

12 TEMPERATURE TRANSMITTERS  
 A. TEMPERATURE TRANSMITTERS FOR RTD ELEMENTS SHALL OUTPUT A 4-20 MA LINEAR SIGNAL OVER THE SPECIFIED RANGE. ZERO POINT AND SPAN SHALL BE ADJUSTABLE OVER A MINIMUM OF 75% OF RANGE.  
 B. ACCURACY: +/- 0.5% OF SPAN  
 C. LINEARITY: + 0.2% OF SPAN  
 D. ISOLATION: INPUT TO OUTPUT, 600 VDC OR A.C. PEAK  
 E. TRANSMITTERS SHALL BE ENCLOSED IN NEMA 1 HOUSING MINIMUM. WHEN EXPOSED TO OUTDOOR AIR USE NEMA 3R.  
 F. TRANSMITTER RANGE SHALL SUIT THE APPLICATION, 100 DEG. F. FOR DUCTS, 150 DEG. F. FOR OUTDOOR SENSING, 100 DEG F FOR CHILLED WATER & 200 DEG FOR HOT WATER.  
 G. TRANSMITTERS IN OUTDOOR AIR SHALL BE PROVIDED WITH SUNSHIELD.  
 H. TRANSMITTERS SHALL BE MANUFACTURED BY FOXBORO, MINCO, HYCAL OR APPROVED EQUAL.

13 HUMIDITY SENSORS & TRANSMITTER - DUCT OR OUTDOOR  
 A. HUMIDITY SENSOR SHALL UTILIZE THIN FILM POLYMER CAPACITOR SENSING, OVER A MINIMUM RANGE OF 10% TO 90% R.H. OUTPUT SHALL BE TEMPERATURE COMPENSATED. SENSOR HOUSING SHALL INCORPORATE A TERMINAL STRIP FOR LEAD WIRE CONNECTION.  
 C. ACCURACY: + 2% R.H. OVER ENTIRE RANGE  
 D. HYSTERESIS: + 0.3% R.H., MAXIMUM  
 E. LINEARITY: 0.7% R.H. OVER ENTIRE RANGE  
 F. OUTPUT RANGE: 4-20MA  
 G. HUMIDITY TRANSMITTERS SHALL BE ENCLOSED IN NEMA 1 HOUSING MINIMUM WHEN EXPOSED TO OUTDOOR AIR USE NEMA 3R.  
 H. MANUFACTURED BY VAISALA, GEN EASTERN, ROTRONIC, OR APPROVED EQ.

14 DIFFERENTIAL PRESSURE SENSORS/TRANSMITTERS (DPSE) - AIR  
 A. DIFFERENTIAL PRESSURE TRANSMITTERS SHALL MEASURE PRESSURE SIGNALS FROM SPACE OR DUCT PROBES AND SHALL OUTPUT A LINEAR 4-20 MA OR DC VOLTAGE SIGNAL  
 B. TRANSMITTER RANGE SHALL BE SELECTED FOR THE APPLICATION, AND SHALL EXCEED THE NOMINAL SYSTEM WORKING PRESSURE BY 50%.  
 C. ACCURACY: OVERALL + 2% OF SPAN  
 D. HYSTERESIS: 0.2% OF SPAN  
 E. LINEARITY: + 0.2% OF SPAN  
 F. OVER RANGE PROTECTION: 500% OF RANGE  
 G. CALIBRATION: ZERO POINT AND SPAN ADJ TO WITHIN 0.1% OF FULL SPAN  
 H. PROVIDE AUTO ZEROING OR INSTALL WITH BYPASS VALVING TO ALLOW FOR MANUAL ZEROING IN READILY ACCESSIBLE LOCATION.  
 I. MANUFACTURED BY ASHCROFT, SETRA, ROSEMOUNT OR AIR MONITOR.

