23 09 23-BAS Standard Diagrams

* C-000 Added: “DESIGNER NOTES: 1. Sequences should not be copy/pasted as is into design documents. These drawings represent general UGA preferences related to monitoring, format, content and operating control sequences. Project specific sequences should be developed with this UGA standard as a starting point. The design engineer shall modify as needed to incorporate project requirements into the sequences. The sequences as presented should not override sound engineering judgment based on specific project requirements.

2. All control drawings from initial submittal onward shall be submitted to ALC for review and comment.

3. Sequences here assume ALC control of all building systems. Designer shall familiarize themselves with how the building systems not in the scope of their project function and modify sequences to be inter operable.”

* C-101 Designer Note for Outside Air Ducted Units edited: Changed “Include in design only after consultation with UGA. Add sequence: Return air damper shall operate inversely to outside damper as described below. When unit starts in occupied mode, the outside air damper shall open to minimum position. During unoccupied periods, the outside air damper shall remain closed. Whenever the freezestat is in alarm, the unit shall be commanded to stop, outside air damper commanded closed and hydronic valves commanded fully open. [For units with CO2 management include: When the space CO2 exceeds alarm set point and fan status is proven on, the outside air damper shall be overridden full open until CO2 falls below set point.]” to “For FCUs with ducted outside air connection, add sequence: When unit starts in occupied mode, the outside air damper shall open to minimum position. During unoccupied periods, the outside air damper shall remain closed. Whenever the freezestat is in alarm, the unit shall be commanded to stop, outside air damper commanded closed and hydronic valves commanded fully open.”
* C-101 RA damper was removed from OA ducted detail.
* C-101 Zone Humidistat was changed from optional to standard equipment.
* C-101 Valve Control Diagram axis labels were added. Vertical axis was labeled “Valve Position” and horizontal axis was labeled “Operating Mode.”
* C-101 Electric Ladder Diagrams were removed.
* C-101 The normal space temperature setpoint was changed from “73°F” to “72.5°F”
* C-101 The normal cooling setpoint was changed from space temperature setpoint “plus 3°F” to “plus 2.5°F.”
* C-101 The normal heating setpoint was changed from space temperature setpoint “minus 3°F” to “minus 2.5°F.”
* C-101 The Demand Control Ventilation Sequence was changed entirely to read” Designer Note: Include Demand Control Ventilation and CO2 sensors onlyonly after consultation with UGA. Add Sequence: Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupnayc and shall not reduce OA CFM to drive the building negative.”

* C-100 Occupancy override sequence was changed from “reset to normal operation at the end of the period” to “reset to scheduled operation at the end of the period”
* C-101 Operator shutdown sequence was changed from “ Deenergizes multiple terminal units” to “deenergizes multiple FCUs”
* C-102 The Demand Control Ventilation Sequence was changed entirely to read” Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Add Sequence: Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupancy and shall not reduce OA CFM to drive the building negative.”

* C-102 Zone Damper Sequence Heating Minimum Volume Setpoint section was deleted in its entirety. This is a cooling only box with no heating mode operation.
* C-102 Sheet Label was changed from “Control Schematic” to “VAV Terminal Control Schematic.”
* C-103 Edited sequence to reflect dual maximum setpoint logic. Under General edited “minimum and maximum flow setpoints” to read “minimum and maximum flow setpoints for both heating and cooling operating modes.
* C-103 Zone Damper sequence, added “Zone damper control shall follow dual maximum setpoint logic” at the beginning of the paragraph.
* C-103 Zone Damper sequence, changed “Heating minimum volume setpoint: Whenever heating is requested from the box in any period, the minimum volume shall be set to an adjustable heating setpoint airflow. Initially, this setpoint shall equal the cooling minimum volume setpoint.” to “Heating Maximum Volume Setpoint: Whenever heating is requested from the box in any period, the airflow volume shall be set the heating setpoint airflow, as scheduled.
* C-103 Hydronic Reheat Sequence, Replaced “whenever the heating minimum volume setpoint is active” with “Upon call for heating via zone thermostat,”
* C-103 Sequence - Graphics and trends, added requirement for historian backup.
* C-103 Occupancy Sensor Sequence, Added note “Designer shall specify occupancy sensors to have aux contact to BAS.”
* C-103 The Demand Control Ventilation Sequence was changed entirely to read” Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Add Sequence: Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupnayc and shall not reduce OA CFM to drive the building negative.”

* C-104 Temperature Control Diagram, changed “airflow setpoint” to read “primary airflow setpoint.”
* C-104 Added Supply Fan Status sensor and associated DI point to points list and schematic.
* C-104 Sequence - Graphics and trends, added requirement for historian backup.
* C-104 The Demand Control Ventilation Sequence was changed entirely to read” Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Add Sequence: Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupnayc and shall not reduce OA CFM to drive the building negative.”

