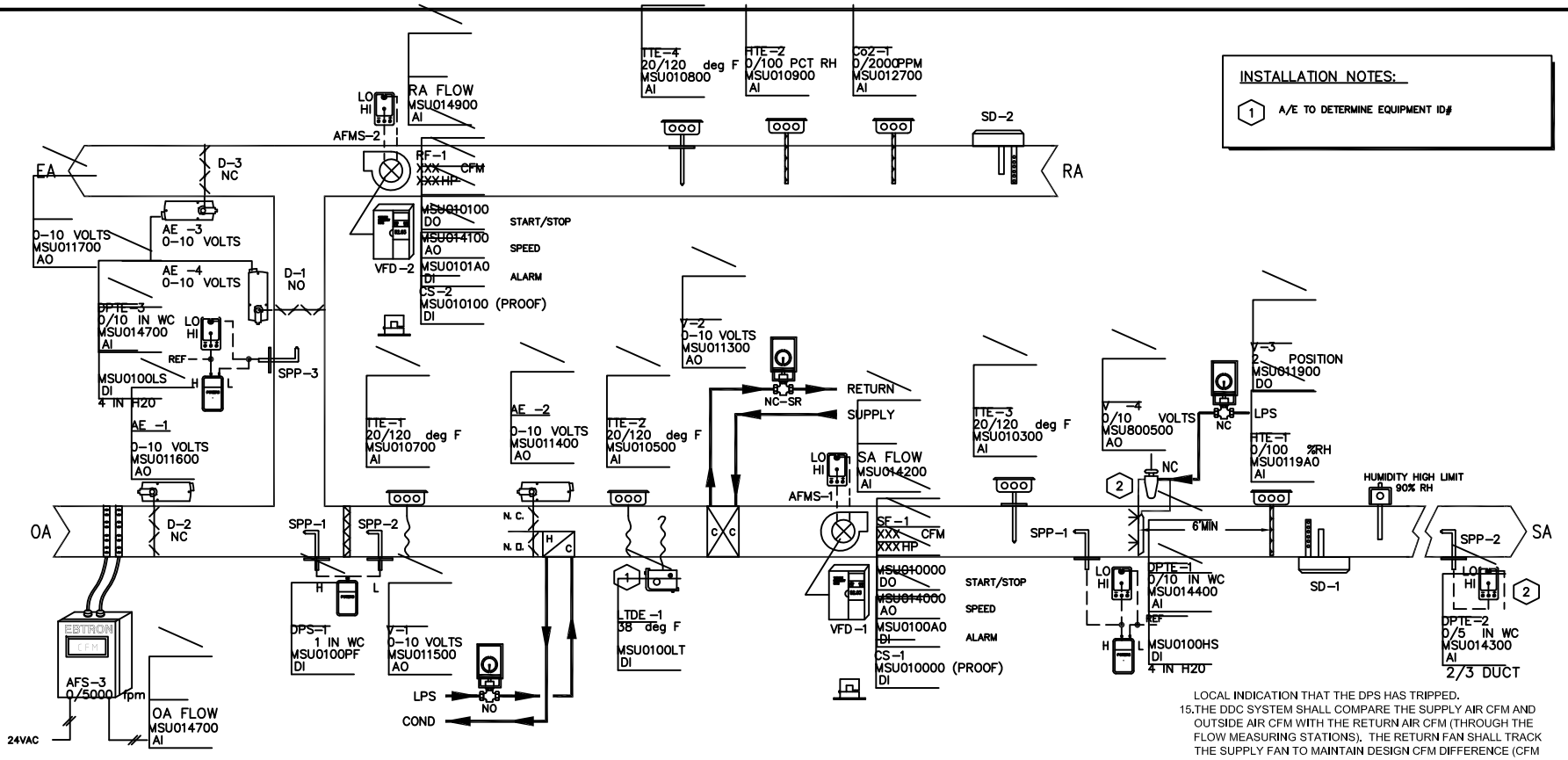

VARIABLE AIR VOLUME AHU WITH FLOWTRACKING AND VIFB STEAM HEAT CONTROL DIAGRAM

SEQUENCE OF OPERATION

NOTE: ALL SETPOINTS DESCRIBED IN THE SEQUENCE WILL BE ADJUSTABLE BY SYSTEM OPERATORS. (CREATE REQUIRED VIRTUAL POINTS). APPROPRIATE DEADBANDS SHALL BE USED TO PREVENT SHORT CYCLING SITUATIONS. ALL FAN MOTOR CONTROL SWITCHES SHALL BE IN "AUTO" POSITION.

