

BMS GENERAL SPECIFICATIONS

GENERAL:

THE PROPOSED BMS FOR THIS PROJECT SHALL ENSURE AN OPTIMUM UTILIZATION OF ENERGY AND THE OPERATION OF ALL ELECTRICAL AND MECHANICAL COMPONENTS/SYSTEMS LISTED HEREIN. THE BMS SHOULD BE ABLE TO MONITOR AND CONTROL THE LISTED BMS EQUIPMENT AND DEVICES TO EFFECTIVELY PERFORM ENERGY MANAGEMENT FUNCTIONS. THE SYSTEM SHALL BE MODULAR IN DESIGN AND CAN BE INSTALLED AND OPERATED IN STAGES. THE FULL PROJECT REQUIREMENT FOR THE BMS SHALL INCLUDE THE FOLLOWING:

* REQUIREMENTS:

THE PROPOSED BMS FOR THIS PROJECT SHALL ENSURE AN OPTIMUM UTILIZATION OF ENERGY AND THE OPERATION OF ALL ELECTRICAL AND MECHANICAL COMPONENTS/SYSTEMS LISTED HEREIN. THE BMS SHOULD BE ABLE TO MONITOR AND CONTROL THE LISTED BMS EQUIPMENT AND DEVICES TO EFFECTIVELY PERFORM ENERGY MANAGEMENT FUNCTIONS. THE SYSTEM SHALL BE MODULAR IN DESIGN AND CAN BE INSTALLED AND OPERATED IN STAGES. THE I/O POINT TABULATION SHOWS THE MINIMUM SCOPE OF BMS WORK. REFER TO THE FINAL I/O POINT COUNT REQUIREMENT. THE PROGRAMMABLE LOGIC CONTROLLER (PLC) PANELS SHOULD BE SIZED TO ACCOMMODATE UP TO 3 TIMES THE TOTAL OF I/O POINTS LISTED IN THE I/O POINT TABULATION FOR FUTURE EXPANSION. THE WALL SPACE SHOULD ALSO ALLOW FUTURE INSTALLATION OF ADDITIONAL PLC. THE FULL PROJECT REQUIREMENT FOR THE BMS SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

* MONITORING:

MONITORING SHALL CONSIST OF AN INDICATION OF THE STATUS SUCH AS:
 - RUNNING HOURS OF MECHANICAL EQUIPMENT (PUMPS, AHUS, FANS, AC SYSTEMS)
 - ELECTRIC METER IN ACCUMULATED KWHRs
 - ELECTRICAL SWITCHBOARD STATUS (HV & LV) ON, OFF, ALARM/MOTOR FAULT/TRIP

* CONTROL:

CONTROLLING SHALL AUTOMATICALLY ACTIVATE THE ASSOCIATED SYSTEMS VIA THE CENTRAL CONTROL PANEL OF THE SYSTEM INCLUDING START/STOP FUNCTION, TIME/LOG CONTROL AND ADJUSTMENTS, STATUS/ALARM INDICATION, SYSTEM PROGRAMMING AND RECORDING. SEQUENCE OF THE FOLLOWING SYSTEMS:
 - CENTRAL CHILLER WATER PLANT INCLUDING, CHILLERS, PUMPS AND COOLING TOWERS.
 - EXPOSED AC EQUIPMENT SUCH AS AHUS AND FOUS.
 - EXHAUST & VENTILATION EQUIPMENT FOR TRANSFORMER, TOILETS, AND COMMON AREAS.

OTHER FUNCTIONS FOR THE BMS SHOULD INCLUDE BUT NOT LIMITED TO:

- KWHR RECORDING FOR EQUIPMENT OR GROUP OF EQUIPMENTS
- RE-START AFTER POWER FAILURE.
- POWER MONITORING AND AUTOMATIC OPTIMIZATION BY REVISED SEQUENCE OF OPERATION FOR MULTIPLE UNITS, START DELAY, EARLY SWITCH OFF, OR BY LOAD SHEDDING PROCEDURE.
- SET POINTS CONTROL/CHANGES/ADJUSTMENTS
- TIMER SETTINGS WITH CALENDARS AND SPECIAL DAYS
- SENSOR MEASURING AND RECORDING
- RUNNING TIME LOGIZATION
- PROVISION FOR FUTURE EXPANSIONS, ETC.

* SYSTEM CONFIGURATION:

THE BMS SHALL BE MODULAR IN DESIGN THAT WILL ALLOW INSTALLATION AND INDEPENDENT OPERATION OF EACH PROGRAMMABLE LOGIC CONTROLLER AND SHALL BE WIRED TO A CENTRAL PC TERMINAL FOR DATA GATHERING AND HUMAN INTERFACE. THE PC TERMINAL SHALL HAVE ITS OWN ACCESS PROTOCOLS AND SPECIFIC FUNCTIONS. THE BMS SYSTEM SHALL BE CAPABLE OF STARTING WITH THE PRIORITY REQUIREMENTS AND EXPANDING INTO THE TOTAL REQUIREMENT OF THE PROJECT IN STAGES.

THE BMS SHALL GATHER DATA ON A CONTINUING BASIS, PROCESS THE DATA AND ISSUE COMMANDS TO THE INDIVIDUAL COMPUTER-BASED LOGIC CONTROLLER TO CLOSE, OPEN, OR MODULATE THE ELECTRICAL-MECHANICAL CONTROLLERS OF ALL SYSTEM BEING MONITORED. EACH PROGRAMMABLE LOGIC CONTROLLER SHALL OPERATE WITH THE CORRESPONDING SENSORS AND INTERFACES ON A STAND-ALONE ARRANGEMENT AND WILL PERFORM PEER-TO-PEER COMMUNICATION WITH THE CENTRAL OPERATOR TERMINAL. THE MEMORY CAPACITY OF EACH PLC SHALL BE FOR A MINIMUM OF TWO YEARS OR AT LEAST 120GBTES.

THE PC WORKSTATION WILL BE LOCATED AT THE ENGINEERING OFFICE INCLUDED WITH PRINTERS, BMS HUB, DISPLAY MONITORS. THE PC TERMINAL OR OPERATOR WORKSTATION SHALL BE THE OPERATIONAL HUB OR ONE COMPATIBLE PERSONAL COMPUTER RUNNING ON WINDOWS ENVIRONMENT AND OPERATED BY MOUSE AND KEYBOARD. THE OPERATOR WORKSTATION SHALL SERVE AS THE HUMAN-MACHINE INTERFACE FOR PROGRAMMING, ANNUNCIATION AND DATA PROCESSING. HARD COPY PRINTOUT CAN BE DIRECTED TO ALARM AND REPORT PRINTERS FOR AUTOMATIC RECORDING. THE MINIMUM REQUIREMENTS FOR AN OPERATOR WORKSTATION SHALL BE:

- MINIMUM INTEL I7 PROCESSOR WITH 3.4 GHZ CORE SPEED OR EQUAL
- PROVIDE AND USE ISOPETE OF RAM
- V.90 MODEM WITH A VOICE/DATA/TAX SPEED OF 56K BAUD
- NOT LESS THAN 100GBTES OF SOLID STATE DRIVE (SSD) SPACE
- SERIAL/PARALLEL INTERFACE PORT
- AT LEAST EIGHT USB PORTS/ BLUETOOTH CONNECTIVITY
- RS232 PORT FOR INTERFACING PURPOSES
- 10/100/1000 ETHERNET WITH RJ45 CONNECTION
- 32" TFT LED/ OLED COLOR GRAPHIC DISPLAY WITH A MINIMUM DISPLAY RESOLUTION OF NOT LESS THAN 1200X GOOD FOR CONTINUOUS OPERATION. MULTI DISPLAY PORTS INCLUDED TO PERFORM MULTI DISPLAY FUNCTION SCREEN MANAGEMENT.
- TAPE BACKUP, INTERNAL ZIP DRIVE, ZOWIE
- UPS WITH CAPACITY CAPABLE OF MAINTAINING THE EQUIPMENT OPERATIONAL FOR A MINIMUM OF 24 HOURS DURING POWER FAILURE.
- WINDOWS 10 OPERATING SYSTEM.
- COMPLETE OPERATOR WORKSTATION SOFTWARE PACKAGE, INCLUDING ANY HARDWARE OR SOFTWARE SERIAL KEYS.
- ORIGINAL INSTALLATION DISKS, LICENSES FOR ALL SOFTWARE, DEVICE DRIVERS, AND PERIPHERALS.
- PROVIDE SOFTWARE REGISTRATION CARDS TO THE OPERATOR FOR ALL SOFTWARE
- TWO (2) CPU's: ONE (1) SERVER AND ONE (1) FOR THE CLIENT MUST BE PROVIDED.
- THE SYSTEM SHALL BE ABLE TO PICK UP THE SIGNALS FROM THE SENSORS, METER CONTROLS, FLOW METERS, ETC., AND BE ABLE TO UTILIZE THE DATA TO OPTIMIZE SYSTEM OPERATION OR SAVE ENERGY. THE SYSTEM SHOULD BE COMPATIBLE WITH OTHER BUILDING UTILITIES, OR PROVIDED WITH INTERFACING MODULES OR DIGITAL TRANSLATORS FOR COMPLETE INTEGRATION OF ALL RELEVANT SYSTEMS. THE SYSTEM SHOULD BE ABLE TO COLLECT DATA ON ENERGY USE AND EQUIPMENT OPERATING RECORD, COMPLETE AND CONSOLIDATE ALL BASIC DATA FOR FUTURE OPTIMIZING PROCEDURES. ALL INFORMATION RELATING TO THE ENERGY USE RECORD SHOULD BE COLLECTED OVER A PREDETERMINED AUDIT TIME PERIOD.

AN INTEGRATED, LICENSED SOFTWARE SHALL BE USED AS THE OPERATOR INTERFACE PROGRAM. ALL INPUTS, OUTPUTS, SET POINTS, AND ALL OTHER PARAMETERS AS DEFINED WITHIN THE BMS POINT SCHEDULES SHALL BE DISPLAYED FOR OPERATOR VIEWING AND MODIFICATION FROM THE OPERATOR INTERFACE SOFTWARE. EACH PLC SHALL COMPLETE AN ENTIRE INTERNAL SCAN IN LESS THAN ONE SECOND. EACH INTERNAL SCAN SHALL CONSIST OF UPDATING ON INPUTS, GATHERING DATA FROM OTHER CONTROLLERS, MAKING NECESSARY MATHEMATICAL CALCULATIONS AND SEQUENCING APPROPRIATE OUTPUTS FOR LOCAL LOOP CONTROL. THE PLC SHALL HAVE AT LEAST 256KB OF USER AVAILABLE RANDOM ACCESS MEMORY (RAM) AND 4MB OF ERASABLE PROGRAMMABLE READ ONLY MEMORY (EPROM).

DURING A POWER FAILURE CONDITION, THE CONTROLLER SHALL:
 A) MAINTAIN INTERNAL CLOCK OPERATION
 B) MAINTAIN ALL PROGRAMS
 C) CONTINUE TO COMMUNICATE OVER THE INTERNAL SYSTEM BUSES TO OTHER COMPONENTS OF THE CONTROL SYSTEM THAT STILL HAVE AC POWER

- SETPOINTS - RUN TIMES
- ALARM LIMITS - POINT STATISTICS
- TIME DELAYS - SCHEDULES
- PID TUNING CONSTANTS

HAZARDOUS:

THE PLC'S SHALL CONTAIN IT'S CONTROL PROGRAMS IN A COMBINATION OF EPROM AND BATTERY BACKED-UP RAM. ALL DATA STORED IN RAM SHALL BE BATTERY BACKED-UP FOR AT LEAST 10 YEARS. EACH PLC SHALL HAVE THE INSTALLED INTELLIGENCE TO PERFORM ALL CONTROL STRATEGIES, WITHOUT CONNECTION TO OTHER CONTROLLERS. IN ADDITION, EACH PLC SHALL BE ABLE TO HAVE IT'S PROGRAM EDITED AND/OR PROGRAMS DELETED AND/OR RELOADED. EACH PLC SHALL COMPLETE AN ENTIRE INTERNAL SCAN IN LESS THAN ONE SECOND. EACH INTERNAL SCAN SHALL CONSIST OF UPDATING ON INPUTS, GATHERING DATA FROM OTHER CONTROLLERS, MAKING NECESSARY MATHEMATICAL CALCULATIONS AND SEQUENCING APPROPRIATE OUTPUTS FOR LOCAL LOOP CONTROL. THE PLC SHALL HAVE AT LEAST 256KB OF USER AVAILABLE RANDOM ACCESS MEMORY (RAM) AND 4MB OF ERASABLE PROGRAMMABLE READ ONLY MEMORY (EPROM).

