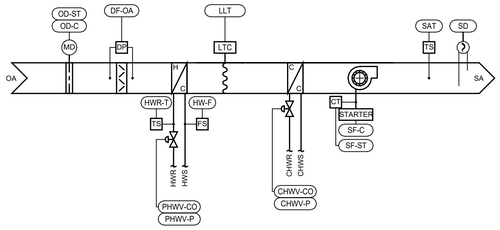
DUCT MOUNTED SMOKE DETECTORS ONLY REQUIRED WHERE SHOWN ON MECHANICAL OR FIRE ALARM FLOOR PLANS.

SEQUENCE OF OPERATIONS GENERAL NOTES

This sequence of operations is organized into the following main categories: operating modes, control setpoint resets, safeties, overrides and interlocks, and component control loops. The operating modes describe the criteria that either enable or disable the various modes of operation. If a mode of operation is not listed within a component control loop section then that mode of operation has no direct influence on the operation of the component. The control setpoint reset section describes the logic and reference variables that will be used to reset control setpoints to a new value within its reset range. The safeties, overrides, and interlocks section outlines the hardwired interlocks that will be required to meet life safety requirements. Safeties and interlocks take precedence over all other control strategies outlined in this document. The control responses of each component for the various modes of operation are described in the component control loop sections.

The sequence of operations, the points list and control diagrams shall be used to provide a complete description of the control philosophy for the controlled equipment. Individual setpoint values, reset ranges, and alarm action levels are listed in the points list. Components and control sensor locations are graphically depicted on the control diagram. The controls contractor shall be responsible for coordinating any necessary time delay setpoints to establish stable system operation.



POINTS LIST - CONSTANT VOLUME MAKEUP AIR UNIT

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SET POINT	SET POINT RESET RANGE	FAIL POSITION	TRENDING INTERVAL	TRENDING STORAGE	DISPLAY GRAPHIC	STATUS ALARM	ALARM RANGE	NOTES
GLOBAL VALUES											
OAT	OUTSIDE AIR TEMPERATURE	AV					X	X			
AIR SENSING											
SAT	SUPPLY AIR TEMPERATURE	AI	80 F CLG; 60 F HTG				X	X	X	45 F > SAT > 85 F	A
OAT-C	OUTSIDE AIR COOLING ENABLE	AV	80 F								A
OAT-H	OUTSIDE AIR HEATING ENABLE	AV	60 F								A
LLT	LOW LIMIT TEMPERATURE	AV	40 F				X	X	X	ON ACTIVATION	
SUPPLY FAN											
SF-C	SUPPLY FAN COMMAND (START/STOP)	BO					X	X			
SF-ST	SUPPLY FAN STATUS	BI					X		X	SF-ST <> SF-C	
OUTSIDE AIR DAMPER (2-POSITION)											
OD-C	OUTSIDE AIR DAMPER COMMAND	BO			NC			X			
OD-ST	OUTSIDE AIR DAMPER STATUS (END SWITCH)	BI					X	X	X	MOD-ST <> MOD-C	
FILTERS											
DF-OA	DIRTY FILTER INDICATION (OA FILTER)	BI	SCHED.					X	X	ON ACTIVATION	A
COOLING COIL - CHILLED WATER MODULATING											
CHWV-CO	CHILLED WATER VALVE CONTROL OUTPUT	AO			NO		X	X			
CHWV-P	CHILLED WATER VALVE POSITION (PERCENT)	AI					X	X	X	CHWV-P <> CHWV-CO	
HEATING COIL - HOT WATER MODULATING											
PHWV-CO	HEATING HOT WATER VALVE CONTROL OUTPUT	AO			NO		X	X			
PHWV-P	HEATING HOT WATER VALVE POSITION (PERCENT)	AI					X	X	X	HHW-P <> HHW-CO	
HWR-T	HEATING HOT WATER RETURN TEMPERATURE	AI							X	HWR-T < 80 F	
HW-F	HEATING HOT WATER FLOW SWITCH	BI							X	FAIL TO CLOSE	
FIRE ALARM/SMOKE DETECTORS											
SD	SMOKE DETECTOR STATUS	BI						X	X	ON ACTIVATION	B

ALL POINTS SHOWN SHALL BE PROVIDED BY BAS CONTRACTOR UNLESS NOTED OTHERWISE.

NOTES:
A. POINT SHALL BE ADJUSTABLE.
B. DEVICE AND RELAY FROM FIRE ALARM SYSTEM PROVIDED BY DIVISION 28 △3

② CONSTANT VOLUME MAKEUP AIR FAN CONTROL DIAGRAM
NTS

SEQUENCE OF OPERATIONS CONSTANT VOLUME MAKEUP AIR AIR HANDLING UNITS (MAU 1, MAU 2)

GENERAL DESCRIPTION

The air handling unit(s) described by this sequence of operations consist(s) of constant volume supply fan, chilled water cooling coil, and a hot water heating coil to serve as makeup air for the kitchen exhaust system.

