CONTROLS LEGEND

AI	ANALOG INPUT
AHJ	AUTHORITY HAVING JURISDICTION
AHU	AIR HANDLING UNIT
AO	ANALOG OUTPUT
ATS	AUTOMATIC TRANSFER SWITCH
C	COMMON
CAC	CUSTOM APPLICATION CONTROLLER
CCP	CHILLER CONTROL PANEL
CH	CHILLER
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CHWV	CHILLED WATER VALVE
CV	CONSTANT VOLUME
DDC	DIRECT DIGITAL CONTROL
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
DP	DIFFERENTIAL PRESSURE SWITCH
DPS	DIFFERENTIAL PRESSURE SENSOR
EMS	ENERGY MANAGEMENT SYSTEM
FAS	FIRE ALARM SYSTEM
LP	LIGHTNING PROTECTION
LS	LIMIT SWITCH
MWL	MAKE–UP WATER LINE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTSIDE AIR
OAF	OUTSIDE AIR FAN
OWS	OPERATORS WORK STATION
P	PUMP
RA	RETURN AIR
REL	RELIEF
RM	ROOM
SA	SUPPLY AIR
SYS	SYSTEM
SF	SUPPLY FAN
UPS	UNINTERRUPTABLE POWER SUPPLY
VFD	VARIABLE FREQUENCY DRIVE
VAC	VOLTS ALTERNATING CURRENT
VAV	VARIABLE AIR VOLUME

T	TEMPERATURE SENSOR (AVERAGING)
T	TEMPERATURE SENSOR (POINT)
	TEMPERATURE PIPING WELL WITH ADJACENT PETE'S PLUG
	GAUGE COCK (BALL VALVE)
SP	STATIC PRESSURE SENSOR
P/E	PNEUMATIC/ELECTRIC SWITCH
	CURRENT SWITCH
	BUTTERFLY VALVE
	TWO–WAY VALVE
	MANUAL GLOBE VALVE
	PUMP
	ACTUATOR
	DISCONNECT
	DAMPER
G	GATEWAY
	CONTACTS
	COMBINATION STARTER
C	COIL
R	RELAY
T	THERMOSTAT
P	PRESSURE SENSOR
T	TEMPERATURE SENSOR (SPACE) WITH COMMUNICATIONS JACK
H	HUMIDITY SENSOR (SPACE)
FMS	AIR FLOW MEASURING STATION
S	SMOKE DETECTOR
X / XX	CONTROL SYSTEM POINT
	THREE–WAY VALVE
C	CARBON DIOXIDE SENSOR (DUCT MOUNTED)
E	ELECTRIC ACTUATOR
OS	OCCUPANCY SENSOR
V	VIBRATION SWITCH
	FLOAT SWITCH
F	FLOW SWITCH