- A) INDICATOR ONLINE
- B) UPDATE ALL MONITORED FUNCTIONS
- C) RESUME OPERATION BASED ON CURRENT TIME AND STATUS
- D) IMPLEMENT SPECIAL BUILDING START-UP STRATEGIES AS REQUIRED
- E) LOG TIME OF POWER OUTAGES AND START-UPS

BMS CABINET:

- FULL BOX - ONE (1) UNIT PER FLOOR SIZED AT 300x300x100 (WxDxH) AS NEEDED
- NETWORK SWITCH - SIZE AND QUANTITY WILL VARY PER REQUIREMENT.
- DIRECT DIGITAL CONTROL (DDC) PANEL - SIZE AND QUANTITY WILL VARY DEPENDING ON THE NUMBER OF POINTS CONTROLLED/ MONITORED PER FLOOR. MOUNTING HEIGHT FROM FTL TO THE TOP OF PANEL MUST BE AT 1800MM.
- CONVENIENCE OUTLET (CO) OUTSIDE THE BMS CABINET FOR UPS (5-10AMP RATING) UNDER NON LIFE SAFETY PANEL. ELECTRICAL TO SPECIFY THE UPS RATING, REQUIRED BRANCH CIRCUITRY, AND RATING.

AUXILIARY (AUX) ROOM:

- AUXILIARY ROOM PER FLOOR SHALL HAVE A MINIMUM SIZE OF 1.5X3.0METERS (4.550M) DEPENDING ON THE SIZE OF RISERS AND CABINETS.
- FULL BOX - ONE (1) UNIT PER FLOOR SIZED AT 300x300x100 (WxDxH) AS NEEDED
- NETWORK SWITCH - SIZE AND QUANTITY WILL VARY PER REQUIREMENT.
- DIRECT DIGITAL CONTROL (DDC) PANEL - SIZE AND QUANTITY WILL VARY DEPENDING ON THE NUMBER OF POINTS CONTROLLED/ MONITORED PER FLOOR. MOUNTING HEIGHT FROM FTL TO THE TOP OF PANEL MUST BE AT 1800MM.
- EXHAUST WILL BE THRU FULLY LOUVERED METAL DOOR.
- GROUNDING TAPPED TO GROUNDING BUSBAR OF AUX ROOM.
- NO SPRINKLERS, CEILING MOUNTED & PORTABLE FIRE EXTINGUISHERS SHALL BE PROVIDED ONLY FOR THE ROOM.
- NO SANITARY/ WATER PIPES SHALL RUN INSIDE THE ROOM.
- CONVENIENCE OUTLET (CO) OUTSIDE THE BMS CABINET FOR UPS (5-10AMP RATING) UNDER NON LIFE SAFETY PANEL. ELECTRICAL TO SPECIFY THE UPS RATING, REQUIRED BRANCH CIRCUITRY, AND RATING.

DURING A POWER FAIL CONDITION, THE CONTROLLER SHALL:

- A) MAINTAIN INTERNAL CLOCK OPERATION
- B) MAINTAIN ALL PROGRAMS
- C) CONTINUE TO COMMUNICATE OVER THE INTERNAL SYSTEM BUSES TO OTHER COMPONENTS OF THE CONTROL SYSTEM THAT STILL HAVE AC POWER

THE PLC SHALL ALSO OFFER A BATTERY BACK-UP MODE THAT PROVIDES:

- A) FULL OPERATION OF THE CONTROL, OUTPUTS UNDER BATTERY BACK-UP
- B) COMMUNICATION TO THE OPERATOR TERMINAL
- C) A MINIMUM OF 48 HOUR BATTERY BACK-UP DURATION

UPON RESTORATION OF POWER, THE PLC SHALL AUTOMATICALLY AND WITHOUT HUMAN INTERVENTION:

- A) UPDATE ALL MONITORED FUNCTIONS
- B) RESUME OPERATION BASED ON CURRENT, SYNCHRONIZED TIME AND STATUS
- C) IMPLEMENT SPECIAL START-UP STRATEGIES AS REQUIRED

* PRINTERS:

COLORLED PRINTERS SHALL BE PROVIDED FOR THE RECORDING OF ALARMS, OPERATOR TRANSACTIONS AND TRENDR LOGGING SYSTEM REPORTS. THE PRINTER UNITS SHOULD BE WIDE CARTRIDGE, INKJET OR LASER PRINTERS FOR HARD COPY PRINTOUTS, SYSTEM LOGS, INFORMATION SUMMARIES, ETC. ONE PRINTER SHOULD BE DEDICATED TO THE RECORDING OF ALARM TRAFFIC ONLY. SECOND PRINTER SHALL BE PROVIDED FOR SYSTEM REPORTS. THE PRINTING SHALL HAVE THE FOLLOWING MINIMUM REQUIREMENTS:

- FOR STANDARD CONTINUOUS PAPER SIZE OF WIDTH 101-254MM, THICKNESS 0.065-0.32
- MINIMUM OF 17 PPM IN BLACK AND 12 PPM IN COLOR
- TIME PRINTING SHOWING 24-HOUR FORM, THE DAY, MONTH, AND YEAR
- MULTI COLORED PRINTS FOR LOG AND ALARMS FOR CLASSIFYING ALARM TYPES

* UNINTERRUPTED POWER SUPPLY (UPS):

THE UPS SHALL BE THE SOLID STATE TYPE AND SHALL CONVERT INCOMING AC POWER TO DC POWER FOR REGULATED FEED TO THE OPERATOR WORKSTATION AND TO EACH PROGRAMMABLE LOGIC CONTROLLER. THE UPS SHALL BE TRUE ON-LINE TYPE WITH AUTOMATIC RE-CHARGING CAPABILITY. THE BATTERY SHALL PROVIDE AT LEAST 30 MINUTES FULL LOAD POWER BACK UP TO THE WORKSTATION AND/OR ALL PLC MEMORIES, ALARMS, INSTRUCTIONS, AND OPERATION REQUIREMENTS, IN THE EVENT OF MAIN POWER

* GRAPHIC DISPLAY:

THE BMS GRAPHICS SHALL INCLUDE A DISPLAY OF THE SINGLE LINE DIAGRAM OF ALL SERVICES ON COLOR MONITOR USING DYNAMIC GRAPHICS. THE DISPLAY SHALL INCLUDE BUT NOT LIMITED TO:
 - CHILLERS, PUMPS, COOLING TOWERS, WATER TREATMENT
 - LOADS, FWH, AHU'S, FOU'S, FANS
 - CISTERNS, TANKS

ROUGHING-IN-S & WIRES:

- PVC PIPE CONDUIITS SHALL BE USED FOR HORIZONTAL (TO AND FROM ENGINEERING OFFICE AND AUX. ROOMS), VERTICAL RISERS, HORIZONTAL DISTRIBUTION (DUE TO FIELD DEVICES), EMBEDDED PIPES, CONCEALED PIPES (UNDER CEILING).
- MC METAL CONDUIITS SHALL BE USED FOR EXPOSED PIPES LOCATED OR TRAVELLED OUTSIDE THE BUILDING.
- WHERE DRIPPING TO FIELD DEVICES AND EQUIPMENT, FLEXIBLE METAL CONDUIITS WILL BE USED.
- WIRES TO BE USED FOR DISTRIBUTION AND RISERS SHALL BE TWISTED PAIR CAT5e OR 6/4S 485 CABLE.

* ELECTRICAL MAXIMUM DEMAND CONTROL:

THE SYSTEM SHALL BE CAPABLE OF MONITORING THE RATE OF POWER CONSUMPTION AND SHALL TAKE CORRECTIVE ACTION TO AVOID HIGH PENALTY CHARGES. LOADS AND SPECIFIC FUNCTIONS. THE BMS SYSTEM SHALL BE CAPABLE OF STARTING WITH THE PRIORITY REQUIREMENTS AND EXPANDING INTO THE TOTAL REQUIREMENT OF THE PROJECT IN STAGES.

* PASSWORDS:

THE SYSTEM SHALL HAVE 3 LEVELS OF USER PROGRAMMABLE PASSWORDS IN ADDITION TO A MASTER PASSWORD, FOR PROGRAMMING SECURITY. UP TO 25 SEPARATE PASSWORDS MAY BE USED. PROGRAMMING ACCESS TO A LEVEL ONE PASSWORD SHALL ALLOW INTEROPERATION OF SYSTEM STATUS ONLY. ACCESS TO A LEVEL TWO PASSWORD SHALL ALLOW CHANGING OF SYSTEM PARAMETERS (SETPOINTS, ETC) AND OVERRIDING AND DISABLING OF INPUTS AND OUTPUTS. ACCESS TO A LEVEL THREE PASSWORD SHALL ALLOW FULL PROGRAMMING OF THE SYSTEM. ACCESS TO A MASTER PASSWORD SHALL ALLOW FULL ACCESS OF THE SYSTEM INCLUDING THE CREATION AND DELETION OF PASSWORDS.

* SOFTWARE MANUAL:

THE SOFTWARE MANUAL SHALL DESCRIBE PROGRAMMING AND TESTING, STARTING WITH A SYSTEM OVERVIEW AND PROCEEDING TO A DETAILED DESCRIPTION OF EACH SOFTWARE FEATURE. THE MANUAL SHALL INSTRUCT THE USER ON PROGRAMMING AND RE-PROGRAMMING ANY PORTION OF THE SYSTEM. THIS SHALL INCLUDE ALL CONTROL PROGRAMS, VARIABLES, SET POINTS, TIME PERIODS, MESSAGES, PASSWORDS AND OTHER INFORMATION NECESSARY TO LOAD, ALTER, TEST AND EXECUTE THE SYSTEM. THE MANUAL SHALL INCLUDE:
 A) COMPLETE DESCRIPTION OF PROGRAMMING LANGUAGE, INCLUDING COMMANDS, EDITING AND WRITING OF CONTROL PROGRAMS, PRINTOUTS AND LOGS, AND MATHEMATICAL CALCULATIONS.
 B) INSTRUCTIONS ON MODIFYING ANY CONTROL POINT, VERIFYING ERROR STATUS, CHANGING PASSWORDS, AND INITIATING OR DISABLING CONTROL PROGRAMS.

* ENERGY SAVINGS SOFTWARE:

THE ENERGY MANAGEMENT SOFTWARE SHALL HAVE NO LIMIT TO THE NUMBER OF TIME SCHEDULES FOR ANY POINT OR NUMBER OF POINTS ASSIGNED. EACH TIME PROGRAMMED CONTROL MODE SHALL OPERATE OVER A USER-DEFINED WEEK. THERE SHALL BE NO LIMIT TO THE NUMBER OF HOLIDAY SCHEDULE TO WHICH ANY TIME SCHEDULE OR NUMBER OF TIME SCHEDULES MAY BE ASSIGNED. IT SHALL BE POSSIBLE TO PROGRAM HOLIDAYS 365 DAYS IN ADVANCE.
 AFTER ESTABLISHING THE DATABASE, THE ENERGY MANAGEMENT SOFTWARE SHALL BE ABLE TO TARGET SAVINGS BY TIMED ON-OFF OPERATION, OR BY RE-SETTING TEMPERATURES (WITHOUT SAKRIFICING COMFORT LEVELS) AT THE CHILLERS, AHUS, AND FOUS. THESE SETTINGS SHALL BE BASED ON ACTUAL TIME OF USE AND ACTUAL OCCUPANCY OF EACH AREA. THE ENERGY MANAGEMENT SOFTWARE SHALL THEREFORE INCLUDE THE PROGRAMME CONFIGURATION FOR DETERMINING THE ACTUAL LOAD DEMAND VERSUS THE REQUIRED PLANT CAPACITY PLUS THE CAPABILITY TO SEQUENCE OF OPERATION OF MULTIPLE EQUIPMENT SUCH AS CHILLERS, PUMPS, AND COOLING TOWERS.
 AS FOR OPTIMUM START/STOP CONTROL, THERE SHALL BE NO LIMIT TO THE NUMBER OF OPTIMUM START SCHEDULES TO WHICH START POINT CAN BE ASSIGNED. THE SYSTEM SHALL BY MONITORING OUTDOOR AIR AND SPACE TEMPERATURES, START THE PLANT AT THE LATEST POSSIBLE TIME TO ACHIEVE THE DESIRED INTERNAL TEMPERATURE BY TARGET TIME. SIMILARLY, THE SYSTEM SHALL STOP THE PLANT AT THE EARLIEST POSSIBLE TIME BEFORE THE END OF THE OCCUPANCY WITHOUT AMBIENT CONDITIONS DETERIORATING BELOW PRE-SET ACCEPTABLE LIMITS. THE OPTIMIZING PROGRAM FOR THE COOLING MODE SHALL BE SELF-ADJUSTING. THE AMOUNT OF ADJUSTMENT SHALL BE AT 0.5 TO 1.00% AS MAY BE DEFINED BY THE OPERATOR.

