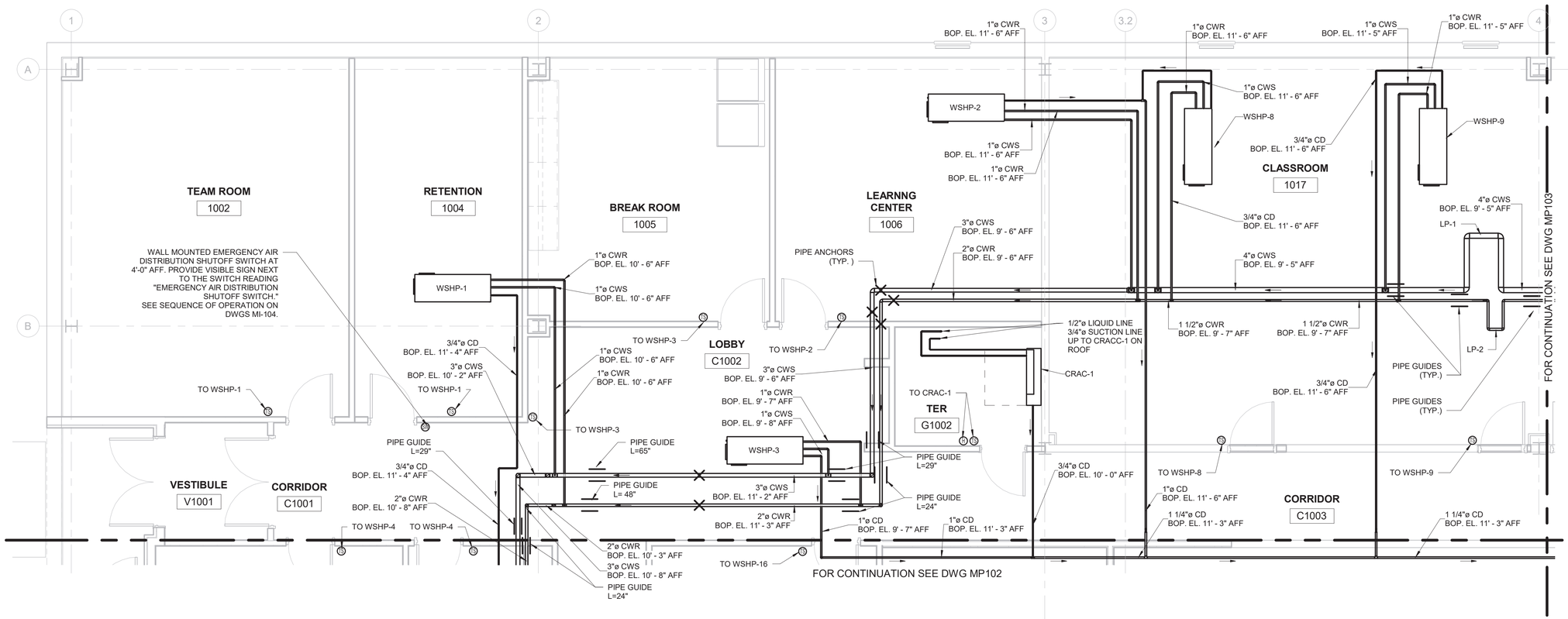
PLAN NORTH

NOTES:

1. SEE DWG M-001 FOR SYMBOLS, LEGEND, AND ABBREVIATIONS.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION WORK.
3. SEE DWGS MH101 TO MH107 FOR CONTINUATION.
4. SEE DWG MH108 FOR ROOF PLAN.
5. SEE DWGS MP202 TO MP207 FOR CONTINUATION.
6. SEE DWGS MI101 TO MI102 FOR CONTROL DIAGRAMS.
7. SEE DWGS M-501 TO M-503 FOR DETAILS.
8. SEE DWGS M-601 TO M-603 FOR EQUIPMENT SCHEDULES.
9. PROVIDE SHUTOFF VALVES AT ALL WATER SUPPLY AND RETURN PIPE BRANCHES. THE SHUTOFF VALVES ARE NOT SHOWN ON THE FLOOR PLAN FOR CLARITY.
10. THE CONTROL VALVE, SHUTOFF VALVES, STRAINER, DRAIN VALVE TOR EACH ROOF MOUNTED DOAS UNIT SHALL BE LOCATED BELOW THE ROOF IN A CLOSE PROXIMITY OF THE CORRESPONDING UNIT.
11. ALL CONDENSER WATER PIPES SHALL BE INSULATED AND JACKETED.
12. FOR ALL CONDENSATE DRAIN PIPES, PROVIDE CLEANOUTS AT EACH 90 DEGREE ELBOWS. PROVIDE CLEANOUTS EVERY 30 FEET ON THE STRAIGHT RUNS.
13. PROVIDE 1/4" PER FOOT SLOPE FOR THE CONDENSATE DRAIN PIPES. PITCH PIPE DOWN IN DIRECTION OF FLOW AS SHOWN ON THE DRAWING



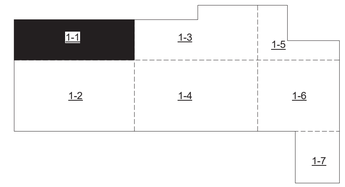
1 MECHANICAL PIPING FLOOR PART PLAN 1-1

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

KEY PLAN-PART 1-1



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CONTRACT NO.: W912QR20R0038
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LOUISVILLE DISTRICT
LOUISVILLE, KY

MOTT MACDONALD
111 Wood Avenue
Iselin, NJ 08830-4172
United States of America
T: + 732-780-6565
F: + 732-577-0551
www.mottmacamericas.com

UNITED STATES ARMY RESERVE CENTER
ORANGEBURG, NEW YORK

MECHANICAL PIPING FLOOR PART PLAN 1-1

SHEET ID

MP101

CORRECTED FINAL SUBMISSION - JULY 29, 2021

PLAN NORTH

NOTES:

1. SEE DWG M-001 FOR SYMBOLS, LEGEND, AND ABBREVIATIONS.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION WORK.
3. SEE DWGS MH101 TO MH107 FOR CONTINUATION.
4. SEE DWG MH108 FOR ROOF PLAN.
5. SEE DWGS MP201, MP203 TO MP207 FOR CONTINUATION.
6. SEE DWGS MI101 TO MI102 FOR CONTROL DIAGRAMS.
7. SEE DWGS M-501 TO M-503 FOR DETAILS.
8. SEE DWGS M-501 TO M-603 FOR EQUIPMENT SCHEDULES.
9. PROVIDE SHUTOFF VALVES AT ALL WATER SUPPLY AND RETURN PIPE BRANCHES. THE SHUTOFF VALVES ARE NOT SHOWN ON THE FLOOR PLAN FOR CLARITY.
10. THE CONTROL VALVE, SHUTOFF VALVES, STRAINER, DRAIN VALVE TOR EACH ROOF MOUNTED DOAS UNIT SHALL BE LOCATED BELOW THE ROOF IN A CLOSE PROXIMITY OF THE CORRESPONDING UNIT.
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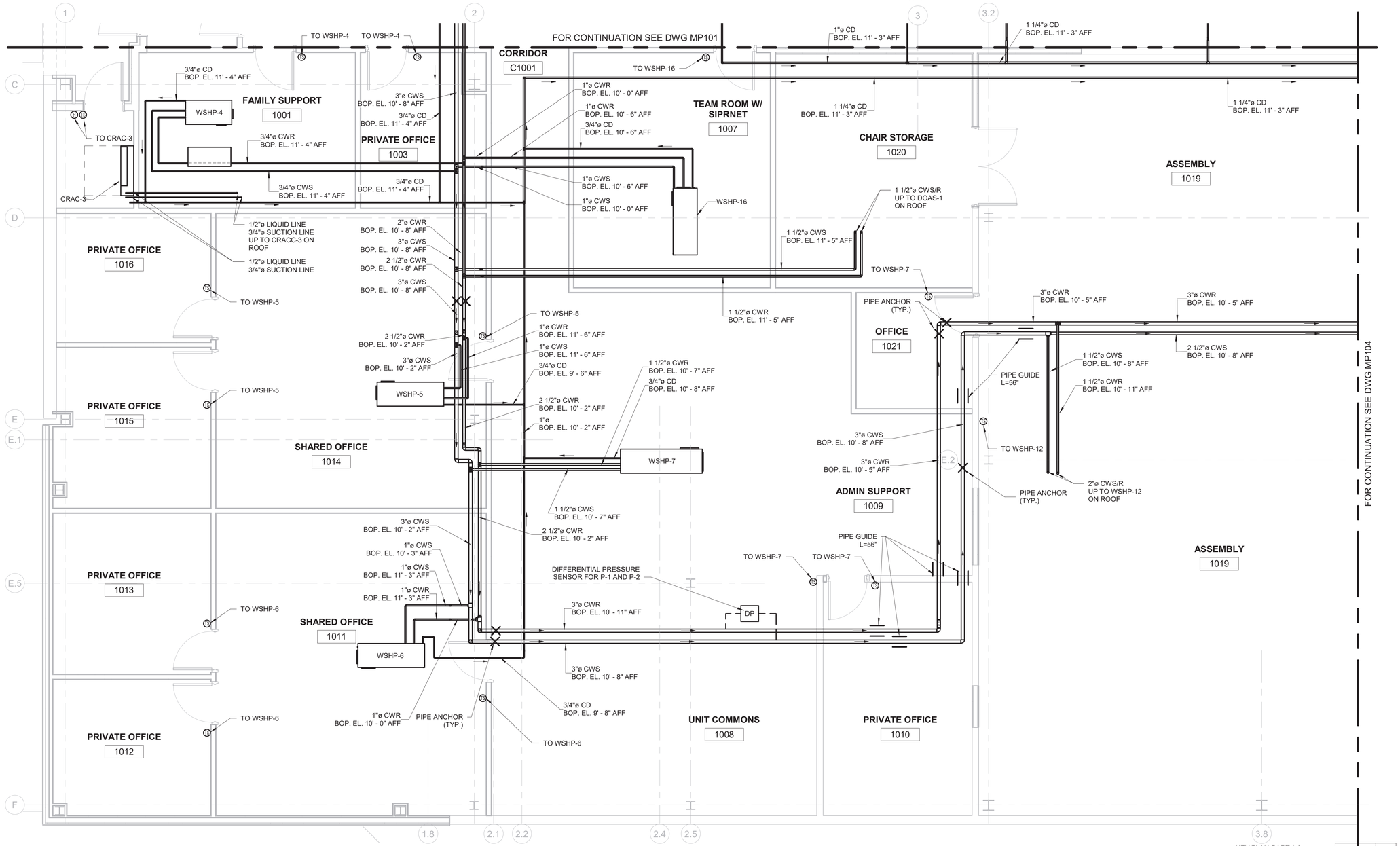

KEY PLAN-PART 1-2

1-1	1-3	1-5
1-2	1-4	1-6
		1-7

1 MECHANICAL PIPING FLOOR PART PLAN 1-2

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

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MOTT MACDONALD
111 Wood Avenue South, Suite 412
Iselin, NJ 08830-2712
United States of America
T- + 732-780-8565
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www.mottmacamericas.com

UNITED STATES ARMY RESERVE CENTER
ORANGEBURG, NEW YORK

MECHANICAL PIPING FLOOR PART PLAN 1-2

SHEET ID

MP102

CORRECTED FINAL SUBMISSION - JULY 29, 2021

PLAN NORTH

NOTES:

1. SEE DWG M-001 FOR SYMBOLS, LEGEND, AND ABBREVIATIONS.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION WORK.
3. SEE DWGS MH101 TO MH107 FOR CONTINUATION.
4. SEE DWG MH108 FOR ROOF PLAN.
5. SEE DWGS MP201, MP202, MP204 TO MP207 FOR CONTINUATION.
6. SEE DWGS MI101 TO MI102 FOR CONTROL DIAGRAMS.
7. SEE DWGS M-501 TO M-503 FOR DETAILS.
8. SEE DWGS M-601 TO M-603 FOR EQUIPMENT SCHEDULES.
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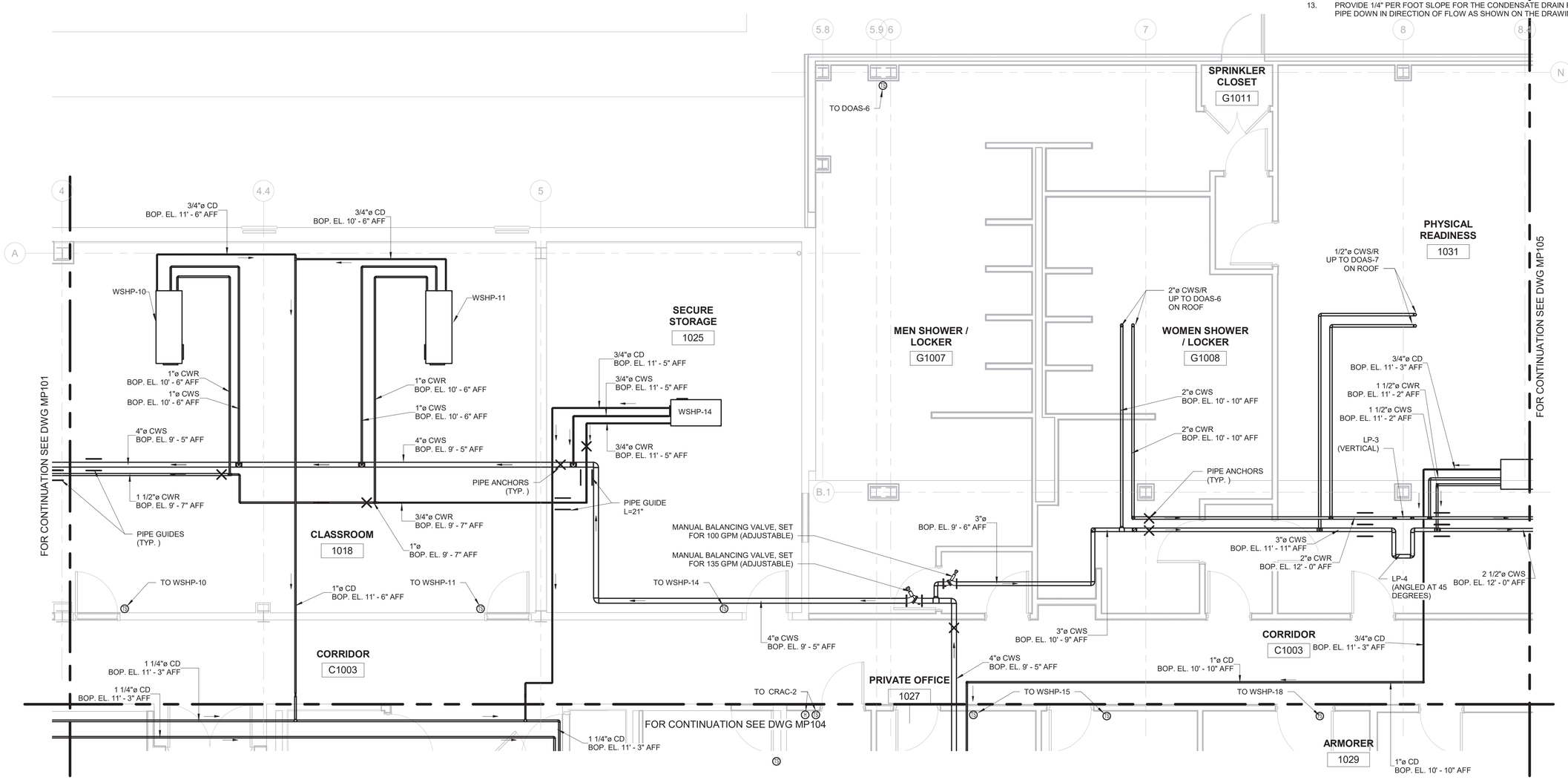


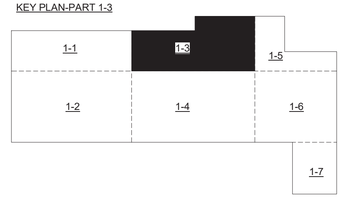
1 MECHANICAL PIPING FLOOR PART PLAN 1-3

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

KEY PLAN-PART 1-3



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MOTT MACDONALD
111 Wood Avenue
Iselin, NJ 08830-4112
United States of America
T: + 732-780-6565
F: + 732-577-0551
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ORANGEBURG, NEW YORK

