GENERAL:

1. This section provides criteria for the design and installation of air handling units.

DESIGN GUIDELINES:

Design General

1. Location
   1.1. For new construction, and existing buildings where possible, locate all air handling units inside the building or in a penthouse. Rooftop locations and above ceiling locations are not permitted without approval from campus Project Manager.
   1.2. Exterior units will be designed specifically for outdoor installation. All piping will be within the unit enclosure.
   1.3. Where exterior equipment is to be located above a roofing system, adequate space shall be provided below equipment to allow for roof maintenance as specified by NRCA Roofing Manual. Avoid multiple rooftop penetrations. Permanent stairs are required for access to unit for any units 18" or more above the roof.
   1.4. Vibration and sound transmission from mechanical equipment will not exceed ASHRAE sound criteria.

2. Coils
   2.1. All coils shall be piped counterflow and be drainable.
   2.2. Coils shall be a maximum of 10 rows and a maximum of 10 fins/in. Eight (8) row coils are preferred, ten (10) rows are allowed due to higher ΔT and/or improved filtration or other air cleaning technology. For MUHC projects, refer to the Supplemental Design Guidelines.
   2.3. When the coil selection requires more than a 10 row coil, designer shall provide 2 independent coils with an access section with doors in between the coils.
   2.4. Cooling coils shall be selected for a 45°F entering water temperature and a 15°F ΔT. See "237000 AHU Chilled Water Coil Piping Detail" provided in this Division of the CPDG webpage.
   2.5. Hot Water Coils
      2.5.1. Hot Water Coils should be designed for 180°F entering water temperature and a 20°F ΔT.
         2.5.1.1. MS&T Only: Hot water coils shall be designed for a 120°F entering water temperature and a 20°F ΔT.
         2.5.1.2. If steam is unavailable, design for 140°F entering water temperature and a 20°F ΔT.
      2.5.2. Hot Water Coils used for pre-heat are required to be pumped. See Detail titled "AHU HW Preheat Coil Piping Detail (MU)" or "AHU Preheat Coil Circulating Pump Detail and Control Valve Sequence of Operation (MS&T)" provided in this Division of the CPDG webpage.
   2.6. Steam Coils shall only be used for replacement of an existing steam coil.

2.6.1. Steam coils shall be designed for 5 psig steam, and gravity return. This may necessitate elevating the unit above the housekeeping pad to provide sufficient height for a gravity return.

2.6.2. Steam heating coils should be designed with a smaller face area than the AHU cabinet. Coil heating capacity is based mostly on the coil size. Coils face area shall be only as large as required by the required heat load. Higher velocity through the steam coil is acceptable. Steam coils which are the same size as the AHU cabinet are greatly oversized and will have very uneven temperatures across the coil face. It is not unusual to see freezing temperatures at the bottom or side opposite the steam supply to the coil. This may cause the steam coil and the adjacent chilled water coil to freeze.

2.6.3. Integral Face and bypass damper pre-heat coils are preferred. Standard internal/external face and bypass coil arrangements are not permitted.

3. Arrangement

3.1. Draw through arrangements are acceptable for units with winter mixed air temperature greater than 40F. Hot water pre-heating coils are required on units with mixed air between 40°F and 55°F. Systems with a mixed air above 55°F do not require heating coils.

3.2. Blow through arrangements are required when winter mixed air temperatures are below 40F. Cooling coils will be located downstream of the supply fan.

3.3. All air handling units will consist of factory fabricated components. Modifying or field fabricating mixing boxes or filter sections are not permitted.

4. Fans

4.1. Fans will be selected to provide highest efficiency and lowest noise characteristics practical while meeting specific system requirements. Sound level shall not exceed 85db, three (3) feet from the unit.

4.2. The following fan types are acceptable:

4.2.1. DWDI, Airfoil or backward inclined

4.2.2. Plenum type

4.3. Inline centrifugal, tubeaxial or vaneaxial fans are **PROHIBITED.**

4.4. Return fans shall be provided only when return/exhaust/relief duct system pressure drop exceeds 0.30” wg.

4.5. Relief fans are required whenever the economizer air relief path ΔP exceeds 0.05” Wg. (0.05” wg exerts 5 lbs of force on a 36” x 72” exterior door and will prevent the door from closing and locking)

4.6. Variable speed drives shall be provided by Division 26, not the AHU manufacturer.

4.7. Central-station air-handling units and their components shall be factory tested in accordance with the applicable portions of ARI 430 - Standard for Central-Station Air-Handling Units and shall be listed and bear the label of the Air-Conditioning and Refrigeration Institute.

