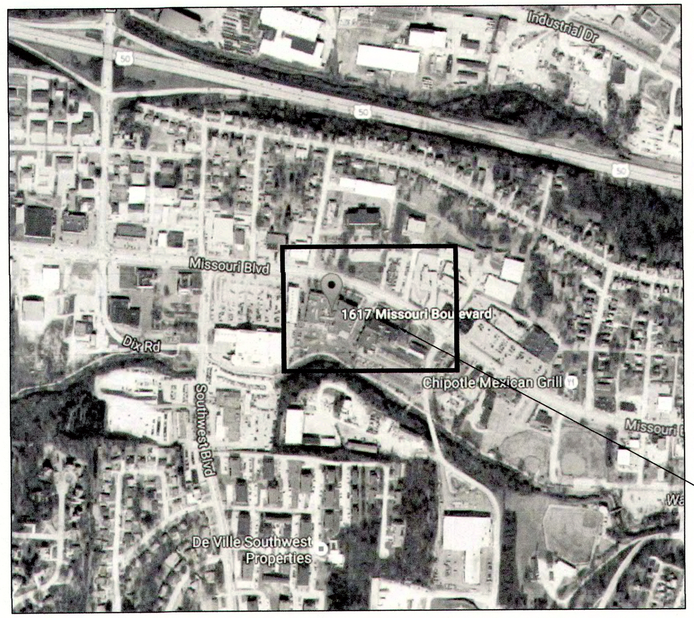
HVAC RETROFIT
at
Material Testing Lab
For
Missouri Department of Transportation
Central District



PROJECT LOCATION

SITE MAP
(NOT TO SCALE)

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PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

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September 23, 2016

COVER SHEET
MECHAANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
G-001

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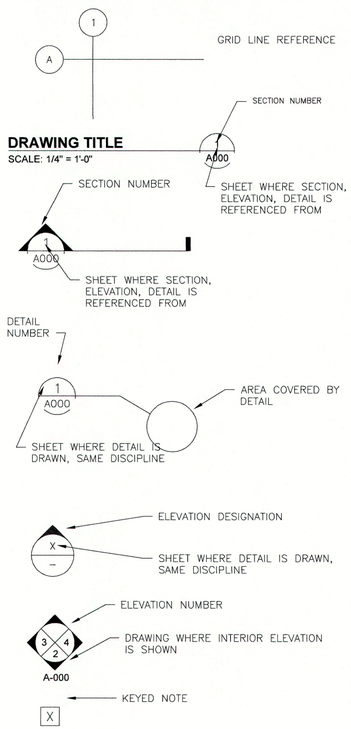
ABBREVIATIONS

AC	AIR CONDITIONING
ACT	ACOUSTICAL CEILING TILE
A.D.	AREA DRAIN
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AHU	AIR HANDLING UNIT
ALT	ALTERNATE
ALUM	ALUMINUM
AVG	AVERAGE
BD	BOARD
BLDG	BUILDING
BLKG	BLOCKING
BO	BOTTOM OF
CCTV	CLOSED CIRCUIT TELEVISION
CFM	CUBIC FEET PER MINUTE
CJ	CONTROL JOINT
CL OR ℄	CENTERLINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
CO	CLEAN OUT
COL	COLUMN
CONC	CONCRETE
CONST	CONSTRUCTION
CONT	CONTINUOUS
CPT	CARPET
CT	CERAMIC TILE
DBL	DOUBLE
DED	DEDICATED
DEMO	DEMOLITION
DF	DRINKING FOUNTAIN
DIA OR ø	DIAMETER
DIM	DIMMER
DN	DOWN
DS	DOWN SPOUT
DW	DISHWASHER
E OR EXST	EXISTING
EA	EACH
EJ	EXPANSION JOINT
EL	ELEVATION
ELECT	ELECTRIC
ELEV	ELEVATOR
EMER	EMERGENCY CIRCUIT OR BATTERY BACK-UP
EQ	EQUAL
EQUIP	EQUIPMENT
EST	ESTIMATE
FA	FIRE ALARM
FAB	FABRICATE
FACP	FIRE ALARM CONTROL PANEL
FCO	FLOOR CLEAN OUT
FD	FLOOR DRAIN
FDC	FIRE ALARM CONNECTION
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FHC	FIRE HOSE CABINET
FIN	FINISH
FL	FLOOR
FLOUR	FLUORESCENT
FO	FACE OF
FRT	FIRE RETARDANT TREATED
FRP	FIBERGLAS REINFORCED PLASTIC
FS	FLOOR SINK
FTG	FOOTING
FURN	FURNISH
GA	GAUGE
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GFI	GROUND FAULT INTERRUPTER
GL	GLASS
GR	GROUT
GYP BD	GYPSUM BOARD
HB	HOSE BIBB
HDW	HARDWARE
HGT	HEIGHT
HM	HOLLOW METAL
HOR	HORIZONTAL
HTR	HEATER
HVAC	HEATING VENTILATION & AIR CONDITIONING
HW	HOT WATER
ID	INSIDE DIAMETER
INC	INCLUDE
INSUL	INSULATION
INT	INTERIOR
JBOX	JUNCTION BOX
JCT	JUNCTION
KD	KNOCK DOWN
KO	KNOCK OUT
LAV	LAVATORY
LT	LIGHT
LVL	LAMINATED VENEER LUMBER
MATL	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MED	MEDIUM
MFG	MANUFACTURING
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MTL	METAL
NO	NUMBER
NOM	NOMINAL
NRC	NOISE REDUCTION COEFFICIENT
OC	ON CENTER
OD	OUTSIDE DIAMETER
OH	OVERHEAD
OPP	OPPOSITE
PT	PAINT
PERF	PERFORATED
PERP	PERPENDICULAR
PL	PROPERTY LINE
PLAM	PLASTIC LAMINATE
PLY	PLYWOOD
PSF	POUNDS PER SQUARE FOOT
PVC	POLYVINYL CHLORIDE
PWR	POWER
QT	QUARRY TILE
QTY	QUANTITY
REL	RELOCATED
RAD	RADIUS
RD	ROOF DRAIN
REF	REFRIGERATOR
REINF	REINFORCED
REQD	REQUIRED
REV	REVISION
RM	ROOM
RO	ROUGH OPENING
RSF	RESILIENT SHEET FLOORING
SC	SEALED CONCRETE
SCHED	SCHEDULE
SF	SQUARE FEET
SS	SOLID SURFACE
SSTL	STAINLESS STEEL
SPECS	SPECIFICATIONS
STC	SOUND TRANSMISSION CLASS
STD	STANDARD
STL	STEEL
SUSP	SUSPENDED
SYM	SYMMETRICAL
SYS	SYSTEM
TO	TOP OF
TS	TUBE STEEL
TYP	TYPICAL
VB	VINYL BASE
VCT	VINYL COMPOSITION TILE
VERT	VERTICAL
VIF	VERIFY IN FIELD
WB	WOOD BASE
WC	WALLCOVERING
WDW	WINDOW
WH	WATER HEATER
WT	WEIGHT
W/	WITH
W/O	WITHOUT
YD	YARD

SYMBOLS LEGEND - GENERAL



GENERAL NOTES

1. CONTRACTOR SHALL EXERCISE APPROPRIATE MEASURES AND CARE TO MINIMIZE EXCESSIVE NOISE LEVELS AND DISRUPTION TO FACILITY OPERATIONS DURING CONSTRUCTION.
2. MAINTAIN WORKING EXITS FROM CONSTRUCTION AREAS AT ALL TIMES. EXIT DOORS MUST BE OPERABLE FROM THE INSIDE WITHOUT USE OF A KEY OR ANY SPECIAL KNOWLEDGE.
3. CDG IS NOT RESPONSIBLE FOR IDENTIFICATION, ANALYSIS OR DESIGN SOLUTIONS CONCERNING REMEDIATION OF ANY HAZARDOUS MATERIALS AT THE OWNER'S SITE INCLUDING, BUT NOT LIMITED TO, ASBESTOS, LEAD, TOXIC MATERIALS AND/OR ANY OTHER TYPES OF MATERIAL, AIR, WASTE OR SOIL CONTAMINATION.
4. ERECT AND MAINTAIN SUITABLE BARRIERS FOR THE DURATION OF THE WORK TO PREVENT TRAFFIC INTO THE CONSTRUCTION AREA ON EACH FLOOR DURING CONSTRUCTION.
5. EQUIPMENT LAYOUTS FOR MECHANICAL AND ELECTRICAL AREAS ARE SHOWN ON MECHANICAL AND ELECTRICAL DRAWINGS.
6. MECHANICAL SUPPORTS TO BE SECURED TO THE CONCRETE SLAB PER THE MANUFACTURERS WRITTEN INSTRUCTIONS.
7. CONTRACTOR IS RESPONSIBLE FOR EXAMINING ALL CONTRACT DOCUMENTS, FIELD CONDITIONS, AND CONFIRMING THAT WORK IS BUILDABLE AS SHOWN BEFORE PROCEEDING WITH CONSTRUCTION. IF THERE ARE ANY QUESTIONS REGARDING THESE OR OTHER COORDINATION ITEMS, THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING CLARIFICATION FROM THE ARCHITECT/ENGINEER & OWNER'S REPRESENTATIVE PRIOR TO PROCEEDING WITH THE WORK IN QUESTION OR RELATED WORK.
8. THE CONTRACTOR'S WORK PERFORMANCE UNDER THESE CONTRACT DOCUMENTS SHALL CONFORM TO THE CONTRACT REQUIREMENTS AND SHALL BE FREE OF ANY DEFECTS IN EQUIPMENT, MATERIAL, AND/OR WORKMANSHIP. THIS SHALL ALSO APPLY TO ALL SUBCONTRACTORS AND SUPPLIERS.
9. THE INTENT OF THE DRAWINGS AND SPECIFICATIONS IS TO INCLUDE ALL LABOR, MATERIALS, AND SERVICES NECESSARY FOR THE COMPLETION OF ALL WORK SHOWN, DESCRIBED OR REASONABLY IMPLIED, BUT NOT LIMITED TO THAT EXPLICITLY INDICATED IN THE CONTRACT DOCUMENTS.
10. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY OF ANY SPECIFIED MATERIALS OR EQUIPMENT WHICH ARE EITHER UNAVAILABLE OR THAT WILL CAUSE A DELAY IN THE CONSTRUCTION COMPLETION SCHEDULE. THE CONTRACTOR SHALL SUBMIT CONFIRMATIONS OF DELIVERY DATES FOR ORDERS OF MATERIALS AND EQUIPMENT.
11. ANY WORK INSTALLED IN CONFLICT WITH THE CONSTRUCTION DRAWINGS, WITHOUT THE PRIOR APPROVAL OF THE OWNER'S REPRESENTATIVE AND THE ARCHITECT/ENGINEER, SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE.
12. THE CONTRACTOR SHALL KEEP ALL CONSTRUCTION AREAS CLEAN AND FREE FROM DEBRIS DURING THE PROJECT.
13. CONSTRUCTION LAY DOWN AND CONTRACTOR PARKING AREAS ARE LIMITED; COORDINATE PARKING AND STORAGE AREAS WITH OWNER PRIOR TO START OF THE PROJECT.
14. DRAWINGS WERE CREATED USING "BASIS OF DESIGN" MATERIALS AND EQUIPMENT. THE CONTRACTOR MAY PROPOSE EQUIVALENT PRODUCTS BY OTHER MANUFACTURERS, HOWEVER, IT WILL BE THE CONTRACTORS RESPONSIBILITY TO COORDINATE THE PROPOSED PRODUCTS WITH THE EXISTING CONDITIONS AND EMPLOY A DESIGN PROFESSIONAL TO MODIFY THE DRAWINGS IF REQUIRED.
15. COORDINATE THE SCHEDULE FOR UNIT SHUT-DOWNS WITH THE OWNER. NO MORE THAN ONE UNIT CAN BE SHUT DOWN AT A TIME.

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

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November 3, 2016

TYPICAL NOTES AND ABBREVIATIONS
GENERAL
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
G-002

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GENERAL NOTES:

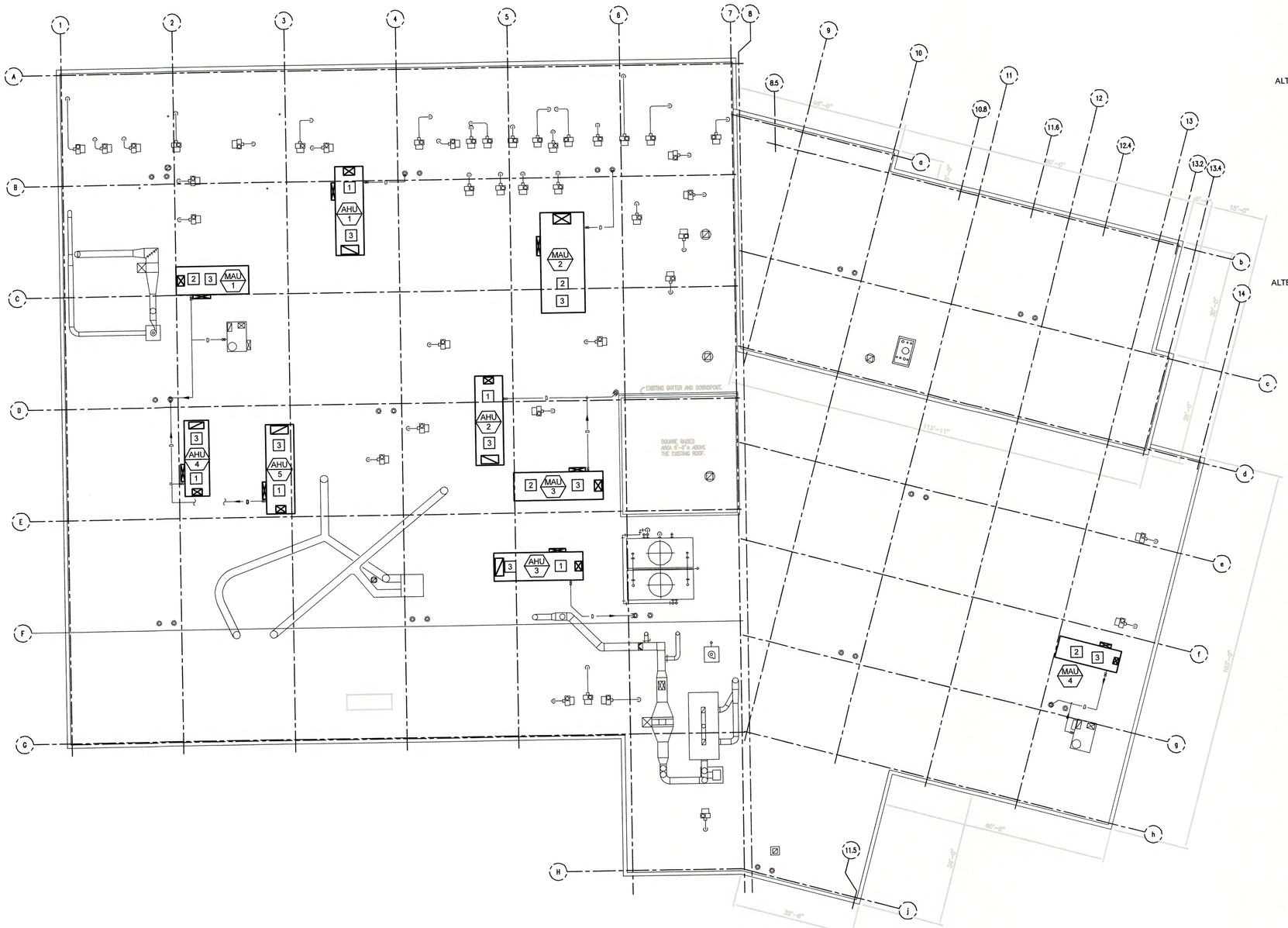
1. MECHANICAL CONTRACTOR TO DEMOLISH EXISTING PNEUMATIC TUBING AND DEVICES, CAP AT NEAREST BRANCH CONNECTION.
2. DAMPERS, VALVES, ACTUATORS, AND FREEZESTATS TO BE COMPATIBLE WITH EXISTING JOHNSON CONTROLS AUTOMATED CONTROL SYSTEM.
3. PARTIALLY REPLACE DAMAGED INSULATION INSIDE ALL ROOFTOP UNITS.

ALTERNATE #1

KEYED NOTES:

1. REPLACE OUTSIDE AND RETURN AIR DAMPERS, FREZESTATES, AND CONTROL VALVES. FOR DETAILS SEE DWG. M-501.
2. REPLACE OUTSIDE AIR DAMPER, FREZESTATES, AND CONTROL VALVES. FOR DETAILS SEE DWG M-502
3. REPLACE DOOR SEALS AND DAMAGED INSULATION INSIDE THE UNIT.

ALTERNATE #1



ROOF PLAN

SCALE: 1/16" = 1'-0"

0 16' 32' 48'

1/16" = 1'-0"

N

PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
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ROOF PLAN
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-101

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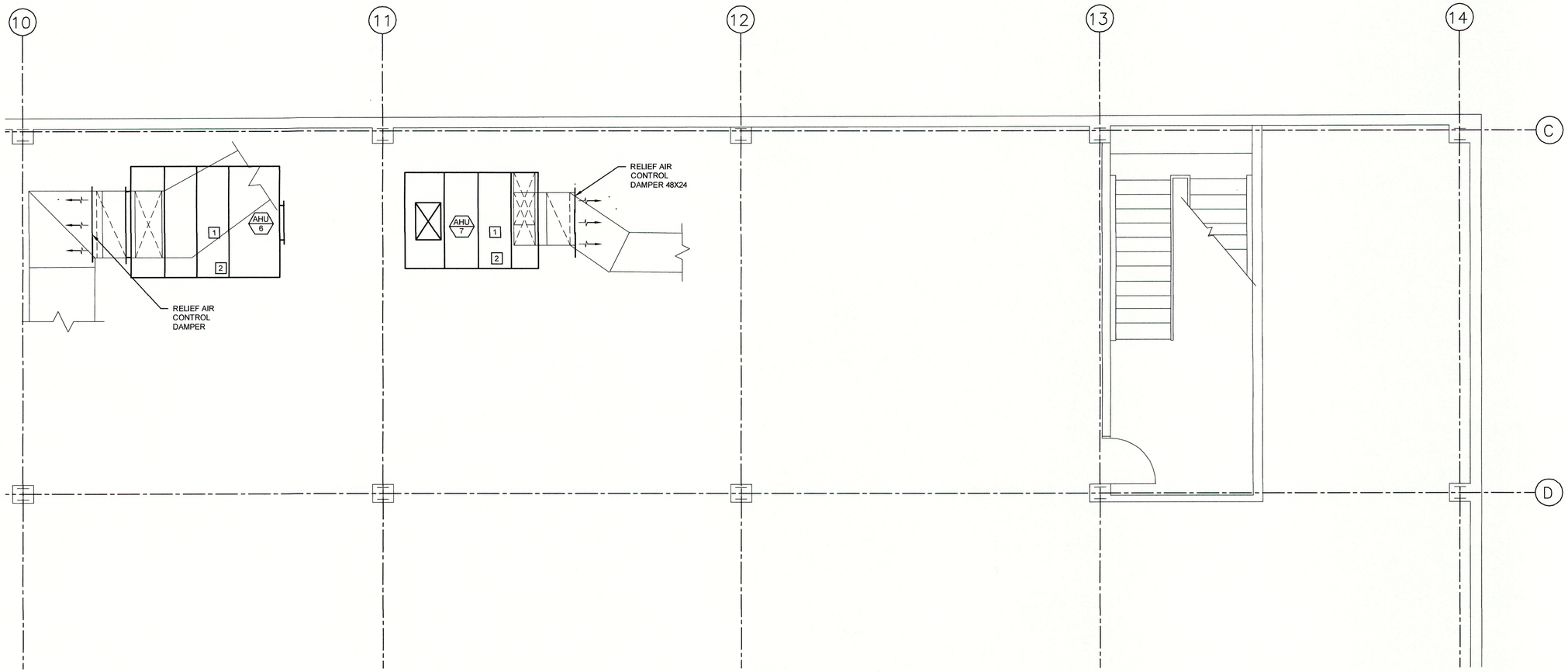

KEYED NOTES:

1. REPLACE OUTSIDE, RETURN AND RELIEF AIR DAMPERS, FREZESTATS, CONTROL VALVES. FOR DETAILS SEE DWG. M-501.
2. REPLACE DOOR SEALS. FOR DETAILS SEE DWG. M-501.