MECHANICAL PIPING FLOOR PART PLAN 1-3

SHEET ID

MP103

CORRECTED FINAL SUBMISSION - JULY 29, 2021

PLAN NORTH

NOTES:

1. SEE DWG M-001 FOR SYMBOLS, LEGEND, AND ABBREVIATIONS.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION WORK.
3. SEE DWGS MH101 TO MH107 FOR CONTINUATION.
4. SEE DWG MH108 FOR ROOF PLAN.
5. SEE DWGS MP201 TO MP203, MP205 TO MP207 FOR CONTINUATION.
6. SEE DWGS MI101 TO MI102 FOR CONTROL DIAGRAMS.
7. SEE DWGS M-501 TO M-503 FOR DETAILS.
8. SEE DWGS M-601 TO M-603 FOR EQUIPMENT SCHEDULES.
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13. PROVIDE 1/4" PER FOOT SLOPE FOR THE CONDENSATE DRAIN PIPES. PITCH PIPE DOWN IN DIRECTION OF FLOW AS SHOWN ON THE DRAWING

FOR CONTINUATION SEE DWG MP103

FOR CONTINUATION SEE DWG MP106

ASSEMBLY 1019

JANITOR G1004

MEN'S TOILET G1003

WOMEN TOILET G1005

STORAGE 1022

KITCHEN 1023

ASSEMBLY 1019

SCULLERY 1024

MECHANICAL G1010

CAN WASH 1039

ELECTRICAL G1009

PRIVATE OFFICE 1027

PRIVATE OFFICE 1028

ARMORER 1029

ARMS VAULT 1030

UNIT STORAGE 1032

PRIVATE OFFICE 1033

STORAGE 1034

1 1/4"ø CD BOP. EL. 11' - 3" AFF

1 1/4"ø CD BOP. EL. 11' - 3" AFF

1"ø CD BOP. EL. 11' - 6" AFF

1 1/4"ø CD BOP. EL. 11' - 3" AFF

1-1/4" CD DN. TERMINATE 18" ABOVE MOP SINK

2"ø CWS/R UP TO DOAS-2 ON ROOF

2"ø CWR BOP. EL. 10' - 5" AFF

2"ø CWS BOP. EL. 11' - 9" AFF

PIPE GUIDE L=74"

3"ø CWR BOP. EL. 10' - 5" AFF

2 1/2"ø CWS BOP. EL. 10' - 8" AFF

4"ø CWR BOP. EL. 10' - 4" AFF

4"ø CWR BOP. EL. 10' - 4" AFF

1 1/2"ø CWS BOP. EL. 10' - 8" AFF

TO WSHP-13

1 1/2"ø CWS BOP. EL. 9' - 11" AFF

1 1/2"ø CWR BOP. EL. 10' - 5" AFF

1 1/2"ø CWS/R UP TO WSHP-13 ON ROOF

SEE DWG MP108 FOR MECHANICAL ROOM G1010 PLAN

TO WSHP-13

1/2"ø LIQUID LINE
3/4"ø SUCTION LINE
UP TO CRACC-2 ON ROOF

TO CRAC-2

CRAC-2

TO WSHP-20

3/4"ø CWS BOP. EL. 9' - 7" AFF

1"ø CD BOP. EL. 9' - 7" AFF

3/4"ø CWR BOP. EL. 11' - 6" AFF

WSHP-20

1"ø CD

1"ø CD BOP. EL. 10' - 10" AFF

TO WSHP-15

TO WSHP-18

1"ø CD BOP. EL. 9' - 7" AFF

1"ø CWS BOP. EL. 11' - 6" AFF

PIPE GUIDE L=50" SEE DWG MP108

3/4"ø CWS BOP. EL. 11' - 6" AFF

WSHP-18

WSHP-15

3/4"ø CD

3/4"ø CWS

3/4"ø CWR BOP. EL. 10' - 9" AFF

4"ø CWS BOP. EL. 9' - 5" AFF

3/4"ø CD BOP. EL. 11' - 5" AFF

1"ø CD BOP. EL. 11' - 6" AFF

3/4"ø CD BOP. EL. 11' - 6" AFF

1"ø CD BOP. EL. 9' - 7" AFF

3/4"ø CWR BOP. EL. 10' - 9" AFF

1"ø CWR BOP. EL. 10' - 9" AFF

1"ø CD BOP. EL. 9' - 7" AFF

1 1/4"ø CD BOP. EL. 9' - 7" AFF

PIPE ANCHORS (TYP.)

3/4"ø CWS BOP. EL. 9' - 0" AFF

3/4"ø CWS BOP. EL. 9' - 0" AFF

LP-5

3"ø CWR BOP. EL. 8' - 11" AFF

PIPE GUIDES (TYP.)

LP-6

3/4"ø CWR BOP. EL. 10' - 2" AFF

3/4"ø CWS BOP. EL. 10' - 0" AFF

TO WSHP-17

3"ø CWR BOP. EL. 8' - 11" AFF

WSHP-17

3/4"ø CD BOP. EL. 10' - 0" AFF

KEY PLAN-PART 1-4

1-1 | 1-3 | 1-5

1-2 | 1-4 | 1-6

1-7

1 MECHANICAL PIPING FLOOR PART PLAN 1-4

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

US Army Corps of Engineers ®

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LOUISVILLE DISTRICT
LOUISVILLE, KY

MOTT MACDONALD
111 Wood Avenue
Iselin, NJ 08830-2713
United States of America
T: + 732-780-8565
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UNITED STATES ARMY RESERVE CENTER
ORANGEBURG, NEW YORK

MECHANICAL PIPING FLOOR PART PLAN 1-4

SHEET ID

MP104

CORRECTED FINAL SUBMISSION - JULY 29, 2021

PLAN NORTH

NOTES:

1. SEE DWG M-001 FOR SYMBOLS, LEGEND, AND ABBREVIATIONS.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION WORK.
3. SEE DWGS MH101 TO MH107 FOR CONTINUATION.
4. SEE DWG MH108 FOR ROOF PLAN.
5. SEE DWGS MP201 TO MP204, MP206, MP207 FOR CONTINUATION.
6. SEE DWGS MI101 TO MI102 FOR CONTROL DIAGRAMS.
7. SEE DWGS M-501 TO M-503 FOR DETAILS.
8. SEE DWGS M-601 TO M-603 FOR EQUIPMENT SCHEDULES.
9. PROVIDE SHUTOFF VALVES AT ALL WATER SUPPLY AND RETURN PIPE BRANCHES. THE SHUTOFF VALVES ARE NOT SHOWN ON THE FLOOR PLAN FOR CLARITY.
10. THE CONTROL VALVE, SHUTOFF VALVES, STRAINER, DRAIN VALVE FOR EACH ROOF MOUNTED DOAS UNIT SHALL BE LOCATED BELOW THE ROOF IN A CLOSE PROXIMITY OF THE CORRESPONDING UNIT.
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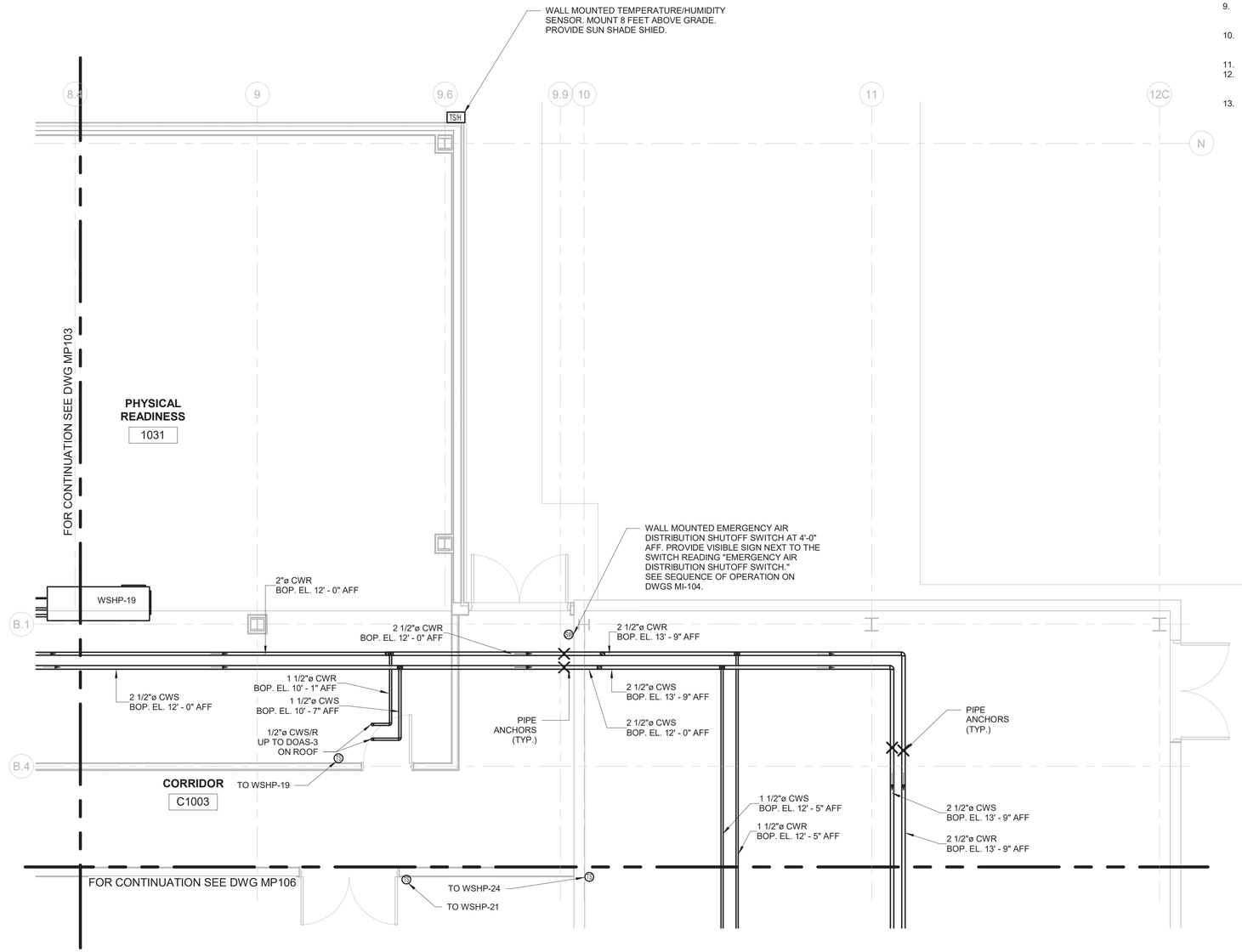
13. PROVIDE 1/4" PER FOOT SLOPE FOR THE CONDENSATE DRAIN PIPES. PITCH PIPE DOWN IN DIRECTION OF FLOW AS SHOWN ON THE DRAWING.



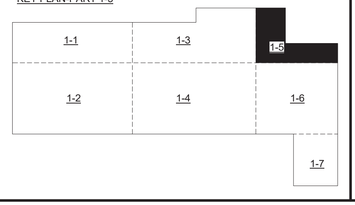
1 MECHANICAL PIPING FLOOR PART PLAN 1-5

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

KEY PLAN-PART 1-5



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LOUISVILLE DISTRICT
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MOTT MACDONALD
111 Wood Avenue
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United States of America
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ORANGEBURG, NEW YORK

MECHANICAL PIPING FLOOR PART PLAN 1-5

SHEET ID

MP105

CORRECTED FINAL SUBMISSION - JULY 29, 2021

PLAN NORTH

FOR CONTINUATION SEE DWG MP105

FOR CONTINUATION SEE DWG MP104

TO WSHP-24

TO WSHP-21

1 1/2"ø CWR
BOP. EL. 12' - 5" AFF

1 1/2"ø CWS
BOP. EL. 12' - 5" AFF

2 1/2"ø CWR
BOP. EL. 13' - 9" AFF

2 1/2"ø CWS
BOP. EL. 13' - 9" AFF

WSHP-24

3/4"ø CD
BOP. EL. 13' - 10" AFF

PIPE GUIDES
(TYP.)

LP-8

1 1/2"ø CWR
BOP. EL. 13' - 3" AFF

1 1/2"ø CWS
BOP. EL. 13' - 9" AFF

3/4"ø CD
BOP. EL. 13' - 10" AFF

3"ø CWR
BOP. EL. 13' - 9" AFF

LP-7

UNIT STORAGE
1032

3/4"ø CD
BOP. EL. 9' - 0" AFF

WSHP-21

3/4"ø CWR
BOP. EL. 9' - 6" AFF

3/4"ø CWS
BOP. EL. 9' - 6" AFF

1"ø CWS
BOP. EL. 9' - 0" AFF

1-1/2"ø CWS/R
UP TO DOAS-5
ON ROOF

2"ø CWS
BOP. EL. 13' - 9" AFF

3/4"ø CWS
BOP. EL. 9' - 0" AFF

1"ø CWS
BOP. EL. 13' - 10" AFF

3/4"ø CD
BOP. EL. 12' - 0" AFF

3"ø CWR
BOP. EL. 8' - 11" AFF

3"ø CWR
BOP. EL. 8' - 11" AFF

PIPE GUIDES
(TYP.)

WSHP-22

PIPE ANCHORS
(TYP.)

3"ø CWR
BOP. EL. 13' - 9" AFF

3/4"ø CD
BOP. EL. 12' - 4" AFF

TO WSHP-22

1 1/2"ø CWR
BOP. EL. 12' - 3" AFF

1 1/2"ø CWS
BOP. EL. 12' - 3" AFF

3/4"ø CD
BOP. EL. 12' - 0" AFF

2"ø CWS
BOP. EL. 13' - 9" AFF

1 1/2"ø CWR
BOP. EL. 12' - 5" AFF

3"ø CWR
BOP. EL. 13' - 9" AFF

1 1/2"ø CWS
BOP. EL. 12' - 5" AFF

1 1/2"ø CWS
BOP. EL. 13' - 9" AFF

PIPE ANCHORS
(TYP.)

