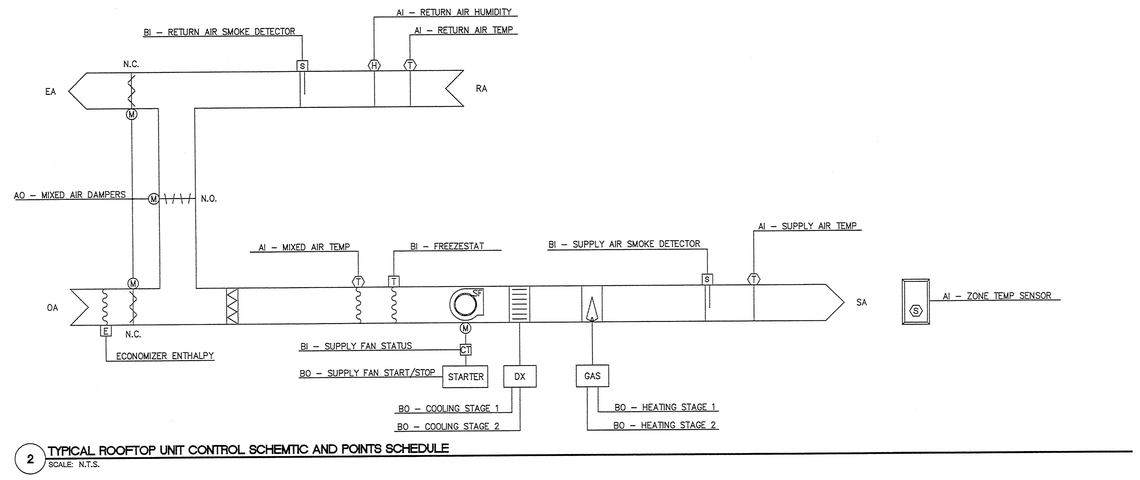


2 TYPICAL ROOFTOP UNIT CONTROL SCHEMTIC AND POINTS SCHEDULE
SCALE: N.T.S.

CONTROL POINTS SCHEDULE

POINT NAME	HARDWARE POINTS AI	AO	BI	BO	SOFTWARE POINTS AV	BV	SCH	TREND	ALARM	STORE ON GRAPHIC	REMARKS
ZONE TEMP	X							X		X	
ZONE SETPOINT ADJUST	X									X	
OUTSIDE AIR HUMIDITY	X							X		X	
MIXED AIR TEMP	X							X		X	
RETURN AIR HUMIDITY	X							X		X	
RETURN AIR TEMP	X							X		X	
SUPPLY AIR TEMP	X							X		X	
MIXED AIR DAMPERS		X						X		X	
ZONE OVERRIDE			X					X		X	
FREEZESTAT			X					X	X	X	
RETURN AIR SMOKE DETECTOR			X					X	X	X	
SUPPLY FAN STATUS			X					X		X	
SUPPLY FAN/START/STOP				X				X		X	
COOLING STAGE 1				X				X		X	
COOLING STAGE 2				X				X		X	
HEATING STAGE 1				X				X		X	
HEATING STAGE 2				X				X		X	
HEATING STAGE 4				X				X		X	
ECONOMIZER ZONE SETPOINT					X			X		X	
SCHEDULE							X				
HEATING SETPOINT								X		X	
COOLING SETPOINT								X		X	
HIGH ZONE TEMP									X		
LOW ZONE TEMP									X		
SUPPLY FAN FAILURE									X		
SUPPLY FAN IN HAND									X		
SUPPLY FAN RUNTIME EXCEEDED									X		
COMPRESSOR RUNTIME EXCEEDED									X		
HIGH MIXED AIR TEMP									X		
LOW MIXED AIR TEMP									X		
HIGH RETURN AIR HUMIDITY									X		
LOW RETURN AIR HUMIDITY									X		
HIGH RETURN AIR TEMP									X		
LOW RETURN AIR TEMP									X		
HIGH SUPPLY AIR TEMP									X		
LOW SUPPLY AIR TEMP									X		
TOTAL	7	1	4	6	1		1	20	16	21	

LEGEND (POINTS LIST)

AI – ANALOG INPUT. A PHYSICAL INPUT TO THE CONTROL MODULE.