GENERAL CONTROL NOTES

1. THE BUILDING MANAGEMENT SYSTEM (BMS) SHALL PROVIDE FOR GLOBAL DISTRIBUTED CONTROL AND MONITORING OF THE INDIVIDUAL ITEMS OF EQUIPMENT AND HVAC SYSTEMS. ALL NECESSARY HARDWARE, SOFTWARE, PROGRAMMING AND SERVICES SHALL BE PROVIDED AS REQUIRED TO PROVIDE A COMPLETELY AUTOMATIC, FUNCTIONAL AND OPERATIONAL SYSTEM.
2. THE BMS CONFIGURATION IS BASED UPON AUTOMATIC LOGIC.
3. THE WORK SHALL INCLUDE, BUT NOT BY WAY OF LIMITATION, MICROPROCESSOR BASED CONTROLLERS, SENSORS, PANELS, SWITCHES, CONDUIT, WIRING, PROGRAMMING, SOFTWARE, FIRMWARE, ROUTERS, HUBS, WORKSTATION SYSTEM GRAPHICS, TERMINATIONS, COMMUNICATIONS WIRING/CABLING, CALIBRATION, ACTIVATION, DE-BUGGING, COMMISSIONING, DEMONSTRATIONS AND TRAINING.
4. COORDINATE THE RANGE, SET POINT, DEAD BAND, CHARACTERISTICS AND MOUNTING LOCATIONS OF SENSORS WITH THE ACTUAL EQUIPMENT FURNISHED. INSTALL SENSORS, TUBING AND WIRING TO BE ACCESSIBLE, PROPERLY SUPPORTED AND ARRANGED SO AS NOT TO IMPEDE OR ENCROACH UPON EQUIPMENT SERVICE AND ACCESS AREAS. ALL DEVICES MOUNTED ON INSULATED SURFACES SHALL INCLUDE APPROPRIATE GALVANIZED STEEL STAND-OFF BRACKETS, THERMOMETER WELLS SHALL HAVE LAGGING EXTENSIONS.
5. WHERE PROPOSED SEQUENCES COULD DEFEAT THE EQUIPMENT MANUFACTURERS RECOMMENDED SAFETIES OR BE INJURIOUS TO THE EQUIPMENT CONTROLLED, ALERT ENGINEER OF CONFLICT PRIOR TO PROCEEDING WITH THE WORK.
6. SEQUENCES DO NOT REFER TO SPECIFIC DEAD BANDS, INTERLOCKS, RESET RATIOS, DELAYS AND RANGES REQUIRED FOR STABLE OPERATION, BUT SHALL BE PROVIDED AND BE FULLY USER ADJUSTABLE AT THE OPERATOR WORKSTATION. ALL OWS ENTERED VALUES AND SET POINTS SHALL BE RETAINED THROUGH A LOSS IN POWER.
7. PROVIDE FOR MODIFICATION OF CONTROL SEQUENCES BASED UPON DIRECTION, CLARIFICATIONS, MODIFICATIONS AND REVISIONS ISSUED BY THE ENGINEER. IN ADDITION, INCLUDE FIELD CALIBRATION OF ALL SENSORS, REVISION TO SET POINTS, SCHEDULES, PID PARAMETERS, DEAD BANDS, DELAYS AND RANGES BASED UPON ACTUAL PERFORMANCE OF CONTROLLED EQUIPMENT, TO PROVIDE FOR STABLE OPERATION WITHOUT EXCESSIVE CYCLING OR HYSTERESIS.
8. DEMONSTRATE SEQUENCE OF OPERATION IN THE PRESENCE OF THE OWNER, AND TEST AND BALANCE FIRM FOR ALL CONTROLLED EQUIPMENT, TO INCLUDE GENERATION OF ALARMS AND SIMULATION OF POWER OUTAGES, REMOTE RESET OF CHILLER PLANT SHUTDOWN, OPERATION ON EMERGENCY POWER, AUTOMATIC RESTART AFTER POWER RESTORATION, AND GENERAL EQUIPMENT FAILURES. PROVIDE MANPOWER TO ASSIST AND SUPPORT CALIBRATION OF ALL SENSORS AS SPECIFIED UNDER SPECIFICATION SECTION 230900.
9. IN ADDITION TO SPECIFIC EQUIPMENT ALARMS NOTED IN THE SEQUENCE, PROVIDE STANDARD ALARMS FOR ITEMS SUCH AS SENSOR FAILURE, OUT OF RANGE (HIGH-LOW LIMITS) AND SIMILAR ITEMS.
10. COORDINATE SEQUENCES AND DATA ACQUISITION REQUIREMENTS AND PROVIDE FOR TREND LOGGING, REPORT GENERATION, CALCULATE RUN HOURS AND SIMILAR PREVENTIVE MAINTENANCE FUNCTIONS.
11. CAC/ASC POINT TABLES, SEQUENCES OF OPERATION, INPUT/OUTPUT SUMMARY TABLES AND CONTROLLER SOFTWARE REQUIREMENTS SHALL BE CONSIDERED COMPLEMENTARY, IN THAT THE WORK OR FEATURES CALLED FOR OR REQUIRED BY ANY ONE, SHALL APPLY TO ALL. THE CONTRACTOR SHALL COORDINATE THESE REQUIREMENTS, RECONCILE ANY DIFFERENCES, AND PROVIDE A COMPLETE SYSTEM WITH ALL OF THE FEATURES, FUNCTIONS AND SEQUENCES SPECIFIED, NOTED INDICATED AND/OR REQUIRED.
12. ALL CONTROL WIRING, INCLUDING POWER, SIGNALING AND COMMUNICATIONS SHALL MEET THE REQUIREMENTS SPECIFIED IN DIVISION 16, EXCEPT THAT ONE HALF INCH DIAMETER CONDUIT IS ACCEPTABLE. POWER WIRING SHALL NOT BE RUN IN THE SAME CONDUIT AS LOW VOLTAGE WIRING, SIGNAL OR COMMUNICATIONS WIRING. FINAL CONNECTION TO SENSORS AND ACTUATORS MAY BE MADE WITH FLEXIBLE CONDUIT NOT EXCEEDING 24 INCHES IN LENGTH. EXPOSED COMMUNICATION CABLING SHALL BE INSTALLED IN CONDUIT, CONCEALED COMMUNICATION CABLING MAY BE RUN EXPOSED BUT SHALL BE PLENUM RATED, SUPPORTED FROM BRIDAL RINGS OR USING 'J' HOOKS FROM THE SIDE OF THE CABLE TRAY, INSTALLATION OF THE WIRING WITHIN THE TRAY IS NOT ALLOWED.
13. WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE. CONDUCTORS SHALL BE COPPER, ONE-PIECE, INSTALLED WITHOUT SPLICES. WIRE NUTS ARE ALLOWED ONLY AT CONNECTION TO END DEVICES. CACS SHALL BE INSTALLED WITHIN CONTROL PANELS. TERMINAL STRIP TYPE CONNECTIONS SHALL BE USED WITHIN CONTROL PANELS WITH NO MORE THAN TWO CONDUCTORS LANDED TO ANY ONE TERMINAL, USE JUMPERS TO AN ADJACENT TERMINAL WHERE NECESSARY TO LAND MORE THAN TWO CONDUCTORS. WIRING WITHIN PANELS SHALL BE RUN PARALLEL AND PERPENDICULAR TO THE PANEL, ARRANGED NEATLY, USING WIRING DUCT FOR MULTIPLE CONDUCTOR RUNS AND SPIRAL WRAPPING OF WIRE BUNDLES. WIRING SHALL BE COLOR CODED AND NUMBER CODED ON BOTH ENDS USING PANDUIT TYPESET PRE-PRINTED LABELS TO MATCH AS-BUILT WIRING DIAGRAMS. CABLING SHALL BE COLOR CODED.
14. 120-VOLT POWER TO AHU CAC CONTROLLERS WILL BE PROVIDED UNDER DIVISION 26 POWER WIRING SHALL BE MINIMUM #12 THWN, LABELED FOR THE CIRCUIT AND PANEL NUMBER FED FROM. MOTOR CONTROL CIRCUITS SHALL BE A MINIMUM OF #14 THWN. TRANSFORMERS, DC POWER RECTIFIERS, 24 VOLT POWER SUPPLIES AND EXTENSION OF POWER TO ACTUATORS, TRANSMITTERS, VAV TERMINAL UNITS AND SIMILAR CONTROL DEVICES AND SENSORS SHALL BE PROVIDED UNDER DIVISION 23.
15. SENSOR WIRING SHALL BE STRANDED #18 HOOK-UP WIRE, 300 VAC LABELED AT BOTH ENDS AS TO THE DEVICE IT SERVES. ANALOG CIRCUIT (4-20 MA / 0-10 VDC) WIRING SHALL BE A TWISTED PAIR.
16. A DEDICATED COMMUNICATIONS NETWORK SHALL BE PROVIDED FOR INTERCONNECTION OF THE CONTROL SYSTEM CONTROLLERS. CONTROL SYSTEM COMMUNICATION NETWORK SHALL BE RUN SEPARATELY FROM OTHER WIRING AND MEET THE MANUFACTURERS REQUIREMENTS.
17. THE DESIGN IS BASED UPON A HARD WIRED SYSTEM; WIRELESS DEVICES SHALL NOT BE USED UNLESS OTHERWISE APPROVED BY THE ENGINEER.
18. IN THE EVENT OF A POWER FAILURE/OUTAGE ALL CONTROLS SHALL RECYCLE TO A NORMAL START SEQUENCE WHEN POWER IS RESTORED. WHERE MULTIPLE UNITS HAVE THE SAME OPERATOR DEFINED START TIME, OR SOFTWARE CALCULATED OPTIMUM START TIME, START-UP OF UNITS SHALL BE STAGGERED TO LIMIT THE KW DEMAND.
19. THE CONFIGURATION DIAGRAM REFLECTS THE REQUIREMENTS OF THE MANUFACTURER USED AS THE BASIS OF DESIGN. THE CONTROL SYSTEM SHALL INCLUDE ALL HARDWARE NECESSARY TO MEET THE SPECIFIED REQUIREMENTS.
20. THE BMS SHALL UTILIZE PROPORTIONAL-INTEGRAL-DERIVATIVE (PID) CONTROL LOOPS. THE CONTRACTOR SHALL TUNE THE LOOPS TO PROVIDE STABLE OPERATION. CONTROL STABILITY SHALL BE DEMONSTRATED BY SIMULATING OR CAUSING A LARGE OFFSET IN THE MEASURED CONTROL INPUT VARIABLE AND PROVIDING A TIME BASED GRAPHICAL TREND LOG OF THE CONTROLLED VARIABLE.
21. COORDINATE VFD COMMUNICATION CARD AND I/O REQUIREMENTS WITH THE DIVISION 26 CONTRACTOR AND PROVIDE PERSONNEL TO ASSIST IN VFD START-UP. EVEN WHERE DATA IS AVAILABLE THROUGH INTERFACES, HARD VFD POINTS SHALL BE PROVIDED AS INDICATED IN THE CAC POINT LIST TABLES.
22. COORDINATE WITH DIVISION 26 FOR MULTIPLEXED INTERFACE TO THE GENERATOR.
23. ALL ROOM NAMES AND NUMBERS USED FOR PROGRAMMING, GRAPHICS, LABELING AND SHOP DRAWINGS SHALL BE COORDINATED WITH THOSE ACTUALLY USED, WHICH MAY DIFFER FROM THE NAMES/NUMBERS ON THE DOCUMENTS.
24. SMOKE AND FIRE/SMOKE DAMPERS ASSOCIATED WITH EACH RTU SHALL BE WIRED THROUGH THE FIRE ALARM SHUTDOWN RELAY CONTROLLING THE PARTICULAR RTU SYSTEM ASSOCIATED WITH THE DAMPER AND THE RTU FAN STOP/START RELAY AUXILIARY CONTACTS UNDER DIVISION 28, THE DAMPERS SHALL BE SHUT WHENEVER THE RTU FAN IS OFF.
25. ALL CACs, 24 VAC POWER SOURCES AND RELAYS SHALL BE LOCATED WITHIN EMS CONTROL PANELS. SENSORS LOCATED OUTDOORS SHALL BE PROVIDED WITH SURGE SUPPRESSION.

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