ALTERNATE #1

GENERAL NOTES:

1. MECHANICAL CONTRACTOR TO DEMOLISH EXISTING PNEUMATIC TUBING AND DEVICES, CAP AT NEAREST BRANCH CONNECTION.
2. DAMPERS, VALVES, ACTUATORS, AND FREEZESTATS TO BE COMPATIBLE WITH EXISTING JOHNSON CONTROLS AUTOMATED CONTROL SYSTEM.

PLAN - ELEVATION
SCALE: 1/64" = 1'-0"

0 10' 20' 30'
3/32" = 1'-0"

PLOT SCALE FACTOR 0.5

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BASEMENT PLAN
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-102

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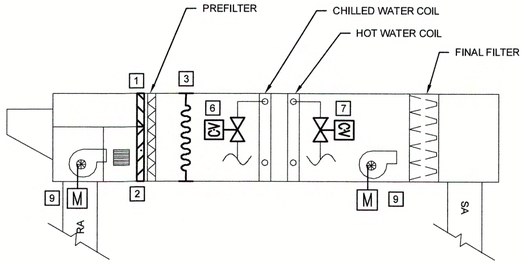

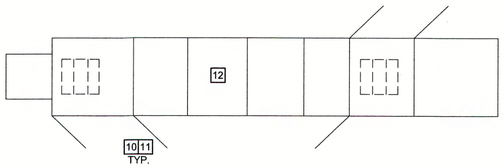

AHU-1, 2, 3, 4
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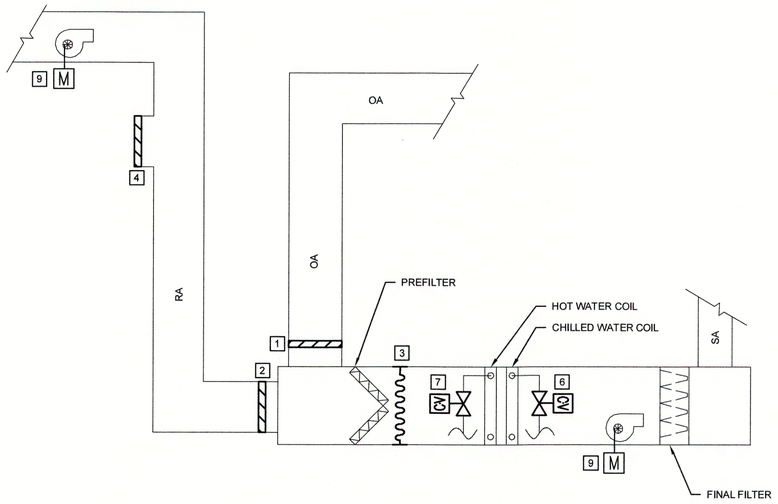
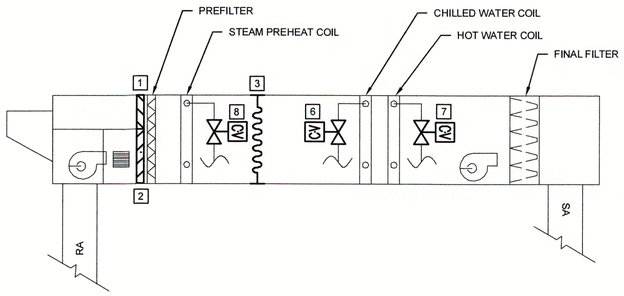
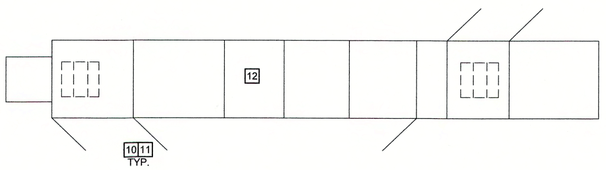
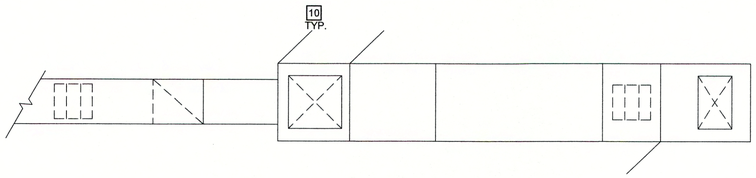






AHU-5
SCALE: NONE



AHU-6 & 7
SCALE: NONE

GENERAL NOTES:

1. MECHANICAL CONTRACTOR TO DEMOLISH EXISTING PNEUMATIC TUBING AND DEVICES, CAP AT NEAREST BRANCH CONNECTION.
2. DAMPERS, VALVES, ACTUATORS, AND FREEZESTATS TO BE COMPATIBLE WITH EXISTING JOHNSON CONTROLS AUTOMATED CONTROL SYSTEM.
3. PARTIALLY REPLACE DAMAGED INSULATION INSIDE ALL ROOFTOP UNITS.

ALTERNATE #1

KEYED NOTES:

1. REPLACE OUTSIDE AIR DAMPER/LINKAGE AND ACTUATOR WITH NEW OPPOSED BLADES DAMPER WITH BLADESEALS AND ELECTRONIC ACTUATOR.
2. REPLACE RETURN AIR DAMPER/LINKAGE AND ACTUATOR WITH NEW OPPOSED BLADES DAMPER WITH BLADESEALS AND ELECTRONIC ACTUATOR.
3. REPLACE LOW LIMIT TEMPERATURE SWITCH (EXISTING FREEZESTAT) WITH NEW AVERAGE TYPE FREEZESTAT.
4. FOR AHU-6 & 7 REPLACE DUCT RELIEF AIR DAMPER/LINKAGE AND ACTUATOR WITH NEW OPPOSED BLADES DAMPER WITH BLADESEALS AND ELECTRONIC ACTUATOR.
5. NOT USED
6. REPLACE CHILLED WATER PNEUMATICALLY OPERATED CONTROL VALVE WITH ELECTRONIC CONTROL VALVE.
7. REPLACE HOT WATER PNEUMATICALLY OPERATED CONTROL VALVE WITH ELECTRONIC CONTROL VALVE.
8. FOR AHU-5 REPLACE STEAM PREHEAT COIL PNEUMATICALLY OPERATED CONTROL VALVE WITH ELECTRONIC CONTROL VALVE.
9. CONTRACTOR TO CHECK FAN'S INLET GUIDE VANES FOR PROPER OPERATION ON ALL UNITS. REPLACE INLET GUIDE VANES ACTUATORS AND LINKAGE FOR WHEELS THAT ARE CURRENTLY OPERATIONAL. THERE IS NO WORK TO BE DONE FOR INOPERABLE GUIDE VANES.
10. REPLACE DOORS' SEAL FOR ALL UNITS.
11. CONTRACTOR TO INSPECT DOOR INSULATION FOR DAMAGE ON ROOFTOP UNITS. REPLACE DAMAGED INSULATION ON DOORS.
12. INSPECT UNIT INTERIORS AND REPLACE DAMAGED INSULATION. MAINTAIN VAPOR BARRIER OVER THE FACE OF THE UNIT INTERIOR INSULATION.

ALTERNATE #1

REV.	DATE	DESCRIPTION	APPROVED
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PLOT SCALE FACTOR 0.5

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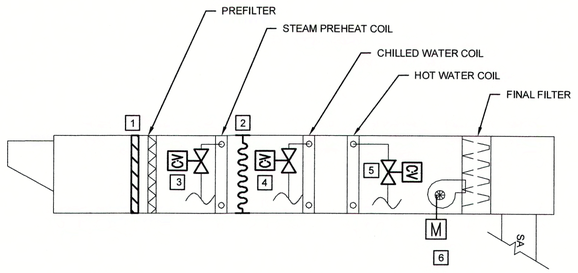
November 15, 2016

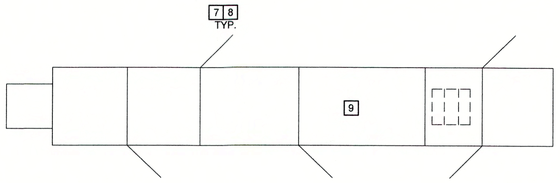
AHU RENOVATION DETAILS
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-501

T:\Working\16066 - modot-material testing lab hvac retrofit\Drawings\M-501 AHU RENOVATION DETAILS.dwg Printed by: PLEVIN Plot scale = 1:1





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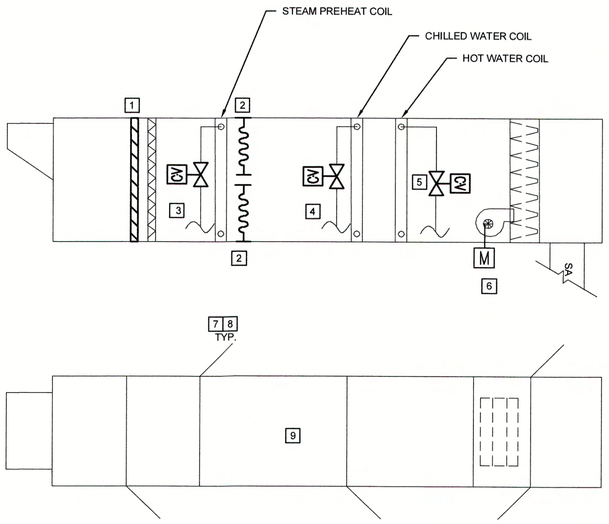

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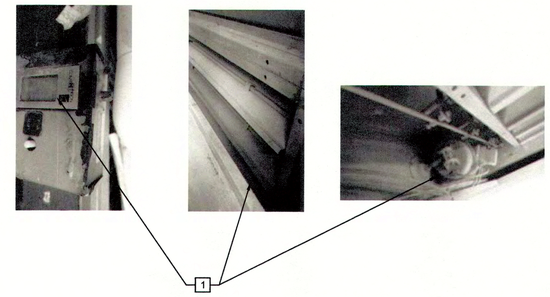

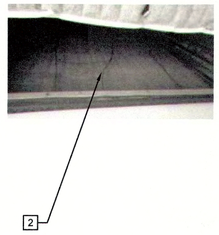

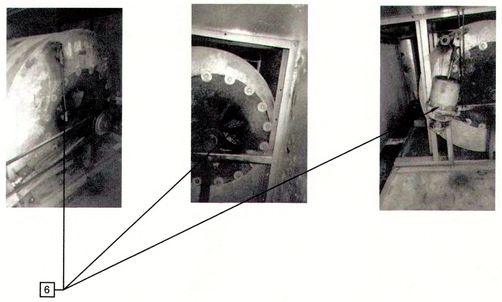

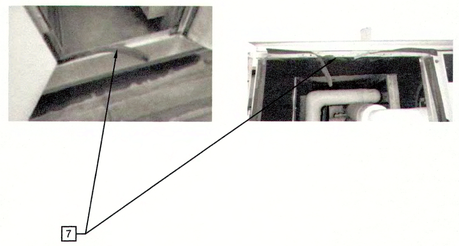

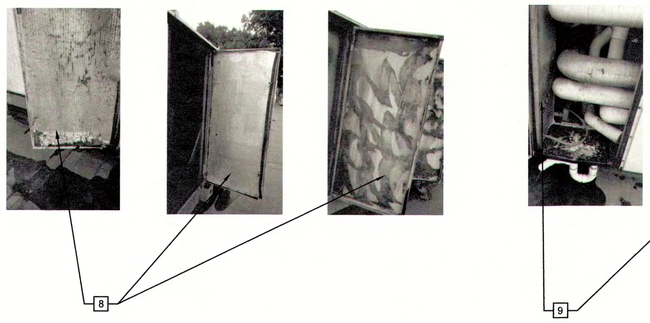

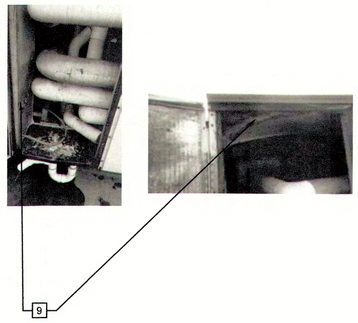

GENERAL NOTES:

1. MECHANICAL CONTRACTOR TO DEMOLISH EXISTING PNEUMATIC TUBING AND DEVICES, CAP AT THE NEAREST BRANCH CONNECTION.
2. DAMPERS, VALVES, ACTUATORS, AND FREEZESTATS TO BE COMPATIBLE WITH EXISTING JOHNSON CONTROLS AUTOMATED CONTROL SYSTEM.
3. PARTIALLY REPLACE DAMAGED INSULATION INSIDE ALL UNITS ON THE ROOF.

ALTERNATE #1

KEYED NOTES:

1. REPLACE OUTSIDE AIR DAMPER/LINKAGE AND ACTUATOR WITH NEW OPPOSED BLADES DAMPER WITH BLADESEALS AND ELECTRONIC ACTUATOR.
2. REPLACE LOW LIMIT TEMPERATURE SWITCH (EXISTING FREEZESTAT) WITH NEW AVERAGE TYPE FREEZESTAT. MULTIPLE FREEZEATATS MAY BE REQUIRED ON LARGER UNITS.
3. REPLACE PREHEAT COIL PNEUMATICALLY OPERATED CONTROL VALVE WITH ELECTRONIC CONTROL VALVE.
4. REPLACE CHILLED WATER PNEUMATICALLY OPERATED CONTROL VALVE WITH ELECTRONIC CONTROL VALVE.
5. REPLACE HOT WATER PNEUMATICALLY OPERATED CONTROL VALVE WITH ELECTRONIC CONTROL VALVE.
6. CONTRACTOR TO CHECK FAN'S INLET GUIDE VANES FOR PROPER OPERATION ON ALL UNITS. REPLACE INLET GUIDE VANES ACTUATORS AND LINKAGE KIT FOR WHEELS THAT ARE CURRENTLY OPERATIONAL. THERE IS NO WORK TO BE DONE FOR INOPERABLE GUIDE VANES.
7. REPLACE DOORS' SEAL FOR ALL UNITS.
8. CONTRACTOR TO CHECK ALL UNITS DOOR INSULATION. REPLACE COMPLETELY OR PARTIALLY DAMAGED INSULATION ON DOORS.
9. PARTIALLY REPLACE DAMAGED INSULATION ON INTERIOR WALLS OF ALL ROOFTOP UNITS. MAINTAIN VAPOR BARRIER OVER THE FACE OF THE UNIT INTERIOR INSULATION.

ALTERNATE #1

PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

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MoDOT

STATE OF MISSOURI
POLINA Y. LEVIN
NUMBER PE-2002016686
PROFESSIONAL ENGINEER
11/19/16
POLINA Y. LEVIN
2002016 686
ENGSEAL
ENGSEALNUM

PYL
November 15, 2016

MAU RENOVATION DETAILS
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-502

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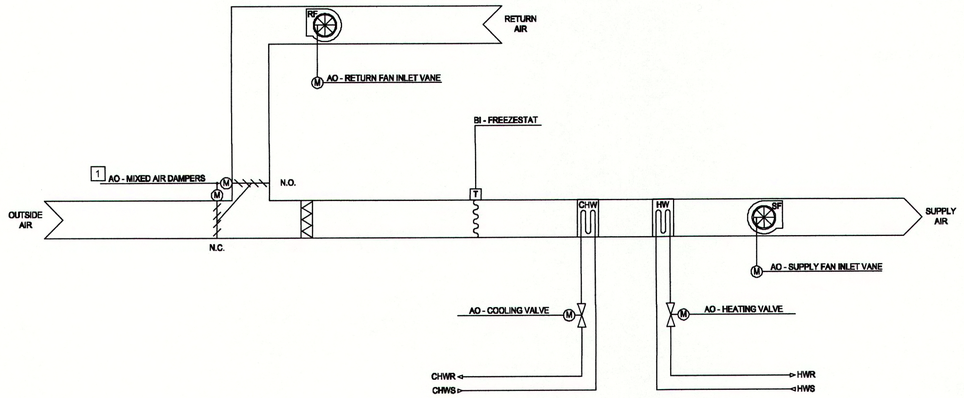
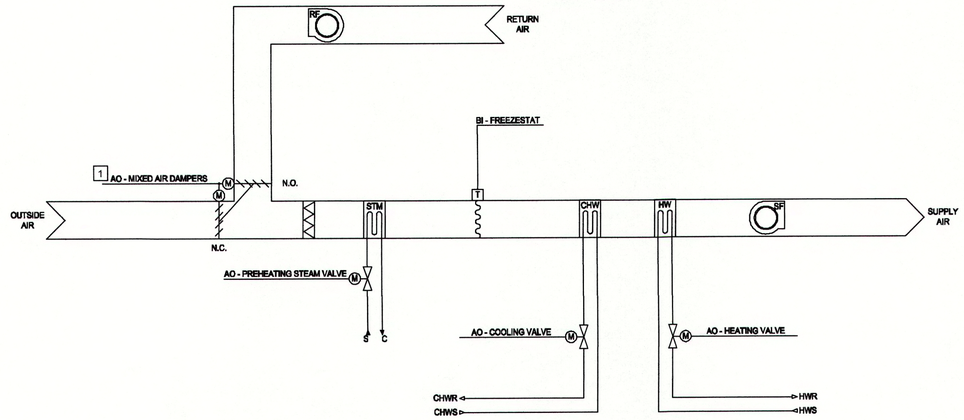
		HARDWARE POINTS				
	Point Name	AI	AO	BI	BO	
1	AHU-1 COOLING VALVE		X			
2	AHU-1 HEATING VALVE		X			
3	AHU-1 FREEZESTAT			X		
4	AHU-1 SUPPLY FAN INLET VANE		X			
5	AHU-1 RETURN FAN INLET VANE [1]		X			
6	AHU-1 OUTSIDE AIR DAMPER [1]		X			
7	AHU-1 RETURN AIR DAMPER [1]		X			
8	AHU-2 COOLING VALVE		X			
9	AHU-2 HEATING VALVE		X			
10	AHU-2 FREEZESTAT			X		
11	AHU-2 SUPPLY FAN INLET VANE		X			
12	AHU-2 RETURN FAN INLET VANE		X			
13	AHU-2 OUTSIDE AIR DAMPER [1]		X			
14	AHU-2 RETURN AIR DAMPER [1]		X			
15	AHU-3 COOLING VALVE		X			
16	AHU-3 HEATING VALVE		X			
17	AHU-3 FREEZESTAT			X		
18	AHU-3 SUPPLY FAN INLET VANE		X			
19	AHU-3 RETURN FAN INLET VANE		X			
20	AHU-3 OUTSIDE AIR DAMPER [1]		X			
21	AHU-3 RETURN AIR DAMPER [1]		X			
22	AHU-4 COOLING VALVE		X			
23	AHU-4 HEATING VALVE		X			
24	AHU-4 FREEZESTAT			X		
25	AHU-4 SUPPLY FAN INLET VANE		X			
26	AHU-4 RETURN FAN INLET VANE		X			
27	AHU-4 OUTSIDE AIR DAMPER [1]		X			
28	AHU-4 RETURN AIR DAMPER [1]		X			
29	AHU-5COOLING VALVE		X			
30	AHU-5 HEATING VALVE		X			
31	AHU-5 PREHEAT STEAM VALVE		X			
32	AHU-2 FREEZESTAT			X		
33	AHU-5 OUTSIDE AIR DAMPER [1]		X			
34	AHU-5 RETURN AIR DAMPER [1]		X			
35	AHU-8 COOLING VALVE		X			
36	AHU-8 HEATING VALVE		X			
37	AHU-8 FREEZESTAT			X		
38	AHU-8 SUPPLY FAN INLET VANE		X			
39	AHU-8 RETURN FAN INLET VANE		X			
40	AHU-8 OUTSIDE AIR DAMPER [1]		X			
41	AHU-8 RETURN AIR DAMPER [1]		X			
42	AHU-8 RELIEF AIR DAMPER		X			
43	AHU-7 COOLING VALVE		X			
44	AHU-7 HEATING VALVE		X			
45	AHU-7 FREEZESTAT			X		
46	AHU-7 SUPPLY FAN INLET VANE		X			
47	AHU-7 RETURN FAN INLET VANE		X			
48	AHU-7 OUTSIDE AIR DAMPER [1]		X			
49	AHU-7 RETURN AIR DAMPER [1]		X			
50	AHU-7 RELIEF AIR DAMPER		X			



