N. STARTERS AND VFD'S SHALL BE PROVIDED WITH ENCLOSURES RATED NEMA 1 FOR INDOOR APPLICATIONS, NEMA 3R WITH ADDITIONAL GASKETING FOR WEATHERPROOF RAINTIGHT OUTDOOR ENCLOSURE OR INDOOR ENVIRONMENTS SUBJECT TO MOISTURE.

O. MOTORS SHALL BE HIGH EFFICIENCY, COMPLY WITH NEMA MG-1 STANDARD AND MEET THE 1992 EPA ENERGY EFFICIENCY ACT AND UTILITY COMPANY REBATE REQUIREMENTS.

P. PROVIDE VARIABLE FREQUENCY DRIVES (VFD) AS MANUFACTURED BY ABB OR EQUIVALENT FOR CONTROL OF PUMPS AS SHOWN ON THE PLANS AND AS SPECIFIED HEREIN. VFD DISTORTION FACTOR SHALL NOT EXCEED 3% THD (VOLTAGE) AT POINT OF COMMON COUPLING, AS DEFINED BY IEEE 519.1992 AND IN NO CASE SHALL THE CURRENT THD EXCEED 10%. VFDS SHALL INCLUDE THE FOLLOWING:

1. PWM TECHNOLOGY INCORPORATING IGBT.
2. 40 CHARACTER FULL ENGLISH DIGITAL DISPLAY. CODES ARE NOT ACCEPTABLE.
3. DC LINE CHOKE.
4. THREE SETS OF NORMALLY CLOSED OR NORMALLY OPEN CONTACTS.
5. CIRCUIT BREAKER DISCONNECT.
6. VFD DRIVE SERVICE SWITCH.
7. SPEED CONTROL DIAL.
8. THERMAL MOTOR OVERLOADS.
9. 3% AC LINE REACTOR PRE-WIRED AND INSTALLED WITHIN VFD ENCLOSURE.
10. FACTORY START-UP SERVICE INCLUDING COMPONENT TESTING, FIELD CHECK OF CONTROL CONNECTION, AND DOCUMENTS STATING THAT ALL WORK AND DRIVE FUNCTIONS ARE DEEMED ACCEPTABLE.
11. PROGRAMMING OF ALL DRIVE PARAMETERS PARTICULAR TO THIS INSTALLATION.
12. 2 YEAR SITE PARTS AND LABOR WARRANTY AFTER START-UP.

Q. VARIABLE FREQUENCY DRIVE MOTORS SHALL COMPLY WITH NEMA MG-1 PART 31.40.4.2 STANDARD SUITABLE FOR VFD OPERATION. CONTRACTOR TO COORDINATE VFD AND MOTOR MANUFACTURERS.

R. ALL VFD DRIVES FOR ALL EQUIPMENT SHALL BE OF THE SAME MANUFACTURER. MECHANICAL CONTRACTOR SHALL COORDINATE VFD DRIVE MANUFACTURER WITH EACH EQUIPMENT VENDOR.