4.8. The fan-system operating point shall fall within range recommended for proper operation as indicated in Figure 5-4, AMCA Standard 201-90 "Fans and Systems". Fan type and characteristics will be selected to assure stable non-pulsing

performance in required operating ranges. Fan's Class shall be high enough for 10% over speed without exceeding RPM for the class. Fan shall be selected low enough on the fan curve to allow 5-10% increase in static pressure without causing the fan to go into the unstable range.

4.8.1. Inlet and Discharge outlets shall be designed to not create a system effect.

5. Filters
   5.1. Filters will comply with ASHRAE Systems and Equipment Handbook, and the following:
      5.1.1. Office areas shall have a minimum MERV 11
      5.1.2. Classrooms shall have a minimum MERV 11
      5.1.3. Laboratories shall have a minimum MERV 13
      5.1.4. Animal areas shall have a minimum efficiency of 85% (MERV 13)

6. Internal Access
   6.1. All units shall be provided with access sections to enable inspection, cleaning and repair of individual components. Access shall be provided to mixing dampers, both sides of coils, and fan sections. LED lights shall be provided in all access sections and connected to a common switch/timer. **MINIMUM WIDTH OF ACCESS SECTION SHALL BE 24".**

7. External Maintenance Access Requirements
   7.1. Access and service space shall comply with International Mechanical Code, section 306.
   7.2. All HVAC equipment will be located to facilitate accessibility, maintainability, and replacement. Minimum clearance on the side for fan access, filter access or coil access is 48". All other sides must have a minimum of 24" to walk around the unit.
   7.3. All coils within air handling units, will be capable of being pulled without obstruction of equipment, pipes, conduit, etc., or requiring removal of any other coil in the same unit. Two units may share the same coil pull space. Coil pull space may utilize a double-wide mechanical room door if the mechanical room is not large enough.
   7.4. Mechanical contract drawings shall show the access areas as a hatched area adjacent to the unit. Access doors shall also be shown at all required locations. A plan and elevation view of each air handling unit is required.
   7.5. All mechanical equipment/systems will be installed on a 4" minimum concrete housekeeping pad, and where required, steel support framing as required to allow proper housekeeping, cooling coil condensate trap installation, steam condensate drainage, and access. Provide a dimensioned detail in the drawings for condensate trap installation applicable to the arrangement and operating pressure.
   7.6. Future replacement of the entire unit shall be considered.

SPECIFICATION REQUIREMENTS:

The following statements shall be included in the contract specification:

1. Access limitations on replacement units: Replacement Air handling Units may be restricted to existing size limitations. Units which exceed these limitations cannot be considered as they will not fit in the existing locations. The size limitations are indicated on the attached data sheets.

2. Unit Construction
   2.1. Unit casing panels shall consist of formed and reinforced exterior 18 gage galvanized steel panels, minimum 2 inch thick, 3.0 lb/cu ft density fiberglass, 4 lb/cu ft mineral wool, or 2 part rigid injected Class I foam insulation and an interior 20 gage G90 solid galvanized steel liner.
      2.1.1. Consider tongue and groove unit casing panels with butyl gasket mating seal, thermal brake technology with hemmed outer edge and wash down option. Seal inner and outer seams with polyurethane.
   2.2. Access doors shall be insulated double wall construction. Latch handles, Ventlock 310 or equal, shall provide positive closure to prevent leakage. Door hinges shall be securely fastened to unit casing. Tack welds are not acceptable. Door gaskets shall be a minimum of 3/8 inch around the entire door perimeter.
   2.3. Unit sections with access doors shall be provided with floors capable of supporting maintenance personnel.
   2.4. Provide a service light in all accessible sections and the fan cabinet.
   2.5. Provide a double wall, internally insulated, triple-sloped stainless steel drain pan under each coil including piping and header. Perimeter collar to be continuously welded. Floor penetrations are not allowed in these sections.
   2.6. Provide unit with an 8" base rail.
   2.7. Base construction to include thermal brake and a minimum R-value of 6.7 per inch. Additional insulation should be considered under cooling coil sections. Shipping splits to be caulked and covered with stainless steel clips.