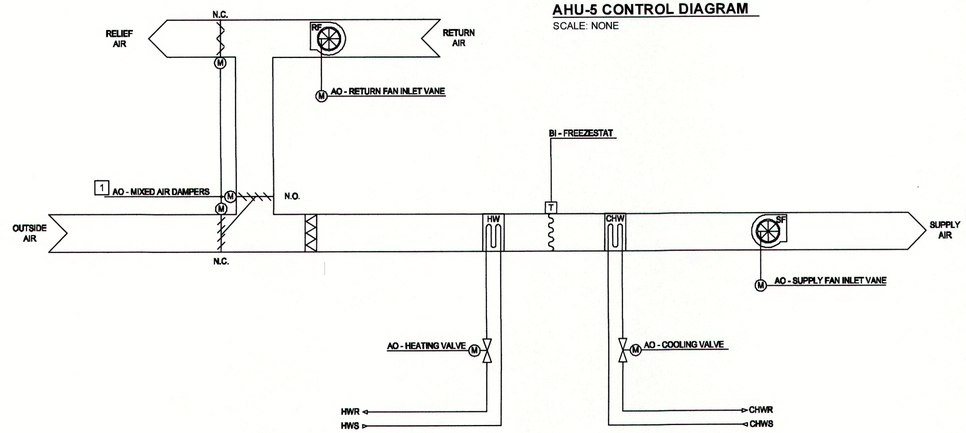
AHU-1, 2, 3, 4 CONTROL DIAGRAM

SCALE: NONE



AHU-5 CONTROL DIAGRAM

SCALE: NONE



AHU-6 & 7 CONTROL DIAGRAM

SCALE: NONE

PLOT SCALE FACTOR 0.5

GENERAL NOTES:

1. MECHANICAL CONTRACTOR TO DEMOLISH EXISTING PNEUMATIC TUBING AND DEVICES, CAP AT NEAREST BRANCH CONNECTION.
2. DAMPERS, VALVES, ACTUATORS, AND FREEZESTATS TO BE COMPATIBLE WITH EXISTING JOHNSON CONTROLS AUTOMATED CONTROL SYSTEM.
3. PROVIDE ANY ADDITIONAL MATERIALS AND DEVICES REQUIRED TO MAKE THE NEW ELECTRONIC DEVICES WORK WITH EXISTING CONTROLS.
4. THE SEQUENCE OF OPERATIONS FOR THE UNITS IS UNCHANGED.

KEYED NOTES:

[1] THE MIXED AIR CONTROL HAS ACTUATORS ON BOTH THE OUTSIDE AND RETURN AIR DAMPER. THEY ARE A SINGLE SOFTWARE POINTS WITH TWO DEVICES.

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November 3, 2016

AHU CONTROL DIAGRAM
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-601

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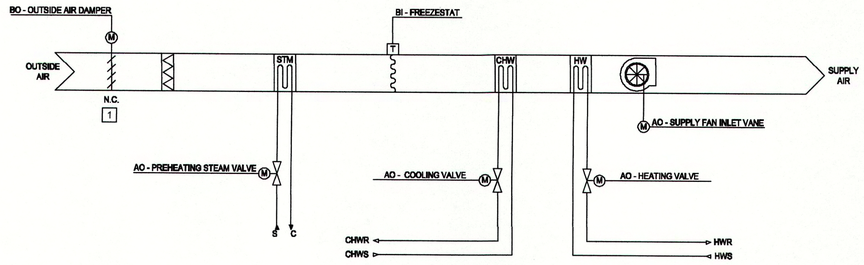
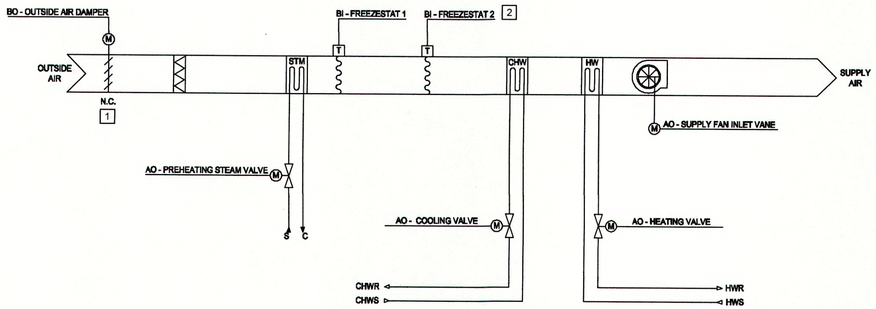
		HARDWARE POINTS			
	POINT NAME	AI	AO	BI	BO
1	MAU-1 COOLING VALVE		x		
2	MAU-1 HEATING VALVE		x		
3	MAU-1 FREEZESTAT			x	
4	MAU-1 SUPPLY FAN INLET VANE		x		
5	MAU-1 OUTSIDE AIR DAMPER [1]				
6	MAU-2 COOLING VALVE		x		
7	MAU-2 HEATING VALVE		x		
8	MAU-2 FREEZESTAT 1			x	
9	MAU-2 FREEZESTAT 2 [2]			x	
10	MAU-2 SUPPLY FAN INLET VANE		x		
11	MAU-2 OUTSIDE AIR DAMPER [1]				
12	MAU-3 COOLING VALVE		x		
13	MAU-3 HEATING VALVE		x		
14	MAU-3 FREEZESTAT			x	
15	MAU-3 SUPPLY FAN INLET VANE		x		
16	MAU-3 OUTSIDE AIR DAMPER [1]				
17	MAU-4 COOLING VALVE		x		
18	MAU-4 HEATING VALVE		x		
19	MAU-4 FREEZESTAT			x	
20	MAU-4 SUPPLY FAN INLET VANE		x		
21	MAU-4 OUTSIDE AIR DAMPER [1]				



MAU-1, 3, 4 CONTROL DIAGRAM
SCALE: NONE



MAU-2 CONTROL DIAGRAM
SCALE: NONE

GENERAL NOTES:

1. MECHANICAL CONTRACTOR TO DEMOLISH EXISTING PNEUMATIC TUBING AND DEVICES, CAP AT NEAREST BRANCH CONNECTION.
2. DAMPERS, VALVES, ACTUATORS, AND FREEZESTATS TO BE COMPATIBLE WITH EXISTING JOHNSON CONTROLS AUTOMATED CONTROL SYSTEM.
3. PROVIDE ANY ADDITIONAL MATERIALS AND DEVICES REQUIRED TO MAKE THE NEW ELECTRONIC DEVICES WORK WITH EXISTING CONTROLS.
4. THE SEQUENCE OF OPERATIONS FOR THE UNITS IS UNCHANGED.

KEYED NOTES:

[1] WIRE DAMPER ACTUATOR TO MAU SUPPLY FAN STARTER AS SHOWN ON THE EXISTING CONTROL DRAWING SEE. SHEET R-008 THROUGH R-011.

[2] MULTIPLE FREEZESTATS MAY BE REQUIRED FOR LARGER UNITS.

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November 3, 2016

MAU CONTROL DIAGRAM
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-602

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

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BIDDING

A. BASE BID: ALL MATERIALS AND LABOR TO REPLACE THE EXISTING PNEUMATIC DEVICES AND CONTROLS WITH ELECTRONIC CONTROLS.

ALTERNATE #1

B. ALTERNATE #1: PROVIDE A SEPARATE COST TO REFURBISH THE UNITS AS INDICATED. THIS INCLUDES ALL MATERIALS AND LABOR TO REPLACE THE DOOR SEALS AND DAMAGED INSULATION INSIDE THE UNITS.

SCOPE OF WORK

A. DOCUMENTATION
1. DOCUMENT EXISTING CONDITIONS. SEE PROJECT PROCEDURES.

SCHEDULE
2. COORDINATE WITH OWNER ON SEQUENCE OF WORK FOR UNITS. PROVIDE ANTICIPATED SCHEDULE WITH DATES FOR EACH UNIT TO BE DOWN. NO MORE THAN ONE UNIT MAY BE DOWN AT A TIME.

B. DEMOLISH EXISTING:
1. PNEUMATIC TUBING AND PNEUMATIC DEVICES.
2. CONTROL WIRING FROM JCI CONTROLLER TO AHU.
3. OUTSIDE, RETURN AND RELIEF AIR DAMPERS WITH LINKAGES FOR ALL UNITS.
4. LOW LIMIT TEMPERATURE SWITCHES (FREEZE STATS).
5. HEATING (STEAM AND HOT WATER) AND COOLING (CHILLED WATER) COILS CONTROL VALVES.

B. INSPECT EXISTING:
1. FAN INLET GUIDE VANES FOR ALL UNITS AND DETERMINE, WHICH ARE CURRENTLY OPERATIONAL.
2. INSULATION ON ROOFTOP UNITS INTERIOR WALLS .
3. INSULATION ON ROOFTOP UNITS DOORS.
4. DOOR SEAL ON ALL UNITS.

C. INSTALL NEW:
1. CONTROL DAMPERS WITH BLADE SEALS.
2. HEATING AND COOLING COILS CONTROL VALVES.
3. ANY REQUIRED LINKAGE KITS.
4. FREEZE STATS.
5. ELECTRONIC ACTUATORS FOR OPERATIONAL FAN INLET GUIDE VANES.
6. CONTROL WIRING FROM CONTROL PANEL TO UNITS IN CONDUITS.
7. PARTIALLY DAMAGED INSULATION ON INTERIOR WALLS OF ROOFTOP UNITS.
8. COMPLETELY OR PARTIALLY DAMAGED INSULATION ON ON ROOFTOP UNITS DOORS.
9. DOOR SEAL ON ALL UNITS.

D. EXCLUDED:
1. ANY WORK ASSOCIATED WITH THE EXISTING HUMIDIFIERS.

PROJECT PROCEDURES

DEFINITIONS
A. MATCH: TO BLEND WITH ADJACENT CONSTRUCTION AND MANIFEST NO APPARENT DIFFERENCE IN MATERIAL TYPE, SPECIES, CUT, FORM, DETAIL, COLOR, GRAIN, TEXTURE, OR FINISH; AS APPROVED BY ARCHITECT.
B. REPAIR: TO CORRECT DAMAGE AND DEFECTS, RETAINING EXISTING MATERIALS, FEATURES, AND FINISHES. THIS INCLUDES PATCHING, PIECING-IN, SPLICING, CONSOLIDATING, OR OTHERWISE REINFORCING OR UPGRADING MATERIALS.
C. REPLACE: TO REMOVE, DUPLICATE, AND REINSTALL ENTIRE ITEM WITH NEW MATERIAL. THE ORIGINAL ITEM IS THE PATTERN FOR CREATING DUPLICATES UNLESS OTHERWISE INDICATED.

FIELD CONDITIONS
A. PREEXISTING CONDITIONS: SHOW PREEXISTING CONDITIONS OF ADJOINING CONSTRUCTION AND SITE IMPROVEMENTS THAT ARE TO REMAIN, INCLUDING FINISH SURFACES, THAT MIGHT BE MISCONSTRUED AS DAMAGE CAUSED BY CONTRACTOR'S ALTERATION WORK OPERATIONS.
B. SURVEY OF EXISTING CONDITIONS: RECORD EXISTING CONDITIONS THAT AFFECT THE WORK BY USE OF PRECONSTRUCTION PHOTOGRAPHS AND/OR PRECONSTRUCTION VIDEOTAPES.
C. DISCREPANCIES: NOTIFY ARCHITECT OF DISCREPANCIES BETWEEN EXISTING CONDITIONS AND DRAWINGS BEFORE PROCEEDING WITH THE WORK.
D. OWNER WILL OCCUPY PORTIONS OF BUILDING IMMEDIATELY ADJACENT TO SELECTIVE DEMOLITION AREA. CONDUCT THE WORK SO OWNER'S OPERATIONS WILL NOT BE DISRUPTED.

PROTECTION
A. PROTECT PERSONS, MOTOR VEHICLES, SURROUNDING SURFACES OF BUILDING, BUILDING SITE, PLANTS, AND SURROUNDING BUILDINGS FROM HARM RESULTING FROM ALTERATION WORK.
1. PROVIDE PROTECTION TO ENSURE SAFE PASSAGE OF PEOPLE AROUND THE WORK AREA AND TO AND FROM OCCUPIED PORTIONS OF BUILDING. PROVIDE TEMPORARY BARRICADES AND OTHER PROTECTION REQUIRED TO PREVENT INJURY TO PEOPLE AND DAMAGE TO ADJACENT BUILDINGS AND FACILITIES TO REMAIN.
2. USE ONLY PROVEN PROTECTION METHODS, APPROPRIATE TO EACH AREA AND SURFACE BEING PROTECTED.
3. CONTAIN DUST AND DEBRIS GENERATED BY ALTERATION WORK, AND PREVENT IT FROM REACHING THE PUBLIC OR ADJACENT SURFACES.
4. PROVIDE TEMPORARY WEATHER PROTECTION, DURING INTERVAL BETWEEN SELECTIVE DEMOLITION AND NEW CONSTRUCTION, TO PREVENT WATER LEAKAGE AND DAMAGE TO STRUCTURE AND INTERIOR AREAS.
B. EXISTING ROOFING: PRIOR TO THE START OF WORK IN AN AREA, INSTALL ROOFING PROTECTION.

DISPOSAL OF DEMOLISHED MATERIALS
A. REMOVE DEMOLITION WASTE MATERIALS FROM PROJECT SITE AND PROPERLY DISPOSE OF THEM.
1. DO NOT ALLOW DEMOLISHED MATERIALS TO ACCUMULATE ON-SITE.
2. REMOVE AND TRANSPORT DEBRIS IN A MANNER THAT WILL PREVENT SPILLAGE ON ADJACENT SURFACES AND AREAS.
3. REMOVE DEBRIS FROM ELEVATED PORTIONS OF BUILDING BY CHUTE, HOIST, OR OTHER DEVICE THAT WILL CONVEY DEBRIS TO GRADE LEVEL IN A CONTROLLED DESCENT.
B. BURNING: DO NOT BURN DEMOLISHED MATERIALS.

CLEANING
A. CLEAN ADJACENT STRUCTURES AND IMPROVEMENTS OF DUST, DIRT, AND DEBRIS CAUSED BY SELECTIVE DEMOLITION OPERATIONS. RETURN ADJACENT AREAS TO CONDITION EXISTING BEFORE SELECTIVE DEMOLITION OPERATIONS BEGAN.

SUBMITTAL PROCEDURES

DEFINITIONS
A. ACTION SUBMITTALS: WRITTEN AND GRAPHIC INFORMATION AND PHYSICAL SAMPLES THAT REQUIRE ENGINEER'S RESPONSIVE ACTION. ACTION SUBMITTALS ARE THOSE SUBMITTALS INDICATED IN INDIVIDUAL SPECIFICATION SECTIONS AS "ACTION SUBMITTALS."
B. INFORMATIONAL SUBMITTALS: WRITTEN AND GRAPHIC INFORMATION AND PHYSICAL SAMPLES THAT DO NOT REQUIRE ENGINEER'S RESPONSIVE ACTION. SUBMITTALS MAY BE REJECTED FOR NOT COMPLYING WITH REQUIREMENTS. INFORMATIONAL SUBMITTALS ARE THOSE SUBMITTALS INDICATED IN INDIVIDUAL SPECIFICATION SECTIONS AS "INFORMATIONAL SUBMITTALS."

SUBMITTAL FORMATS
A. SUBMITTAL INFORMATION: INCLUDE THE FOLLOWING INFORMATION IN EACH SUBMITTAL:
1. PROJECT NAME.
2. DATE.
3. NAME OF ENGINEER.
4. NAME OF CONTRACTOR.
5. NAME OF FIRM OR ENTITY THAT PREPARED SUBMITTAL.
6. NAMES OF SUBCONTRACTOR, MANUFACTURER, AND SUPPLIER.
7. OTHER NECESSARY IDENTIFICATION.
8. REMARKS.
9. SIGNATURE OF TRANSMITTER.
B. OPTIONS: IDENTIFY OPTIONS REQUIRING SELECTION BY ENGINEER.
C. PDF SUBMITTALS: PREPARE SUBMITTALS AS PDF PACKAGE, INCORPORATING COMPLETE INFORMATION INTO EACH PDF FILE. NAME PDF FILE WITH SUBMITTAL NUMBER.

