

### UNIVERSITY OF SOUTH CAROLINA MED PARK 15 - REPLACE AHU-1 AND 2 FP0000164

COLUMBIA, SC

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### **DRAWING INDEX**

#### **MECHANICAL**

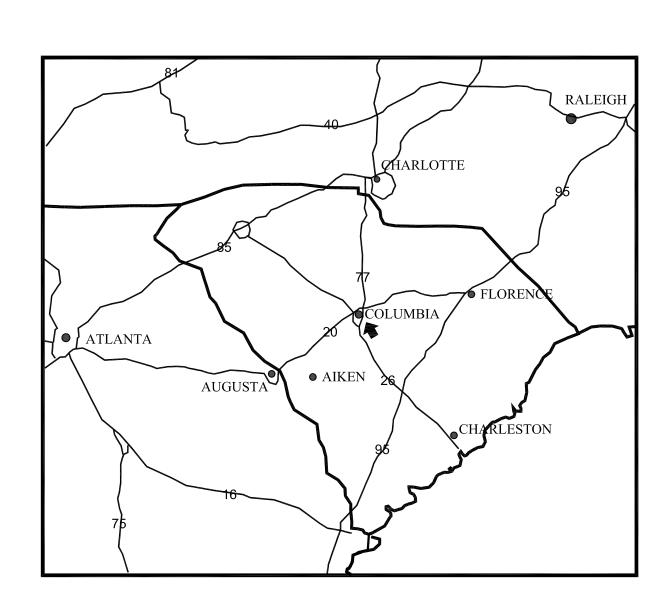
HVAC SPECIFICATIONS
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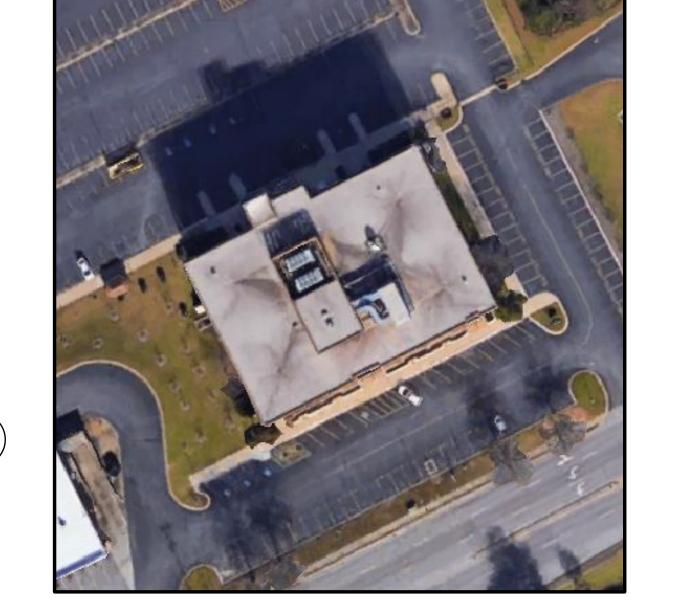
PARTIAL BASEMENT FLOOR PLAN - HVAC DEMOLITION PARTIAL BASEMENT FLOOR PLAN - HVAC RENOVATION

#### **ELECTRICAL**

ELECTRICAL NOTES, SYMBOLS, SCHEDULES, DETAILS, AND ABBREVIATIONS ELECTRICAL DEMOLITION PLANS ELECTRICAL RENOVATION PLANS

**KEY PLAN** 









PART 1 GENERAL

- 1.01 SECTION INCLUDES A. WORK UNDER DIVISION 23 SHALL INCLUDE FURNISHING OF ALL LABOR, ACCESSORIES, TOOLS EQUIPMENT AND MATERIAL REQUIRED TO COMPLETELY EXECUTE INSTALLATION OF THE ENTIRE HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS AS SPECIFIED. WORK SHALL INCLUDE BUT NOT BE LIMITED TO THE FURNISHING, UNLOADING, HANDLING DISTRIBUTION, SETTING, SUPPORTING AND INSTALLATION OF ALL COMPONENTS REQUIRED FOR THE MECHANICAL
- B. DRAWINGS SHALL NOT BE SCALED. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR BUILDING CONSTRUCTION AND DIMENSIONS AND TO ROOM FINISH SCHEDULE ON ARCHITECTURAL DRAWINGS FOR MATERIAL, FINISH AND CONSTRUCTION METHOD OF WALLS. FLOOR AND CEILING IN ORDER TO INSURE PROPER ROUGH—IN AND INSTALLATION OF WORK

- A. FM P7825 APPROVAL GUIDE; FACTORY MUTUAL.
- B. NEMA MG 1 MOTORS AND GENERATORS.
- C. NFPA 70 NATIONAL ELECTRICAL CODE. D. SSPC-PAINT 15 - STEEL JOIST SHOP PAINT; STEEL STRUCTURES PAINTING COUNCIL.
- E. ASME AMERICAN SOCIETY OF MECHANICAL ENGINEERS F. ASTM AMERICAN SOCIETY FOR TESTING MATERIALS
- G. NEMA NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
- H. NFPA NATIONAL FIRE PROTECTION ASSOCIATION
- I. OSHA OCCUPATIONAL SAFETY AND HEALTH ACT
- J. SMACNA SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. K. IBC INTERNATIONAL BUILDING CODE
- L. IMC INTERNATIONAL MECHANICAL CODE
- M. IPC INTERNATIONAL PLUMBING CODE
- N. IFC INTERNATIONAL FIRE CODE O. FACILITY GUIDELINES INSTITUTE (FGI)
- 1.03 INTERPRETATION OF CONTRACT DOCUMENTS: A. EXCEPT WHERE MODIFIED BY A SPECIFIC NOTATION TO THE CONTRARY, IT SHALL BE UNDERSTOOD THAT THE INDICATION AND/OR DESCRIPTION OF ANY ITEM, IN THE DRAWINGS OR SPECIFICATIONS OR BOTH. CARRIES WITH IT THE INSTRUCTION TO FURNISH AND INSTALL THE ITEM, REGARDLESS OF WHETHER OR NOT THIS INSTRUCTION IS EXPLICITLY STATED AS PART OF THE INDICATION OR DESCRIPTION.
- B. IT SHALL BE UNDERSTOOD THAT THE SPECIFICATIONS AND DRAWINGS ARE COMPLIMENTARY AND ARE TO BE TAKEN TOGETHER FOR A COMPLETE INTERPRETATION OF THE WORK.
- C. NO EXCLUSIONS FROM, OR LIMITATIONS IN, THE LANGUAGE USED IN THE DRAWINGS OR SPECIFICATIONS SHALL BE INTERPRETED AS MEANING THAT THE APPURTENANCES OR ACCESSORIES NECESSARY TO COMPLETE ANY REQUIRED SYSTEM OR ITEM OF EQUIPMENT ARE
- D. THE DRAWINGS OF NECESSITY UTILIZE SYMBOLS AND SCHEMATIC DIAGRAMS TO INDICATE VARIOUS ITEMS OF WORK. NEITHER OF THESE HAVE ANY DIMENSIONAL SIGNIFICANCE NOR DO THEY DELINEATE EVERY ITEM REQUIRED FOR THE INTENDED INSTALLATIONS. THE WORK SHALL BE INSTALLED IN ACCORDANCE WITH THE DIAGRAMMATIC INTENT EXPRESSED ON THE DRAWINGS, AND IN CONFORMITY WITH THE DIMENSIONS INDICATED ON FINAL ARCHITECTURAL AND
- STRUCTURAL WORKING DRAWINGS AND ON EQUIPMENT SHOP DRAWINGS. E. NO INTERPRETATION SHALL BE MADE FROM THE LIMITATIONS OF SYMBOLS AND DIAGRAMS THAT ANY ELEMENTS NECESSARY FOR COMPLETE WORK ARE EXCLUDED.
- F. CERTAIN DETAILS APPEAR ON THE DRAWINGS WHICH ARE SPECIFIC WITH REGARD TO THE DIMENSIONING AND POSITIONING OF THE WORK. THESE DETAILS ARE INTENDED ONLY FOR THE PURPOSE OF ESTABLISHING GENERAL FEASIBILITY. THEY DO NOT OBVIATE FIELD COORDINATION FOR THE INTENDED WORK.
- G. INFORMATION AS TO THE GENERAL CONSTRUCTION SHALL BE DERIVED FROM STRUCTURAL AND ARCHITECTURAL DRAWINGS AND SPECIFICATIONS ONLY H. THE USE OF WORDS IN THE SINGULAR SHALL NOT BE CONSIDERED AS LIMITING WHERE OTHER
- INDICATIONS DENOTE THAT MORE THAN ONE ITEM IS REFERRED TO. 1.04 PERFORMANCE REQUIREMENTS A. WORK SHALL BE INSTALLED TO CONFORM WITH ANY CITY OR STATE LAW, REGULATION, CODE,
- ORDINANCE, RULING OR FIRE UNDERWRITERS REQUIREMENT APPLICABLE TO THIS CLASS OF B. ALL INSTALLATIONS FOR CONSTRUCTION PURPOSES SHALL CONFORM WITH THE DEPARTMENT OF
- LABOR "SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION". C. ALL EQUIPMENT WITH ELECTRICAL COMPONENTS SHALL BEAR THE UL LABEL. PART 2 PRODUCTS
- 2.01 MATERIALS AND MANUFACTURERS:
- A. EQUIPMENT AND MATERIALS INSTALLED UNDER THIS CONTRACT SHALL BE NEW AND WITHOUT BLEMISH OR DEFECT.
- B. EACH MAJOR COMPONENT OF EQUIPMENT SHALL HAVE THE MANUFACTURER'S NAME, ADDRES MODEL NUMBER AND RATING ON A PLATE SECURELY AFFIXED IN A CONSPICUOUS PLACE. THE NAMEPLATE OF A DISTRIBUTING AGENT WILL NOT BE ACCEPTABLE. ASME CODE RATINGS. UL LABEL, OR OTHER DATA WHICH IS DIE-STAMPED INTO THE SURFACE OF THE EQUIPMENT SHALL BE STAMPED IN A LOCATION EASILY VISIBLE
- C. IN ALL CASES THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR CHANGES IN DIMENSION OF OTHER THAN FIRST NAMED MANUFACTURER EQUIPMENT, ELECTRICAL CHANGES ETC. REQUIRED FOR PROPER FUNCTION AND FINAL PERFORMANCE. ITEM SHALL COMPLY WITH ALL REQUIREMENTS HEREIN SET FORTH AND AS REQUIRED TO PERFORM AS DESIGNED. 2.02 ELECTRICAL EQUIPMENT
- A. IN GENERAL MOTOR STARTERS AND ADJUSTABLE FREQUENCY DRIVES ARE FURNISHED UNDER DIVISION 26. HOWEVER, IF INTEGRAL CONTROLS AND ELECTRICAL COMPONENTS ARE SPECIFIED WITH THE EQUIPMENT AND ARE FACTORY INSTALLED, THEY SHALL BE FURNISHED UNDER DIVISION 23. REFER TO THE SPECIFIC EQUIPMENT SPECIFICATIONS TO DETERMINE IF INCLUDED UNDER DIVISION 23
- B. WITHIN 60 DAYS OF AWARD OF CONTRACT, THE PERSON RESPONSIBLE FOR WORK IN THIS DIVISION SHALL VERIFY THAT THE APPROPRIATE NUMBER OF CONTACTS HAVE BEEN PROVIDED IN THE STARTERS OR DRIVES AND IF A CONTROL POWER TRANSFORMER IS REQUIRED.
- C. IF ADDITIONAL DEVICES ARE REQUIRED, IT IS THE RESPONSIBLITY OF THIS DIVISION TO COORDINATE AND PROVIDE THE DEVICES REQUIRED TO CONTROL THE EQUIPMENT AS SPECIFIED WITHIN THE STARTERS, ADJUSTABLE FREQUENCY DRIVES AND MOTOR CONTROL CENTERS PROVIDED UNDER DIVISION 23.
- 2.03 SPECIFIED MATERIALS: A. THROUGHOUT THE DRAWINGS AND SPECIFICATIONS, EQUIPMENT AND SYSTEMS HAVE BEEN SELECTED AND ARE REFERENCED BY NAME, MANUFACTURER, MODEL NUMBER, ETC. THESE REFERENCES ARE NOT INTENDED TO LIMIT COMPETITION. PRODUCTS BY OTHER LISTED
- MANUFACTURERS WILL BE ACCEPTABLE B. IF A LISTED MANUFACTURER OTHER THAT THE BASIS OF DESIGN IS USED, IT IS THE CONTRACTOR'S RESPONSIBLITY FOR CHANGES IN DIMENSION, STRUCTURAL, ELECTRICAL
- CHANGES, ETC. REQUIRED FOR PROPER INSTALLATION, FUNCTION AND FINAL PERFORMANCE 2.04 SUBSTITUTION OF SPECIFIED MATERIALS: A. THROUGHOUT THE DRAWINGS AND SPECIFICATIONS, EQUIPMENT AND SYSTEMS HAVE BEEN
- SELECTED AND ARE REFERENCED BY NAME, MANUFACTURER, MODEL NUMBER, ETC. THESE REFERENCES ARE NOT INTENDED TO LIMIT COMPETITION AND IN MOST CASES MATERIALS AND METHODS OF CONSTRUCTION EQUAL TO THAT SPECIFIED WILL BE ACCEPTED PROVIDED PRIOR APPROVAL OF ANY SUBSTITUTE ITEM IS OBTAINED FROM THE ARCHITECT/ENGINEER. ONLY PRODUCTS BY THE LISTED MANUFACTURERS WILL BE ACCEPTABLE. CONTRACTORS AND OTHER MANUFACTURERS MAY SUBMIT REQUESTS TO BE LISTED AS AN ACCEPTABLE MANUFACTURER ON THE SPECIFIED ITEM BY SUBMITTING DOCUMENTATION IN ACCORDANCE WITH THE REQUIREMENTS. ANY ITEM INSTALLED ON THE JOB WHICH HAS NOT BEEN APPROVED IN ACCORDANCE WITH THE NOTED PROCEDURE SHALL BE REMOVED AND REPLACED WITH THE APPROPRIATE APPROVED ITEM AT THE CONTRACTOR'S EXPENSE.
- B. IN ALL CASES THE CONTRACTOR SHALL BE COMPLETELY RESPONSIBLE FOR CHANGES IN DIMENSION OF OTHER THAN FIRST NAMED MANUFACTURER EQUIPMENT, ELECTRICAL CHANGES, FTC. REQUIRED FOR PROPER FUNCTION AND FINAL PERFORMANCE. ITEM SHALL COMPLY WITH ALL REQUIREMENTS HEREIN SET FORTH AND AS REQUIRED TO PERFORM AS DESIGNED.
- PART 3 EXECUTION
- 3.01 PROTECTION OF EQUIPMENT:
- A. PROTECT ALL MATERIALS AND EQUIPMENT FROM DAMAGE DURING STORAGE AT THE SITE AND THROUGHOUT THE CONSTRUCTION PERIOD.
- B. PROTECTION FROM DAMAGE FROM RAIN, DIRT, SUN AND GROUND WATER SHALL BE ACCOMPLISHED BY STORING THE EQUIPMENT ON ELEVATED SUPPORTS AND COVERING THEM ON ALL SIDES WITH PROTECTIVE RIGID OR FLEXIBLE WATER PROOF COVERINGS SECURELY
- C. PIPING SHALL BE PROTECTED BY STORING IT ON ELEVATED SUPPORTS AND CAPPING THE ENDS WITH SUITABLE MATERIAL TO PREVENT DIRT ACCUMULATION IN THE PIPING. 3.02 COORDINATION OF WORK
- A. ALL WORK SHALL BE COORDINATED TO AVOID CONFLICT WITH OTHER CONTRACTORS.
- B. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING TO INSURE THAT THE EQUIPMENT TO BE INSTALLED WILL FIT IN THE SPACE SHOWN ON THE DRAWINGS. IF THERE IS A CONFLICT. THE CONTRACTOR SHALL NOTIFY THE ENGINEER BEFORE BID. BY SUBMITTING A BID THE CONTRACTOR ASSURES THAT THE EQUIPMENT TO BE INSTALLED WILL FIT OR THAT PREVISIONS HAVE BEEN INCLUDED IN THE BID TO MOVE THE EQUIPMENT TO A LOCATION WHERE IT CAN BE INSTALLED WITHOUT CONFLICT.
- 3.03 CONTIGUOUS WORK:
- A. IF ANY PART OF THE CONTRACTOR'S WORK IS DEPENDENT FOR ITS PROPER EXECUTION OR FOR ITS SUBSEQUENT EFFICIENCY OR APPEARANCE ON THE CHARACTER OR CONDITIONS OF CONTIGUOUS WORK NOT EXECUTED BY HIM. THIS CONTRACTOR SHALL EXAMINE AND MEASURE SUCH CONTIGUOUS WORK AND REPORT TO THE ENGINEER IN WRITING ANY IMPERFECTION THEREIN, OR CONDITIONS THAT RENDER IT UNSUITABLE FOR THE RECEPTION OF THIS WORK. SHOULD THE CONTRACTOR PROCEED WITHOUT MAKING SUCH WRITTEN REPORT, HE SHALL BE HELD TO HAVE ACCEPTED SUCH WORK AND THE EXISTING CONDITIONS AND HE SHALL BE RESPONSIBLE.
- 3.04 CERTIFICATES OF INSPECTION AND APPROVAL:
- A. UPON COMPLETION OF WORK, FURNISH TO THE OWNER CERTIFICATES OF INSPECTION OR APPROVAL FROM THE AUTHORITIES HAVING JURISDICTION IF CERTIFICATES OF INSPECTION OR APPROVAL ARE REQUIRED BY LAW OR REGULATION. 3.05 SLEEVES AND OPENINGS:
- A. FURNISH, LOCATE, INSTALL, AND FIREPROOF ALL SLEEVES AND OPENINGS REQUIRED FOR INSTALLATION OF THE WORK.
- 3.06 ACCESS TO EQUIPMENT AND VALVES: A. SHOULD ANY WORK, SUCH AS PIPING, DUCTS, CONDUIT, ETC. BE INSTALLED WITHOUT DUE REGARD TO THE ACCESSIBILITY OF DEVICES INSTALLED BY OTHER CONTRACTORS, THE
- INSTALLATION SHALL BE RELOCATED, OFFSET OR REPOUTED WITHOUT COST TO THE OWNER. 3.07 CUTTING AND PATCHING:
- A. PERFORM ALL CUTTING AND PATCHING REQUIRED FOR INSTALLATION OF THE WORK.

- 3.08 PROJECT CLOSEOUT:
- A. MAINTENANCE MANUALS: AT THE END OF CONSTRUCTION, FURNISH TO THE ENGINEER THREE (3) BOUND AND INDEXED SETS OF MAINTENANCE AND OPERATING INSTRUCTIONS, PARTS LISTS, ELECTRICAL WIRING DIAGRAMS, BALANCE DATA, AND MANUFACTURER'S LITERATURE SUFFICIENT
- FOR OPERATION AND COMPLETE MAINTENANCE OF ALL EQUIPMENT BY THE OWNER. B. APPROVED SUBMITTALS AND SHOP DRAWINGS MAY BE INCLUDED IN THE MAINTENANCE MANUALS INSTEAD OF BEING SEPARATELY FURNISHED, IF DESIRED.
- C. IT IS INTENDED THAT THE DOCUMENTATION PROVIDED IN MAINTENANCE MANUALS, ALONG WITH AS-BUILT DRAWINGS, SHALL BE COMPLETE AND DETAILED ENOUGH TO PERMIT AND FACILITATE TROUBLESHOOTING. ENGINEERING ANALYSIS. AND DESIGN WORK FOR FUTURE CHANGES. WITHOUT EXTENSIVE FIELD INVESTIGATIONS AND TESTING. MANUALS SHALL BE PREPARED SO AS TO EXPLAIN SYSTEM OPERATION AND EQUIPMENT TO THOSE NOT ACQUAINTED WITH THE JOB. D. MANUALS SHALL BE DURABLY BOUND AND CLEARLY IDENTIFIED ON THE FRONT COVER (AND ON THE SPINE OF THICK VOLUMES). IDENTIFICATION SHALL INCLUDE THE BUILDING OR PROJECT NAME, APPLICABLE TRADE (SUCH AS HVAC), APPROXIMATE DATE OF COMPLETION
- (MONTH AND YEAR) AND CONTRACTOR'S NAME. E. MANUALS SHALL BE ORGANIZED INTO WELL DEFINED AND EASY TO LOCATE SECTIONS, WITH INDEX TABS OR SEPARATORS TO DIVIDE THE SECTIONS. A COMPLETE TABLE OF CONTENTS SHALL BE PROVIDED AT THE FRONT INDICATING THE SECTION OR PAGE NUMBER FOR EACH
- SYSTEM, SUBSYSTEM, OR SUPPLIER/MANUFACTURER. F. MANUALS SHALL INCLUDE COMPLETE INFORMATION AND DIAGRAMS ON ALL CONTROLS, INDICATORS, SENSORS, AND SIGNAL SOURCES. CONTROL DIAGRAMS ARE TO SHOW THE LOCATIONS OF COMPONENTS AND MAJOR EQUIPMENT BY ROOM NUMBER OR OTHER
- IDENTIFICATION WHEN ROOM NUMBERS ARE NOT APPLICABLE. LOCATIONS OF OUT-OF-SIGHT COMPONENTS. SUCH AS DUCT MOUNTED SENSORS, FLOW SWITCHES, ETC. SHOULD BE CLEARLY INDICATED. CONTROL DIAGRAMS MUST INCLUDE IDENTIFICATION OF COMPONENTS BY MAKE AND MODEL NUMBER, OPERATING RANGES, RECOMMENDED SET POINTS, RESET SCHEDULES, AND OTHER JOB-SPECIFIC DATA USEFUL FOR TROUBLESHOOTING, CALIBRATION AND MAINTENANCE. COMPLETE NARRATIVE DESCRIPTIONS OF OPERATING SEQUENCES OF CONTROL SYSTEMS AND SUBSYSTEMS SHALL BE INCLUDED ON THE PRINTS ADJACENT TO THE CORRESPONDING SCHEMATICS. CATALOG DATA AND CUTS SHALL BE CLEARLY MARKED TO INDICATE MODEI NUMBERS. SIZES. CAPACITIES. OPERATING POINTS. AND OTHER CHARACTERISTICS OF EACH ITEM USED. THIS SHOULD INCLUDE ACCESSORIES OR SPECIAL FEATURES PROVIDED. WHERE VARIOUS

SIZES OR VARIATIONS OF A SERIES OR MODEL ARE USED, DOCUMENTS SHOULD CLEARLY

- SHOW WHICH ARE USED WHERE. WHERE QUANTITIES ARE APPROPRIATE, SCHEDULE OF USAGE SHOULD BE PROVIDED. MAINTENANCE LITERATURE SHALL INCLUDE COMPLETE INFORMATION FOR IDENTIFYING AND ORDERING REPLACEMENT PARTS, SUCH AS ILLUSTRATED PARTS BREAKDOWNS. G. MAINTENANCE MANUALS MUST INCLUDE COMPLETE BALANCE DATA ON ALL SYSTEMS.
- 3.09 SPARE FILTERS: A. SPARE FILTERS SHALL BE DELIVERED TO OWNER'S REPRESENTATIVE.
- 3.10 WARRANTIES: A. THIS CONTRACTOR WARRANTS THE MECHANICAL SYSTEMS TO BE FREE OF DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE YEAR AFTER DATE OF FINAL PAYMENT. THE EFFECTIVE DATES OF THIS WARRANTY APPLY TO ALL COMPONENTS OF THE MECHANICAL SYSTEMS REGARDLESS OF ANY EQUIPMENT MANUFACTURER'S WARRANTIES WHICH MAY EXPIRE

AT AN EARLIER DATE. ANY SYSTEM MALFUNCTIONS, OR ANY PREVIOUSLY UNDISCOVERED

- NON-COMPLIANCE WITH THE PLANS AND SPECIFICATIONS, DURING THE WARRANTY PERIOD SHALL BE REPAIRED AT NO COST TO THE OWNER. B. DELIVER TO OWNER ALL WARRANTIES, GUARANTEES, ETC. AND OBTAIN WRITTEN RECEIPTS. END OF SECTION
- SECTION 23 0548 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT PART 1 GENERAL
- 1.01 SECTION INCLUDES
- A. VIBRATION ISOLATORS.
- B. SEISMIC SNUBBER ASSEMBLIES. C. SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT.
- 1.02 REFERENCE STANDARDS A. ASCE 7 - MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES; 2010, WITH 2013 SUPPLEMENTS AND ERRATA.
- B. ASHRAE (HVACA) ASHRAE HANDBOOK HVAC APPLICATIONS: 2015. C. FEMA 412 - INSTALLING SEISMIC RESTRAINTS FOR MECHANICAL EQUIPMENT; 2002.
- A. PRODUCT DATA: 1. PROVIDE MANUFACTURER'S PRODUCT LITERATURE DOCUMENTING COMPLIANCE WITH PART 2
- 2. INCLUDE SEISMIC RATING DOCUMENTATION FOR EACH ISOLATOR AND RESTRAINT COMPONENT ACCOUNTING FOR HORIZONTAL, VERTICAL, AND COMBINED LOADS.
- PROVIDE SCHEDULE OF VIBRATION ISOLATOR TYPE WITH LOCATION AND LOAD ON EACH. 2. FULLY DIMENSIONED FABRICATION DRAWINGS AND INSTALLATION DETAILS FOR VIBRATION
- ISOLATION BASES, MEMBER SIZES, ATTACHMENTS TO ISOLATORS, AND SUPPORTED 3. INCLUDE THE CALCULATIONS THAT INDICATE COMPLIANCE WITH THE APPLICABLE BUILDING
- CODE FOR SEISMIC CONTROLS AND THE VIBRATION ISOLATOR MANUFACTURER'S 4. INCLUDE THE SEAL OF THE PROFESSIONAL STRUCTURAL ENGINEER REGISTERED IN THE STATE OF SOUTH CAROLINA IN WHICH THE PROJECT IS LOCATED, ON THE DRAWINGS AND CALCULATIONS WHICH AT A MINIMUM INCLUDE THE FOLLOWING:
- a. Seismic restraint details: Detailed drawings of Seismic restraints and SNUBBERS INCLUDING ANCHORAGE DETAILS THAT INDICATE QUANTITY, DIAMETER, AND DEPTH OF PENETRATION, EDGE DISTANCE, AND SPACING OF ANCHORS. b. EQUIPMENT SEISMIC QUALIFICATION CERTIFICATION: CERTIFICATION BY THE
- WILL WITHSTAND SEISMIC FORCE LEVELS AS SPECIFIED IN THE APPLICABLE BUILDING CODE FOR SEISMIC CONTROLS 1) BASIS FOR CERTIFICATION: INDICATE WHETHER THE WITHSTAND CERTIFICATION IS

MANUFACTURER OR RESPONSIBLE PARTY THAT EACH PIECE OF EQUIPMENT PROVIDED

- BASED ON ACTUAL TESTING OF ASSEMBLED COMPONENTS, ON CALCULATIONS, OR ON HISTORIC DATA. 2) INDICATE EQUIPMENT TO BE SUFFICIENTLY DURABLE TO RESIST DESIGN FORCES AND
- OR REMAIN FUNCTIONAL AFTER THE SEISMIC EVENT. c. DIMENSIONED OUTLINE DRAWINGS OF EQUIPMENT IDENTIFYING CENTER OF GRAVITY, LOCATIONS, AND PROVISIONS FOR MOUNTING AND ANCHORAGE.
- 1.04 QUALITY ASSURANCE A. PERFORM DESIGN AND INSTALLATION IN ACCORDANCE WITH APPLICABLE CODES. B. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING PRODUCTS SPECIFIED IN THIS SECTION, WITH NOT LESS THAN THREE YEARS OF DOCUMENTED
- PART 2 PRODUCTS 2.01 MANUFACTURERS A. KINETICS NOISE CONTROL, INC: WWW.KINETICSNOISE.COM.
- B. MASON INDUSTRIES: WWW.MASON-IND.COM. C. VIBRATION ELIMINATOR COMPANY, INC: WWW.VECO-NYC.COM. 2.02 PERFORMANCE REQUIREMENTS
- A. GENERAL: 1. ALL VIBRATION ISOLATORS, BASE FRAMES AND INERTIA BASES TO CONFORM TO ALL
- UNIFORM DEFLECTION AND STABILITY REQUIREMENTS UNDER ALL OPERATING LOADS. 2. STEEL SPRINGS TO FUNCTION WITHOUT UNDUE STRESS OR OVERLOADING 2.03 VIBRATION ISOLATORS
- A. SEISMIC TYPE: 1. COIL SPRINGS CONSISTING OF SINGLE ELEMENTS:
- a. HOUSING: MANUFACTURED FROM CAST IRON MATERIAL.
- b. DUCTILE MATERIAL: DESIGNED AND RATED FOR SEISMIC APPLICATIONS c. SPRING: RESTRAINED BY HOUSING WITHOUT SIGNIFICANT DEGRADATION OF VIBRATION ISOLATION CAPABILITIES DURING NORMAL EQUIPMENT OPERATING CONDITIONS. d. RESILIENT SNUBBING GROMMET SYSTEM: INCORPORATED AND DESIGNED WITH
- DIRECT METAL-TO-METAL CONTACT BETWEEN SUPPORTED MEMBER AND FIXED RESTRAINT e. RESILIENT PAD: LOCATED IN SERIES WITH SPRING.
- f. COIL SPRINGS: COLOR CODED ELEMENTS TO HAVE A LATERAL STIFFNESS GREATER THAN 0.8 TIMES THE RATED VERTICAL STIFFNESS WITH 50 PERCENT OVERLOAD CAPACITY. q. FINISH: SUITABLE FOR THE APPLICATION.

CLEARANCES OF NO MORE THAN 0.25 INCH (6 MM) IN ANY DIRECTION PREVENTING

- 2. ALL DIRECTIONAL ELASTOMERIC:
- a. MATERIAL: MOLDED FROM OIL, OZONE, AND OXIDANT RESISTANT COMPOUNDS. b. Operating parameters: Designed to operate within the isolator strain limits PROVIDING MAXIMUM PERFORMANCE AND SERVICE LIFE. c. ATTACHMENT METHOD: ENCAPSULATED LOAD TRANSFER PLATE BOLTED TO EQUIPMENT
- AND BASE PLATE WITH ANCHOR HOLE BOLTED TO SUPPORTING STRUCTURE. d. RATING: CAST IRON AND ALUMINUM HOUSINGS RATED FOR SEISMIC RESTRAINT
- e. MINIMUM OPERATING STATIC DEFLECTIONS: DEFLECTIONS INDICATED IN PROJECT DOCUMENTS ARE NOT TO EXCEED PUBLISHED LOAD CAPACITIES. 2.04 SEISMIC SNUBBER ASSEMBLIES
- A. COMPLY WITH: 1. FEMA 412.
- B. ALL DIRECTIONAL EXTERNAL:
- 1. APPLICATION: MINIMUM THREE (3) SNUBBERS ARE REQUIRED FOR EACH EQUIPMENT INSTALLATION, ORIENTED PROPERLY TO RESTRAIN ISOLATED EQUIPMENT IN ALL DIRECTIONS. 2. CONSTRUCTION: INTERLOCKING STEEL CONSTRUCTION ATTACHED TO THE BUILDING
- STRUCTURE AND EQUIPMENT IN A MANNER CONSISTENT WITH ANTICIPATED DESIGN LOADS. 3. PERFORMANCE: EQUIPMENT MOVEMENT AT EACH SNUBBER LOCATION LIMITED TO A MAXIMUM OF 0.25 INCHES (6 MM) IN ANY DIRECTION WITHOUT SIGNIFICANTLY DEGRADING THE VIBRATION ISOLATION CAPABILITY OF THE ISOLATOR DURING NORMAL OPERATING
- 4. RESILIENT PAD: MINIMUM 0.25 INCH (6 MM) THICK CUSHIONS ANY IMPACT AND PREVENTS METAL-TO-METAL CONTACT. PART 3 EXECUTION
- 3.01 INSTALLATION GENERAL
- A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

- 3.02 INSTALLATION SEISMIC A. COMPLY WITH:
  - 2. FEMA 412. END OF SECTION
  - <u>SECTION 23 0553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT</u>
  - PART 1 GENERAL

ASHRAE (HVACA) HANDBOOK – HVAC APPLICATIONS.

- 1.01 SECTION INCLUDES A. NAMEPLATES.
- B. TAGS.
- 1.02 SUBMITTALS A. LIST: SUBMIT LIST OF WORDING, SYMBOLS, LETTER SIZE, AND COLOR CODING FOR MECHANICAL IDENTIFICATION.
- B. CHART AND SCHEDULE: SUBMIT VALVE CHART AND SCHEDULE. INCLUDING VALVE TAG NUMBER. LOCATION, FUNCTION, AND VALVE MANUFACTURER'S NAME AND MODEL NUMBER. C. PRODUCT DATA: PROVIDE MANUFACTURERS CATALOG LITERATURE FOR EACH PRODUCT
- D. MANUFACTURER'S INSTALLATION INSTRUCTIONS: INDICATE SPECIAL PROCEDURES, AND
- INSTALLATION. PART 2 PRODUCTS
- 2.01 IDENTIFICATION APPLICATIONS A. AIR HANDLING UNTIS: NAMEPLATES. B. CONTROL PANELS: NAMEPLATES.
- C. PUMPS AND HEAT EXCHANGERS: NAMEPLATES. 2.02 NAMEPLATES
- B. LETTER COLOR: WHITE. C. LETTER HEIGHT: 1/4 INCH (6 MM). D. BACKGROUND COLOR: BLACK.

A. MANUFACTURERS:

- E. PLASTIC: CONFORM TO ASTM D709. A. METAL TAGS: BRASS WITH STAMPED LETTERS; TAG SIZE MINIMUM 1-1/2 INCH (40 MM)
- DIAMETER WITH SMOOTH EDGES. B. VALVE TAG CHART: TYPEWRITTEN LETTER SIZE LIST IN ANODIZED ALUMINUM FRAME.
- 3.01 PREPARATION A. DEGREASE AND CLEAN SURFACES TO RECEIVE ADHESIVE FOR IDENTIFICATION MATERIALS. 3.02 INSTALLATION
- APPLY WITH SUFFICIENT ADHESIVE TO ENSURE PERMANENT ADHESION AND SEAL WITH CLEAR B. INSTALL TAGS WITH CORROSION RESISTANT CHAIN AT ALL VALVES. PROVIDE VALVE TAG CHART AND INSTALL IN MECHANICAL ROOM.

A. INSTALL NAMEPLATES WITH CORROSIVE—RESISTANT MECHANICAL FASTENERS. OR ADHESIVE.

- <u>SECTION 23 0593 TESTING, ADJUSTING, AND BALANCING FOR HVAC</u>
- PART 1 GENERAL 1.01 SECTION INCLUDES
- A. TESTING, ADJUSTMENT, AND BALANCING OF AIR SYSTEMS. B. MEASUREMENT OF FINAL OPERATING CONDITION OF HVAC SYSTEMS.
- 1.02 REFERENCE STANDARDS A. AABC MN-1 - AABC NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE; ASSOCIATED AIR
- BALANCE COUNCIL; 2002. B. ASHRAE STD 111 - MEASUREMENT, TESTING, ADJUSTING, AND BALANCING OF BUILDING HVAC
- C. NEBB (TAB) PROCEDURAL STANDARDS FOR TESTING ADJUSTING AND BALANCING OF ENVIRONMENTAL SYSTEMS; 2015, EIGHTH EDITION. 1.03 SUBMITTALS
- A. QUALIFICATIONS: SUBMIT NAME OF ADJUSTING AND BALANCING AGENCY AND TAB SUPERVISOR FOR APPROVAL WITHIN 30 DAYS AFTER AWARD OF CONTRACT. B. TAB PLAN: SUBMIT A WRITTEN PLAN INDICATING THE TESTING. ADJUSTING, AND BALANCING STANDARD TO BE FOLLOWED AND THE SPECIFIC APPROACH FOR EACH SYSTEM AND
- 1. SUBMIT SIX WEEKS PRIOR TO STARTING THE TESTING, ADJUSTING, AND BALANCING WORK. 2. INCLUDE CERTIFICATION THAT THE PLAN DEVELOPER HAS REVIEWED THE CONTRACT DOCUMENTS, THE EQUIPMENT AND SYSTEMS, AND THE CONTROL SYSTEM WITH THE ARCHITECT AND OTHER INSTALLERS TO SUFFICIENTLY UNDERSTAND THE DESIGN INTENT FOR
- 3. INCLUDE AT LEAST THE FOLLOWING IN THE PLAN: a. Preface: An explanation of the intended use of the control system. b. LIST OF ALL AIR FLOW, WATER FLOW, SOUND LEVEL, SYSTEM CAPACITY AND EFFICIENCY MEASUREMENTS TO BE PERFORMED AND A DESCRIPTION OF SPECIFIC TEST
- PROCEDURES, PARAMETERS, FORMULAS TO BE USED. c. COPY OF FIELD CHECKOUT SHEETS AND LOGS TO BE USED. LISTING EACH PIECE OF EQUIPMENT TO BE TESTED, ADJUSTED AND BALANCED WITH THE DATA CELLS TO BE
- GATHERED FOR EACH. d. Identification and types of measurement instruments to be used and their MOST RECENT CALIBRATION DATE.
- e. DISCUSSION OF WHAT NOTATIONS AND MARKINGS WILL BE MADE ON THE DUCT AND PIPING DRAWINGS DURING THE PROCESS f. Final test report forms to be used.

a. EXPECTED PROBLEMS AND SOLUTIONS, ETC

- h. SPECIFIC PROCEDURES THAT WILL ENSURE THAT BOTH AIR AND WATER SIDE ARE OPERATING AT THE LOWEST POSSIBLE PRESSURES AND METHODS TO VERIFY THIS. i. DESCRIPTION OF TAB WORK FOR AREAS TO BE BUILT OUT LATER, IF ANY
- j. TIME SCHEDULE FOR DEFERRED OR SEASONAL TAB WORK, IF SPECIFIED. k. FALSE LOADING OF SYSTEMS TO COMPLETE TAB WORK, IF SPECIFIED I. PROCEDURES FOR FIELD TECHNICIAN LOGS OF DISCREPANCIES, DEFICIENT OR UNCOMPLETED WORK BY OTHERS, CONTRACT INTERPRETATION REQUESTS AND LISTS OF
- COMPLETED TESTS (SCOPE AND FREQUENCY). m. PROCEDURES FOR FORMAL PROGRESS REPORTS, INCLUDING SCOPE AND FREQUENCY.
- n. PROCEDURES FOR FORMAL DEFICIENCY REPORTS, INCLUDING SCOPE, FREQUENCY AND DISTRIBUTION. . Progress reports.
- D. FINAL REPORT: INDICATE DEFICIENCIES IN SYSTEMS THAT WOULD PREVENT PROPER TESTING. ADJUSTING, AND BALANCING OF SYSTEMS AND EQUIPMENT TO ACHIEVE SPECIFIED 1. SUBMIT UNDER PROVISIONS OF SECTION 01 4000.
- 2. REVISE TAB PLAN TO REFLECT ACTUAL PROCEDURES AND SUBMIT AS PART OF FINAL 3. SUBMIT DRAFT COPIES OF REPORT FOR REVIEW PRIOR TO FINAL ACCEPTANCE OF PROJECT. PROVIDE FINAL COPIES FOR ARCHITECT AND FOR INCLUSION IN OPERATING AND
- MAINTENANCE MANUALS 4. PROVIDE REPORTS IN SOFT COVER, LETTER SIZE, 3-RING BINDER MANUALS, COMPLETE WITH INDEX PAGE AND INDEXING TABS, WITH COVER IDENTIFICATION AT FRONT AND SIDE. INCLUDE SET OF REDUCED DRAWINGS WITH AIR OUTLETS AND EQUIPMENT IDENTIFIED TO CORRESPOND WITH DATA SHEETS. AND INDICATING THERMOSTAT LOCATIONS.
- 5. INCLUDE ACTUAL INSTRUMENT LIST, WITH MANUFACTURER NAME, SERIAL NUMBER, AND DATE OF CALIBRATION. 6. FORM OF TEST REPORTS: WHERE THE TAB STANDARD BEING FOLLOWED RECOMMENDS A REPORT FORMAT USE THAT; OTHERWISE, FOLLOW ASHRAE STD 111
- 7. UNITS OF MEASURE: REPORT DATA IN BOTH I-P (INCH-POUND) AND SI (METRIC) UNITS. 8. INCLUDE THE FOLLOWING ON THE TITLE PAGE OF EACH REPORT a. NAME OF TESTING, ADJUSTING, AND BALANCING AGENCY.
- b. ADDRESS OF TESTING, ADJUSTING, AND BALANCING AGENCY c. TELEPHONE NUMBER OF TESTING, ADJUSTING, AND BALANCING AGENCY. d. PROJECT NAME.
- e. PROJECT LOCATION. f. PROJECT ARCHITECT. g. PROJECT ENGINEER.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

- h. PROJECT CONTRACTOR PROJECT ALTITUDE.
- j. REPORT DATE. F. PROJECT RECORD DOCUMENTS: RECORD ACTUAL LOCATIONS OF FLOW MEASURING STATIONS AND BALANCING VALVES AND ROUGH SETTING. 1.04 QUALITY ASSURANCE (MOVED TO PART 3)
- 3.01 GENERAL REQUIREMENTS A. PERFORM TOTAL SYSTEM BALANCE IN ACCORDANCE WITH ONE OF THE FOLLOWING: 1. AABC MN-1, AABC NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE. 2. ASHRAE STD 111, PRACTICES FOR MEASUREMENT, TESTING, ADJUSTING AND BALANCING OF BUILDING HEATING, VENTILATION, AIR—CONDITIONING, AND REFRIGERATION SYSTEMS.