OPERATING MODES

OCCUPIED MODE:

The unit shall be in occupied mode per a signal from the Kitchen Hood Control Panel.

UNOCCUPIED MODE:

The unit shall be in unoccupied mode per a signal from the Kitchen Hood Control Panel.

COOLING MODE:

The unit shall be in cooling mode when the outside air temperature (OAT) rises above the outside air cooling enable setpoint (OAT-C)

HEATING MODE:

The unit shall be in heating mode when the outside air temperature (OAT) falls below the outside air heating enable setpoint (OAT-H)

VENTILATION ONLY MODE:

The unit shall be in ventilation only mode when the outdoor air temperature is between the outdoor air cooling enable (OAT-C) and outdoor air heating enable (OAT-H) setpoints.

FREEZE PROTECTION MODE:

The unit shall be in freeze protection mode when:

The unit shall be in freeze protection mode when the supply air temperature sensor (SAT) senses a temperature less than the alarm setpoint.

CONTROL SETPOINT RESETS

Not Used.

SAFETIES, OVERRIDES AND INTERLOCKS

SMOKE DETECTOR INTERLOCK:

The unit shall be disabled via hard wired interlock on activation of a system smoke detector. Display smoke detector relay status (normal or alarm) at the BAS front end.

FIRE ALARM CONTROL PANEL INTERLOCK:

The unit shall be disabled via relay circuit signal from the fire alarm control panel. Division 28 shall provide the relay and leads from relay to unit. BAS contractor shall connect leads to unit. Display relay status (normal or alarm) at BAS front end.

FREEZE PROTECTION MODE INTERLOCK:

The supply fan shall be disabled via hard wired interlock at the supply fan start circuit from the low limit temperature controller.

HOOD INTERLOCK:

The supply fan shall be interlocked with the hood control panel and operate according to the manufacturer's programmed sequences.

COMPONENT CONTROL LOOPS

SUPPLY FAN CONTROL- CONSTANT VOLUME

When in Occupied Mode:
The fan shall be ON.
When in Unoccupied Mode:
The fan shall be OFF. On an override signal from the Kitchen Hood Control Panel, the fan shall operate as in occupied mode until the override is removed.
When in Freeze Protection Mode:
The fan shall be OFF.

OUTSIDE AIR DAMPER (OA)

When in Occupied Mode:
The damper shall be open.
When in Unoccupied Mode:
The damper shall close after the supply fan is off and a time delay .
When in Freeze Protection Mode:
The damper shall close after the supply fan is off and a time delay .

FILTER MONITORING

When in All Modes:
The controller shall monitor the differential pressure across each filter bank and shall provide a signal when the setpoint is exceeded.

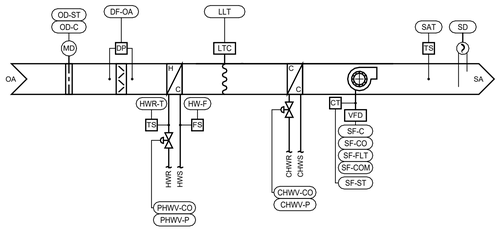
HEATING COIL- HOT WATER VALVE- MODULATING

When in Occupied Mode:
When in Ventilation Only Mode:
The valve shall be closed.
When in Cooling Mode:
The valve shall be closed.
When in Heating Mode:
The controller shall modulate the heating to maintain the supply air temperature setpoint (SAT).

△3
When in Unoccupied Mode:
The valve shall be closed.
On an override signal from the Kitchen Hood Control Panel, the valve shall operate as in occupied mode until the override is removed.
When in Freeze Protection Mode:
The valve shall be fully open.

COOLING COIL CHILLED WATER VALVE - MODULATING

When in Occupied Mode:
When in Ventilation Only Mode:
The valve shall be closed.
When in Cooling Mode:
The valve shall modulate to maintain the supply air temperature setpoint (SAT).
When in Heating Mode:
The valve shall be closed.
When in Unoccupied Mode:
The valve shall be closed.
On an override signal from the Kitchen Hood Control Panel, the valve shall operate as in occupied mode until the override is removed.
When in Freeze Protection Mode:
The valve shall be fully open.
And- The chilled water plant AHU freeze protection mode shall be activated.