SYSTEM OFF:

1. THE SUPPLY AND RETURN FAN SHALL BE OFF. THE OUTSIDE AIR DAMPERS SHALL BE CLOSED. THE EXHAUST DAMPER SHALL BE CLOSED. THE RETURN AIR DAMPER SHALL BE OPEN. COOLING COIL CONTROL VALVE SHALL BE CLOSED. THE HUMIDITY ISOLATION AND CONTROL VALVE SHALL BE CLOSED. HEATING CONTROL VALVE SHALL BE UNDER THE CONTROL OF THE HEATING COIL DISCHARGE AIR TEMPERATURE AT ALL TIMES MAINTAINING A SETPOINT OF 50 DEG. F.

SYSTEM ON:

2. UNIT SHALL OPERATE BASED ON A PROGRAMMED OCCUPANCY SCHEDULE. SCHEDULE SHALL BE CAPABLE OF BEING OVERRIDDEN FROM THE BAS.
3. WHEN THE UNIT IS INDEXED TO START THE OUTSIDE AIR DAMPER SHALL SLOWLY OPEN TO MINIMUM OVER A FIXED PERIOD OF TIME TO PREVENT THE LOW TEMPERATURE DETECTOR FROM TRIPPING DURING COLD WEATHER. THE SUPPLY AND RETURN FANS SHALL BE ENERGIZED. BOTH THE SUPPLY AND RETURN FANS SHALL BE STARTED AT THE VARIABLE FREQUENCY DRIVES MINIMUM OUTPUT AND BE SLOWLY RAMPED UP TO SET POINT OVER A 120 SECOND PERIOD.

ENTHALPY ECONOMIZER CYCLE:

4. THE OUTSIDE AIR ENTHALPY (TOTAL HEAT CONTENT OF AIR) SHALL BE CALCULATED IN THE SOFTWARE BASED ON PSYCHOMETRIC PROPERTIES OF THE OUTSIDE AIR TEMPERATURE AND HUMIDITY. THE RETURN AIR ENTHALPY SHALL BE CALCULATED THE SAME WAY BASED ON THE RETURN AIR TEMPERATURE AND A FIXED CONSTANT SOFTWARE VALUE FOR THE RETURN AIR HUMIDITY.
5. IF THE OUTSIDE AIR ENTHALPY IS GREATER THAN THE RETURN AIR ENTHALPY AND CHILLED WATER IS AVAILABLE AS DETERMINED BY CHILLED WATER SUPPLY TEMPERATURE BEING BELOW 59 DEG. F., THE OUTSIDE, RETURN AIR AND EXHAUST AIR DAMPERS SHALL MODULATE TO MAINTAIN MINIMUM AIR OUTDOOR AIR SETPOINT (TO BE DETERMINED BY A/E FIRM) AS MEASURED BY THE UNIT'S OUTDOOR AIR FLOW STATION IF THE OUTSIDE AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY, THE OUTSIDE, RETURN AIR AND EXHAUST AIR DAMPERS SHALL MODULATE TO MAINTAIN MIXED AIR SETPOINT OF 55 DEG. F. AN ADJUSTABLE DEADBAND OFFSET SHALL BE REQUIRED BETWEEN SWITCH OVER TO PREVENT SHORT CYCLING.
6. WITH THE RETURN AIR/EXHAUST AIR DAMPER SIGNAL BEING SEPARATE FROM THE OUTDOOR AIR DAMPER SIGNAL A DPS SWITCH SHALL BE INTERLOCKED TO THE AHU TO PREVENT OPERATION IN IT'S SETTING IS EXCEEDED. A PANEL MOUNT PILOT LIGHT SHALL BE USED FOR LOCAL INDICATION THAT THE DPS HAS TRIPPED.