3. NEBB PROCEDURAL STANDARDS FOR TESTING ADJUSTING BALANCING OF ENVIRONMENTAL

SYSTEMS. 4. SMACNA HVAC SYSTEMS TESTING, ADJUSTING, AND BALANCING. B. BEGIN WORK AFTER COMPLETION OF SYSTEMS TO BE TESTED, ADJUSTED, OR BALANCED AND COMPLETE WORK PRIOR TO SUBSTANTIAL COMPLETION OF THE PROJECT.

C. WHERE HVAC SYSTEMS AND/OR COMPONENTS INTERFACE WITH LIFE SAFETY SYSTEMS,

TESTING AND INSPECTION PROCEDURES WITH THE AUTHORITIES HAVING JURISDICTION.

D. TAB AGENCY QUALIFICATIONS: 1. COMPANY SPECIALIZING IN THE TESTING, ADJUSTING, AND BALANCING OF SYSTEMS SPECIFIED IN THIS SECTION.

INCLUDING FIRE AND SMOKE DETECTION, ALARM, AND CONTROL, COORDINATE SCHEDULING AND

- 2. CERTIFIED BY ONE OF THE FOLLOWING: a. AABC, ASSOCIATED AIR BALANCE COUNCIL: WWW.AABCHQ.COM; UPON COMPLETION SUBMIT AABC NATIONAL PERFORMANCE GUARANTY.
- b. NEBB. NATIONAL ENVIRONMENTAL BALANCING BUREAU: WWW.NEBB.ORG. c. TABB, THE TESTING, ADJUSTING, AND BALANCING BUREAU OF NATIONAL ENERGY MANAGEMENT INSTITUTE: WWW.TABBCERTIFIED.ORG.
- 3.02 EXAMINATION A. VERIFY THAT SYSTEMS ARE COMPLETE AND OPERABLE BEFORE COMMENCING WORK. ENSURE

- THE FOLLOWING CONDITIONS:

1. SYSTEMS ARE STARTED AND OPERATING IN A SAFE AND NORMAL CONDITION.

2. TEMPERATURE CONTROL SYSTEMS ARE INSTALLED COMPLETE AND OPERABLE

8. ACCESS DOORS ARE CLOSED AND DUCT END CAPS ARE IN PLACE.

ADDITION TO FINAL FILTERS.

6. FANS ARE ROTATING CORRECTLY.

5. DUCT SYSTEMS ARE CLEAN OF DEBRIS.

10. DUCT SYSTEM LEAKAGE IS MINIMIZED.

PROPER SYSTEM BALANCE.

3.03 ADJUSTMENT TOLERANCES

3.04 RECORDING AND ADJUSTING

SPECIFIED SETTINGS.

3.05 AIR SYSTEM PROCEDURE

OUTLET OR INLET.

SECTIONAL AREA OF DUCT.

OBJECTIONABLE DRAFTS AND NOISE.

50 PERCENT LOADING OF FILTERS.

FOR DESIGN CONDITIONS.

3.06 WATER SYSTEM PROCEDURE

DAMPERS TO CHECK LEAKAGE.

7. AIR COIL FINS ARE CLEANED AND COMBED.

13. SERVICE AND BALANCE VALVES ARE OPEN.

A. FIELD LOGS: MAINTAIN WRITTEN LOGS INCLUDING:

THAT SUCH DISRUPTION HAS BEEN RECTIFIED.

RETURN, AND EXHAUST AIR QUANTITIES AT SITE ALTITUDE.

COOLING, AND AT MINIMUM AIR FLOW RATE, FULL HEATING.

HEAT TRANSFER ELEMENTS IN THE SYSTEM.

A. TEST, ADJUST, AND BALANCE THE FOLLOWING:

7. STARTER SIZE, RATING, HEATER ELEMENTS

INDEXED FOR BALANCE POINT.

FLOW TO OTHER PARTS.

3. AIR HANDLING UNITS

3.08 MINIMUM DATA TO BE REPORTED

3.07 SCOPE

1. AIR COILS

5. AIR FILTERS

A. ELECTRIC MOTORS:

I. MANUFACTURER

6. SERVICE FACTOR

8. SHEAVE MAKE/SIZE/BORE

1. IDENTIFICATION/NUMBER

5. AIR FLOW, DESIGN AND ACTUAL

10. WATER FLOW, DESIGN AND ACTUAL

6. ENTERING AIR DB TEMPERATURE, DESIGN AND ACTUAL

7. ENTERING AIR WB TEMPERATURE, DESIGN AND ACTUAL

8. LEAVING AIR DB TEMPERATURE, DESIGN AND ACTUAL

9. LEAVING AIR WB TEMPERATURE, DESIGN AND ACTUAL

12. ENTERING WATER TEMPERATURE, DESIGN AND ACTUAL

13. LEAVING WATER TEMPERATURE, DESIGN AND ACTUAL

11. WATER PRESSURE DROP, DESIGN AND ACTUAL

MODEL/FRAME

3. HP/BHP

B. COOLING COILS:

2. LOCATION

SERVICE

C. HEATING COILS:

2. LOCATION

SERVICE

1. IDENTIFICATION/NUMBER

D. AIR MOVING EQUIPMENT:

2. MANUFACTURER

3. MODEL NUMBER

4. SERIAL NUMBER

1. LOCATION

5. AIR FLOW, DESIGN AND ACTUAL

6. WATER FLOW, DESIGN AND ACTUAL

7. WATER PRESSURE DROP, DESIGN AND ACTUAL

8. ENTERING WATER TEMPERATURE, DESIGN AND ACTUAL

9. LEAVING WATER TEMPERATURE, DESIGN AND ACTUAL

10. ENTERING AIR TEMPERATURE, DESIGN AND ACTUAL

11. LEAVING AIR TEMPERATURE, DESIGN AND ACTUAL

12. AIR PRESSURE DROP, DESIGN AND ACTUAL

5. ARRANGEMENT/CLASS/DISCHARGE

6. AIR FLOW, SPECIFIED AND ACTUAL

9. SUPPLY AIR TEMPERATURE

7. RETURN AIR FLOW, SPECIFIED AND ACTUAL

8. OUTSIDE AIR FLOW, SPECIFIED AND ACTUAL

10. TOTAL STATIC PRESSURE (TOTAL EXTERNAL), SPECIFIED AND ACTUAL

4. MANUFACTURER

5. RPM

4. FANS

A. ADJUST WATER SYSTEMS TO PROVIDE REQUIRED OR DESIGN QUANTITIES.

OF TEMPERATURE DIFFERENTIAL IN CONJUNCTION WITH AIR BALANCING.

4. PHASE, VOLTAGE, AMPERAGE; NAMEPLATE, ACTUAL, NO LOAD

1. RUNNING LOG OF EVENTS AND ISSUES.

CONTRACT INTERPRETATION REQUESTS.

4. LISTS OF COMPLETED TESTS.

9. AIR OUTLETS ARE INSTALLED AND CONNECTED.

11. HYDRONIC SYSTEMS ARE FLUSHED, FILLED, AND VENTED.

12. PROPER STRAINER BASKETS ARE CLEAN AND IN PLACE.

C. BEGINNING OF WORK MEANS ACCEPTANCE OF EXISTING CONDITIONS.

2. DISCREPANCIES, DEFICIENT OR UNCOMPLETED WORK BY OTHERS.

3. PROPER THERMAL OVERLOAD PROTECTION IS IN PLACE FOR ELECTRICAL EQUIPMENT.

4. FINAL FILTERS ARE CLEAN AND IN PLACE. IF REQUIRED, INSTALL TEMPORARY MEDIA IN

B. SUBMIT FIELD REPORTS. REPORT DEFECTS AND DEFICIENCIES THAT WILL OR COULD PREVENT

A. AIR HANDLING SYSTEMS: ADJUST TO WITHIN PLUS OR MINUS 5 PERCENT OF DESIGN FOR

B. HYDRONIC SYSTEMS: ADJUST TO WITHIN PLUS OR MINUS 10 PERCENT OF DESIGN.

B. ENSURE RECORDED DATA REPRESENTS ACTUAL MEASURED OR OBSERVED CONDITIONS

ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS.

D. MARK ON THE DRAWINGS THE LOCATIONS WHERE TRAVERSE AND OTHER CRITICAL

C. PERMANENTLY MARK SETTINGS OF VALVES, DAMPERS, AND OTHER ADJUSTMENT DEVICES

MEASUREMENTS WERE TAKEN AND CROSS REFERENCE THE LOCATION IN THE FINAL REPORT

E. AFTER ADJUSTMENT, TAKE MEASUREMENTS TO VERIFY BALANCE HAS NOT BEEN DISRUPTED OR

DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES, AND RESTORING THERMOSTATS TO

A. ADJUST AIR HANDLING AND DISTRIBUTION SYSTEMS TO PROVIDE REQUIRED OR DESIGN SUPPLY,

B. MAKE AIR QUANTITY MEASUREMENTS IN DUCTS BY PITOT TUBE TRAVERSE OF ENTIRE CROSS

C. ADJUST DISTRIBUTION SYSTEM TO OBTAIN UNIFORM SPACE TEMPERATURES FREE FROM

D. VARY TOTAL SYSTEM AIR QUANTITIES BY ADJUSTMENT OF FAN SPEEDS. PROVIDE DRIVE

F. MEASURE STATIC AIR PRESSURE CONDITIONS ON AIR SUPPLY UNITS, INCLUDING FILTER AND

COIL PRESSURE DROPS, AND TOTAL PRESSURE ACROSS THE FAN. MAKE ALLOWANCES FOR

G. ADJUST OUTSIDE AIR AUTOMATIC DAMPERS, OUTSIDE AIR, RETURN AIR, AND EXHAUST DAMPERS

WHERE MODULATING DAMPERS ARE PROVIDED, TAKE MEASUREMENTS AND BALANCE AT EXTREME

H. MEASURE TEMPERATURE CONDITIONS ACROSS OUTSIDE AIR, RETURN AIR, AND EXHAUST

CONDITIONS. BALANCE VARIABLE VOLUME SYSTEMS AT MAXIMUM AIR FLOW RATE, FULL

B. USE CALIBRATED VENTURI TUBES, ORIFICES, OR OTHER METERED FITTINGS AND PRESSURE

C. ADJUST SYSTEMS TO PROVIDE SPECIFIED PRESSURE DROPS AND FLOWS THROUGH HEAT

E. EFFECT ADJUSTMENT OF WATER DISTRIBUTION SYSTEMS BY MEANS OF BALANCING COCKS.

F. WHERE AVAILABLE PUMP CAPACITY IS LESS THAN TOTAL FLOW REQUIREMENTS OR INDIVIDUAL

SYSTEM PARTS, FULL FLOW IN ONE PART MAY BE SIMULATED BY TEMPORARY RESTRICTION OF

GAUGES TO DETERMINE FLOW RATES FOR SYSTEM BALANCE. WHERE FLOW METERING DEVICES

ARE NOT INSTALLED, BASE FLOW BALANCE ON TEMPERATURE DIFFERENCE ACROSS VARIOUS

TRANSFER ELEMENTS PRIOR TO THERMAL TESTING. PERFORM BALANCING BY MEASUREMENT

D. EFFECT SYSTEM BALANCE WITH AUTOMATIC CONTROL VALVES FULLY OPEN TO HEAT TRANSFER

VALVES, AND FITTINGS. DO NOT USE SERVICE OR SHUT-OFF VALVES FOR BALANCING UNLESS

E. PROVIDE SYSTEM SCHEMATIC WITH REQUIRED AND ACTUAL AIR QUANTITIES RECORDED AT EACH 1.05 QUALITY ASSURANCE

CHANGES REQUIRED. VARY BRANCH AIR QUANTITIES BY DAMPER REGULATION.

F. LEAVE SYSTEMS IN PROPER WORKING ORDER, REPLACING BELT GUARDS, CLOSING ACCESS

G. AT FINAL INSPECTION, RECHECK RANDOM SELECTIONS OF DATA RECORDED IN REPORT.

RECHECK POINTS OR AREAS AS SELECTED AND WITNESSED BY THE OWNER.

SUPPLY SYSTEMS AND PLUS OR MINUS 10 PERCENT OF DESIGN FOR RETURN AND EXHAUST

- E. TAB SUPERVISOR AND TECHNICIAN QUALIFICATIONS: CERTIFIED BY SAME ORGANIZATION AS TAB

- 14. NUMBER OF BELTS/MAKE/SIZE 15. FAN RPM E. RETURN AIR/OUTSIDE AIR:
- 1. IDENTIFICATION/LOCATION

11. INLET PRESSURE

2. DESIGN AIR FLOW

ACTUAL AIR FLOW

4. DESIGN RETURN AIR FLOW

5. ACTUAL RETURN AIR FLOW

6. DESIGN OUTSIDE AIR FLOW

7. ACTUAL OUTSIDE AIR FLOW

8. RETURN AIR TEMPERATURE

OUTSIDE AIR TEMPERATURE

1. SYSTEM ZONE/BRANCH

F. DUCT TRAVERSES:

2. DUCT SIZE

4. DESIGN VELOCITY

5. DESIGN AIR FLOW

6. TEST VELOCITY

7. TEST AIR FLOW

9. AIR TEMPERATURE

8. DUCT STATIC PRESSURE

10. AIR CORRECTION FACTOR

3. AREA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DUCT INSULATION.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

INSULATION; 2014.

MATERIALS; 2015A.

MATERIALS: 2014.

1.04 SUBMITTALS

EXPERIENCE.

PART 2 PRODUCTS

10. REQUIRED MIXED AIR TEMPERATURE

12. DESIGN OUTSIDE/RETURN AIR RATIO

13. ACTUAL OUTSIDE/RETURN AIR RATIO

11. ACTUAL MIXED AIR TEMPERATURE

12. DISCHARGE PRESSURE

- 13. SHEAVE MAKE/SIZE/BORE

END OF SECTION

<u>SECTION 23 0713 - DUCT INSULATION</u>

A. SECTION 23 3100 — HVAC DUCTS AND CASINGS: GLASS FIBER DUCTS.

PROPERTIES BY MEANS OF THE HEAT FLOW METER APPARATUS; 2010.

BUILDING MATERIALS: NATIONAL FIRE PROTECTION ASSOCIATION: 2006.

FOR COMMERCIAL AND INDUSTRIAL APPLICATIONS; 2013.

MATERIALS; CURRENT EDITION, INCLUDING ALL REVISIONS.

MATERIALS AND THICKNESS FOR EACH SERVICE, AND LOCATIONS

AND MECHANICAL DAMAGE, BY STORING IN ORIGINAL WRAPPING.

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

1. KNAUF INSULATION: WWW.KNAUFUSA.COM.

B. INSULATION: ASTM C553; FLEXIBLE, NONCOMBUSTIBLE BLANKET.

A. ASTM C518 — STANDARD TEST METHOD FOR STEADY—STATE THERMAL TRANSMISSION

E. ASTM E96/E96M - STANDARD TEST METHODS FOR WATER VAPOR TRANSMISSION OF

F. NFPA 255 - STANDARD METHOD OF TEST OF SURFACE BURNING CHARACTERISTICS OF

G. SMACNA (DCS) — HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE; 2005.

H. UL 723 - STANDARD FOR TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING

THE TYPE SPECIFIED IN THIS SECTION WITH NOT LESS THAN THREE YEARS OF DOCUMENTED

C. ASTM C612 - STANDARD SPECIFICATION FOR MINERAL FIBER BLOCK AND BOARD THERMAL

- - B. SECTION 23 2213 STEAM AND CONDENSATE HEATING PIPING: PLACEMENT OF HANGERS AND HANGER INSERTS. 1.03 REFERENCE STANDARDS
  - A. ASTM B209 STANDARD SPECIFICATION FOR ALUMINUM AND ALUMINUM-ALLOY SHEET AND PLATE; 2014. B. ASTM B209M — STANDARD SPECIFICATION FOR ALUMINUM AND ALUMINUM—ALLOY SHEET AND
  - C. ASTM C177 STANDARD TEST METHOD FOR STEADY-STATE HEAT FLUX MEASUREMENTS AND THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE GUARDED-HOT-PLATE APPARATUS;
  - 2007 (REAPPROVED 2013). E. ASTM C449 — STANDARD SPECIFICATION FOR MINERAL FIBER HYDRAULIC—SETTING THERMA
  - F. ASTM C518 STANDARD TEST METHOD FOR STEADY-STATE THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE HEAT FLOW METER APPARATUS; 2010.

INSULATING AND FINISHING CEMENT; 2007 (REAPPROVED 2013).

- INSULATION: 2013. H. ASTM C534/C534M - STANDARD SPECIFICATION FOR PREFORMED FLEXIBLE ELASTOMERIC CELLULAR THERMAL INSULATION IN SHEET AND TUBULAR FORM; 2014.
- J. ASTM C552 STANDARD SPECIFICATION FOR CELLULAR GLASS THERMAL INSULATION; 2015. K. ASTM C795 — STANDARD SPECIFICATION FOR THERMAL INSULATION FOR USE IN CONTACT WITH AUSTENITIC STAINLESS STEEL; 2008 (REAPPROVED 2013).

N. NFPA 255 - STANDARD METHOD OF TEST OF SURFACE BURNING CHARACTERISTICS OF

- L. ASTM E84 STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS; 2015A. M. ASTM E96/E96M - STANDARD TEST METHODS FOR WATER VAPOR TRANSMISSION OF
- O. UL 723 STANDARD FOR TEST FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS; CURRENT EDITION, INCLUDING ALL REVISIONS. 1.04 SUBMITTALS
- B. MANUFACTURER'S INSTRUCTIONS: INDICATE INSTALLATION PROCEDURES THAT ENSURE ACCEPTABLE WORKMANSHIP AND INSTALLATION STANDARDS WILL BE ACHIEVED.

A. PRODUCT DATA: PROVIDE PRODUCT DESCRIPTION, THERMAL CHARACTERISTICS, LIST OF

- B. ASTM C553 STANDARD SPECIFICATION FOR MINERAL FIBER BLANKET THERMAL INSULATION A. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING THE PRODUCTS SPECIFIED IN THIS SECTION WITH NOT LESS THAN THREE YEARS OF DOCUMENTED EXPERIENCE.
- 1.06 DELIVERY, STORAGE, AND HANDLING D. ASTM E84 - STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING A. ACCEPT MATERIALS ON SITE, LABELED WITH MANUFACTURER'S IDENTIFICATION, PRODUCT DENSITY, AND THICKNESS. 1.07 FIELD CONDITIONS

A. MAINTAIN AMBIENT CONDITIONS REQUIRED BY MANUFACTURERS OF EACH PRODUCT.

- B. MAINTAIN TEMPERATURE BEFORE, DURING, AND AFTER INSTALLATION FOR MINIMUM OF 24 PART 2 PRODUCTS
- A. PRODUCT DATA: PROVIDE PRODUCT DESCRIPTION, THERMAL CHARACTERISTICS, LIST OF A. MANUFACTURERS: KNAUF INSULATION: WWW.KNAUFUSA.COM. A. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING PRODUCTS OF
- 1.06 DELIVERY, STORAGE, AND HANDLING A. ACCEPT MATERIALS ON SITE IN ORIGINAL FACTORY PACKAGING, LABELLED WITH B. INSULATION: ASTM C547 AND ASTM C795; RIGID MOLDED, NONCOMBUSTIBLE. MANUFACTURER'S IDENTIFICATION, INCLUDING PRODUCT DENSITY AND THICKNESS. 1. 'K' VALUE: ASTM C177, 0.24 AT 75 DEGREES I B. PROTECT INSULATION FROM WEATHER AND CONSTRUCTION TRAFFIC, DIRT, WATER, CHEMICAL,
- A. MAINTAIN AMBIENT TEMPERATURES AND CONDITIONS REQUIRED BY MANUFACTURERS OF ADHESIVES, MASTICS, AND INSULATION CEMENTS. E96/E96M OF 0.02 PERM-INCHES B. MAINTAIN TEMPERATURE DURING AND AFTER INSTALLATION FOR MINIMUM PERIOD OF 24 HOURS. D. VAPOR BARRIER LAP ADHESIVE:
- A. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD/SMOKE DEVELOPED INDEX OF 25/50. MAXIMUM, WHEN TESTED IN ACCORDANCE WITH ASTM E 84, NFPA 255, OR UL 723. F. INDOOR VAPOR BARRIER FINISH: 2.02 GLASS FIBER, FLEXIBLE 1. VINYL EMULSION TYPE ACRYLIC, COMPATIBLE WITH INSULATION, BLACK COLOR. A. MANUFACTURER:
- 2. JOHNS MANVILLE CORPORATION: WWW.JM.COM. OWENS CORNING CORP: WWW.OWENSCORNING.COM A. MANUFACTURER: 4. CERTAINTEED CORPORATION: WWW.CERTAINTEED.COM
- 2. MAXIMUM SERVICE TEMPERATURE: 250 DEGREES F 3. MAXIMUM WATER VAPOR SORPTION: < 3.0 PERCENT BY WEIGHT AT 120 DEGREES F 4. INSULATION SHALL BE OWNENS CORNING TYPE 150 OR EQUAL. C. VAPOR BARRIER JACKET:

1. 'K' VALUE: 0.25 AT 75 DEGREES F, WHEN TESTED IN ACCORDANCE WITH ASTM C518.

1. KRAFT PAPER WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM. 2. MOISTURE VAPOR PERMEABILITY: 0.029 NG/PA S M (0.02 PERM INCH), WHEN TESTED IN ACCORDANCE WITH ASTM E96/E96M. 3. SECURE WITH PRESSURE SENSITIVE TAPE.

D. VAPOR BARRIER TAPE:

- 1. KRAFT PAPER REINFORCED WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM, WITH PRESSURE SENSITIVE RUBBER BASED ADHESIVE. 2.03 GLASS FIBER, RIGID A. MANUFACTURER:
- 2. JOHNS MANVILLE: WWW.JM.COM 3. OWENS CORNING CORPORATION; 700 SERIES FIBERGLAS INSULATION: WWW.OCBUILDINGSPEC.COM. 4. CERTAINTEED CORPORATION: WWW.CERTAINTEED.COM

5. SUBSTITUTIONS: SEE SECTION 01 6000 - PRODUCT REQUIREMENTS.

1. KNAUF INSULATION: WWW.KNAUFINSULATION.COM.

4. MAXIMUM DENSITY: 8.0 LB/CU FT.

3. SECURE WITH PRESSURE SENSITIVE TAPE.

3.01 EXAMINATION

3.03 SCHEDULES

A. SUPPLY AIR DUCT:

- B. INSULATION: ASTM C612; RIGID, NONCOMBUSTIBLE BLANKET 1. 'K' VALUE: 0.24 AT 75 DEGREES F, WHEN TESTED IN ACCORDANCE WITH ASTM C518. 2. MAXIMUM SERVICE TEMPERATURE: 450 DEGREES I 3. MAXIMUM WATER VAPOR ABSORPTION: 5.0 PERCENT.
- C. VAPOR BARRIER JACKET: 1. KRAFT PAPER WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM. 2. MOISTURE VAPOR PERMEABILITY: 0.029 NG/PA S M (0.02 PERM INCH), WHEN TESTED IN ACCORDANCE WITH ASTM E96/E96M.
- 1. KRAFT PAPER REINFORCED WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM, WITH PRESSURE SENSITIVE RUBBER BASED ADHESIVE. PART 3 EXECUTION

B. VERIFY THAT SURFACES ARE CLEAN, FOREIGN MATERIAL REMOVED, AND DRY.

1. PROVIDE INSULATION WITH VAPOR BARRIER JACKETS.

1. FLEXIBLE GLASS FIBER DUCT INSULATION: 2 INCHES THICK.

2. FINISH WITH TAPE AND VAPOR BARRIER JACKET.

A. VERIFY THAT DUCTS HAVE BEEN TESTED BEFORE APPLYING INSULATION MATERIALS.

- 3.02 INSTALLATION A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. B. INSTALL IN ACCORDANCE WITH NAIMA NATIONAL INSULATION STANDARDS. C. INSULATED DUCTS CONVEYING AIR BELOW AMBIENT TEMPERATURE:
- 3. CONTINUE INSULATION THROUGH WALLS, SLEEVES, HANGERS, AND OTHER DUCT PENETRATIONS. 4. INSULATE ENTIRE SYSTEM INCLUDING FITTINGS, JOINTS, FLANGES, FIRE DAMPERS, FLEXIBLE CONNECTIONS, AND EXPANSION JOINTS.
  - B. DUCTWORK IN MECHANICAL ROOMS 1. RIGID GLASS FIBER DUCT INSULATION: 2 INCHES THICK. END OF SECTION

- SECTION 23 0719 HVAC PIPING INSULATION PART 1 GENERAL
- 1.01 SECTION INCLUDES A. PIPING INSULATION.
- B. JACKETS AND ACCESSORIES 1.02 RELATED REQUIREMENTS
- A. SECTION 23 2113 HYDRONIC PIPING: PLACEMENT OF HANGERS AND HANGER INSERTS.
- ALL RIGHTS RESERVED. THIS DRAWING AND THE DESIGN SHOWN PLATE [METRIC]; 2014. THEREON ARE COPYRIGHTED AS PRESCRIBED BY THE LAWS OF
  - THE UNITED STATES AND ARE THE PROPERTY OF GMK ASSOCIATES ARCHITECTURAL DIVISION. ANYONE DUPLICATING, REPRODUCING OR CAUSING TO BE REPRODUCED THE WHOLE OR PART OF THESE DRAWINGS OR THE DESIGN THEREON WITHOUT PERMISSION OF THE
- D. ASTM C195 STANDARD SPECIFICATION FOR MINERAL FIBER THERMAL INSULATING CEMENT; ARCHITECT WILL BE SUBJECT TO LEGAL ACTION.
- G. ASTM C533 STANDARD SPECIFICATION FOR CALCIUM SILICATE BLOCK AND PIPE THERMAL
- I. ASTM C547 STANDARD SPECIFICATION FOR MINERAL FIBER PIPE INSULATION; 2015.
  - MATERIALS; 2014.
  - BUILDING MATERIALS; NATIONAL FIRE PROTECTION ASSOCIATION; 2006.
  - MATERIALS AND THICKNESS FOR EACH SERVICE, AND LOCATIONS. USC SCHOOL OF MEDICINE
    - AHU 1 AND 2 PROJECT # FP00000164
- 2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD/SMOKE DEVELOPED INDEX OF 25/50,

MAXIMUM, WHEN TESTED IN ACCORDANCE WITH ASTM E84, NFPA 255, OR UL 723.

- 2. JOHNS MANVILLE CORPORATION: WWW.JM.COM
- 3. OWENS CORNING CORP: WWW.OWENSCORNING.COM. 4. CERTAINTEED CORPORATION: WWW.CERTAINTEED.COM.
- 2. MAXIMUM SERVICE TEMPERATURE: 850 DEGREES F. 3. MAXIMUM MOISTURE ABSORPTION: 0.2 PERCENT BY VOLUME. C. VAPOR BARRIER JACKET: WHITE KRAFT PAPER WITH GLASS FIBER YARN. BONDED TO ALUMINIZED FILM; MOISTURE VAPOR TRANSMISSION WHEN TESTED IN ACCORDANCE WITH ASTM
- COMPATIBLE WITH INSULATION. E. INSULATING CEMENT/MASTIC: 1. ASTM C195; HYDRAULIC SETTING ON MINERAL WOOL.
- G. INSULATING CEMENT: 1. ASTM C449/C449M 2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION
- ARMACELL LLC: WWW.ARMACELL.US. K-FLEX USA LLC: WWW.KFLEXUSA.COM B. INSULATION: PREFORMED FLEXIBLE ELASTOMERIC CELLULAR RUBBER INSULATION COMPLYING

A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

B. INSTALL IN ACCORDANCE WITH NAIMA NATIONAL INSULATION STANDARDS.

AEROFLEX USA, INC: WWW.AEROFLEXUSA.COM.

PART 3 EXECUTION

F. INSERTS AND SHIELDS:

3.03 SCHEDULE

A. COOLING SYSTEMS:

3.01 EXAMINATION

- 1. MINIMUM SERVICE TEMPERATURE: -40 DEGREES F 2. MAXIMUM SERVICE TEMPERATURE: 220 DEGREES F. 3. CONNECTION: WATERPROOF VAPOR BARRIER ADHESIVE
  - A. VERIFY THAT PIPING HAS BEEN TESTED BEFORE APPLYING INSULATION MATERIALS. B. VERIFY THAT SURFACES ARE CLEAN AND DRY, WITH FOREIGN MATERIAL REMOVED. 3.02 INSTALLATION

WITH ASTM C534/C534M GRADE 3; USE MOLDED TUBULAR MATERIAL WHEREVER POSSIBLE.

- C. GLASS FIBER INSULATED PIPES CONVEYING FLUIDS BELOW AMBIENT TEMPERATURE: 1. PROVIDE VAPOR BARRIER JACKETS, FACTORY-APPLIED OR FIELD-APPLIED. SECURE WITH SELF-SEALING LONGITUDINAL LAPS AND BUTT STRIPS WITH PRESSURE SENSITIVE ADHESIVE. SECURE WITH OUTWARD CLINCH EXPANDING STAPLES AND VAPOR BARRIER MASTIC.
- 2. INSULATE FITTINGS, JOINTS, AND VALVES WITH MOLDED INSULATION OF LIKE MATERIAL AND THICKNESS AS ADJACENT PIPE. FINISH WITH GLASS CLOTH AND VAPOR BARRIER ADHESIVE OR PVC FITTING COVERS. D. FOR HOT PIPING CONVEYING FLUIDS 140 DEGREES F OR LESS, DO NOT INSULATE FLANGES AND UNIONS AT EQUIPMENT, BUT BEVEL AND SEAL ENDS OF INSULATION.

E. GLASS FIBER INSULATED PIPES CONVEYING FLUIDS ABOVE AMBIENT TEMPERATURE

FIELD-APPLIED. SECURE WITH SELF-SEALING LONGITUDINAL LAPS AND BUTT STRIPS WITH PRESSURE SENSITIVE ADHESIVE. SECURE WITH OUTWARD CLINCH EXPANDING STAPLES. 2. INSULATE FITTINGS, JOINTS, AND VALVES WITH INSULATION OF LIKE MATERIAL AND THICKNESS AS ADJOINING PIPE. FINISH WITH GLASS CLOTH AND ADHESIVE OR PVC FITTING

1. PROVIDE STANDARD JACKETS. WITH OR WITHOUT VAPOR BARRIER, FACTORY—APPLIED OR

1. APPLICATION: PIPING 1-1/2 INCHES DIAMETER OR LARGER. 2. SHIELDS: GALVANIZED STEEL BETWEEN PIPE HANGERS OR PIPE HANGER ROLLS AND 3. INSERT LOCATION: BETWEEN SUPPORT SHIELD AND PIPING AND UNDER THE FINISH

4. INSERT CONFIGURATION: MINIMUM 6 INCHES LONG, OF SAME THICKNESS AND CONTOUR AS

5. INSERT MATERIAL: HYDROUS CALCIUM SILICATE INSULATION OR OTHER HEAVY DENSITY

INSULATING MATERIAL SUITABLE FOR THE PLANNED TEMPERATURE RANGE. G. CONTINUE INSULATION THROUGH WALLS, SLEEVES, PIPE HANGERS, AND OTHER PIPI PENETRATIONS. FINISH AT SUPPORTS, PROTRUSIONS, AND INTERRUPTIONS. AT FIRE SEPARATIONS, REFER TO SECTION 07 8400.

ADJOINING INSULATION; MAY BE FACTORY FABRICATED.

1. CHILLED WATER: 1 1/2" GLASS FIBER 2. COOLING COIL CONDENSATE: 3/4" FLEXIBLE ELASTOMERIC CELLULAR END OF SECTION **HVAC SPECIFICATIONS** 

sheet number

<u>drawn by</u> checked by JDR

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CONSTRUCTION

October 8, 2019

PART	SECTION 23 2113 — HYDRONIC PIPING  1 GENERAL
	SECTION INCLUDES CHILLED WATER PIPING, ABOVE GRADE.
B.	EQUIPMENT DRAINS AND OVERFLOWS. PIPE HANGERS AND SUPPORTS.
D.	UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS. VALVES:
E.	1. BALL VALVES.
	2. BUTTERFLY VALVES. 3. CHECK VALVES.
	FLOW CONTROLS. SUBMITTALS
A.	WELDERS CERTIFICATE: INCLUDE WELDERS CERTIFICATION OF COMPLIANCE WITH ASME BPVC-IX.
B.	PRODUCT DATA:  1. INCLUDE DATA ON PIPE MATERIALS, PIPE FITTINGS, VALVES, AND
	ACCESSORIES. 2. PROVIDE MANUFACTURERS CATALOGUE INFORMATION.
C.	3. INDICATE VALVE DATA AND RATINGS.  MANUFACTURER'S INSTALLATION INSTRUCTIONS: INDICATE HANGING AND
D.	SUPPORT METHODS, JOINING PROCEDURES.  PROJECT RECORD DOCUMENTS: RECORD ACTUAL LOCATIONS OF VALVES.
	MAINTENANCE DATA: INCLUDE INSTALLATION INSTRUCTIONS, SPARE PARTS LISTS, EXPLODED ASSEMBLY VIEWS.
	QUALITY ASSURANCE  MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING  PROPRIES OF THE TYPE SPECIFIED IN THIS SECTION. WITH ANNUALLY THEFE
D	PRODUCTS OF THE TYPE SPECIFIED IN THIS SECTION, WITH MINIMUM THREE YEARS OF DOCUMENTED EXPERIENCE.  WELDER QUALIFICATIONS: CERTIFY IN ACCORDANCE WITH ASME BPVC—IX.
J.	PROVIDE CERTIFICATE OF COMPLIANCE FROM AUTHORITY HAVING     JURISDICTION, INDICATING APPROVAL OF WELDERS.
	DELIVERY, STORAGE, AND HANDLING  ACCEPT VALVES ON SITE IN SHIPPING CONTAINERS WITH LABELING IN PLACE.
	INSPECT FOR DAMAGE.  PROVIDE TEMPORARY END CAPS AND CLOSURES ON PIPING AND FITTINGS.
	MAINTAIN IN PLACE UNTIL INSTALLATION.  PROTECT PIPING SYSTEMS FROM ENTRY OF FOREIGN MATERIALS BY TEMPORARY
	COVERS, COMPLETING SECTIONS OF THE WORK, AND ISOLATING PARTS OF COMPLETED SYSTEM.
	2 PRODUCTS CHILLED WATER PIPING, ABOVE GRADE
A.	STEEL PIPE: ASTM A53/A53M, SCHEDULE 40, BLACK; USING ONE OF THE FOLLOWING JOINT TYPES:
	1. WELDED JOINTS: ASTM A234/A234M, WROUGHT STEEL WELDING TYPE FITTINGS; AWS D1.1/D1.1M WELDED.
В.	COPPER TUBE: ASTM B88 (ASTM B88M), TYPE K (A), HARD DRAWN; USING ONE OF THE FOLLOWING JOINT TYPES:
	<ol> <li>SOLDER JOINTS: ASME B16.18 CAST BRASS/BRONZE OR ASME B16.22, SOLDER WROUGHT COPPER FITTINGS.</li> </ol>
	a. SOLDER: ASTM B32 LEAD—FREE SOLDER, HB ALLOY (95—5 TIN—ANTIMONY) OR TIN AND SILVER.
	2. TEE CONNECTIONS: MECHANICALLY EXTRACTED COLLARS WITH NOTCHED AND DIMPLED BRANCH TUBE.
	3. MECHANICAL PRESS SEALED FITTINGS: DOUBLE PRESSED TYPE COMPLYING WITH ASME B16.22, UTILIZING EPDM, NONTOXIC SYNTHETIC RUBBER SEALING ELEMENTS.
	EQUIPMENT DRAINS AND OVERFLOWS
A.	COPPER TUBE: ASTM B88 (ASTM B88M), TYPE K (A), DRAWN; USING ONE OF THE FOLLOWING JOINT TYPES:
	<ol> <li>SOLDER JOINTS: ASME B16.18 CAST BRASS/BRONZE OR ASME B16.22 SOLDER WROUGHT COPPER FITTINGS; ASTM B32 LEAD—FREE SOLDER, HB ALLOY (95-5 TIN-ANTIMONY) OR TIN AND SILVER.</li> </ol>
	PIPE HANGERS AND SUPPORTS
A.	PROVIDE HANGERS AND SUPPORTS THAT COMPLY WITH MSS SP-58.  1. IF TYPE OF HANGER OR SUPPORT FOR A PARTICULAR SITUATION IS NOT INDICATED, SELECT APPROPRIATE TYPE USING MSS SP-58
	RECOMMENDATIONS.  2. HANGERS FOR PIPE SIZES 1/2 TO 1–1/2 INCH: MALLEABLE IRON,
	ADJUSTABLE SWIVEL, SPLIT RING.  3. HANGERS FOR COLD PIPE SIZES 2 INCHES AND GREATER: CARBON STEEL,
	ADJUSTABLE, CLEVIS.  4. MULTIPLE OR TRAPEZE HANGERS: STEEL CHANNELS WITH WELDED SPACERS
	AND HANGER RODS.  5. FLOOR SUPPORT FOR COLD PIPE: CAST IRON ADJUSTABLE PIPE SADDLE, LOCK NUT, NIPPLE, FLOOR FLANGE, AND CONCRETE PIER OR STEEL
	SUPPORT.  6. FLOOR SUPPORT FOR HOT PIPE SIZES TO 4 INCHES: CAST IRON
	ADJUSTABLE PIPE SADDLE, LOCK NUT, NIPPLE, FLOOR FLANGE, AND CONCRETE PIER OR STEEL SUPPORT.
	7. COPPER PIPE SUPPORT: CARBON STEEL RING, ADJUSTABLE, COPPER PLATED.
	<ul><li>8. HANGER RODS: MILD STEEL THREADED BOTH ENDS, THREADED ONE END, OR CONTINUOUS THREADED.</li><li>9. INSERTS: MALLEABLE IRON CASE OF GALVANIZED STEEL SHELL AND</li></ul>
	EXPANDER PLUG FOR THREADED CONNECTION WITH LATERAL ADJUSTMENT, TOP SLOT FOR REINFORCING RODS, LUGS FOR ATTACHING TO FORMS; SIZE
2.05	INSERTS TO SUIT THREADED HANGER RODS. UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS
A.	UNIONS FOR PIPE 2 INCHES AND LESS:  1. COPPER PIPE: BRONZE, SOLDERED JOINTS.
В.	FLANGES FOR PIPE 2 INCHES AND GREATER:  1. COPPER PIPING: BRONZE.
C	2. GASKETS: 1/16 INCH THICK PREFORMED NEOPRENE. DIELECTRIC CONNECTIONS:
	WATERWAYS:     a. WATER IMPERVIOUS INSULATION BARRIER CAPABLE OF LIMITING GALVANIC
	CURRENT TO 1 PERCENT OF SHORT CIRCUIT CURRENT IN A CORRESPONDING BIMETALLIC JOINT.
	b. DRY INSULATION BARRIER ABLE TO WITHSTAND 600 VOLT BREAKDOWN TEST.
	c. CONSTRUCT OF GALVANIZED STEEL WITH THREADED END CONNECTIONS TO MATCH CONNECTING PIPING.
	d. SUITABLE FOR THE REQUIRED OPERATING PRESSURES AND TEMPERATURES.  2 FLANCES:
	<ol> <li>FLANGES:</li> <li>a. DIELECTRIC FLANGES WITH SAME PRESSURE RATINGS AS STANDARD FLANGES.</li> </ol>
	b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a
	CORRESPONDING BIMETALLIC JOINT. c. DRY INSULATION BARRIER ABLE TO WITHSTAND 600 VOLT BREAKDOWN
	TEST. d. CONSTRUCT OF GALVANIZED STEEL WITH THREADED END CONNECTIONS TO
	MATCH CONNECTING PIPING.  e. SUITABLE FOR THE REQUIRED OPERATING PRESSURES AND
	TEMPERATURES. BALL VALVES
A.	UP TO AND INCLUDING 2 INCHES:  1. BRONZE ONE PIECE BODY, CHROME PLATED BRASS BALL, TEFLON SEATS  AND STUFFING POX PINC LEVER HANDLE WITH BALANCING STORE SOLDER
2.07	AND STUFFING BOX RING, LEVER HANDLE WITH BALANCING STOPS, SOLDER ENDS WITH UNION. BUTTERFLY VALVES
	BODY: CAST OR DUCTILE IRON WITH RESILIENT REPLACEABLE EPDM SEAT, WAFER OR LUG ENDS, EXTENDED NECK.
В.	DISC: CONSTRUCT OF ALUMINUM BRONZE, CHROME PLATED DUCTILE IRON, STAINLESS STEEL, DUCTILE IRON WITH EPDM ENCAPSULATION, OR BUNA—N
C.	ENCAPSULATION.  STEM: STAINLESS STEEL WITH STEM OFFSET FROM THE CENTERLINE TO
D.	PROVIDE FULL 360 DEGREE CIRCUMFERENTIAL SETTING.  OPERATOR: 10 POSITION LEVER HANDLE.
	3 EXECUTION INSTALLATION
A.	INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. ROUTE PIPING IN ORDERLY MANNER, PARALLEL TO BUILDING STRUCTURE, AND
	MAINTAIN GRADIENT.  INSTALL PIPING TO CONSERVE BUILDING SPACE AND TO AVOID INTERFERE WITH
	USE OF SPACE.  SLEEVE PIPE PASSING THROUGH PARTITIONS, WALLS AND FLOORS.
	INSTALL FIRESTOPPING TO PRESERVE FIRE RESISTANCE RATING OF PARTITIONS AND OTHER ELEMENTS, USING MATERIALS AND METHODS SPECIFIED.
	SLOPE PIPING AND ARRANGE TO DRAIN AT LOW POINTS. INSERTS:
	<ol> <li>PROVIDE INSERTS FOR PLACEMENT IN CONCRETE FORMWORK.</li> <li>PROVIDE INSERTS FOR SUSPENDING HANGERS FROM REINFORCED CONCRETE</li> </ol>
	SLABS AND SIDES OF REINFORCED CONCRETE BEAMS.  3. WHERE CONCRETE SLABS FORM FINISHED CEILING, LOCATE INSERTS FLUSH
u.	WITH SLAB SURFACE.

<u>IYDRONIC PIPING</u> 2. INSTALL HANGERS TO PROVIDE MINIMUM 1/2 INCH SPACE BETWEEN FINISHED COVERING AND ADJACENT WORK. 3. PLACE HANGERS WITHIN 12 INCHES OF EACH HORIZONTAL ELBOW. 4. USE HANGERS WITH 1-1/2 INCH MINIMUM VERTICAL ADJUSTMENT. DESIGN HANGERS FOR PIPE MOVEMENT WITHOUT DISENGAGEMENT OF SUPPORTED 5. WHERE SEVERAL PIPES CAN BE INSTALLED IN PARALLEL AND AT SAME GS, AND DIELECTRIC CONNECTIONS. ELEVATION, PROVIDE MULTIPLE OR TRAPEZE HANGERS. 6. PROVIDE COPPER PLATED HANGERS AND SUPPORTS FOR COPPER PIPING. I. USE ECCENTRIC REDUCERS TO MAINTAIN TOP OF PIPE LEVEL. J. INSTALL VALVES WITH STEMS UPRIGHT OR HORIZONTAL, NOT INVERTED. 3.02 SCHEDULES A. HANGER SPACING FOR COPPER TUBING. 1. 1/2 INCH AND 3/4 INCH: MAXIMUM SPAN, 5 FEET; MINIMUM ROD SIZE, RS CERTIFICATION OF COMPLIANCE WITH 2. 1 INCH: MAXIMUM SPAN, 6 FEET; MINIMUM ROD SIZE, 1/4 INCH. 3. 1-1/2 INCH AND 2 INCH: MAXIMUM SPAN, 8 FEET; MINIMUM ROD SIZE, PIPE FITTINGS, VALVES, AND 3/8 INCH. 4. 2-1/2 INCH: MAXIMUM SPAN, 9 FEET; MINIMUM ROD SIZE, 3/8 INCH. INFORMATION. TIONS: INDICATE HANGING AND SIZE, 1/4 INCH. ) ACTUAL LOCATIONS OF VALVES. ION INSTRUCTIONS, SPARE PARTS LISTS, NY SPECIALIZING IN MANUFACTURING HIS SECTION, WITH MINIMUM THREE CCORDANCE WITH ASME BPVC-IX. PART 1 GENERAL FROM AUTHORITY HAVING 1.01 SECTION INCLUDES OF WELDERS. A. AIR VENTS. B. STRAINERS. Ontainers with labeling in place. osures on Piping and Fittings. OF FOREIGN MATERIALS BY TEMPORARY WORK, AND ISOLATING PARTS OF 1.04 SUBMITTALS E 40, BLACK; USING ONE OF THE , WROUGHT STEEL WELDING TYPE , TYPE K (A), HARD DRAWN; USING BRASS/BRONZE OR ASME B16.22, LUBRICATION INSTRUCTIONS, AND REPLACEMENT PARTS LIST. SOLDER, HB ALLOY (95–5 1.05 QUALITY ASSURANCE EXTRACTED COLLARS WITH NOTCHED AND DOUBLE PRESSED TYPE COMPLYING NONTOXIC SYNTHETIC RUBBER SEALING INSPECT FOR DAMAGE. TYPE K (A), DRAWN; USING ONE OF BRASS/BRONZE OR ASME B16.22 ASTM B32 LEAD-FREE SOLDER, HB and silver. PART 2 PRODUCTS COMPLY WITH MSS SP-58. 2.01 AIR VENTS OR A PARTICULAR SITUATION IS NOT : USING MSS SP-58

B. HANGER SPACING FOR STEEL PIPING. 1. 1/2 INCH, 3/4 INCH, AND 1 INCH: MAXIMUM SPAN, 7 FEET; MINIMUM ROD 2. 1-1/4 INCHES: MAXIMUM SPAN, 8 FEET; MINIMUM ROD SIZE, 3/8 INCH. 3. 1-1/2 INCHES: MAXIMUM SPAN, 9 FEET; MINIMUM ROD SIZE, 3/8 INCH. 4. 2 INCHES: MAXIMUM SPAN, 10 FEET; MINIMUM ROD SIZE, 3/8 INCH. 5. 2-1/2 INCHES: MAXIMUM SPAN, 11 FEET; MINIMUM ROD SIZE, 3/8 INCH. END OF SECTION SECTION 23 2114 - HYDRONIC SPECIALTIES 1.02 RELATED REQUIREMENTS A. SECTION 23 2113 — HYDRONIC PIPING. B. SECTION 23 2500 - HVAC WATER TREATMENT: PIPE CLEANING. 1.03 REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - BOILER AND PRESSURE VESSEL CODE, SECTION VIII, DIVISION 1 - RULES FOR CONSTRUCTION OF PRESSURE VESSELS; 2015. A. PRODUCT DATA: PROVIDE PRODUCT DATA FOR MANUFACTURED PRODUCTS AND ASSEMBLIES REQUIRED FOR THIS PROJECT. INCLUDE COMPONENT SIZES. ROUGH-IN REQUIREMENTS, SERVICE SIZES, AND FINISHES. INCLUDE PRODUCT DESCRIPTION AND MODEL

B. MANUFACTURER'S INSTALLATION INSTRUCTIONS: INDICATE HANGING AND SUPPORT METHODS, JOINING PROCEDURES. C. PROJECT RECORD DOCUMENTS: RECORD ACTUAL LOCATIONS OF FLOW D. MAINTENANCE DATA: INCLUDE INSTALLATION INSTRUCTIONS, ASSEMBLY VIEWS,

A. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING THE TYPE OF PRODUCTS SPECIFIED IN THIS SECTION, WITH MINIMUM THREE YEARS OF DOCUMENTED EXPERIENCE. 1.06 DELIVERY, STORAGE, AND HANDLING

A. ACCEPT VALVES ON SITE IN SHIPPING CONTAINERS WITH LABELING IN PLACE. B. PROVIDE TEMPORARY PROTECTIVE COATING ON CAST IRON AND STEEL VALVES. C. PROVIDE TEMPORARY END CAPS AND CLOSURES ON PIPING AND FITTINGS. MAINTAIN IN PLACE UNTIL INSTALLATION. D. PROTECT PIPING SYSTEMS FROM ENTRY OF FOREIGN MATERIALS BY TEMPORARY COVERS, COMPLETING SECTIONS OF THE WORK, AND ISOLATING PARTS OF

A. MANUAL TYPE: SHORT VERTICAL SECTIONS OF 2 INCH DIAMETER PIPE TO FORM AIR CHAMBER, WITH 1/8 INCH BRASS NEEDLE VALVE AT TOP OF

2.02 STRAINERS A. MANUFACTURERS: 1. ARMSTRONG INTERNATIONAL, INC: WWW.ARMSTRONGINTERNATIONAL.COM. 2. FLEXICRAFT INDUSTRIES: WWW.FLEXICRAFT.COM. 3. GRINNELL PRODUCTS, A TYCO BUSINESS: WWW.GRINNELL.COM.

4. THE METRAFLEX COMPANY; LPD Y STRAINER: WWW.METRAFLEX.COM/#SLE. B. SIZE 2 INCH AND UNDER: 1. SCREWED BRASS OR IRON BODY FOR 175 PSI WORKING PRESSURE, Y

PATTERN WITH 1/32 INCH STAINLESS STEEL PERFORATED SCREEN. PART 3 EXECUTION 3.01 INSTALLATION

A. INSTALL SPECIALTIES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS B. PROVIDE MANUAL AIR VENTS AT SYSTEM HIGH POINTS AND AS INDICATED. C. PROVIDE VALVED DRAIN AND HOSE CONNECTION ON STRAINER BLOW DOWN

#### END OF SECTION

1.01 SECTION INCLUDES A. MATERIALS. 1. SYSTEM CLEANER.

<u>SECTION 23 2500 - HVAC WATER TREATMENT</u>

CLOSED SYSTEM TREATMENT (WATER) 1.02 SUBMITTALS B. PRODUCT DATA: PROVIDE CHEMICAL TREATMENT MATERIALS, CHEMICALS, AND EQUIPMENT INCLUDING ELECTRICAL CHARACTERISTICS AND CONNECTION

PART 1 GENERAL

2.01 MATERIALS

A. CONCENTRATION:

H. PIPE HANGERS AND SUPPORTS:

1. SUPPORT HORIZONTAL PIPING AS SCHEDULED.

C. SHOP DRAWINGS: INDICATE SYSTEM SCHEMATIC, EQUIPMENT LOCATIONS, AND CONTROLS SCHEMATICS, ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS PART 2 PRODUCTS

A. SYSTEM CLEANER: 1. LIQUID ALKALINE COMPOUND WITH EMULSIFYING AGENTS AND DETERGENTS TO REMOVE GREASE AND PETROLEUM PRODUCTS; SODIUMTRIPOLY PHOSPHATE AND SODIUM MOLYBDATE 2. BIOCIDE CHLORINE RELEASE AGENTS SUCH AS SODIUM HYPOCHLORITE OR CALCIUM HYPOCHLORITE OR MICROBIOCIDES SUCH AS QUARTERNARY

AMMONIA COMPOUNDS, TRIBUTYLTIN OXIDE, METHYLENE BIS (THIOCYANATE). B. CLOSED SYSTEM TREATMENT (WATER): 1. SEQUESTERING AGENT TO REDUCE DEPOSITS AND ADJUST PH; POLYPHOSPHATE

2. CORROSION INHIBITORS: BORON-NITRITE, SODIUM NITRITE AND BORAX. SODIUM TOTYLTRIAZOLE. LOW MOLECULAR WEIGHT POLYMERS. PHOSPHONATES, SODIUM MOLYBDATE, OR SULPHITES. 3. CONDUCTIVITY ENHANCERS; PHOSPHATES OR PHOSPHONATES. PART 3 EXECUTION 3.01 CLEANING SEQUENCE

1. AS RECOMMENDED BY MANUFACTURER. B. CHILLED WATER SYSTEMS: 1. CIRCULATE FOR 48 HOURS, THEN DRAIN SYSTEMS AS QUICKLY AS POSSIBLE. 2. REFILL WITH CLEAN WATER, CIRCULATE FOR 24 HOURS, THEN DRAIN. 3. REFILL WITH CLEAN WATER AND REPEAT UNTIL SYSTEM CLEANER IS

C. USE NEUTRALIZER AGENTS ON RECOMMENDATION OF SYSTEM CLEANER SUPPLIER AND APPROVAL OF ARCHITECT. D. FLUSH OPEN SYSTEMS AND GLYCOL FILLED CLOSED SYSTEMS WITH CLEAN WATER FOR ONE HOUR MINIMUM. DRAIN COMPLETELY AND REFILL. E. REMOVE, CLEAN, AND REPLACE STRAINER SCREENS.

F. INSPECT, REMOVE SLUDGE, AND FLUSH LOW POINTS WITH CLEAN WATER AFTER CLEANING PROCESS IS COMPLETED. INCLUDE DISASSEMBLY OF COMPONENTS AS REQUIRED. 3.02 INSTALLATION

A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. END OF SECTION

SECTION 23 7313 - MODULAR CENTRAL-STATION AIR-HANDLING UNITS PART 1 GENERAL 1.01 SECTION INCLUDES A. FACTORY FABRICATED ASSEMBLY OF MODULAR SECTIONS CONSISTING OF HOUSED CENTRIFUGAL OR PLENUM FANS WITH BELT OR DIRECT DRIVES, COILS, FILTERS, AND OTHER NECESSARY MODULES TO PERFORM ONE OR MORE OF THE FUNCTIONS OF CIRCULATING, CLEANING, HEATING, COOLING, HUMIDIFICATION, DEHUMIDIFICATION. AND MIXING OF AIR WITH CONSTRUCTION SUITABLE FOR INDOOR OR OUTDOOR APPLICATIONS.

1.02 RELATED REQUIREMENTS A. SECTION 23 0513 — COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT. B. SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS. C. SECTION 23 0719 - HVAC PIPING INSULATION. D. SECTION 23 3300 - AIR DUCT ACCESSORIES: FLEXIBLE DUCT CONNECTIONS.

A. AHRI 430 (I-P) - PERFORMANCE RATING OF CENTRAL STATION AIR-HANDLING

B. AMCA 210 - LABORATORY METHODS OF TESTING FANS FOR CERTIFIED

D. AMCA 301 - METHODS FOR CALCULATING FAN SOUND RATINGS FROM

C. AMCA 300 - REVERBERANT ROOM METHOD FOR SOUND TESTING OF FANS;

E. NFPA 90A - STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND

F. SMACNA (DCS) — HVAC DUCT CONSTRUCTION STANDARDS — METAL AND

AERODYNAMIC PERFORMANCE RATING; 2007.

LABORATORY TEST DATA; 2014.

VENTILATING SYSTEMS; 2015.

ASSOCIATION; 2005.

1.04 SUBMITTALS

A. PRODUCT DATA:

1.03 REFERENCE STANDARDS

UNITS; 2014.

PRESSURE WHEN SIZED FOR 2000 FPM FACE VELOCITY. A. COMBINATION VFD — DISCONNECTS: 1. PROVIDE FACTORY MOUNTED, COMBINATION VFD — DISCONNECT FOR EACH FAN MOTOR. 2. FACTORY MOUNT IN FULL METAL ENCLOSURE AND WIRE TO FAN MOTOR. 3. MOUNT VFD-DISCONNECT ON FAN SECTION INTERNALLY IN A NEMA 4 EQUIVALENT UNIT CASING WITHIN A DEDICATED CONTROLS SECTION OR HOUSED FAN SECTION. a. INTERNAL ENCLOSURE CONSTRUCTION CHARACTERISTICS: CASING INTERIOR. 2) ACCESSIBLE FROM UNIT EXTERIOR VIA ACCESS DOOR.

FLEXIBLE; SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL 3) CONSTRUCTION OF ACCESS DOORS SAME THROUGHOUT UNIT. 4. INCLUDE CIRCUIT BREAKER DISCONNECT WITH THROUGH-THE-DOOR INTERLOCKING HANDLE FOR EXTERNALLY MOUNTED STARTERS, SPRING 1. PUBLISHED LITERATURE: INDICATE DIMENSIONS, WEIGHTS, CAPACITIES, RATINGS, GAGES AND FINISHES OF MATERIALS, AND ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS.

2. FILTERS: DATA FOR FILTER MEDIA, FILTER PERFORMANCE DATA, FILTER THE HANDLE IS IN THE ON POSITION. ASSEMBLY, AND FILTER FRAMES. 3. FANS: PERFORMANCE AND FAN CURVES WITH SPECIFIED OPERATING POINT THE FOLLOWING ITEMS: CLEARLY PLOTTED, POWER, RPM. a. VFD AND CONTROLS. 4. SOUND POWER LEVEL DATA: FAN OUTLET AND CASING RADIATION AT RATED b. BINARY OUTPUT ON-OFF WIRING. 5. ELECTRICAL REQUIREMENTS: POWER SUPPLY WIRING INCLUDING WIRING c. ANALOG OUTPUT SPEED-SIGNAL WIRING.

DIAGRAMS FOR INTERLOCK AND CONTROL WIRING, CLEARLY INDICATING FACTORY-INSTALLED AND FIELD-INSTALLED WIRING. CONTROLLER B. SHOP DRAWINGS: INDICATE ASSEMBLY, UNIT DIMENSIONS, WEIGHT LOADING, PART 3 EXECUTION REQUIRED CLEARANCES. CONSTRUCTION DETAILS, FIELD CONNECTION DETAILS, 3.01 INSTALLATION AND ELECTRICAL CHARACTERISTICS AND CONNECTION REQUIREMENTS. C. MANUFACTURER'S INSTRUCTIONS: INCLUDE INSTALLATION INSTRUCTIONS.

B. BOLT SECTIONS TOGETHER WITH GASKETS. D. MAINTENANCE DATA: INCLUDE INSTRUCTIONS FOR LUBRICATION, FILTER REPLACEMENT, MOTOR AND DRIVE REPLACEMENT, SPARE PARTS LISTS, AND WIRING DIAGRAMS. E. MAINTENANCE MATERIALS: FURNISH THE FOLLOWING FOR OWNER'S USE IN DUCTWORK AND FAN WHILE RUNNING. MAINTENANCE OF PROJECT.

1. SEE SECTION 01 6000 - PRODUCT REQUIREMENTS, FOR ADDITIONAL 2. EXTRA FILTERS: ONE SET FOR EACH UNIT. F. OPERATION AND MAINTENANCE MANUALS: INCLUDE IN MANUALS THE

INFORMATION LISTED BELOW. FOR INFORMATION ON HOW TO PREPARE AND

SUBMIT MANUALS SEE SECTION 1780 (CLOSEOUT SUBMITTALS). 1. RECOMMENDED SPARE PARTS 2. SPARE PARTS LISTS 3. OPERATING INSTRUCTIONS 4. MAINTENANCE INSTRUCTIONS, INCLUDING PREVENTATIVE AND CORRECTIVE MAINTENANCE.

5. MAINTENANCE INSTRUCTIONS FOR SPECIAL FINISHES, INCLUDING RECOMMENDED CLEANING METHODS AND MATERIALS, AND SPECIAL PRECAUTIONS IDENTIFYING DETRIMENTAL AGENTS. 6. COPIES OF WARRANTIES 7. WIRING DIAGRAMS

8. SHOP DRAWINGS AND PRODUCT DATA 1.05 DELIVERY, STORAGE, AND HANDLING A. ACCEPT PRODUCTS ON SITE IN FACTORY—FABRICATED PROTECTIVE CONTAINERS. WITH FACTORY—INSTALLED SHIPPING SKIDS AND LIFTING LUGS. INSPECT FOR

B. STORE IN CLEAN DRY PLACE AND PROTECT FROM WEATHER AND CONSTRUCTION TRAFFIC. HANDLE CAREFULLY TO AVOID DAMAGE TO COMPONENTS, 1.03 REFERENCE STANDARDS

ENCLOSURES, AND FINISH. C. DO NOT OPERATE UNITS UNTIL DUCTWORK IS CLEAN, FILTERS ARE IN PLACE. BEARINGS LUBRICATED, AND FAN HAS BEEN TEST RUN UNDER OBSERVATION.

PART 2 PRODUCTS 2.01 MODULAR AIR HANDLER MANUFACTURERS A. THE TRANE COMPANY: WWW.TRANE.COM.

C. DAIKIN D. SUBSTITUTIONS: SEE SECTION 01600 - PRODUCT REQUIREMENT 2.02 GENERAL DESCRIPTION

B. JCI

2.04 FANS

A. CONFIGURATION: FABRICATE WITH FANS PLUS ACCESSORIES. SEE DRAWINGS FOR EXACT CONFIGURATION. B. FABRICATION: CONFORM TO AMCA 99 AND ARI 430. 2.03 CASING

A. CONSTRUCTION: FABRICATE ON CHANNEL BASE AND DRAIN PAN OF WELDED STEEL. ASSEMBLE SECTIONS WITH GASKETS AND BOLTS. 1. OUTSIDE CASING: a. GALVANIZED STEEL

b. FINISH: MANUFACTURERS STANDARD PAINT ON EXTERIOR. 2. INSIDE CASING: a. GALVANIZED STEEL: SOLID, 0.0276 INCH THICK. 3. FLOOR PLATE:

a. GALVANIZED STEEL: 1.382 INCH THICK. B. INSULATION: NEOPRENE COATED, GLASS FIBER, APPLIED TO INTERNAL SURFACES WITH ADHESIVE AND WELD PINS WITH EXPOSED EDGES OF INSULATION COATED WITH ADHESIVE.

1. "K" VALUE AT 75 DEGREES F: MAXIMUM 0.26 BTUH/INCH/SQ FT/DEGREES 2. DENSITY: 1-1/2 INCH THICK, 1-1/2 LBS/CU FT. C. INSPECTION DOORS: GALVANIZED STEEL FOR FLUSH MOUNTING, WITH GASKET,

LATCH, AND HANDLE ASSEMBLIES. D. DRAIN PANS: CONSTRUCT FROM SINGLE THICKNESS STAINLESS STEEL WITH INSULATION BETWEEN LAYERS WITH WELDED CORNERS. CROSS BREAK AND PITCH TO DRAIN CONNECTION. PROVIDE DRAIN PANS UNDER FAN SECTION

A. TYPE: AIR FOIL, SINGLE WIDTH, SINGLE INLET, CENTRIFUGAL OR PLUG TYPE B. PERFORMANCE RATINGS: DETERMINED IN ACCORDANCE WITH AMCA 210. C. SOUND RATINGS: AMCA 301; TESTED TO AMCA 300 AND LABEL WITH AMCA CERTIFIED SOUND RATING SEAL. D. BEARINGS: SELF-ALIGNING, GREASE LUBRICATED, BALL OR ROLLER BEARINGS

WITH LUBRICATION FITTINGS EXTENDED TO EXTERIOR OF CASING WITH PLASTIC TUBE AND GREASE FITTING RIGIDLY ATTACHED TO CASING. E. MOUNTING: LOCATE FAN AND MOTOR INTERNALLY ON WELDED STEEL BASE COATED WITH CORROSION RESISTANT PAINT. FACTORY MOUNT MOTOR ON SLIDE RAILS. PROVIDE ACCESS TO MOTOR, DRIVE, AND BEARINGS THROUGH REMOVABLE CASING PANELS OR HINGED ACCESS DOORS. MOUNT BASE ON

VIBRATION ISOLATORS. F. FLEXIBLE DUCT CONNECTIONS: FOR SEPARATING FAN AND COIL. AND ADJACENT SECTIONS. 2.05 BEARINGS AND DRIVES

A. BEARINGS: HEAVY DUTY PILLOW BLOCK TYPE, SELF-ALIGNING. GREASE-LUBRICATED BALL BEARINGS, WITH ABMA 9 L-10 LIFE AT 50,000 B. SHAFTS: SOLID. COLD ROLLED STEEL. GROUND AND POLISHED. WITH KEY-WAY.

AND PROTECTIVELY COATED WITH LUBRICATING OIL. C. V-BELT DRIVE: CAST IRON OR STEEL SHEAVES, DYNAMICALLY BALANCED BORED TO FIT SHAFTS, AND KEYED. VARIABLE AND ADJUSTABLE PITCH SHEAVES FOR MOTORS 15 HP AND UNDER SELECTED SO REQUIRED RPM IS OBTAINED WITH SHEAVES SET AT MID-POSITION; FIXED SHEAVE FOR 20 HP AND OVER, MATCHED BELTS, AND DRIVE RATED AS RECOMMENDED BY

MANUFACTURER OR MINIMUM 1.5 TIMES NAMEPLATE RATING OF THE MOTOR. D. BELT GUARD: FABRICATE TO SMACNA HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE: 0.106 INCH THICK. 3/4 INCH DIAMOND MESH WIRE SCREEN WELDED TO STEEL ANGLE FRAME OR EQUIVALENT, PRIME COATED SECURE TO FAN OR FAN SUPPORTS WITHOUT SHORT CIRCUITING VIBRATION ISOLATION, WITH PROVISION FOR ADJUSTMENT OF BELT TENSION, LUBRICATION, AND USE OF TACHOMETER WITH GUARD IN PLACE. 2.06 COILS

HEADERS AND RETURN BENDS FULLY CONTAINED WITHIN CASING. SLIDE COILS INTO CASING THROUGH REMOVABLE END PANEL WITH BLANK OFF SHEETS AND SEALING COLLARS AT CONNECTION PENETRATIONS. B. DRAIN PANS: 24 INCH DOWNSTREAM OF COIL AND DOWN SPOUTS FOR COOLING COIL BANKS MORE THAN ONE COIL HIGH.

A. CASING: PROVIDE ACCESS TO BOTH SIDES OF COILS. ENCLOSE COILS WITH

C. ELIMINATORS: THREE BREAK OF GALVANIZED STEEL, MOUNTED OVER DRAIN D. FABRICATION: 1. TUBES: 5/8 INCH OD SEAMLESS COPPER EXPANDED INTO FINS, BRAZED

2. FINS: ALUMINUM. 3. CASING: DIE FORMED CHANNEL FRAME OF GALVANIZED STEEL. E. WATER COOLING COILS: 1. HEADERS: CAST IRON, SEAMLESS COPPER TUBE, OR PRIME COATED STEEL PIPE WITH BRAZED JOINTS.

2. CONFIGURATION: DRAINABLE, WITH THREADED PLUGS FOR DRAIN AND VENT;

THREADED PLUGS IN RETURN BENDS AND IN HEADERS OPPOSITE EACH

2.07 FILTERS A. FILTER MEDIA: UL 900 LISTED, CLASS I OR CLASS II, APPROVED BY LOCAL C. REFER TO DRAWINGS AND SCHEDULES FOR FILTER EFFICIENCY.

2.08 DAMPERS A. DAMPER LEAKAGE: MAXIMUM 2 PERCENT AT 4 INCH WG DIFFERENTIAL 2.09 CONTROLS

1) INTEGRAL PART OF UNIT CASING TO ALLOW FOR THERMAL VENTING TO

LOADED, AND DESIGNED TO REST ONLY IN THE FULL AND LOCKABLE ON OR

5. ALLOW ENCLOSURE ENTRY VIA A CONCEALED DEFEATER MECHANISM WHEN 6. INCLUDE CONTROL TRANSFORMER WITH SUFFICIENT CAPACITY TO SUPPORT

d. ALL INTERFACING WIRING BETWEEN THE VFD AND THE DIRECT DIGITAL

A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

C. INSTALL FLEXIBLE DUCT CONNECTIONS BETWEEN FAN INLET AND DISCHARGE DUCTWORK AND AIR HANDLING UNIT SECTIONS. ENSURE THAT METAL BANDS OF CONNECTORS ARE PARALLEL WITH MINIMUM ONE INCH FLEX BETWEEN

D. PROVIDE FIXED SHEAVES REQUIRED FOR FINAL AIR BALANCE. E. MAKE CONNECTIONS TO COILS WITH UNIONS OR FLANGES. F. HYDRONIC COILS: 1. HYDRONIC COILS: CONNECT WATER SUPPLY TO LEAVING AIR SIDE OF COIL

(COUNTERFLOW ARRANGEMENT). 2. PROVIDE SHUT-OFF VALVE ON SUPPLY LINE AND LOCKSHIELD BALANCING VALVE WITH MEMORY STOP ON RETURN LINE.

3. LOCATE WATER SUPPLY AT BOTTOM OF SUPPLY HEADER AND RETURN WATER CONNECTION AT TOP. 4. PROVIDE MANUAL AIR VENTS AT HIGH POINTS COMPLETE WITH STOP VALVE. 5. ENSURE WATER COILS ARE DRAINABLE AND PROVIDE DRAIN CONNECTION AT LOW POINT

end of Section

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL 1.01 SECTION INCLUDES A. METAL DUCTWORK. 1.02 RELATED REQUIREMENTS

A. SECTION 23 3300 - AIR DUCT ACCESSORIES. B. SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC.

A. ASHRAE (FUND) — ASHRAE HANDBOOK — FUNDAMENTALS; 2013. B. ASTM A36/A36M - STANDARD SPECIFICATION FOR CARBON STRUCTURAL STEEL; C. ASTM A240/A240M - STANDARD SPECIFICATION FOR CHROMIUM AND

CHROMIUM-NICKEL STAINLESS STEEL PLATE, SHEET, AND STRIP FOR PRESSURE VESSELS AND FOR GENERAL APPLICATIONS; 2015B. D. ASTM A480/A480M - STANDARD SPECIFICATION FOR GENERAL REQUIREMENTS FOR FLAT-ROLLED STAINLESS AND HEAT-RESISTING STEEL PLATE, SHEET, AND

E. ASTM A653/A653M - STANDARD SPECIFICATION FOR STEEL SHEET, ZINC-COATED (GALVANIZED) OR ZINC-IRON ALLOY-COATED (GALVANNEALED) BY THE HOT-DIP PROCESS; 2015. F. ASTM E84 - STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS; 2015A.

G. NFPA 90A - STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS; 2015. H. SMACNA (LEAK) — HVAC AIR DUCT LEAKAGE TEST MANUAL; SHEET METAL AND

AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION; 2012, 2ND EDITION. I. SMACNA (DCS) - HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE;

1.04 PERFORMANCE REQUIREMENTS A. NO VARIATION OF DUCT CONFIGURATION OR SIZES PERMITTED EXCEPT BY WRITTEN PERMISSION. SIZE ROUND DUCTS INSTALLED IN PLACE OF RECTANGULAR DUCTS IN ACCORDANCE WITH ASHRAE TABLE OF EQUIVALENT RECTANGULAR AND ROUND DUCTS.

1.05 SUBMITTALS A. PRODUCT DATA: PROVIDE DATA FOR DUCT MATERIALS. B. SHOP DRAWINGS: INDICATE DUCT FITTINGS, PARTICULARS SUCH AS GAGES, SIZES, WELDS, AND CONFIGURATION PRIOR TO START OF WORK FOR 2 INCH PRESSURE CLASS AND HIGHER SYSTEMS.

C. TEST REPORTS: INDICATE PRESSURE TESTS PERFORMED. INCLUDE DATE, SECTION TESTED, TEST PRESSURE, AND LEAKAGE RATE, FOLLOWING SMACNA (LEAK) — HVAC AIR DUCT LEAKAGE TEST MANUAL. D. PROJECT RECORD DOCUMENTS: RECORD ACTUAL LOCATIONS OF DUCTS AND DUCT FITTINGS. RECORD CHANGES IN FITTING LOCATION AND TYPE. SHOW ADDITIONAL FITTINGS USED.

E. OPERATION AND MAINTENANCE MANUALS: INCLUDE IN MANUALS THE INFORMATION LISTED BELOW. FOR INFORMATION ON HOW TO PREPARE AND SUBMIT MANUALS SEE SECTION 1780 (CLOSEOUT SUBMITTALS). 1. SHOP DRAWINGS AND PRODUCT DATA

1.06 REGULATORY REQUIREMENTS A. CONSTRUCT DUCTWORK TO NFPA 90A STANDARDS. 1.07 FIELD CONDITIONS

A. DO NOT INSTALL DUCT SEALANTS WHEN TEMPERATURES ARE LESS THAN THOSE RECOMMENDED BY SEALANT MANUFACTURERS. B. MAINTAIN TEMPERATURES WITHIN ACCEPTABLE RANGE DURING AND AFTER INSTALLATION OF DUCT SEALANTS. PART 2 PRODUCTS 2.01 DUCT ASSEMBLIES

2.02 MATERIALS A. GALVANIZED STEEL FOR DUCTS: GALVANIZED STEEL SHEET, ASTM A 653/A 653M FS TYPE B, WITH G90/Z275 COATING. B. JOINT SEALERS AND SEALANTS: NON-HARDENING, WATER RESISTANT, MILDEW AND MOLD RESISTANT 1. TYPE: HEAVY MASTIC OR LIQUID USED ALONE OR WITH TAPE. SUITABLE FOR

JOINT CONFIGURATION AND COMPATIBLE WITH SUBSTRATES, AND RECOMMENDED BY MANUFACTURER FOR PRESSURE CLASS OF DUCTS. 2. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD OF ZERO, SMOKE DEVELOPED OF ZERO, WHEN TESTED IN ACCORDANCE WITH ASTM E84. HANGER ROD: ASTM A36/A36M; STEEL, GALVANIZED; THREADED BOTH ENDS, THREADED ONE END, OR CONTINUOUSLY THREADED.

D. SUPPLY: GALVANIZED STEEL. 2.03 DUCTWORK FABRICATION CONSTRUCTION STANDARDS AND AS INDICATED.

A. FABRICATE AND SUPPORT IN ACCORDANCE WITH SMACNA HVAC DUCT B. NO VARIATION OF DUCT CONFIGURATION OR SIZE PERMITTED EXCEPT BY WRITTEN PERMISSION. SIZE ROUND DUCT INSTALLED IN PLACE OF RECTANGULAR

DUCTS IN ACCORDANCE WITH ASHRAE HANDBOOK — FUNDAMENTALS. C. PROVIDE DUCT MATERIAL, GAGES, REINFORCING, AND SEALING FOR OPERATING PRESSURES INDICATED. D. CONSTRUCT T'S, BENDS, AND ELBOWS WITH RADIUS OF NOT LESS THAN 1-1/2 TIMES WIDTH OF DUCT ON CENTERLINE. WHERE NOT POSSIBLE AND WHERE

RECTANGULAR ELBOWS MUST BE USED, PROVIDE AIR FOIL TURNING VANES OF PERFORATED METAL WITH GLASS FIBER INSULATION. E. T'S, BENDS, AND ELBOWS: CONSTRUCT ACCORDING TO SMACNA (DCS). F. INCREASE DUCT SIZES GRADUALLY, NOT EXCEEDING 15 DEGREES DIVERGENCE WHEREVER POSSIBLE: MAXIMUM 30 DEGREES DIVERGENCE UPSTREAM OF EQUIPMENT AND 45 DEGREES CONVERGENCE DOWNSTREAM

G. FABRICATE CONTINUOUSLY WELDED ROUND AND OVAL DUCT FITTINGS IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS. H. CLEAN SHOP FABRICATED DUCTWORK OF DEBRIS. OIL AND GREASE. COVER ENDS OF DUCTWORK WITH TEMPORARY CLOSURE MATERIAL AND TAPE. PROTECT DUCTWORK FROM ENTRY OF DUST AND DEBRIS DURING SHOP STORAGE, SHIPMENT AND TEMPORARY STORAGE AT THE JOB SITE. WIPE THE INSIDE OF ALL DUCTWORK TO REMOVE THE DEBRIS. OIL. GREASE.

ETC. ONCE DUCTWORK IS CLEAN, COVER WITH PLASTIC OR METAL TEMPORARY

CLOSURE MATERIAL. SEAL TIGHT SO THAT NO WATER, MOISTURE OR DEBRIS

CAN ENTER THE DUCTWORK. PROTECT DUCTWORK FROM ENTRY OF DUST AND DEBRIS DURING SHOP STORAGE, SHIPMENT AND TEMPORARY STORAGE AT THE JOB SITE PART 3 EXECUTION

POLYETHYLENE ON OPEN DUCTWORK TO PREVENT CONSTRUCTION DUST FROM

E. INSTALL AND SEAL METAL AND FLEXIBLE DUCTS IN ACCORDANCE WITH SMACNA

THERMOMETERS AND CONTROLLERS. PROVIDE PILOT TUBE OPENINGS WHERE

REQUIRED FOR TESTING OF SYSTEMS, COMPLETE WITH METAL CAN WITH SPRING

DEVICE OR SCREW TO ENSURE AGAINST AIR LEAKAGE. WHERE OPENINGS ARE

PROVIDED IN INSULATED DUCTWORK, INSTALL INSULATION MATERIAL INSIDE A

G. LOCATE DUCTS WITH SUFFICIENT SPACE AROUND EQUIPMENT TO ALLOW NORMAL

H. USE CRIMP JOINTS WITH OR WITHOUT BEAD FOR JOINING ROUND DUCT SIZES 8

LEAVE TEMPORARY CLOSURES IN PLACE UNTIL READY FOR INSTALLATION. AT NO

TIME DURING THE INSTALLATION OF THE DUCTWORK SHALL THERE BE ANY

K. PROVIDE TEMPORARY CLOSURES ON THE FACE OF ALL GRILLES, REGISTERS

A. CLEAN DUCT SYSTEM AND FORCE AIR AT HIGH VELOCITY THROUGH DUCT TO

SYSTEM AT A TIME. PROTECT EQUIPMENT THAT COULD BE HARMED BY

EXCESSIVE DIRT WITH TEMPORARY FILTERS, OR BYPASS DURING CLEANING.

END OF SECTION

<u>Section 23 3300 — Air duct accessories</u>

A. SECTION 22 0548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING

D. SECTION 23 3600 - AIR TERMINAL UNITS: PRESSURE REGULATING DAMPER

A. NFPA 90A - STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND

B. SMACNA (DCS) — HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE;

C. UL 555 - STANDARD FOR FIRE DAMPERS; CURRENT EDITION, INCLUDING ALL

D. UL 555S - STANDARD FOR SMOKE DAMPERS; CURRENT EDITION, INCLUDING

A. PRODUCT DATA: PROVIDE FOR SHOP FABRICATED ASSEMBLIES INCLUDING

VOLUME CONTROL DAMPERS. INCLUDE ELECTRICAL CHARACTERISTICS AND

B. SHOP DRAWINGS: INDICATE FOR SHOP FABRICATED ASSEMBLIES INCLUDING

INFORMATION LISTED BELOW. FOR INFORMATION ON HOW TO PREPARE AND

3. MAINTENANCE INSTRUCTIONS, INCLUDING PREVENTATIVE AND CORRECTIVE

A. PRODUCTS REQUIRING ELECTRICAL CONNECTION: LISTED AND CLASSIFIED BY

FIBER FABRIC TO NFPA 90A, MINIMUM DENSITY 30 OZ PER SQ YD.

A. FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION

a. NET FABRIC WIDTH: APPROXIMATELY 3 INCHES WIDE.

LOUVERS & DAMPERS, INC: WWW.LOUVERS-DAMPERS.COM.

B. FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION

D. MULTI-BLADE DAMPER: FABRICATE OF OPPOSED BLADE PATTERN WITH

C. SINGLE BLADE DAMPERS: FABRICATE FOR DUCT SIZES UP TO 6 X 30 INCH.

MAXIMUM BLADE SIZES 8 X 72 INCH. ASSEMBLE CENTER AND EDGE CRIMPED

BLADES IN PRIME COATED OR GALVANIZED CHANNEL FRAME WITH SUITABLE

1. PROVIDE LOCKING, INDICATING QUADRANT REGULATORS ON SINGLE AND

2. ON INSULATED DUCTS MOUNT QUADRANT REGULATORS ON STAND-OFF

A. INSTALL ACCESSORIES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS,

NFPA 90A, AND FOLLOW SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

REFER TO SECTION 23 3100 FOR DUCT CONSTRUCTION AND PRESSURE CLASS

B. PROVIDE DUCT TEST HOLES WHERE INDICATED AND REQUIRED FOR TESTING AND

C. AT FANS AND MOTORIZED EQUIPMENT ASSOCIATED WITH DUCTS. PROVIDE

FLEXIBLE DUCT CONNECTIONS IMMEDIATELY ADJACENT TO THE EQUIPMENT.

D. AT EQUIPMENT SUPPORTED BY VIBRATION ISOLATORS, PROVIDE FLEXIBLE DUCT

CONNECTIONS IMMEDIATELY ADJACENT TO THE EQUIPMENT; SEE SECTION 22

E. PROVIDE BALANCING DAMPERS AT POINTS ON LOW PRESSURE SUPPLY. RETURN.

F. PROVIDE BALANCING DAMPERS ON DUCT TAKE-OFF TO DIFFUSERS, GRILLES,

END OF SECTION

OF THE DIFFUSER, GRILLE, OR REGISTER ASSEMBLY.

AND EXHAUST SYSTEMS WHERE BRANCHES ARE TAKEN FROM LARGER DUCTS AS

REQUIRED FOR AIR BALANCING. INSTALL MINIMUM 2 DUCT WIDTHS FROM DUCT

AND REGISTERS, REGARDLESS OF WHETHER DAMPERS ARE SPECIFIED AS PART

2. NAILOR INDUSTRIES INC: WWW.NAILOR.COM.

1. FABRICATE FOR DUCT SIZES UP TO 6 X 30 INCH.

MOUNTING BRACKETS, BASES, OR ADAPTERS.

3. RUSKIN COMPANY: WWW.RUSKIN.COM.

STANDARDS AND AS INDICATED.

BLADE: 24 GAGE, MINIMUM.

1. BLADE: 18 GAGE, MINIMUM.

MULTI-BLADE DAMPERS.

BALANCING PURPOSES.

E. QUADRANTS:

PART 3 EXECUTION

3.01 INSTALLATION

C. OPERATION AND MAINTENANCE MANUALS: INCLUDE IN MANUALS THE

SUBMIT MANUALS SEE SECTION 1780 (CLOSEOUT SUBMITTALS).

A. RECORD ACTUAL LOCATIONS OF ACCESS DOORS AND TEST HOLES.

B. SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS.

C. SECTION 23 3100 - HVAC DUCTS AND CASINGS.

REMOVE ACCUMULATED DUST. TO OBTAIN SUFFICIENT AIR, CLEAN HALF THE

OPENINGS THAT ARE NOT PROTECTED BY TEMPORARY CLOSURES EXCEPT FOR

I. USE DOUBLE NUTS AND LOCK WASHERS ON THREADED ROD SUPPORTS.

INCH AND SMALLER WITH CRIMP IN DIRECTION OF AIR FLOW.

THE SECTION THAT IS BEING INSTALLED AT THAT TIME.

D. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS. FOR LINED DUCTS,

HVAC DUCT CONSTRUCTION STANDARDS — METAL AND FLEXIBLE.

F. PROVIDE OPENINGS IN DUCTWORK WHERE REQUIRED TO ACCOMMODATE

B. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

3.01 INSTALLATION

ENTERING DUCTWORK SYSTEM.

MAINTAIN SIZES INSIDE LINING.

OPERATING AND MAINTENANCE ACTIVITIES.

METAL RING.

AND DIFFUSERS.

3.02 CLEANING

3.03 SCHEDULES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DUCT TEST HOLES.

1.02 RELATED REQUIREMENTS

AND EQUIPMENT.

ASSEMBLIES.

1.03 REFERENCE STANDARDS

ALL REVISIONS.

1.04 SUBMITTALS

VENTILATING SYSTEMS; 2015.

CONNECTION REQUIREMENTS.

VOLUME CONTROL DAMPERS.

2. OPERATING INSTRUCTIONS

4. COPIES OF WARRANTIES

6. SHOP DRAWINGS AND PRODUCT DATA

1. SPARE PARTS LISTS

MAINTENANCE

5. WIRING DIAGRAMS

1.06 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 DUCT TEST HOLES

1.05 PROJECT RECORD DOCUMENTS

2.02 FLEXIBLE DUCT CONNECTIONS

2.03 VOLUME CONTROL DAMPERS

A. MANUFACTURERS:

B. FLEXIBLE DUCT CONNECTIONS.

C. VOLUME CONTROL DAMPERS.

L. SEAL ALL JOINTS WITH SEALANT.

A. DUCTWORK MATERIAL: STEEL.

B. DUCTWORK PRESSURE CLASS:

2. RETURN/OUTSIDE AIR: 2 INCH.

2. RETURN/OUTSIDE AIR: CLASS A.

1. SUPPLY: 4 INCH

C. DUCTWORK SEAL CLASS:

1. SUPPLY: CLASS A.

A. INSTALL, SUPPORT, AND SEAL DUCTS IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

ENGINEERING C. DURING CONSTRUCTION PROVIDE TEMPORARY CLOSURES OF METAL OR TAPED

consultants

1201 Main Street. Suite 2100 Columbia, S.C. 29201 tel. 803-256-0000 fax 803-255-7243

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project name MED PARK 15 - REPLACE AHU 1 AND 2 PROJECT # FP00000164 project number 18076.01

seals/signature



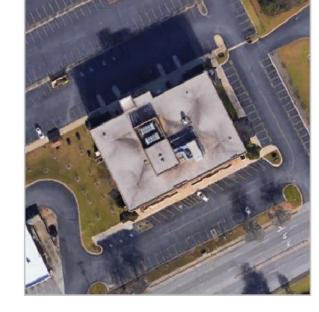


issued for CONSTRUCTION

October 8	, 201

PRODUCTS REQUIRING ELECTRICAL CONNECTION: LISTED AND CLASSIFIED BY				
UNDERWRITERS LABORATORIES INC. AS SUITABLE FOR THE PURPOSE SPECIFIED	nu	mber	item	
AND INDICATED.				
2 PRODUCTS	_			$\dashv$
DUCT TEST HOLES				$\perp$
TEMPORARY TEST HOLES: CUT OR DRILL IN DUCTS AS REQUIRED. CAP WITH				
NEAT PATCHES, NEOPRENE PLUGS, THREADED PLUGS, OR THREADED OR TWIST-ON METAL CAPS.				
FLEXIBLE DUCT CONNECTIONS				$\rightarrow$
FABRICATE IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION				
STANDARDS AND AS INDICATED.				
FLEXIBLE DUCT CONNECTIONS: FABRIC CRIMPED INTO METAL EDGING STRIP.				$\dashv$
1. FABRIC: UL LISTED FIRE-RETARDANT NEOPRENE COATED WOVEN GLASS				
			I .	

key plan



**HVAC SPECIFICATIONS** 

sheet number

<u>drawn by</u> checked by JDR PART 1 GENERAL RELATED DOCUMENTS

- 2.01 ALL WORK OF THIS DIVISION SHALL BE COORDINATED AND PROVIDED BY THE SINGLE CENTRAL CONTROL AND MONITORING SYSTEM (CCMS)
- A. THE WORK OF THIS DIVISION SHALL BE SCHEDULED, COORDINATED, AND INTERFACED WITH THE ASSOCIATED WORK OF OTHER TRADES. REFERENCE THE DIVISION 23 SECTIONS FOR DETAILS.
- B. THE WORK OF THIS DIVISION SHALL BE AS REQUIRED BY THE SPECIFICATIONS, POINT SCHEDULES AND DRAWINGS. 2.02 SCOPE
- A. THIS SECTION INCLUDES THE CONTROLS. INSTRUMENTATION AND ASSOCIATED PIPING AND WIRING REQUIRED TO MAKE THE MECHANICAL SYSTEMS PROVIDED UNDER DIVISION 23 PERFORM AS DESCRIBED IN THESE SPECIFICATIONS AND AS SHOWN. PROVIDE A COMPLETE SYSTEM OF AUTOMATIC TEMPERATURE CONTROL OF THE DIRECT DIGITAL TYPE. THE SYSTEM SHALL BE COMPLETE IN ALL RESPECTS INCLUDING ALL LABOR, MATERIALS, EQUIPMENT, AND SERVICE NECESSARY, AND SHALL BE INSTALLED BY PERSONNEL IN THE DIRECT EMPLOY OF THE MANUFACTURER. PROVIDE A DISTRIBUTED PROCESS NETWORK CONTROL SYSTEM COMPLETE WITH ALL NECESSARY HARDWARE AND SOFTWARE
- INCLUDING ALL PROGRAMMING B. PROVIDE A COMPLETE AND OPERATIONAL CENTRAL CONTROL AND MONITORING SYSTEM (CCMS) INCLUDING ALL DEVICES AND SOFTWARE NECESSARY TO PERFORM THE FUNCTIONS HEREIN DESCRIBED OR INDICATED ON THE DRAWINGS.
- C. THE CMMS SHALL BE A WEB BASED SYSTEM COMMUNICATING OVER THE BUILDING OWNERS LOCAL AREA NETWORK (LAN). CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION WITH THE OWNER'S IT STAFF TO ENSURE THAT THE CMMS WILL PERFORM IN THE OWNER'S ENVIRONMENT WITHOUT DISRUPTION TO ANY OF THE OTHER ACTIVITIES TAKING PLACE ON THAT LAN. TCP/IP CONNECTIONS AND ADDRESSES SHALL BE PROVIDED BY THE OWNER FOR CONNECTION OF SUPERVISORY PANELS TO THE USCA
- D. THE PRIMARY FOCUS OF THE CENTRAL CONTROL AND MONITORING SYSTEM (CCMS) WILL BE TO MONITOR AND CONTROL THE NEW HVAC SYSTEM COMPONENTS. AIR HANDLING UNITS, FANS. HEAT EXCHANGERS, COILS. VALVES, PUMPS, VARIABLE SPEED DRIVES, TRENDING, GRAPHIC FUNCTIONS, ETC. THE SYSTEM SHALL BE EXPANDABLE TO SERVE FUTURE EQUIPMENT SYSTEMS, AND AUXILIARY FIELD DEVICES.
- E. CCMS CONTACTOR SHALL PROVIDE ALL DDC PANELS, POWER SUPPLIES, WIRING, CONDUIT, SOLENOID VALVES, RELAYS, DIFFERENTIAL PRESSURE TRANSMITTERS, DIFFERENTIAL PRESSURE SWITCHES, RTDS, PRESSURE SENSORS, ETC. NECESSARY FOR A COMPLETE AND OPERABLE AUTOMATIC CONTROL SYSTEM AND DDC FIELD PANELS AND CONNECTING LAN.
- F. THE SYSTEMS ENGINEERING PHASE SHALL INCLUDE THE SELECTION AND INTEGRATION OF COMPONENTS INTO A COMPLETE SYSTEM WHICH WILL MEET THE PERFORMANCE AND PRESCRIPTIVE REQUIREMENTS OF THE CONTRACT, TOGETHER WITH DRAWINGS, SPECIFICATIONS, DESCRIPTIONS OF OPERATION, DIAGRAMS INCLUDING SYSTEM ARCHITECTURE AND OTHER MATERIALS LISTED UNDER "SUBMITTALS" PARAGRAPH OF THIS SECTION. THE SUCCESSFUL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SYSTEMS
- 2.03 QUALITY ASSURANCE A. QUALITY ASSURANCE FOR AUTOMATIC CONTROL SYSTEMS INCLUDES A MULTI-STEP PROGRAM CONSISTING OF A PRE-QUALIFICATION PROCEDURE FOR MANUFACTURER AND INSTALLATION SPECIALIST; A SYSTEM ENGINEERING, PRODUCTS AND SHOP DRAWING PHASE; INSTALLATION; TESTING AND ADJUSTING; REPORTING; COMMISSIONING TESTING AND VERIFICATIONS: OPERATING INSTRUCTION AND TRAINING: AND THE SUBMISSION OF MAINTENANCE AND OPERATING MANUALS.

B. CMMS CONTRACTOR

- THE CENTRAL CONTROL AND MONITORING SYSTEM (CMMS) HEREIN SPECIFIED SHALL BE FULLY INTEGRATED AND INSTALLED AS A COMPLETE PACKAGE BY THE CENTRAL CONTROL AND MONITORING SYSTEM CONTRACTOR. THE SYSTEM SHALL INCLUDE ALL WIRING, PIPING, INSTALLATION SUPERVISION, CALIBRATION, ADJUSTMENTS, AND CHECKOUT NECESSARY FOR A COMPLETE AND FULLY OPERATIONAL SYSTEM.
- 2. THE CMMS CONTRACTOR SHALL BE A FACTORY OWNED BRANCH OFFICE THAT IS REGULARLY ENGAGED IN THE ENGINEERING, PROGRAMMING, INSTALLATION AND SERVICE OF CMMSS OF SIMILAR SIZE AND COMPLEXITY. BIDS BY WHOLESALERS, MECHANICAL CONTRACTORS. FRANCHISED DEALERS, APPLIED PARTNERS OR ANY OTHER FIRM WHOSE 6. NETWORK PROCESSING, DATA STORAGE AND COMMUNICATIONS PRINCIPAL BUSINESS IS NOT THAT OF MANUFACTURING AND INSTALLING AUTOMATIC TEMPERATURE CONTROL SYSTEMS SHALL NOT BE
- **ACCEPTABLE** 3. THE CMMS CONTRACTOR SHALL HAVE A MINIMUM OF TEN YEARS EXPERIENCE WITH THE COMPLETE, TURNKEY INSTALLATION OF CMMSS OF SIMILAR SIZE AND TECHNICAL COMPLEXITY.
- 4. THE CMMS SHALL BE COMPLETE IN ALL RESPECTS AND SHALL BE PROVIDED, INSTALLED AND COMMISSIONED BY THE CMMS EQUIPMENT MANUFACTURER. EQUIPMENT MANUFACTURER SHALL BE RESPONSIBLE FOR AND WARRANT THE PROPER INSTALLATION AND OPERATION OF THE CMMS AND CONTROL SYSTEM EQUIPMENT.
- 5. THE FOLLOWING CMMS CONTRACTORS ARE APPROVED TO PROVIDE AND 3.02 CCMS ARCHITECTURE INSTALL THE CMMS FOR THIS PROJECT SUBJECT TO THEIR ABILITY TO MEET ALL REQUIREMENTS OF THIS SPECIFICATION:
- 6. JOHNSON CONTROLS 7. BID APPROVAL DOES NOT IMPLY NOR SUGGEST COMPLIANCE OF SPECIFICATION REQUIREMENTS C. CMMS PRODUCTS MANUFACTURER
- 1. THE CMMS ARCHITECTURE SHALL CONSIST OF THE PRODUCTS OF A MANUFACTURER REGULARLY ENGAGED IN THE PRODUCTION OF CMMSS, AND SHALL BE THE MANUFACTURER'S LATEST STANDARD OF DESIGN. CONTROLLERS AND DDC (DIRECT DIGITAL CONTROL) SYSTEM COMPONENTS SHALL BE CURRENT PRODUCTION PRODUCTS.
- 2. ALL OTHER EQUIPMENT SHALL BE THE PRODUCTS OF THE CMMS MANUFACTURERS OR OF AN APPROVED MANUFACTURER REGULARLY ENGAGED IN PRODUCTION OF SPECIALIZED CMMS MATERIALS OR
- 3. FOLLOWING IS A LIST OF ACCEPTABLE CMMS PRODUCTS MANUFACTURERS:
- 4. JOHNSON CONTROLS 5. BID APPROVAL DOES NOT IMPLY NOR SUGGEST COMPLIANCE OF
- SPECIFICATION REQUIREMENTS. 2.04 WORK INCLUDED AND INTERFACE REQUIREMENTS A. INSTALLATION OF CENTRAL CONTROL AND MONITORING SYSTEM (CMMS
- 1. THE CMMS CONTRACTOR SHALL PROVIDE ALL NECESSARY HARDWARE AND SOFTWARE TO INTEGRATE THE NEW CONTROL SYSTEM WITH THE EXISTING USC SOM CAMPUS CMMS. INTEGRATION MEANS THE ABILITY TO MONITOR, OVERRIDE, CHANGE SETPOINTS, AND PROVIDE REAL—TIME BI-DIRECTIONAL DYNAMIC DATA EXCHANGE BETWEEN THE NEW CONTROL SYSTEM AND THE EXISTING CMMS HARDWARE AND SOFTWARE. 2. THE CMMS CONTRACTOR SHALL UPGRADE EXISTING METASYS SOFTWARE
- TO LATEST VERSION. 3. THE EXISTING USC SOM CAMPUS CMMS IS A JOHNSON CONTROLS METASYS SYSTEM. THE CMMS IS COMPRISED OF MULTIPLE SUPERVISORY CONTROLLERS. MONITORING AND COMMUNICATING WITH VARIOUS BUILDING CONTROL SYSTEMS OVER THE USC SOM CAMPUS
- ETHERNET LAN SYSTEM. THE NEW BUILDING CONTROL SYSTEM WILL BE CONNECTED TO, AND COMMUNICATE WITH, THE EXISTING CAMPUS CMMS OVER THE USC SOM CAMPUS ETHERNET LAN 4. ALL NEW CONTROL POINTS, MONITORING POINTS AND SOFTWARE POINTS SHALL BE AVAILABLE FOR MONITORING AND ADJUSTMENT AT ANY
- SHALL BE ADDED TO THE EXISTING USC SOM CMMS DATABASE AND COMPUTER, WITH CURRENT COPY OF MICROSOFT INTERNET EXPLORER SOFTWARE (RELEASE 6.0 OR LATER), THAT IS CONNECTED TO THE USC SOM LAN. 5. ALL NEW BUILDING SOFTWARE AND DATABASES SHALL BE ARCHIVED ON
- THE HARD DRIVE AT THE USC SOM CMMS SERVER. IN THE EVENT THAT ANY BUILDING CONTROLLER SHOULD LOSE ITS PROGRAM THAT CONTROLLER'S ARCHIVED SOFTWARE PROGRAM SHALL BE DOWNLOADED ACROSS THE CMMS NETWORK FROM THE CMMS SERVER TO THE RESPECTIVE BUILDING CONTROLLER.
- 6. INTEGRITY OF THE EXISTING CMMS SHALL BE MAINTAINED DURING 7. THE NEW BUILDING CONTROL SYSTEM SHALL BE COMPATIBLE IN EVERY
- RESPECT WITH EXISTING METASYS CMMS HARDWARE AND SOFTWARE. ALL NEW CONTROLLERS SHALL BE COMPATIBLE WITH METASYS DATABASE AND METASYS SOFTWARE DEVELOPMENT TOOLS. 2.05 SUBMITTALS
- A. SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES . SUBMITTALS SHALL BE IN DEFINED PACKAGES. EACH PACKAGE SHALL
- BE COMPLETE AND SHALL ONLY REFERENCE ITSELF AND PREVIOUSLY SUBMITTED PACKAGES. THE PACKAGES SHALL BE AS APPROVED BY THE ARCHITECT AND ENGINEER FOR CONTRACT COMPLIANCE. PREPARE AN INDEX OF ALL SUBMITTALS AND SHOP DRAWINGS FOR
- THE INSTALLATION. INDEX SHALL INCLUDE A SHOP DRAWING IDENTIFICATION NUMBER, CONTRACT DOCUMENTS REFERENCE AND ITEM
- 3. THE CCMS CONTRACTOR SHALL CORRECT ANY ERRORS OR OMISSIONS NOTED IN THE FIRST REVIEW. 4. AT A MINIMUM, SUBMIT THE FOLLOWING:
- a. CCMS NETWORK ARCHITECTURE DIAGRAMS INCLUDING ALL NODES AND INTERCONNECTIONS.
- b. SYSTEMS SCHEMATICS, SEQUENCES AND FLOW DIAGRAMS. c. POINTS SCHEDULE FOR EACH POINT IN THE CCMS, INCLUDING: POINT TYPE. OBJECT NAME, EXPANDED ID, DISPLAY UNITS,
- CONTROLLER TYPE, AND ADDRESS. d. Samples of Graphic display screen types and associated

- e. DETAILED BILL OF MATERIAL LIST FOR EACH SYSTEM OR APPLICATION, IDENTIFYING QUANTITIES, PART NUMBERS. DESCRIPTIONS, AND OPTIONAL FEATURES.
- f. CONTROL DAMPER SCHEDULE INCLUDING A SEPARATE LINE FOR EACH DAMPER PROVIDED UNDER THIS SECTION AND A COLUMN FOR EACH OF THE DAMPER ATTRIBUTES, INCLUDING: CODE NUMBER, FAIL POSITION, DAMPER TYPE, DAMPER OPERATOR, DUCT SIZE, DAMPER SIZE, MOUNTING, AND ACTUATOR TYPE
- q. CONTROL VALVE SCHEDULES INCLUDING A SEPARATE LINE FOR EACH VALVE PROVIDED UNDER THIS SECTION AND A COLUMN FOR EACH OF THE VALVE ATTRIBUTES: CODE NUMBER, CONFIGURATION, FAIL POSITION. PIPE SIZE. VALVE SIZE. BODY CONFIGURATION. CLOSE OFF
- PRESSURE, CAPACITY, VALVE CV, DESIGN PRESSURE, AND ACTUATOR h. DETAILS OF ALL CCMS INTERFACES AND CONNECTIONS TO THE WORK OF OTHER TRADES.
- B. PRODUCT DATA SHEETS OR MARKED CATALOG PAGES INCLUDING PART NUMBER, PHOTO AND DESCRIPTION FOR ALL PRODUCTS INCLUDING
- 2.06 RECORD DOCUMENTATION
- A. OPERATION AND MAINTENANCE MANUALS THREE (3) COPIES OF THE OPERATION AND MAINTENANCE MANUALS SHALL BE PROVIDED TO THE OWNER'S REPRESENTATIVE UPON COMPLETION OF THE PROJECT. THE ENTIRE OPERATION AND MAINTENANCE MANUAL SHALL BE FURNISHED ON COMPACT DISC MEDIA, AND INCLUDE THE FOLLOWING FOR THE CCMS PROVIDED:
- a. TABLE OF CONTENTS. b. AS-BUILT SYSTEM RECORD DRAWINGS. COMPUTER AIDED DRAWINGS (CAD) RECORD DRAWINGS SHALL REPRESENT THE AS-BUILT CONDITION OF THE SYSTEM AND INCORPORATE ALL INFORMATION
- SUPPLIED WITH THE APPROVED SUBMITTAL. c. MANUFACTURERS PRODUCT DATA SHEETS OR CATALOG PAGES FOR ALL PRODUCTS INCLUDING SOFTWARE.
- d. SYSTEM OPERATOR'S MANUALS. e. ARCHIVE COPY OF ALL SITE—SPECIFIC DATABASES AND SEQUENCES. f. CCMS NETWORK DIAGRAMS.
- g. INTERFACES TO ALL THIRD-PARTY PRODUCTS AND WORK BY OTHER
- 2. THE OPERATION AND MAINTENANCE MANUAL CD SHALL BE SELF-CONTAINED, AND INCLUDE ALL NECESSARY SOFTWARE REQUIRED TO ACCESS THE PRODUCT DATA SHEETS. A LOGICALLY ORGANIZED TABLE OF CONTENTS SHALL PROVIDE DYNAMIC LINKS TO VIEW AND PRINT ALL PRODUCT DATA SHEETS. VIEWER SOFTWARE SHALL PROVIDE THE ABILITY TO DISPLAY, ZOOM, AND SEARCH ALL DOCUMENTS.
- A. STANDARD MATERIAL AND LABOR WARRANTY . PROVIDE A ONE-YEAR LABOR AND MATERIAL WARRANTY ON THE CCMS
- 2. IF WITHIN TWELVE (12) MONTHS FROM THE DATE OF ACCEPTANCE OF PRODUCT, UPON WRITTEN NOTICE FROM THE OWNER, IT IS FOUND TO BE DEFECTIVE IN OPERATION, WORKMANSHIP OR MATERIALS, IT SHALL BE REPLACED. REPAIRED OR ADJUSTED AT THE OPTION OF THE CCMS CONTRACTOR AT THE COST OF THE CCMS CONTRACTOR. . MAINTAIN AN ADEQUATE SUPPLY OF MATERIALS WITHIN 100 MILES OF
- THE PROJECT SITE SUCH THAT REPLACEMENT OF KEY PARTS AND LABOR SUPPORT, INCLUDING PROGRAMMING. WARRANTY WORK SHALL BE DONE DURING CCMS CONTRACTOR'S NORMAL BUSINESS HOURS. PART 2 PRODUCTS
- LARGE GENERAL DESCRIPTION A. THE BUILDING MANAGEMENT SYSTEM (CCMS) SHALL USE AN OPEN ARCHITECTURE. THE SYSTEM SHALL BE DESIGNED FOR USE ON THE INTERNET, OR INTRANETS USING OFF THE SHELF, INDUSTRY STANDARD
- TECHNOLOGY COMPATIBLE WITH OTHER OWNER PROVIDED NETWORKS. B. THE BUILDING MANAGEMENT SYSTEM SHALL CONSIST OF THE FOLLOWING:
- 1. STANDALONE NETWORK AUTOMATION ENGINE(S) 2. FIELD EQUIPMENT CONTROLLER(S) INPUT/OUTPUT MODULE(S)
- 4. LOCAL DISPLAY DEVICE(S)
- 5. DISTRIBUTED USER INTERFACE(S) FOUIPMENT
- 7. OTHER COMPONENTS REQUIRED FOR A COMPLETE AND WORKING CCMS C. THE SYSTEM SHALL BE MODULAR IN NATURE, AND SHALL PERMIT EXPANSION OF BOTH CAPACITY AND FUNCTIONALITY THROUGH THE
- ADDITION OF SENSORS, ACTUATORS, CONTROLLERS AND OPERATOR DEVICES, WHILE RE-USING EXISTING CONTROLS EQUIPMENT. ). SYSTEM ARCHITECTURAL DESIGN SHALL ELIMINATE DEPENDENCE UPON ANY SINGLE DEVICE FOR ALARM REPORTING AND CONTROL EXECUTION. THE
- FAILURE OF ANY SINGLE COMPONENT OR NETWORK CONNECTION SHALL NOT INTERRUPT THE EXECUTION OF CONTROL STRATEGIES AT OTHER
- 1. THE CCMS SHALL NETWORK MULTIPLE USER INTERFACE CLIENTS AUTOMATION ENGINES, SYSTEM CONTROLLERS AND APPLICATION-SPECIFIC CONTROLLERS. PROVIDE APPLICATION AND DATA SERVER(S) AS REQUIRED FOR SYSTEMS OPERATION.
- 2. THE AUTOMATION NETWORK SHALL BE CAPABLE OF OPERATING AT A COMMUNICATION SPEED OF 100 MBPS, WITH FULL PEER-TO-PEER NETWORK COMMUNICATION.
- 3. NETWORK AUTOMATION ENGINES (NAE) SHALL RESIDE ON THE AUTOMATION NETWORK.
- 4. THE AUTOMATION NETWORK WILL BE COMPATIBLE WITH OTHER CAMPUS-WIDE NETWORKS. WHERE INDICATED, THE AUTOMATION NETWORK SHALL BE CONNECTED TO THE CAMPUS NETWORK AND SHARE RESOURCES WITH IT BY WAY OF STANDARD NETWORKING
- DEVICES AND PRACTICES. B. CONTROL NETWORK
- 1. NETWORK AUTOMATION ENGINES SHALL PROVIDE SUPERVISORY CONTROL OVER THE CONTROL NETWORK. CONTROL NETWORKS SHALL PROVIDE EITHER "PEER-TO-PEER," MASTER-SLAVE, OR SUPERVISED TOKEN PASSING COMMUNICATIONS.
- AND SHALL OPERATE AT A MINIMUM COMMUNICATION SPEED OF 9600 3. DDC CONTROLLERS SHALL RESIDE ON THE CONTROL NETWORK.
- C. DISTRIBUTED WEB BASED USER INTERFACE 1. ALL FEATURES AND FUNCTIONS OF THE DEDICATED USER INTERFACE PREVIOUSLY DEFINED IN THIS DOCUMENT SHALL BE AVAILABLE ON ANY COMPUTER CONNECTED DIRECTLY OR VIA A WIDE AREA OR VIRTUAL PRIVATE NETWORK (WAN/VPN) TO THE AUTOMATION NETWORK AND
- CONFORMING TO THE FOLLOWING SPECIFICATIONS. 2. ALARMS a. ALARMS SHALL BE ROUTED DIRECTLY FROM NETWORK AUTOMATION ENGINES TO PCS AND SERVERS. IT SHALL BE POSSIBLE FOR SPECIFIC ALARMS FROM SPECIFIC POINTS TO BE ROUTED TO SPECIFIC PCS AND SERVERS. THE ALARM MANAGEMENT PORTION
- OF THE USER INTERFACE SHALL, AT THE MINIMUM, PROVIDE THE FOLLOWING FUNCTIONS: 1) LOG DATE AND TIME OF ALARM OCCURRENCE.
- GENERATE A "POP-UP" WINDOW, WITH AUDIBLE ALARM. INFORMING A USER THAT AN ALARM HAS BEEN RECEIVED. 3) ALLOW A USER, WITH THE APPROPRIATE SECURITY LEVEL, TO ACKNOWLEDGE, TEMPORARILY SILENCE, OR DISCARD AN ALARM. .) PROVIDE AN AUDIT TRAIL ON HARD DRIVE FOR ALARMS BY
- RECORDING USER ACKNOWLEDGMENT, DELETION, OR DISABLING OF AN ALARM. THE AUDIT TRAIL SHALL INCLUDE THE NAME OF THE USER, THE ALARM, THE ACTION TAKEN ON THE ALARM, AND A TIME/DATE STAMP. 5) PROVIDE THE CAPABILITY TO DIRECT ALARMS TO AN E-MAIL ADDRESS OR ALPHANUMERIC PAGER. THIS MUST BE PROVIDED
- IN ADDITION TO THE POP UP WINDOW DESCRIBED ABOVE. SYSTEMS THAT USE E-MAIL AND PAGERS AS THE EXCLUSIVE MEANS OF ANNUNCIATING ALARMS ARE NOT ACCEPTABLE.
- 6) ANY ATTRIBUTE OF ANY OBJECT IN THE SYSTEM MAY BE DESIGNATED TO REPORT AN ALARM. 7) THE FMS SHALL ANNUNCIATE DIAGNOSTIC ALARMS INDICATING SYSTEM FAILURES AND NON-NORMAL OPERATING CONDITIONS
- 3. REPORTS AND SUMMARIES a. REPORTS AND SUMMARIES SHALL BE GENERATED AND DIRECTED TO THE USER INTERFACE DISPLAYS, WITH SUBSEQUENT ASSIGNMENT TO PRINTERS, OR DISK. AS A MINIMUM, THE SYSTEM SHALL PROVIDE THE FOLLOWING REPORTS:
- 1) ALL POINTS IN THE CCMS 2) ALL POINTS IN EACH CCMS APPLICATION ALL POINTS IN A SPECIFIC CONTROLLER
- 4) ALL POINTS IN A USER-DEFINED GROUP OF POINTS 5) ALL POINTS CURRENTLY IN ALARM
- 6) ALL POINTS LOCKED OUT 7) ALL CCMS SCHEDULES
- 8) ALL USER DEFINED AND ADJUSTABLE VARIABLES, SCHEDULES, INTERLOCKS AND THE LIKE. 9) SUMMARIES AND REPORTS SHALL BE ACCESSIBLE VIA STANDARD UI FUNCTIONS AND NOT DEPENDENT UPON CUSTOM PROGRAMMING OR USER DEFINED HTML PAGES.

- 10) SELECTION OF A SINGLE MENU ITEM, TOOL BAR ITEM, OR TOOL BAR BUTTON SHALL PRINT ANY DISPLAYED REPORT OR SUMMARY ON THE SYSTEM PRINTER FOR USE AS A BUILDING MANAGEMENT AND DIAGNOSTICS TOOL. 11)THE SYSTEM SHALL ALLOW FOR THE CREATION OF CUSTOM REPORTS AND QUERIES VIA A STANDARD WEB SERVICES XML INTERFACE AND COMMERCIAL OFF-THE-SHELF SOFTWARE SUCH AS MICROSOFT ACCESS, MICROSOFT EXCEL, OR CRYSTAL
- a. A GRAPHICAL DISPLAY FOR TIME-OF-DAY SCHEDULING AND OVERRIDE SCHEDULING OF BUILDING OPERATIONS SHALL BE PROVIDED. AT A MINIMUM, THE FOLLOWING FUNCTIONS SHALL BE PROVIDED:
- 1) WEEKLY SCHEDULES 2) EXCEPTION SCHEDULES
- 3) MONTHLY CALENDARS. 4) WEEKLY SCHEDULES SHALL BE PROVIDED FOR EACH GROUP OF EQUIPMENT WITH A SPECIFIC TIME USE SCHEDULE. 5) IT SHALL BE POSSIBLE TO DEFINE ONE OR MORE EXCEPTION
- SCHEDULES FOR EACH SCHEDULE INCLUDING REFERENCES TO CALENDARS 5. PASSWORD a. MULTIPLE-LEVEL PASSWORD ACCESS PROTECTION SHALL BE PROVIDED TO ALLOW THE USER/MANAGER TO USER INTERFACE
- CONTROL, DISPLAY, AND DATABASE MANIPULATION CAPABILITIES DEEMED APPROPRIATE FOR EACH USER, BASED ON AN ASSIGNED b. A MINIMUM OF FIVE LEVELS OF ACCESS SHALL BE SUPPORTED
- INDIVIDUALLY OR IN ANY COMBINATION AS FOLLOWS: 1) LEVEL 1 = VIEW DATA
- 2) LEVEL 2 = COMMAND3) LEVEL 3 = OPERATOR OVERRIDES 4) LEVEL 4 = DATABASE MODIFICATION 5) LEVEL 5 = DATABASE CONFIGURATION6) LEVEL 6 = ALL PRIVILEGES, INCLUDING PASSWORD ADD/MODIFY
- 7) OPERATORS SHALL BE ABLE TO PERFORM ONLY THOSE COMMANDS AVAILABLE FOR THEIR RESPECTIVE PASSWORDS. DISPLAY OF MENU SELECTIONS SHALL BE LIMITED TO ONLY THOSE ITEMS DEFINED FOR THE ACCESS LEVEL OF THE PASSWORD USED TO LOG-ON.
- 6. DYNAMIC COLOR GRAPHICS a. THE GRAPHICS APPLICATION PROGRAM SHALL BE SUPPLIED AS AN INTEGRAL PART OF THE USER INTERFACE. BROWSER OR WORKSTATION APPLICATIONS THAT RELY ONLY UPON HTML PAGES SHALL NOT BE ACCEPTABLE.
- b. THE GRAPHICS APPLICATIONS SHALL INCLUDE A CREATE/EDIT FUNCTION AND A RUNTIME FUNCTION. THE SYSTEM ARCHITECTURE SHALL SUPPORT AN UNLIMITED NUMBER OF GRAPHICS DOCUMENTS (GRAPHIC DEFINITION FILES) TO BE GENERATED AND EXECUTED. 1) THE GRAPHICS SHALL BE ABLE TO DISPLAY AND PROVIDE ANIMATION BASED ON REAL-TIME DATA THAT IS ACQUIRED, DERIVED, OR ENTERED.
- . HISTORICAL TRENDING AND DATA COLLECTION a. EACH AUTOMATION ENGINE SHALL STORE TREND AND POINT HISTORY DATA FOR ALL ANALOG AND DIGITAL INPUTS AND OUTPUTS, AS 1) ANY POINT, PHYSICAL OR CALCULATED, MAY BE DESIGNATED FOR
- TRENDING. THREE METHODS OF COLLECTION SHALL BE ALLOWED: (a) DEFINED TIME INTERVAL (b)UPON A CHANGE OF VALUE (1) EACH AUTOMATION ENGINE SHALL HAVE THE CAPABILITY TO STORE MULTIPLE SAMPLES FOR EACH PHYSICAL POINT AND 20LIMAKE AAKIARTE RAZED OLON AAAITARTE WEWOKA
- INCLUDING AN INDIVIDUAL SAMPLE TIME/DATE STAMP. POINTS MAY BE ASSIGNED TO MULTIPLE HISTORY TRENDS WITH DIFFERENT COLLECTION PARAMETERS. 2) THE SYSTEM SHALL PROVIDE A CONFIGURABLE DATA STORAGE SUBSYSTEM FOR THE COLLECTION OF HISTORICAL DATA. DATA CAN BE STORED IN EITHER MICROSOFT ACCESS OR SQL
- DATABASE FORMAT. 8. TREND DATA VIEWING AND ANALYSIS a. PROVIDE A TREND VIEWING UTILITY THAT SHALL HAVE ACCESS TO ALL DATABASE POINTS. b. IT SHALL BE POSSIBLE TO RETRIEVE ANY HISTORICAL DATABASE
- POINT FOR USE IN DISPLAYS AND REPORTS BY SPECIFYING THE POINT NAME AND ASSOCIATED TREND NAME. c. THE TREND VIEWING UTILITY SHALL HAVE THE CAPABILITY TO DEFINE TREND STUDY DISPLAYS TO INCLUDE MULTIPLE TRENDS d. DISPLAYS SHALL BE ABLE TO BE SINGLE OR STACKED GRAPHS WITH
- ON-LINE SELECTABLE DISPLAY CHARACTERISTICS, SUCH AS RANGING, COLOR. AND PLOT STYLE. e. DISPLAY MAGNITUDE AND UNITS SHALL BOTH BE SELECTABLE B THE OPERATOR AT ANY TIME WITHOUT RECONFIGURING THE PROCESSING OR COLLECTION OF DATA. THIS IS A ZOOM CAPABILITY. f. DISPLAY MAGNITUDE SHALL AUTOMATICALLY BE SCALED TO SHOW
- FULL GRAPHIC RESOLUTION OF THE DATA BEING DISPLAYED. q. TREND STUDIES SHALL BE CAPABLE OF CALCULATING AND DISPLAYING CALCULATED VARIABLES INCLUDING HIGHEST VALUE, LOWEST VALUE AND TIME BASED ACCUMULATION.

3.03 NETWORK AUTOMATION ENGINES (NAE)

- A. NETWORK AUTOMATION ENGINE (NAE) 1. THE NETWORK AUTOMATION ENGINE (NAE) SHALL BE A FULLY USER-PROGRAMMABLE, SUPERVISORY CONTROLLER. THE NAE SHALL MONITOR THE NETWORK OF DISTRIBUTED APPLICATION—SPECIFIC CONTROLLERS, PROVIDE GLOBAL STRATEGY AND DIRECTION, AND COMMUNICATE ON A PEER-TO-PEER BASIS WITH OTHER NETWORK
- AUTOMATION ENGINES. 2. AUTOMATION NETWORK — THE NAE SHALL RESIDE ON THE AUTOMATION NETWORK AND SHALL SUPPORT A SUBNET OF SYSTEM CONTROLLERS. 3. PROCESSOR - THE NAE SHALL BE MICROPROCESSOR-BASED WITH A MINIMUM WORD SIZE OF 32 BITS. THE NAE SHALL BE A MULTI-TASKING, MULTI-USER, AND REAL-TIME DIGITAL CONTROL
- PROCESSOR. STANDARD OPERATING SYSTEMS SHALL BE EMPLOYED. NAE SIZE AND CAPABILITY SHALL BE SUFFICIENT TO FULLY MEET THE REQUIREMENTS OF THIS SPECIFICATION. 4. MEMORY — EACH NAE SHALL HAVE SUFFICIENT MEMORY TO SUPPORT ITS OWN OPERATING SYSTEM, DATABASES, AND CONTROL PROGRAMS, AND TO PROVIDE SUPERVISORY CONTROL FOR ALL CONTROL LEVEL
- 5. DIAGNOSTICS THE NAE SHALL CONTINUOUSLY PERFORM SELF-DIAGNOSTICS, COMMUNICATION DIAGNOSIS, AND DIAGNOSIS OF ALL PANEL COMPONENTS. THE NETWORK AUTOMATION ENGINE SHALL PROVIDE BOTH LOCAL AND REMOTE ANNUNCIATION OF ANY DETECTED COMPONENT FAILURES, LOW BATTERY CONDITIONS, OR REPEATED FAILURES TO ESTABLISH COMMUNICATION.
- 6. POWER FAILURE IN THE EVENT OF THE LOSS OF NORMAL POWER, THE NAE SHALL CONTINUE TO OPERATE FOR A USER ADJUSTABLE PERIOD OF UP TO 10 MINUTES AFTER WHICH THERE SHALL BE AN ORDERLY SHUTDOWN OF ALL PROGRAMS TO PREVENT THE LOSS OF
- DATABASE OR OPERATING SYSTEM SOFTWARE. a. DURING A LOSS OF NORMAL POWER, THE CONTROL SEQUENCES SHALL GO TO THE NORMAL SYSTEM SHUTDOWN CONDITIONS. ALL CRITICAL CONFIGURATION DATA SHALL BE SAVED INTO FLASH

b. UPON RESTORATION OF NORMAL POWER AND AFTER A MINIMUM

- OFF-TIME DELAY, THE CONTROLLER SHALL AUTOMATICALLY RESUME FULL OPERATION WITHOUT MANUAL INTERVENTION THROUGH A NORMAL SOFT-START SEQUENCE. 3.04 DDC SYSTEM CONTROLLERS
- A. FIELD EQUIPMENT CONTROLLER (FEC) 1. THE FIELD EQUIPMENT CONTROLLER (FEC) SHALL BE A FULLY USER-PROGRAMMABLE, DIGITAL CONTROLLER THAT COMMUNICATES VIA BACNET MS/TP PROTOCOL.
- 2. CONTROLLERS SHALL BE FACTORY PROGRAMMED WITH A CONTINUOUS ADAPTIVE TUNING ALGORITHM THAT SENSES CHANGES IN THE PHYSICAL ENVIRONMENT AND CONTINUALLY ADJUSTS LOOP TUNING PARAMETERS APPROPRIATELY. CONTROLLERS THAT REQUIRE MANUAL TUNING OF LOOPS OR PERFORM AUTOMATIC TUNING ON COMMAND ONLY SHALL NOT BE ACCEPTABLE.
- 3. THE FEC SHALL BE ASSEMBLED IN A PLENUM-RATED HOUSING WITH FLAMMABILITY RATED TO UL94-5VB. 4. THE FEC SHALL INCLUDE A REMOVABLE BASE TO ALLOW PRE-WIRING WITHOUT THE CONTROLLER. 5. THE FEC SHALL ACCOMMODATE THE DIRECT WIRING OF ANALOG AND
- BINARY I/O FIELD POINTS. 6. THE FEC SHALL SUPPORT THE FOLLOWING TYPES OF INPUTS AND a. UNIVERSAL INPUTS — SHALL BE CONFIGURED TO MONITOR ANY OF THE FOLLOWING:
- 2) ANALOG INPUT, CURRENT MODE 3) ANALOG INPUT, RESISTIVE MODE 4) BINARY INPUT, DRY CONTACT MAINTAINED MODE

5) BINARY INPUT. PULSE COUNTER MODE

1) ANALOG INPUT, VOLTAGE MODE

6) BINARY INPUTS - SHALL BE CONFIGURED TO MONITOR EITHER OF THE FOLLOWING: (a)DRY CONTACT MAINTAINED MODE (b)PULSE COUNTER MODE 7) ANALOG OUTPUTS — SHALL BE CONFIGURED TO OUTPUT EITHER OF THE FOLLOWING

FT. BETWEEN THE FEC AND THE FURTHEST CONNECTED DEVICE.

a. HOT WATER, CHILLED WATER/CENTRAL PLANT APPLICATIONS

b. BUILT-UP AIR HANDLING UNITS FOR SPECIAL APPLICATIONS

d. SPECIAL PROGRAMS AS REQUIRED FOR SYSTEMS CONTROL

1. THE INPUT/OUTPUT MODULE (IOM) PROVIDES ADDITIONAL INPUTS AND

2. THE IOM SHALL COMMUNICATE WITH THE FEC OVER EITHER THE FC

1. THE NETWORKED THERMOSTATS SHALL BE CAPABLE OF CONTROLLING

AND PARAMETER ADJUSTMENT FROM THE WEB BASED USER

INTERFACEABLE THROUGH A NETWORK AUTOMATION ENGINE.

2. THE NETWORKED THERMOSTAT SHALL INCLUDE AN INTUITIVE USER

3. THE NETWORKED THERMOSTATS SHALL PROVIDE THE FLEXIBILITY TO

c. REMOTE INDOOR AIR TEMPERATURE SENSOR WITH OCCUPANCY

4. THE NETWORKED THERMOSTATS SHALL PROVIDE THE FLEXIBILITY TO

1. THE NETWORK SENSORS (NS) SHALL HAVE THE ABILITY TO MONITOR

2. THE NS SHALL TRANSMIT THE ZONE INFORMATION BACK TO THE

3. THE NETWORK SENSORS SHALL INCLUDE THE FOLLOWING ITEMS:

a. A BACKLIT LIQUID CRYSTAL DISPLAY (LCD) TO INDICATE THE

b. An LED TO INDICATE THE STATUS OF THE OVERRIDE FEATURE

c. A BUTTON TO TOGGLE THE TEMPERATURE DISPLAY BETWEEN

4. THE NS SHALL BE AVAILABLE WITH EITHER SCREW TERMINALS OR

5. THE NS SHALL BE AVAILABLE IN EITHER SURFACE MOUNT OR WALL

TRANSMITTERS, AND OTHER INPUT DEVICES SHALL BE PROVIDED TO

a. SENSORS AND TRANSMITTERS SHALL BE PROVIDED, AS OUTLINED IN

THE INPUT/OUTPUT SUMMARY AND SEQUENCE OF OPERATIONS.

AND SHALL BE EITHER TWO-WIRE 1000 OHM NICKEL RTD. OR

c. THE FOLLOWING POINT TYPES (AND THE ACCURACY OF EACH) ARE

REQUIRED. AND THEIR ASSOCIATED ACCURACY VALUES INCLUDE

ERRORS ASSOCIATED WITH THE SENSOR, LEAD WIRE, AND A TO D

a. ROOM SENSORS SHALL BE CONSTRUCTED FOR EITHER SURFACE OR

b. ROOM SENSORS SHALL HAVE THE FOLLOWING OPTIONS WHEN

1) SETPOINT RESET SLIDE SWITCH PROVIDING A +3 DEGREE

2) INDIVIDUAL HEATING/COOLING SETPOINT SLIDE SWITCHES.

a. WHEN THERMO WELLS ARE REQUIRED. THE SENSOR AND WELL

SHALL BE SUPPLIED AS A COMPLETE ASSEMBLY, INCLUDING

ACCORDANCE WITH THE SYSTEM WORKING PRESSURE.

c. THERMO WELLS AND SENSORS SHALL BE MOUNTED IN A

THE SENSOR FOR REPAIR OR REPLACEMENT.

AND RATED FOR AMBIENT TEMPERATURES.

b. THERMO WELLS SHALL BE PRESSURE RATED AND CONSTRUCTED IN

THREADOLET OR 1/2" NFT SADDLE AND ALLOW EASY ACCESS TO

d. THERMO WELLS SHALL BE CONSTRUCTED OF 316 STAINLESS STEEL.

a. Outside air sensors shall be designed to withstand the

THEY SHALL ALSO BE PROVIDED WITH A SOLAR SHIELD.

b. SENSORS EXPOSED TO WIND VELOCITY PRESSURES SHALL BE

a. DUCT MOUNT SENSORS SHALL MOUNT IN AN ELECTRICAL BOX

ENVIRONMENTAL CONDITIONS TO WHICH THEY WILL BE EXPOSED.

SHIELDED BY A PERFORATED PLATE THAT SURROUNDS THE SENSOR

c. TEMPERATURE TRANSMITTERS SHALL BE OF NEMA 3R CONSTRUCTION

3) A MOMENTARY OVERRIDE REQUEST PUSH BUTTON FOR ACTIVATION

b. THE TEMPERATURE SENSOR SHALL BE OF THE RESISTANCE TYPE,

d. A BUTTON TO INITIATE A TIMED OVERRIDE COMMAND

1. INSTALLATION, TESTING, AND CALIBRATION OF ALL SENSORS,

BACNET STANDARD PROTOCOL SSPC-135, CLAUSE 9.

TEMPERATURE, HUMIDITY AND SETPOINT.

FAHRENHEIT AND CELSIUS.

MEET THE SYSTEM REQUIREMENTS.

TWO-WIRE 1000 OHM PLATINUM RTD.

CONTROLLER ON THE SENSOR-ACTUATOR BUS (SA BUS) USING

THE FOLLOWING VARIABLES AS REQUIRED BY THE SYSTEMS SEQUENCE

a. A TWO PIPE FAN COIL WITH A SINGLE SPEED FAN.

INTERFACE PROVIDING PLAIN TEXT MESSAGES.

a. TWO LINE. 8 CHARACTER BACKLIT DISPLAY

c. FIVE (5) USER INTERFACE KEYS

SUPPORT THE FOLLOWING INPUTS:

OVERRIDE AND LED INDICATOR.

SUPPORT THE FOLLOWING OUTPUTS:

d. PROPORTIONAL (0 TO 10V) CONTROL

a. THREE SPEED FAN CONTROL

b. ON/OFF CONTROL

c. FLOATING CONTROL

C. NETWORK SENSORS (NS)

OF OPERATIONS:

b. ZONE HUMIDITY

c. ZONE SETPOINT

PHONE JACK.

MOUNT STYLES.

B. TEMPERATURE SENSORS

GENERAL REQUIREMENTS:

CONVERSION:

4. OUTSIDE AIR SENSORS

5. DUCT MOUNT SENSORS

2. ROOM TEMPERATURE SENSORS

WALL BOX MOUNTING.

(ADJUSTABLE) RANGE.

OF AFTER-HOURS OPERATION.

WELLHEAD AND GREENFIELD FITTING.

a. ZONE TEMPERATURE

d. TWO CONFIGURABLE BINARY INPUTS

a. INTEGRAL INDOOR AIR TEMPERATURE SENSOR

b. DUCT MOUNT AIR TEMPERATURE SENSOR

b. LED INDICATORS FOR FAN, HEAT, AND COOL STATUS

BUS OR THE SA BUS USING BACNET STANDARD PROTOCOL SSPC-135,

b. THE NETWORKED THERMOSTAT SHALL SUPPORT REMOTE READ/WRITE

(a)24 VAC TRIAC

(a) ANALOG OUTPUT, VOLTAGE MODE

(b)BINARY OUTPUT MODE

FOLLOWING:

BUS (FC BUS).

AND THE NAE.

c. TERMINAL UNITS

A. INPUT/OUTPUT MODULE (IOM)

3. NETWORKED THERMOSTAT (TEC)

THE FOLLOWING:

2) FAN

3) OVERRIDE

5) UP/DOWN

4) DEGREES C/F

CLAUSE 9.

OUTPUTS FOR USE IN THE FEC.

- COMPLETE ASSEMBLY, INCLUDING LOCK NUT AND MOUNTING PLATE. c. FOR OUTDOOR AIR DUCT APPLICATIONS, A WEATHERPROOF MOUNTING BOX WITH WEATHERPROOF COVER AND GASKET SHALL BE USED. 6. AVERAGING SENSORS (a) ANALOG OUTPUT, VOLTAGE MODE
- a. FOR DUCTWORK GREATER IN ANY DIMENSION THAT 48 INCHES (b) ANALOG OUTPUT, CURRENT MODE AND/OR WHERE AIR TEMPERATURE STRATIFICATION EXISTS. AN AVERAGING SENSOR WITH MULTIPLE SENSING POINTS SHALL BE 8) BINARY OUTPUTS - SHALL OUTPUT THE FOLLOWING:
- b. FOR PLENUM APPLICATIONS, SUCH AS MIXED AIR TEMPERATURE 9) CONFIGURABLE OUTPUTS - SHALL BE CAPABLE OF THE MEASUREMENTS, A STRING OF SENSORS MOUNTED ACROSS THE PLENUM SHALL BE USED TO ACCOUNT FOR STRATIFICATION AND/OR 3.07 OUTPUT DEVICES AIR TURBULENCE. THE AVERAGING STRING SHALL HAVE A MINIMUM A. ACTUATORS OF 4 SENSING POINTS PER 12-FOOT LONG SEGMENT. c. CAPILLARY SUPPORTS AT THE SIDES OF THE DUCT SHALL BE

EASILY ACCESSIBLE FOR REPAIR OR REPLACEMENT

THROUGH A HOLE IN THE DUCT, AND BE POSITIONED SO AS TO BE

b. DUCT SENSORS SHALL BE INSERTION TYPE AND CONSTRUCTED AS A

- 7. THE FEC SHALL HAVE THE ABILITY TO RESIDE ON A FIELD CONTROLLER PROVIDED TO SUPPORT THE SENSING STRING. '. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, SETRA. a. THE FC BUS SHALL BE A MASTER-SLAVE/TOKEN-PASSING (MS/TP)
- . HUMIDITY SENSORS BUS SUPPORTING BACNET STANDARD PROTOCOL SSPC-135, CLAUSE THE SENSOR SHALL BE A SOLID-STATE TYPE, RELATIVE HUMIDITY SENSOR OF THE BULK POLYMER DESIGN. THE SENSOR ELEMENT SHALL b. THE FC BUS SHALL SUPPORT COMMUNICATIONS BETWEEN THE FECS RESIST SERVICE CONTAMINATION.

3. THE HUMIDITY TRANSMITTER SHALL MEET THE FOLLOWING OVERALL

- 2. THE HUMIDITY TRANSMITTER SHALL BE EQUIPPED WITH c. THE FC BUS SHALL SUPPORT A MINIMUM OF 100 IOMS AND FEC IN NON-INTERACTIVE SPAN AND ZERO ADJUSTMENTS, A 2-WIRE ISOLATED ANY COMBINATION. LOOP POWERED, 4-20 MA, 0-100% LINEAR PROPORTIONAL OUTPUT. d. THE FC BUS SHALL OPERATE AT A MAXIMUM DISTANCE OF 15,000
- FT. BETWEEN THE FEC AND THE FURTHEST CONNECTED DEVICE. ACCURACY. INCLUDING LEAD LOSS AND ANALOG TO DIGITAL CONVERSION. 3% BETWEEN 20% AND 80% RH @ 77 DEG F UNLESS 8. THE FEC SHALL HAVE THE ABILITY TO MONITOR AND CONTROL A SPECIFIED ELSEWHERE. NETWORK OF SENSORS AND ACTUATORS OVER A SENSOR-ACTUATOR 4. OUTSIDE AIR RELATIVE HUMIDITY SENSORS SHALL BE INSTALLED WITH A
- RAIN PROOF, PERFORATED COVER. THE TRANSMITTER SHALL BE INSTALLED IN A NEMA 3R ENCLOSURE WITH SEALTITE FITTINGS AND a. THE SA BUS SHALL BE A MASTER-SLAVE/TOKEN-PASSING (MS/TP) STAINLESS STEEL BUSHINGS.
- BUS SUPPORTING BACNET STANDARD PROTOCOL SSPC-135, CLAUSE 5. A SINGLE POINT HUMIDITY CALIBRATOR SHALL BE PROVIDED, IF REQUIRED, FOR FIELD CALIBRATION. TRANSMITTERS SHALL BE SHIPPED b. THE SA BUS SHALL SUPPORT A MINIMUM OF 10 DEVICES PER FACTORY PRE-CALIBRATED.
- c. THE SA BUS SHALL OPERATE AT A MAXIMUM DISTANCE OF 1,200 STAINLESS STEEL, AND SHALL BE EQUIPPED WITH A NEOPRENE GROMMET, BUSHINGS, AND A MOUNTING BRACKET. 9. THE FEC SHALL SUPPORT, BUT NOT BE LIMITED TO, THE FOLLOWING: 7. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, VERIS INDUSTRIES, AND MAMAC.

6. DUCT TYPE SENSING PROBES SHALL BE CONSTRUCTED OF 304

- D. DIFFERENTIAL PRESSURE TRANSMITTERS 1. GENERAL AIR TRANSMITTER REQUIREMENTS: a. Pressure transmitters shall be constructed to withstand 100% PRESSURE OVER-RANGE WITHOUT DAMAGE, AND TO HOLD
  - OVER-RANGE INPUT. b. PRESSURE TRANSMITTERS SHALL TRANSMIT A 0 TO 5 VDC, 0 TO 10 VDC, OR 4 TO 20 MA OUTPUT SIGNAL. c. DIFFERENTIAL PRESSURE TRANSMITTERS USED FOR FLOW MEASUREMENT SHALL BE SIZED TO THE FLOW SENSING DEVICE. AND SHALL BE SUPPLIED WITH TEE FITTINGS AND SHUT-OFF VALVES IN THE HIGH AND LOW SENSING PICK-UP LINES TO ALLOW THE

BALANCING CONTRACTOR AND OWNER PERMANENT, EASY-TO-USE

CALIBRATED ACCURACY WHEN SUBJECT TO A MOMENTARY 40%

- d. A MINIMUM OF A NEMA 1 HOUSING SHALL BE PROVIDED FOR THE TRANSMITTER. TRANSMITTERS SHALL BE LOCATED IN ACCESSIBLE LOCAL CONTROL PANELS WHEREVER POSSIBLE. 2. LOW DIFFERENTIAL AIR PRESSURE APPLICATIONS (0" TO 5" W.C.)
- a. The differential pressure transmitter shall be of industrial QUALITY AND TRANSMIT A LINEAR. 4 TO 20 MA OUTPUT IN RESPONSE TO VARIATION OF DIFFERENTIAL PRESSURE OR AIR PRESSURE SENSING POINTS. b. The differential pressure transmitter shall have NON-INTERACTIVE ZERO AND SPAN ADJUSTMENTS THAT ARE
- ADJUSTABLE FROM THE OUTSIDE COVER AND MEET THE FOLLOWING PERFORMANCE SPECIFICATIONS: 1) (0.00 - 1.00" TO 5.00") W.C. INPUT DIFFERENTIAL PRESSURE RANGES. (SELECT RANGE APPROPRIATE FOR SYSTEM APPLICATION.)

2) 4-20 MA OUTPUT.

- 3) MAINTAIN ACCURACY UP TO 20 TO 1 RATIO TURNDOWN. 4) REFERENCE ACCURACY: +0.2% OF FULL SPAN. 5) ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS AND SETRA. E. POWER MONITORING DEVICES 1. CURRENT MEASUREMENT (AMPS)
- a. CURRENT MEASUREMENT SHALL BE BY A COMBINATION CURRENT TRANSFORMER AND A CURRENT TRANSDUCER. THE CURRENT TRANSFORMER SHALL BE SIZED TO REDUCE THE FULL AMPERAGE OF THE MONITORED CIRCUIT TO A MAXIMUM 5 AMP SIGNAL, WHICH WILL BE CONVERTED TO A 4-20 MA DDC COMPATIBLE SIGNAL FOR USE BY THE FACILITY MANAGEMENT SYSTEM. b. CURRENT TRANSFORMER - A SPLIT CORE CURRENT TRANSFORMER SHALL BE PROVIDED TO MONITOR MOTOR AMPS.
- 1) OPERATING FREQUENCY 50 400 HZ. 2) INSULATION - 0.6 KV CLASS 10KV BIL. 3) UL RECOGNIZED. 4) FIVE AMP SECONDARY.
- 5) SELECT CURRENT RATION AS APPROPRIATE FOR APPLICATION. 6) ACCEPTABLE MANUFACTURERS: VERIS INDUSTRIES 7) CURRENT TRANSDUCER - A CURRENT TO VOLTAGE OR CURRENT TO MA TRANSDUCER SHALL BE PROVIDED. THE CURRENT
- TRANSDUCER SHALL INCLUDE: (a)6X INPUT OVER AMP RATING FOR AC INRUSHES OF UP TO 120 AMPS. (b)MANUFACTURED TO UL 1244 (c) ACCURACY: +.5%, RIPPLE +1%.
- (d)MINIMUM LOAD RESISTANCE 30KOHM. (e)INPUT 0-20 AMPS. (f) OUTPUT 4-20 MA. (a) TRANSDUCER SHALL BE POWERED BY A 24VDC REGULATED
- POWER SUPPLY (24 VDC +5%). (h) ACCEPTABLE MANUFACTURERS: VERIS INDUSTRIES F. STATUS AND SAFETY SWITCHES 1. GENERAL REQUIREMENTS
- a. SWITCHES SHALL BE PROVIDED TO MONITOR EQUIPMENT STATUS, SAFETY CONDITIONS. AND GENERATE ALARMS AT THE CCMS WHEN A FAILURE OR ABNORMAL CONDITION OCCURS. SAFETY SWITCHES SHALL BE PROVIDED WITH TWO SETS OF CONTACTS AND SHALL BE INTERLOCK WIRED TO SHUT DOWN RESPECTIVE EQUIPMENT. 2. CURRENT SENSING SWITCHES
- a. THE CURRENT SENSING SWITCH SHALL BE SELF-POWERED WITH SOLID-STATE CIRCUITRY AND A DRY CONTACT OUTPUT. IT SHALL CONSIST OF A CURRENT TRANSFORMER, A SOLID STATE CURRENT SENSING CIRCUIT. ADJUSTABLE TRIP POINT, SOLID STATE SWITCH, SPDT RELAY. AND AN LED INDICATING THE ON OR OFF STATUS. A CONDUCTOR OF THE LOAD SHALL BE PASSED THROUGH THE WINDOW OF THE DEVICE. IT SHALL ACCEPT OVER-CURRENT UP TO TWICE ITS TRIP POINT RANGE.
- b. CURRENT SENSING SWITCHES SHALL BE USED FOR RUN STATUS FOR FANS, PUMPS, AND OTHER MISCELLANEOUS MOTOR LOADS. c. CURRENT SENSING SWITCHES SHALL BE CALIBRATED TO SHOW A POSITIVE RUN STATUS ONLY WHEN THE MOTOR IS OPERATING UNDER LOAD. A MOTOR RUNNING WITH A BROKEN BELT OR COUPLING SHALL INDICATE A NEGATIVE RUN STATUS.
- d. ACCEPTABLE MANUFACTURERS: VERIS INDUSTRIES 3. AIR FILTER STATUS SWITCHES a. DIFFERENTIAL PRESSURE SWITCHES USED TO MONITOR AIR FILTER STATUS SHALL BE OF THE AUTOMATIC RESET TYPE WITH SPDT CONTACTS RATED FOR 2 AMPS AT 120VAC. b. A COMPLETE INSTALLATION KIT SHALL BE PROVIDED, INCLUDING: STATIC PRESSURE TOPS, TUBING, FITTINGS, AND AIR FILTERS.
- FOR INTENDED SERVICE. d. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, CLEVELAND CONTROLS 4. AIR FLOW SWITCHES a. DIFFERENTIAL PRESSURE FLOW SWITCHES SHALL BE BELLOWS

c. PROVIDE APPROPRIATE SCALE RANGE AND DIFFERENTIAL ADJUSTMENT

ACTUATED MERCURY SWITCHES OR SNAP ACTING MICRO-SWITCHES WITH APPROPRIATE SCALE RANGE AND DIFFERENTIAL ADJUSTMENT FOR INTENDED SERVICE. b. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, CLEVELAND CONTROLS

5. AIR PRESSURE SAFETY SWITCHES

- a. AIR PRESSURE SAFETY SWITCHES SHALL BE OF THE MANUAL RESET TYPE WITH SPDT CONTACTS RATED FOR 2 AMPS AT 120VAC. b. PRESSURE RANGE SHALL BE ADJUSTABLE WITH APPROPRIATE SCALE RANGE AND DIFFERENTIAL ADJUSTMENT FOR INTENDED SERVICE. c. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, CLEVELAND CONTROLS
- 6. LOW TEMPERATURE LIMIT SWITCHES a. THE LOW TEMPERATURE LIMIT SWITCH SHALL BE OF THE MANUAL

RESET TYPE WITH DOUBLE POLE/SINGLE THROW SNAP ACTING CONTACTS RATED FOR 16 AMPS AT 120VAC. b. THE SENSING ELEMENT SHALL BE A MINIMUM OF 15 FEET IN LENGTH AND SHALL REACT TO THE COLDEST 18-INCH SECTION. ELEMENT SHALL BE MOUNTED HORIZONTALLY ACROSS DUCT IN ACCORDANCE WITH MANUFACTURERS RECOMMENDED INSTALLATION **PROCEDURES** c. FOR LARGE DUCT AREAS WHERE THE SENSING ELEMENT DOES NOT

d. THE LOW TEMPERATURE LIMIT SWITCH SHALL BE EQUAL TO

a. DAMPER AND VALVE ACTUATORS SHALL BE ELECTRONIC AND/OR

a. ELECTRONIC DAMPER ACTUATORS SHALL BE DIRECT SHAFT MOUNT.

b. MODULATING AND TWO-POSITION ACTUATORS SHALL BE PROVIDED

SECTIONS SHALL BE SIZED BASED ON ACTUATOR MANUFACTURER'S

RECOMMENDATIONS FOR FACE VELOCITY, DIFFERENTIAL PRESSURE

AND DAMPER TYPE. THE ACTUATOR MOUNTING ARRANGEMENT AND

NORMALLY CLOSED POSITIONS OF THE DAMPERS, AS REQUIRED. ALL

ACTUATORS (EXCEPT TERMINAL UNITS) SHALL BE FURNISHED WITH

MECHANICAL SPRING RETURN UNLESS OTHERWISE SPECIFIED IN THE

SEQUENCES OF OPERATIONS. ALL ACTUATORS SHALL HAVE EXTERNAL

ADJUSTABLE STOPS TO LIMIT THE TRAVEL IN EITHER DIRECTION, AND

SUPPLY. CONSUME NO MORE THAN 15 VA, AND BE UL LISTED. THE

. MODULATING ACTUATORS SHALL ACCEPT 24 VAC OR VDC POWER

CONTROL SIGNAL SHALL BE 2-10 VDC OR 4-20 MA, AND THE

ONE DAMPER ACTUATOR FOR EACH SEPARATELY CONTROLLED

CONTROL PANEL FOR TROUBLE-SHOOTING PURPOSES.

DAMPER SHALL BE WIRED BACK TO A TERMINAL STRIP IN THE

d. TWO-POSITION OR OPEN/CLOSED ACTUATORS SHALL ACCEPT 24 OR

120 VAC POWER SUPPLY AND BE UL LISTED. ISOLATION, SMOKE,

SEQUENCE OF OPERATIONS, SHALL BE FURNISHED WITH ADJUSTABLE

END SWITCHES TO INDICATE OPEN/CLOSED POSITION OR BE HARD

AS SPECIFIED IN SEQUENCES OF OPERATIONS AS "QUICK ACTING,"

SHALL MOVE FULL STROKE WITHIN 20 SECONDS. ALL SMOKE

a. ELECTRONIC VALVE ACTUATORS SHALL BE MANUFACTURED BY THE

INCORPORATED IN ITS DESIGN TO PREVENT DAMAGE TO THE

c. MODULATING AND TWO-POSITION ACTUATORS SHALL BE PROVIDED

AS REQUIRED BY THE SEQUENCE OF OPERATIONS. ACTUATORS

SHALL PROVIDE THE MINIMUM TORQUE REQUIRED FOR PROPER

VALVE CLOSE-OFF AGAINST THE SYSTEM PRESSURE FOR THE

REQUIRED APPLICATION. THE VALVE ACTUATOR SHALL BE SIZED

IN THE SEQUENCE OF OPERATIONS. THE SPRING RETURN FEATURE

VAC POWER SUPPLY AND BE UL LISTED. THE CONTROL SIGNAL

SHALL BE 2-10 VDC OR 4-20 MA AND THE ACTUATOR SHALL

FEEDBACK SIGNAL SHALL BE INDEPENDENT OF THE INPUT SIGNAL,

AND MAY BE USED TO PARALLEL OTHER ACTUATORS AND PROVIDE

TRUE POSITION INDICATION. THE FEEDBACK SIGNAL OF EACH VALVE

TERMINAL STRIP IN THE CONTROL PANEL FOR TROUBLE-SHOOTING

AND OTHER VALVES, AS SPECIFIED IN THE SEQUENCE OF

START/STOP THE ASSOCIATED PUMP OR CHILLER.

f. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS

c. DPDT, 3PDT, OR 4PDT RELAYS SHALL BE PROVIDED, AS

d. CONTACTS SHALL BE RATED FOR 10 AMPS AT 120VAC.

e. RELAYS SHALL HAVE AN INTEGRAL INDICATOR LIGHT AND CHECK

1. A SIGNAL ISOLATION TRANSDUCER SHALL BE PROVIDED WHENEVER AN

CONTROL PANEL). OR IS TO RECEIVE AS AN INPUT SIGNAL FROM A

EXTERNAL CONTROL SYSTEM AS AN INPUT (SUCH AS A CHILLER

2. THE SIGNAL ISOLATION TRANSDUCER SHALL PROVIDE GROUND PLANE

3. SIGNALS SHALL PROVIDE OPTICAL ISOLATION BETWEEN SYSTEMS.

4. ACCEPTABLE MANUFACTURERS: ADVANCED CONTROL TECHNOLOGIES

a. AN INTEGRAL HAND/OFF/AUTO SWITCH SHALL OVERRIDE THE

b. A STATUS INPUT TO THE FACILITY MANAGEMENT SYSTEM SHALL

INDICATE WHENEVER THE SWITCH IS NOT IN THE AUTOMATIC

c. A STATUS LED SHALL ILLUMINATE WHENEVER THE OUTPUT IS ON.

d. An override led shall illuminate whenever the hoa switch is

e. CONTACTS SHALL BE RATED FOR A MINIMUM OF 1 AMP AT 24 VAC.

INDEPENDENT" TYPE CONFIGURED WITH ONE INTEGRATED VALVE BODY

THAT INCORPORATES ONE CHAMBER WITH AN ADJUSTABLE CV AND A

SEPARATE PRESSURE REGULATING CHAMBER USED TO MAINTAIN A

2. EACH CONTROL VALVE SHALL BE INDIVIDUALLY FLOW TESTED AT THE

FACTORY AND VERIFIED TO DEVIATE NO MORE THAN ±5% THROUGH

VERIFIES THE FLOW RATE IN 10° ROTATION INCREMENTS UP TO FULL

ANSI/ISA-S75.11-1985, WITH TRACEABILITY TO NIST AND/OR ISO

4. EACH CONTROL VALVE SHALL BE SUBJECTED TO 70 PSID AND TESTED

LEAKAGE OR BETTER IS REQUIRED FOR CONTROL VALVES 2" NOMINAI

SIZE AND LESS. CLASS III LEAKAGE OR BETTER IS REQUIRED FOR

5. IN ALL CONTROL VALVES 8" AND SMALLER, IT SHALL BE POSSIBLE TO

MODIFY THE VALVE FLOW CHARACTERISTICS WITHOUT REMOVING THE

6. BALANCING VALVES AND ASSOCIATED BALANCING SHALL NOT BE

REQUIRED WHERE PRESSURE INDEPENDENT MODULATING CONTROL

. THE CONTROL VALVE ACTUATOR SHALL MODULATE ALL VALVES UP TO

8. THERE SHALL BE THREE PORTS INSTALLED AT THE FACTORY INTEGRAL

8" IN NOMINAL SIZE FROM 0 TO 100% DESIGN FLOW WHILE ROTATING

TO EACH VALVE AND CAPABLE OF BEING USED TO MEASURE PRESSURE

OR TEMPERATURE. THE FIRST PORT SHALL BE INSTALLED AT THE INLET

TO THE VALVE. THE SECOND SHALL BE INSTALLED BETWEEN THE CV

CHAMBER AND THE PRESSURE REGULATING CHAMBER. THE THIRD

9. THE DIFFERENTIAL PRESSURE BETWEEN THE FIRST AND THE THIRD

PORT SHALL BE USED IN COMMISSIONING TO VERIFY THAT THE

SHALL BE INSTALLED AT THE OUTLET OF THE VALVE. SHOULD THE

PORTS NOT BE PROVIDED AS PART OF THE VALVE BODY THAN THEY

SHALL BE INSTALLED IN A SPOOL PIECE AND ATTACHED TO THE BODY.

