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FULTON COUNTY

CONTRACT DOCUMENTS FOR

20RFP041620K-CRB

FULTON COUNTY JUDICIAL CENTER COMPLEX DDC CONVERSION PROJECT – PHASE II

For

DEPARTMENT OF REAL ESTATE AND ASSET MANAGEMENT

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OWNER - CONTRACTOR AGREEMENT

20RFP041620K-CRB: Fulton County Judicial Center Complex DDC Conversion Project - Phase II

Contractor: Control Concepts, LLC Project No. 20RFP041620K-CRB

Address: 3550 North Parkway, Suite 100 Cumming, GA 30040 Telephone: 770.888.0181

Contact: Todd Hughes, President Email: rblain@intreo.com

THIS AGREEMENT is effective as of the _____ day of _____, 2021, by and between Fulton County, a political subdivision of the State of Georgia (hereinafter called the "County"), and the above named CONTRACTOR in accordance with all provisions of this Construction Agreement ("Contract"), which consists of the following: Owner-Contractor Agreement, Owner's invitation for bid, instructions to bidders, bid form, performance bond, payment bond, acknowledgments, general conditions, special conditions, scope of work and specifications, plans, drawings, exhibits, addenda, Purchasing forms, Office of Contract Compliance Forms, Risk Management insurance provisions forms and written change orders.

The specific Exhibits of this Contract are as follows:

Exhibit A: General Conditions
Exhibit B: Special Conditions (if applicable)
Exhibit C: Addenda
Exhibit D: Bid Form
Exhibit E: Bonds (Bid, Payment & Performance)
Exhibit F: Scope of Work and Technical Specifications
Exhibit G: Exhibits
Exhibit H: Purchasing Forms
Exhibit I: Office of Contract Compliance Forms
Exhibit J: Risk Management Insurance Provisions Forms

WITNESSETH: That the said Contractor has agreed, and by these present does agree with the said County, for and in consideration of a Contract Price of **Six Million Eight Hundred Twenty Nine Thousand Eight Hundred Seventy Five Dollars,** ($**6,829,875.00**) and other good and valuable consideration, and under the penalty expressed on Bonds hereto attached, to furnish all equipment, tools, materials, skill, and labor of every description necessary to carry out and complete in good, firm, and workmanlike manner, the Work specified, in strict conformity with the Drawings and the Specifications hereinafter set forth, which Drawings and Specifications together with the bid submittals made by the Contractor, General Conditions, Special Provisions, Detailed Specifications, Exhibits, and this Construction Agreement, shall all form essential parts of this Contract. The Work covered by this Contract includes all Work indicated on Plans and Specifications and listed in the Bid entitled:

Project Number: **20RFP041620K-CRB**

Fulton County Judicial Center Complex DDC Conversion Project - Phase II

The Contractor, providing services as an Independent Contractor, shall commence the Work with adequate force and equipment within 10 days from receipt of Notice to Proceed ("NTP") from the County, and shall complete the work within **730** calendar days from the Notice to Proceed or the date work begins, whichever comes first. The Contractor shall remain responsible for performing, in accordance with the terms of the Contract, all work assigned prior to the expiration of the said

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calendar days allowed for completion of the work even if the work is not completed until after the expiration of such days. The Contractor shall agree that in the performance of this Contract he will comply with all lawful agreements, if any, which the contractor has made with any association, union or other entity, with respect to wages, salaries and working conditions, so as to cause inconvenience, picketing or work stoppage.

As full compensation for the faithful performance of this Contract, the County shall pay the Contractor in accordance with the General Conditions and the prices stipulated in the Bid, hereto attached.

It is further mutually agreed between the parties hereto that if, at any time after the execution of this Agreement and the Surety Bonds hereto attached for its faithful performance, the County shall deem the surety or sureties upon such bonds to be unsatisfactory, or, if, for any reason, such bonds cease to be adequate to cover the performance of the Work, the Contractor shall, at his expense, within five days after receipt of notice from the County so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the County. In such event no further payment to the Contractor shall be deemed to be due under this Agreement until such new or additional security for the faithful performance of the Work shall be furnished in manner and form satisfactory to the County.

The Contractor hereby assumes the entire responsibility and liability for any and all injury to or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, Servants, or employees, or by any of the Contractor's subcontractors or suppliers, and the Contractor shall indemnify and hold harmless the County, the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents, or any of their subcontractors from and against any and all loss and/or expense which they or any of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of County or Construction Manager negligence (except that no party shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged of record any judgment which may be rendered against the County and the Construction Manager arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County or the Construction Manager, the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify it and the Construction Manager, County's Commissioners, officers, employees, successors, assigns and agents from any and all claims, expense, loss, damages, or injury; and the County, in its discretion, may require the Contractor to furnish a surety bond satisfactory to the County providing for such protection and indemnity, which bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor. **[See General Conditions for similar provision]**

This Contract constitutes the full agreement between the parties, and the Contractor shall not sublet, assign, transfer, pledge, convey, sell or otherwise dispose of the whole or any part of this Contract or his right, title, or interest therein to any person, firm or corporation without the previous consent of the County in writing. Subject to applicable provisions of law, this Contract shall be in full force and effect as a Contract, from the date on which a fully executed and approved counterpart hereof is delivered to the Contractor and shall remain and continue in full force and effect until after the expiration of any guarantee period and the Contractor and his sureties are finally released by the County.

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This agreement was approved by the Fulton County Board of Commissioner on **February 17, 2021**, **Agenda Item# 21-0134**.

[SIGNATURES NEXT PAGE]

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Exhibit A
General Conditions

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GENERAL CONDITIONS

00700-1 FAMILIARITY WITH SITE

Execution of this agreement by the Contractor is a representation that the Contractor has visited the site, has become familiar with the local conditions under which the work is to be performed, and has correlated personal observations with the requirements of this agreement.

00700-2 CONTRACT DOCUMENTS

This agreement consists of Owner's invitation for bid, instructions to bidders, bid form, performance bond, payment bond, acknowledgments, the contract, general conditions, special conditions, specifications, plans, drawings, exhibits, addenda, and written change orders.

A. Notice of Award of Contract:

B. Execution of Contract Documents

Upon notification of Award of Contract, the Owner shall furnish the Contractor the conformed copies of Contract Documents for execution by the Contractor and the Contractor's surety.

Within ten (10) days after receipt the Contractor shall return all the documents properly executed by the Contractor and the Contractor's surety. Attached to each document shall be an original power-of-attorney for the person executing the bonds for the surety and certificates of insurance for the required insurance coverage.

After receipt of the documents executed by the Contractor and his surety with the power-of-attorney and certificates of insurance, the Owner shall complete the execution of the documents. Distribution of the completed documents will be made upon completion.

Should the Contractor and/or Surety fail to execute the documents within the time specified; the Owner shall have the right to proceed on the Bid Bond accompanying the bid.

If the Owner fails to execute the documents within the time limit specified, the Contractor shall have the right to withdraw the Contractor's bid without penalty.

Drawings and Specifications:

The Drawings, Specifications, Contract Documents, and all supplemental documents, are considered essential parts of the Contract, and requirements occurring in one are as binding as though occurring in all. They are intended to define, describe and provide for all Work necessary to complete the Project in an acceptable manner, ready for use, occupancy, or operation by the Owner.

In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

In cases where products or quantities are omitted from the Specifications, the description and quantities shown on the Drawings shall govern.

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Any ambiguities or need for clarification of the Drawings or Specifications shall be immediately reported to the FC Project Manager in writing. Any such ambiguity or need for clarification shall be handled by the FC Project Manager in writing. No clarification of the Drawings and Specifications hereunder by the FC Project Manager shall entitle the Contractor to any additional monies unless a Change Order has been processed as provided by "Changes in the Contract" hereof.

Any work done by the Contractor following a discovery of such differing site condition or ambiguity or need for clarification in the Contract Drawings and Specifications prior to a written report to the FC Project Manager shall not entitle the Contractor to additional monies and shall be done at the Contractor's risk.

The FC Project Manager will furnish the Contractor one (1) electronic copy of the Contract Drawings and the Specifications, one copy of which the Contractor shall have available at all times on the Project site.

00700-3 DEFINITIONS

The following terms as used in this agreement are defined as follows to the extent the definitions herein differ or conflict with those in the Instructions for Bidders, Section 00100, the definitions herein shall control.

Alternate bids – the amount stated in the bid or proposal to be added to or deducted from the amount of the base bid or base proposal if the corresponding change in project scope or alternate materials or methods of construction is accepted.

Base bid – the amount of money stated in the bid or proposal as the sum for which the bidder or proposer offers to perform the work.

Change Order - an alteration, addition, or deduction from the original scope of work as defined by the contract documents to address changes or unforeseen conditions necessary for project completion. A written order to the Contractor issued by the County pursuant to Fulton County Code Section 102-420 for changes in the work within the general scope of the contract documents, adjustment of the contract price, extension of the contract time, or reservation of determination of a time extension.

FC Project Manager - shall mean the individual designated in writing, by the DREAM Department as the FC Project Manager.

Contractor - shall mean the party of the second part to the Contract Agreement or the authorized and legal representative of such party.

Contract Documents- include the Contract Agreement, Contractor's Bid (including all documentation accompanying the Bid and any post-Bid documentation required by the County prior to the Notice of Award), Bonds, all Special Conditions, General Conditions, Supplementary Conditions, Specifications, Drawings and addenda, together with written amendments, change orders, field orders and the FC Project Manager 's written interpretations and clarifications issued in accordance with the General Conditions on or after the date of the Contract Agreement.

Shop drawing submittals reviewed in accordance with the General Conditions, geotechnical investigations and soils report and drawings of physical conditions in or

relating to existing surface structures at or contiguous to the site are not Contract Documents.

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Contract Price - The sum specified in the Agreement to be paid to the Contractor in consideration of the Work.

Contract Time - shall mean the number of consecutive calendar days as provided in the Contract Agreement for completion of the Work, to be computed from the date of Notice to Proceed.

Owner or County - shall mean Fulton County Government, party of the first part to the Contract Agreement, or its authorized and legal representatives.

Day - A calendar day of twenty-four hours lasting from midnight of one day to midnight the next day.

Director - Director of the [insert department name] Department of Fulton County, Georgia or the designee thereof.

Final Completion - shall mean the completion of all work as required in accordance with the terms and conditions of the contract documents.

Liquidated Damages - shall mean the amount, stated in the Contract Agreement, which the Contractor agrees to pay to the Owner for each consecutive calendar day beyond the Contract time required to complete the Project or for failing to comply with associated milestones. Liquidated Damages will end upon written notification from the Owner of Final Acceptance of the Project or upon written notification of from the Owner of completion of the milestone.

Notice to Proceed - A written communication issued by the County to the Contractor authorizing it to proceed with the work, establishing the date of commencement and completion of the work, and providing other direction to the Contractor.

Products - shall mean materials or equipment permanently incorporated into the work.

Project Manual - The Contract Documents.

Provide - shall mean to furnish and install.

Substantial Completion - The date certified by the FC Project Manager when all or a part of the work, as established pursuant to General Condition 0700-81, is sufficiently completed in accordance with the requirements of the contract documents so that the identified portion of the work can be utilized for the purposes for which it is intended.

Work or Project - All of the services specified, indicated, shown or contemplated by the contract documents, and furnishing by the Contractor of all materials, equipment, labor, methods, processes, construction and manufacturing materials and equipment, tools, plans, supplies, power, water, transportation and other things necessary to complete such services in accordance with the contract documents to insure a functional and complete facility.

00700-4 CODES

All codes, specifications, and standards referenced in the contract documents shall be the latest editions, amendments and revisions of such referenced standards in effect as of the date of the request for proposals for this contract.

00700-5 REVIEW OF CONTRACT DOCUMENTS

Before making its proposal to the County, and continuously after the execution of the agreement, the Contractor shall carefully study and compare the contract documents and

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shall at once report to the FC Project Manager any error, ambiguity, inconsistency or omission that may be discovered, including any requirement which may be contrary to any law, ordinance, rule, or regulation of any public authority bearing on the performance of the work. By submitting its proposal, the Contractor agrees that the contract documents, along with any supplementary written instructions issued by or through the FC Project Manager that have become a part of the contract documents, appear accurate, consistent and complete insofar as can be reasonably determined. If the Contractor has timely reported in writing any error, inconsistency, or omission to the FC Project Manager, has properly stopped the affected work until instructed to proceed, and has otherwise followed the instructions of the FC Project Manager, the Contractor shall not be liable to the County for any damage resulting from any such error, inconsistency, or omission in the contract documents. The Contractor shall not perform any portion of the work without the contract documents, approved plans, specifications, products and data, or samples for such portion of the work. For purposes of this section "timely" is defined as the time period in which the contractor discovers, or should have discovered, the error, inconsistency, or omission, with the exercise of reasonable diligence.

00700-6 STRICT COMPLIANCE

No observation, inspection, test or approval of the County or FC Project Manager shall relieve the Contractor from its obligation to perform the work in strict conformity with the contract documents except as provided in General Condition 00700-48.

00700-7 APPLICABLE LAW

All applicable State laws, County ordinances, codes, and rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to this agreement. The Contractor shall comply with the requirements of any Fulton County program concerning non-discrimination in contracting. All work performed within the right of way of the Georgia Department of Transportation and any railroad crossing shall be in accordance with Georgia Department of Transportation regulations, policies and procedures and, where applicable, those of any affected railroad. The Contractor shall comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work as specified and the Contractor agrees to indemnify and hold harmless the County, its officers, agents and employees, as well as the FC Project Manager and the Program Manager against any claim or liability arising from or based on the violation of any law, ordinance, regulation, order or decree affecting the conduct of the work, whether occasioned by the Contractor, his agents or employees.

00700-8 PERMITS, LICENSES AND BONDS

All permits and licenses necessary for the work shall be secured and paid for by the Contractor. If any permit, license or certificate expires or is revoked, terminated, or suspended as a result of any action on the part of the Contractor, the Contractor shall not be entitled to additional compensation or time. The Contractor shall obtain and keep in force at all times performance and payment bonds payable to Fulton County in penal amounts equal to 100% of the Contract price.

00700-9 TAXES

A. The Contractor shall pay all sales, retail, occupational, service, excise, old age benefit and unemployment compensation taxes, consumer, use and other similar taxes, as well as any other taxes or duties on the materials, equipment, and labor for the work provided by the Contractor which are legally enacted by any municipal,

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county, state or federal authority, department or agency at the time bids are received, whether or not yet effective. The Contractor shall maintain records pertaining to such taxes and levies as well as payment thereof and shall make the same available to the County at all reasonable times for inspection and copying. The Contractor shall apply for any and all tax exemptions which may be applicable and shall timely request from the County such documents and information as may be necessary to obtain such tax exemptions. The County shall have no liability to the Contractor for payment of any tax from which it is exempt.

B. The Contractor is obligated to comply with all local and State Sales and Use Tax laws. The Contractor shall provide the Owner with documentation to assist the Owner in obtaining sales and/or use tax refunds for eligible machinery and equipment used for the primary purpose of reducing or eliminating air or water pollution as provided for in Chapter 48-8-3 (36) and (37) of the Official Code of Georgia. All taxes shall be paid by the Contractor. All refunds will accrue to the Owner.

Acceptance of the project as complete and final payment will not be made by the Owner until the Contractor has fully complied with this requirement.

00700-10 DELINQUENT CONTRACTORS

The County shall not pay any claim, debt, demand or account whatsoever to any person firm or corporation who is in arrears to the County for taxes. The County shall be entitled to a counterclaim, back charge, and offset for any such debt in the amount of taxes in arrears, and no assignment or transfer of such debt after the taxes become due shall affect the right of the County to offset any taxes owed against said debt.

00700-11 LIEN WAIVERS

The Contractor shall furnish the County with evidence that all persons who have performed work or furnished materials pursuant to this agreement have been paid in full prior to submitting its demand for final payment pursuant to this agreement. A final affidavit, Exhibit A, must be completed, and submitted to comply with requirements of 00700-11. In the event that such evidence is not furnished, the County may retain sufficient sums necessary to meet all lawful claims of such laborers and materialmen. The County assumes no obligation nor in any way undertakes to pay such lawful claims from any funds due or that may become due to the Contractor.

00700-12 MEASUREMENT

All items of work to be paid for per unit of measurement shall be subject to inspection, measurement, and confirmation by the FC Project Manager.

00700-13 ASSIGNMENT

The Contractor shall not assign any portion of this agreement or moneys due there from (include factoring of receivables) without the prior written consent of the County. The

Contractor shall retain personal control and shall provide personal attention to the fulfillment of its obligations pursuant to this agreement. Any assignment without the express written consent of the County shall render this contract voidable at the sole option of the County.

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00700-14 FOREIGN CONTRACTORS

In the event that the Contractor is a foreign corporation, partnership, or sole proprietorship, the Contractor hereby irrevocably appoints the Secretary of State of Georgia as its agent for service of all legal process for the purpose of this contract only.

00700-15 INDEMNIFICATION

The Contractor hereby assumes the entire responsibility and liability for any and all injury to or death of any and all persons, including the Contractor's agents, servants, and employees, and in addition thereto, for any and all damages to property caused by or resulting from or arising out of any act or omission in connection with this contract or the prosecution of work hereunder, whether caused by the Contractor or the Contractor's agents, Servants, or employees, or by any of the Contractor's subcontractors or suppliers, and the Contractor shall indemnify and hold harmless the County, the FC Project Manager, County's Commissioners, officers, employees, successors, assigns and agents, or any of their subcontractors from and against any and all loss and/or expense which they or any of them may suffer or pay as a result of claims or suits due to, because of, or arising out of any and all such injuries, deaths and/or damage, irrespective of County or FC Project Manager negligence (except that no party shall be indemnified for their own sole negligence). The Contractor, if requested, shall assume and defend at the Contractor's own expense, any suit, action or other legal proceedings arising there from, and the Contractor hereby agrees to satisfy, pay, and cause to be discharged of record any judgment which may be rendered against the County and the FC Project Manager arising there from.

In the event of any such loss, expense, damage, or injury, or if any claim or demand for damages as heretofore set forth is made against the County or the FC Project Manager , the County may withhold from any payment due or thereafter to become due to the Contractor under the terms of this Contract, an amount sufficient in its judgment to protect and indemnify it and the FC Project Manager , County's Commissioners, officers, employees, successors, assigns and agents from any and all claims, expense, loss, damages, or injury; and the County, in its discretion, may require the Contractor to furnish a surety bond satisfactory to the County providing for such protection and indemnity, which bond shall be furnished by the Contractor within five (5) days after written demand has been made therefore. The expense of said Bond shall be borne by the Contractor.

00700-16 SUPERVISION OF WORK AND COORDINATION WITH OTHERS

The Contractor shall supervise and direct the work using the Contractor's best skill and attention. The Contractor shall be solely responsible for all construction methods and procedures and shall coordinate all portions of the work pursuant to the contract subject to the overall coordination of the FC Project Manager. All work pursuant to this agreement shall be performed in a skillful and workmanlike manner.

The County reserves the right to perform work related to the Project with the County's own forces and to award separate contracts in connection with other portions of the project, other work on the site under these or similar conditions of the contract, or work which has been extracted from the Contractor's work by the County.

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When separate contracts are awarded for different portions of the project or other work on the site, the term “separate contractor” in the Contract Documents in each case shall mean the contractor who executes each separate County Agreement.

The Contractor shall cooperate with the County and separate contractors in arranging the introduction and storage of materials and equipment and execution of their work and shall cooperate in coordinating connection of its work with theirs as required by the Contract Documents.

If any part of the Contractor’s Work depends for proper execution or results upon the work of the County or any separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the FC Project Manager any apparent discrepancies or defects in such other work that render it unsuitable for such proper execution and results **within fourteen (14) days** of discovery of such discrepancy or defect. Failure of the Contractor to so report in writing shall constitute an acceptance of the County’s or separate contractor’s work as fit and proper to receive the Work, except as to any defects which may subsequently become apparent in such work by others.

Any costs caused by defective or untimely work shall be borne by the party responsible, therefore.

Should the Contractor wrongfully cause damage to the work or property of the County or to other work or property on the site, including the work of separate contractors, the Contractor shall promptly remedy such damage at the Contractor’s expense.

Should the Contractor be caused damage by any other contractor on the Project, by reason of such other contractor’s failure to perform properly his contract with the County, no action shall lie against the County or the FC Project Manager inasmuch as the parties to this agreement are the only beneficiaries hereof and there are no third party beneficiaries and neither the County nor the FC Project Manager shall have liabilities therefore, but the Contractor may assert his claim for damages solely against such other contractor. The Contractor shall not be excused from performance of the contract by reason of any dispute as to damages with any other contractor or third party.

Where the Work of this Contract shall be performed concurrently in the same areas as other construction work, the Contractor shall coordinate with the FC Project Manager and the separate contractors in establishing mutually acceptable schedules and procedures that shall permit all jobs to proceed with minimum interference.

If a dispute arises between the Contractor and separate contractors as to their responsibility for cleaning up, the County may clean up and charge the cost thereof to the Contractor or contractors responsible therefore as the County shall determine to be just.

00700-17 ADMINISTRATION OF CONTRACT

The Program Manager and the FC Project Manager shall provide administration services as hereinafter described.

For the administration of this Contract, the FC Project Manager shall serve as the County’s primary representative during design and construction and until final payment to the Contractor is due. The FC Project Manager shall advise and consult with the County and the Program Manager. The primary point of contact for the Contractor shall be the FC Project Manager. All correspondence from the Contractor to the County shall be

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forwarded through the FC Project Manager. Likewise, all correspondence and instructions to the Contractor shall be forwarded through the FC Project Manager.

The FC Project Manager will determine in general that the construction is being performed in accordance with design and engineering requirements and will endeavor to guard the County against defects and deficiencies in the Work.

The FC Project Manager will not be responsible for or have control or charge of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, nor will it be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The FC Project Manager will not be responsible for or have control or charge over the acts or omissions of the Contractor, its engineers, consultants, subcontractors, or any of their agents or employees, or any other persons performing the Work.

Based on the FC Project Manager 's observations regarding the Contractor's Applications for Payment, the FC Project Manager shall determine the amounts owing to the Contractor, in accordance with the payment terms of the Contract, and shall issue Certificates for Payment in such amount to the County.

The FC Project Manager shall render interpretations necessary for the proper execution or progress of the Work. Either party to the Contract may make written requests to the FC Project Manager for such interpretations.

Claims, disputes and other matters in question between the Contractor and the County relating to the progress of the Work or the interpretation of the Contract Documents shall be referred to the FC Project Manager for interpretation.

All interpretations of the FC Project Manager shall be consistent with the intent of and reasonably inferable from the Contract Documents and shall be in writing or in graphic form.

Except as otherwise provided in this Contract, the FC Project Manager shall issue a decision on any disagreement concerning a question of fact arising under this Contract. The FC Project Manager shall reduce the decision to writing and mail or otherwise furnish a copy thereof to the Contractor. The decision of the FC Project Manager shall be final and conclusive unless, within thirty (30) days from the date of receipt of such copy, the Contractor files a written appeal with the Director of Public Works and mails or otherwise furnishes the FC Project Manager a copy of such appeal. The decision of the Director of Public Works or the Director's duly authorized representative for the determination of such appeals shall be final and conclusive. Such final decision shall not be pleaded in any suit involving a question of fact arising under this Contract, provided such is not fraudulent, capricious, arbitrary, so grossly erroneous as necessarily implying bad faith, or is not supported by substantial evidence. In connection with any appeal proceeding under this Article, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of Contractor's appeal. Pending any final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the Contract as directed by the FC Project Manager.

The FC Project Manager shall have authority to reject Work which does not conform to the Contract Documents. Whenever, in the FC Project Manager 's opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the County shall have authority to require special inspection or testing of the Work whether or not such Work be then fabricated, installed or completed. The Contractor shall pay for

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such special inspection or testing if the Work so inspected or tested is found not to comply with the requirements of the contract; the County shall pay for special inspection and testing if the Work is found to comply with the contract. Neither the FC Project Manager ’s authority to act under this Subparagraph, nor any decision made by the FC Project Manager in good faith either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the FC Project Manager to the Contractor, any subcontractor, any of their agents or employees, or any other person performing any of the Work.

The Contractor shall provide such shop drawings, product data, and samples as may be required by the FC Project Manager and/or as required by these Contract Documents.

The FC Project Manager shall conduct inspections to determine Substantial Completion and Final Completion and shall receive and forward to the County for review written warranties and related documents required by the Contract Documents and assembled by the Contractor. The FC Project Manager shall approve and issue Certificates for Payment upon compliance with Substantial and Final Completion requirements indicated in General Conditions 00700-81, 00700-82, 00700-84 and 00700-85 of this Agreement.

Except as provided in General Condition 00700-48*,* the Contractor shall not be relieved from the Contractor's obligations to perform the work in accordance with the contract documents by the activities or duties of the County or any of its officers, employees, or agents, including inspections, tests or approvals, required or performed pursuant to this agreement.

00700-18 RESPONSIBILITY FOR ACTS OF EMPLOYEES

The Contractor shall employ only competent and skilled personnel. The Contractor shall, upon demand from the FC Project Manager, immediately remove any superintendent, foreman or workman whom the FC Project Manager may consider incompetent or undesirable.

The Contractor shall be responsible to the County for the acts and omissions of the Contractor’s employees, subcontractors, and agents as well as any other persons performing work pursuant to this agreement for the Contractor.

00700-19 LABOR, MATERIALS, SUPPLIES, AND EQUIPMENT

Unless otherwise provided in this agreement, the Contractor shall make all arrangements with necessary support agencies and utility companies provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the execution and completion of the work.

00700-20 DISCIPLINE ON WORK SITE

The Contractor shall enforce strict discipline and good order among its employees and subcontractors at all times during the performance of the work, to include compliance with the Fulton County Drug Free Work Place Policy. The Contractor shall not employ any subcontractor who is not skilled in the task assigned to it. The FC Project Manager

may, by written notice, require the Contractor to remove from the work any subcontractor or employee deemed by the FC Project Manager to be incompetent.

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00700-21 HOURS OF OPERATION

All work at the construction site shall be performed after regular business hours of the Fulton County government, except upon the FC Project Manager's prior written consent to other work hours. It is further understood that the Contractor's construction schedule will be 5:00 PM – 8:00 AM each day. On the Weekends and Holidays, any work shall cease at 8:00AM the day when the tenant workday resumes. Contractors work schedule shall not violate Fulton County Noise Ordinance by working hours inconsistent with the Fulton County Noise Ordinance. The County's current noise ordinance or other applicable ordinance shall govern. If the Contractor desires to work in excess of this limit, the Contractor shall submit a written request to the FC Project Manager, a minimum of five days prior to the desired work date.

00700-22 FAMILIARITY WITH WORK CONDITIONS

The Contractor shall take all steps necessary to ascertain the nature and location of the work and the general and local conditions which may affect the work or the cost thereof. The Contractor's failure to fully acquaint itself with the conditions which may affect the work, including, but not limited to conditions relating to transportation, handling, storage of materials, availability of utilities, labor, water, roads, weather, topographic and subsurface conditions, other separate contracts to be entered into by the County relating to the project which may affect the work of the Contractor, applicable provisions of law, and the character and availability of equipment and facilities necessary prior to and during the performance of the work shall not relieve the Contractor of its responsibilities pursuant to this agreement and shall not constitute a basis for an equitable adjustment of the contract terms. The County reserves the right to perform with its own forces or to contract with other entities for other portions of the project work, in which case the Contractor's responsibility to assure its familiarity with work conditions hereunder shall include all coordination with such other contractors and the County necessary to insure that there is no interference between contractors as will delay or hinder any contractor in its prosecution of work on the project. The County assumes no responsibility for any understandings or representations concerning conditions of the work made by any of its officers, agents, or employees prior to the execution of this agreement.

00700-23 RIGHT OF ENTRY

The County reserves the right to enter the site of the work by such agent, including the FC Project Manager, as it may elect for the purpose of inspecting the work or installing such collateral work as the County may desire. The Contractor shall provide safe facilities for such access so that the County and its agents may perform their functions.

00700-24 NOTICES

Any notice, order, instruction, claim or other written communication required pursuant to this agreement shall be deemed to have been delivered or received as follows:

Upon personal delivery to the Contractor, its authorized representative, or the FC Project Manager on behalf of the County. Personal delivery may be accomplished by in-person hand delivery or bona fide overnight express service.

Three days after depositing in the United States mail a certified letter addressed to the Contractor or the FC Project Manager for the County. For purposes of mailed notices, the

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County's mailing address shall be 141 Pryor Street, 6th Floor, Atlanta, Georgia 30303, or as the County shall have otherwise notified the Contractor. The Contractor's mailing address shall be the address stated in its proposal or as it shall have most recently notified the FC Project Manager in writing.

00700-25 SAFETY

A. SAFETY, HEALTH AND LOSS PREVENTION

The Contractor shall be responsible for implementing a comprehensive project-specific safety, health and loss prevention program and employee substance abuse program for this project. All Sub-Contractors must either implement their own program or follow the Contractor's safety, health and loss prevention program and employee substance abuse program.

The Contractor's safety, health and loss prevention program and employee substance abuse program must meet or exceed all governmental regulations (OSHA, EPA, DOT, State, local), and any other specific Fulton County requirements

B. COUNTY'S SAFETY, HEALTH, AND LOSS PREVENTION PROCESS GUIDELINES AND REQUIREMENTS

The County and its agents reserve the right, but assume no duty, to establish and enforce safety, health, and loss prevention guidelines and to make the appropriate changes in the guidelines, for the protection of persons and property and to review the efficiency of all protective measures taken by the Contractor. The Contractor shall comply with all safety, health, and loss prevention process guidelines and requirements and changes made by the County or its agent(s). The issuance of any such guidelines or changes by the County or its agent(s) shall not relieve the Contractor of its duties and responsibilities under this Agreement, and the County or its agent(s) shall not thereby assume, nor be deemed to have assumed, any such duties or responsibilities of the Contractor.

C. COMPLIANCE OF WORK, EQUIPMENT, AND PROCEDURES WITH ALL APPLICABLE LAWS and REGULATIONS

All Work, whether performed by the Contractor or its Sub-Contractors of any tier, or anyone directly or indirectly employed by any of them, and all equipment, appliances, machinery, materials, tools and like items incorporated or used in the Work, shall be in compliance with and conform to:

1. All applicable laws, ordinances, rules, regulations and orders of any public, quasi-public or other governmental authority relating to the safety of persons and their protection against injury, specifically including, but in no event limited to, the Federal Occupational Safety and Health Act of 1970, as amended, and all rules and regulations now or hereafter in effect pursuant to said Act.

2. All rules, regulations, and requirements of the County or its agent(s) and its insurance carriers relating there to. In the event of a conflict or differing requirements the more stringent shall govern.

D. PROTECTION OF THE WORK

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1. The Contractor shall, throughout the performance of the Work, maintain adequate and continuous protection of all Work and temporary facilities against loss or damage from whatever cause, shall protect the property of the County and third parties from loss or damage from whatever cause arising out of the performance of the Work, and shall comply with the requirements of the County or its agent(s) and its insurance carriers, and with all applicable laws, codes, rules and regulations, (as same may be amended) with respect to the prevention of loss or damage to property as a result of fire or other hazards.

2. The County or its agent(s) may, but shall not be required to, make periodic inspections of the Project work area. In such event, however, the Contractor shall not be relieved of its aforesaid responsibilities and the County or its agent(s) shall not assume, nor shall it be deemed to have assumed, any responsibility otherwise imposed upon the assurance of Contractor by this Agreement.

E. SAFETY EQUIPMENT

1. The Contractor shall provide to each worker on the Project work area the proper safety equipment for the duties being performed by that worker and will not permit any worker on the Project work area who fails or refuses to use the same. The County or its agent shall have the right, but not the obligation, to order the removal of a worker from the Project work site for his/her failure to comply with safe practices or substance abuse policies.

F. EMERGENCIES

1. In any emergency affecting the safety of persons or property, or in the event of a claimed violation of any federal or state safety or health law or regulation, arising out of or in any way connected with the Work or its performance, the Contractor shall act immediately to prevent threatened damage, injury or loss and to remedy said violation. Failing such action, the County or its agent(s) may immediately take whatever steps it deems necessary including, but not limited to, suspending the Work as provided in this Agreement.

2. The County or its agent(s) may offset any and all costs or expenses of whatever nature, including attorneys' fees, paid or incurred by the County or its agent(s) (whether such fees are for in-house counsel or counsel retained by the County or its agent), in taking the steps authorized by Section 00700-25(G) (1) above against any sums then or thereafter due to the Contractor. The Contractor shall defend, indemnify and hold the County, its officers, agents, and employees harmless against any and all costs or expenses caused by or arising from the exercise by the County of its authority to act in an emergency as set out herein. If the Contractor shall be entitled to any additional compensation or extension of time

change order on account of emergency work not due to the fault or neglect of the Contractor or its Sub-Contractors, such additional compensation or extension of time shall be determined in accordance with General Condition 00700-52 and General Condition 00700-87 of this Agreement.

G. SUSPENSION OF THE WORK

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1. Should, in the judgment of the County or its agent(s), the Contractor or any Sub-Contractor fail to provide a safe and healthy work place, the County or its agent shall have the right, but not the obligation, to suspend work in the unsafe areas until deficiencies are corrected. All costs of any nature (including, without limitation, overtime pay, liquidated damages or other costs arising out of delays) resulting from the suspension, by whomsoever incurred, shall be borne by the Contractor.

2. Should the Contractor or any Sub-Contractor fail to provide a safe and healthy work place after being formally notified in writing by the County or its agents of such non-compliance, the contract may be terminated following the termination provision of the contract.

H. CONTRACTOR'S INDEMNITY OF THE COUNTY FOR CONTRACTOR'S NON-COMPLIANCE WITH SAFETY PROGRAM

1. The Contractor recognizes that it has sole responsibility to assure its Safety Program is implemented and to assure its construction services are safely provided. The Contractor shall indemnify, defend and hold the County and its agents harmless, from and against any and all liability (whether public or private), penalties (contractual or otherwise), losses, damages, costs, attorneys' fees, expenses, causes of action, claims or judgments resulting, either in whole or in part, from any failure of the Contractor, its Sub-Contractors of any tier or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, to comply with the safety requirements of the contract. The Contractor shall not be relieved of its responsibilities under the safety requirements of the Contract should the County or its agent(s) act or fail to act pursuant to its rights hereunder.

2. The Contractor shall not raise as a defense to its obligation to indemnify under this Subparagraph I any failure of those indemnified hereunder to assure Contractor operates safely, it being understood and agreed that no such failure shall relieve the Contractor from its obligation to assure safe operations or from its obligation to so indemnify. The Contractor also hereby waives any rights it may have to seek contribution, either directly or indirectly, from those indemnified hereunder.

3. In any and all claims against those indemnified hereunder by any employee of the Contractor, any Sub-Contractor of any tier or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Subparagraph I shall not be limited in any way as to the amount or type of damages, compensation or benefits payable by or for the Contractor or

any Sub-Contractor of any tier under any workers' compensation act, disability benefit or other employee benefit acts.

00700-26 BLASTING AND EXCAVATION

The Contractor acknowledges that it is fully aware of the contents and requirements of O.C.G.A. § 25-9-1 through 25-9-12 concerning blasting and excavation near underground gas pipes and facilities and shall fully comply therewith.

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00700-27 HIGH VOLTAGE LINES

The Contractor acknowledges that it is fully aware of the contents and requirements O.C.G.A. § 46-3-30 through 46-3-39 concerning safeguards against contact with high voltage lines, and the Contractor shall fully comply with said provisions.

00700-28 SCAFFOLDING AND STAGING

The Contractor acknowledges that it is the person responsible for employing and directing others to perform labor within the meaning of O.C.G.A. § 34-1-1 and agrees to comply with said provisions.

00700-29 CLEAN-UP

The Contractor shall clean up all refuse, rubbish, scrap materials, and debris caused by its operations to the end that the site of the work shall present a neat, orderly and workmanlike appearance at all times.

00700-30 PROTECTION OF WORK

The Contractor shall be responsible for maintenance and protection of the work, which shall include any County-furnished supplies, material, equipment, until final completion of this agreement and acceptance of the work as defined herein. Any portion of the work suffering injury, damage or loss shall be considered defective and shall be corrected or replaced by the Contractor without additional cost to the County.

00700-31 REJECTED WORK

The Contractor shall promptly remove from the project all work rejected by the FC Project Manager for failure to comply with the contract documents and the Contractor shall promptly replace and re-execute the work in accordance with the contract documents and without expense to the County. The Contractor shall also bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement.

00700-32 DEFECTIVE WORK

If the Contractor defaults or neglects to carry out any portion of the work in accordance with the contract documents, and fails within three days after receipt of written notice from the FC Project Manager to commence and continue correction of such default or neglect with diligence and promptness, the County may, after three days following receipt by the Contractor of an additional written notice and without prejudice to any other remedy the County may have, make good such deficiencies and complete all or any portion of any work through such means as the County may select, including the use of a separate Contractor. In such case, an appropriate change order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies. In the event the payments then or thereafter due the Contractor are

not sufficient to cover such amount; the Contractor shall pay the difference to the County on demand.

The County may, at its option, accept defective or nonconforming work instead of requiring its removal or correction. In such case, a change order shall be issued reducing the price due the contractor to the extent appropriate and equitable. Such contract price adjustment shall be affected whether or not final payment has been made.

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00700-33 WARRANTY OF NEW MATERIALS

The Contractor warrants to the County that all materials and equipment furnished under this contract will be new unless otherwise specified, and the Contractor further warrants that all work will be of good quality, free from faults and defects, and in conformance with the contract documents. The warranty set forth in this paragraph shall survive final acceptance of the work.

00700-34 CONTRACTOR'S WARRANTY OF THE WORK

If within one year after the date of issuance of the certificate of final payment pursuant to General Condition 84, or within such longer period of time as may be prescribed by law or by the term of any applicable special warranty required by the contract documents, any of the work is found to be defective or not in accordance with the contract documents, the Contractor shall correct such work promptly after receipt of written notice from the FC Project Manager to do so. This obligation shall survive both final payment for the work and termination of the contract.

00700-35 ASSIGNMENT OF MANUFACTURERS' WARRANTIES

Without limiting the responsibility or liability of the Contractor pursuant to this agreement, all warranties given by manufacturers on materials or equipment incorporated in the work are hereby assigned by the Contractor to the County. If requested, the Contractor shall execute formal assignments of said manufacturer's warranties to the County. All such warranties shall be directly enforceable by the County.

00700-36 WARRANTIES IMPLIED BY LAW

The warranties contained in this agreement, as well as those warranties implied by law, shall be deemed cumulative and shall not be deemed alternative or exclusive. No one or more of the warranties contained herein shall be deemed to alter or limit any other.

00700-37 STOP WORK ORDERS

In the event that the Contractor fails to correct defective work as required by the contract documents or fails to carry out the work in accordance with contract documents, the FC Project Manager, in writing, may order the Contractor to stop work until the cause for such order has been eliminated. This right of the County to stop work shall not give rise to any duty on the part of the County or the FC Project Manager to execute this right for the benefit of the Contractor or for any other person or entity.

00700-38 TERMINATION FOR CAUSE

If the Contractor is adjudged bankrupt, makes a general assignment for the benefit of creditors, suffers the appointment of a receiver on account of its insolvency, fails to supply sufficient properly skilled workers or materials, fails to make prompt payment to subcontractors or materialmen, disregards laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, fails to diligently prosecute the work, or is

otherwise guilty of a material violation of this agreement and fails within seven days after receipt of written notice to commence and continue correction of such default, neglect, or violation with diligence and promptness, the County may, after seven days following receipt by the Contractor of an additional written notice and without prejudice to any other remedy the County may have, terminate the employment of the Contractor and take possession of the site as well as all materials, equipment, tools, construction equipment and machinery thereon. The County may finish the work by whatever methods the County

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deems expedient. In such case, the Contractor shall not be entitled to receive any further payment until the work is completed.

Upon completion of the work, the County shall determine in its sole discretion whether the Contractor is due any compensation for those services the Contractor performed prior to the termination to the satisfaction of the County ("Unpaid Satisfactory Work"), and shall compensate Contractor for the same. The County shall further determine in its sole discretion whether the County's completion of the work was made more costly as a result of failures, acts, or omissions of the Contractor, and if so, shall deduct such amounts ("Overages") from any amounts that may be due to the Contractor. In the event that the Overages exceed the Unpaid Satisfactory Work, the Contractor shall immediately pay the difference to the County on demand. These obligations for payment shall survive the termination of the contract. Termination of this agreement pursuant to this paragraph may result in disqualification of the Contractor from bidding on future County contracts.

00700-39 TERMINATION FOR CONVENIENCE

The County may, at any time upon written notice to the Contractor, terminate the whole or any portion of the work for the convenience of the County. The effective date of the termination shall be provided in the written notice. Said termination shall be without prejudice to any right or remedy of the County provided herein. In addition, in the event this agreement has been terminated by the County through the Termination for Cause provisions due to a claim of default by the Contractor, and it is later determined that the Contractor was not in default pursuant to the provisions of this agreement at the time of termination, then such termination shall be considered a Termination for Convenience pursuant to this paragraph and administered according to the provisions related to Termination for Convenience set out in this Contract.

00700-40 TERMINATION FOR CONVENIENCE - PAYMENT

If the Contract is terminated for convenience by the Owner as provided in this article, Contractor will be paid compensation for those services actually performed as approved by the Owner or his representative. Partially completed tasks will be compensated for based on a signed statement of completion prepared by the Project Manager and submitted to the Contractor which shall itemize each task element and briefly state what work has been completed and what work remains to be done. Contractor shall also be paid for reasonable costs for the orderly filing and closing of the project.

00700-41 TERMINATION FOR CONVENIENCE - PAYMENT LIMITATIONS

Except for normal spoilage, and except to the extent that the County shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor the fair value, as determined by the FC Project Manager , of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the County or to another buyer.

00700-42 COST TO CURE

If the County terminates for cause the whole or any part of the work pursuant to this agreement, then the County may procure upon such terms and in such manner as the FC Project Manager may deem appropriate, supplies or services similar to those so terminated, for the purpose of completing the work for which the Contractor was contractually engaged, and the Contractor shall be liable to the County for any excess

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costs for such similar supplies or services. The Contractor shall continue the performance of this agreement to the extent not terminated hereunder.

00700-43 ATTORNEY'S FEES

Should the Contractor default pursuant to any of the provisions of this agreement, the Contractor and its surety shall pay to the County such reasonable attorney's fees as the County may expend as a result thereof and all costs, expenses, and filing fees incidental thereto.

00700-44 CONTRACTOR'S RESPONSIBILITIES UPON TERMINATION

After receipt of a notice of termination from the County, and except as otherwise directed by the FC Project Manager , the Contractor shall:

1. Stop work under the contract on the date and to the extent specified in the notice of termination;
2. Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the work under the agreement as is not terminated;
3. Unless otherwise directed by the FC Project Manager, terminate all orders and subcontracts to the extent that they relate to the performance of work terminated by the notice of termination;
4. Assign to the County in the manner, at the times, and to the extent directed by the FC Project Manager , all of the rights, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the County shall have the right, at its discretion, to settle or pay any and all claims arising out of the termination of such orders or subcontracts;
5. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts with the approval or ratification of the FC Project Manager, to the extent the FC Project Manager may require, which approval or ratification shall be final for all purposes;
6. Transfer title and deliver to the entity or entities designated by the FC Project Manager, in the manner, at the times, and to the extent, if any, directed by the FC Project Manager, and to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the work as has been terminated:
    a. The fabricated or un-fabricated parts, work, and progress, partially completed supplies, and equipment, materials, parts, tools, dyes, jigs, and other fixtures, completed work, supplies, and other material produced as a part of or acquired in connection with the
    b. performance of the work terminated by the notice of termination; and
    c. The completed or partially completed plans, drawings, information, and other property to the work.
7. Use its best efforts to sell in the manner, at the times, to the extent, and at the prices directed or authorized by the FC Project Manager, any property described in Section 6 of this paragraph, provided, however, that the

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Contractor shall not be required to extend credit to any buyer and further provided that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the County to the Contractor pursuant to this agreement.

8. Complete performance of such part of the work as shall not have been terminated by the notice of termination; and

9. Take such action as may be necessary, or as the FC Project Manager may direct, for the protection and preservation of the property related to the agreement which is in the possession of the Contractor and in which the County has or may acquire an interest.

00700-45 RECORDS

The Contractor shall preserve and make available to the County all of its records, books, documents and other evidence bearing on the costs and expenses of the Contractor and any subcontractor pursuant to this agreement upon three days advance notice to the Contractor.

00700-46 DEDUCTIONS

In arriving at any amount due the Contractor pursuant to the terms of this agreement, there shall be deducted all liquidated damages, advance payments made to the Contractor applicable to the termination portion of the contract, the amount of any claim which the County may have against the Contractor, the amount determined by the FC Project Manager to be necessary to protect the County against loss due to outstanding potential liens or claims, and the agreed price of any materials acquired or sold by the Contractor and not otherwise recovered by or credited to the County.

00700-47 REIMBURSEMENT OF THE COUNTY

In the event of termination for cause or convenience, the Contractor shall refund to the County any amount paid by the County to the Contractor in excess of the costs properly reimbursable to the Contractor.

00700-48 SUSPENSION, INTERRUPTION, DELAY, DAMAGES

The Contractor shall be entitled to only those damages and that relief from termination by the County as specifically set forth in this agreement. The Construction Manager may issue a written order requiring the Contractor to suspend, delay or interrupt all or any part of the work for such period of time as the County may determine to be appropriate for the convenience of the County. If the Construction Manager issues a written order requiring the Contractor to suspend, delay or interrupt all or any part of the work and if the performance of the work is interrupted for an unreasonable period of time by an act of the County or any of its officers, agents, employees, contractors, or consultants in the administration of this agreement, an equitable adjustment may be made for any increase in the Contractor's costs of performance and any increase in the time required for performance of the work necessarily caused by the unreasonable suspension, delay, or interruption. Any equitable adjustment shall be reduced to writing and shall constitute a modification to this agreement. In no event, however, shall an equitable adjustment be made to the extent that performance of this agreement would have been suspended, delayed or interrupted by any other cause, including the fault or negligence of the Contractor. No claim for an equitable adjustment pursuant to this paragraph shall be permitted before the Contractor shall have notified the Construction Manager in writing of the act or failure to act involved, and no claim shall be allowed unless asserted in writing

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to the Construction Manager within ten days after the termination of such suspension, delay or interruption.

00700-49 COMMENCEMENT AND DURATION OF WORK

The County may issue a Notice to Proceed at any time within 120 days following execution of the contract by the County. The Contractor shall commence work pursuant to this agreement within ten days of mailing or delivery of written notice to proceed. The Contractor shall diligently conduct the work to completion within the time specified therefore in the Agreement. The capacity of the Contractor's construction and manufacturing equipment and plan, sequence and method of operation and forces employed, including management and supervisory personnel, shall be such as to insure completion of the work within the time specified in the Agreement. The Contractor and County hereby agree that the contract time for completion of the work is reasonable taking into consideration the average climatic conditions prevailing in the locality of the work and anticipated work schedules of other contractors whose activities are in conjunction with or may affect the work under this contract.

00700-50 TIME OF THE ESSENCE

All time limits stated in this agreement are of the essence of this contract.

00700-51 IMPACT DAMAGES

Except as specifically provided pursuant to a stop work order or change order, the Contractor shall not be entitled to payment or compensation of any kind from the County for direct or indirect or impact damages including, but not limited to, costs of acceleration arising because of delay, disruption, interference or hindrance from any cause whatsoever whether such delay, disruption, interference or hindrance is reasonable or unreasonable, foreseeable or unforeseeable, or avoidable, provided, however, that this provision shall not preclude the recovery of damages by the Contractor for hindrances or delays due solely to fraud or bad faith on the part of the County, its agents, or employees. The Contractor shall be entitled only to extensions in the time required for performance of the work as specifically provided in the contract.

00700-52 DELAY

The Contractor may be entitled to an extension of the contract time, but not an increase in the contract price or damages, for delays arising from unforeseeable causes beyond the control and without the fault or negligence of the Contractor or its subcontractors for labor strikes, acts of God, acts of the public enemy, acts of the state, federal or local government in its sovereign capacity, by acts of another separate contractor, or by an act or neglect of the County.

00700-53 INCLEMENT WEATHER

The Contractor shall not be entitled to an extension of the contract time due to normal inclement weather. Unless the Contractor can substantiate to the satisfaction of the FC Project Manager that there was greater than normal inclement weather and that such greater than normal inclement weather actually delayed the work, the Contractor shall not be entitled to an extension of time therefore. The following shall be considered the normal inclement weather days for each month listed, and extensions of time shall be granted in increments of not less than one half day only for inclement weather in excess of the days set out.

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January	10 days
February	10 days
March	7 days
April	6 days
May	4 days
June	3 days
July	4 days
August	2 days
September	2 days
October	3 days
November	6 days
December	9 days

00700-54 DELAY - NOTICE AND CLAIM

The Contractor shall not receive an extension of time unless a Notice of Delay is filed with the FC Project Manager within ten days of the first instance of such delay, disruption, interference or hindrance and a written Statement of the Claim is filed with the FC Project Manager within 20 days of the first such instance. In the event that the Contractor fails to comply with this provision, it waives any claim which it may have for an extension of time pursuant to this agreement.

00700-55 STATEMENT OF CLAIM - CONTENTS

The Statement of Claim referenced in Article 00700-54 shall include specific information concerning the nature of the delay, the date of commencement of the delay, the construction activities affected by the delay, the person or organization responsible for the delay, the anticipated extent of the delay, and any recommended action to avoid or minimize the delay.

00700-56 WORK BEHIND SCHEDULE, REMEDY BY CONTRACTOR

If the work actually in place falls behind the currently updated and approved schedule, and it becomes apparent from the current schedule that work will not be completed within the contract time, the Contractor agrees that it will, as necessary, or as directed by the FC Project Manager , take action at no additional cost to the County to improve the progress of the work, including increasing manpower, increasing the number of working hours per shift or shifts per working day, increasing the amount of equipment at the site, and any other measure reasonably required to complete the work in a timely fashion.

00700-57 DILIGENCE

The Contractor's failure to substantially comply with the requirements of the preceding paragraph may be grounds for determination by the County that the Contractor is failing to prosecute the work with such diligence as will insure its completion within the time specified. In such event, the County shall have the right to furnish, from its own forces or by contract, such additional labor and materials as may be required to comply with the schedule after 48 hours written notice to the Contractor, and the Contractor shall be liable for such costs incurred by the County.

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00700-58 SET-OFFS

Any monies due to the Contractor pursuant to the preceding paragraph of this agreement may be deducted by the County against monies due from the County to the Contractor.

00700-59 REMEDIES CUMULATIVE

The remedies of the County under Articles 00700-56, 00700-57, and 00700-58 are in addition to and without prejudice to all of the rights and remedies of the County at law, in equity, or contained in this agreement.

00700-60 TITLE TO MATERIALS

No materials or supplies shall be purchased by the Contractor or by any Subcontractor subject to any chattel mortgage or under a conditional sales contract or other agreement by which any interest is retained by the seller. The Contractor hereby warrants that it has good and marketable title to all materials and supplies used by it in the work, and the Contractor further warrants that all materials and supplies shall be free from all liens, claims, or encumbrances at the time of incorporation in the work.

00700-61 INSPECTION OF MATERIALS

All materials and equipment used in the construction of the project shall be subject to adequate inspection and testing in accordance with accepted standards and in accordance with the requirements of the contract documents. Additional tests performed after the rejection of materials or equipment shall be at the Contractor's expense.

00700-62 FC PROJECT MANAGER ’S PRESENCE DURING TESTING

All tests performed by the Contractor shall be witnessed by the FC Project Manager unless the requirement therefore is waived in writing. The FC Project Manager may perform additional tests on materials previously tested by the Contractor, and the Contractor shall furnish samples for this purpose as requested.

00700-63 MATERIALS INCORPORATED IN WORK

The Contractor shall furnish all materials and equipment to be incorporated in the work. All such materials or equipment shall be new and of the highest quality available. Manufactured materials and equipment shall be obtained from sources which are currently manufacturing such materials, except as otherwise specifically approved by the FC Project Manager .

00700-64 STORAGE OF MATERIALS

Materials and equipment to be incorporated in the work shall be stored in such a manner as to preserve their quality and fitness for the work and to facilitate inspection.

00700-65 PAYROLL REPORTS

The Contractor may be required to furnish payroll reports to the FC Project Manager as required by the Owner Controlled Insurance Program.

00700-66 CONTRACTORS' REPRESENTATIVE

Before beginning work, the Contractor shall notify the FC Project Manager in writing of one person within its organization who shall have complete authority to supervise the work, receive orders from the FC Project Manager, and represent the Contractor in all matters arising pursuant to this agreement. The Contractor shall not remove its representative without first designating in writing a new representative. The Contractor's

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representative shall normally be present at or about the site of work while the work is in progress. When neither the Contractor nor its representative is present at the work site, the superintendent, foreman, or other of the Contractor' employee in charge of the work shall be an authorized representative of the Contractor.

00700-67 SPECIALTY SUB-CONTRACTORS

The Contractor may utilize the services of specialty subcontractors on those parts of the project which, under normal contracting practices, are performed by specialty subcontractors. The Contractor shall not award more than seventy-five percent of the work to subcontractors.

00700-68 INSPECTION BY THE FC PROJECT MANAGER

All work pursuant to this agreement shall be subject to inspection by the FC Project Manager for conformity with contract drawings and specifications. The Contractor shall give the FC Project Manager reasonable advance notice of operations requiring special inspection of a portion of the work.

00700-69 WORK COVERED PRIOR TO FC PROJECT MANAGER 'S INSPECTION

In the event that work is covered or completed without the approval of the FC Project Manager , and such approval is required by the specifications or required in advance by the FC Project Manager , the Contractor shall bear all costs involved in inspection notwithstanding conformance of such portion of the work to the contract drawings and specifications.

00700-70 SCHEDULING OF THE WORK

The work of this contract shall be planned, scheduled, executed, and reported as required by the Contract Documents.

00700-71 PROGRESS ESTIMATES

The Contractor shall prepare a written report for the FC Project Manager 's approval, on County forms, of the total value of work performed and materials and equipment obtained to the date of submission. Such a report must accompany each request for a progress payment and is subject to review and approval by the FC Project Manager. Approval of a progress estimate or tendering of a progress payment shall not be considered an approval or acceptance of any work performed, and all estimates and payments shall be subject to correction in subsequent estimates. Progress payments shall be made for all completed activities and for materials suitably stored on-site.

00700-72 PROGRESS PAYMENTS

Upon approval of each monthly estimate of work performed and materials furnished, the FC Project Manager shall approve payment to the Contractor for the estimated value of such work, materials, and equipment, less the amount of all prior payments and any liquidated damages. The Contractor will be paid 100 percent, less retainage, of the cost of materials received and properly stored on-site but not incorporated into the work. Payments for materials or equipment stored on the site shall be conditioned upon submission by the Contractor of bills of sale to establish the County's title to such materials or equipment. The Contractor's request for payment shall provide sufficient detail as to the work completed or materials purchased for which payment is requested to permit meaningful review by the FC Project Manager.

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The Contractor shall submit a "draft" pay application for approval by the FC Project Manager, prior to submitting their final pay application to Accounts Payable.

00700-73 TIME OF PAYMENT

The Contractor will be paid within 45 days following receipt of an approved Progress Estimate. The Contractor expressly agrees that the payment provisions within this Contract shall supersede the rates of interest, payment periods, and contract and subcontract terms provided for under the Georgia Prompt Pay Act, O.C.G.A. §13-11-1 et seq., and that the rates of interest, payment periods, and contract and subcontract terms provided for under the Prompt Pay Act shall have no application to this Contract. The County shall not be liable for any late payment interest or penalty.

Submittal of Invoices: Final Approved nvoices shall be submitted as follows:

Via Mail:
Fulton County Government
141 Pryor Street, SW
Suite 7001
Atlanta, Georgia 30303
Attn: Finance Department – Accounts Payable

OR

Via Email:
Email: Accounts.Payable@fultoncountyga.gov

At minimum, original invoices must reference all of the following information:

1) Vendor Information
   a. Vendor Name
   b. Vendor Address
   c. Vendor Code
   d. Vendor Contact Information
   e. Remittance Address

2) Invoice Details
   a. Invoice Date
   b. Invoice Number (uniquely numbered, no duplicates)
   c. Purchase Order Reference Number
   d. Date(s) of Services Performed
   e. A written report of the total value of work performed and materials and equipment obtained to the date of submission

3) Fulton County Department Information (needed for invoice approval)
   a. Department Name
   b. Department Representative Name

00700-74 RETAINAGE

The County shall retain from each progress payment ten percent of the estimated value of the work performed until the progress payments, including retainage, total 50 percent of the contract price. If a contract includes two or more projects or assignments that have

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been separately priced and have separate budgets, and the performances of such projects or assignments are not related to or dependent upon the performance of any other, the 50 per cent limit shall be based upon the price for each individual project or assignment. Thereafter, no further retainage shall be withheld so long as the Contractor is making satisfactory progress to insure completion of the work within the time specified, therefore. The County may reinstate the ten percent retainage in the event the FC Project Manager determines that the Contractor is not making satisfactory progress to complete the work within the time specified in this agreement or in the event that the FC Project Manager provides a specific cause for such withholding. The County may also withhold retainage upon substantial completion of the work as provided in O.C.G.A. §13-10-81(c). Interest may be paid upon the retainage in accordance with Georgia law.

00700-75 PAYMENT OF SUBCONTRACTORS

The Contractor shall promptly pay each subcontractor upon the receipt of payment from the County. Such payment shall be made from the amount paid to the Contractor pursuant to the subcontractor's work. The Contractor shall also maintain the records of the percentage retained from payments to the Contractor pursuant to such subcontractor's work. The Contractor shall procure agreements from each subcontractor requiring each subcontractor to pay their subcontractors, agents and employees in a similar manner. The County reserves the right to inquire of any subcontractor, supplier, materialmen, or subconsultant, the status of any indebtedness of the Contractor. The County further reserves the right to require the Contractor to designate on each instrument of payment exceeding $400.00 to subcontractors, suppliers, materialmen, and subconsultants that such payment is on account of the work under this Contract.

00700-76 COUNTY'S RESPONSIBILITIES TO SUBCONTRACTORS

Neither the County nor the FC Project Manager shall have any obligation to pay any subcontractor except as otherwise required by law.

00700-77 PROGRESS PAYMENTS - ACCEPTANCE OF WORK

Certification of progress payments, as well as the actual payment thereof, shall not constitute the County’s acceptance of work performed pursuant to this agreement.

00700-78 PAYMENTS IN TRUST

All sums paid to the Contractor pursuant to this agreement are hereby declared to constitute trust funds in the hands of the contractor to be applied first to the payment of

claims of subcontractors, laborers, and suppliers arising out of the work, to claims for utilities furnished and taxes imposed, and to the payment of premiums on surety and other bonds and on insurance for any other application.

00700-79 JOINT PAYMENTS

The County reserves the right to issue any progress payment or final payment by check jointly to the Contractor and any subcontractor or supplier.

00700-80 RIGHT TO WITHHOLD PAYMENT

The FC Project Manager may decline to approve payment and may withhold payment in whole or in part to the extent reasonable and necessary to protect the County against loss due to defective work, probable or actual third party claims, the Contractor's failure to pay subcontractors or materialmen, reasonable evidence that the work will not be completed

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within the contract time or contract price or damage to the County or any other contractor on the project.

00700-81 CERTIFICATE OF SUBSTANTIAL COMPLETION

Upon the Contractor's submission of a request for a certificate of Substantial Completion, the FC Project Manager shall inspect the work and determine whether the work is Substantially Complete. If the work is Substantially Complete, the FC Project Manager shall issue a certificate of Substantial Completion of the work which shall establish the date of Substantial Completion, shall state the responsibilities of the County and the Contractor for security, maintenance, heat, utilities, damage to the work and insurance, and shall fix the time within which the Contractor shall complete the items submitted by the Contractor as requiring correction or further work. The certificate of substantial completion of the work shall be submitted to the County and the Contractor for their written acceptance of the responsibilities assigned to them pursuant to such certificate.

If in the sole opinion of the FC Project Manager, the work is not substantially complete, the FC Project Manager shall notify the Contractor of such, in writing, and outline requirements to be met to achieve Substantial Completion.

00700-82 PAYMENT UPON SUBSTANTIAL COMPLETION

Upon Substantial Completion of the work and upon application by the Contractor and approval by the FC Project Manager, the County shall make payment reflecting 100% work completed, less value of work remaining as determined by FC Project Manager and any authorized retainage.

00700-83 COMMENCEMENT OF WARRANTIES

Warranties required by this agreement shall commence on the date of final completion of the project as determined under Article 00700-84 unless otherwise provided in the certificate of Substantial Completion.

00700-84 FINAL PAYMENT - WAIVER OF CLAIMS, DISPUTE OF FINAL PAYMENT

The acceptance of the Substantial Completion payment shall constitute a waiver of all claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of application for payment at Substantial Completion and except for the retainage sums due at final acceptance. Following the FC Project Manager ’s issuance of the certificate of Substantial Completion and the Contractor's

completion of the work pursuant to this agreement, the Contractor shall forward to the FC Project Manager a written notice that the work is ready for final inspection and acceptance. If after inspection the FC Project Manager certifies that the work is complete and issues written notification of such to the Contractor, the Contractor shall forward to the FC Project Manager a final application for payment. The FC Project Manager shall issue a certificate for payment, which shall approve final payment to the Contractor and shall establish the date of final completion.

In the event the Contractor timely disputes the amount of the final payment, the amount due the Contractor shall be deemed by the Contractor and the County to be an unliquidated sum and no interest shall accrue or be payable on the sum finally determined to be due to the Contractor for any period prior to final determination of such sum, whether such determination be by agreement of the Contractor and the County or by final judgment of the proper court in the event of litigation between the County and the Contractor. The Contractor specifically waives and renounces any and all rights it may have under

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O.C.G.A. §13-6-13 and agrees that in the event suit is brought by the Contractor against the County for any sum claimed by the Contractor under the Contract or for any extra or additional work, no interest shall be awarded on any sum found to be due from the County to the Contractor in the final judgment entered in such suit. All final judgments shall draw interest at the legal rate, as specified by law.

00700-85 DOCUMENTATION OF COMPLETION OF WORK

Neither the final payment nor the remaining retainage shall become due until the Contractor submits the following documents to the FC Project Manager:

a. An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the work have been paid other otherwise satisfied;

b. The surety's consent to final payment; and

c. Any other data reasonably required by the County or FC Project Manager *establishing* payment or satisfaction of all such obligations, including releases, waivers of liens, and documents of satisfaction of debts.

In the event that a subcontractor refuses to furnish a release or waiver as required by the County or FC Project Manager, the Contractor may furnish a bond satisfactory to the County to indemnify the County against such loss. In the event that any lien or indebtedness remains unsatisfied after all payments are made, the contractor shall refund to the County all moneys that the County may become compelled to pay in discharging such lien or other indebtedness, including all costs and reasonable attorney's fees.

00700-86 GOVERNING LAW

Each and every provision of this agreement shall be construed in accordance with and governed by Georgia law. The parties acknowledge that this contract is executed in Fulton County, Georgia and that the contract is to be performed in Fulton County, Georgia. Each party hereby consents to the Fulton Superior Court's sole jurisdiction over any dispute which arises as a result of the execution or performance of this agreement, and each party hereby waives any and all objections to venue in the Fulton Superior Court.

00700-87 CHANGES IN THE WORK

A. CHANGE ORDERS

1. A Change Order is a written order to the Contractor signed to show the approval and the authorization of the County, issued after execution of the Contract, authorizing a change in the Work and/or an adjustment in the Contract Sum or the Contract Time. Change Orders shall be written using forms designated by the County with Contractor providing supporting documentation as required by the FC Project Manager. The Contract Sum and the Contract Time may be changed only by approved Change Order pursuant to Fulton County Procedure 800-6. The amount payable by the Change Order is payment in full for all direct and indirect costs incurred and related to the work under said Change Order, including but not limited to delays, imports, acceleration, disruption and extended overhead. A Change Order signed by the Contractor indicates the Contractor’s agreement therewith, including the adjustment in either or both of the Contract Sum or the Contract Time.

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2. The County, without invalidating the Contract, may order changes in the Work within the general scope of the Contract as defined herein. The time allowed for performance of the work and the contract price to be paid to the Contractor may be adjusted accordingly.

3. The cost or credit to the County resulting from a change in the Work shall be determined in one or more of the following ways:

   a. By mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

   b. By unit prices stated in the Contract Documents or subsequently agreed upon;

   c. By cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

   d. By the method provided in Subparagraph A4 below.

4. If none of the methods set forth in Subparagraphs 3a, 3b, or 3c above is agreed upon, the Contractor, provided a written order signed by the FC Project Manager is received, shall promptly proceed with the Work involved. The cost of such Work shall then be determined by the FC Project Manager on basis of the reasonable expenditures and savings of those performing the Work attributable to the change. The cost of the change shall include only the items listed in Subparagraph 5a below, and in the case of either a decrease or an increase in the Contract Sum, an allowance for overhead and profit in accordance with the schedules set forth in Subparagraphs 5b and 6 below shall be applied to the cost or credit.

   a. In such case, and also under Subparagraph 3a above, the Contractor shall keep and present, in such form as the FC Project Manager may prescribe, an itemized accounting of all actual costs expended, together with appropriate supporting data for inclusion in a Change Order.

   b. All hourly rate charges shall be submitted to the FC Project Manager for prior review and approval. All hourly rate charges shall be properly supported as required by the FC Project Manager with certified payrolls, or their acceptable equivalent. When authorized to proceed for a given change and actual expenditures have been made prior to execution of a Change Order for the entire change, such actual expenditures may be summarized monthly, and if approved, incorporated into a Change Order. When both additions and credits covering related Work or substitutions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of the net increase or decrease, if any, with respect to that change.

5. In Subparagraphs 3 and 4 above, the items included in “Cost and “Overhead” shall be based on the following schedule:

   a. Unless otherwise provided in the Contract Documents, “Cost” shall be limited to the following: cost of materials incorporated into the Work, including sales tax and cost of delivery; cost of direct labor

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(labor cost may include a pro rata share of foreman's account of the change) including social security, old age and unemployment insurance, and fringe benefits required by agreement or custom; workers' or workmen's compensation insurance; rental value of equipment and machinery; costs for preparing Shop Drawings.

b. Unless otherwise provided in the Contract Documents, "Overhead" shall include the following: bond and insurance premiums including increase and decreases from change in the Work, supervision, superintendence, construction parking, wages of timekeepers, watchmen and clerks, small tools, consumable supplies, expendables, incidentals, general office expense, the cost of additional reproduction for the Contractor's subcontractors beyond that agreed upon in the Contract Documents, construction parking, any additional costs of craft supervision by the Contractor's or subcontractors' superintendents, and overhead charges which would be customary and expended regardless of the change in the Work due to other overlapping activities which are included as part of the original Contract, and all other expenses not included in "Cost" above.

c. In the event that a change is issued by the County which would require the expenditure of substantial amounts of special supervision (beyond the foreman level) by the Contractor, the Contractor may, at the sole direction of the FC Project Manager, be allowed to incorporate these charges into the agreement cost for the change.

6. In Subparagraphs 3 and 4 above, the allowance for overhead and profit combined, included in the total cost or credit to the County, shall be based on the following schedule:

a. For the Contractor, for any work performed by the Contractor's own forces, ten (10) percent of the cost.

b. For the Contractor, for any work performed by a Contractor's subcontractor, five (5) percent of the amount due the subcontractor.

c. For each subcontractor or sub-subcontractor involved, for any work performed by that subcontractor's or sub-subcontractor's own forces, ten (10) percent of the cost.

d. For each subcontractor, for work performed by a sub-subcontractor, five (5) percent of the amount due to the sub-subcontractor.

e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 5 above unless modified otherwise.

7. In order to facilitate checking of quotations for extras or credits, all proposals or bids, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs, including labor cost, materials and subcontracts. Labor and materials shall

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be itemized in the manner defined in Subparagraph 4 above. Where major cost items are subcontracts, they shall be itemized also. In no case shall a change be approved without such itemization.

8. No payment shall be made for any changes to the contract that are not included in a fully executed Change Order.

B. CONCEALED, UNKNOWN AND DIFFERING CONDITIONS

1. Should concealed conditions be encountered in the performance of the Work below the surface of the ground, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Contract Documents, or should unknown physical conditions below the surface of the ground or concealed or unknown conditions in an existing structure of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, be encountered, the Contract Sum and Contract Time shall be equitably adjusted by Change Order upon request by either party made **within twenty (20) days after the first observance** of the conditions. No such request for equitable adjustment shall be valid unless the Contractor complies with this (20) days' notice and Subparagraph C.1. below.

2. The Contractor shall promptly, and before such conditions are disturbed, notify the FC Project Manager in writing of any claim of concealed, unknown or differing conditions pursuant to this paragraph. The FC Project Manager shall authorize the Engineer to investigate the conditions, and if it is found that such conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performance of any part of the Work under this Contract,

3. whether or not changed as a result of such conditions, an equitable adjustment shall be recommended to the FC Project Manager .

4. No claim of the Contractor under this clause shall be allowed unless the Contractor has given the notice required in (a) above, prior to disturbing the condition.

5. No claim by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this Contract.

6. Any materially differing site condition as between what is shown on the Drawings and Specifications and actually found on site shall be immediately reported to the FC Project Manager in writing prior to the commencement of Work at the site. Failure of the Contractor to notify the FC Project Manager in writing of the differing site condition prior to performance of Work at the site shall constitute a waiver of any claim for additional monies. Any Change Order necessitated by the differing site condition shall be processed as provided under "Changes in the Contract".

C. REQUESTS FOR ADDITIONAL COST

1. If the Contractor wishes to request an increase in the Contract Sum, the Contractor shall give the FC Project Manager written notice thereof within

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twenty (20) days after the occurrence of the event, or identification of the conditions, giving rise to such request. This notice shall be given by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property in which case the Contractor shall proceed in accordance with Article 00700-25 and Subparagraph A.4 above. No such request shall be valid unless so made within the twenty (20) days specified above. If the County and the Contractor cannot agree on the amount of the adjustment in the Contract Sum, it shall be determined by the FC Project Manager. Any change in the Contract Sum resulting from such claim shall be documented by Change Order.

2. If the Contractor claims that addition cost is involved because of, but not limited to (1) any written interpretation pursuant to General Condition 00700-17 of this Agreement, (2) any order by the County to stop the Work pursuant to Articles 00700-25 and 00700-37 of this Agreement where the Contractor was not at fault, or any such order by the FC Project Manager as the County's agent, or (3) any written order for a minor change in the Work issued pursuant to Paragraph D below, the Contractor shall submit a request for an increase in the Contract Sum as provided in Subparagraph C.1 above. No such claim shall be valid unless the Contractor complies with Subparagraph C.1 above and approved by the County pursuant to Change Order Policy 800-6.

D. MINOR CHANGES IN THE WORK

The FC Project Manager may order minor changes in the Work not involving an adjustment in the Contract Price, extension of the time allowed for performance of the work and not inconsistent with the intent of the Contract Documents. Such changes shall be affected by a written Change Directive issued by the FC Project Manager, and

shall be binding on the County and the Contractor. The Contractor shall carry out such written orders promptly.

E. BONDS

If any change order results in an increase in the contract price, the contractor shall increase the penal sum of the performance and payment bonds to equal the increased price.

00700-88 DISAGREEMENT WITH ORDERS FOR CHANGE

Contractor's written acceptance of a Change Order or other order for changes shall constitute his final and binding agreement to the provisions thereof and a waiver of all claims in connection therewith, whether direct or consequential in nature. Should Contractor disagree with any order for changes, he may submit a notice of potential claim to the FC Project Manager, at such time as the order is set forth in the form of a Change Order. Disagreement with the provisions of an order for changes shall not relieve Contractor of his obligation under Article 00700-87 of this Agreement.

00700-89 NO WAIVER OF REMEDIES

Exercise by the County of any remedy is not exclusive of any other remedy available to County and shall not constitute a waiver of any such other remedies. Failure of the County

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to exercise any remedy, including breach of contract remedies, shall not preclude the County from exercising such remedies in similar circumstances in the future.

00700-90 LAND AND RIGHTS-OF-WAY

The owner will provide, as indicated in the Contract Documents and prior to Notice to Proceed, the lands upon which the work is to be done, right-of-way for access thereto, and such other lands which are designated for the use of the Contractor. The Contractor shall confine the Contractor's work and all associated activities to the easements and other areas designated for the Contractor's use. The Contractor shall comply with any limits on construction methods and practices which may be required by easement agreements. If, due to some unforeseen reason, the necessary easements are not obtained, the Contractor shall receive an equitable extension of contract time dependent upon the effect on the critical path of the project schedule or the County may terminate the Contract for its convenience.

00700-91 COORDINATION WITH STATE DEPARTMENT OF TRANSPORTATION

No clearing or grading shall be completed by Contractor within the State Department of Transportation (DOT) area under construction. The Contractor must coordinate his construction scheduling with DOT.

If the Contractor begins work before DOT's completion date, he must obtain the approval of DOT before starting work in the area. The state DOT has the right to stop the Contractor's work the DOT area.

The Contractor shall receive no additional compensation or damages resulting from delay or work stoppage from DOT actions or scheduling.

Contractor shall obtain DOT drawings of the DOT, project area for verification of road geometry, storm drains, etc. from Georgia Department of Transportation or Fulton County. The Contractor is responsible for obtaining any pertinent DOT revisions.

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EXHIBIT A

FINAL AFFIDAVIT

TO FULTON COUNTY, GEORGIA

I, _____, hereby certify that all suppliers of materials, equipment and service, subcontractors, mechanic, and laborers employed by _____ or any of his subcontractors in connection with the design and/or construction of _____ at Fulton County have been paid and satisfied in full as of _____, 20__, and that there are no outstanding obligations or claims of any kind for the payment of which Fulton County on the above-named project might be liable, or subject to, in any lawful proceeding at law or in equity.

_____
Signature

_____
Title

Personally appeared before me this _____ day of _____, 20_____. _____, who under Oath deposes and says that he is _____of the firm of _____, that he has read the above statement and that to the best of his knowledge and belief same is an exact true statement.

_____
Notary Public

_____
My Commission expires

END OF SECTION

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Exhibit B
Special Conditions

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SPECIAL CONDITIONS

Noise from Construction Operations

The Contractor should take whatever reasonable efforts to minimize the amount of noise during normal business hours. Tenants will occupy the building each day and the goal is to minimize the number of complaints from any construction noise. All work will be done after hours and/or on weekends.

Initially, the following will be required:

- Quiet time hours shall begin at 8:00AM each tenant workday, and end at 5:00PM
- On the Weekends and Holidays, any work shall cease at 8:00AM the day when the tenant workday resumes, and following the same procedures noted above.

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Exhibit C
Addenda

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FULTON COUNTY

#20RFP041620K-CRB
Fulton County Judicial Center Complex DDC Conversion Project - Phase II

ACKNOWLEDGEMENT OF ADDENDUM NO. 1

The undersigned Bidder acknowledges receipt of this Addendum by returning one (1) copy of this Acknowledgement form with the bid submittal package to the Department of Purchasing & Contract Compliance, Fulton County Public Safety Building, 130 Peachtree Street, S.W., Suite 1168, Atlanta, Georgia 30303 by the ITB due date and time on Tuesday, August 4, 2020 at 11:00 a.m.

This is to acknowledge receipt of Addendum No. 1, 23rd day of July, ~~2019~~.2020

Control Concepts LLC
Legal Name of Bidder

Signature of Authorized Representative

Sales Engineer
Title

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#20RFP041620K-CRB
Fulton County Judicial Center Complex DDC Conversion Project – Phase II

ACKNOWLEDGEMENT OF ADDENDUM NO. 2

The undersigned Bidder acknowledges receipt of this Addendum by returning one (1) copy of this Acknowledgement form with the bid submittal package to the Department of Purchasing & Contract Compliance, Fulton County Public Safety Building, 130 Peachtree Street, S.W., Suite 1168, Atlanta, Georgia 30303 by the RFP due date and time on Tuesday, August 11, 2020 at 11:00 a.m.

This is to acknowledge receipt of Addendum No. 2, 30th day of July, 2020.

Control Concepts LLC
Legal Name of Bidder

Signature of Authorized Representative

Sales Engineer
Title

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Exhibit D
Bid Form

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COMPENSATION

The County agrees to compensate the Contractor as follows:

County agrees to compensate Contractor for all services performed under this Agreement in an amount not to exceed **$6,829,875.00** (Six Million Eight Hundred Twenty Nine Thousand Eight Hundred Seventy Five Dollars and 00/100 Cents), which is full payment for a complete scope of work. The detailed costs are provided in the attached **Cost Proposal Form**.

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PROPOSAL FORM

Submitted To: Fulton County Government

Submitted By: Control Concepts LLC

For: **PROPOSAL #20RFP041620K-CRB – Fulton County Judicial Center Complex DDC Conversion Project – Phase II**

Submitted on December 11, 2020

The undersigned, as Proposer, hereby declares that the only person or persons interested in the Proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this Proposal or in the Contract to be entered into; that this Proposal is made without connection with any other person, company or parties making a Proposal; and that it is in all respects fair and in good faith without collusion or fraud.

The Proposer further declares that he has examined the site of the work and informed himself fully in regard to all conditions pertaining to the place where the work is to be done; that he has examined the Drawings and Specifications for the work and contractual documents relative thereto, and has read all instructions to Proposers and General Conditions furnished prior to the openings of Proposals; that he has satisfied himself relative to the work to be performed.

The Proposer proposes and agrees, if this Proposal is accepted, to contract with the Board of Commissioners of Fulton County, Atlanta, Georgia, in the form of contact specified, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary, and to complete the construction of the work in full and complete accordance with the provided, noted, and reasonably intended requirements of the Specifications and Contract Documents to the full and entire satisfaction of the Board of Commissioners of Fulton County, Atlanta, Georgia, with a definite understanding that no money will be allowed for extra work except as set forth in the attached General Conditions and Contract Documents for the following prices.

THE BASE PROPOSAL PLUS ANY ALTERNATES AS DETERMINED BY THE COUNTY IS THE AMOUNT UPON WHICH THE PROPOSER WILL BE FORMALLY EVALUATED AND WHICH WILL BE USED TO DETERMINE THE LOWEST RESPONSIBLE PROPOSER.

The base Proposal may not be withdrawn or modified for a period of sixty (60) days following the receipt of Proposals.

BASE PROPOSAL AMOUNT (Do not include any Proposal Alternates or Options)

$ 6,829,875.00

(Dollar Amount in Numbers)

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Six Million Eight Hundred Twenty Nine Thousand Eight Hundred Seventy Five Dollars

(Dollar Amount in Words)

The Proposer agrees hereby to commence work under this Contract, with adequate personnel and equipment, on a date to be specified in a written "Notice to Proceed" from the County.

The Proposer declares that he understands that the quantities shown for the unit prices items are subject to either increase or decrease, and that should the quantities of any of the items of work be increased, the Proposer proposes to do the additional work at the unit prices stated herein; and should the quantities be decreased, the Proposer also understands that payment will be made on the basis of actual quantities at the unit price Proposal and will make no claim for anticipated profits for any decrease in quantities; and that actual quantities will be determined upon completion of work, at which time adjustments will be made to the contract amount by direct increase or decrease.

Proposer: Todd Hughes, Control Concepts, LLC

Proposer shall list the required compensation for the performance of these services per the table below. Proposer shall include all cost for travel, parking, printing, telephone, reproductions, copies, etc., as part of their compensation in the values of the table below. No additional compensation for any other incurred expenses shall be chargeable to Fulton County.

Item No.	Description	Total Price ($)
1	**Lump Sum for all Construction Phase Work**	$ 6,579,875.00
2	**Owner Controlled Contingency**	$ 250,000.00
	Total Base Proposal Amount (Items 1-2)	$ 6,829,875.00

Unit Prices/Allowance

According to Ductwork Note #7, on Drawing MC-001, the Contractor is required to provide "Metal Access Panels in the Non-Accessible Ceilings, where the VAV's etc., are located, for maintaining and servicing the units. The Contract is to carry an allowance in their bid price for the Access Panels of 3% of the total VAV/PIU count", or a total of 30 Access Panels. Access Panels will be a minimum of 24" X 24".

If there are more or less Access Panels required, than the amount in the allowance indicated above, the contract will be increased or decreased by the following unit price:

Access Panel Unit Price (Add/Deduct): $ 2,000.00 /Each

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All Unit Prices include all work associated with furnishing and installing the Access Panels. The unused portion of the allowance will be subtracted from the contract amount at the conclusion of the work.

The Proposer furthermore agrees that, in the case of a failure on his part to execute the Contract Agreement and Bonds within ten (10) days after receipt of conformed contract documents for execution, the Proposer Bond accompanying his Proposer and the monies payable thereon shall be paid into the funds of the Owner as liquidated damages for such failure.

Enclosed is a Proposer Bond in the approved form, in the sum of:

Five Percent of Base Proposal Amount Dollars

($ $341,494.00) according to the conditions of "Instructions to Proposers" and provisions thereof.

The undersigned acknowledges receipt of the following addenda (list by the number and date appearing on each addendum) and thereby affirms that its Proposer considers and incorporates any modifications to the originally issued Proposing Documents included therein.

ADDENDUM # 1 DATED 7/23/2020

ADDENDUM # 2 DATED 7/30/2020

ADDENDUM # _____ DATED _____

ADDENDUM # _____ DATED _____

PROPOSER: Control Concepts, LLC

Signed by: Todd Hughes

[Type or Print Name]

Title: President

Business Address: 3550 North Parkway, Suite 100

Cumming, Georgia 30040

Business Phone: 770-888-0181

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Note: If the Proposer is a corporation, the Proposer shall be signed by an officer of the corporation; if a partnership, it shall be signed by a partner. If signed by others, authority for signature shall be attached.

The full name and addresses of persons or parties interested in the foregoing Proposer, as principals, are as follows:

Name	Address

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Exhibit E

Bonds (Payment & Performance)

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PAYMENT BOND

INSTRUCTIONS

1. This form is required for use in connection with the Agreement identified on its face. There shall be no deviation from this form without approval by the County.

2. The full legal name and business address of the Principal shall be inserted in the space designated "Principal" on the face of the form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g., an attorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an office of the corporation involved, evidence of this authority must be furnished.

3. Corporation executing the bond as surety must be among those appearing on the U.S. Treasury Department's most current list of approved sureties and must be acting within the amounts and limitations set forth therein.

4. Corporate surety shall be duly authorized by the Commissioner of Insurance of the State of Georgia to transact surety business in the State of Georgia.

5. Do not date this bond. The County will date this bond the same date or later than the date of the Agreement.

6. The Surety shall attach a duly authorized power-of-attorney authorizing signature on its behalf of any attorney-in-fact.

7. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Seal."

8. The name of each person signing this bond shall be typed or printed in the space provided.

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PAYMENT BOND

"County:" means Fulton County Government; a political subdivision of the State of Georgia (hereinafter called the “Owner”).

"Project:" means **#20RFP041620K-CRB, Fulton County Judicial Center Complex DDC Conversion Project – Phase II**

"Principal:" Control Concepts, LLC (hereinafter called the “Principal”)
3550 North Parkway, Suite 100
Cumming, GA 30040

Type of Organization ("X" one): _____ Individual
_____ Partnership
_____ Joint Venture
__X___ Corporation

"Surety:" (Name and Business Address) _____

_____
duly authorized by the Commissioner of Insurance of the State of Georgia to transact surety business in the State of Georgia.

"Contract:" Agreement between Principal and Owner, dated _____ day of _____, 2021, regarding performance of Work relative to the Project.

"Penal Sum:" [100% of contract amount]_____

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal and Surety hereto, as named above, are held and firmly bound to the Owner in the above Penal Sum for the payment of which well and truly to be made we bind ourselves, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal and the Owner entered into a certain written Contract identified above, which is incorporated herein by reference in its entirety (hereinafter called the “Contract”), for construction-type services for the Project identified above;

NOW, THEREFORE, the conditions of this obligation are such that if the Principal shall promptly make payment of all persons working on or supplying labor or materials or equipment for the performance of said work, this obligation shall be void; otherwise of full force and effect.

1. A “Claimant’ shall be defined herein as any subcontractor, person, party, partnership, corporation or the entity furnishing labor, services or materials used, or reasonably required for use, in the performance of the Contract, without regard to whether such labor, services or materials were sold, leased or rented, and without regard to whether such Claimant is or is not in privity of contract with the Principal or any subcontractor performing work on the Project, including, but not limited to, the following labor, services, or materials: water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. In the event a Claimant files a lien against the property of the Owner, and the Principal fails or refuses to satisfy or remove it promptly, the Surety shall satisfy or

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remove the lien promptly upon written notice from the Owner, either by bond or as otherwise provided in the Contract.

3. The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in the payment terms, and any other amendments in or about the Contract and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and amendments.

4. The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment or modifications to the Contract, so as to bind the Principal and Surety, jointly and severally, to the full payment of any Claimant under the Contract, as amended or modified, provided only that the Surety shall not be liable for more than the penal sum of the Bond, as specified in the first paragraph hereof.

5. This Bond is made for the use and benefit of all persons, firms, and corporations who or which may furnish any materials or perform any labor for or on account of the construction-type services to be performed or supplied under the Contract, and any amendments thereto, and they and each of them may sue hereon.

6. No action may be maintained on this Bond after one (1) year from the date the last services, labor, or materials were provided under the Contract by the Claimant prosecuting said action.

7. This Bond is intended to comply with O.C.G.A. Section 13-10-1, and shall be interpreted so as to comply with the minimum requirements thereof. However, in the event the express language of this Bond extends protection to the Owner beyond that contemplated by O.C.G.A. Section 13-10-1 and 36-91-1, *et seq.*, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

IN WITNESS WHEREOF, the Principal and Surety have hereunto affixed their corporate seals and caused this obligation to be signed by their duly authorized representatives this ___ day of _____,

PRINCIPAL:_____

_____
President/Vice President (Sign)

_____
President/Vice President (Type or Print)

Attested to by:

_____
Secretary/Assistant Secretary (Seal)

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SURETY: _____

By: _____
Attorney-in-Fact (Sign)

_____
Attorney-in-Fact (Type or Print)

_____
Secretary/Assistant Secretary (Seal)

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

PERFORMANCE BOND

INSTRUCTIONS

1. This form is required for use in connection with the Agreement identified on its face. There shall be no deviation from this form without approval by the County.

2. The full legal name and business address of the Principal shall be inserted in the space designated "Principal" on the face of the form. The bond shall be signed by an authorized person. Where such person is signing in a representative capacity (e.g., an attorney-in-fact), but is not a member of the firm, partnership, or joint venture, or an office of the corporation involved, evidence of this authority must be furnished.

3. Corporation executing the bond as surety must be among those appearing on the U.S. Treasury Department's most current list of approved sureties and must be acting within the amounts and limitations set forth therein.

4. Corporate surety shall be duly authorized by the Commissioner of Insurance of the State of Georgia to transact surety business in the State of Georgia.

5. Do not date this bond. The County will date this bond the same date or later than the date of the Agreement.

6. The Surety shall attach a duly authorized power-of-attorney authorizing signature on its behalf of any attorney-in-fact.

7. Corporations executing the bond shall affix their corporate seals. Individuals shall execute the bond opposite the word "Seal."

8. The name of each person signing this bond shall be typed or printed in the space provided.

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PERFORMANCE BOND

"County:" means Fulton County Government; a political subdivision of the State of Georgia (hereinafter called the “Owner”).

"Project:" means **#20RFP041620K-CRB, Fulton County Judicial Center Complex DDC Conversion Project – Phase II**

"Principal:" Control Concepts, LLC (hereinafter called the “Principal”)
3550 North Parkway, Suite 100
Cumming, GA 30040

Type of Organization ("X" one): _____ Individual
_____ Partnership
_____ Joint Venture
__X___ Corporation

"Surety:" (Name and Business Address) _____

_____
duly authorized by the Commissioner of Insurance of the State of Georgia to transact surety business in the State of Georgia.

"Contract:" Agreement between Principal and Owner, dated _____ day of _____, 20___, regarding performance of Work relative to the Project.

"Penal Sum:" [100% of contract amount]_____.