* C-105 Schematic, hotwater coil position was moved from TU discharge to plenum air inlet.
* C-105 Fan Enable point was changed from DO start/stop command to AO “VVx Fan Speed” command.
* C-105 DI point was added for Fan Status.
* C-105 Sequence Graphics and trends, added requirement for historian backup.
* C-105 Notes, Note 2 was added to PIU Fan and reads “2. PIU fan motor shall be electronically commutated type with capability to dynamically ramp up and/or down according to output from controller.”
* C-105 Schematic Electric Heat Detail, Designer Note was modified to reflect that the Electric heater was to be “modulated vis proportional SCR Controller.”
* C-105 Temperature Control Diagram was modified to reflect sequence changes in which primary air damper closes to minimum in dead band and heating mode and the first stage of heating involves gradually ramping plenum fan speed prior to opening HW valve.
* C-105 The Demand Control Ventilation Sequence was changed entirely to read” Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupancy and shall not reduce OA CFM to drive the building negative.”

* C-105 Fan Sequence changed from “BAS Shall start fan and it shall run continuously whenever the space is in heating or setback heating. For occupied operation at cooling minimum, fan shall start. For occupied operation at cooling maximum or setback cooling operation, fan shall be off” to “Fan shall be off whenever the terminal unit is in either cooling or satisfied mode. The fan shall energize and ramp up via PID loop as the first stage of heating, upon call for heating by the zone temp sensor. The fan shall operate at full speed prior to opening the HW valve."
* C-105 Zone Damper Heating Volume Setpoint sequence was changed from “the minimum volume shall be set to an adjustable heating setpoint airflow. Initially, this setpoint shall equal to the cooling minimum volume setpoint. During unoccupied heating periods the primary air damper shall be closed” to "the primary damper airflow setpoint shall be the minimum volume setpoint. During unoccupied heating periods, the primary air damper shall be closed."
* C-105 Hydronic Reheat sequence was changed from “N.O. zone reheat coil valve shall modulate in a PI loop to… “If Aux fan speed is at design cfm for a period of 2 min (ADJ) and the zone thermostat calls for heating, the zone reheat coil valve shall modulate in a PI loop to…”
* C-106 Schematic, deleted SA temperature sensors and associated BACnet Read point from All FCU diagrams and Points List.
* C-106 Sequence Graphics and trends, added requirement for historian backup.
* C-201 Added Sample Terminal Unit Summary to be included in BAS Graphic:



* C-201 Notes, Added Note 5: “Include AHU performance graphic sheet with a terminal unit summary table to match example table provided here. Ahu performance graphic shall also include trend plots of AHU SP setpoint and AHU SP as well as AHU trim and respond adjustment tuning setpoints."
* C-201 Schematic, changed AHU Min OA and Min OAD P points from Digital to Analog and adjusted on Points list to reflect new DCV sequence.
* C-201 The Demand Control Ventilation Sequence was changed entirely to read” Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupancy and shall not reduce OA CFM to drive the building negative.”

* C-201 Fan Schematic, modified to reflect fan wall rather than manifolded fan system previously shown.
* C-201 Sequence General – Supply Air Temperature Set Point logic changed from “The supply air temperature setpoint shall be reset from 55F to 65F to maintain terminal unit cooling requests less than 5 (all values adjustable)” to “The supply air temperature setpoint shall be reset from 55F to 60F to maintain terminal unit cooling requests less than 15% of total TUs (all values adjustable).”
* C-201 Sequence General Item 4 changed “provide trends” to provide trends with historian backup”
* C-201 Sequence Operating mode was modified to reflect consistent numbering/lettering of subheadings.
* C-201 Electric Ladder Diagrams were removed.
* C-202 Added Sample Terminal Unit Summary to be included in BAS Graphic:



* C-202 Notes, Added Note 5: “Include AHU performance graphic sheet with a terminal unit summary table to match example table provided here. Ahu performance graphic shall also include trend plots of AHU SP setpoint and AHU SP as well as AHU trim and respond adjustment tuning setpoints."
* C-202 Sequence General – Supply Air Temperature Set Point logic changed from “The supply air temperature setpoint shall be reset from 55F to 65F to maintain terminal unit cooling requests less than 5 (all values adjustable)” to “The supply air temperature setpoint shall be reset from 55F to 60F to maintain terminal unit cooling requests less than 15% of total TUs (all values adjustable).”
* C-202 Electric Ladder Diagrams were removed.
* C-202 Sequence Operating mode was modified to reflect consistent numbering/lettering of subheadings.
* C-202 Optional Demand Control Ventilation Schematic and Sequence was added as follows: ”Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupancy and shall not reduce OA CFM to drive the building negative.”