15 END SWITCH  
 A. MINIMUM RATING OF 10 AMPS, RESISTIVE AT 120 VAC. SWITCH ASSEMBLIES: DOUBLE-POLE DOUBLE-THROW, AND ENCLOSURE SHALL MEET NEMA 3R REQUIREMENTS AS A MINIMUM. SWITCH ACTUATION ARM SHALL BE ALUMINUM OR STAINLESS STEEL AND SHALL FIT OVER DAMPER SHAFT AND FASTENED WITH A SET SCREW THAT IS SCREWED A MINIMUM OF 15% OF THE DIAMETER INTO THE DAMPER SHAFT. LIMIT SWITCHES SHALL BE HONEYWELL MICRO-SWITCH, CUTLER HAMMER, SQUARE D.F3705

16 AIR FLOW METER - DUCT MOUNTED  
 A. AIR FLOW MEASURING STATION EQUAL TO AIR MONITOR FAN-E  
 B. ALUMINUM HONEYCOMB AIR STRAIGHTENER  
 C. MULTIPLE STATIC AND TOTAL SENSORS, CONNECTED TO AVG MANIFOLD  
 D. WELDED 14 GAUGE GALV STEEL CASE  
 E. ACCURACY : 2% OF ACTUAL FLOW

17 SYSTEM STARTUP AND COMMISSIONING  
 A. BAS CONTRACTOR SHALL PROVIDE FULL STARTUP AND COMMISSIONING OF ENTIRE CONTROL SYSTEM.  
 B. BAS CONTRACTOR SHALL PERFORM POINT TO POINT VERIFICATION  
 C. BAS CONTRACTOR SHALL VERIFY SEQUENCE OF OPERATION ON ALL CONTROLLED EQUIPMENT  
 D. BAS CONTRACTOR SHALL WORK WITH BALANCING CONTRACTOR TO FIELD CALIBRATE ALL FLOW MEASURING DEVICES.  
 E. BAS CONTRACTOR SHALL ISSUE STARTUP REPORT. REPORT SHALL INCLUDE 8X11 SNAP SHOTS OF EQUIPMENT GRAPHIC OUTPUT SHEETS, AS PROOF OF STARTUP AND COMMISSIONING.

18 TRAINING  
 A. TRAINING SHALL ENABLE STUDENTS TO ACCOMPLISH THE FOLLOWING OBJECTIVES  
 1 PROFICIENTLY OPERATE SYSTEM  
 2 UNDERSTAND CONTROL SYSTEM ARCHITECTURE AND CONFIGURATION  
 3 UNDERSTAND DCC SYSTEM COMPONENTS  
 4 UNDERSTAND SYSTEM OPERATION, INCLUDING DCC SYSTEM CONTROL AND OPTIMIZING ROUTINES (ALGORITHMS)  
 5 OPERATE WORKSTATION AND PERIPHERALS  
 6 LOG ON AND OFF SYSTEM  
 7 ACCESS GRAPHICS, POINT REPORTS AND LOGS  
 8 ADJUST AND CHANGE SYSTEM SETPOINTS, TIME SCHEDULES AND HOLIDAY SCHEDULES

19 WARRANTY  
 A. WARRANTY LABOR AND MATERIAL FOR SPECIFIED CONTROL SYSTEM FOR 1 YEAR FROM SUCCESSFUL COMMISSIONING OF SYSTEM.

TESTING AND BALANCING OF HVAC SYSTEMS

1 CONTRACTOR SHALL EMPLOY AND PAY FOR SERVICES OF AN AABC OR NEBB CERTIFIED INDEPENDENT BALANCING AGENCY TO PERFORM SPECIFIED TESTING AND BALANCING. SUBMIT REPORT TO ENGINEER FOR REVIEW.

2 MECHANICAL CONTRACTOR SHALL INFORM THE BALANCING AGENCY OF DEVIATIONS FROM CONTRACT DOCUMENTS MADE TO SYSTEMS DURING CONSTRUCTION AND PROVIDE A COMPLETE SET OF RECORD DOCUMENTS FOR AGENCY USE.

3 MECHANICAL CONTRACTOR SHALL PROVIDE SUPPORT SERVICES FROM THE EQUIPMENT MANUFACTURER AND FROM OTHER SOURCES AS REQUIRED DURING TESTING AND BALANCING.

