

## SEQUENCE OF OPERATIONS

### DEDICATED OUTSIDE AIR UNIT: DOAS-1

- Unit shall be normally started/stopped by the DDC system.
- The supply fan and exhaust fan shall be manually started and stopped from the HAND and OFF positions of the HAND-OFF-AUTO switch on the Variable Frequency Drive (VFD) and automatically started and stopped by the DDC system when the switch is in the AUTO position. All safety devices of the VFD shall operate with the switch in the HAND or AUTO position. DDC system shall monitor the HOA position and alarm if the switch is in the HAND or OFF position. The DDC system shall initiate an alarm on the VFD failure as indicated by the VFD alarm.
- DOAS shall operate based on an occupied/unoccupied schedule as designated by the owner.
- DOAS unit shall remain off during morning warm-up or cool down.
- Upon start-up, the outside air and exhaust air dampers shall open and the supply fan and exhaust fan shall slowly ramp up to static pressure setpoint.
- In the event of a power interruption of fan shutdown, the outside air and exhaust air dampers shall close. DOAS shall automatically restart after a power failure.
- Supply air fan speed and exhaust air fan speed shall be modulated via the variable frequency drive to maintain associated duct static pressures based on signals from the associated duct mounted static pressure sensors. Initial static pressure setpoint shall be set at (+) 0.5 w.g. (adjustable) for supply and (-) 0.5 w.g. (adjustable) for exhaust. Final setpoint shall be determined by the test and balance contractor. Variable frequency drive shall be normally stopped. Upon failure of static pressure sensor, the associated fan shall remain at its previous setting and an alarm shall be initiated.
- The units own internal controls shall modulate to maintain discharge air temperature as follows:
  - When ambient temperature is below 60°F (adjustable): heat wheel shall stop/operate and the electric shall energize/modulate based on the SCR controller only during heat wheel operation (applicable to non-failure of the heat wheel) to maintain a discharge temperature between 50°F and 70°F (adjustable). Discharge temperature shall be reset based on a call for heating from any DX fan coil or heat pump. On a call for heat discharge temperature shall reset upwards 5°F every 10 minutes until there are no space heating calls. Provide a 30 minute time delay before temperature reset is made unless there is a call for space heating. Discharge air supply shall then be reset down 5°F every 10 minutes.
  - When ambient temperature is between 60°F (adjustable) and 75°F (adjustable), the heat wheel shall stop.
  - When ambient temperature is above 75°F (adjustable), the heat wheel shall operate, first stage of mechanical cooling shall energize, and DDC shall modulate hot gas reheat coil face and bypass dampers to maintain a discharge temperature between 55°F and 75°F (adjustable). Hot gas reheat coil face and bypass shall be in full bypass until or unless a zone temperature drops to or is below 72°F (adjustable). If a space temperature is at or below 72°F, the hot gas reheat coil face bypass dampers shall modulate to raise the discharge air temperature 5°F every 10 minutes. Provide a 30 minute time delay before resetting the discharge temperature. If all space temperatures are above 74°F the hot gas reheat coil face and bypass dampers shall modulate dropping the discharge temperature 5°F every 15 minutes. If discharge temperature cannot be maintained with the first stage of cooling, the second stage of mechanical cooling shall energize. If both stages of mechanical cooling are energized and the hot gas reheat valve is 90% (adjustable) opening, the second stage of mechanical cooling shall de-energize.
  - On a rise in space humidity as sensed by a minimum of two space humidity sensors (as applicable) in the occupied area above 60% RH (adjustable), dehumidification mode shall energize; heat wheel shall operate, cooling shall energize to maintain a 55°F cooling coil leaving air temperature and hot gas reheat coil face and bypass dampers shall modulate to maintain discharge air temperature subject to "c" above. On a drop in humidity below 50% RH (adjustable) dehumidification mode shall stop.
- A smoke detector in the supply and exhaust duct will signal fire alarm for unit shut down.
- Supply and exhaust duct static pressures shall be reset upwards/downwards in 0.15" increments based on associated supply air VAV's or exhaust dampers. If a terminal unit or damper is 95% open or greater, the static pressure shall be reset up. If the worst-case terminal unit or damper is between 85% and 95% static pressure, setpoint shall remain constant. If the worst-case terminal unit or damper is less than 85% open static pressure, setpoint shall reset down. Provide a 5 minute (adjustable) time delay between each incremental step.
- Activation of the Emergency Fan Stop switch shall stop the supply and exhaust fans.
- Activation of Fan Stop signal from the fire alarm panel shall stop the DOAS unit.
- DDC shall monitor the units supply airflow and exhaust airflow.
- DDC shall monitor the units supply and exhaust air temperatures and humidities as designated in the point list.
- DDC shall monitor Amps and KWH and trend log results for the DOAS unit.
- DDC shall calculate building leakage based on the difference between the outside supply airflow and the exhaust airflow.

### OUTSIDE AIR SUPPLY VARIABLE VOLUME TERMINAL UNITS, VAV:

- Units shall be enabled/disabled by the DDC system based on a time schedule.
- Units shall provide airflows as scheduled.
- VAV's shall modulate to maintain carbon dioxide concentration levels at 700 PPM above outdoor concentration levels as sensed by the associated carbon dioxide space sensor as applicable.
- Outside airflow and temperature shall be monitored by the DDC system.

