PART 1: GENERAL

1.01 RELATED SECTIONS

A. Section 01004 – Energy Guidelines
B. Section 01008 – Energy Modeling Guidelines
C. Section 15545 – Chilled Water System
D. Section 15550 – Heat Generation
E. Section 15556 – Clean Steam Generation
F. Section 15790 – Coils
G. Section 15955 – Building Automation and Control System Guidelines
H. Section 16450 – Variable Frequency Drives

1.02 RELATED STANDARD DETAILS

A. Detail 3.4.2, Piping Legend

1.03 SUMMARY COMMENTS

A. For each project, the designer should prepare a Design Narrative/Intent and Basis of Design document for review with project stakeholders.

B. System design and equipment selection should be determined by minimum life cycle cost including first, operating and maintenance costs. Design mechanical systems in conformance with the Energy Guidelines outlined in Cornell Energy Guidelines Standard, Section 01004.

C. The consultant will review acceptable systems types with Cornell during the Schematic Design Phase, at the latest. Systems shall be selected and designed to meet the project specific Energy Use Intensity (kbtu/ft²) targets as set by Cornell. Modeling of mechanical systems shall be in conformance with the Cornell Energy Modeling Guidelines Standard, Section 01008.

D. Generally, spaces should not be humidified. Animal rooms and libraries are to be humidified in accordance with project specific design guidelines.

E. Perimeter zones should be heated by hot water radiation.
F. Provide capability to shutdown air supply and exhaust systems in unoccupied parts of the building. Investigate space use, programming, and where cost effective, serve significantly different areas that are on different occupancy schedules from separate air systems.

G. Generally, intakes should be located near grade, remote from automotive exhausts and sited to avoid lab exhaust reentry. Laboratory hoods shall exhaust above the roof. These needs are best served by a MER low in the structure to contain the supply air and related equipment and, in lab buildings, a penthouse MER for the exhaust fans. Designers should apply air flow modeling tools to confirm appropriate sighting of the intake location. As part of developing the design intent, designers should assess the need for the outside air intakes to be hardened for security within guidelines established by ASHRAE.

1.04 DESIGN CONDITIONS

A. Facilities in Ithaca, NY shall be designed for the following conditions:

<table>
<thead>
<tr>
<th></th>
<th>Outside</th>
<th>Inside</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer Dry Bulb</td>
<td>88°F</td>
<td>75°F</td>
</tr>
<tr>
<td>Web Bulb</td>
<td>73°F</td>
<td>63°F</td>
</tr>
<tr>
<td>Winter Dry Bulb</td>
<td>-5°F</td>
<td>70°F</td>
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1.05 ACOUSTICAL AND VIBRATION CONTROL

A. The Designer should apply good practice and design the air handlers, ductwork, and piping systems so as to create a quiet system appropriate for the specific project. Sound and vibration criteria should be defined early in the project and documented in the Design Intent and developed with the Basis of Design.

B. Generally, classroom and office environments are designed to meet NC 30, and laboratories designed to meet NC 50.

1.06 ENERGY CONSERVATION

A. The Energy Conservation Construction Code of New York State allows commercial buildings to meet the requirements of ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except for Low-Rise Residential Buildings OR the requirements contained in Chapter 5 of the ECCC of NYS. Either compliance path is acceptable to Cornell.

B. Static Pressures: High estimated static pressures for fans and head pressures for pumps cause larger than necessary fans, pumps and motors that waste energy and unnecessarily increase size of electrical service. Calculate realistic static pressures without double safety factors. Ductwork and piping pressure calculations shall be made available to Facilities Engineering for review.
C. Attention should be given to the following sections from ASHRAE Standard 90.1.

1. Load Calculations: Heating and cooling system design loads for the purpose of sizing systems and equipment should be determined in accordance with generally accepted engineering standards and handbooks acceptable to the adopting authority (e.g., ASHRAE Handbook–Fundamentals).

2. Exhaust Air Energy Recovery: Individual fan systems that have both a design supply air capacity of 5000 cfm or greater and have a minimum outside air supply of 70% or greater of the design supply air quantity shall have an energy recovery system with at least 50% recovery effectiveness. Fifty percent energy recovery effectiveness means a change in the enthalpy of the outdoor air supply equal to 50% of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the heat recovery system to permit air economizer operation as required by 6.5.1.1 of 90.1, Air Economizers. See 90.1 for exceptions.

3. Fan System Power Limitation: Each HVAC system as fan system design conditions shall not exceed the allowable fan system motor nameplate hp or fan system bhp. This includes supply fans, return/relief fans, exhaust fans, and fan-powered terminal units associated with systems providing heating or cooling capability. See 90.1 for exceptions.

4. Freeze Protection and Snow/Ice Melting Systems: Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, should include automatic controls capable of shutting off the systems when outside air temperatures are above 40°F, or when the conditions of the protected fluid will prevent freezing. See 90.1 for additional requirements.

5. Ventilation Controls for High-Occupancy Areas: Demand control ventilation (DCV) is required for spaces larger than 500 ft² and with a design occupancy for ventilation of greater than 40 people per 1000 ft² of floor area and served by systems with one or more of the following: an air-side economizer, automatic modulating control of the outdoor air damper or a design outdoor airflow greater than 3000 cfm. See 90.1 for exceptions.

