The following information shall be included in specifications prepared for use on all University of Cincinnati projects. This information is supplemental and not intended to be a complete specification.

## GENERAL STANDARDS

### General Criteria

**Review & Approval** - The University of Cincinnati office of Planning+Design+Construction (P+D+C) along with Facilities Management (FM) will have final approval on all Automatic Temperature Control (ATC) control drawings and sequences of operation prior to any field installation being performed. It is necessary that the Departments be involved because the installed system will have to be fully compatible with existing ATC servers/systems.

**Competitive Bidding** - The University is limiting competitive bidding (in regards to ATC) to Siemens and Automated Logic. Controller product details and BACnet requirements are not critical to the specification. Sequence of Operations and point requirements should be the focus of the ATC specification.

## PRODUCT STANDARDS

### Product Manufacturers

**Existing ATC Systems** - The University of Cincinnati currently has two Automatic Temperature Control (ATC) systems on campus, Siemens Apogee and Automated Logic. The Siemens system is installed/supported by the local Siemens branch and the Automated Logic system is installed/supported by Emcor Cincinnati. The ATC section of the contract will be competitively bid by these two vendors.

The new ATC installation shall be an extension of the existing campus system. All controls and components shall be compatible with the existing system and shall be fully integrated into one of the two existing ATC server.

### System Requirements

**Control Panel** - A separate control panel will be installed for each major piece of equipment. All control panels will be designed with spare point capacity – minimum of 2 AI, 2 AO, 2 DI, 2 DO.

**Interface Requirements** -

- Fan/Pump VFD’s:
  - Stop/Start control shall be a hardwired DO from the DDC panel.
  - Operating (run) status shall be hardwired from the drive to a DI at the DDC panel.
  - Differential Pressure sensors used for speed control shall hardwired to an AI’s in the DDC panel.
  - Speed control algorithms shall be performed in the DDC panel, using a hardwired AO (4-20 mA or 0-10v) for speed control.
- All other VFD data shall be communicated to the DDC system via LAN or BACnet.
- Package Units w/OEM controllers (e.g. lab air control system, chillers, boilers, etc…)
- Stop/Start control shall be a hardwired DO from the DDC panel.
- Shall interface with the DDC system via the BACnet protocol.

**Point Naming Standard** - ATC contractor will follow UC’s point naming standard. All devices, with the exception of zone controls, will be labeled with the DDC point name.

**Room Temperature Sensor** – A Room temperature sensor will be provided with LCD display, unoccupied override, setpoint adjustment and interface jack.

**Heat Exchanger Valves** – Steam control valves to heat exchangers shall be normally closed – fail closed.

**Safety Wiring & Notification** –
- All safeties are to initiate hard wired shutdown and alarm notification. Wire VFD’s so that all safeties and interlocks remain operational (inclusive of isolation dampers, isolation valves, end switches, interlocks, safeties etc) when drive is placed in Auto, Hand or Bypass mode.
- On all 100% OA units, all low temperature detectors (freezestats) provided by the BMS contractor to adequately protect the cooling coil shall be wired in parallel to a panel-mounted time delay relay (TDR). The TDR shall be energized whenever any low-temperature detector senses temperatures below 40 degrees F for 2 minutes (adjustable). The relay shall disable all supply fans associated with the AH, energize a local red-alarm pilot light, and annunciate an alarm on the BMS. The BMS contractor shall provide a reset button adjacent to the pilot light which will manually reset the TDR and allow the fans to operate. The low temperature detectors shall be automatic reset type.
- Whenever an air handler is programmed to be shut down by the fire alarm system, there shall be a DO on the fire system connected to a DI on the DDC system to indicate such shutdown. The DDC system shall initiate an alarm.

**Control Devices** - Each control device (e.g. mixed air dampers, preheat coil valve, cooling coil valve) in an air handling unit will have its own dedicated sensor and setpoint. Vaisala HMS 110/112 is the basis of design for outside air temperature and humidity sensors. Include humidity sensors in air handler mixed air chamber, return air and supply air streams. Humidity sensors shall be ± 2%RH accuracy or better. Temperature sensors shall be ± 1°F accuracy or better.