AO – ANALOG OUTPUT. A PHYSICAL OUTPUT FROM THE CONTROL MODULE.

AV – ANALOG VALUE. AN INTERMEDIATE (SOFTWARE) POINT THAT MAY BE EDITABLE OR READ–ONLY. EDITABLE AVS ARE TYPICALLY USED TO ALLOW THE USER TO SET A FIXED CONTROL PARAMETER, SUCH AS A SETPOINT. READ ONLY AVS ARE TYPICALLY USED TO DISPLAY THE STATUS OF A CONTROL OPERATION.

BI – BINARY INPUT. A PHYSICAL INPUT TO THE CONTROL MODULE.

BO – BINARY OUTPUT. A PHYSICAL OUTPUT FROM THE CONTROL MODULE.

BV – BINARY VALUE. AN INTERMEDIATE (SOFTWARE) POINT THAT MAY BE EDITABLE OR READ–ONLY. EDITABLE BVS ARE TYPICALLY USED TO ALLOW THE USER TO SET A FIXED CONTROL PARAMETER, SUCH AS A SETPOINT. READ ONLY BVS ARE TYPICALLY USED TO DISPLAY THE STATUS OF A CONTROL OPERATION.

SCH – SCHEDULE. THE CONTROL ALGORITHM FOR THIS EQUIPMENT SHALL INCLUDE A USER EDITABLE SCHEDULE.

TREND – THE CONTROL SYSTEM SHALL BE CONFIGURED TO COLLECT AND DISPLAY A TREND LOG OF THIS OBJECT. THE TRENDING INTERVAL SHALL BE NO LESS THAN ONE SAMPLE EVERY 5 MINUTES. (CHANGE OF VALUE TRENDING, WHERE A SAMPLE IS TAKEN EVERY TIME THE VALUE CHANGES BY MORE THAN A USER–DEFINED MINIMUM, IS AN ACCEPTABLE ALTERNATIVE.)

ALARM – THE CONTROL SYSTEM SHALL BE CONFIGURED TO GENERATE AN ALARM WHEN THIS OBJECT EXCEEDS USER DEFINABLE LIMITS, AS DESCRIBED IN THE SEQUENCE OF CONTROLS.

CONTRACTOR AND DANFOSS CONTROL NOTES:

1.) ALL HARDWARE, SENSORS, RELAYS, COMM–WIRE, MODEM, AND NC DIALER SHALL BE SUPPLIED AND INSTALLED FOR COMPLETE FUNCTIONAL SYSTEM.

2.) INSTALLATION SHALL CONFORM TO WHOLE FOODS MARKET CONTROL PROTOCOL.

3.) PROVIDE AND INSTALL DANFOSS CONTROLLER (MμKS255), PROVIDE REQUIRED HARDWARE, RELAYS, AND COMM–WIRE.

4.) ALL ELECTRICAL WORK IS TO BE DONE IN ACCORDANCE WITH THE 2005 NATIONAL ELECTRICAL CODE. CABLES, JUNCTION BOXES,CONDUITS ARE TO BE SECURELY FASTENED IN PLACE (2005 NEC ARTICLE 300.11 SECURING AND SUPPORTING).

5.) CAT 5, CMP (COMMUNICATIONS PLENUM) CABLES ARE TO BE USED FOR LOW VOLTAGE CABLING – VERIFY CABLE CATEGORY WITH OWNER PRIOR TO STARTING THE INSTALLATION. LOW VOLTAGE CABLES ARE TO BE SUPPORTED IN ACCORDANCE WITH 2005 NATIONAL ELECTRICAL CODE ARTICLE 800 AND EIA/TIA STANDARDS.