* LOAD CYCLING:

THE SYSTEM SHALL BE CAPABLE OF CYCLING LOADS TO REDUCE ELECTRICAL CONSUMPTION. THE PROGRAM SHALL HAVE AN OPERATOR-DEFINED MINIMUM ON TIME, MINIMUM OFF TIME AND MAXIMUM OFF TIME. A TEMPERATURE DETECTOR SHALL BE ASSIGNED TO EACH POINT ON THE LOAD CYCLING PROGRAM. SHOULD THE SPACE TEMPERATURE EXCEED PRE-SET LIMITS, THE LOAD CYCLING SHALL BE OVERRODDED AND THE PRE-SET RETURNED TO THE TIME CONTROL PROGRAM UNTIL THE SPACE TEMPERATURE HAS RETURNED TO AN ACCEPTABLE LEVEL.

* INTEGRATED CONTROL:

THE SYSTEM SHALL BE CAPABLE OF PERFORMING PROPORTIONAL CONTROL, INTEGRAL CONTROL, DERIVATIVE CONTROL OR ANY COMBINATION OF THESE. THE PRIMARY INPUT TO A CONTROL LOOP SHALL BE WITHIN A MEASURED VALUE (°C, °RH, ETC) OR A CALCULATED VALUE. THE SECONDARY OR RESET INPUT SHALL BE EITHER A MEASURED VALUE (°C, °RH, ETC) OR A CALCULATED VALUE. THE SET POINT OF ANY CONTROL LOOP SHALL BE CAPABLE OF BEING ADJUSTED BY THE EVENT OR AS A RESULT OF A CALCULATION.

* TESTING AND COMMISSIONING:

THE SYSTEM SHALL BE TESTED BY COMPONENTS, BY LOCAL OPERATIONAL UNIT, AND AS AN ENTIRE SYSTEM. THE TESTS AND VERIFICATION PROCEDURE SHOULD BE PRESENTED PRIOR TO THE AWARD OF THE CONTRACT, AND SHOULD BE IN FULL AGREEMENT WITH THE REQUIREMENTS OF THIS PROJECT. THE FOLLOWING SHALL BE SHOWN ON THE TEST AND VERIFICATION PROCEDURE:

- BMS CAPABILITY TO MONITOR OPERATING DATA, GATHER THE RELEVANT DATA, AND ESTABLISH A DATA BANK AS BASIS FOR FUTURE ENERGY SAVINGS PROGRAM.
- VERIFICATION IF THE REQUIRED ENERGY OPTIMIZATION AND ENERGY SAVINGS SOFTWARE ARE INSTALLED IN THE MAIN COMPUTER.
- VERIFICATION IF OTHER PROGRAMS (PROPERLY LICENSED AND DOCUMENTED) AS CLAIMED BY THE CONTRACTOR ARE INSTALLED AND OPERATIONAL IN THE BMS.
- VERIFICATION IF ALL SENSORS AND ACTUATORS AS SPECIFIED BY THE CONTRACT DOCUMENTS, AND AS REQUIRED TO FULFILL THE SPECIFIED FUNCTIONS ARE ACTUALLY PROVIDED AND PROPERLY CALIBRATED TO SHOW CORRECT INFORMATION AND DATA.
- VERIFY IF THE BMS SOFTWARE CAN ACTUALLY PROCESS THE GATHERED DATA IN ORDER TO PRODUCE ALTERNATIVE SUGGESTIONS FOR ENERGY SAVINGS.
- TEST, RUN, AND COMMISSION THE SYSTEM FOR A PERIOD OF ONE MONTH. THE TESTS WILL NECESSITATE NUMEROUS READINGS. IT WILL INVOLVE PRELIMINARY ADJUSTMENTS AND CALIBRATION OF THE MANY CIRCUIT AND STATIONS. THE DATA PRESENTED HEREIN MAY JUST BE THE INITIAL READINGS.
- ADJUST, RE-SET, AND RE-COMMISSION THE SYSTEM FOR A PERIOD OF 2 MONTHS. THE CONTRACTOR SHALL PRESENT THE METHOD OF ADJUSTMENTS, THE CALIBRATION PROCEDURES, AND THE TEST READINGS AFTER THE ADJUSTMENTS. ALL READINGS SHOULD CORRESPOND TO THE TAB READINGS AT THE CHILLERS, PUMPS, AHU'S, FOU'S, ETC., AND THE SETTINGS OF DAMPERS, VALVES, AND CONTROLS. ALL SETTINGS FOR BMS AND TAB SHOULD BE PROPERLY RECORDED AND TABULATED FOR COMPARISON. IT IS THE RESPONSIBILITY OF THE BMS CONTRACTOR TO CALIBRATE THE READINGS SO THAT WHAT IS SHOWN AT THE ACTUAL POINT OF OPERATION IS THE SAME DATA PRESENTED IN THE PC MONITOR OR THE PRINTOUT.
- FINE TUNE AND TURN OVER THE SYSTEM AFTER A TOTAL OF 3 MONTHS. ALTHOUGH CERTAIN VALUES ARE INDICATED IN THE PLANS FOR AIR VOLUMES AND WATER FLOW, THESE MAY SERVE AS GUIDE VALUES ONLY. THE FINAL DETERMINING FACTOR WILL BE THE ACTUAL ROOM TEMPERATURES THAT SHOULD BE BETWEEN AN ACCEPTABLE RANGE OF 20°C TO 24°C. THESE TEMPERATURES MAY ALSO VARY DEPENDING ON THE REQUIREMENT OF THE ROOM, SUCH AS AT 18°C FOR THE COOL KITCHEN AREA.
- DURING THE 6-MONTH PERIOD OF TESTING, ADJUSTING, AND FINE-TUNING, THE CONTRACTOR SHALL TRAIN THE MUSEUM PERSONNEL IN THE OPERATION OF THE BMS WITHIN THE SAME PERIOD. THE CONTRACTOR SHALL TURN OVER TO THE CLIENT THE 3 SETS OF COMPLETE INSTALLATION PLANS, CATALOGS, BROCHURES, INSTALLATION MANUALS, AND OPERATING PROCEDURE OF THE BMS.
- THE WARRANTY PERIOD OF THE SYSTEM SHALL COVER 12 MONTHS FROM THE DATE OF COMMISSIONING. IT IS THEREFORE EXPECTED THAT THE OPERATOR OF THE CONTRACTOR SHALL REMAIN AT THE SITE FOR A TOTAL OF

12 MONTHS FROM THE DATE OF SYSTEM COMMISSIONING.

* GENERAL NOTES:

- ALL SYSTEM CONFIGURATIONS, I/O POINT COUNT AND QUANTITIES, ARE PROVISIONAL IN NATURE IN ORDER TO ESTABLISH A COMMON BASIS
- THE SCOPE OF ACTUAL CONTRACT MAY VARY FROM THIS SYSTEM PRESENTATION, BUT THE UNIT COSTS SHALL BE USED FOR ADDITIVE AND DEDUCTIVE COMPUTATIONS.

CHILLED WATER SYSTEM

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HLI
PACKAGED WATER CHILLER						
AT 2ND LEVEL (CH-1 TO CH-3)	3					
LEAVING CHILLED WATER TEMPERATURE (CHWS TEMP. SENSOR)	3					
ENTERING CHILLED WATER TEMPERATURE (CHWR TEMP. SENSOR)	3					
MOTORIZED ISOLATION VALVE STATUS CHW RETURN & SUPPLY	3					
FAN MOTOR STATUS				10		
FAN TRIP STATUS				10		
VARIABLE FREQUENCY DRIVE (SPEED MONITORING)					10	
FAN CONTROL ON/OFF/MODULATING					10	
SUPPLY AIR TEMPERATURE SENSOR (FOR SUPPLY AIR)	10					
MIXED AIR TEMPERATURE MONITORING (FOR MIXED AIR)	10					
HUMIDITY SENSOR HUMIDITY MONITORING (FOR SUPPLY AIR)	10					
TWO WAY CHW MODULATING VALVE (VALVE STATUS)	10					
CHW MODULATING VALVE CONTROL ON/OFF/ MODULATING	10					
OUTDOOR AIR MOTORIZED DAMPER STATUS	10					
OUTDOOR AIR MOTORIZED DAMPER CONTROL ON/OFF/MODULATING	10					
RETURN AIR MOTORIZED DAMPER STATUS	10					
RETURN AIR MOTORIZED DAMPER CONTROL ON/OFF/ MODULATING	10					
CARBON DIOXIDE (CO2) SENSOR AT RETURN DUCT	10					
I/O TOTAL		70	30	20	0	20
I/O TOTAL	10					140

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HLI
CHILLED WATER PUMP						
AT 2ND LEVEL (CHW-1 TO CHW-3)	3					
PUMP MOTOR START/ STOP CONTROL	3					
ON/ OFF STATUS				3		
HAND/ OFF/ AUTO STATUS				3		
PUMP TRIP STATUS				3		
CHILLED WATER SUPPLY FLOW METERING	3					
I/O TOTAL	27	0	0	0	0	54
I/O TOTAL	3					81

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HLI
CHILLED WATER HEADER						
AT 2ND LEVEL (CHILLED WATER SUPPLY MAIN HEADERS)	1					
TEMPERATURE MONITORING	1					
PRESSURE MONITORING	1					
AT 2ND LEVEL (CHILLED WATER RETURN MAIN HEADERS)	1					
TEMPERATURE MONITORING	1					
PRESSURE MONITORING	1					
AT 2ND LEVEL (CHILLED WATER SUPPLY/RETURN MAIN HEADERS)	1					
DIFFERENTIAL PRESSURE	1					
DIFFERENTIAL TEMPERATURE	1					
MOTORIZED ISOLATION VALVE CHW SUPPLY & RETURN STATUS				1		
I/O TOTAL	6	0	1	0	0	
I/O TOTAL	3					7

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HLI
CONDENSER WATER PUMP						
AT 2ND LEVEL (COWP-1 TO COWP-3)	3					
PUMP MOTOR START/ STOP CONTROL	3					
ON/ OFF STATUS				3		
HAND/ OFF/ AUTO STATUS				3		
PUMP TRIP STATUS				3		
I/O TOTAL	0	0	0	3	9	
I/O TOTAL	3					12

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HLI
CONDENSER WATER PUMP						
AT 2ND LEVEL (COWP-1 TO COWP-3)	3					
PUMP MOTOR START/ STOP CONTROL	3					
ON/ OFF STATUS				3		
HAND/ OFF/ AUTO STATUS				3		
PUMP TRIP STATUS				3		
I/O TOTAL	0	0	0	3	9	
I/O TOTAL	3					12

BASEMENT-PODIUM BOH I/O POINT TABULATION

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HLI
AR HANDLING UNIT	10					
AT GND LEVEL (AHU-1/1/1/2/1/3)	3					
AT 2ND LEVEL (AHU-8/8/2/8/3/PP/EL/FRZ/FRS)	7					
FAN MOTOR STATUS				10		
FAN TRIP STATUS				10		
VARIABLE FREQUENCY DRIVE (SPEED MONITORING)					10	
FAN CONTROL ON/OFF/MODULATING					10	
SUPPLY AIR TEMPERATURE SENSOR (FOR SUPPLY AIR)	10					
MIXED AIR TEMPERATURE MONITORING (FOR MIXED AIR)	10					
HUMIDITY SENSOR HUMIDITY MONITORING (FOR SUPPLY AIR)	10					