POINTS LIST - VARIABLE VOLUME MAKEUP AIR UNIT

POINT ID	DESCRIPTION	POINT TYPE	DEFAULT SET POINT	SET POINT RESET RANGE	FAIL POSITION	TRENDING INTERVAL	TRENDING STORAGE	DISPLAY GRAPHIC	STATUS ALARM	ALARM RANGE	NOTES
GLOBAL VALUES											
OAT	OUTSIDE AIR TEMPERATURE	AV					X	X			
AIR SENSING											
SAT	SUPPLY AIR TEMPERATURE	AI	80 F CLG; 60 F HTG				X	X	X	45 F > SAT > 85 F	A
OAT-C	OUTSIDE AIR COOLING ENABLE	AV	80 F								A
OAT-H	OUTSIDE AIR HEATING ENABLE	AV	60 F								A
LLT	LOW LIMIT TEMPERATURE	AV	40 F				X	X	X	ON ACTIVATION	
SUPPLY FAN											
SF-COM	SUPPLY FAN VFD COMMUNICATION	COM						X			
SF-C	SUPPLY FAN COMMAND (START/STOP)	BO					X	X			
SF-CO	SUPPLY FAN CONTROL OUTPUT - SPEED (PERCENT)	AO		SCHED							
SF-ST	SUPPLY FAN STATUS	BI					X		X	SF-ST <> SF-C	
SF-FLT	SUPPLY FAN VFD FAULT	BI					X	X	X	COMMON ALARM	
OUTSIDE AIR DAMPER (2-POSITION)											
OD-C	OUTSIDE AIR DAMPER COMMAND	BO			NC			X			
OD-ST	OUTSIDE AIR DAMPER STATUS (END SWITCH)	BI					X	X	X	MOD-ST <> MOD-C	
FILTERS											
DF-OA	DIRTY FILTER INDICATION (OA FILTER)	BI	SCHED.					X	X	ON ACTIVATION	A
COOLING COIL - CHILLED WATER MODULATING											
CHWV-CO	CHILLED WATER VALVE CONTROL OUTPUT	AO			NO		X	X			
CHWV-P	CHILLED WATER VALVE POSITION (PERCENT)	AI					X	X	X	CHWV-P <> CHWV-CO	
HEATING COIL - HOT WATER MODULATING											
PHWV-CO	HEATING HOT WATER VALVE CONTROL OUTPUT	AO			NO		X	X			
PHWV-P	HEATING HOT WATER VALVE POSITION (PERCENT)	AI					X	X	X	HHW-P <> HHW-CO	
HWR-T	HEATING HOT WATER RETURN TEMPERATURE	AI							X	HWR-T < 80 F	
HW-F	HEATING HOT WATER FLOW SWITCH	BI							X	FAIL TO CLOSE	
FIRE ALARM/SMOKE DETECTORS											
SD	SMOKE DETECTOR STATUS	BI						X	X	ON ACTIVATION	B

ALL POINTS SHOWN SHALL BE PROVIDED BY BAS CONTRACTOR UNLESS NOTED OTHERWISE.

NOTES:
A. POINT SHALL BE ADJUSTABLE.
B. DEVICE AND RELAY FROM FIRE ALARM SYSTEM PROVIDED BY DIVISION 28 △3

① VARIABLE AIR VOLUME MAKEUP AIR UNIT CONTROL DIAGRAM
NTS

SEQUENCE OF OPERATIONS MAKEUP AIR UNITS (MAU 3)

This sequence of operations is organized into the following main categories: operating modes; control setpoint resets; safeties, overrides and interlocks; and component control loops. The operating modes describe the criteria that either enable or disable the various modes of operation. If a mode of operation is not listed within a component control loop section then that mode of operation has no direct influence on the operation of the component. The control setpoint reset section describes the logic and reference variables that will be used to reset control setpoints to a new value within its reset range. The safeties, overrides, and interlocks section outlines the hardwired interlocks that are required to meet life safety requirements. Safeties and interlocks take precedence over all other control strategies outlined in this document. The control responses of each component for the various modes of operation are described in the component control loop sections. Setpoints shall be adjustable (adj.) as noted.

The sequence of operations, the points list and control diagrams shall be used to provide a complete description of the control philosophy for the controlled equipment. Individual setpoint values, reset ranges, and alarm action levels are listed in the points list. Components and control sensor locations are graphically depicted on the control diagram. The controls contractor shall be responsible for coordinating any necessary time delay setpoints to establish stable system operation.

GENERAL DESCRIPTION

The air handling unit(s) described by this sequence of operations consist(s) of a constant speed or variable air volume supply fan, chilled water cooling coil, and a gas fired heating coil to serve as makeup air for the kitchen exhaust system.