3"ø CWR
BOP. EL. 13' - 9" AFF

3/4"ø CD
BOP. EL. 12' - 0" AFF

FOR CONTINUATION SEE DWG MP107

STAGING
1035

NOTES:

1. SEE DWG M-001 FOR SYMBOLS, LEGEND, AND ABBREVIATIONS.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION WORK.
3. SEE DWGS MH101 TO MH107 FOR CONTINUATION.
4. SEE DWG MH108 FOR ROOF PLAN.
5. SEE DWGS MP201 TO MP205, MP207 FOR CONTINUATION.
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KEY PLAN-PART 1-6

1-1	1-3	1-5
1-2	1-4	1-6
		1-7

1 MECHANICAL PIPING FLOOR PART PLAN 1-6

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

US Army Corps of Engineers ®

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MOTT MACDONALD
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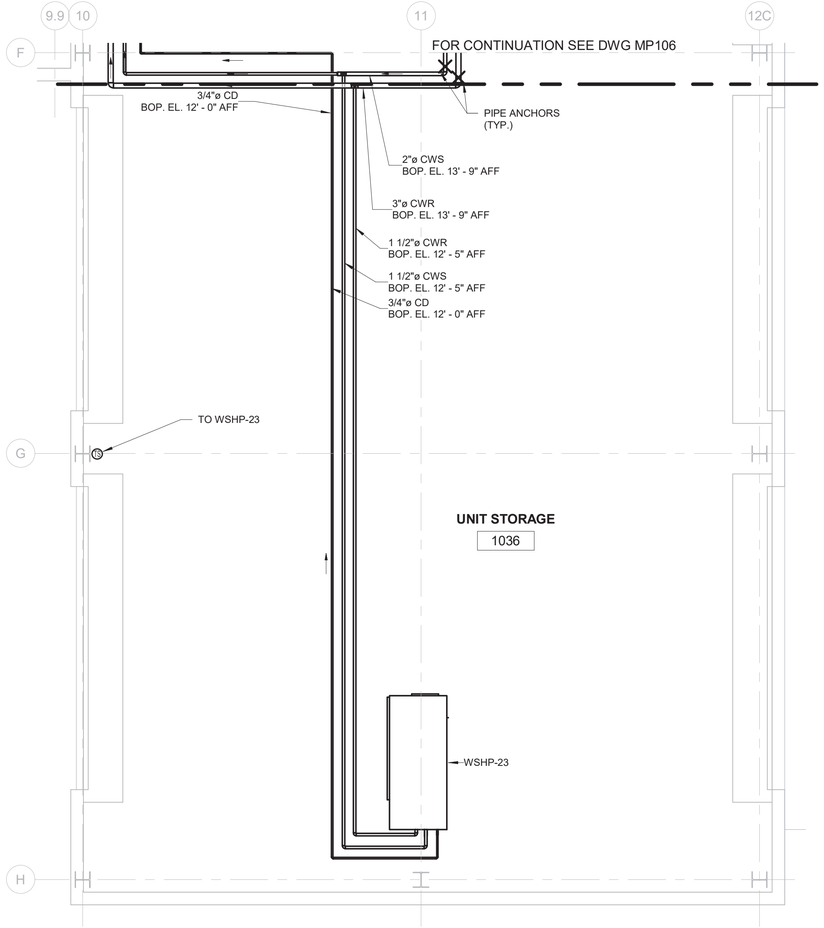
MECHANICAL PIPING FLOOR PART PLAN 1-6

SHEET ID

MP106

CORRECTED FINAL SUBMISSION - JULY 29, 2021

PLAN NORTH



1 MECHANICAL PIPING FLOOR PART PLAN 1-7

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

NOTES:

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KEY PLAN-PART 1-7

1-1	1-3	1-5
1-2	1-4	1-6

1-7

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MARK	DESCRIPTION	DATE

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US ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT
LOUISVILLE, KY

111 Wood Avenue
Iselin, NJ 08830-1410
United States of America
T: + 732-750-8565
F: + 732-577-0551
www.mottmacamericas.com

MOTT MACDONALD

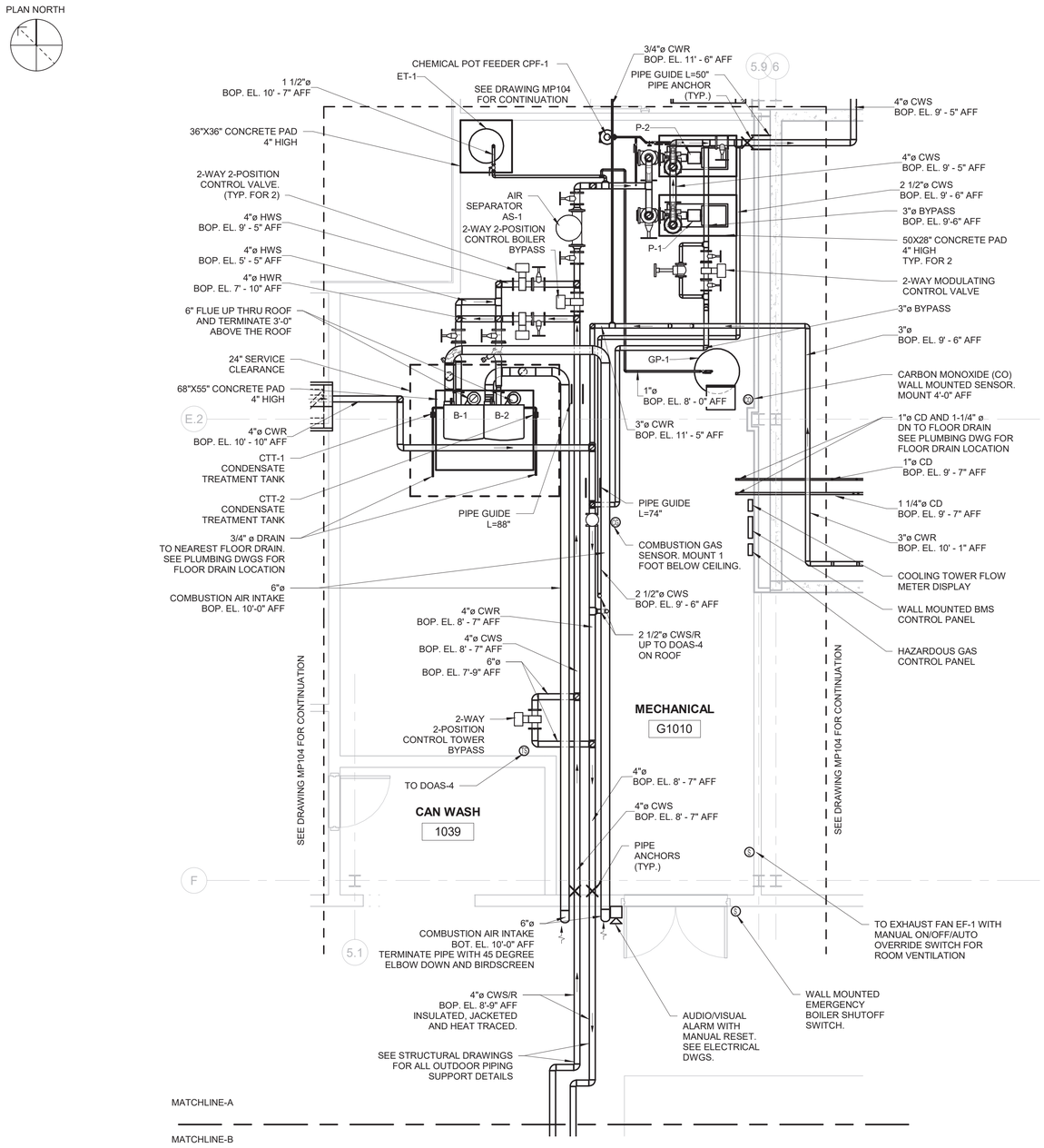
UNITED STATES ARMY RESERVE CENTER
ORANGEBURG, NEW YORK

MECHANICAL PIPING FLOOR PART PLAN 1-7

SHEET ID

MP107

CORRECTED FINAL SUBMISSION - JULY 29, 2021

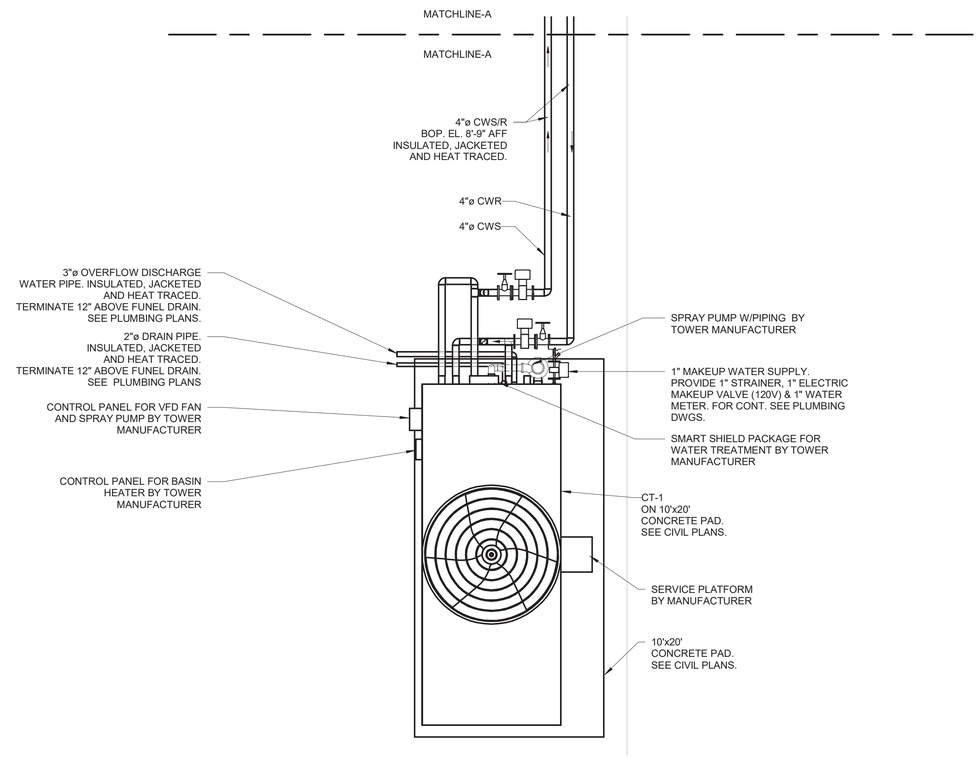


1 MECHANICAL PIPING-MECHANICAL ROOM G1010 PLAN

1/4" = 1'-0"

NOTES:

1. SEE DWG M-001 FOR LEGEND, ABBREVIATIONS & GENERAL NOTES.
2. SEE DWGS MD101 AND MD102 FOR DEMOLITION FLOOR PLANS.
3. SEE DWG MH104 FOR DUCTWORK FLOOR PLAN.
4. SEE DWGS MI101 TO MI104 FOR CONTROL SCHEMATICS & SEQUENCE OF OPERATION.
5. SEE DWGS M-501 TO M-503 FOR DETAILS.
6. SEE DWGS M-601 TO M-603 FOR EQUIPMENT SCHEDULES.
7. ALL CONDENSER WATER AND CONDENSATE DRAIN PIPES SHALL BE INSULATED.
8. PROVIDE HEAT TRACING, THERMAL INSULATION AND JACKETING FOR THE COOLING TOWER MOUNTED SPRAY PUMP AND SPRAY PIPING, STANDPIPE ASSEMBLY, MAKEUP PIPING AND SOLENOID VALVE, OVERFLOW AND DRAIN LINES, ANY OTHER CONNECTIONS TO ACCESSORIES AT OR BELOW THE WATER LEVEL SUCH AS ELECTRONIC WATER LEVEL CONTROLLERS. THE CONTRACTOR SHALL PROVIDE, FIELD INSTALL, AND WIRE THE HEAT TRACING SYSTEM WHICH SHALL OPERATE UNDER BUILT IN CONTROLS (BY HEAT TRACING MANUFACTURER). INTEGRATE OPERATION OF THE HEAT TRACING SYSTEM TO THE BMS FOR MONITORING AND ALARMS. SEE ELECTRICAL DWGS FOR THE HEAT TRACING SYSTEM.
9. FOR ALL CONDENSATE DRAIN PIPES, PROVIDE CLEANOUTS AT EACH 90 DEGREE ELBOWS. PROVIDE CLEANOUTS EVERY 30 FEET ON THE STRAIGHT RUNS.
10. PROVIDE 1/4" PER FOOT SLOPE FOR THE CONDENSATE DRAIN PIPES. PITCH PIPE DOWN IN DIRECTION OF FLOW AS SHOWN ON THE DRAWING



2 MECHANICAL PIPING-COOLING TOWER PLAN

1/4" = 1'-0"

0 2' 4' 8'

SCALE: 1/4"=1'-0

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MOTT MACDONALD
111 Wood Avenue South, Suite 410
Iselin, NJ 08830-2710
United States of America
T: + 732-780-8565
F: + 732-577-0551
www.mottmacamericas.com

UNITED STATES ARMY RESERVE CENTER
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MECHANICAL PIPING-MECHANICAL ROOM G1010 PLAN

SHEET ID

MP108

CORRECTED FINAL SUBMISSION - JULY 29, 2021

GENERAL ABBREVIATIONS
- BMS - BUILDING MANAGEMENT SYSTEM
- UM - UNIT MANUFACTURER, EQUIPMENT
- PUB - PROGRAMMABLE UNITARY CONTROLLER

DIRECT DIGITAL CONTROLS ABBREVIATIONS
- AI - ANALOG INPUT
- AO - ANALOG OUTPUT
- CI - CONFIGURABLE INPUT
- CO - CONFIGURABLE OUTPUT
- BI - BINARY INPUT
- BO - BINARY OUTPUT
- DDC - DIRECT DIGITAL CONTROL
- I/O - INPUT/OUTPUT POINT
- PID - PROPORTIONAL, INTEGRAL, DERIVATIVE
- N.O. - NORMALLY OPEN
- N.C. - NORMALLY CLOSED
- S.R. - SPRING RETURN
- N.S.R. - NON-SPRING RETURN

COMPUTER OR ELECTRONICS
- CPU - CENTRAL PROCESSING UNIT
- EEPROM - ELECTRONICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY
- GUI - GRAPHICAL USER INTERFACE
- LAN - LOCAL AREA NETWORK
- WAN - WIDE AREA NETWORK
- PC - PERSONAL COMPUTER
- OWS - OPERATOR WORKSTATION
- RAM - RANDOM ACCESS MEMORY
- ROM - READ ONLY MEMORY
- TCP/IP - TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL
- UPS - UNINTERRUPTIBLE POWER SUPPLY

COOLING PLANT ABBREVIATIONS
- P- - PRIMARY
- S- - SECONDARY
- CWP - CONDENSER WATER PUMP
- CWS - CONDENSER WATER SUPPLY
- CWR - CONDENSER WATER RETURN
- CTWR - COOLING TOWER

HEATING PLANT ABBREVIATIONS
- B, BLR - BOILER
- BP - BOILER PUMP
- HX - HEAT EXCHANGER
- HWP - HOT WATER PUMP, PRIMARY (P-), SECONDARY (S-)
- HWS/R - HOT WATER SUPPLY/RETURN
- MER - MECHANICAL EQUIPMENT ROOM

HVAC EQUIPMENT ABBREVIATIONS
- AC - AIR CONDITIONING UNIT
- ACCU - AIR COOLED CONDENSING UNIT
- HVAC - HEATING,VENTILATING & AIR CONDITIONING UNIT
- MAU - MAKEUP AIR UNIT
- RTU - ROOF TOP UNIT
- EF - EXHAUST FAN
- HP - HEAT PUMP
- HWC - HOT WATER COIL
- RHC - REHEAT COIL
- UV - UNIT VENTILATOR

FIELD DEVICES ABBREVIATIONS
- CT/CS - CURRENT TRANSDUCER
- CS - CURRENT SWITCH
- CO - CO SENSOR
- FAS - FIRE ALARM SYSTEM
- FACP - FIRE ALARM CONTROL PANEL
- HOA - HAND-OFF-AUTO
- LPS - LOW PRESSURE SWITCH
- HPS - HIGH PRESSURE SWITCH
- ES - END-SWITCH
- LDS - LIQUID DETECTION SWITCH
- LCD - LIQUID CRYSTAL DISPLAY
- LED - LIGHT EMITTING DIODE
- LLS - LOW LIMIT TEMPERATURE SWITCH
- LWCO - LOW WATER CUTOUT SWITCH
- M - ACTUATOR
- MS - MOTOR STARTER
- VFD - VARIABLE FREQUENCY DRIVE
- O/L - OVERLOADS
- OCC - OCCUPANCY SENSOR
- PDT - PRESSURE DIFFERENTIAL TRANSDUCER
- PDS - PRESSURE DIFFERENTIAL SWITCH
- R - CONTROL PILOT RELAY
- RH - RELATIVE HUMIDITY SENSOR
- SD - SMOKE DETECTOR
- SPDT - SINGLE POLE DOUBLE THROW
- SPST - SINGLE POLE SINGLE THROW
- SW - SWITCH
- T/TS - TEMPERATURE / TEMPERATURE SENSOR
- TC - THERMOSTAT SWITCH
- 2W/3W - 2-WAY OR 3-WAY
- CV - CONSTANT AIR VOLUME (AIR)
- CV - FLOW COEFFICIENT (WATER)
- V - VALVE, TEMPERATURE CONTROL

POWER AND ENERGY ABBREVIATIONS
- AWG - AMERICAN WIRE GAUGE
- KW/KWH - KILO-WATTS
- KWH - KILO-WATT-HOURS
- MA - MILLI-AMPERE
- VA - VOLTAGE-AMPERE
- VAC/VDC - VOLTAGE ALTERNATING CURRENT
- VDC - VOLTAGE DIRECT CURRENT
- THERMS - UNIT OF NATURAL GAS USE
- GAL - GALLONS OF WATER USE