SUBMITTAL PROCEDURES
A. PREPARE AND SUBMIT SUBMITTALS REQUIRED.
1. EMAIL: PREPARE SUBMITTALS AS PDF PACKAGE, AND TRANSMIT TO ENGINEER BY SENDING VIA EMAIL INCLUDE PDF TRANSMITTAL FORM.
2. INCLUDE THE FOLLOWING INFORMATION IN EMAIL SUBJECT LINE: 16066 MODOT MATERIAL TESTING LAB HVAC.
3. ENGINEER WILL RETURN ANNOTATED FILE. ANNOTATE AND RETAIN ONE COPY OF FILE AS A DIGITAL PROJECT RECORD DOCUMENT FILE.
B. PROCESSING TIME: ALLOW TIME FOR SUBMITTAL REVIEW, INCLUDING TIME FOR RESUBMITTALS, AS FOLLOWS. TIME FOR REVIEW SHALL COMMENCE ON ENGINEER'S RECEIPT OF SUBMITTAL. NO EXTENSION OF THE CONTRACT TIME WILL BE AUTHORIZED BECAUSE OF FAILURE TO TRANSMIT SUBMITTALS ENOUGH IN ADVANCE OF THE WORK TO PERMIT PROCESSING, INCLUDING RESUBMITTALS.
1. INITIAL REVIEW: ALLOW 15 DAYS FOR INITIAL REVIEW OF EACH SUBMITTAL. ALLOW ADDITIONAL TIME IF COORDINATION WITH SUBSEQUENT SUBMITTALS IS REQUIRED.
2. RESUBMITTAL REVIEW: ALLOW 7 DAYS FOR REVIEW OF EACH RESUBMITTAL.

SUBMITTALS REQUIRED
A. PRODUCT DATA
1. DAMPERS
2. VALVES
3. ACTUATORS
4. FREEZESTATS
5. POWER SUPPLIES
6. LINKAGES
7. DIELECTRIC FITTINGS
8. INSULATION
9. TAPE
B. SHOP DRAWINGS
1. UPDATED CONTROL DRAWINGS
C. SAMPLES
1. DOOR GASKET MATERIAL

SUBMITTAL REQUIREMENTS
A. PRODUCT DATA: COLLECT INFORMATION INTO A SINGLE SUBMITTAL FOR EACH TYPE OF PRODUCT OR EQUIPMENT.
1. MARK EACH COPY OF EACH SUBMITTAL TO SHOW WHICH PRODUCTS AND OPTIONS ARE APPLICABLE.
2. INCLUDE THE FOLLOWING INFORMATION, AS APPLICABLE:
- MANUFACTURER'S CATALOG CUTS.
3. FOR EQUIPMENT, INCLUDE THE FOLLOWING IN ADDITION TO THE ABOVE, AS APPLICABLE:
- WIRING DIAGRAMS THAT SHOW FACTORY-INSTALLED WIRING.
B. SHOP DRAWINGS: PREPARE PROJECT-SPECIFIC INFORMATION.
1. PREPARATION: FULLY ILLUSTRATE REQUIREMENTS IN THE CONTRACT DOCUMENTS. INCLUDE THE FOLLOWING INFORMATION, AS APPLICABLE:
- IDENTIFICATION OF PRODUCTS.
- SCHEDULES.
- COMPLIANCE WITH SPECIFIED STANDARDS.
- NOTATION OF COORDINATION REQUIREMENTS.
2. PAPER SHEET SIZE: EXCEPT FOR TEMPLATES, PATTERNS, AND SIMILAR FULL-SIZE DRAWINGS, SUBMIT SHOP DRAWINGS ON SHEETS AT LEAST 8-1/2 BY 11 INCHES, BUT NO LARGER THAN 30 BY 42 INCHES.

ALTERNATE #1

C. SAMPLES: SUBMIT SAMPLES FOR REVIEW OF KIND, COLOR, PATTERN, AND TEXTURE FOR A CHECK OF THESE CHARACTERISTICS WITH OTHER MATERIALS.
1. IDENTIFICATION: PERMANENTLY ATTACH LABEL ON UNEXPOSED SIDE OF SAMPLES THAT INCLUDES THE FOLLOWING:
- PROJECT NAME AND SUBMITTAL NUMBER.
- GENERIC DESCRIPTION OF SAMPLE.
- PRODUCT NAME AND NAME OF MANUFACTURER.
- SAMPLE SOURCE.
- NUMBER AND TITLE OF APPLICABLE SPECIFICATION SECTION.
- SPECIFICATION PARAGRAPH NUMBER AND GENERIC NAME OF EACH ITEM.
2. PAPER TRANSMITTAL: INCLUDE PAPER TRANSMITTAL INCLUDING COMPLETE SUBMITTAL INFORMATION INDICATED.

CONTRACTOR'S REVIEW
A. ACTION SUBMITTALS AND INFORMATIONAL SUBMITTALS: REVIEW EACH SUBMITTAL AND CHECK FOR COORDINATION WITH OTHER WORK OF THE CONTRACT AND FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. NOTE CORRECTIONS AND FIELD DIMENSIONS. MARK WITH APPROVAL STAMP BEFORE SUBMITTING TO ENGINEER.

ENGINEER'S REVIEW
A. ACTION SUBMITTALS: ENGINEER WILL REVIEW EACH SUBMITTAL, INDICATE CORRECTIONS OR REVISIONS REQUIRED, AND RETURN IT.
1. PDF SUBMITTALS: ENGINEER AND CONSTRUCTION MANAGER WILL INDICATE, VIA MARKUP ON EACH SUBMITTAL, THE APPROPRIATE ACTION.
B. INFORMATIONAL SUBMITTALS: ENGINEER WILL REVIEW EACH SUBMITTAL AND WILL NOT RETURN IT, OR WILL RETURN IT IF IT DOES NOT COMPLY WITH REQUIREMENTS. ENGINEER WILL FORWARD EACH SUBMITTAL TO APPROPRIATE PARTY.
C. INCOMPLETE SUBMITTALS ARE UNACCEPTABLE, WILL BE CONSIDERED NONRESPONSIVE, AND WILL BE RETURNED FOR RESUBMITTAL WITHOUT REVIEW.
D. ENGINEER WILL RETURN WITHOUT REVIEW SUBMITTALS RECEIVED FROM SOURCES OTHER THAN CONTRACTOR.
E. SUBMITTALS NOT REQUIRED BY THE CONTRACT DOCUMENTS WILL BE RETURNED BY ENGINEER WITHOUT ACTION.

CONTROL DAMPER

FURNISH AND INSTALL VD-1250 ALUMINUM DAMPER JOHNSON CONTROLS® VD-1250 LOW LEAKAGE ALL ALUMINUM VOLUME CONTROL DAMPERS, OR APPROVED EQUAL.

FRAMES ARE TO BE CONSTRUCTED OF FORMED EXTRUDED ALUMINUM WITH LINKAGE CONCEALED IN THE SIDE CHANNEL TO ELIMINATE NOISE AND FRICTION. COMPRESSIBLE SPRING STAINLESS STEEL SIDE SEALS AND SELF-LUBRICATING BEARINGS SHALL ALSO BE PROVIDED.

BLADES ARE TO BE CONSTRUCTED WITH EXTRUDED ALUMINUM IN AIRFOIL SHAPE. DAMPER BLADE WIDTH SHALL NOT EXCEED 6 IN. AND SHALL HAVE SEALS. BLADE PINS SHALL BE 1/2 IN. PLATED STEEL HEX. BLADE OPERATION IS TO BE OPPOSED.

PERFORMANCE SHALL BE DESIGNED FOR TIGHT SHUTOFF AND TESTED IN ACCORDANCE WITH AMCA STANDARD 500. LEAKAGE FOR A DAMPER WITH SEALS SHALL NOT EXCEED 3 CFM PER SQUARE FOOT AT A 1 IN. W.G. THE DAMPER MUST BE RATED TO OPERATE OVER A TEMPERATURE RANGE OF -72 TO 275°F (-58 TO 135°C).

SIZING CONTRACTOR SHALL VERIFY THE EXISTING DAMPERS SIZE AND REPLACE IT WITH THE SAME SIZE DAMPERS MATCHING EXISTING EQUIPMENT OR DUCTS.

ELECTRIC SPRING RETURN ACTUATORS

JOHNSON CONTROLS, M9220 ACTUATORS OR APPROVED EQUAL ARE DIRECT MOUNT, SPRING RETURN ELECTRIC ACTUATORS THAT OPERATE ON THESE AVAILABLE POWER OPTIONS:
- AC 24 V AT 50/60 HZ OR DC 24 V (AGX, BGX, GGX, HGX)
- AC 120 V AT 60 HZ (BAX)
- AC 230 V AT 50/60 HZ (BDX)

CONTROL VALVE

JOHNSON CONTROLS VG1000 SERIES OR APPROVED EQUAL BALL VALVES WITH SINGLE PORT AND CHARACTERIZED DISK.

PRESSURE RATING FOR NPS 1 AND SMALLER: NOMINAL 600 WOG.

PRESSURE RATING FOR NPS 1-1/2 THROUGH NPS 2: NOMINAL 400 WOG.

CLOSE-OFF PRESSURE: 200 PSIG.

PROCESS TEMPERATURE RANGE: ZERO TO 212 DEG F.

BODY AND TAIL PIECE: FORGED BRASS.

END CONNECTIONS: AS REQUIRED BY EXISTING PIPING.

BALL: 300 SERIES STAINLESS STEEL.

STEM AND STEM EXTENSION:
- MATERIAL TO MATCH BALL.
- BLOWOUT-PROOF DESIGN.
- SLEEVE OR OTHER APPROVED MEANS TO ALLOW VALVE TO BE OPENED AND CLOSED WITHOUT DAMAGING THE INSULATION OR THE VAPOR BARRIER SEAL.

BALL SEATS: REINFORCED PTFE.

STEM SEAL: EPDM DOUBLE O-RINGS.

FLOW CHARACTERISTIC: EQUAL PERCENTAGE.

LOW LIMIT THERMOSTAT (FREEZESTAT)

PENN MODEL A70 HA-IC OR APPROVED EQUAL. CAPILLARY TUBE LENGTH APPROPRIATE TO THE SIZE OF THE UNIT. CONTACTS SHOULD OPEN ON LOW TEMPERATURE TO SHUT DOWN THE UNIT. INSTALL CAPILLARY ACROSS THE FACE OF THE COIL PER MANUFACTURER'S RECOMMENDATIONS.

ENCLOSED POWER SOURCE

FUNCTIONAL DEVICES, INC MODEL PSH300A OR APPROVED EQUAL. NEMA 1 ENCLOSURE, 300VA TRANSFORMER, 24VAC ON-OFF SWITCH WITH BREAKER, 3-24VAC 100VA CLASS 2 OUTPUTS WITH LED INDICATOR.

PREFORMED PIPE INSULATION

MINERAL-FIBER, PREFORMED PIPE INSULATION: TYPE I, 850 DEG F

MATERIALS: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 547, TYPE I, GRADE A, WITH FACTORY-APPLIED ASJ-SSL.

THICKNESS: MATCH EXISTING INSULATION TO REMAIN.

PVC FITTING COVERS: HIGH-IMPACT-RESISTANT, UV-RESISTANT PVC FACTORY FABRICATED FITTING COVERS FOR ELBOWS AND TEES.

ASJ-SSL: ASJ WITH SELF-SEALING, PRESSURE-SENSITIVE, ACRYLIC-BASED ADHESIVE COVERED BY A REMOVABLE PROTECTIVE STRIP; COMPLYING WITH ASTM C 1136, TYPE I.

ASJ TAPE: WHITE VAPOR-RETARDER TAPE MATCHING FACTORY-APPLIED JACKET WITH ACRYLIC ADHESIVE, COMPLYING WITH ASTM C 1136.
1. WIDTH: 3 INCHES (75 MM).
2. THICKNESS: 11.5 MILS (0.29 MM).
3. ADHESION: 90 OUNCES FORCE/INCH (1.0 N/MM) IN WIDTH.
4. ELONGATION: 2 PERCENT.
5. TENSILE STRENGTH: 40 LBF/INCH (7.2 N/MM) IN WIDTH.
6. ASJ TAPE DISKS AND SQUARES: PRECUT DISKS OR SQUARES OF ASJ TAPE.

MINERAL-FIBER ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A.

ASJ ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A FOR BONDING INSULATION JACKET LAP SEAMS AND JOINTS.

PVC JACKET ADHESIVE: COMPATIBLE WITH PVC JACKET.

VAPOR-BARRIER MASTIC: WATER BASED; SUITABLE FOR INDOOR USE ON BELOW-AMBIENT SERVICES. MATERIALS SHALL BE COMPATIBLE WITH INSULATION MATERIALS, JACKETS, AND SUBSTRATES.
1. WATER-VAPOR PERMEANCE: ASTM E 96/E 96M, PROCEDURE B, 0.013 PERM AT 43-MIL DRY FILM THICKNESS.
2. SERVICE TEMPERATURE RANGE: MINUS 20 TO PLUS 180 DEG F .
3. SOLIDS CONTENT: ASTM D 1644, 58 PERCENT BY VOLUME AND 70 PERCENT BY WEIGHT.
4. COLOR: WHITE.

EQUIPMENT INSULATION

MINERAL-FIBER BLANKET INSULATION: MINERAL OR GLASS FIBERS BONDED WITH A THERMOSETTING RESIN. COMPLY WITH ASTM C 553, TYPE II AND ASTM C 1290, TYPE III WITH FACTORY-APPLIED FSK JACKET.

THICKNESS: MATCH EXISTING INSULATION TO REMAIN.

FACTORY-APPLIED FSK JACKET: ALUMINUM-FOIL, FIBERGLASS-REINFORCED SCRIM WITH KRAFT-PAPER BACKING; COMPLYING WITH ASTM C 1136, TYPE II.

FSK TAPE: FOIL-FACE, VAPOR-RETARDER TAPE MATCHING FACTORY-APPLIED JACKET WITH ACRYLIC ADHESIVE; COMPLYING WITH ASTM C 1136.

ALTERNATE #1

1. WIDTH: 3 INCHES.
2. THICKNESS: 6.5 MILS.
3. ADHESION: 90 OUNCES FORCE/INCH IN WIDTH.
4. ELONGATION: 2 PERCENT.
5. TENSILE STRENGTH: 40 LBF/INCH IN WIDTH.
6. FSK TAPE DISKS AND SQUARES: PRECUT DISKS OR SQUARES OF FSK TAPE.

MINERAL-FIBER ADHESIVE: COMPLY WITH MIL-A-3316C, CLASS 2, GRADE A.

ACCESS DOOR GASKET

APPLY GASKET AROUND ENTIRE PERIMETERS OF DOOR FRAME. GASKET SHALL HAVE ADHESIVE BACKING TO BOND THE GASKET TO THE DOOR. THOROUGHLY CLEAN AND PREPARE THE AREA FOR THE INSTALLATION OF THE GASKET PER THE MANUFACTURER'S INSTRUCTIONS.

MATERIALS: PROVIDE ONE OF THE FOLLOWING PRODUCT:
A. TPV (THERMOPLASTIC VULCANIZATES)
B. EPDM
C. TPR (THERMOPLASTIC RUBBER)

DIELECTRIC FITTINGS

GENERAL REQUIREMENTS: ASSEMBLY OF COPPER ALLOY AND FERROUS MATERIALS WITH SEPARATING NONCONDUCTIVE INSULATING MATERIAL. INCLUDE END CONNECTIONS COMPATIBLE WITH PIPES TO BE JOINED.

A. DIELECTRIC UNIONS:
1. STANDARD: ASSE 1079.
2. PRESSURE RATING: 125 PSIG MINIMUM AT 180 DEG F.
3. END CONNECTIONS: SOLDER-JOINT COPPER ALLOY AND THREADED FERROUS.

B. DIELECTRIC FLANGES:
1. STANDARD: ASSE 1079.
2. FACTORY-FABRICATED, BOLTED, COMPANION-FLANGE ASSEMBLY.
3. PRESSURE RATING: 125 PSIG MINIMUM AT 180 DEG F .
4. END CONNECTIONS: SOLDER-JOINT COPPER ALLOY AND THREADED FERROUS; THREADED SOLDER-JOINT COPPER ALLOY AND THREADED FERROUS.

C. DIELECTRIC-FLANGE INSULATING KITS:
1. NONCONDUCTING MATERIALS FOR FIELD ASSEMBLY OF COMPANION FLANGES.
2. PRESSURE RATING: 150 PSIG.
3. GASKET: NEOPRENE OR PHENOLIC.
4. BOLT SLEEVES: PHENOLIC OR POLYETHYLENE.
5. WASHERS: PHENOLIC WITH STEEL BACKING WASHERS.

REV.	DATE	DESCRIPTION	APPROVED
0	11/3/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

T:\Working\16066 - modot-material testing lab hvac retrofit\Drawings\M-603 SPECIFICATIONS.dwg Printed by: PLEVIN Plot scale = 1:1

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MoDOT

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FOLINA Y. LEVIN
NUMBER PE-2002016686
PROFESSIONAL ENGINEER
11/5/16
FOLINA Y. LEVIN
2002016686
ENGSEAL
ENGSEALNUM

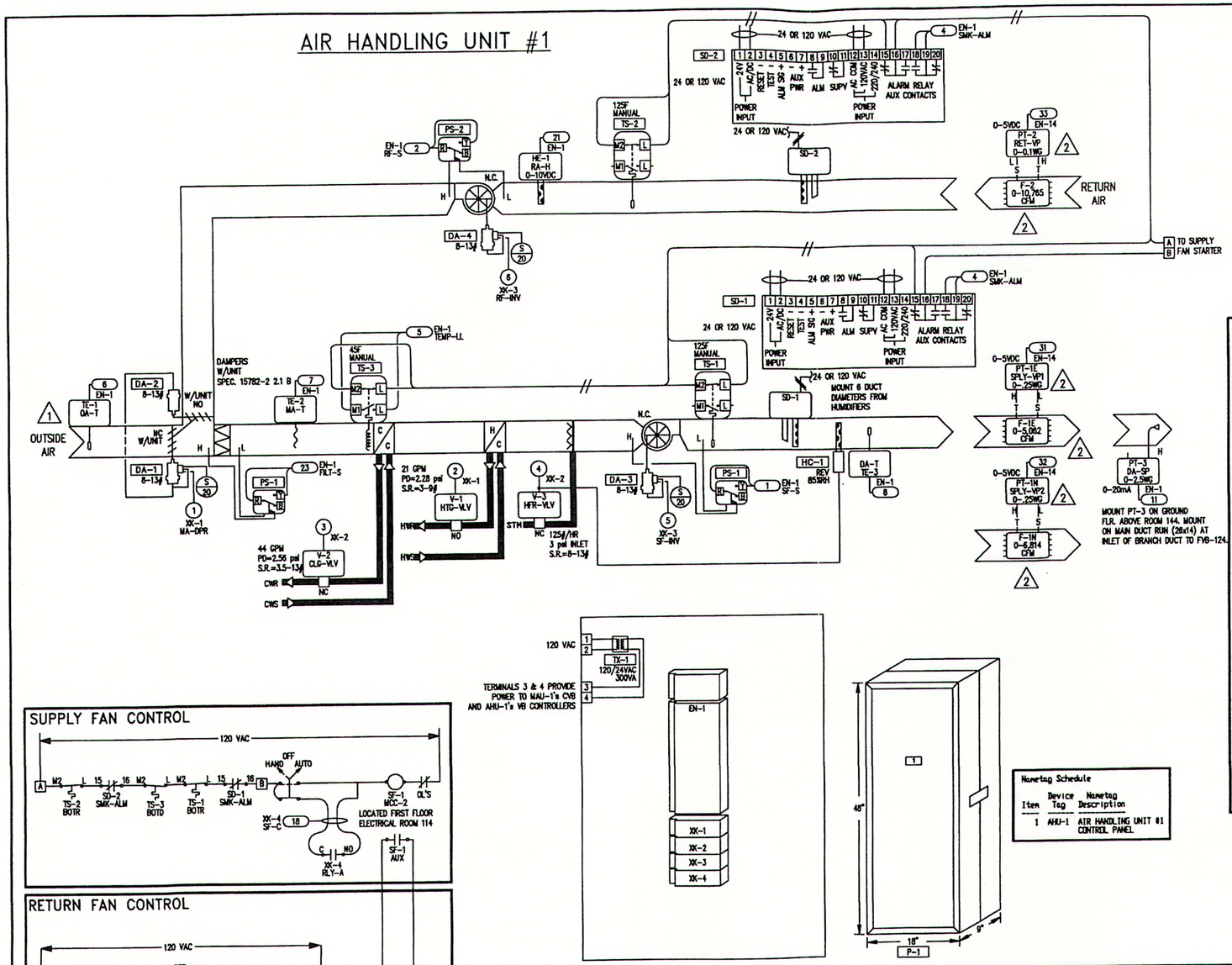
PYL
November 3, 2016

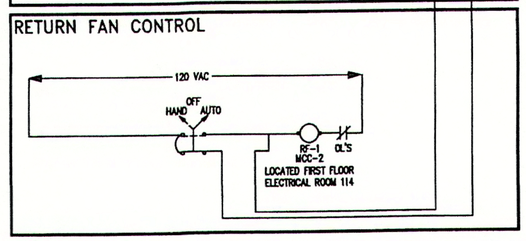
SPECIFICATIONS
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
M-603