TO EXCEED ANSI/FCI 70-2-1998 LEAKAGE RATINGS. CLASS IV

RATED FLOW (OPTION WITH 1/2"). ALL TESTING SHALL BE PERFORMED

THE SELECTED OPERATING PRESSURE RANGE. A CALIBRATED

WITH INSTRUMENTS CALIBRATED TO THE REQUIREMENTS OF

3. CONTROL VALVE RANGEABILITY SHALL BE 100:1 MINIMUM.

CONTROL VALVES LARGER THAN 2".

VALVE FROM THE PIPING SYSTEM.

THE VALVE STEM A MAXIMUM OF 90°.

VALVES ARE INSTALLED.

PERFORMANCE TAG SHALL BE PROVIDED WITH EACH VALVE THAT

CONSTANT DIFFERENTIAL PRESSURE ACROSS THE CONTROL SURFACE

I. ALL MODULATING CONTROL VALVES SHALL BE OF THE"PRESSURE

1. EXTERNAL MANUAL OVERRIDE STATIONS SHALL PROVIDE THE FOLLOWING:

f. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, LECTRO

WITH RETAINING SPRINGS OR CLIPS.

APPROPRIATE FOR APPLICATION.

C. ELECTRONIC SIGNAL ISOLATION TRANSDUCERS

b. MOUNTING BASES SHALL BE SNAP-MOUNT.

TO INDICATE OPEN/CLOSED POSITION OR BE HARD WIRED TO

a. CONTROL PILOT RELAYS SHALL BE OF A MODULAR PLUG-IN DESIGN

PROVIDE A CLAMP POSITION FEEDBACK SIGNAL OF 2-10 VDC. THE

OF THE VALVES. AS REQUIRED. ALL DIRECT SHAFT MOUN

TO LIMIT THE TRAVEL IN EITHER DIRECTION.

e. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, MAMAC.

b. EACH ACTUATOR SHALL HAVE CURRENT LIMITING CIRCUITRY

DAMPER ACTUATORS SHALL BE QUICK ACTING.

3. ELECTRONIC VALVE ACTUATORS

VALVE MANUFACTURER.

ACTUATOR.

B. CONTROL RELAYS

1. CONTROL PILOT RELAYS

BUTTON.

REMOTE SYSTEM.

ISOLATION BETWEEN SYSTEMS.

D. EXTERNAL MANUAL OVERRIDE STATIONS

. CONTROL VALVES (CHILLED WATER)

STANDARDS.

CONTROLLED DEVICE PILOT RELAY.

IN EITHER THE HAND OR OFF POSITION.

EXHAUST FAN, AND OTHER DAMPERS, AS SPECIFIED IN THE

ACTUATOR SHALL PROVIDE A CLAMP POSITION FEEDBACK SIGNAL (

2-10 VDC. THE FEEDBACK SIGNAL SHALL BE INDEPENDENT OF THE

INPUT SIGNAL AND MAY BE USED TO PARALLEL OTHER ACTUATORS

AND PROVIDE TRUE POSITION INDICATION. THE FEEDBACK SIGNAL OF

SPRING RETURN FEATURE SHALL PERMIT NORMALLY OPEN OR

A GEAR RELEASE TO ALLOW MANUAL POSITIONING.

AS REQUIRED BY THE SEQUENCE OF OPERATIONS. DAMPER

PNEUMATIC, AS SPECIFIED IN THE SYSTEM DESCRIPTION SECTION.

OF THE AIR STREAM.

1. GENERAL REQUIREMENTS

JOHNSON CONTROLS A70.

2. ELECTRONIC DAMPER ACTUATORS

- THROUGH THE CONTROL VALVE USING THE VALVE STEM POSITION AND THE DIFFERENTIAL PRESSURE MEASUREMENT BETWEEN THE FIRST AND PROVIDE FULL COVERAGE OF THE AIR STREAM, ADDITIONAL SWITCHES FLOW RATE IN OPERATION THROUGH THE VALVE. SHALL BE PROVIDED AS REQUIRED TO PROVIDE FULL PROTECTION
  - SECOND PORT IN THE VALVE. IF THESE VALVE FEATURES ARE NOT AVAILABLE, A FLOW METER SHALL BE INSTALLED TO VERIFY ACTUAL 11. ALL VALVES SHALL BE WARRANTED BY THE MANUFACTURER FOR NO

MINIMUM DIFFERENTIAL PRESSURE (TYPICALLY 5 PSID) REQUIRED FOR

10. THE DIFFERENTIAL PRESSURE BETWEEN THE FIRST AND SECOND PORTS

SHALL BE USED TO VERIFY PROPER VALVE OPERATION AND FLOW

REGULATION. IT SHALL BE POSSIBLE TO VERIFY THE FLOW RATE

LESS THAN 5 YEARS FROM THE DATE OF PURCHASE. F. ELECTRONIC/PNEUMATIC TRANSDUCERS

PRESSURE INDEPENDENT OPERATION IS AVAILABLE.

- 1. ELECTRONIC TO PNEUMATIC TRANSDUCERS SHALL PROVIDE:
- a. OUTPUT: 3-15 PSIG. b. INPUT: 4-20 MA OR 0-10 VDC.
- c. MANUAL OUTPUT ADJUSTMENT. d. PRESSURE GAUGE. e. EXTERNAL REPLACEABLE SUPPLY AIR FILTER f. ACCEPTABLE MANUFACTURERS: JOHNSON CONTROLS, MAMAC
- A. LOCAL CONTROL PANELS ALL CONTROL PANELS SHALL BE FACTORY CONSTRUCTED, INCORPORATING THE CCMS MANUFACTURER'S STANDARD DESIGNS AND LAYOUTS. ALL CONTROL PANELS SHALL BE UL INSPECTED AND LISTED AS AN ASSEMBLY AND CARRY A UL 508 LABEL LISTING COMPLIANCE.
- CONTROL PANELS SHALL BE FULLY ENCLOSED, WITH PERFORATED SUB-PANEL, HINGED DOOR, AND SLOTTED FLUSH LATCH. IN GENERAL, THE CONTROL PANELS SHALL CONSIST OF THE DDC CONTROLLER(S), DISPLAY MODULE AS SPECIFIED AND INDICATED ON THE PLANS, AND I/O DEVICES—SUCH AS RELAYS, TRANSDUCERS, AND
- THE CONTROL PANEL DUE TO FUNCTION. WHERE SPECIFIED THE DISPLAY MODULE SHALL BE FLUSH MOUNTED IN THE PANEL FACE UNLESS OTHERWISE NOTED. . ALL I/O CONNECTIONS ON THE DDC CONTROLLER SHALL BE PROVIDE VIA REMOVABLE OR FIXED SCREW TERMINALS 4. LOW AND LINE VOLTAGE WIRING SHALL BE SEGREGATED. ALL PROVIDED

TERMINAL STRIPS AND WIRING SHALL BE UL LISTED, 300-VOLT

SERVICE AND PROVIDE ADEQUATE CLEARANCE FOR FIELD WIRING.

SO FORTH-THAT ARE NOT REQUIRED TO BE LOCATED EXTERNAL TO

5. ALL WIRING SHALL BE NEATLY INSTALLED IN PLASTIC TRAYS OR TIE-WRAPPED. 6. A CONVENIENCE 120 VAC DUPLEX RECEPTACLE SHALL BE PROVIDED IN EACH ENCLOSURE, FUSED ON/OFF POWER SWITCH, AND REQUIRED TRANSFORMERS

2. INPUT: 120 VAC +10%, 60HZ.

B. ACTUATION / CONTROL TYPE

- WIRED TO START/STOP ASSOCIATED FAN. TWO-POSITION ACTUATORS, B. POWER SUPPLIES 1. DC POWER SUPPLIES SHALL BE SIZED FOR THE CONNECTED DEVICE LOAD. TOTAL RATED LOAD SHALL NOT EXCEED 75% OF THE RATED CAPACITY OF THE POWER SUPPLY.
  - 3. OUTPUT: 24 VDC. 4. LINE REGULATION: +0.05% FOR 10% LINE CHANGE. 5. LOAD REGULATION: +0.05% FOR 50% LOAD CHANGE. 6. RIPPLE AND NOISE: 1 MV RMS, 5 MV PEAK TO PEAK.

AND LOCATED NEXT TO THE POWER SUPPLY.

POWER SUPPLY. PART 3 EXECUTION 4.01 CCMS SPECIFIC REQUIREMENTS BASED ON VALVE MANUFACTURER'S RECOMMENDATIONS FOR FLOW AND PRESSURE DIFFERENTIAL. ALL ACTUATORS SHALL FAIL IN THE A. GRAPHIC DISPLAYS LAST POSITION UNLESS SPECIFIED WITH MECHANICAL SPRING RETURN

8. A POWER DISCONNECT SWITCH SHALL BE PROVIDED NEXT TO THE

PROVIDE A COLOR GRAPHIC SYSTEM FLOW DIAGRAM DISPLAY FOR EACH

SYSTEM WITH ALL POINTS AS INDICATED ON THE POINT LIST. ALL

- SHALL PERMIT NORMALLY OPEN OR NORMALLY CLOSED POSITIONS TERMINAL UNIT GRAPHIC DISPLAYS SHALL BE FROM A STANDARD DESIGN LIBRARY. ROTATIONAL ACTUATORS SHALL HAVE EXTERNAL ADJUSTABLE STOPS 2. USER SHALL ACCESS THE VARIOUS SYSTEM SCHEMATICS VIA A GRAPHICAL PENETRATION SCHEME AND/OR MENU SELECTION. d. MODULATING ACTUATORS SHALL ACCEPT 24 VAC OR VDC AND 120
  - a. CONTROLS SHALL BE PROVIDED BY EQUIPMENT MANUFACTURER AS SPECIFIED HEREIN. b. ALL DAMPER AND VALVE ACTUATION SHALL BE ELECTRIC.
- ACTUATOR (EXCEPT TERMINAL VALVES) SHALL BE WIRED BACK TO A 2. AIR HANDLING EQUIPMENT a. ALL AIR HANDERS SHALL BE CONTROLLED WITH A HVAC-DDC e. TWO-POSITION OR OPEN/CLOSED ACTUATORS SHALL ACCEPT 24 OR b. ALL DAMPER AND VALVE ACTUATION SHALL BE ELECTRIC. 120 VAC POWER SUPPLY AND BE UL LISTED. BUTTERFLY ISOLATION 4.02 INSTALLATION PRACTICES
- OPERATIONS, SHALL BE FURNISHED WITH ADJUSTABLE END SWITCHES A. CCMS WIRING 1. ALL CONDUIT, WIRING, ACCESSORIES AND WIRING CONNECTIONS REQUIRED FOR THE INSTALLATION OF THE BUILDING MANAGEMENT SYSTEM, AS HEREIN SPECIFIED, SHALL BE PROVIDED BY THE CCMS CONTRACTOR UNLESS SPECIFICALLY SHOWN ON THE ELECTRICAL DRAWINGS UNDER DIVISION 26 ELECTRICAL. ALL WIRING SHALL COMPLY WITH THE REQUIREMENTS OF APPLICABLE PORTIONS OF DIVISION 16 AND ALL LOCAL AND NATIONAL ELECTRIC CODES, UNLESS SPECIFIED OTHERWISE IN THIS SECTION.
  - 2. ALL CCMS WIRING MATERIALS AND INSTALLATION METHODS SHALL COMPLY WITH CCMS MANUFACTURER RECOMMENDATIONS. 3. THE SIZING, TYPE AND PROVISION OF CABLE, CONDUIT, CABLE TRAYS AND RACEWAYS SHALL BE THE DESIGN RESPONSIBILITY OF THE CCMS CONTRACTOR. IF COMPLICATIONS ARISE, HOWEVER, DUE TO THE INCORRECT SELECTION OF CABLE, CABLE TRAYS, RACEWAYS AND/OR CONDUIT BY THE CCMS CONTRACTOR, THE CONTRACTOR SHALL BE
- RESPONSIBLE FOR ALL COSTS INCURRED IN REPLACING THE SELECTED COMPONENTS 4. CLASS 2 WIRING a. ALL CLASS 2 (24VAC OR LESS) WIRING SHALL BE INSTALLED IN ANALOG OUTPUT SIGNAL FROM THE CCMS IS TO BE CONNECTED TO AN CONDUIT UNLESS OTHERWISE SPECIFIED. b. CONDUIT IS NOT REQUIRED FOR CLASS 2 WIRING IN CONCEALED
  - ACCESSIBLE LOCATIONS. CLASS 2 WIRING NOT INSTALLED IN CONDUIT SHALL BE SUPPORTED EVERY 5' FROM THE BUILDING STRUCTURE UTILIZING METAL HANGERS DESIGNED FOR THIS APPLICATION. WIRING SHALL BE INSTALLED PARALLEL TO THE BUILDING STRUCTURAL LINES. ALL WIRING SHALL BE INSTALLED IN
  - ACCORDANCE WITH LOCAL CODE REQUIREMENTS 5. CLASS 2 SIGNAL WIRING AND 24VAC POWER CAN BE RUN IN THE SAME CONDUIT. POWER WIRING 120VAC AND GREATER CANNOT SHARE THE SAME CONDUIT WITH CLASS 2 SIGNAL WIRING. 6. PROVIDE FOR COMPLETE GROUNDING OF ALL APPLICABLE SIGNAL AND COMMUNICATIONS CABLES, PANELS AND EQUIPMENT SO AS TO ENSURE
  - SYSTEM INTEGRITY OF OPERATION. GROUND CABLING AND CONDUIT AT THE PANEL TERMINATIONS. AVOID GROUNDING LOOPS. ALL WIRING SHALL BE INSTALLED IN CONDUIT OR RACEWAY EXCEPT AS NOTED ELSEWHERE IN THIS SPECIFICATION. MINIMUM CONTROL WIRING
  - CONDUIT SIZE 1/2' 2. WHERE IT IS NOT POSSIBLE TO CONCEAL RACEWAYS IN FINISHED LOCATIONS, SURFACE RACEWAY (WIREMOLD) MAY BE USED AS APPROVED BY THE ARCHITECT. 3. ALL CONDUITS AND RACEWAYS SHALL BE INSTALLED LEVEL, PLUMB, AT RIGHT ANGLES TO THE BUILDING LINES AND SHALL FOLLOW THE
  - CONTOURS OF THE SURFACE TO WHICH THEY ARE ATTACHED. FLEXIBLE METAL CONDUIT SHALL BE USED FOR VIBRATION ISOLATION AND SHALL BE LIMITED TO 3 FEET IN LENGTH WHEN TERMINATING TO VIBRATING EQUIPMENT. FLEXIBLE METAL CONDUIT MAY BE USED WITHIN PARTITION WALLS. FLEXIBLE METAL CONDUIT SHALL BE UL LISTED.
  - PROVIDE FIRE STOPPING FOR ALL PENETRATIONS USED BY DEDICATED CCMS CONDUITS AND RACEWAYS. 2. ALL OPENINGS IN FIRE PROOFED OR FIRE STOPPED COMPONENTS SHALL BE CLOSED BY USING APPROVED FIRE RESISTIVE SEALANT 3. ALL WIRING PASSING THROUGH PENETRATIONS, INCLUDING WALLS SHALL BE IN CONDUIT OR ENCLOSED RACEWAY.

4. PENETRATIONS OF FLOOR SLABS SHALL BE BY CORE DRILLING. ALL

EASY IDENTIFICATION AND TROUBLESHOOTING.

- PENETRATIONS SHALL BE PLUMB, TRUE, AND SQUARE. D. CCMS IDENTIFICATION STANDARDS 1. NODE IDENTIFICATION. ALL NODES SHALL BE IDENTIFIED BY A PERMANENT LABEL FASTENED TO THE ENCLOSURE. LABELS SHALL BE SUITABLE FOR THE NODE LOCATION. a. CABLE TYPES SPECIFIED IN ITEM A SHALL BE COLOR CODED FOR
- E. CCMS PANEL INSTALLATION 1. THE CCMS PANELS AND CABINETS SHALL BE LOCATED AS INDICATED AT AN ELEVATION OF NOT LESS THAN 2 FEET FROM THE BOTTOM EDGE OF THE PANEL TO THE FINISHED FLOOR. EACH CABINET SHALL BE ANCHORED PER THE MANUFACTURER'S RECOMMENDATIONS. 2. THE CCMS CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING
- MECHANICAL CONTRACTORS. 1. ALL INPUT DEVICES SHALL BE INSTALLED PER THE MANUFACTURER RECOMMENDATION

2. LOCATE COMPONENTS OF THE CCMS IN ACCESSIBLE LOCAL CONTROL

PANELS WHEREVER POSSIBLE.

G. HVAC INPUT DEVICES — GENERAL

PANEL LOCATIONS WITH OTHER TRADES AND ELECTRICAL AND

- 1. ALL INPUT DEVICES SHALL BE INSTALLED PER THE MANUFACTURER RECOMMENDATION 2. LOCATE COMPONENTS OF THE CCMS IN ACCESSIBLE LOCAL CONTROL PANELS WHEREVER POSSIBLE.
- 3. THE MECHANICAL CONTRACTOR SHALL INSTALL ALL IN—LINE DEVICES
- SUCH AS TEMPERATURE WELLS, PRESSURE TAPS, AIRFLOW STATIONS, 4. INPUT FLOW MEASURING DEVICES SHALL BE INSTALLED IN STRICT
- COMPLIANCE WITH ASME GUIDELINES AFFECTING NON-STANDARD APPROACH CONDITIONS. 5. OUTSIDE AIR SENSORS a. SENSORS SHALL BE MOUNTED ON THE NORTH WALL TO MINIMIZE
- SOLAR RADIANT HEAT IMPACT OR LOCATED IN A CONTINUOUS INTAKE FLOW ADEQUATE TO MONITOR OUTSIDE AIR CONDITIONS ACCURATELY. b. SENSORS SHALL BE INSTALLED WITH A RAIN PROOF, PERFORATED
- 6. DUCT TEMPERATURE SENSORS: a. DUCT MOUNT SENSORS SHALL MOUNT IN AN ELECTRICAL BOX THROUGH A HOLE IN THE DUCT AND BE POSITIONED SO AS TO BE EASILY ACCESSIBLE FOR REPAIR OR REPLACEMENT.

b. THE SENSORS SHALL BE INSERTION TYPE AND CONSTRUCTED AS A

c. FOR DUCTWORK GREATER IN ANY DIMENSION THAN 48 INCHES OR

COMPLETE ASSEMBLY INCLUDING LOCK NUT AND MOUNTING PLATE.

- WHERE AIR TEMPERATURE STRATIFICATION EXISTS SUCH AS A MIXED AIR PLENUM, UTILIZE AN AVERAGING SENSOR. d. THE SENSOR SHALL BE MOUNTED TO SUITABLE SUPPORTS USING
- FACTORY APPROVED ELEMENT HOLDERS. . SPACE SENSORS: a. SHALL BE MOUNTED PER ADA REQUIREMENTS.

b. PROVIDE LOCKABLE TAMPER-PROOF COVERS IN PUBLIC AREAS

- AND/OR WHERE INDICATED ON THE PLANS. 8. LOW TEMPERATURE LIMIT SWITCHES: a. INSTALL ON THE DISCHARGE SIDE OF THE FIRST WATER OR STEAM COIL IN THE AIR STREAM.
- MOUNT ELEMENT HORIZONTALLY ACROSS DUCT IN A SERPENTINE PATTERN INSURING EACH SQUARE FOOT OF COIL IS PROTECTED BY 1 FOOT OF SENSOR. c. FOR LARGE DUCT AREAS WHERE THE SENSING ELEMENT DOES NOT

PROVIDE FULL COVERAGE OF THE AIR STREAM, PROVIDE ADDITIONAL

SWITCHES AS REQUIRED TO PROVIDE FULL PROTECTION OF THE AIR

CLOSING AGAINST THE MAXIMUM SYSTEM SHUT-OFF PRESSURE. THE

ACTUATOR SHALL MODULATE IN A SMOOTH FASHION THROUGH THE

9. AIR DIFFERENTIAL PRESSURE STATUS SWITCHES: a. INSTALL WITH STATIC PRESSURE TIPS, TUBING, FITTINGS, AND AIR

H. HVAC OUTPUT DEVICES

- 1. ALL OUTPUT DEVICES SHALL BE INSTALLED PER THE MANUFACTURERS RECOMMENDATION. THE MECHANICAL CONTRACTOR SHALL INSTALL ALL IN-LINE DEVICES SUCH AS CONTROL VALVES, DAMPERS, AIRFLOW STATIONS, PRESSURE WELLS, ETC. 2. ACTUATORS: ALL CONTROL ACTUATORS SHALL BE SIZED CAPABLE OF
- ENTIRE STROKE. WHEN ANY PNEUMATIC ACTUATOR IS SEQUENCED WITH ANOTHER DEVICE, PILOT POSITIONERS SHALL BE INSTALLED TO ALLOW FOR PROPER SEQUENCING. 3. CONTROL DAMPERS: SHALL BE OPPOSED BLADE FOR MODULATING 7. AN APPROPRIATELY SIZED FUSE AND FUSE BLOCK SHALL BE PROVIDED
  - INSTALLED FOR TWO POSITION APPLICATIONS. 4. CONTROL VALVES: SHALL BE SIZED FOR PROPER FLOW CONTROL WITH EQUAL PERCENTAGE VALVE PLUGS. THE MAXIMUM PRESSURE DROP FOR WATER APPLICATIONS SHALL BE 5 PSI. THE MAXIMUM PRESSURE DROP FOR STEAM APPLICATIONS SHALL BE 7 PSI. 5. ELECTRONIC SIGNAL ISOLATION TRANSDUCERS: WHENEVER AN ANALOG OUTPUT SIGNAL FROM THE BUILDING MANAGEMENT SYSTEM IS TO BE CONNECTED TO AN EXTERNAL CONTROL SYSTEM AS AN INPUT (SUCH

CONTROL OF AIRFLOW. PARALLEL BLADE DAMPERS SHALL BE

TRANSDUCER. SIGNAL ISOLATION TRANSDUCER SHALL PROVIDE GROUND PLANE ISOLATION BETWEEN SYSTEMS. SIGNALS SHALL PROVIDE OPTICAL ISOLATION BETWEEN SYSTEMS

SIGNAL FROM A REMOTE SYSTEM, PROVIDE A SIGNAL ISOLATION

AS A CHILLER CONTROL PANEL), OR IS TO RECEIVE AS AN INPUT A

A. THE CCMS CONTRACTOR SHALL PROVIDE THE FOLLOWING TRAINING 1. ONE DAY OF ON-SITE ORIENTATION BY A SYSTEM TECHNICIAN WHO IS FULLY KNOWLEDGEABLE OF THE SPECIFIC INSTALLATION DETAILS OF THE PROJECT. THIS ORIENTATION SHALL, AT A MINIMUM, CONSIST OF A REVIEW OF THE PROJECT AS-BUILT DRAWINGS, THE CCMS SOFTWARE LAYOUT AND NAMING CONVENTIONS, AND A WALK THROUGH OF THE

END OF SECTION

FACILITY TO IDENTIFY PANEL AND DEVICE LOCATIONS.

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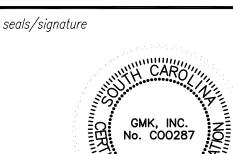
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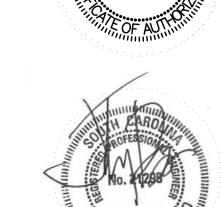


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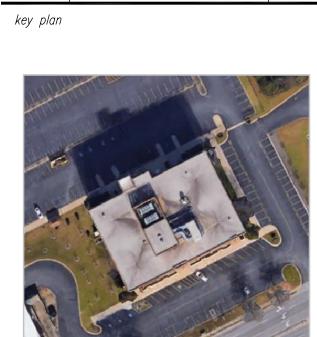
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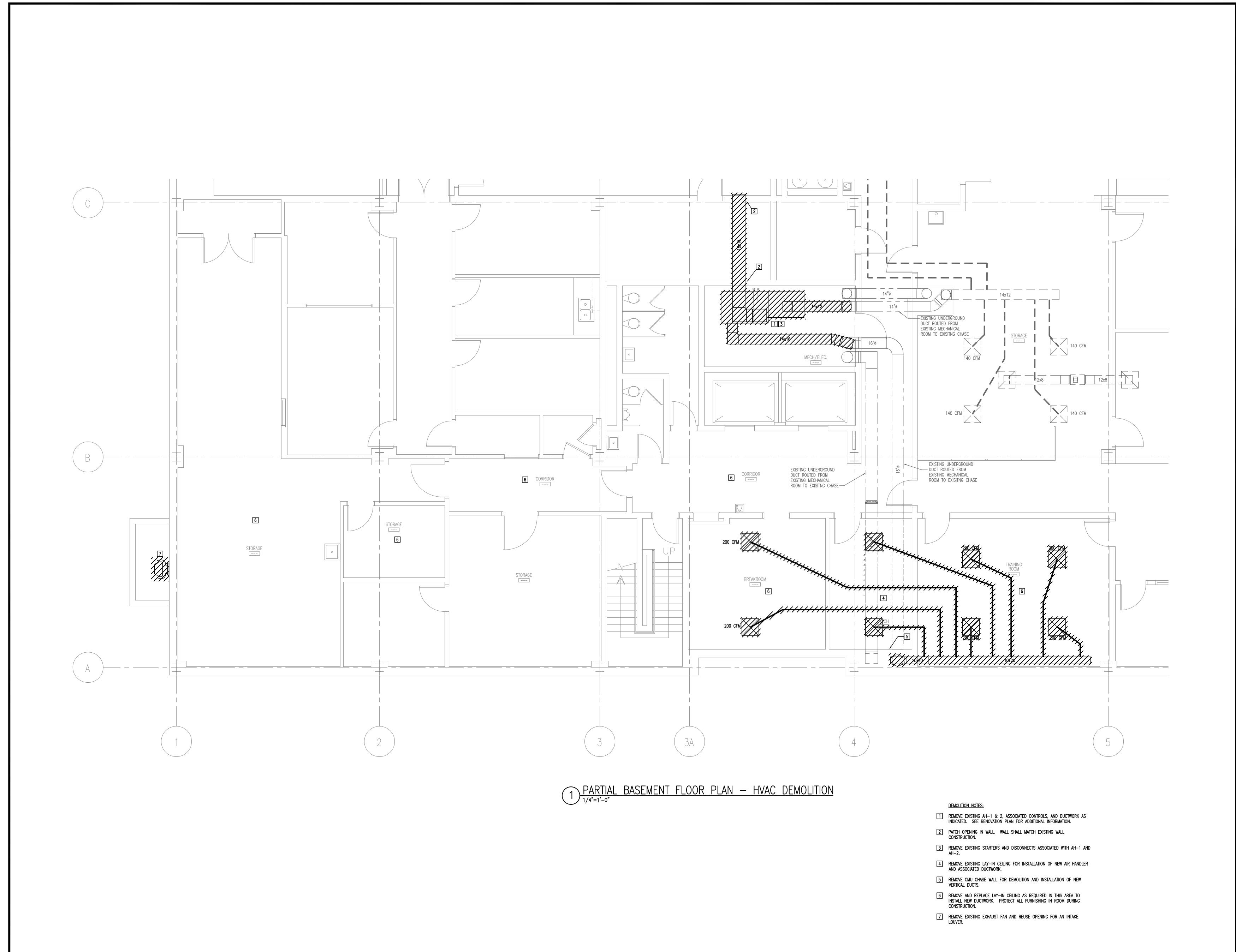
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**HVAC SPECIFICATIONS** 

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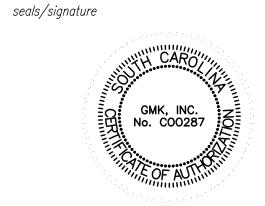
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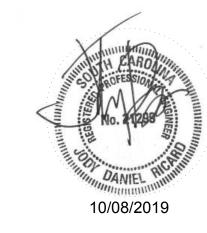
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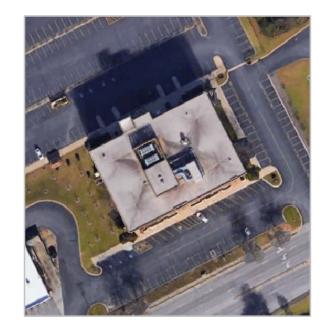




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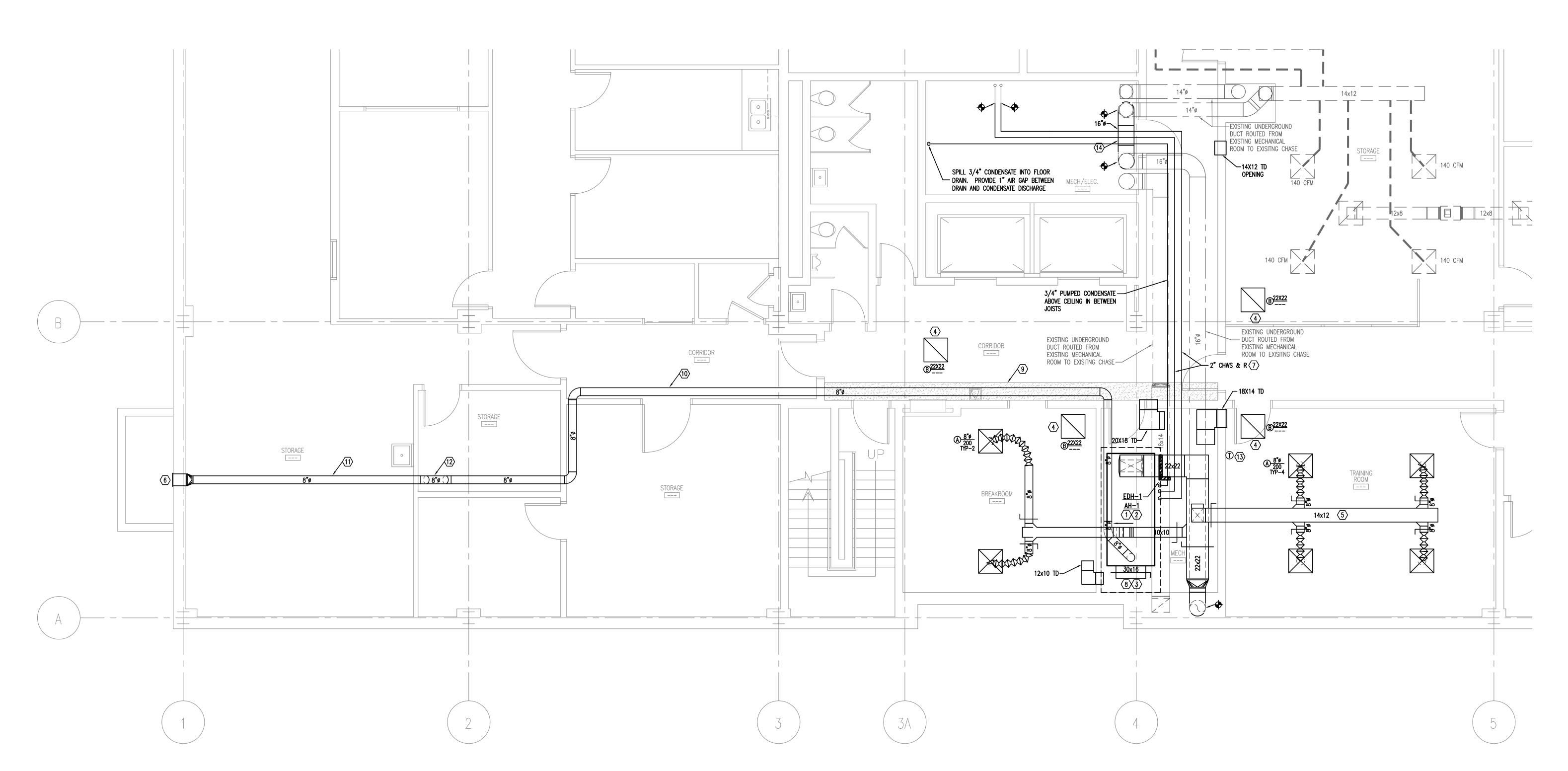
key plan



PARTIAL BASEMENT FLOOR PLAN **HVAC DEMOLITION** 

sheet number

drawn by JDR checked by JWB



1 PARTIAL BASEMENT FLOOR PLAN - HVAC RENOVATION

- 1) PROVIDE DEEP SEAL P-TRAP FULL SIZE OF UNIT CONNECTION AND SPILL CONDENSATE INTO CONDENSATE PUMP. PUMP CONDENDATE ABOVE CEILING INTO EXISTING MECHANICAL ROOM AND SPILL INTO FLOOR DRAIN. CONDENSATE PIPING SHALL SLOPE A MINIMUM 1/8" PER FT.
- 2 PROVIDE NEW 6" HOUSEKEEPING PAD FOR NEW AC-1. HOUSEKEEPING PAD SHALL BE A MINIMUM OF 6" LARGER IN ALL DIMENSIONS OF NEW UNIT.
- CONNECT RETURN DUCT TO UNIT. PROVIDE DUCT DETECTOR IN RETURN DUCT AND CONNECT TO EXISTING FIRE ALARM SYSTEM. SEE ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION.
- (4) INSTALL NEW RETURN GRILLE IN EXISITNG LAY—IN CEILING. COORIDATE GRILLE LOCATION WITH EXISTING LIGHTING AND CEILING MOUNTED DEVICES.
- 5 ROUTE RIGID AND FLEXIBLE DUCT BETWEEN STRUCTURAL BAR JOIST.
- PROVIDE NEW INTAKE LOUVER IN EXISTING OPENING. INSTALL NEW INTAKE LOUVER IN EXISTING OPENING. FIELD VERIFY OPENING PRIOR TO ORDERING INTAKE LOUVER. LOUVER SHALL BE GREENHECK ESD-403 OR APPROVED EQUAL. TRANSITION OUTSIDE AIR DUCT TO LOUVER SIZE.
- 7 ROUTE CHILLED WATER PIPING IN BETWEEN STRUCTURAL JOIST TO NEW MECHANICAL ROOM.
- PROVIDE WIRE GRILLE OVER DUCT OPENING. SEE WIRE GRILLE DETAIL FOR ADDITIONAL INFORMATION.
- 9 ROUTE OUTSIDE AIR DUCT IN NEW SOFFIT. SEE SOFFIT DETAIL FOR ADDITIONAL INFORMATION.
- ROUTE OUTSIDE AIR DUCT BELOW CEILING. CONTRACTOR SHALL INSTALL DUCT TIGHT TO EXISTING CEILING.
- (11) ROUTE OUTSIDE AIR DUCT BETWEEN STRUCTURAL JOIST.
- OFFSET OUTSIDE AIR DUCT BELOW STRUCTURAL BEAM AND ROUTE BELOW EXISTING CEILING.
- (13) INSTALL NEW TEMPERATURE SENSOR AT LOCATION SHOWN. NEW SENSOR SHALL CONTROL OPERATION OF NEW AH-1.
- CONNECT EXISTING UNDERGROUND DUCTS WITH NEW DUCT LOCATED IN EXISTING MECH/ELEC. ROOM.