BMS GENERAL SPECIFICATIONS

GENERAL:

THE PROPOSED BMS FOR THIS PROJECT SHALL ENSURE AN OPTIMUM UTILIZATION OF ENERGY AND THE OPERATION OF ALL ELECTRICAL AND MECHANICAL COMPONENTS/SYSTEMS LISTED HEREIN. THE BMS SHOULD BE ABLE TO MONITOR AND CONTROL THE LISTED M&E EQUIPMENT AND DEVICES TO EFFECTIVELY PERFORM ENERGY MANAGEMENT FUNCTIONS. THE SYSTEM SHALL BE MODULAR IN DESIGN AND CAN BE INSTALLED AND OPERATED IN STAGES. THE FULL PROJECT REQUIREMENT FOR THE BMS SHALL INCLUDE THE FOLLOWING:

* REQUIREMENTS:

THE PROPOSED BMS FOR THIS PROJECT SHALL ENSURE AN OPTIMUM UTILIZATION OF ENERGY AND THE OPERATION OF ALL ELECTRICAL AND MECHANICAL COMPONENTS/SYSTEMS LISTED HEREIN. THE BMS SHOULD BE ABLE TO MONITOR AND CONTROL THE LISTED M&E EQUIPMENT AND DEVICES TO EFFECTIVELY PERFORM ENERGY MANAGEMENT FUNCTIONS. THE SYSTEM SHALL BE MODULAR IN DESIGN AND CAN BE INSTALLED AND OPERATED IN STAGES. THE I/O POINT TABULATION SHOWS THE MINIMUM SCOPE OF BMS WORK. REFER TO THE FINAL I/O POINT COUNT REQUIREMENT. THE PROGRAMMABLE LOGIC CONTROL (PLC) PANELS SHOULD BE SIZED TO ACCOMMODATE UP TO 3 TIMES THE TOTAL OF I/O POINTS LISTED IN THE I/O POINT TABULATION FOR FUTURE EXPANSION. THE WALL SPACE SHOULD ALSO ALLOW FUTURE INSTALLATION OF ADDITIONAL PLC. THE FULL PROJECT REQUIREMENT FOR THE BMS SHALL INCLUDE BUT NOT LIMITED TO THE FOLLOWING:

* MONITORING:

- MONITORING SHALL CONSIST OF AN INDICATION OF THE STATUS SUCH AS:
 - RUNNING HOURS OF MECHANICAL EQUIPMENT (PUMPS, AHUS, FANS, AC SYSTEMS)
 - ELECTRIC METER IN ACCUMULATED KIWHRS
 - ELECTRICAL SWITCHBOARD STATUS (HV & LV) ON, OFF, ALARM/MOTOR FAULT/TRIP

* CONTROL:

CONTROLLING SHALL AUTOMATICALLY OPERATE THE ASSOCIATED SYSTEMS VIA THE CENTRAL CONTROL PANEL OF THE SYSTEM INCLUDING START/STOP FUNCTION, TIMELOCK CONTROL AND ADJUSTMENTS, STATUS/ALARM INDICATION, SYSTEM PROGRAMMING AND OPERATING SEQUENCE OF THE FOLLOWING SYSTEMS:

- CENTRAL CHILLER WATER PLANT INCLUDING CHILLERS, PUMPS AND COOLING TOWERS.
- ROOM AC EQUIPMENT SUCH AS AHUS AND FDU'S.
- EXHAUST & VENTILATION EQUIPMENT FOR TRANSFORMER, TOILETS, AND COMMON AREAS.

OTHER FUNCTIONS FOR THE BMS SHOULD INCLUDE BUT NOT LIMITED TO:

- KWHR RECORDING FOR EQUIPMENT OR GROUP OF EQUIPMENTS
- RE-START AFTER POWER FAILURE
- POWER MONITORING AND AUTOMATIC OPTIMIZATION BY REVISED SEQUENCE OF OPERATION FOR MULTIPLE UNITS, START DELAY, EARLY SWITCH OFF, OR BY LOAD SHEDDING PROCEDURE.
- SET POINTS CONTROL/CHANGES/ADJUSTMENTS
- THICK SETTINGS WITH CALENDARS AND SPECIAL DAYS
- SENSOR MEASURING AND RECORDING
- RUNNING TIME TOTALIZATION
- PROVISION FOR FUTURE EXPANSIONS, ETC.

* SYSTEM CONFIGURATION:

THE BMS SHALL BE MODULAR IN DESIGN THAT WILL ALLOW INSTALLATION AND INDEPENDENT OPERATION OF EACH PROGRAMMABLE LOGIC CONTROLLER AND SHALL BE WIRED TO A CENTRAL PC TERMINAL FOR DATA GATHERING AND HUMAN INTERFACE. THE PC TERMINAL SHALL HAVE ITS OWN ACCESS PROTOCOL AND SPECIFIC FUNCTIONS. THE BMS SYSTEM SHALL BE CAPABLE OF STARTING WITH THE PRIORITY REQUIREMENTS AND EXPANDING INTO THE TOTAL REQUIREMENT OF THE PROJECT IN STAGES.

THE BMS SHALL GATHER DATA ON A CONTINUING BASIS, PROCESS THE DATA AND ISSUE COMMANDS TO THE INDIVIDUAL COMPUTER-BASED LOGIC CONTROLLER TO CLOSE, OPEN, OR MODULATE THE ELECTRO-MECHANICAL CONTROLLERS OF ALL SYSTEM BEING MONITORED. EACH PROGRAMMABLE LOGIC CONTROLLER SHALL OPERATE WITH THE CORRESPONDING SENSORS AND CONTROLLERS ON A STAND-ALONE ARRANGEMENT AND WILL PERFORM FREEDOM OF COMMUNICATION WITH THE CENTRAL OPERATOR TERMINAL. THE MEMORY CAPACITY OF EACH PLC SHALL BE FOR A MINIMUM OF TWO YEARS OR AT LEAST 120GBYTES.

THE PC WORKSTATION SHALL BE LOCATED AT THE ENGINEERING OFFICE INCLUDING PRINTERS, BMS HUB, DISPLAY MONITORS. THE PC TERMINAL OR OPERATOR WORKSTATION SHALL BE THE ORDINARY IBM OR IBM COMPATIBLE PERSONAL COMPUTER RUNNING ON WINDOWS ENVIRONMENT AND OPERATED BY MOUSE AND KEYSBOARD. THE OPERATOR WORKSTATION SHALL SERVE AS THE HUMAN-MACHINE INTERFACE FOR PROGRAMMING, ANNUNCIATION AND DATA PROCESSING. HARD COPY PRINTOUT CAN BE DIRECTED TO ALARM AND REPORT PRINTERS FOR AUTOMATIC RECORDING. THE MINIMUM REQUIREMENTS FOR AN OPERATOR WORKSTATION SHALL BE:

- MINIMUM INTEL I7 PROCESSOR WITH 3.4 GHZ CORE SPEED OR EQUAL
- PROVIDE AND USE ISOBYTE OF RAM
- 1930 WOODM WITH A VOICE/DATA/FAX SPEED OF 56K BAUDS
- NOT LESS THAN 100GBYTES OF SOLID STATE DRIVE (SSD) SPACE
- SERIAL/PARALLEL INTERFACE PORT
- AT LEAST EIGHT USB PORTS/ BLUETOOTH CONNECTIVITY
- RS232 PORT FOR INTERFACING PURPOSES
- 10/100/1000 ETHERNET WITH RJ45 CONNECTION
- 32" TFT LED/OLED COLOR GRAPHIC DISPLAY WITH A MINIMUM DISPLAY RESOLUTION OF NOT LESS THAN 1200H GOOD FOR CONTINUOUS OPERATION. MULTI DISPLAY PORTS INCLUDED TO PERFORM MULTI DISPLAY FUNCTION SCREEN MANAGEMENT.
- TAPE BACKUP INTERNAL ZIP DRIVE, 250MB
- UPS WITH CAPACITY CAPABLE OF MAINTAINING THE EQUIPMENT OPERATIONAL FOR A MINIMUM OF 24 HOURS DURING POWER FAILURE.
- WINDOWS TO OPERATING SYSTEM.
- COMPLETE OPERATOR WORKSTATION SOFTWARE PACKAGE, INCLUDING ANY HARDWARE OR SOFTWARE SERIAL KEYS.
- ORIGINAL INSTALLATION DISKS, LICENSES FOR ALL SOFTWARE, DEVICE DRIVERS, AND PERIPHERALS.
- PROVIDE SOFTWARE RECOVERY CARDS TO ALL SOFTWARE
- TWO (2) CPU's: ONE (1) SERVER AND ONE (1) FOR THE CLIENT MUST BE PROVIDED.
- THE SYSTEM SHALL BE ABLE TO PICK UP THE SIGNALS FROM THE SENSORS, METER CONTROLS, FLOW METERS, ETC., AND BE ABLE TO UTILIZE THE DATA TO OPTIMIZE SYSTEM OPERATION OR SAVE ENERGY. THE SYSTEM SHOULD BE COMPATIBLE WITH THE OTHER BUILDING UTILITIES, OR PROVIDED WITH INTERFACING MODULES OR DIGITAL TRANSLATORS FOR COMPLETE INTEGRATION OF ALL RELEVANT SYSTEMS. THE SYSTEM SHOULD BE ABLE TO COLLECT DATA ON ENERGY USE AND EQUIPMENT OPERATING RECORD, COMPARE AND CONSOLIDATE ALL BASE DATA FOR FUTURE OPTIMIZING PROCEDURES. ALL INFORMATION RELATING TO THE ENERGY USE RECORD SHOULD BE COLLECTED OVER A PREDETERMINED AUDIT TIME PERIOD.

AN INTEGRATED, LICENSED SOFTWARE SHALL BE USED AS THE OPERATOR INTERFACE PROGRAM. ALL INPUTS, OUTPUTS, SET POINTS, AND ALL OTHER PARAMETERS AS DEFINED WITHIN THE BMS POINT SCHEDULES SHALL BE DISPLAYED FOR OPERATOR VIEWING AND MODIFICATION FROM THE OPERATOR INTERFACE SOFTWARE.

THE OPERATOR WORKSTATION SOFTWARE SHALL PROVIDE CONTEXT-SENSITIVE HELP MENUS AND INSTRUCTIONS FOR EACH OPERATION AND/OR APPLICATION CURRENTLY BEING PERFORMED. ALL CONTROLLER SOFTWARE OPERATING PARAMETERS SHALL BE DISPLAYED FOR THE OPERATOR TO VIEW OR MODIFY. THESE SHALL INCLUDE:

- SETPOINTS
- ALARM LIMITS
- TIME DELAYS
- PID TUNING CONSTANTS
- POINT STATISTICS
- SCHEDULES

HARDWARE:

THE PLC'S SHALL CONTAIN IT'S CONTROL PROGRAMS IN A COMBINATION OF EPROM AND BATTERY BACKED-UP RAM. ALL DATA STORED IN RAM SHALL BE BATTERY BACKED-UP FOR AT LEAST 10 YEARS. EACH PLC SHALL HAVE THE INSTALLED INTELLIGENCE TO HANDLE ALL CONTROL STRATEGIES, WITHOUT COMMUNICATION TO OTHER CONTROLLERS. IN ADDITION, EACH PLC SHALL BE ABLE TO HAVE IT'S PROGRAM EDITED AND/OR MODIFIED. EACH PLC SHALL COMPLETE AN ENTIRE INTERNAL SCAN IN LESS THAN ONE SECOND. EACH INTERNAL SCAN SHALL CONSIST OF UPDATING ON INPUTS, GATHERING DATA FROM OTHER CONTROLLERS, MAKING NECESSARY MATHEMATICAL CALCULATIONS AND SEQUENCING APPROPRIATE OUTPUTS FOR LOCAL LOOP CONTROL. THE PLC SHALL HAVE AT LEAST 256KB OF USER AVAILABLE RANDOM ACCESS MEMORY (RAM) AND 4MB OF ERASABLE PROGRAMMABLE READ ONLY MEMORY (EPROM).