3. Fan Section
   3.1. Refer to *23 3400 Fans, Specifications, 1. Fans*
   3.2. Fan Drive shall have an OSHA compliant guard.
   3.3. Units using "Fan Wheels" shall be AMCA Certified and include backdraft dampers or other approved means to automatically blank off fan upon failure.

4. Motors
   4.1. Refer to *23 3400 Fans, Specifications. 2. Motors*.

5. Coils

   5.1. All coils shall have a minimum of .025" tube wall thickness and 5/8" O.D. minimum diameter. All coils shall have copper coils, aluminum fins, and non-ferrous headers.
   5.2. Coils shall be a maximum of 10 rows and a maximum of 10 fins/in.
   5.3. Evaluate possibility of removable panel on both sides of AHU at coils.

5.4. For stacked coils, provide intermediate drain pan with ½" closed cell rubber insulation affixed under the drain pan to prevent carryover.
5.5. Cooling coil and casing design must include measures to prevent bypass of air around coil to reduce possibility of condensation carry over.

6. Access/Plenum Sections
   6.1. Full-sized 24" access sections shall be provided between all coil and filter sections. Access sections shall have hinged doors with door handles. Access doors shall be provided on all sections to provide access to filters; coils, front and back of fans; dampers, etc. Bolted or screwed panels are not acceptable.
   6.2. The door swing shall be the opposite of the pressure in the access section.

7. Filter Section
   7.1. Provide disposable type, cotton/polyester material with additional non-woven glass fibers on the exit face. Filter performance shall be as scheduled. Air filters shall comply with Section 605 International Mechanical Code and NFPA Standard 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and be UL Class 2.
   7.2. Filters shall be rated in accordance with ASHRAE Standard 52 "Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter."
   7.3. Filter rack to provide positive means to secure filters and gasketing to limit bypass air.

8. Mixing Boxes/Economizer Sections
   8.1. Provide parallel-blade dampers in a reinforced, galvanized steel cabinet. Damper blades shall be galvanized steel mechanically fastened to steel operating rod. Connect operating rods for each set of dampers together with a common linkage and interconnect linkages so dampers operate simultaneously and in the opposite direction (one opens when the other closes).

SCHEDULE TO BE INCLUDED IN THE DRAWINGS

TAG NO.		
MANUFACTURER/MODEL #		
AHU TYPE		
FAN **TOTAL AIRFLOW**		
MINIMUM OUTSIDE AIRFLOW		
TOTAL/EXTERNAL SP		
HP/VOLTS/PHASE		

COOLING COIL **TYPE**		
CFM		
MAX FACE VEL. (FPM)		
AIR PRESS DROP		
MIN. CAPACITY, TOTAL (BTUH)		
MIN. CAPACITY, SENSIBLE (BTUH)		
ENT. AIR TEMP (DB/WB)		
LV. AIR TEMP (DB/WB)		
ENT WATER TEMP (F)		
LV WATER TEMP (F)		
WATER PRESS DROP (FT)		
WATER FLOW (GPM)		
HEATING COIL **TYPE**		
CFM		
MAX FACE VEL. (FPM)		
AIR PRESS DROP		
MIN. CAPACITY, TOTAL (BTUH)		
MIN. CAPACITY, SENSIBLE (BTUH)		
ENT. AIR TEMP (DB/WB)		
LV. AIR TEMP (DB/WB)		
ENT WATER TEMP (F)		
LV WATER TEMP (F)		
WATER PRESS DROP (FT)		
WATER FLOW (GPM)		
FILTER SECTION		
PRE-FILTER TYPE / DEPTH		
PRE-FILTER PRESS DROP - CLEAN/DIRTY		
PRE-FILTER EFFICIENCY/ARRESTANCE		
FINAL FILTER TYPE / DEPTH		
FINAL FILTER PRESS DROP - CLEAN/DIRTY		

FINAL FILTER EFFICIENCY/ARRESTANCE		

REFERENCES

237000 AHU Chilled Water Coil Piping Detail

237000 AHU Chilled Water Coil Piping Detail – Multiple

237000 AHU Hot Water Coil Piping Detail

237000 AHU Hot Water Coil Piping Detail – Multiple

237000 AHU Hot Water Preheat Coil Piping Detail

237000 AHU Hot Water Preheat Coil Piping Detail – Multiple

237000 AHU Hot Water Reheat Coil Piping Detail

AHU Preheat Coil Circulating Pump Detail and Control Valve Sequence of Operation (MS&T)