* C-202 Schematic and Points List were modified to add damper position feedback DO points for Min OA, Max OA, RA and EA Dampers.
* C-203 Added Sample Terminal Unit Summary to be included in BAS Graphic:



* C-203 Notes, Added Note 5: “Include AHU performance graphic sheet with a terminal unit summary table to match example table provided here. Ahu performance graphic shall also include trend plots of AHU SP setpoint and AHU SP as well as AHU trim and respond adjustment tuning setpoints."
* C-203 Discharge Temperature Control sequence, number 1 changed from “setpoint shall be reset from 55F to 65F (both adjustable) to maintain terminal unit cooling requests less than 4 (adj)” to “setpoint shall be reset from 55F to 60F (both adjustable) to maintain terminal unit cooling requests less than 15% of total TUs (adjustable).”
* C-203 Electric Ladder Diagrams were removed.
* C-204 Optional Demand Control Ventilation Schematic and Sequence was added as follows:”Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupancy and shall not reduce OA CFM to drive the building negative.”

* C-204 Added Sample Terminal Unit Summary to be included in BAS Graphic:



* C-204 Notes, Added Note 5: “Include AHU performance graphic sheet with a terminal unit summary table to match example table provided here. Ahu performance graphic shall also include trend plots of AHU SP setpoint and AHU SP as well as AHU trim and respond adjustment tuning setpoints."
* C-204 Electric Ladder Diagrams were removed.
* C-204 Schematic and Points List were updated to remove Reheat and Chilled Water Freeze pumps and associated Statuses
* C-204 Schematic and Points List updated to include AI point for monitoring filter DP.
* C-204 Schematic and points list was updated to remove interlock between OA, EA and RA Dampers.
* C-204 Schematic and Points List were updated with Damper position feedback points for OA, EA and RA dampers.
* C-204 Schematic and Points List were updated to include Supply and Return Water Temperature sensors (AI) for each coil.
* C-204 Sequence for Freeze Safety was modified to remove chilled water coil pumps from the sequence and Exhaust Air Dampers shall be commanded to close in response to operation of the freeze stat.
* C-204 Sequence for Damper Control was modified to command the exhaust air dampers closed during non-economizer operations.
* C-204 Sequence for Discharge Temperature Control was modified to change the supply air temperature reset schedule from “55F to 65F” to “55F to 60F.”
* C-204 Sequence for Discharge Temperature Control was modified to remove “3. When the unit is energized for morning cool-down or setback cooling, the discharge setpoint shall be the warmest zone temperature, minus 15F.” Instead, we will rely on ALC’s standard Optimum Start/Stop sequence.
* C-204 Sequence “Preheating Section” was changed to “Preheating Valve”.
* C-301 Schematic and points list was updated to remove interlock between EA and RA Dampers.
* C-301 Schematic, changed AHU Min OA and Min OAD P points from Digital to Analog and adjusted on Points list to reflect new DCV sequence.
* C-301 Demand Control Ventilation Sequence was replaced to read as follows: ”Designer Note: Include Demand Control Ventilation and CO2 sensors only after consultation with UGA. Min outside airflow setpoint shall be adjusted dynamically between the upper and lower minimum OA setpoints based on the following reset schedule:



An Alarm shall be generated if space CO2 exceeds 1500 ppm.

DCV sequence shall not increase OA CFM setpoint greater than min ventilation required by code, its purpose is to reduce ventilation below code minimum for periods of partial occupancy and shall not reduce OA CFM to drive the building negative.”

* C-301 Sequence “Preheating Section” was changed to “Preheating Valve”.
* C-301 Sequence for Space Temperature Control was modified to change Setback Cooling and Setback Heating default setpoints from “85°F” and “60°F” to “90°F” and “55°F”.
* C-301 Sequence for Damper Control was modified so that “Mixing Dampers” were changed to “Return Dampers”
* C-301 Sequence for Damper Control was modified from “The exhaust air damper shall be closed and return air damper open” to “The exhaust air damper and return air dampers shall modulate proportionally with the max outside air damper during economizer mode.”
* C-301 Electric Ladder Diagrams were removed.
* C-302 Electric Ladder Diagrams were removed.
* C-302 Schematic and points list were modified so that AHx Bypass Damper position feedback was added for suppy and exhaust bypass dampers.
* C-401 Schematic and points list were modified so that Valve Position Feedback (AI) was included for both 1/3 and 2/3 valves.
* C-401 Schematic and Points list were modified so that HWP’s 1 and 2 KW are being monitored by the BAS via their VFD BACnet interfaces.
* C-402 Schematic and Points list were modified so that chilled water valve position feedback (AI).
* C-402 Ladder Diagrams have been removed.
* C-501 Ladder Diagrams have been removed.
* C-502 Electric unit heater ladder diagram has been removed.