- INDICATOR ONLINE
- UPDATE ALL MONITORED FUNCTIONS
- RESUME OPERATION BASED ON CURRENT TIME AND STATUS
- IMPLEMENT SPECIAL BUILDING START-UP STRATEGIES AS REQUIRED
- LOG TIME OF POWER OUTAGES AND START-UPS

BMS CABINET:

1. RACK BOX - ONE (1) UNIT PER FLOOR SIZED AT 300x300x100 (WxDxH) AS NEEDED
2. NETWORK SWITCH - SIZE AND QUANTITY WILL VARY PER REQUIREMENT.
3. DIRECT DIGITAL CONTROL (DDC) PANEL - SIZE AND QUANTITY WILL VARY DEPENDING ON THE NUMBER OF POINTS CONTROLLINGLY MONITORED PER FLOOR. MOUNTING HEIGHT FROM FTL TO THE TOP OF PANEL MUST BE AT 1800MM.
4. CONVENIENCE OUTLET (CO) OUTSIDE THE BMS CABINET FOR UPS (5-10Wm RATING) UNDER NON LIFE SAFETY PANEL. ELECTRICAL TO SPECIFY THE UPS RATING, REQUIRED BRANCH CIRCUITRY, AND RATING.

AUXILIARY (AUX) ROOM:

1. AUXILIARY ROOM PER FLOOR SHALL HAVE A MINIMUM SIZE OF 1.5x3.0METERS (4.550M) DEPENDING ON THE SIZE OF RISERS AND CABINETS.
2. RACK BOX - ONE (1) UNIT PER FLOOR SIZED AT 300x300x100 (WxDxH) AS NEEDED
3. NETWORK SWITCH - SIZE AND QUANTITY WILL VARY PER REQUIREMENT.
4. DIRECT DIGITAL CONTROL (DDC) PANEL - SIZE AND QUANTITY WILL VARY DEPENDING ON THE NUMBER OF POINTS CONTROLLINGLY MONITORED PER FLOOR. MOUNTING HEIGHT FROM FTL TO THE TOP OF PANEL MUST BE AT 1800MM.
5. EXHAUST WILL BE THRU FULLY LOUVERED METAL DOOR.
6. GROUNDING TAPPED TO GROUNDING BUSBAR AT ALL ROOM.
7. NO SPRINKLERS, CEILING MOUNTED & PORTABLE FIRE EXTINGUISHERS SHALL BE PROVIDED ONLY FOR THE ROOM.
8. NO SANITARY/ WATER PIPES SHALL RUN INSIDE THE ROOM.
9. CONVENIENCE OUTLET (CO) OUTSIDE THE BMS CABINET FOR UPS (5-10Wm RATING) UNDER NON LIFE SAFETY PANEL. ELECTRICAL TO SPECIFY THE UPS RATING, REQUIRED BRANCH CIRCUITRY, AND RATING.

DURING A POWER FAIL CONDITION, THE CONTROLLER SHALL:

- MAINTAIN INTERNAL CLOCK OPERATION
- MAINTAIN ALL PROGRAMS
- CONTINUE TO COMMUNICATE OVER THE INTERNAL SYSTEM BUSES TO OTHER COMPONENTS OF THE CONTROL SYSTEM THAT STILL HAVE AC POWER

THE PLC SHALL ALSO OFFER A BATTERY BACK-UP MODE THAT PROVIDES:

- FULL OPERATION OF THE CONTROL OUTPUTS UNDER BATTERY BACK-UP
- COMMUNICATION TO THE OPERATOR TERMINAL
- A MINIMUM OF 48 HOUR BATTERY BACK-UP DURATION

UPON RESTORATION OF POWER, THE PLC SHALL AUTOMATICALLY AND WITHOUT HUMAN INTERVENTION:

- UPDATE ALL MONITORED FUNCTIONS
- RESUME OPERATION BASED ON CURRENT, SYNCHRONIZED TIME AND STATUS
- IMPLEMENT SPECIAL START-UP STRATEGIES AS REQUIRED

* PRINTERS:

COLORIED PRINTERS SHALL BE PROVIDED FOR THE RECORDING OF ALARMS, OPERATOR TRANSACTIONS AND TREND LOGGING SYSTEM REPORTS. THE PRINTER UNITS SHOULD BE WIDE CARTRIDGE, INKJET OR LASER PRINTERS FOR HARD COPY PRINTOUTS, SYSTEM LOGS, INFORMATION SUMMARIES, ETC. ONE PRINTER SHOULD BE DEDICATED TO THE RECORDING OF ALARM TRAFFIC ONLY. SECOND PRINTER SHALL BE PROVIDED FOR SYSTEM REPORTS. THE PRINTERS SHALL HAVE THE FOLLOWING MINIMUM REQUIREMENTS:

- FOR STANDARD CONTINUOUS PAPER SIZE OF WIDTH 101-254MM, THICKNESS 0.065-0.32
- MINIMUM OF 17 PPM IN BLACK AND 12 PPM IN COLOR
- TIME PRINTING SHOWING 24-HOUR FORM, THE DAY, MONTH, AND YEAR
- MULTI COLORED PRINTS FOR LOGS AND ALARMS FOR CLASSIFYING ALARM TYPES

* UNINTERRUPTED POWER SUPPLY (UPS):

THE POWER SUPPLY FOR BMS SHALL INCORPORATE AUTOMATICALLY CONNECTED STANDBY POWER IN THE FORM OF AN UNINTERRUPTED POWER SUPPLY. UPON RESTORATION OF THE MAIN SUPPLY POWER FOLLOWING AN INTERRUPTION, THE POWER SUPPLY SHALL AUTOMATICALLY REVERT TO NORMAL OPERATION. POWER FAILURES SHALL HAVE A SHORT TIME DELAY SUFFICIENT TO ALLOW RESTORATION OR TRANSFER TO AN ALTERNATIVE SUPPLY. PROTECTION TO ALL EQUIPMENT (I.E. ALL DDC, SERVER, AND WORKSTATION) AND CABLES SHALL BE PROVIDED BY MEANS OF SURGE SUPPRESSORS.

THE UPS SHALL BE THE SOLID STATE TYPE AND SHALL CONVERT INCOMING AC POWER TO DC POWER FOR REGULATED FEED TO THE OPERATOR WORKSTATION AND TO EACH PROGRAMMABLE LOGIC CONTROLLER. THE UPS SHALL BE TRUE-ON-LINE TYPE WITH AUTOMATIC RE-CHARGING CAPABILITY. THE BATTERY SHALL PROVIDE AT LEAST 30 MINUTES FULL LOAD POWER BACK UP TO THE WORKSTATION AND/OR ALL PLC MEMORIES, ALARMS, INSTRUCTIONS, AND OPERATION REQUIREMENTS, IN THE EVENT OF MAIN POWER

* GRAPHIC DISPLAY:

THE BMS GRAPHICS SHALL INCLUDE A DISPLAY OF THE SINGLE LINE DIAGRAM OF ALL SERVICES ON COLOR MONITOR USING DYNAMIC GRAPHICS. THE DISPLAYS TO BE DISPLAYED SHALL INCLUDE BUT NOT LIMITED TO:

- CHILLERS, PUMPS, COOLING TOWERS, WATER TREATMENT
- DOAS, ERW, AHU'S, FDU'S, FANS
- CISTERNS, TANKS

ROUGHING-IN'S & WIRES:

1. PVC PIPE CONDUITS SHALL BE USED FOR HORIZONTAL (TO AND FROM ENGINEERING OFFICE AND AUX. ROOMS), VERTICAL RISERS, HORIZONTAL DISTRIBUTION (ODC TO FIELD DEVICES), EMBEDDED PIPES, CONCEALED PIPES (UNDER CEILING), EXPOSED PIPES (INSIDE THE BUILDING).
2. IMC METAL CONDUITS SHALL BE USED FOR EXPOSED PIPES LOCATED OR TRAVELLED OUTSIDE THE BUILDING.
3. FLEXIBLE DISPROPS TO FIELD DEVICES AND EQUIPMENT. FLEXIBLE METAL CONDUITS WILL BE USED.
4. WIRES TO BE USED FOR DISTRIBUTION AND RISERS SHALL BE TWISTED PAIR CAT5 OR 6/RS 485 CABLE.

* ELECTRICAL MAXIMUM DEMAND CONTROL:

THE SYSTEM SHALL BE CAPABLE OF MONITORING THE RATE OF POWER CONSUMPTION AND SHALL TAKE CORRECTIVE ACTION TO AVOID HIGH PENALTY CHARGES BY SHEDDING ELECTRICAL LOADS WHEN THE PRE-SET DEMAND LEVEL PROTECTED WOULD BE EXCEEDED. THERE SHALL BE A MINIMUM OF 8 LEVELS OF PRIORITY FOR LOADS AVAILABLE TO BE SHED. THE ORDER OF PRIORITY IN EACH LEVEL SHALL BE ROTATED TO PREVENT ANY SINGLE LOAD IN A PRIORITY LEVEL FROM ALWAYS BEING SHED FIRST. A LOG SHALL BE AVAILABLE TO MONITOR THE CONSUMPTION PROFILE OVER EACH DEMAND PERIOD.

* PASSWORDS:

THE SYSTEM SHALL HAVE 3 LEVELS OF USER PROGRAMMABLE PASSWORDS IN ADDITION TO A MASTER PASSWORD. FOR PROGRAMMING SECURITY, UP TO 25 SEPARATE PASSWORDS MAY BE USER PROGRAMMED. ACCESS TO A LEVEL ONE PASSWORD SHALL ALLOW INTERROGATION OF SYSTEM STATUS ONLY. ACCESS TO A LEVEL TWO PASSWORD SHALL ALLOW CHANGING OF SYSTEM PARAMETERS (SETPOINTS, ETC) AND OVERRIDING AND DISABLING OF INPUTS AND OUTPUTS. ACCESS TO A LEVEL THREE PASSWORD SHALL ALLOW FULL PROGRAMMING OF THE SYSTEM. ACCESS TO A MASTER PASSWORD SHALL ALLOW FULL ACCESS OF THE SYSTEM INCLUDING THE CREATION AND DELETION OF PASSWORDS.

* SOFTWARE MANUAL:

THE SOFTWARE MANUAL SHALL DESCRIBE PROGRAMMING AND TESTING, STARTING WITH A SYSTEM OVERVIEW AND PROCEEDING TO A DETAILED DESCRIPTION OF EACH SOFTWARE FEATURE. THE MANUAL SHALL INSTRUCT THE USER ON PROGRAMMING AND RE-PROGRAMMING ANY PART OF THE SYSTEM. THE MANUAL SHALL INCLUDE ALL CONTROL PROGRAMS, VARIABLES, SET POINTS, THE PERIODS, MESSAGES, PASSWORDS AND OTHER INFORMATION NECESSARY TO LOAD, ALTER, TEST AND EXECUTE THE SYSTEM. THE MANUAL SHALL INCLUDE:

- COMPLETE DESCRIPTION OF PROGRAMMING LANGUAGE, INCLUDING COMMANDS, EDITING AND WRITING OF CONTROL PROGRAMS, PRINTOUTS AND LOGS, AND MATHEMATICAL CALCULATIONS.
- INSTRUCTIONS ON MODIFYING ANY CONTROL POINT, VERIFYING ERROR STATUS, CHANGING PASSWORDS, AND INSTANTI OR DISABLING CONTROL PROGRAMS.

* ENERGY SAVINGS SOFTWARE:

THE ENERGY MANAGEMENT SOFTWARE SHALL HAVE NO LIMIT TO THE NUMBER OF TIME SCHEDULES FOR ANY POINT OR NUMBER OF POINTS ASSIGNED. EACH TIME-PROGRAMMED CONTROL MODE SHALL OPERATE OVER A SEVEN-DAY WEEK. THERE SHALL BE NO LIMIT TO THE NUMBER OF HOLIDAY SCHEDULES TO WHICH ANY TIME SCHEDULE OR NUMBER OF TIME SCHEDULES MAY BE ASSIGNED. IT SHALL BE POSSIBLE TO PROGRAM HOLIDAYS 365 DAYS IN ADVANCE.