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal and Surety hereto, as named above, are held and firmly bound to the Owner in the above Penal Sum for the payment of which well and truly to be made we bind ourselves, our executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal and the Owner entered into a certain written Contract identified above, which is incorporated herein by reference in its entirety (hereinafter called the “Contract”), for construction-type services for the Project identified above;

NOW, THEREFORE, the conditions of this obligation are such that if the Principal shall faithfully and fully comply with, perform and fulfill all of the undertakings, covenants, conditions and all other of the terms and conditions of said Contract, including any and all duly authorized modifications of such Contract, within the original term of such Contract and any extensions thereof, which shall include, but not be limited to any obligations created by way of warranties and/or guarantees for workmanship and materials which warranty and/or guarantee may extend for a period of time of one year beyond completion of said Contract, this obligation shall be void; otherwise, of full force and effect.

Whenever the Principal shall be, and declared by the Owner to be, in default under the Construction-Type Contract, the Surety shall promptly remedy the default as follows:

1. Complete the Contract in accordance with its terms and conditions; or, at the sole option of the Owner,

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2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by the Surety and the Owner of the lowest responsible bidder, arrange for a contract between such bidder and Owner and make available as the work progresses (even though there should be a default or succession of defaults under the Contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the penal sum set forth in the first paragraph hereof, as may be adjusted, and the Surety shall make available and pay to the Owner the funds required by this Paragraph prior to the payment of the Owner of the balance of the contract price, or any portion thereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by the Owner to the Contractor under the Contract, and any amendments thereto, less the amount paid by the Owner to the Contractor; or, at the sole option of the Owner,

3. Allow Owner to complete the work and reimburse the Owner for all reasonable costs incurred in completing the work.

In addition to performing as required in the above paragraphs, the Surety shall indemnify and hold harmless the Owner from any and all losses, liability and damages, claims, judgments, liens, costs and fees of every description, including reasonable attorney's fees, litigation costs and expert witness fees, which the Owner may incur, sustain or suffer by reason of the failure or default on the part of the Principal in the performance of any or all of the terms, provisions, and requirements of the Contract, including any and all amendments and modifications thereto, or incurred by the Owner in making good any such failure of performance on the part of the Principal.

The Surety shall commence performance of its obligations and undertakings under this Bond promptly and without delay, after written notice from the Owner to the Surety.

The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and any other amendments in or about the Contract, and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, change in payment terms, and amendments.

The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment to the Contract, so as to bind the Principal and the Surety to the full and faithful performance of the Contract as so amended or modified, and so as to increase the penal sum to the adjusted Contract Price of the Contract.

No right of action shall accrue on this Bond to or for the use of any person, entity or corporation other than the Owner and any other obligee named herein, or their executors, administrators, successors or assigns.

This Bond is intended to comply with O.C.G.A. Section 36-91-1 et seq., and shall be interpreted so; as to comply with; the minimum requirements thereof. However, in the event the express language of this Bond extends protection to; the Owner beyond that contemplated by O.C.G.A. Section 36-91-1 et seq. and O.C.G.A. Section 13-10-1, as amended, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

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IN WITNESS WHEREOF, the Principal and the Surety have caused these presents to be duly signed and sealed this _____ day of _____, 20___.

PRINCIPAL:_____

_____
President/Vice President (Sign)

_____
President/Vice President (Type or Print)

Attested to by:

_____
Secretary/Assistant Secretary (Seal)

SURETY:_____

By: _____
Attorney-in-Fact (Sign)

_____
Attorney-in-Fact (Type or Print)

END OF SECTION

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Exhibit F

Scope of Work and Technical Specifications

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FULTON COUNTY JUSTICE CENTER COMPLEX, BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT CONTRACT

SPECIFICATIONS
Issued for Bid

November 18, 2019

S. L. King & Associates, Inc.
270 Peachtree Street, N.W., Suite 1600, Atlanta, GA 30303
404-524-5800

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

SECTION 000100 – TABLE OF CONTENTS

	ISSUE DATE	LATEST REVISION DATE
Division 0 – Procurement and Contracting Requirements		
000100 Table of Contents	11/18/2019	
Division 1 – General Requirements		
011000 Summary	11/18/2019	
011100 Project Procedures	11/18/2019	
012973 Schedules of Values	11/18/2019	
013100 Project Management and Coordination	11/18/2019	
013200 Construction Progress Documentation	11/18/2019	
013213 Schedule of the Work	11/18/2019	
013300 Submittal Procedures	11/18/2019	
013529 Health Safety and Emergency Procedures	11/18/2019	
014219 Reference Standards	11/18/2019	
015719 Environmental Protection	11/18/2019	
017700 Closeout Procedures	11/18/2019	
017823 Operation and Maintenance Data	11/18/2019	
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Division 8 – Doors		
083113 Access Doors and Frames	11/18/2019	
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092900 Gypsum Board	11/18/2019	
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Division 23 – Mechanical		
230100 Mechanical General Provisions	11/18/2019	
230500 Basic Mechanical Materials and Methods	11/18/2019	
230513 Common Motor Requirements for HVAC Equipment	11/18/2019	
230529 Hangers and Supports for HVAC Piping and Equipment	11/18/2019	
230548 Vibration Isolation	11/18/2019	
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230593 Testing, Adjusting and Balancing for HVAC	11/18/2019	
230713 Duct Insulation	11/18/2019	
230800 HVAC Commissioning	11/18/2019	
230900 Building Management System.	11/18/2019	
233113 Metal Ducts	11/18/2019	
233300 Air Duct Accessories	11/18/2019	
233600 Air Terminal Units	11/18/2019	
255000 Integrated Automation Systems (IAS)	11/18/2019	
Division 26 – Electrical		
260499 Basic Electrical Requirements	11/18/2019	
260519 Low-Voltage Electrical Power Conductors and Cables	11/18/2019	

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260523 Control-voltage Electrical Power Cables 11/18/2019
260526 Grounding and Bonding for Electrical Systems 11/18/2019
260529 Hangers and Support for Electrical Systems 11/18/2019

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260533 Raceways and Boxes for Electrical Systems.....11/18/2019
260544 Sleeves & Sleeve Seal for Electrical Raceway & Cabling 11/18/2019
260553 Identification for Electrical Systems 11/18/2019
262726 Wiring Devices 11/18/2019
262813 Fuses 11/18/2019

Informational Attachments to Construction Documents (reserved)

END OF TABLE OF CONTENTS 000100

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Construction schedule.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and drawing conventions.
8. Miscellaneous provisions.

1.2 PROJECT INFORMATION

A. Project Identification: Fulton County Justice Center Complex Upgrades to Building Automation System and Terminal Unit Replacement FY2020.

B. Owner's Name: Fulton County Government of the State of Georgia.

C. Address of work to be performed: 185 Central Ave SW, Atlanta, GA 30303

D. Program Manager’s Name: Heery/McAfee3 – a joint venture.

E. The Project consists of providing a new building automation system and renovations to and retrofit of the existing HVAC system.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Fulton County is seeking the services of an experienced and qualified contractor to be the primary responsible party to deliver a complete, turnkey solution for all work as defined by the Contract Documents that include Design Drawings and Specifications. As illustrated in these contract documents, the work will require mechanical, electrical and control system expertise.

B. The Fulton County Justice Center Complex (FCJCC) and consists of 1,013,763 square feet comprised of the following buildings and their approximate areas:

1.	Lewis R. Slaton Courthouse (FCC)	274,628 square feet
2.	Charles L. Carnes Justice Center Building (JCB)	124,135 square feet
3.	Justice Center Tower (JCT)	615,000 square feet

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Scope of demolition and removal work is described in the project documents and is to be coordinated with provided As-Built Documentation. Scope of alterations work is described in the project documents and coordinated with provided As-Built Documentation.

C. Building Automation System Upgrades General Scope of Work includes, but is not limited to the following:

The new BAS will automatically control and monitor ALL existing HVAC equipment as specified and shown on the drawings. Contractor will furnish submittal drawings, material, installation, programming, standard start-up and coordinate commissioning of BAS system with the owner appointed commissioning agent.

The BAS shall be an Integrated Automation System (IAS) implementation using a Niagara Framework and BACnet IP and BACnet MS/TP network topology with the following controllers:

1. Tridium 8000 Java Application Control Engines (JACE)
2. Building Controllers (B-BCs)
3. Advanced Application Controllers (B-AAC)
4. Application Specific Controllers (B-ASC)
5. New and existing Variable Frequency Drives (VFDs)
6. BACnet Chiller Integration
7. Energy and BTU Metering equipment
8. Integration of the existing Trane DDC Control System into the Niagara IAS Platform
9. Future Integration for Fire Alarm, Access Control, Security and Lighting

The following HVAC equipment shall be incorporated into the new BAS:

1. Variable Volume Chilled Water Air Handling Units
2. Constant Volume Chilled Water Air Handling Units
3. New VAV Terminal Units retrofitted under this project scope
4. Fan Coil Units located in the JCT
5. Packaged and Split System DX Air Conditioning Units
6. Unit heaters with electric heating coils for the FCC Air Handling Mechanical Rooms
7. Domestic Water Pumps
8. Various Supply, Exhaust and Smoke Control Fans
9. Main Distribution Panel Electrical Energy Metering, Chilled Water BTU Metering and Cooling Tower Make-up Water Metering
10. Include all VFDs on the BACnet network
11. Existing Trane BACnet DDC controls shall remain and all HVAC equipment associated with these controls shall not require new BACnet controls

The following system improvements shall be provided:

1. Replace all existing air handling unit chilled water valves with new pressure independent control valves and actuators. Open balancing circuit setter valves and tag as not in use.

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2. Test and replace as required all low temperature safety devices, damper end switches, high-pressure and low-pressure cutout safety switches.
3. Test, identify and report on any outside air or return air dampers determined to be inoperative.
4. Furnish and install new damper actuators on all outside and return air dampers for HVAC equipment in this scope.
5. Furnish and install air flow measuring stations in the outside air duct where noted.
6. Furnish and install new AHU-1 Supply Fan variable frequency drives in the JCB (qty 2)
7. Furnish and install new VAV terminal units at all locations with factory mounted controls as noted on drawings
    - VAV terminal unit controls shall use staged heating and not SCR heat
    - VAV terminal unit controls shall include I/O space and functionality for future lighting integration including occupancy sensors and current transducer
    - VAV retrofit shall include replacement of all series fan powered terminal units with parallel fan powered units.
8. Furnish and install Network Controllers and BACnet routers and repeaters as required for a fully functioning system that meets data throughput requirements noted in the contract documents.
9. Provide all ancillary piping, conduit, panels, wiring, power and devices for a complete system.

D. Terminal Unit Replacement General Scope of Work includes, but is not limited to the following:

There are nine hundred and sixty seven (967) existing terminal units at the Fulton County Justice Center Complex that will be replaced under this project, two hundred seventy (270) in the Slaton County Courthouse (FCC), one hundred fifty eight (158) in the Carnes Justice Center Building (JCB, and five hundred thirty nine (539) in the Justice Center Tower (JCT).

The work under this project consist, in general, of the following:

1. Demolition of (967) existing terminal units within the Fulton County Justice Center Complex
2. Installation of the replacement terminal units with new hanger supports
3. Disconnecting and reconnecting of electrical connections for the replacement terminal units.
4. Heaters for all new terminal units shall be staged heating elements, SCR heat is not permitted.
5. Extend or trim sheet metal and/or as necessary to connect terminal unit to ductwork.
6. Furnish and install new access panels for non-accessible ceilings where the VAV/PIU's, etc. are located for maintaining and servicing the units.
7. Test and Balance activities for each new replacement terminal unit.
8. Work terminal unit replacement work performed on site is expected to be after hours and must conform to the requirements of available times as stipulated by Fulton County Project Managers.

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9. All existing conditions and locations of terminal units shall be verified before any work is to begin. Discrepancies between the project documents and existing conditions shall be brought forth to Fulton County Project Managers for resolution prior to work commencing.

E. Design Drawings consist of the following:

SHEET #	SHEET TITLE
MC-000	Mechanical Controls - Cover Sheet
MC-001	Mechanical Controls - General Notes, Legends & Abbreviations
MC-10SLW	Justice Center Tower - Service Level Plan - West
MC-10SLE	Justice Center Tower - Service Level Plan - East
MC-10PW	Justice Center Tower - Parking Level Plan - West
MC-10PE	Justice Center Tower - Parking Level Plan - East
MC-10GW	Justice Center Tower - Ground Floor Plan - West
MC-10GE	Justice Center Tower - Ground Floor Plan - East
MC-101W	Justice Center Tower - First Floor Plan - West
MC-101E	Justice Center Tower - First Floor Plan - East
MC-102W	Justice Center Tower - Second Floor Plan - West
MC-102E	Justice Center Tower - Second Floor Plan - East
MC-103W	Justice Center Tower - Third Floor Plan - West
MC-103E	Justice Center Tower - Third Floor Plan - East
MC-104W	Justice Center Tower - Fourth Floor Plan - West
MC-104E	Justice Center Tower - Fourth Floor Plan - East
MC-105W	Justice Center Tower - Fifth Floor Plan - West
MC-105E	Justice Center Tower - Fifth Floor Plan - East
MC-107W	Justice Center Tower - Seventh Floor Plan - West
MC-107E	Justice Center Tower - Seventh Floor Plan - East
MC-108W	Justice Center Tower - Eighth Floor Plan - West
MC-108E	Justice Center Tower - Eighth Floor Plan - East
MC-109W	Justice Center Tower - Ninth Floor Plan - West
MC-109E	Justice Center Tower - Ninth Floor Plan - East
MC-10RW	Justice Center Tower - Roof Plan - West
MC-10RE	Justice Center Tower - Roof Plan - East
MC-20B	Fulton County Courthouse - Basement Floor Plan
MC-20G	Fulton County Courthouse - Ground Floor Plan
MC-201	Fulton County Courthouse - First Floor Plan
MC-202	Fulton County Courthouse - Second Floor Plan
MC-203	Fulton County Courthouse - Third Floor Plan
MC-204	Fulton County Courthouse - Fourth Floor Plan
MC-205	Fulton County Courthouse - Fifth Floor Plan
MC-206	Fulton County Courthouse - Sixth Floor Plan
MC-207	Fulton County Courthouse - Seventh Floor Plan
MC-208	Fulton County Courthouse - Eighth Floor Plan
MC-209	Fulton County Courthouse - Ninth Floor Plan
MC-20PH	Fulton County Courthouse - Penthouse Floor Plan
MC-30B	Justice Center Building - Basement Floor Plan
MC-30G	Justice Center Building - Ground Floor Plan
MC-301	Justice Center Building - First Floor Plan
MC-302	Justice Center Building - Second Floor Plan

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MC-303	Justice Center Building - Third Floor Plan
MC-30R	Justice Center Building - Roof Plan
MC-400	Justice Center Tower - Enlarged First Fl Interstitial Mech Rms
MC-401	Justice Center Tower - Enlarged Second Fl Interstitial Mech Rms
MC-500	Justice Center Complex - Mechanical Controls Details
MC-501	Justice Center Tower - Mechanical Controls Details
MC-502	Justice Center Tower - Mechanical Controls Details
MC-520	Fulton County Courthouse - Mechanical Controls Details
MC-530	Justice Center Building - Mechanical Controls Details
MC-600	Justice Center Tower - Mechanical Schedules
MC-601	Justice Center Tower - Mechanical Schedules
MC-602	Justice Center Tower - Mechanical Schedules
MC-620	Fulton County Courthouse - Mechanical Schedules
MC-621	Fulton County Courthouse - Mechanical Schedules
MC-630	Justice Center Building - Mechanical Schedules
MC-700	Justice Center Tower - Mechanical Controls Schematics
MC-701	Justice Center Tower - Mechanical Controls Schematics
MC-702	Justice Center Tower - Mechanical Controls Schematics
MC-703	Justice Center Tower - Mechanical Controls Schematics
MC-720	Fulton County Courthouse - Mechanical Controls Schematics
MC-721	Fulton County Courthouse - Mechanical Controls Schematics
MC-722	Fulton County Courthouse - Mechanical Controls Schematics
MC-723	Justice Center Tower - Mechanical Controls Schematics
MC-730	Justice Center Building - Mechanical Controls Schematics
MC-731	Justice Center Building - Mechanical Schematic
MC-740	Justice Center Complex - Mechanical Controls Schematics
MC-741	Justice Center Complex - Mechanical Controls Schematics
MC-742	Justice Center Complex - Mechanical Controls Schematics

1.4 WORK SEQUENCE

A. Coordinate construction schedule and operations with Fulton County Justice Center staff and program manager.

1.5 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: As determined by the Program Manager.

B. Arrange use of site and premises to allow:

1. Owner occupancy.
2. Work by Others.
3. Work by Owner.
4. Use of site and premises by the public.

C. Provide access to and from site as required by law and by Owner:

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1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Existing building spaces may not be used for storage.

E. Utility Outages and Shutdown:

1. Limit disruption of utility services to hours the building is unoccupied.
2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days' notice to Owner and authorities having jurisdiction.
3. Prevent accidental disruption of utility services to other facilities.

1.6 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to avoid conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner in writing not less than 72 hours in advance of activities that will affect Owner's operations. Contractor must adhere to Owner's concerns in response to such notifications to Owner.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: All work in occupied areas shall be performed after hours and/or on weekends, unless otherwise approved in writing by the Owner. FCJC will provide security personnel for contractor support while contractor is on site.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

D. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.

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1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 Heery/McAfee3 will schedule a meeting after Notice of Award for Contractor to attend to discuss bonds, insurance certificates, progress schedule, progress meetings, site mobilization, field decisions, submittals, payment applications, change orders, and contract closeout procedures

3.2 Contractor is responsible for providing any telecommunications services needed for Contractor’s performance of work during the performance of this contract.

3.3 Contractor to provide for barriers needed to secure site from entry by unauthorized parties.

3.4 Contractor to coordinate any needed vehicular access and hauling rotes with Owner.

3.5 Contractor to provide waste removal to keep site clean and orderly. Containers shall have lids and trash shall be removed from site periodically. Open free-fall chutes are not permitted. Flammable materials shall be kept outside the structure.

3.6 Contractor shall perform all demolition activities with regard to the safety of the Owner’s property, and all individuals on site and their property. Shoring and support shall be provided as necessary to fulfill this regard. Care shall be made to minimize disruption and distraction of Owner personnel on site.

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3.7 Contractor shall provide Owner (3) three days' notice of any disruption in any utility or service.

3.8 Contractor shall remove temporary material, utilities, and equipment. No existing equipment shall be abandoned in place. Clean and repair all damage caused by installation of work or temporary facility, utility, or material. Restore all permanent facilities used during construction to pre-construction condition.

3.9 All existing products or material on site, foreseen or not, are the property of the Owner.

3.10 Coordinate deliveries to minimize storage time. All stored deliveries shall keep seals and labels intact. Sensitive materials will be stored in climate-controlled environments favorable to the material. Store material to prevent corrosion, discoloration, or staining to itself and/or the Owner's property.

3.11 Provide product submittals within 15 days of the agreement.

3.12 Cut and patch as necessary to install the work, and repair material affected by the installation of the work. All cut and patch work shall be completed to a clean and orderly appearance, matching existing finishes.

3.13 Contractor shall furnish and install new access panels for non-accessible ceilings where the VAV/PIU's, etc. are located for maintaining and servicing the units.

3.14 Skilled and experience installers shall cut and patch exterior elements exposed to weather and moisture.

3.15 Contractor shall keep site clean of debris. A final cleaning of work is required prior to final assessment of project.

3.16 Contractor shall protect installed work from damage.

3.17 Notify Heery/McAfee3 when work is considered ready for Substantial Completion. Review this work on site with Heery/McAfee3 and Owner. Correct deficiencies in work noted by Heery/McAfee3 and Owner. Notify Heery/McAfee3 when correction of deficiencies is complete. Correct any remaining deficiencies from Heery/McAfee's final inspection.

3.18 Contractor shall provide O&M manuals and warranties to Heery/McAfee3 for all equipment and materials within a month after Substantial Completion.

END OF SECTION 011000

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SECTION 011100 - PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work of this section includes project requirements for:

1. Cutting and patching.
2. Submittals.
3. Temporary facilities and controls.
4. Materials.
5. Product options.
6. Contract closeout.
7. Cleaning up.

1.2 CUTTING AND PATCHING

A. Summary:

1. Contractor's responsibilities:

a. Contractor shall be responsible for cutting, fitting and patching required to complete the work and as follows:

1) Make new and existing parts fit together.
2) Provide penetrations of structural and non-structural surfaces for installation of materials and products as specified.

b. In addition to Contract requirements, perform the following:

1) Uncover work to provide for observation of covered work.
2) Remove samples of existing installed materials for testing and for matching of new materials.
3) Remove work to provide for alteration, restoration or refinishing of existing work.

c. Do not endanger work by cutting or altering work.

d. Do not cut or alter work not of this Contract without written consent of Owner.

2. Costs incurred for ill-timed work or uncovering of work shall include cost for services of Owner's consultants.

B. Job conditions:

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1. During cutting and patching operations, should suspect asbestos or asbestos-containing materials, or any other material listed as a hazardous material by the Environmental Protection Agency be discovered, notify Construction Consultant and Owner, secure jobsite from inclement weather and discontinue that portion of the work until further instructed.
2. Drawings indicating existing building conditions are available from the Owner for general information only. The Owner assumes no responsibility for the actual condition of work to be altered. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations may occur by Owner's removal and salvage operations prior to the start of the demolition work.
3. Conduct operations and the removal of debris to ensure minimum interference with roads, streets, walks and adjacent facilities.
4. Do not close or obstruct streets or walks without permission from authorities having jurisdiction. Provide flagman where public thoroughfares are used for debris removal. Maintain thoroughfares free of dirt and debris caused by removals or hauling operations.
5. Conduct removal operations to minimize disruption or interference with building occupants and operation, and the use of building facilities not included in the work. Coordinate phasing of work with the Owner, as directed by the Owner.
6. Protect portions of existing building indicated to remain. Repair or replace portions of building damaged by this work, at no additional cost.
7. Provide temporary enclosures or other methods to limit dust transmission to adjacent areas. Provide temporary weatherproof enclosures for portions of work exposed to weather. Provide temporary noise reduction barriers to separate work areas from adjacent occupied areas.
8. Maintain building security. Secure construction area during non-working hours.
9. Where removal or alteration of concealed structural members is required, which are not included in detail on drawings, submit details for review by Engineer prior to proceeding.
10. Provide temporary fire protection devices. Coordinate with local building officials and Owner's insurance carrier.
11. Provide temporary protective walkways or covering on existing finish floor surfaces to protect existing and new floor finishes.
12. Schedule high noise level operations to non-business hours as acceptable to Owner where working in close proximity to existing business operations.
13. Limit exterior dust by sprinkling or other acceptable methods.

1.2 SUBMITTALS

A. General Provisions:
1. Provisions specified are mandatory procedures for preparing and submitting specified submittals.
2. Submittals shall be in orderly sequence and timed to cause no delay in the Work.
3. Job delays occasioned by requirement of resubmission of submittals not in accord with Contract Documents are Contractor's responsibility and will not be considered valid justification for extension of Contract time.

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4. Commence no portion of work requiring submittals until submittal has been reviewed and accepted by Engineer.

B. Submittal Schedule:

1. At least five days prior to date of pre-construction conference, submit a list of all required submittals, by specification section. Indicate timing for submission of required submittals and relation to construction sequence.
2. During course of the Work, maintain an updated submittal schedule showing status of all submittals. Provide copies for Owner's and Engineer information at project meetings and at other times when requested.

C. Sample Preparation:

1. Prepare samples in sizes, shapes and finishes in accord with provisions of individual specification sections.
2. Samples submitted for color, sheen or texture selection for review shall be actual samples of the required material. Where a range of color, sheen or texture is anticipated or proposed, samples shall indicate full range proposed, from which Owner and Engineer may select the exact range to be provided.
3. The number of samples submitted shall be the number required by Contractor, plus one which will be retained by the Owner, unless otherwise indicated.
4. Attach a tag to each sample, sized to accept Contractor's stamp and Engineer 's review comments. Samples submitted to Engineer shall have tag stamped with Contractor's stamp and appropriate action shall be indicated thereon.

D. Shop Drawing Preparation:

1. Drawings shall conform to the following requirements:

   a. Number drawings consecutively.
   b. Indicate working and erection dimensions and relationships to adjacent work.
   c. Show arrangements and sectional views, where applicable.
   d. Indicate material, gauges, thicknesses, finishes and characteristics.
   e. Indicate anchoring and fastening details, including information for making connections to adjacent work.
   f. Contract documents prepared by the Engineer and his consultants will not be acceptable as shop drawing submittals.

2. Form: Submit electronic copies of shop drawings in .pdf form.

E. Product Data Preparation:

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1. Include product manufacturer's standard printed material, dated, with product description and installation instructions indicated. Product data may also contain test and performance data, illustrations and special details.
2. Form: Number of copies submitted shall be the number required by Contractor, plus one which will be retained by Engineer, plus one which will be retained by the Owner.

F. Contractor's Review:

1. Review, stamp with approval and submit to the Engineer submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals made by the Contractor, which are not required by the Contract Documents, will be returned without action.
2. By approving and submitting submittals, Contractor represents that he has determined and verified materials, field measurements, and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
3. The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Engineer's review of submittals unless the Contractor has specifically informed the Engineer in writing of such deviation at the time of submittal and the Engineer has given written acceptance to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples or similar submittals by the Engineer's review thereof.
4. The Contractor shall direct specific attention, in writing or on resubmitted submittals, to revisions other than those requested by the Engineer on previous submittals.
5. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Engineer shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.
6. Where work is indicated "By Others," Contractor shall indicate responsibility for providing and coordinating such work, whether by Subcontractors or under separate contracts.
7. Contractor agrees that submittals processed by Engineer are not Construction Change Directives or Change Orders; that purpose of submittals by Contractor is to demonstrate that Contractor understands design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing fabrication and installation methods he intends to use.
8. Contractor represents by submitting submittals that he has complied with provisions herein specified. Submissions made without Contractor's approval indicated thereon will be returned without being reviewed for compliance with this requirement.
9. Date each submittal and indicate name of Project, , Contractor, Subcontractor, as applicable, description or name of equipment, material or product, and identify location at which it is to be used in the Work.

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10. Accompany submittal with transmittal letter containing project name, Contractor's name, number and type of submittals, titles and other pertinent data. Transmittal shall outline deviations, if any, in submittals from requirements of Contract Documents.
11. Perform no portion of the Work requiring submittal and review of submittals until the respective submittal has been reviewed and accepted by the Engineer.

G. Engineer's Review:

1. Engineer will review each submittal, mark it with appropriate action, and return it to Contractor with reasonable promptness, except where it must be held for coordination and the Contractor is so advised.
2. Engineer's review or other appropriate action is only for checking for conformance with information given and the concepts expressed in the Contract Documents. Engineer's acceptance of a specific item shall not indicate acceptance of an assembly in which item is a component.
3. Engineer's review of submittals shall not relieve Contractor of responsibility for deviation from requirements of Contract Documents unless Contractor has informed Engineer in writing of such deviation at time of submission and Engineer has given written acceptance to the specific deviation. Engineer's review shall not relieve Contractor from responsibility for errors or omissions in submittals.
4. Submittals required to be submitted "For Information Only" are required to demonstrate that the Work complies with performance requirements of the Contract Documents. Such submittals, if acceptable to Engineer, will not be returned to Contractor.
5. Engineer will return one copy of reviewed shop drawings for printing and distribution by Contractor.

H. Resubmission:

1. Make corrections and changes indicated for unacceptable submittals, and resubmit in same manner as specified above until Engineer's acceptance is obtained.
2. On re-submittal transmittal, direct specific attention to revisions other than corrections requested by Engineer on previous submittals, if any.

I. Distribution:

1. Contractor is responsible for obtaining and distributing copies of submittals to his subcontractors and material suppliers after, as well as before, final acceptance. Prints of reviewed shop drawings shall be made from transparencies which carry the Engineer's appropriate comments.
2. For duration of project, Contractor shall maintain a file of accepted submittals which shall be delivered to Owner as a part of project closeout documents.

1.4 TEMPORARY FACILITIES AND CONTROLS

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A. Temporary Storage Facilities: Materials and equipment may be stored on-site at locations acceptable to the Owner. The Contractor is solely responsible for security of designated storage areas.

B. Site access and Parking:

1. Parking for construction personnel shall be in locations acceptable to the Owner.

C. Temporary Utilities:

1. Electrical service: Electrical power service of existing voltage and amperage may be obtained from Owner's present facility at no cost to Contractor. Contractor shall be responsible for making connections to Owner's service and for extensions of service. Contractor shall provide additional higher voltage power service and pay all costs for such power, including connections and extensions, if required by him for construction purposes.
2. Temporary heat and ventilation:

    a. Provide temporary heat and ventilation as may be required by product manufacturers for proper product installation and performance of manufactured products.
    b. Provide ventilation to prevent accumulation of dust, fumes or gases and to cure materials and disperse humidity.

3. Water: Water for construction purposes may be obtained from Owner's present facility. Contractor shall be responsible for extending lines from source and for making connections.
4. Sanitary toilet facilities: Provide and maintain temporary toilet facilities for construction personnel. Existing facilities may not be used by personnel. Locate temporary toilet facilities in locations acceptable to Owner. Or construction personnel will able to use Fulton County's Facilities. Location will be directed by the Owner.

D. Temporary Hoist and Staging Equipment: Provide temporary equipment for transportation of personnel, materials and equipment.

1. Provide protective devices for structure during equipment use.
2. Do not overload building structural system with temporary equipment; do not overload hoisting equipment or staging.

E. Security:
1. For off-hours work of construction personnel, coordinate security clearance with the Owner's building security.

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2. Provide security guards as necessary to direct traffic during work operations. Security provisions to prevent loss of the contractor's tools, equipment, materials shall be at the sole discretion of the Contractor.

F. Building Access:

1. The Contractor shall generally be prohibited from entering the areas of the building except where work is in progress. Access to work areas through the building shall be approved by and coordinated with the Owner. Work and access shall cause no disruption to building occupants or facility operations.
2. Schedule the Work and arrange material storage in a manner which leaves the project site as unencumbered as possible. Provide temporary barriers and enclosures, and maintain the site in clean condition at all times.
3. The Contractor shall be responsible for correcting damages to the building caused by his work or passage. Soiled or damaged materials shall be replaced or repaired to satisfaction of the Owner.

G. Special Protection Requirements:

1. Protect buildings and building components from damage, staining or defacing due to the Work. Correct or replace damaged materials or finishes to satisfaction of the Owner.
2. Provide barricades as required at areas captured for executing The Work.
3. Protect building from rain or water leakage during the course of The Work. Openings shall not be left unprotected overnight.
4. Protect landscape planting from damage, including toxic overspray or run-off from cleaning materials. Damaged or ruined planting shall be replaced by the Contractor with plants of identical variety, size and configurations. Replace damaged ground cover materials to match existing.
5. If required by work, provide protective enclosures at building entrances and exterior walkways to protect building occupants. Enclosures shall include protection from cleaning and applied materials. Coordinate placement and location of all protective enclosures with Owner. Building entrances and exits shall not be made inaccessible unless approved in advance by Owner and local fire officials.
6. Provide protection against overspray of cleaning materials or paint contacting building occupants or vehicles in drives or parking areas. Drives shall not be blocked to extent of restricting vehicular access, and parking area restrictions shall be kept to a minimum. Barriers and restrictions shall be approved in advance by the Owner. Do not work with materials subject to being wind-blown during times of high winds.
7. Protect surfaces of fresh coating products from damage or discoloration due to rain, dust or physical damage. Replace damaged or defaced materials which cannot be restored to satisfaction of the Owner.

H. Relocation and Removal:

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1. Relocate temporary facilities during construction as required by progress of the Work at no additional cost to the Owner.
2. At completion of the Work or at the time of permanent utility connections, as applicable, remove temporary facilities, including connections and debris resulting from temporary installation.

1.5 MATERIALS

A. Delivery, Storage and Handling:

1. Deliver manufactured products to project site in manufacturer's original packaging with labels and seals intact. Labels shall indicate manufacturer and product name, description, mixing and application instructions. Where applicable, labels shall indicate fire resistive classifications. Include material Safety Data Sheets with all material shipments.
2. Inspect materials upon delivery to ensure they are proper.
3. Comply with manufacturer's instructions and recommendations for product storage and handling.
4. Prevent corrosion, soiling or breakage of materials or contact with deleterious materials.
5. Handle materials and equipment to prevent damage, deterioration or contamination. Install no materials which are physically damaged or stained prior to time for installation.
6. Store and handle fluid products subject to spillage in areas where spills will not deface finished surfaces or other work.
7. Flammable or hazardous materials:

    a. Store minimum quantities in protected areas.
    b. Provide appropriate type fire extinguishers near storage areas.
    c. Observe manufacturer's precautions and applicable ordinances and regulations.

8. Comply with manufacturer's product data in all aspects of basic material usage, handling, installation and substrate preparation, except where more stringent requirements are specified.

B. Materials Containing Hazardous Substances:

1. The intent of the Contract Documents is to exclude all materials which contain known hazardous substances, including materials containing asbestos, polychlorinated biphenyl (PCB), or any other known substances determined to be a health hazard by the United States Environmental Protection Agency (EPA) and other recognized agencies. In studying the Contract Documents and at any time during execution of the Work, the Contractor shall at once report to the Construction Consultant any materials containing hazardous substances that he may discover. Do not proceed with installation of materials containing known hazardous substances.

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2. Where products are specified by product, by manufacturer, by reference standard or in descriptive manner without manufacturer's name, model number or trade name, Contractor shall select materials meeting specified requirements which do not contain known hazardous substances in any form.

C. Substrate Conditions:

1. Verify and obtain substrate conditions, tolerances and material alignments to receive applied or attached materials and construction.
2. Substrates shall be sound, clean, dry and free of imperfections and conditions which would be detrimental to receipt of applied materials and finishes.
3. Align materials to give smooth, uniform surface planes within specified tolerances and straight, level and plumb surfaces.
4. Inspect substrates prior to installation of applied materials and finishes. Correct unacceptable conditions prior to proceeding with work.
5. Existing sub-surfaces receiving new finishes shall have existing finish removed or, if sound, prepared in accord with manufacturer's product data to receive new specified finish.

D. Finished Surfaces:

1. Finished surfaces shall be clean, uniform and free of damages, soiling or defects in material and finish.
2. Protection:

a. Protect finished surfaces from damage and soiling during application, drying or curing, as applicable.
b. Provide temporary protective coverings or barriers required.

1.6 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Products are specified by reference standards, performance and manufacturer's name and model number or trade name.

1. When proprietary products are specified, no substitutions are allowed.
2. When specified only by reference standard or performance, Contractor may select any product meeting specified standards or performance requirements, by any manufacturer.
3. When several products or manufacturers are specified as being acceptable, Contractor has the option of choosing among those named.
4. When one product or manufacturer is specified or indicated as the "basis of design", "basis of selection" or "scheduled", Contractor shall bear costs associated with changes required for application or installation of other products or assemblies.

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B. In the event that specified items cannot be delivered to the jobsite and incorporated into the Work at such times and in such quantities as to cause no delay, then Con-tractor may request a substitution. Should the accepted substitution provide a cost savings, the Contract price will be adjusted by Change Order, with Owner receiving the benefit of the net savings. No increase in the Contract price will be allowed on substitutions made after the award of Contract, except where the Contractor can verify a timely placement of orders appropriate to the materials and conditions involved.

C. Inability to obtain specified items due to Contractor's failure to place timely orders will not be considered reason for authorizing substitutions.

1.7 CONTRACT CLOSEOUT

A. Closeout Timing:

1. Contractor shall prepare, assemble and transmit the items listed herein to the Owner in care of the Construction Consultant.
2. Documents, tools, equipment, demonstrations and other closing requirements shall be submitted or performed and accepted prior to Date of Final Acceptance.

B. Detail Requirements:

1. Inspection reports:

a. Submit certificates from applicable local governmental agencies that the construction has been inspected as required by laws.
b. Submit one copy of testing agencies inspection and test reports.

2. Warranties:

a. Contractor shall furnish his warranty and shall require each subcontractor to furnish his warranty, in writing. Assemble, bind, label and transmit warranties as required for other manuals above. Unless specifically indicated otherwise in individual sections, the period for warranties shall begin on the Date of Substantial Completion and shall continue for one year. Warranties shall state the Date of Substantial Completion and the date on which the warranty expires.
b. Contractor shall forward manufacturers' and installers' warranties as specified in the individual specification sections. Assemble, bind, label and transmit warranties as required for other manuals above. Unless specifically indicated otherwise in individual sections, the period for warranties shall begin on the Date of Substantial Completion. Warranties shall state the Date of Substantial Completion and the date on which the warranty expires.

1.8 CLEANING UP

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A. General Requirements:

1. Contractor shall keep the project site free from accumulation of waste materials and rubbish at all times during the construction period. At completion of the Work, he shall remove all waste materials and rubbish from and about the project, as well as his tools, construction equipment, machinery and surplus materials, except those specifically required by the Contract Documents to be left for the Owner's maintenance.
2. If Contractor fails to keep project clean or to clean up prior to Date of Substantial Completion, the Owner may do so, and the cost will be charged to the Contractor.

B. Safety Requirements:

1. Store volatile waste in covered metal containers. Remove from project site daily.
    a. Allow no volatile wastes to accumulate on project site.
    b. Provide adequate ventilation during use of volatile substances.
2. Do not burn or bury waste materials or rubbish on project site. Comply with governmental and environmental regulatory requirements for disposal of waste.
3. Dispose of no volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains, on pavements, in gutters or on project site.
4. Dispose of no waste or cleaning materials containing materials harmful to plant growth on project site. As quickly as possible, clean up materials which are accidentally spilled.

C. Cleanup During Construction:

1. Execute cleaning procedures to ensure that building, project site and adjacent properties are maintained free from debris and rubbish.
2. Wet down materials subject to blowing. Throw no waste materials from heights.
3. Provide covered on-site containers for waste collection. Place all waste materials and rubbish in containers in an expeditious manner to prevent accumulation. Remove waste from project site when containers become full.
4. Legally dispose of all waste materials, rubbish, volatile materials and cleaning materials off project site.
5. Dispose of no materials in waterways.
6. Protect newly finished and clean surfaces from contamination during cleaning operations.
7. Allow no accumulation of debris contributing to survival or spread of rodents, roaches or other pests. On a daily basis, remove debris containing food scraps.

D. Final Cleanup:

1. Clean all finished surfaces in accord with manufacturer's product data and requirements specified in specification sections, prior to Date of Substantial Completion. All general

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and specific cleaning shall be performed prior to Contractor's request that the project or portion thereof be inspected for Substantial Completion.

2. Remove dust, debris, oils, stains, fingerprints and labels from exposed finish surfaces.
3. Repair, patch and touch up marred surfaces to match adjacent finishes. Replace materials which cannot be repaired or patched.
4. Clean disturbed areas of project site of debris.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials for Replacement of Work Removed: Comply with specification sections for type of work to be performed.

2.2 REMOVED MATERIAL

A. Reuse of Material: Reuse of any items involved in the work is subject to the Contractor's ability to remove, store and reinstall the item without permanently damaging or marring the items to be reused. If the Contractor is unable to reuse any item as prescribed herein, he shall substitute new material to match existing in lieu of reusing same. Contractor may also elect to use material to match existing in lieu of reuse of existing for his own convenience. Approved new materials used shall match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination:

1. Visit project site and compare locations of work with indications in Contract Documents. Report any discrepancies discovered for resolution.
2. Examine existing conditions of the project, including elements subject to damage or to movement during cutting and patching.
3. After uncovering work, inspect conditions affecting installation of products or performance of work.
4. Report unsatisfactory or questionable conditions to Construction Consultant in writing; do not proceed with work until Construction Consultant has provided further instructions.

B. Preparation:

1. Provide adequate temporary support to ensure the structural value or integrity of the affected portion of the work.

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2. Provide devices and methods to protect other portions of the project from damage.
3. Provide protection from the elements for that portion of the project which may be exposed by cutting and patching work.

3.2 PREPARATION

A. Plan scheduling and phasing of the work to minimize interference with Owner's existing operations that will remain in use during the work. Minimize disruption of building operations and use of adjacent facilities.

B. Security:

1. Contractor shall provide safe access to occupied areas during the course of the work.
2. Provide fences, enclosures, barricades or partitions to segregate work areas from occupied and used areas.

C. Comply with governing regulations pertaining to environmental protection and water usage. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding and pollution.

D. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition operations, as directed by the Construction Consultant or governing authorities. Return adjacent areas to condition existing prior to the start of the work.

3.3 CUTTING AND PATCHING

A. Performance:

1. Execute cutting, patching and demolition by methods which will prevent damage to other work and will provide surfaces to receive installation of repairs.
2. Execute work by methods which will prevent settlement or damage to other work.
3. Elements of a structural or support nature, including concealed elements exposed by the removal of existing elements of the work, shall be inspected and the Engineer notified should additional work be indicated due to loss of structural integrity, rot, rust, corrosion or other similar condition.
4. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
5. Restore work which has been cut or removed; install new products to provide complete work in accord with requirements of Contract Documents.
6. Fit work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces. Fire stop penetrations through fire-rated construction.
7. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

a. For continuous surfaces: Refinish to nearest intersection.

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b. For an assembly: Refinish the entire unit.

8. Repair damaged adjacent surfaces and finishes to original condition.
9. Maintain integrity of fire-resistant and rated construction.

B. Restoration:

1. Remove existing elements of a particular visual nature with care and in such manner that maximum reuse is possible. Label, clean, protect and store to ensure reusability or reinstallation, as applicable, to as near original condition as possible.
2. Existing items of significant visual or operational value to Owner, not planned for reinstallation, shall be made available for Owner's retention for use in other work.
3. Repairs of visual or finish materials requiring new material shall be made using materials which will match existing work in type, size, texture and all other visual aspects as approved by Owner.
4. Restore elements of a structural or support nature, or other concealed elements exposed by the removal of existing elements of the work.
5. Finish surfaces requiring removal and repair, but designated to receive a new finish obscuring the nature of the original surface, may be repaired using materials most expedient to the nature of the work and which will result in a uniform, sound finished new surface of at least equal strength to existing adjacent material replaced. Sub surfaces to receive the new finish shall be of like nature to existing surrounding surfaces and acceptable to new finish surfacing installer for receipt of new materials without extra surface preparation for the repaired area.

END OF SECTION 011100

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SECTION 012973 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 GENERAL SUMMARY

A. The Contractor shall submit to the Construction Manager a Schedule of Values for the entire Contract, either within ten (10) days of Contract award or fifteen (15) days prior to the first Application for Payment deadline, whichever comes first.

B. Breakdown and Content: The Schedule of Values will be submitted in a format as prescribed by and to the level of detail specified by the Construction Manager.

1. The sum of the parts of the Schedule of Values shall aggregate to the total Contract Sum.
2. The minimum level of breakdown will normally be:

    a. General Conditions line item(s) as required.
    b. Construction costs, by CSI Division or major trade, and broken down into labor and material line items for specific areas of the facility.
    c. Stored material projections.

3. Schedule of Values items shall have a direct and understandable relation to the Project CPM Schedule.

1.2 SCHEDULE OF VALUES UTILIZATION

A. Applications for Payment: The Schedule of Values, unless objected to by the Construction Manager or the Engineer, shall be the basis for the Contractor's Applications for Payment.

B. Changes to the Schedule of Values: The Construction Manager shall have the right to require the Contractor to alter the value or add/delete categories listed on the Schedule of Values at any time for the following reasons:

1. The Schedule of Values appears to be incorrect or unbalanced.
2. A revision to the segregation of values is required due to the Contractor revising the sequence of construction or assembly of building components, which in turn invalidates the Schedule of Values.
3. Change Orders are issued to the Contractor and require incorporation into the Schedule of Values.

C. Stored Materials: The Contractor is required to correlate the documentation for payment of stored materials requested in the Application for Payment against the agreed upon breakdown of the Schedule of Values. The Construction Manager reserves the right to not process the Application for Payment if this correlation has not been submitted in conjunction with the Application.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 102973

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SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project meetings.

1.2 DEFINITIONS

A. RFI: Request from Owner, FCCPM, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

B. FCCPM: Fulton County Construction Project Manager

C. Construction Documents: The written and graphic, professionally sealed documents prepared by the Engineer of Record that fully communicate the work to be provided by the contractor during the construction phase of the project. . The construction documents are the documents submitted for the construction permit.

1.3 SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

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2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered as changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.

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2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: FCCPM will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of FCCPM.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to FCCPM.

D. FCCPM Action: FCCPM will review each RFI, determine action required, and respond. Allow seven working days for FCCPM's response for each RFI. RFIs received by FCCPM after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

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a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. FCCPM's action may include a request for additional information, in which case FCCPM's time for response will date from time of receipt of additional information.
3. FCCPM's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal in accordance with Fulton County Change Order Policy 800-6.

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify FCCPM in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of FCCPM.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date FCCPM's response was received.

F. On receipt of FCCPM's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify the FCCPM within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner of scheduled meeting dates and times at least 48 hours prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees at least 24 hours prior to meeting.

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3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including FCCPM, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to FCCPM, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, FCCPM, Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Distribution of the Contract Documents.
j. Submittal procedures.
k. Sustainable design requirements.
l. Preparation of record documents.
m. Use of the premises and existing building.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise FCCPM of scheduled meeting dates.

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2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at regular weekly intervals.

1. Attendees: In addition to representatives of Owner, FCCPM, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction

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behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Status of sustainable design documentation.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of proposal requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

END OF SECTION 013100

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.
3. Two paper copies.

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B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Schedule: Initial schedule, of size required to display entire schedule for entire design and construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S SCHEDULE

A. Time Frame: Extend schedule from date established for the Notice of Award to final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

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2. The schedule is to include milestones for production, reviews, and completion of 100% final construction documents.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
2. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
3. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for FCCPM’s administrative procedures necessary for certification of Substantial Completion.
5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

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E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the original County accepted schedule.

F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award that maintains project duration agreed to by County.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice of Award. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities. Duration of project is to conform to the duration accepted by the County.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice of Award.

a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

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1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing and commissioning.
    j. Punch list and final completion.
    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.

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2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

PART 3 - EXECUTION

3.1 CONTRACTOR'S SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

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B. Distribution: Distribute copies of approved schedule to FCCPM, separate contractors, testing and inspecting agencies, and other parties identified by Contractor and Owner with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

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SECTION 013213 - SCHEDULING OF THE WORK

PART 1 - GENERAL

1.1 INTRODUCTION

A. This Section describes the construction scheduling and progress reporting requirements of the Contract. The primary objectives of the requirements of this Section are:

1. to insure adequate planning and execution of the Work by the Contractor;
2. to assist the County and Construction Manager in evaluating the progress of the Work;
3. to provide for optimum coordination by Contractor of its trades, subcontractors and suppliers, and of its Work with the work or services provided by the County or any separate contractors; and
4. to permit the timely prediction or detection of events or occurrences which may affect the timely execution of the Work.

1.2 GENERAL SCHEDULING REQUIREMENTS

A. The Work of this Contract shall be planned, scheduled, executed, and reported using the critical path method (CPM). The Contractor shall use one of the following software programs to develop its Detailed Construction Schedule:

1. Primavera Project Planner, latest version.
2. Microsoft Project, latest version (MPX file).

B. The Detailed Construction Schedule, as defined herein, shall represent the Contractor's commitment and intended plan for completion of the Work in compliance with the Contract completion date and interim milestone dates specified. The Detailed Construction Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors or the County, and interface dates with utility companies, the County's operations, and others. The Detailed Construction Schedule shall anticipate all necessary manpower and resources to complete the Work within the dates set forth.

C. Once approved by the Construction Manager, the Detailed Construction Schedule will become the Schedule of Record, and will be the basis for coordinating the Work, scheduling the Work, monitoring the Work, reviewing progress payment requests, evaluating time extension requests, and all other objectives listed above. No other schedule will be recognized for this Contract.

D. The Contractor is responsible for determining the sequence of activities, the time estimates of the detailed construction activities and the means, methods, techniques and procedures to be employed. The Detailed Construction Schedule shall represent the Contractor's best judgment of how it will prosecute the Work in compliance with the Contract requirements. The Contractor shall ensure that Detailed Construction Schedule is current and accurate and is properly and

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timely monitored, updated and revised as Project conditions and the Contract Documents may require.

E. When there are separate contractors working concurrently on the Project whose work must interface or be coordinated with the Work of the Contractor, the Contractor shall coordinate its activities with the activities of the separate contractors, and the Detailed Construction Schedule shall take into account and reflect such work by others.

F. The Contractor shall be solely responsible for expediting the delivery of all materials and equipment to be furnished by it so that the progress of construction shall be maintained according to the currently approved construction schedule for the Work. The Contractor shall notify the Construction Manager in writing, and in a timely and reasonable manner, whenever the Contractor determines or anticipates that the delivery date of any material or equipment to be furnished by the Contractor will be later than the delivery date indicated by the currently approved construction schedule, or required consistent with the completion requirements of this Contract, subject to schedule updates as herein provided.

1.3 DETAILED CONSTRUCTION SCHEDULE

A. Within two (2) weeks after the Notice to Proceed, the Contractor shall submit a Detailed Construction Schedule according to the requirements established herein.

B. The Detailed Construction Schedule shall consist of a time-scaled, detailed network graphic representation of all activities which are part of the Contractor's construction plan and an accompanying listing of activity's dependencies and interrelationships. The Detailed Construction Schedule submission shall include, but not be limited to, the following information:

1. Project name.
2. Distinct, logical and identifiable subdivisions of Work.
3. Activities for all aspects of the Work, with durations not exceeding fourteen (14) calendar days for all activities for which the Contractor will perform actual construction work. Material procurement, submittals, concrete curing and other similar activities may exceed fourteen (14) calendar days if approved by the Construction Manager. Related activities, each of a duration of five (5) calendar days or less, may be shown as one activity together, if not on the critical path of timely job completion.
4. Outage schedules for existing utility services that will be interrupted during the performance of the Work.
5. Acquisition and installation of equipment and materials supplied and/or installed by the County or separate contractors.
6. All start dates, milestones, float and completion dates.
7. An accounting of the number of workdays anticipated to be lost due to weather. This accounting shall be in accordance with allowable days per month provided in Section 8 of General Conditions (00-700-53).
8. A tabular report listing all predecessor and successor activities for each activity.
9. A legible time scaled network diagram showing the critical path.
10. A listing of the project calendar, indicating the anticipated days of work performance.

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11. A computer disk, in a form and format acceptable to the Construction Manager, of the Detailed Construction Schedule including all required submission information resident in the computer system and containing all of the files associated with the schedule.

C. Schedule Reports: Schedule submissions will contain the following minimum information for each activity:

1. Activity number, description and estimated duration.
2. Anticipated start and finish dates.
3. Responsibility for activity.
4. The cost loading values for each activity.

D For all major equipment and materials to be fabricated or supplied for the Project, the Detailed Construction Schedule shall show a sequence of activities including:

1. Preparation of shop drawings and sample submissions.
2. A reasonable time for review of shop drawings and samples or such time as specified in the Contract Documents.
3. Shop fabrication, delivery and storage.
4. Erection or installation.
5. Testing of equipment and materials.

E. The Contractor shall submit, as a part of the data submitted to the Construction Manager, a narrative report indicating the anticipated allocation by the Contractor of the following resources and work shifts for each activity which he proposes to be utilized on the Project:

1. labor resources;
2. equipment resources; and
3. whether it proposes the Work to be performed on single, double or triple shifts, and whether it is to be done on a 5, 6 or 7-day work week basis.

F The Construction Manager shall have the right to require the Contractor to modify any portion of the Contractor's Detailed Construction Schedule, or Recovery Schedule, as herein required, (including cost loading) with the Contractor bearing the expense thereof, which the Construction Manager reasonably determines to be:

1. impractical or unreasonable;
2. based upon erroneous calculations or estimates;
3. not in compliance with other provisions of the Contract Documents.
4 required in order to ensure proper coordination by the Contractor of the Work of its subcontractors and with the work or services being provided by any separate contractors;
5 necessary to avoid undue interference with the County's operations or those of any utility companies or adjoining property owners;
6. necessary to ensure completion of the Work by the milestone and completion dates set forth in the Contract Documents;
7. required in order for the Contractor to comply with the requirements of this Section or any other requirements of the Contract Documents; or
8. not in accordance with the Contractor's actual operations.

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1.4 COST LOADING

A. As part of the submission of the Detailed Construction Schedule, the Contractor shall submit a breakdown of the expected value of each of the schedule activities for which payment is required.

B. The cost breakdown of the Detailed Construction Schedule shall have a direct correlation to the Schedule of Values to be used as the basis for Applications for Payment.

1.5 UPDATING OF CONSTRUCTION SCHEDULE/PROGRESS REPORTS

A. Not less than seven (7) calendar days before the submission of the monthly progress payment request, or on a date specified by the Construction Manager, the Contractor shall arrange for its Project Manager, Superintendent and necessary subcontractors and suppliers to attend a monthly schedule meeting with the Construction Manager to review the Contractor's report of actual progress. Said report shall set forth up-to-date and accurate progress data, and shall be prepared by the Contractor in consultation with all principal subcontractors and suppliers.

B. The progress report of the Contractor shall show the activities, or portions of activities, completed during the reporting period, the actual start and finish dates for these activities, remaining duration and/or estimated completion dates for activities currently in progress, and quantities of material installed during the reporting period.

C. At the monthly schedule meeting a total review of the Project will take place including but not limited to, the following:

1. Current update of the Detailed Construction Schedule.
2. Anticipated detailed construction activities for the subsequent report period.
3. Critical items pending.
4. Contractor requested changes to the Detailed Construction

D. The Contractor shall submit a narrative with the progress report which shall include, but not be limited to, a description of problem areas, current and anticipated delaying factors and their impact, explanations of corrective actions taken or planned, any proposed newly planned activities or changes in sequence, and proposed logic for a Recovery Schedule, if required, as further described herein. The report shall also include:

1. A narrative describing actual Work accomplished during the reporting period.
2. A list of major construction equipment used on the Project during the reporting period.
3. The total number of men by craft actually engaged in the Work during the reporting period, with such total stated separately as to office, supervisory, and field personnel.
4. A manpower and equipment forecast for the succeeding thirty (30) days, stating the total number of men by craft, and separately stating such total as to office, supervisory and field personnel.

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5. A list of Contractor supplied materials and equipment, indicating current availability and anticipated job site delivery dates.
6. Anticipated changes or additions to Contractor's supervisory personnel.

E. As part of the updating process, the Construction Manager will calculate, based upon progress data provided by the Contractor and agreed to by the Construction Manager, the value of Work completed based on the sum of the cost loading amounts for all activities, including activities specifically defined for stored materials, less the amount previously paid. Summation of all values of each activity less the appropriate percent of retainage shall be the maximum amount payable to the Contractor, provided that the Contractor has complied with all requirements of the Contract Documents.

F. No invoice for payment shall be submitted and no payment whatsoever will be made to the Contractor until the required narrative reports, as defined herein, have been submitted and the Detailed Construction Schedule has been updated.

1.6 RECOVERY SCHEDULE

A. Should the updated Detailed Construction Schedule, at any time during the Contractor's performance, show, in the sole opinion of the Construction Manager, that the Contractor is behind schedule for any milestone or completion date for any location or category of work, the Contractor, at the request of the Construction Manager, shall prepare a Recovery Schedule within five (5) days, at no additional cost to the County (unless the County is solely responsible for the event or occurrence which has caused the schedule slippage), explaining and displaying how the Contractor intends to reschedule its Work in order to regain compliance with the Detailed Construction Schedule within thirty (30) calendar days.

B. If the Contractor believes that all of the time can be recovered within thirty (30) calendar days, the Contractor will be permitted to prepare a Recovery Schedule as set forth below. However, if the Contractor believes it will take more than thirty (30) days to recover all of the lost time, it shall prepare and submit a request for revision to the Detailed Construction Schedule and comply with all of the requirements of a Schedule Revision as set forth in Paragraph 1.7 below.

C. The Contractor shall prepare and submit to the Construction Manager a one-month maximum duration Recovery Schedule, incorporating the best available information from sub consultants, subcontractors and others which will permit a return to the Detailed Construction Schedule at the earliest possible time. The Contractor shall prepare a Recovery Schedule to the same level of detail as the Detailed Construction Schedule. The Recovery Schedule shall be prepared in coordination with other separate contractors on the Project.

D. Within two (2) days after submission of the Recovery Schedule to the Construction Manager, the Contractor and any of the necessary subcontractors, suppliers, vendors, manufacturers, etc. shall participate in a conference with the Construction Manager to review and evaluate the Recovery Schedule. Within two (2) days of the conference, the Contractor shall submit the revisions necessitated by the review for the Construction Manager's review and approval. The Contractor

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shall use the approved Recovery Schedule as its plan for returning to the Detailed Construction Schedule.

E. The Contractor shall confer continuously with the Construction Manager to assess the effectiveness of the Recovery Schedule. As a result of these conferences, the Construction Manager will direct the Contractor as follows:

1. If the Construction Manager determines the Contractor continues behind schedule, the Construction Manager will direct the Contractor to prepare a Schedule Revision and comply with all of the requirements of a Schedule Revision as stated herein and the other requirements of the Contract Documents; provided, however, that nothing herein shall limit in any way the rights and remedies of the County and Construction Manager as provided elsewhere in the Contract Documents; or
2. If the Construction Manager determines the Contractor has successfully complied with provisions of the Recovery Schedule, the Construction Manager will direct the Contractor to return to the use of the approved Detailed Construction Schedule.

F. In carrying out any approved Recovery Schedule, or whenever it becomes apparent that any critical activity completion date may not be met, the Contractor shall take any or all of the following minimum actions, as may be required, at no additional cost to the County:

1. Increase manpower to put the Work back on schedule.
2. Increase the number of working hours per shift, shifts per working day, working days per week, amount of construction equipment, or any combination which will place the Work back on schedule.
3. Reschedule activities to achieve maximum practical concurrence and place the Work back on schedule.

G. If the Contractor fails to take appropriate action as required by this Paragraph 1.6 to recover delays in the schedule, the Construction Manager may take action to attempt to put the Work back on schedule and deduct the cost of such action from monies due or to become due the Contractor in accordance with the Contract Documents.

1.7 SCHEDULE REVISIONS

A. Should the Contractor desire to or be otherwise required under the Contract Documents to make modifications or changes in its method of operation, its sequence of Work or the duration of the activities in its Construction Schedule, it shall do so in accordance with the requirements of this Paragraph and the Contract Documents. The approved Detailed Construction Schedule may only be revised by written approval of the Construction Manager as provided herein.

B. The Contractor shall submit requests for revisions to the Detailed Construction Schedule to the Construction Manager, using a Schedule Revision Form provided by the Construction Manager, together with written rationale for revisions and description of logic for rescheduling work, substantiating that the milestone and completion dates will be met as listed in the Contract

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Documents. Proposed revisions acceptable to the Construction Manager and County will be approved in writing and incorporated into the Detailed Construction Schedule.

C. Requests for revision will be accompanied by evidence acceptable to the Construction Manager that the Contractor's suppliers, subcontractors and sub-subcontractors are in agreement with the proposed revisions.

D. If there are separate contractors on the Project, the approval of the separate contractors shall be obtained to make the proposed schedule revisions. If accepted by the Construction Manager and County, the revisions shall be binding upon the Contractor and all separate contractors on the Project.

E. The impact of all change orders to this Contract shall be included in the Detailed Construction Schedule.

1.8 FLOAT TIME

A. Float or slack time associated with one chain of activities is defined as the amount of time between earliest start date and latest start date or between earliest finish date and latest finish date for such activities, as calculated as part of the currently approved construction schedule. Float or slack time shown on the currently approved construction schedule is not for exclusive use or benefit of either the County or the Contractor and is available for use by either of them according to whichever first needs the benefit of the float to facilitate the effective use of available resources and to minimize the impact of Project problems, delays, impact, acceleration or changes in the Work which may arise during performance. The Contractor specifically agrees that float time may be used by the County or Construction Manager in conjunction with their review activities or to resolve Project problems. The Contractor agrees that there will be no basis for any modification of the milestone or completion dates or an extension of the Contract Time, or a claim for additional compensation as a result of any Project problem, delay, impact, acceleration, or change order which only results in the loss of available float on the currently approved construction schedule.

B. Float time shown on any construction schedule shall not be used arbitrarily by the Contractor in a manner which, in the opinion of the Construction Manager, unnecessarily delays separate contractors from proceeding with their work in a way which is detrimental to the interests of the County.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 013213

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SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require FCCPM’s responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require FCCPM’s responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by the construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by FCCPM and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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a. FCCPM reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on FCCPM's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. FCCPM will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

C. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by FCCPM.
3. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of FCCPM.
e. Name of Contractor.
f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless FCCPM observes noncompliance with provisions in the Construction Documents, initial submittal may serve as final submittal.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to FCCPM.

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5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. FCCPM will discard submittals received from sources other than Contractor.

    a. Transmittal Form for Paper Submittals: Use CSI Form 12.1A.
    b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of FCCPM.
        7) Name of Contractor.
        8) Name of firm or entity that prepared submittal.
        9) Names of subcontractor, manufacturer, and supplier.
        10) Category and type of submittal.
        11) Submittal purpose and description.
        12) Specification Section number and title.
        13) Specification paragraph number or drawing designation and generic name for each of multiple items.
        14) Drawing number and detail references, as appropriate.
        15) Indication of full or partial submittal.
        16) Transmittal number, numbered consecutively.
        17) Submittal and transmittal distribution record.
        18) Remarks.
        19) Signature of transmitter.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by FCCPM.

4. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.

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d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations: Identify deviations from the Bidding Documents on submittals.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from and FCCPM's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from FCCPM's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Email electronic submittals as PDF electronic files directly to FCCPM specifically established for Project.

   a. FCCPM, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Submit electronic submittals via email as PDF electronic files.

   a. FCCPM, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. FCCPM, will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. FCCPM will not return copies.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

   a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.

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b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.
b. Three paper copies of Product Data unless otherwise indicated. FCCPM, will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.

1. Preparation: Fully illustrate requirements in the Construction Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm.

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3. Submit Shop Drawings in the following format:

    a. PDF electronic file.
    b. Two opaque (bond) copies of each submittal. FCCPM will return one copy(ies).

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

    a. PDF electronic file.

E. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

H. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Construction Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Construction Documents and, where required, is authorized by manufacturer for this specific Project.

L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Construction Documents. Include evidence of manufacturing experience where required.

M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Construction Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Construction Documents.

O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Construction Documents.

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P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Construction Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Construction Documents.

S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Construction Documents.

2.2 DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Construction Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to FCCPM.

B. Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Construction Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Construction Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to FCCPM.

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B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Construction Documents.

3.2 FULTON COUNTY CONSTRUCTION PROJECT MANAGER'S ACTION

A. FCCPM will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: FCCPM will review each submittal, make marks to indicate corrections or revisions required, and return it. FCCPM will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: FCCPM will review each submittal and will not return it, or will return it if it does not comply with requirements. FCCPM will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

END OF SECTION 013300

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SECTION 013529 - HEALTH, SAFETY, AND EMEREGENCY PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this section consists of establishing an effective accident prevention program and providing a safe environment for all personnel and visitors.

1.2 SUBMITTALS

A. Accident Prevention Program: Before on-site work begins, submit for approval an accident prevention program. The Project Manager will review the proposed program for compliance with OSHA and project requirements. If the program requires any revisions or corrections, the Contractor shall resubmit the program within 10 days. No progress payments will be made until the program is approved.

The program shall include:

1. Name of responsible supervisor to carry out the program.
2. Weekly and monthly safety meetings.
3. First aid procedures.
4. Outline of each phase of the work, the hazards associated with each major phase, and the methods proposed to ensure property protection and safety of the public, National Park Service personnel, and Contractor's employees.
5. Identify the work included under each phase by reference to specification section or division numbers.
6. Training, both initial and continuing.
7. Planning for possible emergency situations, such as floods, fires, cave-ins, slides, explosions, power outages, and wind storms. Such planning shall take into consideration the nature of construction, site conditions, and degree of exposure of persons and property.
8. Cleaning.
9. Fire Protection.

B. Submit a copy of test reports, as required by OSHA, for personnel working with hazardous materials.

C. Submit a report of safety meetings and of inspections.

D. Upon request, submit proof of employees' qualifications to perform assigned duties in a safe manner.

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1.3 QUALITY ASSURANCE

A. Clauses entitled "Accident Prevention" and "Permits and Responsibilities" of the contract. In case of conflicts between Federal, state, and local safety and health requirements, the most stringent shall apply. Equipment or tools not meeting OSHA requirements will not be allowed on the project sites. Failure to comply with the requirements of this section and related sections may result in suspension of work.

B. Qualifications of Employees:

1. Ensure that employees are physically qualified to perform their assigned duties in a safe manner.
2. Do not allow employees to work whose ability or alertness is impaired because of drugs, fatigue, illness, intoxication, or other conditions that may expose themselves or others to injury.
3. Operators of vehicles, mobile equipment, hoisting equipment, and hazardous plant equipment shall be able to understand signs, signals, and operating Instructions, and be capable of operating such equipment. Provide operating instructions for all equipment. Newly hired operators shall be individually tested by an experienced operator or supervisor to determine if they are capable of safely operating equipment.

1 .4 ACCIDENT REPORTING

A. Reportable Accidents: A reportable accident is defined as death, occupational disease, traumatic injury to employees or the public, property damage by accident in excess of $100, and fires. Notify Project Manager immediately in the event of a reportable accident. Within 7 days of a reportable accident, fill out and forward to Project Manager an Accident/Property Damage Report.

B. All Other Accidents: The Contractor shall report all other accidents to the Project Manager as soon as possible and assist the Project Manager and other officials as required in the investigation of the accident.

PART 2 - PRODUCTS

2 .1 FIRST AID FACILITIES

A. Provide adequate facilities for the number of employees and the type of construction at the site.

2 .2 PERSONNEL PROTECTIVE EQUIPMENT

A. Meet requirements of NIOSH and MSHA.

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3 .1 EMERGENCY INSTRUCTIONS

A. Post telephone numbers and reporting instructions for ambulance, physician, hospital, fire department, and police in conspicuous locations at the work site.

3 .2 FIRE AND LIFE SAFETY

A. Provide and maintain the fire and life safety requirements in NFPA 241 (Standard for Safeguarding Construction, Alteration, and Demolition Operations).

B. Contractor shall have a Hazard Communications Plan; store hazardous materials in accordance with manufacturer’s and OSHA recommendations; immediately report all spills of hazardous materials to the park; and maintain a spill emergency response kit.

3 .3 PROTECTIVE EQUIPMENT

A. Inspect personal protective equipment daily and maintain in a serviceable condition. Clean, sanitize, and repair, as appropriate, personal items before issuing them to another individual.

B. Inspect and maintain other protective equipment and devices before use and on a periodic basis to ensure safe operation.

3 .4 SAFETY MEETINGS

A. As a minimum, conduct weekly 15-minute "toolbox" safety meetings. These meetings shall be conducted by a foreman and attended by all construction personnel at the worksite.

B. Conduct monthly safety meetings for all levels of supervision. Notify the Project Manager of meeting dates and times. These meetings shall be used to review the effectiveness of the Contractor's safety effort, to resolve current health and safety problems, to provide a forum for planning safe construction activities, and for updating the accident prevention program. The Project Manager will attend the meeting and enter the results of the meetings into the daily log.

3 .5 HARD HATS AND PROTECTIVE EQUIPMENT AREAS

A. A hard hat area will be designated by the Project Manager. The hard hat area shall be posted by the Contractor in a manner satisfactory to the Project Manager.

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B. It is the Contractor's responsibility to require all those working on or visiting the site to wear hard hats and other necessary protective equipment at all times. As a minimum, provide six hard hats for use by visitors. Change liners before reissuing hats.

3 .6 TRAINING

A. First Aid: Provide adequate training to ensure prompt and efficient first aid.

B. Hazardous Material: Train and instruct each employee exposed to hazardous material in safe and approved methods of handling and storage. Hazardous materials are defined as explosive, flammable, poisonous, corrosive, oxidizing, irritating, or otherwise harmful substances that could cause death or injury.

END OF SECTION 013529

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SECTION 014219 - REFERENCE STANDARDS

PART 1 - GENERAL

1.1 APPLICABILITY OF STANDARDS

A. Where reference is made to standards or specifications published by various organizations ("standards"), the Work shall conform to latest edition of such standards as amended and revised in effect at the date of Contract, unless a specific date is indicated.

B. Where material is designated for certain applications, material shall conform to standards designated in the applicable building code governing the Work. Similarly, unless otherwise specified, installation methods and standards of workmanship shall also conform to standards required by such code. Where no particular material is specified for a certain use, the Contractor shall select from choices offered in the governing code.

C. Where a standard does not provide all information necessary for the complete installation of an item, comply with manufacturer's instructions for installation and workmanship.

D. Where specific articles, sections, divisions or headings for standards are not given, such standards shall apply as appropriate. Standards when included in the Contract Documents by abbreviations or otherwise shall form a part of Contract Documents. In the event of conflicts between cited standards and/or the Contract Documents, the more stringent shall govern.

1.2 ABBREVIATIONS AND ACRONYMS

A. Abbreviations and acronyms used throughout the Contract Documents refer to associations, institutes, societies and other public bodies who publish standards which are readily available to the public, and to the titles of the standards which they publish. Where such abbreviations or acronyms are used in the Contract Documents, they shall mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

B. Whenever initials representing such a body are shown, followed by a number or a combination of numerals and letters, reference is to a particular standard to which Contractor shall conform. The number or combination of numerals and letters following abbreviation designates the particular standard to be followed.

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1.3 CONTRACTOR'S DUTIES AND RESPONSIBILITIES

A. The Contractor shall be responsible when required by Contract Documents, or upon written request from the Construction Manager, to deliver required proof that materials or workmanship, or both, meet or exceed the requirements of a reference standard.

1.4 CONFLICTING STANDARDS

A. Where compliance with two or more standards is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different but apparently equal and other uncertainties to the Architect, through the Construction Manager, for a decision before proceeding.

1.5 COPIES OF STANDARDS

A. Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

END OF SECTION 014219

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SECTION 015719 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all facilities, establish procedures, and conduct construction activities in a manner which will ensure compliance with the County's environmental requirements and other regulations controlling construction activities at the Project site.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products, devices and materials shall be approved by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION PROCEDURES

A. General:

1. Conform to laws, ordinances, restrictions, and rules of governmental bodies having enforcement power in regard to site preservation and erosion control.
2. Prevent droppings of petroleum products, cementitious waste and chemical substances on the ground or into storm, sanitary drains or waterways.
3. The Contractor shall designate one person, the Superintendent or other, to enforce strict discipline on activities related to generation of wastes, pollution of air/water, generation of noise and similar harmful or deleterious effects which might violate regulations or reasonably irritate persons at or in vicinity of the Project site.
4. Take special precautions when working on floors directly above occupied floors. Minimize noise, dust, or other environmental hazards to spaces.

B. Noise Control:

1. Provide mufflers on combustion engine powered equipment to minimize noise.

C. Air Quality Control:

1. Maintain acceptable air quality at all times.

D. Water Control:

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1. All equipment necessary to keep work area free from the accumulation of water during the entire progress of the Work shall be the responsibility of the Contractor.
2. Keep the building or portions thereof free from water ingress due to construction operations at all times until Final Completion of the Work.
3. Dispose of water in such a manner as will not endanger public health or cause damage or expense to public or private property. Abide by the requirements of all public authorities having jurisdiction.

E. Dust Control:

1. Effectively confine dust, dirt and noise to the actual construction area(s) until Substantial Completion of the Work.
2. Clean up operations shall be by vacuuming, wet mopping, wet sweeping, or wet power brooming. In sandblasting operations, if any, confine the dust.
3. Use wet-cutting methods for cutting concrete, stone, and masonry. Do not shake out bags containing cement, lime, and other dust-causing substances.
4. Keep dust down at all times, including non-working days, weekends and holidays. Temporary methods consisting of water sprinkling or similar methods will be permitted to control dust. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.
5. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

F. Snow and Ice Removal:

1. Arrange for removal of snow and ice in and about the premises, as necessary to conform with local regulations on public sidewalks adjacent to the site, and as necessary on and about the site and the Work to permit safe access to continue or perform work.
2. When performing work under exposed conditions, remove snow and ice for the protection and execution of the Work.

G. Vermin Control: Control vermin during the construction period. If vermin are encountered, provide extermination arrangements as necessary.

H. Disposal of Debris, Chemicals and Waste:

1. Dispose of debris, chemicals, and waste off the site in compliance with Federal, State and local laws and regulations.
2. Collect and contain materials before disposal in an orderly fashion and by means which prevent contamination of air, water and soil.
3. Store chemicals in watertight containers.

I. Clean-Up and Restoration of the Site:

1. Maintain the site in good order through periodic pick up and clean-up of construction waste and wind-borne trash. Dispose of all waste and trash in tightly covered containers and schedule regular removal of trash and waste from the site.

2. Existing site work damaged during construction shall be restored to good and acceptable condition.

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J. Damage from Storms: Secure the site to avoid damage to the Work materials, as well as damage to adjacent property.

END OF SECTION 015719

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SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

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1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
8. Complete final cleaning requirements, including touchup painting.

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9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, FCCPM will either proceed with inspection or notify Contractor of unfulfilled requirements. FCCPM will notify Contractor of items, either on Contractor's list or additional items identified by engineer, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, FCCPM will either proceed with inspection or notify Contractor of unfulfilled requirements. FCCPM will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order, proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

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3. Submit list of incomplete items in the following format:

    a. MS Excel electronic file.
    b. PDF electronic file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

   a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Sweep concrete floors broom clean in unoccupied spaces.
   i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
   k. Remove labels that are not permanent.
   l. Wipe surfaces of mechanical and electrical equipment [, elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
   p. Leave Project clean and ready for occupancy.

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3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to FCCPM.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. **Three** bound paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. FCCPM will return **two** reviewed copies with noted comments.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least **15** days before commencing demonstration and training. FCCPM will return copy with comments.

1. Correct or revise each manual to comply with FCCPM’s comments. Submit copies of each corrected manual within **15** days of receipt of Architect's and FCCPM’s comments and prior to commencing demonstration and training.

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2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for FCCPM.
7. Name and contact information for Engineer.
8. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

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G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, **loose-leaf** binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, **and** subject matter of contents**, and indicate Specification Section number on bottom of spine**. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

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D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Precautions against improper use.
9. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

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C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

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D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set of marked-up record prints.
2) Submit PDF electronic files of scanned record prints.
3) Submit record digital data files.
4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

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1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Record data as soon as possible after obtaining it.
    c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with FCCPM and provide one copy of marked-up record prints to FCCPM. Following receipt of written request from FCCPM, prepare full sets of corrected digital data files of the Construction Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Construction Drawings.
2. Format: DWG, Version, Microsoft Windows operating system.
3. Format: Annotated PDF electronic file.
4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
5. Refer instances of uncertainty to Engineer through FCCPM for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Construction Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Engineer and FCCPM.
    e. Name of Contractor.

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2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file and paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Construction Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for FCCPM’s reference during normal working hours.

END OF SECTION 017839

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SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents:
1. Drawings and general provisions of the Subcontract apply to this Section.
2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Includes:
1. Furnishing only of metal access doors required for the Project except for such access doors as are specified as part of Mechanical and Electrical Divisions.

C. Related Sections:
1. Division 01 Section "General Requirements."
2. Division 01 Section "Project Procedures."
3. Installation of access doors is a part of the work of the trades having responsibility for the surface in which the doors occur.
4. Furnishing of access doors required for plumbing, HVAC, and electrical work: See Divisions 22, 23, and 26.

1.2 REFERENCES

A. General:
1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

1.3 SUBMITTALS

A. Submit under provisions of Division 01 Section "General Requirements."

B. Product Data: Manufacturer's product data.

C. Shop Drawings: Show metal gages, sizes, types and attachment to adjacent construction.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Manufacture: Best Access Doors, Karp Associates, Inc., Milcor, or approved equal.

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B. Metal: Cold rolled steel except use stainless steel for doors in ceramic tile [and in Food Service areas]; 16 gage for frames; 14 gage for panels (20 gage for fire rated doors).

C. Finish: Baked prime coat except for stainless steel which shall have No. 4 satin finish.

D. Hardware: Manufacturer's standard hinge assembly except hinges for doors in gypsum wallboard shall be fully concealed, screwdriver cam locks (turn knob and latch for fire rated doors). Doors generally accessible to public and located within 78" of floor shall have keyed cylinder locks, all keyed alike, 6 keys total.

E. Types:

	Best Access	Karp	Milcor
Masonry and Ceramic Tile	BA-MDS	DSC-214M	M
Gypsum Wallboard (Flush Type)	BA-PS-5030	DSC-214PL	K
Fire Rated Doors (1-1/2 Hour)	BA-FW-5015	KRP 350FR	CFRAD

F. Minimum size: 24 by 24 inches, unless otherwise noted.

PART 3 - EXECUTION NOT USED

END OF SECTION 083113

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SECTION 092900 — GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Interior gypsum board.
2. Tile backing panels.

B. Related Sections include the following:
1. Section 095113 — Acoustical Ceilings: Non-structural framing and suspension systems that support gypsum board.
2. Section 099123 – Interior painting for primers applied to gypsum board surfaces.

1.2 SUBMITTALS

A. Contractor will submit manufacturer's written statement on recycled content, manufacturing location and source/origin of the raw materials.

B. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.4 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated. Establish Level 4 drywall finish.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C l396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum Co.
      b. BPB America Inc.
      c. Lafarge North America Inc.
      d. National Gypsum Company.
      e. PABCO Gypsum.
      f. Temple.
      g. USG Corporation.

B. Regular Type:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.

C. Type X:
   1. Thickness: 5/8 inch ; '/i inch.
   2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch, Type X.
   2. Long Edges: Tapered.

E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 1/2 inch.
   2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C l396M.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum Co.
      b. BPB America Inc.
      c. G-P Gypsum.
      d. Lafarge North America Inc.
      e. National Gypsum Company.
      f. PABCO Gypsum.
      g. Temple.
      h. USG Corporation.

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i. Core: 5/8 inch, Type X-rated assembly indicated on Drawings.

2. Complying with ASTM C 1177/C ll77M.
   a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
3. Core: 5/8 inch, Type X.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.
      g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.
   1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting- type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

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a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 4 finish, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

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B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: As indicated on Drawings
   2. Type X: As indicated on Drawings where required for fire-resistance-rated assembly
   3. Ceiling Type: As indicated on Drawings.
   4. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   5. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   6. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   7. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

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B. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
5. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

C. APPLYING TILE BACKING PANELS

C. Water—Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4—inch gap where panels abut other construction or penetrations.

D. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

E. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. Bullnose Bead: Use at outside corners where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use a exposed panel edges where indicated.

D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use a exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

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3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Finish Level: Level 4 minimum.

C. Prefill open joints, rounded or beveled edges, and damaged surface areas.

D. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

3.6 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Specification Sections, apply to this Section.

1. SUMMARY

A. This Section includes ceilings composed of acoustical panels and exposed suspension systems.

1. SUBMITTALS

A. General: Submit the following according to Conditions of the Contract and Division 1 Sections.

1. Product Data: Submit product data for product specified.
2. Reflected ceiling plan coordination drawings:

a. Ceiling suspension members.
b. Method of attaching hangers to building structure.
c. Size and location of initial access modules.
d. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinkler heads; and special moldings at walls, column penetrations, and other junctures with adjoining construction.

3. Samples:

a. Manufacturer's standard sample size for each panel type specified.
b. Manufacturer's standard sample for grid showing all components in grid system.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-response tests are performed by a qualified testing and inspecting agency. Qualified testing and inspecting agencies include Underwriters Laboratories (UL), Warnock Hersey, or another agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.

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3. Acoustical panel ceilings indicated are identical in materials and construction to those tested for fire resistance per ASTM E 119.
4. Fire-resistance-rated, acoustical panel ceilings are indicated by design designations listed in the UL "Fire Resistance Directory," in the Warnock Hersey "Certification Listings," or in the listing of another qualified testing and inspecting agency.
5. Products are identified with appropriate markings of applicable testing and inspecting agency.

B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1. Obtain both acoustical panels and suspension system from the same manufacturer.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING TILE

A. Basis of Design: Armstrong Industries: Calla #2824
1. Edge: Square Tegular
2. Size: 24-inches x 24-inches.
3. Color: White
4. Surface Burning Characteristics: Class A (flame spread 25 or less); UL Labeled.

B. Acceptable Manufacturers subject to compliance with requirements:
1. USG, Interiors Inc.
2. National.

2.2 ACOUSTICAL CEILING TILE: SOUND CONTROL

A. Basis of Design: Kinetics Noise Control: Quiet
Tile l. Edge: Square Tegular
2. Size: 24-inches x 24-inches.
3. Color: White
4. Surface Burning Characteristics: Class A (flame spread 25 or less); UL Labeled.
5. Kinetics Noise Control SRP perimeter board with non-hardening acoustical sealant.

2.3 METAL SUSPENSION SYSTEM

A. Wide—Face, Single—Web, Corrosion Resistant Steel Suspension System: Main and cross runners roll formed from pre—painted or electrolytic zinc—coated, cold—rolled steel sheet, with pre—painted 15/16—inch— wide flanges.

1. Structural Classification - ASTM C 635: Intermediate-duty system.
2. Finish: Painted white.

2.4 ACCESSORIES

A. Metal Suspension System Standard: Provide manufacturer’s standard corrosion resistant metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

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B. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon Steel Wire: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so that its stress at 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than the yield stress of wire, but provide not less than No. 12-gauge, 0.106-inch- (2.69-mm-) diameter wire.

D. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.

E. Extruded-Aluminum Edge Moldings and Trim: Manufacturer's extruded-aluminum edge moldings and

F. Fasteners: Screw type fasteners as recommended by the metal suspension system materials manufacturer for installation of suspension system members to substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Measure each ceiling area and establish the layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook."

1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
2. CISCA Recommendations for Acoustical Ceilings: Comply with CISCA "Recommendations for Direct-Hung Acoustical Tile and Lay-In Panel Ceilings."

B. Suspend ceiling hangers from building's structural members ONLY. Comply with manufacturer's requirements regarding number and spacing of hanger wires to support the suspension system.

1. Install hangers plumb and free from contact with objects within ceiling plenum that are not part of the supporting structure or of the ceiling suspension system.
2. Do not splice hanger wire.

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3. Do not support suspension systems from other system hangers, conduit, piping, or ductwork.

C. Install edge moldings and trim at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw to attach moldings to substrate at intervals not over 16 inches on center and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

a. Staples are NOT acceptable for fastening moldings to substrates.

2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

3.4 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Refer to Field Quality Control in Section 09255 — Gypsum Board Assemblies.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 099123 -INTERIOR PAINTING

PART 1 - GENERAL

1.1 Drawing and general provisions of the contract including general and supplementary corrections and Division 1 specification sections, apply to this section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Gypsum board.
2. Steel.
3. Galvanized metal.
4. Aluminum (not anodized or otherwise coated).
5. Wood.
6. Concrete masonry units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required, prepare actual brush out and submit three sets of 12” x 12” sample of each finish and color.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

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2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

    a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site ready-mixed in original containers with labels intact; labels bearing manufacturer's name, paint type, color and recommended installation and reducing procedures.

B. Storage and Handling:
1. Store materials in location acceptable to concerned entities.
2. Store materials not in use in tightly covered containers will-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
3. Maintain neat, clean conditions in storage area; remove rags and waste materials at end of each day's work; store rags in closed containers.
4. Close containers at end of day's work. Leave no materials open.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew paint; or to damp or wet surfaces.
1. Apply no materials in spaces where dust is being generated.

C. Protection: Cover finished work of other trades and surfaces not being painted concurrently and prefinished items.

D. Safety Precautions:
1. Provide temporary fire protection equipment in materials storage area.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 INTERIOR PAINT

A. Basis of Design: Sherwin Williams

1. Color: As selected by Architect from manufacturers standard colors.

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B. Acceptable Manufacturers: Products of the following manufacturers similar in type and quality are acceptable for use, subject to approval of product o\list:
1. Porter Paints/PPG Industries.
2. Benjamin Moore Co.
3. Duron Paint Co.

C. Where products other than those of the manufacturer listed as the standard of quality are specified in Painting Schedule, such products have been selected to achieve specific results and substitutions will be allowed only in accordance with Product Options and Substitutions section.

D. Miscellaneous Materials:
1. Paint thinners and tints shall be products of same manufacturer as paints or approved by manufacturer for use with their products.
2. Shellac, turpentine, patching compounds and similar materials required for execution of work shall be pure, best quality products.
3. Mildewcide paint additive for paints and stains not already containing mildewcide:
   a. Acceptable product: Enviro-Chem, Inc.; Stay-Clean I/E.
   b. Characteristics: 50.0% 2- (4 — Thiazolyl) Benzinadazole; EPA Registration No. 10445-76-47332.
4. Insecticide paint additive for exterior paints and stains:
   a. Acceptable product: Enviro-Chem, Inc.; CPF —2D
   b. Characteristics: 87% Diazinon; EPA Registration No. 47332-4.

E. Colors and Gloss:
1. Colors shall match color chips selected by Architect with initial approval based on brush-out submittals and final approval based on mock-ups.
2. Gloss, minimum, unless otherwise indicated:
   a. Walls: Low luster or eg-shel
   b. Ceilings, soffits and other horizontal surfaces: Flat.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Colors: As indicated in finish schedule.

2.3 INTERIOR SYSTEMS

A. HOLLOW METAL DOORS / FRAMES:
1. Gloss Finish (Solvent Base)
   a. 1st Coat: S-W Pro Industrial Pro-CrylOR Primer, B66-310 Series (2-4 mils dry)
   b. 2nd Coat:S-W Industrial Enamel, B54 Series
   c. 3rd Coat: S-W Industrial Enamel, B54 Series (2.0 - 4.0 mils dry per coat)

B. GYPSUM WALL BOARD:

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1. Eg-Shel / Satin Finish;
   a. 1st Coat: S-W ProMar 200 Latex Primer, B28W8200
      (4 mils wet, 1.2 mils dry)
   b. 2nd Coat: S-W ProMarR 200 Latex Eg-Shel, B20W2200 Series
   c. 3rd Coat: S-W ProMarB 200 Latex Eg-Shel, B20W2200 Series
      (4 mils wet, 1.6 mils dry per coat)

C. TOILET ROOM WALLS:
   1. Epoxy System (Water Base) Semi -Gloss Finish
      a. 1st Coat: S-W ProMar 200 Interior Latex Primer, B28W200
         (4 mils wet, 1.1 mils dry per coat)
      b. 2nd Coat: S-W Pro Industrial Pre-Catalysed Waterbased Epoxy, K46-151 Series
      c. 3rd Coat: S-W Pro Industrial Pre-Catalysed Waterbased Epoxy, K46-151 Series
         (4 mils wet, 1.5 mils dry per coat)

D. WOOD DOOR SEALER (CLEAR):
   1. Water Reducible Polyurethane (topcoat) Available in Satin or Gloss Finish
      Semi-Transparent Stain
      a. 1st Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series
      b. 2nd Coat: S-W WoodClassics Waterborne Polyurethane Varnish, A68 Series
         (400-500 sq ft/gal).

   2. Polyurethane (topcoat) Available in Satin or Gloss Finish
      Semi-Transparent Stain
      a. 1st Coat: S-W WoodClassics Polyurethane Varnish, A67 Series
      b. 2nd Coat: S-W WoodClassics Polyurethane Varnish, A67 Series
         (350-400 sq ft/gal).

E. CONCRETE FLOOR SEALER:
   1. Basis of Design: Sherwin Williams: H & C Infusion Series.
   2. Color: Clear

F. EPOXY FLOOR COATING
   1. Basis of Design: Dur-a-Flex: Dur-a-quartz Delux Topcoat Q28 (fine)
   2. Color: Selected by Architect.

G. CONCRETE MASONRY UNITS:
   1. Basis of Design: Pro Industrial Heavy Duty Block Filler # B42W00150
   2. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Wood: 15 percent.
   2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

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D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099123

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SECTION 230100 - MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:

1. General requirements for all Division 23 work.
2. General submittal requirements.
3. General quality assurance requirements.

B. Related Sections:

1. All Division 23 specification sections, including the following:
   a. Basic Mechanical Materials and Methods: Section 230500.
   b. Common Motor Requirements for HVAC Equipment: Section 230513.
   c. Identification for HVAC Piping and Equipment: Section 230553.
   d. Vibration Isolation and Seismic Restraint: Section 230548.
   e. Mechanical/Duct Insulation: Section 230713.
   f. Hangers and supports for HVAC piping & Equipment: Section 230529.
   g. Metal Ducts: Section 233113.
   h. Air Duct Accessories: Section 233300.
   i. Air Terminal Units: Section 233600.
   j. Test and Balance: Section 230593.
   k. Mechanical/HVAC Commissioning: Section 230800.
2. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.
3. Electrical Work: Division 26 of these specifications,

C. Scope:

1. Provide improvements to the existing air handling systems served by air handling units to be replaced. Improvements are intended to provide complete and operating systems at the end of the construction. Refer to the Heery International Project Narrative for air handling units to be replaced.