AIR HANDLING UNIT #1





Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-1	AIR HANDLING UNIT #1 CONTROL PANEL

FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-3-DA-4	2	D-3244-3	DPR ACT 8-13# W/POS
F-2	1	38 X 36	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1E	1	28 X 16	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1N	1	16 X 37	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1-PS-2	3	P32AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
S9-1-S9-2	2	DH400WCDC1	DUCT DETECTOR, ION,
	2	ST-5	SAMPLING TUBE FOR
TE-1	1	TE-6313P-1	TEMP SENSOR; 1000 OHM, NI
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE; 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE; 2-C
V-1	1	V-3754-1023	1" NO GL 3-68 W/A 13.9CV
V-2	1	V-3974-1012	1-1/2" NC GL 9-13# W/A
V-3	1	V-3974-1004	3/4" NC GL 9-13# W/A 8.6

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-392	SCREW-ON LANCOID NAME-
ACC	4	PD-113-3	TERMINAL BLOCK; MEDIUM
P-1	1	M-8108-1848	CONTROL CABINET;STD. FACE
PT-2	1	DPT-2640-1	DIFF PRESS TRANS;0/0.1"WC
PT-1E,PT-1N	2	DPT-2640-2	DIFF PRESS TRANS;0/.25"WC
TX-1	1	TZ-5000-11	TRANSFORMER; POWER,

Sequence of Operation

Metasys Enclosure, EN-1 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

Occupied

Unit fans will run continuously. EN-1 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain a 55F discharge air temperature setpoint, adj. TE-3 provides feedback for the discharge air temperature control. The mixed air dampers will be allowed to modulate only if the outdoor air temperature is below the economizer setpoint of 55F, adj. When the outdoor air temperature is above the economizer setpoint, the mixed air dampers will be commanded to a minimum outdoor air position.

Humidifier valve V-3 will be modulated to maintain the return air humidity setpoint, 55 %RH, adj. High limit humidity controller HC-1 will modulate V-3 to a closed position when the humidifier discharge humidity approaches 85 %RH.

The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

The return fan inlet vanes will be modulated to maintain an airflow differential between the supply and return fans. The airflow differential setpoint is adjustable at the Metasys Operator Workstation.

Unoccupied

During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72

High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj, the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

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DRAWING TITLE: AIR HANDLING UNIT #1

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

JOHNSON CONTROLS Systems & Services Division

JOHNSON CONTROLS 2188 WELSCH IND. CT. ST. LOUIS, MO. 63146 314-569-1570 1-800-825-8550

FILE: AHU-1

NO.	REVISION-LOCATION	ECN	DATE	BY
2	VOLU-PROBES		07/27/94	JDC
1	OA SENSOR W/SHLD		04/07/94	JDC

REFERENCE DRAWING

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 07/21/94	BY DATE

CONTRACT NUMBER 94524-0001

DRAWING NUMBER 1

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

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ENGSEALNUM

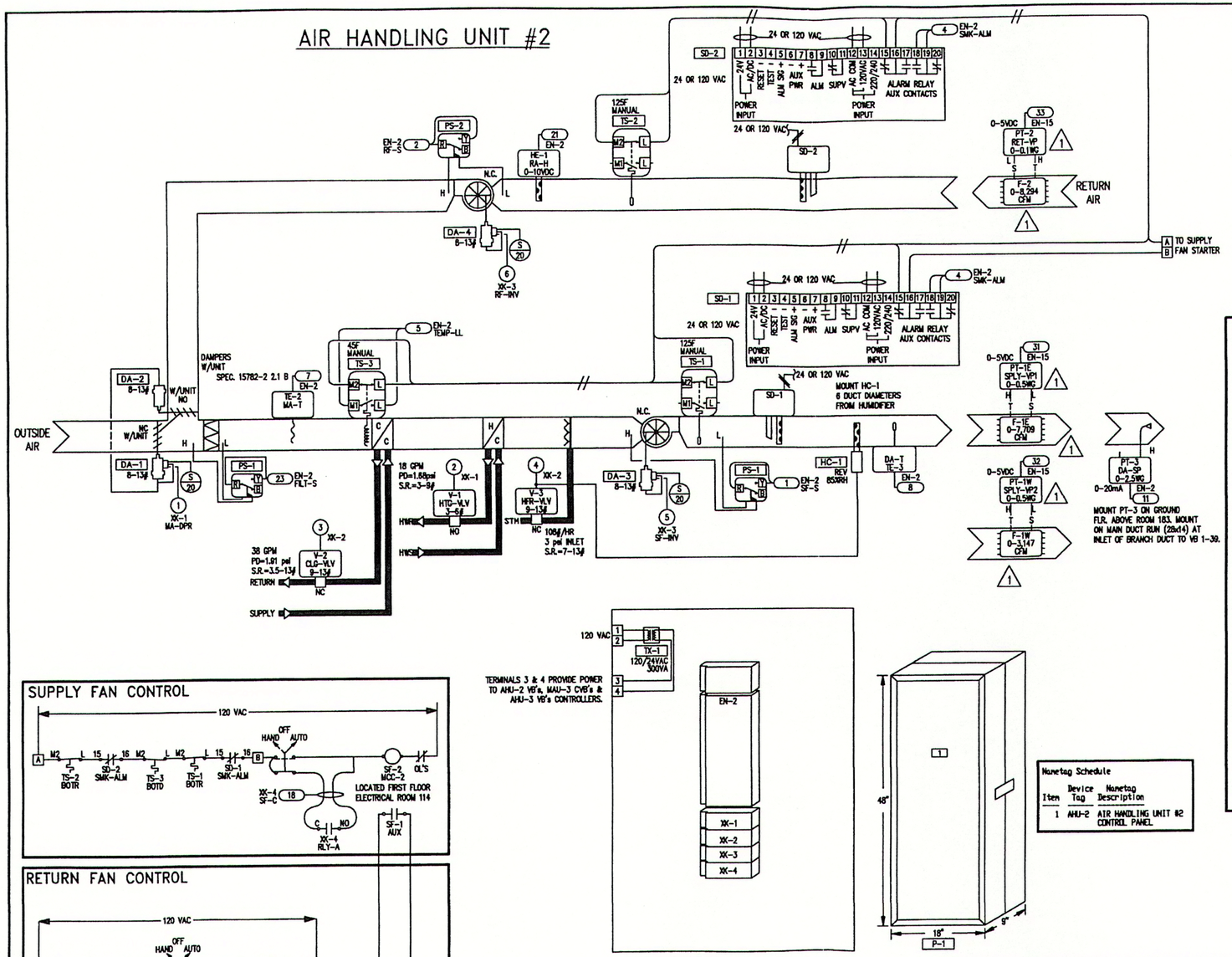
PYL
November 3, 2016

AHU-1 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

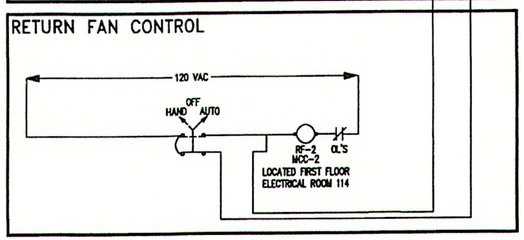
DRAWING NO.
R-001

AIR HANDLING UNIT #2



SUPPLY FAN CONTROL

RETURN FAN CONTROL



Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-2	AIR HANDLING UNIT #2 CONTROL PANEL

FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-3-DA-4	2	D-3244-3	DPR ACT 8-13# W/POS
F-2	1	43 X 25	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1E	1	30 X 16	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1W	1	18 X 12	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1-PS-2	3	P32AF-1C	SENSITIVE DIFF PRESS CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1-SD-2	2	DH400ACDCI	DUCT DETECTOR, ION,
	2	ST-5	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVG.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-3754-1023	1" NO GL 3-68 W/A 13.9CV
V-2	1	V-3974-1012	1-1/2" NC GL 9-13# W/A
V-3	1	VTH-TC047-314	VALVE; 1/2" NC 9-13 4.7CV

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-392	SCREW-ON LAMCOID NAME-
ACC	4	PD-113-3	TERMINAL BLOCK; MEDIUM
P-1	1	M-8108-1848	CONTROL CABINET;STD. FACE
PT-2	1	DPT-2640-1	DIFF PRESS TRANS;0/0.1"WC
PT-1E,PT-1W	2	DPT-2640-3	DIFF PRESS TRANS;0/0.5"WC
TX-1	1	TZ-5080-11	TRANSFORMER; POWER,

Sequence of Operation

Metasys Enclosure, EN-2 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

Occupied

Unit fans will run continuously. EN-2 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain

a 55F discharge air temperature setpoint, adj. TE-3 provides feedback for the discharge air temperature control. The mixed air dampers will be allowed to modulate only if the outdoor air temperature is below the economizer setpoint of 55F, adj. When the outdoor air temperature is above the economizer setpoint, the mixed air dampers will be commanded to a minimum outdoor air position.

Humidifier valve V-3 will be modulated to maintain the return air humidity setpoint, 55 %RH, adj. High limit humidity controller HC-1 will modulate V-3 to a closed position when the humidifier discharge humidity approaches 85 %RH.

The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

The return fan inlet vanes will be modulated to maintain an airflow differential between the supply and return fans. The airflow differential setpoint is adjustable at the Metasys Operator Workstation.

Unoccupied

During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72°

High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj., the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

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DRAWING TITLE: AIR HANDLING UNIT #2

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
	1	VOLU-PROBES		07/27/94	JDC

SALES ENGR	PROJECT MGR	APPL ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 01/21/94	BY DATE

JOHNSON CONTROLS
Systems & Services Division

JOHNSON CONTROLS
2188 WELSCH IND. CT.
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314-569-1570
1-800-825-8550

CONTRACT NUMBER: 94524-0001
DRAWING NUMBER: 3

FILE: AHU-2

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

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STATE OF MISSOURI
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PROFESSIONAL ENGINEER
11/15/16
POLINA Y. LEVIN 2002016686
ENGSEAL
ENGSEALNUM

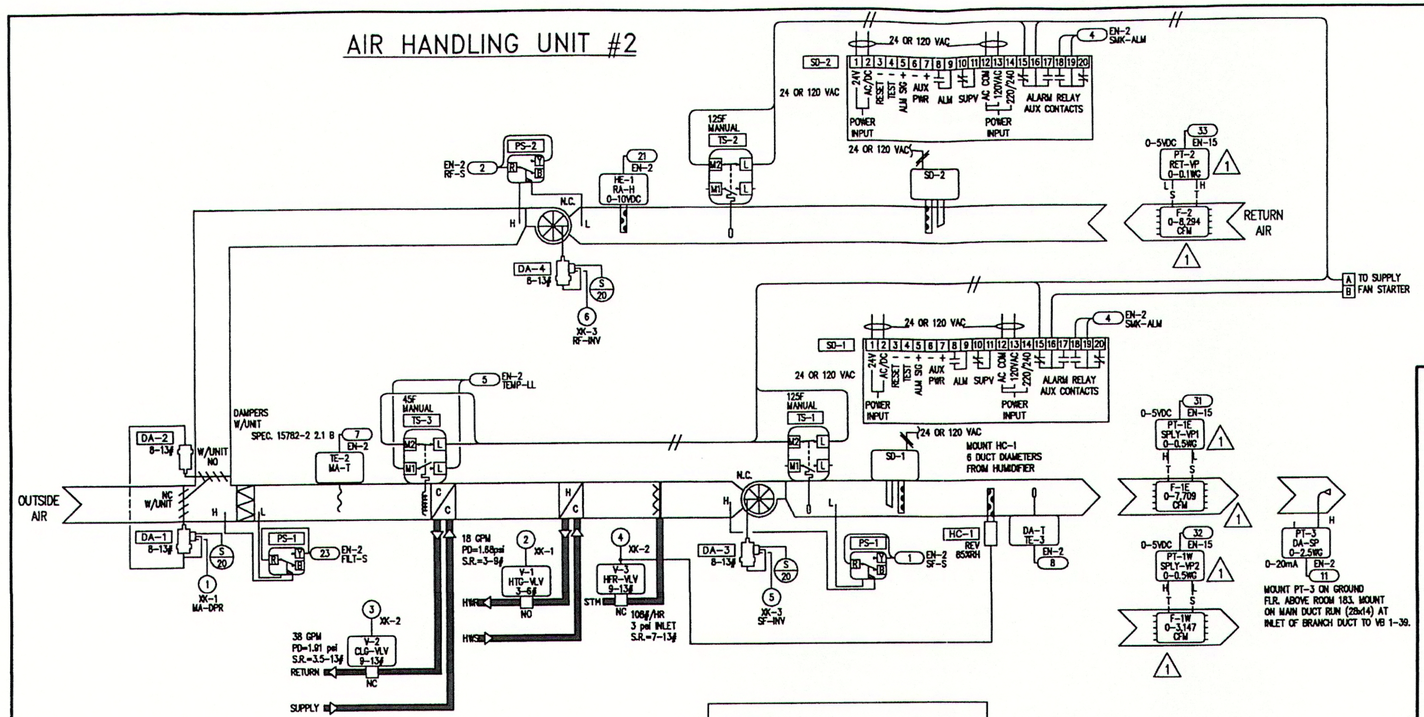
PYL
November 3, 2016

AHU-2 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

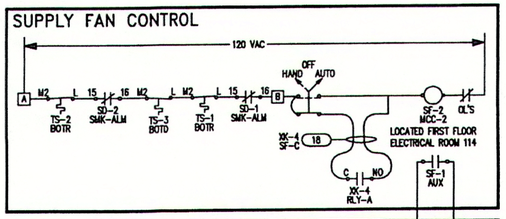
CDG PROJECT NO.
16066

DRAWING NO.
R-002

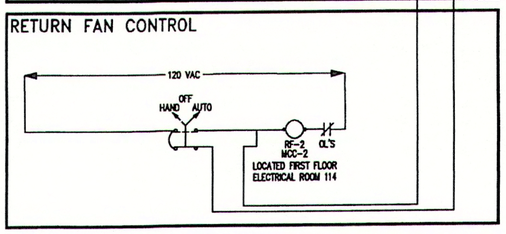
AIR HANDLING UNIT #2

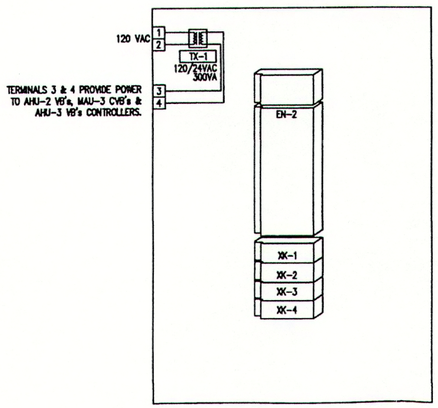


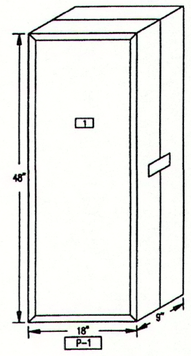
SUPPLY FAN CONTROL



RETURN FAN CONTROL







Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-2	AIR HANDLING UNIT #2 CONTROL PANEL

FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-3-DA-4	2	D-3244-3	DPR ACT 8-13# W/POS
F-2	1	43 X 25	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1E	1	30 X 16	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1W	1	18 X 12	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1-PS-2	3	PS2AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1-SD-2	2	DH400ACDCI	DUCT DETECTOR, ION,
	2	ST-S	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-3754-1023	1" NO GL 3-6# W/A 13.9CV
V-2	1	V-3974-1012	1-1/2" NC GL 9-13# W/A
V-3	1	VTH-TC047-314	VALVE; 1/2" NC 9-13 4.7CV

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	N-8008-392	SCREW-ON LAMCOID NAME-
ACC	4	PD-113-3	TERMINAL BLOCK; MEDIUM
P-1	1	N-8108-1848	CONTROL CABINET;STD. FACE
PT-2	1	DPT-2640-1	DIFF PRESS TRANS;0/0.1"WC
PT-1E,PT-1W	2	DPT-2640-3	DIFF PRESS TRANS;0/0.5"WC
TX-1	1	TZ-5080-11	TRANSFORMER; POWER,

Sequence of Operation

Metasys Enclosure, EN-2 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

Occupied

Unit fans will run continuously. EN-2 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain

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Unoccupied

During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72°

High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj., the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

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DRAWING TITLE: AIR HANDLING UNIT #2

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

REFERENCE DRAWING		NO.	REVISION-LOCATION	ECN	DATE	BY
		1	VOLU-PROBES		07/27/94	JDC

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 01/27/94 BY	DATE

FILE: AHU-2

JOHNSON CONTROLS
Systems & Services Division

JOHNSON CONTROLS
2188 WELSCH IND. CT.
ST. LOUIS, MO. 63146
314-569-1570
1-800-825-8550

CONTRACT NUMBER: 94524-0001

DRAWNG NUMBER: 3

PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

T:\Working\16066 - modot-material testing lab hvac retrofit\Drawings\R-003 AHU-3 REFERENCE DRAWING.dwg Printed by: PLEVIN Plot scale = 1:1

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STATE OF MISSOURI
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NUMBER PE-2002016686
PROFESSIONAL ENGINEER
11/15/16
POLINA Y. LEVIN
2002016686
ENGSEAL
ENGSEALNUM