### EXHAUST AIR MODULATING DAMPERS:

- Exhaust modulating dampers serving the toilet area shall modulate based on input from the airflow station to maintain constant exhaust airflow.
- Exhaust modulating dampers serving the occupied space shall modulate based on space static pressure sensors to maintain a space static pressure of (+) 0.05" (adjustable).

INPUT/ OUTPUT SUMMARY	OUTPUTS				INPUTS										SOFTWARE				NOTES									
	DIGITAL		ANALOG		DIGITAL					ANALOG					ALARM		ENERGY MANAGEMENT											
	START/STOP	OPEN/CLOSE	ENABLE/DISABLE	OCCUPIED/UNOCCUPIED	DDC MODULATION	SETPOINT ADJUST	DIFF. PRESS. SWITCH	CURRENT SWITCH	ON/OFF	OPEN/CLOSE CONTACT	MANUAL OVERRIDE	AIRFLOW (CFM)	STATIC PRESSURE	GPM	%SPEED/Hz/CURRENT	TEMPERATURE	HUMIDITY/DEWPOINT	POWER (AMPS/KW/KWH)		CO2 LEVEL (PPM)	DIFFERENTIAL PRESSURE	EQUIPMENT FAILURE	HI/LO LIMIT	TEMPERATURE	TIME SCHEDULE	RUN TIME	OVERRIDE PROGRAM	DAY/NIGHT SETBACK
DEDICATED OUTSIDE AIR UNIT	X																			X		X		X				
SUPPLY AIR FAN (VFD)				X			X							X						X								
SUPPLY AIR FAN VFD HOA POSITION								X																				TOTAL OF THREE POSITIONS
EXHAUST AIR FAN (VFD)					X		X						X							X								TOTAL OF THREE POSITIONS
EXHAUST AIR FAN VFD HOA POSITION								X																				TOTAL OF THREE POSITIONS
SUPPLY DUCT STATIC PRESSURE												X								X								
EXHAUST DUCT STATIC PRESSURE												X								X								
SPACE STATIC PRESSURE												X								X								5 BUILDING STATIC STATIONS
SUPPLY AIR TEMPERATURE															X													DISCHARGE FROM UNIT
COOLING STAGES (VARIES)			X																									
HEATING STAGES (VARIES)			X																									
WHEEL OPERATION			X				X																					
OSA/EXHAUST DAMPERS		X																										
HEAT WHEEL BYPASS DAMPERS		X																										
HOT GAS REHEAT COIL F&B DAMPERS				X																								④
SMOKE DETECTOR								X																				SUPPLY AND EXHAUST
AIR FILTER DIFFERENTIAL PRESSURE																			X	X								SUPPLY AND EXHAUST
OUTSIDE AIR SUPPLY VAV				X							X																	③
EXHAUST AIR DAMPERS				X																								③
TOILET EXHAUST AIRFLOW STATIONS											X																	③
SPACE STATIC PRESSURE SENSORS											X																	③
DEDICATED OUTSIDE AIR UNIT ENHANCED POINTS																												①
OUTSIDE AIR FLOW							X		X																			
EXHAUST AIR FLOW							X		X																			
SUPPLY AIR HUMIDITY														X														DISCHARGE FROM UNIT
SUPPLY AIR TEMPERATURE														X														DISCHARGE OF COOLING COIL
SUPPLY AIR HUMIDITY UP														X														DISCHARGE OF COOLING COIL
SUPPLY AIR TEMPERATURE UP														X														UPSTREAM OF HEAT WHEEL
SUPPLY AIR TEMPERATURE DOWN														X														DOWNSTREAM OF HEAT WHEEL
SUPPLY AIR HUMIDITY UP															X													UPSTREAM OF HEAT WHEEL
SUPPLY AIR HUMIDITY DOWN															X													DOWNSTREAM OF HEAT WHEEL
EXHAUST AIR TEMPERATURE UP															X													UPSTREAM OF HEAT WHEEL
EXHAUST AIR TEMPERATURE DOWN															X													DOWNSTREAM OF HEAT WHEEL
EXHAUST AIR HUMIDITY UP															X													UPSTREAM OF HEAT WHEEL
EXHAUST AIR HUMIDITY DOWN															X													DOWNSTREAM OF HEAT WHEEL
AMPS																	X											
KWH																	X											
BUILDING LEAKAGE										X																		②
OUTSIDE AIR VAV SUPPLY AIR TEMPERATURE														X														③

- ENHANCED POINTS ASSOCIATED WITH THE LIVING LAB
- BASED ON THE DIFFERENCE BETWEEN THE SUPPLY AIRFLOW AND EXHAUST AIRFLOW
- SEE PLANS FOR QUANTITY AND LOCATION
- MONITORING ONLY BY THE DDC SYSTEM, UNIT CONTROLS FUNCTION

PRELIMINARY ONLY  
NOT FOR CONSTRUCTION



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ASHRAE HEADQUARTERS  
ADDITION AND RENOVATION

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DRAWING TITLE:

DOAS-1 CONTROL  
SEQUENCE & POINTS  
LIST

PROJECT NUMBER:

200614

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DRAWING NUMBER:

M6.1