1.2 SUBMITTALS

A. Procedures:

1. General: Unless otherwise indicated, make submittals in accordance with requirements of Section 011000 – General Requirements
2. Schedule: see Bid Manual for schedule
3. No extension of the Contract Time will be authorized because of failure to provide an acceptable quality of submittal
4. Identification: Place a permanent label or title block on each submittal for identification.
   a. Indicate name of firm or entity that prepared each submittal on label or title block.
   b. Provide a space minimum 4 by 5 inches on label or beside title block to record Architect/Engineer's review and action.
   c. Include the following information on label for processing and recording action taken:

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1) Project name.
2) Date.
3) Name and address of Architect/Engineer.
4) Name and address of Bidder.
5) Name and address of supplier.
6) Name of manufacturer.
7) Number and title of appropriate Specification Section.
8) Other necessary identification.

d. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

5. Number of Copies: Submit six copies to Owner representative, Heery. Four copies will be returned to the successful Bidder. Unless resubmittal is required by Architect/Engineer observation of noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
6. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect/Engineer will discard submittals received from sources other than successful Bidder.
7. Action by Architect/Engineer: Architect/Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
   a. Approved.
   b. Approved as corrected.
   c. Not approved.
8. Final Submittal Distribution: Furnish copies of final (incorporating Architect/Engineer's corrections) submittals to contractors, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms, and copy those transmittals to the Construction Manager.
   a. Use for Construction: Use only final submittals with mark indicating action taken by Architect/Engineer in connection with construction.
   b. One additional copy of all final corrected submittals shall be furnished labeled "For the Test & Balance Agency".

B. Submittals shall include the following information:

1. Product data:
   a. Equipment capacity at design conditions.
   b. Shipping weight.
   c. Installed weight.
   d. Operating weight.
   e. Furnished specialties and accessories.
   f. Installation instructions.
   g. Start-up instructions.
2. Shop drawings which indicate:
   a. Equipment dimensions.
   b. Weight distribution.
   c. Required clearances.
   d. Methods of assembly.
   e. Location and size of all field connections.
3. Wiring diagrams:
   a. Required power supply.
   b. Control ladder diagram including interlocks.
   c. Clearly differentiate between factory-installed wiring and field-wiring.

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C. Project Record Documents: In addition to requirements in Sections 011000, upon completion of installation, submit three copies of record (as-built) documents. Provide the specified number of copies on both paper and as electronic media.

1. Drawings shall be submitted in both DWG or DXF and PDF format.
2. Approved submittal data, as-built information, construction test reports, checklists, manufacturer O & M manuals and training manuals shall be submitted as Adobe PDF files. PDF files shall be organized with Bookmarks. Provide Bookmarks for each Specification Section, each type of equipment. PDF shall be generated directly from Adobe and shall be word searchable. Scanned images are not acceptable.
3. The documents shall be submitted for approval prior to final completion and shall include:
   a. Buried Piping: Mark the actual installed depths (invert elevations) of all buried piping and show the measured horizontal distances from permanent features such as building walls on record drawings. Mark all changes in the location of piping, ducts and equipment in accordance with Section 01100.
   b. Shop Drawings, corrected for as-built condition, for all systems including piping and ductwork.

D. Operating and Maintenance Manuals

1. Provide manuals as required by Sections 011000.
2. Furnish 4 copies of manuals for work in Division 23.
3. Provide multiple binders if a single binder would exceed 2-1/2 inches in thickness. Delete or mark through extraneous data.
4. Provide tab pages with metal or plastic reinforced holes to separate each major item or closely related group of items with typed item names on the tabs. Supply a table of contents at the beginning of each volume listing all items, the manufacturers and the name, address and phone number of the nearest authorized service representative.
5. Manuals shall be submitted to A/E for approval within two weeks of approval of submittal data.
6. Manuals shall include the following:
   a. Equipment performance curves and tables (from submittal data).
   b. Control diagrams of factory wired equipment.
   c. Warranties and guarantees that extend more than one year from the date of Substantial Completion, bound in Copy No. 1.
   d. Approved submittal data.
   e. Equipment start-up and shutdown procedures.
   f. Troubleshooting procedures.
   g. Parts list.
   h. Equipment servicing.
   i. Preventative maintenance schedules and procedures.
   j. List of special tools required for maintenance.
   k. Maintenance instruction.
   l. Lubrication requirements.
   m. Valve lists for the various piping systems.
   n. Schedule of all air filters.
   o. Control system product data.
   p. Shop drawings.
   q. Warranties and guarantees that extend more than one year from the date of Architect’s Final Certificate, bound in Copy No. 1.
7. For all equipment, manuals shall be provided that include: equipment start-up and shutdown procedures; troubleshooting procedures; parts list; equipment servicing; preventative maintenance schedules and procedures; list of special tools required for maintenance; maintenance instructions; and lubrication requirements.

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1.3 QUALITY ASSURANCE

A. All work shall comply with Codes as described on construction documents.

B. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical products of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years unless specified otherwise in another section of this specification.

C. Installer's Qualifications: Firm with not less than 5 years of experience installing equipment and products similar to that required for this project unless specified otherwise in another section of this specification

PART 2 - PRODUCTS

2.1 ASBESTOS PROHIBITION

A. Asbestos and asbestos-containing products shall not be used.

2.2 MANUFACTURERS

A. Manufacturers listed in this specification will only be considered provided they comply with all of the requirements of the Drawings and Specifications. A manufacturer’s listing in this specification does not ensure that the manufacturer’s product meets the requirements of the Drawings and Specifications.

2.3 EQUIPMENT AND MATERIALS

A. All equipment and materials shall be new unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTRUCTION OF PERSONNEL

A. The Bidder shall furnish qualified instructors to review the operation and maintenance manuals with the Owner's representatives. Instruction shall include function, starting, operating, control, adjustment, troubleshooting, servicing, maintenance, and shutdown procedures. Instructor man-hours furnished shall be not less than those listed below.

1. Terminal Units — 4 hrs. with sample of all unit types on project

3.2 WARRANTIES AND GUARANTEES

A. Manufacturer shall warrant all parts and labor for a period of 1 year starting from the date of substantial completion. Submit a written warranty.

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B. Refer to the requirements for CORRECTIONS FOR WORK under the GENERAL CONDITIONS.

3.3 NOISE AND VIBRATION

A. Excessive noise and/or vibration produced by any equipment supplied under Division 15 will be cause for rejection and shall be corrected by the Bidder.

B. The vibration of rotating equipment shall not exceed the peak-to-peak displacement (maximum allowable vibration) values listed below.

1. Under 600 rpm: 4 mils maximum allowable vibration, unless otherwise limited.
2. 600 to 900 rpm: 3 mils maximum allowable vibration, unless otherwise limited.
3. 901 to 1200 rpm: 2 mils maximum allowable vibration, unless otherwise limited.
4. 1201 to 1800 rpm: 1.5 mils maximum allowable vibration, unless otherwise limited.
5. 1801 to 2400 rpm: 1.0 mils maximum allowable vibration, unless otherwise limited.
6. 2401 to 3600 rpm: 0.5 mils maximum allowable vibration, unless otherwise limited.
7. Over 3600 rpm: 0.3 mil maximum allowable vibration, unless otherwise limited.

Where 1 mil equals 0.001 inch.

C. Amplitude measurement at driving (motor) and driven (such as fan) speeds shall not exceed specified values.

D. Axial vibration shall not exceed radial (perpendicular to shaft) at any bearing or measuring location.

E. Equipment that fails to deliver specified capacities or which causes the motor running currents to exceed the nameplate ratings at specified capacity will be rejected and shall be corrected by the Bidder.

F. For equipment installed on inertia blocks, allowable vibration shall be reduced by the ratio of the weight of the equipment to the total weight of the equipment and the inertia block.

3.4 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Materials shall be protected from damage by factory-packing.

B. Acceptance at Site: Construction Manager will reject any damaged materials upon arrival.

C. Storage and Protection: Store materials in a manner to prevent damage.

D. Handling: Use manufacturer's recommended material handling procedures when unloading and moving materials.

E. Equipment, piping and ductwork shall be stored at least six inches off the ground on blocking racks and kept clean.

F. All code stamps and nameplates shall be protected from damage and must be clean and legible before final inspection.

3.5 PROJECT CONDITIONS

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A. Review drawings to determine project conditions.

B. Determine working clearances around and between construction elements such as beams, columns, and walls.

C. Determine access requirements around other work, including working clearances to mechanical controls and electrical equipment.

D. Determine spaces reserved for electrical equipment.

E. Locations of the equipment on the drawings are approximate, unless dimensioned. Determine exact locations before roughing in ductwork, piping and electrical work.

F. Field Measurements:

1. Field-measure installation location to ensure proper fit and clearance.
2. Field-measure existing piping connections and installation location to ensure proper fit and clearance.

3.6 PAINTING

A. Touch-up or repaint any factory finished mechanical equipment on which the finish is damaged with paint provided by the manufacturer to match the original paint.

3.7 ABBREVIATIONS OF STANDARDS

A. AABC Associated Air Balance Council

B. ANSI American National Standards Institute

C. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

D. ASME American Society of Mechanical Engineers

E. ASTM American Society for Testing and Materials

F. NFPA National Fire Protection Association

G. UL Underwriters' Laboratories, Inc.

H. NEMA National Electrical Manufacturers Associations.

I. ETL Electrical Testing Laboratories.

J. NEC National Electric Code.

K. HI Hydraulic Institute.

3.8 OPERATIONAL TESTS

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A. Prior to the inspection to determine substantial completion, the Contractor shall put all mechanical systems into service and check for proper operation. Prior to inspection to determine substantial completion, contractor shall confirm in writing to the Architect or Owner that all of the items in the following condensed checklist are complete:

1. Correct rotation of motors and ratings of overload heaters are verified.
2. Specified filters are installed and spares are on hand when specified.
3. All equipment has been started, checked, lubricated and adjusted in accordance with the manufacturer's recommendations.
4. All manual valves have been fully opened and closed.
5. All manufacturer's certificates of start-up specified have been delivered to the Architects and Engineers.
6. All equipment has been cleaned and damaged painted finishes have been touched-up with paint provided by the manufacturer to match the original paint.
7. Damaged fins on heat exchangers have been combed out. Missing or damaged parts have been replaced.
8. Equipment labels, pipe marker labels, ceiling markers and valve tags are installed.
9. All code stamps and nameplates must be clean and legible.
10. Valve tag schedules, corrected control diagrams, sequence of operation lists and start-stop instructions have been posted.
11. Test and balance work is complete and systems operate as specified.
12. Automatic control set points are as designated and performance of controls conforms with the sequence of operation.
13. Maintenance manuals have been delivered and instructions to the operating personnel have been made.
14. Contractor has performed tests and demonstrations required by authority having jurisdiction.
15. Correct motor starter overload heaters are installed.

B. Prior to the inspection to determine substantial completion, the Contractor shall operate all mechanical systems as required to demonstrate that the installation and performance of these systems conform to the requirements of the Contract Documents.

3.9 DRAWINGS

A. The mechanical drawings are diagrammatic and do not show every fitting and detail. All piping systems, duct systems and equipment are intended to be complete. The Contractor shall include in his bid and provide all necessary offsets, connections, supports, fittings, details, materials and labor to complete the work as specified.

3.10 OCCUPANCY BY OWNER

A. During construction, the Owner will continue to occupy the building 24 hours per day, seven days per week. Construction shall not adversely affect the Owner’s working environment and beneficial occupancy of the building. Interruption of the building life safety systems will not be permitted. Excessive noise, dust or air pollution will not be permitted. Coordinate all shutdowns of systems with the Owner. All shutdowns must be approved in writing.

3.11 SEQUENCING AND SCHEDULING

A. Sequence work in accordance with manufacturer's installation instructions.

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B. Coordinate with other building elements and finishes to avoid conflicts.

3.12 PREPARATION

A. Protection: Protect surrounding elements from work of this Division.

B. Surface Preparation: Clean surfaces to receive work.

C. Operate all equipment as necessary for the test and balance work.

D. Operate the controls and safeties for all equipment.

E. Repair all malfunctioning controls and safeties.

3.13 CLEANING

A. Clean all new equipment using materials and methods recommended by equipment manufacturers.

B. Clean finishes of all new equipment to remove dust and dirt.

C. Remove dust and debris from inside and outside of all equipment and materials furnished.

D. Clean exposed factory-finished surfaces.

3.14 VOLTAGE VERIFICATION

A. Before furnishing electric motors, heaters and other equipment that includes electrically operated components, the Contractor shall verify that the voltage, phase and Hertz ratings conform to the electrical characteristics of the circuits shown for the equipment on the electrical Drawings.

3.15 EQUIPMENT LOCATION CHANGES

A. The Owner reserves the right to change the location of any outlet, pipe, drain, fixture, or diffuser as much as ten (10) feet from the location shown on the Drawings without additional cost to the Owner, provided the change is made before the roughing work has been installed. If location changes are required, the Architect will provide the Contractor with written instructions.

END OF SECTION 230100

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SECTION 230500 - BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:
1. Coupling and fan guards.
2. Access doors.
3. Supplementary Steel.

B. Related Sections:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.
2. All Division 15 specification sections, including the following:
   a. Mechanical General Provisions: Section 23010
   b. Vibration Isolation and Seismic Restraint: Section 23240.
   c. Mechanical Insulation: Section 23250.
   d. Duct: Section 23890.
   e. Air Terminal Units: Section 233600.

1.2 SUBMITTALS

A. Product data, for each product specified in this section.

B. Welder qualification statement, for information.

1.3 QUALITY ASSURANCE

A. Welding: Before any pipe welding is performed, the Contractor shall submit a copy of his Welding Procedure Specification together with the Procedure Qualification Record and qualifications of the performance of welders and welding operators as required by Section IX of the ASME Boiler and Pressure Vessel Code.

B. Inspection, Examination and Testing of Welds:

1. All welds in piping specified to be in accordance with the ASME code for Building Services Piping, ANSI/ASME B31.9 shall be inspected, examined and tested as specified in Chapter VI of that code, which requires visual examination of welds.
2. Building services piping to be inspected includes but is not limited to chilled water piping.

C. The testing laboratory inspection shall consist of visual examination of welds to determine that the welds do or do not meet the acceptance criteria.

D. Owner employed testing laboratory inspection and examination of welds will be furnished once for each weld, unless otherwise noted.

E. Welds that do not meet the acceptance criteria shall be remade and re-inspected. The Contractor shall pay the cost of re-inspections.

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F. Welder Qualifications - Piping: Qualify welding processes and each welder in accordance with AWS D10.9, Acceptance Requirement Level AR-3.

G. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

H. The design, manufacture and testing of mechanical equipment and materials shall conform to or exceed the latest applicable NEMA, ASME and ANSI standards.

I. All materials must be new and bear a U.L. label. Materials that are not covered by U.L. testing standards shall be tested and listed by an independent testing laboratory of a governmental agency, which laboratory shall be acceptable to the Architect, Owner and code enforcing authority.

J. These drawings and specifications define the minimum quality of product equipment by designating a manufacturer's trade name and catalog model number. The design has been based on this equipment selection and where more than one name is given, the first is the basis of the design. Other named equipment will require a request for substitution and be submitted as indicated herein.

1.4 MATERIALS AND SUBSTITUTIONS

A. Materials shall be new and of specified quality. Deliver materials to and store them at the project in unbroken factory containers, indication manufacturer's brand, and name of materials, which shall be used throughout the work.

B. Clearly and permanently mark or stamp all materials with manufacturer's standard nameplate showing the model number and performance data. All materials shall be new and unused and provided with nameplates to indicate what function it serves.

C. Brands or trade names are mentioned to set standards of quality; use no substitute materials unless acceptable in writing by the Architect. Acceptance of substitute materials does not relieve the Contractor of responsibility for providing a workable and functioning system as designed.

D. Proof of equality is the sole responsibility of the Contractor. Descriptive data must be adequate to show the Architect why the materials or equipment meets the job requirements.

E. Material submission is a requirement of these specifications. No payment for any work will be approved until this is done. Partial compliance or partial submittals will not be considered to show intent or ability to perform the work properly.

F. Mark any submittal "As Specified", or accompanied by a letter from the supplier explaining in detail what the difference if any, exists between the submitted item and the specified item. Failure to point out differences will be considered cause for non-acceptance. The Architect and the Engineer will not assume any responsibility for any delays, damage, or expenses incurred by others due to such action.

G. Revisions or additional work required, due to the use of substitute materials, shall be fully indicated on detailed drawings submitted with the shop drawings. Substitutions proposed because of insufficient time for delivery of previously approved item shall be accompanied by the original purchase order with date and "received" stamp by the vendor.

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1.5 OPERATING AND MAINTENANCE MANUALS

A. Deliver to the Architect, for the Owner's use, three (3) complete operating and maintenance manuals covering all equipment and systems installed under this Division.

B. Include spare parts, lists, wiring diagrams and operating instructions for all operating instructions for all operating equipment, as well as approved submittals. All information shall be in a three ring binder with hard cover and tab indexes. Provide index in front cover indicating parts name, date and local vendors for furnishing parts and information on equipment.

1.6 EQUIPMENT HANDLING

A. New equipment received at site prior to installation shall be stored indoors; when outdoors shall be mounted a minimum of 6" above grade with at least (1) layer of heavy polyethylene plastic sheet weather proof covering anchored to prevent damage by high winds.

B. Care shall be exercised during construction to avoid damage of any kind to mechanical equipment. Equipment shall be protected from dust and moisture during construction. Failure of the Contractor to protect the equipment as outlined herein shall be grounds for rejection of the equipment.

C. Where equipment is specified to be installed in accordance with manufacturers recommendations, a copy of these recommendations shall be kept on the job site at all times and shall be made available to the Owners upon request.

D. The general arrangement and location of piping, ductwork and equipment is shown on the Drawings, and shall be installed in accordance therewith, except for minor changes required by conflicts with other trades.

1.7 JOB CONDITIONS

A. Visit to site is required of all bidders prior to submission of bid. All bidders will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

1.8 DRAWINGS AND SPECIFICATIONS

A. All drawings and all divisions of these specifications shall be considered as a whole. This contractor shall inform and report any apparent discrepancies before submitting bid.

B. Every effort to make these drawings as accurate as available information allows has been made; however, the final location of piping, ductwork and equipment shall be verified and coordinated prior to installation.

PART 2 - PRODUCTS

2.1 COUPLING AND FAN GUARDS

A. The Contractor shall require the manufacturers of all mechanical equipment to furnish factory fabricated guards to meet OSHA requirements for all motor driven couplings, belts, and fans to

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prevent accidental contact with and injury from moving machinery. The Contractor shall check all protective guards on mechanical equipment for completeness and shall fabricate and install additional parts wherever necessary to provide complete protective enclosure of moving parts.

1. Belts and pulleys within air handling units shall have protective guards in every case.

B. Guards that cover ends of shafts shall have opening for tachometer. Guards over fan inlets or outlets shall have ample free area for the rated air flow. Guards and lubrication fittings shall be arranged to permit normal lubrication without removing the guards.

C. Plenum fans in air handling units shall have guards around wheels which meet OSHA requirements in every case.

2.2 ACCESS DOORS IN ARCHITECTURAL MATERIALS

A. Access door type and location shall be approved by Architect.

B. Access doors in duct are specified elsewhere in Division 15.

2.3 SUPPLEMENTARY STEEL

A. All supplementary supporting steel not shown on the Drawings but required for mechanical equipment, piping and ducts shall be furnished and installed under this Section of the Specifications.

PART 3 - EXECUTION

3.1 BUILDING ATTACHMENTS AND FASTENERS

A. Install products in accordance with manufacturer's instructions.

B. Select building attachments that are suitable for surfaces to which they attach.

C. Select building attachments with suitable load rating to support installed products.

D. Use preset inserts to fasten supports to concrete slabs.

E. Use expansion anchors, including drilled-in type, to fasten supports to concrete surfaces and slabs. Powder-actuated anchors are not accepted.

F. Use beam clamps to attach supports and hangers to building structural steel.

G. Obtain permission of the Architect before cutting or drilling structural

H. Elements and before welding to structural elements.

I. Interface installation of inserts with concrete specified in Division 3.

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3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.3 REVIEW OF CONTRACTOR'S TESTS

A. All tests made by the Contractor or manufacturers' representatives are subject to observation and review by the Owner and Architects & Engineers; the Contractor shall provide timely notices.

3.4 TEST LOGS

A. The Contractor shall maintain test logs listing the tests on all mechanical piping, ductwork, equipment and systems showing dates, items tested, inspectors' names, and remarks on success or failure of the tests.

3.5 CLEANING UP AND REMOVAL OF SCRAP

A. For work under all Mechanical Sections, trash and scrap shall be cleaned up and removed from the site as the work progresses.

3.6 STRUCTURAL COORDINATION

A. Allow for all necessary cutting and coring of slab, floors and roof as necessary to perform the work.

B. Coordinate all rooftop mechanical equipment with structural drawings.

3.7 ACCESS DOOR AND PANELS

A. Provide ceiling access doors or panels for air terminal units, fire dampers, smoke dampers, combination fire/smoke dampers, manual balancing dampers, control dampers, smoke detectors, and all other devices requiring access which are not located above easily removable ceiling components.

B. Contractor shall install equipment and route piping and ductwork so that valves, dampers and equipment with moving parts are accessible through lift-out panels and other access openings/panels shown on the drawings.

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C. Where access panel is required, but not shown on plans, notify Architect and submit drawing showing access panel location and location of equipment or valve that requires access.

END OF SECTION 23050

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SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. All wiring shall confirm to Division 16, Electrical.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

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C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.

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3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 MOTORS AND STARTERS

A. Motors larger than 1/2 HP shall be 3 phase, unless noted otherwise on Drawings or in these specifications; 1/2 HP and smaller shall be single phase unless otherwise indicated. Motors and other electrically operated equipment shall be nameplate rated to operate with the voltage, phase and Hertz indicated on the Electrical Drawings. Motor nameplate ratings shall be 200 V for 208 V circuits, 230 V for 240 V circuits, 265 V for 277 V circuits and 460 V for 480 V circuits.

B. All motors shall be NEMA Premium Efficiency.

C. All motors shall have minimum 1.15 service factors.

D. All motors' insulation shall be rated minimum Class F.

E. Actual motor full load amperes shall not exceed full load ampere ratings as listed in NEC Article 430.

F. Job installed starters shall be Joslyn-Clark, Allen-Bradley, Square D, Gould, General Electric, Cutler Hammer/Westinghouse or Siemens, ABB.

G. Starters for 3 phase motors shall be magnetic type and unless otherwise indicated shall be as follows:

1. NEMA 1 enclosure, combination line starter with fused disconnect and thermal overload protection on all 3 phases. Provide fuses complying with Division 16 - Disconnect Switches.
2. Starters outdoors shall have stainless steel rainproof NEMA 3R enclosures.
3. 24 V coil or 120 V coil (to agree with control circuit - not to exceed 120 V) and control transformer built-in, with fuses in primary leads and in hot secondary lead, other secondary grounded.
4. Four sets of auxiliary contacts plus additional interlock contacts as required for specified performance.
5. Provide red running lights for all starters.

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6. H.O.A. control for all automatically controlled starters and remotely controlled starters. Furnish ON-OFF selector switch where there is no automatic, remote or interlock control.
7. Additional starter specifications are given in other sections.
8. The short circuit Ampere Interrupting Capacity (AIC) rating shall be as indicated on the Electrical Drawings. If not indicated on the Electrical Drawings, the minimum AIC rating shall be 65,000 amps.

H. Controls for single phase motors, unless noted otherwise, shall be manual type motor rated switches with thermal overload device (except omit overload device from switches for motors with built-in overload protection) and, if indoors, NEMA type 1 enclosure except for installation in toilets or public spaces or when noted for flush mounting. In such locations, furnish jumbo stainless steel flush plate and pull box. Provide red running lights for all starters. Starters outdoors shall have stainless steel rainproof NEMA 3R enclosures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

3.2 ELECTRIC WIRING

A. The Electrical Division specifies mounting of job installed starters, power wiring through job mounted starters to motors and/or to power terminals of pre-wired equipment, with wiring and raceway as indicated on the Electrical Drawings. All additional wiring and raceway necessary for the mechanical systems shall be provided as part of the work under the Mechanical Division.

B. Control and interlock wiring for job installed controls is specified under the HVAC Control System Section.

C. Flexible cable, installed with slack so that it does not transmit vibration, shall be used in connections to all motors and to controls mounted on mechanical equipment.

D. The installation of all wiring shall conform to the Electrical Division of the Specifications.

E. Equipment specified as factory wired or pre-wired shall be checked by the Contractor and if the wiring is incomplete or defective it shall be completed and/or corrected as part of the work under the section in which the equipment is specified.

3.3 MOTORS AND STARTERS

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A. Furnish starters (motor control switches) for all motors supplied with mechanical equipment except where starters are indicated in motor control centers on the Electrical Drawings, which are specified in the Electrical Division.

END OF SECTION 230513

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fastener systems.
4. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.5 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

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B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

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I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

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B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting" Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

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H. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

I. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

J. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

K. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 230548 - VIBRATION ISOLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:

1. Vibration isolation for equipment.
2. This specification is part of the general conditions for the HVAC, plumbing and electrical contracts.

B. Related Sections:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.
2. All Division 23 specification sections, including the following.
   a. Mechanical General Provisions: Section 23010.
   b. Basic Mechanical Materials and Methods: Section 23050
   c. Air Terminal Units: Section 23930.
   d. Duct: Section 23890.

C. Related Work:

1. Equipment pad design shall be as specified in Section 23050. Attachment shall be designed and certified according to this section by the isolation supplier. Material and labor required for attachment and construction shall be by Section 23050.
2. Equipment pads shall be sized to accommodate a minimum of six (6) inches of clearance all around the equipment and its mounting package.
3. Supplementary Support Steel: Structural support and connections for all equipment, including roof mounted equipment, specified in other Sections shall comply with the seismic requirements of this Section. This specification is part of the general conditions for the HVAC, plumbing and electrical contracts.

D. Equipment Isolation Packages By Others:

1. Substitution of internally or externally isolated and restrained equipment supplied by the equipment vendor, in lieu of the isolation and restraints specified in this section, is acceptable provided all conditions of this section are met. The equipment manufacturer shall provide a stamped and certified letter stating that the seismic restraints are in full compliance with these specifications. Letters from field offices or representatives are unacceptable.
2. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be seismically attached to the structure. This attachment and certification thereof shall be by this section.

1.2 SUBMITTALS

A. Product Data:

1. Submit product data for each product specified in this section.
2. See Section 23010 for additional general requirements.

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3. Catalog cuts or data sheets on specific vibration isolators and restraints to be utilized detailing compliance with the Specification including Specification reference "TYPE" as per "PRODUCTS" section of this Specification.
4. An itemized list of all isolated and non-isolated equipment with detailed schedules showing isolators and seismic restraints proposed for each piece of equipment, referencing materials used.
5. Show base construction for equipment; include dimensions, structural member sizes and support point locations.
6. When walls and slabs are used as seismic restraint locations, details of acceptable methods for attachment of ducts, conduit and pipe must be included.
7. Indicate isolation devices selected with dimensional and deflection data.
8. Provide details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
9. Coordinated drawings shall be marked-up with the specific locations and types of restraints indicated for all pipe, duct and conduit.
10. For ceiling suspended equipment provide minimum/maximum installation angle allowed for restraint system.
11. Calculate thrust for fan heads, axial and centrifugal fans to determine whether thrust restraints are required (See EQUIPMENT INSTALLATION Section).

1.3 QUALITY ASSURANCE

A. It is the intent of this Specification to provide vibration isolation supports for all new equipment, piping and ductwork as may be required to prevent transmission of vibration to the building structure.

B. Manufacturer of vibration control equipment shall:

1. Determine vibration isolation sizes and locations.
2. Provide installation instructions, drawings and field supervision to insure proper installation and performance of systems.
3. Certify correctness of installation upon completion.

1.4 DEFINITIONS

A. The term EQUIPMENT will be used throughout this Specification. It includes all non-structural components within the facility and/or serving this facility install in this work, such as equipment located in outbuildings or outside of the main structure on grade within five feet of the foundation wall. Equipment buried underground is excluded but entry of services through the foundation walls is included.

B. Positive Attachment: Positive attachment is defined as a support location with a cast-in or wedge type expansion anchor, a double sided beam clamp, or a welded or through bolted connection to the structure.

C. Transverse Bracing: Restraint(s) applied to limit motion perpendicular or angular to the centerline of the pipe, duct, or conduit.

D. Longitudinal Bracing: Restraint(s) applied to limit motion along the centerline of the pipe, duct, conduit, etc.

E. Rigid mounted equipment is any equipment mounted directly to structure.

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F. Flexible mounted equipment is any equipment mounted on resilient supports, ceiling suspended, or roof supported.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products of Amber/Booth, Mason Industries, Inc., Vibration Eliminator Company, Vibration Mountings and Controls and Kinetics Noise Controls are acceptable provided their systems strictly comply with intent, structural design, performance and deflections of this Specification.

2.2 DESCRIPTION

A. Isolators: The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness shall be out of resonance with equipment forcing frequencies or support structure natural frequency.

2.3 VIBRATION ISOLATION

A. General:

1. Corrosion protection for both indoor and outdoor applications shall be as follows:
   Springs: Zinc electroplated or powder coat; where exposed to the weather, PVC or neoprene coating is required.
   a. Hardware: Zinc electroplated.
   b. All other metal parts: Zinc electroplated, powder coat, hot spray or hot dipped galvanized.
2. Steel components shall be cleaned and painted. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.
3. Height saving brackets used with isolators having 2.5" deflection or greater shall be of the pre-compression type to limit exposed bolt length.

B. Attachments: Hardware and devices such as beam clamps, anchor bolts, cables and cast-in-place plates must be by this section's supplier to ensure seismic compliance and certification. The Contractor has the option to utilize alternate fastening devices (anchor bolts) so long as the sizing and dimensions on seismic submittals are followed.

2.4 VIBRATION ISOLATORS AND TYPE DESCRIPTION

A. The theoretical vertical natural frequency for each support point, based upon load per isolator and isolator stiffness shall be out of resonance with equipment forcing frequencies or support structure natural frequency.

TYPE A: Spring hanger isolator:

1. Spring element with steel upper spring retainer and a lower elastomeric retainer cup with an integral bushing to insulate lower support rod from the hanger box.
2. Steel hanger box shall be hinged to allow for a minimum of 30 degrees misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.

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3. When used on ductwork, provide eye bolts for attachment to duct straps.
   a. Amber Booth Type BSSA, BSA.
   b. Kinetics Noise Control, Inc. Type SH.
   c. Mason Industries, Inc. Type 30.
   d. Vibration Eliminator Company, Inc. Type SNC.
   e. Vibration Mountings and Controls Type SH30A.

B. TYPE B: Elastomer hanger isolator:

1. Molded neoprene element with an integral bushing to insulate lower support rod from the hanger box.
2. Steel hanger box shall be hinged to allow for a minimum of 30 degrees misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.
3. When used on ductwork, provide eye bolts for attachment to duct straps.
   a. Amber Booth Type HRD,BR.
   b. Kinetics Noise Control, Inc. Type RH.
   c. Mason Industries, Inc. Type HD.
   d. Vibration Eliminator Company, Inc. Type C.
   e. Vibration Mountings and Controls Type RH.

2.5 FLEXIBLE CONNECTORS

A. Connectors shall be installed on the equipment side of shutoff valves, horizontal and parallel to equipment shafts. Piping shall be supported and/or anchored to resist pipe movement beyond the allowable movement of the flexible connector. The manufacturer's submittal package must detail the design precautions included and/or the installation precautions required.

B. TYPE FC-1: Elastomer Connector:

1. Manufactured of nylon tire cord and neoprene, both molded and cured in hydraulic presses.
2. Straight connectors shall have two (2) spheres with stabilizing ring in between, for sizes 2" thru 24".
3. Rated at 220 psi at 150° F, dropping linearly to 150 psi at 220°F for sizes 1-1/2" to 12".
4. Standard connectors on isolated equipment and on unanchored piping shall employ control rods with neoprene end fittings isolated from anchor plates by means of neoprene bushings when pressures exceed:
   a. 170 psi on pipe sizes to 8"
5. Connectors installed on unanchored piping shall have control rods or cables.
6. Connectors shall be installed pre-extended per manufacturer's recommendations to prevent elongation under pressure.
7. Minimum safety factor of 3:1 at maximum pressure ratings.
8. Connectors bolted gate, butterfly or check valves to have a minimum 5/8" flange spacer installed between the connector and the coupling flange.
   a. Amber Booth Type - None available.
   b. Kinetics Noise Control, Inc. Type VMT.
   c. Mason Industries, Inc. Type MFTNC, MFTFU.
   d. Vibration Eliminator Company, Inc. Type - None available.
   e. Vibration Mountings and Controls Type VMT.

PART 3 - EXECUTION

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3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

3.2 EQUIPMENT INSTALLATION

A. Fan powered Equipment shall be isolated with Type A or Type B hangar isolators. Non-fan powered equipment does not require hangar isolators.

B. Additional Requirements:

1. The minimum operating clearance under bases shall be 2".
2. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment and isolators.
3. Spring isolators shall be installed after all equipment is installed without changing equipment elevations.
4. After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.
5. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolators or the isolation system. The equipment shall be free to move in all directions.
6. Install equipment with flexibility in wiring.
7. Thrust restraints shall be installed on all cabinet fan heads or on axial or centrifugal fans whose thrust exceeds 10% of unit weight, and where noted or shown on drawings.
8. Equipment pads for equipment in this section must be properly doweled or bolted, using wedge type expansion anchors, to the structure to meet the acceleration criteria. Anchor equipment or isolators to equipment pads.

END OF SECTION 23240

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SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Ceiling markers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Brimar Industries, Inc.
    c. Craftmark Pipe Markers.
    d. Kolbi Pipe Marker Co.
    e. LEM Products Inc.
    f. Marking Services, Inc.

2. Material and Thickness: Brass, 0.032-inch stainless steel, 0.025-inch aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
3. Letter Color: Black.
4. Background Color: White.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 CEILING MARKERS/LABELS

1. Description: metal thumb tacks with standard diameter head.
2. Color: match color specified for component located above ceiling tile.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 CEILING MARKERS

A. Use ceiling markers to indicate location of each mechanical device that is located above the ceilings.

B. For every, air terminal box located above the ceiling, provide a marker attached to the ceiling at the point of access. These markers shall be thumb tacks colored as follows:

Air terminal boxes

END OF SECTION 230553

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SECTION 230593 - TEST AND BALANCE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:
1. Testing of existing ambient noise levels before construction
2. Testing, adjusting and balancing of improved air conditioning systems, air distribution systems.
3. Reporting of final balanced and measured values.

B. Related Sections:

1. Drawings and general provisions of Contract, including General Conditions and Division - 1 specification sections.
2. All Division 23 specification sections, including the following:
   a. Mechanical General Provisions: Section 250100.
   b. Basic Mechanical Materials and Methods: Section 230500.
   c. Mechanical Identification: Section 230553.
   d. Metal Duct: Section 233113.
   e. Air Terminal Units: Section 233600.
   f. Mechanical Commissioning: Section 230800.
3. Perform all tests and adjustments specified under other sections of the Specifications.

1.2 SCOPE OF WORK

A. Test existing HVAC-system-induced ambient noise levels for air terminal units replaced unit by this scope of work.

B. Test and balance of new air terminal units including fan air delivery performance.

C. Test and balance report shall include all information specified below and required by referenced documents, and shall include the following features:

1. Schematic diagrams of each replaced air terminal, showing air pressure profiles. Diagrams shall be no larger than 11”x17”, and shall fold neatly into the final report binder.
2. Plan-view diagrams of all air distribution devices served by each terminal unit and air handling unit zone. Air distribution devices’ references (numbers or designators) shall be clearly shown on this diagram, and shall key the report information. Diagrams shall be no larger than 11”x17”, and shall fold neatly into the final report binder.
3. Plan-view diagrams of all control devices where calibration was verified. Control devices’ references (numbers or designators) shall be clearly shown on this diagram, and shall key the report information. Diagrams shall be no larger than 11”x17”, and shall fold neatly into the final report binder.
4. Actual testing date and testing technician’s initials for each system or component shall be written on each sheet of the final report.
5. Actual pressure and airstream drybulb and wetbulb temperatures for each system shall be recorded on each sheet of the final report.
6. Final report shall include the corrections related to barometric pressure and airstream temperature.
7. Provide copies of the referenced standards along with final report.

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D. Test and balance new terminal unit controls for maximum airflow as follows:

1. Set all VAV terminal units to their max airflow setpoint.
2. Allow time for the system to stabilize.
3. Confirm all VAV terminal units are achieving their respective maximum airflow setting.
4. Measure the total supply airflow at the AHU through duct traverse or other acceptable means.
5. Compare the sum of all terminal unit airflow readings through the DDC to the total airflow reading as measured at the AHU.
6. If the two readings are within 5%, proceed to the Minimum airflow test.
7. If the two readings vary more than 5%, determine the terminal unit or units that are incorrect and retest until readings are within 5%.

E. Test and balance new terminal unit controls for minimum airflow as follows:

1. Set all VAV terminal units to their min airflow setpoint.
2. Allow time for the system to stabilize.
3. Confirm all VAV terminal units are achieving their respective maximum airflow setting.
4. Measure the total supply airflow at the AHU through duct traverse or other acceptable means.
5. Compare the sum of all terminal unit airflow readings through the DDC to the total airflow reading as measured at the AHU.
6. If the two readings are within 5%, proceed to the Minimum airflow test.
7. If the two readings vary more than 5%, determine the terminal unit or units that are incorrect and retest until readings are within 5%.

If changes are made to terminal unit airflow calibration factors AFTER a successful test if either Max or Min, retest both settings until readings are within 5%.

1.3 SUBMITTALS

A. Submit name of the Test and Balance Agency with the names of subcontractors. Submit the name and registration number of the Certified Test and Balance Engineer.

B. Progress Reports: The Test and Balance Agency shall submit copies of the progress reports described in Part 3 as follows:

1. Contractor: 3 copies.
2. Owner: 1 copy.

C. Final Report: The final test report described in Part 3 shall be typed, bound in booklet form, and submitted through the Contractor to the Engineer/Owner. Any deficiencies or excesses in components or systems shall be detailed in the front of the report. Provide enough copies for 3 for the Owner, 2 for the Owner's representative (Heery), and 2 for Contractor.

1.4 QUALITY ASSURANCE

A. Test And Balance Agency:

1. The Contractor shall procure the services of an independent Test and Balance Agency to perform the testing and balancing and prepare reports to the Contractor and to the Engineer.

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2. The Test and Balance Agency shall be a certified member of the Associated Air Balance Council or of the National Environmental Balancing Bureau. The Test and Balance Agency shall be independent of any contractor or manufacturer.
   a. The TAB Field Supervisor shall be a full-time employee of the TAB Agency and shall be certified for his/her role by the Associated Air Balance Council or of the National Environmental Balancing Bureau.
   b. The TAB Field Technician shall be a full-time employee of the TAB Agency and shall be certified for his/her role by the Associated Air Balance Council or of the National Environmental Balancing Bureau.

B. Airside and thermal testing and balancing shall be performed in accordance with these specifications and in accordance with the ANSI/ASHRAE Standard 111-2008, “Measurement, Testing, Adjusting and Balancing of Building HVAC Systems.”

1. Where these specifications and the above-referenced standard are silent, testing and balancing shall be performed in accordance with the Associated Air Balance Council’s “National Standards for Total System Balance”, 6th edition (2002).

C. Noise and vibration testing shall be performed in accordance with these specifications and in accordance with Chapters 18 and 19 of the Associated Air Balance Council’s “National Standards for Total System Balance”, 6th edition (2002).

1. HVAC-induced ambient noise levels shall be measured in: an octave-band basis, from 31.5 hz to 8000 hz.
2. Vibration shall be measured in a deflection basis and in a velocity basis. Vibration shall be measure at each bearing for each rotating machine. Vibration of cabinets shall be measured at bearing points.

D. HVAC system's air flow rates shall be balanced within the following tolerances:

1. Supply, Return, and Equipment with Fans: plus or minus 5 per cent for flowrates greater than 4,000 cfm; plus or minus 10 per cent for flowrates equal to or less than 4,000 cfm.
2. Air Outlets and Inlets: plus or minus 10 per cent.
3. All airflow measured airflow quantities shall be corrected for barometric pressure and temperature.

1.5 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate and coordinate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

D. Some remedial proportional balancing of existing diffusers will be performed as necessary to achieve design air flow for terminal units.

PART 2 - PRODUCTS
(Not applicable.)

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PART 3 - EXECUTION

3.1 OPERATION OF EQUIPMENT

A. The Contractor shall put all heating, ventilating and air conditioning systems into full operation and shall operate the systems at all times that test and balance work is in progress. The Contractor's start-up, adjustment and placing in operation of the mechanical systems shall include but is not limited to assembly of all parts, alignment of drives, tightening sheaves on shafts, checking motors for correct rotation and reconnecting where necessary, providing correct starter overload heaters, removing dirt and blockage, and placing the systems in good operating condition. The test and balance Agency shall report any deficiencies in readiness for testing.

3.2 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Test, adjust and balance all airside systems airside equipment in accordance with these specifications and in accordance with Chapter 9 the ANSI/ASHRAE Standard 111-2008, “Measurement, Testing, Adjusting and Balancing of Building HVAC Systems.” Measurements and accuracy shall be as prescribed in this specification and in Chapters 4 and 7 of the ANSI/ASHRAE Standard 111-2008, “Measurement, Testing, Adjusting and Balancing of Building HVAC Systems.”

1. Take care to correct for pressure and temperature effects when determining heat content and humidity values of each air stream.

B. Noise and vibration testing shall be performed in accordance with these specifications and in accordance with Chapters 18 and 19 of the Associated Air Balance Council’s “National Standards for Total System Balance”, 6th edition (2002).

1. HVAC-induced ambient noise levels shall be measured in: an octave-band basis, from 31.5 hz to 8000 hz.
2. Vibration shall be measured in a deflection basis and in a velocity basis. Vibration shall be measure at each bearing for each rotating machine. Vibration of cabinets shall be measured at bearing points.

C. Where these specifications and the above-referenced standards are silent, test, adjust and balance in accordance with the Associated Air Balance Council’s “National Standards for Total System Balance”, 6th edition (2002).

D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports.
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to specification Section 230713 “Duct Insulation.”

E. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings. If a balancing device is provided with a memory stop, it shall be set and locked.

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F. Take and report testing and balancing measurements in inch-pound (IP) units.

G. Block airside particulate filters to mimic loaded-filter pressure drops during airside system balancing.

H. For variable-air-volume systems, develop a plan to simulate diversity.

3.3 PROGRESS REPORTS

A. The Test and Balance Agency shall furnish reports to both the Contractor and the Engineer throughout the progress of the job listing items that are deficient, not installed, or not operating.

B. The Test and Balance Agency shall inspect all HVAC systems for such things as dirt, blockage, damper hook-up, filter condition and installation, pumps, piping, tightness of sheaves on pulleys, drive alignment, fan guards, and inlet screens. Any other items affecting the cleanliness or proper operation of the mechanical systems shall be checked and noted.

C. Check and report on the installation and accessibility of all fire and smoke dampers. Report shall include list of dampers and missing access panels.

3.4 CONTROL SENSOR CALIBRATION VERIFICATION

A. Verify calibration of temperature (±0.5 deg-F), and flow sensors (±10%).

3.5 REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Report all airside and thermal testing and adjusting data as prescribed in Section 12 of the ANSI/ASHRAE Standard 111-2008, “Measurement, Testing, Adjusting and Balancing of Building HVAC Systems.”
2. Noise and vibration testing shall be performed in accordance with these specifications and in accordance with Chapter 1, Section 5 and in Appendix 1.5 of the Associated Air Balance Council’s “National Standards for Total System Balance”, 6th edition (2002).
    a. HVAC-induced ambient noise levels shall be measured in: an octave-band basis, from 31.5 hz to 8000 hz; in an A-weighted Sound Level basis; and in an NC Rating Curve basis.
3. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
4. Include a list of instruments used for procedures, along with proof of calibration.
5. Include schematic layouts of air and hydronic distribution systems. Represent each system with a single-line diagram and include the following:
    a. Quantities of outdoor, supply, return, and exhaust airflows.
    b. Water flow rates.
    c. Duct, outlet, and inlet sizes.
    d. Pipe and valve sizes and locations.
    e. Balancing stations.
    f. Position of balancing devices.
6. Include schematic diagrams of each replaced air handling system: air filter section (as applicable), dehumidification section (as applicable), and air handling unit, showing air pressure profiles.

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7. Include actual testing date and testing technician's initials for each system or component on each sheet of the final report.
8. Include actual pressure and airstream drybulb and wetbulb temperatures for each system on each sheet of the final report.
9. Final report shall include the corrections related to barometric pressure and airstream temperature.
10. Include in report manufacturer-provided outlet factors, fan curves with the measured operating conditions plotted on the curves.
11. Temperature Control Sensor Verification: List each temperature, pressure or flow sensor, showing Agency- measured value and temperature control system's read value. Include plan-view diagrams of all control devices where calibration was verified. Control devices' references (numbers or designators) shall be clearly shown on this diagram, and shall key the report information.
12. All data shall be presented on sheets no larger than 11"x17", folded neatly into an 8-1/2"x11" report binder.

3.6 REPORT VERIFICATION

A. At the discretion of the Owner and Commissioning Agent, the Test and Balance Agency with the Owner or Commissioning Agent shall perform field verification of test report in accordance with Chapter 23, Section 5 of the Associated Air Balance Council's "National Standards for Total System Balance", 6th edition (2002). Report verification shall be done within 90 days from the completed Test and Balance report.

END OF SECTION 230593

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SECTION 230713 – MECHANICAL/DUCT INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section Includes:
   1. Duct system insulation.

B. Related Sections:

   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.
   2. All Division 23 specification sections, including the following:
      a. Mechanical General Provisions: Section 23010.
      b. Basic Mechanical Materials and Methods: Section 23050.
      c. Mechanical Identification: Section 23190.
      d. Air Terminal Units: Section 23930.
      e. Vibration Isolation: Section 23240.
      f. Metal Duct: Section 233113.

1.2 SUBMITTALS

A. Submit for each type of mechanical insulation and accessory. Include installation instructions and manufacturers recommendations.

B. Submit dimensional shop drawings and construction details of the chilled water pump enclosures. Include insulation material data, casing data, and hardware data along with the shop drawing, keyed to details in the shop drawing.

C. Include manufacturer's product number, K-value, thickness, and accessories in tabular forms for each type of different application.

1.3 QUALITY ASSURANCE

A. Conform to "National Commercial and Industrial Insulation Standards."

B. For all insulation above ground and in steam tunnel extension: Flame spread index 25; smoke developed index 50.

C. Insulation and Ancillary Materials: Rated in accordance with ASTM E 84, NFPA 255, or UL 723. Affix manufacturer's stamp or label showing fire/ smoke indexes on shipping containers or insulation.

1.4 DEFINITIONS

A. The term "concealed" used in this Section of Specifications shall apply to items located in furred spaces, pipe and duct shafts, spaces above ceilings or below raised floors, and trenches with solid covers. The term "exposed" shall apply to items that are not concealed.

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B. The term "fittings" used in this Section of Specifications refers to all types of fittings including solder type, weld type, screwed and flanged fittings, also all elbows, tees, wyes, valves, couplings, hubs, traps, strainers, air separators, scale pockets, thermometer wells and similar devices that are part of the piping system.

C. The term "valves" used in this Section of the Specifications refers to all types of manual valves, automatic valves, stops, cocks, flow regulators and similar devices.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Fiberglass Insulation:

1. For piping:
   a. Description: conforming to ASTM C 547 Class 1.
   b. Conductivity: 0.23 Btu-in/hr-sq.ft.-°F at 75°F.
   c. Pipe operating temperature range: 0°F-850°F.
2. For pipe fittings: Description: preformed compressed fiberglass or batt as specified with piping system.
3. For ductwork:
   a. Batt type:
      1) Description: glass fibers factory laminated to FRK with sealing flange provided on one edge.
      2) Conductivity: 0.23 Btu-in/hr-sq ft-°F at 75°F.
      3) Density: 0.75 lbs per cubic foot.
      4) Testing Standard: ASTM C 553 Type I Class B-2.
   b. Board type:
      1) Description: inorganic glass fibers formed with thermosetting resin into boards.
      2) Conductivity: 0.23 Btu-in/hr-sq ft-°F at 75°F.
      3) Density: 3 lbs per cubic foot.
4. Acceptable manufacturers: CertainTeed Corporation; Knauf Fiber Glass GmbH; Manville Corporation; Owens-Corning Fiberglas Corporation

2.2 JACKETING MATERIALS

A. Foil-Scrim-Kraft or Foil Reinforced Kraft (FSK or FRK):

1. Description: foil-scrim-kraft (foil on exposed surface) factory applied to insulation.
2. Water vapor permeance: 0.02 perm per ASTM E 96.
3. Fasteners: 18 gauge stainless steel wire.

2.3 DUCT INSULATION APPLICATIONS

A. Supply Duct

1. Location: inside, concealed above ceiling.
   a. Type: fiberglass batt.
   b. Thickness: 2”.
   c. Jacket: FSK
2. Location: inside, exposed to view (if not internally lined, however):

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a. Type: fiberglass board.
b. Thickness: 2”.
c. Jacket: FSK

3. Location: in all mechanical rooms.
a. Type: fiberglass board.
b. Thickness: 2”.
c. Jacket: FSK

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean and dry surfaces prior to insulating.

B. Provide positive ventilation in enclosed areas where volatile materials are used to apply insulation.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install insulation materials to obtain smooth and even surfaces. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be insulated. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor retarder on insulation.

D. Extend insulation without interruption through walls, floors, and similar penetrations, unless otherwise indicated.

E. Do not apply insulation to hot surfaces.

F. Notify Architect two weeks before insulation work will begin to allow observation of uninsulated pipe and duct systems.

3.3 DUCT INSULATION

A. Insulate all systems indicated under Applications.

B. Insulate in accordance with manufacturer’s instructions.

C. Do not insulate return duct located in return air plenums.

D. Unless otherwise noted, insulation is not required on lined ducts except for 6" overlap where the lining ends.

E. Install duct wrap to allow maximum fullness at corners (avoid excessive compression). Minimum thickness at corners is 1". Insulation shall be butted tightly at joints and vapor barrier facing shall be overlapped a minimum of 2". Insulation shall be removed from lap prior to stapling. All seams shall be stapled approximately 6" on center with outward clinching staples, then sealed with a foil vapor barrier tape, or vapor barrier mastic.

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F. Where ducts are over 24" in width, the duct wrap shall be additionally secured to the bottom of rectangular ducts with mechanical fasteners spaced on 18" centers (maximum), to prevent sagging of insulation. Cut off and cap the points of fastener pins. Seal all penetrations of facing so as to provide a vapor-tight system.

G. Apply board insulation to the outside of the ducts with edges tightly butted: impale insulation on pins welded to the duct and secure with speed washers. Spacing of pins shall be as required to hold insulation firmly in place but not less than one pin per square foot. Install galvanized sheet steel angles to protect outside corners. Seal all joints with pressure sensitive aluminum tape. The board insulation shall cover flanges, reinforcing angles and other projections with not less than one-half the thickness specified for the flat surfaces.

H. The ends of duct insulation (which shall terminate at the face of fire rated partitions, walls and floors) shall turn out to cover the steel angle flanges around fire and smoke dampers; seal the jacket vapor tight to the face of the partition, wall or floor. Do not conceal duct access doors with insulation; vapor seal the insulation around the door.

I. Wrap exterior of duct wrap insulation with 0.062 inch stainless steel wire.

3.4 EQUIPMENT INSULATION

A. Insulate all equipment indicated under Applications.

B. Insulate equipment neatly, leaving smooth continuous surface. Fill in scored block, seams, chipped edges, and depressions, and remove surface irregularities.

C. Cover insulated surfaces with jacketing neatly fitted and firmly secured. Lap seams at least 2”. Apply over vapor retarder where applicable.

D. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames, and accessories.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Duct specifications, elsewhere in Division 23.

3.6 PROTECTION AND REPAIR

A. Provide instruction required for protection of insulation to installers of related work during construction period, to avoid damage and deterioration.

B. Repair all insulation damaged during construction, prior to receipt of Final Certificate.

3.7 CLEANING

A. Repair and clean insulation surfaces to achieve a new appearance.

B. Clean insulation, using materials and methods recommended by manufacturer.

END OF SECTION 230713

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SECTION 230800 – MECHANICAL/HVAC COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. Section Includes Contractor commissioning responsibilities for the air terminal units and associated ductwork and control. Commissioning is done under a separate contract.

B. Equipment and Systems to be commissioned shall be as listed in the paragraph titled “Commissioned Systems”.

1.2 DESCRIPTION

A. Commissioning during the construction phase is intended to achieve the following specific objectives:

1. Verify that applicable equipment and systems are installed according to the Contract Documents and the manufacturer’s recommendations and to industry accepted minimum standards.
2. Verify and document performance of equipment and systems.
3. Verify that O&M documentation is complete.
4. Verify that operating personnel are adequately trained.

1.3 COORDINATION

A. Coordinate work in this section with the Commissioning Authority (CxA).

B. The commissioning (Cx) team:

1. Commissioning Authority (CxA): Heery International
2. Using Agency
3. Contractor(s) (C)

1.4 SCHEDULING

A. C shall schedule commissioning activities with assistance from the CxA and Cx team.

B. C shall integrate all commissioning activities into the master schedule. Address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

C. Include the following commissioning events in the schedule.

1. Each test
2. Equipment installation start and completion.
3. Equipment Start-up.
4. Test and Balance.
5. Functional Testing.
6. Training.
7. Seasonal Testing

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D. As construction progresses, C shall include more detailed schedule information when provided by the CxA.

E. C shall provide the CxA with no less than seven (7) calendar days' notice of tests. Allow three (3) weeks for Functional Testing

1.5 COMMISSIONING PROCESS

A. Overview of the commissioning tasks during construction.

1. Commissioning during construction begins with a scope review meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members.
2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending. Meeting will be used to plan, coordinate, schedule activities and resolve problems.
3. Equipment documentation is submitted to the CxA concurrent with submittal review by the Design Professional. Following approval by Design Professional, provide submittal to CxA that includes detailed start-up procedures.
4. The CxA works with the Contractor in developing startup plans and startup documentation formats, including providing the Contractor with Pre-Functional Checklists to be completed, during the startup process.
5. In general, testing and verification proceeds from simple to complex; from component, to equipment, to systems and then inter-system levels. All Pre-Functional checklists must be completed before functional testing.
6. The Contractor performs and documents the equipment receipt, installation, pre-functional checkout and initial startup. The CxA verifies that the installation, pre-functional checkout and initial startup were completed according to the plans. The CxA will witness pre-functional tests and start-up of selected equipment.
7. The CxA develops specific equipment and system functional performance test procedures.
8. The Contractor reviews and executes the procedures under the direction of the CxA.
9. Any items of non-compliance in material, installation or setup are corrected by the Contractors and then the system is retested.
10. The CxA reviews the O&M documentation for completeness.
11. Commissioning is completed before Substantial Completion.
12. The CxA reviews, pre-approves and helps the Contractor coordinate the training provided by the Contractor and verifies that proper training was completed.
13. Deferred testing is conducted, as specified or required.

1.6 QUALITY ASSURANCE

A. Commissioning shall be consistent with

1. ASHRAE Guideline '0' -2013, The Commissioning Process.
2. ASHRAE Guide 1.1 - 2007, HVAC&R Technical Requirements for The Commissioning Process.
3. ASHRAE Guideline 1.5 - 2012, The Commissioning Process for Smoke Control Systems
4. AHRAE Standard 202 – 2013, Commissioning Process for Buildings and Systems

B. Documentation for Operations and Maintenance shall be consistent with Guideline 4-2008 (RA 2013), Preparation of Operating and Maintenance Documentation for Building Systems

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1.7 COMMISSIONED SYSTEMS

A. The systems to be commissioned are identified in the table below. Further Contractor requirements for each activity are defined in this specification.

Equipment and Systems								
Equipment / System	Spec Section	Product submittal to CxA	Receiving Report	Pre-Functional Checklist	Notify CxA of Tests/Start Up	Test Reports to CxA	System Functional Test	Notes
Terminal Units	233600	✓	✓	✓	✓	✓	✓	
Test and Balance	230593			✓	✓	✓		
DDC Controls	230923	✓	✓	✓	✓	✓	✓	

1.8 CxA RESPONSIBILITIES

A. The role of the CxA is to develop and coordinate the execution of a testing plan and to observe and document that systems are complete and functioning in accordance with the Contract Documents.

B. The CxA has no responsibility for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CxA will assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the Construction Manager, Contractor and the Design Professional.

1.9 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall perform the inspections and tests as specified herein. Each specified inspection or test shall be documented utilizing the forms provided by the Commissioning Agent or approved forms submitted by the Contractor.

B. In general, the Contractor's duties for commissioning include:

1. Coordinate the commissioning work with the CxA to include commissioning activities into the master schedule.
2. Make adjustments to commissioning activities schedule when impacted by construction progress.
3. Provide proper notification to CxA of all activities defined in this specification that require the CxA be present.
4. Attend a commissioning scoping meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.
5. Operate equipment as required for commissioning, coordinating activities between trades

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6. Complete commissioning checklists and sign-off indicating completion of all items.
7. Review commissioning progress and deficiency reports, and respond where requested.
8. Coordinate the resolution of non-compliance deficiencies identified in all phases of commissioning.
9. The Contractor shall provide the equipment and technical personnel to perform such tests and inspections. The Contractor shall furnish any personnel necessary to assist in the testing and inspection.
10. The contractor shall schedule qualified factory personnel shall participate in all Functional Test sessions of their equipment or system to assist with the operation of the vendor supplied equipment as determined by the manufacturer to protect warranties.
11. Coordinate the training of Using Agency personnel; submit training materials to CxA for review.
12. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

C. Warranty Period

1. Execute seasonal or deferred functional testing, witnessed by the CxA.
2. Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.10 SUBMITTALS

A. Submittals to CxA:

1. All submittals including equipment submittals and shop drawings that are Approved or Approved with Notations by the Design Professional.
2. All test reports including factory tests and manufacturer startup tests that are specified on the Drawings or in the Specifications.
3. Training Agenda
4. Commissioning Documents as defined herein.
5. Installation and Startup Manuals and O&M Documentation for all commissioned equipment, within 30 days of an approved submittal. Manuals may be submitted as received and are not required to be submitted as one bound volume.
6. Test and Balance reports
7. Corrective items identified to by corrected by the Contractor
   a. Draft copies of balance reports within 7 days of the completion of each system.
   b. All initial test reports to CxA within 7 days of completion of the individual tests.
8. Sign-off by Using Agency acknowledging receipt of the operation and maintenance documentation package.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Commissioning shall be a continual process throughout the project through the warranty phase of the project. Commissioning shall be a joint effort of the CxA, Design Professional, CM, and the Contractor including subs and testing agencies specified in the Contract Documents.

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3.2 PHASED COMMISSIONING

A. If the project will require the completion and operation of systems for occupancy in stages the commissioning shall be scheduled for completion accordingly. Any interim operational requirements and sequences shall be defined in the Contract Documents.

B. Start up and operation of the equipment for during each phase includes the minimum requirements;

1. Completion of Contractor's Receiving Reports and Verification Checklists.
2. Verification all equipment safeties are operational.
3. A plan assigning responsibility for maintenance and operation of the equipment
4. All equipment with filters shall have filters checked on a weekly basis and changed when pressure drops exceeds the scheduled loaded filter pressure drop. Contractor to record pressure drop at each check.
5. All equipment and ductwork to be clean prior to starting equipment.
6. Motor rotation and motor load data shall be taken at initial startup and monthly thereafter.

3.3 COMMISSIONING SUPERVISION

A. The Contractor shall assign a single individual to be responsible for the trade commissioning activities. This individual shall have first-hand knowledge of the construction.

3.4 COMMISSIONING ISSUES LIST

A. The CxA shall develop and maintain a method for identifying commissioning related issues and tracking those items. The primary means of communicating these items are through a Commissioning Issues List that maintains a record of Cx related items until closure.

B. The Contractor shall be responsible for responding to the CxA within 7 days of an item being issued. The response shall either identify and schedule the action to be taken or a reason for any exception to the item.

3.5 SITE TESTS

A. Contractor will schedule normal site tests in advance, and advise the CxA of the test dates in order to permit them to be witnessed. This should be no less than 7 days.

B. The Contractor will verify all tests are completed and provide documented results.

3.6 CONSTRUCTION COMMISSIONING VERIFICATION

A. Equipment Submittals

1. The Contractor provides copies of all Equipment Submittal transmittals, including the Design Professional response and comments to the CxA.

B. Receipt of Equipment

1. Contractor shall complete an equipment receipt report for all commissioned equipment. This report shall verify the manufacturer and model match the submittal and the condition

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of the equipment as received. This report form shall be provided by the CxA and when completed returned to the CxA.

C. Verification of Installation

1. The Contractor shall maintain a record of installation and coordination to verify the proper installation of equipment and systems using the Pre-Functional Checklist (PFC) provided by the CxA. Only individuals that have direct knowledge and witnessed that a line item task on the PFC was actually performed shall initial or check that item off.
2. Initial equipment startup shall proceed based on the written start up plan.
3. The Contractor shall be responsible for completion of the checklists as work is completed and maintaining the PFC up to date.
4. The contractor shall complete Pre-Functional Checklists and provide to the CxA prior to start up for review and shall be submitted complete prior to Functional Performance Tests.
5. Startup of equipment shall not proceed before installation is complete.
6. Deficiencies: The Contractor shall correct deficiencies noted during Contractor review. The installing Contractor shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CxA as soon as outstanding items have been corrected and resubmit an updated checklist. The CxA shall maintain a record of completed checklists and tests.

3.7 PREFUNCTIONAL CHECKLISTS (PC) AND START UP PLANS

A. Prefunctional checking includes verification of proper installation and start-up for each piece of equipment and system. Prefunctional checking is required to establish that the equipment and systems are installed and operational so the functional testing can proceed without unnecessary delays. Prefunctional checklists and start-up testing must be completed prior to functional testing of equipment, subsystems and systems.

1. Prefunctional checking is be performed by the Contractor.
2. Prefunctional Checklists (PCs) are prepared by the CxA and completed by the Contractor. If the Contractor prefers to use Contractor's standard PCs, these should be submitted to the CxA for approval.
3. The CxA will verify that the Contractor has completed the PCs.
4. Only individuals that have direct knowledge and have witnessed that a line item task on the Pre-Functional Checklist was actually performed shall initial or check that item off. It is not acceptable for supervisors to fill out these forms unless they have actually witnessed the test.

B. The Contractor develops the start-up plans by combining the CxA's PFC with the manufacturer's start-up and checkout procedures and any other Contractor checkout forms. The start-up plan includes:

1. The CxA's Pre-Functional checklists and procedures.
2. The manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added at the end.
3. The manufacturer's installation and start-up forms.
4. Summary statement and a Contractor signature block at the end of each checklist and start-up plan to indicate completion.
5. The Contractor submits the startup plan to the CxA for review and approval.
6. The CxA reviews and checks the procedures and the format, noting any procedures that need to be added or revised.

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7. The Contractor will verify the completion of preliminary steps, (checklists, schedule manufacturer rep, completion of necessary control items, etc.) and advise the Team when the equipment is ready.
8. Manufacturers shall be present for all items requiring manufacturer's start up.
9. Labeling of Equipment and Disconnects shall be provided.
10. All ductwork, piping and equipment shall be cleaned prior to starting any equipment.
11. Do not operate HVAC systems in a mode that would induce unconditioned, humid outside air into the building.
12. The Contractor shall execute startup and provide the CxA with a signed and dated copy of the completed start-up and Pre-Functional checklists.
13. Provide two weeks' notice to CxA of startup dates.

C. Verification of PFCs by CxA.

1. The CxA will verify PFCs by witnessing the testing and installation. CxA will document verification by signatures or initials on the PFCs.
2. The Contractor shall plan for the CxA to witness at least 25% of the Test and Balance testing as it progresses. If the CxA is not in attendance for any test because CxA was not given the specified advance notice of testing, the Contractor shall repeat the un-witnessed testing, at the CxA discretion.

3.8 FUNCTIONAL TESTING

A. Functional Tests

1. The CxA will develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Contractor shall provide assistance to the CxA in developing the procedures. Prior to execution, the CxA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection.
2. Each function and test shall be performed under conditions that simulate actual conditions as close as practically possible. The Contractor shall provide all necessary materials and system modifications to produce the necessary flows, pressures, temperatures necessary to execute the test according to the specified conditions. At completion of the test, the Contractor shall return all affected building equipment and systems to their pre-test condition.

B. Prerequisites

1. The following generic prerequisite checklist items are required to be listed on each written functional test form. These will be completed and checked off by CxA prior to functional testing. Similar prerequisite checklist items will be used for Division 16.
   a. All related equipment has been started up and start-up reports and Pre-Functional checklists submitted and approved ready for functional testing:
   b. All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with loop tuning and sensor calibrations completed.
   c. Piping system flushing complete and required report approved.
   d. Water treatment system complete and operational.
   e. Vibration control report approved (if required).
   f. Test and balance (TAB) complete and approved for the system.
   g. All Design Professional punchlist items for this equipment corrected.
   h. These functional test procedures reviewed and approved by installing Division.
   i. Safeties and operating ranges reviewed by the CxA.

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C. Coordination and Scheduling.

1. The CxA will schedule functional tests through the Contractor, and the Using Agency. The CxA shall direct, witness and document the functional testing of all equipment and systems. The Contractor shall operate the equipment and execute the tests.
2. All associated systems shall be complete, cleaned and operational prior to the Start of Functional Testing for any equipment The Contractor shall verify all sequences and operations in the Functional Test Procedure prior to notifying the CxA the system is ready for Functional Testing.
3. The air balancing and water balancing is completed before functional testing or air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
4. The CxA will recommend solutions to problems found, however the Contractor has the responsibility to remedy problems.
5. The CxA will recommend solutions to design problems found. The Design Professional has the responsibility to advise the Contractor of the remedy to those problems. The Contractor has the responsibility to remedy problems.

D. Functional Test Requirements

1. Test requirements and Functional Testing will be completed by the CxA prior to Substantial Completion. This does not mean all items on the test must have been passed, but the essential functions for safety, operating control and ventilation must be verified as meeting the design intent.
2. The CxA shall direct and verify Functional Tests unless this responsibility is specifically assigned by the CxA to the Contractor. Functional Tests assigned by the CxA to the Contractor shall be reviewed and approved by the CxA.
3. Functional Tests shall test complete systems (air side/water side, electrical distribution) under all defined sequences of operation. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, no flow, equipment failure, etc. shall also be tested.

E. Summary of HVAC Functional Testing

1. General
   a. See “Commissioned Systems” table for list of systems to be functionally tested.
   b. The CxA will provide the Functional Test procedures. The Contractor will perform the testing. CxA will witness the testing.
2. Building Automation System / Building Temperature Controls
   a. Functional tests will include of all operating modes and sequences installed by a separate control upgrade project.
   b. Trending will be used to verify:
      1) Control loops stable, non-hunting, non-oscillating control, with minimum overshoot in response to transient and upset conditions.
      2) Space and air temperatures maintained within ±1ºF of setpoint.
      3) See paragraph “Temperature Control System (TCS or BAS) Trending” for additional trending requirements.
3. Terminal Unit (TU)
   a. Schedule/Override/Set Up/Set Back, Occupied/Unoccupied, Normal and Emergency Modes
   b. Damper Operation during All Modes
   c. Electric heat operation
   d. Airflow sensor and temperature sensor operation

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e. Fan operation
f. Capacity verification.
g. Operation of safeties
h. Graphics verification

F. Documentation, Non-Conformance and Approval of Tests

1. Approval. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA and by the Using Agency PM, if necessary. The CxA recommends acceptance of each test to the Using Agency PM using a standard form. The Using Agency PM gives final approval on each test using the same form, providing a signed copy to the CxA and the
2. Deficiencies: All deficiencies or non-conformance issues shall be noted and reported to the CM. These items shall be added to the Commissioning Issues List. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form. The burden of responsibility to solve, correct and retest problems is with the Contractor and Design Professional.
   a. The Contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CxA.
   b. The Contractor reschedules the test and the test is repeated.
   c. Any required retesting by any Contractor shall not be considered a justified reason for a claim of delay or for a time extension by the Contractor.
3. Deficiency Disputes:
   a. The deficiency shall be documented on the non-compliance form with the Contractor's response and a copy given to the Using Agency PM and to the Contractor.
   b. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Using Agency's PM.
   c. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.

3.9 DEFERRED TESTING

A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of Using Agency. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

3.10 TRAINING

A. The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed.

1. The Contractor shall maintain a record of training including the name and organization of the trainer and the attendees. The Contractor shall submit 2 copies of the records to the Using Agency, 1 to the Design Professional, 1 to the Construction Manager, and 1 to the CxA

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2. A formal Training Outline shall be submitted to the CxA for review and comment. This shall include the session title, duration, content to be covered and instructor. This agenda shall be submitted 4 weeks prior to the start of training
3. The Contractor provides the training. The CxA is responsible for overseeing the content and adequacy of the training for commissioned equipment.

B. Content

1. Training shall be performed consistent with Contract Documents.
2. The Design Professional shall at the first training session present the overall system design concept and the design concept of each equipment section.
3. Content shall include start up, automatic and manual operation, adjustment, maintenance and troubleshooting.
4. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the HVAC training conducted by others.
5. Training shall include on-site training demonstrating equipment functions and operator interface. Included in these sessions shall be demonstrations requiring operators to perform normal equipment operations.
6. All training shall be recorded on DVD format. The Contractor shall submit 2 copies to the Using Agency, and 1 to the Owner Representative (Heery).

C. Schedule

1. Training shall be included in the project schedule.
2. Classroom training shall be completed prior to the Substantial Completion.
3. Hands on equipment training shall be conducted after equipment is operational.

3.11 WRITTEN WORK PRODUCTS

A. The commissioning process requires a number of written work products by the Contractor including:

1. Schedules incorporating Commissioning based on CxA input.
2. Sequence clarifications
3. Prefunctional checklists and start-up plan with CxA input.
4. PCs and start-up forms executed
5. TAB progress reports
6. BAS commissioning documentation
7. Final TAB report
8. Record Documents including Design Professional Approved Submittals, Installation and O&M manuals
9. Overall training plan
10. Specific training agendas
11. Trend results

3.12 MAINTENANCE

A. Equipment operated prior to the date of substantial completion shall be maintained in accordance with manufacturer's recommendations. In addition, provide complete water treatment for hydronic systems operated prior to date of substantial completion.

B. Records of all maintenance, both periodic and repairs, prior to Building Acceptance will be maintained in 3 Ring Notebook in a location accessible to the Commissioning Agent.

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3.13 TEST EQUIPMENT

A. General

1. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor and/or the Division specific test agency for the equipment being tested.
2. Datalogging equipment and software required to test equipment will be provided by the CxA.
3. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Section 15990 Test and Balance.

END OF SECTION 230800

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SECTION 23 09 00 - BUILDING MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building Management System (BMS), utilizing direct digital controls for monitoring and controlling of HVAC systems.
2. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

B. Related Requirements:

1. Section 011000 "General Narrative" for BAS Upgrade and Terminal Unit Replacement Project Summary and Requirements.
2. Section 23 05 00 - Basic Mechanical Materials and Methods: Performance and reference standards for products and materials required for the Project.
3. Section 230800 "Mechanical / HVAC Commissioning" for terminal units and DDC control systems.
4. Section 250000 "Integrated Automation Systems" for integrated enterprise automation that connects DDC Controls with other integrated building systems.

1.2 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:

1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.

D. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and

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support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized, and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.

J. DOCSIS: Data-Over Cable Service Interface Specifications.

K. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

L. HLC: Heavy load conditions.

M. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

N. LAN: Local area network.

O. LNS: LonWorks Network Services.

P. LON Specific Definitions:

1. FTT-10: Echelon Transmitter-Free Topology Transceiver.
2. LonMark: Association comprising suppliers and installers of LonTalk products. Association provides guidelines for implementing LonTalk protocol to ensure interoperability through a standard or consistent implementation.
3. LonTalk: An open standard protocol developed by the Echelon Corporation that uses a "Neuron Chip" for communication. LonTalk is a register trademark of Echelon.
4. LonWorks: Network technology developed by Echelon.
5. Node: Device that communicates using CEA-709.1-C protocol and that is connected to a CEA-709.1-C network.
6. Node Address: The logical address of a node on the network, consisting of a Domain number, Subnet number, and Node number. "Node number" portion of an address is a number assigned to device during installation, is unique within a subnet, and is not a factory-set unique Node ID.
7. Node ID: A unique 48-bit identifier assigned at factory to each CEA-709.1-C device. Sometimes called a "Neuron ID."
8. Program ID: An identifier (number) stored in a device (usually EEPROM) that identifies node manufacturer, functionality of device (application and sequence), transceiver used, and intended device usage.
9. Standard Configuration Property Type (SCPT): Pronounced "skip-it." A standard format type maintained by LonMark International for configuration properties.
10. Standard Network Variable Type (SNVT): Pronounced "snivet." A standard format type maintained by LonMark used to define data information transmitted and received by individual nodes. "SNVT" is used in two ways. It is an acronym for "Standard Network Variable Type" and is often used to indicate a network variable itself (i.e., it can mean "a network variable of a

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standard network variable type").

11. Subnet: Consists of a logical grouping of up to 127 nodes, where logical grouping is defined by node addressing. Each subnet is assigned a number, which is unique within a Domain. See "Node Address."
12. TP/FT-10: Free Topology Twisted Pair network defined by CEA-709.3 and is most common media type for a CEA-709.1-C control network.
13. TP/XF-1250: High-speed, 1.25-Mbps, twisted-pair, doubly terminated bus network defined by "LonMark Interoperability Guidelines" typically used only to connect multiple TP/FT-10 networks.
14. User-Defined Configuration Property Type (UCPT): Pronounced "U-Keep-It." A Configuration Property format type that is defined by device manufacturer.
15. User-Defined Network Variable Type (UNVT): Network variable format defined by device manufacturer. UNVTs create non-standard communications that other vendors' devices may not correctly interpret and may negatively impact system operation. UNVTs are not allowed.

Q. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

R. Modbus TCP/IP: An open protocol for exchange of process data.

S. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

T. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

U. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

V. PDA: Personal digital assistant.

W. Peer to Peer: Networking architecture that treats all network stations as equal partners.

X. POT: Portable operator's terminal.

Y. RAM: Random access memory.

Z. RF: Radio frequency.

AA. Router: Device connecting two or more networks at network layer.

BB. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

CC. UPS: Uninterruptible power supply.

DD. USB: Universal Serial Bus.

EE. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

FF. VAV: Variable air volume.

GG. WLED: White light emitting diode.

1.3 SYSTEM DESCRIPTION

A. Scope: Furnish all labor, materials and equipment necessary for a complete and operating Building

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Management System (BMS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All controllers furnished in this section shall communicate over an ASHRAE 135 BACnet open protocol bus.

1. Only systems that utilize the Niagara 4 Framework shall satisfy the requirements of this section.
2. System architecture shall fully support a multi-vendor environment and be able to integrate third party systems via LonTalk, BACnet,SNMP and Modbus.
3. System architecture shall provide at a minimum TLS v1.2 encrypted secure Web access using any of the current versions of Microsoft Internet Explorer, Mozilla Firefox, or Google Chrome browsers from any computer on the owner's LAN.
4. All control devices furnished with this Section shall be programmable directly from the Niagara 4 Workbench embedded toolset upon completion of this project. The use of configurable or programmable controllers or software tools and applications that require a specific Niagara 4 license brand to operate for post-installation maintenance shall not be acceptable.
5. The BMS Server shall host all graphic files for the control system.
6. A Technician Service Tool shall be provided on a laptop computer licensed for the necessary engineering software for BMS support; including engineering/programming software for the BMS Server, NACs, graphical user interface modification/creation, and field devices.
7. Owner shall receive all Administrator level login and passwords for engineering toolset at first training session. The Owner shall have full licensing and full access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the BMS.
8. OPEN NIC STATEMENTS - All Niagara 4 software licenses shall have the following NiCS: "accept.station.in=*"; "accept.station.out=*"and "accept.wb.in=*"and "accept.wb.out=*". All open NIC statements shall follow Niagara Open NIC specifications.
9. All JACE hardware licenses and certificates shall be stored on local MicroSD memory card employing encrypted “safe boot” technology.
10. To ensure quality the integrator will supply all JACE 8000 hardware products used on this project from the Tridium Richmond, VA shipping facility. JACE 8000 hardware products not meeting this requirement will not be allowed.

B. ASHRAE 135 Protocol:

1. ASHRAE 135 communication protocol shall be sole and native protocol used throughout entire DDC system.
2. DDC system shall not require use of gateways except to integrate HVAC equipment and other building systems and equipment, not required to use ASHRAE 135 communication protocol.
3. If used, gateways shall connect to DDC system using ASHRAE 135 communication protocol and Project object properties and read/write services indicated by interoperability schedule.
4. Operator workstations, controllers and other network devices shall be tested and listed by BACnet Testing Laboratories.

C. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided on request, with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. Federal Communications Commission (FCC), Rules and Regulations, Volume II -July 1986 Part 15 Class A Radio Frequency Devices.
2. FCC, Part 15, Subpart B, Class B
3. FCC, Part 15, Subpart C
4. FCC, Part 15, Subpart J, Class A Computing Devices.
5. UL 504 - Industrial Control Equipment.
6. UL 506 - Specialty Transformers.
7. UL 910 - Test Method for Fire and Smoke Characteristics of Electrical and Optical-Fiber Cables Used in Air-Handling Spaces.

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8. UL 916 - Energy Management Systems All.
9. UL 1449 - Transient Voltage Suppression.
10. Standard Test for Flame Propagation Height of Electrical and Optical - Fiber Cables Installed Vertically in Shafts.
11. EIA/ANSI 232-E - Interface Between Data Technical Equipment and Data Circuit Terminal Equipment Employing Serial Binary Data Interchange.
12. EIA 455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
13. IEEE C62.41- Surge Voltages in Low-Voltage AC Power Circuits.
14. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
    a. NEMA 250 - Enclosures for Electrical Equipment.
15. NEMA ICS 1 - Industrial Controls and Systems.
16. NEMA ST 1 - Specialty Transformers.
17. NCSBC Compliance, Energy: Performance of control system shall meet or surpass the requirements of ASHRAE/IESNA 90.1-1999.
18. CE 61326
19. C-Tick
20. cUL

1.4 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:
1. Actuator: Control device that opens or closes valve or damper in response to control signal.
2. AI: Analog Input.
3. AO: Analog Output.
4. Analog: Continuously variable state over stated range of values.
5. ASC: Application Specific Controller
6. BMS: Building Management System.
7. DDC: Direct Digital Control.
8. Discrete: Binary or digital state.
9. DI: Discrete Input.
10. DO: Discrete Output.
11. FC: Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
12. FO: Fail open (position of control device or actuator). Device moves to open position on loss of control signal or energy source.
13. GUI: Graphical User Interface.
14. HVAC: Heating, Ventilating and Air Conditioning.
15. IDC: Interoperable Digital Controller.
16. ILC: Interoperable Lon Controller.
17. LAN: Local Area Network.
18. Modulating: Movement of a control device through an entire range of values, proportional to an infinitely variable input value.
19. Motorized: Control device with actuator.
20. NAC: Network Area Controller.
21. NC: Normally closed position of switch after control signal is removed or normally closed position of manually operated valves or dampers.
22. NO: Normally open position of switch after control signal is removed; or the open position of a controlled valve or damper after the control signal is removed; or the usual position of a manually operated valve.
23. OSS: Operating System Server, host for system graphics, alarms, trends, etc.
24. Operator: Same as actuator.
25. PC: Personal Computer.
26. Peer-to-Peer: Mode of communication between controllers in which each device connected to

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network has equal status and each shares its database values with all other devices connected to network.

27. P: Proportional control; control mode with continuous linear relationship between observed input signal and final controlled output element.
28. PEC: Programmable Equipment Controllers
29. PI: Proportional-Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controller variable (reset control).
30. PICS: BACnet Product Interoperability Compliance Statement.
31. PID: Proportional-Integral-Derivative control, control mode with continuous correction of final controller output element versus input signal based on proportional error, its time history (reset) and rate at which it's changing (derivative).
32. Point: Analog or discrete instrument with addressable database value.
33. PUC: Programmable Unitary Controller
34. UC: Unitary DDC Controller
35. WAN: Wide Area Network.

1.5 PRE-INSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Fulton County Government Center Complex, 141 Pryor Street, Atlanta, GA 30303.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: For each type of product include the following:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
5. Product description with complete technical data, performance curves, and product specification sheets.
6. Installation, operation and maintenance instructions including factors effecting performance.
7. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
    a. DDC controllers.
    b. Enclosures.
    c. Electrical power devices.
    d. UPS units.
    e. Accessories.
    f. Instruments.
    g. Control dampers and actuators.
    h. Control valves and actuators.
    i. Sensors.
    j. Control devices.
    k. Flowmeters.
    l. Equipment integration controllers
8. When manufacturer's product datasheets apply to a product series rather than a specific product

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model, clearly indicate and highlight only applicable information.

9. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.
10. Open NIC Statement for all Niagara4 licenses indicating that the licenses comply with Niagara Open NIC specifications.

C. Software Submittal:

1. Cross-referenced listing of software to be loaded on each operator workstation, server, gateway and DDC controller.
2. Description and technical data of all software provided and cross-referenced to products in which software will be installed.
3. Operating system software, operator interface and programming software, color graphic software, DDC controller software, maintenance management software, and third-party software.
4. Include a flow diagram and an outline of each subroutine that indicates each program variable name and units of measure.
5. Listing and description of each engineering equation used with reference source.
6. Listing and description of each constant used in engineering equations and a reference source to prove origin of each constant.
7. Description of operator interface to alphanumeric and graphic programming.
8. Description of each network communication protocol.
9. Description of system database, including all data included in database, database capacity and limitations to expand database.
10. Description of each application program and device drivers to be generated, including specific information on data acquisition and control strategies showing their relationship to system timing, speed, processing burden and system throughout.
11. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.

D. System Description:

1. Full description of DDC system architecture, network configuration, operator interfaces and peripherals, servers, controller types and applications, gateways, routers and other network devices, and power supplies.
2. Complete listing and description of each report, log and trend for format and timing and events which initiate generation.
3. System and product operation under each potential failure condition including, but not limited to, the following:

    a. Loss of power.
    b. Loss of network communication signal.
    c. Loss of controller signals to inputs and outpoints.
    d. Operator workstation failure.
    e. Gateway failure.
    f. Network failure
    g. Controller failure.
    h. Instrument failure.
    i. Control damper and valve actuator failure.

4. Complete bibliography of documentation and media to be delivered to Owner.
5. Description of testing plans and procedures.
6. Description of Owner training.

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E. Shop Drawings:

1. Include plans, elevations, sections, and mounting details where applicable.
2. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail means of vibration isolation and show attachments to rotating equipment.
4. Plan Drawings indicating the following:

    a. Screened backgrounds of walls, structural grid lines, HVAC equipment, ductwork and piping.
    b. Room names and numbers with coordinated placement to avoid interference with control products indicated.
    c. Each desktop operator workstation, server, gateway, router, DDC controller, control panel instrument connecting to DDC controller, and damper and valve connecting to DDC controller, if included in Project.
    d. Exact placement of products in rooms, ducts, and piping to reflect proposed installed condition.
    e. Location of all VAV terminal units and associated thermostat / temperature sensor.
    f. Network communication cable and raceway routing, DDC controller communication cable and raceway routing, VAV terminal unit communication and raceway routing.
    g. Proposed routing of wiring, cabling, conduit, and tubing, coordinated with building services for review before installation.

5. Schematic drawings for each controlled HVAC system indicating the following:

    a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
    b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
    c. A graphic showing location of control I/O in proper relationship to HVAC system.
    d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
    e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
    f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
    g. Narrative sequence of operation.
    h. Graphic sequence of operation, showing all inputs and output logical blocks.

6. Control panel drawings indicating the following:

    a. Panel dimensions, materials, size, and location of field cable, raceways, and tubing connections.
    b. Interior subpanel layout, drawn to scale and showing all internal components, cabling and wiring raceways, nameplates and allocated spare space.
    c. Front, rear, and side elevations and nameplate legend.
    d. Unique drawing for each panel.

7. DDC system network riser diagram indicating the following:

    a. Each device connected to network with unique identification for each.
    b. Interconnection of each different network in DDC system.
    c. For each network, indicate communication protocol, speed and physical means of interconnecting network devices, such as copper cable type, or fiber-optic cable type.

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Indicate raceway type and size for each.

d. Each network port for connection of an operator workstation or other type of operator interface with unique identification for each.

8. Monitoring and control signal diagrams indicating the following:

a. Control signal cable and wiring between controllers and I/O.
b. Point-to-point schematic wiring diagrams for each product.
c. Control signal tubing to sensors, switches and transmitters.
d. Process signal tubing to sensors, switches and transmitters.

9. Color graphics indicating the following:

a. Itemized list of color graphic displays to be provided.
b. For each display screen to be provided, a true color copy showing layout of pictures, graphics and data displayed.
c. Intended operator access between related hierarchical display screens.

F. Shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers' catalog data sheets and installation instructions. Submit in printed electronic format. Samples of written Controller Checkout Sheets and Performance Verification Procedures for applications similar in scope shall be included for approval.

G. Shop drawings shall also contain complete wiring and schematic diagrams, sequences of operation, control system bus layout and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.

H. Upon completion of the work, provide 3 complete sets of 'as-built' drawings and other project-specific documentation in 3-ring hard-backed binders and on Flash media.

I. Any deviations from these specifications or the work indicated on the drawings shall be clearly identified in the Submittals.

1.7 QUALITY ASSURANCE

A. DDC System Provider Qualifications:

1. Nationally recognized manufacturer of DDC systems and products.
2. DDC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. DDC systems and products that have been successfully tested and in use on at least three past projects.
4. Having complete published catalog literature, installation, operation and maintenance manuals for all products intended for use.
5. This office shall maintain parts inventory and shall have all testing and diagnostic equipment necessary to support this work, as well as staff trained in the use of this equipment.
6. Having full-time in-house employees for the following:

a. Product, application engineering, and software engineering
b. Technical support for DDC system installation training, commissioning and troubleshooting of installations.
c. Owner operator training.

B. Single Source Responsibility of Supplier:

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1. The Control System Contractor shall be responsible for the complete installation and proper operation of the control system. The Control System Contractor shall exclusively be in the regular and customary business of design, installation and service of computerized building management systems similar in size and complexity to the system specified.
2. The Control System Contractor shall be the manufacturer of the primary DDC system components or shall have been the authorized representative for the primary DDC components manufacturer for at least 5 years. All control panels shall be assembled by the Control System Contractor in a UL-Certified 508A panel shop.

C. DDC System Provider Qualifications:

1. Authorized representative of, and trained by, DDC system manufacturer.
2. In-place facility located within seventy-five (75) miles of Project.
3. Demonstrated past experience with installation of DDC system products being installed for period within five consecutive years before time of bid.
4. Demonstrated past experience on three (3) existing facility renovation projects of similar complexity, scope and value.
5. Each person assigned to Project shall have demonstrated past experience.
6. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
7. Service and maintenance staff assigned to support Project during warranty period.
8. Product parts inventory to support on-going DDC system operation for a period of not less than 5 years after Substantial Completion.

D. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in the production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.

1.8 DELIVERY, STORAGE AND HANDLING

A. Maintain integrity of shipping cartons for each piece of equipment and control device through shipping, storage and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
3. Install updates only after receiving Owner's written authorization.
4. Warranty service shall occur during normal business hours and commence within twenty-four (24) hours of Owner's warranty service request.
5. Warranty Period: Twenty four (24) months from date of Substantial Completion.