4 MECHANICAL CONTRACTOR SHALL PREPARE DUCTWORK SYSTEMS FOR LEAK TESTING PRIOR TO INSTALLATION OF EXTERNAL INSULATION, INCLUDING CAPPING DUCT RUN OUTS AND LEAVING TAPS-IN FOR THE TEST EQUIPMENT.

5 BALANCING CONTRACTOR SHALL COORDINATE AND ASSIST BAS CONTRACTOR IN CALIBRATION OF ALL FLOW MEASURING DEVICES.

6 BALANCING CONTRACTOR SHALL REPORT ANY DEFECTS OR DEFICIENCIES NOTED DURING PERFORMANCE OF SERVICES TO THE ENGINEER.

7 BALANCING CONTRACTOR SHALL LEAK TEST ALL DUCT SYSTEMS THAT ARE PART OF A SUPPLY, RETURN, OUTSIDE, OR EXHAUST AIR SYSTEM, EQUAL OR GREATER THAN 25 FEET IN LENGTH, AND DIRECTLY OR INDIRECTLY CONNECTED TO A FAN.

8 INSTALLATION TOLERANCE  
 A. ADJUST AIR SYSTEMS TO PLUS OR MINUS 5 PERCENT, MAXIMUMS AND MINIMUMS, FROM FIGURES INDICATED.  
 B. ADJUST AIR TERMINAL DEVICES [OUTLETS AND INLETS] TO PLUS OR MINUS 5 PERCENT BETWEEN ROOMS EXCEPT THAT MULTIPLE DEVICES ON THE SAME SYSTEM BRANCH WITHIN EACH ROOM MAY BE ADJUSTED TO PLUS OR MINUS 10 PERCENT.  
 C. ADJUST PIPING SYSTEMS TO PLUS OR MINUS 5 PERCENT OF DESIGN CONDITIONS INDICATED.

9 ADJUSTING  
 A. RECORDED DATA SHALL REPRESENT ACTUALLY MEASURED, OR OBSERVED CONDITION.  
 B. PERMANENTLY MARK SETTINGS OF VALVES, DAMPERS AND OTHER ADJUSTMENT DEVICES ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS.  
 C. AFTER ADJUSTMENT, TAKE MEASUREMENTS TO VERIFY BALANCE HAS NOT BEEN DISRUPTED OR THAT SUCH DISRUPTION HAS BEEN RECTIFIED.  
 D. LEAVE SYSTEMS IN PROPER WORKING ORDER, REPLACING BELT GUARDS, CLOSING ACCESS DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES AND RESTORING THERMOSTATS TO SPECIFIED SETTINGS.  
 E. RECORD HEATING DISCHARGE TEMPERATURE FROM TERMINAL DEVICES WHEN SET TO THE HEATING MODE.  
 F. RECORD COOLING AND HEATING DISCHARGE TEMPERATURE FROM AIR HANDLING UNIT SYSTEMS.

10 CALIBRATION  
 A. CALIBRATE AIR FLOW MEASURING STATIONS IN DUCTWORK, AHUS AND TERMINAL BOXES.  
 B. CALIBRATE TEMPERATURE TRANSMITTERS IN AHUS, PIPING, DUCTWORK, AND TERMINAL BOXES.  
 C. CALIBRATE HUMIDITY TRANSMITTERS IN AHUS AND DUCTWORK.  
 D. CALIBRATE PRESSURE TRANSMITTERS IN AHUS, PIPING AND DUCTWORK.