AFTER ESTABLISHING THE DATABASE, THE ENERGY MANAGEMENT SOFTWARE SHOULD BE ABLE TO TARGET SAVINGS BY TIMED ON/OFF OPERATION, OR BY RE-SETTING TEMPERATURES (WITHOUT SACRIFICING COMFORT LEVELS) AT THE CHILLERS, AHUS, AND FDU'S. THESE SETTINGS SHALL BE BASED ON ACTUAL TIME OF USE AND ACTUAL OCCUPANCY OF EACH AREA. THE ENERGY MANAGEMENT SOFTWARE SHALL THEREFORE INCLUDE THE PROGRAMMABLE CONFIGURATION FOR DETERMINING THE ACTUAL LOAD DEMAND VERSUS THE RECORDING PLANT CAPACITY PLUS THE CAPABILITY TO SEQUENCE OF MULTIPLE EQUIPMENT SUCH AS CHILLERS, PUMPS, AND COOLING TOWERS.

AS FOR OPTIMUM START/STOP CONTROL, THERE SHALL BE NO LIMIT TO THE NUMBER OF OPTIMUM START SCHEDULES TO WHICH POINTS CAN BE ASSIGNED. THE SYSTEM SHALL, BY MONITORING OUTDOOR AIR AND SPACE TEMPERATURES, START THE PLANT AT THE LATEST POSSIBLE TIME TO ACHIEVE THE DESIRED INTERIOR TEMPERATURE BY TARGET TIME. SIMILARLY, THE SYSTEM SHALL STOP THE PLANT AT THE EARLIEST POSSIBLE TIME BEFORE THE END OF THE OCCUPANCY WITHOUT AMBIENT CONDITIONS DETERIORATING BELOW PRE-SET ACCEPTABLE LIMITS. THE OPTIMIZING PROGRAM FOR THE COOLING MODE SHALL BE LOAD-ADJUSTING. THE AMOUNT OF ADJUSTMENT SHALL BE AT 0% TO 100% AS MAY BE DEFINED BY THE OPERATOR

* LOAD CYCLING:

THE SYSTEM SHALL BE CAPABLE OF CYCLING LOADS TO REDUCE ELECTRICAL CONSUMPTION. THE PROGRAM SHALL HAVE AN OPERATOR-DEFINED MINIMUM ON TIME, MAXIMUM OFF TIME, AND MAXIMUM OFF TIME. A TEMPERATURE DETECTOR SHALL BE ASSIGNED TO EACH POINT ON THE LOAD CYCLING PROGRAM. SHOULD THE SPACE TEMPERATURE EXCEED PRE-SET LIMITS, THE LOAD CYCLING SHALL BE OVERSHEDD AND THE PLANT RETURNED TO THE TIME CONTROL PROGRAM UNTIL THE SPACE TEMPERATURE HAS RETURNED TO AN ACCEPTABLE LEVEL.

* INTEGRATED CONTROL:

THE SYSTEM SHALL BE CAPABLE OF PERFORMING PROPORTIONAL CONTROL, INTEGRAL CONTROL, DERIVATIVE CONTROL OR ANY COMBINATION OF THE THREE. THE PRIMARY INPUT TO A CONTROL LOOP SHALL BE WITHIN A MEASURED VALUE (% RH, SRH, ETC.) OR A CALCULATED VALUE. THE SECONDARY OR RESET INPUT SHALL BE EITHER A MEASURED VALUE (% RH, SRH, ETC.) OR A CALCULATED VALUE. THE SET POINT OF ANY CONTROL LOOP SHALL BE CAPABLE OF BEING ADJUSTED BY TIME EVENT OR AS A RESULT OF A CALCULATION.

* TESTING AND COMMISSIONING:

THE SYSTEM SHALL BE TESTED BY COMPONENTS, BY LOCAL OPERATIONAL UNIT, AND AS AN ENTIRE SYSTEM. THE TESTS AND VERIFICATION PROCEDURE SHOULD BE PRESENTED PRIOR TO THE AWARD OF THE CONTRACT, AND SHOULD BE IN FULL AGREEMENT WITH THE REQUIREMENTS OF THIS PROJECT. THE FOLLOWING SHALL BE SHOWN ON THE TEST AND VERIFICATION PROCEDURE:

- BMS CAPABILITY TO MONITOR OPERATING DATA, GATHER THE RELEVANT DATA, AND ESTABLISH A DATA BANK AS BASIS FOR FUTURE ENERGY SAVINGS PROGRAM.
- VERIFICATION IF THE REQUIRED ENERGY OPTIMIZATION AND ENERGY SAVINGS SOFTWARE ARE INDEED INSTALLED IN THE MAIN COMPUTER.
- VERIFICATION IF OTHER PROGRAMS (PROPERLY LICENSED AND DOCUMENTED) AS CLAIMED BY THE CONTRACTOR ARE INSTALLED AND OPERATIONAL IN THE BMS.
- VERIFICATION IF ALL SENSORS AND ACTUATORS AS SPECIFIED BY THE CONTRACT DOCUMENTS, AND AS REQUIRED TO FULFILL THE SPECIFIED FUNCTIONS ARE ACTUALLY PROVIDED AND PROPERLY CALIBRATED TO SHOW CORRECT INFORMATION AND DATA.
- VERIFY IF THE BMS SOFTWARE CAN ACTUALLY PROCESS THE GATHERED DATA IN ORDER TO PRODUCE ALTERNATIVE SUGGESTIONS FOR ENERGY SAVINGS.
- TEST, RUN, AND COMMISSION THE SYSTEM FOR A PERIOD OF ONE MONTH. THE TESTS WILL NECESSITATE NUMEROUS READINGS. IT WILL INVOLVE PRELIMINARY ADJUSTMENTS AND CALIBRATION OF MANY OPERAND STATIONS. THE DATA PRESENTED HEREIN MAY JUST BE THE INITIAL READINGS.
- ADJUST, RE-SET, AND RE-COMMISSION THE SYSTEM FOR A PERIOD OF 2 MONTHS. THE CONTRACTOR SHALL PRESENT THE METHOD OF ADJUSTMENTS, THE CALIBRATION PROCEDURES, AND THE TEST READINGS. AFTER THE ADJUSTMENTS, ALL READINGS SHOULD CORRESPOND TO THE TAB READINGS AT THE CHILLERS, PUMPS, AHUS, FDU'S, ETC., AND THE SETTINGS OF DAMPERS, VALVES, AND CONTROLS. ALL SETTINGS FOR BMS AND TAB SHOULD BE PROPERLY RECORDED AND TABULATED FOR COMPARISON. IT IS THE RESPONSIBILITY OF THE BMS CONTRACTOR TO CALIBRATE THE READINGS SO THAT WHAT IS SHOWN AT THE ACTUAL POINT OF OPERATION IS THE SAME DATA PRESENTED IN THE PC MONITOR OF THE BMS.
- FINE TUNE AND TURN OVER THE SYSTEM AFTER A TOTAL OF 3 MONTHS. ALTHOUGH CERTAIN VALUES ARE INDICATED IN THE PLANS FOR AIR VOLUMES AND WATER FLOW, THESE MAY SERVE AS GUIDE VALUES ONLY. THE FINAL DETERMINING FACTOR WILL BE THE ACTUAL ROOM TEMPERATURES THAT SHOULD BE BETWEEN AN ACCEPTABLE RANGE OF 20°C TO 24°C. THESE TEMPERATURES MAY ALSO VARY DEPENDING ON THE REQUIREMENT OF THE ROOM, SUCH AS AT 18°C FOR THE COOL KITCHEN AREA.
- DURING THE 6-MONTH PERIOD OF TESTING, ADJUSTING, AND FINE-TUNING, THE CONTRACTOR SHALL TRAIN THE MUSEUM PERSONNEL IN THE OPERATION OF THE BMS. WITHIN THE SAME PERIOD, THE CONTRACTOR SHALL TURN OVER TO THE CLIENT THE 3 SETS OF COMPLETE INSTALLATION PLANS, CATALOGS, BROCHURES, INSTALLATION MANUALS, AND OPERATING PROCEDURE OF THE BMS.
- THE WARRANTY PERIOD OF THE SYSTEM SHALL COVER 12 MONTHS FROM THE DATE OF COMMISSIONING. IT IS THEREFORE EXPECTED THAT THE OPERATOR OF THE CONTRACTOR SHALL REMAIN AT THE SITE FOR A TOTAL OF 12 MONTHS FROM THE DATE OF SYSTEM COMMISSIONING.

* GENERAL NOTES:

1. ALL SYSTEM CONFIGURATIONS, I/O POINT COUNT AND QUANTITIES, ARE PROVISIONAL IN NATURE IN ORDER TO ESTABLISH A COMMON BASIS
2. THE SCOPE OF ACTUAL CONTRACT MAY VARY FROM THIS SYSTEM PRESENTATION, BUT THE UNIT COSTS SHALL BE USED FOR ADDITIVE AND DEDUCTIVE COMPUTATIONS.

CASINO MVAC EQUIPMENT I/O POINT TABULATION

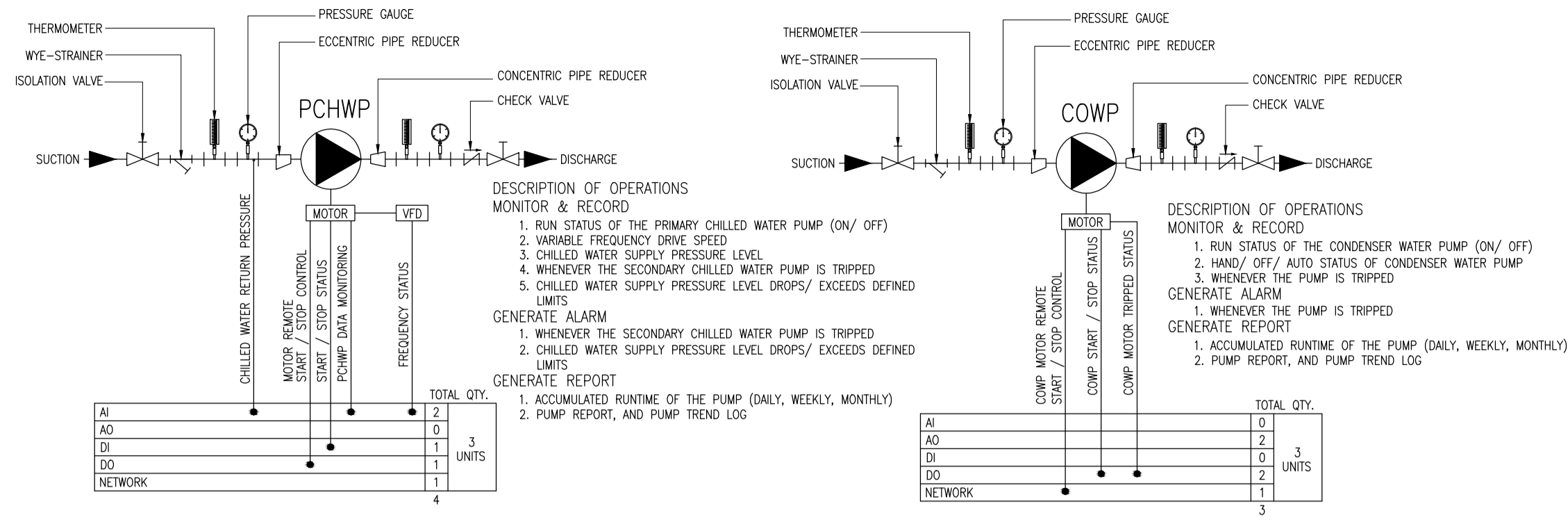
EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HUI
DEDICATED OUTDOOR AIR SYSTEM (DOAS)						
AT 2ND LEVEL (DOAS-2M)	1					
START/ STOP CONTROL OF FRESH AIR FAN				1		
FRESH AIR FAN MOTOR STATUS			1			
FRESH AIR FAN FAN TRIP STATUS			1			
FRESH AIR FAN MOTOR ON/OFF/AUTO STATUS			1			
STATIC PRESSURE TRANSMITTER FOR FRESH AIR FAN	1					
VARIABLE FREQUENCY DRIVE (VFD) FOR FRESH AIR FAN					1	
FRESH AIR FAN CONTROL ON/OFF/MODULATING						1
AMBIENT DB TEMPERATURE SENSOR (AMBIENT-SUPPLY AIR)	1					
AMBIENT AIR MONITORING (AMBIENT-SUPPLY AIR)	1					
HUMIDITY SENSOR HUMIDITY MONITORING (AMBIENT-SUPPLY AIR)	1					
OUTDOOR AIR MOTORIZED DAMPER STATUS	1					
OUTDOOR AIR MOTORIZED DAMPER CONTROL ON/OFF/MODULATING						1
RETURN AIR MOTORIZED DAMPER STATUS	2					
RETURN AIR MOTORIZED DAMPER CONTROL ON/OFF/MODULATING						2
RECOVERY WHEEL MOTOR STATUS	1					
RECOVERY WHEEL TRIP STATUS	1					
I/O TOTAL	9	2	8	2	4	
I/O TOTAL	1					25

EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HUI
AIR HANDLING UNIT						
AT 2ND LEVEL (AHU-2M1/2M2)	2					
FAN MOTOR STATUS				2		
FAN TRIP STATUS				2		
VARIABLE FREQUENCY DRIVE (SPEED MONITORING)					2	
FAN CONTROL ON/OFF/MODULATING						2
SUPPLY AIR TEMPERATURE SENSOR (FOR SUPPLY AIR)	2					
MIXED AIR TEMPERATURE MONITORING (FOR MIXED AIR)	2					
HUMIDITY SENSOR HUMIDITY MONITORING (FOR SUPPLY AIR)	2					
TWO WAY CMV MODULATING VALVE (VALVE STATUS)	2					
CMV MODULATING VALVE CONTROL ON/OFF/ MODULATING					2	
OUTDOOR AIR MOTORIZED DAMPER STATUS	2					
OUTDOOR AIR MOTORIZED DAMPER CONTROL ON/OFF/MODULATING						2
RETURN AIR MOTORIZED DAMPER STATUS	2					
RETURN AIR MOTORIZED DAMPER CONTROL ON/OFF/ MODULATING						2
CARBON DIOXIDE (CO2) SENSOR AT RETURN DUCT	2					
CARBON MONOXIDE (CO) SENSOR AT RETURN DUCT	2					
I/O TOTAL	16	6	4	0	4	
I/O TOTAL	2					30

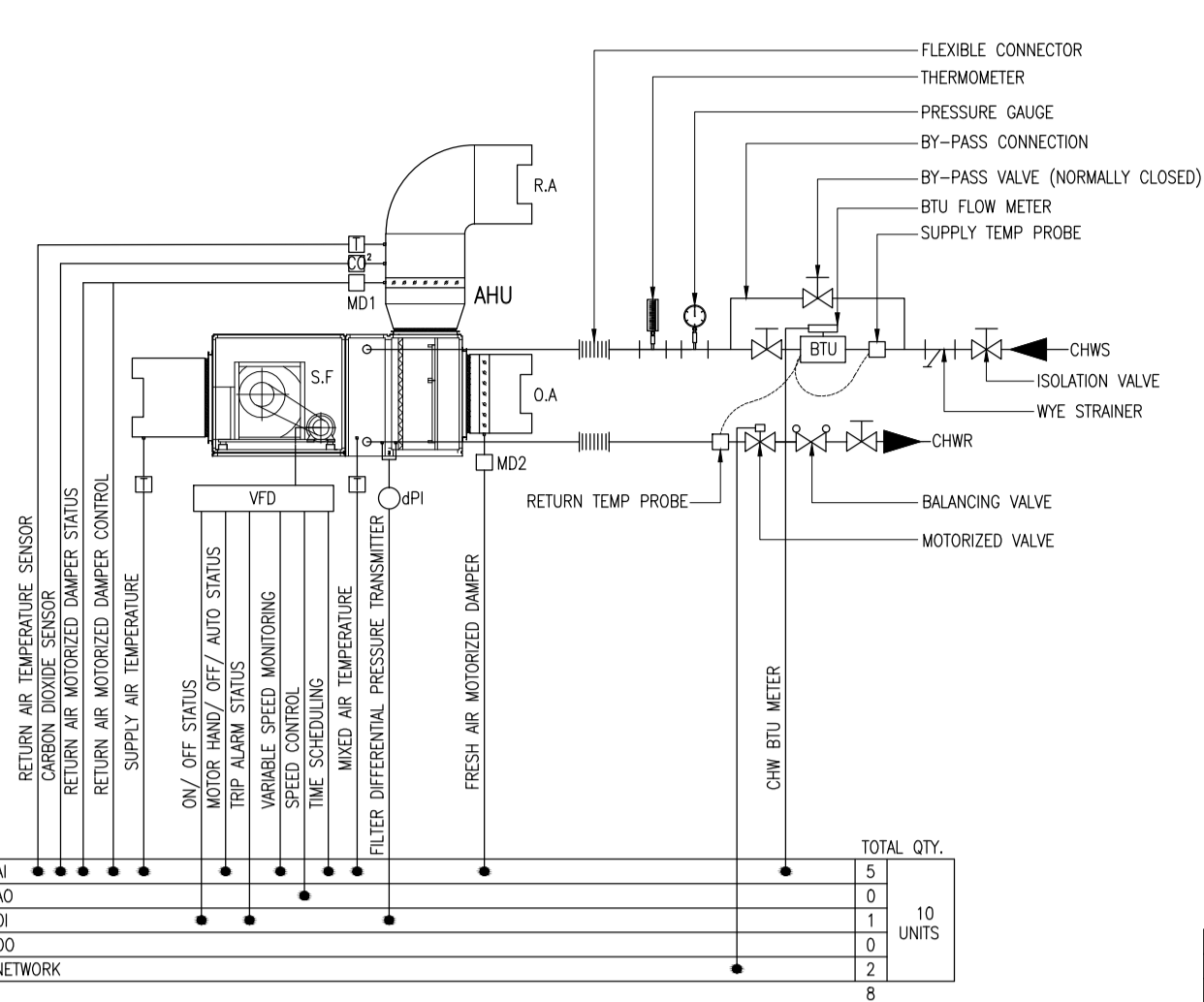
EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HUI
AIR IONIZERS	2					
FOR EQUIPMENT SERVING CASINO: 2ND LEVEL (AHU-2M1/2M2)	2					
EQUIPMENT STATUS				2		
EQUIPMENT TRIP STATUS				2		
VOC MONITORING	2					
I/O TOTAL	0	0	4	0	0	
I/O TOTAL	2					4

HOTEL & ROOFDECK I/O POINT TABULATION

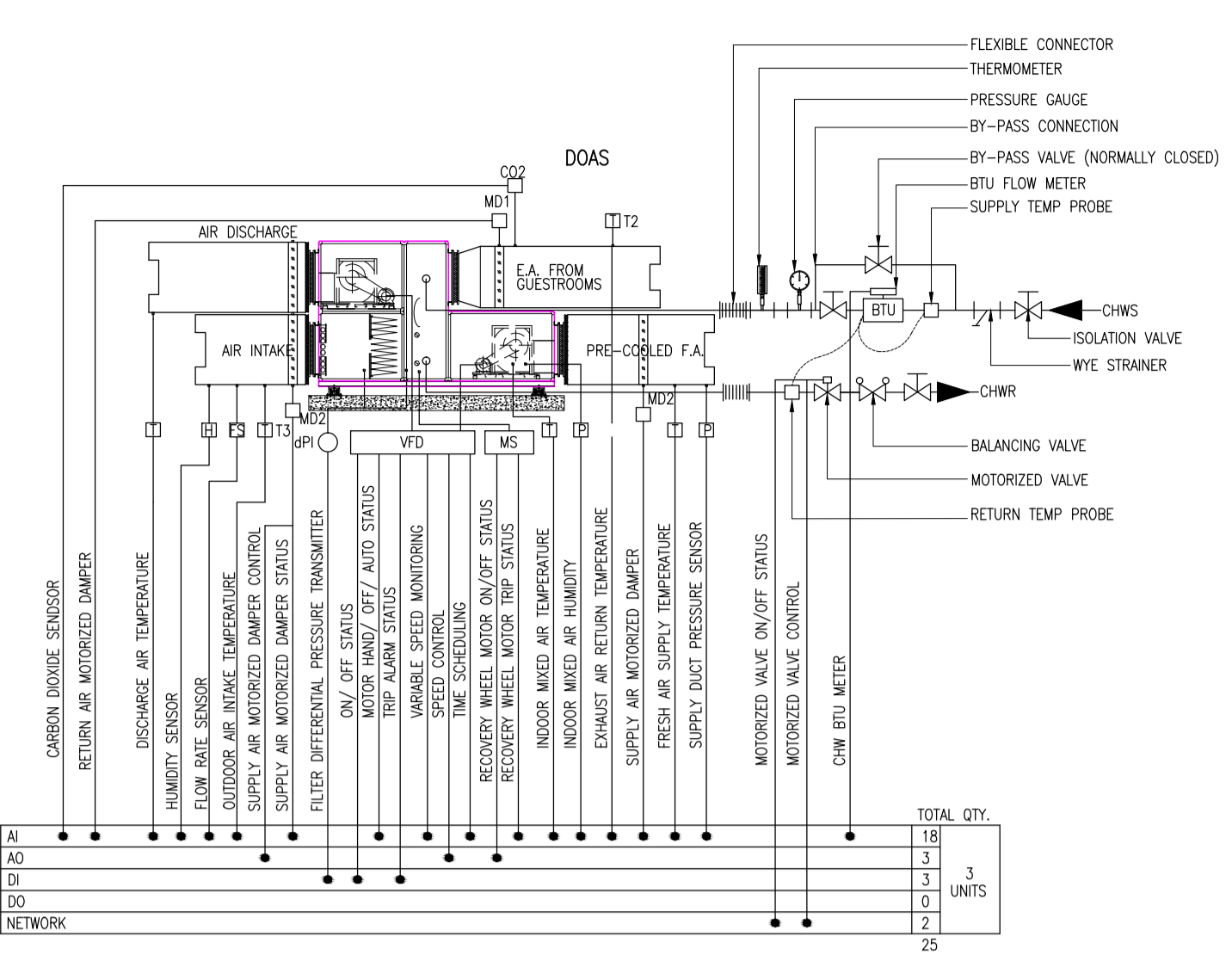
EQUIPMENT MONITORING	QTY	AI	AO	DI	DO	HUI
DEDICATED OUTDOOR AIR SYSTEM (DOAS)						
AT ROOFDECK (DOAS-RO1/RO2 SERVING GUESTROOMS)	2					
START/ STOP CONTROL OF FRESH AIR FAN				2		
FRESH AIR FAN MOTOR STATUS			2			
FRESH AIR FAN TRIP STATUS			2			
FRESH AIR FAN MOTOR ON/OFF/AUTO STATUS			2			
STATIC PRESSURE TRANSMITTER FOR FRESH AIR FAN	2					
VARIABLE FREQUENCY DRIVE (VFD) FOR FRESH AIR FAN					2	
FRESH AIR FAN CONTROL ON/OFF/MODULATING						2
AMBIENT DB TEMPERATURE SENSOR (AMBIENT-SUPPLY AIR)	2					
AMBIENT AIR MONITORING (AMBIENT-SUPPLY AIR)	2					
HUMIDITY SENSOR HUMIDITY MONITORING (AMBIENT-SUPPLY AIR)	2					
OUTDOOR AIR MOTORIZED DAMPER STATUS	2					
OUTDOOR AIR MOTORIZED DAMPER CONTROL ON/OFF/MODULATING						2
RETURN AIR MOTORIZED DAMPER STATUS	2					
RETURN AIR MOTORIZED DAMPER CONTROL ON/OFF/AUTO STATUS						2
RECOVERY WHEEL MOTOR STATUS	1					
RECOVERY WHEEL TRIP STATUS	1					
I/O TOTAL	18	4	14	4	8	
I/O TOTAL	2					48