6.) MECHANICAL/CONTROL CONTRACTOR TO PROVIDE AND INSTALL 120V/1PH CIRCUIT FOR ALL REQUIRED CONTROLLERS AND CONTROLS.

7.) FURNISH AND INSTALL ALL HARDWARE AND WIRING AS INDICATED. CONTRACTOR RESPONSIBLE FOR ALL DRILLING AND PATCHING. COORDINATE ROUTING WITH BUILDING OWNER PRIOR TO INSTALLATION.

KITCHEN HOOD EXHAUST SEQUENCE OF OPERATION

H–1L,H–1M AND H–1R SERVING KITCHEN EQUIPMENT LINE

NORMAL OPERATION:

EXHAUST FAN KEF–1, 2, 3 AND MAKE–UP AIR UNIT MAU–1 SERVE KITCHEN EXHAUST HOOD H–1L, H–1M & H–1R. WHEN THE HOOD MOUNTED EXHAUST FAN/MAKE–UP AIR UNIT SWITCH IS TURNED TO THE "ON" POSITION, BOTH KEF–1, 2, 3 AND MAU–1 ARE ENERGIZED. WHEN THE THE HOOD MOUNTED EXHAUST FAN/MAKE–UP AIR UNIT SWITCH IS TURNED TO THE "OFF" POSITION, BOTH KEF–1, 1A, 1B AND MAU–1 ARE SHUTDOWN.

FIRE–EXTINGUISHING SYSTEM OPERATION:

UPON THE ACTIVATION OF THE FIRE–EXTINGUISHING SYSTEM, KEF–1, 1A AND1B SHALL CONTINUE TO OPERATE, UNLESS FAN SHUTDOWN IS REQUIRED BY A LISTED COMPONENT OF THE VENTILATION SYSTEM OR BY THE DESIGN OF THE FIRE–EXTINGUISHING SYSTEM. IT SHALL NOT BE REQUIRED TO RESTART THE HOOD EXHAUST FAN WHEN THE FIRE–EXTINGUISHING SYSTEM IS ACTIVATED IF THE KEF–1, 1A AND 1B COOKING EQUIPMENT SERVED BY THE FAN HAD PREVIOUSLY BEEN SHUTDOWN.
WHEN THE FIRE–EXTINGUISHING SYSTEM DISCHARGES, MAU–1 SHALL BE SHUTDOWN.

H–3 SERVING ROTISSERIE

NORMAL OPERATION:

EXHAUST FAN KEF–3 SERVES EXHAUST HOOD H–3. WHEN THE HOOD MOUNTED EXHAUST FAN SWITCH IS TURNED TO THE "ON" POSITION, KEF–3 IS ENERGIZED. WHEN THE THE HOOD MOUNTED EXHAUST FAN SWITCH IS TURNED TO THE "OFF" POSITION, KEF–3 IS SHUTDOWN.

FIRE–EXTINGUISHING SYSTEM OPERATION:

UPON THE ACTIVATION OF THE FIRE–EXTINGUISHING SYSTEM, KEF–3 SHALL CONTINUE TO OPERATE, UNLESS FAN SHUTDOWN IS REQUIRED BY A LISTED COMPONENT OF THE VENTILATION SYSTEM OR BY THE DESIGN OF THE FIRE–EXTINGUISHING SYSTEM. IT SHALL NOT BE REQUIRED TO RESTART THE HOOD EXHAUST FAN WHEN THE FIRE–EXTINGUISHING SYSTEM IS ACTIVATED IF THE KEF–3 AND COOKING EQUIPMENT SERVED BY THE FAN HAD PREVIOUSLY BEEN SHUTDOWN.