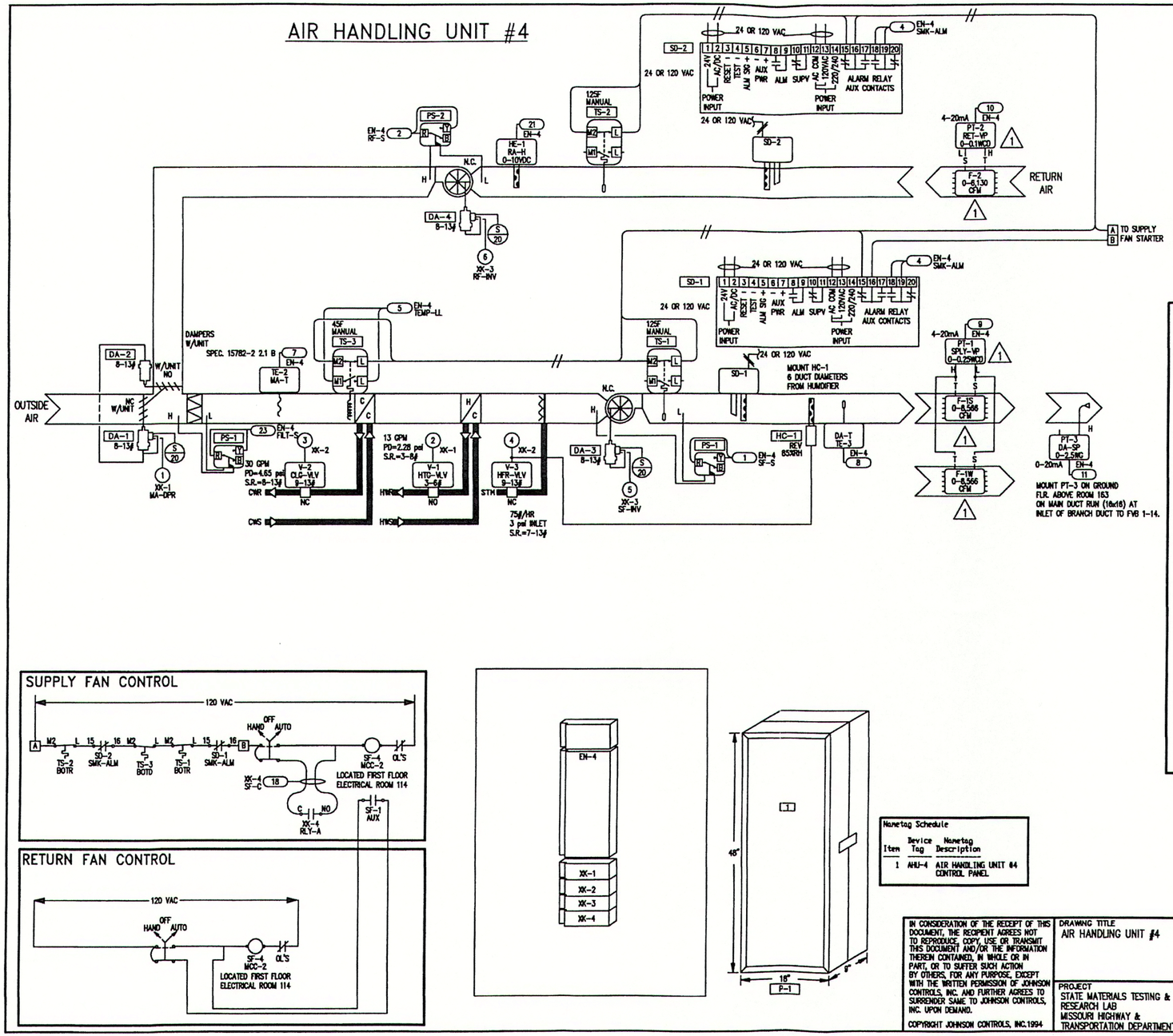
PYL
November 15, 2016

AHU-3 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
R-003

AIR HANDLING UNIT #4



FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-3-DA-4	2	D-3244-3	DPR ACT 8-13# W/POS
F-2	1	43 X 19	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-1S,F-1W	2	24 X 16	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1-PS-2	3	P3EAF-1C	SENSITIVE DIFF PRESS CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1-SD-2	2	DH400ACDCI	DUCT DETECTOR, ION,
	2	ST-S	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-3754-1022	3/4" NO GL 3-6# W/A 8.6CV
V-2	1	V-3974-1005	1" NC GL 9-13# W/A 13.9
V-3	1	VTN-TC047-314	VALVE; 1/2" NC 9-13 4.7CV

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-392	SCREW-ON LAMCOID NAME-
P-1	1	M-8108-1848	CONTROL CABINET;STD. FACE
PT-1	1	DPT-2641-2	DIFF PRESS TRANS;0/0.25
PT-2	1	DPT-2641-1	DIFF PRESS TRANS;0/0.1"WC

Sequence of Operation

Metasys Enclosure, EN-4 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

Occupied
Unit fans will run continuously. EN-4 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain a 55F disharge air temperature setpoint, adj. TE-3 provides feedback for the discharge air temperature control. The mixed air dampers will be allowed to modulate only if the outdoor air temperature is below the economizer setpoint of 55F, adj. When the outdoor air temperature is above the economizer setpoint, the mixed air dampers will be commanded to a minimum outdoor air position.

Humidifier valve V-3 will be modulated to maintain the return air humidity setpoint, 55 %RH, adj. High limit humidity controller HC-1 will modulate V-3 to a closed position when the humidifier discharge humidity approaches 85 %RH.

The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

The return fan inlet vanes will be modulated to maintain an airflow differential between the supply and return fans. The airflow differential setpoint is adjustable at the Metasys Operator Workstation.

Unoccupied
During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72°

High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj., the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

SUPPLY FAN CONTROL

RETURN FAN CONTROL

Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-4	AIR HANDLING UNIT #4 CONTROL PANEL

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DRAWING TITLE: AIR HANDLING UNIT #4

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB, MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
	1	VOLU-PROBES		07/26/96	JDC

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 07/21/94	BY DATE

JOHNSON CONTROLS
Systems & Services Division

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1-800-825-8550

CONTRACT NUMBER: 94524-0001

DRAWING NUMBER: 7

FILE: AHU-4

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

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ENGSEALNUM

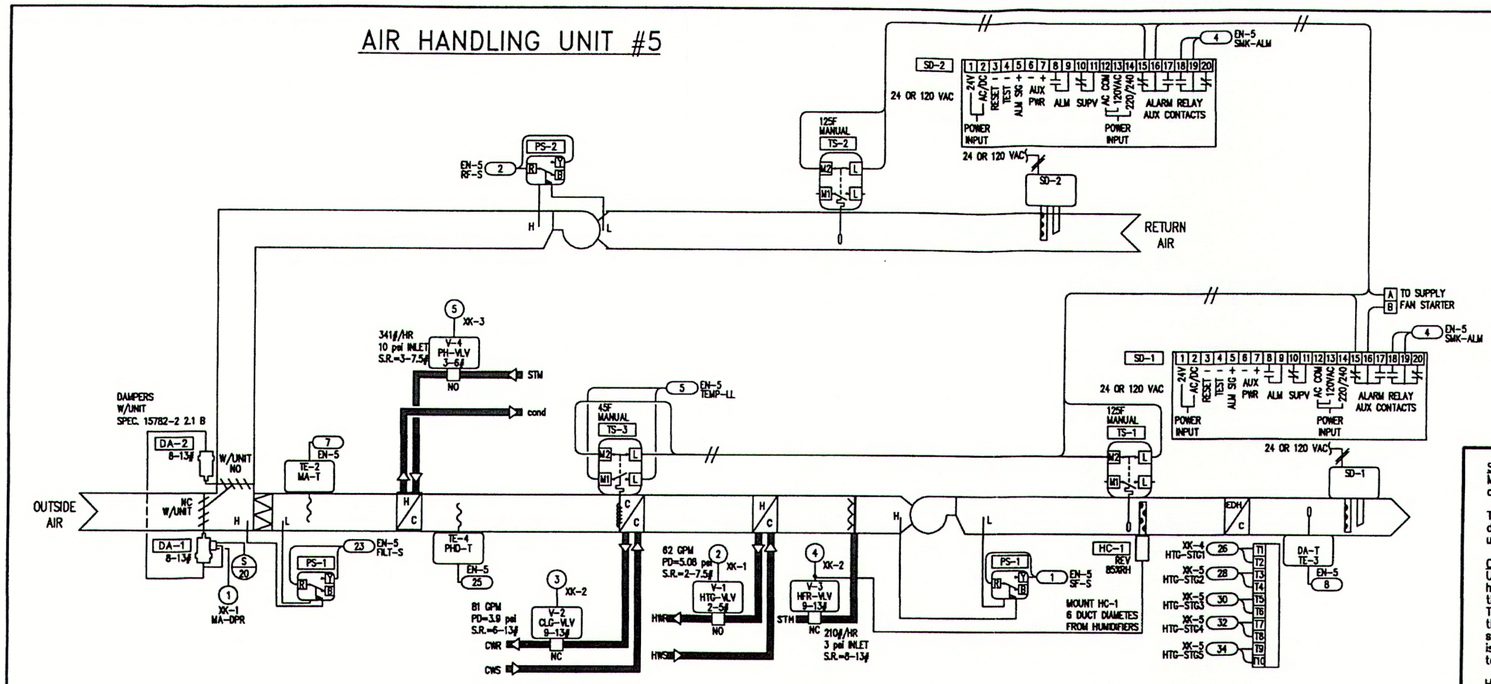
PYL
November 3, 2016

AHU-4 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

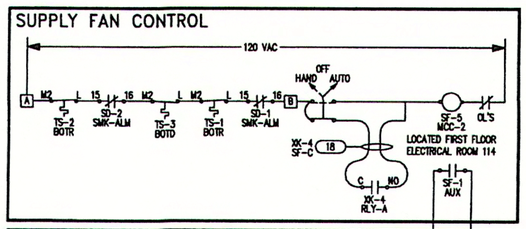
DRAWING NO.
R-004

AIR HANDLING UNIT #5

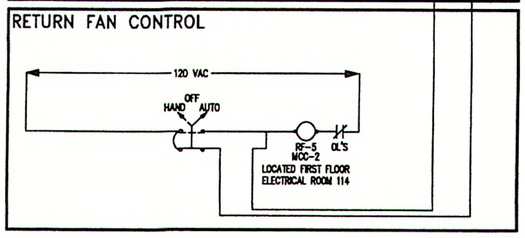


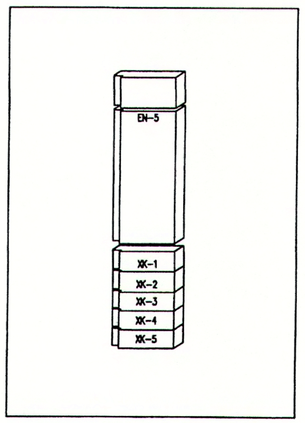
SEE JCI DRWG # 34 FOR AHU-5 SPACE HUMIDITY AND TEMPERATURE SENSOR LOCATIONS.

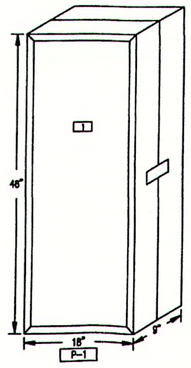
SUPPLY FAN CONTROL



RETURN FAN CONTROL







Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-5	AIR HANDLING UNIT #5 CONTROL PANEL

FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2	1	D-3153-2	DAMPER ACTUATOR 8-13#
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%
PS-1-PS-2	3	PSDNF-1C	SENSITIVE DIFF PRES CTL
SD-1-SD-2	2	DH400ACDCI	DUCT DETECTOR, ION,
	2	ST-5	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TE-4	1	TE-6140-2	TEMP SENSING ELEMENT, 8'
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-5254-1	1-1/2" NO GL 2-5# 4R
V-2	1	V-5464-3	2" NC GL 9-13# 4R
V-3	1	V-3974-1005	1" NC GL 9-13# W/A 13.9
V-4	1	V-3754-1022	3/4" NO GL 3-6# W/A 8.6CV

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-292	SCREW-ON LAMCOID NAME-
P-1	1	M-8104-1848	CONTROL CABINET;STD. FACE

Sequence of Operation

Metasys Enclosure, EN-5 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

The preheat coil valve, V-4 will be modulated to maintain a 55F preheat discharge temperature as sensed by TE-4. This applies both when the unit is off and on.

Occupied

Unit fans will run continuously. EN-5 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain the average space air temperature setpoint, 72F adj.
The mixed air dampers will be allowed to modulated if the outdoor air temperature is below the economizer temperature setpoint of 55F, adj. When the outdoor air temperature is above the economizer setpoint, the mixed air dampers will be commanded to a minimum outdoor air position, adj.

Humidifier valve V-3 will be modulated to maintain the average space air humidity setpoint, 45 %RH, adj. High limit humidity controller HC-1 will modulate V-3 to a closed position when the humidifier discharge humidity approaches 85 %RH. The cooling valve will be modulated for dehumidification when the average space humidity reaches 55%RH. The 5 electric reheat stages will be modulated to maintain the average zone temperature only if the hot water coil is unable to satisfy the space heating demand. When the average space temperature falls 1F below setpoint and the hot water valve has been 100% open for five minutes, EN-8 will cycle heating stages 1 through 5 to maintain the average zone temperature setpoint.

Unoccupied

During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72F

High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj, the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

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DRAWING TITLE: AIR HANDLING UNIT #5

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

FILE: AHU-5

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED	
DEM	CPS	RNR	BY RNR DATE 01/21/94	BY	DATE

JOHNSON CONTROLS
Systems & Services Division

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CONTRACT NUMBER: 94524-0001
DRAWING NUMBER: 17

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

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11/15/16
POLINA.LEVIN 2002016686

ENGSEAL
ENGSEALNUM

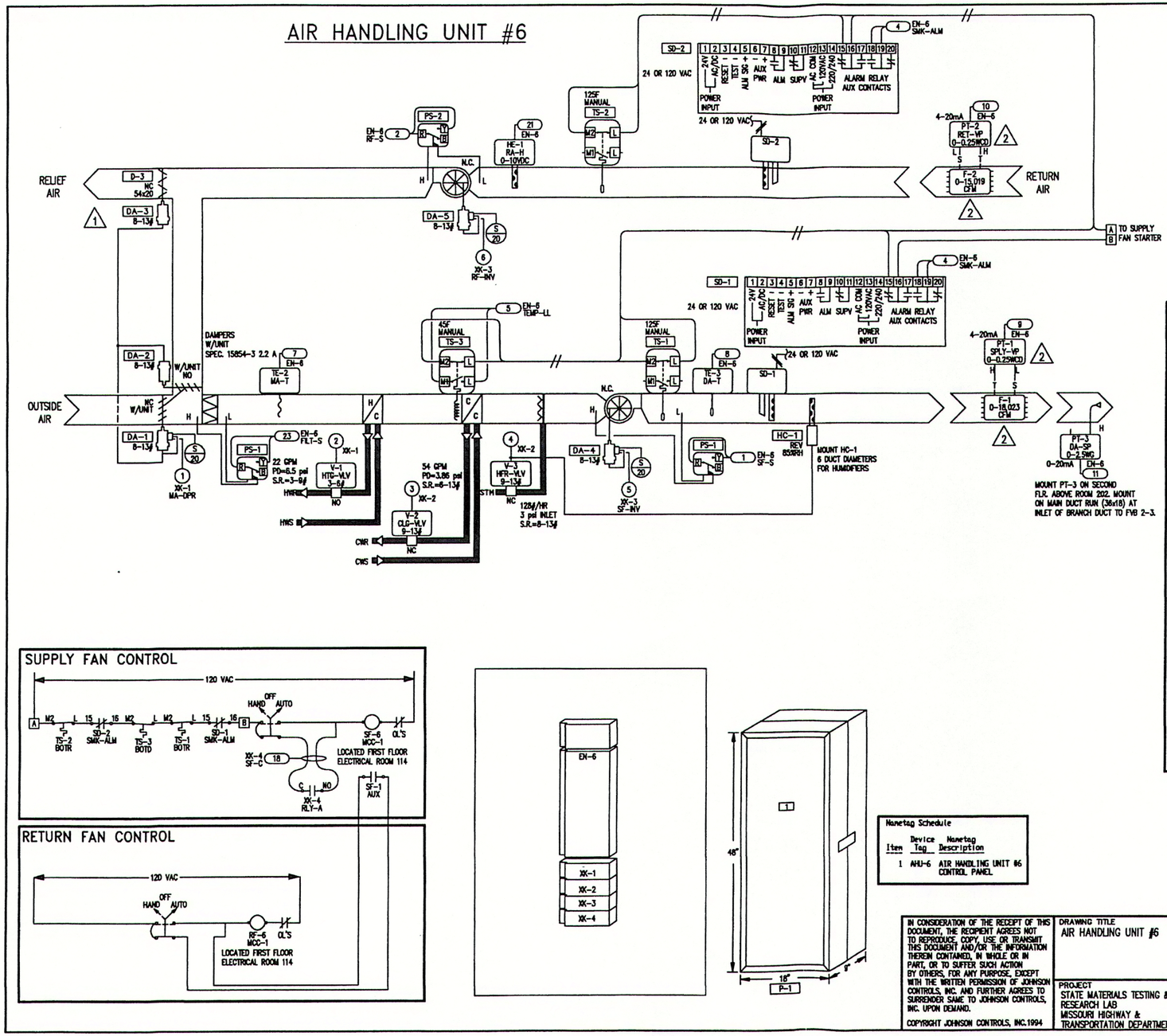
PYL
November 3, 2016

AHU-5 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
R-005

AIR HANDLING UNIT #6



FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
D-3	1	CDPAS-5402200	CONTROL DAMPER OB 54W x 20H
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2-DA-3	2	D-3153-2	DAMPER ACTUATOR 8-13#
DA-4-DA-5	2	D-3244-3	DPR ACT 8-13# W/POS
F-1	1	36 X 36	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-2	1	20 X 54	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
HC-1	1	H-3614-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1-PS-2	3	P32AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1-SD-2	2	DH400ACDCT	DUCT DETECTOR, ION.
	2	ST-5	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-3754-1022	3/4" NO GL 3-6# V/A 8.6CV
V-2	1	V-5464-1	1-1/2" NC GL 9-13# AR
V-3	1	V-3974-1004	3/4" NC GL 9-13# V/A 8.6

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-392	SCREW-ON LANCOID NAME-
P-1	1	M-8108-1848	CONTROL CABINET;STD. FACE
PT-1-PT-2	2	DPT-2641-2	DIFF PRESS TRANS;0/0.25

Sequence of Operation
Metasys Enclosure, EN-6 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

Occupied
Unit fans will run continuously. EN-6 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain a 55F discharge air temperature setpoint, adj. TE-3 provides feedback for the discharge air temperature control. The mixed air dampers will be allowed to modulate only if the outdoor air temperature is below the economizer setpoint of 55F, adj. When the outdoor air temperature is above the economizer setpoint, the mixed air dampers will be commanded to a minimum outdoor air position.

Humidifier valve V-3 will be modulated to maintain the return air humidity setpoint, 55 %RH, adj. High limit humidity controller HC-1 will modulate V-3 to a closed position when the humidifier discharge humidity approaches 85 %RH.

The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

The return fan inlet vanes will be modulated to maintain an airflow differential between the supply and return fans. The airflow differential setpoint is adjustable at the Metasys Operator Workstation.