CONTROL MEDIA ABBREVIATIONS
- SFSS - SUPPLY FAN COMMAND
- SFST - SUPPLY FAN STATUS
- EFSS - EXHAUST FAN COMMAND
- EFST - EXHAUST FAN STATUS
- RFSS - RETURN FAN COMMAND
- RFST - RETURN FAN STATUS
- SAT - SUPPLY AIR TEMPERATURE
- SAH - SUPPLY AIR HUMIDITY
- DAT - DISCHARGE AIR TEMPERATURE
- DAH - DISCHARGE AIR HUMIDITY
- MAT - MIXED AIR TEMPERATURE
- RAT - RETURN AIR TEMPERATURE
- RARH - RETURN AIR HUMIDITY
- RMT - SPACE TEMPERATURE
- RMSP - SPACE SETPOINT ADJUSTMENT
- CLG - COOLING STAGE COMMAND
- HTG - HEATING STAGE COMMAND
- HGR - HOT GAS REHEAT COMMAND
- ZND - ZONE DAMPER COMMAND
- RAD - RETURN AIR DAMPER COMMAND
- OAD - OUTSIDE AIR DAMPER COMMAND
- RVSS - ROOF VENT DAMPER COMMAND
- FLTR - FILTER STATUS
- HWV - HOT WATER VALVE
- LLS- - LOW LIMIT SWITCH STATUS
- OAT - OUTDOOR AIR TEMPERATURE
- OAH - OUTDOOR AIR HUMIDITY
- CO - CARBON MONOXIDE LEVEL
- HWDP - HOT WATER DIFFERENTIAL PRESSURE
- HWS - HOT WATER SUPPLY TEMPERATURE
- HWR - HOT WATER RETURN TEMPERATURE
- HWPSS - HOT WATER PUMP COMMAND
- HWPCS - HOT WATER PUMP STATUS
- HWPDP - HOT WATER PUMP DIFFERENTIAL PRESSURE
- HWBYP - HOT WATER BYPASS VALVE
- HWFL - HOT WATER FLOW
- MWFL - MAKEUP WATER FLOW
- BCPFLT - BOILER CONTROL PANEL FAULT
- BPCS - BOILER PUMP STATUS

I/O CONTROL POINT

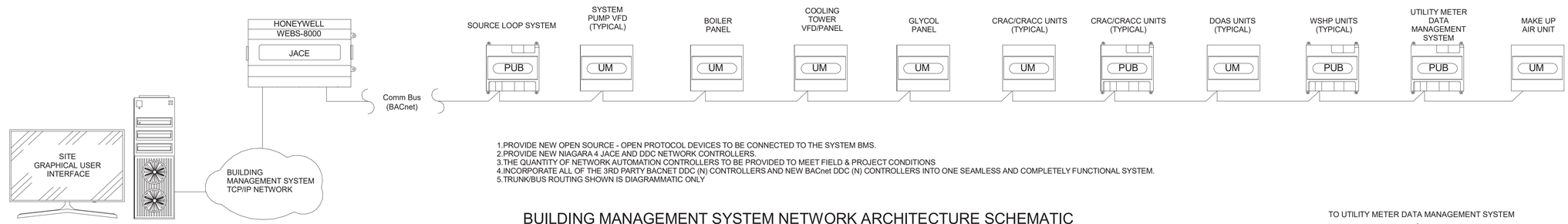
## XXX	POINT DESIGNATION
XXX	POINT TYPE
##	AO ANALOG OUTPUT
	AI ANALOG INPUT
	BO BINARY OUTPUT
	BI BINARY INPUT
	BAV BACNET ANALOG VALUE
	BBV BACNET BINARY VALUE
	COMM COMMUNICATION BUS
	H/W WIRED INTERLOCK
	FAS FIRE ALARM SYSTEM

- AQ - AQUASTATIC SWITCH (SPDT)
- AFS - AIR FLOW STATION (ANALOG)
- FS - FLOW SWITCH (DIGITAL)
- FL - FLOW SENSOR (ANALOG)
- M - CONTROL ACTUATOR
- DPS - DIFFERENTIAL PRESSURE SWITCH (SPDT)
- DPT - DIFFERENTIAL PRESSURE TRANSDUCER (ANALOG)
- CONTROL WIRE OR CABLE
- ES - POSITION END SWITCH (SPST)
- RH - RELATIVE HUMIDITY SENSOR
- CO - CARBON-MONOXIDE SENSOR
- XT - CONTROL TRANSFORMER
- IAQ - INDOOR AIR QUALITY SENSOR
- MS - MAGNETIC STARTER
- VFD - VARIABLE FREQUENCY DRIVE
- R - CONTROL RELAY (SPDT)
- CT - CURRENT TRANSDUCER SENSOR (ANALOG)
- CS - CURRENT SWITCH SENSOR (DIGITAL)
- UPS - UNINTERRUPTABLE POWER SUPPLY
- TS - TEMPERATURE SENSOR (PROBE)
- TS - TEMPERATURE SENSOR (AVERAGING)
- LLS - LOW-LIMIT TEMPERATURE SWITCH (SPDT)
- SD - SMOKE DETECTOR (DUCT)
- TC - THERMOSTAT SWITCH (SPDT)

BUILDING MANAGEMENT SYSTEM (BMS) TERMINOLOGY AND CONTROL POINT LEGEND

BUILDING MANAGEMENT SYSTEM (BMS) DEVICE LEGEND

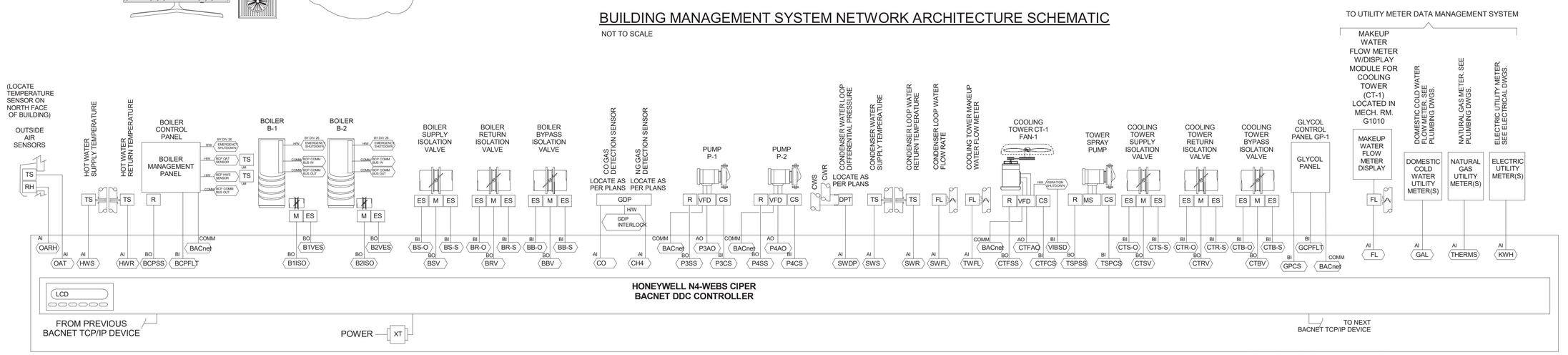
NOT TO SCALE



1. PROVIDE NEW OPEN SOURCE - OPEN PROTOCOL DEVICES TO BE CONNECTED TO THE SYSTEM BMS.
2. PROVIDE NEW NIAGARA 4 JACE AND DDC NETWORK CONTROLLERS.
3. THE QUANTITY OF NETWORK AUTOMATION CONTROLLERS TO BE PROVIDED TO MEET FIELD & PROJECT CONDITIONS
4. INCORPORATE ALL OF THE 3RD PARTY BACNET DDC (N) CONTROLLERS AND NEW BACnet DDC (N) CONTROLLERS INTO ONE SEAMLESS AND COMPLETELY FUNCTIONAL SYSTEM.
5. TRUNK/BUS ROUTING SHOWN IS DIAGRAMMATIC ONLY

BUILDING MANAGEMENT SYSTEM NETWORK ARCHITECTURE SCHEMATIC

NOT TO SCALE



CONDENSER WATER LOOP SYSTEM SCHEMATIC

NOT TO SCALE

BOILERS - COOLING TOWER - PUMPS

US Army Corps of Engineers ®

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LOUISVILLE DISTRICT
LOUISVILLE, KY

MOTT MACDONALD
111 Wood Avenue
Iselin, NJ 08830-4172
United States of America
T- + 732-780-8565
F- + 732-577-0551
www.mottmacamericas.com

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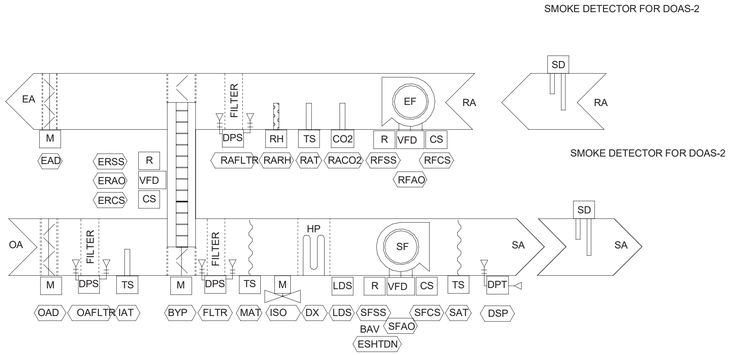
MECHANICAL CONTROL SCHEMATICS - SHEET 1

SHEET ID

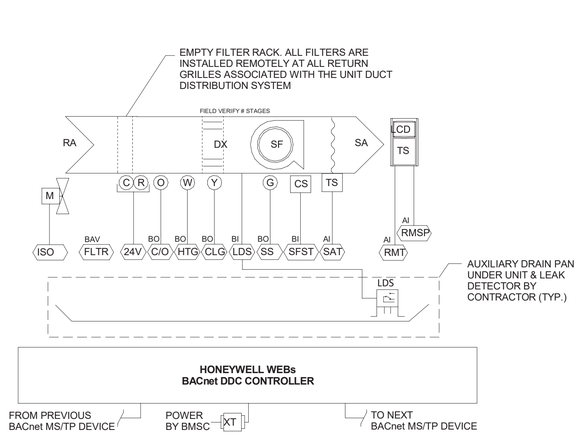
MI101

CORRECTED FINAL SUBMISSION - JULY 29, 2021



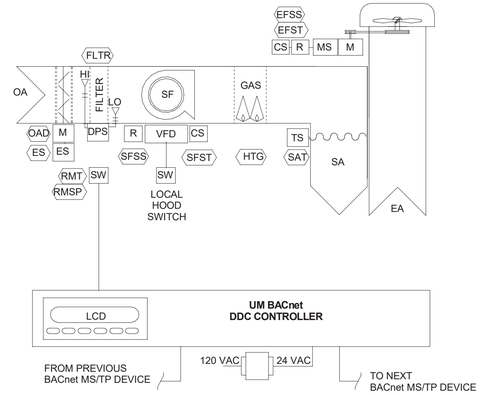
DOAS WATER SOURCE UNITS SCHEMATIC (TYPICAL FOR DOAS-1 THRU DOAS-6)

NOT TO SCALE



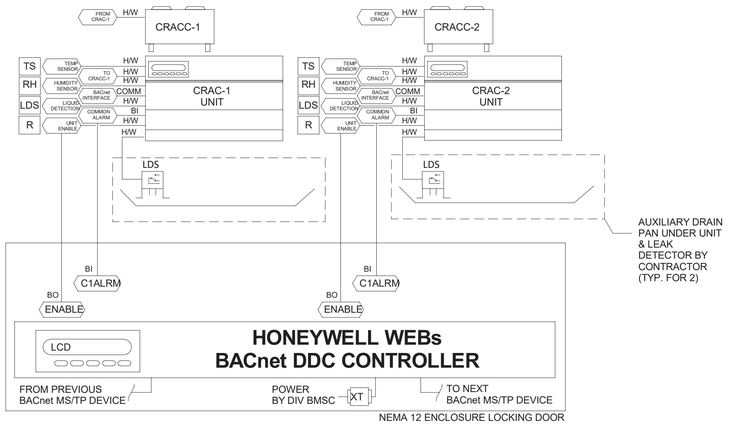
WATER SOURCE HEAT PUMPS SCHEMATIC (TYPICAL FOR WSHP-1 THRU WSHP-24)

NOT TO SCALE



MAKEUP AIR UNIT (MAU-1) CONTROL SCHEMATIC

NOT TO SCALE — NATURAL GAS HEATING



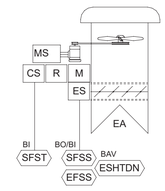
COMPUTER ROOM AIR CONDITIONING UNIT SCHEMATIC (TYPICAL FOR CRAC-1/CRACC-1 & CRAC-2/CRACC-2)

NOT TO SCALE

NOTE: PROVIDE CONTROL POINTS ON THE ASSOCIATED INTERLOCKED EQUIPMENT DDC CONTROLLER

TYPICAL EXHAUST FAN SCHEMATIC

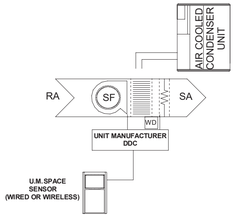
NOT TO SCALE — DDC - INTERLOCKED



NOTE: PROVIDE CONTROL POINTS ON THE ASSOCIATED INTERLOCKED EQUIPMENT DDC CONTROLLER

SUPPLY FAN SCHEMATIC

NOT TO SCALE — DDC - INTERLOCKED



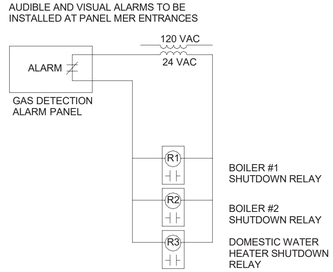
DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNIT SCHEMATIC

NOT TO SCALE — STAND-ALONE

NOTES:
1. PROVIDE CONTROL POINTS ON THE CLOSEST DDC CONTROLLER
2. SCHEMATIC IS TYPICAL FOR 2 SWITCHES

EMERGENCY AIR DISTRIBUTION SHUTOFF SWITCH SCHEMATIC

NOT TO SCALE — MANUAL



NOTES:

THE CONTRACTOR SHALL PROVIDE ALL THE NECESSARY WIRING AND DEVICE REQUIRED TO PERFORM THE FOLLOWING SEQUENCE OF OPERATIONS:

1. NORMAL OPERATION (CO & CH4 LEVELS BELOW WARNING & ALARM SETPOINTS)
- THE PANEL ALARM CONTACT IS CLOSED.
- R1 / R2 / R3 RELAYS ARE ENERGIZED
- RELAY CONTACTS ARE CLOSED
- EQUIPMENT IS ALLOWED TO OPERATE AS SEQUENCED

2. ALARM OPERATION (CO OR CH4 LEVELS ABOVE SETPOINT)
- THE PANEL ALARM CONTACT IS OPENED.
- R1 / R2 / R3 RELAYS ARE DE-ENERGIZED, RELAY CONTACTS
- ARE OPENED
- EQUIPMENT IS DISABLED

MECHANICAL RM. HAZARDOUS GAS MONITORING & ALARM INTERLOCKS SCHEMATIC

NOT TO SCALE — HARDWIRED

US Army Corps of Engineers ®

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MECHANICAL CONTROL SCHEMATICS - SHEET 2