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PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of this section, Section 255000, Integrated Automation Facility Controls, and the Tridium Niagara Framework version N4, provide products by one of the following:

1. Automated Logic Corporation.
2. Honeywell International Inc.
3. Johnson Controls, Inc.
4. Siemens Industry, Inc., Building Technologies Division.
5. Trane.
6. Distech.

B. Substitutions: Not permitted.

2.2 GENERAL

A. The Building Management System (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, network area controllers, graphics and programming and other control devices for a complete system as specified herein.

B. The installed system shall provide secure strong password access to all features, functions and data contained in the overall BMS.

C. Latest encryption technologies (TLS v1.2) shall be provided for NAC to NAC communications; NAC to BMS Server communications and client user communications.

D. System integrator shall coordinate security policies with the owner’s IT (Information Technology) department.

2.3 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURE

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system utilizing open protocols to create an automation infrastructure.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. Physical connection of any BACnet control equipment, such as chillers, shall be via BACnet IP or BACnet MS/TP. BACnet Ethernet or BACnet Arcnet communications are not acceptable for NAC, BMS Server or field device communication.

C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. With the exception of any previously installed legacy systems which cannot be updated to current open communication technologies, components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system shall incorporate the ability to access all data using HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

F. System architecture shall consist of no more than three levels of LANs.

1. Level one LAN shall connect network controllers and operator workstations.

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2. Level one or Level two LAN shall connect programmable application controllers to other programmable application controllers, and to network controllers.
3. Level two or Level three LAN shall connect application-specific controllers to programmable application controllers and network controllers.
4. Level two or Level three LAN shall connect application-specific controllers to application-specific controllers.

G. Number of LANs and associated communication shall be transparent to operator. All I/O points residing on any LAN shall be capable of global sharing between all system LANs.

H. System design shall eliminate dependence on any single device for system alarm reporting and control execution. Each controller shall operate independently by performing its' own control, alarm management and historical data collection.

I. Special Network Architecture Requirements:

1. The intended network architecture is to have IP level connections to the Fulton County Government IP network per building. Within each building, the intent is to have a high speed Level one network as the primary backbone with building controllers and BACnet routers on the level one network.
2. Central Energy Plant Systems: For control applications for the central plant, include a dedicated LAN of programmable building controllers that reside within the same network segment.
3. Air-Handling Systems: For control applications of an air-handling system that consists of air-handling unit(s) and VAV terminal units, include a dedicated LAN of application-specific controllers serving VAV terminal units that reside within the same network segment below a BACnet router.

2.4 BMS SERVER HARDWARE (Owner Supplied)

A. Minimum Computer Configuration (Hardware Independent).
- Processor: Intel® Xeon® CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors
- Operating System: Windows 10, 64-bit Windows 8.1 Enterprise, 2012 R2 Standard, RHEL-7
- Memory: 4 GB minimum
- Mass storage as required for system operation and data archiving
- Display: Video card and monitor capable of displaying 1024 x 768 pixel resolution or greater
- Network Support: Ethernet adapter (10/100 Mb with RJ-45 connector)
- Connectivity: Full-time high-speed ISP connection recommended for remote site access (i.e., T1, ADSL, cable modem) and IPv6 compliant

B. Standard Client: The thin-client Web Browser BMS GUI shall be Microsoft Internet Explorer (10.0 or later) running on Microsoft 7+. No special software shall be required to be installed on the PCs used to access the BMS via a web browser.

C. Owner may choose to provide a virtual environment that meets the minimum specification above.

2.5 NETWORK AREA CONTROLLER (NAC)

A. Manage communications between the programmable equipment controllers (PEC), application specific controllers (ASC) and unitary controllers (UC) which are connected to its communications trunks, manage communications between itself and other system network controllers (NAC) and with any operator workstations (OWS) that are part of the BMS, and perform control and operating strategies for the system based on information from any controller connected to the BMS.

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B. The controllers shall be fully programmable to meet the unique requirements of the facility it shall control.

C. The controllers shall be capable of peer-to-peer communications with other NAC's and with any OWS connected to the BMS, whether the OWS is directly connected, connected via cellular modem or connected via the Internet.

D. The NAC shall employ a device/point count capacity license model that supports expansion capabilities.

E. The NAC shall be enabled to support and shall be licensed to include the following Open protocol drivers (client and server) by default:
1. BACnet
2. Lon
3. MODBUS
4. SNMP
5. KNX

F. The NAC shall be capable of executing application control programs to provide:
1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Niagara Analytics
7. Integration of LonWorks, BACnet, and MODBUS controller data.
8. Network management functions for all NAC, PEC, UC and ASC based devices.

G. Certifications – All NACs shall be listed under with the following agencies at the certification levels appropriate to them:
1. UL 916
2. CE EN 61326-1
3. FCC Part 15 Subpart B, Class B
4. FCC Part 15 Subpart C
5. C-UL listed to Canadian Standards Association (CSA) C22.2 No. 205-M1983 “Signal Equipment”
6. 1999/5/EC R&TTE Directive
7. CCC
8. SRRC
9. RSS
10. ROHS
11. IEEE802.11a/b/g/n
12. IEEE802.11n HT20 @ 2.4GHz
13. IEEE802.11n HT20/HT40 @ 5GHz
14. Configurable radio (Off, WAP, or Client)
15. WPAPSK/WPA2PSK supported

H. Minimum Specifications:
1. Operating temperature: -20–60°C
2. Storage temperature: -40–85°C
3. Humidity: 5%–95% — Non condensing
4. Shipping & vibration: ASTM D4169, Assurance Level II
5. MTTF: 10 years+
6. Batteryless operation

I. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a

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minimum of 16 simultaneous users.

J. The NAC shall provide alarm recognition, storage, routing, management and analysis to supplement distributed capabilities of equipment or application specific controllers.

K. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via cellular modem, or wide-area network.
   1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but not limited to:
      a. Alarm.
      b. Return to normal.
      c. To default.
   2. Alarms shall be annunciated in any of the following manners as defined by the user:
      a. Screen message text.
      b. Email of complete alarm message to multiple recipients.
      c. Pagers via paging services that initiate a page on receipt of email message.
      d. Graphics with flashing alarm object(s).
   3. The following shall be recorded by the NAC for each alarm (at a minimum):
      a. Time and date.
      b. Equipment (air handler #, access way, etc.).
      c. Acknowledge time, date, and user who issued acknowledgement.

L. Programming software and all controller "Setup Wizards" shall be embedded into the NAC.

M. The NAC shall support the following security functions.
   1. Module code signing to verify the author of programming tool and confirm that the code has not been altered or corrupted.
   2. Role-Based Access Control (RBAC) for managing user roles and permissions.
   3. Require users to use strong credentials.
   4. Data in Motion and Sensitive Data at Rest be encrypted.
   5. LDAP and Kerberos integration of access management.
   6. A CPU that incorporates secure boot technologies.

N. The NAC shall support the data modeling structures provide with Niagara4 to utilize Search; Hierarchy; Template; and Permission functionality:
   1. Metadata: Descriptive tags to define the structure of properties.
   2. Tagging: Process to apply metadata to components
   3. Tag Dictionary

O. The NAC shall employ template functionality. Templates are a containerized set of configured data tags, graphics, histories, alarms... that are set to be deployed as a unit based upon manufacturer's controller and relationships. All lower level communicating controllers (PEC, UC, AVAV, VFD…) shall have an associated template file for reuse on future project additions.

P. The NAC shall be provided with a 5 Year Software Maintenance license. Labor to implement not included.

Q. Spare I/O Point Capacity:

   1. 20 percent of each AI, AO, BI, and BO point connected to controller.
   2. Minimum Spare I/O Points per Controller:

      a. AIs: Three.
      b. AOs: Three.
      c. BIs: Five.
      d. BOs: Five.

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2.6 PROGRAMMABLE EQUIPMENT CONTROLLER (PEC)

A. HVAC control shall be accomplished BACnet based devices where the application has BTL Listed PICS defined. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. Minimum Requirements:
   1. The controller shall be fully programmable with full functionality on any Niagara 4 brand platform.
      a. Support downloads to the controller from any brand of Niagara 4 platform.
      b. Support uploads from the controller to any brand of Niagara 4 platform.
      c. Support simulation/debug mode of the controller.
      d. Maintain native GUI.
      e. Native function-block programming software and all controller “Setup Wizards” shall be embedded within the Niagara 4 environment.

C. All PECs shall be application programmable and shall at all times maintain their certification. All control sequences within or programmed into the PEC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained.

D. The PEC shall provide LED indication of communication and controller performance to the technician, without cover removal.

E. The PEC shall not require any external configuration tool or programming tool. All configuration and programming tasks shall be accomplished and accessible from within the Niagara 4 environment.

F. The following integral and remote Inputs/Outputs shall be supported per each PEC:
   1. Eight integral dry contact digital inputs.
   2. Any two digital inputs may be configured as pulse counters with a maximum pulse read rate of 15 Hz.
   3. Eight integral analog inputs (configurable as 0-10V, 0-10,000 ohm or, 20K NTC).
   4. Six integral 4-20 ma analog outputs.
   5. Eight integral 24 Vac Triac digital outputs, configurable as maintained or floating motor control outputs.
   6. One integral 20 Vdc, 65-mA power supply for auxiliary devices.
   7. If a 20 Vdc 65-mA power supply terminal is not integral to the PEC, provide at each PEC a separate, fully isolated, enclosed, current limited and regulated UL listed auxiliary power supply for power to auxiliary devices.

G. Each PEC shall have expansion ability to support additional I/O requirements through the use of remote input/output modules.

H. PEC Controllers shall support at minimum the following control techniques:
   1. General-purpose control loops that can incorporate Demand Limit Control strategies, Set point reset, adaptive intelligent recovery, and time of day bypass.
   2. General-purpose, non-linear control loops.
   3. Start/stop Loops.
   4. If/Then/Else logic loops.
   5. Math Function loops (MIN, MAX, AVG, SUM, SUB, SQRT, MUL, DIV, ENTHALPY).

I. Spare I/O Point Capacity:

   1. 20 percent of each AI, AO, BI, and BO point connected to controller.
   2. Minimum Spare I/O Points per Controller:

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a. AIs: Two.
b. AOs: Two.
c. BIs: Three.
d. BOs: Three.

2.7 UNITARY CONTROLLER (UC)

A. The unitary controller (UC) platform shall be designed specifically to control HVAC - ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units and radiant panels. The control shall use BACnet based devices where the application has BTL Listed PICS defined. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. Minimum Requirements:
1. The controller shall be fully programmable with full functionality on any Niagara 4 brand platform.
   a. Support downloads to the controller from any brand of Niagara 4 platform.
   b. Support uploads from the controller to any brand of Niagara 4 platform.
   c. Support simulation/debug mode of the controller.
   d. Maintain native GUI.
   e. Native function-block programming software and all controller “Setup Wizards” shall be embedded within the Niagara 4 environment.
2. The controller shall be capable of either integrating with other devices or stand-alone operation.
3. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications. Controller memory minimum requirements include:
   a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 2 Kilobytes.
4. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77 degrees F (25 degrees C).
   c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
5. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
6. The controller shall have an internal DC power supply to power external sensors.
   a. Power Output: 20 VDC ±10% at 75 mA.
7. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller in manual mode under control of software tool.
   d. Controller lost its configuration.
   e. No power to controller, low voltage, or controller damage.
   f. Processor and/or controller are not operating.
8. The minimum controller Environmental ratings.
   a. Operating Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C).

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b. Storage Temperature Ambient Rating: -40 degrees to 150 degrees F (-40 degrees to 65.5 degrees C).
c. Relative Humidity: 5% to 95% non-condensing.

9. The controller shall have the additional approval requirements, listings, and approvals:
   a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
   b. CSA (LR95329-3) Listed.
   c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
   d. Meets Canadian standard C108.8 (radiated emissions).
   e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity).
   f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission).
10. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
11. The controller shall have a mix of digital inputs (DI), digital Triac outputs (DO), analog outputs (AO), and universal inputs (UI).
   a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
   b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
   c. Input and Output wiring terminals shall be designated with color coded labels.
   d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).
12. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
13. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.
   a. Discharge air control and low limit.
   b. Pressure-dependent dual duct without flow mixing.
   c. Variable air volume with return flow tracking.
   d. Economizer with differential enthalpy.
   e. Minimum airflow coordinated with CO2.
   f. Unit ventilator cycle (1, 2, 3) 2-pipe.
   g. Unit ventilator cycle (1, 2, 3) 2-pipe with face/bypass.
   h. Unit ventilator cycle (1, 2, 3) 4-pipe.
   i. Unit ventilator cycle (1, 2, 3) 4-pipe with EOC valve.

C. Spare I/O Point Capacity:

1. 10 percent of each AI, AO, BI, and BO point connected to controller.
2. Minimum Spare I/O Points per Controller:

   a. AIs: One.
   b. AOs: One.
   c. BIs: One.
   d. BOs: One.

2.8 VARIABLE AIR VOLUME CONTROLLER (VAV)

A. The VAV controller platform shall be designed specifically for room-level VAV control - pressure-independent air flow control, pressure dependent damper control, supply and exhaust pressurization/de-pressurization control; temperature, humidity, complex CO2, occupancy, and emergency control. Equipment includes: VAV terminal unit, VAV terminal unit with reheat, Series fan powered terminal unit, Parallel fan powered terminal unit, Supply and Exhaust air volume terminals and Constant volume dual-duct terminal unit. Control shall be accomplished using BACnet

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based devices where the application has BTL Listed PICS defined. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara 4 Framework, that allow standard and customizable control solutions required in executing the "Sequence of Operation".

B. Minimum Requirements:
1. The controller shall be fully programmable with full functionality on any Niagara 4 brand platform.
   a. Support downloads to the controller from any brand of Niagara 4 platform.
   b. Support uploads from the controller to any brand of Niagara 4 platform.
   c. Support simulation/debug mode of the controller.
   d. Maintain native GUI.
   e. Native function-block programming embedded software and all controller “Setup Wizards” shall be embedded within the Niagara 4 environment.
2. The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.
3. The controller shall have an internal velocity pressure sensor.
   a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
   b. Operating Range: 0 to 1.5 inch H2O (0 to 374 Pa).
   c. Accuracy: ±2% of full scale at 32 degrees to 122 degrees F (0 degrees to 50 degrees C); ±1% of full scale at null pressure.
4. The controller shall have two microprocessors. The Host processor contains on-chip FLASH program memory, FLASH information memory, and RAM to run the main HVAC application. The second processor for network communications.
   a. FLASH Memory Capacity: 60 Kilobytes with 8 Kilobytes for application program.
   b. FLASH Memory settings retained for ten years.
   c. RAM: 2 Kilobytes.
5. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
   a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
   b. Accuracy: ±1 minute per month at 77 degrees F (25 degrees C).
   c. Power Failure Backup: 24 hours at 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
6. The controller shall have Significant Event Notification, Periodic Update capability and Failure Detect when network inputs fail to be detected within their configurable time frame.
7. The controller shall have an internal DC power supply to power external sensors.
   a. Power Output: 20 VDC ±10% at 75 mA.
8. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller in manual mode under control of software tool.
   d. Controller lost its configuration.
   e. No power to controller, low voltage, or controller damage.
   f. Processor and/or controller are not operating.
9. The minimum controller Environmental ratings:
   a. Operating Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
   b. Storage Temperature Ambient Rating: 32 degrees to 122 degrees F (0 degrees to 50 degrees C).
   c. Relative Humidity: 5% to 95% non-condensing.
10. The controller shall have the additional approval requirements, listings, and approvals:
   a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.

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b. CSA (LR95329-3) Listed.
c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
d. Meets Canadian standard C108.8 (radiated emissions).
e. Conforms requirements European Consortium standard EN 61000-6-1; 2001 (EU Immunity).
f. Conforms requirements European Consortium standard EN 61000-6-3; 2001 (EU Emission).

11. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
12. The controller shall provide an integrated actuator option.
    a. Actuator type: Series Floating.
    b. Rotation stroke: 95 degrees ±3 degrees for CW or CCW opening dampers.
    c. Torque rating: 44 lb-inch (5 Nm).
    d. Run time for 90 degrees rotation: 90 seconds at 60 Hz.
13. The controller shall have digital inputs (DI), digital Triac outputs (DO), three analog outputs (AO), and universal inputs (UI).
    a. Analog outputs (AO) shall be capable of being configured as digital outputs (DO).
    b. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring.
    c. Input and Output wiring terminals shall be designated with color coded labels.
14. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
15. The controller shall have a loop execution response time of 1 second.
16. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.
    a. VAV terminal unit.
    b. VAV terminal unit fan speed control.
    c. Series fan.
    d. Parallel fan.
    e. Regulated air volume (room pressurization/de-pressurization).
    f. CV dual-duct.
    g. Room CO2 control.
    h. Room Humidity.
    i. TOD occupancy sensor stand-by set points.

C. Spare I/O Point Capacity:

1. 10 percent of each AI, AO, BI, and BO point connected to controller.
2. Minimum Spare I/O Points per Controller:

    a. AIs: One.
    b. AOs: One.
    c. BIs: One.
    d. BOs: One.

2.9 PERFORMANCE REQUIREMENTS

A. Project Specific Design: Engage a qualified professional to design DDC system to satisfy requirements indicated.

B. System Performance Objectives:

1. DDC system shall manage HVAC systems including Central Energy Plant, Air Handling Units, select Supply and Exhaust Fans, VAV Terminal Units, select DX Package Units, and VRF AC Units.

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2. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
3. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
4. DDC system shall operate while unattended by an operator and through operator interaction.
5. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.
6. DDC system shall provide for future integration capabilities for systems including, but not limited to, programmable lighting controls, security, access and CCTV systems and fire alarm systems.

C. DDC System Speed:

1. Response Time of Connected I/O:

   a. AI point values connected to DDC system shall be updated at least every two seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
   b. BI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
   c. AO points connected to DDC system shall begin to respond to controller output commands within one second. Global commands shall also comply with this requirement.
   d. BO point values connected to DDC system shall respond to controller output commands within two seconds. Global commands shall also comply with this requirement.

2. Display of Connected I/O:

   a. Analog point COV connected to DDC system shall be updated and displayed at least every five seconds for use by operator.
   b. Binary point COV connected to DDC system shall be updated and displayed at least every ten seconds for use by operator.
   c. Alarms of analog and digital points connected to DDC system shall be displayed within 30 seconds of activation or change of state.
   d. Graphic display refresh shall update within four seconds.
   e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations shall not exceed graphic refresh rate indicated.

D. Network Bandwidth: Design each network of DDC system to include at least thirty (30) percent available spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions.

E. Future Expandability:

1. DDC system size shall be expandable to an ultimate capacity of at least two times total I/O points indicated.
2. Additional DDC controllers, I/O and associated wiring shall be all that is needed to achieve ultimate capacity. Initial network infrastructure shall be designed and installed to support ultimate capacity.
3. Operator interfaces installed initially shall not require hardware and software additions and revisions for ultimate capacity.

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F. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.10 OTHER CONTROL SYSTEM HARDWARE

A. Control valve and damper actuators shall be furnished by the Control System Contractor:

1. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

a. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
b. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
c. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
d. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
e. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
f. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

2. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

a. Valves: Size for torque required for valve close off at maximum pump differential pressure.
b. Dampers: Size for running torque calculated as follows:

1) Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
2) Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
3) Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
4) Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
5) Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
6) Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

c. Coupling: V-bolt and V-shaped, toothed cradle.
d. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
e. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
f. Power Requirements (Two-Position Spring Return): 24-V ac.
g. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
h. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.

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i. Temperature Rating: 40 to 104 deg F.
j. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
k. Run Time: 30 seconds.

3. Control Valve Actuators:

a. All actuators shall have inherent current limiting motor protection. Valve actuators shall be 24-volt, electronic type, modulating or two-position as required for the correct operating sequence.
b. Actuators on valves needing ' fail-safe' operation shall have spring return to Normal position.
c. Modulating valves shall be positive positioning in response to the signal.
d. Actuators for VAV terminal unit heating coils shall be "drive-open; drive-closed" type.
e. All valve actuators shall be UL listed.

B. Control Valves shall be furnished by the Control System Contractor:

1. Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
2. Hydronic system ball valves shall have the following characteristics:

a. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
b. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
c. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

1) Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
2) Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

d. Sizing: 3-psig maximum pressure drop at design flow rate or the following:

1) Two Position: Line size.
2) Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.

e. Flow Characteristics: Two-way valves shall be pressure independent characterized control valves (PICCV) with 0-10V water coil flow reading in gpm.
f. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

3. All control valves 2-1/2 inches (63.5 mm) or larger shall have position indication. All hot water control valves shall be Normally-Open arrangement; all chilled water control valves shall be Normally-Closed arrangement.

C. Wall Mount Room Temperature sensors: Each room temperature sensor shall provide temperature indication to the digital controller, provide the capability for a software-limited occupant set point adjustment (warmer-cooler slider bar or switch) and limited operation override capability. Room Temperature Sensors shall be 20,000-ohm thermistor type with a temperature range of -40 to 140 degrees F (-38 to 60 degrees C). The sensor shall be complete with a decorative cover and suitable for mounting over a standard electrical utility box. These devices shall have an accuracy of 0.5 degrees F

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(.024 degrees C) over the entire range.

D. Duct-mounted and Outside Air Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of ±; 0.2 degrees C. Outside air sensors shall include an integral sun shield. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F(-38 to 71 degrees C) The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 feet (2438 mm) long sensor element. These devices shall have accuracy of 0.5 degrees F (.024 degrees C) over the entire range.

E. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degrees F (0 to 60 degrees C). Sensors shall be selected for wall, duct or outdoor type installation as appropriate.

F. Carbon Dioxide Sensors (CO2): Sensors shall utilize Non-dispersive infrared technology (N.D.I.R.), repeatable to plus or minus 20 PPM. Sensor range shall be 0 - 2000 PPM. Accuracy shall be plus or minus five percent (5%) or 75 PPM, whichever is greater. Response shall be less than one minute. Input voltage shall be 20 to 30 VAC or DC. Output shall be 0 - 10 VDC. Sensor shall be wall or duct mounted type, as appropriate for the application, housed in a high impact plastic enclosure.

G. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

H. Differential Analog (duct) Static Pressure Transmitters Provide a pressure transmitter with integral capacitance type sensing and solid-state circuitry. Accuracy shall be plus or minus 1% of full range; range shall be selected for the specific application. Provide zero and span adjustment capability. Device shall have integral static pickup tube.

I. Differential Air Pressure Switches: Provide SPDT type, UL-approved, and selected for the appropriate operating range where applied. Switches shall have adjustable set points and barbed pressure tips.

J. Water Flow Switches: Provide a SPST type contact switch with bronze paddle blade, sized for the actual pipe size at the location. If installed outdoors, provide a NEMA-4 enclosure. Flow switch shall be UL listed.

K. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. All electrical devices within a control panel shall be factory wired. Control panel shall be assembled by the BMS in a UL-Certified 508A panel shop. A complete set of ' as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

L. Pipe and Duct Temperature sensing elements: 20,000-ohm thermistor temperature sensors with and accuracy of ±1% accuracy. Their range shall be -5 to 250 degrees F (-20 to 121 degrees C). Limited range sensors shall be acceptable provided they are capable of sensing the range expected for the point at the specified accuracy. Thermal wells with heat conductive gel shall be included.

M. Low Air Temperature Sensors: Provide SPST type switch, with 15 to 55 degrees F (-9 to 13 degrees C), range, vapor-charged temperature sensor.

N. Variable Frequency Drives: The variable frequency drive (VFD) shall be designed specifically for use in Heating, Ventilation, and Air Conditioning (HVAC) applications in which speed control of the motor can be applied. The VFD, including all factory installed options, shall have UL & CSA

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approval. VFD's shall include communications capability with DDC BMS via built-in interface card (MODBUS or BACnet).

O. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a sub base and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.

P. Emergency Stop Switches: Provide toggle-type switch with normally-closed contact. Switch shall be labeled "AIR HANDLER EMERGENCY SHUTOFF, NORMAL - OFF.".

Q. Transducers: Differential pressure transducers shall be electronic with a 4-20 mA output signal compatible to the Direct Digital Controller. Wetted parts shall be stainless steel. Unit shall be designed to operate in the pressure ranges involved.

R. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120 VAC/24 VAC operation.

S. Line voltage protection: All DDC system control panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

2.11 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.

1. Wire size shall be at least No. 14 AWG.
2. Conductor shall be 7/24 soft annealed copper strand with 2- to 2.5-inch lay.
3. Conductor insulation shall be 600 V, Type THWN or Type THHN, and 90 deg C according to UL 83.
4. Conductor colors shall be black (hot), white (neutral), and green (ground).
5. Furnish wire on spools.

B. Single Twisted Shielded Instrumentation Cable above 24 V:

1. Wire size shall be a minimum No. 18 AWG.
2. Conductors shall be a twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch lay.
3. Conductor insulation shall have a Type THHN/THWN or Type TFN rating.
4. Shielding shall be 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
5. Outer jacket insulation shall have a 600-V, 90-deg C rating and shall be Type TC cable.
6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
7. Furnish wire on spools.

C. Single Twisted Shielded Instrumentation Cable 24 V and Less:

1. Wire size shall be a minimum No. 18 AWG for binary and analog control outputs.
2. Wire size shall be a minimum No. 22 AWG for binary and analog signal inputs.
3. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch lay.
4. Cable shall be plenum rated where used in return air plenum space.

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5. Cable shall comply with NFPA 70.
6. Conductor insulation shall have a nominal 15-mil thickness, constructed from flame-retardant PVC.
7. Shielding shall be 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
8. Outer jacket insulation shall have a 300-V, 105-deg C rating and shall be Type PLTC cable.
9. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
10. Furnish wire on spools.

D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.

1. Cable shall be plenum rated where used in return air plenum space.
2. Cable shall comply with NFPA 70.
3. Cable shall have a unique color that is different from other cables used on Project.
4. Copper Cable for Level One Ethernet Network:

    a. 100BASE-TX.
    b. TIA/EIA 586, Category 6.
    c. Minimum No. 24 AWG stranded conductor.
    d. Shielded Twisted Pair (STP).
    e. Thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, Class CMP as plenum rated

5. Copper Cable for Levels Two and Three Controllers Networks:

    a. BACnet RS-232, RS-485 Low-Cap Communication Wire
    b. Minimum No. 22 AWG (7/30) stranded conductor.
    c. Nominal 12.5 pF/FT
    d. Thermoplastic insulated conductors, enclosed in a thermoplastic outer jacket, Class CMP as plenum rated.

2.12 RACEWAYS FOR CONTROL WIRING, CABLING, AND TUBING

A. Metal Conduits, Tubing, and Fittings:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with NEMA ANSI C80.1 and UL 6.
3. ARC: Comply with NEMA ANSI C80.5 and UL 6A.
4. IMC: Comply with NEMA ANSI C80.6 and UL 1242.
5. PVC-Coated Steel Conduit: PVC-coated IMC.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040 inch, minimum.

6. EMT: Comply with NEMA ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; aluminum.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
9. Fittings for Metal Conduit: Comply with NEMA ANSI FB 1 and UL 514B.

    a. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
    b. Fittings for EMT:

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c. Material: Steel.
d. Type: Setscrew.
e. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
f. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

10. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

B. Metal Wireways and Auxiliary Gutters:

1. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.

a. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
3. Wireway Covers: Screw-cover type unless otherwise indicated.
4. Finish: Manufacturer's standard enamel finish.

C. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.

2.13 ACCESSORIES

A. Damper Blade Limit Switches:

1. Sense positive open and/or closed position of the damper blades.
2. NEMA 250, Type 13, oil-tight construction.
3. Arrange for the mounting application.
4. Additional waterproof enclosure when required by its environment.
5. Arrange to prevent "over-center" operation.

B. Manual Valves:

1. Needle Type:

a. PTFE packing.
b. Construct of brass for use with copper and polyethylene tubing and of stainless steel for use with stainless-steel tubing.
c. Aluminum T-bar handle.
d. Include tubing connections.

2. Ball Type:

a. Body: Bronze ASTM B 62 or ASTM B 61
b. Ball: Type 316 stainless steel.
c. Stem: Type 316 stainless steel.

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d. Seats: Reinforced PTFE.
e. Packing Ring: Reinforced PTFE.
f. Lever: Stainless steel with a vinyl grip.
g. 600 WOG.
h. Threaded or flanged end connections.

3. Ball Type:

a. Body: WCB Carbon Steel
b. Ball: CF&M stainless steel.
c. Stem: Type 304 stainless steel.
d. Seats: Reinforced PTFE.
e. Packing Ring: Reinforced PTFE.
f. Lever: WCB Carbon Steel
g. 300 WOG.
h. Threaded or flanged end connections.

2.14 IDENTIFICATION

A. Instrument Air Pipe and Tubing:

1. Engraved tag shall bear the following information:

a. Service (Example): "Instrument Air."
b. Pressure Range (Example): 0 to 30 psig.

2. Letter size shall be a minimum of 0.25 inch high.
3. Tag shall consist of white lettering on blue background.
4. Tag shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded blue with contrasting white center exposed by engraving through outer layer.
5. Include tag with a brass grommet, chain and S-hook.

B. Control Equipment, Instruments, and Control Devices:

1. Provide engraved tag bearing unique identification.

a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.

2. Letter size shall be as follows:

a. Operator Workstations: Minimum of 0.5 inch high.
b. Printers: Minimum of 0.5 inch high.
c. DDC Controllers: Minimum of 0.5 inch high.
d. Gateways: Minimum of 0.5 inch high.
e. Repeaters: Minimum of 0.5 inch high.
f. Enclosures: Minimum of 0.5 inch high.
g. Electrical Power Devices: Minimum of 0.25 inch high.
h. UPS units: Minimum of 0.5 inch high.
i. Accessories: Minimum of 0.25 inch high.
j. Instruments: Minimum of 0.25 inch high.
k. Control Damper and Valve Actuators: Minimum of 0.25 inch high.

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3. Tag shall consist of white lettering on black background.
4. Tag shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded black with contrasting white center exposed by engraving through outer layer.
5. Tag shall be fastened with drive pins.
6. Instruments, control devices and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

C. Valve Tags:

1. Brass tags and brass chains attached to valve.
2. Tags shall be at least 1.5 inches in diameter.
3. Include tag with unique valve identification indicating control influence such as flow, level, pressure, or temperature; followed by location of valve, and followed by three-digit sequential number. For example: TV-1.001.
4. Valves with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

D. Raceway and Boxes:

1. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
2. Paint cover plates on junction boxes and conduit same color as the tape banding for conduits. After painting, label cover plate "HVAC Controls," using an engraved phenolic tag.
3. For raceways housing pneumatic tubing, add a phenolic tag labeled "HVAC Instrument Air Tubing."
4. For raceways housing air signal tubing, add a phenolic tag labeled "HVAC Air Signal Tubing."

E. Equipment Warning Labels:

1. Acrylic label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size shall be at least 14-point type with white lettering on red background.
3. Warning label shall read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering shall be enclosed in a white line border. Edge of label shall extend at least 0.25 inch beyond white border.

2.15 BMS SERVER & WEB BROWSER GUI - SYSTEM OVERVIEW

A. The BMS Contractor shall provide system software based on server/thin-client architecture, designed around the open standards of web technology. The BMS Server shall communicate using Ethernet and TCP. Server shall be accessed using a web browser over Owner intranet and remotely over the Internet.

B. The intent of the thin-client architecture is to provide the operator(s) complete access to the BMS system via a web browser. The thin-client web browser Graphical User Interface (GUI) shall be browser and operating system agnostic, meaning it will support HTML5 enabled browsers without requiring proprietary operator interface and configuration programs or browser plug-ins. Microsoft, Firefox, and Chrome browsers (current released versions), and Windows as well as non-Window operating systems.

C. The BMS Server software shall support at least the following server platforms (Windows 7, 8.1, Server 12). The BMS Server software shall be developed and tested by the manufacturer of the system

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stand-alone controllers and network controllers/routers.

D. The web browser GUI shall provide a completely interactive user interface and shall provide a HTML5 experience that supports the following features as a minimum:
1. Trending.
2. Scheduling.
3. Electrical demand limiting.
4. Duty Cycling.
5. Downloading Memory to field devices.
6. Real time 'live' Graphic Programs.
7. Tree Navigation.
8. Parameter change of properties.
9. Set point adjustments.
10. Alarm / event information.
11. Configuration of operators.
12. Execution of global commands.
13. Add, delete, and modify graphics and displayed data.

E. Software Components: All software shall be the most current version. All software components of the BMS system software shall be provided and installed as part of this project. BMS software components shall include:
1. Server Software, Database and Web Browser Graphical User Interface.
2. 5 Year Software Maintenance license. Labor to implement not included.
3. Embedded System Configuration Utilities for future modifications to the system and controllers.
4. Embedded Graphical Programming Tools.
5. Embedded Direct Digital Control software.
6. Embedded Application Software.
7. Analytic Services

F. BMS Server Database: The BMS Server software shall utilize a Java Database Connectivity (JDBC) compatible database such as: MS SQL 8.0, Oracle 8i or IBM DB2. BMS systems written to Non - Standard and/or Proprietary databases are NOT acceptable.

G. Thin Client - Web Browser Based: The GUI shall be thin client or browser based and shall meet the following criteria:
1. Web Browser's for PC's: Only the current released browser (Explorer/Firefox/Chrome) will be required as the GUI and a valid connection to the server network. No installation of any custom software shall be required on the operator's GUI workstation/client. Connection shall be over an intranet or the Internet.
2. Encrypted communication between the Web Browser GUI and BMS Server shall use Secure Socket Layer TLS v1.2 as a minimum accept level of encryption.

2.16 WEB BROWSER GRAPHICAL USER INTERFACE

A. Web Browser Navigation: The Thin Client web browser GUI shall provide a comprehensive user interface. Using a collection of web pages, it shall be constructed to "feel" like a single application, and provide a complete and intuitive mouse/menu driven operator interface. It shall be possible to navigate through the system using a web browser to accomplish requirements of this specification. The Web Browser GUI shall (as a minimum) provide for navigation, and for display of animated graphics, schedules, alarms/events, live graphic programs, active graphic set point controls, configuration menus for operator access, reports and reporting actions for events.

B. Login: On launching the web browser and selecting the appropriate domain name or IP address, the operator shall be presented with a login page that will require a login name and strong password. Navigation in the system shall be dependent on the operator's role-based application control

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privileges.

C. Navigation: Navigation through the GUI shall be accomplished by clicking on the appropriate level of a navigation tree (consisting of an expandable and collapsible tree control like Microsoft's Explorer program) and/or by selecting dynamic links to other system graphics. Both the navigation tree and action pane shall be displayed simultaneously, enabling the operator to select a specific system or equipment and view the corresponding graphic. The navigation tree shall as a minimum provide the following views: Geographic, Network, Groups and Configuration.
   1. Geographic View shall display a logical geographic hierarchy of the system including: cities, sites, buildings, building systems, floors, equipment and objects.
   2. Groups View shall display Scheduled Groups and custom reports.
   3. Configuration View shall display all the configuration categories (Operators, Schedule, Event, Reporting and Roles).

D. Action Pane: The Action Pane shall provide several functional views for each subsystem specified. A functional view shall be accessed by clicking on the corresponding button:
   1. Graphics: Using graphical format suitable for display in a web browser, graphics shall include aerial building/campus views, color building floor-plans, equipment drawings, active graphic set point controls, web content and other valid HTML elements. The data on each graphic page shall automatically refresh.
   2. Dashboards: User customizable data using drag and drop HTML5 elements. Shall include Web Charts, Gauges, and other custom developed widgets for web browser. User shall have ability to save custom dashboards.
   3. Search: User shall have multiple options for searching data based upon Tags. Associated equipment, real time data, Properties, and Trends shall be available in result.
   4. Properties: Shall include graphic controls and text for the following: Locking or overriding objects, demand strategies, and any other valid data required for setup. Changes made to the properties pages shall require the operator to depress an 'accept/cancel' button.
   5. Schedules: Shall be used to create, modify/edit and view schedules based on the systems hierarchy (using the navigation tree).
   6. Alarms: Shall be used to view alarm information geographically (using the navigation tree), acknowledge alarms, sort alarms by category, actions and verify reporting actions.
   7. Charting: Shall be used to display associated trend and historical data, modify colors, date range, axis and scaling. User shall have ability to create HTML charts through web browser without utilizing chart builder. User shall be able to drag and drop single or multiple data points, including schedules, and apply status colors for analysis.
   8. Logic - Live Graphic Programs: Shall be used to display' live' graphic programs of the control algorithm, (micro block programming) for the mechanical/electrical system selected in the navigation tree.
   9. Other actions such as Print, Help, Command, and Logout shall be available via a drop-down window.

E. Color Graphics: The Web Browser GUI shall make extensive use of color in the graphic pane to communicate information related to set points and comfort. Animated .gifs or .jpg, vector scalable, active set point graphic controls shall be used to enhance usability. Graphics tools used to create Web Browser graphics shall be non-proprietary and conform to the following basic criteria:
   1. Display Size: The GUI workstation software shall graphically display in a minimum of 1024 by 768 pixels 24 bit True Color.
   2. General Graphic: General area maps shall show locations of controlled buildings in relation to local landmarks.
   3. Color Floor Plans: Floor plan graphics shall show heating and cooling zones throughout the buildings in a range of colors, as selected by Owner. Provide a visual display of temperature relative to their respective set points. The colors shall be updated dynamically as a zone's actual comfort condition changes.
   4. Mechanical Components: Mechanical system graphics shall show the type of mechanical

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system components serving any zone through the use of a pictorial representation of components. Selected I/O points being controlled or monitored for each piece of equipment shall be displayed with the appropriate engineering units. Animation shall be used for rotation or moving mechanical components to enhance usability. .

5. Minimum System Color Graphics: Color graphics shall be selected and displayed via a web browser for the following:
   a. Each piece of equipment monitored or controlled including each terminal unit.
   b. Each building.
   c. Each floor and zone controlled.

F. Hierarchical Schedules: Utilizing the Navigation Tree displayed in the web browser GUI, an operator (with proper access credentials) shall be able to define a Normal, Holiday or Override schedule for an individual piece of equipment or room, or choose to apply a hierarchical schedule to the entire system, site or floor area. For example, Independence Day ' Holiday' for every level in the system would be created by clicking at the top of the geographic hierarchy defined in the Navigation Tree. No further operator intervention would be required and every control module in the system with would be automatically downloaded with the ' Independence Day' Holiday. All schedules that affect the system/area/equipment highlighted in the Navigation Tree shall be shown in a summary schedule table and graph.

1. Schedules: Schedules shall comply with the LonWorks and BACnet standards, (Schedule Object, Calendar Object, Weekly Schedule property and Exception Schedule property) and shall allow events to be scheduled based on:
   a. Types of schedule shall be Normal, Holiday or Override.
   b. A specific date.
   c. A range of dates.
   d. Any combination of Month of Year (1-12, any), Week of Month (1-5, last, any), Day of Week (M-Sun, Any).
   e. Wildcard (example, allow combinations like second Tuesday of every month).
2. Schedule Categories: The system shall allow operators to define and edit scheduling categories (different types of "things" to be scheduled; for example, lighting, HVAC occupancy, etc.). The categories shall include: name, description, icon (to display in the hierarchy tree when icon option is selected) and type of value to be scheduled.
3. Schedule Groups: In addition to hierarchical scheduling, operators shall be able to define functional Schedule Groups, comprised of an arbitrary group of areas/rooms/equipment scattered throughout the facility and site. For example, the operator shall be able to define an ' individual tenant' group - who may occupy different areas within a building or buildings. Schedules applied to the ' tenant group' shall automatically be downloaded to control modules affecting spaces occupied by the ' tenant group'.
4. Intelligent Scheduling: The control system shall be intelligent enough to automatically turn on any supporting equipment needed to control the environment in an occupied space. If the operator schedules an individual room in a VAV system for occupancy, for example, the control logic shall automatically turn on the VAV air handling unit, chiller, boiler and/or any other equipment required to maintain the specified comfort and environmental conditions within the room.
5. Partial Day Exceptions: Schedule events shall be able to accommodate a time range specified by the operator (ex: board meeting from 6 pm to 9 pm overrides Normal schedule for conference room).
6. Schedule Summary Graph: The schedule summary graph shall clearly show Normal versus Holiday versus Override Schedules and the net operating schedule that results from all contributing schedules. Note: In case of priority conflict between schedules at the different geographic hierarchy, the schedule for the more detailed geographic level shall apply.

G. Alarms: Alarms associated with a specific system, area, or equipment selected in the Navigation Tree, shall be displayed in the Action Pane by selecting an ' Alarms' view. Alarms, and reporting actions shall have the following capabilities:

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1. Alarms View: Each Alarm shall display an Alarms Category (using a different icon for each alarm category), date/time of occurrence, current status, alarm report and a bold URL link to the associated graphic for the selected system, area or equipment. The URL link shall indicate the system location, address and other pertinent information. An operator shall easily be able to sort events, edit event templates and categories, acknowledge or force a return to normal in the Events View as specified in this section.
2. Alarm Categories: The operator shall be able to create, edit or delete alarm categories such as HVAC, Maintenance, Fire, or Generator. An icon shall be associated with each alarm category, enabling the operator to easily sort through multiple events displayed.
3. Alarm Templates: Alarm template shall define different types of alarms and their associated properties. As a minimum, properties shall include a reference name, verbose description, severity of alarm, acknowledgement requirements, and high/low limit and out of range information.
4. Alarm Areas: Alarm Areas enable an operator to assign specific Alarm Categories to specific Alarm Reporting Actions. For example, it shall be possible for an operator to assign all HVAC Maintenance Alarm on the 1st floor of a building to email the technician responsible for maintenance. The Navigation Tree shall be used to setup Alarm Areas in the Graphic Pane.
5. Alarm Time/Date Stamp: All events shall be generated at the DDC control module level and comprise the Time/Date Stamp using the standalone control module time and date.
6. Alarm Configuration: Operators shall be able to define the type of Alarm generated per object. A ' network' view of the Navigation Tree shall expose all objects and their respective Alarm Configuration. Configuration shall include assignment of Alarm, type of Acknowledgement and notification for return to normal or fault status.
7. Alarm Summary Counter: The view of Alarm in the Graphic Pane shall provide a numeric counter, indicating how many Alarms are active (in alarm), require acknowledgement and total number of Alarms in the BMS Server database.
8. Alarm Auto-Deletion: Alarms that are acknowledged and closed shall be auto-deleted from the database and archived to a text file after an operator defined period.
9. Alarm Reporting Actions: Alarm Reporting Actions specified shall be automatically launched (under certain conditions) after an Alarm is received by the BMS Server software. Operators shall be able to easily define these Reporting Actions using the Navigation Tree and Graphic Pane through the web browser GUI. Reporting Actions shall be as follows:
    a. Print: Alarm information shall be printed to the BMS Server's PC or a networked printer.
    b. Email: Email shall be sent via any POP3-compatible e-mail server (most Internet Service Providers use POP3). Email messages may be copied to several email accounts. Note: Email reporting action shall also be used to support alphanumeric paging services, where email servers support pagers.
    c. File Write: The ASCII File write reporting action shall enable the operator to append operator defined alarm information to any alarm through a text file. The alarm information that is written to the file shall be completely definable by the operator. The operator may enter text or attach other data point information (such as AHU discharge temperature and fan condition upon a high room temperature alarm).
    d. Write Property: The write property reporting action updates a property value in a hardware module.
    e. SNMP: The Simple Network Management Protocol (SNMP) reporting action sends an SNMP trap to a network in response to receiving an alarm.
    f. Run External Program: The Run External Program reporting action launches specified program in response to an event.

H. Trends: As system is engineered, all points shall be enabled to trend. Trends shall both be displayed and user configurable through the Web Browser GUI. Trends shall comprise analog, digital or calculated points simultaneously. A trend log's properties shall be editable using the Navigation Tree and Graphic Pane.
    1. Viewing Trends: The operator shall have the ability to view trends by using the Navigation

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Tree and selecting a Trends button in the Graphic Pane. The system shall allow y- and x-axis maximum ranges to be specified and shall be able to simultaneously graphically display multiple trends per graph.

2. Local Trends: Trend data shall be collected locally by Multi-Equipment/Single Equipment general-purpose controllers, and periodically uploaded to the BMS Server if historical trending is enabled for the object. Trend data, including run time hours and start time date shall be retained in non-volatile module memory. Systems that rely on a gateway/router to run trends are NOT acceptable.
3. Resolution. Sample intervals shall be as small as one second. Each trended point will have the ability to be trended at a different trend interval. When multiple points are selected for displays that have different trend intervals, the system will automatically scale the axis.
4. Dynamic Update. Trends shall be able to dynamically update at operator-defined intervals.
5. Zoom/Pan. It shall be possible to zoom-in on a particular section of a trend for more detailed examination and ' pan through' historical data by simply scrolling the mouse.
6. Numeric Value Display. It shall be possible to pick any sample on a trend and have the numerical value displayed.
7. Copy/Paste. The operator shall have the ability to pan through a historical trend and copy the data viewed to the clipboard using standard keystrokes (i.e. CTRL+C, CTRL+V).

I. Security Access: Systems that Security access from the web browser GUI to BMS Server shall require a Login Name and Strong Password. Access to different areas of the BMS system shall be defined in terms of Role-Based Access Control privileges as specified:

1. Roles: Roles shall reflect the actual roles of different types of operators. Each role shall comprise a set of ' easily understood English language' privileges. Roles shall be defined in terms of View, Edit and Function Privileges.
   a. View Privileges shall comprise: Navigation, Network, and Configuration Trees, Operators, Roles and Privileges, Alarm/Event Template and Reporting Action.
   b. Edit Privileges shall comprise: Set point, Tuning and Logic, Manual Override, and Point Assignment Parameters.
   c. Function Privileges shall comprise: Alarm/Event Acknowledgement, Control Module Memory Download, Upload, Schedules, Schedule Groups, Manual Commands, Print and Alarm/Event Maintenance.
2. Geographic Assignment of Roles: Roles shall be geographically assigned using a similar expandable/collapsible navigation tree. For example, it shall be possible to assign two HVAC Technicians with similar competencies (and the same operator defined HVAC Role) to different areas of the system.

2.17 GRAPHICAL PROGRAMMING

A. The system software shall include a Graphic Programming Language (GPL) for all DDC control algorithms resident in all control modules. Any system that does not use a drag and drop method of graphical icon programming shall not be accepted. All systems shall use a GPL method used to create a sequence of operations by assembling graphic microblocks that represent each of the commands or functions necessary to complete a control sequence. Microblocks represent common logical control devices used in conventional control systems, such as relays, switches, high signal selectors etc., in addition to the more complex DDC and energy management strategies such as PID loops and optimum start. Each microblock shall be interactive and contain the programming necessary to execute the function of the device it represents.

B. Graphic programming shall be performed while on screen and using a mouse; each microblock shall be selected from a microblock library and assembled with other microblocks necessary to complete the specified sequence. Microblocks are then interconnected on screen using graphic "wires," each forming a logical connection. Once assembled, each logical grouping of microblocks and their interconnecting wires then forms a graphic function block which may be used to control any piece of equipment with a similar point configuration and sequence of operation.

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C. Graphic Sequence: The clarity of the graphic sequence shall be such that the operator has the ability to verify that system programming meets the specifications, without having to learn or interpret a manufacturer's unique programming language. The graphic programming shall be self-documenting and provide the operator with an understandable and exact representation of each sequence of operation.

D. GPL Capabilities: The following is a minimum definition of the capabilities of the Graphic Programming software:
1. Function Block (FB): Shall be a collection of points, microblocks and wires which have been connected together for the specific purpose of controlling a piece of HVAC equipment or a single mechanical system.
2. Logical I/O: Input/Output points shall interface with the control modules in order to read various signals and/or values or to transmit signal or values to controlled devices.
3. Microblocks: Shall be software devices that are represented graphically and may be connected together to perform a specified sequence. A library of microblocks shall be submitted with the integratorsystem integrator’s bid.
4. Wires: Shall be Graphical elements used to form logical connections between microblocks and between logical I/O.
5. Reference Labels: Labels shall be similar to wires in that they are used to form logical connections between two points. Labels shall form a connection by reference instead of a visual connection, i.e. two points labeled 'A' on a drawing are logically connected even though there is no wire between them.
6. Parameter: A parameter shall be a value that may be tied to the input of a microblock.
7. Properties: Dialog boxes shall appear after a microblock has been inserted which has editable parameters associated with it. Default parameter dialog boxes shall contain various editable and non-editable fields, and shall contain 'push buttons' for the purpose of selecting default parameter settings.
8. Icon: An icon shall be graphic representation of a software program. Each graphic microblock has an icon associated with it that graphically describes its function.
9. Menu-bar Icon: Shall be an icon that is displayed on the menu bar on the GPL screen, which represents its associated graphic microblock.
10. Live Graphical Programs: The Graphic Programming software shall support a ' live' mode, where all input/output data, calculated data and set points shall be displayed in a ' live' real-time mode.

2.18 LONWORKS NETWORK MANAGEMENT

A. LonWorks devices and controllers shall not be accepted.

2.19 BMS DATA MODEL AND SEMANTIC TAGGING

A. The BMS will represent all of the data, regardless of communication protocol or integration method, as common human and machine interpretable meta data. Examples of the meta data include but are not limited to buildings, floors, air handlers, meters and zones, among other commonly understood terminology of the building operators and building managers. Data will be represented in a hierarchical format such as Buildings > Floors > Equipment.

B. The BMS will also have the ability to create tags that represent location and descriptive data that have nothing to do with the application of the particular data or group of data. Examples of this tagging may include operators’ names, room names, etc. These tags shall be free form text in nature and shall be searchable by the user interface.

C. The BMS will have the ability to use a Niagara Framework, Haystack or Custom tagging dictionaries or a combination of these dictionaries as well as any future tag dictionaries.

2.20 ANALYTICS

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A. The BMS will support sequences, actions and routines to be programmed to execute against the data model. The execution of each analytics sequence shall be by; a scheduled trigger; interval based trigger, or an event based trigger. The analytics sequences shall be definable and customizable by the owner or the integrator without the requirement to use line code programming. The programming and creation of the rules shall be in a wire sheet framework where objects are added to the wire sheet and connected together. Each of the sequences shall have the ability to execute independently or with dependency on other sequences.

B. As separate programming language for analytic algorithm development or service will not be allowed. The analytic software shall use the historical data and/or real time BMS data without having to first store the data in a database that is separate from the BMS data.

C. The analytic algorithms shall be supported on both the BMS Server and NACs to provide data analysis in real time within the limits of NACs and the BMS Server data communication and resources as well as historical based on the BMS Server historian.

D. The specification calls for analytics of both historical and real time data for reporting, diagnostics and event notification.

E. For energy and equipment optimization analytics, the analytic software shall change set point values and commands as analytic results dictate.

2.21 SOFTWARE ANALYSIS AND REPORTING TOOLS

A. Accessing the system shall be via a web browser or mobile devices including IOS, Windows Mobile and Android. In general the system shall enable the user to:

B. Access and view data from all smart meters from a central dashboard

C. Analyze utility usage patterns

D. Measure its CO2 footprint

E. Assess energy performance of buildings

F. Identify variances using KPIs, targets, comparisons to historical patterns, etc.

G. Investigate the time, duration and cause of variances

H. Generate time-of-use consumption and peak loads (e.g. peak, shoulder and off peak kWh and KvA)

I. Calculate tenant usage by meter and generate invoices

J. Modify the system and reports to reflect changes in building operations

K. Apportion utilities to various building users

L. Use algorithms for the analysis of gas and water leakages (based on volume or flow)

M. Tools to set-up new meters

N. Configure dashboards

O. Use a variety of common reporting formats e.g. text files (txt, csv), Microsoft Excel (xls, xlsx), Adobe Portable Document Format (pdf) and Extensible Markup Language (.xml)

P. Print reports via a local printer (with appropriate page management) and to email reports

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Q. Easily understand the meter hierarchy and distinguish virtually meters

R. Generate aggregated or discrete reports at any point in the meter hierarchy

S. Customize meter groupings for reporting

T. Set up reporting schedules and mailing lists for automated report sending

U. Perform consumption and scenario forecasting

2.22 SYSTEM NAVIGATION

A. System navigation shall be via a standardized navigation tree with hyperlinked for each user, given access to specific areas of the data model. Each user's navigation will dynamically update based on the permissions given in the data model.

B. In addition, the user shall be able to access a system, a building or group of buildings by navigating via a Campus Map, Site Plan, or building floor plan.

C. Each user shall have the ability to modify his own dashboard as the need arises by simply saving the current Dashboard session.

2.23 BASIC ANALYTIC DASHBOARDS

A. Dashboards as a minimum shall contain (for each building group, building, area, switchboard, or grouping in the metering tree) graphics showing live and historical utilities usage, loads and CO2 emissions. Specifically dashboards shall show:

B. Utility Usage for default period

C. Profile of usage for default period

D. Contribution of child nodes for default period

E. CO2 emissions

2.24 ANALYTIC GRAPHICAL DATA OUTPUTS

A. Time-series daily load profiles displayed with time, in intervals of an hour or less, along the horizontal axis and load along the vertical axis

B. Overlay plots displaying multiple daily profiles on a single 24-hour time-series graph

C. Viewing of multiple time series data points on the same graph

D. Calendar profile: View up to an entire month of consumption profiles on a single screen as one long time series

E. X-Y scatter plots: X-Y scatter plots for visualizing correlations between two variables

F. Intuitive graphical axes that are scaled and labeled

2.25 ANALYTICAL DATA OUTPUTS

A. Basic statistical analysis such as mean, median, standard deviation, correlation, and regression.

B. Benchmarking against set building energy standards

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C. Intra/inter-facility comparisons against the building's historical data or across multiple buildings

D. Aggregate data among multiple data points. Integrate different energy units using energy conversions

E. Data mining (data slice/drill-down) time series data by monthly, weekly, daily, hourly, or trended interval

F. Normalization of energy usage or demand by factors such as building area, number of occupants, outside air temperature, and cooling or heating degree-days (CDD, HDD) to make a fair comparison between buildings

G. Hierarchical summary of usage and cost information by different levels

H. A comprehensive and simple graphical programming tool allowing the users to create their own views, graphs, charts, gauges, and other widgets for viewing live or historical data. Dashboards shall be capable of export to printers or PDF, CSV, Excel or image formats for use in reports, spreadsheets or as live media to display systems

I. Utility Outputs

J. Energy cost breakdown using energy tariff and usage data to calculate daily or hourly energy cost breakdown and validate utility bills

K. Real-time cost tracking to calculate electricity costs daily or hourly using real-time meter reading and rate tariffs

L. End-use cost allocation to tenants using user-defined parameters and algorithms to estimate end-use energy consumption from whole-building energy

2.26 ANALYTIC FORECASTING AND ESTIMATING

A. The software shall offer an accessible programming environment such that complex calculations and formulas can be created using the stored data. For example, the software must be able to calculate greenhouse gas equations, or create a water leak detection model that can be used to generate alerts, or generate load profiles, peak demand prediction and other energy demand management functions. Note that systems that require an external controller to be deployed to provide this capability are not acceptable.

B. Data shall be stored for review and later manipulation using built-in energy analysis tools for load collection and reconciliation to the utility meters, load profiling, load duration, rollup (into varying periods), load base-lining (period comparison), comparison and rating of building performance, identification of cyclic loads, abnormal loads, service outage events, load contribution from each meter, cost comparison, tariff modeling, normalization to parameters such as Gross Floor Area (GFA) and Ambient conditions (e.g. Degree Days).

2.27 BMS INTEGRATION AND MANUAL DATA ENTRY

A. The software shall feature a rich set of enterprise data integration tools. This will allow the system to export data to SQL databases (such as Oracle or SQL Server) or spreadsheets. The system must offer open SQL data connectivity (such as ODBC) in addition to export of CSV files.

B. The software must be capable of user-friendly import of meter data either by meter or in bulk by defining a data structure and method for users to input ad-hoc data or historical utility data.

2.28 ALARMS

A. The BMS shall provide functionality to set alarm for thresholds on each individually metered value

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and send alert notifications for corrective action via SMS, SNMP and Email.

B. Alarm thresholds levels shall be displayed in dashboards using color. An alarm console shall be included allowing users to view, prioritize, acknowledge and archive alarms. The user shall be able to quickly view the historical performance of the alarm source as well as any related data to the alarm source from the alarm console.

2.29 WORKFLOW

A. The system shall provide functionality that allows users to create workflows based on triggered events (such as alarms).
   1. Examples:,
      a. in the event of a water leak alarm, the system may create a water leak report and email it automatically to relevant personnel for action.
      b. the creation of energy reports (e.g. csv files) which are automatically exported to a carbon reporting system on a daily, or weekly or monthly frequency

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 GENERAL

A. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

B. Install products to satisfy more stringent of all requirements indicated.

C. Install products level, plumb, parallel, and perpendicular with building construction.

D. Support products, tubing, piping wiring and raceways. Brace products to prevent lateral movement and sway or a break in attachment when subjected to a reasonable and customary force.

E. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

F. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

G. Firestop penetrations made in fire-rated assemblies. Comply with requirements in Section 078413

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"Penetration Firestopping."

H. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

I. Fastening Hardware:

1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.

J. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

K. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Control System Contractor in accordance with these specifications.

L. Equipment furnished that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Control System Contractor.

M. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

3.4 NETWORK NAMING AND NUMBERING

A. Coordinate with Owner and provide unique naming and addressing for networks and devices.
B. ASHRAE 135 Networks:

1. MAC Address:

a. Every network device shall have an assigned and documented MAC address unique to its network.
b. Ethernet Networks: Document MAC address assigned at its creation.

2. Network Numbering:

a. Assign unique numbers to each new network.
b. Provide ability for changing network number through device switches or operator interface.
c. DDC system, with all possible connected LANs, can contain up to 65,534 unique networks.

3. Device Object Identifier Property Number:

a. Assign unique device object identifier property numbers or device instances for each device network.
b. Provide for future modification of device instance number by device switches or operator interface.
c. LAN shall support up to 4,194,302 unique devices.

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4. Device Object Name Property Text:

    a. Device object name property field shall support 32 minimum printable characters.
    b. Assign unique device "Object Name" property names with plain-English descriptive names for each device.

        1) Example 1: Device object name for device controlling boiler plant at Building 1000 would be "HW System B1000."
        2) Example 2: Device object name for a VAV terminal unit controller could be "VAV unit 102".

5. Object Name Property Text for Other Than Device Objects:

    a. Object name property field shall support 32 minimum printable characters.
    b. Assign object name properties with plain-English names descriptive of application.

        1) Example 1: "Zone 1 Temperature."
        2) Example 2 "Fan Start and Stop."

6. Object Identifier Property Number for Other Than Device Objects:

    a. Assign object identifier property numbers according to Drawings indicated.
    b. If not indicated, object identifier property numbers may be assigned at Installer's discretion but must be approved by Owner in advance, be documented and be unique for like object types within device.

3.5 WIRING

A. All electrical control wiring to the control panels shall be the responsibility of the Control System Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 16), the National Electrical Code and any applicable local codes. All control wiring shall be installed in raceways.

C. Excess wire shall not be looped or coiled in the controller cabinet.

D. Incorporate electrical noise suppression techniques in relay control circuits.

E. There shall be no drilling on the controller cabinet after the controls are mounted inside.

F. Careful stripping of wire while inside the cabinet is required to ensure that no wire strand fragments land on circuit boards.

G. Use manufacturer-specified wire for all network connections.

H. Use approved optical isolation and lightning protection when penetrating building envelope.

I. Read installation instructions carefully. Any unavoidable deviations shall be approved by owner's rep prior to installation.

3.6 ACCEPTANCE TESTING

A. Upon completion of the installation, the Control System Contractor shall load all system software and start-up the system. The Control System Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.

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B. The Control System Contractor shall perform tests to verify proper performance of components, routines and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

C. System Acceptance:

1. Satisfactory completion is when the Control System Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative.

2. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

D. DDC System Response Time Test:

1. Simulate HLC.

a. Heavy load shall be an occurrence of 50 percent of total connected binary COV, one-half of which represent an "alarm" condition, and 50 percent of total connected analog COV, one-half of which represent an "alarm" condition, that are initiated simultaneously on a one-time basis.

2. Initiate 10 successive occurrences of HLC and measure response time to typical alarms and status changes.
3. Measure with a timer having at least 0.1-second resolution and 0.01 percent accuracy.
4. Purpose of test is to demonstrate DDC system, as follows:

a. Reaction to COV and alarm conditions during HLC.
b. Ability to update DDC system database during HLC.

5. Passing test is contingent on the following:

a. Alarm reporting at printer beginning no more than [two] <Insert number> seconds after the initiation (time zero) of HLC.
b. All alarms, both binary and analog, are reported and printed; none are lost.
c. Compliance with response times specified.

6. Prepare and submit a report documenting HLC tested and results of test including time stamp and print out of all alarms.

E. DDC System Network Bandwidth Test:

1. Test network bandwidth usage on all DDC system networks to demonstrate bandwidth usage under DDC system normal operating conditions and under simulated HLC.
2. To pass, none of DDC system networks shall use more than 70 percent of available bandwidth under normal and HLC operation.

3.7 FINAL REVIEW

A. Submit written request to Construction Manager when DDC system is ready for final review. Written request shall state the following:

1. DDC system has been thoroughly inspected for compliance with contract documents and found to be in full compliance.
2. DDC system has been calibrated, adjusted and tested and found to comply with requirements

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of operational stability, accuracy, speed and other performance requirements indicated.

3. DDC system monitoring and control of HVAC systems results in operation according to sequences of operation indicated.
4. DDC system is complete and ready for final review.

B. Review by Construction Manager shall be made after receipt of written request. A field report shall be issued to document observations and deficiencies.

C. Take prompt action to remedy deficiencies indicated in field report and submit a second written request when all deficiencies have been corrected. Repeat process until no deficiencies are reported.

D. Should more than two reviews be required, DDC system manufacturer and Installer shall compensate entity performing review for total costs, labor and expenses, associated with third and subsequent reviews. Estimated cost of each review shall be submitted and approved by DDC system manufacturer and Installer before making the review.

E. Prepare and submit closeout submittals when no deficiencies are reported.

F. A part of DDC system final review shall include a demonstration to parties participating in final review.

1. Provide staff familiar with DDC system installed to demonstrate operation of DDC system during final review.
2. Provide testing equipment to demonstrate accuracy and other performance requirements of DDC system that is requested by reviewers during final review.
3. Demonstration shall include, but not be limited to, the following:

a. Accuracy and calibration of 20 I/O points randomly selected by reviewers. If review finds that some I/O points are not properly calibrated and not satisfying performance requirements indicated, additional I/O points may be selected by reviewers until total I/O points being reviewed that satisfy requirements equals quantity indicated.
b. HVAC equipment and system hardwired and software safeties and life-safety functions are operating according to sequence of operation. Up to 10 I/O points shall be randomly selected by reviewers. Additional I/O points may be selected by reviewers to discover problems with operation.
c. Correct sequence of operation after electrical power interruption and resumption after electrical power is restored for randomly selected HVAC systems.
d. Operation of randomly selected dampers and valves in normal-on, normal-off and failed positions.
e. Reporting of alarm conditions for randomly selected alarms, including different classes of alarms, to ensure that alarms are properly received by operators and operator workstations.
f. Trends, summaries, logs and reports set-up for Project.
g. For up to three HVAC systems randomly selected by reviewers, use graph trends to show that sequence of operation is executed in correct manner and that HVAC systems operate properly through complete sequence of operation including different modes of operations indicated. Show that control loops are stable and operating at set points and respond to changes in set point of 20 percent or more.
h. Software's ability to communicate with controllers, operator workstations, uploading and downloading of control programs.
i. Software's ability to edit control programs off-line.
j. Data entry to show Project-specific customizing capability including parameter changes.
k. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
l. Execution of digital and analog commands in graphic mode.
m. Spreadsheet and curve plot software and its integration with database.
n. Online user guide and help functions.
o. Multitasking by showing different operations occurring simultaneously on four

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quadrants of split screen.

p. System speed of response compared to requirements indicated.

q. For Each Network and Programmable Application Controller:

1) Memory: Programmed data, parameters, trend and alarm history collected during normal operation is not lost during power failure.
2) Operator Interface: Ability to connect directly to each type of digital controller with a portable operator workstation and PDA. Show that maintenance personnel interface tools perform as indicated in manufacturer's technical literature.
3) Standalone Ability: Demonstrate that controllers provide stable and reliable standalone operation using default values or other method for values normally read over network.
4) Electric Power: Ability to disconnect any controller safely from its power source.
5) Wiring Labels: Match control drawings.
6) Network Communication: Ability to locate a controller's location on network and communication architecture matches Shop Drawings.
7) Nameplates and Tags: Accurate and permanently attached to control panel doors, instrument, actuators and devices.

r. For Each Operator Workstation:

1) I/O points lists agree with naming conventions.
2) Graphics are complete.
3) UPS unit, if applicable, operates.

s. Communications and Interoperability: Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. Use ASHRAE 135 protocol analyzer to help identify devices, view network traffic, and verify interoperability. Requirements must be met even if only one manufacturer's equipment is installed.

1) Data Presentation: On each operator workstation, demonstrate graphic display capabilities.
2) Reading of Any Property: Demonstrate ability to read and display any used readable object property of any device on network.
3) Set Point and Parameter Modifications: Show ability to modify set points and tuning parameters indicated. Modifications are made with messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
4) Peer-to-Peer Data Exchange: Network devices are installed and configured to perform without need for operator intervention to implement Project sequence of operation and to share global data.
5) Alarm and Event Management: Alarms and events are installed and prioritized according to Owner. Demonstrate that time delays and other logic are set up to avoid nuisance tripping. Show that operators with sufficient privileges are permitted.
6) Schedule Lists: Schedules are configured for start and stop, mode change, occupant overrides, and night setback as defined in sequence of operations.
7) Schedule Display and Modification: Ability to display any schedule with start and stop times for calendar year. Show that all calendar entries and schedules are modifiable from any connected operator workstation by an operator with sufficient privilege.
8) Archival Storage of Data: Data archiving is handled by operator workstation and

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server and local trend archiving and display is accomplished.

9) Modification of Trend Log Object Parameters: Operator with sufficient privilege can change logged data points, sampling rate, and trend duration.
10) Device and Network Management:

a) Display of network device status.
b) Display of BACnet Object Information.
c) Silencing devices transmitting erroneous data.
d) Time synchronization.
e) Remote device re-initialization.
f) Backup and restore network device programming and master database(s).
g) Configuration management of routers.

3.8 OPERATOR TRAINING / DEMONSTRATION

A. During system commissioning and at such time acceptable performance of the Control System hardware and software has been established, the Control System Contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The Control System Contractor shall provide no less than 15 days of comprehensive training in multiple sessions for system orientation, product maintenance and troubleshooting, programming and engineering. These classes are to be spread out during the 1st year warranty period. The first class starting after final commissioning and the last class is to be in the last month of 1-year warranty period.

1. Stagger training over multiple training classes to accommodate Owner's requirements. All training shall occur before end of warranty period.
2. Total days of training shall be broken into not more than five separate training classes.
3. Each training class shall be not less than three consecutive day(s).
4. Contractor shall make recommendations for on on-site and/or off-site training sessions; however, owner shall have the final determination of the number of on-site and/or off-site training sessions.

C. Training Schedule

1. Schedule training with Owner 30 business days before expected Substantial Completion.
2. Schedule training to provide Owner with at least 10 business days of notice in advance of training.
3. Training shall occur within normal business hours at a mutually agreed on time. Unless otherwise agreed to, training shall occur Monday through Friday, except on U.S. Federal holidays, with two morning sessions and two afternoon sessions. Each morning session and afternoon session shall be split in half with 30-minute break between sessions. Morning and afternoon sessions shall be separated by 60-minute lunch period. Training, including breaks and excluding lunch period, shall not exceed eight hours per day.
4. Provide staggered training schedule as requested by Owner.

D. Training Attendee List and Sign-in Sheet

1. Request from Owner in advance of training a proposed attendee list with name, phone number and e-mail address.
2. Provide a preprinted sign-in sheet for each training session with proposed attendees listed and no fewer than six blank spaces to add additional attendees.
3. Preprinted sign-in sheet shall include training session number, date and time, instructor name,

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phone number and e-mail address, and brief description of content to be covered during session. List attendees with columns for name, phone number, e-mail address and a column for attendee signature or initials.

4. Circulate sign-in sheet at beginning of each session and solicit attendees to sign or initial in applicable location.
5. At end of each training day, send Owner an e-mail with an attachment of scanned copy (PDF) of circulated sign-in sheet for each session.

E. Training Attendee Headcount:

1. Plan in advance of training for fifteen (15) attendees.
2. Make allowance for Owner to add up to two attendee(s) at time of training.
3. Headcount may vary depending on training content covered in session. Attendee access may be restricted to some training content for purposes of maintaining system security.

F. Training Attendee Prior Knowledge: For guidance in planning required training and instruction, assume attendees have the following:

1. High school and technical school education and degree.
2. Intermediate user knowledge of computers and office applications.
3. Advanced knowledge of HVAC systems.
4. Basic knowledge of DDC systems.
5. Basic knowledge of DDC system and products installed.

G. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of all training materials and visual presentations.
2. Hard-copy materials shall be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of all hard-copy materials.

H. Instructor Requirements:

1. One or multiple qualified instructors, as required, to provide training.
2. Instructors shall have not less than five years of providing instructional training on not less than five past projects with similar DDC system scope and complexity to DDC system installed.

I. Organization of Training Sessions:

1. Organize training sessions into logical groupings of technical content and to reflect different levels of operators having access to system. Plan training sessions to accommodate the following three levels of operators:

   a. Daily operators.
   b. Advanced operators.
   c. System managers and administrators.

2. Plan and organize training sessions to group training content to protect DDC system security. Some attendees may be restricted to some training sessions that cover restricted content for purposes of maintaining DDC system security.

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J. Training Outline:

1. Submit training outline for Owner review at least 10 business day before scheduling training.
2. Outline shall include a detailed agenda for each training day that is broken down into each of four training sessions that day, training objectives for each training session and synopses for each lesson planned.

K. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power and data connectivity for instructor and each attendee.
2. Instructor shall provide training materials, projector and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training shall include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration and service requirements.
5. Operator workstation provided with DDC system shall be used in training. If operator workstation is not indicated, provide a temporary workstation to convey training content.

L. Off-Site Training:

1. Provide conditioned training rooms and workspace with ample tables desks or tables, chairs, power and data connectivity for each attendee.
2. Provide capability to remotely access to Project DDC system for use in training.
3. Provide a workstation for use by each attendee.

M. Training Content for Daily Operators:

1. Basic operation of system.
2. Understanding DDC system architecture and configuration.
3. Understanding each unique product type installed including performance and service requirements for each.
4. Understanding operation of each system and equipment controlled by DDC system including sequences of operation, each unique control algorithm and each unique optimization routine.
5. Operating operator workstations, printers and other peripherals.
6. Logging on and off system.
7. Accessing graphics, reports and alarms.
8. Adjusting and changing set points and time schedules.
9. Recognizing DDC system malfunctions.
10. Understanding content of operation and maintenance manuals including control drawings.
11. Understanding physical location and placement of DDC controllers and I/O hardware.
12. Accessing data from DDC controllers.
13. Operating portable operator workstations.
14. Review of DDC testing results to establish basic understanding of DDC system operating performance and HVAC system limitations as of Substantial Completion.
15. Running each specified report and log.
16. Displaying and demonstrating each data entry to show Project-specific customizing capability. Demonstrating parameter changes.
17. Stepping through graphics penetration tree, displaying all graphics, demonstrating dynamic updating, and direct access to graphics.
18. Executing digital and analog commands in graphic mode.
19. Demonstrating control loop precision and stability via trend logs of I/O for not less than 10 percent of I/O installed.
20. Demonstrating DDC system performance through trend logs and command tracing.
21. Demonstrating scan, update, and alarm responsiveness.

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22. Demonstrating spreadsheet and curve plot software, and its integration with database.
23. Demonstrating on-line user guide, and help function and mail facility.
24. Demonstrating multitasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
25. Demonstrating the following for HVAC systems and equipment controlled by DDC system:

    a. Operation of HVAC equipment in normal-off, -on and failed conditions while observing individual equipment, dampers and valves for correct position under each condition.
    b. For HVAC equipment with factory-installed software, show that integration into DDC system is able to communicate with DDC controllers or gateways, as applicable.
    c. Using graphed trends, show that sequence of operation is executed in correct manner, and HVAC systems operate properly through complete sequence of operation including seasonal change, occupied and unoccupied modes, warm-up and cool-down cycles and other modes of operation indicated.
    d. Hardware interlocks and safeties function properly and DDC system performs correct sequence of operation after electrical power interruption and resumption after power is restored.
    e. Reporting of alarm conditions for each alarm, and confirm that alarms are received at assigned locations, including operator workstations.
    f. Each control loop responds to set point adjustment and stabilizes within time period indicated.
    g. Sharing of previously graphed trends of all control loops to demonstrate that each control loop is stable and set points are being maintained.

N. Training Content for Advanced Operators:

1. Making and changing workstation graphics.
2. Creating, deleting and modifying alarms including annunciation and routing.
3. Creating, deleting and modifying point trend logs including graphing and printing on an ad-hoc basis and operator-defined time intervals.
4. Creating, deleting and modifying reports.
5. Creating, deleting and modifying points.
6. Creating, deleting and modifying programming including ability to edit control programs off-line.
7. Creating, deleting and modifying system graphics and other types of displays.
8. Adding DDC controllers and other network communication devices such as gateways and routers.
9. Adding operator workstations.
10. Performing DDC system checkout and diagnostic procedures.
11. Performing DDC controllers operation and maintenance procedures.
12. Performing operator workstation operation and maintenance procedures.
13. Configuring DDC system hardware including controllers, workstations, communication devices and I/O points.
14. Maintaining, calibrating, troubleshooting, diagnosing and repairing hardware.
15. Adjusting, calibrating and replacing DDC system components.

O. Training Content for System Managers and Administrators:

1. DDC system software maintenance and backups.
2. Uploading, downloading and off-line archiving of all DDC system software and databases.
3. Interface with Project-specific, third-party operator software.
4. Understanding password and security procedures.
5. Adding new operators and making modifications to existing operators.
6. Operator password assignments and modification.

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7. Operator authority assignment and modification.
8. Workstation data segregation and modification.

P. Video of Training Sessions:

1. Provide a digital video and audio recording of each training session. Create a separate recording file for each session.
2. Stamp each recording file with training session number, session name and date.
3. Provide Owner with two copies of digital files on DVDs or flash drives for later reference and for use in future training.
4. Owner retains right to make additional copies for intended training purposes without having to pay royalties.

3.9 WARRANTY PERIOD SERVICES

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of two years from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly repaired or replaced by the Control System Contractor at no expense to the Owner.

C. When requested within 24 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to four visits to Project during other-than-normal occupancy hours for this purpose.

D. Maintenance of Control Hardware: The Control System Contractor shall inspect, repair, replace, adjust, and calibrate, as required, the controllers, control devices and associated peripheral units during the warranty period. The Control System Contractor shall then furnish a report describing the status of the equipment, problem areas (if any) noticed during service work, and description of the corrective actions taken. The report shall clearly certify that all hardware is functioning correctly.

E. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include full maintenance service by DDC system manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies. This service shall coincide with the warranty period and be at no additional cost to the owner during the warranty period. Provide annual pricing for this service to continue for five consecutive years after the warranty period.

F. Software Service of Computer Software Programs: The Control System Contractor shall maintain all software during the standard warranty period. In addition, all factory or sub-vendor upgrades to software during the warranty period shall be added to the systems, when they become available, at no additional cost. In addition to first year standard warranty, software provided by Control System Contractor shall come with a 5 Year Software Maintenance license. All NAC and BMS Servers are included in this coverage. Labor to implement upgrades in years two through five are not included in standard warranty.

G. Technical Support: Beginning at Substantial Completion, software service agreement shall be provided to include software support which will coincide with the warranty period and be at no additional cost to the owner during the warranty period.

H. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within twenty-four (24) months from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software and be at no additional cost to the owner during the warranty period.

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1. Upgrade Notice: At least 30 days to allow Owner to schedule and access system and to upgrade computer equipment if necessary.

I. Technical Support and Software Upgrade Service Agreement Pricing: Provide annual pricing for service described above to continue after the warranty period for five consecutive years.

J. Service Period: Calls for service by the Owner shall be honored within 24 hours and are not to be considered as part of routine maintenance.

K. Service Documentation: A copy of the service report associated with each owner-initiated service call shall be provided to the owner.

3.10 WARRANTY ACCESS

A. The Owner shall grant to the Control System Contractor reasonable access to the BMS during the warranty period. Remote access to the BMS (for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period) will be allowed.

3.11 OPERATION & MAINTENANCE MANUALS

A. See Division 1 for requirements. O&M manuals shall include the following elements, as a minimum:
1. As-built control drawings for all equipment.
2. As-built Network Communications Diagram.
3. General description and specifications for all components.
4. Completed Performance Verification sheets.
5. Completed Controller Checkout/Calibration Sheets.

3.12 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.

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5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

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2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ductmate Industries, Inc.
b. Elgen Manufacturing.
c. Linx Industries (formerly Lindab).
d. McGill AirFlow LLC.
e. MKT Metal Manufacturing.
f. SEMCO LLC.
g. Sheet Metal Connectors, Inc.
h. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches Insert dimension in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

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1. Galvanized Coating Designation: G60 or G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches, 4 inches or 6 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.

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4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m) and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

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3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

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B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

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4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Provide drainage and cleanup for wash-down procedures.

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5. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Ducts Connected to Split Heat Pump:

a. Pressure Class: Positive 1-inch wg.
b. Minimum SMACNA Seal Class: A, B or C.
c. SMACNA Leakage Class for Rectangular: 12 or 24 I.
d. SMACNA Leakage Class for Round and Flat Oval: 12 or 24.

C. Return Ducts:

1. Ducts Connected to Split Heat Pump:

a. Pressure Class: Positive or negative 1-inch wg or 2-inch wg.
b. Minimum SMACNA Seal Class: A, B or C.
c. SMACNA Leakage Class for Rectangular: 12 or 24.
d. SMACNA Leakage Class for Round and Flat Oval: 12 or 24.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

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3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.
c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Control dampers.
3. Flange connectors.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
e. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

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B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 or G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aire Technologies.
b. American Warming and Ventilating; a Mestek Architectural Group company.
c. Flexmaster U.S.A., Inc.
d. Flex-Tek Group.
e. McGill AirFlow LLC.
f. Nailor Industries Inc.
g. Pottorff.
h. Ruskin Company.
i. Safe Air - Dowco Products.
j. Trox USA Inc.

2. Standard leakage rating, with linkage outside airstream.

3. Suitable for horizontal or vertical applications.
4. Frames:

a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
b. Mitered and welded corners.
c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

a. Multiple or single blade.
b. Parallel- or opposed-blade design.

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c. Stiffen damper blades for stability.
d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.

7. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Arrow United Industries.
3. Cesco Products; a division of MESTEK, Inc.
4. Flex-Tek Group.
5. Greenheck Fan Corporation.
6. Lloyd Industries, Inc.
7. McGill AirFlow LLC.
8. Metal Form Manufacturing, Inc.
9. Nailor Industries Inc.
10. Pottorff.
11. Ruskin Company.

B. Frames: Per Manufacturer’s standards.

C. Blades: Per Manufacturer’s standards.

D. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

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1. Oil-impregnated bronze, molded synthetic, Oil-impregnated stainless-steel sleeve or Stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc.
3. Hardcast, Inc.
4. Nexus PDQ.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.
2. Ductmate Industries, Inc.
3. Duro Dyne Inc.
4. Hardcast, Inc.
5. METALAIRE, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall.

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2.7 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aire Technologies.
2. American Warming and Ventilating; a Mestek Architectural Group company.
3. Cesco Products; a division of MESTEK, Inc.
4. CL WARD & Family Inc.
5. Ductmate Industries, Inc.
6. Elgen Manufacturing.
7. Flexmaster U.S.A., Inc.
8. Greenheck Fan Corporation.
9. McGill AirFlow LLC.
10. Nailor Industries Inc.
11. Pottorff.
12. Ventfabrics, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Ductmate Industries, Inc.

B. Labeled according to UL 1978 by an NRTL.

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C. Panel and Frame: Minimum thickness 0.0528-inch carbon or 0.0428-inch stainless steel.

D. Fasteners: Carbon or Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Hardcast, Inc.
5. JP Lamborn Co.
6. Ventfabrics, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

2.10 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. JP Lamborn Co.
3. McGill AirFlow LLC.
4. Thermaflex; a Flex-Tek Group company.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

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2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action Nylon strap in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive Liquid adhesive plus tape Adhesive plus sheet metal screws.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

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E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

G. Install access doors with swing against duct static pressure.

H. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

I. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. Connect terminal units to supply ducts directly or with maximum 12-inch Insert value lengths of flexible duct. Do not use flexible ducts to change directions.

L. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

M. Connect flexible ducts to metal ducts with draw bands and adhesive plus sheet metal screws.

N. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

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1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

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SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Air terminal units and accessories.

B. Related Sections:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to this Section.
2. All Division 23 specification sections, including the following:
   a. Mechanical General Provisions: Section 230100.
   b. Mechanical Identification: Section 230553.
   c. Vibration Isolation: Section 230548.
   d. Test and Balance: Section 230593.
   e. Hangers and Supports: Section 230529.
   f. Direct Digital Control: Section 230923.

3. Electrical Work: Division 26 of these specifications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of air terminal unit.

B. Submit schedule showing air pressure loss at maximum cfm used on drawings.

C. Shop Drawings: For air terminal units.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Conform to NFPA 90A.

B. Test air terminal units in accordance with ARI Standard 880, Appendix A.

PART 2 - PRODUCTS

2.1 AIR TERMINAL UNITS (TU)

A. Manufacturers: Products of the following manufacturers, provided they comply with requirements of the contract documents and are participating members in the ARI 880 Certification Program, will be among those considered acceptable and other manufacturers not listed will require written request and acceptance prior to the bid:
   1. E.H. Price.
   2. Titus HVAC Products Division.
   3. Johnson Controls.
   4. The Trane Company.
   5. Daikin.

B. Terminal Unit Controls: The following controls will be provided by the controls contractor.

   1. Direct digital controller for pressure independent primary air control (DDC).
   2. Damper actuator.
   3. Air flow transducer.
   4. Discharge air temperature sensor.
   5. Room control sensor.

C. Air terminal unit manufacturer shall provide the following:

   1. Unit casing.
   2. Primary air control damper.
   3. Multipoint Velocity sensor: This Section shall provide velocity pressure/flow CFM curves to controls contractor to enable proper CFM calculation.
   4. Transformer: Where fans and electric heaters are used, transformers provided with the electric heater may be used for control power. When unit does not have a fan or heater, provide control 120:24 stepdown transformer. Power source to the box shall be provided by controls contractor where it does not currently exist.
   5. Electric heating coil and other heat coil appurtenances including control relays.
   6. Fan, motor, motor contactor and other appurtenances including control relays.

D. Air terminal unit manufacturer shall mount and wire all components furnished by controls contractor to accomplish the required control sequences including the following:

   1. Damper actuators.
   2. Controllers.
   3. Air velocity pickup pressure sensor.
   4. Discharge air temperature sensor.

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E. Primary Air Control Damper in Insulated Metal Casing: Volume regulation within 5 percent, between 0.5 and 6.0 inches static pressure, water gage. The primary air device shall provide shut-off with a leakage rate not over 2% at 1" S.P. or 4% of the rated CFM at 3" S.P. for 1,800 CFM and smaller units, and not over 6% at 3" S.P. for larger units.

F. Unit shall be single-wall construction with 1" thick dual density glass fiber insulation.

G. Housing: 20 gauge minimum galvanized sheet metal. (Seal all joints.)

H. The sound ratings are a requirement for submission. Selected size units as furnished on this project shall be tested in an independent testing laboratory. Unit maximum radiated sound power levels as published by manufacturer shall not exceed the following with 1.5 inch inlet static pressure and design primary airflow (0.25 inch downstream static pressure):

Sound Power Levels Octave Band (Hz)	CFM 600	1000	1500	1800
125	63	64	65	69
250	57	60	62	64
500	51	52	57	56
1000	45	48	52	51
2000	44	49	52	51

I. Electric Heaters:

1. Heaters are to be listed by Underwriters Laboratories and shall meet the requirements of the National Electrical Code.
2. Heaters shall have 80% nickel, 20% chromium resistance coils. Coils shall be supported by ceramic bushings recessed and staked into embossed openings in supporting brackets. Coils shall be machine-crimped into stainless steel terminals which are insulated with high temperature phenolic or ceramic bushings.
3. Over temperature Protection: All heaters shall be furnished with one disk type, automatic reset thermal cutout for primary over temperature protection. All heaters shall also be furnished with a disk type, load-carrying manual reset thermal cutout factory wired in series with each heater stage for secondary protection.
4. Heaters shall be rated for the voltage, phase and number of heating stages. 1st stage of heat for electric coil shall be up to 4.5 kW, 2nd stage is for more than 4.5 kW. SCR heater control shall not be used. All internal wiring shall be suitable for 105 degree C. Fuses shall be provided in all heaters. Heaters scheduled for voltages above 120V shall have control transformer with fused primary and secondary.
5. Built-in and wired factory installed controls shall include thermal cutouts, airflow switch, separate switch for each stage and built-in unfused disconnect switch. Two-stage switches are not acceptable.

2.2 SOURCE QUALITY CONTROL

A. Regulatory Requirements: Conform to NFPA 90A.

B. Factory Tests: Test assembled air terminal units according to AHRI 880.

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1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, heating element size and AHRI certification seal.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 5, "Hangers and Supports" and with Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.2 TERMINAL UNIT INSTALLATION

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

C. Install wall-mounted thermostats.

D. Where installing conduit or piping adjacent to air terminal unit, allow space for service and maintenance.

E. Comply with requirements in Section 233113 "Metal Ducts" for connecting ducts to air terminal units.

F. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

G. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows, heating element size and AHRI certification seal. Comply with

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requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Air terminal unit will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

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SECTION 255000 – INTEGRATED AUTOMATION SYSTEMS (IAS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
C. Section 230900 "Building Management System"

1.02 SCOPE OF WORK

A. This project requires the installation of a new Integrated Automation System constructed using a Niagara Framework with BACnet Field Level Devices. The new IAS shall utilize multiple JACE 8000 controllers, networked with a Niagara Framework Web Supervisor and new BACnet controllers and other integration and control devices as required to meet the project scope requirements.

B. The Contractor will be required to perform the following:

1. Furnish, install, configure and commission a new Niagara Framework using BACnet IP and BACnet MS/TP programmable and application specific DDC controllers for the equipment identified in the drawings MC-000 through MC-742, including all components, software and applications required to meet the sequence of operation and the design/performance intent of the systems. Refer to the project scope of work summary on sheet MC-001.

2. Provide BACnet Building Controllers (B-BCs), Advanced Application Controllers (B-AACs), Application Specific Controllers (B-ASCs) as specified herein and as indicated on the drawings and in specification section 230923, Direct Digital Control for HVAC. Provide I/O and ancillary devices as specified and indicated on the drawings, and as necessary to perform the sequences of operation. Provide BTL or Niagara Framework-based certified products that communicate on BACnet IP and MS/TP topology channels to meet the functional specifications.

3. All Network Controllers (NCs) shall be BTL BBC certified.

4. Furnish and install electronic energy meters to monitor energy usage and measure the efficiency of energy use within the facility as shown on the drawings.

5. Furnish and install all low voltage step-down transformers with associated low voltage connections, power supplies and power/communication/input/output cabling necessary for the control system.

6. Furnish and install conduit, junction boxes, fittings, panels, enclosures, and hardware as specified in the specifications, on the drawings and as required by Code.

7. Provide Graphical User Interface Development for all the devices identified above and illustrated within the drawings.

8. It is the contractor’s responsibility to review all the design documents and specifications and report any discrepancies to the owner.

1.03 GENERAL IAS INSTALLATION SCOPE OF WORK

A. Contractor shall implement a Niagara Framework based open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Fulton County Government (FCG) shall be the named license holder of all software associated with any and all incremental work on the project. Only Niagara Framework based products are acceptable for the IAS.

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B. The FCG shall receive ownership of all job specific configuration documentation, data files and application-level software developed for the project. This shall include all custom, job specific software code, databases, passwords and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for admin and programming level access to any component or software program shall be provided to the FCG.

C. It is the owner's intent to purchase an open system capable of being serviced and expanded by any acceptable system integrator that has and maintains certification (TCP) to work on Niagara Framework systems. The Niagara Compatibility Statement (NICS) for all Niagara Software shall allow open access and be set as follows: accept.station.in="*" accept.station.out="*" accept.wb.out="*" accept.wb.in="*". In any case, the FCG shall maintain the right to direct contractor to modify any software license, regardless of supplier, as desired by the FCG. The Contractor shall not install any "brand specific" software, applications or utilities on Niagara Framework based devices.

D. All hardware and field level devices installed, (i.e.; BCs, AACs, ASCs), for the project shall not be limited in their ability to communicate with a specific brand of Niagara Framework device. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replace of or in parallel with existing components.

E. Provide and install all wiring required for a complete system, including communication bus, analog points, digital points, low voltage power, emergency power, and spare communication bus. Splices are not permitted within the IAS FAC LAN or DLN communication cables. Only continuous bus topologies, MS/TP or continuous homeruns are allowed for these networks. Capacity of any bus shall be limited to 80% of the allowable device count to allow for future minor modifications or expansions to the network.

F. Provision of all documentation called out in the specifications including, but not limited to, submittals, O&M manuals, commissioning submittals, CAD based as-built documentation, and training manuals. Provide both hard copies and electronic files on electronic media.

G. Training of facility personnel, and or maintenance contractor, on the operation and maintenance of the system.

H. System point to point check out, verification and documentation. Assist the Owner/CxA, and/or TAB Firm in verification and functional performance testing and GUI acceptance testing.

I. Graphical User Interface Development. The Contractor shall develop the graphics, tools, features, and network integration as required.

1.04 CONTROL DIAGRAMS AND SCHEDULES

A. The control diagrams and schedules provided for this project are an integral part of the project design. The specifications, design drawings and schedules illustrate the complete design.

B. Refer to design drawings and Fulton County Justice Center Complex (FCJCC) as-built drawings for information on the existing HVAC and building components and intended new BAS control functions.

1.05 SEQUENCES OF OPERATION

A. Program each Niagara Framework Network Controller, and third-party BC, AAC, ASC device, etc., to perform the sequences of operation provided on the drawings. Provide all necessary hardware on each piece of equipment in order for the equipment to perform the specified sequence and to meet the requirements of the point lists.

B. The Contractor shall be responsible for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation.

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1.06 CODES

A. Comply with all current codes, ordinances, regulations, and the local requirements.

1.07 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

2. American National Standards Institute (ANSI)

3. UL 916: Energy Management Systems

4. BACnet Testing Lab

1.08 COORDINATION OF WORK WITH EXISTING CONDITIONS

A. Certain products, systems and interface devices may be provided by other trades or vendors. Examine the Contract Documents to ascertain the requirements to install, wire, program, commission, and/or interface to these systems. Particular attention must be paid towards the interface boards submitted by the various equipment providers. It is the Contractor's responsibility to verify the submitted interfaces will integrate properly into the IAS. Report any discrepancies to the Owner.

B. This contractor shall specifically be required to fully integrate the existing Trane BAS controls recently installed in limited areas of the Fulton County Justice Center Tower, particularly the central plant and air handling systems on floors five through nine. Furnish and install the required number of JACE network controllers to discover all data through BACnet integration. It will be this contractor's responsibility to expose all Trane data that may or may not be currently exposed via BACnet in order to satisfy the requirement of this project. It is anticipated that at least two JACE8000 controllers will be required to perform this scope.

C. Wherever work interconnects with work of other trades, coordinate with other trades and with the Owner's representative to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment.

D. Provide sleeves and conduit for passage of pipes, and wiring through structural masonry, concrete walls and floors, and elsewhere for the proper protection of the IAS work.

1.09 PARTS LIST

A. As part of the submittal, provide an accurate parts list including manufacturer, model number and quantity for all hardware and software.

1.10 QUALITY ASSURANCE

A. Provide a Niagara Framework as the basis of the new IAS. The Contractor shall be fully certified in the development and customization of the Niagara Framework software.

B. All microprocessor-based control products used shall conform to BTL Certified Standards, and/or Niagara Framework.

C. The IAS and components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.

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D. Functionality and Completeness: Contractor shall furnish and install all hardware, software and programming necessary to provide a complete and functioning system as specified. Contractor shall include all hardware, software and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with the Specifications.

1.11 INSTALLER'S QUALIFICATIONS

A. Installer's Qualifications: The Contractor shall have a successful history in the design and installation of Niagara Framework based Integrated Automation Systems to provide web browser monitoring and control of BACnet field level devices. Contractor must demonstrate experience in IAS installations for not less than 5 years and in DDC installation projects with point counts equal to this Project and systems of the same character as this Project.

B. Installer's Experience with Proposed Product Line: Firms shall have specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least three (3) projects of similar size and complexity. Submittals shall document this experience with references. Provide evidence of Niagara TCP certification as part of the submittal process.

1.12 BID PACKAGE SUBMITTAL

A. Provide the following submittals as part of the bid package.

1. Proposed device schedule including all hardware and software.

2. Qualifications

3. One-line diagram indicating how the new Niagara Framework network controllers will integrate with the IAS BACnet field level devices.

4. One-line diagram and description indicating how the new Niagara Framework network controllers will integrate with the existing Trane BACnet field level devices.

5. An overall sequence of the construction as it pertains to the installation of the Integrated Automation System.

1.13 SUBMITTALS

A. General: Submit under provisions of Section 013300, Section 230900 and this section.

B. Electronic Submittals: While all requirements for hard copy submittal apply, IAS control submittals and operation and maintenance (O&M) information shall also be provided in electronic format as follows:

1. Drawings and Diagrams: Shop Drawings shall be provided on electronic media as an AutoCAD drawing per Owner's CAD standards.

2. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format

C. Qualifications: Manufacturer, Installer, and Key personnel qualifications as indicated for the appropriate items.

D. Submit a list of no less than three similar projects, which utilize the Niagara Framework (or equivalent acceptable to FCGC) for Enterprise connectivity to provide an Integrated Automation System that consists of web-browser control and monitoring of the proposed BACnet field level devices. These projects must be on-line and functional such that representatives from the Owner can observe the Integrated Automation System and Interface in full operation. Include proper references and contact numbers of these reference projects.

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E. Submit validation which indicates the successful completion of the Niagara Framework TCP certification course.

F. Submit resumes of installing staff indicating passing certificates for training on the BACnet, Tridium TCP certification line of controls to be installed as part of this project.

G. GUI development software

1. Provide screen captures of graphical user interfaces developed by the Contractor on previous projects. These screen shots shall represent work performed by the contractor and not of the company from the line of controls which the Contractor represents. Provide client contact information for the Owner to validate.

H. Product Data: Submit manufacturer's technical product data for each Niagara Framework based Network Controller, control device, sensor, actuator, relay, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.

I. Products: Within twenty-one (21) days after date of notice to proceed, submit for acceptance a list of all material and equipment manufacturers whose products are proposed, as well as names of all subcontractors whom the Contractor proposes to employ.

J. Submit documentation indicating NICs and/or BTL compliance and include Protocol Implementation Conformance (PIC) Statements.

K. Submit Shop Drawings for each control system.

L. Control Logic Documentation:

1. Provide a written description of each control sequence.

2. Include control response, settings, set points, throttling ranges, gains, reset schedules, adjustable parameters and limits as part of as-built documentation.

M. Submit an IAS Start-Up Test Agenda and Schedule for review and approval.

N. Record Documents:

1. Provide record copies of product data and control Shop Drawings updated to reflect the final installed condition.

2. Accurately record actual set points and settings of controls, final sequence of operation, including changes to programs made after submission and approval of Shop Drawings and including changes to programs made during specified testing.

3. Record copies shall include individual floor plans with device (controllers, routers, sensors, etc.) locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring.

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1.14 SYSTEM ARCHITECTURE

A. The system provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Facility Local Area Network (Level One LAN) and Device Level Network (Level Two LAN) shall be based on industry standard open platforms as specified herein and utilize commonly available operation, management and application software. All software packages and databases shall be licensed to the Owner to allow unrestricted maintenance and operation of the IAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.

B. The system architecture shall implement a new building IAS which is based on the Niagara Framework and consists of an Ethernet-based, wide area network (WAN), a single Local Area Network (LAN) that supports NCs, BCs, AACs, ASCs, Operator Workstations (OWS), Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable.

1. WAN: Internet-based Fulton County network connecting multiple facilities with a central data warehouse and server, accessible via standard web-browser. This is the infrastructure that shall be used to connect the Justice Center Complex BAS to the Niagara server located in the Government Center Complex. This contractor shall coordinate with FCG IT.

2. Facility Local Area Network (FAC LAN, Level One LAN): The FAC LAN shall be an Ethernet-based, 100 Mbps Ethernet LAN connecting Local NCs, BCs, AACs IAS Server and OWSs. The FAC LAN serves as the backbone for the NCs communications path and is the connection point to the future WAN. Contractor shall provide a FAC LAN as a dedicated LAN for the control system. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support 1000base-T gigabit Ethernet throughput.

3. Device Level Network (DLN, Level Two LAN): Network used to connect AACs and ASCs. These shall be Peer to Peer devices as defined in the BTL standard. Network speed shall be a minimum of 1000 kbps or as required for BACnet communications.

4. ARCnet and/or Token-Ring based FAC LANs and DLNs shall not be acceptable.

C. Remote Data Access: The system shall support the Internet Browser-based remote access to the building data. The IAS contractor shall coordinate with the Owner's IT department to insure all remote browser access (if desired by the owner) is protected with the latest Niagara Software updates and a VPN (Virtual Private Network) must be installed to protect the owner's network from cyber-attacks.

D. Browser-based access: A remote/local user using a standard browser will be able access all control system facilities and graphics via the WAN or direct connection, with proper username and password. Only native Internet browser-based user interfaces (HTML5, Java, XML, CCS3 JAVA Script, etc.) that do not require plug-ins (thin clients) are acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Firefox™ or Chrome™.

E. The communication speed between the controllers, LAN interface devices, CSS, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition.

F. Niagara Framework Control Systems Server (CSS): A server that maintains the systems configuration and programming database. It shall allow secure multiple-access to the control information.

G. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a server that resides on the FAC LAN. User tools for DLN and FAC LAN management shall be provided and licensed to the Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations and settings.

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H. Database Schema shall be published and provided to the Owner to facilitate easy access to DLN and FAC LAN data.

1.15 SUBSTITUTIONS

A. Wherever the words “for review” or “for acceptance” are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, submit all information pertinent to the adequacy and adaptability of the proposed apparatus to the Owner’s Representative and secure their approval before the apparatus is ordered. Refer to general condition requirements for substitutions.

1.16 WARRANTY

A. The entire IAS and all ancillary equipment required for its operation shall be free from defects in workmanship and material under normal use and service. If within 24 months from the date of substantial completion the installed equipment is found to be defective in operation, workmanship or materials, the Contractor shall replace, repair or adjust the defect at no cost to the Owner.

B. The warranty period for work and systems of this project shall commence after written notification of Owner’s substantial completion.

C. Corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

D. The Owner reserves the right to make changes to the IAS during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any such changes made by Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the IAS.

E. At no cost to the Owner, during the Warranty Period, Contractor shall provide maintenance services for software including all current software updates, firmware and hardware PRODUCTS. Prior to the closeout of the warranty period, the IAS contractor shall meet with the owner’s representative to address any questions or concerns and offer ongoing Software Maintenance Services to the owner. Refer to section 230900 for additional warranty requirements.

1.17 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

1.18 MANUFACTURERS

A. Acceptable Manufacturers – Network Controllers

1. Niagara Framework JACE 8000

1.19 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not be used in any way for the permanent installation except where Drawings or Specifications specifically allow existing materials to remain in place.

B. The make and model of network switches, routers, ups, control system server computers, personal computers (PC), notebook PC’s, and monitors shall comply with Owner’s current standards as of the date of Substantial Completion. Contact Owner for the current hardware standards.

C. Refer to specification section 230900 for field level controller, device and sensor specifications.

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1.20 STAND-ALONE FUNCTIONALITY

A. The Contractor shall furnish and install single controllers with the physical and software resource count for standalone operation of each piece of HVAC equipment controlled. The sequence of operation and required points for control shall reside on a single controller. Remote I/O modules (via a field wired communications bus) are not acceptable for points required to achieve the sequence of operation. Expansion I/O modules plugged directly into the controller may be utilized for expansion.

1.21 THIRD PARTY INTERFACES

A. Manufacturer third party interfaces shall be limited to equipment which the IAS contractor cannot or has not been contracted to control directly via DDC controllers. This equipment shall include the following. CRUs, Chillers, Energy Meters, VFDs and future Integration to Fire Alarm Systems, Security and Access Control Systems and Lighting Systems.

1.22 ENERGY MANAGEMENT APPLICATIONS

A. The IAS shall have the ability to perform energy management routines via preprogrammed function blocks or template programs.

1.23 MAINTENANCE MANAGEMENT APPLICATIONS

A. The IAS shall have the ability to monitor equipment status and generate maintenance messages based on operator-designated run-time, starts, and calendar date limits via preprogrammed function blocks or template programs.

1. Provide General HVAC equipment reminders that occur every 1,000 (adjustable) hours of equipment runtime, and

2. Provide Seasonal HVAC equipment recurring reminders that are calendar based.

3. Maintenance reminders shall follow standard alarm handling and messaging protocol including but not limited to:

a) Native language point descriptor such as "Primary chilled water pump, Central Energy Plant, 1st Floor"

b) Discrete action messages, such as "Air Handling Unit 21, maintenance runtime hours exceeded, schedule PM routines"

c) Include extended message capability to allow assignment and printing of extended action messages. Capability shall be operator programmable and assignable on a per point basis.

d) Multiple messages and alarms shall be available per HVAC equipment item.

1.24 UNIFORMITY

A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer

PART 2 - EXECUTION

2.01 PREPARATION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

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B. These specifications call out certain duties of the Contractor and any subcontractor(s). They are not intended as a material list of all items required by the Contract.

2.02 INSTALLATION

A. Utilize licensed electricians for all new and retrofitted electrical distribution systems and comply with Division 26 electrical specifications.

B. Provide related items and work indicated on the IAS Drawings and items and work called for in this Division of the Specifications. This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start up, configuration, programming and commissioning coordination on each control product and system to provide fully operable systems in accordance with the specified functional performance.

C. Installation shall be in accordance with manufacturer's published recommendations and shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

D. The IAS Drawings show the general arrangement of the respective systems. Follow these Drawings as closely as actual building construction and the work of other trades will permit. Provide devices, power, fittings, sensors, controllers, wiring and accessories, which may be required but are not shown on the Drawings or specified herein. The Contractor shall be responsible for achieving the sequence of operations and intent of the system design.

E. All installation shall be in accordance with manufacturer's published recommendations.

F. Limit LAN cable lengths to no longer than 80% of the longest dimension published by the manufacturer of the cable between the most remote network nodes.

G. Comply with all rules, guidelines and procedures defined by the owner's IT authority.

2.03 DIGITAL CONTROL PANELS, CONTROLLER QUANTITY AND LOCATION

A. Individual Digital Control Panels (DCP) are referenced to indicate allocation of points to each DCP and DCP location. Digital control panels shall consist of one or multiple controllers to meet requirements of this Specification.

B. Contractor shall extend power to the DCP from an acceptable power panel (coordinate with Division 26).

2.04 NETWORK MANAGEMENT FUNCTIONAL REQUIREMENTS

A. Contractor shall thoroughly and completely configure IAS system control devices, software, supplemental software, application programming, network communications, CSS, OWS, remote operator workstations, portable operator's terminal, printer, and network communications to permit the functional requirements of the IAS herein specified. The setup shall include as a minimum the following network management procedure:

1. Automatic backup of the DDC System database to appropriate media.

2. Program, load and debug all software installations, including integration of third party applications (e.g. analytics and energy management).

3. Network user auditing routine.

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2.05 SURGE PROTECTION

A. Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all NCs, operator interfaces, printers, routers and other hardware and interface devices. All equipment shall be capable of handling voltage variations 10 % above or below measured nominal value, with no effect on hardware, software, communications, and data storage.

2.06 CONTROL POWER SOURCE AND SUPPLY

A. IAS Contractor shall provide all power source wiring required for operation of all equipment and devices provided under Division 25 and the IAS Drawings.

2.07 PRODUCT DELIVERY, STORAGE, HANDLING, PROTECTION AND CLEANING

A. All products and materials shall be new, clean, and free of defects, damage and corrosion.

B. Ship and store products and materials in a manner which will protect them from damage, weather, and entry of debris until final acceptance.

2.08 SITE CLEAN UP

A. At conclusion of each day's work, and at the request of the owner, clean up and remove from the site all rubbish, debris and trash accumulated during the day as a result of work of the Contractor.

B. Marks on walls or ceiling tiles caused by the Contractor shall be cleaned by the Contractor. Ceiling tiles, drywall, carpet, paint, and all architectural finishes damaged by the Contractor shall be replaced by the Contractor.

2.09 IAS CONTRACTOR'S CHECK OUT (CCO) START-UP TESTING, ADJUSTING, CALIBRATION

A. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration and Acceptance Phase. Contractor shall conduct the CCO which addresses the start-up, testing, adjustments, and calibrations of all work and/or systems under this Contract.

B. All CCO testing procedures shall be documented in the CCO report to be provided by the contractor to the Owner/CxA.

2.10 SUMMARY OF IAS ACCEPTANCE PROCEDURE

A. Submit product data, Shop Drawings, logic documentation, and sample graphics to the Engineer of Record, and receive approval.

B. Install IAS. Obtain Owner/CxA acceptance of each phase of installation when installation consists of a renovation in an occupied space.

C. Submit as-built record documents.

D. Provide the Owner/CxA an agenda and schedule of CCO testing activities for approval and coordination.

E. Provide written notice that the system is ready for Owner acceptance testing. Schedule IAS Demonstrations and Owner/CxA Commissioning.

F. Demonstrate IAS systems to Owner/Engineer. Perform functional performance testing including sequence of operation, point to point verification to graphical interface, historical data logging, and alarms.

G. Owner/CxA to provide detailed punch list to contractor.

H. Contractor to repair issues on Owner/CxA punch list in seven (7) calendar days.

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I. Contractor provides all usernames, passwords, software, GUI, databases, licenses, and application programming tool(s) to the Owner.

J. Contractor Trains Owner on all aspects of the IAS including architecture, devices, software, final sequences and modes of operation.

K. Owner issues letter to contractor declaring that system is substantially complete. Date of this letter starts the warrantee period,

L. Revise and re-submit as-built record Drawings and O&M Manuals.

M. Final Acceptance. Owner issues letter to contractor accepting system.

END OF SECTION 25 00 00

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SECTION 260499 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND DEFINITIONS

A. Contract Drawings, Specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 26.

B. “Drawings” or “Contract Drawings”, as used herein, refer to the Project Contract Drawings.

C. “Specifications” or “Contract Specifications”, as used herein, refer to the Project Contract Specifications.

D. “Documents” or “Contract Documents”, as used herein, refer to the Project Contract Drawings, Specifications, and general conditions and requirements.

E. “Division” or “SECTION 26”, as used herein, refers to all project Electrical Section Specifications.

F. “Contractor”, as used herein, refers to the Electrical Contractor (including his sub-contractors and his electrical/etc. equipment manufacturers and suppliers who provide his equipment), who has responsibility to furnish and install the “Scope of Work”, as described herein and per the Contract Documents.

G. The requirements of this Section apply to the entire Scope of Work including that shown on the Drawings, in the Division 26 Section Specifications, and in the General and Supplementary Conditions, and Division 1 Specifications.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for electrical installations. The following general, administrative and procedural requirements are included in this Section to expand the requirements specified elsewhere in general project specifications:

1. Scope of work.
2. Applicable standards/Quality assurance.
3. Interpretation of drawings.
4. Priority of contract documents.
5. Submittals.
6. Record documents.
7. Operation and Maintenance manuals.
8. Materials.
9. Codes, inspections and fees.

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10. Delivery, storage and handling.
11. Tests and settings.
12. Manufacturer's services.
13. Size of equipment.
14. Enclosure types.
15. Hazardous areas.
16. Coordination and Fault Study.
17. Training.
18. Warranty.

B. Related Sections:

1. All Division 26 Section Specifications.

1.3 SCOPE OF WORK

A. Furnish all labor, supervision, materials, equipment and incidentals required to make ready for use complete functional electrical systems as shown on the Drawings and specified herein.

B. The work shall include furnishing, installing, interconnecting and testing the equipment and materials specified in all other Sections of the Division 26 Specifications and shown on the Drawings.

C. The work shall include furnishing, coordinating, and installing the following:

1. It is intended that Contractor coordinate with the Electrical Utility Company, to the extent necessary, so that an appropriate, complete and reliable electrical service or supply, is provided for this project. Electrical Utility Company cost charges, for modification and extension of all on-site, project-related, Utility-required, infrastructure installations, materials, improvements, etc, which benefit the Owner, shall be borne by Owner. Projects warranting Electrical Utility charges for off-site Utility Infrastructure improvements or modifications shall likewise have such costs borne by Owner. However, unless otherwise indicated or negotiated with the Owner, Contractor shall include in his bid price and bear responsibility for any and all of the following:

a. Project services transformer pad, vault, and / or work to enable / facilitate Utility interface or "point-of-tie-in" interface.
b. Determination and implementation of Utility requirements and details and locations of major equipment, including project service transformer(s).
c. Empty conduit with pull wire or conduit sleeves between project service transformer(s) and Utility primary voltage point-of tie-in, as per Utility.
d. Utility requirements for metering and installation.
e. Complete conduit and wiring and termination of secondary voltage conductors between the project service transformer(s) and the project service entrance equipment.
f. Concrete encasement of primary conductors when required by Utility and / or called for on the Contract Drawings.

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g. Concrete encasement of project service transformer(s) secondary, where required and /or called for on the Contract Drawings.
h. Utility required fencing, bollards, grounding, signage and all miscellaneous appurtenances.

2. Contractor shall include all of these costs related to Electric Utility Company service or supply, in his scope, cost estimates, bids, etc. Intent is that these costs will be passed from Utility, through Contractor, on to Owner as part of the electrical subcontract bid price and subsequent payment requests.

3. Unless specified otherwise, complete, functional, fully installed, interconnected and tested systems for power, control, lighting, grounding, telephone, data, fire alarm, communications, signaling, security, lightning protection, electrical heat tracing of piping, etc. as indicated in other Sections of Division 26 and as shown on the Drawings are included in Division 26 scope.

4. Electrical service from Power Company or designated tie-in point, per the Contract Drawings and/or as required by the Power Company.

5. Conduit, wire, field connections and installation for all motors, motor controllers, control devices, control panels, communications systems components, signage and “packaged” equipment furnished under other Divisions of these Specifications, to the extent shown on the Drawings.

6. Installation, mounting and field wiring for all field-mounted devices furnished under other Divisions of these Specifications, which have electrical or electronic wiring connections. All conduit, wire, and interconnections between device elements, transmitters, local indicators and control panels, etc. Installation of all cables and equipment furnished by others is included as work under this Specification, to the extent shown on the Drawings.

7. Nominal 120 volt or greater power utility, power wiring and appropriate conduit or raceway for all equipment and devices utilizing or requiring such power including power for heating, ventilating, air conditioning, (HVAC), mechanical and/or plumbing equipment and appurtenances furnished under other Divisions of these Specifications. Include power wiring for all air handlers, fans, condensing units, heat pumps, heaters, heat tracing, unit heaters, pumps, powered induction units (PIUs), terminal units, fan coil units, variable air volume units (VAVs), dampers, louvers, motorized operators, valves and any and all other similar HVAC, mechanical and/or plumbing equipment. Include power wiring for all such equipment on the Division 15 Drawings and /or Specifications. Provide power wiring and conduit from power source to equipment physical locations and provide wiring terminations as required. Unless noted otherwise, excluded from Division 16 responsibility are conduit and wiring for “HVAC Controls”, “Building Management Systems (BMS)” and “Sequence of Operations” controls and systems operating at “low” voltages below 120 volts nominal. See applicable Sections of Division 15 for reference.

8. Complete, functional, fully installed, interconnected and tested systems for power, control, lighting and grounding, as indicated in other sections of Division 26 and as shown on the Contract Drawings.

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9. Unless specified otherwise, the Contractor shall review the shop drawings of all electrically operated equipment and equipment with electrical connections furnished under all divisions of these specifications. The Contractor shall wire and interconnect all materials, devices, components, systems and packages requiring “field wiring”. Where applicable, Contractor shall make electrical interconnections per manufacturer’s requirements. This includes, but is not limited to, devices that are parts of “packages” but which are shipped separately and require field connection. Also, the Contractor shall identify terminals and prepare drawings or wiring tables if necessary for interconnections. “Rough-in” shall be based on the Drawings.

10. Demolition, where required.

11. Concrete Work: Construct curbs, pads, vaults and similar supports for electrical equipment where required. Provide 4" thickness housekeeping pads at floor mounted equipment, covering entire area occupied by equipment. Dowel pads to structural slab. Perform concrete work in accordance with applicable portions of Concrete sections. Minimum compressive strength of concrete shall be same as specified for slabs on grade.

D. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section or other applicable sections shall be furnished at no extra cost.

E. Where applicable, the Contractor or his authorized representatives shall, before preparing his proposal, visit all areas of the existing site, buildings and structures in which work under this section is to be performed and inspect carefully the present installation.

F. Where applicable, all power interruptions to existing equipment shall be at Owner’s convenience with 72 hours (minimum) notice. Each interruption shall have prior approval.

G. Temporary power connections as required shall be provided by the Contractor at no additional expense to Owner. All temporary wiring shall be in accordance with NEC. The Contractor shall provide to the Project Manager; details, methods, materials, etc. prior to making temporary connections. Furnish and install all equipment and materials including control equipment, motor starters, branch and feeder circuit breakers, panelboards, transformers, etc., for temporary power. Remove temporary installations prior to / at job completion. Temporary power includes that required by Electrical Contractor.

H. The work shall include complete testing of all equipment and wiring at the completion of work and making any minor correction changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.

I. Where applicable, field identify and verify all existing underground structure and utilities, including electrical and mechanical piping.

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J. Excavation and backfilling, including gravel or sand bedding for underground electrical work is included in Division 26.

K. Complete coordination with other contractors. The Contractor shall coordinate with other contractors equipment submittals and obtain all relevant submittals.

L. To the extent applicable, complete coordination with the Electric Utility. The Contractor shall complete applicable Electric Utility forms and comply with and respond to Electric Utility requests for information. Such are as related to, but not limited to, sizes and types of new electrical loads, anticipated load diversity/ demand, generators, and size, rating and characteristics of Owner's new electrical equipment, etc., to the extent required by the Electric Utility. Intent is that the Electric Utility will, from such coordination with Contractor, be able to finalize Electric Utility's incoming electrical service ratings and details, service transformer(s) ratings and details, and proper interconnection with Owner's equipment.

1.4 APPLICABLE STARDARDS/QUALITY ASSURANCE

A. All electrical equipment, materials, and installation shall be in accordance with the latest edition of all codes and standards of the following organizations:

1. National Fire Protection Association (NFPA), including (but not limited to):

    a. National Electrical Code (NEC), NFPA 70
    b. Life Safety Code, NFPA 101
    c. Emergency and Standby Power Systems, NFPA 110

2. American National Standards Institute (ANSI), including (but not limited to):
    a. National Electrical Safety Code, ANSI C2

3. Occupational Safety and Health Act (OSHA)
4. Federal Communication Commission (FCC)
5. National Electrical Manufacturers Association (NEMA)
6. Insulated Cable Engineers Association (ICEA)
7. Institute of Electrical and Electronics Engineers (IEEE)
8. National Electrical Testing Association (NETA)
9. American Society of Testing and Materials (ASTM)
10. Illumination Engineering Society (IES)
11. Uniform Building Code (UBC)
12. International Conference of Building Officials (ICBO)
13. NECA
14. ADA
15. Energy Code
16. All applicable State and Local codes, amendments, and regulations.
17. Appropriate Authorities Having Jurisdiction.

B. Where codes and/or standards conflict, the more conservative document shall be followed.

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C. Per OSHA, all electrical equipment and materials shall be listed by Underwriter's Laboratories, Inc. (UL), or other Nationally Recognized Testing Laboratory (NRTL), and shall bear the appropriate UL or NRTL listing mark or classification marking. Equipment, materials, etc. utilized not bearing a UL or NRTL certification shall be field certified by UL or NRTL prior to equipment acceptance and use.

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.5 INTERPRETATION OF DRAWINGS

A. Electrical loads (kVA, kW, Horsepower, Amperes, etc.) and wiring requirements indicated on the electrical drawings are estimates representative of standard mechanical equipment. Electrical equipment ratings, bus ratings, circuit wire sizes, circuit wire quantities, conduit sizes, conduit quantities and overcurrent protection device ratings indicated on the Contract Drawings are based on such equipment. Contractor is advised that prior to installation he must compare indicated electrical equipment ratings, wire sizes and quantities, conduit sizes and quantities and overcurrent protective device ratings versus approved shop drawings of actual equipment being furnished. Contractor shall provide electrical materials of first quality and conforming to the requirements of the actual equipment being furnished, reflecting increased ratings, wire sizes and quantities, conduit sizes and quantities and overcurrent protective device ratings where required to match shop drawings. Overcurrent protective device ratings shall be decreased if required to match actual equipment requirements and/or manufacturer's recommendation. Other electrical ratings, wire sizes and quantities and conduit sizes and quantities shall not be decreased to less than that indicated on the electrical Drawings.

B. The Contract Drawings are diagrammatic and show equipment and conduit in general locations. They are not intended to show exact locations of equipment or conduit runs. Contract Drawings shall not be scaled by the contractor for such purpose; exact locations shall be determined in field by the contractor.

C. Unless otherwise approved by the Project Manager, conduit shown or specified exposed shall be installed exposed; conduit shown or specified concealed shall be installed concealed.

D. Where circuits are shown as "home-runs", all necessary fittings and boxes shall be provided for a complete raceway installation.

E. Verify with the Project Manager the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

F. Any work installed contrary to or without approval by the Project Manager shall be subject to change as directed by the Project Manager, and no extra compensation will be allowed for making these changes. Intent is for Contractor to seek and receive approval of intended installation from Project Manager before proceeding with actual installation.

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G. The exact locations of equipment, fixtures, outlets, and similar devices shown on the Contract Drawings are approximate only. Exact locations and quantities shall be as approved by the Project Manager during construction. Obtain in the field all information relevant to the placing of electrical work, and in case of any interference with other work, proceed as directed by the Project Manager and furnish all labor and materials necessary to complete the work in an approved manner.

H. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.

I. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of equipment.

J. All connections to equipment shall be made as required, and in accordance with the approved shop and setting drawings.

K. Redesign of electrical or mechanical work, which is required due to the contractor's use of an alternate item, arrangement of equipment, and/or layout other than specified herein, shall be done by the Contractor at his own expense. Redesign and detailed plans shall be submitted to the Project Manager for approval. No additional compensation will be provided for changes in the work, either his own or others, caused by such redesign.

L. The Contractor shall coordinate his work with the work of the different trades so that interferences between conduits, piping, drainage, civil, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required to accomplish this shall be furnished and installed by the contractor without additional expense to Owner. In case interference develops, the Project Manager is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

1.6 PRIORITY OF THE CONTRACT DOCUMENTS

A. If during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and Contract Drawings, furnish the higher performance requirements. The higher performance requirements shall be considered the equipment, material, device or installation method that represents the most stringent option, the highest quality, or the largest quantity.

B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Project Manager and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.

C. Detailed drawings shall govern over general drawings, larger scale drawings take precedence over smaller scale drawings and change order drawings shall govern over

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Contract Drawings. Contract Drawings shall govern over shop drawings until shop drawings have been approved by the Project Manager. Once shop drawings have been approved, by the Project Manager, they shall become the governing documents. Nevertheless, should an approved shop drawing contain a conflict, omission and / or error, contrary to the Contract Drawings and / or Contract Documents, so as to void or diminish the original intent of the Contract Drawings and /or Contract Documents, then the Contract Drawings and / or Contract Documents shall govern.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or applicable code, the provision of the Contract Documents will take precedence if they are more stringent or cause a higher level of performance.

1.7 SUBMITTALS

A. Submit to the Project Manager, in accordance with the General Conditions, and the Special Conditions, and copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:

B. Shop drawings shall be submitted for the following equipment:

1. Panelboards/Switchboards.
2. Transformers.
3. Lighting Fixtures, Lamps and Controls.
4. Pullboxes and Handholes, Frames and Covers.
5. Grounding Hardware and Connections.
6. Raceways, Boxes, Fittings and Hangers.
7. Wires and Cable.
8. Switches, Receptacles and Covers.
9. Disconnect Switches.
10. Generator set, Automatic Transfer Switch and Fuel system.
11. Transient Voltage Surge Suppression.
12. Lightning Protection.
13. As required by other Division 26 sections.

C. The Manufacturer’s name and product designation and catalog numbers shall be submitted for the following material utilized:

1. Testing Equipment.
2. Ground System Resistance Test Equipment.

D. Prior to submittal, all shop drawings shall be checked for accuracy and Contract requirements. Shop drawings shall bear the date checked. In addition, each shop drawing submitted shall include a copy of the applicable specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and, therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin

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to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justifications for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

E. The Project Manager's review shall be only for conformance with the design concept of the project and compliance with the Specification and Contract Drawings. The Project Manager's review shall not change the requirements of the Contract Documents, nor shall this review relieve the Contractor of errors in shop drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Contract Drawings, which may not be indicated in the shop drawings, is included as work under this Section.

F. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

G. No material shall be ordered or shop work started until the Project Manager's approval of shop drawings has been given.

H. Submit Record Documents. See Article 1.8

I. Submit Operation and Maintenance Manuals. See Article 1.9

1.8 RECORD DOCUMENTS

A. Prepare record documents indicating installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed) dimensioned from prominent building lines or station platforms.
3. Approved substitutions, contract modifications, and actual equipment and materials installed.
4. Record power one line diagrams, panel schedules, and control diagrams.

1.9 OPERATION AND MAINTENANCE MANUALS

A. Prepare operation and maintenance manuals include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping,

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shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

B. Operation and Maintenance Data

1. Submit complete operations and maintenance data for all equipment furnished under this Division. The manuals shall be prepared specifically for the installation and shall include all required cuts, drawings, equipment lists, descriptions, complete parts list, etc, that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.10 MATERIALS

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Sample of materials or Manufacturers shall be submitted for approval as required by the Project Manager.

B. Equipment shall be suitable in all ways for the intended application. Ratings shall match or exceed the requirements of the indicated Reference Standards, Contract Drawings and Specifications. Electrical short circuit interrupting ratings shall meet the requirements of NEC Article 110. Additionally, electrical equipment shall have fully rated interrupting ratings. Equipment employing “series” rated interrupting capabilities shall not be acceptable.

C. Electrical equipment shall at all times during construction be adequately protected against mechanical damage, water damage, corrosion, dirt, dust and foreign material. Equipment equipped with internal electrical heaters shall have them energized to keep the equipment dry. Doors to cabinets, panelboards, control panels and other similar equipment shall be kept closed at all times when work on them is not being done. Panelboards and similar Electrical equipment shall not be stored out-of-doors. Such Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been subject to possible injury by water, it shall be replaced at no additional cost to Owner, the damaged units or systems shall remain on site and returned to the manufacturer after the replacement units or systems have been delivered to the site. Under no circumstances will electrical equipment damaged by water be rehabilitated or repaired, new equipment shall be supplied, and all costs associated with replacement shall be borne by the contractor.

D. Any damage to factory applied paint finish shall be repaired using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting specification, at no additional cost to Owner.

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1.11 CODES, INSPECTIONS AND FEES

A. All equipment, materials, and installation shall be in accordance with the requirements of the local authority having jurisdiction (AHJ). The AHJ is defined as the electrical inspector, fire marshal and/or any authorized City, County, Georgia State or Federal agent.

B. Contractor shall obtain all necessary permits, inspections, certificates of acceptance, certificates of occupancy, etc. Contractor shall pay all fees related to these items. Contractor shall submit to the authority having jurisdiction the necessary drawings in the size and quantity as required by the authority having jurisdiction. These permits, inspections, and certificates shall cover all aspects of the electrical systems, including the fire alarm system. The permits, inspections and certificates shall be obtained by contractor from the appropriate authority having jurisdiction including, but not limited to, building departments, inspection authorities, plan review examiners, fire marshals, insurers, etc.

C. Obtain required inspection stickers indicating installation suitability from the local authority having jurisdiction. Install as directed by authority having jurisdiction.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Inspect products for completeness and conditions; if it is to be stored, reseal for protection; unpack and handle equipment in accordance with manufacturer's recommendations.

C. Store products in dry spaces, free from corrosives. Heat storage areas to prevent condensation, and dust free. Keep equipment clean by covering or by other measures as necessary. Store shipping section on level surfaces.

D. Store equipment and material under cover, and off the ground or floors exposed to rain.

E. For outdoor storage, protection covers of 10 mil thick black sheet plastic shall be fitted. Covers shall be reinforced to withstand wind and precipitation. Set materials on skid or platforms of height to avoid damage or deterioration from spattering and ground waste.

1.13 TESTS AND SETTING

A. Test all systems furnished under Division 26 and repair or replace all defective work. Make all necessary adjustments to the systems and instruct Owner's personnel in the proper operation of the systems.

B. SHORT CIRCUIT AND COORDINATION STUDY AND ARC FLASH STUDY

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1. Contractor shall complete and provide the Short Circuit and Coordination Study and an Arc Flash Study by engaging the major electrical equipment Manufacturer for the complete study. The Manufacturer of switchboards and panelboards shall provide the complete study including a coordination study between the main protective devices for the system, feeder protective devices and all downstream protective devices to ensure a coordinated system to the greatest extent feasible. Costs for any changes to the equipment sizes and ratings due to this Coordination Study shall be a part of the Contractor's bid. Submit this Coordination Study in the shop drawing submittals. Arc Flash labels shall be specified in the study and provided and installed by the contractor.

C. Make the following minimum tests and checks prior to energizing electrical equipment:

1. Mechanical inspection, testing and setting of all circuit breakers, disconnect switches, motor starters, control equipment, etc. for proper operation.

2. Test grounding of new main switchboard and continuity of grounding between the new switchboard and all existing "re-powered" panels and loads. Visually inspect for specified ground connections. Perform ground resistance test at all connections to switchboards and panelboards. Use three point or fall of potential method. Verify single point connection (at the counterpoise) between the grounded and grounding systems. Additional ground rod is required if resistance is greater than 25 ohms.

3. Test transformers by visually inspect all components for damage, check bushings and insulators for cracks; transformer casing for evidence of leakage; pressure, temperature and liquid level gauges for proper indications.

4. Test wires and cables as specified.

5. Ground Fault Systems: Visually inspect for damage and improper connections.

6. Transfer and Other Relay Schemes: Investigate intended function, and verify correct operation

7. Check all wire and cable terminations. Verify to the Project Manager, connections meet the equipment's torque requirements.

8. Field set all transformers taps, as required, to obtain the proper secondary voltage.

9. Check motor nameplates for correct phase and voltage.

10. Check the ampere rating of all thermal overloads for motors and submit a typed record to the Project Manager of same, as well as locations and designations, listing the nameplate service factor, horsepower, and full load current. If inconsistencies are found, new thermal elements shall be supplied and installed by this contractor.

11. Check rotation of all motors, obtain permission from the Project Manager to start the motors, and proceed to check the motor for proper rotation. If the motor

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rotates in the wrong direction, correct rotation at the motor. Take all necessary precautions not to damage any equipment.

12. Carefully check interlocking, control and instrument wiring for each system, and/or part of a system to ascertain that the system will function properly and as indicated by schematic and wiring diagrams where applicable.

13. Provide all instruments, personnel and equipment required for the tests specified herein.

D. All testing shall be scheduled and coordinated by the Contractor. Notify Owner at least two (2) weeks in advance of conducting tests. The contractor shall have qualified personnel present during all testing.

E. The following additional tests and checks shall be made prior to the energizing of electrical equipment. Contractor shall engage the services of an independent testing firm. Tests shall be conducted by the independent testing firm, and a certified test report shall be submitted stating that the equipment meets and operates in accordance with the manufacturers and job specifications, and that equipment and installation conforms to all applicable standards and specifications:

1. Testing of protective relays for calibration and proper operation.
2. Over potential, high potential, insulation resistance, and shield continuity tests for cables.
3. Mechanical inspection of switches and circuit breakers to assure proper operation.
4. Three copies of certified test reports shall be furnished to the Project Manager for all tests.

1.14 MANUFACTURER'S SERVICES

A. Provide Manufacturer's services for testing and start-up of the following equipment:

1. As required by other Division 26 sections.

B. The Manufacturers of the above listed equipment shall provide an experienced Field Service Engineer to accomplish the following tasks:

1. The equipment shall be visually inspected upon completion of installation and prior to energization to assure that wiring is correct, interconnection complete and the installation is in compliance with the Manufacturer's criteria. Documentation shall be reviewed to assure that all Contract Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on-site. Documentation shall be red-lined to reflect any changes or modifications made during the installation to assure correct type and quantity.

2. The Field Service Engineer shall provide engineering support during the energization and check-out of each major assembly. They shall perform any calibration or adjustment required for the equipment to meet the Manufacturer's performance specifications.

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3. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with Manufacturer's test specifications.

1.15 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship its material in sections sized to permit passing through such restricted areas in the structure.

B. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passing through such restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

1.16 ENCLOSURE TYPE

A. Unless otherwise specified herein or shown on the Contract Drawings, electrical enclosures shall have the following ratings:

1. NEMA 1 for dry, secure, indoor locations.

2. Tamper proof / Vandal resistant features, hardware, and locking where enclosures are accessible to the public and in non-secure locations.

3. NEMA 3R or 4 for outdoor locations, rooms below grade (including basements and buried vaults), "DAMP" and "WET" locations. Enclosure material shall be stainless steel or carbon steel with baked or electrostatically applied enamel finish.

4. NEMA 4X for "CORROSIVE" locations. Enclosure material shall be stainless steel or fiberglass reinforced polyester.

1.17 EQUIPMENT IDENTIFICATION

A. Equipment or devices specified in the individual sections to be identified shall be identified by machine cut stencil unless the equipment is identified by the manufacturer. Identification of flush mounted cabinets and panelboards shall be on the inside of the device. Surface mounted equipment shall be identified on the outside cover. Equipment operating on 208Y/120 volt system shall be identified with black labels with white inner core, 480Y/277 volt equipment with red labels with white inner core.

1.18 HAZARDOUS AREAS

A. All equipment, materials, and installation techniques used in areas designated as hazardous in the Specification Sections, or on the Contract Drawings shall be in strict accordance with NEC Articles 500, 501, 502 and 503.

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B. All equipment and materials used in hazardous areas shall be UL listed for the appropriate hazardous area classification.

1.19 TRAINING

A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner's key personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all equipment and systems.

1.20 WARRANTY

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Provide a warranty for all electrical equipment in accordance with the general requirements of specification. Unless specified more stringently elsewhere in the general requirements, the components of the electrical system shall be warranted for a period of one (1) year from the date of final acceptance, against defective materials, design and workmanship.

END OF SECTION 260499

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 and Type XHHW-2.

C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

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PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10AWG and smaller; stranded for No. 8AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway

B. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-2-THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

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F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

   Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

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B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

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SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Multimode optical-fiber cabling.
2. UTP cabling.
3. RS-485 cabling.
4. Low-voltage control cabling.
5. Control-circuit conductors.
6. Identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

E. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

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C. Source quality-control reports.

D. Field quality-control reports.

E. Maintenance Data: For wire and cable to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.
2. Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install UTP and optical fiber cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

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2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262 by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

1. Flame Travel Distance: 60 inches (1520 mm) or less.
2. Peak Optical Smoke Density: 0.5 or less.
3. Average Optical Smoke Density: 0.15 or less.

B. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

C. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.3 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems".

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.4 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

B. Painting: Paint plywood on all sides and edges with black latex paint.

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2.5 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.6 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, power-limited tray cable, in cable tray, complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

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2.7 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.8 SOURCE QUALITY CONTROL

A. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows if possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Secure conduits to backboard if entering room from overhead.

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3. Extend conduits 3 inches (75 mm) above finished floor.
4. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
   Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.

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2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (305 mm) in diameter below each feed point.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).

4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.

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2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits, No. 12 AWG.

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping".

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems".

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems".

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

C. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 260523

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning and Grounding.
7. ILSCO.
8. O-Z/Gedney; A Brand of the EGS Electrical Group.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

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B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Exothermically welded connectors except at test wells and as otherwise indicated.

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3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Exothermically welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-

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tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a

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dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 260526

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

A. Product Data: For steel slotted support systems.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
4. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Hilti Inc.
        2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
        3) MKT Fastening, LLC.
        4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and

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pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.

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D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. Provide vertically mounted strut on all wall surface types for support of electrical equipment.
2. To Wood: Fasten with lag screws or through bolts.
3. To New Concrete: Bolt to concrete inserts.
4. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with best engineering practices for installation requirements for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

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C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with best engineering practices requirements in cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal with application of appropriate primer and matching finish paint.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
2. Communications Systems conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

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2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. ARC: Comply with ANSI C80.5 and UL 6A.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel or aluminum.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

    a. Material: Steel.
    b. Type: Setscrew.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. LFNC: Comply with UL 1660.

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D. Continuous HDPE: Comply with UL 651B.

E. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

F. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: Comply with UL 514B.

H. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

I. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R for wet or outdoor locations, unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy aluminum, Type FD, with gasketed cover.

D. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable or Semi-adjustable.
3. Shape: Rectangular.

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4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep

J. Gangable boxes are prohibited.

K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R for wet or outdoor locations, with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

L. Cabinets:

1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of hot-dip galvanized-steel diamond plate.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

a. Loading dock.

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b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.
d. Gymnasiums.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

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E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from Type EPC-40-PVC to GRC or IMC before rising above floor.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

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1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

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2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

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SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

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a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel.
4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

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C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
2. Sealant shall have VOC content of 400 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide [1/4-inch (6.4-mm)] annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

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5. Install sleeves for floor penetrations. Extend sleeves installed in floors [2 inches (50 mm)] above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

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C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

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C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

C. Tag

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).

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3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

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C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm)

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below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30A, and 120V to ground: Install labels at 30-foot (10-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power (Inverter).
2. Power.

C. Power-Circuit Conductor Identification, 600 V or Less: all conductors shall have factory applied color coding.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

a. Color shall be factory applied.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

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2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for whole circuit emergency lighting battery back-up.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

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c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

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1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 5351 (single), CR5362 (duplex).
b. Hubbell; HBL5351 (single), HBL5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI RECEPTACLES

A. General Description:

1. Straight blade, feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

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1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; VGF20.
    b. Hubbell; GFR5352L.
    c. Pass & Seymour; 2095.
    d. Leviton; 7590.

2.5 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    1) Single Pole:
        a) Cooper; AH1221.
        b) Hubbell; HBL1221.
        c) Leviton; 1221-2.
        d) Pass & Seymour; CSB20AC1.

    2) Two Pole:
        a) Cooper; AH1222.
        b) Hubbell; HBL1222.
        c) Leviton; 1222-2.
        d) Pass & Seymour; CSB20AC2.

    3) Three Way:
        a) Cooper; AH1223.
        b) Hubbell; HBL1223.
        c) Leviton; 1223-2.
        d) Pass & Seymour; CSB20AC3.

    4) Four Way:
        a) Cooper; AH1224.
        b) Hubbell; HBL1224.
        c) Leviton; 1224-2.
        d) Pass & Seymour; CSB20AC4.

C. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; AH1221L.
    b. Hubbell; HBL1221L.
    c. Leviton; 1221-2L.
    d. Pass & Seymour; PS20AC1-L.

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2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

A. Device Color:

1. Wiring Devices: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

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2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

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H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

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SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits, panelboards, and switchboards.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

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PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Service Entrance: Class L, fast acting.

B. Feeders: Class J, fast acting.

C. Motor Branch Circuits: Class RK5 time delay.

D. Other Branch Circuits: Class J, fast acting.

E. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 262813

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Exhibit G

Exhibits

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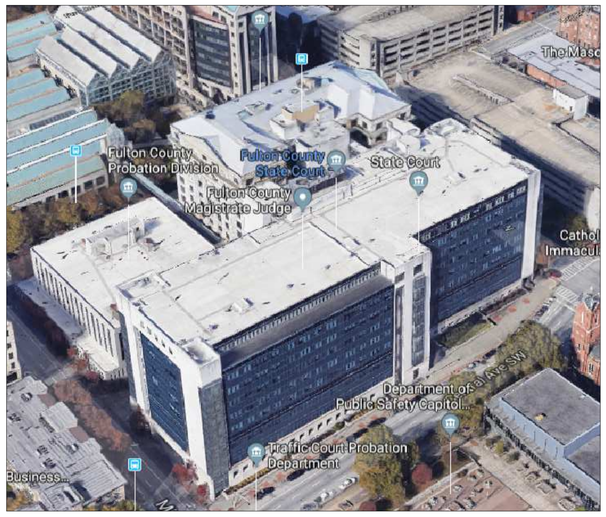
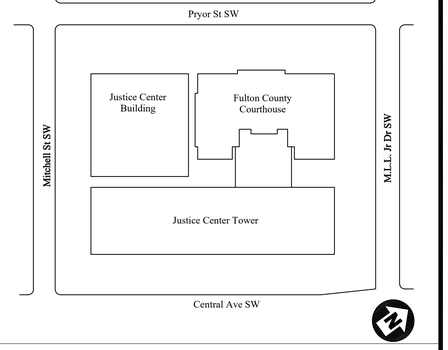


FULTON COUNTY JUSTICE CENTER COMPLEX SHEET LIST TABLE			
SHEET NUMBER	SHEET TITLE	SHEET NUMBER	SHEET TITLE
MC-000	MECHANICAL CONTROLS - COVER SHEET	MC-208	FULTON COUNTY COURTHOUSE - EIGHTH FLOOR PLAN
MC-001	MECHANICAL CONTROLS - GENERAL NOTES, LEGENDS & ABBREVIATIONS	MC-209	FULTON COUNTY COURTHOUSE - NINTH FLOOR PLAN
MC-10SLW	JUSTICE CENTER TOWER - SERVICE LEVEL PLAN - WEST	MC-20PH	FULTON COUNTY COURTHOUSE - PENTHOUSE FLOOR PLAN
MC-10SLE	JUSTICE CENTER TOWER - SERVICE LEVEL PLAN - EAST	MC-30B	JUSTICE CENTER BUILDING - BASEMENT FLOOR PLAN
MC-10PW	JUSTICE CENTER TOWER - PARKING LEVEL PLAN - WEST	MC-30G	JUSTICE CENTER BUILDING - GROUND FLOOR PLAN
MC-10PE	JUSTICE CENTER TOWER - PARKING LEVEL PLAN - EAST	MC-301	JUSTICE CENTER BUILDING - FIRST FLOOR PLAN
MC-10GW	JUSTICE CENTER TOWER - GROUND FLOOR PLAN - WEST	MC-302	JUSTICE CENTER BUILDING - SECOND FLOOR PLAN
MC-10GE	JUSTICE CENTER TOWER - GROUND FLOOR PLAN - EAST	MC-303	JUSTICE CENTER BUILDING - THIRD FLOOR PLAN
MC-101W	JUSTICE CENTER TOWER - FIRST FLOOR PLAN - WEST	MC-30R	JUSTICE CENTER BUILDING - ROOF PLAN
MC-101E	JUSTICE CENTER TOWER - FIRST FLOOR PLAN - EAST	MC-400	JUSTICE CENTER TOWER - ENLARGED FIRST FL INTERSTITIAL MECH RMS
MC-102W	JUSTICE CENTER TOWER - SECOND FLOOR PLAN - WEST	MC-401	JUSTICE CENTER TOWER - ENLARGED SECOND FL INTERSTITIAL MECH RMS
MC-102E	JUSTICE CENTER TOWER - SECOND FLOOR PLAN - EAST	MC-500	MECHANICAL CONTROLS - JUSTICE CENTER COMPLEX - DETAILS
MC-103W	JUSTICE CENTER TOWER - THIRD FLOOR PLAN - WEST	MC-501	MECHANICAL CONTROLS - JUSTICE CENTER TOWER - DETAILS
MC-103E	JUSTICE CENTER TOWER - THIRD FLOOR PLAN - EAST	MC-502	MECHANICAL CONTROLS - JUSTICE CENTER TOWER - DETAILS
MC-104W	JUSTICE CENTER TOWER - FOURTH FLOOR PLAN - WEST	MC-520	MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - DETAILS
MC-104E	JUSTICE CENTER TOWER - FOURTH FLOOR PLAN - EAST	MC-530	MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - DETAILS
MC-105W	JUSTICE CENTER TOWER - FIFTH FLOOR PLAN - WEST	MC-600	MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEDULES
MC-105E	JUSTICE CENTER TOWER - FIFTH FLOOR PLAN - EAST	MC-601	MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEDULES
MC-107W	JUSTICE CENTER TOWER - SEVENTH FLOOR PLAN - WEST	MC-602	MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEDULES
MC-107E	JUSTICE CENTER TOWER - SEVENTH FLOOR PLAN - EAST	MC-620	MECHANICAL CONTROLS- FULTON COUNTY COURTHOUSE- SCHEDULES
MC-108W	JUSTICE CENTER TOWER - EIGHTH FLOOR PLAN - WEST	MC-621	MECHANICAL CONTROLS- FULTON COUNTY COURTHOUSE- SCHEDULES
MC-108E	JUSTICE CENTER TOWER - EIGHTH FLOOR PLAN - EAST	MC-630	MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - SCHEDULES
MC-109W	JUSTICE CENTER TOWER - NINTH FLOOR PLAN - WEST	MC-700	MECHANICAL CONTROLS- JUSTICE CENTER TOWER- SCHEMATICS
MC-109E	JUSTICE CENTER TOWER - NINTH FLOOR PLAN - EAST	MC-701	MECHANICAL CONTROLS- JUSTICE CENTER TOWER- SCHEMATICS
MC-10RW	JUSTICE CENTER TOWER - ROOF PLAN - WEST	MC-702	MECHANICAL CONTROLS- JUSTICE CENTER TOWER- SCHEMATICS
MC-10RE	JUSTICE CENTER TOWER - ROOF PLAN - EAST	MC-703	MECHANICAL CONTROLS- JUSTICE CENTER TOWER- SCHEMATICS
MC-20B	FULTON COUNTY COURTHOUSE - BASEMENT FLOOR PLAN	MC-720	MECHANICAL CONTROLS- FULTON COUNTY COURTHOUSE- SCHEMATICS
MC-20G	FULTON COUNTY COURTHOUSE - GROUND FLOOR PLAN	MC-721	MECHANICAL CONTROLS- FULTON COUNTY COURTHOUSE- SCHEMATICS
MC-201	FULTON COUNTY COURTHOUSE - FIRST FLOOR PLAN	MC-722	MECHANICAL CONTROLS- FULTON COUNTY COURTHOUSE- SCHEMATICS
MC-202	FULTON COUNTY COURTHOUSE - SECOND FLOOR PLAN	MC-723	MECHANICAL CONTROLS- FULTON COUNTY COURTHOUSE- SCHEMATICS
MC-203	FULTON COUNTY COURTHOUSE - THIRD FLOOR PLAN	MC-730	MECHANICAL CONTROLS- JUSTICE CENTER BUILDING- SCHEMATICS
MC-204	FULTON COUNTY COURTHOUSE - FOURTH FLOOR PLAN	MC-731	MECHANICAL CONTROLS- JUSTICE CENTER BUILDING- SCHEMATICS
MC-205	FULTON COUNTY COURTHOUSE - FIFTH FLOOR PLAN	MC-740	MECHANICAL CONTROLS- JUSTICE CENTER COMPLEX- SCHEMATICS
MC-206	FULTON COUNTY COURTHOUSE - SIXTH FLOOR PLAN	MC-741	MECHANICAL CONTROLS- JUSTICE CENTER COMPLEX- SCHEMATICS
MC-207	FULTON COUNTY COURTHOUSE - SEVENTH FLOOR PLAN	MC-742	MECHANICAL CONTROLS- JUSTICE CENTER COMPLEX- SCHEMATICS



FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

OWNER

FULTON COUNTY GOVERNMENT
OF THE STATE OF GEORGIA
141 PRYOR ST SW
ATLANTA, GA 30303

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270 PEACHTREE STREET N.W. SUITE 1600
ATLANTA, GA 30303
T: 404-524-4800
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FCURA PROGRAM MANAGER

HEERY / McAFEE3 - A JOINT VENTURE
999 PEACHTREE ST NE
ATLANTA, GA 30309

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FULTON COUNTY

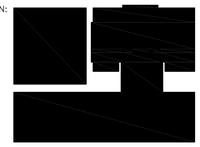
FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED

NO.	DESCRIPTION	DATE

KEY PLAN:



SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - COVER SHEET

DRAWING NO.
MC-000

ISSUED FOR BID

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

HVAC GENERAL NOTES

1. DRAWINGS ARE DIAGRAMMATIC. CONTRACTOR SHALL COORDINATE EXACT LOCATIONS AND ELEVATIONS OF ALL AIR TERMINAL UNITS AND ASSOCIATED DUCTWORK CONNECTIONS AND POWER PRIOR TO INSTALLATION.
2. CONTRACTOR SHALL VISIT THE SITE TO COORDINATE NEW WORK WITH EXISTING CONDITIONS. LOCATIONS SHOWN FOR EQUIPMENT ARE APPROXIMATE LOCATION AND ARE LOCATED PER EXISTING "RECORD" DRAWINGS.
3. DO NOT LOCATE VALVES, DAMPERS, ACTUATORS, CONTROL COMPONENTS, ANY EQUIPMENT WITH MOVING PARTS OR ANY EQUIPMENT REQUIRING ACCESS OR REGULAR MAINTENANCE ABOVE INACCESSIBLE CEILINGS.
4. COORDINATE MECHANICAL AND ELECTRICAL SUCH THAT DUCTWORK OR MECHANICAL EQUIPMENT ARE NOT LOCATED OVER ANY ELECTRICAL EQUIPMENT.
5. DO NOT LOCATE DUCT AND EQUIPMENT SUCH THAT ACCESS IS UNACCEPTABLE FOR FACILITIES MAINTENANCE AND REPAIR.
6. REPLACE EXISTING SPACE/ROOM THERMOSTATS/SENSORS WITH NEW ONES AND LOCATE AT THE SAME LOCATIONS. FIELD VERIFY LOCATION AND CONFIRM HEIGHT OF EXISTING SENSORS/THERMOSTATS, RELOCATED AS REQUIRED FOR ADA HEIGHT REQUIREMENTS, 48" A.F.F.
7. THE CONTRACTOR SHALL VERIFY ELECTRICAL POWER AND CONTROL VOLTAGE AND PHASE FOR EACH PIECE OF EQUIPMENT PRIOR TO BID AND BEFORE ORDERING ANY ELECTRICALLY OPERATED EQUIPMENT.
8. ALL ELECTRICAL WIRING IN CEILING PLENUMS SHALL BE PLENUM RATED CABLE OR RUN IN CONDUIT.
9. REFER TO EACH DRAWING SHEET FOR NOTES SPECIFIC TO THAT SHEET.
10. IF A DISCREPANCY OR CONFLICTING REQUIREMENT IS FOUND, CONTACT THE ENGINEER-OF-RECORD IMMEDIATELY. THE ORDER OF PRECEDENCE FOR DIVISION 23 IS AS FOLLOWS:
    1 CURRENT DESIGN CODES AND APPLICABLE GOVERNMENT REGULATIONS
    2 SPECIFICATIONS
    3 SCHEDULES
    4 GENERAL NOTES
    5 DETAILS
    6 FLOOR PLANS
11. PROVIDE ALL NECESSARY LABOR AND MATERIALS FOR THE REPLACEMENT OF ALL AIR TERMINAL UNITS. ANY COMPONENT OR MATERIALS OBVIOUSLY A PART OF THE SYSTEM AND NECESSARY FOR ITS PROPER OPERATION, ALTHOUGH NOT SPECIFICALLY MENTIONED HEREIN, SHALL BE PROVIDED AS IF CALLED FOR IN DETAIL.
12. WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH ALL STATE AND LOCAL CODES, ANY AND ALL GOVERNMENT REGULATIONS AND NFPA STANDARD 90A.
13. ATTAIN AND PAY FOR ALL REQUIRED PERMITS AND FEES.
14. MATERIALS AND WORKMANSHIP SHALL BE GUARANTEED AGAINST DEFECTS FOR ONE YEAR.
15. PROTECT ALL MATERIALS AND EQUIPMENT FROM DAMAGE.
16. EQUIPMENT AND MATERIALS SHALL BE NEW, UNLESS OTHERWISE SPECIFIED.
17. ALL WORK SHALL BE COORDINATED WITH EXISTING CONDITION AND ALL OTHER TRADES BEFORE ANY INSTALLATION IS MADE.
18. INSTALLATION OF ALL EQUIPMENT SHALL PERMIT ACCESSIBILITY FOR SERVICE AND/OR REPLACEMENT.
19. EXISTING ELECTRICAL DISCONNECTS AND/OR BREAKERS TO REMAIN. NEW AIR TERMINAL TO BE RECONNECTED TO EXISTING POWER. FILED VERIFY LOCATION AND TYPE OF POWER REQUIREMENT TO EACH TERMINAL UNIT. MECHANICAL WORK SHALL INCLUDE CONTROL AND INTERLOCK WIRING REQUIRED FOR PROPER OPERATION OF THE SYSTEM, AND SHALL INCLUDE FURNISHING OF MAGNETIC STARTERS OR CONTRACTS WHERE REQUIRED, UNLESS OTHERWISE NOTED. THE REUSE OF EXISTING ELECTRICAL WIRING CONNECTIONS IS PERMITTED PROVIDED THEY ARE OF THE APPROPRIATE SIZE AND LENGTH TO MEET NEC AND UNIT SERVICEABILITY.
20. COORDINATED VOLTAGE AND PHASE OF EACH PIECE OF EQUIPMENT WITH ELECTRICAL CONTRACTOR BEFORE ORDERING.
21. COMPLETION AND TESTS SHALL INCLUDE CLEANING AND LUBRICATION OF ALL EQUIPMENT, AND ADJUSTMENTS FOR PROPER OPERATION, ADJUST DAMPERS, REGISTERS AND DIFFUSERS FOR PROPER AIR DISTRIBUTION. CHECK UNDER ACTUAL OPERATING CONDITIONS AND MAKE ADJUSTMENTS FOR A UNIFORM TEMPERATURE THROUGH THE CONDITIONED SPACE.
22. EQUIPMENT SHALL BE STARTED AND STOPPED, CONTROLLED AND/OR MONITORED BY THE BUILDING AUTOMATION SYSTEM (BAS).
23. THE OWNER AND ENGINEER ARE NOT RESPONSIBLE FOR THE CONTRACTOR'S SAFETY PRECAUTIONS OR MEANS, METHODS, TECHNIQUES, CONSTRUCTION SEQUENCES, OR PROCEDURES REQUIRED TO PERFORM WORK.
24. ALL MISCELLANEOUS STRUCTURAL SUPPORTS REQUIRED FOR HVAC EQUIPMENT INSTALLATIONS SHALL BE PROVIDED BY HVAC CONTRACTOR.
25. ALL THERMOSTATIC CONTROLS SHALL HAVE 5°F DEADBAND.
26. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH STATE CODES, MANUFACTURER'S APPROVED PUBLISHED LITERATURE, AND AUTHORITIES HAVING JURISDICTION.

DUCTWORK NOTES

1. ALL EXISTING DUCTWORK TO REMAIN.
2. FIELD VERIFY SIZE OF DUCT INLET AND OUTLET TO EACH EXISTING TERMINAL UNIT AND REPLACE AND/OR TRANSITION AS NEEDED TO RECONNECT TO NEW UNIT.
3. IF NEW DUCTWORK IS REQUIRED TO CONNECT TO NEW TERMINAL UNITS, USE THE SAME MATERIAL AS EXISTING WITH NEW INSULATION.
4. ALL DUCT TRANSITIONS FROM SQUARE TO ROUND SHALL BE SMOOTH AND GRADUAL SQUARE TO ROUND TRANSITIONS.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SHEET METAL TRANSITIONS AT AIR TERMINAL UNITS, PIU'S, AND OTHER SIMILAR EQUIPMENT.
6. RUNOUTS TO TERMINAL UNITS SHALL BE SAME SIZE AS UNIT CONNECTION UNLESS RUNOUTS LENGTH EXCEEDS 5'-0", THEN RUNOUTS SHALL BE 2" LARGER DIAMETER THAN INLET CONNECTION.
7. THIS CONTRACTOR SHALL PROVIDE METAL ACCESS PANELS IN THE NON-ACCESSIBLE CEILINGS, WHERE THE VAV's, ETC. ARE LOCATED, FOR MAINTAINING AND SERVICING THE UNITS. CONTRACTOR TO CARRY AN ALLOWANCE IN THEIR BID PRICE FOR ACCESS PANELS FOR 10% OF THE TOTAL VAV/PIU COUNT.

DEMOLITION NOTES

1. THE DRAWINGS DEPICT ONLY GENERALLY THE EXISTING CONDITIONS. THE CONTRACTOR SHALL MAKE FIELD OBSERVATIONS AND CONFIRM THE LOCATIONS OF EXISTING TERMINAL UNITS THAT NEED TO BE REPLACED.
2. DEMOLITION WORK SHALL BE DONE BY THE CONTRACTOR. THE CONTRACTOR SHALL COORDINATE ALL WORK CONCERNING EXISTING EQUIPMENT AND SYSTEMS REMAINING IN THE BUILDING.
3. ALL EXISTING CONTROL PANEL DEVICES, SENSORS, WIRING, CONDUIT ACCESSORIES NOT REQUIRED FOR NEW BAS SHALL BE REMOVED BY THIS CONTRACTOR.
4. SMOKE CONTROL RELAY PANELS AT LOCATIONS SHOWN SHALL REMAIN AS PART OF FAS. REFER TO PLANS FOR EXAMPLES.
5. THE CONTRACTOR IS RESPONSIBLE TO FOLLOW BUILDING MANAGEMENT RULES WITH REGARD TO TRASH, ELEVATORS, NOISE, SPRINKLERS, AND FIRE ALARM.
6. THE CONTRACTOR SHALL MAINTAIN IN OPERATION ALL EXISTING UTILITIES DURING CONSTRUCTION.
7. ITEMS IDENTIFIED TO BE SALVAGED SHALL BE STOCKPILED IN THE AREA FOR REMOVAL BY THE OWNER; ALL OTHER ITEMS TO BE REMOVED SHALL BE DISPOSED OF LEGALLY OFF SITE.
8. ALL DEMOLITION WORK WILL BE SCHEDULED WITH BUILDING MANAGEMENT AND PERFORMED ONLY FOLLOWING APPROVAL.
9. THE CONTRACTOR SHALL INFORM BUILDING MANAGEMENT AND RECEIVE SCHEDULE APPROVAL FOR ANY REQUIRED UTILITY SHUTDOWN
10. PATCH WALL AND/OR CEILING LOCATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES.

THE BUILDING AUTOMATION SYSTEM UPGRADE PROJECT INCLUDES BUT IS NOT LIMITED TO THESE GENERAL SCOPE OF WORK NOTES

FULTON COUNTY IS SEEKING THE SERVICES OF AN EXPERIENCED AND QUALIFIED CONTRACTOR TO BE THE PRIMARY RESPONSIBLE PARTY TO DELIVER A COMPLETE, TURNKEY SOLUTION FOR ALL WORK AS DEFINED BY THE CONTRACT DOCUMENTS THAT INCLUDE DESIGN DRAWINGS AND SPECIFICATIONS. THE WORK AS ILLUSTRATED IN THESE CONTRACT DOCUMENTS WILL REQUIRE MECHANICAL, ELECTRICAL AND CONTROL SYSTEM EXPERTISE.

A. THIS IS A TURNKEY PROJECT AND SHALL INCLUDE, BUT NOT LIMITED TO ALL CONTROL EQUIPMENT AND ASSOCIATED SOFTWARE APPLICATION AND WIRING; REPLACEMENT OF TERMINAL UNITS AND ASSOCIATED DUCTWORK AND BALANCING/COMMISSIONING OF HVAC SYSTEMS.

B. FURNISH, INSTALL, PROGRAM AND COMMISSION A NEW NATIVE BACNET COMPLIANT, ENTERPRISE BUILDING AUTOMATION SYSTEM (BAS) AT THE FULTON COUNTY JUSTICE CENTER COMPLEX, WHICH INCLUDES THREE BUILDINGS, THE JUSTICE CENTER TOWER (JCT), THE FULTON COUNTY COURTHOUSE (FCC), AND THE JUSTICE CENTER BUILDING (JCB).

C. THE NEW BAS WILL AUTOMATICALLY CONTROL AND MONITOR ALL EXISTING HVAC EQUIPMENT AS SPECIFIED. CONTRACTOR WILL FURNISH SUBMITTAL DRAWINGS, MATERIAL, INSTALLATION, PROGRAMMING, STANDARD START-UP AND COORDINATE COMMISSIONING OF BAS SYSTEM WITH THE OWNER APPOINTED COMMISSIONING AGENT.

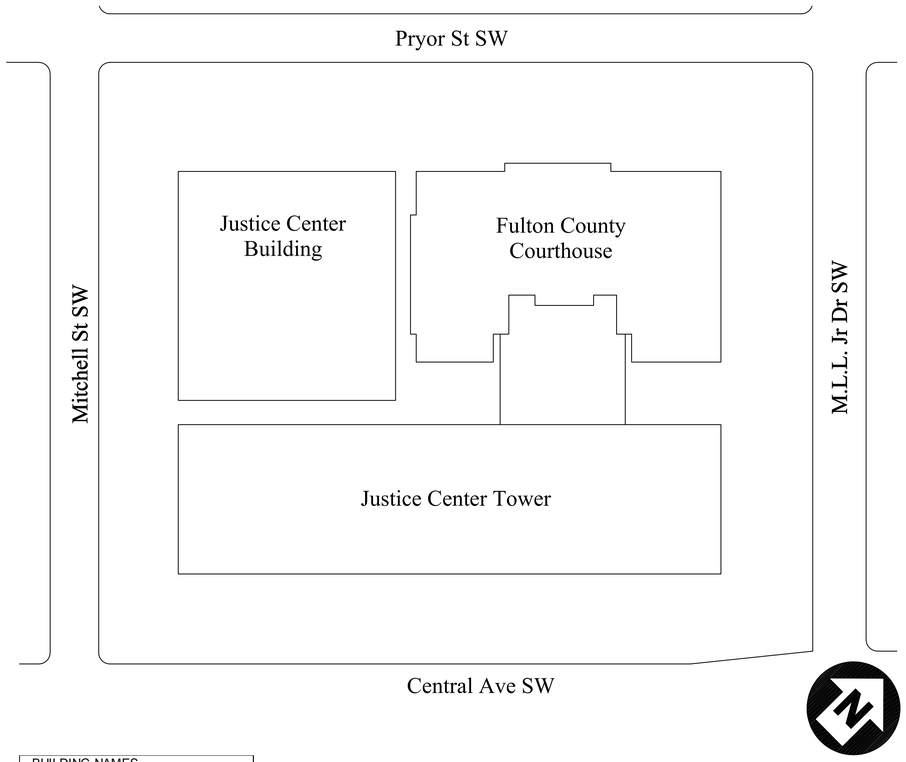
D. THE BAS SHALL BE AN INTEGRATED AUTOMATION SYSTEM (IAS) IMPLEMENTATION USING A NIAGARA FRAMEWORK AND BACNET IP AND BACNET MS/TP NETWORK TOPOLOGY WITH THE FOLLOWING CONTROLLERS:
1. TRIDIUM 8000 JAVA APPLICATION CONTROL ENGINES (JACE).
2. BUILDING CONTROLLERS (B-BCS).
3. ADVANCED APPLICATION CONTROLLERS (B-AAC).
4. APPLICATION SPECIFIC CONTROLLERS (B-ASC).
5. NEW AND EXISTING VARIABLE FREQUENCY DRIVES (VFDS).
6. ENERGY AND BTU METERING EQUIPMENT.
7. FULL INTEGRATION OF THE EXISTING TRANE DDC CONTROL SYSTEM INTO THE NIAGARA IAS PLATFORM.
8. FUTURE INTEGRATION FOR FIRE ALARM, ACCESS CONTROL, SECURITY AND LIGHTING.

E. THE FOLLOWING HVAC EQUIPMENT SHALL BE INCORPORATED INTO THE NEW BAS:
1. VARIABLE VOLUME CHILLED WATER AIR HANDLING UNITS.
2. CONSTANT VOLUME CHILLED WATER AIR HANDLING UNITS.
3. UNIT HEATERS WITH ELECTRIC HEATING COILS FOR THE CENTRAL ENERGY PLANT.
4. DOMESTIC WATER PUMPS.
5. NEW VAV TERMINAL UNITS RETROFITTED UNDER THIS PROJECT SCOPE.
6. NEW PACKAGED DX AIR CONDITIONING UNITS RETROFITTED UNDER A SEPARATE CONTRACT SCOPE.
7. VARIOUS SUPPLY, EXHAUST AND SMOKE CONTROL FANS (ALL SMOKE SEQUENCES ARE MANAGED BY A NEWLY FURNISHED FAS UNDER SEPARATE CONTRACT SCOPE).
8. MAIN DISTRIBUTION PANEL ELECTRICAL ENERGY METERING, CHILLED WATER BTU METERING AND COOLING TOWER MAKE-UP WATER METERING.

F. THE FOLLOWING HVAC EQUIPMENT IMPROVEMENTS SHALL BE PROVIDED:
1. REPLACE ALL EXISTING AIR HANDLING UNIT CHILLED WATER VALVES WITH NEW PRESSURE INDEPENDENT CONTROL VALVES AND ACTUATORS.
2. TEST AND REPLACE AS REQUIRED ALL LOW TEMPERATURE SAFETY DEVICES, DAMPER END SWITCHES, HIGH-PRESSURE AND LOW-PRESSURE CUTOUT SAFETY SWITCHES.
3. TEST, IDENTIFY AND REPORT ON ANY OUTSIDE AIR OR RETURN AIR DAMPERS DETERMINED TO BE INOPERATIVE.
4. FURNISH AND INSTALL NEW ELECTRIC DAMPER ACTUATORS ON ALL OUTSIDE AND RETURN AIR DAMPERS.
5. FURNISH AND INSTALL AIR FLOW MEASURING STATIONS IN THE OUTSIDE AIR DUCT WHERE NOTED.
6. FURNISH AND INSTALL NEW AHU-1 SUPPLY AIR FAN VARIABLE FREQUENCY DRIVES IN JCB (QTY 2).
7. FURNISH AND INSTALL NEW VAV TERMINAL UNITS AT ALL LOCATIONS WITH FACTORY MOUNTED CONTROLS AS NOTED ON DRAWINGS.
   - VAV TERMINAL UNIT CONTROLS SHALL USE STAGED HEATING AND NOT SCR HEAT
   - VAV TERMINAL UNIT CONTROLS SHALL INCLUDE I/O SPACE AND FUNCTIONALITY FOR FUTURE LIGHTING INTEGRATION INCLUDING OCCUPANCY SENSORS AND CURRENT TRANSDUCER MONITORING OF LIGHTING CIRCUITS FOR LOCAL OCCUPANCY STATUS/CONTROL.
8. LOCATE AND FURNISH ALL REQUIRED POWER FOR NEW BACNET CONTROL PANELS AND DEVICES AS REQUIRED.
9. FURNISH AND INSTALL IP AND BACNET ROUTERS AND REPEATERS AS REQUIRED FOR A FULLY FUNCTIONING SYSTEM THAT MEETS DATA THROUGHPUT REQUIREMENTS NOTED IN THE SPECIFICATONS

G. MAINTENANCE MANAGEMENT SOFTWARE.
SYSTEM SHALL MONITOR EQUIPMENT STATUS AND GENERATE MAINTENANCE MESSAGES BASED ON OPERATOR-DESIGNATED RUN-TIMES, STARTS AND CALENDAR DATE LIMITS.
1. PROVIDE GENERAL HVAC EQUIPMENT REMINDERS THAT OCCUR EVERY 1.000 (ADJUSTABLE) HOURS OF EQUIPMENT RUNTIME.
2. PROVIDE SEASONAL HVAC EQUIPMENT RECURRING REMINDERS THAT ARE CALENDAR BASED.
3. INCLUDE MULTIPLE EXTENDED MESSAGE CAPABILITY TO ALLOW OPERATOR ASSIGNMENT AND PRINTING OF EXTENDED MAINTENANCE MESSAGES PER INDIVIDUAL HVAC EQUIPMENT.
4. REFER TO SPECIFICATION INTEGRATED AUTOMATION SYSTEM SECTION 250000.

H. EXISTING TRANE BAS CONTROLS INTEGRATION.
1. THIS CONTRACTOR SHALL SPECIFICALLY BE REQUIRED TO FULLY INTEGRATE THE EXISTING TRANE BAS CONTROLS RECENTLY INSTALLED IN LIMITED AREAS OF THE FULTON COUNTY JUSTICE CENTER TOWER, PARTICULARLY THE CENTRAL PLANT AND AIR HANDLING SYSTEM ON FLOORS FIVE THROUGH NINE. FURNISH AND INSTALL THE REQUIRED NUMBER OF JACE NETWORK CONTROLLERS TO DISCOVER ALL DATA THROUGH BACNET INTEGRATION. IT WILL BE THIS CONTRACTOR RESPONSIBILITY TO EXPOSE ALL TRANE DATA MAY OR MAY NOT BE CURRENTLY EXPOSED VIA BACNET IN ORDER TO SATISFY THE REQUIREMENTS OF THIS PROJECT. IT IS ANTICIPATED THAT AT LEAST TWO JACE8000 CONTROLLERS WILL BE REQUIRED TO PERFORM THIS SCOPE.



BUILDING NAMES
FCC - FULTON COUNTY COURTHOUSE
JCB - JUSTICE CENTER BUILDING
JCT - JUSTICE CENTER TOWER

ABBREVIATION LEGEND

ABBREV	DESCRIPTION	ABBREV	DESCRIPTION
AHU	AIR HANDLING UNIT	LCS	LOCAL CONTROL STATION
AI	ANALOG INPUT	LCP	LOCAL CONTROL PANEL
AO	ANALOG OUTPUT	LOS	LOCK OUT STOP
BLDG	BUILDING	NIP	NETWORK INTERFACE PANEL
B	BOILER	O/C	OPEN/CLOSER
BOP	BOTTOM OF PIPE (ELEVATION)	O/R	OVERRIDE
CHG	CHILLER GODBOLD BLDG	O/O	ON/OFF
CH	CHILLER	OCR	OPEN-CLOSE-REMOTE
CHWP	CHILLED WATER PUMP	OIT	OPERATOR INTERFACE TERMINAL
CHWR	CHILLED WATER RETURN	OSC	OPEN-STOP-CLOSE
CHWS	CHILLED WATER SUPPLY	PA	PROFIBUS PA
COS	CHANGE OF STATE	POC	POINT OF CONTROL
CR	CONDENSATE RETURN	PRV	PRESSURE REDUCING VALVE
CWP	CONDENSER WATER PUMP	PS	PRESSURE SENSOR
CWR	CONDENSER WATER RETURN	RST	RESET
CWS	CONDENSER WATER SUPPLY	R/L	REMOTE/LOCAL
DI	DIGITAL INPUT	RIO	REMOTE I/O PANEL
DO	DIGITAL OUTPUT	S/S	START/STOP
DP	PROFIBUS DP	SIL	SILENCE
DPS	DIFFERENTIAL PRESSURE SWITCH	TT	TEMPERATURE TRANSMITTER
E-STOP	EMERGENCY STOP	UPS	UNINTERRUPTABLE POWER SUPPLY
ET	EXPANSION TANK	V	VARIABLE SPEED
FM/FS	FLOW METER / FLOW SWITCH	VAV	VARIABLE AIR VOLUME (VAV)
F/R	FORWARD/REVERSE	VFD	VARIABLE FREQUENCY DRIVE (VFD)
FOR	FORWARD-OFF-REVERSE	*	SUPPLIED WITH ELECTRICAL OR MECHANICAL EQUIPMENT
FOS	FAST-OFF-SLOW	* *	SUPPLIED WITH VENDOR PACKAGE
HMI	HUMAN MACHINE INTERFACE	Δ	SUPPLIED BY CONTROLS SYSTEMS INTEGRATOR
HOA	HAND-OFF-AUTO		
HOR	HAND-OFF-REMOTE		
HW	HOT WATER		
HWP	HOT WATER PUMP		
IP	ETHERNET I/P		
L/R	LOWER/RAISE		
LAR	LOWER-AUTO-RAISE		
LAP	LOCAL ALARM PANEL		

SYMBOL LEGEND

SYMBOL	DESCRIPTION
N.C. C N.O.	3-WAYAUTOMATIC CONTROL VALVE - NORMALLY OPEN, CLOSED AND COMMON PORTS INDICATED
N.C.	2-WAY AUTOMATIC CONTROL VALVE - NORMALLY CLOSED
N.O.	2-WAY AUTOMATIC CONTROL VALVE - NORMALLY OPEN
M N.C.	AUTOMATIC BUTTERFLY VALVE - NORMALLY CLOSED
M N.O.	AUTOMATIC BUTTERFLY VALVE - NORMALLY OPEN
C M N.O. N.C.	AUTOMATIC LINKED BUTTERFLY VALVES - NORMALLY OPEN, CLOSED AND COMMON PORTS INDICATED
	MANUAL BALL VALVE FOR SHUT-OFF OR BALANCING
SW	STOP AND WASTE BALL VALVE
	BALL VALVE WITH PRESSURE TAP
	BALL VALVE WITH PRESSURE TAP AND MEMORY STOP
	BALL VALVE WITH PRESSURE AND TEMPERATURE TAP
	BALL VALVE WITH PRESS. & TEMP. TAP AND MEMORY STOP
	MANUAL BALANCING BALL VALVE WITH MEMORY STOP
	NORMALLY CLOSED MOTORIZED BALL VALVE
	NORMALLY OPEN MOTORIZED BALL VALVE
	VALVE BOX
	AUTOMATIC CONTROL FLOW CONTROL VALVE WITH PRESSURE AND TEMPERATURE TAP
	MANUAL GATE VALVE
	MANUAL GLOBE VALVE
	CALIBRATED BALANCING VALVE
	MANUAL PLUG VALVE
	MANUAL BUTTERFLY VALVE
	WHEEL OPERATED BUTTERFLY VALVE
	GAGE COCK
OR	CHECK VALVE
	VACUUM BREAKER
	GAS COCK
	PRESSURE REGULATING OR REDUCING VALVE - EUIP. MARK
	STRAINER WITH BLOW DOWN VALVE
	STRAINER
	MANUAL AIR VENT
S	REFRIGERANT SOLENOID VALVE - 2 WAY
	FLANGE CONNECTION
	UNION
	SAFETY RELIEF VALVE - EQUIP. MARK

SYMBOL	DESCRIPTION
X X X	CONTROL POINT
AFM	AIRFLOW MEASURING STATION
S OR S	SENSOR
	TEMPERATURE SENSOR WITH AVERAGING ELEMENT
MD OR MD	MOTORIZED DAMPER
SD	SMOKE DAMPER
DP	STATIC PRESSURE SENSOR
M	MOTOR
VFD	VARIABLE FREQUENCY DRIVE
T OR T	TEMPERATURE SENSOR/THERMOSTAT
H OR H	HUMIDITY SENSOR/HUMIDISTAT
CO2 OR C OR C	CARBON DIOXIDE SENSOR
SMK	SMOKE DETECTOR SENSOR
ES	DAMPER END SWITCH
MD OR	HUMIDIFIER
TS	PIPING TEMPERATURE SENSOR/THERMOMETER
	PIPING PRESSURE GAUGE
DP	PIPING DIFFERENTIAL PRESSURE SENSOR
M	PIPING FLOW METER
	PIPING TWO-WAY CONTROL VALVE
	PIPING THREE WAY CONTROL VALVE
AO	ANALOG OUTPUT
AI	ANALOG INPUT
DO	DIGITAL OUTPUT
DI	DIGITAL INPUT
	KNIFE GATE VALVE
	DIAPHRAGM VALVE
	ANGLE VALVE
	NEEDLE VALVE
S	SOLENOID VALVE - 3 WAY

SYMBOL	DESCRIPTION
S	SOLENOID VALVE - 4 WAY
	PNEUMATIC DIAPHRAGM CONTROL VALVE
	SELF-CONTAINED PRESSURE REGULATING VALVE
	SELF-CONTAINED BACK PRESSURE REGULATING VALVE
	SLIDE GATE
	WEIR GATE
OR	STOP GATE
EM	ELECTRIC MOTOR
P	PNEUMATIC ACTUATOR
	PNEUMATIC CYLINDER
VS	MECHANICAL VARIABLE SPEED REDUCER
M	SUBMERSIBLE PUMP
M	CENTRIFUGAL PUMP
M	VERTICAL TURBINE PUMP
M	PROGRESSIVE CAVITY PUMP
M	ROTARY LOBE PUMP
M	SUBMERSIBLE CHOPPER PUMP
M	PERISTALTIC OR HOSE PUMP
M	DIAPHRAGM PUMP
M	BLOWER
M	GRINDER
FE L	ANNULAR FLOW ELEMENT
	TURBINE OR PROPELLER METER
FE	DOPPLER OR TRANSIT TIME SONIC FLOW ELEMENT
	SONIC LEVEL ELEMENT
	FLOAT ON DISPLACER LEVEL ELEMENT
	CONDUCTANCE PROBE TYPE LEVEL ELEMENT

SYMBOL	DESCRIPTION	SINGLE FUNCTION	MULTIPLE FUNCTION	DESCRIPTION
	ULTRASONIC LEVEL TRANSDUCER			
RADAR	RADAR LEVEL TRANSMITTER			FIELD MOUNTED INSTRUMENT OR DEVICE
PI	PRESSURE INDICATOR			FRONT OF PANEL MOUNTED INSTRUMENT ON LOCAL PANEL
FE	THERMAL DISPERSION FLOW ELEMENT			REAR OF PANEL MOUNTED INSTRUMENT ON LOCAL PANEL
	TRANSIT TIME OR DOPPLER ULTRASONIC FLOW METER			FRONT OF PANEL MOUNTED INSTRUMENT ON MAIN PANEL
	DOUBLE CHECK VALVE			
	DIAPHRAGM CHECK			REAR OF PANEL MOUNTED INSTRUMENT ON MAIN PANEL
	RUPTURE DISC			
	PRESSURE OR VACUUM RELIEF VALVE			PLC PROGRAMMED FUNCTION OPERATOR ACCESSIBLE THRU WORKSTATION HMI DISPLAY
	AIR RELIEF VALVE			
	CHEMICAL DIAPHRAGM SEAL			PLC PROGRAMMED FUNCTION OPERATOR ACCESSIBLE THRU REMOTE O/T DISPLAY
	INLINE PRESSURE SEAL			
	MIXER	#	#	I/O POINT OR PORTAL. EITHER VIRTUAL OR HARDWIRED.
	AGITATOR			
	SURFACE AERATOR			ELECTRICAL INTERLOCK
HW				HARDWIRED I/O INTERFACE
PA				PROFIBUS PA I/O INTERFACE
F OR F	FILTER			
DP				PROFIBUS DP I/O INTERFACE
IP				ETHERNET IP I/O INTERFACE
	VENT WITH CAP OR SCREEN			CONNECT TO EXISTING
	SPRAY SYSTEM			
	CHANNEL AIR DIFFUSER			
	FLOAT OPERATED VALVE			
	IN-LINE STATIC MIXER			
	EJECTOR/EDUCTOR			
	HOSE COUPLING			
	SAMPLE TAP (REMOTE)			
	SAMPLE TAP (LOCAL)			
	PULSATION DAMPENER			
ES	ELECTRICAL SUPPLY			
PTZ	CAMERA WITH PAN, TILT AND ZOOM			
	CAMERA WITH FIXED POSTION AND FOCAL LENGTH			

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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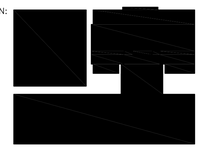
KEY PLAN:



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DRAWING TITLE
MECHANICAL CONTROLS - GENERAL NOTES, LEGENDS & ABBREVIATIONS

DRAWING NO.
MC-001

ISSUED FOR BID

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#	MECHANICAL CONTROLS KEYED NOTES
1	ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY, N.I.C.
2	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT, SEE CONTROLS SCHEMATICS ON SHEETS MC-702.
3	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
4	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR FAN COIL UNITS
5	FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.
6	FURNISH AND INSTALL NEW BACNET CONTROLLER TO EXISTING EXHAUST FAN. REFER TO SCHEMATICS ON SHEET MC-702.
7	CONDENSER UNIT ASSOCIATED WITH ACU-7.
8	CONDENSER UNIT ASSOCIATED WITH ACU-8.
9	WATER MAKE-UP AND SPRING EQUIPMENT SHOWN FOR CLARITY PURPOSES ONLY, N.I.C.

1 JUSTICE CENTER TOWER - SERVICE LEVEL PLAN - WEST
MC-10SLW SCALE: 1/8" = 1'-0"

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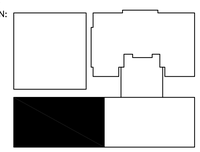

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SERVICE LEVEL PLAN - WEST

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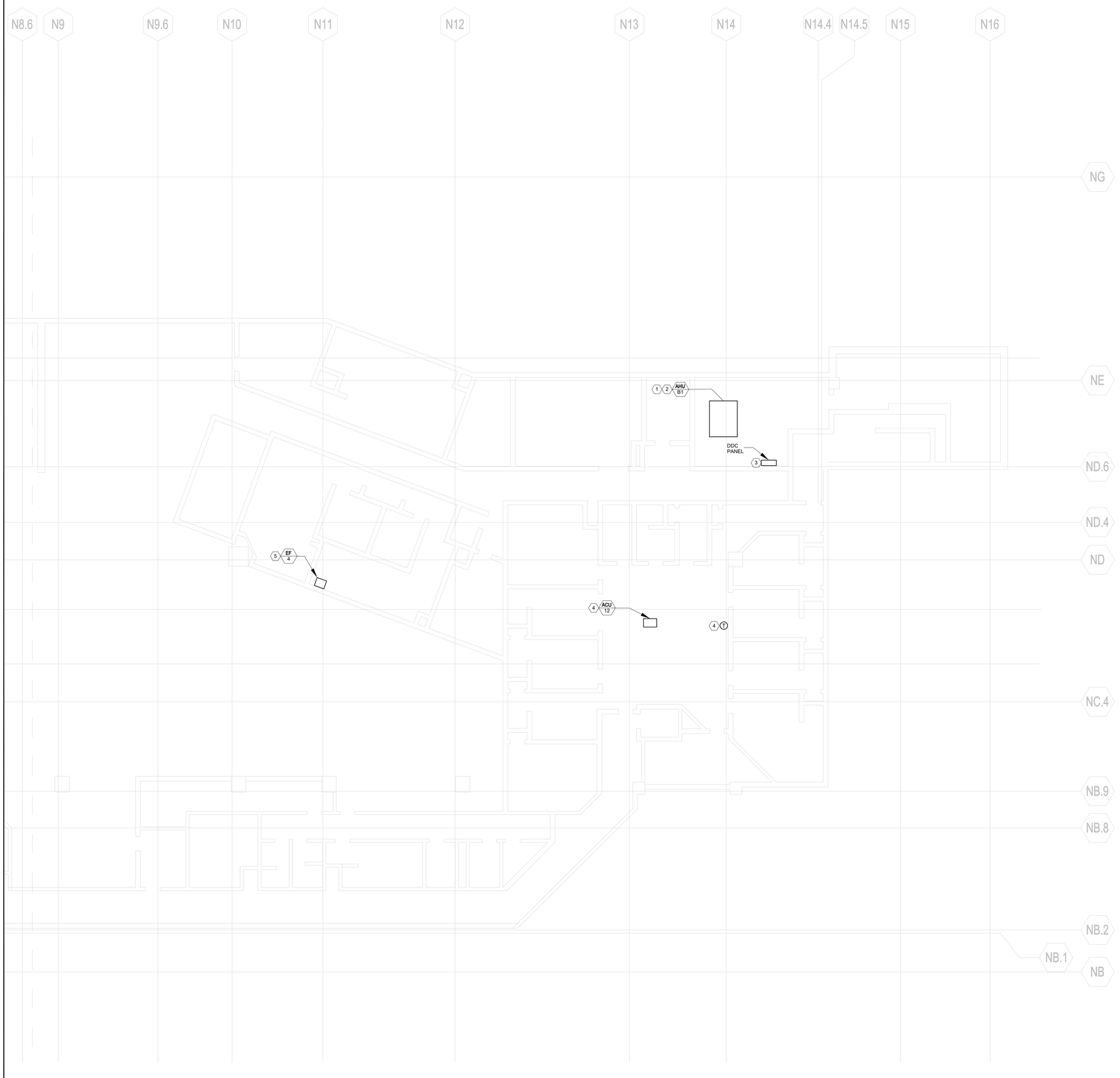

MECHANICAL CONTROLS KEYED NOTES

1. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT, SEE CONTROLS SCHEMATICS ON SHEETS MC-701.
2. FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
3. REMOVE AND DISPOSE THE EXISTING DDC PANEL.
4. FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.
5. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR EXISTING EXHAUST FAN. REFER TO SCHEMATICS ON SHEET MC-702.

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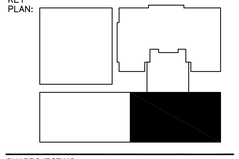

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SERVICE LEVEL PLAN - EAST

DRAWING NO.

MC-10SLE

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1 MC-10SLE JUSTICE CENTER TOWER - SERVICE LEVEL PLAN - EAST
SCALE: 1/8" = 1'-0"

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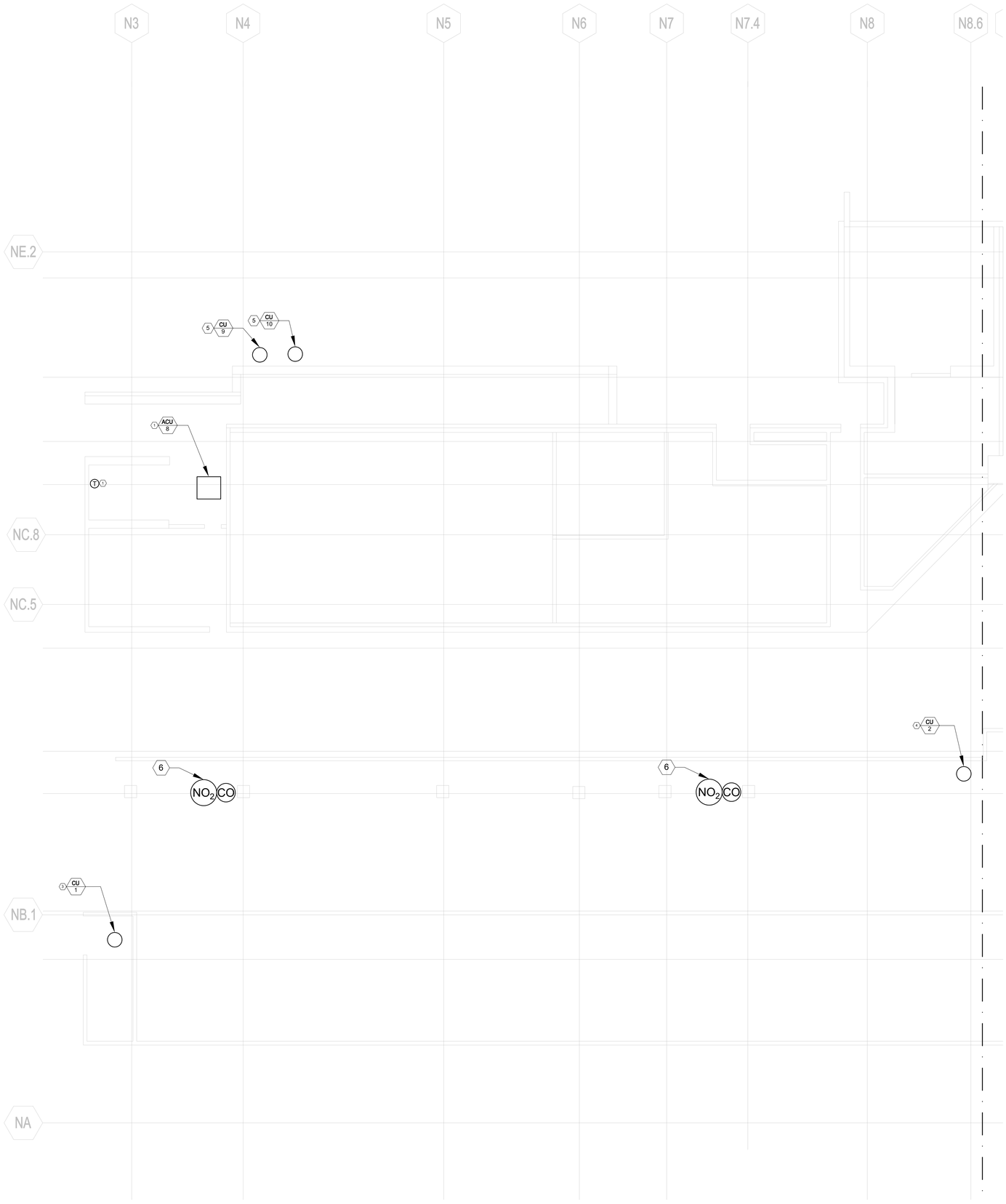

MECHANICAL CONTROLS KEYED NOTES

1. FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.
2. CONDENSER UNIT ASSOCIATED WITH ACU-8.
3. CONDENSER UNIT ASSOCIATED WITH ACU-1.
4. CONDENSER UNIT ASSOCIATED WITH ACU-2.
5. CONDENSER UNITS CU-9 & CU-10 ASSOCIATED WITH ACU-9 & ACU-10 UNITS ON GROUND FLOOR AT TG500 ROOM AND CONTROL ROOM.
6. PROVIDE WALL MOUNT CO & NO2 VERIS GAS DETECTION SENSOR, MODEL GWNP SERIES. LOCATE CO SENSOR AT 3'-5" AFF, NO2 SENSOR AT 1'-3" BELOW CEILING. SENSORS SHALL RESIDE ON BACNET NETWORK AND COMMUNICATE WITH EXHAUST AND SUPPLY FAN CONTROLLERS SERVING GARAGE VENTILATION. SEE DETAIL 3 ON SHEET MC-702 FOR MORE INFORMATION.

1 MC-10PW — JUSTICE CENTER TOWER - PARKING LEVEL PLAN - WEST
SCALE: 1/8" = 1'-0"

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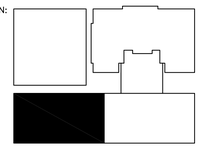

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - PARKING LEVEL PLAN - WEST

DRAWING NO.

MC-10PW

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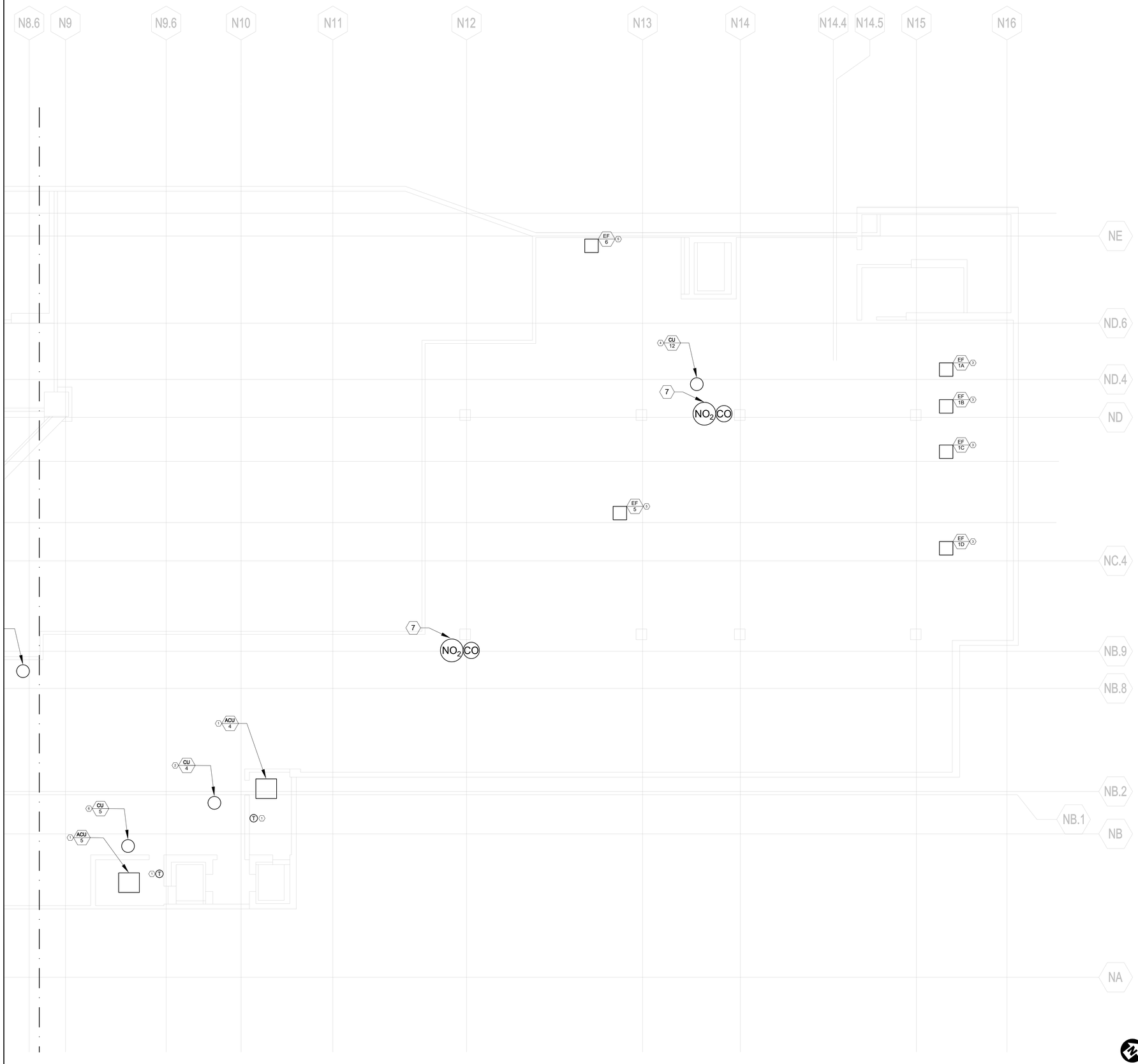

MECHANICAL CONTROLS KEYED NOTES

#	
1	FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.
2	CONDENSER UNIT ASSOCIATED WITH ACU-4.
3	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR EXISTING GARAGE EXHAUST FANS. REFER TO SCHEMATICS ON SHEET MC-702.
4	CONDENSER UNIT ASSOCIATED WITH ACU-12.
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR EXISTING EXHAUST FANS TO REMAIN. REFER TO SCHEMATICS ON SHEET MC-702.
6	CONDENSER UNIT ASSOCIATED WITH ACU-5.
7	PROVIDE WALL MOUNT CO & NO2 VERIS GAS DETECTION SENSOR, MODEL GWNP SERIES. LOCATE CO SENSOR AT 3'-5" AFF, NO2 SENSOR AT 1'-3" BELOW CEILING. SENSORS SHALL RESIDE ON BACNET NETWORK AND COMMUNICATE WITH EXHAUST AND SUPPLY FAN CONTROLLERS SERVING GARAGE VENTILATION. SEE DETAIL 3 ON SHEET MC-702 FOR MORE INFORMATION.

1 MC-10PE JUSTICE CENTER TOWER - PARKING LEVEL PLAN - EAST
SCALE: 1/8" = 1'-0"

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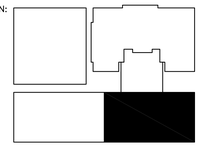

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DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER TOWER - PARKING LEVEL PLAN - EAST

DRAWING NO.

MC-10PE

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1 MC-10GW JUSTICE CENTER TOWER - GROUND FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-601 & MC-602 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.

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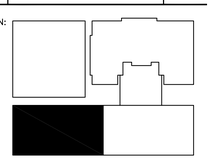

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - GROUND FLOOR PLAN - WEST

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MC-10GW

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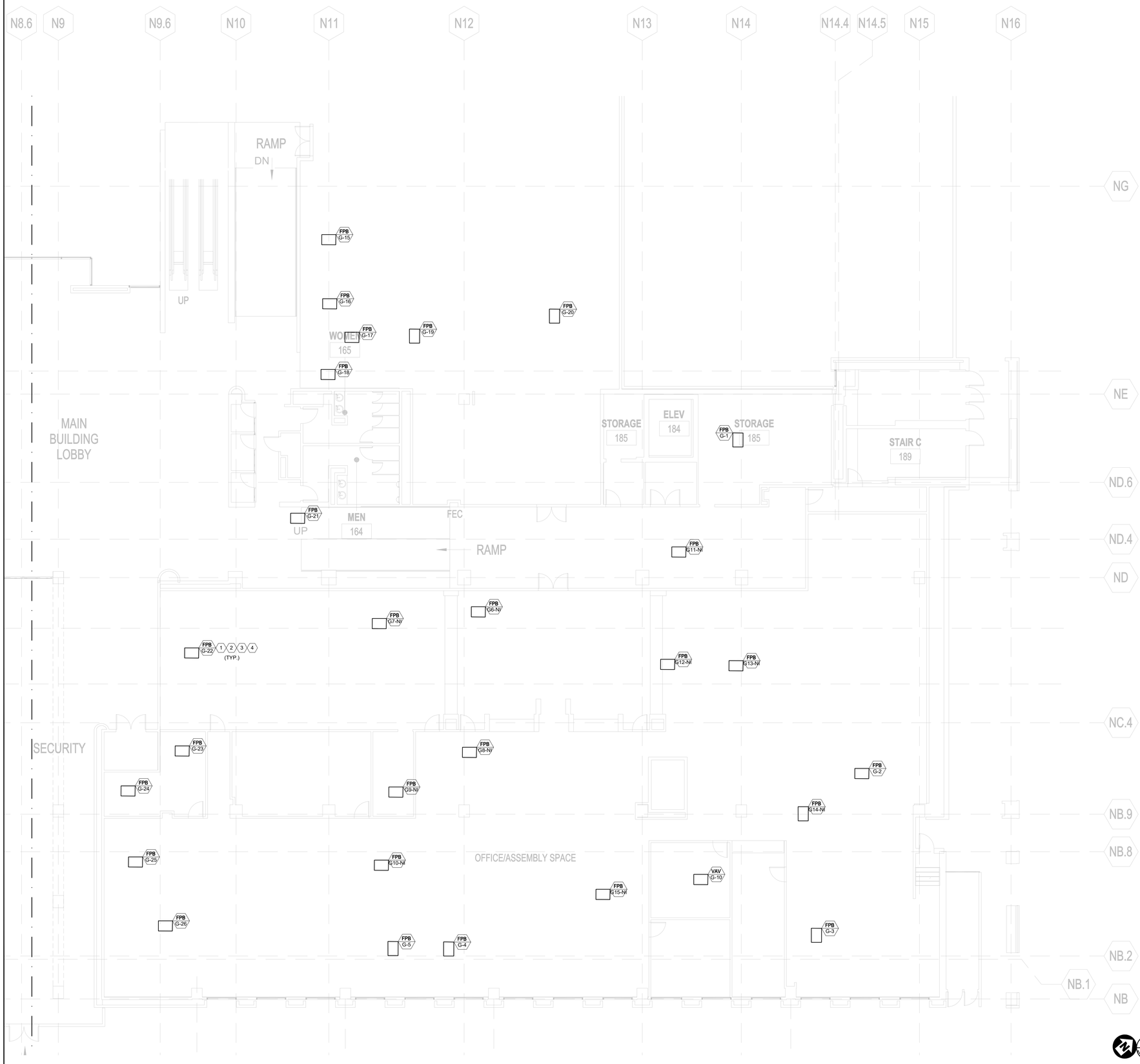

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-601 & MC-602 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL

1 MC-10GE — JUSTICE CENTER TOWER - GROUND FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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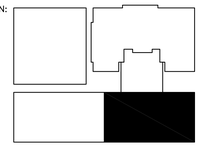

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - GROUND FLOOR PLAN - EAST

DRAWING NO.

MC-10GE

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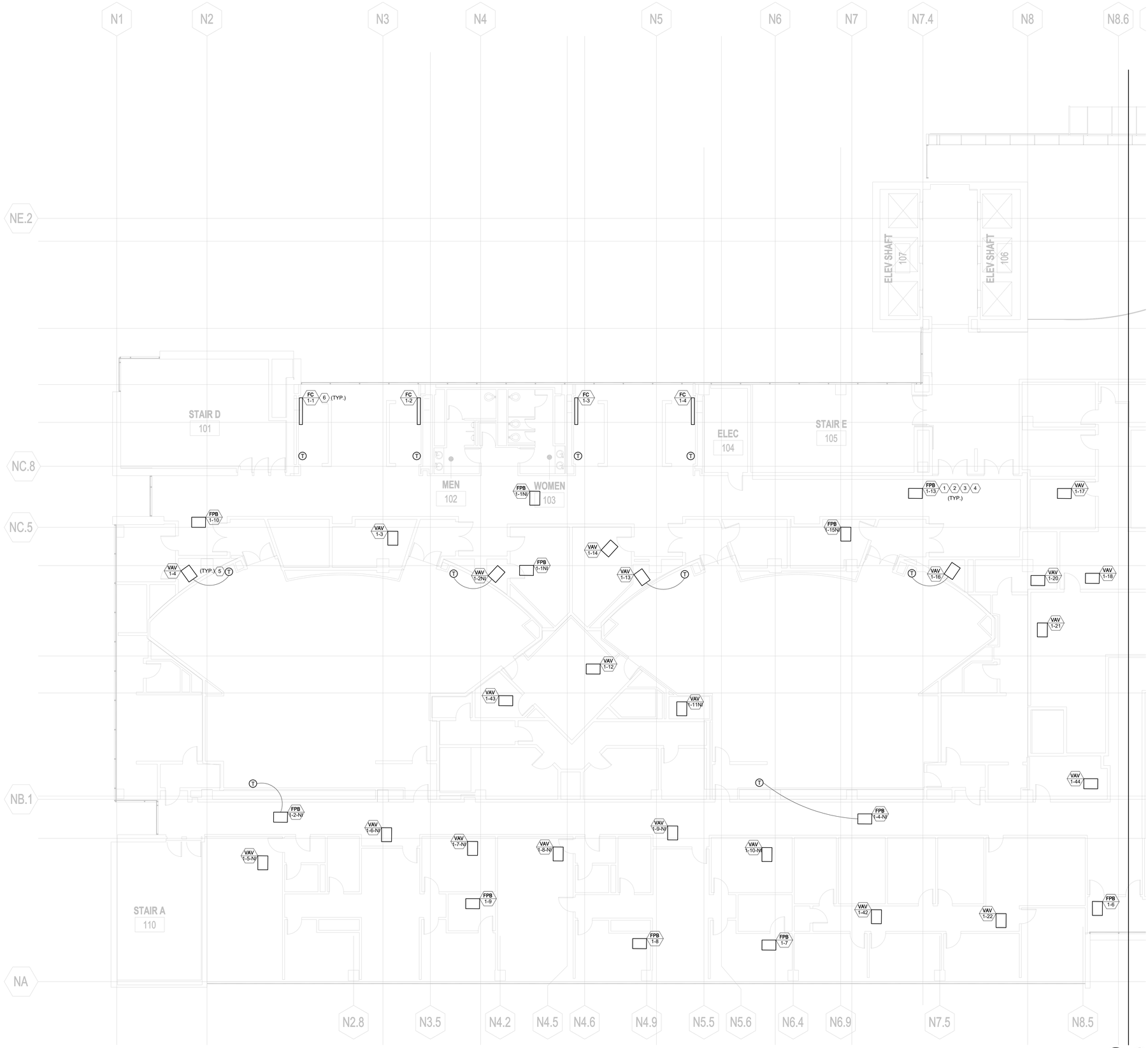

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-601 & MC-602 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6. FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR FAN COIL UNITS. REFER TO SCHEMATICS ON SHEET MC-702.

1 MC-101W — JUSTICE CENTER TOWER - FIRST FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

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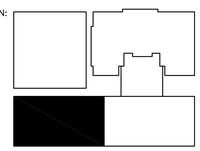

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ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - FIRST FLOOR PLAN - WEST

DRAWING NO.
MC-101W

ISSUED FOR BID

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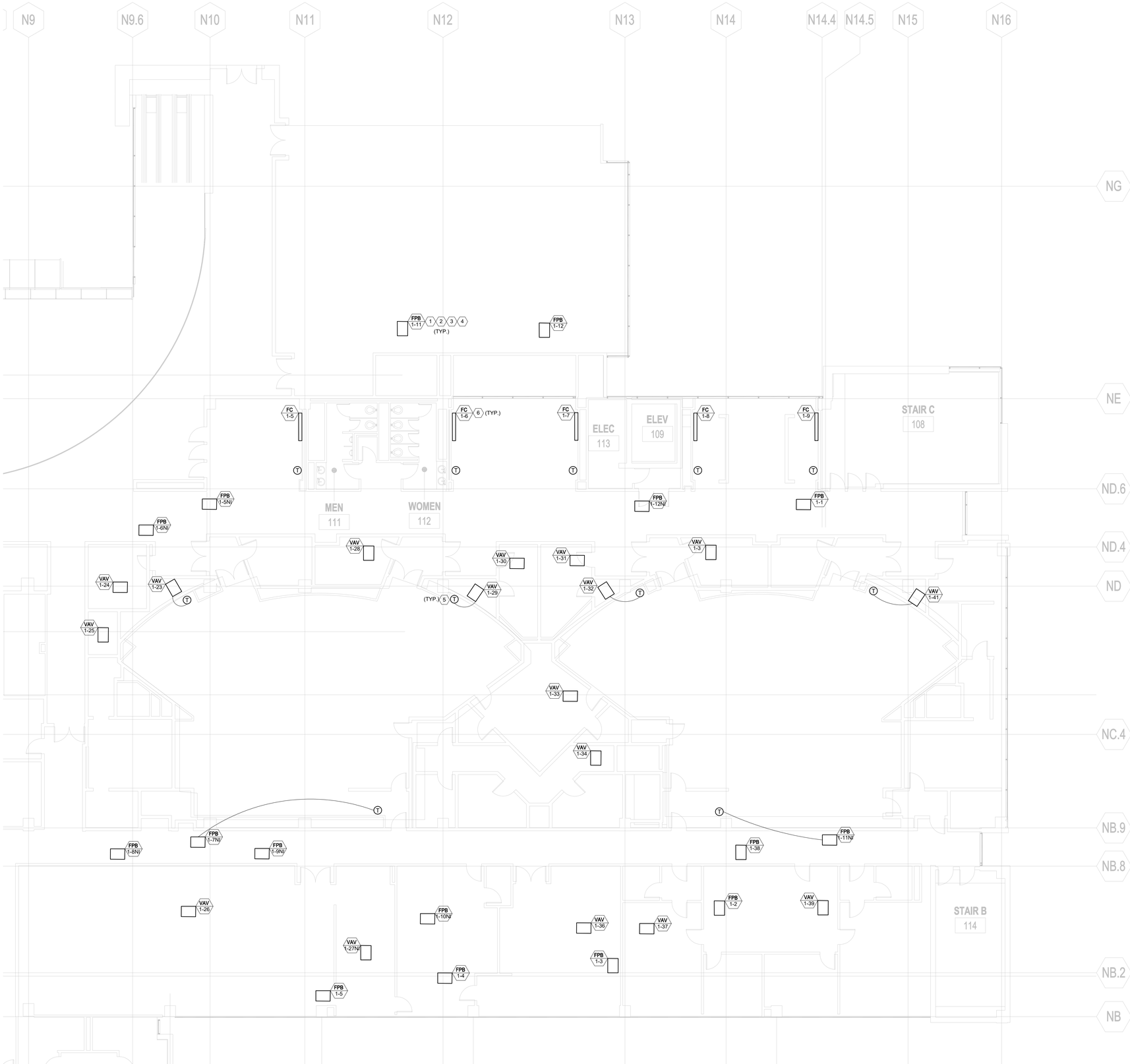

1 MC-101E JUSTICE CENTER TOWER - FIRST FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-601 & MC-602 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6	FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR FAN COIL UNITS. REFER TO SCHEMATICS ON SHEET MC-702.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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REVISIONS / ISSUED

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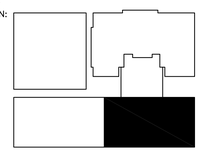
KEY PLAN:



SLK PROJECT NO.	2019002
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REVIEWED BY	AYG/GBH
SCALE	AS INDICATED
ISSUE DATE	11/18/2019

DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER TOWER - FIRST FLOOR PLAN - EAST

DRAWING NO.

MC-101E

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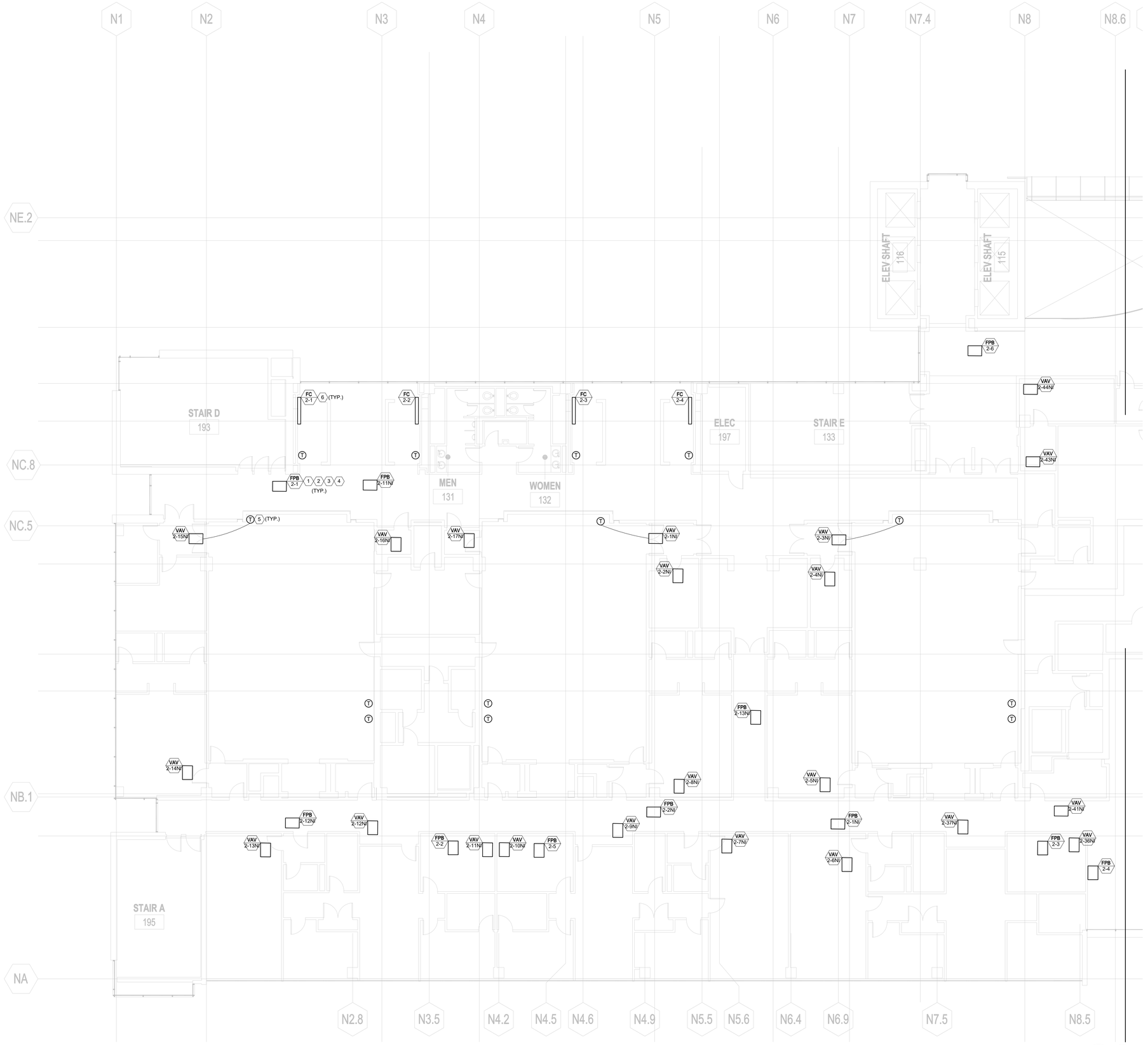

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
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3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6. FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR FAN COIL UNITS. REFER TO SCHEMATICS ON SHEET MC-702.

1 MC-102W — JUSTICE CENTER TOWER - SECOND FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

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DRAWING NO.

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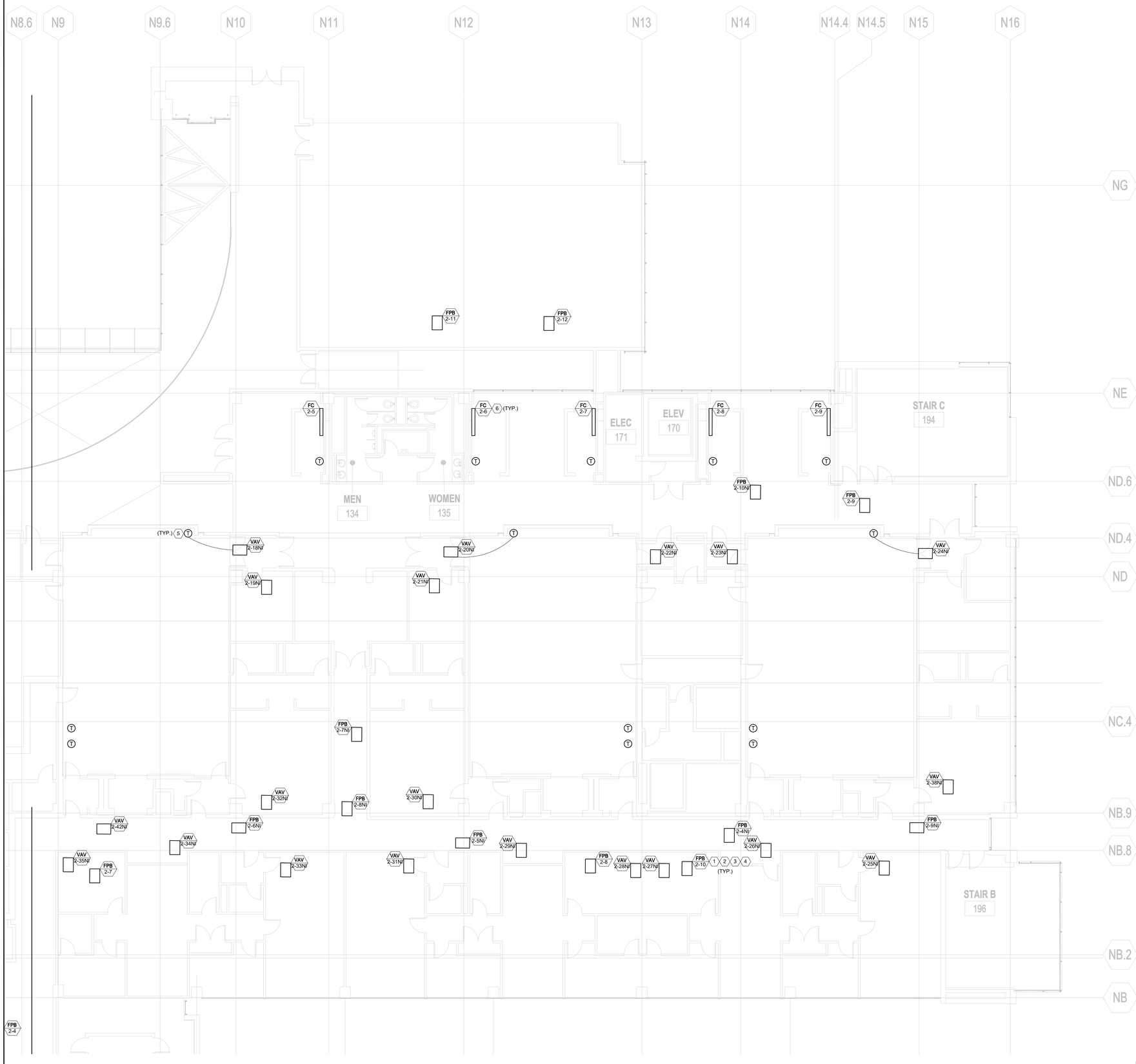

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL.
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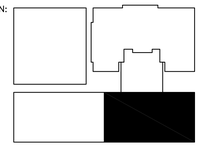

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DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SECOND FLOOR PLAN - EAST

DRAWING NO.

MC-102E

ISSUED FOR BID

1 MC-102E JUSTICE CENTER TOWER - SECOND FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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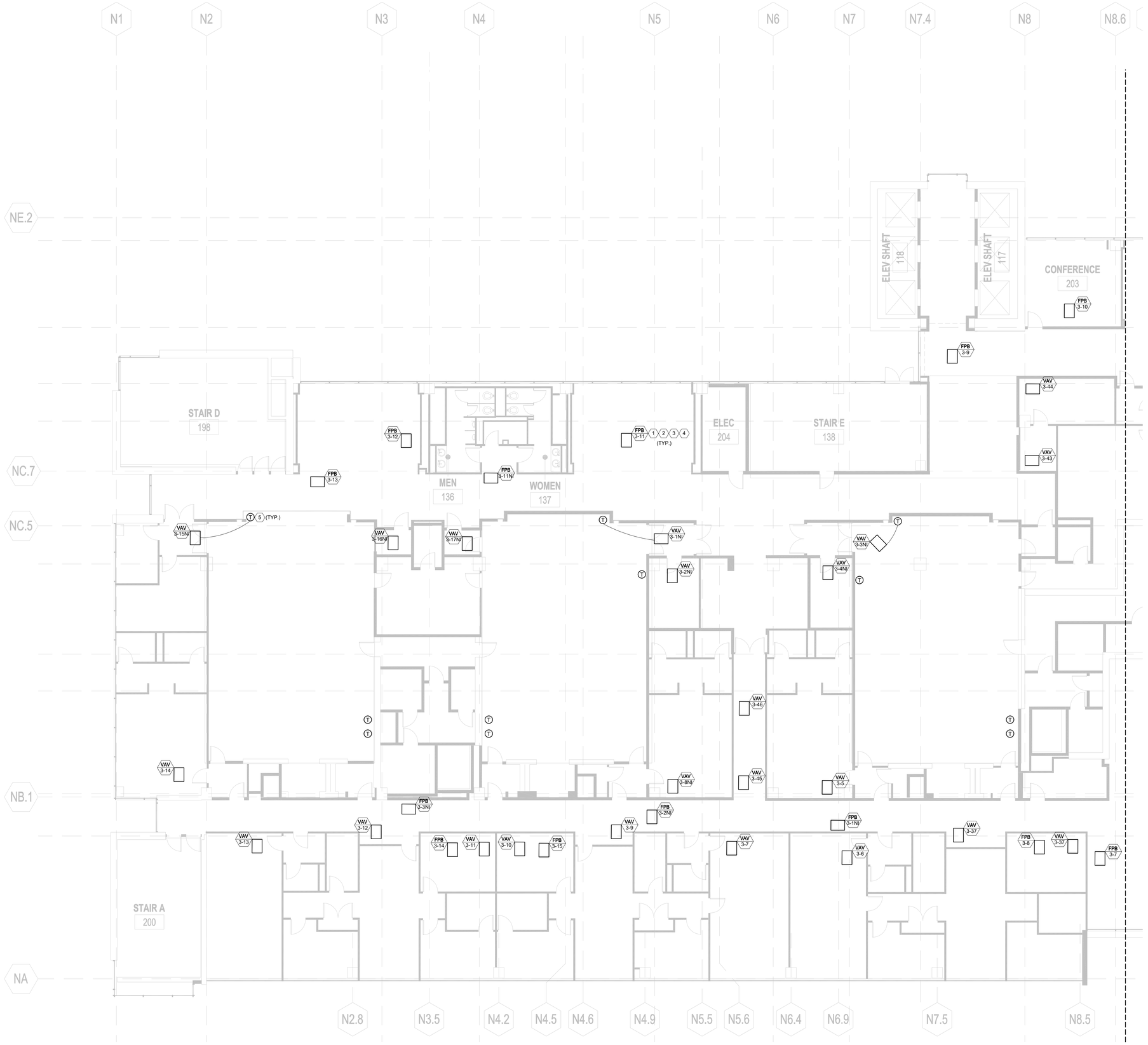

MECHANICAL CONTROLS KEYED NOTES

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4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.

1 MC-103W — JUSTICE CENTER TOWER - THIRD FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

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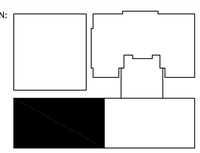

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DRAWING NO.
MC-103W

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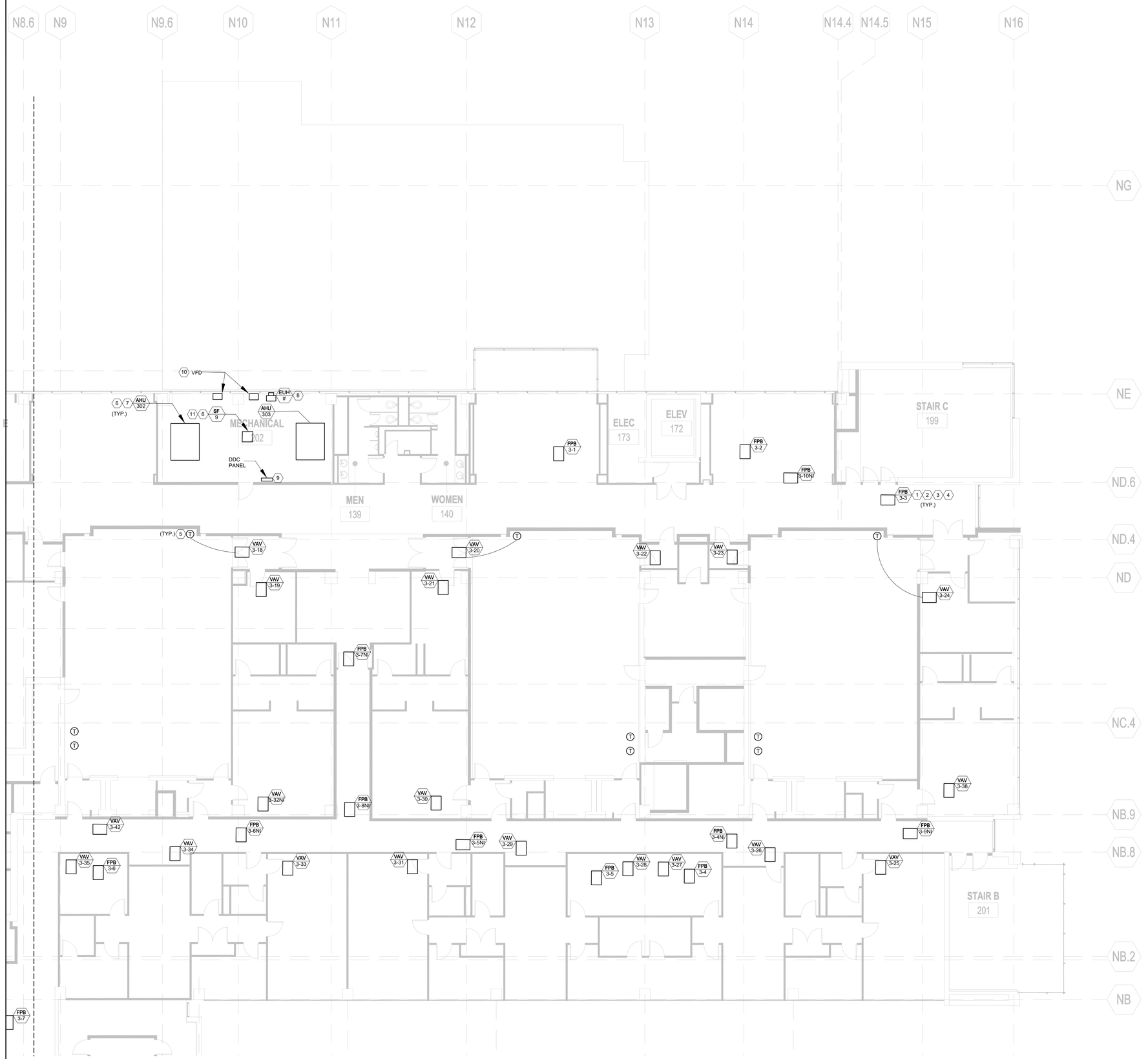

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4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEETS MC-700.
7	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
8	ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
11	THE EXISTING OUTSIDE AIR FAN TO REMAIN.

1 MC-103E JUSTICE CENTER TOWER - THIRD FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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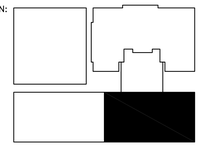

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - THIRD FLOOR PLAN - EAST

DRAWING NO.

MC-103E

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4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEETS MC-700.
7. FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
8. ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
9. REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
11. THE EXISTING OUTSIDE AIR FAN TO REMAIN.

1 MC-104W — JUSTICE CENTER TOWER - FOURTH FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

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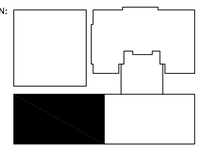

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - FOURTH FLOOR PLAN - WEST

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MC-104W

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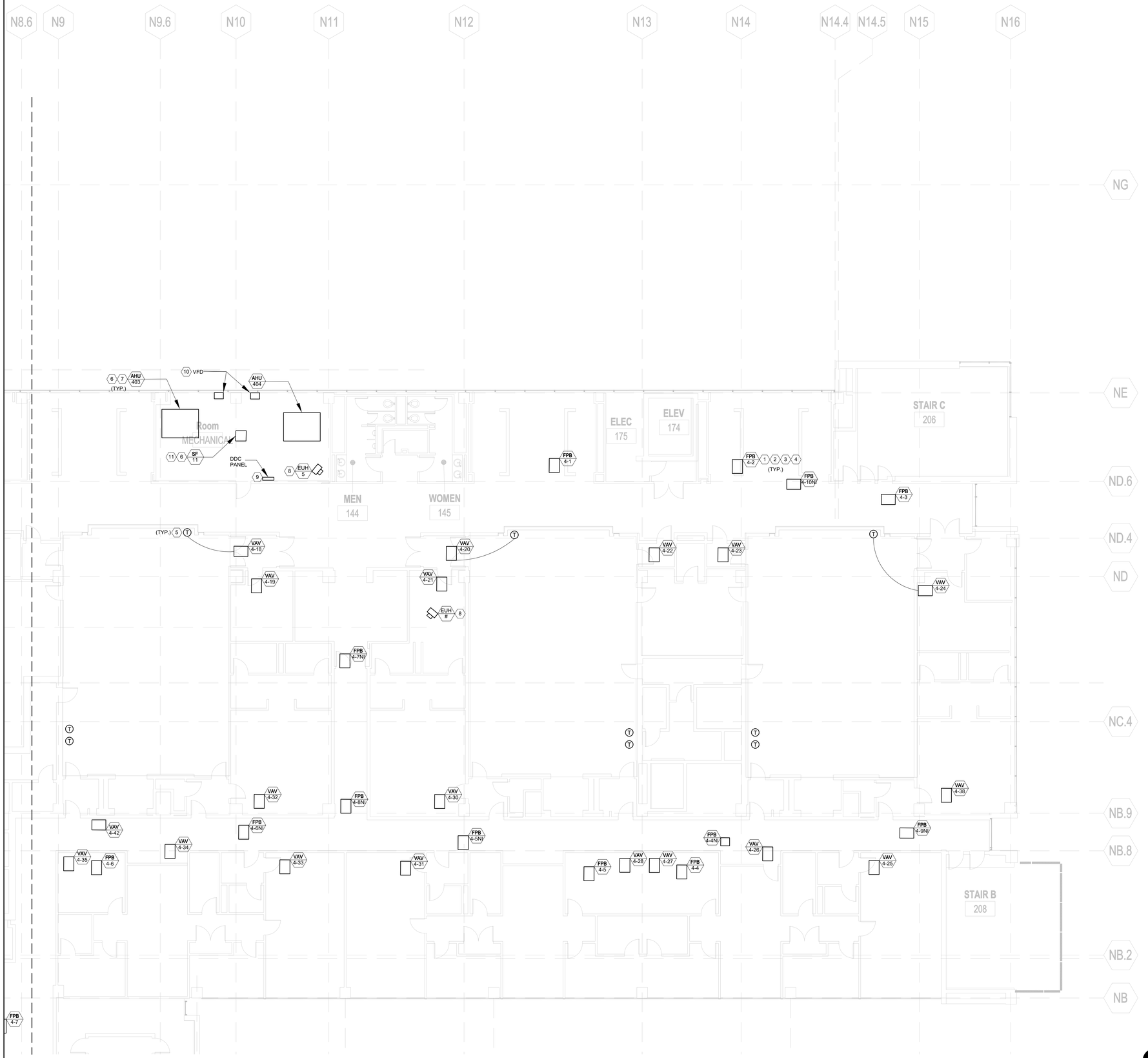

MECHANICAL CONTROLS KEYED NOTES

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8. ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
9. REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
11. THE EXISTING OUTSIDE AIR FAN TO REMAIN.

1 MC-104E — JUSTICE CENTER TOWER - FOURTH FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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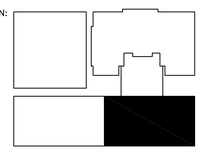

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DRAWING NO.
MC-104E

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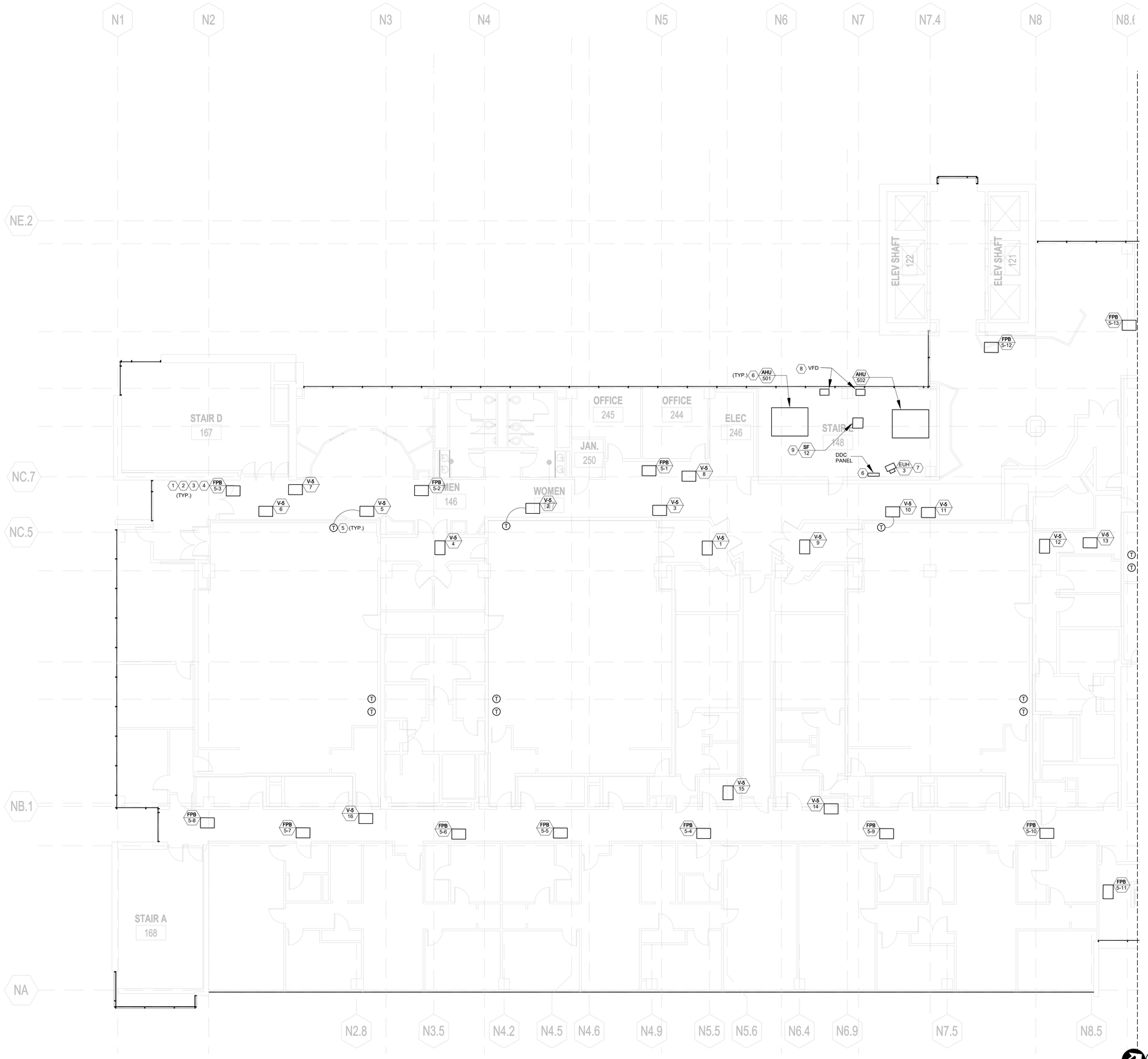

1 MC-105W JUSTICE CENTER TOWER - FIFTH FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

#	MECHANICAL CONTROLS KEYED NOTES
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
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5	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6	THE NEW TRANE BACNET DDC CONTROLS TO REMAIN. REFER TO SHEET MC-742
7	ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	THE EXISTING OUTSIDE AIR FAN TO REMAIN.

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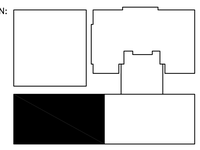

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SCALE	AS INDICATED
ISSUE DATE	11/18/2019

DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER TOWER - FIFTH FLOOR PLAN - WEST

DRAWING NO.

MC-105W

ISSUED FOR BID

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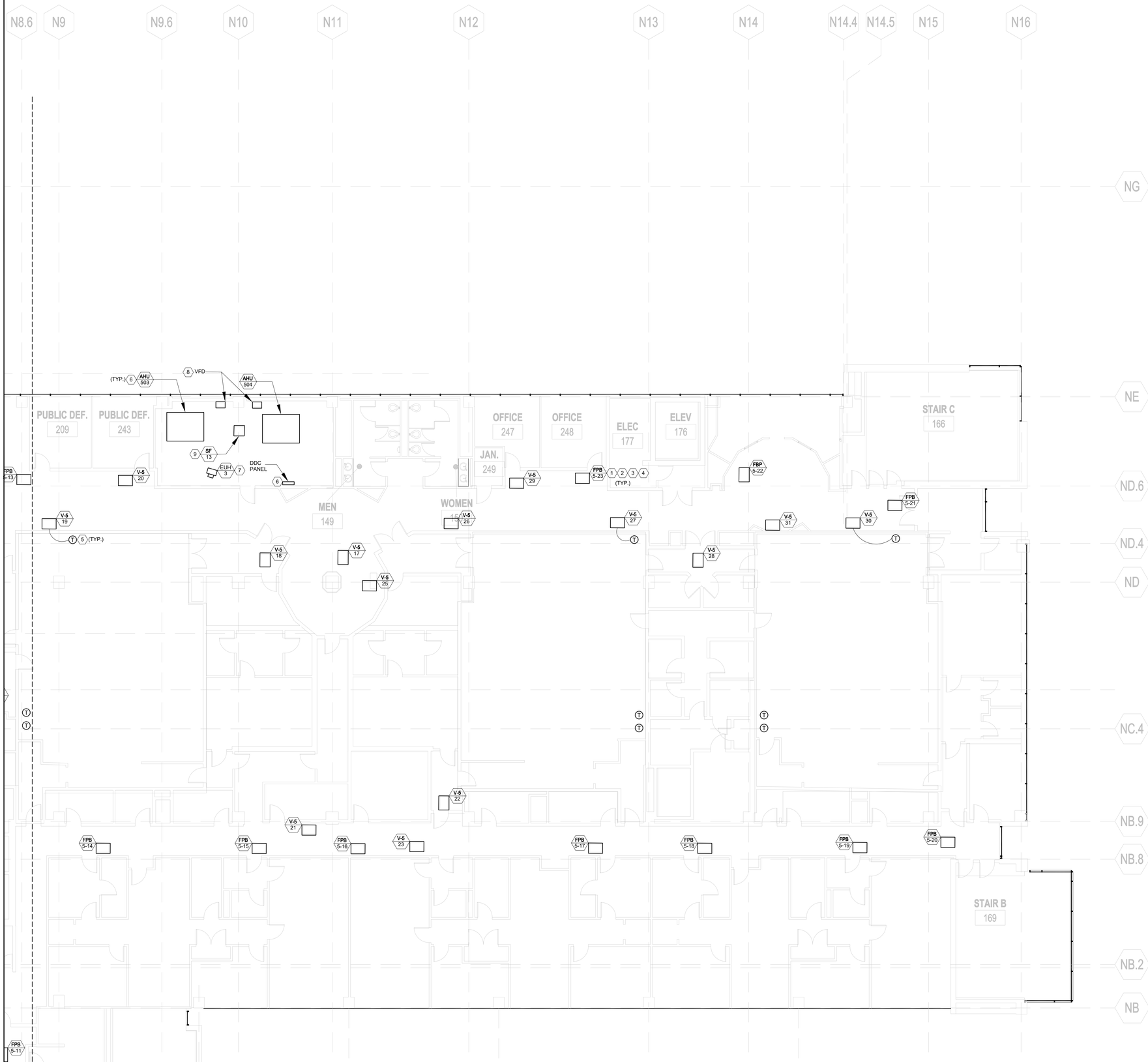

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/AV SCHEDULE ON SHEET MC-601 & MC-602 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6	THE NEW TRANE BACNET DDC CONTROLS TO REMAIN. REFER TO SHEET MC-742
7	ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	THE EXISTING OUTSIDE AIR FAN TO REMAIN.

1 MC-105E JUSTICE CENTER TOWER - FIFTH FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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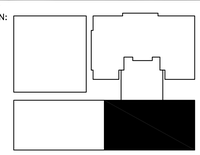

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DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - FIFTH FLOOR PLAN - EAST

DRAWING NO.
MC-105E

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1 MC-107W JUSTICE CENTER TOWER - SEVENTH FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-601 & MC-602 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
6. THE NEW TRANE BACNET DDC CONTROLS TO REMAIN AND SHALL BE CONNECTED TO NEW BACNET NETWORK. REFER TO SHEET MC-742
7. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8. THE EXISTING OUTSIDE AIR FAN TO REMAIN.
9. AREA OF THE TENANT FIT-OUT WITH NEW VAV BOXES SHLL BE EXCLUDED FROM THE SCOPE OF THIS CONTRACT. COORDINATE WITH THE HEERY CM/PM FOR EXACT LOCATIONS. ALL VAV BOXES FURNISHED SEPARATELY UNDER THE TENANT FIR-OUT SHALL BE ADDED TO THE BACNET NETWORK IN THIS SCOPE.

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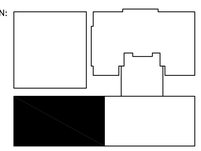

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SEVENTH FLOOR PLAN - WEST

DRAWING NO.
MC-107W

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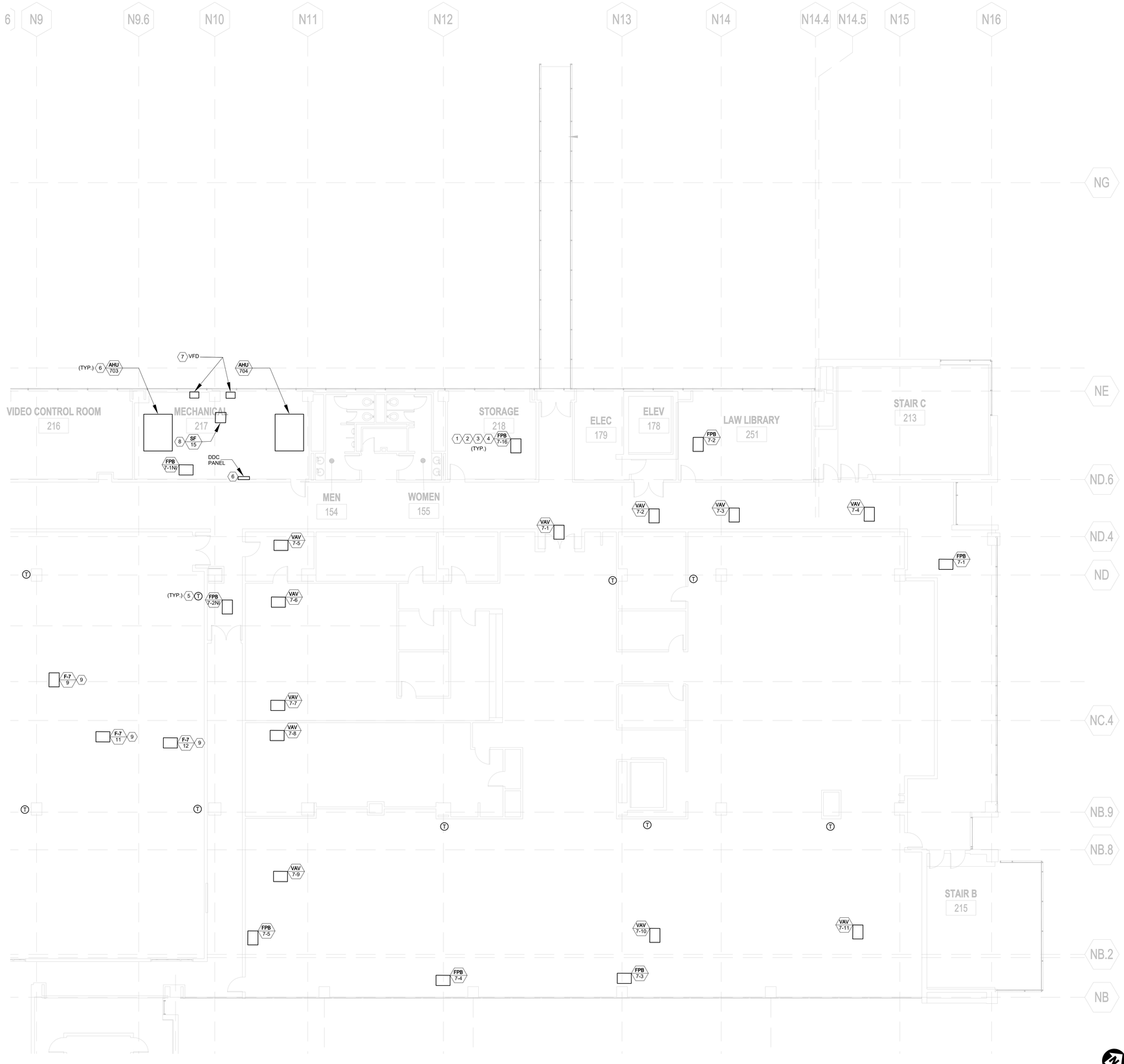

MECHANICAL CONTROLS KEYED NOTES

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1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
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4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN JURY ASSEMBLY PER MANUFACTURER'S INSTRUCTIONS.
6	THE NEW TRANE BACNET DDC CONTROLS TO REMAIN AND SHALL BE CONNECTED TO NEW BACNET NETWORK. REFER TO SHEET MC-742
7	THE EXISTING VFD TO REMAIN.
8	THE EXISTING OUTSIDE AIR FAN TO REMAIN.
9	AREA OF THE TENANT FIT-OUT WITH NEW VAV BOXES SHLL BE EXCLUDED FROM THE SCOPE OF THIS CONTRACT. COORDINATE WITH THE HEERY CM/PM FOR EXACT LOCATIONS. ALL VAV BOXES FURNISHED SEPARATELY UNDER THE TENANT FIR-OUT SHALL BE ADDED TO THE BACNET NETWORK IN THIS SCOPE.

1 MC-107E JUSTICE CENTER TOWER - SEVENTH FLOOR PLAN - EAST
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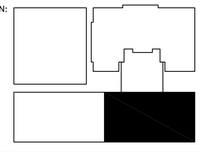

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DRAWING NO.

MC-107E

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1 MC-108W JUSTICE CENTER TOWER - EIGHTH FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
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4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
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8. THE EXISTING OUTSIDE AIR FAN TO REMAIN.

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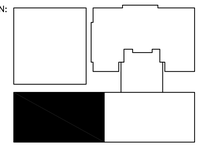

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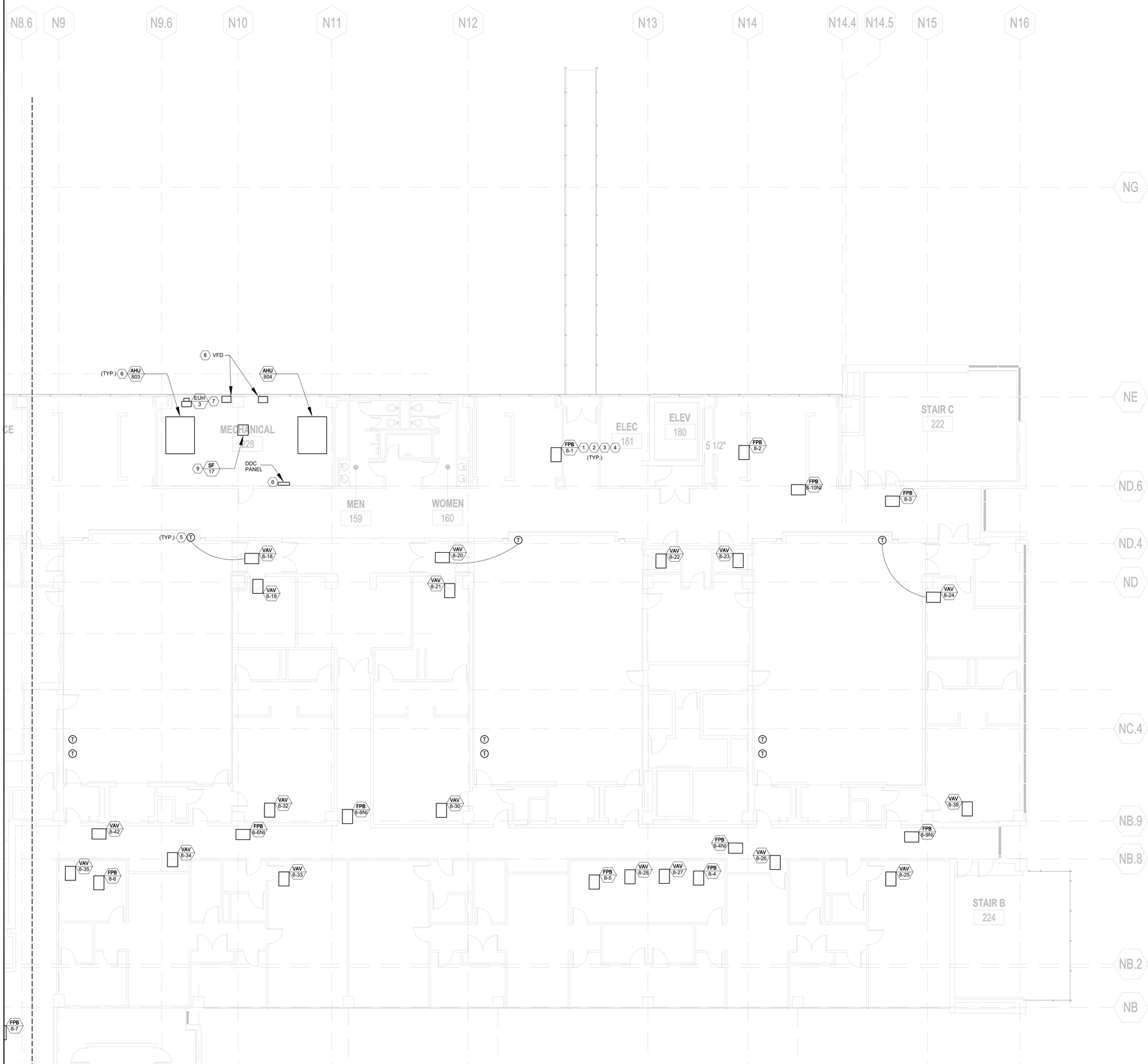

MECHANICAL CONTROLS KEYED NOTES

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8. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9. THE EXISTING OUTSIDE AIR FAN TO REMAIN.

1 MC-108E — JUSTICE CENTER TOWER - EIGHTH FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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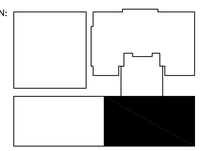

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - EIGHTH FLOOR PLAN - EAST

DRAWING NO.

MC-108E

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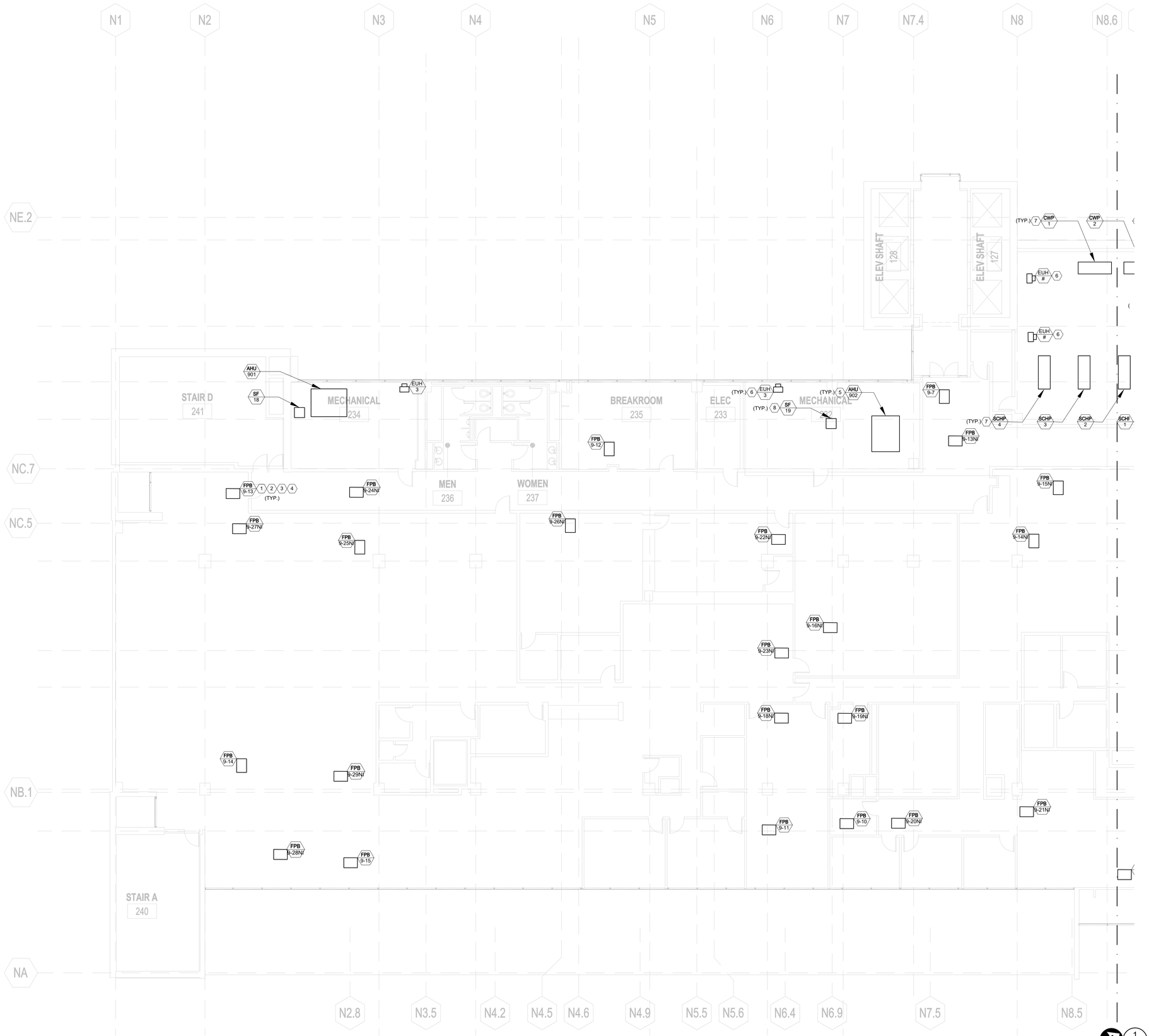

MECHANICAL CONTROLS KEYED NOTES

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4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-500 FOR MORE INFORMATION. TYPICAL
5. THE NEW TRANE BACNET DDC CONTROLS TO REMAIN. REFER TO SHEET MC-742
6. ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
7. CONDENSER WATER PUMPS, CHILLED WATER PUMPS, HEAT EXCHANGERS, WATER-COOLED CHILLERS LOCATED AT CENTRAL PLANT SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
8. THE EXISTING OUTSIDE AIR FAN TO REMAIN.

1 MC-109W — JUSTICE CENTER TOWER - NINTH FLOOR PLAN - WEST
SCALE: 1/8" = 1'-0"

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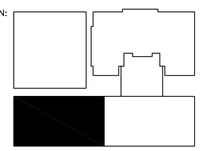

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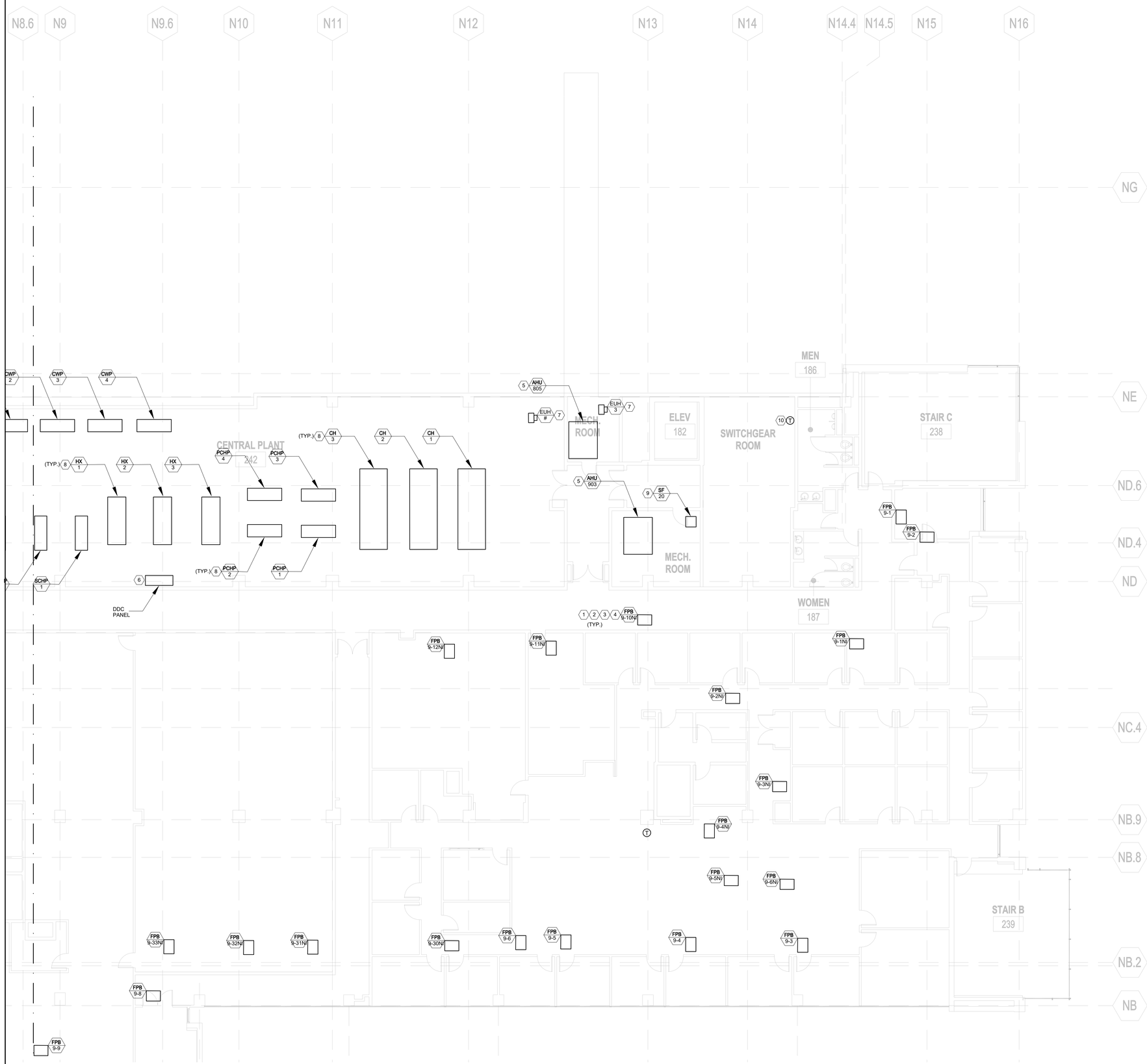

MECHANICAL CONTROLS KEYED NOTES

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5	THE NEW TRANE BACNET DDC CONTROLS TO REMAIN. REFER TO SHEET MC-742
6	THE NEW TRANE BACNET DDC CONTROLS ON CENTRAL PLANT TO REMAIN. REFER TO SHEET MC-742.
7	ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
8	CONDENSER WATER PUMPS, CHILLED WATER PUMPS, HEAT EXCHANGERS, WATER-COOLED CHILLERS LOCATED AT CENTRAL PLANT SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
9	INSTALL FREEZE STAT IN MECHANICAL ROOM SERVED BY SF-20. INTERLOCK WITH SF-20 FAN STARTER TO DISABLE FAN BELOW 38 DEG F.
10	FURNISH AND INSTALL NEW TEMPERATURE SENSOR TO MONITOR THE ELECTRICAL SWITCHGEAR ROOM.

1 MC-109E — JUSTICE CENTER TOWER - NINTH FLOOR PLAN - EAST
SCALE: 1/8" = 1'-0"

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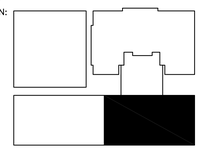

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MC-109E

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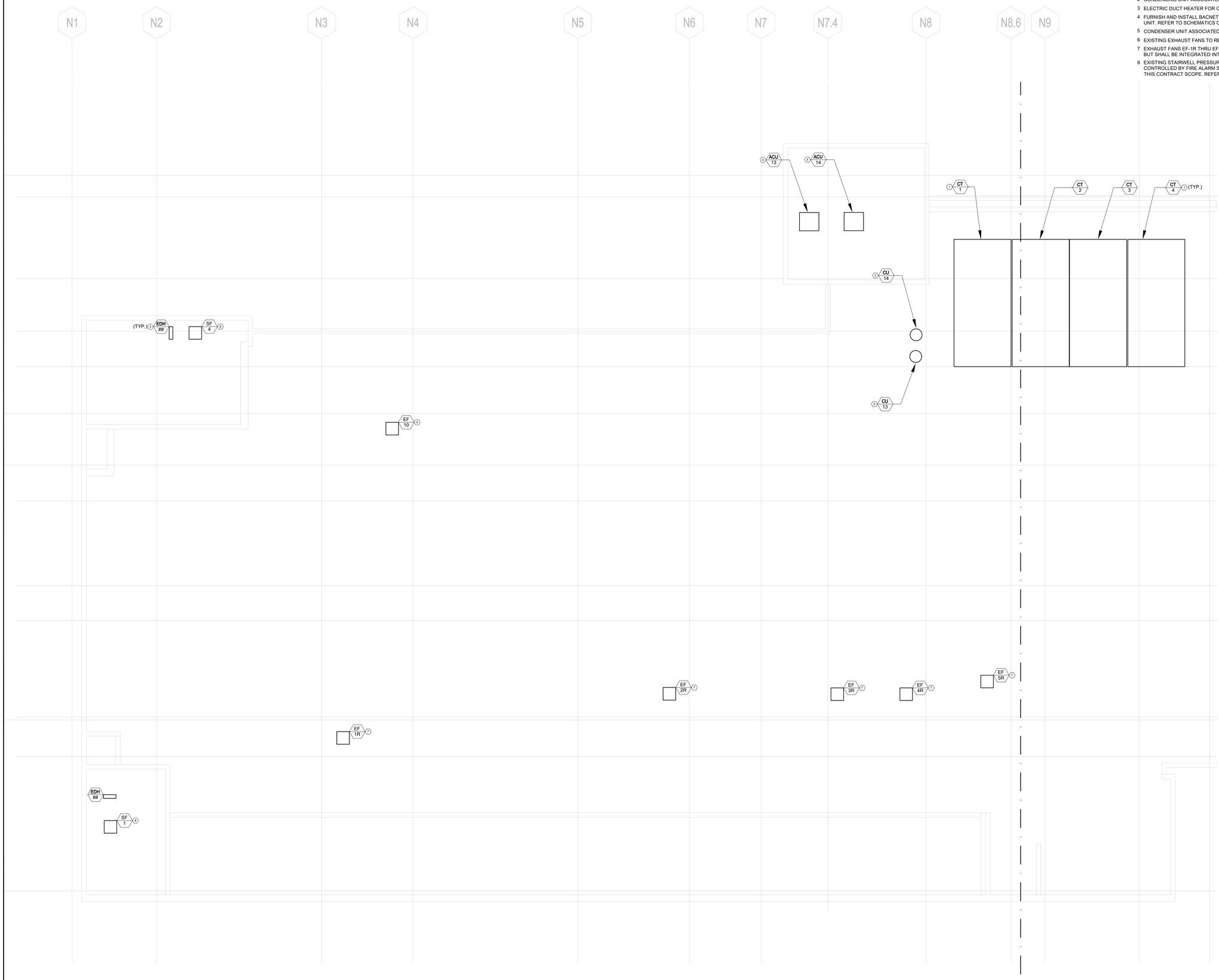

MECHANICAL CONTROLS KEYED NOTES

1. COOLING TOWERS SHOWN FOR CLARITY PURPOSES ONLY, N.I.C
2. CONDENSING UNIT ASSOCIATED WITH ACU-13
3. ELECTRIC DUCT HEATER FOR CLARITY PURPOSES ONLY. N.I.C.
4. FURNISH AND INSTALL BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.
5. CONDENSER UNIT ASSOCIATED WITH ACU-14.
6. EXISTING EXHAUST FANS TO REMAIN.
7. EXHAUST FANS EF-1R THRU EF-5R ARE NOT IN SCOPE FOR NEW CONTROLS BUT SHALL BE INTEGRATED INTO NEW NIAGARA 4 NETWORK.
8. EXISTING STAIRWELL PRESSURIZATION FANS TO REMAIN AND SHALL BE CONTROLLED BY FIRE ALARM SYSTEM. ADD STATUS MONITORING UNDER THIS CONTRACT SCOPE. REFER TO SCHEMATICS MC-702.

1 MC-10RW JUSTICE CENTER TOWER - ROOF PLAN - WEST
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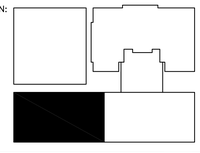

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ISSUE DATE 11/18/2019

DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER TOWER - ROOF PLAN - WEST

DRAWING NO.

MC-10RW

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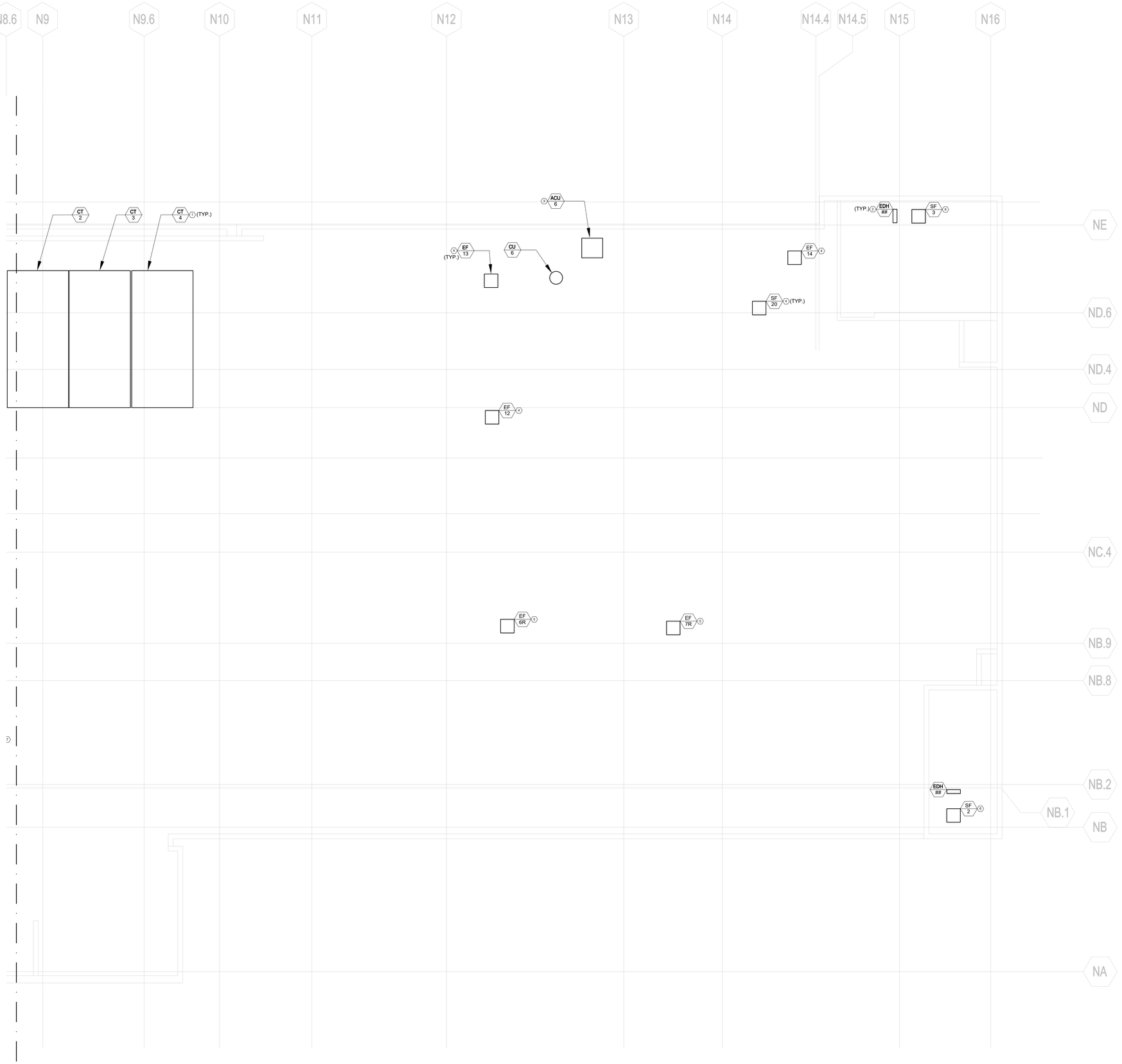

JUSTICE CENTER TOWER - ROOF PLAN - EAST
SCALE: 1/8" = 1'-0"

MECHANICAL CONTROLS KEYED NOTES

1 COOLING TOWERS SHOWN FOR CLARITY PURPOSES ONLY, N.I.C
2 ELECTRIC DUCT HEATER SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.
3 FURNISH AND INSTALL BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-703.
4 EXISTING SUPPLY EXHAUST FANS TO REMAIN.
5 EXHAUST FANS EF-6R, EF-7R AND EF-14 ARE NOT IN SCOPE FOR NEW CONTROLS BUT SHALL BE INTEGRATED INTO NEW NIAGARA 4 NETWORK.
6 EXISTING STAIRWELL PRESSURIZATION FANS TO REMAIN AND SHALL BE CONTROLLED BY FIRE ALARM SYSTEM. ADD STATUS MONITORING UNDER THIS CONTRACT SCOPE. REFER TO SCHEMATICS MC-702.
7 EXISTING EXHAUST FAN EF-13 SHOWN FOR CLARITY PURPOSES ONLY. N.I.C.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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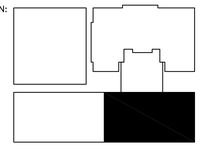
NO.	DESCRIPTION	DATE

KEY PLAN:



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DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER TOWER - ROOF PLAN - EAST

DRAWING NO.

MC-10RE

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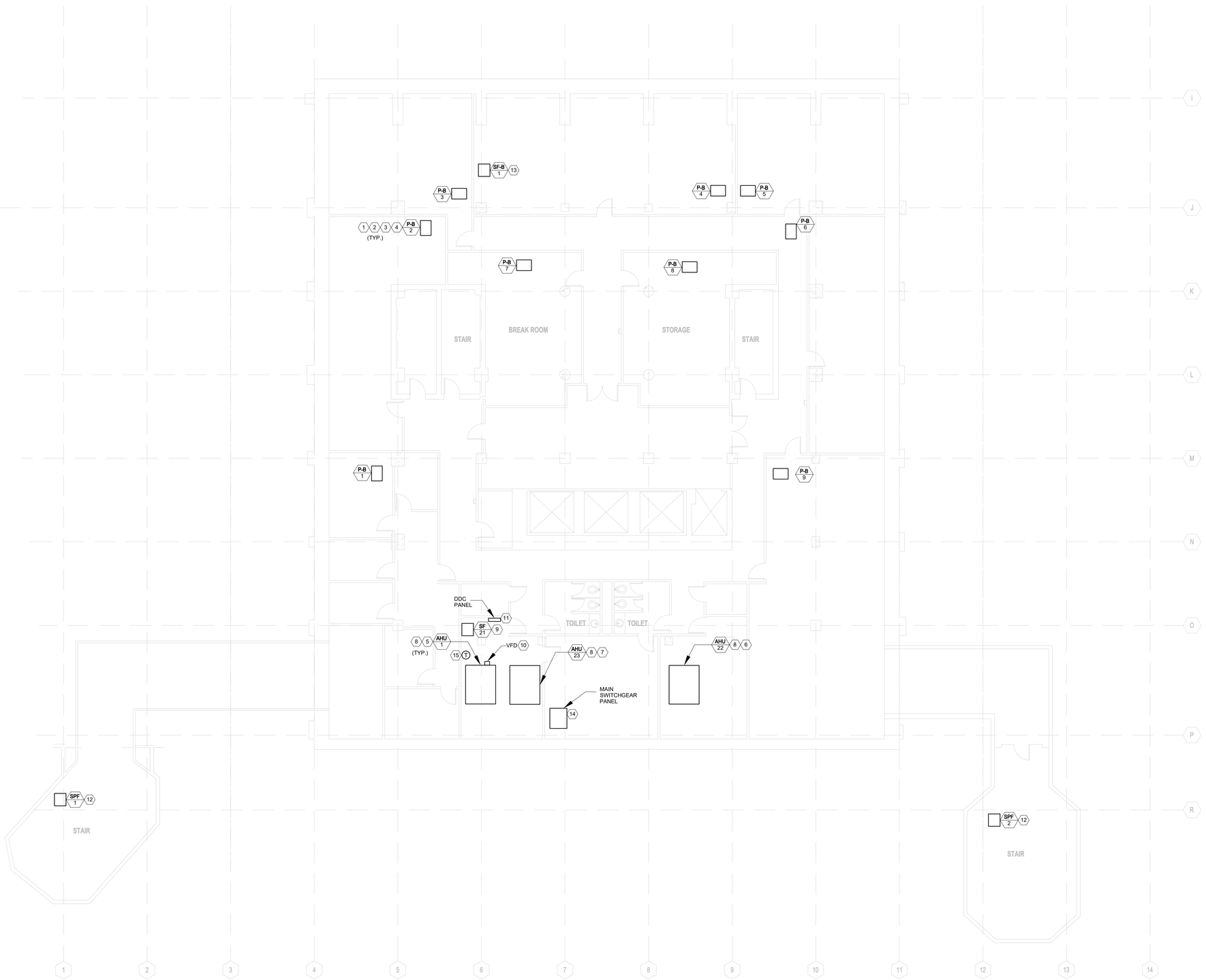

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT-1, REFER TO CONTROLS SCHEMATICS ON SHEET MC-720.
6. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT-22, REFER TO CONTROLS SCHEMATICS ON SHEET MC-721.
7. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT-23, REFER TO CONTROLS SCHEMATICS ON SHEET MC-722.
8. FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
9. THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE FURNISHED WITH NEW BACNET CONTROLLER. REFER TO SCHEMATICS ON SHEET MC-720.
10. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO NEW BACNET NETWORK.
11. REMOVE AND DISPOSE THE EXISTING DDC PANEL.
12. EXISTING STAIRWELL PRESSURIZATION FANS TO REMAIN AND SHALL BE CONTROLLED BY FIRE ALARM SYSTEM. ADD STATUS MONITORING UNDER THIS CONTRACT SCOPE. REFER TO SCHEMATICS MC-722
13. EXISTING SUPPLY FAN SERVING COMPUTER ROOMS LOCATED ON GROUND FLOOR. SHOWN FOR CLARITY PURPOSES ONLY, N.I.C.
14. FURNISH AND INSTALL ELECTRICAL POWER METER MONITORING AT BUILDING MAIN ELECTRICAL METERS, SEE CONTROLS SCHEMATICS ON SHEET MC-722.
15. FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-20B FULTON COUNTY COURTHOUSE - BASEMENT FLOOR PLAN
SCALE: 1/8" = 1'-0"

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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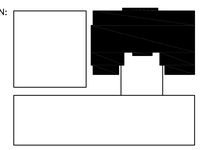

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ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE BASEMENT FLOOR PLAN

DRAWING NO.
MC-20B

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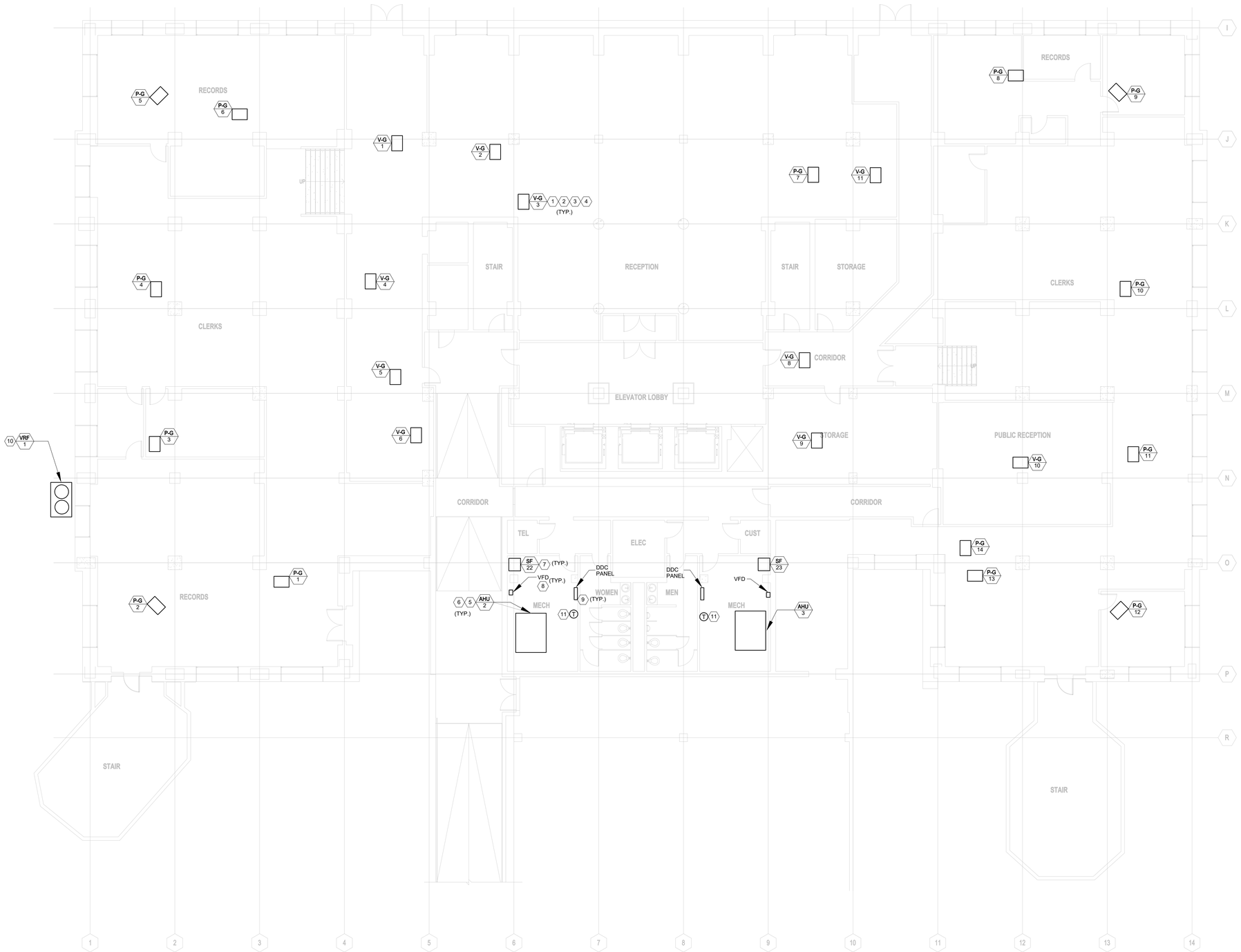

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN, SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6. FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7. THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9. REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10. FURNISH AND INSTALL NEW BACNET CONTROLLER TO THE EXISTING VRF SYSTEM, ASSOCIATED WITH SIX INDOOR UNITS LOCATED AT BRIDGE ON 2ND FLOOR. REFER TO SCHEMATICS ON SHEET MC-702.
11. FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-20G FULTON COUNTY COURTHOUSE - GROUND FLOOR PLAN
SCALE: 1/8" = 1'-0"

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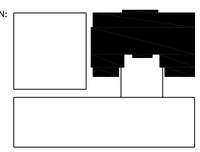

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - GROUND FLOOR PLAN

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MC-20G

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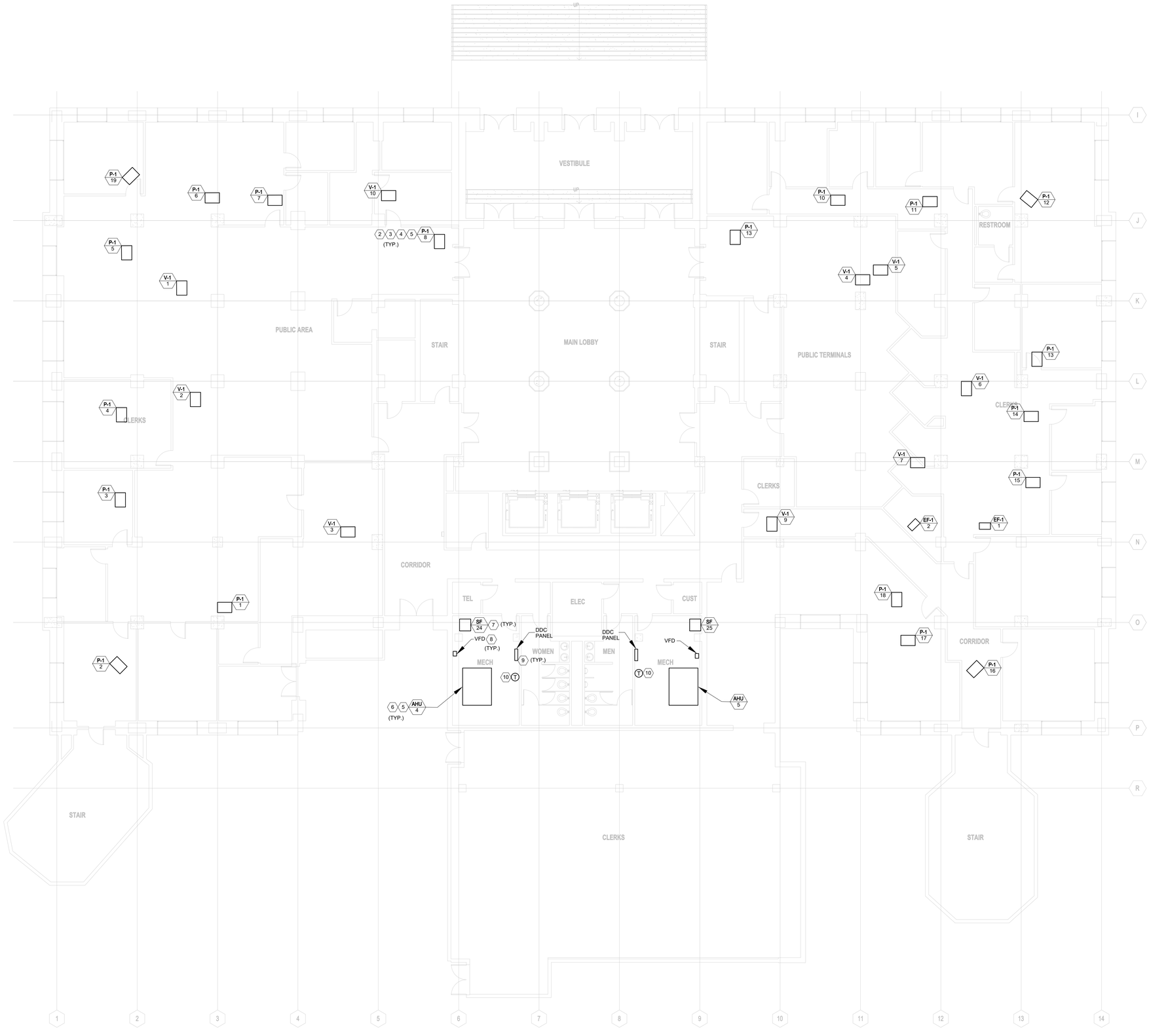

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-201 FULTON COUNTY COURTHOUSE - FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"

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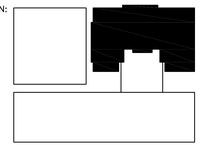

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - FIRST FLOOR PLAN

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MC-201

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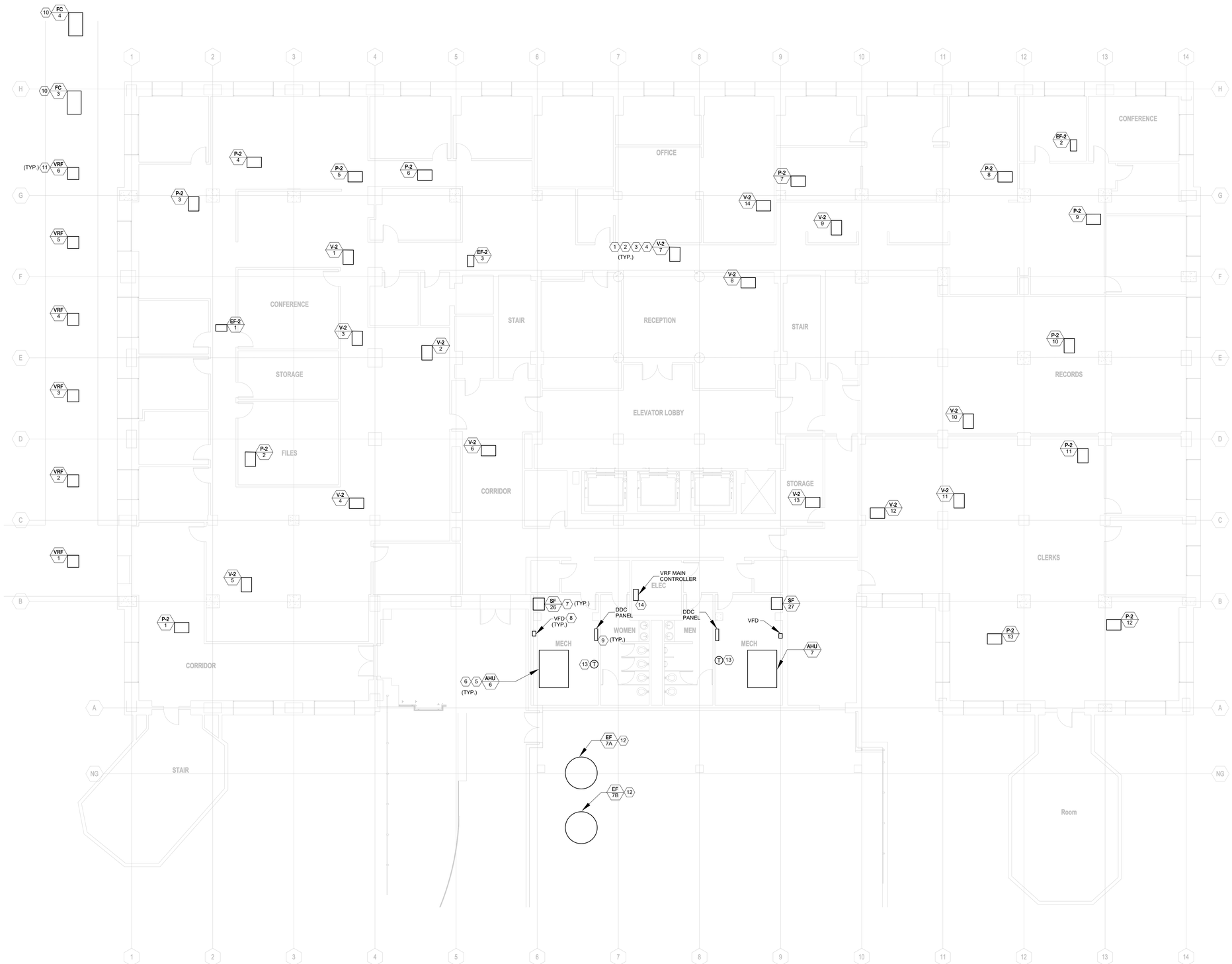

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	FURNISH AND INSTALL NEW BACNET THERMOSTAT FOR FAN COIL UNITS. REFER TO SCHEMATICS ON SHEET MC-722.
11	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR DX UNITS ASSOCIATED WITH VRF SYSTEM. REFER TO SCHEMATICS ON SHEET MC-703.
12	EXISTING EXHAUST FANS SHALL BE CONTROLLED BY THE FIRE ALARM SYSTEM. ADD STATUS MONITORING UNDER THIS CONTRACT SCOPE. REFER TO SCHEMATICS ON SHEET MC-721.
13	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.
14	EXISTING VRF SYSTEM MAIN CONTROLLER TO REMAIN AND SHALL BE CONNECTED TO THE NIAGARA 4 NETWORK. FIELD VERIFIED FOR EXACT LOCATION.

1 MC-202 FULTON COUNTY COURTHOUSE - SECOND FLOOR PLAN
SCALE: 1/8" = 1'-0"

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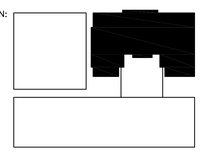

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SECOND FLOOR PLAN

DRAWING NO.
MC-202

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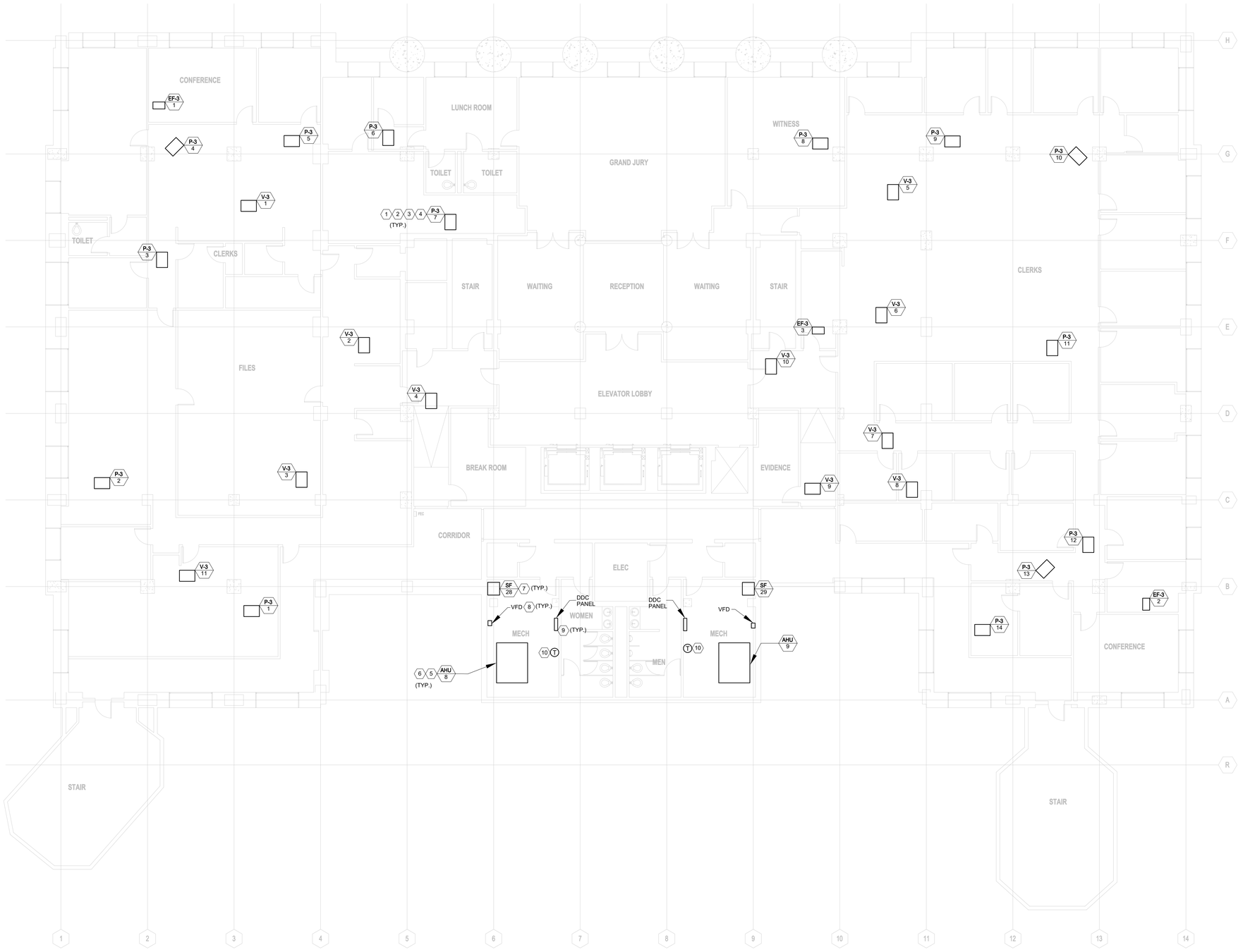

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN, SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-203 FULTON COUNTY COURTHOUSE - THIRD FLOOR PLAN
SCALE: 1/8" = 1'-0"

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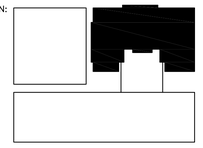

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - THIRD FLOOR PLAN

DRAWING NO.
MC-203

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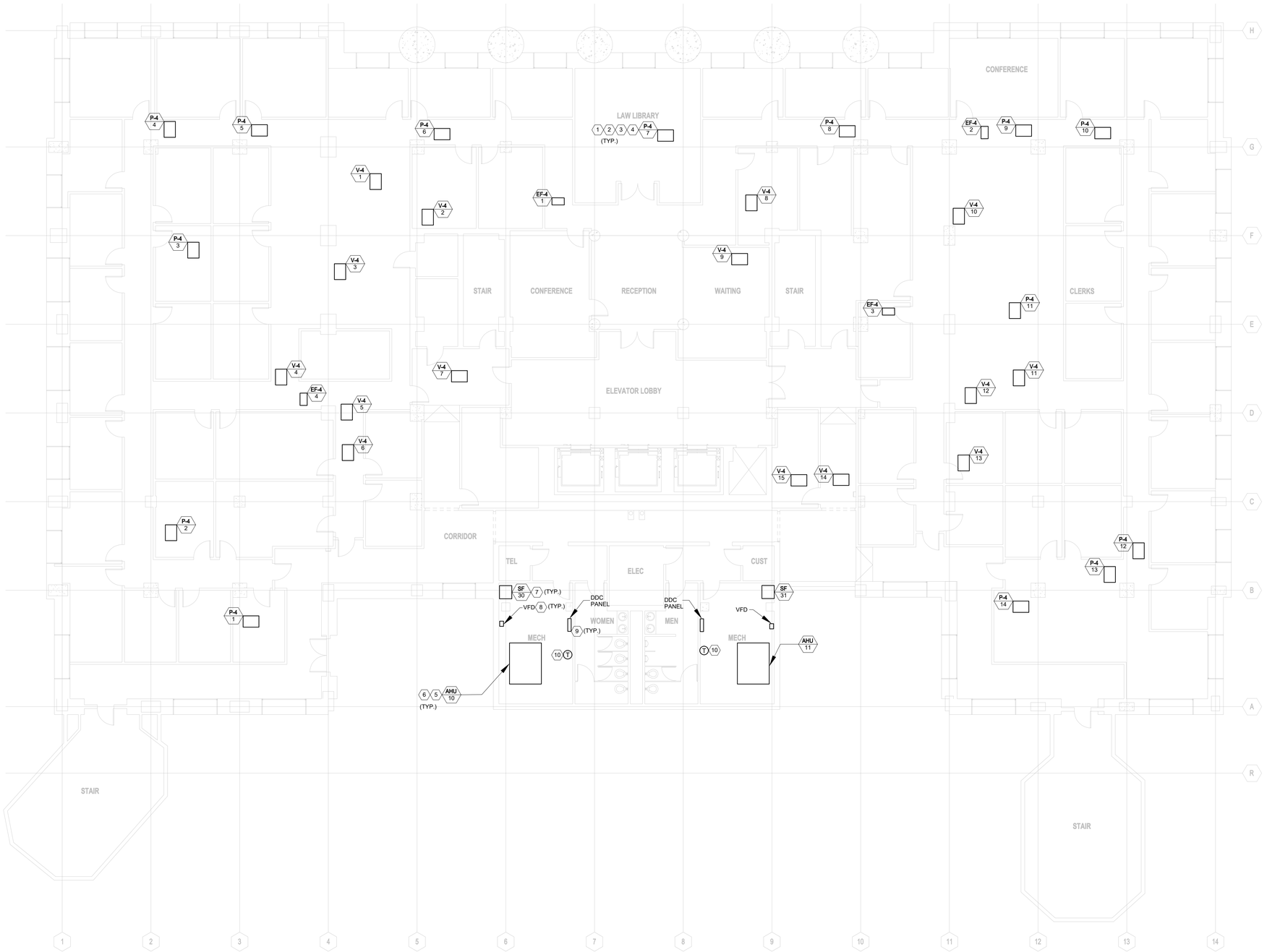

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-204 FULTON COUNTY COURTHOUSE - FOURTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - FOURTH FLOOR PLAN

DRAWING NO.
MC-204

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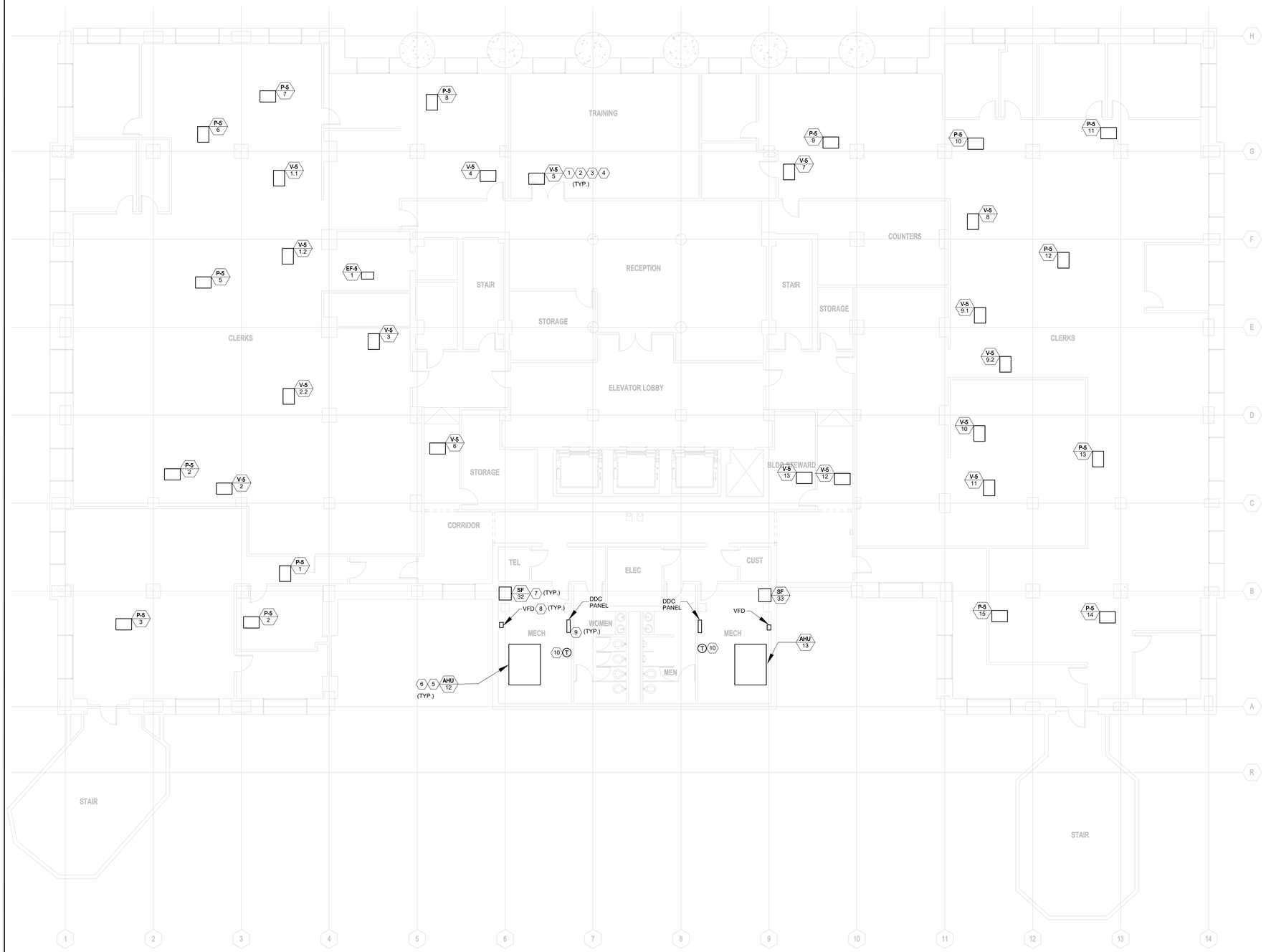

MECHANICAL CONTROLS KEYED NOTES

(#)

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6. FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK. NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7. THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8. THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9. REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10. FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-205 FULTON COUNTY COURTHOUSE - FIFTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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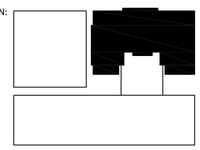
NO.	DESCRIPTION	DATE

KEY PLAN:



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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - FIFTH FLOOR PLAN

DRAWING NO.

MC-205

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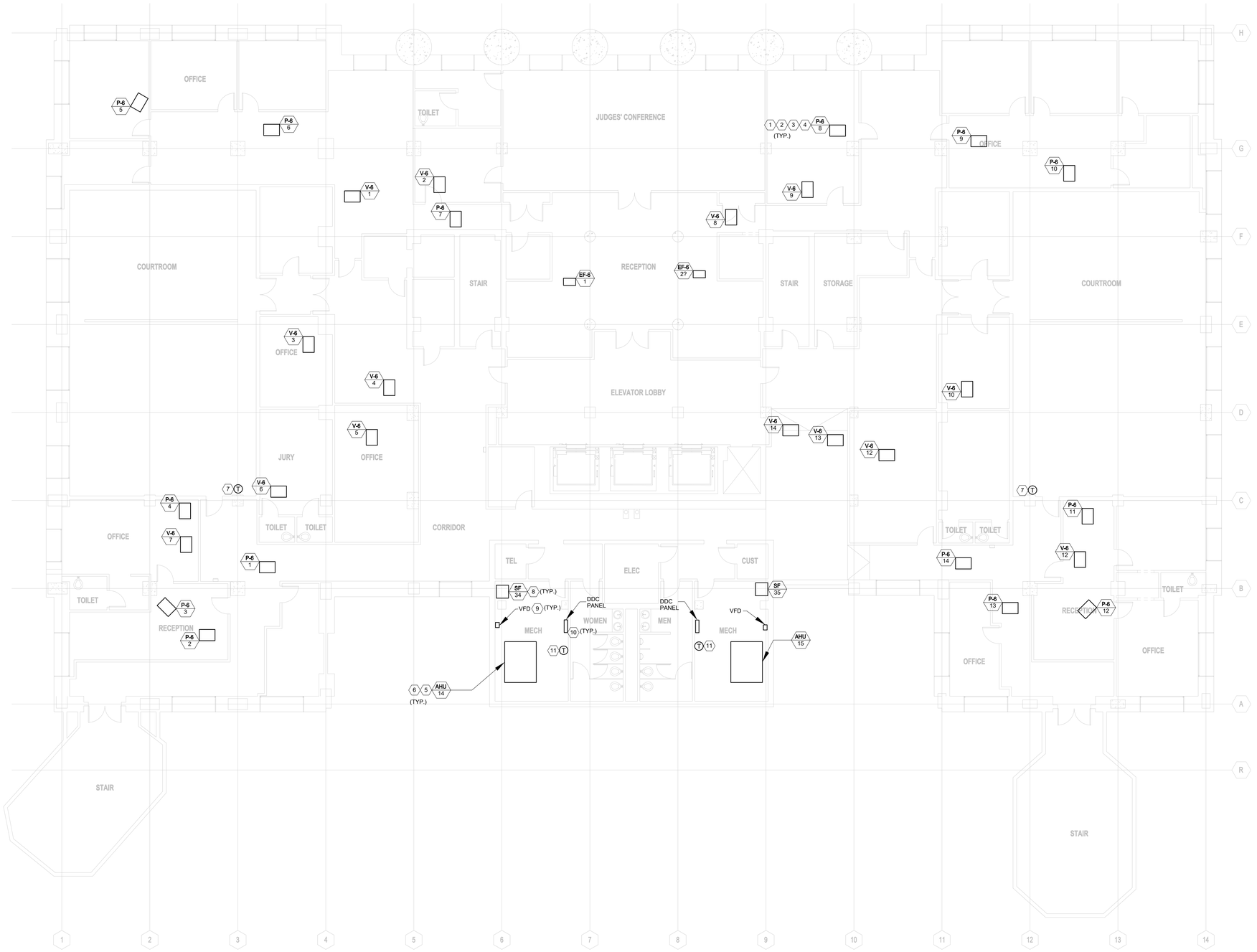

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN, SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
8	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
10	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
11	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-206 FULTON COUNTY COURTHOUSE - SIXTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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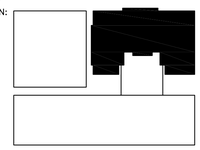

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SIXTH FLOOR PLAN

DRAWING NO.

MC-206

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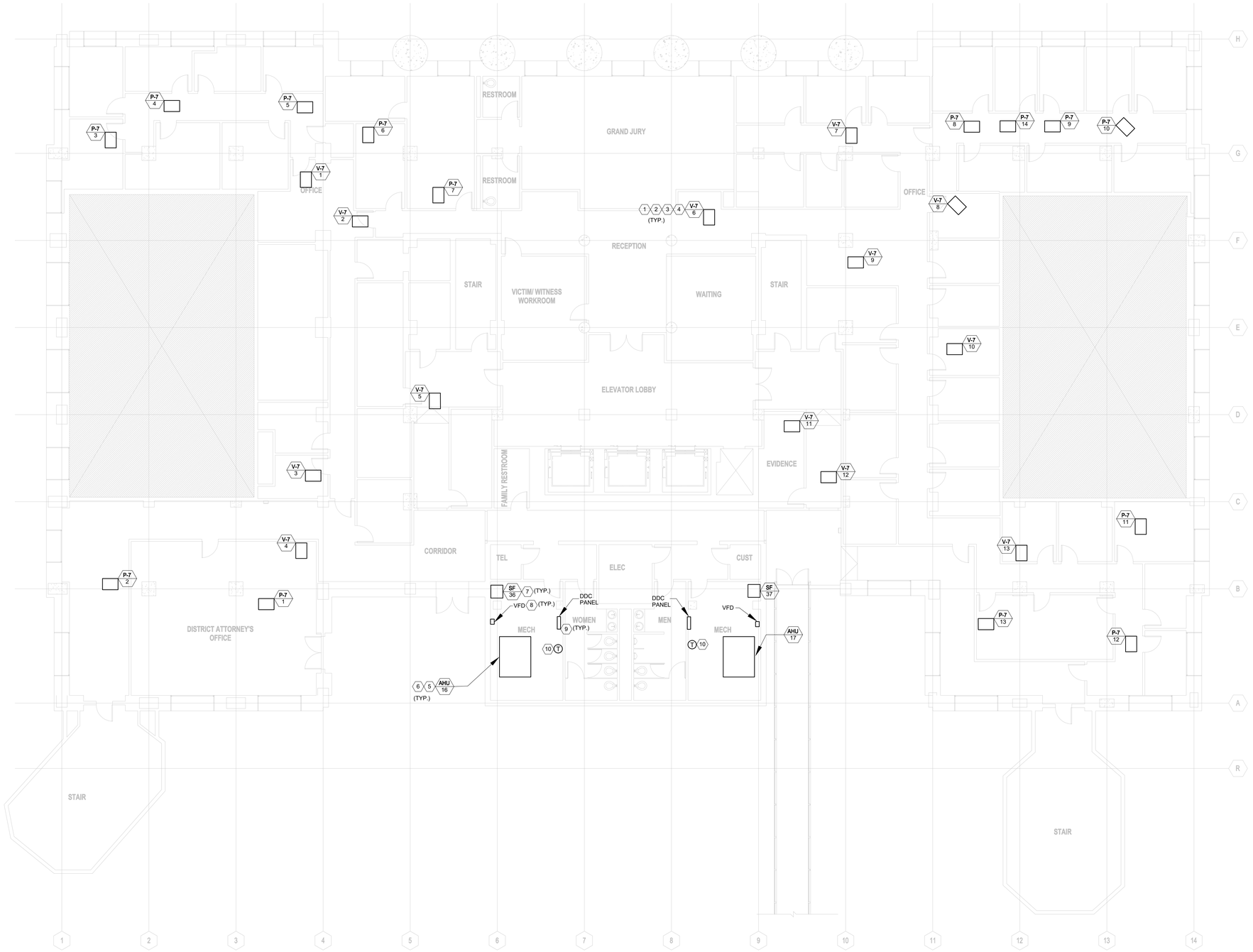

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN, SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-207 FULTON COUNTY COURTHOUSE - SEVENTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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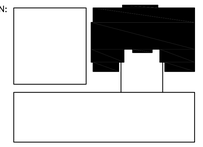

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SEVENTH FLOOR PLAN

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MC-207

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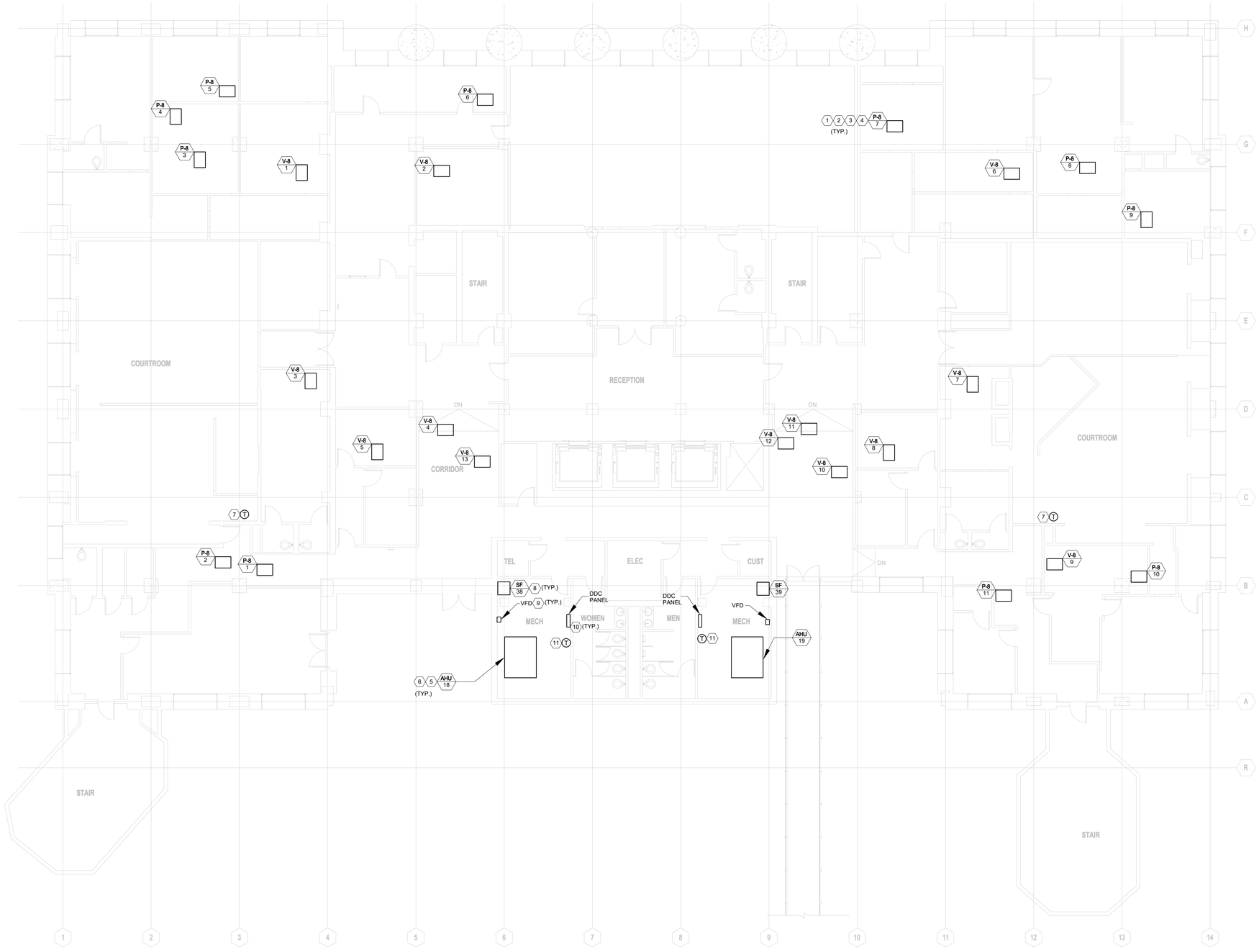

#	MECHANICAL CONTROLS KEYED NOTES
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	FURNISH AND INSTALL NEW CO2 / TEMPERATURE / RH SENSORS IN COURTROOMS PER MANUFACTURER'S INSTRUCTIONS.
8	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
10	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
11	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-208 FULTON COUNTY COURTHOUSE - EIGHTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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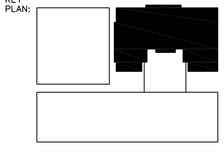

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - EIGHTH FLOOR PLAN

DRAWING NO.

MC-208

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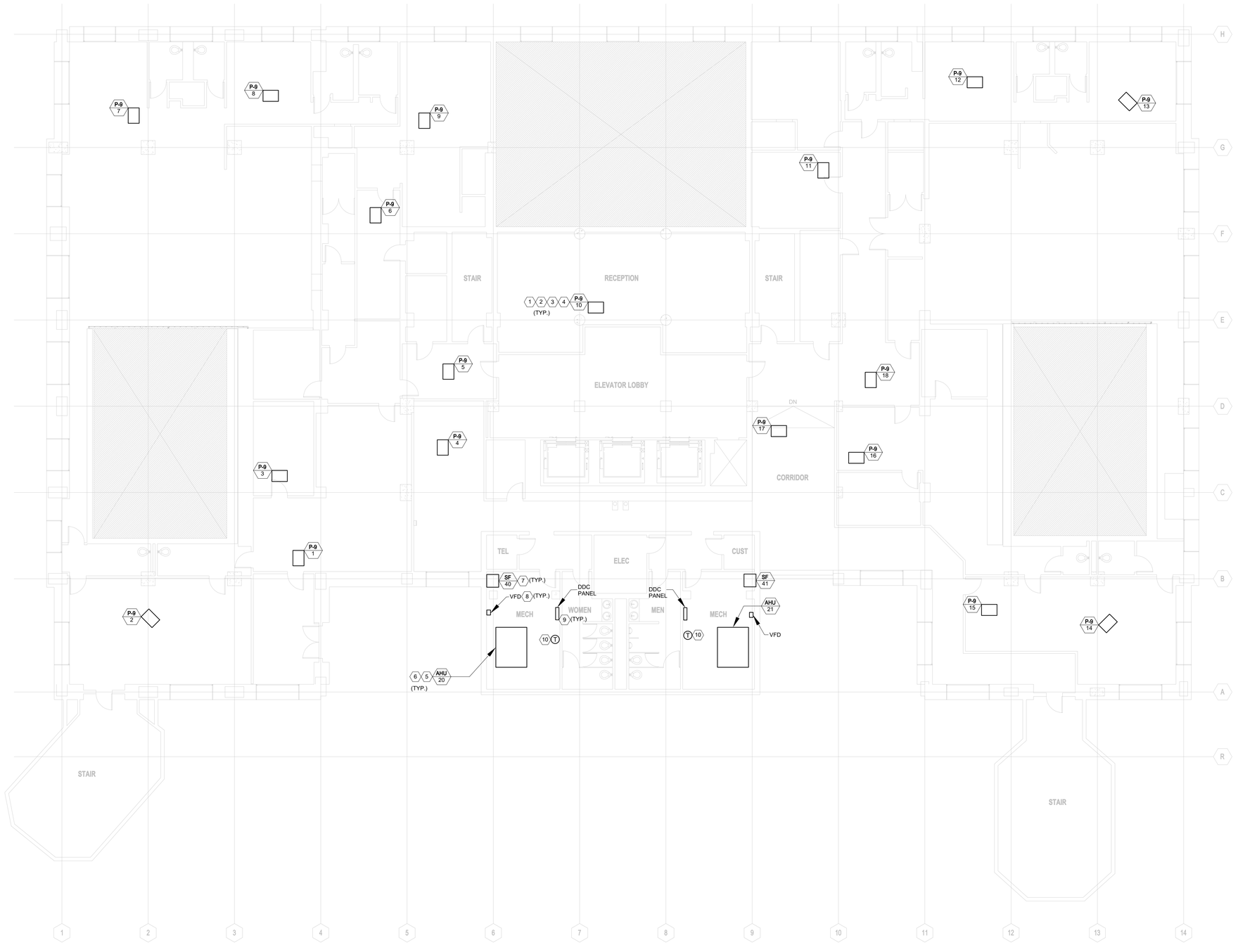

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-620 & MC-621 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-520 FOR MORE INFORMATION. TYPICAL
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-720.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	THE EXISTING OUTSIDE AIR FAN TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
8	THE EXISTING VFD TO REMAIN AND SHALL BE CONNECTED TO BACNET NETWORK.
9	REMOVE AND DISPOSE THE EXISTING DDC PANEL.
10	FURNISH AND INSTALL ROOM TEMPERATURE SENSOR AND SAFETY SENSOR- REFER TO SCHEMATICS ON SHEET MC-720.

1 MC-209 FULTON COUNTY COURTHOUSE - NINTH FLOOR PLAN
SCALE: 1/8" = 1'-0"

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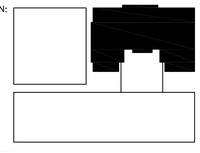

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MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - NINTH FLOOR PLAN

DRAWING NO.

MC-209

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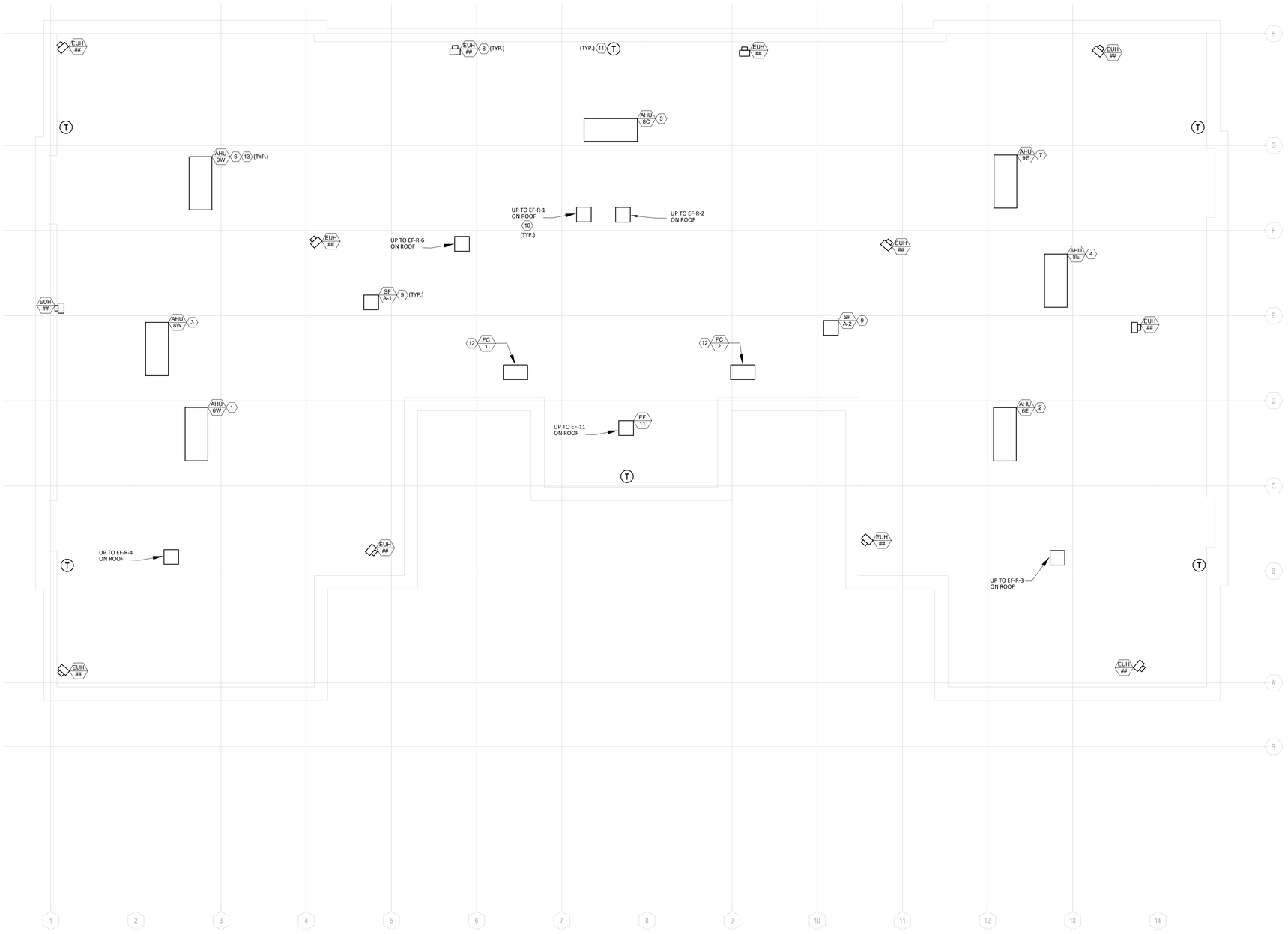

MECHANICAL CONTROLS KEYED NOTES

1. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-6W. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-6W SINGLE ZONE VAV SERVING COURTROOM LOCATED ON SIXTH FLOOR WEST SIDE.
2. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-6E. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-6E SINGLE ZONE VAV SERVING COURTROOM LOCATED ON SIXTH FLOOR EAST SIDE.
3. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-8W. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-8W SINGLE ZONE VAV SERVING COURTROOM LOCATED ON EIGHT FLOOR WEST SIDE.
4. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-8E. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-8E SINGLE ZONE VAV SERVING COURTROOM LOCATED ON EIGHT FLOOR EAST SIDE.
5. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-8C. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-8C SINGLE ZONE VAV SERVING COURTROOM LOCATED ON EIGHT FLOOR NORTH CENTRAL.
6. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-9W. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-9W SINGLE ZONE VAV SERVING COURTROOM LOCATED ON NINTH FLOOR WEST SIDE.
7. FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AHU-9E. SEE CONTROLS SCHEMATICS ON SHEET MC-723. AHU-9E SINGLE ZONE VAV SERVING COURTROOM LOCATED ON NINTH FLOOR EAST SIDE.
8. ELECTRIC UNIT HEATER SHOWN FOR CLARITY PURPOSE ONLY. N.I.C.
9. EXISTING STAIRWELL PRESSURIZATION FANS TO REMAIN AND SHALL BE CONTROLLED BY FIRE ALARM SYSTEM. ADD STATUS MONITORING UNDER THIS CONTRACT SCOPE. REFER TO SCHEMATICS MC-702.
10. EXISTING EXHAUST FANS TO REMAIN AND SHALL BE INTEGRATED TO THE NEW BACNET NETWORK. REFER TO SCHEMATICS ON SHEET MC-722. THE EXACT LOCATION OF THE FANS ARE ON THE ROOF.
11. FURNISH AND INSTALL NEW TEMPERATURE SENSORS IN PENTHOUSE PER MANUFACTURER'S INSTRUCTIONS.
12. EXISTING CHILLED WATER FAN COIL UNITS SERVING ELEVATOR ROOMS TO REMAIN. SHOWN FOR CLARITY PURPOSES ONLY, N.I.C.

1 MC-20PH FULTON COUNTY COURTHOUSE - PENTHOUSE FLOOR PLAN
SCALE: 1/8" = 1'-0"

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FULTON COUNTY

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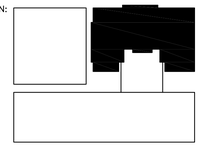

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FULTON COUNTY COURTHOUSE - PENTHOUSE FLOOR PLAN

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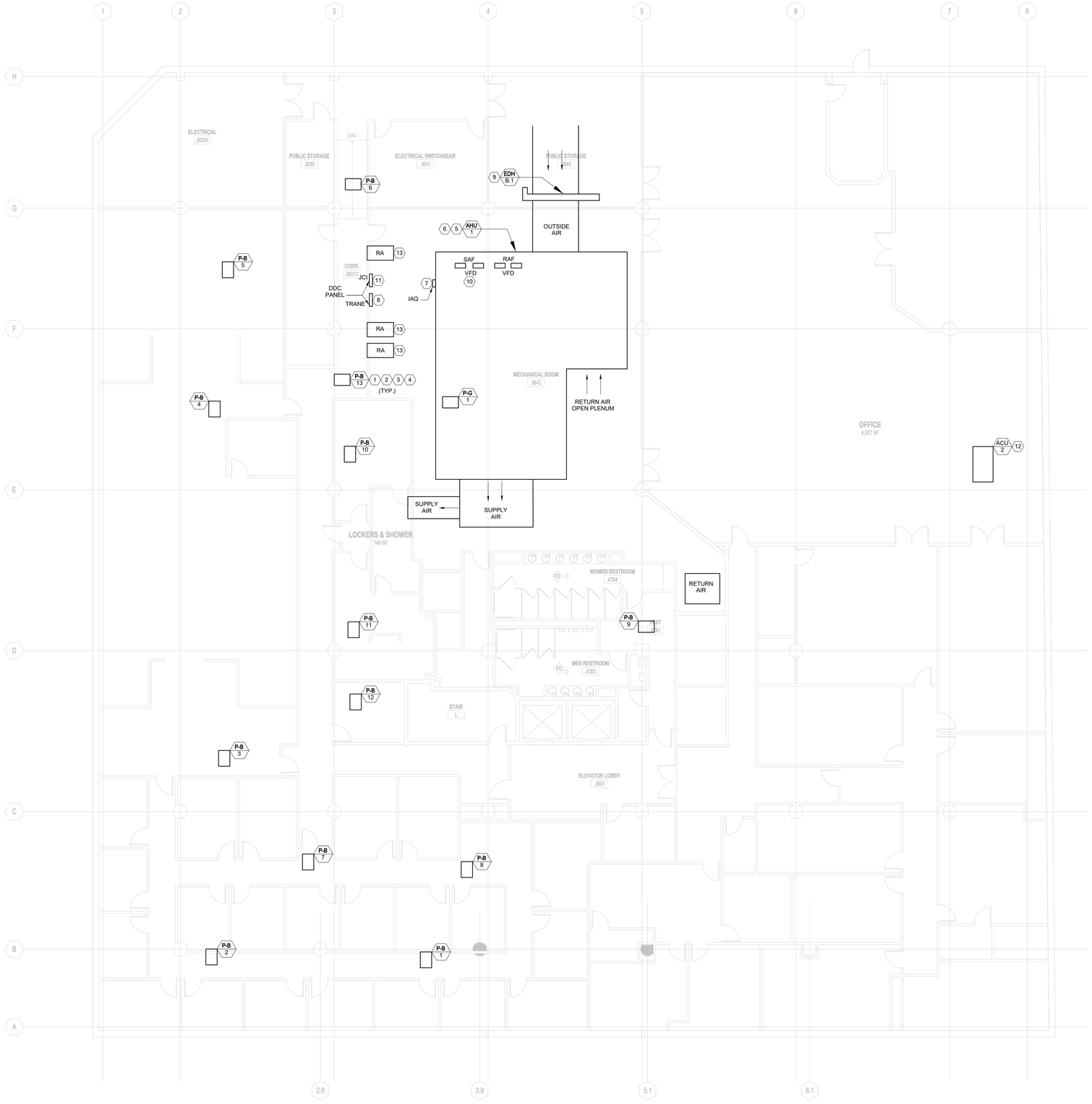

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL.
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-630 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL.
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL.
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-530 FOR MORE INFORMATION. TYPICAL.
5	FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT, SEE CONTROLS SCHEMATICS ON SHEETS MC-730.
6	FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
7	REPLACE EXISTING Ebtron IAQ ENFORCER WITH NEW GTx108-F FAN ARRAY AIRFLOW MEASURING SYSTEM. FURNISH AND INSTALL NEW FAN INLET FLOW PROBES AND CONNECT TO NEW GTC108 TRANSMITTER WITH BACNET COMMUNICATION PORT AND ANALOG OUTPUT SIGNALS FOR INDIVIDUAL FAN FLOW AND TEMPERATURE READINGS. FURNISH ONE NEW SYSTEM FOR SUPPLY FANS AND ONE SYSTEM FOR RETURN FANS. COORDINATE WITH Ebtron REPRESENTATIVE , HILL COMPANY, ROSWELL, GA, 770.751.0070.
8	TRANE BACNET DDC PANEL TO REMAIN, SEE NOTE D.7 ON SHEET MC-001.
9	OUTSIDE AIR DUCT HEATER EDH-B1 IN OA SUPPLY DUCT . SEE CONTROL SCHEMATICS SHEET MC-730.
10	FURNISH AND INSTALL TWO (2) NEW 75 HP ABB VFDs TO REPLACE EXISTING CUTLER HAMMER VFDs ON SUPPLY FANS TO MATCH ABB VFDs ON THE RETURN FANS. DISCONNECT VFDs. TO BE REPLACED FROM THE EXISTING ELECTRICAL CIRCUIT, CONNECT NEW VFDs TO THE EXISTING CIRCUIT.
11	REMOVE AND DISPOSE THE EXISTING JCI CONTROL PANEL.
12	FURNISH AND INSTALL BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-731.
13	RETURN AIR ATTENUATOR WITH FIRE/SMOKE DAMPER AT HIGH LEVEL ABOVE CEILING IN CORRIDOR. SHOWN FOR CLARITY PURPOSES.

1 MC-30B — JUSTICE CENTER BUILDING - BASEMENT FLOOR PLAN
SCALE: 1/8" = 1'-0"

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FULTON COUNTY

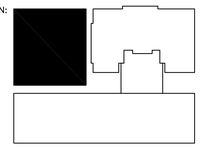
FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED

NO.	DESCRIPTION	DATE

KEY PLAN:



SLK PROJECT NO. 2019002
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REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019

DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - BASEMENT FLOOR PLAN

DRAWING NO.

MC-30B

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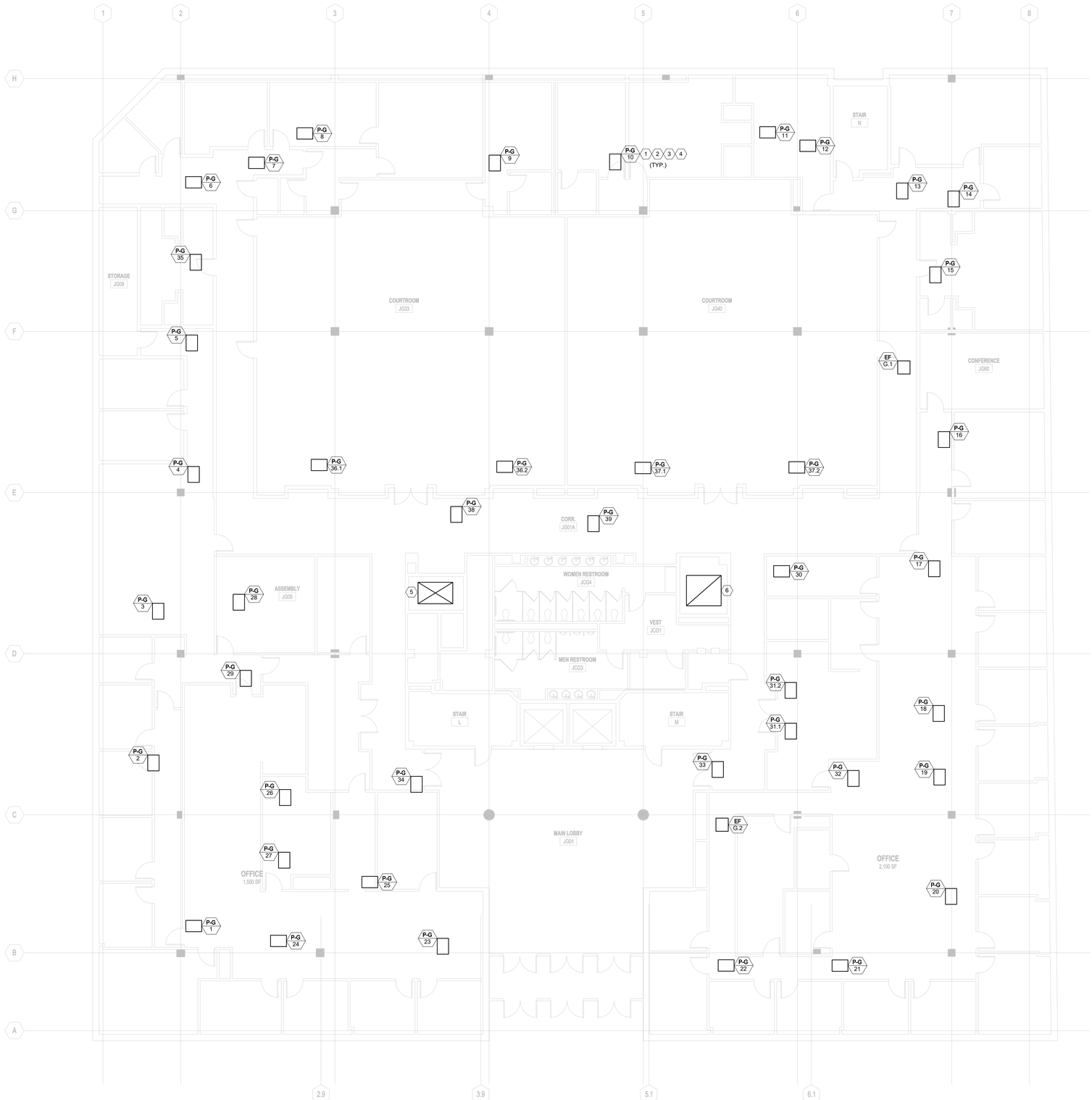

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-630 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-530 FOR MORE INFORMATION. TYPICAL
5. SUPPLY AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.
6. RETURN AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.

1 MC-101 MECHANICAL CONTROLS - GROUND FLOOR PLAN
SCALE: 1/16" = 1'-0"

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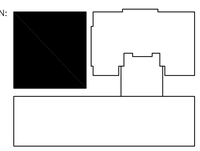

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ISSUE DATE	11/18/2019

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MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - GROUND FLOOR PLAN

DRAWING NO.

MC-30G

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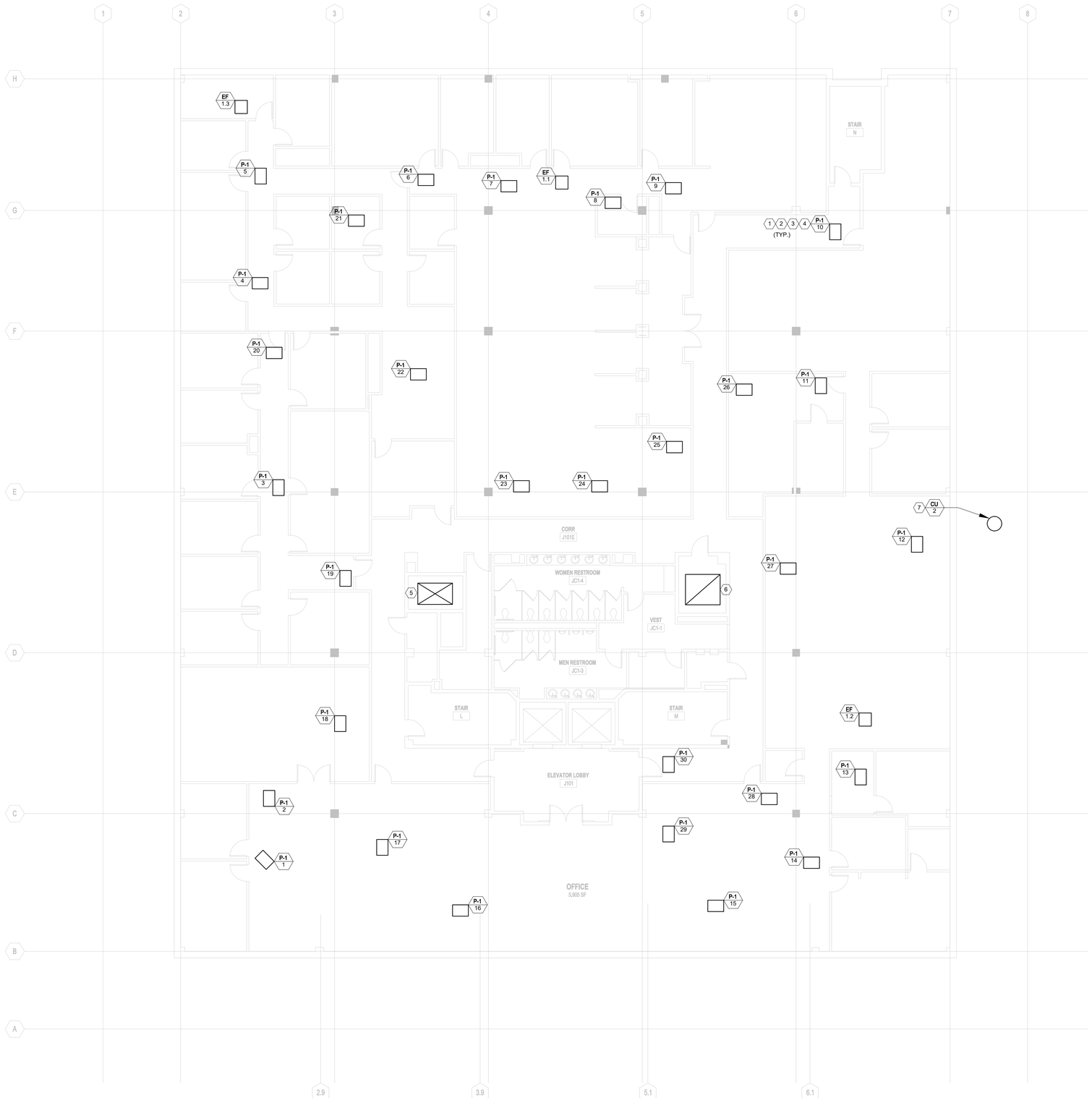

MECHANICAL CONTROLS KEYED NOTES

#	
1	REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2	REFER TO FTU/VAV SCHEDULE ON SHEET MC-630 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3	MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4	RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-530 FOR MORE INFORMATION. TYPICAL
5	SUPPLY AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.
6	RETURN AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.
7	CONDENSER UNIT ASSOCIATED WITH ACU-2. REFER TO SHEET MC-30B FOR MORE INFORMATION.

1 MC-102 MECHANICAL CONTROLS - FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"

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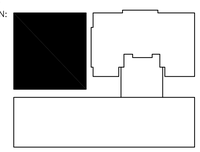

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SCALE	AS INDICATED
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DRAWING TITLE

MECHANICAL CONTROLS
-JUSTICE CENTER BUILDING -
FIRST FLOOR PLAN

DRAWING NO.

MC-301

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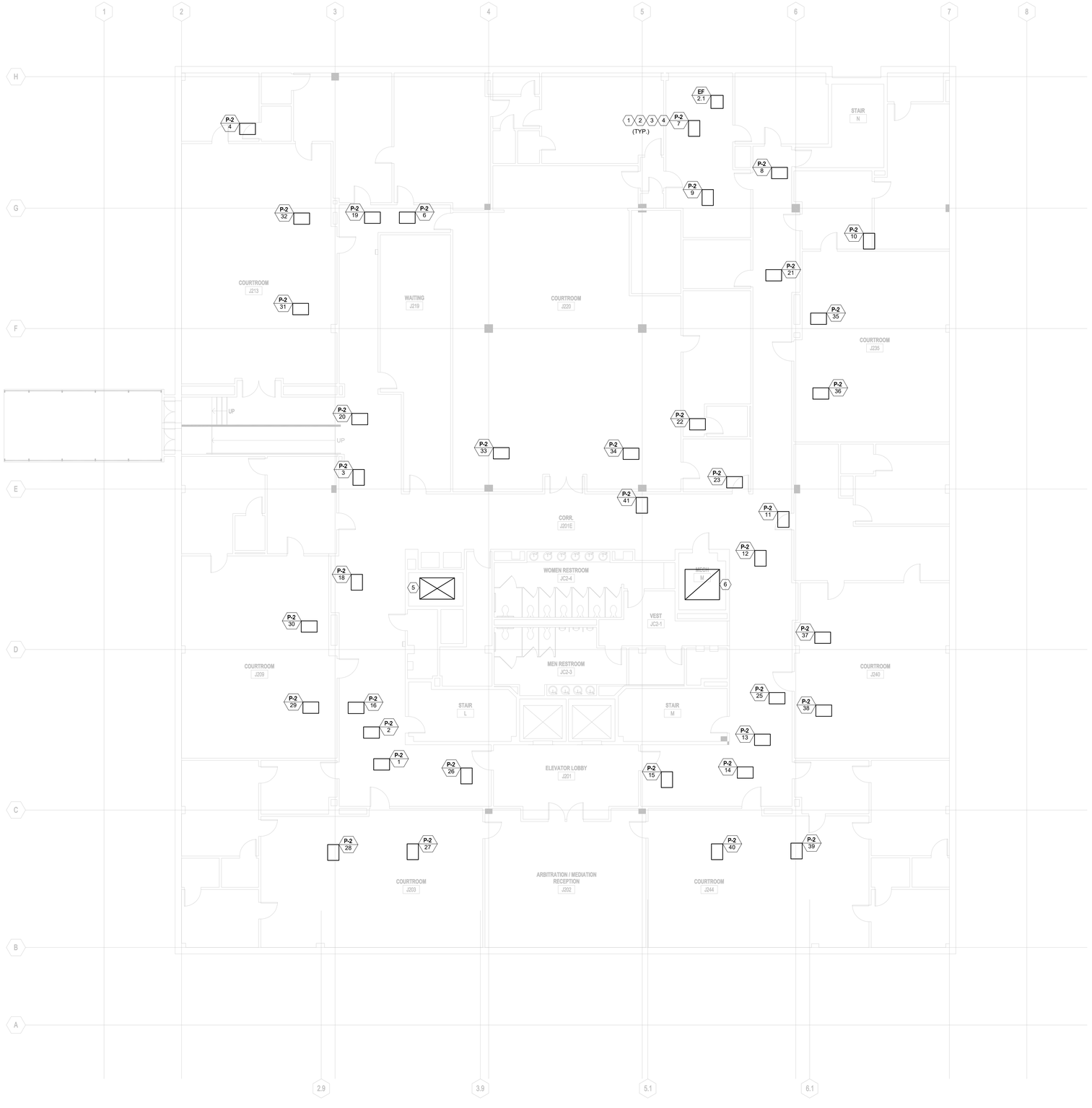

MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU)/VAV BOX AND CONTROLS. PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES. TYPICAL
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-630 FOR SIZE AND CAPACITY OF NEW UNIT. TYPICAL
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSATLL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740. TYPICAL
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNIT'S INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-530 FOR MORE INFORMATION. TYPICAL
5. SUPPLY AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.
6. RETURN AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.

1 / MC-103 MECHANICAL CONTROLS - SECOND FLOOR PLAN
SCALE: 1/16" = 1'-0"

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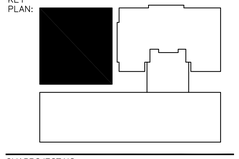

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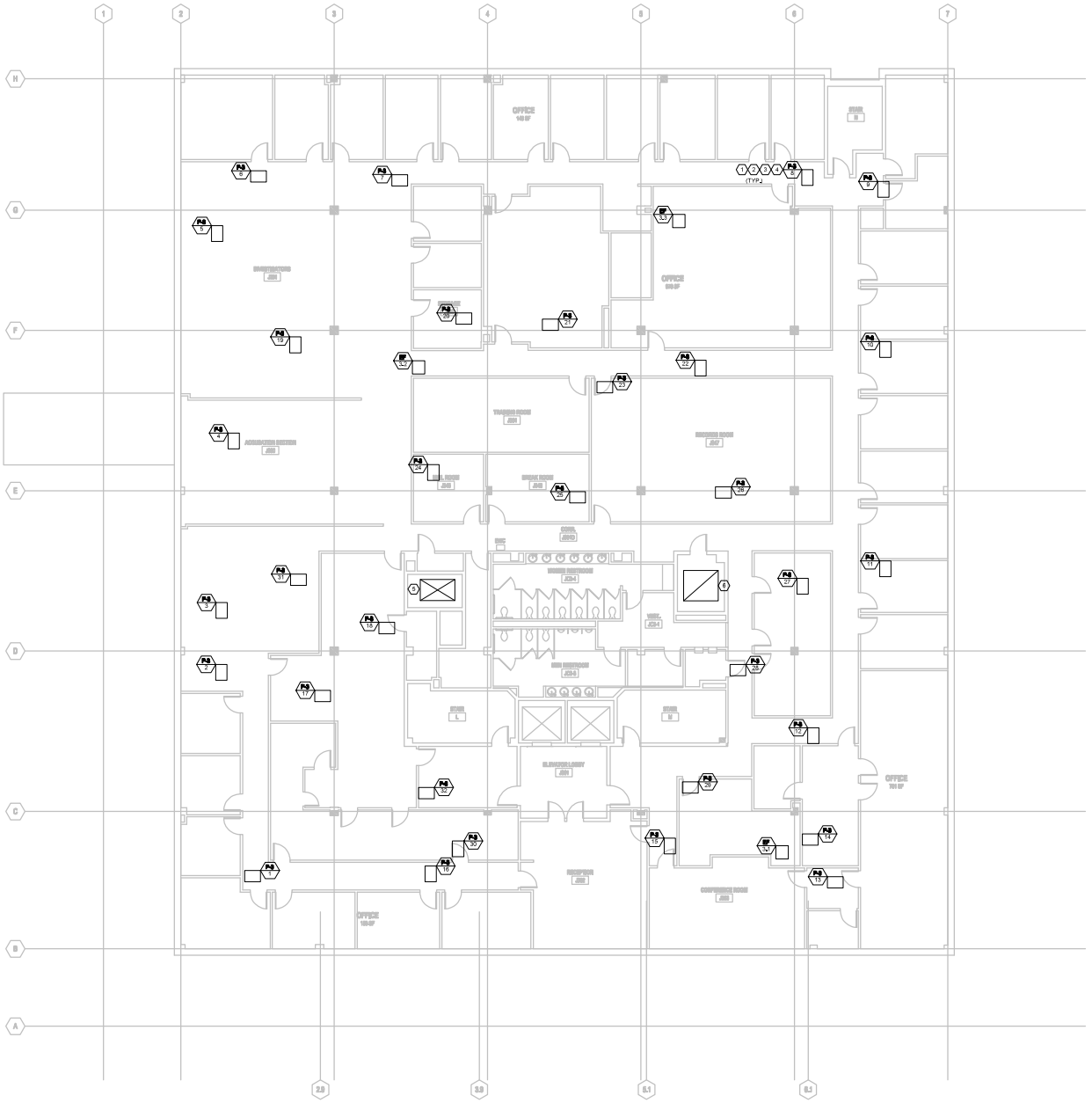
DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - SECOND FLOOR PLAN

DRAWING NO.
MC-302

ISSUED FOR BID



MECHANICAL CONTROLS KEYED NOTES

1. REMOVE AND DISPOSE OF AN EXISTING FAN TERMINAL UNIT (FTU/VAV BOX AND CONTROLS). PATCH CEILING AND/OR WALL PENETRATIONS AFFECTED BY DEMOLITION WORK TO MATCH ADJACENT SURFACES, TYPICAL.
2. REFER TO FTU/VAV SCHEDULE ON SHEET MC-600 FOR SIZE AND CAPACITY OF NEW UNIT, TYPICAL.
3. MOUNT NEW FTU/VAV PER MANUFACTURER'S INSTRUCTIONS AND LOCATE AT THE SAME LOCATION AS EXISTING. FIELD VERIFY EXACT LOCATION OF EXISTING UNIT. MANUFACTURE TO FACTORY MOUNT/INSTALL DDC CONTROLS FURNISHED BY CONTROL VENDOR. SEE CONTROLS SCHEMATICS ON SHEET MC-740, TYPICAL.
4. RECONNECT NEW FTU/VAV TO EXISTING DUCTWORK. PROVIDE TRANSITION AS REQUIRED FOR NEW UNITS' INLET AND/OR OUTLET CONNECTION. FIELD VERIFY EXACT SIZE AND LOCATION OF EXISTING DUCTWORK. REFER TO DETAILS ON SHEET MC-400 FOR MORE INFORMATION, TYPICAL.
5. SUPPLY AIR RISER DUCTWORK FROM THE AHU-1 LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.
6. RETURN AIR RISER DUCTWORK FROM THE AHU LOCATED ON THE BASEMENT FLOOR. REFER TO SCHEMATICS ON SHEET MC-731.

1 MC-404 MECHANICAL CONTROLS - THIRD FLOOR PLAN
SCALE: 1/16" = 1'-0"

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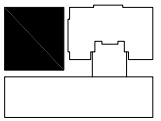

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DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - THIRD FLOOR PLAN

DRAWING NO.
MC-303

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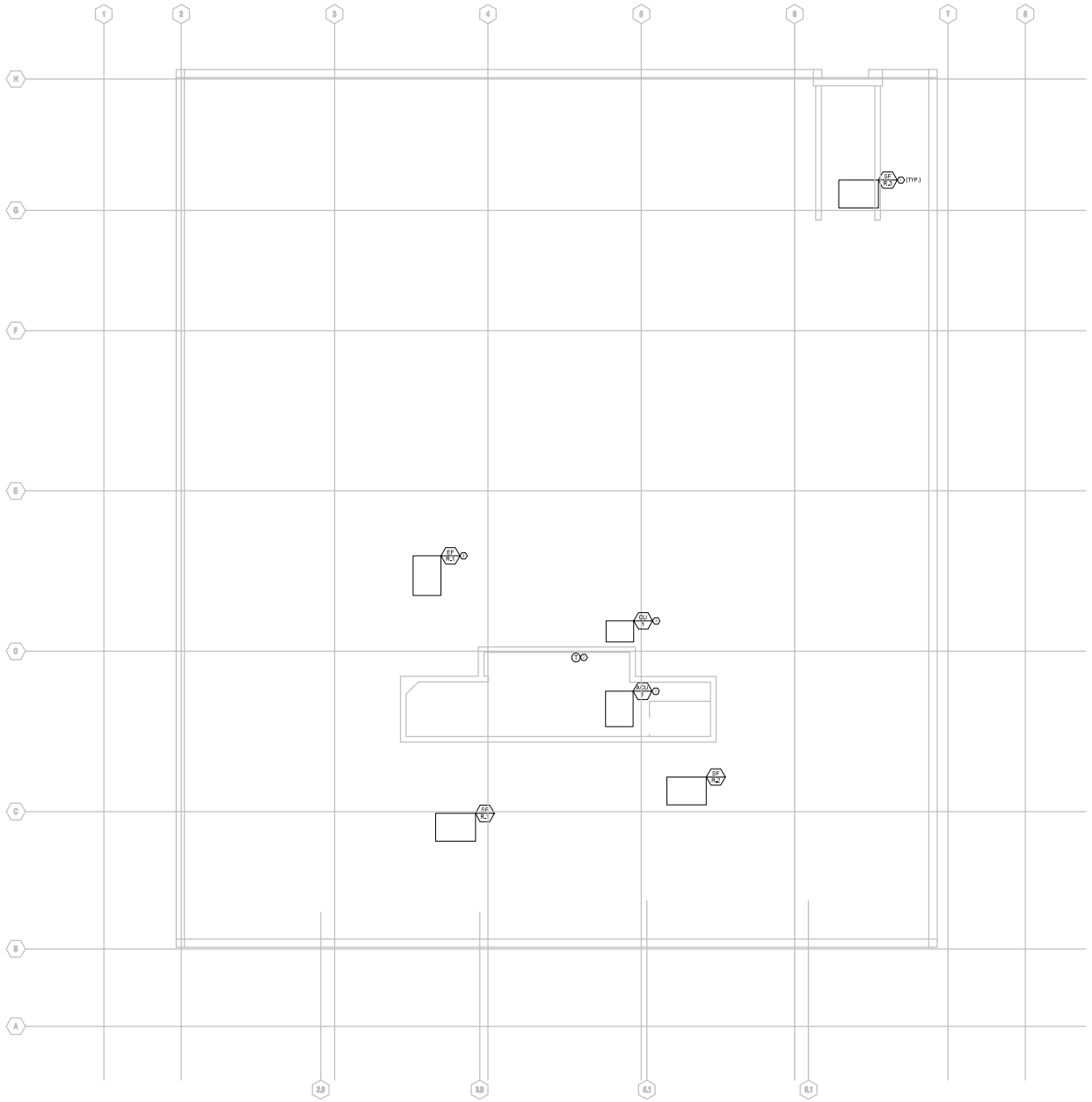

MECHANICAL CONTROLS KEYED NOTES

1 EXISTING STAIRWELL PRESSURIZATION FANS TO REMAIN AND SHALL BE CONTROLLED BY FIRE ALARM SYSTEM. ADD STATUS MONITORING UNDER THIS CONTRACT SCOPE. REFER TO SCHEMATICS MC-731.

2 FURNISH AND INSTALL BACNET THERMOSTAT FOR SPLIT SYSTEM INDOOR UNIT. REFER TO SCHEMATICS ON SHEET MC-731.

3 CONDENSER UNIT ASSOCIATED WITH AC1-1.

4 EXISTING EXHAUST FAN TO REMAIN AND SHALL BE INTEGRATED TO THE NEW BACNET NETWORK. REFER TO SCHEMATICS ON SHEET MC-731.

1 / MC-005 JUSTICE CENTER BUILDING - ROOF PLAN
SCALE: 1/8" = 1'-0"

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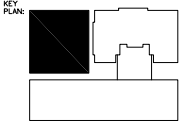

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DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - ROOF PLAN

DRAWING NO.
MC-30R

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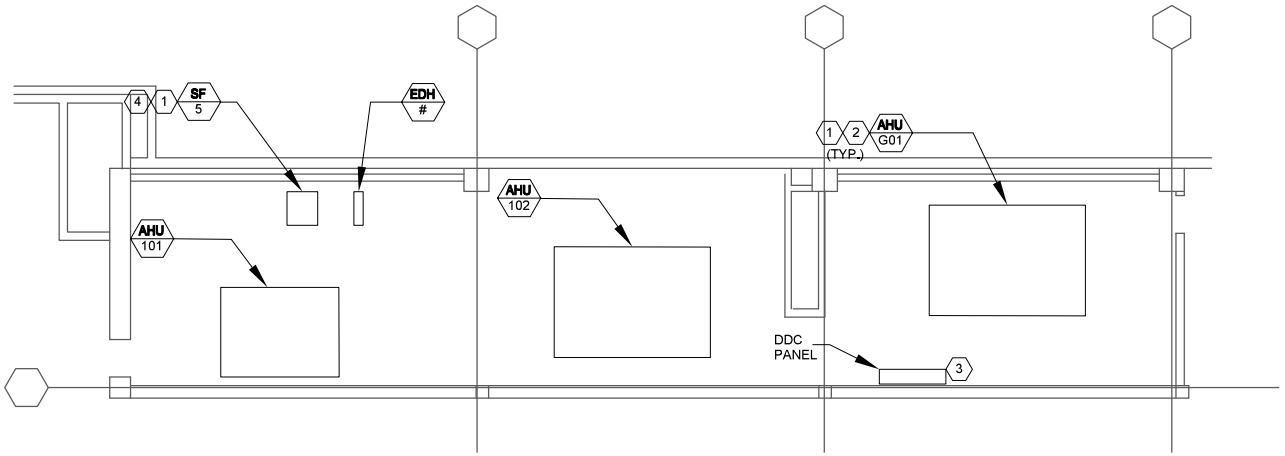
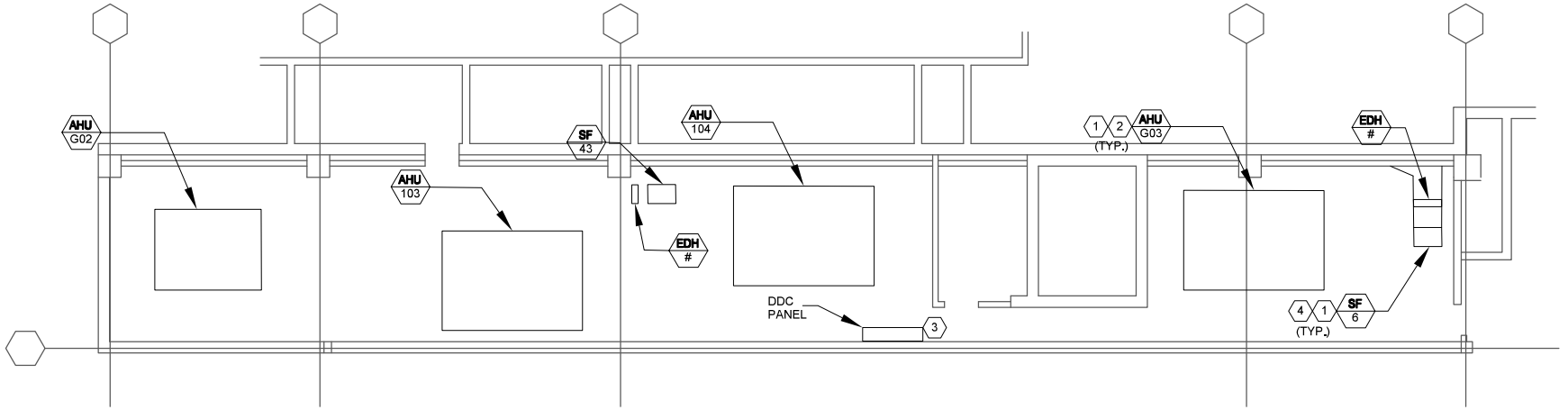


1 MC-400 AHUs LOCATED AT WEST WING INTERSTITIAL ON 1ST FLOOR
SCALE: NONE

(#) MECHANICAL CONTROLS KEYED NOTES

1 FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-700.
2 FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.J ON SHEET MC-001 FOR ADDITIONAL INFORMATION.
3 REMOVE AND DISPOSE THE EXISTING DDC PANEL. FIELD VERIFIED THE DDC PANEL LOCATION.
4 EXISTING SUPPLY FAN TO REMAIN.