11 AIR SYSTEM PROCEDURE  
 A. ADJUST AIR HANDLING AND DISTRIBUTION SYSTEMS TO PROVIDE DESIGN SUPPLY, RETURN AND EXHAUST AIR QUANTITIES.  
 B. MAKE AIR QUANTITY MEASUREMENTS INDICATE BY PITOT TUBE TRAVERSE OF ENTIRE CROSS SECTIONAL AREAS OF DUCT.  
 C. MEASURE AIR QUANTITIES AT AIR INLETS AND OUTLETS (AIR TERMINAL DEVICES)  
 D. USE VOLUME DAMPERS IN NECKS OF AIR TERMINAL DEVICES TO REGULATE AIR QUANTITIES ONLY TO EXTENT THAT ADJUSTMENTS DO NOT CREATE OBJECTIONABLE AIR MOTION OR SOUND LEVELS. EFFECT VOLUME CONTROL BY DUCT MOUNTED VOLUME DAMPERS LOCATED AT BRANCH TAKE-OFFS.  
 E. MEASURE STATIC AIR PRESSURE CONDITIONS ON AIR HANDLING UNITS, INCLUDING FILTER, COIL, AND OTHER COMPONENT PRESSURE DROPS, AND TOTAL PRESSURE ACROSS THE FAN. (MAKE ALLOWANCES FOR 100 PERCENT LOADING [INITIAL VERSUS CHANGE PRESSURE DROP] OF FILTERS.

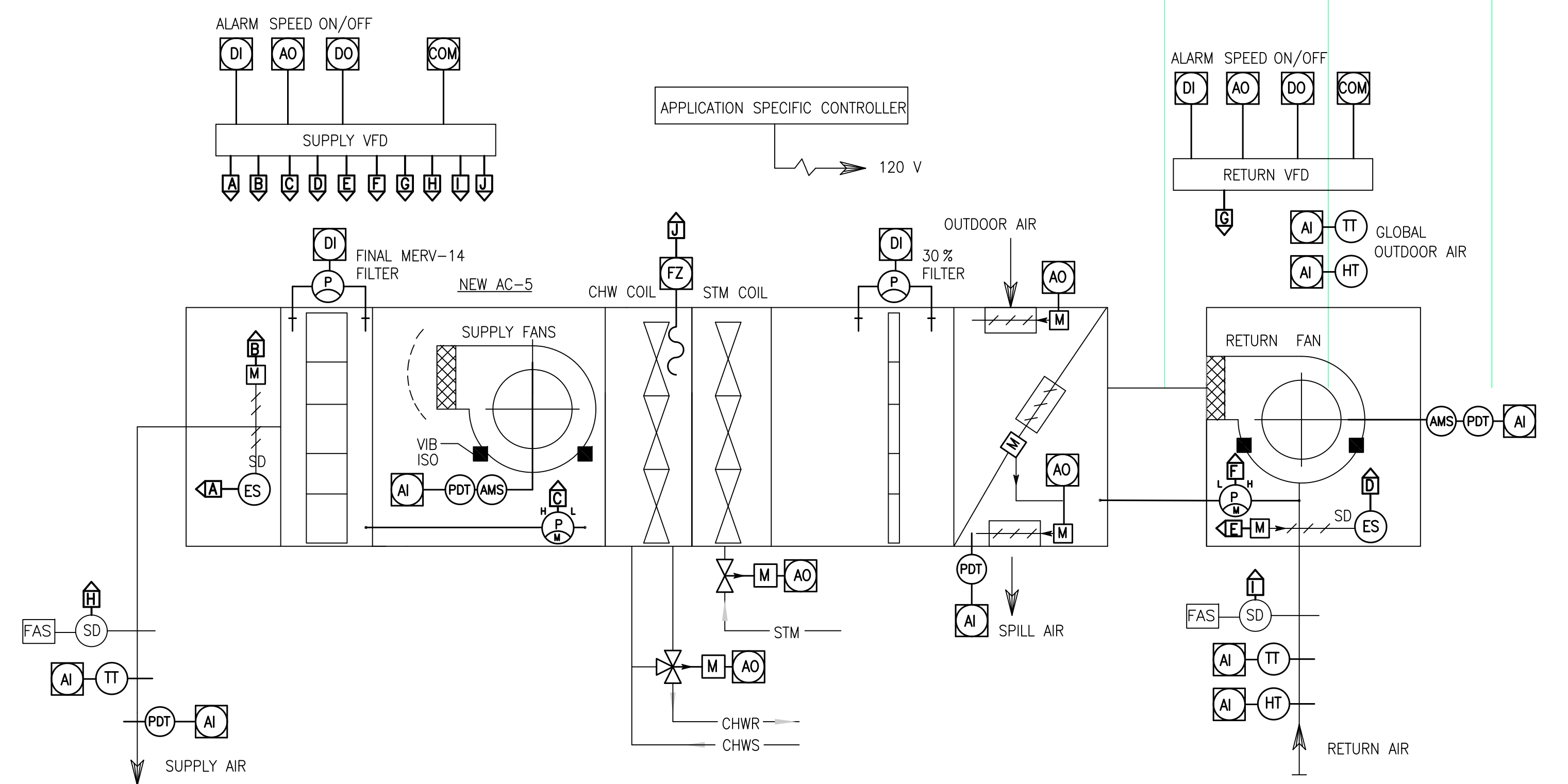
12 FINAL PUNCH LIST  
 A. BALANCING CONTRACTOR SHALL ALLOW FOR 4 HOURS OF SPOT CHECKING OF AIR AND WATER BALANCING DURING THE ENGINEER'S FINAL PUNCH LIST. IF SPOT CHECKS REVEAL THAT BALANCING REPORT WAS NOT ACCURATE ENTIRE SYSTEM WILL BE REBALANCED. THE BALANCING CONTRACTOR WILL BARE ALL COSTS OF REBALANCING.

