



CONTROL SYMBOLS

	TEMPERATURE SENSOR
	THERMOMETER
	PRESSURE SENSOR
	PRESSURE SWITCH
	DAMPER W/ACTUATOR
	VALVE W/ACTUATOR (2-WAY)
	VALVE W/ACTUATOR (3-WAY)
	FLOW SENSOR
	FLOW SWITCH
	SMOKE DETECTOR (REFER TO DIV. 16)
	NORMALLY CLOSED
	NORMALLY OPEN
	CONTROL SIGNAL TO DEVICE

MULTI-ZONE UNIT (MZ-1) CONTROL SCHEMATIC
SCALE: NONE

GENERAL

1. Provide a dedicated DDC panel to control the multi-zone unit and associated fan (EF-1).
2. Provide a programmable 24 hour time clock with adjustable occupied/unoccupied settings.
3. Provide necessary sensors for global points (outside air temperature).

SYSTEM START UP

1. Supply air fan, return air fan, CU-1 and CU-2 are provided with three phase power via a phase converter. Phase converter does not operate continuously, only when there is a demand for three phase power. Prior to activation of HVAC equipment powered by phase converter, an authorization from phase converter control panel must be received at individual DDC panel(s) controlling HVAC equipment. ATC contractor shall furnish and install control relays and wiring between DDC controllers and phase converter control panel. Upon receipt of signal from DDC panel(s) to initiate HVAC control sequence, a signal shall be sent to phase converter to activate phase converter. When phase converter has been activated and power generation proven, a signal will be sent back to HVAC controller authorizing initiation of HVAC control sequence. Coordinate installation with Electrical Contractor for control tie-in points at phase converter control panel. Provide an alarm light at the DDC control panel; this light will be red and will be activated should phase converter fail to deliver three phase power on demand from equipment control sequence.
2. System shall start-up with signal from either hand or auto position of H-O-A switch on motor starter of supply air fan of multi-zone unit. Return air fan and exhaust fan (EF-1) shall follow through interlocks. Provide a time delay of thirty seconds between start-up of supply fan and return fan, and between return fan and exhaust fan. Control sequence shall commence with outside air damper (and relief air damper) in minimum position.
3. During occupied time period, supply, return and exhaust fans shall operate continuously.
4. During unoccupied time period, supply, return and exhaust fans will not operate, and outside air damper (and relief air damper) will be completely closed.

SPACE TEMPERATURE CONTROL

1. Each of the eight zones of the multi-zone unit shall be provided with a local temperature sensor, as located on the drawings.
2. During occupied time period, sensors, through the unit DDC panel, shall modulate the multi-zone dampers, mixing hot deck & cold deck air streams to maintain zone temperature set points.
3. During unoccupied time period, temperature sensors will be locked out of control system.

SUMMER OPERATION

1. Cooling system shall be activated when outside temperature exceeds 73F. Controls shall be provided to maintain cooling system on, once activated, for a minimum of one hour.
2. DDC system shall provide signals to the remote air-cooled condensing units to maintain cold deck supply air temperature set point. On call for cooling first activate the lead condensing unit, then activate lag condensing unit. Provide automatic lead lag changeover based on actual run time.
3. Cold deck temperature shall be reset from a minimum of 55F upward to maintain at least one zone in the full cooling position (no mixture with neutral deck). Cold deck temperature reset shall be limited by a high limit humidity sensor located in the return air duct with a set point of 50% relative humidity.
4. When outside air temperature is above return air temperature, outside air damper will remain in minimum outside air position, and neutral zone air temperature will be the mixed air temperature. When outside air is below return air temperature, DDC system will control economiser dampers to reset mixed air temperature downward until at least one zone is in the full bypass position (no mixture with cold deck).

INTERMEDIATE OPERATION (NO HEATING OR COOLING)

1. When outside air temperature is between 60F and 73F, neither heating nor cooling system will be in operation.
2. Return air temperature sensor shall operate economiser dampers from minimum outside air position to 100% outside air as required to maintain set point of 75F.
3. Zone dampers shall be full open to cold deck to minimize pressure drop through system.

WINTER OPERATION

1. Hot water circulation pumps shall be activated when outside air temperature is below 58F. During occupied hours, as determined by the time clock, both the multi-zone unit coil pump, and the perimeter zone pump will operate. During unoccupied hours, only the perimeter zone pump will operate. After a time delay, the boiler control circuit will be activated, provided flow switches in return water piping prove flow.
2. Hot water heating pumps P-1 and P-2 shall be provided with current sensors to monitor pump status, and shall alarm upon loss of pump flow by sounding an alarm and illuminating dedicated lights (red) in boiler room. Back-up pump P-3 shall be manually switched over by opening and closing appropriate valves. When valves have been re-positioned, a selector switch shall be positioned to indicate which pump (P-1 or P-2) pump P-3 is providing back-up. Pump P-3 shall assume operation of failed pump. Pump P-3 shall be provided with current sensor to monitor pump status and shall alarm upon failure as described for P-1 and P-2 above.
3. Boilers shall be provided with a master control panel, which will cycle boilers on in sequence to maintain supply water temperature set point and provide lead/log control on a weekly basis and water temperature reset control for each boiler. Lead/log control shall be capable of operating either manually or automatically and shall have on/auto/off switch for each stage to allow removal of boiler from sequence without re-wiring.
4. Supply water temperature set point shall be reset based on outside air temperature from 180F when outside temperature is below 0F. The hot water supply air temperature will be reset downward from 180F to 140F proportionally to an outside air temperature increase from 0F to 50F. Hot water supply air temperature will remain at 140F from outside air temperatures of 50F to 58F. Hot water reset shall be programmed into the boiler master control panel.
5. Provide a PID control and delay time to anticipate system temperature, preventing unnecessary cycling of boilers.
6. Control panel shall incorporate a sequencer to stage boilers on and off in response to water temperature sensor. Upon a signal from water temperature sensor lead boiler shall fire and associated circulator shall start. If lead boiler cannot meet system demand then lag boiler shall fire and its associated circulator shall start. Boilers and pumps shall sequence off in reverse order.
7. A digital display capable of manually stepping through all set points and system data shall be provided with LED's to indicate lead stage and boiler operating status.
8. Hot deck air temperature will be maintained at 120F to allow mixed air temperature to be a minimum of 100F.
9. Neutral deck will always be the mixture of minimum outside air with return air.



No.	DATE	REVISION

DUNCAN • WISNIEWSKI ARCHITECTURE
265 SOUTH CHAMPLAIN STREET, BURLINGTON, VERMONT 05401 (802) 864-9988

Hallam Associates
60 Ferris Street, Suite 300
St. Albans, Vermont 05478
(802) 888-4821

WILLISTON INFORMATION CENTER
189 NORTHBOUND
STATE PROJECT # IM-BLDG (4)

HVAC FLOW SCHEMATIC

DRAWN: J.LAMOTHE	PROJ.No: 10215
CHECKED: M.COOK	DATE: JAN 15, 2001

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