

PART 1 - GENERAL

1.1 SEQUENCES

- .1 Present sequencing of operations for systems, in accordance with IM 250005 - 2009: Energy Management and Control Systems (EMCS) Design Manual.

1.2 GENERAL

- .1 Following sequences apply for all the mechanical systems, when it is necessary.
 - .2 Critical protections or those required by codes (detection of gas, fire, etc.) will not have to be by-passed in any way, neither manually, nor by computer. If an input is required to the centralized system, supply a relay to execute the double function of control and alarm.
 - .3 When there is an input of information for proof of operation, a total of hours of operation of mechanical equipments (compressors, water tower, ventilators, pumps, air conditioning devices, etc.) will automatically be made, complete with operator control resetting.
 - .4 Program alarms for all the following situations:
 - .1 Discrepancy between command and state signals.
 - .2 Room temperature at more than 2 °C from the set-point.
 - .3 System temperature at more than 2 °C from the set-point for longer than 30 minutes.
 - .4 Hydronic network temperature at more than 1 °C from the set-point for longer than 30 minutes.
 - .5 Other values: Greater than 5% discrepancy with the set-point.
 - .5 When the program switches control modes (example: cooling with heating), a dead range must be included on set-points. Also, several control stages in sequence contain a minimum time IN and OUT. These measures eliminate the danger of equipment cyclic functioning.
 - .6 When restarting after breakdown, systems will be restarted with 15 minutes intervals (adjustable delay).
 - .7 All butterfly control valves will be corrected by software programming or by characterised connecting rod and actuators to maintain a proportional valve flow with the control signal.
 - .8 The following sequences must be read together with drawings and list of points. Supply all the control points necessary for the control sequences performing, listed or implicit.
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- .9 Program trend log points for all the input and output analog points and variables that change in the time.
- .10 Unless otherwise specified, alarms will be transfer to following devices when these are a part of planned system in drawings or existing:

POINTS	ALARM	OPERATION HOURS	TENDANCE	ALARM DESTINATION	COMMENTS
ANALOG INPUTS	X		X	F,P,S	
ANALOG OUTPUTS	X		X	F,P,S	
DIGITAL INPUTS	X	X		F,P,S	Related to the correspondin g output
DIGITAL OUTPUTS		X		F,P,S	
SET-POINTS	X		X	F,P,S	
VARIABLES	X			F,P,S	
SYSTEM CONTROL	X			F,P,M	

F: File M: Modem P: Printer S: Screen

- .11 An optimal start program controls morning start-up of all air handling units in order to reach the "occupied" temperature set-point. The calculation takes into account outdoor air temperature, actual indoor air temperature, and warm-up period required, based upon past performance. Under "Heating" mode, start-up is delayed as long as possible. Under "cooling" mode, unit shall start and run on free cooling when possible. Outdoor air dampers are to remain closed during the morning warm-up period until the temperature reaches 20 °C.

1.3 CONTROL OF THE ROOFTOP VENTILATION UNIT

- .1 System description:
- .1 The system is a rooftop unit with fixed flow. The supply fan is equipped with a variable speed drive for balancing purpose, while the exhaust fans also has a variable speed drive to balance the exhaust flow with the admitted fresh air. The system also includes 2 mechanical stages of DX cooling, one being modulating, and an electric humidifier Terminal control is a VAV box in the remote monitoring room with terminal reheat.

- .2 The unit supplies a server room and the prison remote monitoring room.
- .2 Sequence of operation:
 - .1 System stopped:
 - .1 Supply and exhaust fans are stopped.
 - .2 The cooling unit and the humidifier are stopped.
 - .3 Fresh air damper is closed, return air damper is opened.
 - .2 System running:
 - .1 The system operates continuously.
 - .2 The room temperature sensor controls in sequence the mechanical cooling, including the modulating compressor. When outside air temperature is below 19°C, the room sensor modulates the outside air dampers between the minimum position 10% and 100% and controls the exhaust fan speed to maintain room temperature at setpoint. The supply air sensor limit the minimum air supply temperature at 13°C.
 - .3 The system stops when the supply temperature is below 4°C and allows twice an automatic resetting of the system. On a third frost detection in 30 minutes, the system stops and priority alarm is reported to central station.
 - .4 The return humidity sensor modulates humidifier with controller to maintain the set point of 30% relative humidity. A flow switch stops the humidifier when there is no flow. A high moisture limit stops humidification when it detects a greater level than 85% relative humidity.
- .3 Alarms:
 - .1 Unwanted fans status.
 - .2 Low / high temperature limit ($\pm 2^{\circ}\text{C}$).
 - .3 High humidity (5%).
 - .4 Freeze alarm.

1.4 VAV BOX WITH REHEAT COIL CONTROL

- .1 On a cooling demand by the room sensor, the variable volume box opens and supplies the necessary air flow to reach the room set point (adjustable).
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- .2 On a heating demand by the room sensor, the variable volume box closes to its minimum of 30% (adjustable) of the total flow of the box. If the heating demand is not satisfied, the controller modulates the electric coil to maintain the room set point (adjustable).

PART 2 - PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION
