

**FPB-VAV SEQUENCE OF OPERATION**

**SERIES FAN POWERED BOX WITH ELECTRIC HEAT SEQUENCE OF OPERATION**  
 THE CONTROLLER MODULATES THE PRIMARY AIR DAMPER OF THE TERMINAL BOX FOR COOLING AND CONTROLS STAGES OF ELECTRIC REHEAT FOR HEATING. THE TERMINAL BOX ALSO HAS A SERIES FAN FOR AIR CIRCULATION. FOR THIS APPLICATION TO WORK PROPERLY, AN AHU MUST PROVIDE COOL SUPPLY AIR DURING OCCUPIED TIMES.

THE CURRENT SETPOINT WILL HOLD THE VALUE OF ONE OF THE FOLLOWING DETERMINED BY THE SCHEDULE (ADJUSTABLE) AND HEATING OR COOLING MODE: DAY COOL SETPOINT, DAY HEAT SETPOINT, NIGHT COOL SETPOINT, OR NIGHT HEAT SETPOINT.

THE CONTROL FLOW MINIMUM AND MAXIMUM WILL HOLD THE VALUE EITHER THE COOL FLOW MINIMUM AND MAXIMUM (ADJUSTABLE) OR THE HEAT FLOW MINIMUM AND MAXIMUM (ADJUSTABLE), DETERMINED BY THE HEATING OR COOLING MODE.

**COOLING MODE**  
 THE CONTROLLER WILL TRANSITION INTO COOLING MODE WHEN THE CONTROL TEMP IS ABOVE THE CURRENT SETPOINT. THE PRIMARY AIR DAMPER IS MODULATED BASED UPON THE COOLING DEMAND TO THE APPROPRIATE FLOW SETPOINT IN THE RANGE BETWEEN THE COOL FLOW MINIMUM AND COOL FLOW MAXIMUM. THE ELECTRIC REHEAT IS OFF DURING COOLING MODE. IF THE RTU SUPPLY TEMPERATURE IS GREATER THAN THE CONTROL TEMP, THE FLOW SETPOINT IS OVERRIDDEN BY THE SYSTEM MANAGER TO MAINTAIN ITS MINIMUM VALUE.

**HEATING MODE**  
 THE CONTROLLER WILL TRANSITION INTO HEATING MODE WHEN THE CONTROL TEMP IS BELOW THE CURRENT SETPOINT MINUS THE SWITCH DEAD BAND. THE AIRFLOW OUT OF THE TERMINAL BOX WILL BE MAINTAINED AT THE HEAT FLOW MINIMUM SETPOINT. THE ELECTRIC HEAT STAGES ARE MODULATED USING A DUTY CYCLE OF 10 MINUTES. FOR EXAMPLE, A HEATING DEMAND OF 60% FOR 2 STAGES OF ELECTRIC HEAT WOULD ENABLE THE 1ST STAGE OF HEATING FOR THE ENTIRE 10 MINUTES, AND THE 2ND STAGE OF HEATING WOULD BE ON FOR 2 MINUTES AND OFF FOR 8 MINUTES. IF THE RTU IS PROVIDING HEAT AND THE DAT RISES ABOVE 65 DEG. F, THE VAV ELECTRIC HEAT WILL BE OVERRIDDEN TO OFF BY THE SYSTEM MANAGER TO PREVENT AN EXCESSIVELY HOT LEAVING AIR TEMPERATURE THAT CAN LEAD TO PREMATURE HEATER COIL FAILURE.

**SERIES FAN OPERATION**  
 IN OCCUPIED MODE THE FAN IS ON ALL OF THE TIME.

IN UNOCCUPIED MODE THE FAN WILL TURN ON IF EITHER OF THE FOLLOWING CONDITIONS OCCURS:

- HEAT STAGE 1 TURNS ON.
- THE PRIMARY AIRFLOW, FLOW, IS GREATER THAN THE VALUE IN SERIES ON.

IN UNOCCUPIED MODE THE FAN WILL TURN OFF IF BOTH OF THE FOLLOWING CONDITIONS OCCUR:

- HEAT STAGE 1 TURNS OFF FOR AT LEAST ONE FULL DUTY CYCLE (DEFAULT 10 MINUTES).
- THE PRIMARY AIRFLOW, FLOW, IS LESS THAN THE VALUE IN SERIES OFF.

**SINGLE DUCT COOLING-ONLY SEQUENCE OF OPERATION**  
 THE CONTROLLER MODULATES THE PRIMARY AIR DAMPER OF THE TERMINAL BOX BETWEEN MINIMUM AND MAXIMUM CFM SETPOINTS TO MAINTAIN THE CURRENT SETPOINT. THE CONTROLLER IS ALWAYS IN COOL MODE. IF THE ZONE TEMPERATURE IS BELOW ITS CURRENT SETPOINT, THE TERMINAL UNIT CONTROLLER WILL MODULATE THE DAMPER TO MAINTAIN THE CONTROL FLOW MINIMUM CFM. IF THE RTU SUPPLY AIR TEMPERATURE IS GREATER THAN THE ZONE TEMPERATURE, THEN THE DAMPER SHALL BE OVERRIDDEN TO THE CONTROL FLOW MINIMUM CFM SETPOINT BY THE SYSTEM MANAGER. IN ORDER FOR THIS APPLICATION TO WORK PROPERLY, THE CENTRAL AIR HANGING UNIT MUST PROVIDE COOL SUPPLY AIR DURING OCCUPIED TIMES.

THE CURRENT SETPOINT WILL HOLD THE VALUE OF EITHER THE DAY COOL SETPOINT OR THE NIGHT COOL SETPOINT DEPENDING ON THE SCHEDULE (ADJUSTABLE). THE NIGHT COOL SETPOINT IS SET TO THE SAME VALUE OF THE PARENT AHU.

THE CONTROL FLOW MINIMUM AND MAXIMUM HOLD THE VALUE OF THE COOL FLOW MINIMUM AND MAXIMUM.

**DEMAND CONTROL VENTILATION (DCV) - REQUIRES CO2 SENSOR**  
 THE ZONE CONTROLLER MONITORS THE CO2 SENSOR AND CAN OVERRIDE THE TEMPERATURE CONTROL TO RESPOND TO INCREASING CO2 LEVELS WHEN THE ZONE IS OCCUPIED. IF THE SENSOR'S VALUE REMAINS BELOW THE DCV START CTRL SETPOINT, THE OCCUPIED MIN AIRFLOW SETPOINT PROVIDES THE BASE VENTILATION RATE AS DEFINED BY ASHRAE. AS THE CO2 LEVEL EXCEEDS THE DCV START CTRL SETPOINT AND THE AIR SOURCE IS IN COOLING OR VENTILATION MODE, THE CONTROLLER INCREASES AIRFLOW TO THE ZONE STARTING AT THE OCCUPIED MIN AIRFLOW AND THEN PROPORTIONALLY INCREASES VENTILATION AS THE CO2 LEVEL INCREASES. IF THE SENSOR'S VALUE EXCEEDS THE DCV MAX CTRL SETPOINT, THE CONTROLLER MAINTAINS THE DCV MAX VENT AIRFLOW UNTIL THE ZONE'S CO2 LEVEL DECREASES.

WHEN THE ZONE IS UNOCCUPIED, THE UNOCCUPIED MIN AIRFLOW PROVIDES THE BASE VENTILATION AS REQUIRED.  
 IF THE CONTROLLER IS CONFIGURED FOR AUXILIARY HEAT, THE CONTROLLER WILL MAINTAIN THE ZONE'S TEMPERATURE AT A HEATING SETPOINT THAT IS TEMPORARILY INCREASED TO A VALUE HALFWAY BETWEEN THE HEATING AND COOLING SETPOINTS WHENEVER DCV IS ACTIVE. THIS PREVENTS AN EXCESSIVE DROP IN ZONE TEMPERATURE CAUSED BY THE ADDITIONAL VENTILATION. IF AUXILIARY HEAT IS NOT AVAILABLE, THE DCV MAX VENT AIRFLOW SETPOINT SHOULD BE READJUSTED TO PREVENT OVERCOOLING OR SET TO 0 TO DISABLE DCV AT THE ZONE.

**COORDINATION NOTE:**

NEW AHU E-1 PROVIDED UNDER CDB PROJECT #805-030-020 MUST MEET THE FOLLOWING CRITERIA:  
 COOLING CAPACITY: 20 TONS  
 AIR FLOW: 7425 CFM  
 MINIMUM OA DAMPER POSITION: 25%

AIR DEVICE SCHEDULE				
ITEM TAG	MANUFACTURER & MODEL NUMBER	DESCRIPTION	FINISH	REMARKS
A	"TITUS" OMNI-AA	ALUMINUM 24"x24" SUPPLY DIFFUSER	-	1-4
	"KRUEGER" 5PLQ			
	"PRICE" ASPD			
B	"TITUS" 300-FS	16X6 ADJUSTABLE BLADE, DOUBLE DEFLECTION SUPPLY REGISTER	-	1-4
	"KRUEGER" 5880			
	"PRICE" 22DAL			
C	"TITUS" TMRA-AA	ALUMINUM ADJUSTABLE ROUND DIFFUSER	-	2-5
	"KRUEGER" 5RM2			
	"PRICE" ARCD			
E	"TITUS" 350-RL	8X8 ANGLED HORIZONTAL FIXED BLADE SINGLE DEFLECTION EXHAUST GRILLE	-	2-4
	"KRUEGER" AFS580			
	"PRICE" 630			
F	"TITUS" 350-RL	24X12 ANGLED HORIZONTAL FIXED BLADE SINGLE DEFLECTION RETURN GRILLE	-	2-4
	"KRUEGER" AFS580			
	"PRICE" 630			
G	"TITUS" 350-RL	44X44 ANGLED HORIZONTAL FIXED BLADE SINGLE DEFLECTION TRANSFER GRILLE	-	2-4
	"KRUEGER" AFS580			
	"PRICE" 630			
H	"TITUS" 350-RL	16X16 ANGLED HORIZONTAL FIXED BLADE SINGLE DEFLECTION EXHAUST GRILLE	-	2-4
	"KRUEGER" AFS580			
	"PRICE" 630			

REMARKS:  
 1. 4-WAY THROW UNLESS OTHERWISE NOTED  
 2. PROVIDE ADAPTOR BOOT AS REQUIRED  
 3. VENTILATION CONTRACTOR SHALL COORDINATE FRAME STYLES AND FINISH COLOR WITH ARCHITECTURAL PLANS  
 4. OPPOSED BLADE DAMPER  
 5. UNIFORM 360 DEGREE DISCHARGE

VENTILATION SCHEDULE													
ROOM NUMBER	ROOM NAME	OCCUPANCY CLASSIFICATION	FLOOR AREA FT2	NUMBER OF PEOPLE	IMC 2009 REQUIREMENTS					ACTUAL		EQUIPMENT	
					OA CFM/PERSON	OA CFM/FT2	O.A.I CFM	E.A. CFM	SUPPLY CFM	OA CFM	EXHAUST CFM	SUPPLY FAN	EXHAUST FAN
100	CORRIDOR 1	CORRIDOR	341	0	0	0.06	20	0	300	75	0	E-1	-
101	FLEX SPACE 1	MULTIUSE ASSEMBLY	2608	96	7.5	0.06	876	0	4425	1106	200	E-1	EF-1
102	TEAM MEETING ROOM	CONFERENCE	148	7	5.0	0.06	46	0	225	56	0	E-1	-
103	OFFICE	OFFICE	88	1	5.0	0.06	10	0	100	25	0	E-1	-
104	LEARNING LAB	CONFERENCE	609	30	5.0	0.06	189	0	850	213	0	E-1	-
105	CORRIDOR 2	CORRIDOR	45	0	0.0	0.06	3	0	50	13	0	E-1	-
106	TOILET	TOILET ROOM*	58	0	0.0	0.00	0	0	70	0	0	E-1	CEF-1
107	FLEX SPACE 2	MULTIUSE ASSEMBLY	947	41	7.5	0.06	364	0	1475	369	0	E-1	-
108	STORAGE	STORAGE INACTIVE	55	0	0.0	0.00	0	0	0	0	0	-	-
109	MAKER SPACE	COMPUTER LAB	522	13	10.0	0.12	193	0	775	194	925	E-1	EF-2
110	STORAGE	STORAGE	178	0	0.0	0.12	21	0	100	25	0	E-1	-
111	CONFERENCE ROOM 1	CONFERENCE	249	12	5.0	0.06	77	0	350	88	0	E-1	-
112	CONFERENCE ROOM 2	CONFERENCE	260	13	5.0	0.06	81	0	350	88	0	E-1	-
113	STORAGE	STORAGE INACTIVE	57	0	0.0	0.00	0	0	0	0	0	-	-
114	STORAGE	STORAGE INACTIVE	18	0	0.0	0.00	0	0	0	0	0	-	-
115	STORAGE	STORAGE INACTIVE	18	0	0.0	0.00	0	0	0	0	0	-	-
TOTAL			6201	214	-	-	1881	70	9000	2250	1205	-	-

\* MECHANICAL EXHAUST IS REQUIRED AND RECIRCULATION IS PROHIBITED.

**SERIES FAN-POWERED BOX (FPB) SCHEDULE**

TAG	AREA SERVED	MANUFACTURER / MODEL	SIZE			CFM		PRESSURES		FAN			Electric Heat Coil			Electrical		Unit Information					
			UNIT	INLET (IN. DIA.)	OUTLET	MIN CFM	DESIGN CFM	MAX (IN. H2O)	MIN (IN. H2O)	FLOW (CFM)	ESP	HP	HEATING CFM	KW	EAT	LAT	Volts/Ph.	Steps	FLA	MCA	MOP	Volts/Ph.	Hand
FPB-1	CORRIDOR 1 / FLEX SPACE 1 -100/101	TITUS #DTFS-F	C	10	15x12	270	900	1	0.1	900	0.3	1/4	900	9	69	100	277/1	2	-	40.1	45	277/1	RH
		DAIKIN #MQQFC6	C4	8	20x17.5									9	69	100		1	-	37	40		
		TRANE #VSEF	03SQ	8	12x12									7.5	69	95		2	1.6	35.8	40		

REMARKS:  
 1. VENTILATION CONTRACTOR SHALL INSTALL AS PER MANUFACTURER RECOMMENDATIONS  
 2. VENTILATION CONTRACTOR SHALL FIELD INSTALL NECESSARY DCV CONTROL DEVICES AND INTEGRATE FPB CONTROL WITH EXISTING JOHNSON METASYS BAS.  
 3. PROVIDE WITH FACTORY MOUNTED DISCONNECT SWITCH AND VIBRATION ISOLATORS  
 4. INLET CONNECTION TO UNIT SHALL BE MINIMUM OF 24" OF STRAIGHT RIGID DUCT  
 5. FURNISH WITH FACTORY INSTALLED ACTUATOR.  
 6. HEATING CONTRACTOR TO FIELD INSTALL NECESSARY TEMPERATURE CONTROLS AND RELATED END-DEVICES

**ELECTRIC HEAT (EH) BASEBOARD SCHEDULE**

TAG	MANUFACTURER / MODEL	LOCATION	LENGTH (IN.)	NO. OF ELEMENTS	WATTS	V / PH / HZ	AMPS	REMARKS
EH-1	QMARK #SHA-09500	FLEX SPACE 1	(3) 108	2	(3) 4500	277/1/60	(3) 16.2	1-4
	BERKO #ASL509500		(3) 108		(3) 4500		(3) 16.2	
	INDEECO #BH1916U		(3) 94.5		(3) 4000		(3) 14.4	
			(1) 35.4		(1) 1500		(1) 5.4	
EH-2	QMARK #SHA-09500	FLEX SPACE 1	(1) 28	2	(1) 1000	277/1/60	(1) 3.6	1-4
	BERKO #ASL509500							
	INDEECO #BH1916U		(1) 23.6					
EH-3	QMARK #SHA-09500	FLEX SPACE 1	(1) 28	2	(1) 1000	277/1/60	(1) 3.6	1-4
	BERKO #ASL509500							
	INDEECO #BH1916U		(1) 23.6					

REMARKS:  
 1. HEATING CONTRACTOR SHALL INSTALL AS PER MANUFACTURER RECOMMENDATIONS  
 2. HEATING CONTRACTOR SHALL FURNISH WITH FACTORY INSTALLED DISCONNECT SWITCH AND TWO STAGE THERMOSTAT - TAMPER RESISTANT  
 3. HEATING CONTRACTOR SHALL FURNISH WITH ARCHITECTURAL PEDESTAL LEG  
 4. HEATING CONTRACTOR SHALL FURNISH WITH FACTORY APPLIED DARK BRONZE FINISH TO MATCH ARCHITECTURAL CURTAIN WALL. REFER TO ARCHITECTURAL PLANS FOR ADDITIONAL INFORMATION. PROVIDE BLANK SECTIONS AND CORNER SECTIONS FOR CONTINUOUS LOOK.

**EXHAUST FAN (EF) SCHEDULE**

TAG	QUANTITY	STATUS	MANUFACTURER	MODEL #	DRIVE	LOCATION	AREA SERVED	BLOWER SECTION			ELECTRICAL DATA		SONES	BASE UNIT WEIGHT (LBS.)	REMARKS
								CFM	ESP [IN. W.C.]	HP	RPM	V / PH / HZ			
EF-1	1	NEW	GREENHECK	G-070-VG	DIRECT	ROOF	101 FLEX SPACE	200	0.500	1/6	1,725	115/1/60	-	5.7	31
			TWIN CITY	BCRD-070D	BELT			1/4	1,725	-	7.3	58			
			LOREN COOK	ACED-EC	DIRECT			1/4	1,725	-	6.1	60			
EF-2	1	NEW	GREENHECK	G-095-VG	DIRECT	ROOF	MAKER SPACE	925	0.375	1/6	1,628	115/1/60	-	10.4	38
			TWIN CITY	BCRD-100D	BELT			1/4	1,250	-	9.3	74			
			LOREN COOK	ACED-EC	DIRECT			1/2	1,725	-	7.5	100			

REMARKS:  
 1. VENTILATION CONTRACTOR SHALL INSTALL AS PER MANUFACTURER RECOMMENDATIONS  
 2. PROVIDE FAN WITH DISCONNECT SWITCH, MOTOR MOUNTED SPEED CONTROL, BACKDRAFT DAMPER, BIRDSCREEN, AND 12" FACTORY FABRICATED ROOF CURB  
 3. VENTILATION CONTRACTOR TO INTERLOCK EF TO LOCAL WALL SWITCH WITH INDICATOR LIGHT.

**VAV BOX SCHEDULE**

TAG	AREA SERVED	CFM		CONTROL CONFIG.	MANUFACTURER / MODEL	PRIMARY INLET SIZE (IN. DIA.)	OUTLET SIZE (IN.)	REMARKS
		MIN CFM	DESIGN CFM					
VAV-1	MAKER SPACE - 109	265	875	RIGHT HAND	TITUS DESV	9	15X12	1-3
					DAIKIN MQTH15	8	12x10	
					TRANE VCCF	8	11x10	
VAV-2	CONFERENCE ROOM 2 - 112	105	350	RIGHT HAND	TITUS DESV	6	15X8	1-3
					DAIKIN MQTH15	6	12x8	
					TRANE VCCF	5	10x8	
VAV-3	FLEX SPACE 2 - 107	445	1475	RIGHT HAND	TITUS DESV	12	15X15	1-3
					DAIKIN MQTH15	12	16X15	
					TRANE VCCF	12	17X14	
VAV-4	CONFERENCE ROOM 1 - 111	105	350	RIGHT HAND	TITUS DESV	6	15X8	1-3
					DAIKIN MQTH15	6	12x8	
					TRANE VCCF	5	10x8	
VAV-5	LEARNING LAB - 104	345	850	RIGHT HAND	TITUS DESV	10	15X12	1-3
					DAIKIN MQTH15	10	14x12.5	
					TRANE VCCF	8	11x10	
VAV-6	FLEX SPACE 1 -101	1100	3875	LEFT HAND	TITUS DESV	16	15X18	1-3
					DAIKIN MQTH15	16	24x18	
					TRANE VCCF	16	23x18	
VAV-7	OFFICE / TEAM MEETING RM - 102/103	100	325	RIGHT HAND	TITUS DESV	6	15X8	1-3
					DAIKIN MQTH15	6	12x8	
					TRANE VCCF	5	10x8	

REMARKS:  
 1. VENTILATION CONTRACTOR SHALL INSTALL AS PER MANUFACTURER RECOMMENDATIONS  
 2. VENTILATION CONTRACTOR SHALL FIELD INSTALL NECESSARY DCV CONTROL DEVICES AND INTEGRATE VAV CONTROL WITH EXISTING JOHNSON METASYS BAS.  
 3. PROVIDE WITH FACTORY MOUNTED DISCONNECT SWITCH AND VIBRATION ISOLATORS  
 4. INLET CONNECTION TO UNIT SHALL BE MINIMUM OF 24" OF STRAIGHT RIGID DUCT  
 5. FURNISH WITH FACTORY INSTALLED ACTUATOR.  
 6. HEATING CONTRACTOR TO FIELD INSTALL NECESSARY TEMPERATURE CONTROLS AND RELATED END-DEVICES

**101% DESIGN SUBMITTAL**

**MECHANICAL SCHEDULES**

CONSTRUCT INNOVATION CENTER - ACADEMIC BUILDING  
 ILLINOIS MATH & SCIENCE ACADEMY  
 1500 SULLIVAN ROAD  
 AURORA, IL 60506

BUILDING #CP 078

CDB PROJECT NO.  
805-030-019

DATE  
6/2/2015

SHEET NO.

**HV1.0**



3 Executive Court, Unit 4, South Barrington, Illinois 60010  
 rtmassociates.com | 847.756.4180

NOTE: CONTRACTOR SHALL OBTAIN AND VERIFY ALL DIMENSIONS AND CONDITIONS AT JOB SITE AND BE FULLY RESPONSIBLE FOR SAME.

REVISIONS			CCA PROJ. #:	PREPARED	OFF.
NO.	DATE	REMARKS	14357		
			DRAWN	APPROVED	
			JLI/TRB		
			CHECKED	APPROVED	
			TJH/DB		

CORDOGAN, CLARK & ASSOCIATES, INC  
 ARCHITECTS ENGINEERS  
 www.cordoganclark.com

Aurora, Illinois 60506  
 716 North Wells Street  
 Chicago, Illinois 60610  
 Tel: 630.996.4676  
 Fax: 630.896.4887

Chicago  
 716 North Wells Street  
 Chicago, Illinois 60610  
 Tel: 312.943.7300  
 Fax: 312.943.4771



State of Illinois  
 Bruce Rauner, Governor  
 Illinois Capital Development Board