Unoccupied
During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72'

High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj., the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

SUPPLY FAN CONTROL

RETURN FAN CONTROL

Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-6	AIR HANDLING UNIT #6 CONTROL PANEL

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DRAWING TITLE: AIR HANDLING UNIT #6

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

JOHNSON CONTROLS
Systems & Services Division

JOHNSON CONTROLS
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1-800-825-8550

FILE: AHU-6

REV.	DATE	DESCRIPTION	BY
2		VOLU-PROBES	07/28/86 JDC
1		RELIEF DPR & ACT	04/07/86 JDC

REFERENCE DRAWING NO. | REVISION-LOCATION | ECN | DATE | BY

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 01/21/84	BY DATE

CONTRACT NUMBER: 94524-0001
DRAWING NUMBER: 19

PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

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PROFESSIONAL ENGINEER
11/15/16
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ENGSEAL
ENGSEALNUM

PYL
November 3, 2016

AHU-6 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
R-006

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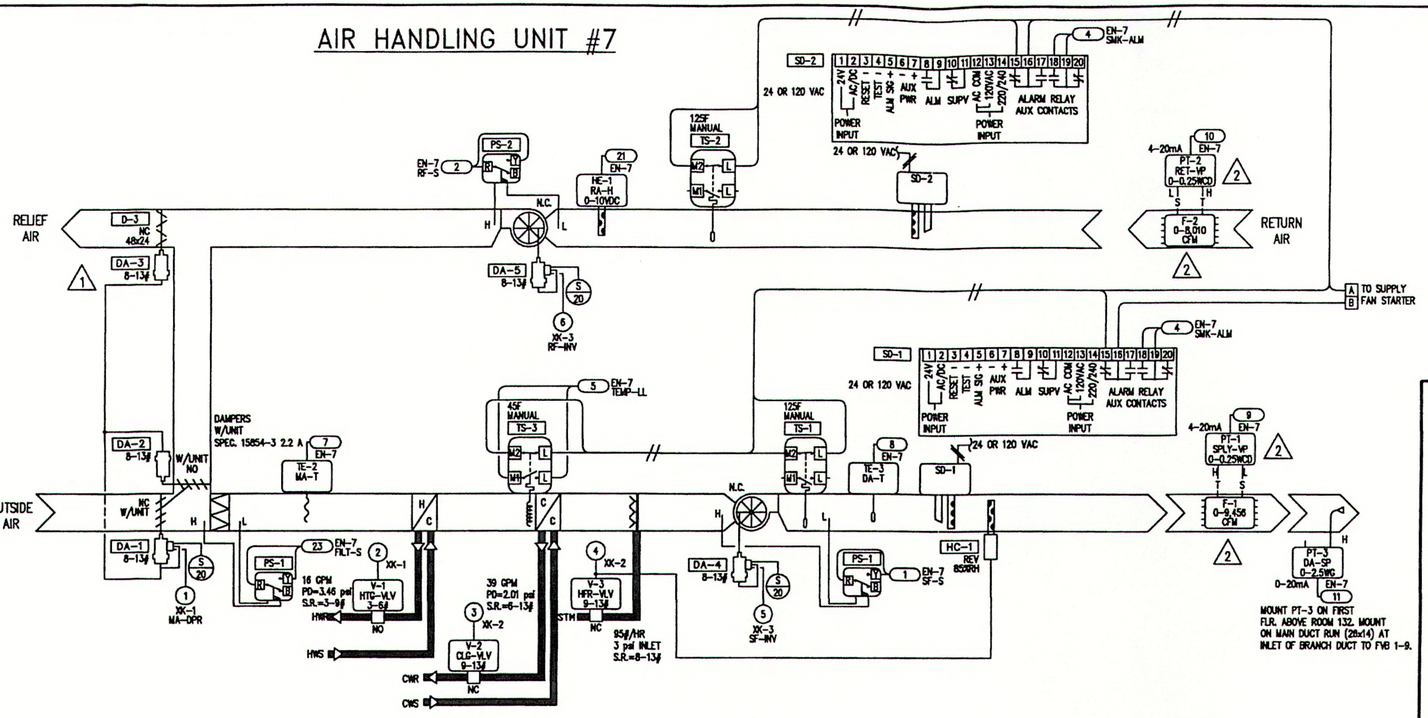
AIR HANDLING UNIT #7



FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
D-3	1	CDPAS-4801X240	CONTROL DAMPER CD 48W x 24H
DA-1	1	D-3153-1	DPR ACT 8-13# W/POS
DA-2-DA-3	2	D-3153-2	DAMPER ACTUATOR 8-13#
DA-4-DA-5	2	D-3244-3	DPR ACT 8-13# W/POS
F-1	1	20 X 34	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
F-2	1	18 X 32	VOLU-PROBE/1 FLOW STATION-AIRMONITOR
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1-PS-2	3	P302AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1-SD-2	2	DH400ACDCI	DUCT DETECTOR, ION,
	2	ST-5	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TE-3	1	TE-6311P-1	TEMP SENSOR; 1000 OHM, NI
TS-1-TS-2	2	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-3754-1022	3/4" NO GL 3-5# W/A 8.6CV
V-2	1	V-5464-1	1-1/2" NC GL 9-13# 4R
V-3	1	VTH-TC047-314	VALVE; 1/2" NC 9-13 4.7CV

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	H-8000-392	SCREW-ON LANCOID NAME-
P-1	1	H-8108-1848	CONTROL CABINET;STD. FACE
PT-1-PT-2	2	DPT-2641-2	DIFF PRESS TRANS;0/0.25

Sequence of Operation

Metasys Enclosure, EN-7 will start and stop supply fan according to operator entered time schedule at Metasys operator workstation.

Occupied

Unit fans will run continuously. EN-7 will modulate cooling coil valve V-2, heating coil valve V-1 and mixed air dampers in sequence to maintain a 55F disharge air temperature setpoint, adj. TE-3 provides feedback for the discharge air temperature control. The mixed air dampers will be allowed to modulate only if the outdoor air temperature is below the economizer setpoint of 55F, adj. When the outdoor air temperature is above the economizer setpoint, the mixed air dampers will be commanded to a minimum outdoor air position.

Humidifier valve V-3 will be modulated to maintain the return air humidity setpoint, 55 %RH, adj. High limit humidity controller HC-1 will modulate V-3 to a closed position when the humidifier discharge humidity approaches 85 %RH.

The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

The return fan inlet vanes will be modulated to maintain an airflow differential between the supply and return fans. The airflow differential setpoint is adjustable at the Metasys Operator Workstation.

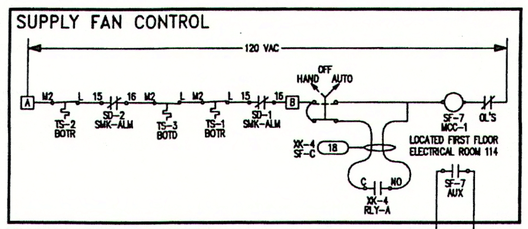
Unoccupied

During unoccupied periods, the mixed air dampers will be commanded to closed outdoor air position. Unit fans will be cycled to keep average space temperature of the zones served by this unit within a range of 60F and 85F, both adjustable. When unit is commanded on during unoccupied mode, the discharge temperature setpoint will be increased to 90F on a call for heating and 55F on a call for cooling.

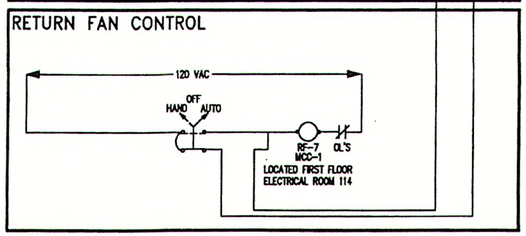
Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average space temperature is below 72'

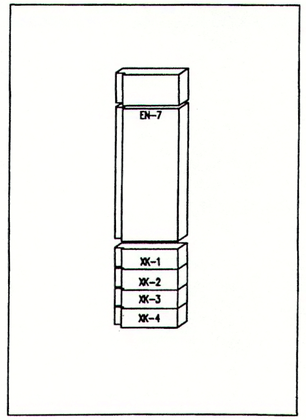
High limit temperature thermostats TS-1 and TS-2 monitor the discharge and return duct temperatures respectively. If either thermostat senses a temperature in excess of their setpoint, 125F, adj, the unit will be shut down. Supply and return smoke detectors, SD-1 and SD-2 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

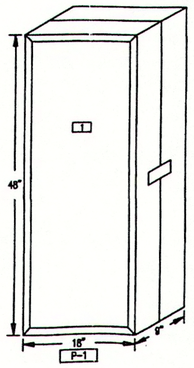
SUPPLY FAN CONTROL



RETURN FAN CONTROL







Nametag Schedule

Item	Device Tag	Nametag Description
1	AHU-7	AIR HANDLING UNIT #7 CONTROL PANEL

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DRAWING TITLE: AIR HANDLING UNIT #7

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

FILE: AHU-7

NO.	REVISION-LOCATION	ECN	DATE	BY
2	VOLU-PROBES		07/28/16	JDC
1	RELIEF DPR & ACT		04/07/16	JDC

REFERENCE DRAWING

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 01/21/94	BY DATE

JOHNSON CONTROLS
Systems & Services Division

JOHNSON CONTROLS
2188 WELSH IND. CT.
ST. LOUIS, MO. 63146
314-569-1570
1-800-825-8550

CONTRACT NUMBER: 94524-0001
DRAWING NUMBER: 21

PLOT SCALE FACTOR 0.5

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

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MoDOT

STATE OF MISSOURI
POLINA Y. LEVIN
NUMBER PE-2002016686
PROFESSIONAL ENGINEER
11/3/16
POLINA LEVIN 2002016686
ENGSEAL ENGSEALNUM

PYL
November 3, 2016

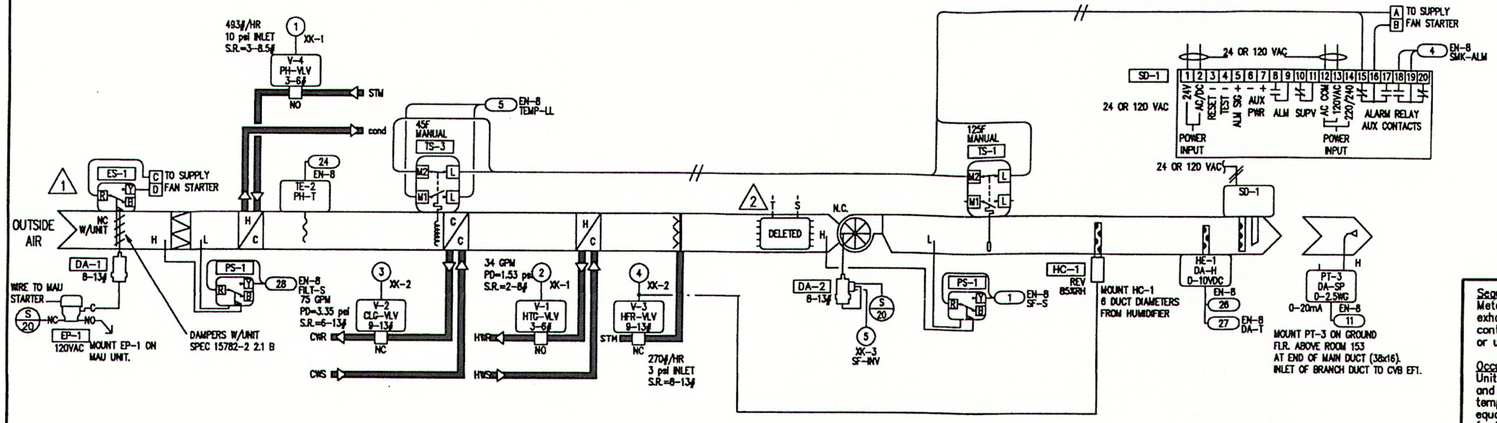
AHU-7 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO. 16066

DRAWING NO. R-007

T:\Working\16066 - modot-material testing lab hvac retrofit\Drawings\R-007 AHU-7 REFERENCE DRAWING.dwg Printed by: PLEVIN Plot scale = 1:1

MAKE-UP AIR UNIT #1



FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-2	1	D-3244-3	DPR ACT 8-13# W/POS
EP-1	1	V11NAA-100	3-WAY AIR VALVE;W/BARBED
ES-1	1	P-370	DAMPER END SWITCH-BELIMO
HC-1	1	H-3610-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1	2	P32AF-1C	SENSITIVE DIFF PRESS CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1	1	IRH00ACDCI	DUCT DETECTOR, ION, SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TS-1	1	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-5254-1	1-1/2" NO GL 2-5# 4R
V-2	1	V-5464-3	2" NC GL 9-13# 4R
V-3	1	V-3974-1005	1" NC GL 9-13# W/A 13.9
V-4	1	V-3754-1028	1-1/2" NO GL 3-6# W/A

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-0000-392	SCREW-ON LAMCOID NAME-
P-1	1	M-0100-1848	CONTROL CABINET;STD. FACE

Sequence of Operation

Metasys Enclosure, EN-8 will start and stop the supply fan whenever any exhaust fan in the area this unit serves is energized. Supply fan will continue to operate until all exhaust fans are in the served area stop or until unoccupancy period.

Occupied

Unit fans will run continuously. EN-8 will modulate cooling coil valve V-2, and heating coil valve V-1 in sequence to maintain the discharge air temperature setpoint, adj. The discharge air temperature setpoint will be equal to the space temperature in lab room 151. HE-1 provides feedback for the discharge air temperature control.

The preheat steam valve, V-4 will be modulated to maintain the preheat discharge air temperature setpoint of 45F, adj.

Humidifier valve V-3 will be modulated to maintain the discharge humidity setpoint, adj. The discharge air humidity setpoint will be equal to the spoce humidity in lab room 151. High limit humidity controller HC-1 will modulate V-3 to closed position when the humidifier discharge humidity approaches 85 %RH.

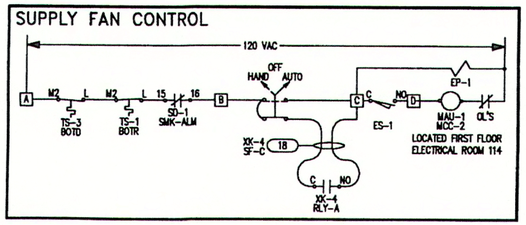
The make up air unit will provide air to the hoods at the same temperature and humidity as are present in surrounding lab room to prevent energy exchange between make up air and the lab room environment.

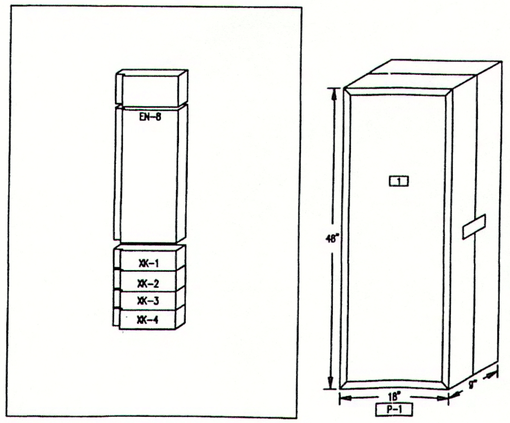
The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average exhaust hood air temperature is below 72°

High limit temperature thermostat TS-1 monitors the discharge air temperature. If TS-1 senses a temperature in excess of the setpoint, 125°F, adj., the unit will be shut down. Supply smoke detector, SD-1 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45°F temperature.

SUPPLY FAN CONTROL





Nametag Schedule

Item	Device Tag	Nametag Description
1	MAU-1	MAKE UP AIR UNIT #1 CONTROL PANEL

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DRAWING TITLE: MAKE UP AIR UNIT #1

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

REFERENCE DRAWING NO.	REVISION-LOCATION	ECN	DATE	BY
	2 DELETE FLOW STA		07/27/95	JDC
	1 BELIMO ENDSWITCH		04/07/95	JDC

SALES ENGR: DEM | PROJECT MGR: CPS | APPL. ENGR: RNR | DRAWN: BY RNR DATE 01/21/94 | APPROVED: BY DATE

FILE: MAU-1

JOHNSON CONTROLS
Systems & Services Division

JOHNSON CONTROLS
2188 WELSCH IND. CT.
ST. LOUIS, MO. 63146
314-569-1570
1-800-825-8550

CONTRACT NUMBER: 94524-0001

DRAWING NUMBER: 9

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

T:\Working\16066 - modot-material testing lab hvac retrofit\Drawings\R-008 MAU-1 REFERENCE DRAWING.dwg Printed by: PLEVIN Plot scale = 1:1

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MoDOT

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NUMBER PE-2002016686
PROFESSIONAL ENGINEER
Polina Levin 11/3/16
POLINA Y. LEVIN
2002016686
ENGSEAL
ENGSEALNUM

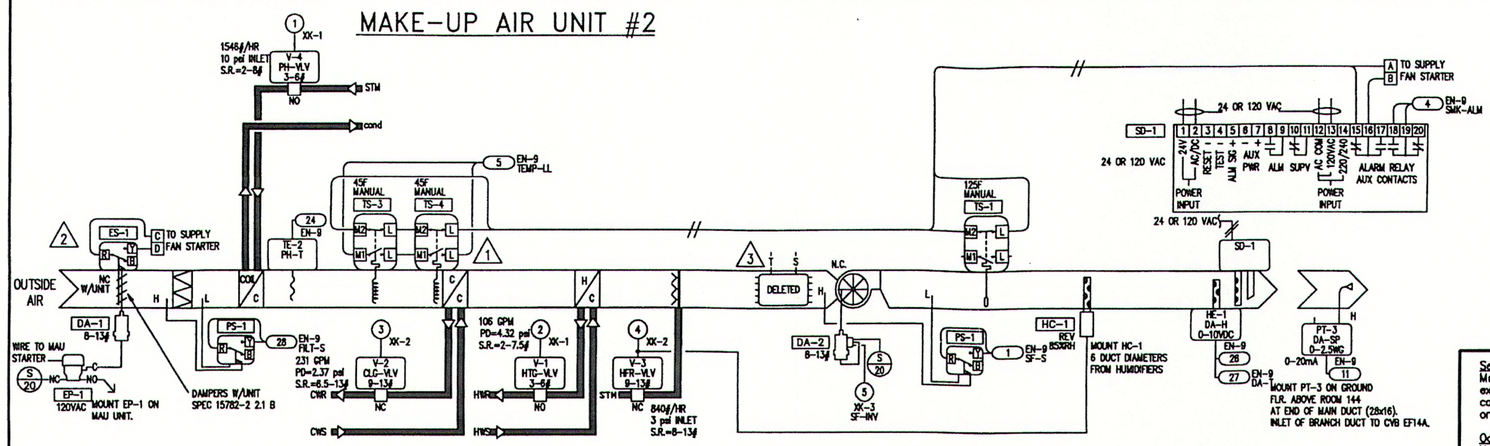
PYL
November 3, 2016

MAU-1 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

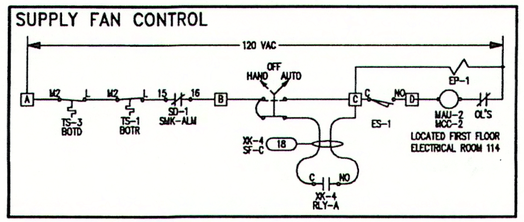
CDG PROJECT NO.
16066

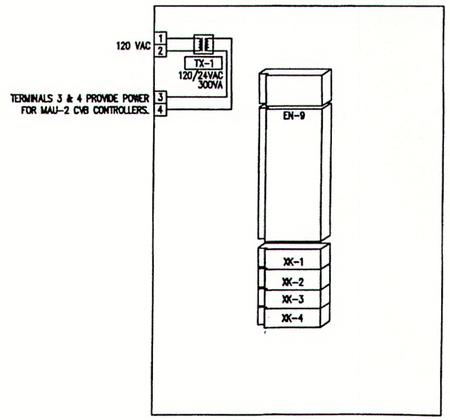
DRAWING NO.
R-008

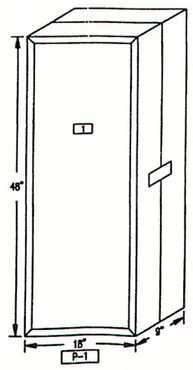
MAKE-UP AIR UNIT #2



SUPPLY FAN CONTROL







Nametag Schedule

Item	Device Tag	Nametag Description
1	MAU-2	MAKE UP AIR UNIT #2 CONTROL PANEL

FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-2	1	D-3244-3	DPR ACT 8-13# W/POS
EP-1	1	V11HAA-100	3-WAY AIR VALVE;1/4"BARBED
ES-1	1	P-370	DAMPER END SWITCH-BELIMO
HC-1	1	H-3610-1001	HUMIDITY CONTR REV (85%
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1	2	P32AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2541-5	DIFF PRESS TRANS;0/2.5"WC
ST-1	1	DH400ACDC1	DUCT DETECTOR, ION,
	1	ST-S	SAMPLING TUBE FOR
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TS-1	1	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3-TS-4	2	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-3222-7	2-1/2" NO FLG SR 2-5# 5%
V-2	1	V-5462-13	4" NC FLG SR 9-13# 150CV
V-3	1	V-5464-3	2" NC FL 9-13# 4R
V-4	1	V-5254-4	2" NO FL 2-5# 4R

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8000-392	SCREW-ON LAMCOID NAME-
ACC	4	PD-113-3	TERMINAL BLOCK; MEDIUM
P-1	1	M-8100-1848	CONTROL CABINET;STD. FACE
TX-1	1	TZ-5000-11	TRANSFORMER; POWER,

Sequence of Operation

Metasys Enclosure, EN-9 will start and stop the supply fan whenever any exhaust fan in the area this unit serves is energized. Supply fan will continue to operate until all exhaust fans in the served area stop or until unoccupancy period.