SHEET ID
MI102

CORRECTED FINAL SUBMISSION - JULY 29, 2021

HVAC CONTROLS GENERAL NOTES

1. BASIS OF DESIGN BMS SYSTEM FOR ALL HVAC EQUIPMENT IS BACNET / NIAGARA VERSION 4.X BY HONEYWELL OR APPROVED EQUAL.
2. THE HEAD-END OF THE NEW DDC SYSTEM SHALL BE CONNECTED TO THE NIAGARA/JACE BOX AND THE NIAGARA/JACE BOX SHALL BE CONNECTED TO ARNET.
3. BMS SYSTEM SHALL CONSIST OF A SERIES OF NON-PROPRIETARY FIELD AND/OR FACTORY MOUNTED NETWORKED DIRECT DIGITAL CONTROLLERS (DDC) THAT MUST COMMUNICATE NATIVE BACNET (IP). BACNET MS/TP SHALL BE USED FOR COMMUNICATION TO THIRD PARTY CONTROLS ONLY. ALL CONTROLS SHALL BE HARDWIRED. WIRELESS CONNECTIONS ARE NOT ACCEPTABLE.
4. BMS SYSTEM CONSIST OF A SERVER PC SUPERVISOR THAT WILL COMMUNICATE VIA THE BACNET OPEN PROTOCOL WITH THE INDIVIDUAL FACTORY OR FIELD MOUNTED DDC CONTROLLERS REQUIRED FOR THIS PROJECT. THE SERVER PC SUPERVISOR WILL ALSO INCLUDE THE EMBEDDED OPERATOR INTERFACE SOFTWARE TO DISPLAY EQUIPMENT AND/OR FLOOR PLAN GRAPHICS, AN ALARM SUMMARY, OVERRIDE PAGES, ETC. THAT ARE REQUIRED FOR A BMS OPERATOR TO MANAGE THE FACILITY. IN THE EVENT OF A BMS COMMUNICATION FAILURE THE DDC CONTROLLERS ASSOCIATED WITH THE HVAC EQUIPMENT WILL CONTINUE TO OPERATE IN A STAND-ALONE FASHION AND CONTINUE TO PROVIDE COMFORT HEATING AND COOLING TO THE OCCUPANTS.
5. THE SPECIFIED BMS, DDC AND UNIT CONTROLLERS MUST BE PROGRAMMED TO MEET THE DESIGNED SEQUENCE OF OPERATIONS AS DESCRIBED ON THE MECHANICAL SPECIFICATIONS OR DRAWINGS. THE SPECIFIED CONTROL SYSTEM SHALL BE IMPLEMENTED WITH OPTIMIZED SYSTEM LEVEL OPTIMIZATION STRATEGIES.
6. BMS SYSTEM SHALL CONTROL AND MONITOR HVAC EQUIPMENT TO PROVIDE ALARM NOTIFICATIONS AT THE SERVER PC SUPERVISOR.
7. DDC SYSTEM SHALL BE ABLE TO ACCEPT UPGRADES AND INTERFACE WITH FUTURE VERSIONS BY THE SAME MANUFACTURER, WITHOUT REPLACING THE HARDWARE, CONTROL MODULES, PROCESSORS, GATEWAYS, OR SENSORS.
8. ALL POWER WIRING 120 VAC AND ABOVE IS ASSUMED TO BE PROVIDED UNDER DIVISION 26 UNLESS OTHERWISE SPECIFIED.
9. CONDUIT: POWER AND LOW VOLTAGE SIGNAL WIRING SHALL ENTER BMS CONTROL CABINETS IN SEPARATE CONDUITS.
10. CONDUIT REQUIRED IN THE MECHANICAL ROOM, FROM ANY BMS CONTROL CABINET TO 8' ABOVE FINISHED FLOOR, AND ANYWHERE ELSE CABLE MAY BE SUBJECT TO PHYSICAL HARM. SOME PROJECTS MAY HAVE MORE STRINGENT CONDUIT REQUIREMENTS THAN LISTED HEREIN, SEE PROJECT SPECIFICATION FOR FURTHER DETAILS.
11. MINIMUM SIZE: 3/4" FOR CONDUIT ENTERING CONTROL PANELS, 1/2" FLEX TO DEVICES ACCEPTABLE, 1/2" STUB UP FOR THERMOSTATS ACCEPTABLE (SUBJECT TO BUILDING/JOB REQUIREMENTS).
12. MAXIMUM FILL: 75% CAPACITY.
13. OPEN CABLING: ALL OPEN CABLES ARE TO BE ADEQUATELY SUPPORTED, NO CABLING IS TO LAY LOOSELY ON CEILING TILES. CABLING SHALL NOT BE TIED TO SPRINKLER PIPING.
14. CABLE MARKERS: EACH CABLE MUST BE MARKED AT EACH END USING A BRADY STYLE SELF-ADHESIVE MARKER. MARKERS SHALL BE PLACED SUCH THAT THEY ARE NOT CUT OFF AND ARE VISIBLE WITHOUT CUTTING WIRING BUNDLES.
15. GROUNDING: AN ESTABLISHED ELECTRICAL SERVICE EARTH GROUND MUST BE CONNECTED TO THE BASEPLATE OF ALL CONTROLLERS. THIS MAY BE ACCOMPLISHED BY DIRECT CONNECTION TO THE CONTROLLER BASEPLATE OR AN EARTH GROUND-TO PANEL BACKPLANE -TO BASEPLATE CONNECTION.
16. CODE COMPLIANCE: THE NATIONAL ELECTRICAL CODE (NEC), NATIONAL PLUMBING CODE (NPC), NATIONAL FIRE PROTECTION ASSOCIATION (NFPA), AND ANY OTHER NATIONAL OR LOCAL ORDINANCE OR CODE SHALL ALWAYS BE CONSIDERED MINIMUM REQUIREMENTS AND ABS WIRING STANDARDS SHALL NOT OVERRIDE ANY OF THE REQUIREMENTS OF THESE CODES.

SEQUENCE OF OPERATION

1. GLOBAL OUTSIDE AIR TEMPERATURE & HUMIDITY

1.1 GENERAL: THE CONSTRUCTOR SHALL PROVIDE, INSTALL AND WIRE THE OUTSIDE AIR TEMPERATURE & HUMIDITY SENSORS WITH A WEATHER/SUNSHIELD ENCLOSURE SHALL BE PROVIDED ON THE NORTHERN EXPOSURE OF THE BUILDING.

1.2 THE BMS SHALL CALCULATE THE OUTSIDE AIR ENTHALPY AND PROVIDE TO THE CONNECTED DDC DEVICES GLOBAL VALUES OF THE OUTSIDE AIR TEMPERATURE, HUMIDITY AND ENTHALPY FOR USE IN THEIR INDIVIDUAL CONTROL SEQUENCES, WHEN REQUIRED. THE BMS SHALL ALSO PROVIDE TRENDING OF THESE PARAMETERS FOR USE BY THE OPERATOR IN DETERMINING PAST AND CURRENT OUTSIDE AIR CONDITIONS OF THE SITE.

2. <u>WATER SOURCE HEAT PUMPS (WSHP-1 THROUGH WSHP-24)</u>

2.1 GENERAL: THE UNIT MANUFACTURER (UM) SHALL PROVIDE UNIT WITH INTEGRAL CONTROLS OUTLINED UNDER THE EQUIPMENT SPECIFICATIONS & SCHEDULES. THE UNIT MANUFACTURER (UM) SHALL ALSO PROVIDE A 2-POSITION WATER ISOLATION CONTROL VALVE (ISO). THE CONTRACTOR SHALL PROVIDE, FIELD INSTALL AND WIRE A BACNET MS/TP DDC CONTROLLER, ENCLOSURE, TRANSFORMERS, CONTROL VALVES, SENSORS, RELAYS, & ALL NECESSARY EQUIPMENT REQUIRED TO MEET THIS SPECIFICATION WITH SYSTEM CONTROL SEQUENCE AND COMPLETE INTEGRATION TO BMS.

2.2 SCHEDULING: THE SCHEDULE SHALL BE COMMUNICATED TO THE UNIT'S BACNET MS/TP DDC CONTROLLER AS ESTABLISHED IN THE GUI.

2.3 WATER SOURCE HEAT PUMPS (WSHP-2, 8, 9, 10, 11, 14, 16, 18 THROUGH 24) SERVING A SINGLE OFFICE OR A SPACE, SHALL BE CONTROLLED BY A SINGLE SPACE TEMPERATURE SENSOR'S OUTPUT (SEE PLANS FOR SENSOR LOCATION). WATER SOURCE HEAT PUMPS (WSHP-1, 3, 4, 5, 6, 7, 13, 15 & 17) SERVING MULTIPLE OFFICES OR MULTIPLE SPACES, SHALL BE CONTROLLED BY AVERAGING SPACE TEMPERATURE SENSORS' OUTPUT (SEE PLANS FOR SENSORS LOCATION). SPACE TEMPERATURE SENSOR (RMT): EACH SPACE TEMPERATURE SENSOR (RMT) SHALL HAVE A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (RMT) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT (RMSP) WITH AN OVERRIDE PUSHBUTTON; WHEN THE BUTTON IS DEPRESSED, THE UNIT SHALL BE SCHEDULED INTO THE “OCCUPIED” MODE FOR UP TO 3 HOURS (ADJ.); UPON THE EXPIRATION OF THE OVERRIDE, THE UNIT SHALL REVERT TO ITS SCHEDULED MODE. THE SPACE HEATING (HSP/UHSP) AND COOLING (CSP/UCSP) SHALL BE CONTROLLED FROM THE GUI. THE SETPOINTS SHALL BE INITIALLY SET AT 68 °F (ADJ.) FOR HEATING (HSP) & 78 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

2.4 “UNOCCUPIED” MODE: THE HEAT PUMP'S FAN SHALL BE COMMANDED “OFF”; THE COMPRESSOR SHALL BE COMMANDED “OFF”. THE CHANGEOVER VALVE (COV) SHALL BE IN THE HEATING POSITION; THE WATER ISOLATION VALVE (ISO) SHALL BE “CLOSED”.

2.5 “UNOCCUPIED COOLING” MODE: WHEN THE SPACE TEMPERATURE OR AVERAGE SPACE TEMPERATURE (RMT) IS HIGHER THAN THE “UNOCCUPIED COOLING” SETPOINT (UCSP) OF 80 °F (ADJ.); THE HEAT PUMP UNIT'S FAN (SS) SHALL BE COMMANDED “ON”, WHEN THE HEAT PUMP'S FAN HAS BEEN PROVEN “ON” BY THE FAN CURRENT SWITCH (SFST), THE CHANGEOVER VALVE (C/O) SHALL SWITCH TO “COOLING”, THE WATER ISOLATION VALVE (ISO) SHALL OPEN, THE COMPRESSOR STAGES (CLG) SHALL BE SEQUENCED ON. WHEN THE SPACE TEMPERATURE OR AVERAGE SPACE TEMPERATURE (RMT) IS LOWER THAT THE “UNOCCUPIED COOLING” SETPOINT (UCSP) HYSTERESIS; THE COMPRESSOR STAGES (CLG) SHALL BE SEQUENCED OFF, THE CHANGEOVER VALVE (C/O) SHALL REPOSITION FOR “HEATING”, THE WATER ISOLATION VALVE (ISO) SHALL CLOSE, THE UNIT SHALL REVERT BACK TO THE SCHEDULED SEQUENCE, THE HEAT PUMP'S FAN (SS) SHALL BE COMMANDED “OFF”. THE OWNER SHALL HAVE THE ABILITY TO MODIFY/DISABLE THIS FEATURE VIA SOFTWARE.

2.6 “UNOCCUPIED HEATING” MODE: WHEN THE SPACE TEMPERATURE OR AVERAGE SPACE TEMPERATURE (RMT) IS LOWER THAN THE “UNOCCUPIED HEATING” SETPOINT (UHSP) OF 55 °F (ADJ.), THE HEAT PUMP UNIT'S FAN (SS) SHALL BE COMMANDED “ON”. WHEN THE HEAT PUMP'S FAN HAS BEEN PROVEN “ON” BY THE FAN CURRENT SWITCH (SFST), THE WATER ISOLATION VALVE (ISO) SHALL OPEN, THE COMPRESSOR STAGES (HTG) SHALL BE SEQUENCED ON. WHEN THE SPACE TEMPERATURE OR AVERAGE SPACE TEMPERATURE (RMT) IS HIGHER THAN THE “UNOCCUPIED HEATING” SETPOINT (UHSP) HYSTERESIS, THE COMPRESSOR STAGES (HTG) SHALL BE SEQUENCED OFF, THE HEAT PUMP'S FAN (SS) SHALL BE COMMANDED “OFF”, THE WATER ISOLATION VALVE (ISO) SHALL CLOSE, THE UNIT SHALL REVERT BACK TO THE SCHEDULED SEQUENCE, THE OWNER SHALL HAVE THE ABILITY TO MODIFY/DISABLE THIS FEATURE VIA SOFTWARE.

2.7 “OCCUPIED” MODE: THE HEAT PUMP'S FAN (SS) SHALL BE COMMANDED “ON” AND RUN CONTINUOUSLY. WHEN THE HEAT PUMP'S FAN HAS BEEN PROVEN “ON” BY THE FAN CURRENT SWITCH (SFST), THE WATER ISOLATION CONTROL VALVE (ISO) SHALL OPEN.

2.8 “HEATING” MODE: (HEAT PUMP COMPRESSOR): THE SPACE TEMPERATURE (RMT) OR AVERAGE SPACE TEMPERATURE, THROUGH THE BACNET MS/TP DDC CONTROLLER, SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (HTG) TO MAINTAIN THE SPACE HEATING SETPOINTS (HSP). WHEN THE SPACE TEMPERATURE OR AVERAGE SPACE TEMPERATURE (RMT) IS LOWER THAN THE SPACE HEATING SETPOINT (HSP), THE HEAT PUMP UNIT'S CHANGE OVER-VALVE (C/O) SHALL BE POSITIONED TO “HEATING”, THE BACNET MS/TP DDC CONTROLLER SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (HTG) ON. WHEN THE SPACE TEMPERATURE OR AVERAGE SPACE TEMPERATURE (RMT) IS HIGHER THAN THE SPACE HEATING SETPOINT (HSP), THE BACNET MS/TP DDC CONTROLLER, SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (HTG) “OFF”.

2.9 REMOTE MOUNTED AIR FILTERS MONITORING: THE FILTERS SHALL BE INSTALLED AT EACH CEILING MOUNTED RETURN GRILLE WHICH IS ASSOCIATED WITH THE WATER SOURCE HEAT PUMP DUCTWORK SYSTEM. THE BACNET MS/TP DDC CONTROLLER SHALL MONITOR THE HEAT PUMP UNIT'S FAN RUN TIME (SFCS) & SHALL PROVIDE A MAINTENANCE REMINDER (FILTER) AT THE GUI WHEN THE FILTER REPLACEMENT TIMER SETTING (FILTERSP) HAS BEEN REACHED. SET THE FILTER REPLACEMENT AT 90 DAYS INTERVAL (ADJUSTABLE).

SEQUENCE OF OPERATION (CONT.)

3. <u>DOAS WATER SOURCE HEAT PUMPS (DOAS-1 THROUGH DOAS-7)</u>

3.1 GENERAL:

3.1.1 THE UNIT MANUFACTURER (UM) SHALL PROVIDE UNIT WITH INTEGRAL CONTROLS OUTLINED UNDER THE EQUIPMENT SPECIFICATIONS & SCHEDULES. THE UNIT MANUFACTURER (UM) SHALL ALSO PROVIDE A 2-POSITION WATER ISOLATION CONTROL VALVE (ISO). THE CONTRACTOR SHALL PROVIDE, FIELD INSTALL AND WIRE A BACNET MS/TP DDC CONTROLLER, ENCLOSURE, TRANSFORMERS, CONTROL VALVES, SENSORS, RELAYS, & ALL NECESSARY EQUIPMENT REQUIRED TO MEET THIS SPECIFICATION WITH SYSTEM CONTROL SEQUENCE AND COMPLETE INTEGRATION TO BMS.

3.1.2 THE SUPPLY AND EXHAUST FANS IN THE DOAS UNITS HAVE ETHER THE ELECTRONICALLY COMMUTATED MOTORS (ECM) OR VARIABLE FREQUENCY DRIVES (VFD) WHICH SHALL BE USED FOR INITIAL BALANCING PURPOSES.

3.2 SCHEDULING: THE SCHEDULE SHALL BE COMMUNICATED TO THE UNIT'S BACNET MS/TP DDC CONTROLLER AS ESTABLISHED IN THE GUI.

3.3 DOAS-4, & DOAS-6 UNITS OPERATION SHALL BE CONTROLLED BY A DEDICATED SPACE MOUNTED TEMPERATURE SENSOR (RMT): THE SPACE TEMPERATURE SENSOR (RMT) SHALL HAVE A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (RMT) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT (RMSP) WITH AN OVERRIDE PUSHBUTTON; WHEN THE BUTTON IS DEPRESSED, THE UNIT SHALL BE SCHEDULED INTO THE “OCCUPIED” MODE FOR UP TO 3 HOURS (ADJ.); UPON THE EXPIRATION OF THE OVERRIDE, THE UNIT SHALL REVERT TO ITS SCHEDULED MODE. THE SPACE HEATING (HSP/UHSP) AND COOLING (CSP/UCSP) SHALL BE CONTROLLED FROM THE GUI. THE SETPOINTS SHALL BE INITIALLY SET AT 72 °F (ADJ.) FOR HEATING (HSP) & 78 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

3.4 DOAS-1, DOAS-2, DOAS-3, DOAS-5 & DOAS-7 UNITS OPERATION SHALL BE CONTROLLED BY DUCT MOUNTED TEMPERATURE SENSORS. THE TEMPERATURE SENSOR SHALL BE MOUNTED IN THE DISCHARGE AIR DUCT OF EACH UNIT. THE SUPPLY DUCT HEATING (HSP/UHSP) AND COOLING (CSP/UCSP) SHALL BE CONTROLLED FROM THE GUI. THE SETPOINTS SHALL BE INITIALLY SET AT 72 °F (ADJ.) FOR HEATING (HSP) & 78 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

3.5 “UNOCCUPIED” MODE: THE UNIT SHALL DE-ENERGIZE, THE OUTSIDE AIR INTAKE AND EXHAUST DAMPERS SHALL CLOSE, AND THE CONTROL VALVE AT THE CONDENSER WATER SUPPLY SHALL CLOSE. THE CHANGEOVER VALVE (COV) SHALL BE IN THE HEATING POSITION; THE WATER ISOLATION VALVE (ISO) SHALL BE “CLOSED”.

3.6 “OCCUPIED” MODE: THE UNIT'S SUPPLY AND EXHAUST FANS SHALL BE COMMANDED “ON” AND RUN CONTINUOUSLY. WHEN THE UNIT'S SUPPLY AND EXHAUST FAN HAS BEEN PROVEN “ON” BY THE FAN CURRENT SWITCHES (SFST), THE WATER ISOLATION CONTROL VALVE (ISO) SHALL OPEN.

3.7 “HEATING” MODE: (HEAT PUMP COMPRESSOR): THE SPACE TEMPERATURE OR DUCT MOUNTED TEMPERATURE SENSOR, THROUGH THE BACNET MS/TP DDC CONTROLLER, SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (HTG) TO MAINTAIN THE SPACE HEATING OR DISCHARGE AIR TEMPERATURE SETPOINTS. WHEN THE SPACE TEMPERATURE OR DISCHARGE AIR TEMPERATURE IS LOWER THAN THE HEATING SETPOINT (HSP), THE UNIT'S CHANGE OVER-VALVE (C/O) SHALL BE POSITIONED TO “HEATING”, THE BACNET MS/TP DDC CONTROLLER SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (HTG) ON. WHEN THE SPACE TEMPERATURE OR DISCHARGE AIR TEMPERATURE IS HIGHER THAN THE SPACE OR DISCHARGE AIR HEATING SETPOINT (HSP), THE BACNET MS/TP DDC CONTROLLER SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (HTG) “OFF”.

3.8 “COOLING” MODE: THE SPACE TEMPERATURE OR DUCT MOUNTED TEMPERATURE SENSOR, THROUGH THE BACNET MS/TP DDC CONTROLLER, SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (CLG) TO MAINTAIN THE SPACE OR DISCHARGE AIR COOLING SETPOINTS (CSP). THE HEAT PUMP UNIT'S CHANGE OVER-VALVE (C/O) SHALL BE POSITIONED TO COOLING. WHEN THE SPACE OR DISCHARGE AIR TEMPERATURE IS HIGHER THAN THE SPACE OR DISCHARGE AIR COOLING SETPOINT (CSP), THE BACNET MS/TP DDC CONTROLLER SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (CLG) ON. WHEN THE SPACE OR DISCHARGE AIR TEMPERATURE IS LOWER THAN THE SPACE OR DISCHARGE AIR COOLING SETPOINT (CSP), THE BACNET MS/TP DDC CONTROLLER SHALL SEQUENCE THE HEAT PUMP COMPRESSORS (CLG) “OFF”. DURING THE “COOLING” MODE THE “HEATING” MODE SHALL BE DISABLED.

3.9 ECONOMIZER (COMPARATIVE ENTHALPY):

3.9.1 THE UNIT CONTROLLER SHALL MEASURE THE SUPPLY AIR TEMPERATURE AND MODULATE THE ECONOMIZER DAMPER POSITIONS AS THE FIRST STAGE OF COOLING TO MAINTAIN SUPPLY AIR TEMPERATURE SETPOINT.

3.9.2 THE OUTSIDE AIR DAMPER SHALL BE OPEN TO THE MINIMUM OUTSIDE AIR CFM SETTING ANYTIME THE UNIT IS IN OCCUPIED MODE. THE OUTSIDE AIR DAMPER SHALL BE CLOSED WHEN THE UNIT IS DISABLED.

3.9.3 THE ECONOMIZER SHALL BE ENABLED WHEN THE OUTSIDE AIR ENTHALPY IS LESS THAN RETURN/EXHAUST AIR ENTHALPY BY 2.0 BTU/LB AND THE SUPPLY FAN IS RUNNING.

3.9.4 THE ECONOMIZER SHALL DISABLE WHEN OUTSIDE AIR ENTHALPY IS GREATER THAN RETURN/EXHAUST ENTHALPY OR THE SUPPLY AIR TEMPERATURE FALLS BELOW THE SUPPLY AIR TEMPERATURE LOW LIMIT OF 40 DEG F. (ADJ.).

3.10 ENERGY RECOVERY WHEEL:

3.10.1 THE UNIT CONTROLLER SHALL MEASURE THE SUPPLY AIR TEMPERATURE AND RUN THE ENERGY RECOVERY WHEEL AS THE FIRST STAGE OF HEATING / COOLING TO MAINTAIN SUPPLY AIR TEMPERATURE SETPOINT.

3.10.2 COOLING RECOVERY MODE: WHEN THE OUTDOOR AIR OA ENTHALPY IS HIGHER THAN THE RETURN/EXHAUST AIR RA/EA ENTHALPY AND THE OUTDOOR AIR TEMPERATURE IS GREATER THAN THE ENERGY RECOVERY ENABLE SETPOINT THE WHEEL SHALL BE TURNED ON AND BOTH OUTSIDE AIR OA AND EXHAUST AIR EA BYPASS DAMPERS SHALL BE CLOSED. THE EXHAUST AIR BYPASS DAMPER SHALL MODULATE (AS NECESSARY) TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (ADJ.).

3.10.3 HEATING RECOVERY MODE: WHEN THE OUTSIDE AIR OA ENTHALPY IS LESS THAN THE RA ENTHALPY AND THE OA TEMPERATURE IS LESS THAN THE ENERGY RECOVERY ENABLE SETPOINT THE WHEEL SHALL BE TURNED ON AND BOTH OA AND EA BYPASS DAMPERS SHALL BE CLOSED. THE EA BYPASS DAMPER SHALL MODULATE (AS NECESSARY) TO MAINTAIN DISCHARGE AIR TEMPERATURE AT SETPOINT (ADJ.).

3.10.4 WHEN THE OA ENTHALPY IS LESS THAN THE RA/EA ENTHALPY AND THE AHU IS COOLING (OR AIRSIDE ECONOMIZING), THE WHEEL SHALL BE TURNED OFF AND BOTH OA AND EA BYPASS DAMPERS SHALL BE OPEN.

3.10.5 IF THE OA TEMPERATURE DROPS BELOW THE FROST THRESHOLD SETPOINT (ADJ.), THE OA BYPASS DAMPER SHALL MODULATE TO MAINTAIN THE EXHAUST SIDE LEAVING TEMPERATURE SETPOINT OF 20 DEG. F (ADJ.). IF THE OA BYPASS DAMPER REACHES 100% OPEN FOR 5 MINUTES (ADJ.), THE WHEEL SHALL BE TURNED OFF TO PREVENT FROSTING.

3.11 MINIMUM OUTSIDE AIR

3.11.1 THE OUTSIDE AIR DAMPER SHALL BE OPEN TO THE MINIMUM OUTSIDE AIR CFM SETTING ANYTIME THE UNIT IS OPERATING. THE OUTSIDE AIR DAMPER SHALL BE CLOSED WHEN THE UNIT IS DISABLED.

3.11.2 THE UNIT SHALL OVERRIDE NORMAL OUTSIDE AIR DAMPER OPERATION AND MODULATE THE DAMPER TO MAINTAIN OUTSIDE AIRFLOW SETPOINT.

3.12 DEHUMIDIFICATION

3.12.1 A FACTORY-INSTALLED HOT GAS REHEAT (HGRH) COIL SHALL BE AVAILABLE ON THE LEAD CIRCUIT OR WITH A SECOND COIL FOR REHEAT BOTH REFRIGERANT CIRCUITS. CYCLING OR MODULATING HGRH SHALL BE AVAILABLE.

3.12.2 THE UNIT CONTROLLER SHALL MEASURE THE RETURN/EXHAUST AIR HUMIDITY AND OVERRIDE THE COOLING SEQUENCE TO MAINTAIN RETURN AIR HUMIDITY AT OR BELOW 60% RH (ADJ.). DEHUMIDIFICATION SHALL BE CAPABLE OF BEING ENABLED WHENEVER THE SUPPLY FAN STATUS IS ON.

3.12.3 DURING DEHUMIDIFICATION THE COOLING SHALL OPERATE TO MAINTAIN RETURN/EXHAUST AIR HUMIDITY AND THE REHEAT HOT GAS BYPASS COIL SHALL REHEAT THE AIR TO DISCHARGE AIR TEMPERATURE SETPOINT.

3.13 FILTER DIFFERENTIAL PRESSURE SWITCHES

A DIFFERENTIAL PRESSURE SWITCH SHALL MONITOR THE DIFFERENTIAL PRESSURE ACROSS THE FILTER\ WHEN THE FAN IS RUNNING. IF THE SWITCH CLOSES DURING NORMAL OPERATION A DIRTY FILTER ALARM SHALL BE ANNUNCIATED AT THE BAS.

3.14 SMOKE DETECTORS

THE SMOKE DETECTORS SHALL BE INSTALLED AT THE SUPPLY AND RETURN/EXHAUST DUCT AT THE DOAS-2 UNIT. UPON ACTIVATION OF THE SMOKE DETECTOR, A SIGNAL SHALL BE SENT TO THE BUILDING'S FIRE ALARM PANEL. THE BUILDING'S FIRE ALARM PANEL SHALL SHUTDOWN THE DOAS-2 UNIT.

SEQUENCE OF OPERATION (CONT.)

4. <u>CONDENSER WATER LOOP SYSTEM (PUMPS P-1 & P-2, BOILERS B-1 & B-2, COOLING TOWER CT-1)</u>

4.1 GENERAL:

4.1.1 CONDENSER WATER LOOP TEMPERATURE SETPOINTS: WHEN THE CONDENSER WATER LOOP TEMPERATURE REACHES MAXIMUM SETPOINT THE COOLING TOWER TURNS ON TO REJECT HEAT AND HOLD THE MAXIMUM SETPOINT. WHEN THE CONDENSER WATER LOOP TEMPERATURE REACHES MINIMUM SETPOINT THE BOILER(S) TURNS ON TO HOLD MINIMUM SETPOINT. SET MAXIMUM / MINIMUM CONDENSER WATER SETPOINTS AT 95 °F / 60°F (ADJUSTABLE).

4.1.2 SYSTEM ENABLE MODE: THE CONDENSER WATER LOOP SYSTEM SHALL BE ENABLED WHENEVER SYSTEM IS SCHEDULED “ON” VIA BMS CONTROL SYSTEM. A MANUAL OVERRIDE OF THE BMS CONTROL SYSTEM SHALL BE PROVIDED TO ALLOW THE OPERATOR TO MANUALLY “ENABLE” THE SYSTEM.

4.2 CONDENSER WATER CIRCULATING PUMPS (P-1 AND P-2)

4.2.1 THE PUMP SHALL BE CONTROLLED BY A LOCAL UNIT CONTROLLER CONNECTED TO THE BMS SYSTEM.

4.2.2 SYSTEM ENABLE: THE LEAD PUMP SHALL BE COMMANDED “ON” AFTER THE CONDENSER WATER SYSTEM IS ENABLED AND THE CONDENSING WATER SUPPLY CONFIRMS STEADY FLOW BY A FLOW METER LOCATED IN THE CONDENSER WATER LOOP.

4.2.3 SYSTEM DISABLE: THE LEAD PUMP SHALL BE COMMANDED “OFF” IMMEDIATELY IF EITHER THE COOLING TOWER BYPASS CONTROL VALVE OR/AND THE BOILER BYPASS CONTROL VALVE IS NOT PROVEN “OPEN" BY ITS POSITION SWITCH, OR THE CONDENSER WATER LOOP DOES NOT HAVE A STEADY FLOW. OTHERWISE, WHEN THE LOOP WATER SYSTEM IS DISABLED, THE LEAD LOOP WATER PUMP SHALL REMAIN “ON” FOR AN ADDITIONAL 30 MINUTES (ADJ.).

4.2.4 LEAD / LAG CONTROL: EACH LOOP WATER PUMP SHALL BE MONITORED BY A CURRENT SWITCH (P#CS) FOR THE OPERATIONAL STATUS OF THE PUMP. IF THE LEAD PUMP FAILS TO OPERATE AFTER A DELAY OF 30 SECONDS (ADJ.), THE LAG PUMP SHALL BE COMMANDED “ON”. WHEN THE LAG PUMP IS STARTED IN AN ALARM CONDITION, THE LEAD PUMP SHALL BE COMMANDED “OFF”.

4.2.5 LEAD ROTATION: THE LEAD PUMP SHALL BE ROTATED EVERY 168 HOURS (ADJUSTABLE) OF ACCUMULATED RUN TIME OR VIA A MANUAL SELECTION POINT ON THE GRAPHICAL USER INTERFACE (GUI).

4.2.6 WATER SYSTEM PRESSURE CONTROL: A DIFFERENTIAL PRESSURE SENSOR (DPT), AS SHOWN ON THE DRAWINGS, SHALL MONITOR DIFFERENTIAL PRESSURE IN THE CONDENSER WATER SYSTEM. WHEN AN INCREASE IN THE SYSTEM PRESSURE (SWDP) IS ABOVE THE LOOP SYSTEM DIFFERENTIAL PRESSURE SETPOINT (SWDPSP), THE BMS VIA BACNET MS/TP DDC CONTROLLER SHALL MODULATE THE PUMP VARIABLE FREQUENCY DRIVE SPEED UNTIL THE SYSTEM DIFFERENTIAL PRESSURE (SWDP) LOWERS TO THE SYSTEM DIFFERENTIAL PRESSURE SETPOINT (SWDPSP). WHEN A DECREASE IN THE SYSTEM PRESSURE (SWDP) IS BELOW THE LOOP SYSTEM DIFFERENTIAL PRESSURE SETPOINT (SWDPSP), THE BMS SHALL MODULATE THE PUMP VARIABLE FREQUENCY DRIVE SPEED UNTIL THE SYSTEM DIFFERENTIAL PRESSURE (SWDP) RISES TO THE SYSTEM DIFFERENTIAL PRESSURE SETPOINT (SWDPSP). THE DIFFERENTIAL SETPOINT (SWDPSP) SHALL BE 20 PSIG (ADJUSTABLE). THE VFD'S AT THE PUMPS SHALL BE PROVIDED WITH A RAMP UP/DOWN TIME DELAY. THE TIME DELAY SHALL ALLOW THE PUMPS TO RAMP UP/DOWN SPEED OVER A 2 MINUTE PERIOD (ADJUSTABLE) WHEN THEY ARE ENABLED.

4.2.7 CONDENSER WATER LOOP FLOW MONITORING: A CONDENSER LOOP WATER SYSTEM BYPASS CONTROL VALVE (SWBYP) SHALL BE NORMALLY CLOSED. A FLOW METER (SWFL) SHALL MONITOR THE CONDENSER WATER FLOW RATE AND SEND A SIGNAL TO MODULATE 2-WAY CONTROL VALVE AT THE BYPASS SO THAT THE MINIMUM FLOW THROUGH THE SYSTEM IS SATISFIED. SET MINIMUM FLOW SET POINT AT 100 GPM (ADJUSTABLE).

4.2.8 COOLING TOWER MAKEUP WATER MONITORING: A FLOW METER SHALL MEASURE THE AMOUNT OF WATER PROVIDE TO THE COOLING TOWER BASIN SYSTEM. WHEN THE MAKE-UP WATER FLOW EXCEEDS THAT MAKE-UP WATER FLOW SETPOINT OF 3 GPM (ADJUSTABLE) IN ANY 10 MINUTE (SLIDING TIME WINDOW) PERIOD, THE BACNET DDC CONTROLLER SHALL GENERATE AN ALARM. THE BMS SHALL CALCULATE ACCOMULATIVE AMOUNT OF THE MAKEUP WATER PROVIDED TO THE COOLING TOWER ON DAILY, MONTHLY & YEARLY (ADJUSTABLE) BASIS.