**EXECUTION STANDARDS**

**System Installation**

**DDC System Installation** - The Automatic Temperature Control (ATC) contractor shall furnish and install a complete direct digital control (DDC) system as hereinafter specified. The control system shall include all sensors, transmitters, valve & damper actuators, relays, switches, wire, tubing, thermometers, gauges, and conduit external to the DDC panels and all other necessary equipment and control devices required to maintain the conditions as described and detailed in Plans and Specifications.

**DDC Panel Installation** - ATC contractor shall mount the DDC panels, mount the field devices, and run the input/output wiring from the field devices to the panels.
Server Upgrade - Upgrade existing server with the manufacturer's latest software release and add new system devices, objects, application programs, graphics and required system wide functionality (alarm and event notifications, COV subscriptions, schedules, trending, and device management requirements so that new facility provides complete and consistent operation with existing systems. Maintain the server at the most current software version for a period of three years from end of project.

Attic Stock – Provide 10% of all the different controllers and sensors used on the project.

Training – Provide factory training sessions for two individuals (room and board excluded). This is in addition to on-site, job-specific training.

Network & Power Wiring Installation - ATC contractor shall run all network wiring other than the building / campus Ethernet network. ATC shall provide and install all power wiring to terminal equipment controllers. All Network (BACnet, ARCnet, LAN, BLN, FLN, etc…) cables shall be labeled to indicate where (device & room number) the other end is terminated.

Energy Management Routines – The ATC Contractor shall provide Energy Management Routines - Provide all systems, zones and units with the following sequences and functions:

1. Night Setback Time Schedules for occupied and unoccupied hours when zone is without occupancy sensor.
2. Occupant Override of night setback.
3. Chilled water and hot water pump and differential pressure setpoint optimization routines.
4. Fan static reset based on terminal unit damper positions.
5. Power Failure - equipment restart sequencing.
6. Energy Reports - Provide equipment runtime, historical trends for all analog point, produce detailed energy consumption for utilities (kW, CHW & Steam) and alarm history. The historical database will store the daily, monthly and yearly history. Trend all analog point and archive for one year. Consult with U.C. Metering Group

Standard Sequences - CFM tracking is the preferred method of building pressure control. Lead / Standby or Lead / Lag rotation should be alarmed on a runtime threshold basis but the rotation should be manually initialized by the operator.

Documentation & Commissioning

Documentation Submittals - Submittals will include full control diagrams for each system. Submittals will be reviewed by FM and a Sequence of Operations review meeting will be held with the ATC contractor. At this meeting the Functional Performance Test for commissioning will be developed from the agreed upon sequences.

System Verification – Provide FM with one week of trend date (15-minute interval) that verifies proper sequencing and loop tuning.

DDC Points & Settings - After programming but prior to startup, the ATC will provide FM with a full points list indicating DDC point name, type of device, and range. The ATC will also indicate initial trend configuration settings and alarm level settings. FM will modify and return to ATC to use in system startup. All point names will follow U.C. Standard point naming scheme (contact FM for most current list).
**Drawing Documents** - Contractor shall provide as a minimum, individual drawings for each system shown and listed in the Sequence of Operation and a system diagram showing all system hardware components (i.e., signal air and points wiring). ATC diagrams shall include all of the building locations and room numbers of the systems being controlled and the components or sensors performing the control. Both electronic and hard copies of record drawings, points list, programs, and sequences are required.

**Drawing Requirements** - Drawings shall show all system hardware, field devices, electrical work as well as all control work, with each drawing containing the following minimum information:

1. Control diagrams of AHU’s, Heat Exchangers etc.
2. Control air supply, DDC system and communication diagram.
3. ATC Panels, terminal indication, physical panel layout, location
4. Control Device termination with numbering for control signal.
5. Panel and System diagrams with wire numbers and device names.
6. Network wiring diagrams **shall** reflect the physical layout (*panel # to panel #*)

**Record Drawings** - The contractor shall maintain a record set of drawings which he shall mark up with each deviation clearly indicated in red pencil. It shall be clearly identified as to the actual routing of 24 volt AC power wiring, building network cabling between building controllers and VAV terminal equipment and enclosures, VFDs, etc. These drawings (physical copy and a scanned electronic version) shall be turned over to the Construction Manager upon completion by the contractor and will become the property of the University of Cincinnati.

--- END OF SECTION ---