13 SHEAVE CHANGES  
 A. BALANCING CONTRACTOR SHALL PROVIDE SHEAVE CHANGES AS NEEDED TO PROPERLY BALANCE SYSTEM. BALANCING CONTRACTOR SHALL NOT USE ATO CONTROL DEVICES ( CONTROL DAMPERS, VFDs, ETC) TO BALANCE SYSTEM. ON VFD DRIVEN EQUIPMENT SHEAVES SHALL BE SET TO ALLOW MOTOR TO OPERATE ACROSS THE LINE WHILE MEETING DESIGN CAPACITY.

14 REPORT  
 A. SUBMIT BALANCE AND TESTING REPORT FOR ENGINEER REVIEW AND APPROVAL. PROVIDE REPORT ON NEBB OR AABC FORMS. CLEARLY INDICATE INITIAL VERSE FINAL READING, DESIGN VERSE FIELD VALUES. INDICATE ANY SYSTEM DEFICIENCIES.

VENTILATION SCHEDULE

Zone	Room Number	Room Name	Ceiling Height (ft)	Room Area SQFT	Outside Air ACH	Total ACH	PeopleMax	CFM Outside Air from ACH	CFM Total Air from ACH	Supply Air	MaxExh
4	101	Waiting	8	359	-	-	7	-	-	300	-
-	103	ADA toilet	8	68	-	10	0	-	91	0	100
3	104	Hyperbaric	8	795	2	6	3	212	636	710	-
3	108	Corridor	8	609	2	2	0	162	162	180	-
3	109	Multi-Purpose	8	117	-	-	2	-	-	100	-
1	110	Consult	8	176	-	-	2	-	-	150	-
1	111	Treatment 4	8	176	2	6	3	47	141	170	-
3	112	Clean	8	44	2	4	0	12	23	40	-
3	113	Soiled	8	44	2	10	0	12	59	40	60
1	114	Treatment 3	8	179	2	6	3	48	143	170	-
2	115	Treatment 2	8	164	2	6	3	44	131	160	-
2	116	Treatment 1	8	223	2	6	3	59	178	200	-
-	117	Toilet	8	26	-	10	0	-	35	0	50
4	118	Fire Alarm	8	46	-	-	0	-	-	75	-
4	120	Med Gas	8	20	-	10	0	-	27	75	100
4	121	ADA toilet	8	71	-	10	0	-	95	75	100
4	122	Admin/Work	8	243	-	-	2	-	-	200	-
5	123	Supply	8	27	2	4	0	7	14	50	-
5	124	EVS	8	110	-	10	0	-	147	100	150
5	XX	Elevator Lobby	8	216	-	-	0	-	-	100	-
5	XX	Lobby	8	239	-	-	0	-	-	100	-