OPERATING MODES

OCCUPIED MODE:

The unit shall be in occupied mode per a signal from the Kitchen Hood Control Panel.

UNOCCUPIED MODE:

The unit shall be in unoccupied mode per a signal from the Kitchen Hood Control Panel.

COOLING MODE:

The unit shall be in cooling mode when the outside air temperature (OAT) rises above the outside air cooling enable setpoint (OAT-C)

HEATING MODE:

The unit shall be in heating mode when the outside air temperature (OAT) falls below the outside air heating enable setpoint (OAT-H)

VENTILATION ONLY MODE:

The unit shall be in ventilation only mode when the outdoor air temperature is between the outdoor air cooling enable (OAT-C) and outdoor air heating enable (OAT-H) setpoints.

FREEZE PROTECTION MODE:

The unit shall be in freeze protection mode when:

The unit shall be in freeze protection mode when the supply air temperature sensor (SAT) senses a temperature less than the alarm setpoint.

CONTROL SETPOINT RESETS

Not Used.

SAFETIES, OVERRIDES AND INTERLOCKS

FIRE ALARM CONTROL PANEL INTERLOCK:

The unit shall be disabled via relay circuit signal from the fire alarm control panel. Division 28 shall provide the relay and leads from relay to unit. BAS contractor shall connect leads to unit. Display relay status (normal or alarm) at BAS front end.

FREEZE PROTECTION MODE INTERLOCK:

The supply fan shall be disabled via hard wired interlock at the supply fan start circuit from the low limit temperature controller.

HOOD INTERLOCK:

The supply fan shall be interlocked with the hood control panel and operate according to the manufacturer's programmed sequences.

COMPONENT CONTROL LOOPS

SUPPLY FAN CONTROL- SINGLE ZONE VARIABLE VOLUME:

When the HOA switch is in hand position, the variable speed supply fan shall operate at a speed set manually by the operator at the user interface of the drive.

When the HOA switch is in off position, the fan shall be off.

When the HOA switch is in auto position, the variable speed supply fan shall operate subject to the unit enable signal, and unit operating modes.

When in Occupied Mode:
The fan shall energize and slowly ramp to the initial minimum fan speed determined during system startup. Minimum fan speed shall be established during balancing. The supply fan shall be controlled and operated by the Kitchen Hood Control Panel in response to the associated exhaust hood airflow.
When in Unoccupied Mode:
The fan shall be OFF. On an override signal from the zone level, the fan shall operate as in occupied mode until the override is removed.
When in Freeze Protection Mode:
The fan shall be OFF.

OUTSIDE AIR DAMPER (OA)

When in Occupied Mode:
The damper shall be open.
When in Unoccupied Mode:
The damper shall close after the supply fan is off and a time delay.
When in Freeze Protection Mode:
The damper shall close after the supply fan is off and a time delay.

FILTER MONITORING

When in All Modes:
The controller shall monitor the differential pressure across each filter bank and shall provide a signal when the setpoint is exceeded.

HEATING COIL- HOT WATER VALVE- MODULATING

When in Occupied Mode:
When in Ventilation Only Mode:
The valve shall be closed.
When in Cooling Mode:
The valve shall be closed.
When in Heating Mode:
The controller shall modulate the heating to maintain the supply air temperature setpoint (SAT).
When in Unoccupied Mode:
The valve shall be closed.
On an override signal from the Kitchen Hood Control Panel, the valve shall operate as in occupied mode until the override is removed.

△3
When in Freeze Protection Mode:
The valve shall be fully open.

COOLING COIL CHILLED WATER VALVE - MODULATING

When in Occupied Mode:
When in Ventilation Only Mode:
The valve shall be closed.
When in Cooling Mode:
The valve shall modulate to maintain the supply air temperature setpoint (SAT).
When in Heating Mode:
The valve shall be closed.
When in Unoccupied Mode:
The valve shall be closed.
On an override signal from the Kitchen Hood Control Panel, the valve shall operate as in occupied mode until the override is removed.
When in Freeze Protection Mode:
The valve shall be fully open.
And- The chilled water plant AHU freeze protection mode shall be activated.

SEAN O. ESLER

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EXPIRES 12/31/2025

ISSUE/REVISION LOG:

No.	DESCRIPTION	DATE
3	Revision 3 - Owner Changes	04/23/2025

STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
No. 17560
SEAN O. ESLER
4/24/2025

ISSUED FOR REVIEW:	05/14/2024
ISSUED FOR BID:	05/14/2024
ISSUED FOR PERMIT:	05/14/2024

M7.08

MECHANICAL CONTROLS

LSL PROJECT NUMBER: 2024-107.000

BENTON, ARKANSAS