45,000 CFM / 100% OA / 55F LAT / 8.0" TSP, 3.0" ESP; Connected to AHU-2 for redundancy.
 - ii. AHU-2: Installed 2004; Lab Ventilation: Recirculating, Single fan, heat recovery / preheat coil, CHW coil, humidifier. Provides supply air to all office spaces on floors 1 through 5. Capable of 100% OA capacity to provide redundancy for lab ventilation (AHU-1); CV / Draw Through; 45,000 CFM / 100% OA / 55F LAT / 8.0" TSP, 3.0" ESP; Connected to AHU-1 for redundancy.
 - iii. HVU-1: Installed 2004; Smoke Control: 100% OA, Single fan, heat recovery / hot water preheat. Provides smoke control for stairwell vestibule.
 - iv. EAHU-1: Lab Exhaust and Heat Recovery: 100% Exhaust, Single fan, heat recovery coil. Recovers heat from exhaust air for OA intake preheat at AHU-1 & AHU-2; CV / Draw Through; 40,000 CFM / 100% OA / 55F LAT / 6.0" TSP, 3.0" ESP.