Occupied

Unit fans will run continuously. EN-9 will modulate cooling coil valve V-2, and heating coil valve V-1 in sequence to maintain the discharge air temperature setpoint, adj. The discharge air temperature setpoint will be equal to the space temperature in lab room 144. HE-1 provides feedback for the discharge air temperature control.

The preheat steam valve, V-4 will be modulated to maintain the preheat discharge air temperature setpoint of 45T, adj.

Humidifier valve V-3 will be modulated to maintain the discharge humidity setpoint, adj. The discharge air humidity setpoint will be equal to the space humidity in lab room 144. High limit humidity controller HC-1 will modulate V-3 to closed position when the humidifier discharge humidity approaches 85 %RH.

The make up air unit will provide air to the hoods at the same temperature and humidity as are present in surrounding lab room to prevent energy exchange between make up air and the lab room environment.

The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average exhaust hood air temperature is below 72°

High limit temperature thermostat TS-1 monitors the discharge air temperature. If TS-1 senses a temperature in excess of the setpoint, 125F, adj., the unit will be shut down. Supply smoke detector, SD-1 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

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DRAWING TITLE: MAKE UP AIR UNIT #2

PROJECT: STATE MATERIALS TESTING & RESEARCH LAB MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

NO.	REVISION-LOCATION	ECN	DATE	BY
3	DELETE FLOW STA		07/27/96	JDC
2	BELIMO ENDSWITCH		04/07/96	JDC
1	2ND LOW LIMIT		04/07/96	JDC

REFERENCE DRAWING | SALES ENGR | PROJECT MGR | APPL. ENGR | DRAWN | APPROVED
DEM | CPS | RNR | BY RNR DATE 01/21/94 BY | DATE

JOHNSON CONTROLS Systems & Services Division

JOHNSON CONTROLS, 2188 WELSCH IND. CT., ST. LOUIS, MO. 63146, 314-569-1570, 1-800-825-8550

CONTRACT NUMBER 94524-0001

DRAWING NUMBER 11

FILE: MAU-2

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

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POLINA Y. LEVIN
NUMBER PE-2002016686
PROFESSIONAL ENGINEER
POLINA LEVIN 2002016686 11/9/16

ENGSEAL
ENGSEALNUM

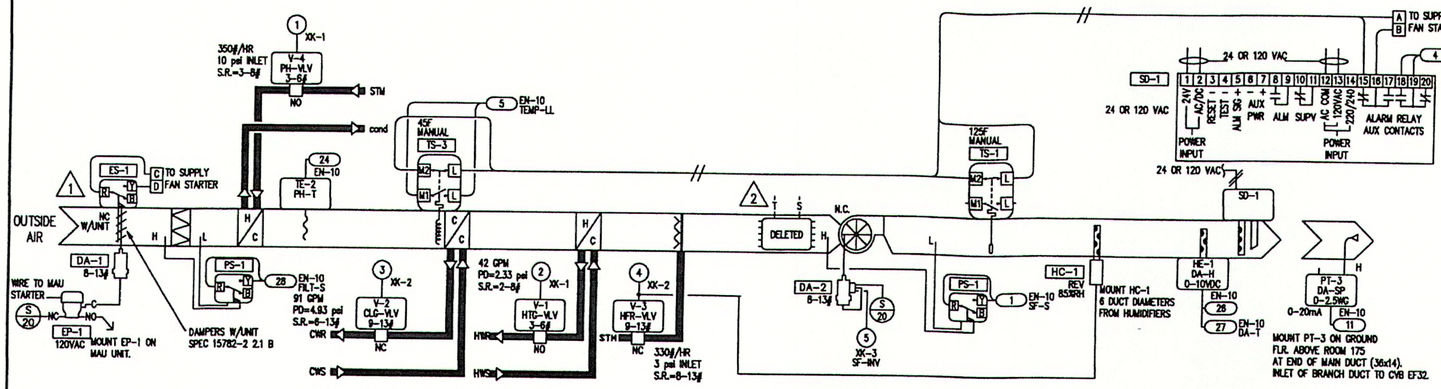
PYL
November 3, 2016

MAU-2 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO. 16066

DRAWING NO. R-009

MAKE-UP AIR UNIT #3



FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-2	DAMPER ACTUATOR 8-13#
DA-2	1	D-3244-3	DPR ACT 8-13# W/POS
EP-1	1	V11HAA-100	3-WAY AIR VALVE;W/BARDED
ES-1	1	P-370	DAMPER END SWITCH-BCLIMD
HC-1	1	H-3618-1001	HUMIDITY CONTR REV (85%)
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1	2	P36AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1	1	DH400ACDCI	DUCT DETECTOR, ION, SAMPLING TUBE FOR
	1	ST-9	TEMP SENSOR; NI, 17' AVE.
TE-2	1	TE-6316P-1	TEMP CONTROL 4 WIRE, 2-C
TS-1	1	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	1-1/2" NO GL 2-5# 4R
V-1	1	V-5254-1	2" NC GL 9-13# 4R
V-2	1	V-5464-3	1" NC GL 9-13# W/A 13.9
V-3	1	V-3974-1005	1" NO GL 3-6# W/A 13.9CV
V-4	1	V-3754-1023	

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-392	SCREW-ON LAMCOID NAME-
P-1	1	M-8108-1848	CONTROL CABINET;STD. FACE

Sequence of Operation

Metasys Enclosure, EN-10 will start and stop the supply fan whenever any exhaust fan in the area this unit serves is energized. Supply fan will continue to operate until all exhaust fans in the served area stop or until unoccupancy period.

Occupied
Unit fans will run continuously. EN-10 will modulate cooling coil valve V-2, and heating coil valve V-1 in sequence to maintain the discharge air temperature setpoint, adj. The discharge air temperature setpoint will be equal to the space temperature in lab room 176. HE-1 provides feedback for the discharge air temperature control.

The preheat steam valve, V-4 will be modulated to maintain the preheat discharge air temperature setpoint of 45F, adj.

Humidifier valve V-3 will be modulated to maintain the discharge humidity setpoint, adj. The discharge air humidity setpoint will be equal to the space humidity in lab room 176. High limit humidity controller HC-1 will modulate V-3 to closed position when the humidifier discharge humidity approaches 85 %RH.

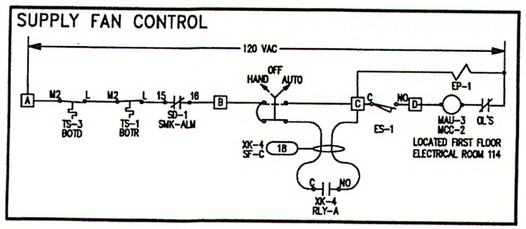
The make up air unit will provide air to the hoods at the same temperature and humidity as are present in surrounding lab room to prevent energy exchange between make up air and the lab room environment.

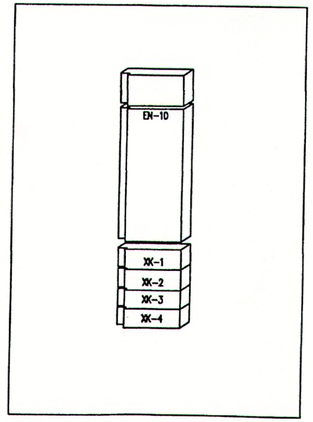
The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

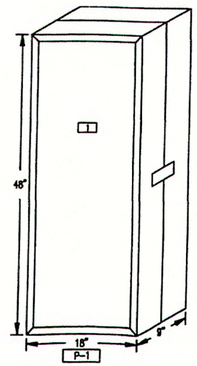
Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average exhaust hood air temperature is below 72°

High limit temperature thermostat TS-1 monitors the discharge air temperature. If TS-1 senses a temperature in excess of the setpoint, 125°F, adj., the unit will be shut down.
Supply smoke detector, SD-1 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

SUPPLY FAN CONTROL







Nametag Schedule

Item	Device Tag	Nametag Description
1	MAU-3	MAKE UP AIR UNIT #3 CONTROL PANEL

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DRAWING TITLE
MAKE UP AIR UNIT #3

PROJECT
STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
	2	DELETE FLOW STA		07/27/95	JDC
	1	BELIMO ENDSWITCH		04/07/95	JDC

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
DEM	CPS	RNR	BY RNR DATE 07/21/94	BY DATE

FILE: MAU-3

JOHNSON CONTROLS
Systems & Services Division

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ST. LOUIS, MO. 63146
314-569-1570
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CONTRACT NUMBER 94524-0001
DRAWING NUMBER 13

REV.	DATE	DESCRIPTION	APPROVED
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

PLOT SCALE FACTOR 0.5

T:\Working\16066 - modot-material testing lab hvac retrofit\Drawings\R-010 MAU-3 REFERENCE DRAWING.dwg Printed by: PLEVIN Plot scale = 1:1

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STATE OF MISSOURI
POLINA Y. LEVIN
NUMBER PE-2002016686
PROFESSIONAL ENGINEER
11/15/16
POLINA Y. LEVIN 2002016686
ENGSEAL
ENGSEALNUM

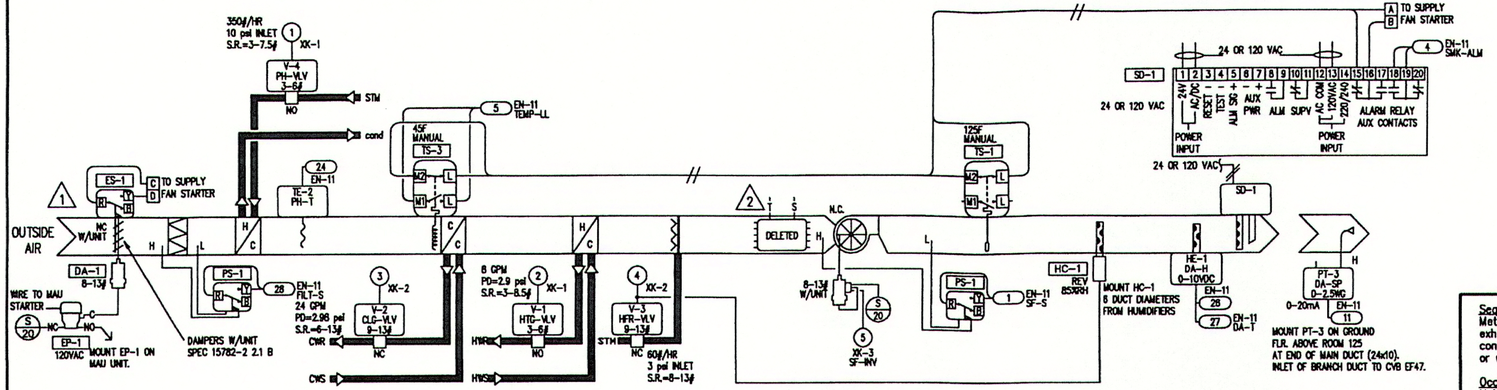
PYL
November 3, 2016

MAU-3 REFERENCE DRAWING
MECHANICAL DRAWINGS
HVAC RETROFIT
MATERIAL TESTING LAB BUILDING

CDG PROJECT NO.
16066

DRAWING NO.
R-010

MAKE-UP AIR UNIT #4



FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1	1	D-3153-2	DAMPER ACTUATOR 8-13#
EP-1	1	V11AAA-100	3-WAY AIR VALVE,W/BARBED
ES-1	1	P-370	DAMPER END SWITCH-BELIMO
HC-1	1	H-3618-1001	HUMIDITY CONTR REV GRSX
HE-1	1	HE-6310-2	TRANS RH/TEMP;DUCT 0/100%
PS-1	2	P32AF-1C	SENSITIVE DIFF PRES CTL
PT-3	1	DPT-2641-5	DIFF PRESS TRANS;0/2.5"WC
SD-1	1	DH400ACDCI	DUCT DETECTOR, ION, SAMPLING TUBE FOR
	1	ST-5	
TE-2	1	TE-6316P-1	TEMP SENSOR; NI, 17' AVE.
TS-1	1	A70KA-1C	TEMP CONTROL 4 WIRE, 2-C
TS-3	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	VTN-TN047-312	VALVE; 1/2" NO 3-68 4.7CV
V-2	1	V-3974-1005	1" NC GL 9-13# V/A 13.9
V-3	1	VTN-TC047-314	VALVE; 1/2" NC 9-13 4.7CV
V-4	1	V-3754-1022	3/4" NO GL 3-68 V/A 8.6CV

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	1	M-8008-292	SCREW-ON LAMCOID NAME-
P-1	1	M-8104-1848	CONTROL CABINET;STD. FACE

Sequence of Operation

Metasys Enclosure, EN-11 will start and stop the supply fan whenever any exhaust fan in the area this unit serves is energized. Supply fan will continue to operate until all exhaust fans in the served area stop or until unoccupancy period.

Occupied
Unit fans will run continuously. EN-11 will modulate cooling coil valve V-2, and heating coil valve V-1 in sequence to maintain the discharge air temperature setpoint, adj. The discharge air temperature setpoint will be equal to the space temperature in lab room 125. HE-1 provides feedback for the discharge air temperature control.

The preheat steam valve, V-4 will be modulated to maintain the preheat discharge air temperature setpoint of 45F, adj.

Humidifier valve V-3 will be modulated to maintain the discharge humidity setpoint, adj. The discharge air humidity setpoint will be equal to the space humidity in lab room 125. High limit humidity controller HC-1 will modulate V-3 to closed position when the humidifier discharge humidity approaches 85 %RH.

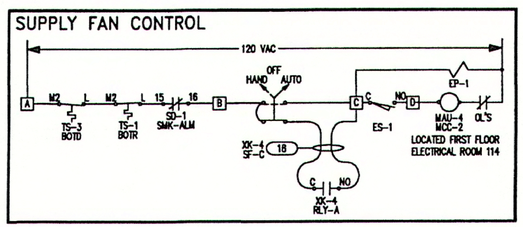
The make up air unit will provide air to the hoods at the same temperature and humidity as are present in surrounding lab room to prevent energy exchange between make up air and the lab room environment.

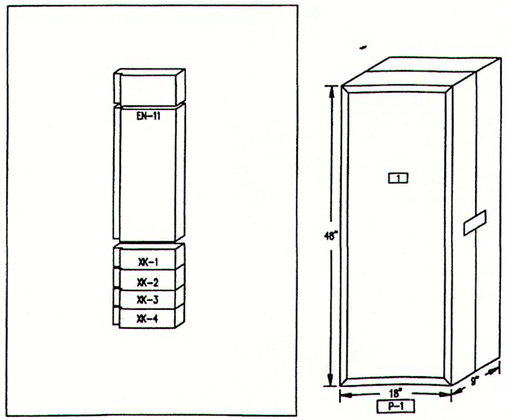
The supply fan inlet vanes will modulated to maintain the static pressure setpoint, 1 inWC,adj. Pressure transmitter, PT-3 provides feedback for the static pressure control.

Morning warmup will be time scheduled at the Metasys operator workstation. The unit will be commanded into morning warmup only if both of the following conditions are met. 1) The morning warmup schedule is on 2) The average exhaust hood air temperature is below 72°

High limit temperature thermostat TS-1 monitors the discharge air temperature. If TS-1 senses a temperature in excess of the setpoint, 125F, adj, the unit will be shut down. Supply smoke detector, SD-1 will shut down unit operations in alarm conditions. Low limit thermostat, TS-3 will shut down unit operations upon detection of a 45F temperature.

SUPPLY FAN CONTROL





Nametag Schedule

Item	Device Tag	Nametag Description
1	MAU-4	MAKE UP AIR UNIT #4 CONTROL PANEL

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DRAWING TITLE
MAKE UP AIR UNIT #4

PROJECT
STATE MATERIALS TESTING & RESEARCH LAB
MISSOURI HIGHWAY & TRANSPORTATION DEPARTMENT

REV.	DATE	DESCRIPTION	APPROVED
2		DELETE FLOW STA	07/27/95 JDC
1		BELIMO ENDSWITCH	04/07/95 JDC
0	11/03/16	ISSUED FOR CONSTRUCTION	MLS

REFERENCE DRAWING NO. | REVISION-LOCATION | ECN | DATE | BY

SALES ENGR | PROJECT MGR | APPL. ENGR | DRAWN | APPROVED
DEM | CPS | RNR | BY RNR DATE 01/21/94 | BY | DATE

FILE: MAU-4

CONTRACT NUMBER 94524-0001

DRAWING NUMBER 15

JOHNSON CONTROLS
Systems & Services Division

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PLOT SCALE FACTOR 0.5

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MAU-4 REFERENCE DRAWING
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HVAC RETROFIT
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CDG PROJECT NO.
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DRAWING NO.
R-011