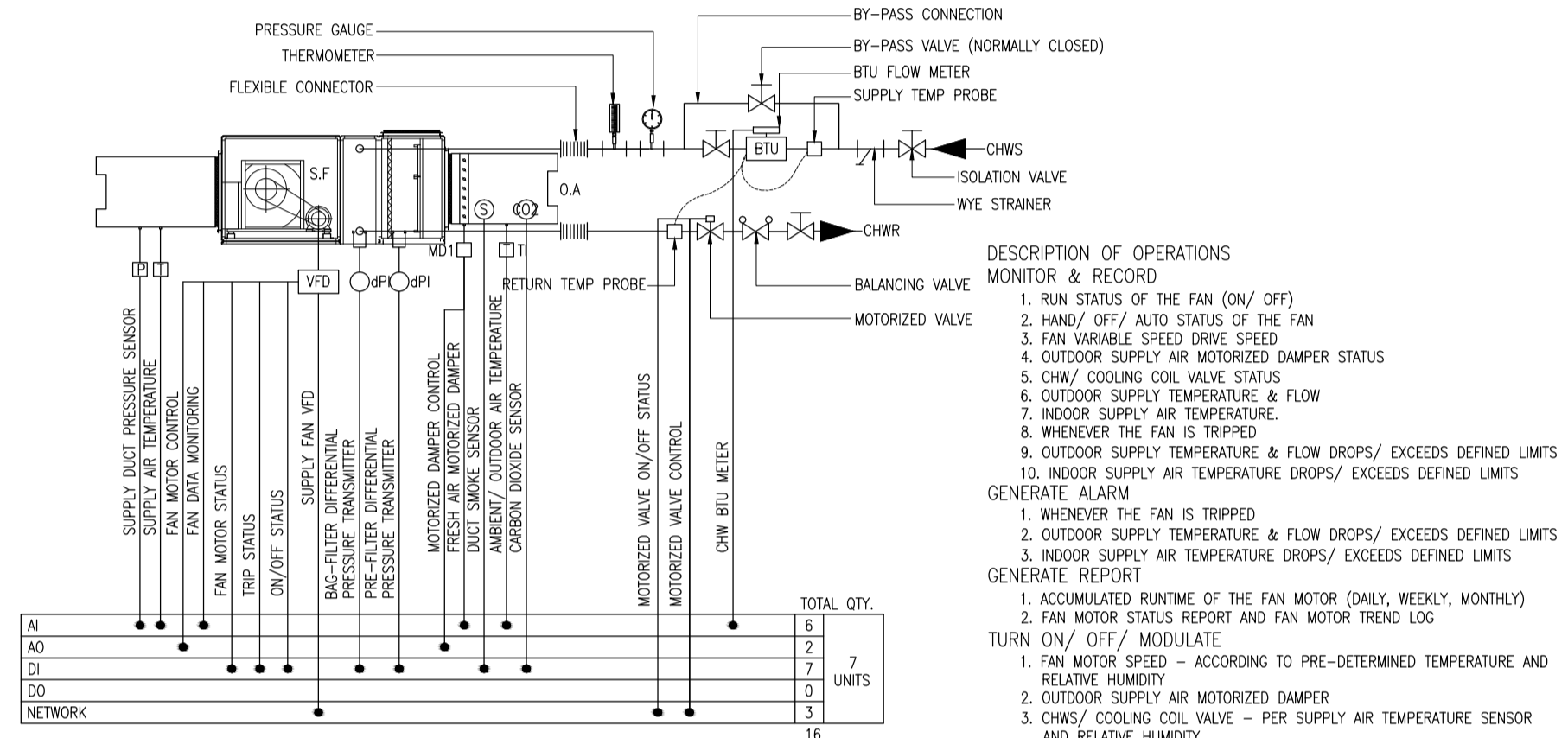
1 BMS-04 NOT TO SCALE



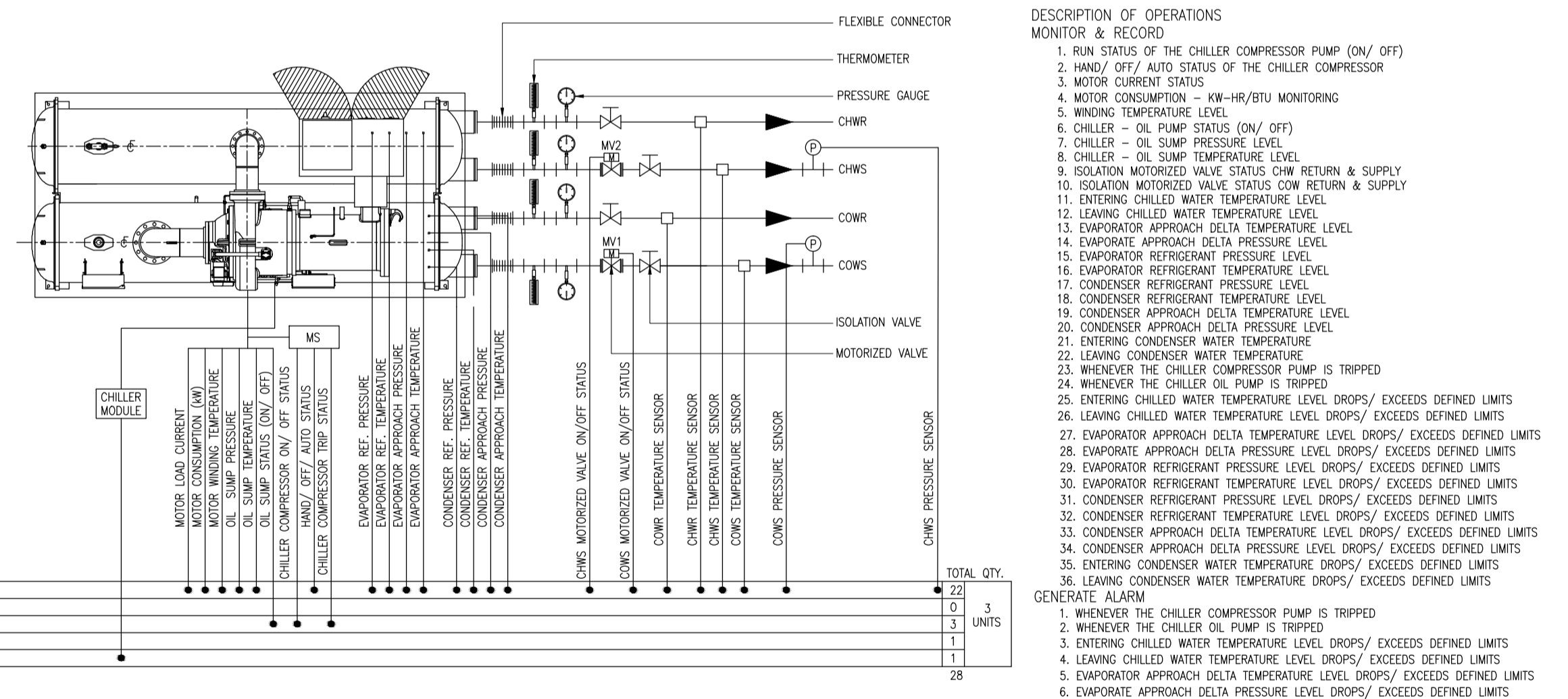
1 BMS-04 NOT TO SCALE



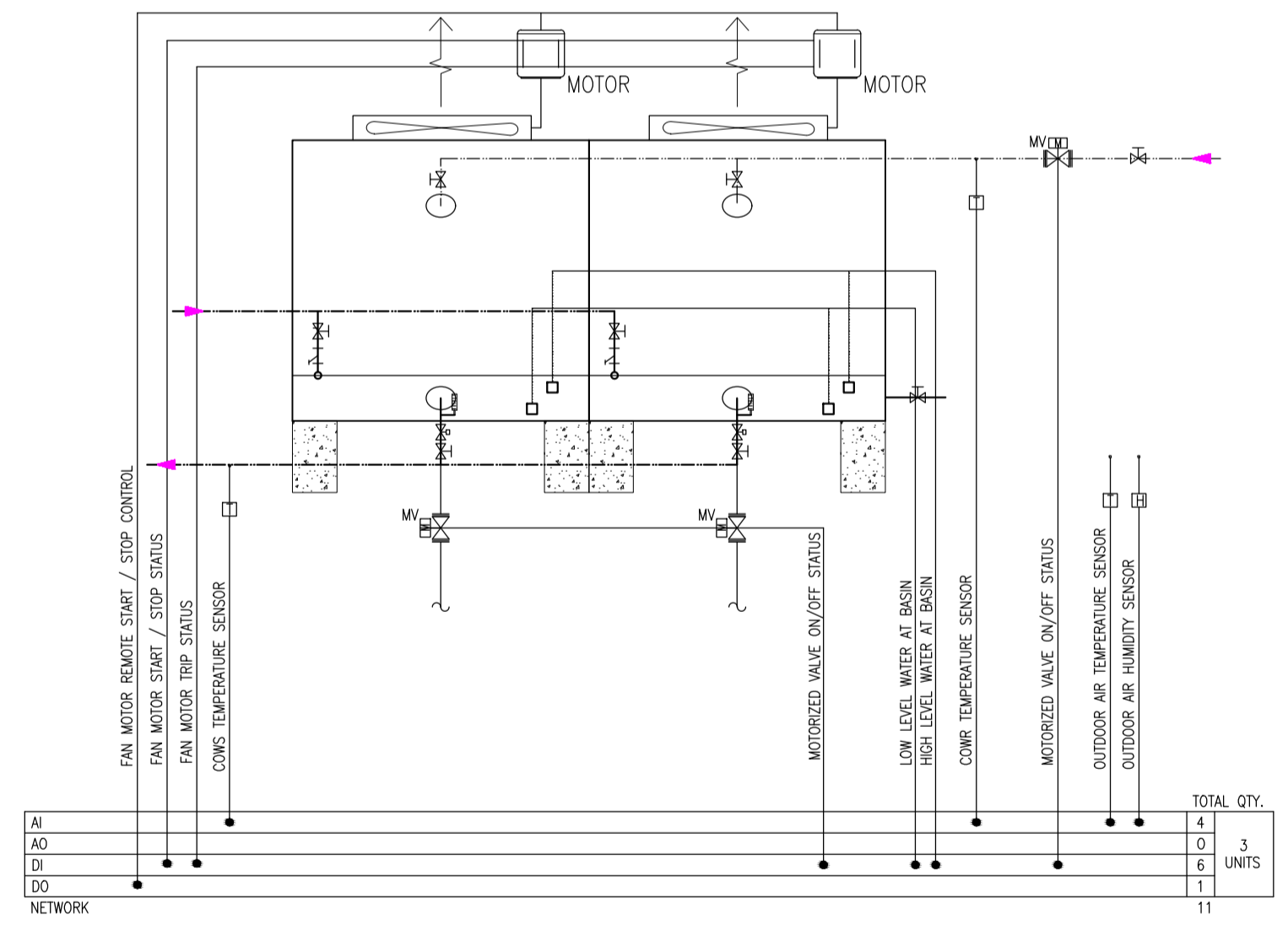
1 M-03 NOT TO SCALE



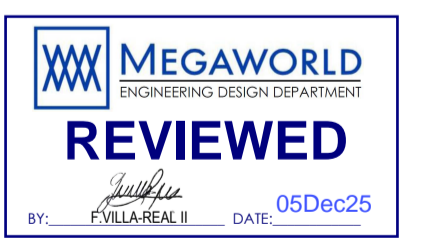
1 BMS-04 NOT TO SCALE



1 M-03 NOT TO SCALE



1 M-03 NOT TO SCALE



REFERENCES	DATE
ARCHITECTURAL	08-01-2025
RCP	00-00-0000
STRUCTURAL	08-01-2025

CONSTRUCTION BULLETIN
DATE: OCTOBER 2025

REYNALDO J. CALPO
PROFESSIONAL MECHANICAL ENGINEER

REG. NO.	0001764	TIN	104-334-983
PTR. NO.	10471032	ISSUED:	01/06/2025 MAKATI



HERMELYN A. CULLANO
ARCHITECT
REG. NO.: 10589
P.T.R. NO.: 8857744
DATE ISSUED: 10JAN22
ISSUED AT: MAKATI CITY
T.L.N.: 159.508.116

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TEL: 881-1880/81

PROJECT TITLE: KINGSFORD HOTEL BACOLOD
LOCATION: MANHATTAN STREET, THE UPPER EAST, BACOLOD CITY, NEGROS OCCIDENTAL
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SECTION 33 - REPUBLIC ACT 9266



NO.:	DATE:	REVISION (S):	DESIGNED BY:	RPP/JMP
			DRAWN BY:	
			CHECKED BY:	RJC/JMP
			APPROVED BY:	RJC
			PROJECT CODE:	

SHEET CONTENT(S):	PROCESS AND INSTRUMENTATION DIAGRAM	SHEET NUMBER:	BMS-03
FILE NAME:			