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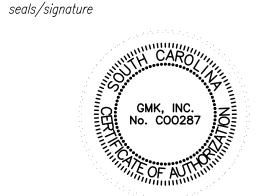
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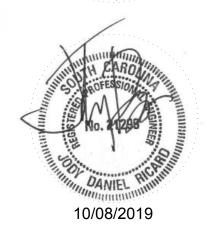


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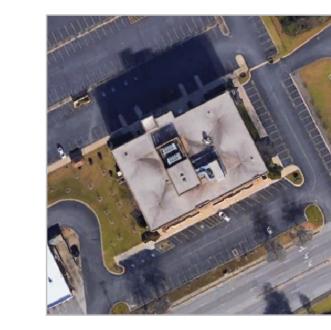




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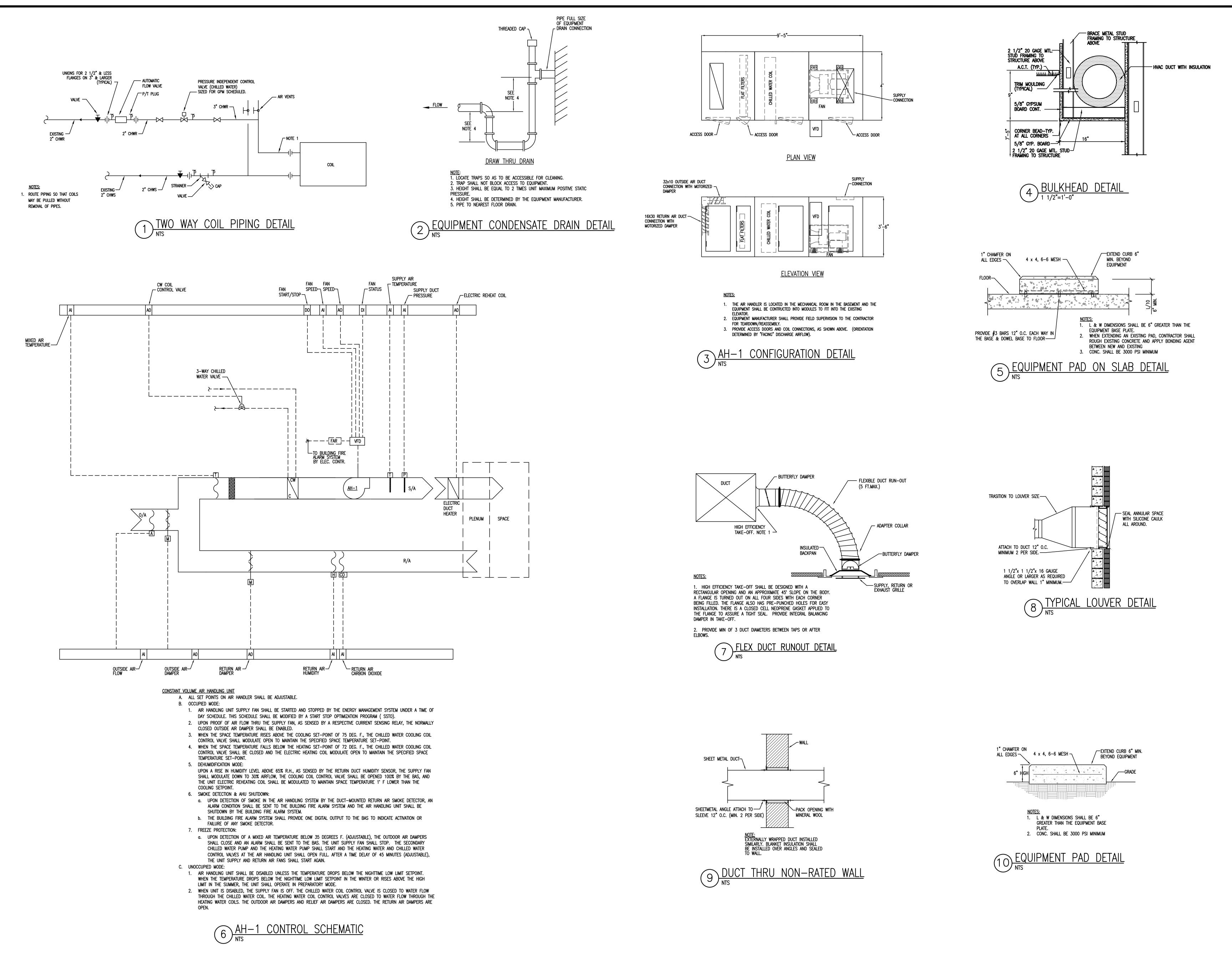
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PARTIAL BASEMENT FLOOR PLAN -**HVAC RENOVATION** 

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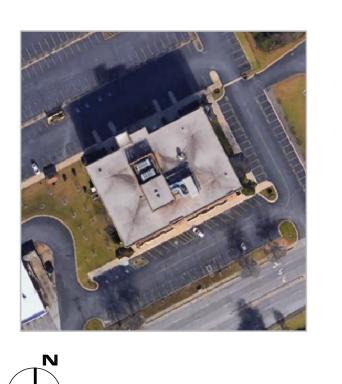


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HVAC DETAILS

sheet number

M6.1

drawn by JDR checked by JDR

	AIR DISTRIBUTION SCHEDULE								
TAG	DESCRIPTION	NECK	MODULE SIZE	MOUNT	CONSTR.	MFGR	MODEL	NOTES	
Α	SQUARE PLAQUE CEILING SUPPLY	AS SHOWN	24x24	LAY-IN	ALUMINUM	PRICE	SERIES ASPD	1,2,3	
В	PERFORATED CEILING RETURN/EXHAUST	AS SHOWN	24x24	LAY-IN	ALUMINUM	PRICE	SERIES APDDR	3	

1. FURNISH WITH OPPOSED BLADE DAMPER 4. PROVIDE RADIATION DAMPER AT FIRE RATED CEILING 2. 4-WAY DEFLECTION UNLESS NOTED OTHERWISE 5. PROVIDE WITH PLENUM

3. BAKED	BAKED ENAMEL OFF—WHITE FINISH									
		ASPD-31	(NC 25)	R/A I	BOOTS	APDDR-3	1 (NC 25)	RCG-C-L (NC		
FLEX	CFM	NECK	CFM	NECK	CFM	NECK	CFM	SIZE	CFM	
6	0-120	6	210	6X6	0-90	6X6	250	6X6, 8X4, 7X5	170	
8	120-225	8	330	8X8	90-165	8X8	450	8X6, 12X4, 10X5	235	
10	225-400	10	475	10X10	165-260	10X10	700	10X6, 16X4, 12X5	290	
12	400-700	12	630	12X12	260-380	12X12	1000	12X6, 8X8, 18X4	325	
14	700-900	14	800	14X14	380-520	14X14	1400	16X6, 24X4, 18X5	<b>4</b> 15	
16	900-1300	15	890	18X18	520-850	18X18	1600	18X6, 12X8, 10X10	465	
MAX 5	5' RUNS			*300-4	00 FPM	22X22	2000	30X4, 20X6, 14X8	535	

#### MECHANICAL DEMOLITION NOTES

- DRAWINGS SHOW GENERAL INTENT OF DEMOLITION. QUANTITIES, LOCATIONS, SIZES AND EQUIPMENT ARE SHOWN TO INDICATE TYPE OF SYSTEM INSTALLED AND DOES NOT NECESSARILY REPRESENT EXACT CONDITIONS. CONTRACTOR SHALL FIELD VERIFY BEFORE BIDDING.
  - 2. DEMOLITION OF EQUIPMENT, SYSTEMS, AND COMPONENTS SHALL INCLUDE ALL SUPPORTS, PADS, HANGERS, INSULATION, CONTROLS, STARTERS, ACCESSORIES, AND APPURTENANCES NOT REQUIRED FOR THE INSTALLATION OF THE NEW SYSTEM.
- WHEN PARTIAL DEMOLITION OF A SYSTEM IS INDICATED, THE PART OF THE SYSTEM SHOWN TO REMOVED SHALL BE REMOVED TO THE ACTIVE MAIN OR BRANCH IF NOT REQUIRED FOR THE INSTALLATION OF THE NEW SYSTEM. THE ACTIVE MAIN OR BRANCH SHALL BE REPAIRED TO MATCH NEW INSTALLATION AS MUCH AS PRACTICAL. IF SYSTEM IS INSULATED, INSULATION SHALL BE PATCHED AND FINISHED REPAIR (IE: VAPOR BARRIER, COATING, ETC.)
- PATCHING OF BUILDING STRUCTURES AND FINISHES SHALL PERTAIN TO ALL WALLS, FLOORS, SLABS, ROOFS, STRUCTURES, AND FINISHES. PATCHES SHALL MATCH EXISTING STRUCTURE, FIRE RATING AND FINISH.
- 5, ALL OPENINGS CREATED BY THE ABANDONMENT OR REMOVAL OF EXISTING SYSTEMS SHALL BE PATCHED.
- 6. ALL WALLS, ROOFS, SLABS, STRUCTURES, AND FINISHES WHOSE FINISH IS IRREGULAR DUE TO THE REMOVAL OF SYSTEMS, SUPPORTS, PADS, ACCESSORIES, AND APPURTENANCES SHALL BE PATCHED.
- ALL FINISHES SHALL MATCH EXISTING FINISH. WHEN FINISH OBVIOUSLY DOES NOT MATCH EXISTING FINISH SUCH AS SHADE OF PAINT, AGE OF FINISH, ETC., THE FINISH SHALL BE APPLIED TO THE PATCH AND THE SURFACE IN ALL DIRECTIONS UNTIL A SURFACE CHANGE OF A MINIMUM OF 45 DEGREES.
- 8. REMOVAL OF SYSTEMS SHALL INCLUDE COMPLETE SYSTEM WHENEVER PRACTICAL. IF NOT, SYSTEM (IE: PIPE, CONDUIT, ETC.) SHALL BE REMOVED TO 1 INCH BELOW SURFACE.

#### MECHANICAL GENERAL NOTES

1. DO NOT SCALE DRAWINGS; SEE ARCHITECTURAL DRAWINGS AND REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF DOORS, WINDOWS, CEILING, DIFFUSERS, ETC.

2. ALL DUCTWORK INSULATION SHALL BE RUN CONTINUOUSLY THROUGH FLOORS, ROOFS AND PARTITIONS EXCEPT WHERE PROHIBITED BY FIRE CODES. 3. LOCATE ALL THERMOSTATS 4'-0" ABOVE FINISH FLOOR; ALIGN WITH LIGHT

4. ALL DUCTWORK LOCATIONS SHALL BE COORDINATED WITH THE WORK UNDER OTHER DIVISIONS OF THE SPECIFICATIONS TO AVOID INTERFERENCE. 5. CORRECT SETTINGS ON ALL BALANCING FITTINGS SHALL BE PERMANENTLY

6. AIR DISTRIBUTION SYSTEMS WITH MORE THAN ONE BRANCH, OR MULTIPLE OUTLETS ON A BRANCH, SHALL HAVE VOLUME DAMPERS TO BALANCE AIR FLOWS. SPIN-IN FITTINGS ARE PERMITTED FOR CONNECTING FLEX DUCT TO BRANCH OR TRUNK DUCTS WHERE FLEX DUCTS ARE INDICATED. IF FLEX DUCT CANNOT BE CONNECTED WITH A SPIN-IN, A HARD DUCTED TAKEOFF MUST BE

7. HIGH EFFICIENCY TAKEOFFS SHALL BE USED ON ALL HARD DUCTED SUPPLY BRANCHES. 8. PROVIDE ALL TRANSITIONS REQUIRED FOR INSTALLATION OF DUCT, EXHAUST

9. ALL DUCT IS GALVANIZED SHEET METAL EXCEPT AS NOTED. 10. DUCT SIZES ARE CLEAR INSIDE DIMENSIONS.

FANS, AND ALL OTHER EQUIPMENT AND APPURTENANCES.

11. AIR DISTRIBUTION UNITS SHALL HAVE TRIM REQUIRED FOR FINISHED

ABBREVIATIONS								
Air Conditioning Above Above Finished Floor Brake Horsepower Cubic Feet Per Minute Duct Smoke Detector Dry Bulb Temperature Entering Air Temperature Electric or Electrical Entering Air Wet Bulb Exhaust Fire Damper	N/A NIC NTS OBD OD PD RAT REH SAT SP SPEC	Not Applicable Not in Contract Not To Scale Opposed Blade Damper Outside Diameter Pressure Drop Return Air Return Relative Humidity Supply Air Sheet Static Pressure Specifications						

Return
Return
Relative Humidity
Supply Air
Sheet
Static Pressure
Specifications
Supply
Thermostat
Temperature
Thermostat
Typical
Wet Bulb Temperature

	HVAC	LEGEND	
<b>@</b>		DUCT SMOKE D	ETECTO
		CHANGE IN DUCT E (DUCT RISE UNLESS S	LEVATIO SPECIFIE
		DUCT TURNIN	IG DOWN

DUCT TURNING UP

DUCT HEATER SCHEDULE										
		CAPACITY		ELECTRICAL (VOLTS/PHASE)	MANUFACTURER					
TAG NO.	CFM	HEATING (MBH)	KW		(BASIS OF DESIGN)	MODEL NO.	NOTES			
EDH-1	1750	61.4 18.0		460/3	MARKEL	HF	1,2,3,4			
1. INTEGRAL FUSED DISCONNECT 3. CONTACTOR 2. INSERT OPEN COIL TYPE 4. SCR CONTROL										

Horsepower

Leaving Air Temperature Leaving Air Wet Bulb

	COIL SCHEDULE																
TAG LOCATION		CAPACITY	MAX. AIR VELOCITY	AIR PRESS , DROP			1011	ENTE	AIR TEMF RING		/ING	WATER  ENTERING LEAVING CDM PRESS DROP			PRESS DROP	MAXIMUM NO. OF	NOTES
		CFM	VELOCITY (FPM)	(IN. WG.)	MBH	SENS. MBH	KW	DB °F	WB °F	DB °F	WB °F	TEMP. 'F	TEMP. 'F	GPM	PRESS DROP (FT. WATER)	NO. OF FINS/IN.	
CC-1	AH-1	3500	500	0.54	145.6	98.0		81.5	68.0	55.4	54.3	44	55	29.0	5.0	12	
																<u> </u>	

	AIR HANDLER UNIT SCHEDULE														
TAG	CAPACITY CFM	MINIMUM O.A.	FAN CFM	FAN TYPE	SUPPLY FAN SP (IN. W.G.) MOTOR TOTAL EXT RPM HP			ELECTRICAL AIR VOLTS/PHASE VOLUME CONTROL		COOLING COIL EQ. NO. PREFILTERS TYPE	PREFILTERS TYPE	ACCESSORIES	MANUFACTURER	REMARKS	
AH-1	3500	200	3500	PLENUM	3.33	1.0	1800	5.0	460/3	VFD	CC-1	MERV 8	 	JCI SOLUTION XTI	1,2,3,4
	1. SINGLE POINT CONNECTION 3. FUSED DISCONNECT 2. FACTORY MOUNTED VFD 4. CONDENSATE PUMP														

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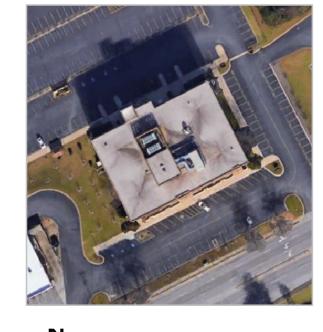




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number	item	date



HVAC LEGENDS, NOTES,
ABBREVIATIONS, AND SCHEDULES

sheet number

drawn by JDR checked by JDR

#### **GENERAL NOTES:**

- 1. DO NOT SCALE DRAWINGS. LOCATE OUTLETS, EQUIPMENT AND OTHER ELECTRICAL DEVICES AS INDICATED AND COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE EXACT LIGHTING FIXTURE LOCATIONS WITH ARCHITECTURAL REFLECTED CEILING PLAN.
- MINIMUM SIZE CONDUCTOR FOR POWER SHALL BE #12 AWG. PROVIDE DEDICATED NEUTRAL FOR EACH MULTI-WIRE BRANCH CIRCUIT IN COMPLIANCE WITH NEC.
- 3. ALL FUSES SHALL BE DUAL-ELEMENT TYPE, "FUSETRON" BY BUSSMAN, "ECON" BY ECONOMY, OR FERRAZ
- 4. BRANCH CIRCUITS TO BE 2#12, 12GND, 3/4"C MINIMUM. 20A 120V CIRCUITS LONGER THAN 75' TO BE 2#10, #10GND, 3/4"C MINIMUM FOR VOLTAGE DROP. 20A, 120V CIRCUITS LONGER THAN 150' TO BE 2#8, #8GND, 3/4"C MINIMUM FOR VOLTAGE DROP. UNLESS OTHERWISE NOTED IN PANELBOARD SCHEDULES OR ON DRAWINGS.
- 5. ALL BRANCH CIRCUIT LOADS SHALL BE BALANCED ACROSS PANELBOARD BUSSES TO OBTAIN MINIMUM NEUTRAL
- 6. ALL FLEXIBLE CONDUIT SHALL CONTAIN A GREEN WIRE BONDED TO RIGID RACEWAY, BOX OR FIXTURE AT EACH END OF FLEX. SIZE GROUND PER NEC TABLE 250-122.
- 7. COORDINATE WITH OTHER TRADES TO CONCEAL ELECTRICAL WORK AND PROVIDE OUTLETS IN CORRECT LOCATIONS. 8. OBTAIN ROUGH—IN DIAGRAMS FOR ALL EQUIPMENT AND INSTALL ELECTRICAL WORK ACCORDING TO DIAGRAMS.
- MOUNT LIGHTING FIXTURES AT HEIGHTS SHOWN OR SCHEDULED ON DRAWINGS OR AS DIRECTED ON JOB BY ENGINEER UNLESS NOTED OTHERWISE.
- 10. SEAL ALL PENETRATIONS TO RATED WALLS, CEILINGS AND FLOORS WITH UL LISTED FIREPROOFING SYSTEM. THIS IS TO INCLUDE BUT IS IN NO WAY LIMITED TO CONDUCTOR, RACEWAY AND DEVICE PENETRATIONS. SUBMIT SYSTEM AND INSTALLATION DETAILS AS PART OF SHOP DRAWING SUBMITTAL.
- 11. WHERE NOT INDICATED OTHERWISE, EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED PER NEC TABLE
- 12. ALL METAL CONDUITS 1" AND LARGER SHALL HAVE A GROUNDING BUSHING BONDING CONDUIT TO ENCLOSURE.
- 13. REMOVE DRYWALL DUST AND MUD FROM THE INTERIOR OF BOXES BEFORE INSTALLING DEVICES.
- 14. AT SUBSTANTIAL COMPLETION CLEAN ALL LIGHT FIXTURES AND CLEAN ALL DEVICES IN THE CONSTRUCTION AREAS. REPLACE DAMAGED DEVICES AND DEVICE PLATES AS NEEDED.
- 15. VERIFY ALL MECHANICAL EQUIPMENT LOCATIONS AND ELECTRICAL REQUIREMENTS WITH MECHANICAL PLANS. IF MECHANICAL EQUIPMENT BEING PROVIDED DOES NOT MATCH DESIGN NOTIFY ENGINEER IMMEDIATELY.
- 16. CONCEAL ALL CONDUIT AND RACEWAY. IF CONDITIONS REQUIRE CONDUIT OR RACEWAY TO BE RUN EXPOSED COORDINATE ROUTING WITH ENGINEER AND PAINT AS REQUIRED BY ENGINEER.
- 17. ELECTRICAL WORK SHALL COMPLY WITH ALL NATIONAL, STATE AND LOCAL CODES, REQUIREMENTS AND ORDINANCES.
- 18. ALL BACKBOXES SHALL BE MINIMUM 4" SQUARE.
- 19. ALL EMT FITTINGS SHALL BE STEEL COMPRESSION TYPE WITH INSULATED THROAT.

INDICATED ON PANEL SCHEDULE.

- 20. PROVIDE PLASTIC ENGRAVED NAMEPLATES ON ALL ELECTRICAL DISTRIBUTION EQUIPMENT INCLUDING DISCONNECT SWITCHES AND VARIABLE FREQUENCY DRIVES. DISCONNECT SWITCHES VARIABLE FREQUENCY DRIVES SHALL INDICATE NAME OF EQUIPMENT BEING FED AND SOURCE CIRCUIT. ALL NAMEPLATES ON NORMAL POWER EQUIPMENT SHALL BE BLACK WITH WHITE LETTERING.
- 21. PROVIDE TYPEWRITTEN LABELS INDICATING SOURCE PANEL NAME AND CIRCUIT NUMBER FOR ALL 120V AND GREATER DEVICES INCLUDING ALL LIGHT SWITCHES AND RECEPTACLES. LABELS SHALL BE THERMAL TRANSFER TYPE, 3/8" WITH 1/4" LETTERING. WHITE BACKGROUND FOR BLACK DEVICES, CLEAR BACKGROUND OTHERWISE.

	ELECTRICAL SYMBOL SCHEDULE - GENERAL
GENERAL	
PP1-2,4	BRANCH CIRCUIT RACEWAY. RUN CONCEALED IN CEILING OR WALLS. ARROWHEAD DENOTES HOMERUN TO PANEL. TEXT DENOTES PANEL NAME AND CIRCUIT NUMBERS FOR HOMERUN. INSTALL GROUND WIRE IN ALL RACEWAYS. #12 AWG MINIMUM AND AS PER CODE.
PP1	ELECTRICAL DISTRIBUTION OR BRANCH CIRCUIT PANELBOARD. TEXT DENOTES NAME, REFER TO DRAWINGS FOR LOCATION. SEE POWER RISER DIAGRAM AND PANEL SCHEDULES. SURFACE OR FLUSH MOUNTED AS

EL	ECTRICAL SYMBOL SCHEDULE - FIRE ALARM & NURSE CALL
FIRE ALARM	
F	FIRE ALARM PULL STATION. SEE SPECIFICATIONS.
∇15	FIRE ALARM HORN/STROBE. NUMBER INDICATES CANDELA RATING. SEE SPECIFICATIONS.
015	FIRE ALARM STROBE ONLY. NUMBER INDICATES CANDELA RATING. SEE SPECIFICATIONS.
<b>SD</b>	CEILING MOUNTED SMOKE DETECTOR. SEE SPECIFICATIONS.
(m)——	DUCT SMOKE DETECTOR WITH SAMPLING TUBE. INSTALLED ON RETURN OR RETURN AND SUPPLY AS REQUIRED, SEE DIV 15 DRAWINGS AND COORDINATE. "WP" DENOTES WEATHERPROOF HOUSING FOR OUTDOOR UNITS.
[FAA]	FIRE ALARM REMOTE ANNUNCIATOR PANEL. SEE SPECIFICATIONS.
FACP	MAIN FIRE ALARM CONTROL PANEL. SEE RISER DIAGRAM AND SPECIFICATIONS.

ELECTRI	CAL SYMBOL SCHEDULE - LIGHTING SYSTEMS AND ACCESSORIES
LIGHTING	
A o	CEILING MOUNTED LIGHT FIXTURE. REFER TO LIGHT FIXTURE SCHEDULE FOR TYPE AND MOUNTING. SEE RECESSED LAY-IN FIXTURE DETAIL FOR LAY-IN FIXTURES MOUNTED IN CEILING GRID. LETTER DENOTES FIXTURE TYPE.
<u> </u>	STRIP FIXTURE, REFER TO LIGHT FIXTURE SCHEDULE FOR TYPE AND MOUNTING. LETTER DENOTES FIXTURE TYPE.
^/^/ <del>^</del>	WALL MOUNTED INCANDESCENT, COMPACT FLUORESCENT, LED OR HID FIXTURE. REFER TO LIGHT FIXTURE SCHEDULE FOR TYPE. MOUNTING HEIGHTS AS INDICATED ON DRAWINGS OR IN LIGHT FIXTURE SCHEDULE OR AS DIRECTED BY OWNER. LETTER DENOTES FIXTURE TYPE. PROVIDE COLD WEATHER BALLASTS FOR ALL FIXTURES LOCATED OUTDOORS.
<b>^</b> O	CEILING MOUNTED INCANDESCENT, COMPACT FLUORESCENT, LED OR HID FIXTURE. REFER TO LIGHT FIXTURE SCHEDULE FOR TYPE AND MOUNTING. PROVIDE MOUNTING HARDWARE APPROPRIATE FOR TYPE OF CEILING WHERE FIXTURE IS INSTALLED. SEE ARCHITECTURAL REFLECTED CEILING PLAN. LETTER DENOTES FIXTURE TYPE.
<b>^</b> ⊕	INCANDESCENT, COMPACT FLUORESCENT, LED OR HID PENDANT MOUNTED FIXTURE. SECURE TO STRUCTURE WITH APPROPRIATE MOUNTING HARDWARE. REFER TO LIGHT FIXTURE SCHEDULE FOR TYPE. SUSPENSION TYPE AND LENGTH AS INDICATED ON DRAWINGS OR IN LIGHT FIXTURE SCHEDULE OR AS DIRECTED BY ARCHITECT. LETTER DENOTES FIXTURE TYPE.
⊗/೪	LED EXIT SIGN, WALL OR CEILING MOUNTED, STEM DENOTES WALL MOUNTED. SINGLE FACE FOR WALL MOUNTED, FACES AS INDICATED BY DARKENED AREAS FOR CEILING MOUNTED. ARROWS DENOTE CHEVRONS INDICATING DIRECTION OF EXIT AS INDICATED ON DRAWINGS. REFER TO LIGHT FIXTURE SCHEDULE FOR TYPE.
\$	120-277V, 20A SINGLE POLE LIGHT SWITCH. HEAVY DUTY TYPE. PROVIDE NEUTRAL CONDUCTOR TO ALL SWITCH LOCATIONS.

	ELECTRICAL SYMBOL SCHEDULE - POWER
POWER	
P	120V, 20A DUPLEX RECEPTACLE, NEMA 5-20R. WALL MOUNTED, REFER TO TYPICAL MOUNTING HEIGHTS DETAIL. REFER TO ADDITIONAL NOTATIONS BELOW WHERE INDICATED ON DRAWINGS.
#	120V, 20A DUPLEX RECEPTACLE, NEMA 5-20R. WALL MOUNTED AT 42" AFF OR 6" ABOVE COUNTERTOP BACKSPLASH UNLESS OTHERWISE NOTED. REFER TO ADDITIONAL NOTATIONS BELOW WHERE INDICATED ON DRAWINGS.
8	120V, 20A QUADRAPLEX RECEPTACLE CONSISTING OF TWO DUPLEX RECEPTACLES IN COMMON BACKBOX, NEMA 5-20R. WALL MOUNTED, REFER TO TYPICAL MOUNTING HEIGHTS DETAIL. REFER TO ADDITIONAL NOTATIONS BELOW WHERE INDICATED ON DRAWINGS.
#	120V, 20A QUADRAPLEX RECEPTACLE CONSISTING OF TWO DUPLEX RECEPTACLES IN COMMON BACKBOX, NEMA 5-20R. WALL MOUNTED AT 42" AFF OR 6" ABOVE COUNTERTOP BACKSPLASH UNLESS OTHERWISE NOTED. REFER TO ADDITIONAL NOTATIONS BELOW WHERE INDICATED ON DRAWINGS.
라	HEAVY DUTY DISCONNECT SWITCH, SEE SCHEDULE.
⊠h	VARIABLE FREQUENCY DRIVE.
$\boxtimes$	MOTOR STARTER.

		LIGHT FIXTURE SCHEDULE			
TYPE	DESCRIPTION	CATALOG NUMBER	LAMPS	WATTAGE	NOTES
S1	4' LED LENSED STRIPLIGHT WITH 3000 LUMEN OUTPUT.	METALUX #4SNLED-LD5-30SL-LW-UNV-L840-CD1	LED BY MFR.	25W	SUSPEND TO APPROXIMATELY 9' AFF COORDINATE EXACT LOCATION WITH MECHANICAL EQUIPMENT AND DUCTWORK BEING INSTALLED. MINIMUM 8'-6".

- LIGHTING FIXTURES, INSTALLATION, SUPPORT, WIRING AND RELATED WORK SHALL COMPLY WITH GENERAL NOTES, FIXTURE SCHEDULE, FIXTURE DETAILS, SPECIFICATIONS AND ALL CONTRACT DRAWINGS. PROVIDE ALL ACCESSORIES REQUIRED FOR A COMPLETE INSTALLATION AND COORDINATE WITH WORK BY OTHER TRADES. PROVIDE ALL REQUIRED MOUNTING HARDWARE, SUPPORTS, ACCESSORIES AND TRIM REQUIRED FOR A COMPLETE INSTALLATION. COORDINATE FIXTURE MOUNTING WITH CEILING AND WALL CONSTRUCTION WHERE INSTALLED. OTHER MANUFACTURERS ACCEPTABLE WHERE EQUIVALENT
- IN PERFORMANCE AND AESTHETICS. SUBMIT FOR APPROVAL ACCORDING TO SPECIFICATIONS OR IF NOT SPECIFIED, WITH SHOP DRAWINGS. FIXTURES SHALL BE LISTED AND LABELED BY ETL OR UL FOR DRY, DAMP, WET OR HAZARDOUS/CLASIFIED LOCATIONS AS APPROPRIATE FOR THE INSTALLATION, UNLESS MORE STRINGENT REQUIREMENTS ARE INDICATED OR SPECIFIED.

WHERE FIXTURES ARE INDICATED ON DRAWINGS TO BE CONNECTED AS NIGHTLIGHTS, CONNECT FIXTURE INPUT (AND BATTERY WHERE APPLICABLE) LINE SIDE OF ANY SWITCHING OR CONTROLS.

#### FIRE ALARM SYSTEM PARTIAL RENOVATION AND EXTENSION GENERAL NOTES:

- INCLUDE IN BID ALL LABOR, MATERIALS, PROGRAMMING, ETC AS REQUIRED FOR COMPLETE SYSTEM IN ACCORDANCE WITH THE INTENT OF THESE DRAWINGS. CONTRACTOR SHALL FURNISH AND INSTALL ALL COMMUNICATIONS PATHWAYS AS REQUIRED FOR A COMPLETE SYSTEM. COORDINATE ALL PATHWAY LOCATIONS PRIOR TO ANY ROUGH-INS. IF CONDITIONS REQUIRE CONDUIT OR RACEWAY TO BE RUN EXPOSED COORDINATE ROUTING WITH ARCHITECT AND PAINT AS
- REQUIRED BY ARCHITECT. ALL NEW DEVICES SHALL BE COMPATIBLE WITH THE EXISTING SYSTEM AND NOTIFICATION APPLIANCES SHALL BE CAPABLE OF STROBE SYNCHRONIZATION WITH THE EXISTING DEVICES TO REMAIN IN ALL AREAS.
- CONTRACTOR SHALL BE RESPONSIBLE FOR SUBMITTING TO ENGINEER AND TO AHJ ALL REQUIRED CALCULATIONS AND DETAILS OF RENOVATED SYSTEM. THIS INCLUDES BUT IS IN NO WAY LIMITED TO, POINT TO POINT WIRING DIAGRAMS, REVISED VOLTAGE DROP CALCULATIONS, REVISED BATTERY CALCULATIONS, AND
- ALL ADDITIONAL DOCUMENTATION REQUIRED FOR APPROVAL BY THE AHJ FOR THE COMPLETE SYSTEM AFTER RENOVATION. PROVIDE ADDITIONAL POWER SUPPLIES, NAC EXTENDER PANELS, OR SIMILAR AUXILIARY EQUIPMENT AS REQUIRED FOR ADDITION OF NEW DEVICES AND
- RELOCATION OF EXISTING DEVICES AT LOCATIONS REFERENCED ON DRAWINGS. ONLY DEVICES AFFECTED IN AREAS OF RENOVATION ARE INDICATED ON DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING LOCATION AND
- CIRCUITING OF ALL DEVICES IN ADJACENT AREAS TO MAINTAIN OPERATION OF SYSTEM DURING AND AFTER RENOVATION. APPROVAL AND PERMIT SHALL BE OBTAINED BY THE AHJ PRIOR TO COMMENCING ANY WORK.
- PROVIDE RECORD OF COMPLETION TO ENGINEER AND AHJ PER NFPA 72.

DEVICE DESCRIPTION	DUPLEX RECEPTACLE	FIRE ALARM HORN STROBE/ FIRE ALARM STROBE	LIGHT SWITCH OR OTHER LIGHTING CONTROL DEVICE	LIGHT SWITCHES AND OTHER LIGHTING CONTROL DEVICES SHALL ALWAYS BE LOCATED ON THE STRIKE SIDE OF THE DOORWAY UNLESS NOTED
DEVICE SYMBOL	P	<u>å</u> /å	\$	OTHERWISE ON THE PLANS OR IN THE SPECIFICATIONS.
FINISHED CEILING				FINISHED CEILING
LOCATION OF DEVICES RELATIVE TO FLOOR, CEILING AND DOOR OPENINGS.		LENS SHALL BE BETWEEN 80" AND 96" AFF.		STRIKE SIDE
				HINGE SIDE —
			3"→	OUTSIDE EDGE OF DOOR CASING
				■ DOOR CASING
			i     48" 	
	© Ø			
FINISHED FLOOR	16"			FINISHED FLOOR—
	****ALL	MOUNTING HEIGHTS ARE TYPICAL UNLESS OTHER	RWISE NOTED ON PLAN	S.****

DEVICE MOUNTING HEIGHTS

#### GENERAL DEMOLITION NOTES:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR DISCONNECTION AND REMOVAL OF ANY ELECTRICAL DEVICES OR SYSTEMS AS REQUIRED FOR BUILDING RENOVATION WORK. COORDINATE WITH MECHANICAL DRAWINGS AND PROVIDE LABOR AND MATERIALS FOR ALL WORK REQUIRED TO DISCONNECT DEVICES, LIGHT FIXTURES, ETC AT WALLS AND CEILINGS SCHEDULED FOR DEMOLITION OR MODIFICATION.

WHERE DEVICES OR FIXTURES ARE REMOVED OR OTHERWISE MODIFIED TO ACCOMMODATE NEW CONSTRUCTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL CONNECTIONS AND WIRING TO EXISTING BRANCH CIRCUITS AND DEVICES AND EXTENDING CIRCUITS AS REQUIRED TO MAINTAIN CONNECTIVITY TO EXISTING ADJACENT DEVICES AND FIXTURES TO REMAIN. NOTIFY OWNER PRIOR TO DISCONNECTION OR REMOVAL OF ANY ELECTRICAL SYSTEM DEVICE OR EQUIPMENT.

CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING STYLES AND FINISHES OF EXISTING DEVICES, COVER PLATES, AND FIXTURES, NEW DEVICES SHALL BE FURNISHED TO CLOSELY MATCH AESTHETIC CHARACTERISTICS OF EXISTING FIXTURES AND DEVICES.

WHERE DEVICES OR EQUIPMENT ARE ABANDONED OR DEMOLISHED AS PART OF THE SCOPE OF WORK, THE OWNER HAS FIRST RIGHT OF REFUSAL TO ALL EQUIPMENT, WIRING, AND MATERIALS DEMOLISHED. THE CONTRACTOR SHALL PROVIDE FOR PROPER DISPOSAL OF ALL EQUIPMENT AND MATERIALS NOT ACCEPTED BY THE OWNER. CONTRACTOR SHALL PROVIDE FOR REASONABLE TRANSPORTATION TO STORAGE FACILITY AS DIRECTED BY THE OWNER FOR ALL EQUIPMENT AND MATERIALS FOR WHICH THE OWNER CHOOSES TO RETAIN POSSESSION OF AFTER REMOVAL.

CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PATCHING, PAINTING, ETC AS REQUIRED TO CLOSELY MATCH ADJACENT BUILDING FINISHES WHERE DEVICES OR EQUIPMENT ARE REMOVED.

WHERE DEVICES OR FIXTURES ARE DEMOLISHED OR OTHERWISE ABANDONED AS PART OF THIS WORK, THE CONTRACTOR SHALL REMOVE ALL WIRING, RACEWAY, AND PERIPHERAL MATERIALS AND SUPPORTS TO SOURCE PANEL OR TO NEAREST JUNCTION BOX WHERE CIRCUIT SERVES OTHER DEVICES OR FIXTURES IN ADJACENT AREAS WHICH ARE TO REMAIN. FIELD COORDINATE.

of renovation work. REMOVE ALL CEILING MOUNTED DEVICES FROM CEILINGS BEING DEMOLISHED OR REWORKED AND REINSTALL AT SAME LOCATION OR NEW LOCATION AS DESCRIBED ON RENOVATION DRAWINGS. WHERE ANY NEW CEILINGS ARE LOWERED AND ARE BELOW LEVEL OF EXISTING WALL MOUNTED DEVICES,

CONTRACTOR SHALL RELOCATE EXISTING DEVICES BELOW NEW CEILING LEVEL AND EXTEND

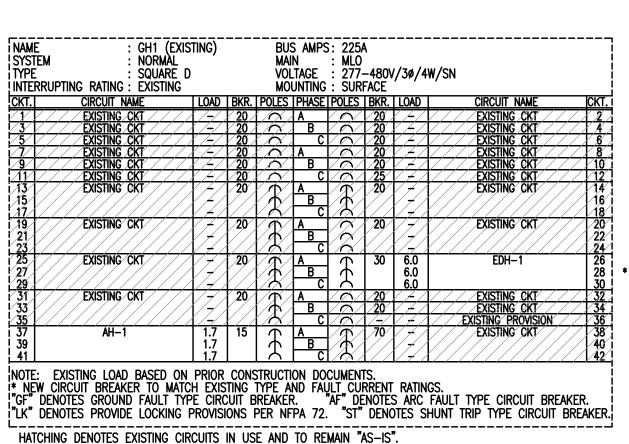
CONTRACTOR SHALL PROVIDE REVISED CIRCUIT DIRECTORIES IN ALL PANELBOARDS ASSOCIATED WITH AREA OF RENOVATION TO INDICATE ALL LOADS BOTH EXISTING AND MODIFIED/NEW UPON COMPLETION

CAREFULLY REVIEW MECHANICAL DEMOLITION PLANS. EXAMINE WORK TO BE DONE AND PROVIDE ALL ELECTRICAL WORK AS REQUIRED FOR DEMOLITION OF WALLS, CEILINGS, EQUIPMENT, OR SIMILAR AS DESCRIBED IN CONTRACT DOCUMENT SET. THIS INCLUDES RELOCATION, REROUTING, ETC OF ELECTRICAL CIRCUITS OR INFRASTRUCTURE WHERE REQUIRED FOR WORK UNDER OTHER TRADES WHETHER SPECIFICALLY INDICATED ON ELECTRICAL DRAWINGS OR NOT. CONTRACTOR IS REQUIRED TO VISIT THE SITE PRIOR TO PLACING BID AND INCLUDE IN BID ANY LABOR AND MATERIALS ASSOCIATED WITH RELOCATION OR MODIFICATION OF EXISTING ELECTRICAL SYSTEMS WHICH MAY BE AFFECTED BY WORK IN THE AREAS OF RENOVATION OR ADJACENT BUILDING AREAS.

WIRING/RACEWAY AS REQUIRED.

R	ACEWAY MATERIAL SCHEDULE
UTILITY  SERVICE ENTRANCE	SERVICE EQUIPMENT SERVICE DISCONNECT BRANCH CIRCUIT  RACEWAY MATERIALS: FEEDERS: EMT, IMC, GRS BRANCH CIRCUITS CONCEALED ABOVE CEILING/IN WALLS: EMT, IMC, GRS BRANCH CIRCUITS EXPOSED (INTERIOR): EMT  FINAL CONNECTIONS TO MECHANICAL EQUIPMENT (3' MAX): FLEXIBLE WATERTIGHT CONDUIT IN DAMP AND WET LOCATIONS, FLEXIBLE METAL CONDUIT IN DRY LOCATIONS.
	LIGHT FIXTURE WHIPS (3' MAX): AC/MC CABLE IN DRY LOCATIONS.

	ABBREVIATIONS
	ABBINEVIATIONS
Α	AMPERE.
AFF	ABOVE FINISHED FLOOR.
AFG	ABOVE FINISHED GRADE.
BKR	BREAKER.
C	CONDUIT.
CATV	CABLE TELEVISION CIRCUIT.
CKT	CIRCUIT.
EC	ELECTRICAL CONTRACTOR, DIVISION 26 (DIV 26).
EF	EXHAUST FAN.
EMT	ELECTRICAL METALLIC TUBING.
FCU GC	FAN COIL UNIT.
GF GF	GENERAL CONTRACTOR, DIVISION 00 THROUGH 14.
GRS	GROUND FAULT CIRCUIT INTERRUPTER.
HID	GALVANIZED RIGID STEEL CONDUIT. HIGH INTENSITY DISCHARGE.
IG	DEVICE SHALL HAVE ISOLATED GROUND. SEE SPECIFICATIONS.
IMC	INTERMEDIATE METALLIC CONDUIT.
JB or J-BOX	JUNCTION BOX.
KVA	KILOVOLT AMPERES.
KW	KILOWATT.
MAX	MAXIMUM.
MC	MECHANICAL CONTRACTOR, DIVISION 23 (DIV 23).
MDP	MAIN DISTRIBUTION PANEL.
MIN	MINIMUM.
MFR	MANUFACTURER.
NMC	NONMETALLIC—SHEATHED CABLE.
٧	VOLT.
NEC	NATIONAL ELECTRICAL CODE. (NFPA 70).
SWBD	SWITCHBOARD.
TYP	TYPICAL.
UNO	unless noted otherwise.
WC	WATER COOLER.
XFMR	TRANSFORMER.