6. Duct Leakage Testing: Ductwork that is designed to operate at static pressures in excess of 3 in. w.c. shall be leak-tested according to industry-accepted test procedures.
1.07 MECHANICAL EQUIPMENT ROOMS

A. All mechanical equipment should be within the Mechanical Equipment Rooms (MER). Generally, rooftop units are not acceptable; exceptions require approval from Cornell.

B. MERs shall be large enough to encourage proper servicing of equipment and include access for replacement of all mechanical equipment. Mechanical Rooms must be accessible by a standard stair or elevator. Ship’s ladders and steep stairs are NOT acceptable. Doors shall be a minimum of 36 inches wide. Adjoining pieces of equipment shall be separated by a minimum of three feet. Provide space to store two changes of air filters, lubricants, etc.

C. Mechanical Rooms shall be well lighted using fluorescent lamps, maintain a minimum of 35 foot-candles, 2.5 feet above the floor. Lighting shall be switched at each exit. Similarly, adequate electrical outlets should be provided in the MERs.

D. Floor drains are required. They are to be connected to the sanitary sewer system, not to any storm sewer. Do not run cooling coil condensate drains across mechanical room floor. Position drains so as not to let any pipe run across floor.

E. MERs above the lowest floor shall be curbed and all floor penetrations sleeved to 2" above the floor. Thermally and acoustically insulate MERs under occupied areas. Provide thermostatically controlled ventilation as required. Waterproof MER floors above all occupied areas.

F. All un-insulated, uncoated steel components installed by the mechanical contractor should be primed and finish painted (i.e., supports, hangers, etc.).

1.08 SYSTEM DESCRIPTIONS

A. Computer Room and Data Center Air Conditioning Units:

1. Computer room air conditioners (CRACs), in-row cooling, and in-rack cooling systems will be considered. Final choice in system shall be made using Life Cycle Costing. If CRACs are to be used, as a minimum, a hot aisle/cold aisle approach shall be designed to minimize energy use.

2. Generally, humidifiers shall not be provided. Contact Cornell with special circumstances. Where humidification is provided, humidifiers shall be electrode type, and not infrared.

3. Reheat shall be by hot water where possible.
B. Closed Loop Hydronic Systems:
   1. Expansion tanks shall be diaphragm type, and the pre-charge pressure shall be specified to suit the system. Air elimination shall be installed in each heating system at the point of lowest air solubility and vented to atmosphere. A chemical pot feeder shall be installed across the hot water pump.
   2. Hydronic loops with pumps larger than 2 hp shall be equipped with variable frequency drives regulating loop differential pressure.

C. Dampers:
   1. Outside air and exhaust air dampers shall include seals to provide a tight closure. Dampers shall not leak in excess of 4 CFM per square foot of damper area when closed against 1.0 in. w.c. when tested in accordance with AMCA Standard 500.

D. Unit Heaters:
   1. Steam unit heater traps shall be F&T type with strainer.
   2. Hot water unit heaters are preferred over steam whenever possible.

E. Fan Coil Units:
   1. The use of fan coil units is acceptable.
   2. Cooling coil condensate drains shall be no smaller than 3/4" diameter. All coils shall be of the “low flow” or “high water temperature rise” type with temperature rises selected as high as practical (minimum of 10°F). Installation shall require extended drain pans with the control valve installed over the pan. Condensate piping should be run by gravity through dedicated insulated copper lines with an indirect connection to sanitary drain with 1/8" per foot pitch. Do not install condensate pumps without prior approval from Facilities Engineering.

F. Chilled Beam Systems:
   1. The use of active and passive chilled beam cooling systems is acceptable where deemed appropriate.
   2. Space conditions shall be maintained during cooling season at a 75 °F dry bulb temperature with humidity levels between 50-55%.
   3. Dedicated outside air systems serving as ventilation air for passive chilled beams, or primary air for active chilled beams shall be sufficiently dehumidified.
4. The amount of ventilation/primary air delivered to the space shall be sufficient to offset the expected space latent heat gains. Depending on the dehumidification system utilized, this amount of air will most likely exceed Code minimum ventilation air requirements.

5. A dedicated and independent chilled water cooling loop shall be provided for chilled beam cooling systems, and shall be separated from the main campus chilled water system via a plate and frame heat exchanger. As a result, it is not feasible to use the return water temperature from standard chilled water devices as supply water to chilled beam systems.

6. Deviations from these standards must be submitted with a detailed justification for the deviation, and must be approved by Facilities Engineering prior to design.

PART 2: PRODUCTS

2.01 PREFERRED MANUFACTURERS:

A. Computer Room and Data Center AC Units
   1. Liebert
   2. Stoltz

B. Motors
   1. Baldor
   2. GE
   3. Marathon

C. Motor Starters
   1. Allen Bradley
   2. Cutler Hammer
   3. General Electric
   4. Square D

D. Chilled Beams
   1. Halton
   2. Semco
   3. Swegon

2.02 MOTORS

A. Motors shall comply with ASHRAE 90.1 and the requirements of the Energy Policy Act of 1992 where applicable. Motors below 1/2 HP shall be 120/1/60. Motors 1/2 HP and above shall be 200/3/60 on 208/3/60 systems, 230/3/60 on 240/3/60 systems, or 460/3/60 on 480/3/60 volt systems. 208/230 volt dual range motors are not preferred.
B. Motors shall be of the premium efficiency, high power factor type for minimum life cycle costs. Nominal efficiencies shall be established in accordance with NEMA Standard MG 1.

C. Motors for use with variable frequency drives shall be rated for inverter duty, and shall be furnished with AEGIS bearing protection rings.