



ENERGY RECOVERY VENTILATOR (ERV-X)  
CONTROL DIAGRAM  
NOT TO SCALE

POINTS LIST - ENERGY RECOVERY VENTILATOR											
POINT NAME	HARDWARE POINTS				SOFTWARE POINTS						
	AI	AO	BI	BO	SETPOINT	AV	BV	LOOP	SCHED	TREND	ALARM
<b>SUPPLY AIR</b>											
BUILDING STATIC PRESSURE	X									X	X
CC VALVE		X								X	X
CC LAT	X									X	X
RHC VALVE										X	X
SF AIRFLOW	X									X	X
SF STATUS			X							X	X
SF START/STOP				X						X	X
SF VFD FAULT										X	X
SF VFD SPEED		X								X	X
SA LAT	X									X	X
SA STATIC PRESSURE	X									X	X
SA DAMPER				X						X	X
HIGH STATIC SHUTDOWN			X							X	X
SA SMOKE DETECTOR			X							X	X
<b>RETURN AIR</b>											
RA EAT	X									X	X
RA AIRFLOW	X									X	X
RA STATIC PRESSURE	X									X	X
LOW STATIC SHUTDOWN			X							X	X
RA SMOKE DETECTOR			X							X	X
RA DAMPER		X								X	X
<b>EXHAUST AIR</b>											
EF STATUS			X							X	X
EF VFD FAULT			X							X	X
EF VFD SPEED		X								X	X
EF START/STOP				X						X	X
EA DAMPER		X								X	X
EA EAT	X									X	X
<b>SETPOINTS</b>											
EMERGENCY SHUTDOWN					N/A		X			X	X
BUILDING DIFFERENTIAL PRESSURE SETPOINT					0.03 in w.g.	X				X	X
CC LAT SETPOINT					NOTE 1	X				X	X
RA STATIC PRESSURE SETPOINT					NOTE 1	X				X	X
SA LAT SETPOINT					55°F	X				X	X
SA STATIC PRESSURE SETPOINT					NOTE 1	X				X	X
<b>ALARMS</b>											
HIGH RETURN AIR TEMPERATURE					IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90°F (ADJ.)					X	10 MIN.
LOW RETURN AIR TEMPERATURE					IF THE RETURN AIR TEMPERATURE IS LESS THAN 45°F (ADJ.)					X	10 MIN.
HIGH SUPPLY AIR TEMPERATURE					IF THE SUPPLY AIR TEMPERATURE IS 5°F GREATER THAN ITS SETPOINT (ADJ.)					X	10 MIN.
LOW SUPPLY AIR TEMPERATURE					IF THE SUPPLY AIR TEMPERATURE IS 5°F LESS THAN ITS SETPOINT (ADJ.)					X	10 MIN.
HIGH RETURN AIR STATIC PRESSURE					IF THE RETURN AIR STATIC PRESSURE IS 25% GREATER THAN SETPOINT (ADJ.)					X	6 MIN.
LOW RETURN PLENUM STATIC PRESSURE					IF THE RETURN AIR PLENUM STATIC PRESSURE IS 25% LESS THAN SETPOINT (ADJ.)					X	6 MIN.
HIGH SUPPLY AIR STATIC PRESSURE					IF THE SUPPLY AIR STATIC PRESSURE IS 25% GREATER THAN SETPOINT (ADJ.)					X	6 MIN.
LOW SUPPLY AIR STATIC PRESSURE					IF THE SUPPLY AIR STATIC PRESSURE IS 25% LESS THAN SETPOINT (ADJ.)					X	6 MIN.
HIGH BUILDING STATIC PRESSURE					IF THE BUILDING STATIC PRESSURE IS 25% GREATER THAN SETPOINT (ADJ.)					X	10 MIN.
LOW BUILDING STATIC PRESSURE					IF THE BUILDING STATIC PRESSURE IS 25% LESS THAN SETPOINT (ADJ.)					X	10 MIN.
SF FAILURE					COMMANDED ON, BUT THE STATUS IS OFF					X	10 MIN.
SF IN HAND					COMMANDED OFF, BUT THE STATUS IS ON					X	10 MIN.
SF RUNTIME EXCEEDED					STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.)					X	10 MIN.
EF FAILURE					COMMANDED ON, BUT THE STATUS IS OFF					X	10 MIN.
EF IN HAND					COMMANDED OFF, BUT THE STATUS IS ON					X	10 MIN.
EF RUNTIME EXCEEDED					STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.)					X	10 MIN.
PREFILTER CHANGE REQUIRED					PREFILTER HAS BEEN IN USE FOR MORE THAN 2200 HOURS (ADJ.)					X	10 MIN.
FINAL FILTER CHANGE REQUIRED					AFTER FILTER HAS BEEN IN USE FOR MORE THAN 2200 HOURS (ADJ.)					X	10 MIN.
<b>NOTES:</b>											
1 SEE STANDARD TRENDING POINTS LIST SCHEDULE ON SHEET M-701 FOR APPLICABLE TREND INTERVALS											
2 SEE EQUIPMENT SCHEDULES FOR SETPOINT VALUES											
3 SEE PROJECT DESIGN CONDITIONS SCHEDULE FOR SETPOINT VALUES											

## SEQUENCE OF OPERATIONS ENERGY RECOVERY VENTILATOR (ERV-X) GENERAL DESCRIPTION

The energy recover ventilator described by this sequence of operations consist(s) of a variable speed supply fan, variable speed exhaust fan energy recovery wheel (ERW), chilled water cooling coil, and hot water reheat coil that operate with zone level variable air volume terminal units to provide heating, ventilation and air-conditioning for the conditioned space as shown on the drawings.

### OPERATING MODES

#### OCCUPIED MODE

The ERV shall be in occupied mode per the project design conditions schedule shown on the control drawings.

#### UNOCCUPIED MODE

The ERV shall be in unoccupied mode for all periods not included in the occupied hours of operation. Overrides of unoccupied schedule are defined at the zone level control.

#### COOLING ENERGY RECOVERY MODE- ENTHALPY ENABLED

The ERV shall be in cooling energy recovery mode when:

The economizer mode is disabled.

The outside airflow rate is equal to the minimum outside air (MOA) setpoint.

The outside air enthalpy (OAE) is greater than the return air enthalpy (RAE).

#### HEATING ENERGY RECOVERY MODE

The unit shall be in heating energy recovery mode when:

The unit is not in economizer mode.

The outside air temperature (OAT) is 5 degrees below the return air temperature (RAT).

### CONTROL SETPOINT RESETS

#### VENTILATION RESET

System Level Ventilation Reset - If the space temperature setpoint is satisfied, the controller shall modify the minimum outside airflow setpoint value between the minimum airflow at minimum fan speed and the minimum outside airflow values shown on the ERV schedule subject to the maximum zone level CO2 setpoint of 1,000 ppm (adj.).

### SAFETIES, OVERRIDES AND INTERLOCKS

#### SMOKE DETECTOR INTERLOCK

The unit shall be disabled via hard wired interlock at the fan start circuit upon receipt of signal from the fire alarm control panel.

#### FIRE ALARM CONTROL PANEL INTERLOCK

The unit shall be disabled via hard wired interlock at the fan start circuit upon activation of dust high static pressure controller.

#### HIGH SUPPLY AIR STATIC PRESSURE INTERLOCK

The unit shall be disabled via hard wired interlock at the fan start circuit upon activation of dust high static pressure controller.

#### LOW RETURN AIR STATIC PRESSURE INTERLOCK

The unit shall be disabled via hard wired interlock at the fan start circuit upon activation of dust low static pressure controller.

#### SUPPLY FAN INTERLOCK

Exhaust fan shall be interlocked to be OFF with the associated unit supply fan.

### COMPONENT CONTROL LOOPS

#### SUPPLY FAN CONTROL-VFD

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:

At fan startup, the fan shall energize and slowly ramp to the initial minimum fan speed determined during system startup. On a call for cooling or heating, the fan shall operate at a constant speed to maintain its airflow setpoint.

Upon receiving a ventilation reset command, the supply fans shall modulate subject to the ventilation reset controls.

#### When in Unoccupied Mode:

The fan shall be OFF.

#### EXHAUST FAN (EF) - BUILDING PRESSURE

The exhaust fan provides building relief-exhaust and energy recovery exhaust to maintain the building differential setpoint and energy recovery operation.

#### When in Occupied Mode:

The exhaust fan shall be ON when the associated ERV supply fan is on

The exhaust fan VFD speed shall vary to maintain the building differential pressure (BDP) setpoint.

#### When in Unoccupied Mode:

The exhaust fan shall be OFF.

#### FILTER MONITORING

The unit filters shall be monitored for preventative maintenance and diagnostic purposes.

#### When in all Modes:

The controller shall monitor the fan runtime to provide maintenance reminder at 50% of filter elapsed time (1100 hours) and an alarm at 100% elapsed time (2200 hours).

#### ENERGY RECOVERY WHEEL (ERW)

The energy recovery system consists of a total heat energy recovery wheel (ERW) operated with a variable speed drive and bypass dampers to provide pre-conditioned minimum outside air.

#### When in Occupied Mode:

The ERW shall operate when the unit is in either cooling recovery mode or heating recovery mode.

ERW self cleaning- the heat wheel shall run at 5 % speed (adj.) for 10 sec (adj.) every 4-hr (adj.) when the unit runs.

#### When in Unoccupied Mode:

The heat wheel shall be disabled, the minimum outside air dampers are closed and the bypass dampers are open.

#### When in Cooling Recovery Mode:

The ERW shall be on.

The ERW bypass dampers shall be closed.

#### When in Heating Recovery Mode:

The ERW shall be on.

The ERW bypass dampers shall be closed.

#### When in Economizer Mode:

The ERW bypass dampers shall be open.

#### COOLING COIL- CHILLED WATER VALVE- MODULATING

#### When in Occupied Mode:

The cooling coil valve shall modulate to maintain the cooling supply air temperature setpoint (SAT).

#### When in Unoccupied Mode:

The cooling valve shall close.

#### REHEAT COIL- HOT WATER VALVE- MODULATING

#### When in Occupied Mode:

The controller shall modulate the heating valve to maintain the supply air temperature setpoint (SAT).

#### When in Unoccupied Mode:

The heating valve shall close.

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SHEET REVISED  
AND REISSUED.

		CONSULTANT INFORMATION		ARCHITECT		Office of Construction and Facilities Management		SHEET TITLE MECHANICAL CONTROLS IV		PROJECT PHASE BID DOCUMENTS		PROJECT TITLE CONSTRUCT REPLACEMENT WAREHOUSE		VA PROJECT NUMBER 649-414	
		STRUCTURAL / CIVIL ENGINEER H2B, INC. 1225 N. LOOP WEST, SUITE 800 HOUSTON, TX 77008 (713) 864-2900		COMMISSIONING GLHN ARCHITECTS & ENGINEERS, INC. 11020 KING STREET, SUITE 350 TUCSON, AZ 85716 (520) 881-4546		MECH. / ELEC. / PLUMB. / TECH. ENGINEER SPUR DESIGN 11020 KING STREET, SUITE 350 OVERLAND PARK, KS 66210 (405) 842-6100						PROJECT LOCATION 500 AZ-89, PRESCOTT, AZ 86301		BUILDING NUMBER 165	
		FIRE PROTECTION ENGINEER POOLE FIRE PROTECTION, INC. 19910 W. 161ST STREET OLATHE, KS 66062 (913) 882-8859		LANDSCAPE ARCHITECT ARC STUDIOS INC. 3117 E. FLOWER STREET TUCSON, AZ 85716 (520) 882-8855				APPROVED: PROJECT DIRECTOR		FULLY SPRINKLERED				DRAWING NUMBER 165-M-704	
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