EXISTING CONNECTED LOAD REMOVED\* (KVA): 20.8

NEW ADDITIONAL CONNECTED LOAD (KVA): 23.0 CONNECTED LOAD INCREASE (KVA): 2.2

ENGINEERING

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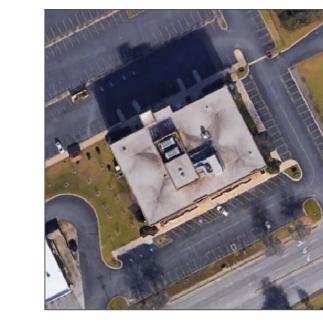




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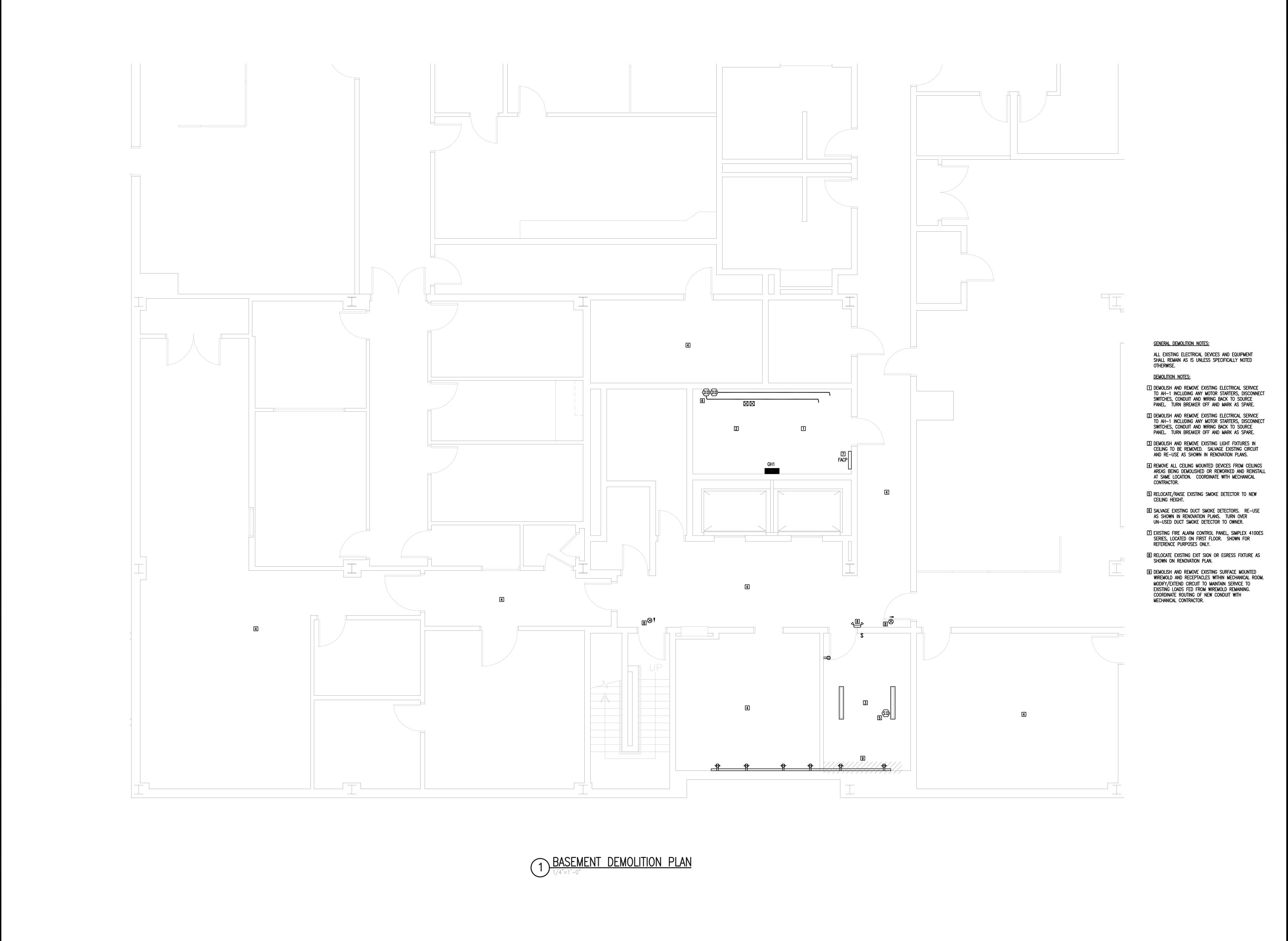
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**ELECTRICAL NOTES, SYMBOLS,** SCHEDULES, DETAILS, AND **ABBREVIATIONS** 

sheet number

checked by RMI





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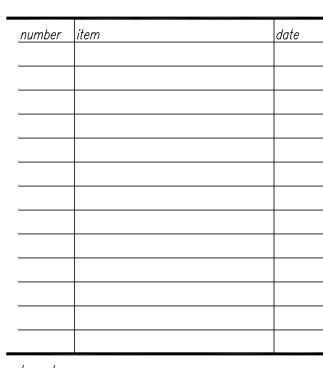
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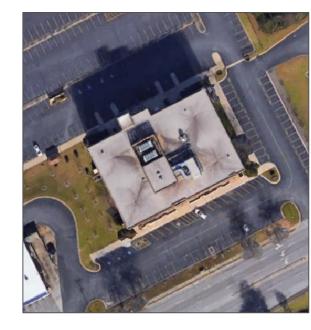


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key plan

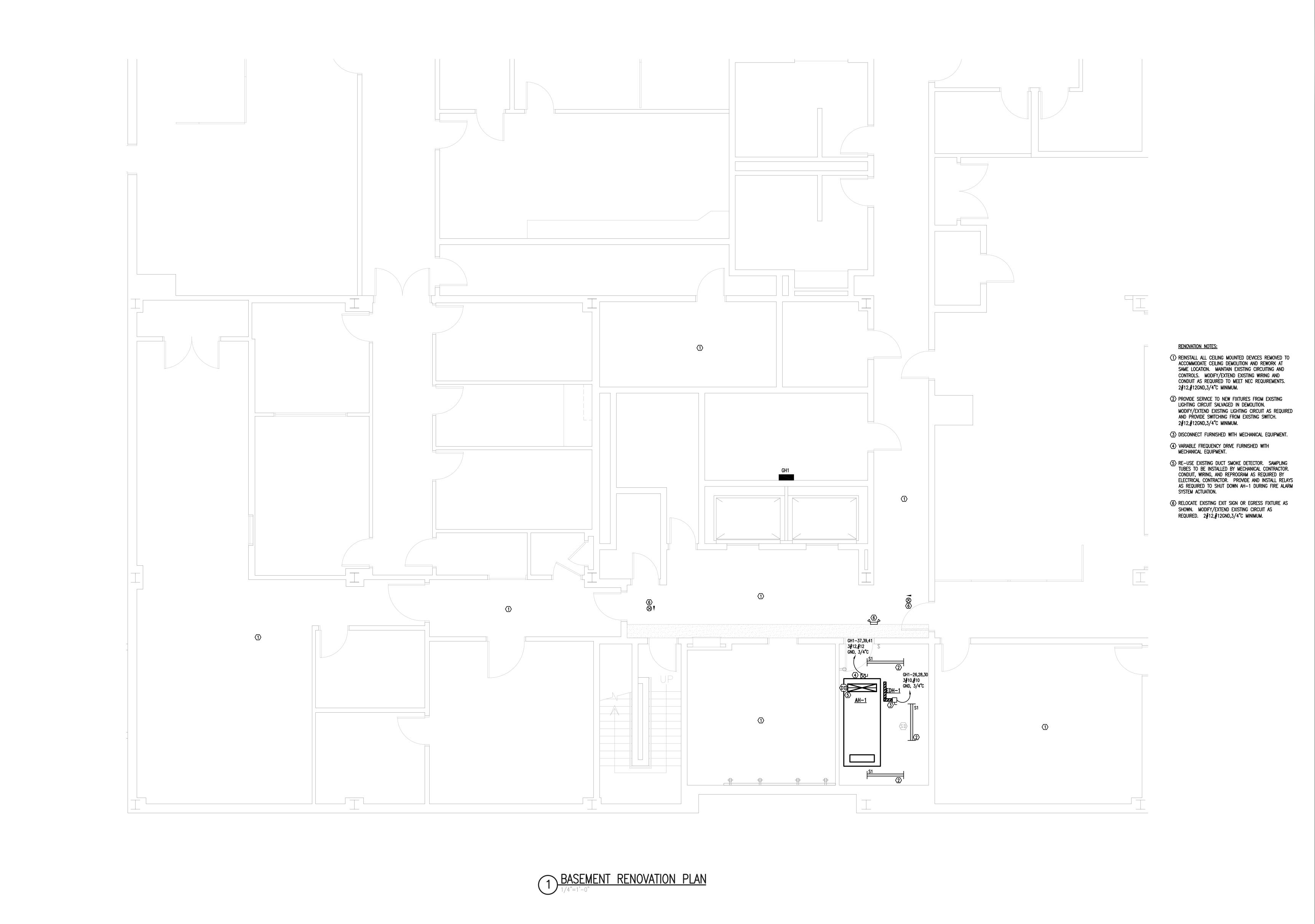




sheet title
ELECTRICAL DEMOLITION
PLANS

sheet number

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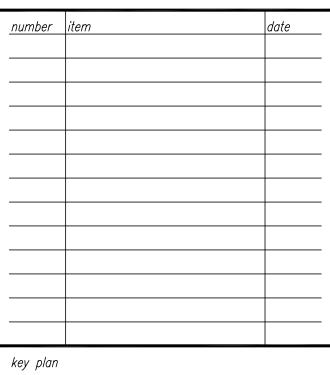
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sheet title
ELECTRICAL RENOVATION
PLANS

sheet number

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**ELECTRICAL SPECIFICATIONS** 

1. GENERAL PROVISIONS

A. WORK INCLUDED IN THESE SPECIFICATIONS AND INCLUDED ON THE DRAWINGS SHALL INCLUDE FURNISHING ALL LABOR, MATERIALS, SUPPLIES, AND EQUIPMENT TO PERFORM ALL WORK REQUIRED INCLUDING CUTTING, CHANNELING, CHASING, DEMOLITION (IF ANY) TO INSTALL A COMPLETE AND WORKING ELECTRICAL SYSTEM(S) IN ACCORDANCE WITH THESE SECTIONS OF THE SPECIFICATIONS AND THE ACCOMPANYING DRAWINGS. THIS SHALL INCLUDE ALL REQUIRED PREPARATION WORK, DEMOLITION, RACEWAYS, COORDINATION, ETC. REQUIRED TO INSTALL THE ELECTRICAL SYSTEM.

B. THE ELECTRICAL WORK SHALL INCLUDE, BUT IN NO WAY BE LIMITED TO THE FOLLOWING:

1. FIRE ALARM SYSTEM ADDITIONS RACEWAYS. 3. ELECTRICAL DISTRIBUTION SYSTEM.

4. INTERIOR LIGHTING SYSTEMS. 5. INTERIOR POWER SYSTEMS.

6. WIRING DEVICES. 7. CONNECTION AND INSTALLATION OF EQUIPMENT FURNISHED UNDER OTHER DIVISIONS OF THE SPECIFICATION.

C. THE CONTRACTOR IS RESPONSIBLE FOR INCLUDING ANY AND ALL WORK RELATED TO THE ELECTRICAL THAT IS NOTED IN ANY PART OF THE SPECIFICATIONS OR ANY PART OF THE DRAWINGS, INCLUDING DIVISIONS 1, 23 AND ANY OTHER SECTIONS. THE CONTRACTOR WILL SUPPLY POWER TO EQUIPMENT AT THE VOLTAGE INDICATED ON THE DRAWINGS. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR COORDINATING THE EQUIPMENT VOLTAGES, CONTROL EQUIPMENT, WIRING, AND LOCATIONS AND TYPE OF TERMINATIONS/CONNECTIONS AND/OR DISCONNECTS REQUIRED TO COMPLY WITH THE NATIONAL ELECTRICAL CODE, INTERNATIONAL BUILDING CODE, INTERNATIONAL ENERGY CONSERVATION CODE, ALL LOCAL CODES, AND THE EQUIPMENT MANUFACTURER'S REQUIREMENTS.

D. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC IN NATURE EXCEPT WHERE SPECIFIC DIMENSIONS, OR SPECIFIC DETAILS ARE SHOWN ON THE ELECTRICAL, MECHANICAL, OR ARCHITECTURAL DRAWINGS. THE CONTRACTOR SHALL REFER TO OTHER DRAWINGS FOR EXACT LOCATIONS OF EQUIPMENT, BUILDING DIMENSIONS, ARCHITECTURAL DETAILS AND CONDITIONS AFFECTING THE ELECTRICAL WORK; HOWEVER, FIELD MEASUREMENTS TAKE PRECEDENCE OVER DIMENSIONED DRAWINGS. THE ELECTRICAL CONTRACTOR SHALL PROVIDE ALL LABOR AND MATERIALS AND ALL INCIDENTAL ELEMENTS: JUNCTION AND PULL BOXES, FILTERS, PULL WIRES, CONNECTORS, SUPPORT MATERIALS, FUSES, DISCONNECT SWITCHES, LAMPS, AND LABELS, TO INSTALL, CONNECT, START-UP AND RESULT IN A COMPLETE AND WORKING SYSTEM IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE INSTALLATION OF ALL ELECTRICAL WORK WITH THE WORK OF OTHER CONTRACTORS AND/OR TRADES. THE ELECTRICAL DRAWINGS ARE SUCH THAT THE ELECTRICAL SERVICE TO EQUIPMENT FURNISHED AND INSTALLED UNDER OTHER SECTIONS OF THE CONTRACT DOCUMENTS (EXAMPLES, BUT NOT LIMITED TO: ELEVATORS, KITCHEN EQUIPMENT, HVAC EQUIPMENT, WATER HEATERS. FANS. PUMPS. MOTORS. ETC) IS COORDINATED FOR THE SPECIFIED EQUIPMENT ONLY. IF THE EQUIPMENT INSTALLED UNDER OTHER DIVISIONS OF THE CONTRACT DOCUMENTS IS NOT THE SPECIFIED EQUIPMENT IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO COORDINATE THE ELECTRICAL SERVICE/INTERFACE REQUIREMENTS WITH THE ELECTRICAL CONTRACTOR.

E. PROVIDE ALL WIRING, CONNECTORS, FITTINGS, CONNECTIONS, AND ALL ACCESSORIES FOR THE COMPLETE INSTALLATION OF, AND FINAL CONNECTIONS TO, EQUIPMENT FURNISHED UNDER OTHER DIVISIONS OF THE SPECIFICATIONS AND WHERE INDICATED ON THE DRAWINGS OR

F. ALL SAFETY DISCONNECT SWITCHES SHALL BE PROVIDED UNDER DIVISION 26 UNLESS NOTED OTHERWISE. THE ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL FUSES THAT ARE SIZED IN ACCORDANCE TO THE EQUIPMENT NAMEPLATE OF THE EQUIPMENT SERVED.

G. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL REQUIRED PERMITS AND COMPLYING WITH ALL NATIONAL (NEC. IBC, NFPA), STATE, COUNTY, AND MUNICIPAL CODES AND REGULATIONS. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING: 1. FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

2. NFPA 70 (NATIONAL ELECTRICAL CODE) 3. ANSI/ASME A17.1 (SAFETY CODE FOR ELEVATORS AND ESCALATORS)

4. AMERICANS WITH DISABILITIES ACT (ADA).

5. INTERNATIONAL BUILDING CODE (IBC).

OTHERWISE SPECIFIED.

6. INTERNATIONAL FIRE ALARM CODE. 7. INTERNATIONAL ENERGY CONSERVATION CODE (IECC) 2009 EDITION.

H. THE CONTRACTOR SHALL KEEP A SET OF CONSTRUCTION DRAWINGS DURING THE LENGTH OF THE PROJECT ON WHICH HE SHALL NOTE ANY AND ALL CHANGES FROM THE ORIGINAL DRAWINGS. THIS RECORD SET OF DRAWINGS SHALL BE UPDATED DAILY.

ELECTRICAL SUBCONTRACTOR SHALL SUBMIT FOR REVIEW BY THE ENGINEER DETAILED SHOP DRAWINGS OF ALL MATERIAL LISTED BELOW. ALL SUBMITTAL DATA SHALL BE SUBMITTED AT ONE TIME. NO MATERIAL OR EQUIPMENT FOR WHICH ENGINEER'S REVIEW IS REQUIRED SHALL BE DELIVERED TO THE JOB SITE OR INSTALLED UNTIL THE ELECTRICAL CONTRACTOR HAS IN HIS POSSESSION THE REVIEWED AND APPROVED SHOP DRAWINGS FOR THE PARTICULAR MATERIAL AND/OR EQUIPMENT. THE ELECTRICAL CONTRACTOR SHALL ASSEMBLE, ORGANIZE, PREPARE AND REVIEW FOR CORRECTNESS SHOP DRAWINGS ON ALL MATERIALS, EQUIPMENT, FIXTURES AND DEVICES TO BE USED. IF MATERIAL SUBMITTED IS THE RESULT OF "VALUE ENGINEERING" OR "PRIOR APPROVAL" CHANGES THE SUBMITTAL MUST CONTAIN SUPPORTING DOCUMENTATION OF THE APPROVED CHANGES, OTHERWISE IT WILL BE REVIEWED AGAINST THE SPECIFIED PRODUCTS ON THESE PLANS. THE ELECTRICAL CONTRACTOR SHALL FURNISH THE NUMBER OF COPIES SPECIFIED BY THE ARCHITECT OR ONE (1) PDF ELECTRONIC COPY OF SHOP DRAWINGS IF NO NUMBER IS SPECIFIED BY THE ARCHITECT. SHOP DRAWINGS THAT ARE INCORRECTLY SUBMITTED, CONTAIN ERRORS OR OMISSIONS, OR NOT IN THE FORM AND SEQUENCE SPECIFIED SHALL BE REJECTED AS UNAPPROVED.

REVIEW OF SHOP DRAWINGS IN NO WAY RELIEVES THE CONTRACTOR OF HIS RESPONSIBILITY OF QUANTITY, DIMENSIONS, WEIGHTS, MEANS AND METHODS, SAFETY, OR COORDINATION WITH OTHERS.

FAILURE OF THE CONTRACTOR TO SUBMIT SHOP DRAWINGS TO THE ENGINEER WITH REASONABLE TIME FOR REVIEW SHALL NOT ENTITLE THE CONTRACTOR TO AN EXTENSION OF CONTRACT TIME. REASONABLE REVIEW TIME IS FIFTEEN WORKING DAYS UNLESS OTHERWISE SPECIFIED.

AT MINIMUM SHOP DRAWINGS SHALL BE SUBMITTED FOR

LIGHTING FIXTURES CIRCUIT BREAKERS AND/OR ANY DEVICE USED TO MODIFY AN EXISTING PANELBOARD OR SWITCHBOARD

SAFETY SWITCHES BASIC MATERIALS; WIRE, CONDUIT, FITTINGS, WIRING DEVICES

REQUESTS FOR SUBSTITUTION

SUBMIT REQUESTS FOR SUBSTITUTION TO ENGINEER THROUGH THE ARCHITECT BY US MAIL OR COURIER NO FEWER THAN TEN (10) WORKING DAYS PRIOR TO BID TIME. REQUESTS SHALL CONTAIN CUTSHEETS, CATALOG NUMBERS, ETC. ANY APPROVAL WILL BE IN WRITING BY THE ENGINEER. SUBSTITUTED ITEMS WILL NOT RESULT IN AN INCREASE IN COST TO THE OWNER.

K. CATALOG NUMBERS AND NAMES THAT APPEAR IN THE SPECIFICATIONS OR ON THE PLANS MAY BE INCOMPLETE OR OBSOLETE AND ARE FOR DESCRIPTIVE PURPOSES ONLY. AS SUCH THEY MAY NOT INDICATE ALL OF THE PARTS, PIECES AND SYSTEMS REQUIRED FOR A COMPLETE AND OPERATING INSTALLATION. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR, THE VENDOR AND THE SUPPLIER TO REVIEW THE PLANS, SPECIFICATIONS AND APPLICATIONS TO DETERMINE THE CORRECT ITEM(S) REQUIRED TO INCLUDE ALL INSTALLATION AND SUPPORT MATERIALS AND SYSTEMS FOR A COMPLETE AND WORKING INSTALLATION.

2. FIRE SPREAD PREVENTION MATERIAL

A. THE WORK SHALL INCLUDE THE REQUIREMENT TO INSTALL FIRE SPREAD PREVENTION MATERIAL WHEREVER THE ELECTRICAL CONTRACTOR INSTALLS OR PENETRATES A MATERIAL (WALL, ETC.) TO INSTALL ELECTRICAL EQUIPMENT OR MATERIALS.

B. FIRE RESISTANCE RATING: WHENEVER A FIRE RATED WALL. FLOOR. FLOOR—CEILING OR ROOF—CEILING ASSEMBLY IS SHOWN WITH THROUGH-PENETRATIONS, PROVIDE MATERIALS AND APPLICATION PROCEDURES WHICH HAVE BEEN TESTED AND CLASSIFIED BY UL AND APPROVED BY FM FOR THE ASSEMBLY.

C. INSTALLATION SHALL BE IN ACCORDANCE WITH THE PRINTED INSTRUCTIONS AS SUPPLIED BY THE MANUFACTURER.

3. RACEWAYS/CONDUITS AND ASSOCIATED EQUIPMENT

A. THE WORK SHALL INCLUDE ALL RACEWAYS, CONDUITS, FITTINGS, AND ALL OTHER EQUIPMENT REQUIRED TO INSTALL A RACEWAY SYSTEM. THIS SHALL INCLUDE, BUT NOT LIMITED TO THE FOLLOWING: 1. RIGID METAL CONDUIT AND FITTINGS.

2. ELECTRICAL METALLIC TUBING AND FITTINGS. 3. FLEXIBLE METAL CONDUIT AND FITTINGS.

4. LIQUID TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS.

B. UNLESS OTHERWISE NOTED ON THE DRAWINGS ROUTE ALL CONDUCTORS IN CONDUIT.

C. UNLESS OTHERWISE NOTED, ALL SIGNAL SYSTEMS SHALL HAVE THEIR WIRING INSTALLED IN CONDUIT/RACEWAYS. CONDUIT ROUTING AND DEVICE WIRING FOR SIGNAL SYSTEM COMPONENTS IS NOT SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL COORDINATE WITH THE SIGNAL SYSTEM MANUFACTURER TO DETERMINE THE CONDUIT (SIZE AND ROUTING) AND WIRING REQUIREMENTS TO CIRCUIT THE EQUIPMENT SHOWN ON

THE DRAWINGS. D. SPECIFIED PRODUCTS AND THEIR AREAS OF USE SHALL BE AS FOLLOWS:

FEEDERS: EMT, IMC, GRS BRANCH CIRCUITS CONCEALED ABOVE CEILING/IN WALLS: EMT, IMC, GRS

BRANCH CIRCUITS EXPOSED (INTERIOR): EMT FINAL CONNECTIONS TO MECHANICAL EQUIPMENT (3' MAX): FLEXIBLE WATERTIGHT CONDUIT IN DAMP AND WET LOCATIONS, FLEXIBLE METAL

CONDUIT IN DRY LOCATIONS. LIGHT FIXTURE WHIPS (3' MAX): AC/MC CABLE IN DRY LOCATIONS.

E. FITTINGS SHALL BE COMPRESSION TYPE, CONCRETE TIGHT FOR ALL EMT RACEWAYS. FOR RIGID GALVANIZED STEEL AND IMC, FITTINGS SHALL BE THREADED GALVANIZED IRON, HEAVY STEEL, CONCRETE TIGHT.

F. SIZE CONDUIT FOR CONDUCTOR TYPE INSTALLED; 3/4 INCH MINIMUM SIZE.

4. WIRE AND CABLE - 600 VOLTS AND LESS

A. WORK SHALL INCLUDE THE FURNISHING AND INSTALLING OF ALL REQUIRED WIRE AND CABLE TO COMPLETE THE WIRING AND ELECTRICAL SYSTEM. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING: 1. BUILDING WIRE. 2. WIRING CONNECTIONS AND TERMINATIONS.

B. ALL SERVICE ENTRANCE POWER CABLE SHALL BE TYPE USE, 75 DEGREE C, COPPER CONDUCTOR. FEEDERS AND BRANCH CIRCUITS LARGER THAN 6 AWG: COPPER, STRANDED CONDUCTOR, 600 VOLT INSULATION, THHN, FEEDERS AND BRANCH CIRCUITS 6 AWG AND SMALLER: COPPER CONDUCTOR, 600 VOLT INSULATION, THHN. 6 AND 8 AWG, STRANDED CONDUCTOR; SMALLER THAN 8 AWG, SOLID CONDUCTOR. MINIMUM SIZE SHALL BE #12 FOR ALL WIRING ABOVE 48 VOLTS. ALL CONDUCTORS IN DAMP OR WET LOCATIONS (INCLUDING BELOW GRADE) SHALL BE LISTED FOR THAT USE, THWN-2 OR EQUIVALENT.

C. ALL CABLES SHALL BE COLOR CODED. COLOR CODING SHALL BE AS FOLLOWS: 208/120 VOLT 480/277 VOLT

BLACK Brown ORANGE YELLOW WHITE NEUTRAL

D. EACH WIRE OR CABLE IN A FEEDER AT ITS TERMINAL POINTS, AND IN EACH PULL-BOX, JUNCTION BOX, AND PANEL GUTTER THROUGH WHICH IT PASSES SHALL BE IDENTIFIED TO SHOW THE CIRCUIT NUMBER OF THE BREAKER THAT IT CONNECTS TO. EACH COMMON WIRE, COMMON CIRCUIT TO COMMON LOOP OF A SYSTEM, FIRE ALARM, SOUND SYSTEM, TV SYSTEM, OR ANY SIGNAL SYSTEM CONDUCTOR, SHALL BE IDENTIFIED.

E. ALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE NEC. ALL SPLICES SHALL BE IN JUNCTION BOXES AND SHALL BE ELECTRICALLY AND MECHANICALLY SECURE. WHERE A CIRCUIT HOME RUN IS SHOWN ON THE PLANS WITHOUT ANY CONDUCTOR OR RACEWAY IDENTIFICATION, IT SHALL BE A MINIMUM OF 2 # 12, 1 # 12 GROUND, 3/4" CONDUIT. PLACE AN EQUAL NUMBER OF CONDUCTORS FOR EACH PHASE OF A CIRCUIT IN SAME RACEWAY OR CABLE." SPLICE ONLY IN JUNCTION OR OUTLET BOXES. NEATLY TRAIN AND LACE WIRING INSIDE BOXES, EQUIPMENT, AND PANELBOARDS. PERFORM CONTINUITY TEST ON ALL POWER AND EQUIPMENT BRANCH CIRCUIT CONDUCTORS. VERIFY PROPER

5. WIRING DEVICES

PHASING CONNECTIONS.

A. THE SHALL INCLUDE THE FURNISHING AND INSTALLING OF ANY AND ALL WIRING DEVICES REQUIRED TO MAKE A COMPLETE AND FUNCTIONING WIRING SYSTEM. SEE THE DRAWINGS FOR SYMBOLS AND DESCRIPTIONS OF DEVICES.

B. DUPLEX RECEPTACLE SHALL BE 20 AMPERE, 120 VOLT, 2-POLE, 3-WIRE, NEMA 5-20R. UNIT SHALL BE SELF-GROUNDING, COMPLYING WITH NEMA WD 1 AND NEMA WD 6. AND LISTED AS COMPLYING WITH UL 498. AND WHERE APPLICABLE FS W-C-596: TYPES AND INDICATED ON DRAWINGS. RECEPTACLES SHALL HAVE TERMINAL SCREWS FOR SIDE WIRING OR SCREW ACTUATED BINDING CLAMP FOR BACK WIRING WITH SEPARATE GROUND TERMINAL SCREW, PROVIDE AND INSTALL UNBREAKABLE COVER PLATE ON DRY WALLS (COLOR PER ARCHITECT) OR OVERSIZED BRUSHED ALUMINUM FOR MASONRY WALLS.

C. LIGHT SWITCHES SHALL BE 20 AMPERE, 120-277 VOLT, INDUSTRIAL SPECIFICATION GRADE, COMPLYING WITH NEMA WD 1 AND NEMA WD 6, AND LISTED AS COMPLYING WITH UL 20 AND WHERE APPLICABLE. FS W-S-896: WITH STANDARD TOGGLE TYPE SWITCH ACTUATOR AND MAINTAINED CONTACTS: SINGLE POLE SINGLE THROW, DOUBLE POLE SINGLE THROW, THREE WAY, OR FOUR WAY AS INDICATED ON THE DRAWINGS. SWITCHES SHALL HAVE TERMINAL SCREWS FOR SIDE WIRING OR SCREW ACTUATED BINDING CLAMP FOR BACK WIRING WITH SEPARATE GROUND TERMINAL SCREW. PROVIDE AND INSTALL UNBREAKABLE COVER PLATE ON DRY WALLS (COLOR PER ARCHITECT) OR OVERSIZED BRUSHED ALUMINUM FOR MASONRY WALLS.

D. INSTALLATION SHALL BE PER NEC. INCLUDE GROUND WIRE AND CONNECTION WITH ALL RECEPTACLE CIRCUITS. QUADRAPLEX RECEPTACLES SHALL BE TWO DUPLEX RECEPTACLES INSTALLED IN A TWO GANG BOX. INSTALL WALL SWITCHES 48 INCHES ABOVE FLOOR, OFF POSITION DOWN. INSTALL CONVENIENCE RECEPTACLES 18 INCHES ABOVE FLOOR, 6 INCHES ABOVE COUNTER, BACK SPLASH, GROUNDING POLE ON TOP. INSTALL DEVICES AND WALL PLATES FLUSH AND LEVEL. PROVIDE GROUND FAULT RECEPTACLE IN AREAS WHERE THE NEC REQUIRES GFCI DEVICES. GROUND FAULT RECEPTACLE SHALL NOT BE CIRCUITED TO PROTECT NON GROUND FAULT RECEPTACLES OR DEVICES.

6. SECONDARY GROUNDING

A. WORK INCLUDED SHALL INCLUDE POWER SYSTEM GROUNDING, AND ELECTRICAL EQUIPMENT AND RACEWAY GROUNDING AND BONDING. GROUND ELECTRICAL WORK IN ACCORDANCE WITH NEC ARTICLE 250, LOCAL CODES AS SPECIFIED HEREIN, AND AS SHOWN ON THE DRAWINGS.

B. BOND TOGETHER EXISTING GROUNDING SYSTEM, EXPOSED NON-CURRENT CARRYING METAL PARTS OF NEW ELECTRICAL EQUIPMENT, NEW METAL RACEWAY SYSTEMS, GROUNDING CONDUCTOR IN RACEWAYS AND CABLES, RECEPTACLE GROUND CONNECTORS.

C. PROVIDE A GROUNDING SYSTEM THAT INCLUDES ALL CONNECTIONS AND TESTING OF: GROUND RODS, GROUND CABLES, GROUND BUSES, CONDUITS, FITTINGS, ANCHORS, SUPPORTS, CADWELD(R) MATERIALS AND EQUIPMENT, AND OTHER MATERIALS AS REQUIRED FOR A COMPLETE INSTALLATION.

D. PROVIDE A SEPARATE, INSULATED EQUIPMENT GROUNDING CONDUCTOR IN FEEDER AND BRANCH CIRCUITS. TERMINATE EACH END ON A GROUNDING LUG, BUS, OR BUSHING.

E. INSTALL EQUIPMENT GROUNDING CONDUCTORS IN RACEWAY WITH FEEDER AND BRANCH CIRCUIT CONDUCTORS. GROUND INTERIOR LIGHTING FIXTURES WITH GROUNDING CONDUCTOR TO RIGID METAL RACEWAYS SERVING THEM. FLEXIBLE METAL CONDUIT SHALL HAVE A GROUND WIRE INSTALLED WITH THE POWER CONDUCTORS. WHERE CONNECTIONS ARE MADE TO MOTORS OR EQUIPMENT WITH FLEXIBLE METAL CONDUIT. GROUNDING CONDUCTOR SHALL BE STRANDED COPPER CONDUCTOR WITHIN THE CONDUIT, BONDED TO THE EQUIPMENT AND TO THE RIGID METAL RACEWAY SYSTEM. AT EACH CONVENIENCE OUTLET, INSTALL A GROUNDING CLIP ATTACHED TO THE OUTLET BOX AND LEAVE A SUFFICIENT LENGTH OF #12 WIRE WITH GREEN COLORED INSULATION TO CONNECT TO THE GROUNDING TERMINAL OF THE RECEPTACLE.

7. FIRE ALARM AND DETECTION SYSTEM ADDITIONS

A. FURNISH AND INSTALL ADDITIONS TO THE EXISTING FIRE ALARM SYSTEM FOR THE FACILITY AS SHOWN ON THE DRAWINGS. THIS SHALL

INCLUDE. BUT IN NO WAY BE LIMITED TO THE FOLLOWING: 1. A/V UNITS (CHIMES AND/OR HORNS WITH FLASHING STROBE LIGHTS TO MATCH EXISTING SYSTEM).

2. VISUAL UNITS (FLASHING STROBE ONLY).

3. SMOKE/HEAT DETECTORS INCLUDING DUCT DETECTORS. 4. AUTOMÁTIC REPORTING SYSTEM OF ALL ALARMS TO THE LOCAL FIRE DEPARTMENT.

B. CONDUIT ROUTING AND DEVICE WIRING IS NOT SHOWN ON THE DRAWINGS. THE ELECTRICAL CONTRACTOR SHALL COORDINATE WITH THE FIRE ALARM MANUFACTURER TO DETERMINE THE CONDUIT (SIZE AND ROUTING) AND WIRING REQUIREMENTS TO CIRCUIT THE EQUIPMENT

SHOWN ON THE DRAWINGS. C. THE TOTAL FIRE ALARM SYSTEM SHALL COMPLY WITH ALL NATIONAL, STATE, AND LOCAL CODES. THIS SHALL INCLUDE, BUT NOT BE LIMITED

TO THE FOLLOWING: 1. NATIONAL ELECTRIC CODE

SIGNALS. FURNISH AUDIBLE TROUBLE SIGNAL SILENCING SWITCHES WITH RING BACK OR AUTOMATIC RESET FEATURE. ALARM INITIATING CIRCUITS

2. STANDARD BUILDING CODE

D. MATCH EXISTING BUILDING SYSTEM.

PORTION OF THE DEVICE.

3. ALL NFPA CODES 4. AMERICANS WITH DISABILITIES ACT (ADA)

E. THE SYSTEM OPERATION SHALL INCLUDE INDIVIDUAL ZONE SUPERVISION, ANNUNCIATION BY ZONE, BATTERY STANDBY POWER, DOUBLE SUPERVISION, AND NON-CODED, CONTINUOUS RINGING, WITH AUTOMATIC REPORTING OF ALARMS TO THE LOCAL FIRE DEPARTMENT. ELECTRICAL SUPERVISION SHALL INCLUDE ALL ALARM INITIATING CIRCUITS. ALL AUDIBLE AND VISUAL ALARM SIGNAL CIRCUITS. ALL POWER SUPPLIES. AUTOMATIC REPORTING SYSTEM. SUPERVISORY POWER AND OPERATING POWER. FAILURE OF ANY SUPERVISED CIRCUIT SHALL OPERATE THE SYSTEM TROUBLE

SHALL BE CLASS B SUPERVISED. ANY 'OFF-NORMAL' CONDITION OF ANY SWITCH IN THE SYSTEM SHALL OPERATE THE SYSTEM TROUBLE SIGNALS.

F. OPERATION OF ANY MANUAL STATION OR AUTOMATIC DETECTOR IN THE SYSTEM SHALL: 1. SOUND ALL AUDIBLE ALARM HORNS IN THE SYSTEM UNTIL RESET PROCEDURES ARE INITIATED. 2. ILLUMINATE THE PROPER ZONE ALARM LAMP ON THE CONTROL PANEL.

3. FLASH ALL VISUAL ALARM INDICATORS, WHEN ALARM HORNS ARE SOUNDING. 4. SHUT DOWN ALL HVAC AIR HANDLING EQUIPMENT.

REQUIREMENTS OF THE LOCAL FIRE DEPARTMENT AS TO AUTOMATIC REPORTING.

5. AUTOMATICALLY NOTIFY THE LOCAL FIRE DEPARTMENT. INCLUDE ANY AND ALL EQUIPMENT REQUIRED TO ACCOMPLISH THIS REQUIREMENT. ANY AND ALL EQUIPMENT SHALL COMPLY WITH

G. CLOSING OF ANY SPRINKLER VALVE SHALL PRODUCE A TROUBLE SIGNAL AT THE FIRE ALARM CONTROL UNIT (FAC) AND AT THE FIRE ALARM ANNUNCIATOR (FAA). THE TROUBLE SIGNAL SHALL CONSIST OF A VISUAL LIGHT AND AN AUDIBLE TROUBLE TONE.

H. SMOKE DETECTORS SHALL BE DUAL CHAMBER, IONIZATION TYPE, WITH INTEGRAL ALARM INDICATOR LAMP. EACH DETECTOR SHALL CONTAIN AN INTERNAL TEST CONNECTION AND SENSITIVITY ADJUSTMENT TO PROVIDE CONTINUOUSLY VARIABLE SENSITIVITY SETTINGS.

I. HEAT DETECTORS SHALL BE FIXED TEMPERATURE TYPE, WITH REPLACEABLE HEAT COLLECTOR, RATED AT 135 DEGREES F. (200 DEGREES F. IF

J. ALARM SIGNAL DEVICES SHALL BE COMBINATION AUDIOVISUAL HORN/LAMP UNITS, SEMI-FLUSH MOUNTED WITH VIBRATING HORN MECHANISM AND STROBE LAMP ASSEMBLY. BOTH HORN AND LAMP SHALL BE DESIGNED FOR CONNECTION TO SUPERVISED CIRCUITS. STROBE LAMP SHALL BE RATED AS SHOWN ON DRAWINGS. THE VISUAL ONLY INDICATOR SHALL BE IDENTICAL TO THE HORN/LAMP UNIT EXCEPT USING THE STROBE ONLY. ALL ALARM SIGNAL DEVICES CONTAINING VISUAL ALARM INDICATORS SHALL HAVE THE "FIRE" LETTERED ON EITHER SIDE OF THE VISUAL

K. ALL CONDUCTORS SHALL BE INSTALLED IN METALLIC RACEWAYS. ALL CONDUCTORS SHALL BE COPPER, #14 MINIMUM. ALL CONNECTIONS TO TERMINALS ON ANY EQUIPMENT IN FIRE ALARM SYSTEM SHALL BE MADE USING SPADE LUGS OF A SUITABLE SIZE AND TYPE FOR THE FURNISHED

L. FIRE ALARM SYSTEM SHALL BE INSTALLED BY A U.L. CERTIFIED COMPANY. FIRE ALARM SYSTEM SHALL HAVE A U.L. CERTIFIED CONTROL STATION. MONITORING COMPANY SHALL BE U.L. CERTIFIED.

M. FIRE ALARM ADDITION CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING COMPLIANCE WITH INTERNATIONAL FIRE CODE SECTION 907.1.1.



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CONSTRUCTION

October 8, 2019

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**ELECTRICAL SPECIFICATIONS** 

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