OUTSIDE AIR VENTILATION-CARBON DIOXIDE (CO2) CONTROL:

7. WHEN IN OCCUPIED MODE, THE CONTROLLER SHALL MEASURE THE RETURN AIR CO2 LEVELS AND MODULATE THE OUTSIDE AIR DAMPER OPEN ON RISING CO2 CONCENTRATIONS, OVERRIDING NORMAL DAMPER TEMPERATURE AND MINIMUM OUTDOOR AIR FLOW OPERATIONS. CO2 SETPOINT OF 750 PPM (ADJ.)
8. ALARM SHALL BE PROVIDED AS FOLLOWS: HIGH RETURN AIR CARBON DIOXIDE CONCENTRATION: IF THE RETURN AIR CO2 CONCENTRATION IS GREATER THAN 1000 PPM (ADJ.)

DISCHARGE AIR CONTROL:

9. THE DISCHARGE AIR TEMPERATURE SENSOR SHALL MODULATE THE HEATING VALVE, COOLING VALVE AND THE FACE AND BYPASS DAMPER TO MAINTAIN A DISCHARGE AIR SETPOINT OF 55 DEG.F.
10. WHEN THE OUTDOOR AIR TEMPERATURE IS ABOVE 55 DEG. F. THE HEATING VALVE SHALL BE CLOSED, THE FACE AND BYPASS DAMPER SHALL BE OPEN TO THE COIL AND THE COOLING VALVE SHALL MODULATE OPEN TO MAINTAIN DISCHARGE AIR SETPOINT
11. WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 55 DEG. F. THE COOLING VALVE SHALL BE CLOSED AND THE STEAM HEATING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN DISCHARGE AIR SETPOINT ABOVE 42° F, BELOW 40° F THE HEATING COIL CONTROL VALVE SHALL BE FULL OPEN AND THE FACE AND BYPASS DAMPER SHALL MODULATE TO MAINTAIN DISCHARGE AIR SETPOINT. THE HEATING COIL AIR TEMPERATURE SENSOR SHALL ACT AS A LOW LIMIT AND NOT ALLOW THE HEATING COIL DISCHARGE TEMPERATURE TO FALL BELOW 45 DEG. F.(ADJ).

HUMIDIFIER CONTROL

12. WHEN THE SYSTEM IS CALLING FOR HEATING THE HUMIDIFIER SHALL BE ENABLED AND THE ISOLATION VALVE SHALL BE OPENED THOUGHT THE DDC. ON A CALL FOR HUMIDIFICATION THE DDC SHALL MODULATE DUCT HUMIDIFIER CONTROL VALVE TO MAINTAIN SPACE HUMIDITY SETPOINT. THE SETPOINT SHALL BE RESET, 30% RH WHEN OAT IS 55 DEGREES AND 25% WHEN OAT IS 35 DEGREES. A DDC DISCHARGE HUMIDITY SENSOR SHALL BE USED TO PREVENT HUMIDITY LEVELS FROM EXCEEDING 90% RH
13. HUMIDIFIER OPERATION SHALL BE HARDWIRED INTERLOCKED TO PREVENT OPERATION WHEN AHU IS NOT IN OPERATION AND A HARDWIRED HIGH LIMIT SHALL PROVIDE OVERRIDE CONTROL WHEN 95% RH SETPOINT IS REACHED

SUPPLY AND RETURN FAN SPEED CONTROL

14. THE STATIC PRESSURE SENSOR (LOCATED 2/3 DOWN STREAM OF THE MAIN SUPPLY DUCT) SHALL MODULATE THE SUPPLY FAN VARIABLE FREQUENCY DRIVE (THRU LAN COMMUNICATION CAPABILITIES) TO MAINTAIN THE SUPPLY STATIC PRESSURE SETPOINT. A DDC DISCHARGE STATIC PRESSURE SENSOR SHALL BE USED TO PREVENT THE SYSTEM FROM EXCEED THE DESIGNED PRESSURE MAXIMUM (MAXIMUM DETERMINED BY A/E FIRM). THE CONTROL SETPOINT SHALL BE 0.25 LESS THE DESIGNED MAXIMUM. A HARDWIRED DPS SWITCH SHALL BE USED TO PREVENT FAN OPERATION ONCE DESIGNED PRESSURE IS EXCEEDED. A PANEL MOUNT PILOT LIGHT SHALL BE USED FOR LOCAL INDICATION THAT THE DPS HAS TRIPPED.
15. THE DDC SYSTEM SHALL COMPARE THE SUPPLY AIR CFM AND OUTSIDE AIR CFM WITH THE RETURN AIR CFM (THROUGH THE FLOW MEASURING STATIONS). THE RETURN FAN SHALL TRACK THE SUPPLY FAN TO MAINTAIN DESIGN CFM DIFFERENCE (CFM OFFSET TO BE DETERMINED BY A/E FIRM).

MINIMUM NIGHT TEMPERATURE CONTROL

16. THE DDC SYSTEM SHALL MONITOR A DOZEN SPACE TEMPERATURES THROUGHOUT THE AREA SERVED BY THE AHU TO PREVENT ANYONE SPACE FROM FALLING BELOW 62 DEG. F. WHEN THE OUTDOOR AIR TEMPERATURE IS BELOW 55 DEG. F.
17. DURING THE OFF CYCLE OF THE UNIT THE SPACE CONTROLS WILL BE ALLOWED TO MODULATE TO MAINTAIN 65 DEG. F SPACE TEMPERATURES.
18. WHEN ONE OF THE MONITORED SPACES FALLS BELOW 62 DEG. F. THE AHU SHALL START UP AND RUN AT 100% RETURN AIR MODE, THE SUPPLY SPEED SHALL MODULATE AS DESCRIBED ABOVE AND THE RETURN FAN SPEED SHALL BE CONTROLLED TO MATCH THE SUPPLY FAN'S AIR VOLUME. THE DISCHARGE AIR TEMPERATURE SETPOINT DURING THE "MODE" SHALL BE RAISED TO 90 DEG .F. THE AHU SHALL CONTINUE TO RUN UNTIL THE LOWEST SPACE TEMPERATURE RISES TO 65 DEG. F.

SAFETIES

19. THE SMOKE DETECTOR SHALL STOP THE SUPPLY AND RETURN FANS THROUGH THE FIRE ALARM SYSTEM WHEN SMOKE IS DETECTED.
20. FREEZE STAT ALARM SHALL ANNUNCIATE AT THE BAS, MANUAL RESET OF THE FREEZE STAT SHALL BE REQUIRED BEFORE AIR HANDLING UNIT RESTARTS. A PANEL MOUNT PILOT LIGHT SHALL BE USED FOR LOCAL INDICATION THAT THE FREEZE STAT HAS TRIPPED.
21. WHEN ANY SAFETY DEVICE TRIPS/ACTIVATION ALL CONTROL DEVICES SHALL FAIL TO THE NORMAL FAIL SAFE POSITIONS

ALARMING

NORMAL

- SUPPLY FAN FAILURE
- RETURN FAN FAILURE
- DISCHARGE AIR TEMPERATURE (+/- 5 DEGREES OF SETPOINT)
- DUCT STATIC PRESSURE (+/- 25% OF SETPOINT)
- HIGH DISCHARGE STATIC PRESSURE ALARM
- DISCHARGE HUMIDITY HIGH LIMIT (90%)
- FREEZESTAT
- FILTER STATUS
- CO2 ALARM

"ENHANCED" 24/7

MICHIGAN STATE UNIVERSITY
Infrastructure Planning and Facilities

VAV AHU W FLOW TRACKING AND VIFB STEAM HEAT CONTROL DIAGRAM

DATE 9/10/10
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REVISION 7/11/16 RLANDRUM
DETAIL NO. XXXXXX-XX
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