H–6, 6A AND H–7 PASTA AREA & ASIAN BBQ

NORMAL OPERATION:

EXHAUST FAN KEF–6, 6A AND KEF–10 SERVES EXHAUST HOODS H–6, 6A AND H–7 RESPECTIVLY. WHEN THE HOOD MOUNTED EXHAUST FANS SWITCH IS TURNED TO THE "ON" POSITION, KEF–6, 6A & 7 IS ENERGIZED. WHEN THE THE HOOD MOUNTED EXHAUST FAN SWITCH IS TURNED TO THE "OFF" POSITION, KEF–6 6A & 7 IS SHUTDOWN.

FIRE–EXTINGUISHING SYSTEM OPERATION:

UPON THE ACTIVATION OF THE FIRE–EXTINGUISHING SYSTEM, KEF–6, 6A & 7 SHALL CONTINUE TO OPERATE, UNLESS FAN SHUTDOWN IS REQUIRED BY A LISTED COMPONENT OF THE VENTILATION SYSTEM OR BY THE DESIGN OF THE FIRE–EXTINGUISHING SYSTEM. IT SHALL NOT BE REQUIRED TO RESTART THE HOOD EXHAUST FAN WHEN THE FIRE–EXTINGUISHING SYSTEM IS ACTIVATED IF THE KEF–6, 6A & 7 AND COOKING EQUIPMENT SERVED BY THE FAN HAD PREVIOUSLY BEEN SHUTDOWN.

HOODS H–2, 4, 5, 5A, 8

EACH HOOD IS PROVIDED WITH A HOOD MOUNTED EXHAUST FAN SWITCH. WHEN THE SWITCHED IS TURNED TO THE "ON" POSITION, THE ASSOCIATED EXHAUST FAN IS ENERGIZED. WHEN THE SWITCH IS TURNED TO THE "OFF" POSITION, THE EXHAUST FAN IS SHUTDOWN.

RUN CONDITIONS – SCHEDULED:

THE UNIT SHALL RUN ACCORDING TO A USER DEFINABLE TIME SCHEDULE IN THE FOLLOWING MODES:
OCCUPIED MODE: THE UNIT SHALL MAINTAIN
A 72F (ADJ.) COOLING SETPOINT
A 70F (ADJ.) HEATING SETPOINT.
UNOCCUPIED MODE (NIGHT SETBACK): THE UNIT SHALL MAINTAIN
A 85F (ADJ.) COOLING SETPOINT.
A 55F (ADJ.) HEATING SETPOINT.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH ZONE TEMP: IF THE ZONE TEMPERATURE IS GREATER THAN THE COOLING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).
LOW ZONE TEMP: IF THE ZONE TEMPERATURE IS LESS THAN THE HEATING SETPOINT BY A USER DEFINABLE AMOUNT (ADJ.).

ZONE OPTIMAL START:
THE UNIT SHALL USE AN OPTIMAL START ALGORITHM FOR MORNING START–UP. THIS ALGORITHM SHALL MINIMIZE THE UNOCCUPIED WARM–UP OR COOL–DOWN PERIOD WHILE STILL ACHIEVING COMFORT CONDITIONS BY THE START OF SCHEDULED OCCUPIED PERIOD.

FREEZE PROTECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A FREEZESTAT STATUS.

SUPPLY AND RETURN AIR SMOKE DETECTION:
THE UNIT SHALL SHUT DOWN AND GENERATE AN ALARM UPON RECEIVING A RETURN AIR SMOKE DETECTOR STATUS.

SUPPLY FAN:
THE SUPPLY FAN SHALL RUN ANYTIME THE UNIT IS COMMANDED TO RUN, UNLESS SHUTDOWN ON SAFETIES. TO PREVENT SHORT CYCLING, THE SUPPLY FAN SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.

ALARMS SHALL BE PROVIDED AS FOLLOWS:
SUPPLY FAN FAILURE: COMMANDED ON, BUT THE STATUS IS OFF.
SUPPLY FAN IN HAND: COMMANDED OFF, BUT THE STATUS IS ON.
SUPPLY FAN RUNTIME EXCEEDED: STATUS RUNTIME EXCEEDS A USER DEFINABLE LIMIT (ADJ.).