2.09 AUTOMATIC TEMPERATURE CONTROL

A. GENERAL

1. PROVIDE ALL CONTROL, POWER, AND INTERLOCK WIRING INCLUDING CONDUITS AND INSTALL PER THE NEW YORK STATE AND NATIONAL ELECTRIC CODE. SUBMIT TERMINAL TO TERMINAL WIRING DIAGRAM, SEQUENCE OF OPERATION AND CUTS OF ALL COMPONENTS FOR APPROVAL. PROVIDE ALL RELAYS, SWITCHES, DAMPERS AND ACTUATORS, THERMOSTATS, PANELS, LIMIT SAFETIES, TRANSFORMERS, TIME CLOCKS, CONTROL VALVES AND OTHER DEVICES TO ACCOMPLISH THE DESIRED SEQUENCE OF OPERATION.
2. FURNISH AND INSTALL AS HEREIN SPECIFIED, A COMPLETE AUTOMATIC TEMPERATURE CONTROL SYSTEM OF THE DDC TYPE WITH BACNET COMMUNICATION PROTOCOL.
3. THE MANUFACTURER SHALL BE ALBIREO ENERGY, ABM, AUTOMATED LOGIC, SCHNEIDER ELECTRIC, HONEYWELL OR APPROVED EQUAL BY THE ENGINEER. MANUFACTURER SHALL BE APPROVED BY ENGINEER BEFORE BID AWARD. THE ATC CONTRACTOR SHALL BE AN INDEPENDENT CONTRACTOR NOT AFFILIATED WITH THE MECHANICAL CONTRACTOR.
4. ALL TEMPERATURE CONTROL SYSTEMS AND COMPONENTS ARE TO BE FULLY MODULATING TYPE, EXCEPT WHERE NOTED OTHERWISE.
5. THE NEW BMS SYSTEM SHALL BE A WEB-BASED SYSTEM.
6. BMS SOFTWARE & GRAPHICS:
   A) PROVIDE ENTERPRISE SERVER SOFTWARE TO ALLOW ALL NETWORK CONTROLLERS (INCLUDING GRAPHICS, ALARMS, SCHEDULES, ETC) TO BE ACCESSIBLE FROM THE WORKSTATION SIMULTANEOUSLY FOR OPERATIONS AND ENGINEERING TASKS.
   B) WEB-STATION SHALL REQUIRE SECURE USERNAME AND PASSWORD LOGIN.
   C) PROVIDE A SYSTEM GRAPHIC PAGE ON THE WORKSTATION & WEB GRAPHICS FOR EACH HVAC SYSTEM WITH ALL MONITORING AND CONTROL POINTS AS SPECIFIED.
   D) THE BMS CONTRACTOR SHALL PROVIDE A GRAPHIC REPRESENTATION OF EACH FLOOR PLAN AND EACH SYSTEM, SHOWING DEVICES AND ALARMS INDICATED ON THE INPUT/OUTPUT SUMMARY.
   E) PROVIDE A GRAPHICAL FLOOR PLAN SHOWING LEAK DETECTORS AND INDICATE STATUS.
   F) THE BMS SHALL PROVIDE GRAPHICAL SUMMARY PAGES FOR EQUIPMENT AND THEIR CRITICAL POINTS, AC UNIT LEAK DETECTION.
   G) ALL EQUIPMENT GRAPHICS SHALL BE DYNAMIC
   H) THE FLOOR GRAPHICS SHALL INCLUDE UNIQUE COLOR CODES FOR TEMPERATURE VARIATIONS FROM SETPOINT.
   I) THE GRAPHIC INTERFACE SHALL BE SIMPLE POINT AND CLICK NAVIGATION AND ALLOW SCHEDULE CHANGES, SETPOINT CHANGES, ALARM ACKNOWLEDGEMENT, TREND CONFIGURATION, ETC.
7. TRAINING
   A) THE BMS CONTRACTOR SHALL PROVIDE A MINIMUM OF (8) HOURS ON-SITE TRAINING FOR FACILITY STAFF ON-SITE. TRAINING CAN BE PERFORMED IN SEPARATE (4) HOUR INTERVALS AT THE DISCRETION OF THE OWNER.
   B) THE BMS CONTRACTOR SHALL PROVIDE HARDCOPY OF AS-BUILT DRAWINGS AND REVIEW ALL MAINTENANCE REQUIREMENTS AND PROCEDURES FOR ALL EQUIPMENT
8. ALL CONTROLS MUST BE THE PRODUCT OF ONE MANUFACTURER. ALL AUTOMATIC CONTROL VALVES AND DAMPER OPERATORS SHALL BE MANUFACTURED BY THE TEMPERATURE CONTROL MANUFACTURER.
9. THE MANUFACTURER OF THE AUTOMATIC CONTROL EQUIPMENT SHALL SUBMIT THE FOLLOWING FOR APPROVAL: A SCHEMATIC DIAGRAM OF EACH CONTROL SYSTEM WHICH SHALL INDICATE THE PROPER SEQUENCE OF OPERATION AND RANGE OF THE CONTROLS FOR ALL CYCLES, PROVIDE TERMINAL POINT TO TERMINAL POINT ELECTRICAL WIRING DIAGRAMS FOR APPROVAL, A COMPLETE DESCRIPTION OF THE AUTOMATIC OPERATION OF EACH SYSTEM WHERE THE DESCRIPTION INCLUDES THE DUTY OF EACH THERMOSTAT, VALVE, SWITCH, ETC., INCORPORATED IN THE CONTROL SYSTEM WITH A SCHEDULE AND ILLUSTRATION OF ALL CONTROL INSTRUMENTS AND EQUIPMENT INCLUDING CONTROL PANELS AND DEVICES FOR EACH SYSTEM.
10. INDIVIDUAL SMOKE DETECTORS SHALL BE INSTALLED (PROVIDED BY ELECTRICAL CONTRACTOR) IN THE RETURN DUCT OF ALL AIR HANDLING SYSTEMS SHARING A COMMON CEILING OR DUCT PLENUM AS REQUIRED BY CODE.
11. FOR AIR DISTRIBUTION SYSTEMS 2,000 CFM OR LARGER, INSTALL SMOKE DETECTORS (PROVIDED BY ELECTRICAL CONTRACTOR) IN MAIN SUPPLY DUCT (DOWNSTREAM OF AIR FILTERS AND AHEAD OF ANY BRANCH CONNECTIONS) AND MAIN RETURN DUCT (UPSTREAM OF ANY FILTERS AND BEFORE RETURN AIR IS DILUTED WITH OUTDOOR AIR).
12. ALL SMOKE DETECTORS SHALL BE TIED TO THE BUILDING FIRE ALARM SYSTEM. A SIGNAL FROM THE BUILDING FIRE ALARM SYSTEM SHALL AUTOMATICALLY SHUT DOWN SYSTEM FANS. SIGNAL, INTERLOCK WIRING, POWER WIRING AND FINAL CONNECTIONS WILL BE PROVIDED BY ELECTRICAL CONTRACTOR.

B. ELECTRIC WIRING:

1. ALL ELECTRIC WORK (EXCEPT FOR MOTOR FEEDERS, WIRING BETWEEN MOTORS, MOTOR CONTROLLERS, FEEDER PANELS, FUSES, CIRCUIT BREAKERS AND BUS BARS) REQUIRED FOR THE AUTOMATIC TEMPERATURE CONTROL SYSTEM SHALL BE PROVIDED BY THIS CONTRACTOR. WORK SHALL INCLUDE BUT NOT BE LIMITED TO TIME SWITCHES, DAMPER MOTORS, DAMPER SWITCHES, ELECTRIC THERMOSTAT, ELECTRIC RELAYS, E/P SWITCHES, INTERLOCKING WIRING, WIRE, CONDUIT, ETC.
1. ALL CONTROL POWER, WIRING AND TRANSFORMERS FOR DAMPERS, ACUATORS, VAV BOXES, CONTROL PANELS, ETC. TO BE PROVIDED BY THE CONTROLS CONTRACTOR FROM A SOURCE DESIGNATED BY THE ELECTRICAL CONTRACTOR. CIRCUITS FOR CONTROL DEVICES HAVE BEEN DESIGNATED IN THE ELECTRICAL PANEL SCHEDULES.
2. THE CONTROL MANUFACTURER SHALL INCLUDE WIRING DIAGRAMS IN HIS SHOP DRAWINGS SUBMITTALS FULLY COORDINATED WITH THE ELECTRICAL CONTRACTORS WORK. IT SHALL BE THE AUTOMATIC TEMPERATURE CONTROL CONTRACTORS RESPONSIBILITY TO PROVIDE ALL WIRING AND CONDUIT AS REQUIRED TO ACHIEVE THE FUNCTION CALLED FOR IN THESE SPECIFICATIONS, CONFORMING WITH LOCAL CODES FOR MATERIAL AND INSTALLATION. THE ELECTRICAL SPECIFICATION FOR THE PROJECT ELECTRICAL WORK IS TO BE FOLLOWED.

T. CONTROL PANELS SHALL BE NEMA 1 FOR INDOOR APPLICATIONS, NEMA 3R WITH ADDITIONAL GASKETING FOR WEATHERPROOF RAINTIGHT OUTDOOR ENCLOSURE OR INDOOR ENVIRONMENTS SUBJECT TO MOISTURE. THEY SHALL BE PROVIDED WITH WELDED ANGLE BRACKETS AND A BAKED PRIME COAT ENAMEL FINISH. THE PANEL DOORS SHALL BE HINGED LOCKING TYPE. CONTROL PANELS SHALL CONTAIN ALL CENTRAL CONTROL DEVICES, SUCH AS CONTROLLERS, RELAYS, SWITCHES, PILOT LIGHTS, TERMINAL BLOCKS, AND ALL OTHER ACCESSORIES AS REQUIRED FOR A WORKABLE ENVIRONMENTAL CONTROL SYSTEM. ALL COMPONENTS WITHIN THE CONTROL PANELS SHALL BE PRE-WIRED TO NUMBERED TERMINAL TRIPS, READY FOR FIELD CONNECTION FOR FIELD MOUNTED CONTROL COMPONENTS. PROVIDE ENGRAVED NAMEPLATES TO LABEL THE CONTROLLED EQUIPMENT. PROVIDE A PLASTIC LAMINATED CONTROL SCHEMATIC DRAWING HUNG NEXT TO EACH CONTROL PANEL.

U. THE SYSTEM INSTALLATIONS SHALL BE SUPERVISED BY THE AUTOMATIC CONTROL MANUFACTURER, WHO SHALL COORDINATE WITH AND INSTRUCT PIPING OR SHEET METAL TRADES AS TO TEES OR TAPPINGS TO BE INSTALLED IN PIPING OR EQUIPMENT AND OPENINGS THAT ARE REQUIRED IN SHEET METAL FOR THE SETTING AND INSTALLATIONS OF CONTROL DEVICES THEREIN BY THESE TRADES.

V. ALL ROOM THERMOSTATS/SENSORS AND SWITCH LOCATIONS SHALL BE SUBMITTED FOR REVIEW BY THE ARCHITECT AND ENGINEER PRIOR TO INSTALLATION WHETHER THE DEVICES ARE SHOWN ON PLANS OR NOT.

W. ALL ROOM THERMOSTATS/SENSORS SHALL HAVE OVERRIDE SWITCH, LOCAL READOUT AND LOCAL ADJUSTMENT. READOUT AND ADJUSTMENT SHALL BE CAPABLE OF BEING LOCKED OUT AT THE BMS.

X. AUTOMATIC VALVES:

1. ALL AUTOMATIC CONTROL AND ISOLATION VALVES SHALL BE OF THE ELECTRONIC TYPE, UNLESS OTHERWISE SPECIFIED, QUIET IN OPERATION, AND SHALL BE ARRANGED TO SPRING RETURN FAIL SAFE, IN A NORMALLY CLOSED POSITION. CONTROL VALVES SHALL BE FULLY PROPORTIONING AND ISOLATION VALVES SHALL BE 2-POSITION. VALVES TO HAVE ADJUSTABLE OPERATING RANGES AND STARTING POINTS TO PROVIDE FLEXIBILITY OF ADJUSTMENT IN SEQUENCING AND THROTTLING. MODULATING VALVES SHALL BE PROVIDED WITH PILOT POSITIONERS.
2. VALVES SHALL BE SIZED BY THE TEMPERATURE CONTROL MANUFACTURER AND GUARANTEED TO MEET THE HEATING OR COOLING REQUIREMENTS AS SPECIFIED. CONTROL VALVES SHALL BE SUITABLE FOR PRESSURE CONDITIONS AND CLOSE AGAINST 110% OF PUMP DIFFERENTIAL PRESSURE.
3. ALL VALVE BODIES SHALL HAVE THE SAME PRESSURE CHARACTERISTICS AS THE PIPE IN WHICH IT IS INSTALLED.
4. VALVES 2 INCHES AND SMALLER UNLESS OTHERWISE SPECIFIED SHALL HAVE BRONZE BODIES WITH SCREWED CONNECTIONS. VALVES SHALL BE FISHER TYPE ED, WARREN TYPE 20/70, K&M SERIES GCG, OR AS APPROVED.
5. VALVES BETWEEN 2-1/2" AND 4 INCH UNLESS OTHERWISE SPECIFIED, SHALL HAVE CAST IRON OR CARBON STEEL BODIES WITH FLANGED CONNECTIONS IN ACCORDANCE WITH THE PIPING SPECIFICATIONS. VALVES SHALL BE FISHER STYLE ED, WARREN TYPE 20/70 OR 1800 SERIES GCG, K&M SERIES GCG OR AS APPROVED.

I. AUTOMATIC DAMPERS:

1. PROVIDE CONTROLS FOR ALL THE AUTOMATIC DAMPERS, AS SPECIFIED IN THE DUCTWORK SECTION, AND SHOWN ON THE DRAWINGS.
2. CONTROL MOTORS OR ACTUATORS SHALL BE OF THE ELECTRONIC TYPE, UNLESS OTHERWISE NOTED, OF APPROPRIATE SIZE AND QUANTITIES TO PROVIDE TWO-POSITION.

J. SEQUENCES OF OPERATION - FURNISH AND MOUNT ALL DEVICES AS REQUIRED TO PERFORM THE FOLLOWING SEQUENCES OF OPERATION:

1. CONSULT MECHANICAL CONTROL DIAGRAMS.

PART 3- EXECUTION

3.01 A. PROVIDE AND INSTALL ALL EQUIPMENT AND ACCESSORIES OF THE SIZES AND CAPACITIES AS SCHEDULED AND AS INDICATED ON THE DRAWINGS AND IN ACCORDANCE WITH APPROVED SHOP DRAWINGS AND MANUFACTURERS RECOMMENDATIONS. PROVIDE ALL MOTOR STARTERS AS REQUIRED; MOTOR STARTERS WILL BE INSTALLED BY THIS CONTRACTOR AND WIRED BY ELECTRICAL TRADE.

K. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL REQUIRED CLEARANCES FOR SERVICING AND MAINTENANCE. COORDINATE REQUIREMENTS WITH ALL TRADES.

L. IDENTIFICATION OF EQUIPMENT AND CONTROLS:

1. ALL EQUIPMENT SHALL BE STENCILED OR LABELED WITH LAMACOID PLATES SCREWED THEREON WHICH SHALL INDICATE SYSTEMS SERVICE.
2. MOTOR STARTERS SHALL BE PROVIDED WITH LAMACOID PLATES WHICH INDICATE SYSTEM SERVED.
3. CONTRACTOR TO SUBMIT LIST OF EQUIPMENT TO RECEIVE LABELS AND THE COORDINATED DESIGNATIONS, SIZE OF LABEL LETTERING, PLATE SIZE AND COLOR FOR REVIEW PRIOR TO INSTALLATION.

M. FOR ALL FLOOR MOUNTED EQUIPMENT PROVIDE A 4" OR 6” HIGH CONCRETE HOUSE-KEEPING PAD; WHERE FLOOR STANDS ARE INDICATED PROVIDE FLOOR STAND OF STRUCTURAL STEEL OR STEEL PIPES AND FITTINGS AND BOLT TO PAD; FOR ROOF MOUNTED EQUIPMENT PROVIDE SUPPORTS WITH APPROVED ANCHORS DIRECTLY FROM BUILDING STEEL STRUCTURE. PROVIDE SUPPLEMENTARY STEEL AS REQUIRED TO ADEQUATELY SUPPORT THE LOAD.

3.02 CHEMICAL CLEANING AND PRETREATMENT

A. CLEANING OF PIPING SHALL BE PERFORMED IN THE PRESENCE OF A BUILDING REPRESENTATIVE.

B. PROVIDE ALL DISPERSANTS, SCALE INHIBITORS AND CORROSION INHIBITORS AS REQUIRED FOR CLEANING AND TREATING ALL PIPING SYSTEMS. CHROMATES SHALL NOT BE USED.

C. ALL CHEMICALS TO BE USED FOR PIPE CLEANING SHALL BE APPROVED BY THE BASE BUILDING CHEMICAL TREATMENT COMPANY.

D. FLUSH PIPING SYSTEMS WITH THE APPROVED CLEANING CHEMICAL TO REMOVE PIPE DOPE, SLUSHING COMPOUNDS, CUTTING OILS AND OTHER LOOSE EXTRANEOUS MATERIALS. SEAL ENDS AFTER CLEANING.

E. THE CONTRACTOR SHALL:

1. SATISFY EACH CHEMICAL HAS THE PROPER FEED RATES FOR CLEANING AND PRETREATMENT OF EACH SYSTEM AND RECORD.
2. CHECK THAT THE CLEANING SOLUTION IS ACTUALLY IN EACH SYSTEM.
3. SATISFY WHEN TO FLUSH THE SYSTEM.
4. CHECK EACH SYSTEM FOLLOWING FLUSHING TO ENSURE CLEANING CHEMICALS HAVE BEEN REMOVED FROM EACH SYSTEM AND TEST TO ENSURE PH OF NEW SYSTEM IS WITHIN 0.5 OF FRESH INCOMING WATER.

F. BLOCK MODULATING VALVES, ZONE VALVES AND OTHER SYSTEM RESTRICTIONS. PROVIDE BY PASS PIPING AND VALVING TO ISOLATE NEW AND EXISTING TO BE RE-USED EQUIPMENT SUCH AS CHILLERS, COILS, HEAT EXCHANGERS, ETC. FROM THE CLEANING PROCESS.

G. PROVIDE PORTABLE PUMPS TO CIRCULATE WATER FOR CLEANING PURPOSES AT RESPECTIVE FLOWS FOR FOUR (4) HOURS. REMOVE AND CLEAN STRAINERS. BLOW OFF LOW POINTS WITH STEAM AFTER CLEANING AND BEFORE TRAPS ARE INSTALLED. DRAIN ENTIRE SYSTEM.

H. CHEMICAL USED FOR CLEANING OF SYSTEMS SHALL COMPLY WITH THE RECOMMENDATIONS OF THE MANUFACTURERS OF THE MAJOR COMPONENTS IN THE SYSTEM AND SHALL BE APPROVED FOR USE.

I. UPON INITIAL FILL (FOLLOWING SYSTEM FLUSHING) THE APPROVED CHEMICALS WHICH PROVIDE A PROTECTIVE COATING TO PREVENT OXIDATION OF THE CLEANED SYSTEM SHALL BE ADDED.

3.03 WATER TREATMENT

C. PROVIDE ALL BIOCIDES AND BIODISPERSANTS AS REQUIRED TO TREAT WATER SYSTEMS FOR THE PREVENTION OF MICROBIOLOGICAL GROWTH. CHROMATES SHALL NOT BE USED.

D. PROVIDE A VENTURI CHEMICAL FEED FITTING AND SYSTEM OR EACH SYSTEM TO BE TREATED. FITTINGS SHALL BE NALCO BIODUCTOR OR APPROVED EQUAL.

E. PROVIDE ALL CONTROLS AND EQUIPMENT REQUIRED FOR AN AUTOMATIC BLEED AND CHEMICAL FEET SYSTEM.

F. AFTER CHEMICAL CLEANING AND PRETREATMENT OF PIPING SYSTEMS ANALYZE WATER SYSTEMS TO DETERMINE SPECIFIC BIOCIDES AND INHIBITORS TO BE USED.

G. ADD THE NECESSARY BLEND OF INHIBITORS, BIOCIDES AND DISPERSANTS FOR PROPER CONTROL OF CORROSION, SCALING AND MICROBIOLOGICAL GROWTH. SUBMIT IN WRITING THE RECOMMENDED FEED RATE OF ALL CHEMICALS AND BLEED RATE OF ALL SYSTEMS. USE PROPER CHEMISTRY TO PROVIDE THE FOLLOWING MINIMUM LEVELS:

1. CLOSED SYSTEM BACTERIA COUNTS BELOW 10^3 COLONIES PER MILLILITER (AEROBIC & NON AEROBIC). PH LEVELS TO BE BETWEEN 7.0 AND 9.0 CORROSION RATE TO BE LESS THAN 1/2 MILS/YEAR STEEL, 1/10 MIL/YEAR COPPER.
2. OPEN SYSTEM TREATMENT (CONDENSER WATER) PROVIDE AGENTS TO REDUCE SCALE DEPOSITS, TO ADJUST PH AND TO INHIBIT CORROSION. TREATMENT SHALL NOT CONTAIN ANY CHROMATES OR OTHER TOXIC SUBSTANCES. USE PROPER CHEMISTRY TO PROVIDE BACTERIA COUNTS BELOW 10^5 COLONIES PER MILLIMETER (AEROBIC AND NON-AEROBIC). PH TO BE BETWEEN 7.5 AND 8.5. CORROSION RATES TO BE LESS THAN 1 MILS/YEAR - STEEL AND 1/10 MILS/YEAR COPPER.

3.04 EQUIPMENT START-UP AND TESTING

A. UPON COMPLETION OF THE INSTALLATION, THIS CONTRACTOR SHALL ENSURE THAT ALL EQUIPMENT AND SYSTEMS ARE TESTED AND BALANCED UNDER FIELD OPERATING CONDITIONS TO DEMONSTRATE ITS COMPLIANCE WITH SPECIFICATION REQUIREMENTS.

B. SHOULD ANY PART OF THE EQUIPMENT OR SYSTEM FAIL TO MEET THE CONTRACT REQUIREMENTS, THIS CONTRACTOR SHALL ADJUST, REPAIR OR REPLACE ALL DEFECTIVE OR INOPERATIVE PARTS AND AGAIN CONDUCT THE COMPLETE START-UP TEST.

C. SUBMIT SYSTEM START UP SHEETS AND TEST RESULTS TO THE OWNER AND ENGINEER.

3.05 PERFORMANCE TESTS AND COMMISSIONING

A. COMMISSIONING IS MORE DETAILED THAN EQUIPMENT START-UP TESTING AND SHALL BE PERFORMED ON THIS PROJECT TO DEMONSTRATE TO THE COMMISSIONING AUTHORITY (CXA) A COMPLETE AND SUCCESSFUL WORKING INSTALLATION IN ALL OPERATIONAL MODES AS OUTLINED IN THE SEQUENCE OF OPERATIONS. THIS CONTRACTOR SHALL:

1. ATTEND ALL PRE-COMMISSIONING AND ANY SUBSEQUENT COMMISSIONING MEETINGS WITH ASSOCIATED SUB-CONTRACTORS AND MANUFACTURERS REPRESENTATIVES THAT ARE REQUIRED TO COMPLETE THE COMMISSIONING OF THE EQUIPMENT AND SYSTEMS PROVIDED.
2. REVIEW THE COMMISSIONING PLAN TYPICALLY PREPARED AND ISSUED BY THE CXA.
3. COMPLETE PRE-STARTUP AND STARTUP ON ALL INSTALLED EQUIPMENT PRIOR TO ALL COMMISSIONING ACTIVITIES.
4. COMPLETE AND SUBMIT A PRE-FUNCTIONAL CHECKLIST DISTRIBUTED BY THE CXA FOR EACH PIECE OF EQUIPMENT AND SYSTEM TO BE COMMISSIONED. ANY ISSUES ENCOUNTERED DURING START-UP SHOULD BE LISTED IN THE COMMENT SECTION.
5. PERFORM FUNCTIONAL PERFORMANCE TESTING OUTLINED IN THE COMMISSIONING PLAN.
6. WORK CLOSELY WITH THE CXA IN IDENTIFYING ALL OPERATING, MAINTENANCE, FAILURE MODES THAT MUST BE DEMONSTRATED AS PART OF THE COMMISSIONING PROCESS.
7. COORDINATE, SCHEDULE AND COMPLETE COMMISSIONING TASKS WITH THE CXA.
8. BE RESPONSIBLE FOR ALL COSTS FOR TESTING, INCLUDING RE-TESTING DUE TO DEFICIENCIES/NON-COMPLIANCE WITH THE SPECIFICATIONS. RE-TESTING COSTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL NOT CONSTITUTE JUSTIFICATION FOR ADDITIONAL COSTS TO THE OWNER.
9. INCLUDE OVERTIME LABOR AS NEEDED FOR TESTING.
10. RESPONSIBLE TO SUPPLY AND CONNECT ALL TESTING EQUIPMENT REQUIRED FOR ANY PART OF THE COMMISSIONING PROCESS (I.E. LOAD BANKS, CABLES, INFRARED SCANNING, TEMPORARY COOLING MEANS, TESTING MATERIALS AND CHEMICALS, ETC.)
11. SUBMIT MANUFACTURER ACCEPTANCE TESTING DOCUMENTATIONS (STARTUP AND MANUAL DOCUMENTS) TO THE COMMISSIONING AUTHORITY.

B. FUNCTIONAL PERFORMANCE TESTING:

1. START UP OF SYSTEMS AND COMPONENTS SHALL BE PERFORMED BY CONTRACTORS AND MANUFACTURER TECHNICIANS AS APPLICABLE PRIOR TO FUNCTIONAL PERFORMANCE TESTING (FPT) IN THE PRESENCE OF THE CXA. ALL POWER, SAFETIES AND CONTROL INTERLOCKS SHALL BE MADE OPERATIONAL. PRE-TEST VERIFICATION BY THE CONTRACTOR OF COMPONENTS AND SYSTEMS IS MANDATORY TO VERIFY OPERATION BEFOREHAND AND AVOID LAST MINUTE CORRECTIVE WORK OR REPEAT TESTING. SUBMISSION OF PRE-FUNCTION CHECKLISTS SHALL COMMUNICATE THAT SUCH PROCESS HAS OCCURRED.
2. ONCE PRE-FUNCTION CHECKLISTS HAVE BEEN SUBMITTED TO AND REVIEWED BY THE CXA, FUNCTIONAL TESTING CAN BE SCHEDULED BY THE CXA.
3. THE CXA MUST BE KEPT INFORMED OF THE CONSTRUCTION SCHEDULE AND GIVEN TWO (2) WEEKS NOTICE OF THE ANTICIPATED FUNCTIONAL TESTING TIMEFRAME WINDOW.
4. FUNCTIONAL TESTING SHOULD FOLLOW THE SYSTEMS TESTING AND BALANCING PROCESS.
5. PERFORMANCE TEST PROCEDURES ARE INTENDED TO DEMONSTRATE AND RECORD THE PERFORMANCE OF EQUIPMENT AND SYSTEMS UNDER SAFETY AND OPERATIONAL SCENARIOS AS APPLICABLE INCLUDING:
   A) RESPONSE TO SAFETIES IN MANUAL AND AUTOMATIC MODE
   B) SIGNALS TO FIRE ALARM, SECURITY AND TENANT ALARM PANELS
   C) SEQUENCE OF OPERATION, STEP BY STEP
   D) INTERLOCK WITH OTHER PIECES OF EQUIPMENT (E.G., VALVES, LEAK DETECTORS, ETC.)
   E) CONTROL SYSTEM RESPONSE AND ANNUNCIATION OF SENSOR/MONITOR POINTS
6. THE FUNCTIONAL TESTING PROCEDURES ARE EXECUTED BY THE CONTRACTORS, UNDER THE DIRECTION OF, AND RECORDED BY THE CXA. THE CONTRACTOR SHALL PROVIDE A FIELD TECHNICIAN AND A REPRESENTATIVE FROM THE AUTOMATIC TEMPERATURE CONTROLS CONTRACTOR TO OPERATE EQUIPMENT AND CONFIRM RESPONSES IN THE PRESENCE OF THE CXA AND OWNER'S APPOINTED REPRESENTATIVE.
7. ANY NON-COMPLIANCE ITEMS FOUND SHALL BE LISTED IN A COMMISSIONING ISSUES LOG PREPARED BY THE CXA. CONTRACTORS SHALL ENSURE THAT CORRECTIVE ACTION OF LISTED DEFICIENCIES IS IMPLEMENTED AND SHALL RESPOND UPON COMPLETION OF SUCH TO THE CXA VIA THE PROVIDED AREAS IN THE COMMISSIONING ISSUES LOG.
8. ITEMS OF NON-COMPLIANCE IN MATERIAL, INSTALLATION OR SETUP ARE CORRECTED AT THE CONTRACTOR'S EXPENSE.
9. ONCE THE CONTRACTOR INDICATES THAT ALL DEFICIENCIES HAVE BEEN ADDRESSED, THE SYSTEMS SHALL BE RETESTED.

C. SYSTEMS TO BE COMMISSIONED:

1. ROOFTOP AIR CONDITIONING UNITS WITH GAS-FIRED FURANCE (RTAC-R-1&2)
2. ROOFTOP HEATING & VENTILATING UNITS (HV-R-1 THRU 12)
3. DESTRATIFICATION FANS (DSF-4-1 THRU 43)
4. CONDENSING BOILERS (B-1-1&2)
5. HOT WATER CIRCULATING PUMPS (HWP-1-1&2)
6. HOT WATER UNIT HEATERS (HWUH-A,B&C)
7. ELECTRIC RADIANT FLOOR HEATING (ERFH-1,2,3,4&5)
8. HOT WATER FINNED TUBE RADIATORS (FTR)
9. VARIABLE AIR VOLUME BOXES WITH AND WITHOUT HEATING COILS
10. ALL TRANSFER & EXHAUST FANS) (TXF-X-X & TF-X-X)
11. HEATING CONTROL VALVES
12. BMS / CONTROLS

3.06 AIR AND WATER BALANCING

A. AIR AND WATER SYSTEM BALANCING SHALL BE PERFORMED BY AN APPROVED INDEPENDENT CERTIFIED TESTING AND BALANCING FIRM. THE TESTING AND BALANCING FIRM SHALL BE AABC, NEBB, TABB CERTIFIED OR DIRECTLY SUPERVISED BY A STAFFED LICENCED PROFESSIONAL ENGINEER WITH A MINIMUM OF FIVE YEARS EXPERIENCE. AIR AND WATER SYSTEM BALANCING SHALL BE PERFORMED IN THE PRESENCE OF A BUILDING REPRESENTATIVE.

B. MAKE ALL REQUIRED ADJUSTMENTS OF ALL NEW AIR AND WATER SYSTEM DEVICES UNTIL ALL SPECIFIED PERFORMANCES ARE MET. PROVIDE NECESSARY PIPING AND CONNECTIONS FOR BALANCING ALL WATER SYSTEMS. PROVIDE VOLUME DAMPERS AS REQUIRED FOR FINAL BALANCING OF AIR SYSTEMS. PROVIDE A CLEAN SET OF AIR FILTERS AT ALL AIR CONDITIONING UNITS AND CLEAN ALL STRAINERS PRIOR TO ANY BALANCING.

C. SUBMIT THREE (3) AIR AND WATER BALANCING REPORTS FOR REVIEW CONSISTING OF DESIGN AND ACTUAL READINGS OF ALL EQUIPMENT/DEVICES, LOCATION PLANS OF ALL EQUIPMENT/DEVICES BALANCED, BALANCING EQUIPMENT USED AND METHODS OF BALANCING.

D. ALL REPORTS SHALL INDICATE PRELIMINARY READINGS PRIOR TO BALANCING AND FINAL READINGS AFTER BALANCING HAS BEEN COMPLETED. IF IT IS DETERMINED THAT DRIVE CHANGES ARE REQUIRED, CONTRACTOR SHALL PROVIDE ALL NECESSARY NEW COMPONENTS.

E. CONTRACTOR SHALL INCLUDE IN THEIR BID TWO (2) JOB SITE COMFORT BALANCES UPON ACCEPTANCE OF THE FINAL BALANCING REPORT.

F. CONTRACTOR SHALL SUBMIT WATER BALANCE DATA SHEETS AND REPORTS WHICH TABULATE TEST DATA FOR FINAL ADJUSTED SYSTEM CONDITIONS WITHIN 2% OF DESIGN QUANTITIES FOR SYSTEM COMPONENTS INDICATING GPM AND PRESSURE DROP AT PIPE RISERS AND MAINS; PERFORMANCE CHARACTERISTICS FOR ALL PUMPS INDICATING RPM, GPM, TDH, AMPS, SUCTION AND DISCHARGE HEAD PRESSURE, BHP AND HP AT DESIGN AND NO FLOW CONDITIONS; PRESSURE DROP ACROSS COILS, EQUIPMENT, EACH RISER AND MAIN. MARK BALANCING VALVE TAG OF BALANCED POSITION.

G. CONTRACTOR SHALL SUBMIT AIR BALANCE DATA SHEETS AND REPORTS WHICH TABULATE TEST DATA FROM FINAL ADJUSTED SYSTEM CONDITIONS WITHIN 10% OF DESIGN QUANTITIES FOR SYSTEM COMPONENTS AIR OUTLETS, RETURNS AND TERMINAL UNITS INDICATING CFM AND PRESSURE DROP AT DUCT RISERS AND MAINS; PERFORMANCE CHARACTERISTICS FOR ALL FANS AND AIR CONDITIONING EQUIPMENT INDICATING RPM, CFM, PRESSURE DROP ACROSS EACH COMPONENT (FILTERS, COILS, DAMPERS, ETC), AMPS, SUCTION AND DISCHARGE STATIC PRESSURE, OUTSIDE AIR CFM, BHP AND HP AT DESIGN CONDITIONS; AIR OUTLET DISCHARGE TEMPERATURE AND CFM; TERMINAL BOX INLET SP, MINIMUM AND MAXIMUM AIR SETTINGS.

H. CONTRACTOR TO PROVIDE TRAVERSE READING AT BASE BUILDING MAIN SUPPLY AND RETURN SHAFTS AND PROVIDE STATIC PRESSURE READINGS DOWNSTREAM AND UPSTREAM OF ALL REHEAT/HEAT COILS AND PRV.

I. THE FINAL REPORT AFTER COMFORT BALANCE IS PERFORMED SHALL BE PROVIDED TO THE BUILDING MANAGER.

J. PRE-CONSTRUCTION AIR TESTING:

1. MEASURE PRESSURE, TEMPERATURE, AND VOLUME OF AIR FROM EXISTING BASE BUILDING RETURN AND SUPPLY AIR SYSTEMS SERVING THE SCOPE OF WORK AREA BEFORE STARTING WORK. SUBMIT REPORT TO ENGINEER IMMEDIATELY AFTER COMPLETION OF TEST.

3.07 ELECTRICAL WORK

A. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR POWER WIRING UNDER A SEPARATE DIVISION OF CONTRACT WORK. AUTOMATIC TEMPERATURE, SAFETY AND INTERLOCKING CONTROLS FOR MOTORS, MOTOR STARTERS AND OTHER ELECTRICAL APPARATUS AND DEVICES SHALL BE PROVIDED BY THE HVAC CONTRACTOR. CONTROL WIRING SHALL INCLUDE BUT NOT LIMITED TO ALL 12, 24, AND 120 VOLT WIRING.

B. THE MECHANICAL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL TERMINAL POINT TO TERMINAL POINT, COMPLETELY COORDINATED AND INTEGRATED WIRING DIAGRAMS FOR ALL WIRING REQUIRING FIELD INSTALLATION BY THE ELECTRICAL CONTRACTOR.

C. SPECIFIC WIRING DIAGRAMS OF FACTORY INSTALLED EQUIPMENT WIRING SHALL ALSO BE SUBMITTED FOR APPROVAL AND FURNISHED TO THE ELECTRICAL CONTRACTOR FOR HIS INSTALLATION REQUIREMENTS AND OTHER USES.

D. HVAC CONTRACTOR SHALL MAINTAIN ALL EXISTING CONTROL CONNECTIONS FOR STARTERS TO BE REUSED. CONTRACTOR SHALL COORDINATE EXISTING CONDITIONS AND PROVIDE ALL CONTACTS AND RELAYS REQUIRED FOR EXISTING STARTERS TO BE REPLACED WITH NEW.

E. HVAC CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR THE INSTALLATION OF DUCT DETECTORS. DUCT DETECTOR SHALL BE FURNISHED AND WIRED BY THE ELECTRICAL CONTRACTOR AND MOUNTED BY THE HVAC CONTRACTOR.

TO THE BEST KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS AND SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2020 ENERGY CONSERVATION CONSTRUCTION CODE OF NEW YORK STATE.

ARCHITECT
di Domenico + Partners LLP
Architecture
Landscape Architecture
Planning
3743 Crescent Street, 3rd Floor
Long Island City, New York 11101
Tel 212-337-0400
Fax 212-337-3567

CIVIL PLANNING ENGINEER
JMC Planning Engineering Landscape Architecture & Land Surveying, PLLC
120 Bedford Road
Armonk, New York 10504
Tel 914-273-5225
Fax 914-273-2102

MEP ENGINEER
BURNS ENGINEERING, PC.
1261 Broadway, Suite 708
New York, New York 10001
Tel 212-962-3503

STRUCTURAL ENGINEER
GEI Consultants
GEI50
1385 Broadway, 20th FL
New York, New York 10018
Tel 212-687-8282

MANHATTAN BEER DISTRIBUTORS
20 DUNNIGAN DRIVE
SUFFERN, NEW YORK

KEY PLAN

REV	DESCRIPTION	DATE
	ISSUED FOR DOB SUBMISSION	09/10/2021
	ISSUED FOR BID	10/15/2021
	ISSUED FOR PROGRESS	01/18/2022

DRAWN BY :

CHECKED BY :

APPROVED BY :

DATE :

SCALE :

DRAWING TITLE :

MECHANICAL SPECIFICATIONS SHEET #5

DWG NUMBER :

M-805