4.3 SYSTEM IN HEAT REJECTION MODE

4.3.1 INITIAL CONDITIONS:

4.3.1.1 A CONDENSER WATER LOOP PUMP (P-1 OR P-2) IS COMMANDED “ON”.

4.3.1.2 THE COOLING TOWER BYPASS CONTROL VALVE IS COMMANDED “OPEN” (CTBV) AND IS PROVEN “OPEN” BY ITS POSITION SWITCH (CTB-O).

4.3.1.3 THE COOLING TOWER ISOLATION CONTROL VALVES ARE COMMANDED “SHUT” AND ARE PROVEN “SHUT” BY THEIR POSITION SWITCHES (CTS-S AND CTR-S).

4.3.1.4 THE BOILERS' BYPASS CONTROL VALVE IS COMMANDED “OPEN” (BBV) AND IS PROVEN “OPEN” BY ITS POSITION SWITCH (BB-S).

4.3.1.5 THE BOILERS' ISOLATION CONTROL VALVES ARE COMMANDED “SHUT” AND ARE PROVEN “SHUT” BY THEIR POSITION SWITCHES (BS-S AND BR-S).

4.3.2 CHANGEOVER TO HEAT REJECTION:

4.3.2.1 A CONDENSER WATER LOOP PUMP (P-1 OR P-2) SHALL REMAIN COMMANDED “ON”.

4.3.2.2 THE BOILERS' BYPASS CONTROL VALVE SHALL REMAIN “OPEN”.

4.3.2.3 THE BOILERS' ISOLATION CONTROL VALVES SHALL REMAIN “SHUT”.

4.3.2.4 THE COOLING TOWER ISOLATION CONTROL VALVES (CTSV AND CTRV) SHALL BE COMMANDED “OPEN” AND AFTER BOTH ARE PROVEN “OPEN” BY THEIR POSITION SWITCHES (CTS-O AND CTR-O) THE COOLING TOWER BYPASS CONTROL VALVE (CTBV) SHALL BE COMMANDED “SHUT” AND SHALL BE PROVEN “SHUT” BY ITS POSITION SWITCH (CTB-S).

4.3.3 COOLING TOWER CT-1 CONTROL (HEAT REJECTION)

4.3.3.1 GENERAL OPERATION: THE COOLING TOWER MANUFACTURER (UM) SHALL PROVIDE FACTORY THE COOLING TOWER FAN VFD WITH A BACNET COMMUNICATION CARD AND THEIR ASSOCIATED SAFETY CIRCUITRY (VIBRATION SHUTDOWN, OVERLOADS, ETC.), BASING HEATER, WATER MAKEUP VALVE W/ Y-STRAINER. OPERATION OF THE COOLING TOWER SHALL STAGE ITS COMPONENTS (SPRAY PUMP, FAN, ETC.) IN SEQUENCE TO MAINTAIN CONDENSER WATER SUPPLY TEMPERATURE SETPOINT.

4.3.3.2 SYSTEM ENABLE: THE COOLING TOWER CONTROL SHALL BE ENABLED WHEN THE COOLING TOWER SUPPLY AND RETURN CONTROL VALVES ARE BOTH PROVEN “OPEN” BY THEIR POSITION SWITCHES (CTS-O / CTR-O)

4.3.3.3 TEMPERATURE CONTROL: THE BACNET MS/TP DDC CONTROLLER SHALL CONTROL THE COOLING TOWER SPRAY PUMP (TSPSS) AND THE COOLING TOWER FAN (CTFSS) VARIABLE FREQUENCY DRIVE SPEED (CTFAO) TO MAINTAIN THE CONDENSER WATER LOOP TEMPERATURE SETPOINT (SWSP). WHEN THE LOOP WATER RETURN TEMPERATURE (SWR) IS HIGHER THAT THE LOOP WATER SETPOINT (SWSP), THE BMS SHALL COMMAND “ON” THE COOLING TOWER SPRAY PUMP (TSPSS). IF THE CONDENSER WATER RETURN TEMPERATURE (SWR) IS STILL HIGHER THAN THE LOOP WATER SETPOINT (SWSP), THE COOLING TOWER FAN (CTFSS) SHALL BE COMMANDED “ON”, THEN THE COOLING TOWER FAN VFD SPEED (CTFAO) SHALL MODULATE THE UPWARD TO 100%. THE REVERSE SEQUENCE SHALL OCCUR AS THE LOOP WATER RETURN TEMPERATURE (SWR) LOWERS TO THE LOOP WATER SETPOINT (SWSP).

4.3.3.4 SUB-FREEZING WEATHER (UNIT OPERATING): DURING SUB-FREEZING WEATHER THE MINIMUM RECOMMENDED SPEED FOR VARIABLE SPEED CONTROLLERS IS 50%. DURING OPERATION A MINIMUM BASIN WATER TEMPERATURE OF 40ºF (ADJ.) MUST BE MAINTAINED TO PREVENT FREEZING. MINIMUM CONTROL POINT FOR PROCESS FLUID SHOULD NEVER BE LOWER THAN 50º F (ADJ.). WHEN THE UNIT IS IN OPERATION DURING FREEZING WEATHER CAPACITY CONTROL REQUIREMENTS ARE 50% FAN SPEED AND MINIMUM FLOW RATE AT 250 GPM (ADJ.) - THE PROCESS FLUID TEMPERATURES SHALL NOT DROP BELOW 50 DEG. F (ADJ.).

4.3.3.5 SUB-FREEZING WEATHER (UNIT OFF): BASIN HEATER SHALL OPERATE TO KEEP THE RECIRCULATING WATER FROM FREEZING WHEN THE RECIRCULATION PUMP IS OFF. THE UNIT FAN SHALL NOT OPERATE WHEN THE RECIRCULATION PUMP IS OFF. THE BASIN HEATER SHALL MAINTAIN 40 DEG. F. (ADJUSTABLE) BASIN WATER TEMPERATURE AT A 0 DEG. F AMBIENT TEMPERATURE WHEN THE UNIT COMPLETELY SHUT DOWN.

4.3.3.6 ICE MANAGEMENT (DEFROST CYCLE): DURING DEFROST CYCLE THE FAN SHALL BE OPERATE IN REVERSE AT 50% FAN SPEED WHILE THE RECIRCULATING PUMP FLOW WATER THROUGH THE UNIT'S COIL CONDENSER WATER SYSTEM AT 250 GPM (ADJ.). THE DEFROST CYCLE SHALL BE MANUALLY SELECTABLE AT THE BMS OR AUTOMATIC IF OPERATOR HAS DEFINED FREQUENCY AND LENGTH.

4.3.3.7 COOLING TOWER FAN VIBRATION: THE COOLING TOWER MANUFACTURER (UM) SHALL PROVIDE, FACTORY INSTALL & WIRE A VIBRATION SWITCH. IF THE COOLING TOWER HAS EXCESSIVE VIBRATION, THE SWITCH SHALL SHUTDOWN THE COOLING TOWER FAN; PROVIDE A NORMALLY “CLOSED” CONTACT “ON” THE VIBRATION SWITCH.

4.3.3.8 BASIN WATER LEVEL CONTROL: THE BMS SHALL MONITOR THE WATER LEVEL. UPON LOW LEVEL ALARM BEING TRIGGERED AN ALARM SHALL GENERATE AT THE BMS AND THE ELECTRIC MAKEUP VALVE SHALL OPEN. THE ELECTRIC MAKEUP VALVE SHALL REMAIN OPEN UNTIL THE SUMP HIGH LEVEL ALARM IS TRIGGERED. UPON HIGH LEVEL ALARM BEING TRIGGERED AN ALARM SHALL GENERATE AT THE BMS AND THE MAKEUP WATER ISOLATION VALVE SHALL CLOSE. ELECTRIC MAKEUP VALVE WIRED AS PER COOLING TOWER MANUFACTURER'S DIRECTIONS.

US Army Corps of Engineers ®

NOT FOR CONSTRUCTION

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US ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT
LOUISVILLE, KY

MOTT MACDONALD
111 Wood Avenue
Iselin NJ 08830-4112
United States of America
T: + 732-780-6565
F: + 732-577-9551
www.mottmacamericas.com

UNITED STATES ARMY RESERVE CENTER
ORANGEBURG, NEW YORK

MECHANICAL CONTROL SEQUENCE OF OPERATION - SHEET 1

SHEET ID
MI103

CORRECTED FINAL SUBMISSION - JULY 29, 2021

SEQUENCE OF OPERATION (CONT.)

4.3.3.9 HEAT TRACING AND THERMAL INSULATION SHALL BE PROVIDED FOR THE COOLING TOWER MOUNTED SPRAY PUMP AND SPRAY PIPING, STANDPIPE ASSEMBLY, MAKEUP PIPING AND SOLENOID VALVE, OVERFLOW AND DRAIN LINES, ANY OTHER CONNECTIONS OT ACCESSORIES AT OR BELOW THE WATER LEVEL SUCH AS ELECTRONIC WATER LEVEL CONTROLLERS. THE CONTRACTOR SHALL PROVIDE, FIELD INSTALL & WIRE THE HEAT TRACING SYSTEM WHICH SHALL OPERATE UNDER BUILT IN CONTROL (BY HEAT TRACING UNIT MANUFACTURER) AND AS SHOWN ON THE ELECTRICAL DRAWINGS. INTEGRATE OPERATION OF THE HEAT TRACING SYSTEM TO THE BMS FOR MONITORING AND ALARMS.

4.3.3.10 WHEN HEAT REJECTION IS NO LONGER REQUIRES AS IT DETERMINED BY THE WATER LOOP TEMPERATURE SENSOR, THE SYSTEM SHALL OPERATE AS FOLLOWS:

4.3.3.10.1 A CONDENSER WATER LOOP PUMP (P-1 OR P-2) SHALL REMAIN "ON" OPERATING FOR 45 MINUTES (ADJ.) AND SHUTDOWN.

4.3.3.10.2 POSITION OF ALL CONTROL VALVES AT THE COOLING TOWER AND BOILERS SHALL BE AS STATED IN PARAGRAPHS 4.3.1.2 THROUGH 4.3.1.5 ABOVE.

4.3.4 COOLING TOWER WATER TREATMENT SYSTEM

4.3.4.1 THE WATER TREATMENT SYSTEM SHALL OPERATED UNDER BUILT IN CONTROL (BY EQUIPMENT MANUFACTURER). THE BAS SYSTEM SHALL MONITOR OPERATION OF THE WATER TREATMENT SYSTEM.

4.4 SYSTEM IN HEAT INJECTION MODE

4.4.1 INITIAL CONDITIONS

4.4.1.1 A CONDENSER WATER LOOP PUMP (P-1 OR P-2) IS COMMANDED "ON".

4.4.1.2 THE COOLING TOWER BYPASS CONTROL VALVE IS COMMANDED "OPEN" (CTBV) AND IS PROVEN BY ITS POSITION SWITCH (CTB-O).

4.4.1.3 THE COOLING TOWER ISOLATION CONTROL VALVES ARE COMMANDED "SHUT" AND ARE PROVEN "SHUT" BY THEIR POSITION SWITCHES (CTS-S AND CTR-S).

4.4.1.4 THE BOILERS' BYPASS CONTROL VALVE IS COMMANDED "OPEN" (BBV) AND IS PROVEN "OPEN" BY ITS POSITION SWITCH (BB-S).

4.4.1.5 THE BOILERS' ISOLATION CONTROL VALVES ARE COMMANDED "SHUT" AND ARE PROVEN "SHUT" BY THEIR POSITION SWITCHES (BS-S AND BR-S).

4.4.2 CHANGEOVER TO HEAT INJECTION:

4.4.2.1 A CONDENSER WATER LOOP PUMP (P-1 OR P-2) SHALL REMAIN COMMANDED "ON".

4.4.2.2 THE COOLING TOWER BYPASS CONTROL VALVE SHALL REMAIN "OPEN".

4.4.2.3 THE COOLING TOWER ISOLATION CONTROL VALVES SHALL REMAIN "SHUT").

4.4.2.4 THE BOILERS' ISOLATION CONTROL VALVES (BSV AND BRV) SHALL BE COMMANDED "OPEN" AND AFTER BOTH ARE PROVEN "OPEN" BY THEIR POSITION SWITCHES (BS-O AND BR-O) THE BOILERS' BYPASS CONTROL VALVE (BBV) SHALL BE COMMANDED "SHUT" AND SHALL BE PROVEN "SHUT" BY ITS POSITION SWITCH (BB-S).

4.4.3 BOILER CONTROL (BOILERS B-1 & B-2)

4.4.3.1 GENERAL: THE BOILER MANUFACTURER (UM) SHALL PROVIDE BOILER WITH ALL ASSOCIATED SAFETIES AND CONTROLS.

4.4.3.2 SYSTEM ENABLE: THE HOT WATER BOILER CONTROL SHALL BE ENABLED (BCPSS) WHEN A WATER FLOW IN THE LOOP IS PROVEN BY A WATER FLOW SWITCH. THE BMS VIA BACNET MS/TP DDC CONTROLLER SHALL STAGE FIRING RATE OF THE HOT WATER BOILERS TO MAINTAIN THE HOT WATER SETPOINT (HWSP). WHEN THE HOT WATER SUPPLY TEMPERATURE (HWS) IS LESS THAN THE HOT WATER SETPOINT (HWSP) THE BMS VIA BACNET MS/TP DDC CONTROLLER SHALL COMMAND ON THE HOT WATER BOILERS SEQUENTIALLY. THE REVERSE SEQUENCE SHALL OCCUR AS THE HOT WATER SUPPLY TEMPERATURE (HWS) RAISES TO THE HOT WATER SETPOINT (HWSP). SET SUPPLY HOT WATER TEMPERATURE SET POINT AT 95°F (ADJUSTABLE).

4.4.3.3 LEAD / LAG CONTROL: EACH HOT WATER BOILER SHALL BE MONITORED FOR THE OPERATIONAL STATUS OF THE BOILER. IF THE LEAD HOT WATER BOILER FAILS TO OPERATE, THE LAG HOT WATER BOILER SHALL BE COMMANDED "ON". WHEN THE LAG HOT WATER BOILER IS STARTED IN AN ALARM CONDITION, THE LEAD HOT WATER BOILER SHALL BE COMMANDED "OFF".

4.4.3.4 LEAD ROTATION: THE LEAD HOT WATER BOILER SHALL BE ROTATED EVERY 168 HOURS OF ACCUMULATED RUN TIME OR VIA A MANUAL SELECTION POINT ON THE GUI.

4.4.3.5 THE BOILERS CONTROL SHALL BE INTEGRATED TO BMS AND MONITOR THE BOILER MANAGEMENT PANEL, INCLUDING THE ENABLING (BCPSS) AND FAULT (BCPFLT).

4.4.3.6 EMERGENCY BOILER SHUTOFF SWITCH: ACTIVATION OF THE EMERGENCY SHUTOFF SWITCH SHALL IMMEDIATELY SHUTDOWN ALL BOILERS BY DISCONNECTING THE BOILERS FROM ALL SOURCES OF POWER TO THE BURNER CONTROLS.

4.4.3.7 WHEN HEAT INJECTION IS NO LONGER REQUIRES AS IT DETERMINED BY THE WATER LOOP TEMPERATURE SENSOR LOCATED AT THE CONDENSER LOOP, THE SYSTEM SHALL OPERATE AS FOLLOWS:

4.4.3.7.1 A CONDENSER WATER LOOP PUMP (P-1 OR P-2) SHALL REMAIN "ON" OPERATING FOR 45 MINUTES (ADJ.) AND SHUTDOWN.

4.4.3.7.2 POSITION OF ALL CONTROL VALVES AT THE COOLING TOWER AND BOILERS SHALL BE AS STATED IN PARAGRAPHS 4.3.1.2 THROUGH 4.3.1.5 ABOVE.

5. COMPUTER ROOM AIR CONDITIONING UNITS (CRAC-1/CRACC-1, CRAC-2/CRACC-2 & CRAC-3/CRACC-3)

5.1 GENERAL: THE UNIT MANUFACTURER (UM) SHALL PROVIDE THE UNITS WITH ALL INTERNAL CONTROLS AND SEQUENCES TO PERFORM THEIR FUNCTIONS. THE CONTRACTOR SHALL PROVIDE A BACNET MS/TP DDC CONTROLLER, SENSORS, RELAYS, STATUS SENSORS TO MONITOR THE UNITS ALARM CONDITION, EXTERNAL INTERLOCK WIRING WITH TERMINATION BETWEEN THE INDOOR CRAC AND ITS ASSOCIATED OUTDOOR CRACC CONDENSING UNIT, INTEGRATION OF THE UNITS' CONTROLS INTO BMS.