COOLING STAGES:
THE CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND STAGE THE COOLING TO MAINTAIN ITS COOLING SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
THE COOLING SHALL BE ENABLED WHENEVER:
OUTSIDE AIR TEMPERATURE IS GREATER THAN 60F (ADJ.).
AND THE ECONOMIZER IS DISABLED OR FULLY OPEN.
AND THE ZONE TEMPERATURE IS ABOVE COOLING SETPOINT.
AND THE SUPPLY FAN STATUS IS ON.
AND THE HEATING IS NOT ACTIVE.

GAS HEATING STAGES:
THE CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND STAGE THE HEATING TO MAINTAIN ITS HEATING SETPOINT. TO PREVENT SHORT CYCLING, THERE SHALL BE A USER DEFINABLE (ADJ.) DELAY BETWEEN STAGES, AND EACH STAGE SHALL HAVE A USER DEFINABLE (ADJ.) MINIMUM RUNTIME.
THE HEATING SHALL BE ENABLED WHENEVER:
OUTSIDE AIR TEMPERATURE IS LESS THAN 55F (ADJ.).
AND THE ZONE TEMPERATURE IS BELOW HEATING SETPOINT.
AND THE SUPPLY FAN STATUS IS ON.
AND THE COOLING IS NOT ACTIVE.

ECONOMIZER:
THE CONTROLLER SHALL MEASURE THE ZONE TEMPERATURE AND MODULATE THE ECONOMIZER DAMPERS IN SEQUENCE TO MAINTAIN A SETPOINT 2F LESS THAN THE ZONE COOLING SETPOINT. THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM ADJUSTABLE POSITION OF 20% (ADJ.) OPEN WHENEVER OCCUPIED.
THE ECONOMIZER SHALL BE ENABLED WHENEVER:
OUTSIDE AIR TEMPERATURE IS LESS THAN 65F (ADJ.).
AND THE OUTSIDE AIR ENTHALPY IS LESS THAN 28BTU/LB (ADJ.).
AND THE OUTSIDE AIR TEMPERATURE IS LESS THAN THE RETURN AIR TEMPERATURE.
AND THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY.
AND THE SUPPLY FAN STATUS IS ON.
THE ECONOMIZER SHALL CLOSE WHENEVER:
MIXED AIR TEMPERATURE DROPS FROM 45F TO 40F (ADJ.).
OR ON LOSS OF SUPPLY FAN STATUS.
OR FREEZESTAT (IF PRESENT) IS ON.
THE OUTSIDE AND EXHAUST AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN WHEN THE UNIT IS OFF. IF OPTIMAL START UP IS AVAILABLE, THE MIXED AIR DAMPER SHALL OPERATE AS DESCRIBED IN THE OCCUPIED MODE EXCEPT THAT THE OUTSIDE AIR DAMPER SHALL MODULATE TO FULLY CLOSED.

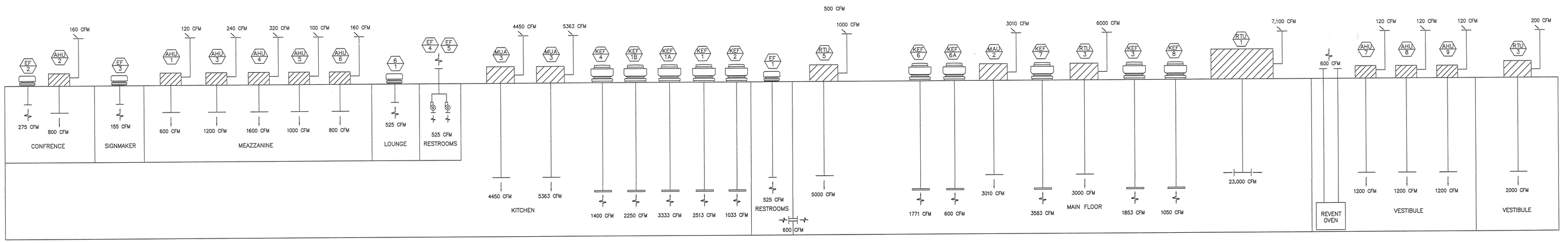
MINIMUM OUTSIDE AIR VENTILATION – FIXED PERCENTAGE:
THE OUTSIDE AIR DAMPERS SHALL MAINTAIN A MINIMUM POSITION (ADJ.) DURING BUILDING OCCUPIED HOURS AND BE CLOSED DURING UNOCCUPIED HOURS.