SEQUENCE OF OPERATION

- AIR HANDLING UNIT SHALL BE ENABLED FROM BAS FRONT END.
- SUPPLY FAN: SPEED SHALL MODULATE TO MAINTAIN DUCTWORK STATIC PRESSURE.
- RETURN FAN: SPEED SHALL MODULATE TO MAINTAIN CFM DIFFERENTIAL; SUPPLY CFM - CONSTANT CFM ( ).
- ECONOMIZER MODE / MIXING BOX:  
 A. WHEN OUTSIDE AIR ENTHALPY IS ABOVE RETURN AIR ENTHALPY DAMPERS SHALL BE IN MIN OA (OAM) POSITION, (30%).  
 \*OA DAMPER POSITION (OAD) = DETERMINED BY CO2 SENSORS.  
 \*SPILL DAMPER POSITION = [ (OAD - OAM) / (100 - OAM)] \*100%  
 \*RETURN DAMPER POSITION = 100% - SPILL DAMPER POSITION.  
 B. WHEN OUTSIDE AIR ENTHALPY IS BELOW RETURN AIR ENTHALPY DAMPERS SHALL BE IN FULL OUTSIDE AIR POSITION.  
 C. WHEN OUTSIDE AIR TEMP IS BELOW SUPPLY AIR TEMP SETPOINT (SATSP) DAMPERS SHALL MODULATE TO MAINTAIN SAT SETPOINT.
- COOLING SUPPLY AIR TEMPERATURE (SAT): WITH A RISE IN SAT, THE CHILLED WATER CONTROL VALVE SHALL MODULATE OPEN.
- HEATING SUPPLY AIR TEMPERATURE (SAT): WITH A FALL IN SAT, THE STEAM CONTROL VALVE SHALL MODULATE OPEN.
- SMOKE DETECTOR: IF SMOKE IS SENSED BY SENSOR UNIT SHALL BE DE-ENERGIZED AND VALVES AND DAMPERS SHALL INDEX TO NORMAL POSITION.
- FAN STATIC SWITCH: IF STATIC PRESSURE SWITCH IS TRIPED UNIT SHALL BE DE-ENERGIZED AND VALVES AND DAMPERS SHALL INDEX TO NORMAL POSITION.
- UNOCCUPIED MODE: UNIT SHALL INDEX OUTSIDE AIR DAMPER CLOSED, SPILL DAMPER CLOSED AND RETURN DAMPER TO FULL OPEN.
- FILTERS: IF FILTER(S) STATIC EXCEEDS SETPOINT AND ALARM SHALL BE SENT TO THE BAS.
- FREEZE STAT: IF TEMPERATURE FALLS BELOW 38F, UNIT SHALL DE-ENERGIZE AND DAMPERS AND VALVES SHALL INDEX TO NORMAL POSITION.

NOTE: RETURN FAN, RETURN FAN VFD, ECONOMIZER DAMPERS, AND DAMPER CONTROLS ARE EXISTING. AC-5 AND AC-5 CONTROLS SHALL BE NEW.

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PROJECT: MAINE MEDICAL CENTER  
 BRIGHTON CAMPUS  
 WOUND CARE AND HYPERBARIC MEDICINE  
 333 BRIGHTON AVENUE  
 PORTLAND, ME 04103

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KEY PLAN: GROUND FLOOR

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ISSUE DATES:

- ▲ JANUARY 26, 2015
- ▲ STATE APPROVALS
- ▲ MARCH 20, 2015
- ▲ BLDG. DEPT. REVIEW

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DRAWN BY: ALS

CHECKED BY: BMF

SCALE: AS NOTED

PROJECT NO.: P14110

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SHEET TITLE:  
 MECHANICAL SPECIFICATIONS AND CONTROLS

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DRAWING NO.:  
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