5.2 THE UNIT SHALL OPERATE UNDER BUILT-IN CONTROLS BY UNIT MANUFACTURER. THE UNIT SHALL ENABLE CONTINUOUSLY AND OPERATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE AND HUMIDITY SET POINTS VIA THE SPACE MOUNTED HUMIDISTAT AND THERMOSTAT. SET SPACE TEMPERATURE AT 72 (ADJUSTABLE) AND HUMIDITY AT 45 °F (ADJUSTABLE).

5.3 LEAK DETECTOR: A LEAK DETECTOR IN THE UNIT SHALL BE PROVIDED BY UNIT MANUFACTURE THE LEAK DETECTOR SHALL BE WIRED TO THE UNIT SUCH THAT WHEN A LEAK IS DETECTED THE UNIT SHALL SHUT DOWN AND AN ALARM SHALL BE ANNUNCIATED AT THE BMS.

5.4 AUXILIARY DRAIN PAN WITH A LEAK DETECTOR: A LEAK DETECTOR SHALL BE PROVIDED BY THE CONTRACTOR. THE LEAK DETECTOR SHALL BE WIRED TO THE UNIT SUCH THAT WHEN A LEAK IS DETECTED THE UNIT SHALL SHUT DOWN AND AN ALARM SHALL BE ANNUNCIATED AT THE BMS.

6. SPLIT SYSTEM HEAT PUMP UNIT (HP-1/HPC-1)

6.1 THE UNIT SHALL OPERATE UNDER BUILT-IN CONTROLS BY UNIT MANUFACTURER. THE UNIT SHALL ENABLE CONTINUOUSLY AND OPERATE AS REQUIRED TO MAINTAIN SPACE TEMPERATURE SET POINT VIA THE SPACE MOUNTED TEMPERATURE SENSOR.

6.2 SPACE TEMPERATURE SENSOR (RMT): THE UNIT MANUFACTURER SHALL PROVIDE SPACE TEMPERATURE SENSORS (RMT) WITH A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (RMT) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT (RMSP). THE SETPOINTS SHALL BE SET AT 74 °F (ADJUSTABLE).

7.1. MAKE-UP AIR UNIT MUA-1 AND EXHAUST FAN EF-3 (SERVICING KITCHEN HOOD IN THE KITCHEN 1023)

7.1 OPERATION OF THE MUA-1 UNIT AND THE EF-3 EXHAUST FAN SHALL BE UNDER THE CONTROL PANEL OF THE KITCHEN HOOD (BY KITCHEN HOOD SUPPLIER).

7.2 OPERATION OF THE EF-3 FAN SHALL BE MONITORED/CONTROLLED BY CONTROL PANEL OF THE KITCHEN HOOD.

7.3 INITIAL START OF THE MUA-1 AND EF-3 UNITS SHALL BE DETERMINED BY A MANUAL OPERATOR COMMAND, INITIATING PRE-PROGRAMMED CONTROL ALGORITHM, RESIDING IN THE CONTROL CENTER OF THE KITCHEN HOOD.

7.3.1 WHEN OPERATION OF THE KITCHEN HOOD IS INITIATED, THE SUPPLY FAN IN THE MUA-1 SHALL OPERATE CONTINUOUSLY. THE OUTSIDE AIR DAMPER AT THE UNIT SHALL OPEN, AND THE NATURAL GAS FURNACE SHALL MODULATE AS REQUIRED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE (AS DETECTED BY A DUCT MOUNTED TEMPERATURE SENSOR) AT 68°F (ADJUSTABLE). THE MUA-1 UNIT SHALL DE-ENERGIZE WHEN THE KITCHEN HOOD IS NOT OPERATING, THE OUTSIDE AIR DAMPER SHALL BE CLOSED, AND THE NATURAL GAS FURNACE SHALL DE-ENERGIZE.

7.3.2 WHEN OPERATION OF THE KITCHEN HOOD IS INITIATED, THE EXHAUST FAN EF-3 SHALL OPERATE CONTINUOUSLY. THE EF-3 FAN SHALL DE-ENERGIZE WHEN THE KITCHEN HOOD IS NOT OPERATING.

7.4 EMERGENCY MODE

IF THE FREEZESTAT LOCATED AT DOWNSTREAM OF THE NATURAL GAS FURNACE OF THE MUA-1 UNIT DETECTS THE TEMPERATURE BELOW 45°F (ADJUSTABLE), THE SUPPLY FAN SHALL STOP, THE OUTSIDE AIR DAMPER SHALL CLOSE. ALARM CONDITION WHEN THE UNIT IN THE EMERGENCY MODE TO THE BMS.

SEQUENCE OF OPERATION (CONT.)

8. GLYCOL MAKE-UP PACKAGE (GP-1)

8.1 THE GLYCOL PACKAGE WILL OPERATE UNDER BUILT-IN CONTROLS (BY UNIT MANUFACTURER) AND WILL MAINTAIN A CONSISTENT PRESSURE IN CLOSED CONDENSER WATER SYSTEM LOOP BY FEEDING GLYCOL ON A PRESSURE DROP.

8.2 GLYCOL PANEL SYSTEM MONITORING: THE CONTRACTOR SHALL INTEGRATE TO BMS (BACNET) AND MONITOR THE GLYCOL SYSTEM PANEL, INCLUDING STATUS (GPCS) AND FAULT (GCPFLT).

8.3 IF THE GLYCOL MAKE-UP PACKAGE IS SHUT DOWN BY THE BUILT-IN SAFETY CONTROLS, THE AUDIBLE AND VISUAL ALARM SHALL INITIATE AT THE LOCAL GLYCOL MAKE-UP PACKAGE CONTROL PANEL. AN ALARM SIGNAL SHALL BE SENT TO BMS.

9. EXHAUST FANS EF-1 & EF-5 AND MOTOR OPERATED DAMPERS BEHIND LOUVERS (MECHANICAL AND ELECTRICAL ROOM VENTILATION)

9.1 GENERAL: THE CONTRACTOR SHALL PROVIDE A CONTROL RELAY (R), A CURRENT SWITCH (CS), AND DAMPER STATUS END-SWITCH (ES) TO COMMAND (EFSS OR SFSS) AND MONITOR (EFST OR SFST) THE FAN. PROVIDE WALL MOUNTED THERMOSTATS IN EACH ROOM WITH MANUAL ON/OFF/AUTO OVERRIDE SWITCH.

9.2 INTERLOCK OPERATION AS FOLLOWS:
A. EXHAUST FAN EF-1 WITH MOTOR OPERATED DAMPERS AT THE FAN AND BEHIND THE AIR INTAKE LOUVER IN THE MECHANICAL ROOM.
B. EXHAUST FAN EF-5 WITH MOTOR OPERATED DAMPERS AT THE FAN AND BEHIND THE AIR INTAKE LOUVER IN THE ELECTRICAL ROOM.

9.3 IF THE SPACE AIR TEMPERATURE RISES ABOVE THE SET POINT, THE EXHAUST FAN SHALL START AND OPERATE CONTINUOUSLY. THE EXHAUST FAN SHALL NOT OPERATE UNTIL THE END SWITCHES AT THE RESPECTIVE MOTOR OPERATED DAMPERS INDICATE THAT ALL DAMPERS ARE OPEN.

9.4 WHEN THE SPACE TEMPERATURE DROPS BELOW THE SET POINT, THE EXHAUST FAN SHALL STOP AND ALL RESPECTIVE MOTOR OPERATED DAMPERS SHALL CLOSE.

9.5 THE BMS SHALL MONITOR THE SPACE TEMPERATURE AND STATUS OF THE EXHAUST FAN AND ALL RESPECTIVE MOTOR OPERATED DAMPERS.

9.6 SET SPACE TEMPERATURE SET POINT AT 80°F (ADJUSTABLE).

10. SUPPLY FAN SF-1 AND EXHAUST FAN EF-2 (VENTILATION FOR THE EXISTING EMERGENCY GENERATOR)

10.1 GENERAL: THE CONTRACTOR SHALL PROVIDE A CONTROL RELAY (R), A CURRENT SWITCH (CS), AND DAMPER STATUS END-SWITCH (ES) TO COMMAND (EFSS OR SFSS) AND MONITOR (EFST OR SFST) THE FANS.

10.2 INTERLOCK OPERATION OF THE SUPPLY AND EXHAUST FANS, MOTOR OPERATED DAMPERS AT EACH FAN WITH THE EXISTING EMERGENCY GENERATOR LOCATED IN THE MECHANICAL ROOM.

10.3 WHEN THE EXISTING EMERGENCY GENERATOR IS ON, THE SUPPLY AND EXHAUST FANS SHALL START AND OPERATE CONTINUOUSLY. THE SUPPLY OR EXHAUST FAN SHALL NOT OPERATE UNTIL THE END SWITCHES AT THE RESPECTIVE MOTOR OPERATED DAMPERS INDICATE THAT ALL DAMPERS ARE OPEN.

10.4 WHEN THE EXISTING EMERGENCY GENERATOR IS OFF, THE SUPPLY AND EXHAUST FANS SHALL STOP AND ALL RESPECTIVE MOTOR OPERATED DAMPERS SHALL CLOSE.

10.5 THE BMS SHALL MONITOR STATUS OF THE SUPPLY AND EXHAUST FANS AND ALL RESPECTIVE MOTOR OPERATED DAMPERS.

11. EXHAUST FAN EF-4 (SERVICING KITCHEN HOOD LOCATED IN SCULLERY 1024)

11.1 OPERATION OF THE EF-4 EXHAUST FAN SHALL BE UNDER THE CONTROL PANEL OF THE KITCHEN HOOD (BY KITCHEN HOOD SUPPLIER).

11.2 INITIAL START OF THE EF-4 FAN SHALL BE DETERMINED BY A MANUAL OPERATOR COMMAND, INITIATING PRE-PROGRAMMED CONTROL ALGORITHM, RESIDING IN THE CONTROL CENTER OF THE KITCHEN HOOD.

11.3 WHEN OPERATION OF THE KITCHEN HOOD IS INITIATED, THE EXHAUST FAN EF-4 SHALL OPERATE CONTINUOUSLY. THE EF-4 FAN SHALL DE-ENERGIZE WHEN THE KITCHEN HOOD IS NOT OPERATING.

11.4 OPERATION OF THE EXHAUST FAN SHALL BE MONITORED/CONTROLLED BY CONTROL PANEL OF THE KITCHEN HOOD.

12. HAZARDOUS GAS MONITORING SYSTEM

12.1 THE HAZARDOUS GAS MONITORING SYSTEM SHALL BE PROVIDED IN THE MECHANICAL ROOM AND CONSIST OF:

- DIGITAL GAS DETECTION AND CONTROL SYSTEM
- A WALL MOUNTED CARBON MONOXIDE (CO) SENSOR LOCATED 2-3 FEET ABOVE THE FLOOR
- COMBUSTIBLE GAS (CH4) SENSOR LOCATED 1 FOOT BELOW THE CEILING
- AUDIO/VISUAL ALARMS WITH RESET BUTTON (LOCATED INDOOR AT THE MECHANICAL ROOM DOOR)
- COMBINATION STROBES/HORNS INDICATORS (LOCATED OUTDOOR AT THE MECHANICAL ROOM DOOR)

12.2 INTERLOCK OPERATION OF THE HAZARDOUS GAS DETECTION AND CONTROL SYSTEM WITH AUTOMATIC SAFETY NATURAL GAS SHUTOFF VALVES (VALVES AS SHOWN ON PLUMBING DWGS), BOILERS B-1 & B-2, AND DOMESTIC WATER HEATER DWH-1 (SHOWN ON PLUMBING DRAWINGS).

12.3 WHEN CARBON MONOXIDE (CO) LEVEL RISES ABOVE 25 PPM (ADJUSTABLE) OR COMBUSTIBLE GAS LEVEL RISES ABOVE LOWER EXPLOSIVE LIMIT (LEL) SET POINT OF 20% LEL (ADJUSTABLE), AN AUDIBLE & VISUAL ALARMS IN AND JUST OUTSIDE THE MECHANICAL ROOM SHALL INITIATE, THE BOILERS B-1 & B-2 AND DOMESTIC WATER HEATER SHALL DISABLE, THE AUTOMATIC SAFETY NATURAL GAS SHUTOFF VALVES SHALL CLOSE. A HARDWIRED CONNECTION SHALL PROVIDE AN ALARM TO THE BMS.

12.5 THE LOCAL ALARM DEVICE SHALL HAVE AN ALARM SILENCE BUTTON.

12.6 WHEN THE CARBON MONOXIDE OR THE COMBUSTION GAS LEVELS DROP BELOW THE SET POINTS, THE HAZARDOUS GAS DETECTION AND CONTROL SYSTEM SHALL DEACTIVATE. START UP OF THE BOILERS AND DOMESTIC WATER HEATER SHALL BE DONE MANUALLY BY OPERATOR.

13. EMERGENCY AIR DISTRIBUTION SHUTOFF SWITCH (TYPICAL FOR 2)

13.1 BUILDING - EMERGENCY SHUTDOWN MODE: THE CONTRACTOR SHALL PROVIDE, INSTALL & WIRE A MANUAL MUSH-ROOM HEAD STYLE, SWITCH WITH A PROTECTIVE FLIP COVER. THIS SWITCH SHALL BE LOCATED AS SHOWN ON DRAWINGS & SHALL ALLOW FOR MANUAL OPERATION.

13.2 SHUTDOWN INITIATION MODE: WHEN THE SWITCH IS PUSHED, ALL OF THE DDC CONTROLLED EQUIPMENT SHALL BE COMMANDED "OFF" INCLUDING:

- CLOSE OUTSIDE AND EXHAUST AIR DAMPERS IN DOAS-1 THROUGH DOAS-6 UNITS
- CLOSE OA INTAKE DAMPER IN MAU-1
- SHUT DOWN EXHAUST FANS EF-1, EF-2, EF-3, EF-4
- SHUT DOWN SUPPLY FAN SF-1
- CLOSE MOTOR OPERATED DAMPERS AT SF-1, EF-1 THRU EF-4 FANS
- CLOSE AIR INTAKE MOTOR OPERATED DAMPER IN THE MECHANICAL ROOM
- CLOSE AIR INTAKE MOTOR OPERATED DAMPER IN THE ELECTRICAL ROOM

13.3 ACTIVATION OF THE EMERGENCY SWITCH SHALL SHUTDOWN THE DDC CONTROLLED EQUIPMENT REGARDLESS OF THEIR OPERATION MODE (OCCUPIED / UNOCCUPIED) AND CLOSE ASSOCIATED LOW LEAKAGE DAMPERS WITH 30 SECONDS OF SWITCH ACTIVATION

13.4 PROVIDE VISIBLE SIGN NEXT TO EACH EMERGENCY SWITCH READING: "EMERGENCY AIR DISTRIBUTION SHUTOFF SWITCH". SEE MECHANICAL DRAWINGS FOR LOCATION OF THE SWITCHES.

14. UTILITY METER DATA MANAGEMENT SYSTEM

14.1 ALL ENERGY USAGE METERS (GAS, WATER AND ELECTRIC) SHALL BE CONNECTED TO THE BMS SYSTEM FOR MONITORING. DATA SHALL BE STORED LOCALLY AT THE BMS.

14.2 THE FOLLOWING DATA SHALL BE MONITORED FOR EACH METER:

- HOURLY LOAD PROFILES FOR EACH DAY
- MONTHLY AVERAGE DAILY LOAD PROFILES
- MONTHLY AND ANNUALLY ENERGY CONSUMPTION
- MONTHLY AND ANNUAL PEAK DEMAND

US Army Corps of Engineers ®

NOT FOR CONSTRUCTION

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US ARMY CORPS OF ENGINEERS
LOUISVILLE DISTRICT
LOUISVILLE, KY

MOTT MACDONALD
111 Wood Avenue
Iselin, NJ 08830-4172
United States of America
T. + 732-780-8565
F. + 732-577-0551
www.mottmacamericas.com

UNITED STATES ARMY RESERVE CENTER
ORANGEBURG, NEW YORK

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