MIXED AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE MIXED AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT) OR PREHEATING CONTROL (IF PRESENT).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS GREATER THAN 90F (ADJ.).
LOW MIXED AIR TEMP: IF THE MIXED AIR TEMPERATURE IS LESS THAN 45F (ADJ.).

RETURN AIR HUMIDITY:
THE CONTROLLER SHALL MONITOR THE RETURN AIR HUMIDITY AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT) OR HUMIDITY CONTROL (IF PRESENT).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS GREATER THAN 70% (ADJ.).
LOW RETURN AIR HUMIDITY: IF THE RETURN AIR HUMIDITY IS LESS THAN 35% (ADJ.).

RETURN AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE RETURN AIR TEMPERATURE AND USE AS REQUIRED FOR ECONOMIZER CONTROL (IF PRESENT).
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS GREATER THAN 90F (ADJ.).
LOW RETURN AIR TEMP: IF THE RETURN AIR TEMPERATURE IS LESS THAN 45F (ADJ.).

SUPPLY AIR TEMPERATURE:
THE CONTROLLER SHALL MONITOR THE SUPPLY AIR TEMPERATURE.
ALARMS SHALL BE PROVIDED AS FOLLOWS:
HIGH SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS GREATER THAN 120F (ADJ.).
LOW SUPPLY AIR TEMP: IF THE SUPPLY AIR TEMPERATURE IS LESS THAN 45F (ADJ.).



AIR BALANCE SCHEDULE (kitchen)

UNIT NO.	OUTSIDE AIR CFM
MUA–1	5363
RTU–6	4450
TOTAL O.A. CFM	9,813
UNIT NO.	EXHAUST AIR CFM
KEF–1	2513
KEF–1A	3333
KEF–1B	2250
KEF–2	1033
KEF–4	1400
TOTAL EXHAUST CFM	10,529
AIR PRESSURE RESULT	716 CFM – NEGATIVE

AIR BALANCE SCHEDULE (excluding kitchen)

UNIT NO.	OUTSIDE AIR CFM
RTU–1	7100
RTU–2	200
RTU–4	600
RTU–5	1000
MUA–2	3010
MUA–3	1713
TOTAL O.A. CFM	13,623
UNIT NO.	EXHAUST AIR CFM
KEF–3	1854
KEF–5	1200
KEF–6	1771
KEF–6A	600
KEF–7	3563
KEF–8	1050
EF–1	525
REVENT OVEN	580
TOTAL EXHAUST CFM	11,143
AIR PRESSURE RESULT	2,480 – POSITIVE

1 BUILDING AIR BALANCE SCHEMTIC AND SCHEDULE
SCALE: N.T.S.

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WHOLE FOODS MARKET

EQUIPMENT AND VE CHANGES

PROPOSED GROCERY STORE
2 SOMERSET STREET
PORTLAND, CUMBERLAND COUNTY, MAINE

No. Date Desc.

REVISIONS
No. Date Desc.

ARCHITECT/ENGINEER SEAL

Designed	GM
Drawn	GM
Checked	ML
Approved	ML
Scale	AS NOTED
Project No.	0400829
Date	04–24–06
CAD File	

Title
HVAC SEQUENCE OF OPERATIONS

Sheet No.
M8.01

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