2 MC-400 AHUs LOCATED AT EAST WING INTERSTITIAL ON 1ST FLOOR
SCALE: NONE

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DRAWING TITLE
JUSTICE CENTER TOWER - ENLARGED FIRST FL INTERSTITIAL MECH RMS

DRAWING NO.
MC-400

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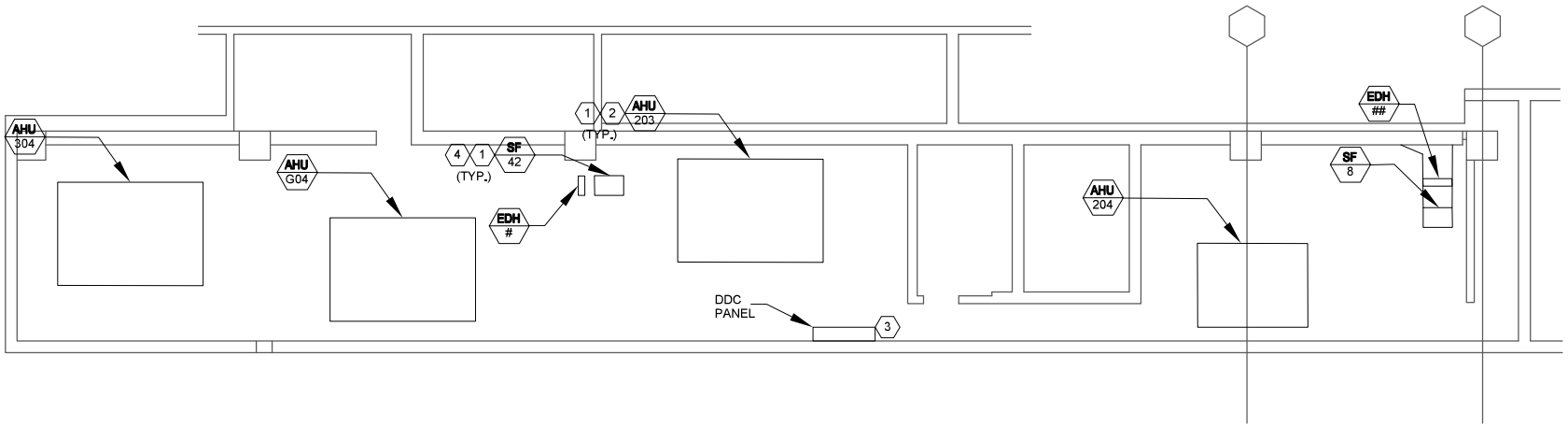
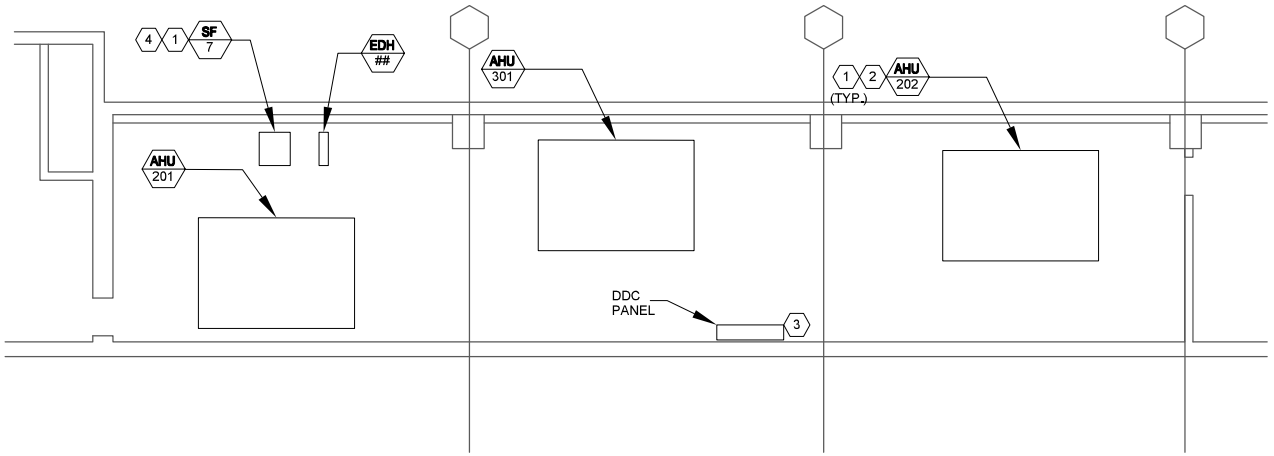


1 MC-401 AHUs LOCATED AT EAST WING INTERSTITIAL ON 2ND FLOOR
SCALE: PHOTO



2 MC-401 AHUs LOCATED AT WEST WING INTERSTITIAL ON 2ND FLOOR
SCALE: NONE

(#) MECHANICAL CONTROLS KEYED NOTES

1 FURNISH AND INSTALL NEW BACNET CONTROLLER FOR AIR HANDLING UNIT AND SUPPLY FAN. SEE CONTROLS SCHEMATICS ON SHEET MC-700.
2 FURNISH AND INSTALL NEW COOLING COIL CONTROL VALVE. REFER TO GENERAL SEQUENCE OF WORK NOTE E.1 ON SHEET MC-601 FOR ADDITIONAL INFORMATION.
3 REMOVE AND DISPOSE THE EXISTING DDC PANEL. FIELD VERIFIED THE DDC PANEL LOCATION.
4 EXISTING SUPPLY FAN TO REMAIN.

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DRAWING TITLE
JUSTICE CENTER TOWER - ENLARGED SECOND FL INTERSTITIAL MECH RMS

DRAWING NO.
MC-401

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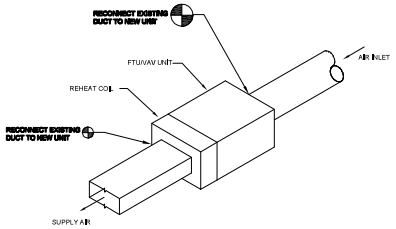
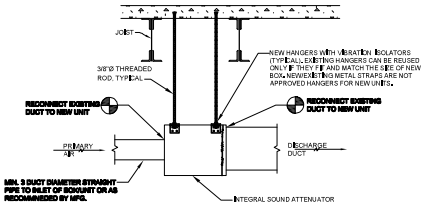
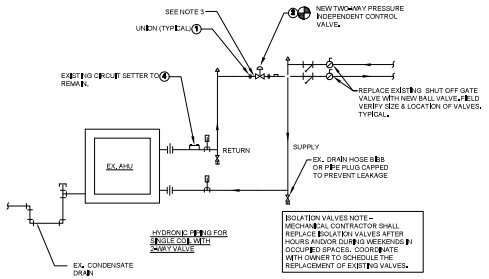


1 M-600 FTU/VAV UNIT W/ ELECTRIC REHEAT COIL
SCALE: NONE

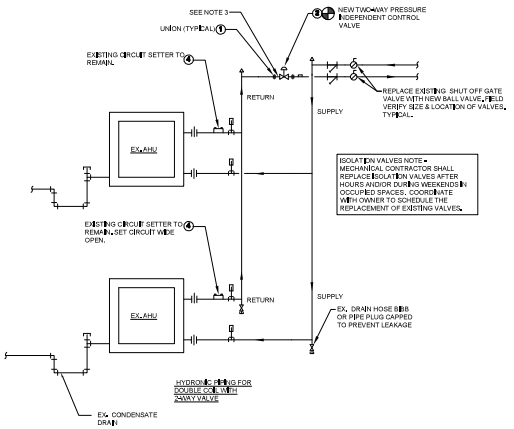


2 M-600 FTU/VAV UNIT SUPPORT DETAIL
SCALE: NONE



NOTES:
1. USE DIELECTRIC OR BRONZE UNIONS WHERE PIPING AND APPENDAGE MATERIALS DIFFER.
2. CONTROL VALVE INSTALLED BETWEEN UNIONS OR FLANGES AS REQUIRED.
3. INSTALL CONCENTRIC REDUCERS BOTH SIDES OF CONTROL VALVE AS REQUIRED.
4. EXISTING CIRCUIT SETTER TO REMAIN.
5. EXISTING PIPING SPECIALTIES TO REMAIN UNLESS NOTED OTHERWISE.

3 M-600 CHILLED SINGLE WATER COIL CONNECTION (2-WAY VALVE) FOR EXISTING AHUs
SCALE: NONE



NOTES:
1. USE DIELECTRIC OR BRONZE UNIONS WHERE PIPING AND APPENDAGE MATERIALS DIFFER.
2. CONTROL VALVE INSTALLED BETWEEN UNIONS OR FLANGES AS REQUIRED.
3. INSTALL CONCENTRIC REDUCERS BOTH SIDES OF CONTROL VALVE AS REQUIRED.
4. EXISTING CIRCUIT SETTER TO REMAIN.
5. EXISTING PIPING SPECIALTIES TO REMAIN UNLESS NOTED OTHERWISE.

4 M-600 CHILLED DUAL WATER COIL CONNECTION (2-WAY VALVE) FOR EXISTING AHUs
SCALE: NONE

TERMINAL UNIT TEST AND BALANCE PROCEDURE

THE CONTRACTOR SHALL EMPLOY A CERTIFIED TEST AND BALANCE COMPANY TO VERIFY PROPER OPERATION OF THE NEW TERMINAL UNIT CONTROLS AS FOLLOWS:

MAXIMUM AIRFLOW:

1) SET ALL VAV TERMINAL UNITS TO THEIR MAX AIRFLOW SETPOINT
2) ALLOW TIME FOR THE SYSTEM TO STABILIZE
3) CONFIRM ALL VAV TERMINAL UNITS ARE ACHIEVING THEIR RESPECTIVE MAXIMUM AIRFLOW SETTING
4) MEASURE THE TOTAL SUPPLY AIRFLOW AT THE AHU THROUGH DUCT TRAVERSE OR OTHER ACCEPTABLE MEANS
5) COMPARE THE SUM OF ALL TERMINAL UNIT AIRFLOW READINGS THROUGH THE DDC TO THE TOTAL AIRFLOW READING AS MEASURED AT THE AHU
6) IF THE TWO READINGS ARE WITHIN 5%, PROCEED TO THE MINIMUM AIRFLOW TEST
7) IF THE TWO READINGS VARY MORE THAN 5%, DETERMINE THE TERMINAL UNIT OR UNITS THAT ARE INCORRECT AND RETEST UNTIL READINGS ARE WITHIN 5%

MINIMUM AIRFLOW:

1) SET ALL VAV TERMINAL UNITS TO THEIR MIN AIRFLOW SETPOINT
2) ALLOW TIME FOR THE SYSTEM TO STABILIZE
3) CONFIRM ALL VAV TERMINAL UNITS ARE ACHIEVING THEIR RESPECTIVE MINIMUM AIRFLOW SETTING
4) MEASURE THE TOTAL SUPPLY AIRFLOW AT THE AHU THROUGH DUCT TRAVERSE OR OTHER ACCEPTABLE MEANS
5) COMPARE THE SUM OF ALL TERMINAL UNIT AIRFLOW READINGS THROUGH THE DDC TO THE TOTAL AIRFLOW READING AS MEASURED AT THE AHU
6) IF THE TWO READINGS ARE WITHIN 5%, THE TEST IS COMPLETE
7) IF THE TWO READINGS VARY MORE THAN 5%, DETERMINE THE TERMINAL UNIT OR UNITS THAT ARE INCORRECT AND RETEST UNTIL READINGS ARE WITHIN 5%

IF CHANGES ARE MADE TO TERMINAL UNIT AIRFLOW CALIBRATION FACTORS AFTER A SUCCESSFUL TEST OF EITHER MAX OR MIN, RETEST BOTH SETTINGS UNTIL READINGS ARE WITHIN 5%.

5 M-600 TERMINAL UNIT TEST AND BALANCE PROCEDURE
SCALE: NONE

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
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DRAWING TITLE
MECHANICAL CONTROLS – JUSTICE CENTER COMPLEX – DETAILS

DRAWING NO.
MC-500

ISSUED FOR BID

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DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

1 PHOTO CARRIER SZ CHW AHU — SCALE: PHOTO — 1

2 PHOTO CHW FAN COIL UNIT 1-1 — SCALE: PHOTO — 1

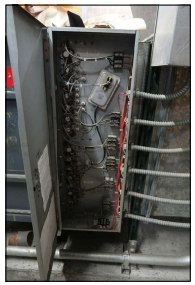
3 PHOTO DX SPLIT SYSTEM ACU-7 — SCALE: PHOTO — 2

4 PHOTO MZ CHW AHU B-1 — SCALE: PHOTO — 3

5 PHOTO EXISTING CONTROL PANEL, AHU B-1 — SCALE: PHOTO — 3

(#) MECHANICAL CONTROLS KEYED NOTES

1 UPS ROOM, SERVICE LEVEL WEST, SHEET MC-10SLW
2 TELEPHONE ROOM, SERVICE LEVEL WEST, SHEET MC-10SLW
3 MECH ROOM, SERVICE LEVEL EAST, SHEET MC-10SLE
4 FIRST FLOOR WEST COURTROOM WAITING AREA, SHEET MC-101W
5 FIRST FLOOR INTERSTITIAL WEST, SHEET MC-400
6 FIRST FLOOR INTERSTITIAL EAST, SHEET MC-400
7 SECOND FLOOR INTERSTITIAL WEST, SHEET MC-401



6 PHOTO ELECTRIC DUCT HEATER, AHU B-1 — SCALE: PHOTO — 3

7 PHOTO ZONE ACTUATORS, AHU B-1 — SCALE: PHOTO — 3

8 PHOTO CHW FAN COIL UNIT 1-4 — SCALE: PHOTO — 4

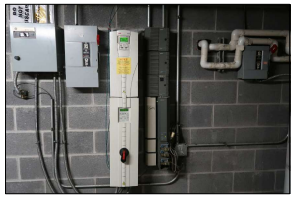
9 PHOTO CHW VAV AHU 101 — SCALE: PHOTO — 5

10 PHOTO CHW VAV AHU 102 — SCALE: PHOTO — 5

11 PHOTO EXISTING CONTROL PANELS, AHUs 101, 102 — SCALE: PHOTO — 5

12 PHOTO CHW VAV AHU G01 — SCALE: PHOTO — 5

13 PHOTO CHW VAV AHU G01 — SCALE: PHOTO — 5



14 PHOTO EXISTING CONTROL PANEL AND VFD, AHU G01 — SCALE: PHOTO — 5

15 PHOTO CHW VAV AHU G02 — SCALE: PHOTO — 6

16 PHOTO OA DUCT HEATER, AHU G02 — SCALE: PHOTO — 6

17 PHOTO CHW VAV AHU 104 — SCALE: PHOTO — 6

18 PHOTO EXISTING CONTROL PANELS, AHUs G02, G03, 103, 104 — SCALE: PHOTO — 6

19 PHOTO CHW VAV AHU 204 — SCALE: PHOTO — 7

20 PHOTO EXISTING CONTROL PANELS, AHUs G04, 203, 204, 304 — SCALE: PHOTO — 7

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DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - DETAILS

DRAWING NO.
MC-501

ISSUED FOR BID

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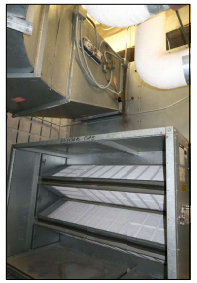
1 PHOTO — CHW VAV AHU 302 — SCALE: PHOTO — 1

2 PHOTO — CHW VAV AHU 303 — SCALE: PHOTO — 1

3 PHOTO — OA FAN SF-9 — SCALE: PHOTO — 1

4 PHOTO — EXISTING CONTROL PANELS, AHUs 302, 303 — SCALE: PHOTO — 1



5 PHOTO — ZONE ACTUATORS, AHU B-1 — SCALE: PHOTO — 1

MECHANICAL CONTROLS KEYED NOTES

1. MECH ROOM, THIRD FLOOR T305, SHEET MC-103E
2. MECH ROOM, FOURTH FLOOR T408, SHEET MC-104W
3. MECH ROOM, FOURTH FLOOR T405, SHEET MC-104E
4. MECH ROOM, FIFTH FLOOR T505, SHEET MC-105E
5. MECH ROOM, CENTRAL PLANT, SHEET MC-109E
6. SEVENTH FLOOR EAST, SHEET MC-107E
7. FIRST FLOOR WEST, SHEET MC-101W (TYPICAL)

6 PHOTO — EXISTING MA DAMPER ACTUATORS, AHU 302 — SCALE: PHOTO — 1

7 PHOTO — EXISTING CONTROL PANEL, AHU B-1 — SCALE: PHOTO — 1

8 PHOTO — CHW VAV AHU 401 — SCALE: PHOTO — 2

9 PHOTO — EXISTING CHW CONTROL VALVE, AHU 401 — SCALE: PHOTO — 2

10 PHOTO — CHW VAV AHU 403 — SCALE: PHOTO — 3

11 PHOTO — CHW VAV AHU 404 — SCALE: PHOTO — 3

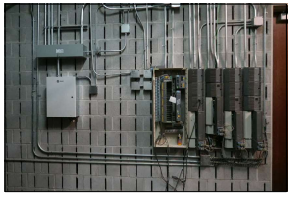
12 PHOTO — OA FAN SF-11 — SCALE: PHOTO — 3

13 PHOTO — EXISTING CONTROL PANELS, AHUs 403, 404 — SCALE: PHOTO — 3

14 PHOTO — EXISTING VFDs, AHUs 403, 404 — SCALE: PHOTO — 3

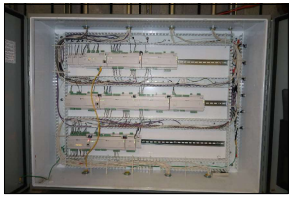
15 PHOTO — CHW VAV AHU 503 — SCALE: PHOTO — 4

16 PHOTO — CHW VAV AHU 504 — SCALE: PHOTO — 4



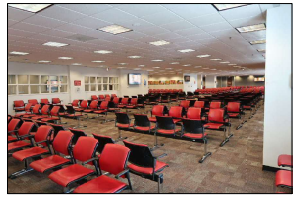
NEW TRANE AND LEGACY JCI CONTROL PANELS

17 PHOTO — SCALE: PHOTO — 4



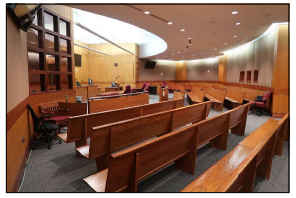
NEW TRANE CONTROL PANEL, CENTRAL PLANT CONTROLS

18 PHOTO — SCALE: PHOTO — 5



JURY ASSEMBLY REQUIRES TEMP/CO2/RH SENSORS

19 PHOTO — SCALE: PHOTO — 6



COURTROOMS REQUIRE TEMP/CO2/RH SENSORS

20 PHOTO — SCALE: PHOTO — 7

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DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - DETAILS

DRAWING NO.
MC-502

ISSUED FOR BID

1 PHOTO — CHW VAV AHU 6E, 6TH FLOOR COURTROOM — SCALE: PHOTO — 1

2 PHOTO — CHW VAV AHU 8E, 8TH FLOOR COURTROOM — SCALE: PHOTO — 1

3 PHOTO — CHW VAV AHU 9E, 9TH FLOOR COURTROOM — SCALE: PHOTO — 1

4 PHOTO — EXISTING JCI DDC PANELS, EAST AHUs — SCALE: PHOTO — 1

5 PHOTO — CHW VAV AHU 8C, 9TH FLOOR COURTROOM — SCALE: PHOTO — 1

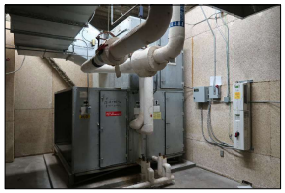
6 PHOTO — CHW VAV AHU 6W, 6TH FLOOR COURTROOM — SCALE: PHOTO — 1

7 PHOTO — CHW VAV 8W, 8TH FLOOR COURTROOM — SCALE: PHOTO — 1

8 PHOTO — CHW VAV AHU 9W, 9TH FLOOR COURTROOM — SCALE: PHOTO — 1

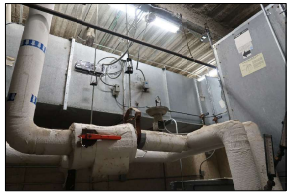
9 PHOTO — EXISTING JCI DDC PANELS, WEST AHUs — SCALE: PHOTO — 1

10 PHOTO — STAIRWELL SMOKE SUPPLY FAN — SCALE: PHOTO — 1



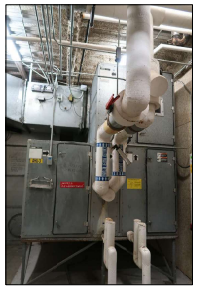
11 PHOTO — CHW VAV AHU 20, 9TH FLOOR VAVs — SCALE: PHOTO — 2

12 PHOTO — AHU 20 OA FAN BELOW RETURN AIR DUCT — SCALE: PHOTO — 2



13 PHOTO — AHU 20 SUPPLY AIR DUCT AND CHW VALVE — SCALE: PHOTO — 1

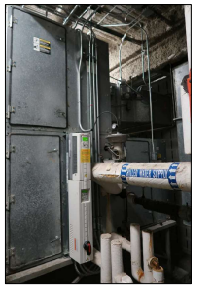
14 PHOTO — EXISTING JCI DDC PANEL, AHU 20 — SCALE: PHOTO — 2



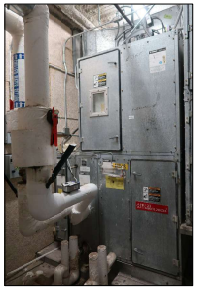
15 PHOTO — CHW VAV AHU 3, GROUND FLOOR VAVs — SCALE: PHOTO — 3

16 PHOTO — AHU 3 OA FAN ADJACENT TO RETURN AIR DUCT — SCALE: PHOTO — 6

17 PHOTO — EXISTING JCI DDC PANEL, AHU 3 — SCALE: PHOTO — 3



18 PHOTO — EXISTING CONTROL PANELS, CHW VAV AHU 1, BASEMENT VAVs — SCALE: PHOTO — 4



19 PHOTO — CHW CAV AHU 23, SWITCH GEAR ROOM — SCALE: PHOTO — 4

20 PHOTO — EXISTING JCI NAE & DDC PANEL, AHU 1 & 23 — SCALE: PHOTO — 4

(#) MECHANICAL CONTROLS KEYED NOTES

1 PENTHOUSE MECH ROOM, SHEET MC-20PH
2 AHU 20 MECH ROOM, SHEET MC-209
3 AHU 3 MECH ROOM, SHEET MC-20G
4 AHU 1 AND AHU 23 MECH ROM, SHEET MC-20B

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - DETAILS

DRAWING NO.
MC-520

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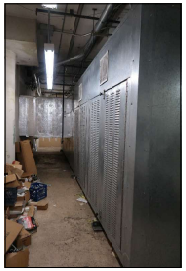
1 PHOTO — BUILT-UP AHU 1 SERVING JUSTICE CENTER BUILDING — SCALE: PHOTO — 1



2 PHOTO — AHU 1 OA DUCT AND LOCATION OF VFDs — SCALE: PHOTO — 1

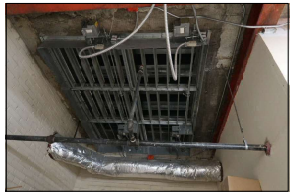
3 PHOTO — AHU 1 RETURN AIR DUCT FROM BASEMENT — SCALE: PHOTO — 1

4 PHOTO — AHU 1 RETURN FAN VFDs TO REMAIN — SCALE: PHOTO — 1

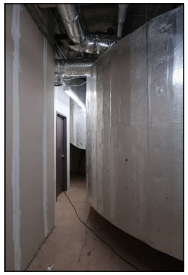
5 PHOTO — AHU 1 SUPPLY FAN VFDs TO BE REPLACED — SCALE: PHOTO — 1

(#) MECHANICAL CONTROLS KEYED NOTES

1 BASEMENT MECH ROOM, SHEET MC-30B
2 FIRST FLOOR ELEC ROOM JC1-5, SHEET MC-301
3 FIRST FLOOR MECH ROOM JC1-8, SHEET MC-301



6 PHOTO — AHU 1 RETURN AIR SHAFT FROM DUCT RISER — SCALE: PHOTO — 1



7 PHOTO — AHU 1 SUPPLY AIR DUCT TO RISER — SCALE: PHOTO — 1

8 PHOTO — AHU 1 SUPPLY AIR DUCT TO BASEMENT VAVs — SCALE: PHOTO — 1

9 PHOTO — AHU 1 RETURN AIR FANS — SCALE: PHOTO — 1

10 PHOTO — AHU 1 RETURN FAN INLET PROB AFMS — SCALE: PHOTO — 1

11 PHOTO — AHU 1 SUPPLY AIR FANS — SCALE: PHOTO — 1

12 PHOTO — AHU 1 DUAL CHILLED WATER COIL — SCALE: PHOTO — 1

13 PHOTO — AHU 1 DUAL CHILLED WATER COIL PIPING AND VALVES — SCALE: PHOTO — 1

14 PHOTO — AHU 1 AFMS PANEL — SCALE: PHOTO — 1

15 PHOTO — EXISTING JCI PANEL ADJACENT TO NEW TRANE PANEL — SCALE: PHOTO — 1

16 PHOTO — AHU 1 EXISTING JCI PANELS — SCALE: PHOTO — 1

17 PHOTO — NEW TRANE PANEL FOR CHW SYSTEM DP SENSOR — SCALE: PHOTO — 1

18 PHOTO — AHU 1 FIRST FLOOR SUPPLY DUCT ISOLATION FIRE DAMPER — SCALE: PHOTO — 2

19 PHOTO — EXISTING JCI PANELS IN ELECTRIC ROOM — SCALE: PHOTO — 2

20 PHOTO — AHU 1 FIRST FLOOR RETURN DUCT ISOLATION FIRE DAMPER — SCALE: PHOTO — 3

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MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - DETAILS

DRAWING NO.
MC-530

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AIR HANDLING UNITS SCHEDULE

EQUIP	BLDG	LOCATION	FLOOR	DWG NO.	TYPE	SA CFM	OA CFM	% OA CFM	HP	GPM	REQ. VALVE Cv @ 4 PSI	CONTROL
AHU-B1	JCT	MECHANICAL EAST ROOM	SERVICE LEVEL	MC-105LE	MULTIZONE	7,620	4,320	57%	10	66.4	33.20	VFD
AHU-G01	JCT	1st INTERSTITIAL LEVEL (WEST)	GROUND LEVEL	MC-400	VAV	16,560	2,480	15%	25	113	56.50	VFD
AHU-G02	JCT	1st INTERSTITIAL LEVEL (EAST)	GROUND LEVEL	MC-400	VAV	6,350	1,140	18%	10	43.4	21.70	VFD
AHU-G03	JCT	1st INTERSTITIAL LEVEL (EAST)	GROUND LEVEL	MC-400	VAV	7,445	1,340	18%	10	50.8	25.40	VFD
AHU-G04	JCT	2nd INTERSTITIAL LEVEL (EAST)	GROUND LEVEL	MC-401	VAV	14,810	2,680	18%	20	160.4	80.20	VFD
AHU-101	JCT	1st INTERSTITIAL LEVEL (WEST)	1st FLOOR	MC-400	VAV	11,080	3,455	31%	15	75.6	37.80	VFD
AHU-102	JCT	1st INTERSTITIAL LEVEL (WEST)	1st FLOOR	MC-400	VAV	14,460	4,510	31%	20	98.7	49.35	VFD
AHU-103	JCT	1st INTERSTITIAL LEVEL (EAST)	1st FLOOR	MC-400	VAV	12,780	3,110	24%	15	81.2	40.60	VFD
AHU-104	JCT	1st INTERSTITIAL LEVEL (EAST)	1st FLOOR	MC-400	VAV	11,366	3,545	31%	15	77.6	38.80	VFD
AHU-201	JCT	2nd INTERSTITIAL LEVEL (WEST)	2nd FLOOR	MC-401	VAV	12,170	2,840	23%	15	82.2	41.10	VFD
AHU-202	JCT	2nd INTERSTITIAL LEVEL (WEST)	2nd FLOOR	MC-401	VAV	13,225	3,085	23%	15	81.3	40.65	VFD
AHU-203	JCT	2nd INTERSTITIAL LEVEL (EAST)	2nd FLOOR	MC-401	VAV	15,185	3,540	23%	20	106.5	53.25	VFD
AHU-204	JCT	2nd INTERSTITIAL LEVEL (EAST)	2nd FLOOR	MC-401	VAV	10,866	2,535	23%	15	73.3	36.65	VFD
AHU-301	JCT	2nd INTERSTITIAL LEVEL (WEST)	2nd FLOOR	MC-401	VAV	13,010	2,785	21%	15	80	40.00	VFD
AHU-302	JCT	MECH ROOM T305	3rd FLOOR	MC-103E	VAV	16,525	3,535	21%	25	111.6	55.80	VFD
AHU-303	JCT	MECH ROOM T305	3rd FLOOR	MC-103E	VAV	12,266	2,625	21%	15	82.8	41.40	VFD
AHU-304	JCT	2nd INTERSTITIAL LEVEL (EAST)	2nd FLOOR	MC-401	VAV	14,288	3,055	21%	20	96.4	48.20	VFD
AHU-401	JCT	MECH ROOM T408	4th FLOOR	MC-104W	VAV	13,010	2,785	21%	15	81.8	40.90	VFD
AHU-402	JCT	MECH ROOM T408	4th FLOOR	MC-104W	VAV	13,470	3,535	26%	15	90.9	45.45	VFD
AHU-403	JCT	MECH ROOM T405	4th FLOOR	MC-104E	VAV	15,320	2,625	17%	20	90.3	45.15	VFD
AHU-404	JCT	MECH ROOM T405	4th FLOOR	MC-104E	VAV	14,285	5,715	40%	20	90.4	45.20	VFD
AHU-501	JCT	MECH ROOM T525	5th FLOOR	MC-105W	VAV	13,010	2,785	21%	15	87.8	43.90	VFD
AHU-502	JCT	MECH ROOM T525	5th FLOOR	MC-105W	VAV	13,470	3,535	26%	15	90.9	45.45	VFD
AHU-503	JCT	MECH ROOM T516	5th FLOOR	MC-105E	VAV	15,320	2,625	17%	20	91.3	45.65	VFD
AHU-504	JCT	MECH ROOM T516	5th FLOOR	MC-105E	VAV	14,288	3,055	21%	20	96.4	48.20	VFD
AHU-701	JCT	MECH ROOM 153	7th FLOOR	MC-107W	VAV	19,080	4,445	23%	20	130.2	65.10	VFD
AHU-702	JCT	MECH ROOM 153	7th FLOOR	MC-107W	VAV	16,040	3,735	23%	20	110	55.00	VFD
AHU-703	JCT	MECH ROOM 217	7th FLOOR	MC-107E	VAV	17,010	3,020	18%	20	115	57.50	VFD
AHU-704	JCT	MECH ROOM 217	7th FLOOR	MC-107E	CV	6,180	-		7 1/2	43	21.50	VFD
AHU-801	JCT	MECH ROOM 158	8th FLOOR	MC-108W	VAV	13,315	2,820	21%	15	90	45.00	VFD
AHU-802	JCT	MECH ROOM 158	8th FLOOR	MC-108W	VAV	13,690	2,466	18%	15	92.4	46.20	VFD
AHU-803	JCT	MECH ROOM 228	8th FLOOR	MC-108E	VAV	15,320	3,256	21%	20	90.3	45.15	VFD
AHU-804	JCT	MECH ROOM 228	8th FLOOR	MC-108E	VAV	14,288	3,030	21%	20	96.4	48.20	VFD
AHU-805	JCT	SUPPLIES ROOM 231	9th FLOOR	MC-109E	CV	6,412	-		7 1/2	44	22.00	VFD
AHU-901	JCT	MECH ROOM 234	9th FLOOR	MC-109W	VAV	13,020	1,350	10%	15	92.8	46.40	VFD
AHU-902	JCT	MECH ROOM 232	9th FLOOR	MC-109W	VAV	16,100	2,300	14%	20	114.7	57.35	VFD
AHU-903	JCT	MECH ROOM 229	9th FLOOR	MC-109E	VAV	17,190	2,450	14%	20	122.5	61.25	VFD

Air Handling Unit Location

AHU#	BLDG	LOCATION	FLOOR	DWG NO.	VAV TERMINAL UNITS	VAV/CV Area Served BLDG	FLOOR	DWG NO.
AHU-B1	JCT	MECHANICAL EAST ROOM	SERVICE LEVEL	MC-105LE	NA	NA	NA	NA
AHU-G01	JCT	1st INTERSTITIAL LEVEL (WEST)	GROUND LEVEL	MC-400	FPB-G-6 TO FPB-G-14, FPB-N-G-27, VAV-G-1 VAV-G-3 TO VAV-G-9, FPB-G1-NI TO FPB-G5-NI	JCT	GROUND	MC-10GW
AHU-G02	JCT	2nd INTERSTITIAL LEVEL (EAST)	GROUND LEVEL	MC-400	FPB-N-G-4, FPB-N-G-5, FPB-G6-NI TO FPB-G10-NI	JCT	GROUND	MC-10GE
AHU-G03	JCT	1st INTERSTITIAL LEVEL (EAST)	GROUND LEVEL	MC-400	FPB-N-G-1 TO FPB-N-G-3, FPB-G11-NI TO FPB-G15-NI, VAV-G-10	JCT	GROUND	MC-10GE
AHU-G04	JCT	2nd INTERSTITIAL LEVEL (EAST)	GROUND LEVEL	MC-401	FPB-N-G-15 TO FPB-N-G-26	JCT	GROUND	MC-10GE
AHU-101	JCT	1st INTERSTITIAL LEVEL (WEST)	1st FLOOR	MC-400	FPB-N-1-9, FPB-N-1-10, VAV-1-3, VAV-1-4, VAV-1-1NI, VAV-1-2NI, FPB-1-1NI TO FPB-1-3NI, VAV-1-43 VAV-1-44, VAV-1-5NI TO VAV-1-8NI	JCT	1ST	MC-101W
AHU-102	JCT	1st INTERSTITIAL LEVEL (WEST)	1st FLOOR	MC-400	FPB-N-1-6 TO FPB-N-1-8, FPB-N-1-13, VAV-1-9 TO VAV-1-18, VAV-1-20 TO VAV-1-22, VAV-1-42, VAV-1-44, FPB-1-4NI	JCT	1ST	MC-101W
AHU-103	JCT	2nd INTERSTITIAL LEVEL (EAST)	1st FLOOR	MC-400	FPB-N-1-4, FPB-N-1-5, FPB-1-5NI TO FPB-1-10NI, VAV-1-23 TO VAV-1-30	JCT	1ST	MC-101E
AHU-104	JCT	2nd INTERSTITIAL LEVEL (EAST)	1st FLOOR	MC-400	FPB-N-1-1 TO FPB-N-1-3, FPB-N-1-11, FPB-N-1-12, FPB-N-1-11NI, FPB-N-1-12NI, VAV-1-3, VAV-1-31 TO VAV-1-34, VAV-1-36 TO VAV-1-39, VAV-1-41	JCT	1ST	MC-101E
AHU-201	JCT	2nd INTERSTITIAL LEVEL (WEST)	2nd FLOOR	MC-401	FPB-N-2-1, FPB-N-2-2, VAV-2-11NI TO VAV-2-17NI, FPB-2-11NI, FPB-2-11N, FPB-2-3NI, VAV-2-1NI, VAV-2-2NI	JCT	2ND	MC-102W
AHU-202	JCT	2nd INTERSTITIAL LEVEL (WEST)	2nd FLOOR	MC-401	FPB-N-2-3 TO FPB-N-2-5, VAV-2-3NI TO VAV-2-10NI, FPB-2-13NI, FPB-2-1NI, FPB-2-2NI, VAV-2-43NI, VAV-2-44NI, VAV-2-36NI, VAV-2-37NI, VAV-2-41NI	JCT	2ND	MC-102W
AHU-203	JCT	2nd INTERSTITIAL LEVEL (EAST)	2nd FLOOR	MC-401	FPB-N-2-6 TO FPB-N-2-8, FPB-N-2-11, FPB-N-2-12, VAV-2-18NI TO VAV-2-21NI, VAV-2-28NI TO VAV-2-33NI, FPB-2-5N TO FPB-2-8NI	JCT	2ND	MC-102E
AHU-204	JCT	2nd INTERSTITIAL LEVEL (EAST)	2nd FLOOR	MC-401	FPB-N-2-9, FPB-N-2-10, FPB-2-4NI, FPB-2-9N, FPB-2-10NI, VAV-2-22N TO VAV-2-27NI, VAV-2-38NI	JCT	2ND	MC-102E
AHU-301	JCT	2nd INTERSTITIAL LEVEL (WEST)	2nd INTERSTITIAL LEVEL	MC-401	FPB-N-3-11 TO FPB-N-3-14, FPB-3-11NI, VAV-3-1NI, VAV-3-2NI, VAV-3-11 TO VAV-3-17	JCT	3RD	MC-103W
AHU-302	JCT	MECH ROOM T305	3rd FLOOR	MC-103E	FPB-N-3-4 TO FPB-N-3-6, VAV-3-18, VAV-3-19, FPB-3-5NI TO FPB-3-8NI, VAV-3-28 TO VAV-3-35, VAV-3-42	JCT	3RD	MC-103E
AHU-303	JCT	MECH ROOM T305	3rd FLOOR	MC-103E	FPB-N-3-7, FPB-N-3-8, FPB-N-3-15, VAV-3-3 TO VAV-3-10, VAV-3-43 TO VAV-3-45, FPB-3-1NI, FPB-3-2NI, VAV-3-36, VAV-3-37	JCT	3RD	MC-103W
AHU-304	JCT	2nd INTERSTITIAL LEVEL (EAST)	2nd INTERSTITIAL LEVEL	MC-401	FPB-N-3-1 TO FPB-N-3-3, FPB-N-3-9, FPB-N-3-10, VAV-3-20 TO VAV-3-27, VAV-3-38, FPB-3-9NI, FPB-3-10NI, FPB-3-4NI	JCT	3RD	MC-103E
AHU-401	JCT	MECH ROOM T408	4th FLOOR	MC-104W	FPB-N-4-11 TO FPB-N-4-14, VAV-4-1, VAV-4-2, FPB-4-11N, VAV-4-11 TO VAV-4-17, FPB-4-3NI	JCT	4TH	MC-104W
AHU-402	JCT	MECH ROOM T408	4th FLOOR	MC-104W	FPB-N-4-7, FPB-N-4-8, FPB-N-4-15, VAV-4-3 to VAV-4-10, VAV-4-45, VAV-4-46, FPB-4-1NI, FPB-4-2NI, VAV-4-36, VAV-4-37	JCT	4TH	MC-104W
AHU-403	JCT	MECH ROOM T405	4th FLOOR	MC-104E	FPB-N-4-5, FPB-N-4-6, FPB-N-4-9, FPB-N-4-10, VAV-4-43, VAV-4-44, VAV-4-18, VAV-4-19, FPB-4-5N to FPB-4-8NI, VAV-4-28 to VAV-4-35, VAV-4-42	JCT	4TH	MC-104E
AHU-404	JCT	MECH ROOM T405	4th FLOOR	MC-104E	FPB-N-4-1 to FPB-N-4-4, FPB-4-4NI, VAV-4-20 to VAV-4-27, FPB-4-9NI, FPB-4-10NI, VAV-4-38	JCT	4TH	MC-104E
AHU-501	JCT	MECH ROOM T525	5th FLOOR	MC-105W	FPB-N-5-1 to FPB-N-5-3, V-5-1 to V-5-8	JCT	5TH	MC-105W
AHU-502	JCT	MECH ROOM T525	5th FLOOR	MC-105W	FPB-N-5-4 to FPB-N-5-11, V-5-9 to V-5-16	JCT	5TH	MC-105W
AHU-503	JCT	MECH ROOM T516	5th FLOOR	MC-105E	FPB-N-5-12 to FPB-N-5-20, V-5-13 to V-5-23	JCT	5TH	MC-105E
AHU-504	JCT	MECH ROOM T516	5th FLOOR	MC-105E	FPB-N-5-21 to FPB-N-5-23, V-5-25 to V-5-31	JCT	5TH	MC-105E
AHU-701	JCT	MECH ROOM 153	7th FLOOR	MC-107W	FPB-N-7-11 TO FPB-N-7-15, VAV-7-1, VAV-7-2, VAV-7-25, VAV-7-26, VAV-7-29 TO VAV-7-41, FPB-7-4NI TO FPB-7-6NI	JCT	7TH	MC-107W
AHU-702	JCT	MECH ROOM 153	7th FLOOR	MC-107W	FPB-N-7-6 TO FPB-N-7-10, VAV-7-12 TO VAV-7-24, FPB-7-3NI	JCT	7TH	MC-107W
AHU-703	JCT	MECH ROOM 217	7th FLOOR	MC-107E	FPB-N-7-1 TO FPB-N-7-5, FPB-7-1NI, FPB-7-2NI, VAV-7-1 TO VAV-7-11	JCT	7TH	MC-107E
AHU-704	JCT	MECH ROOM 217	7th FLOOR	MC-107E	NA	NA	NA	NA
AHU-801	JCT	MECH ROOM 158	8th FLOOR	MC-108W	FPB-N-8-11 TO FPB-N-8-14, VAV-8-1, VAV-8-2, VAV-8-11 TO VAV-8-17, FPB-8-3NI, FPB-8-11NI, FPB-8-12NI	JCT	8TH	MC-108W
AHU-802	JCT	MECH ROOM 158	8th FLOOR	MC-108W	FPB-N-8-7, FPB-N-8-8, FPB-N-8-15, VAV-8-3 TO VAV-8-10, FPB-8-1NI, FPB-8-2NI, FPB-8-13NI, VAV-8-36, VAV-8-37	JCT	8TH	MC-108W
AHU-803	JCT	MECH ROOM 228	8th FLOOR	MC-108E	FPB-N-8-5, FPB-N-8-6, FPB-N-8-9, FPB-N-8-10, VAV-8-18, VAV-8-19, VAV-8-28 TO VAV-8-35, VAV-8-42 TO VAV-8-44, FPB-8-5NI TO FPB-8-8NI	JCT	8TH	MC-108E
AHU-804	JCT	MECH ROOM 228	8th FLOOR	MC-108E	FPB-N-8-1 TO FPB-N-8-4, VAV-8-20 TO VAV-8-27, VAV-8-38, FPB-8-4NI, FPB-8-9NI, FPB-8-10NI	JCT	8TH	MC-108E
AHU-805	JCT	SUPPLIES ROOM 231	9th FLOOR	MC-109E	NA	NA	NA	NA
AHU-901	JCT	MECH ROOM 234	9th FLOOR	MC-109W	FPB-N-9-12 TO FPB-N-9-15, FPB-9-24NI TO FPB-9-29NI	JCT	9TH	MC-109W
AHU-902	JCT	MECH ROOM 232	9th FLOOR	MC-109W	FPB-N-9-7 TO FPB-N-9-11, FPB-9-13NI TO FPB-9-16NI, FPB-9-18NI TO FPB-9-23N	JCT	9TH	MC-109W
AHU-903	JCT	MECH ROOM 229	9th FLOOR	MC-109E	FPB-N-9-1 TO FPB-N-9-6, FPB-9-1NI TO FPB-9-6NI, FPB-9-10NI TO FPB-9-12NI, FPB-9-30NI TO FPB-9-33NI	JCT	9TH	MC-109E

SUPPLY AND EXHAUST FANS SCHEDULE

EQUIP	BLDG	LOCATION	DWG NO.	TYPE	CFM	HP	SERVICE	DUTY	CONTROL	MONITOR
SF-1	JCT	ROOF	MC-10RW	PROPELLER	18,000	7 1/2	TOWER STAIRWELL PRESSURIZATION	BUSINESS HOURS	NO	YES
SF-2	JCT	ROOF	MC-10RE	PROPELLER	18,000	7 1/2	TOWER STAIRWELL PRESSURIZATION	BUSINESS HOURS	NO	YES
SF-3	JCT	ROOF	MC-10RE	PROPELLER	18,000	7 1/2	TOWER STAIRWELL PRESSURIZATION	BUSINESS HOURS	NO	YES
SF-4	JCT	ROOF	MC-10RW	PROPELLER	18,000	7 1/2	TOWER STAIRWELL PRESSURIZATION	BUSINESS HOURS	NO	YES
SF-5	JCT	1st INT W - MECH ROOM	MC-400	PROPELLER	5,475	1	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-6	JCT	1st INT E - MECH ROOM	MC-400	PROPELLER	670	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-7	JCT	2nd INT W - MECH ROOM	MC-401	PROPELLER	4,360	3/4	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-8	JCT	2nd INT E - MECH ROOM	MC-401	PROPELLER	2,800	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-9	JCT	3rd E - MECH ROOM	MC-103E	PROPELLER	3,080	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-10	JCT	4th W - MECH ROOM	MC-104W	PROPELLER	3,155	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-11	JCT	4th E - MECH ROOM	MC-104E	PROPELLER	2,845	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-12	JCT	5th W - MECH ROOM	MC-105W	PROPELLER	3,155	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-13	JCT	5th E - MECH ROOM	MC-105E	PROPELLER	2,845	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-14	JCT	7th W - MECH ROOM	MC-107W	PROPELLER	4,095	3/4	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-15	JCT	7th E - MECH ROOM	MC-107E	PROPELLER	1,910	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-16	JCT	8th W - MECH ROOM	MC-108W	PROPELLER	2,860	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-17	JCT	8th E - MECH ROOM	MC-108E	PROPELLER	3,140	3/4	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-18	JCT	9th W - MECH ROOM	MC-109W	PROPELLER	925	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-19	JCT	9th CENTRAL MECH ROOM	MC-109W	PROPELLER	1,150	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-20	JCT	9th E - MECH ROOM	MC-10RE	PROPELLER	1,225	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-42	JCT	2nd INT E - MECH ROOM	MC-401	PROPELLER	3,110	1/2	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-43	JCT	1st INT E - MECH ROOM	MC-400	PROPELLER	4,340	3/4	OUTSIDE AIR	BUSINESS HOURS	YES	YES
EF-1A	JCT	PARKING EAST	MC-10PE	TUBE AXIAL	17,500	15	GENERAL EXHAUST	NOXIOUS GAS SENSOR	YES	YES
EF-1B	JCT	PARKING EAST	MC-10PE	TUBE AXIAL	17,500	15	GENERAL EXHAUST	NOXIOUS GAS SENSOR	YES	YES
EF-1C	JCT	PARKING EAST	MC-10PE	TUBE AXIAL	17,500	15	GENERAL EXHAUST	NOXIOUS GAS SENSOR	YES	YES
EF-1D	JCT	PARKING EAST	MC-10PE	TUBE AXIAL	17,500	15	GENERAL EXHAUST	NOXIOUS GAS SENSOR	YES	YES
EF-1R	JCT	ROOF	MC-10RW	CENTRIFUGAL	7,735	3	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-2R	JCT	ROOF	MC-10RW	CENTRIFUGAL	4,680	1 1/2	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-3	JCT	FIRE PUMP ROOM	MC-10SLW	PROPELLER	2,355	1/4	GENERAL EXHAUST	BUSINESS HOURS	NO	YES
EF-3R	JCT	ROOF	MC-10RW	CENTRIFUGAL	5,225	1 1/2	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-4	JCT	SL WEST	MC-10SLE	SIDEWALL	1,000	1/6	GENERAL EXHAUST	BUSINESS HOURS	YES	YES
EF-4R	JCT	ROOF	MC-10RW	CENTRIFUGAL	5,350	1	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-5	JCT	PARKING EAST	MC-10PE	UPBLAST CENTRIFUGAL	3,240	3/4	GENERAL EXHAUST	BUSINESS HOURS	YES	YES
EF-5R	JCT	ROOF	MC-10RW	CENTRIFUGAL	3,570	3	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-6	JCT	PARKING EAST	MC-10PE	CENTRIFUGAL	5,000	1/2	GENERAL EXHAUST	BUSINESS HOURS	YES	YES
EF-6R	JCT	ROOF	MC-10RE	CENTRIFUGAL	5,215	1 1/2	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-7R	JCT	ROOF	MC-10RE	CENTRIFUGAL	7,275	3	INTERIOR EXHAUST	BUSINESS HOURS	TRANE	TRANE
EF-10	JCT	ROOF WEST	MC-10RW	UTILITY	8,070	3	GENERAL EXHAUST	BUSINESS HOURS	YES	YES
EF-12	JCT	ROOF EAST	MC-10RE	UTILITY	5,000	1 1/2	CENTRAL PLANT	REF. SENSOR	TRANE	TRANE
EF-13	JCT	ROOF EAST	MC-10RE	CENTRIFUGAL	3,000	3/4	GENERAL EXHAUST	BUSINESS HOURS	YES	YES
EF-14	JCT	STAIR C ROOF	MC-10RE	SIDEWALL	1,110	1/4	ELEC ROOM ON 9TH FLOOR	T-STAT	TRANE	TRANE
EF-15	JCT	UPS ROOM SL	MC-10SLW	PROPELLER	6,670	1	GENERAL EXHAUST	CONTINUOUSLY	YES	YES

DX SPLIT SYSTEMS SCHEDULE

EQUIP	BLDG	LOCATION	TOTAL CAPACITY BTU/HR	SENSIBLE CAPACITY BTU/HR	ENT AIR DB °F	ENT AIR WB °F	REMARK
ACU-1/CU-1	JCT	SERVICE LEVEL	60,000	48,000	80	67	2 KW HEAT
ACU-2/CU-2	JCT	SL / PL	36,000	28,800	80	67	EQUIP RM CENTRAL
ACU-4/CU-4	JCT	PARKING LEVEL	42,000	33,600	80	67	EQUIPMENT ROOM EAST
ACU-5/CU-5	JCT	PARKING LEVEL	42,000	33,600	80	67	EQUIPMENT ROOM WEST
ACU-6/CU-6	JCT	ROOF	60,000	48,000	80	67	SERVING ELEVATOR ROOM
ACU-7/CU-7	JCT	TELE/SERVICE LEVEL	92,000	70,400	80	67	1 KW HEAT
ACU-8/CU-8	JCT	SECURITY	30,000	24,000	80	67	2 KW HEAT
ACU-9/CU-9	JCT	GROUND / PL	18000	14400	80	67	SERVING TG500
ACU-10/CU-10	JCT	PL / GROUND	48000	38400	80	67	SERVING CONTROL ROOM
ACU-11/CU-11	JCT	SERVICE LEVEL	60000	48000	80	67	PUBLIC BLDGS DEPT. MAIN
ACU-12/CU-12	JCT	SL / PL	13,900	8,900	80	67	SERVING HOLDING
ACU-13/CU-13	JCT	ROOF	120,000	96,000	80	67	SERVING ELEVATOR ROOM
ACU-14/CU-14	JCT	ROOF	120,000	96,000	80	67	SERVING ELEVATOR ROOM

AIR HANDLING UNIT NEW COOLING COIL VALVE (EPIV) SCHEDULE BELIMO PRESSURE INDEPENDENT CONTROLL VALVES BASIS OF DESIGN

Tag	BLDG	Req. Flow	Body Size	Rated Flow	Close Off Pressure	Valve Part Nr.	Actuator Part Nr.
AHU-B1	JCT	66.4	2"	70	200 psi	P2200S-070	ARX24-EP
AHU-G01	JCT	113	2-1/2"	115	100 psi	P6250S-115	ARX24-PI
AHU-G02	JCT	43.4	2"	44.1	200 psi	P2200S-441	ARX24-EP
AHU-G03	JCT	50.8	2"	52.5	200 psi	P2200S-525	ARX24-EP
AHU-G04	JCT	150.4	3"	165	100 psi	P6300S-165	ARX24-PI
AHU-101	JCT	75.6	2"	76.1	200 psi	P2200S-761	ARX24-EP
AHU-102	JCT	98.7	2-1/2"	100	100 psi	P6250S-100	ARX24-PI
AHU-103	JCT	81.2	2"	85	200 psi	P2200S-850	ARX24-EP
AHU-104	JCT	77.6	2"	80	200 psi	P2200S-800	ARX24-EP
AHU-201	JCT	82.2	2"	85	200 psi	P2200S-850	ARX24-EP
AHU-202	JCT	81.3	2"	85	200 psi	P2200S-850	ARX24-EP
AHU-203	JCT	106.5	2-1/2"	110	100 psi	P6250S-110	ARX24-PI
AHU-204	JCT	73.3	2"	76.1	200 psi	P2200S-761	ARX24-EP
AHU-301	JCT	80	2"	80	200 psi	P2200S-800	ARX24-EP
AHU-302	JCT	111.6	2-1/2"	115	100 psi	P6250S-115	ARX24-PI
AHU-303	JCT	82.8	2"	85	200 psi	P2200S-850	ARX24-EP
AHU-304	JCT	96.4	2-1/2"	100	100 psi	P6250S-100	ARX24-PI
AHU-401	JCT	81.8	2"	85	200 psi	P2200S-850	ARX24-EP
AHU-402	JCT	90.9	2"	95	200 psi	P2200S-950	ARX24-EP
AHU-403	JCT	90.3	2-1/2"	100	100 psi	P6250S-100	ARX24-PI
AHU-404	JCT	90.4	2-1/2"	100	100 psi	P6250S-100	ARX24-PI

FAN COIL UNITS SCHEDULE

EQUIP	BLDG	LOCATION	TYPE	CAPACITY (BTU/HR)
FCU-1-1	JCT	1st WEST WAITING ROOM	WALL RECESSED	36000
FCU-1-2	JCT	1st WEST WAITING ROOM	WALL RECESSED	36000
FCU-1-3	JCT	1st WEST WAITING ROOM	WALL RECESSED	36000
FCU-1-4	JCT	1st WEST WAITING ROOM	WALL RECESSED	36000
FCU-1-5	JCT	1st EAST WAITING ROOM	WALL RECESSED	36000
FCU-1-6	JCT	1st EAST WAITING ROOM	WALL RECESSED	36000
FCU-1-7	JCT	1st EAST WAITING ROOM	WALL RECESSED	36000
FCU-1-8	JCT	1st EAST WAITING ROOM	WALL RECESSED	36000
FCU-1-9	JCT	1st EAST WAITING ROOM	WALL RECESSED	36000
FCU-2-1	JCT	2nd WEST WAITING ROOM	WALL RECESSED	36000
FCU-2-2	JCT	2nd WEST WAITING ROOM	WALL RECESSED	36000
FCU-2-3	JCT	2nd WEST WAITING ROOM	WALL RECESSED	36000
FCU-2-4	JCT	2nd WEST WAITING ROOM	WALL RECESSED	36000
FCU-2-5	JCT	2nd EAST WAITING ROOM	WALL RECESSED	36000
FCU-2-6	JCT	2nd EAST WAITING ROOM	WALL RECESSED	36000
FCU-2-7	JCT	2nd EAST WAITING ROOM	WALL RECESSED	36000
FCU-2-8	JCT	2nd EAST WAITING ROOM	WALL RECESSED	36000
FCU-2-9	JCT	2nd EAST WAITING ROOM	WALL RECESSED	36000

NOTE 1. FAN COIL UNITS EQUIPPED WITH CHILLED WATER COIL AND TWO STAGE ELECTRIC HEAT

SLKING & Associates, Inc
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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED		
NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEDULES

DRAWING NO.
MC-600

ISSUED FOR BID

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

NOTES:
1. FURNISH VAV UNITS WITH ELECTRIC HEAT, THERMAL CUT-OFF SAFETY DEVICES, ELECTRIC HEATER AIRFLOW SWITCH AND DISCONNECT SWITCH.
2. CONTROLS TO BE PROVIDED BY CONTROL CONTRACTOR AND FACTORY MOUNTED & CALIBRATED BY MANUFACTURER.
3. UNIT SHALL BE PROVIDED WITH AIRFLOW STATION/PICKUP AND LINED WITH 1" ECO-SHIELD LINER.
4. AN INTERNALLY LINE ELBOW ON THE PLENUM AIR INLET SHALL BE FIELD INSTALLED FOR FPU UNITS.
5. 1ST STAGE OF HEAT FOR ELECTRIC COIL IS UP TO 4.5 KW AND 2ND STAGE MORE THAN 4.5 KW.
6. UNITS TO BE PROVIDED WITH HANGERS/BRACKETS SUPPORTS AND ISOLATION VIBRATORS.
7. FURNISH FPU WITH ECM MOTORS AND SOUND ATTENUATOR.
8. NOISE CRITERIA LEVEL SHALL NOT BE MORE THAN 35 DB FOR FAN POWERED UNITS AND VAV BOXES.
9. THE FINAL INSTALLED EXTERNAL STATIC PRESSURE, EXCLUDING INDUCED AIR INLET FILTER PRESSURE DROP, MAY VARY BETWEEN 0.2 AND 0.4. FINAL ADJUSTMENT SHALL BE MADE IN THE FIELD DURING TAB
10. THE CONTRACTOR SHALL PROVIDE ACCESS PANELS IN THE NON-ACCESSIBLE CEILINGS, WHERE THE VAV'S, ETC. ARE LOCATED, FOR MAINTAINING AND SERVICING THE UNITS

TITUS IS THE BASIS OF DESIGN FOR THE AIR TERMINAL UNITS. REFER TO SPECIFICATION FOR OTHER APPROVED/EQUAL MANUFACTURERS.

TYPE OF UNIT	MODEL #
FPU	DTQP
VAV	DESV

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL	ELECTRIC DATA			PARALLEL FAN		ELECTRIC DATA		
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE	KW	VOLTS	PHASE	HZ	FAN CFM	HP	VOLTS	PHASE	HZ
FPB-N-G-6	FPT	AHU-GC1	JCT	GROUND	900	140	10	8.9	480	3	60	540	1/3	277	1	60
FPB-N-G-7	FPT	AHU-GC1	JCT	GROUND	750	110	10	7.5	480	3	60	450	1/4	277	1	60
FPB-N-G-8	FPT	AHU-GC1	JCT	GROUND	1075	160	12	10.6	480	3	60	645	1/3	277	1	60
FPB-N-G-9	FPT	AHU-GC1	JCT	GROUND	1150	170	12	11.4	480	3	60	690	1/3	277	1	60
FPB-N-G-10	FPT	AHU-GC1	JCT	GROUND	1080	160	12	10.7	480	3	60	648	1/3	277	1	60
FPB-N-G-11	FPT	AHU-GC1	JCT	GROUND	1100	170	12	10.9	480	3	60	660	1/3	277	1	60
FPB-N-G-12	FPT	AHU-GC1	JCT	GROUND	1100	170	12	11	480	3	60	660	1/4	277	1	60
FPB-N-G-13	FPT	AHU-GC1	JCT	GROUND	400	60	8	4	480	3	60	240	1/8	277	1	60
FPB-N-G-14	FPT	AHU-GC1	JCT	GROUND	300	80	8	5	480	3	60	300	1/8	277	1	60
FPB-N-G-27	FPT	AHU-GC1	JCT	GROUND	1100	170	12	11	480	3	60	660		277	1	60
VAV-G-1	VAV	AHU-GC1	JCT	GROUND	360	50	6									
FPB-G1-NI	FPT	AHU-GC1	JCT	GROUND	1400	210	12	7.57	480	3	60	840		277	1	60
FPB-G2-NI	FPT	AHU-GC1	JCT	GROUND	400	60	8	2.28	277	1	60	240		277	1	60
VAV-G-3	VAV	AHU-GC1	JCT	GROUND	480	70	8							277	1	60
FPB-G3-NI	FPT	AHU-GC1	JCT	GROUND	1620	240	12	9.23	480	3	60	972		277	1	60
FPB-G4-NI	FPT	AHU-GC1	JCT	GROUND	300	50	6	1.71	277	1	60	180		277	1	60
VAV-G-4	VAV	AHU-GC1	JCT	GROUND	760	110	8									
VAV-G-5	VAV	AHU-GC1	JCT	GROUND	140	20	6									
VAV-G-6	VAV	AHU-GC1	JCT	GROUND	360	50	6									
VAV-G-7	VAV	AHU-GC1	JCT	GROUND	240	40	5									
VAV-G-8	VAV	AHU-GC1	JCT	GROUND	540	80	7									
VAV-G-9	VAV	AHU-GC1	JCT	GROUND	930	140	9									
FPB-G5-NI	FPT	AHU-GC1	JCT	GROUND	1085	160	10	6.18	480	3	60	651				
FPB-N-G-4	FPT	AHU-GC2	JCT	GROUND	940	140	10	10	480	3	60	564	1/3	277	1	60
FPB-N-G-5	FPT	AHU-GC2	JCT	GROUND	930	140	10	10	480	3	60	558	1/3	277	1	60
FPB-G6-NI	FPT	AHU-GC2	JCT	GROUND	520	80	8	2.56	277	1	60	312		277	1	60
FPB-G7-NI	FPT	AHU-GC2	JCT	GROUND	1320	200	12	7.52	480	3	60	792		277	1	60
FPB-G8-NI	FPT	AHU-GC2	JCT	GROUND	810	120	8	4.61	480	3	60	486		277	1	60
FPB-G9-NI	FPT	AHU-GC2	JCT	GROUND	510	80	6	2.50	277	1	60	306		277	1	60
FPB-G10-NI	FPT	AHU-GC2	JCT	GROUND	1320	200	8	7.52	480	3	60	792		277	1	60
FPB-N-G-1	FPT	AHU-GC3	JCT	GROUND	450	70	8	5	480	3	60	270	1/4	277	1	60
FPB-N-G-2	FPT	AHU-GC3	JCT	GROUND	450	70	8	5	480	3	60	270	1/4	277	1	60
FPB-N-G-3	FPT	AHU-GC3	JCT	GROUND	1020	150	12	11.2	480	3	60	612	1/3	277	1	60
FPB-G11-NI	FPT	AHU-GC3	JCT	GROUND	2080	310	14	11.85	480	3	60	1248		277	1	60
FPB-G12-NI	FPT	AHU-GC3	JCT	GROUND	1240	190	10	7.06	480	3	60	744		277	1	60
FPB-G13-NI	FPT	AHU-GC3	JCT	GROUND	750	110	8	4.27	480	3	60	450		277	1	60
FPB-G14-NI	FPT	AHU-GC3	JCT	GROUND	470	70	6	2.68	277	1	60	282		277	1	60
FPB-G15-NI	FPT	AHU-GC3	JCT	GROUND	990	150	10	5.64	480	3	60	594		277	1	60
VAV-G-10	VAV	AHU-GC3	JCT	GROUND	250	40	4									
FPB-N-G-15	FPT	AHU-GC4	JCT	GROUND	1400	210	12	12.7	480	3	60	840	3/4	277	1	60
FPB-N-G-16	FPT	AHU-GC4	JCT	GROUND	2160	320	16	19.2	480	3	60	1296	3/4	277	1	60
FPB-N-G-17	FPT	AHU-GC4	JCT	GROUND	500	80	8	4.4	480	3	60	300	1/4	277	1	60
FPB-N-G-18	FPT	AHU-GC4	JCT	GROUND	2900	440		26.1	480	3	60	1740	3/4	277	1	60
FPB-N-G-19	FPT	AHU-GC4	JCT	GROUND	840	130	10	7.4	480	3	60	504	1/3	277	1	60
FPB-N-G-20	FPT	AHU-GC4	JCT	GROUND	840	130	10	7.4	480	3	60	504	1/3	277	1	60
FPB-N-G-21	FPT	AHU-GC4	JCT	GROUND	400	60	8	3.5	277	1	60	240	1/4	277	1	60
FPB-N-G-22	FPT	AHU-GC4	JCT	GROUND	300	50	8	2.7	277	1	60	180	1/8	277	1	60
FPB-N-G-23	FPT	AHU-GC4	JCT	GROUND	150	20	6	11.2	480	3	60	90	1/8	277	1	60
FPB-N-G-24	FPT	AHU-GC4	JCT	GROUND	600	90	10	4.8	480	3	60	360	1/4	277	1	60
FPB-N-G-25	FPT	AHU-GC4	JCT	GROUND	600	90	10	4.8	480	3	60	360	1/4	277	1	60
FPB-N-G-26	FPT	AHU-GC4	JCT	GROUND	400	60	8	3.5	277	1	60	240	1/4	277	1	60
FPB-N-1-9	FPT	AHU-101	JCT	1ST	1610	240	14	20.3	480	3	60	966	3/4	277	1	60
FPB-N-1-10	FPT	AHU-101	JCT	1ST	1500	230	14	19	480	3	60	900	3/4	277	1	60
VAV-1-4	VAV	AHU-101	JCT	1ST	1400	210	12									
VAV-1-3	VAV	AHU-101	JCT	1ST	260	40	5									
VAV-1-1NI	VAV	AHU-101	JCT	1ST	150	20	4									
VAV-1-2NI	VAV	AHU-101	JCT	1ST	1400	210	12									
FPB-1-1NI	FPT	AHU-101	JCT	1ST	800	120	8	4.56	480	3	60	480		277	1	60
VAV-1-43	VAV	AHU-101	JCT	1ST	310	50	6									
VAV-1-8NI	VAV	AHU-101	JCT	1ST	225	30	5									
VAV-1-7NI	VAV	AHU-101	JCT	1ST	160	20	4									
VAV-1-6NI	VAV	AHU-101	JCT	1ST	380	60	6									
VAV-1-5NI	VAV	AHU-101	JCT	1ST	225	30	5									
FPB-1-2NI	FPT	AHU-101	JCT	1ST	2000	300	14	11.39	480	3	60	1200		277	1	60
FPB-1-3NI	FPT	AHU-101	JCT	1ST	700	110	8	3.99	277	1	60	420		277	1	60
FPB-N-1-6	FPT	AHU-102	JCT	1ST	1160	170	12	14.6	480	3	60	696	1/3	277	1	60
FPB-N-1-7	FPT	AHU-102	JCT	1ST	1740	260	14	22	480	3	60	1044	3/4	277	1	60
FPB-N-1-8	FPT	AHU-102	JCT	1ST	1610	240	14	20.4	480	3	60	966	3/4	277	1	60
FPB-N-1-13	FPT	AHU-102	JCT	1ST	920	140	10	9.2	480	3	60	552	1/4	277	1	60
VAV-1-9	VAV	AHU-102	JCT	1ST	380	60	6									
VAV-1-10	VAV	AHU-102	JCT	1ST	160	20	4									
VAV-1-11	VAV	AHU-102	JCT	1ST	270	40	5									
VAV-1-12	VAV	AHU-102	JCT	1ST	455	70	8									
VAV-1-13	VAV	AHU-102	JCT	1ST	1400	210	12									
VAV-1-14	VAV	AHU-102	JCT	1ST	150	20	4									
VAV-1-15I	VAV	AHU-102	JCT	1ST	260	40	5									
FPB-1-4NI	FPT	AHU-102	JCT	1ST	2000	300	14	11.39	480	3	60	1200		277	1	60
VAV-1-16	VAV	AHU-102	JCT	1ST	1400	210	12									
VAV-1-17	VAV	AHU-102	JCT	1ST	360	50	6									
VAV-1-18	VAV	AHU-102	JCT	1ST	390	60	6									
VAV-1-20	VAV	AHU-102	JCT	1ST	620	90	7									
VAV-1-21	VAV	AHU-102	JCT	1ST	300	50	6									
VAV-1-22	VAV	AHU-102	JCT	1ST	400	60	7									
VAV-1-42	VAV	AHU-102	JCT	1ST	640	100	8									
VAV-1-44	VAV	AHU-102	JCT	1ST	400	60	7									
FPB-N-1-4	FPT	AHU-103	JCT	1ST	1260	190	12	16	480	3	60	756	1/3	277	1	60
FPB-N-1-5	FPT	AHU-103	JCT	1ST	1420	210	12	18	480	3	60	852	3/4	277	1	60
FPB-1-5NI	FPT	AHU-103	JCT	1ST	400	60	6	2.28	277	1	60	240		277	1	60
FPB-1-6NI	FPT	AHU-103	JCT	1ST	400	60	6	2.28	277	1	60	240		277	1	60
VAV-1-23	VAV	AHU-103	JCT	1ST	1400	210	12									
VAV-1-24	VAV	AHU-103	JCT	1ST	120	20	5									
VAV-1-25	VAV	AHU-103	JCT	1ST	520	80	8									
VAV-1-26	VAV	AHU-103	JCT	1ST	1400	210	12									
VAV-1-27NI	VAV	AHU-103	JCT	1ST	250	40	5									
VAV-1-28	VAV	AHU-103	JCT	1ST	260	40	5									
VAV-1-29	VAV	AHU-103	JCT	1ST	1400	210	12									
VAV-1-30	VAV	AHU-103	JCT	1ST	120	20	4									
FPB-1-7NI	FPT	AHU-103	JCT	1ST	2000	300	14	11.39	480	3	60	1200		277	1	60
FPB-1-8NI	FPT	AHU-103	JCT	1ST	560	80	8	3.19	277	1	60	336		277	1	60
FPB-1-9NI	FPT	AHU-103	JCT	1ST	400	60	6	2.28	277	1	60	240		277	1	60
FPB-1-10NI	FPT	AHU-103	JCT	1ST	450	70	6	2.56	277	1	60	270		277	1	60
FPB-N-1-1	FPT	AHU-104	JCT	1ST	1675	250	14	20.6	480	3	60	1005	3/4	277	1	60
FPB-N-1-2	FPT	AHU-104	JCT	1ST	1310	200	12	16.1	480	3	60	786	3/4	277	1	60
FPB-N-1-3	FPT	AHU-104	JCT	1ST	830	120	10	10.2	480	3	60	498	1/4	277	1	60
FPB-N-1-11	FPT	AHU-104	JCT	1ST	920	140	10	9.2	480	3	60	552	1/4	277	1	60
FPB-N-1-12	FPT	AHU-104	JCT	1ST	920	140	10	9.2	480	3	60	552	1/4	277	1	60
FPB-1-11NI	FPT	AHU-104	JCT	1ST	2000	300	14	11.39	480	3	60	1200		277	1	60
FPB-1-12NI	FPT	AHU-104	JCT	1ST	300	50	6	1.71	277	1	60	180		277	1	60
VAV-1-3	VAV	AHU-104	JCT	1ST	260	40	5									
VAV-1-31	VAV	AHU-104	JCT	1ST	120	20	4									
VAV-1-32	VAV	AHU-104	JCT	1ST	1400	210	12									
VAV-1-33	VAV	AHU-104	JCT	1ST	505	80	7									
VAV-1-34	VAV	AHU-104	JCT	1ST	580	90	7									
VAV-1-36	VAV	AHU-104	JCT	1ST	380	60	6									
VAV-1-37	VAV	AHU-104	JCT	1ST	150	20	4									
VAV-1-38	VAV	AHU-104	JCT	1ST	300	50	6									
VAV-1-39	VAV	AHU-104	JCT	1ST	150	20	4									
VAV-1-41	VAV	AHU-104	JCT	1ST	1400	210	12									

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL	ELECTRIC DATA			PARALLEL FAN		ELECTRIC DATA		
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE	KW	VOLTS	PHASE	HZ	FAN CFM	HP	VOLTS	PHASE	HZ
FPB-N-2-1	FPT	AHU-201	JCT	2ND	2110	320	16	23.9	480	3	60	1266	2X 3/4	277	1	60
FPB-N-2-2	FPT	AHU-201	JCT	2ND	1655	250	14	18.7	480	3	60	993	3/4	277	1	60
VAV-2-11NI	VAV	AHU-201	JCT	2ND	180	30	4									
VAV-2-12NI	VAV	AHU-201	JCT	2ND	380	60	6									
VAV-2-13NI	VAV	AHU-201	JCT	2ND	225	30	5									
VAV-2-14NI	VAV	AHU-201	JCT	2ND	450	70	7									
VAV-2-15NI	VAV	AHU-201	JCT	2ND	1500	230	12									
VAV-2-16NI	VAV	AHU-201	JCT	2ND	600	90	8									
VAV-2-17NI	VAV	AHU-201	JCT	2ND	360	50	6									
FPB-2-11NI	FPT	AHU-201	JCT	2ND	1000	150	12	5.70	480	3	60	600		277	1	60
FPB-2-12NI	FPT	AHU-201	JCT	2ND	600	90	8	3.42	277	1	60	360		277	1	60
FPB-2-3NI	FPT	AHU-201	JCT	2ND	1590	240	12	9.06	480	3	60	954		277	1	60
VAV-2-1NI	FPT	AHU-201	JCT	2ND	1500	230	14	8.54	480	3	60	900		277	1	60
VAV-2-2NI	FPT	AHU-201	JCT	2ND	120	20	4	0.68	277	1	60	72		277	1	60
FPB-N-2-3	FPT	AHU-202	JCT	2ND	810	120	10	19	480	3	60	486	3/4	277	1	60
FPB-N-2-4	FPT	AHU-202	JCT	2ND	1520	230	14	16	480	3	60	912	3/4	277	1	60
FPB-N-2-5	FPT	AHU-202	JCT	2ND	1770	270	14	18.6	480	3	60	1062	3/4	277	1	60
VAV-2-3NI	VAV	AHU-202	JCT	2ND	1500	230	12									
VAV-2-4NI	VAV	AHU-202	JCT	2ND	120	20	4									
VAV-2-5NI	VAV	AHU-202	JCT	2ND	560	80	8									
VAV-2-6NI	VAV	AHU-202	JCT	2ND	225	30	5									
VAV-2-7NI	VAV	AHU-202	JCT	2ND	225	30	5									
VAV-2-8NI	VAV	AHU-202	JCT	2ND	410	60	7									
VAV-2-9NI	VAV	AHU-202	JCT	2ND	380	60	5									
VAV-2-10NI	VAV	AHU-202	JCT	2ND	180	30	4									
FPB-2-13NI	FPT	AHU-202	JCT	2ND	400	60	6	2.28	277	1	60	240		277	1	60
FPB-2-1NI	FPT	AHU-202	JCT	2ND	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-2-2NI	FPT	AHU-202	JCT	2ND	1590	240	12	9.06	480	3	60	954		277	1	60
VAV-2-43NI	VAV	AHU-202	JCT	2ND	375	60	6									
VAV-2-44NI	VAV	AHU-202	JCT	2ND	180	30	4									
VAV-2-36NI	VAV	AHU-202	JCT	2ND	180	30	4									
VAV-2-37NI	VAV	AHU-202	JCT	2ND	380	60	6									
VAV-2-41NI	VAV	AHU-202	JCT	2ND	100	20	4									
FPB-N-2-6	FPT	AHU-203	JCT	2ND	1300	200	12	14.8	480	3	60	780	3/4	277	1	60
FPB-N-2-7	FPT	AHU-203	JCT	2ND	1565	230	14	17.8	480	3	60	939	3/4	277	1	60
FPB-N-2-8	FPT	AHU-203	JCT	2ND	1780	270	14	15.5	480	3	60	1068	3/4	277	1	60
FPB-N-2-11	FPT	AHU-203	JCT	2ND	950	140	10	4.5	480	3	60	570	1/4	277	1	60
FPB-N-2-12	FPT	AHU-203	JCT	2ND	950	140	10	9.5	480	3	60	570	1/4	277	1	60
VAV-2-18NI	VAV	AHU-203	JCT	2ND	1500	230	12									
VAV-2-19NI	VAV	AHU-203	JCT	2ND	120	20	4									
VAV-2-20NI	VAV	AHU-203	JCT	2ND	1500	230	12									
VAV-2-21NI	VAV	AHU-203	JCT	2ND	120	20	4									
VAV-2-28NI	VAV	AHU-203	JCT	2ND	160	20	4									
VAV-2-29NI	VAV	AHU-203	JCT	2ND	380	60	6									
VAV-2-30NI	VAV	AHU-203	JCT	2ND	460	70	7									
VAV-2-31NI	VAV	AHU-203	JCT	2ND	225	30	5									
VAV-2-32NI	VAV	AHU-203	JCT	2ND	460	70	7									
VAV-2-33NI	VAV	AHU-203	JCT	2ND	225	30	5									
FPB-2-5NI	FPT	AHU-203	JCT	2ND	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-2-6NI	FPT	AHU-203	JCT	2ND	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-2-7NI	FPT	AHU-203	JCT	2ND	400	60	6	2.28	277	1	60	240		277	1	60
FPB-2-8NI	FPT	AHU-203	JCT	2ND	800	120	10	4.56	480	3	60	480		277	1	60
FPB-N-2-9	FPT	AHU-204	JCT	2ND	2300	350	14	24.4	480	3	60	1380	2X 3/4	277	1	60
FPB-N-2-10	FPT	AHU-204	JCT	2ND	1780	270	14	18.9	480	3	60	1068	3/4	277	1	60
FPB-2-4NI	FPT	AHU-204	JCT	2ND	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-2-9NI	FPT	AHU-204	JCT	2ND	500	80	8	2.85	277	1	60	300		277	1	60
FPB-2-10NI	FPT	AHU-204	JCT	2ND	600	90	10	3.42	277	1	60	360		277	1	60
VAV-2-22NI	VAV	AHU-204	JCT	2ND	600	90	8									
VAV-2-23NI	VAV	AHU-204	JCT	2ND	360	50	6									
VAV-2-24NI	VAV	AHU-204	JCT	2ND	1500	230	12									
VAV-2-25NI	VAV	AHU-204	JCT	2ND	225	30	5									
VAV-2-26NI	VAV	AHU-204	JCT	2ND	380	60	6									
VAV-2-27NI	VAV	AHU-204	JCT	2ND	160	20	4									
VAV-2- 38NI	VAV	AHU-204	JCT	2ND	410	60	7									
FPB-N-3-11	FPT	AHU-301	JCT	3RD	1000	150	12	10	480	3	60	600	1/3	277	1	60
FPB-N-3-12	FPT	AHU-301	JCT	3RD	1000	150	12	10	480	3	60	600	1/3	277	1	60
FPB-N-3-13	FPT	AHU-301	JCT	3RD	1750	260	14	17.5	480	3	60	1050	3/4	277	1	60
FPB-N-3-14	FPT	AHU-301	JCT	3RD	1655	250	14	16.6	480	3	60	993	3/4	277	1	60
FPB-3-11NI	FPT	AHU-301	JCT	3RD	1000	150	10	5.70	480	3	60	600		277	1	60
VAV-3-1NI	VAV	AHU-301	JCT	3RD	1500	230	12									
VAV-3-2NI	VAV	AHU-301	JCT	3RD	120	20	4									
VAV-3-11	VAV	AHU-301	JCT	3RD	180	30	4									
VAV-3-12	VAV	AHU-301	JCT	3RD	380	60	6									
VAV-3-13NI	VAV	AHU-301	JCT	3RD	225	30	5									
VAV-3-14	VAV	AHU-301	JCT	3RD	450	70	7									
VAV-3-15	VAV	AHU-301	JCT	3RD	1500	230	12									
VAV-3-16NI	VAV	AHU-301	JCT	3RD	600	90	8									
VAV-3-17NI	VAV	AHU-301	JCT	3RD	360	50	6									
FPB-N-3-7	FPT	AHU-303	JCT	3RD	1520	230	14	14.8	480	3	60	912	3/4	277	1	60
FPB-N-3-8	FPT	AHU-303	JCT	3RD	1810	270	14	17.6	480	3	60	1086	3/4	277	1	60
FPB-N-3-15	FPT	AHU-303	JCT	3RD	1770	270	14	17.5	480	3	60	1062	3/4	277	1	60
VAV-3-3NI	VAV	AHU-303	JCT	3RD	120	20	4									
VAV-3-4NI	VAV	AHU-303	JCT	3RD	1500	230	12									
VAV-3-5	VAV	AHU-303	JCT	3RD	460	70	7									
VAV-3-6	VAV	AHU-303	JCT	3RD	225	30	5									
VAV-3-7	VAV	AHU-303	JCT	3RD	225	30	5									
VAV-3-8NI	VAV	AHU-303	JCT	3RD	460	70	7									
VAV-3-9	VAV	AHU-303	JCT	3RD	380	60	7									
VAV-3-10	VAV	AHU-303	JCT	3RD	180	30	4									
VAV-3-43	VAV	AHU-303	JCT	3RD	375	60	6									
VAV-3-44	VAV	AHU-303	JCT	3RD	180	30	4									
VAV-3-45	VAV	AHU-303	JCT	3RD	500	80	8									
VAV-3-46	VAV	AHU-303	JCT	3RD	300	50	7									
FPB-3-1NI	FPT	AHU-303	JCT	3RD	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-3-2NI	FPT	AHU-303	JCT	3RD	1590	240	12	9.06	480	3	60	954		277	1	60
VAV-3-36	VAV	AHU-303	JCT	3RD	180	30	4									
VAV-3-37	VAV	AHU-303	JCT	3RD	380	60	7									
FPB-N-3-4	FPT	AHU-302	JCT	3RD	1780	270	14	17.9	480	3	60	1068	3/4	277	1	60
FPB-N-3-5	FPT	AHU-302	JCT	3RD	1780	270	14	20.5	480	3	60	1068	3/4	277	1	60
FPB-N-3-6	FPT	AHU-302	JCT	3RD	1565	230	14	18	480	3	60	939	3/4	277	1	60
VAV-3-18	VAV	AHU-302	JCT	3RD	1500	230	12									
VAV-3-19	VAV	AHU-302	JCT	3RD	120	20	4									
FPB-3-5NI	FPT	AHU-302	JCT	3RD	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-3-6NI	FPT	AHU-302	JCT	3RD	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-3-7NI	FPT	AHU-302	JCT	3RD	750	110	6	4.27	480	3	60	450		277	1	60
FPB-3-8NI	FPT	AHU-302	JCT	3RD	800	120	10	4.56	480	3	60	480		277	1	60
VAV-3-28	VAV	AHU-302	JCT	3RD	160	20	4									
VAV-3-29	VAV	AHU-302	JCT	3RD	380	60	6									
VAV-3-30	VAV	AHU-302	JCT	3RD	460	70	7									
VAV-3-31	VAV	AHU-302	JCT	3RD	225	30	5									
VAV-3-32NI	VAV	AHU-302	JCT	3RD	460	70	7									
VAV-3-33	VAV	AHU-302	JCT	3RD	225	30	5									
VAV-3-34	VAV	AHU-302	JCT	3RD	380	60	6									
VAV-3-35	VAV	AHU-302	JCT	3RD	180	30	4									
VAV-3-42	VAV	AHU-302	JCT	3RD	650	100	8									
FPB-N-3-1	FPT	AHU-304	JCT	3RD	800	120	10	8.1	480	3	60	480	1/4	277	1	60
FPB-N-3-2	FPT	AHU-304	JCT	3RD	1000	150	12	10.1	480	3	60	600	1/3	277	1	60
FPB-N-3-3	FPT	AHU-304	JCT	3RD	2300	350	14	23.1	480	3	60	1380	2X 3/4	277	1	60
FPB-N-3-9	FPT	AHU-304	JCT	3RD	1300	200	12	12.7	480	3	60	780	3/4	277	1	60
FPB-N-3-10	FPT	AHU-304	JCT	3RD	1200	180	12	11.7	480	3	60	720	1/3	277	1	60
VAV-3-20	VAV	AHU-304	JCT	3RD	1500	230	12									
VAV-3-21	VAV	AHU-304	JCT	3RD	120	20	4									
VAV-3-22	VAV	AHU-304	JCT	3RD	600	90	8									
VAV-3-23	VAV	AHU-304	JCT	3RD	360	50	6									
VAV-3-24	VAV	AHU-304	JCT	3RD	1500	230	12									
VAV-3-25	VAV	AHU-304	JCT	3RD	225	30	5									
VAV-3-26	VAV	AHU-304	JCT	3RD	380	60	6									
VAV-3-27	VAV	AHU-304	JCT	3RD	160	20	4									
VAV-3-38	VAV	AHU-304	JCT	3RD	360	50	7									
FPB-3-9NI	FPT	AHU-304	JCT	3RD	600	90	8	3.42	277	1	60	360		277	1	60
FPB-3-10NI	FPT	AHU-304	JCT	3RD	1000	150	10	5.70	480	3	60	600		277	1	60
FPB-3-4NI	FPT	AHU-304	JCT	3RD	1590	240	12	9.06	480	3	60	954		277	1	60

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL	ELECTRIC DATA			PARALLEL FAN		ELECTRIC DATA		
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE	KW	VOLTS	PHASE	HZ	FAN CFM	HP	VOLTS	PHASE	HZ
FPE-N-4-11	FPT	AHU-401	JCT	4TH	1000	150	12	10	480	3	60	630	1/3	277	1	60
FPE-N-4-12	FPT	AHU-401	JCT	4TH	1000	150	12	10	480	3	60	630	1/3	277	1	60
FPE-N-4-13	FPT	AHU-401	JCT	4TH	1750	260	14	17.5	480	3	60	1050	3/4	277	1	60
FPE-N-4-14	FPT	AHU-401	JCT	4TH	1655	250	14	16.6	480	3	60	993	3/4	277	1	60
VAV-4-1	VAV	AHU-401	JCT	4TH	1500	230	12									
VAV-4-2	VAV	AHU-401	JCT	4TH	120	20	4									
FPE-4-11NI	FPT	AHU-401	JCT	4TH	1000	150	10	5.70	480	3	60	630		277	1	60
VAV-4-11	VAV	AHU-401	JCT	4TH	180	30	4									
VAV-4-12	VAV	AHU-401	JCT	4TH	380	60	5									
VAV-4-13	VAV	AHU-401	JCT	4TH	225	30	5									
VAV-4-14	VAV	AHU-401	JCT	4TH	450	70	7									
VAV-4-15	VAV	AHU-401	JCT	4TH	1500	230	12									
VAV-4-16	VAV	AHU-401	JCT	4TH	600	90	8									
VAV-4-17	VAV	AHU-401	JCT	4TH	260	40	5									
FPB-4-3NI	FPT	AHU-401	JCT	4TH	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-N-4-7	FPT	AHU-402	JCT	4TH	1520	230	14	16.7	480	3	60	912		277	1	60
FPB-N-4-8	FPT	AHU-402	JCT	4TH	1810	270	14	19.9	480	3	60	1086		277	1	60
FPE-N-4-15	FPT	AHU-402	JCT	4TH	1770	270	14	19.5	480	3	60	1062		277	1	60
VAV-4-3	VAV	AHU-402	JCT	4TH	1500	230	12									
VAV-4-4	VAV	AHU-402	JCT	4TH	120	20	4									
VAV-4-5	VAV	AHU-402	JCT	4TH	460	70	7									
VAV-4-6	VAV	AHU-402	JCT	4TH	225	30	5									
VAV-4-7	VAV	AHU-402	JCT	4TH	225	30	5									
VAV-4-8	VAV	AHU-402	JCT	4TH	460	70	7									
VAV-4-9	VAV	AHU-402	JCT	4TH	380	60	5									
VAV-4-10	VAV	AHU-402	JCT	4TH	180	30	4									
VAV-4-45	VAV	AHU-402	JCT	4TH	600	90	8									
VAV-4-46	VAV	AHU-402	JCT	4TH	400	60	7									
FPB-4-1NI	FPT	AHU-402	JCT	4TH	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-4-2NI	FPT	AHU-402	JCT	4TH	1590	240	12	9.06	480	3	60	954		277	1	60
VAV-4-36	VAV	AHU-402	JCT	4TH	180	30	4									
VAV-4-37	VAV	AHU-402	JCT	4TH	380	60	5									
FPB-N-4-5	FPT	AHU-403	JCT	4TH	1780	270	14	17.3	480	3	60	1068	3/4	277	1	60
FPB-N-4-6	FPT	AHU-403	JCT	4TH	1565	230	14	15.2	480	3	60	939	3/4	277	1	60
FPB-N-4-9	FPT	AHU-403	JCT	4TH	1300	200	12	12.6	480	3	60	780	3/4	277	1	60
FPE-N-4-10	FPT	AHU-403	JCT	4TH	1200	180	12	11.7	480	3	60	720	1/3	277	1	60
VAV-4-43	VAV	AHU-403	JCT	4TH	375	60	5									
VAV-4-44	VAV	AHU-403	JCT	4TH	180	30	4									
VAV-4-18	VAV	AHU-403	JCT	4TH	1500	230	12									
VAV-4-19	VAV	AHU-403	JCT	4TH	120	20	4									
FPB-4-5NI	FPT	AHU-403	JCT	4TH	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-4-6NI	FPT	AHU-403	JCT	4TH	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-4-7NI	FPT	AHU-403	JCT	4TH	750	110	5	4.27	480	3	60	450		277	1	60
FPB-4-8NI	FPT	AHU-403	JCT	4TH	800	120	10	4.56	480	3	60	480		277	1	60
VAV-4-28	VAV	AHU-403	JCT	4TH	160	20	4									
VAV-4-29	VAV	AHU-403	JCT	4TH	380	60	5									
VAV-4-30	VAV	AHU-403	JCT	4TH	460	70	7									
VAV-4-31	VAV	AHU-403	JCT	4TH	225	30	5									
VAV-4-32	VAV	AHU-403	JCT	4TH	460	70	7									
VAV-4-33	VAV	AHU-403	JCT	4TH	225	30	5									
VAV-4-34	VAV	AHU-403	JCT	4TH	550	80	5									
VAV-4-35	VAV	AHU-403	JCT	4TH	300	50	4									
VAV-4-42	VAV	AHU-403	JCT	4TH	650	100	8									
FPB-N-4-1	FPT	AHU-404	JCT	4TH	800	120	10	8	480	3	60	480	1/4	277	1	60
FPB-N-4-2	FPT	AHU-404	JCT	4TH	1000	150	12	10	480	3	60	630	1/3	277	1	60
FPB-N-4-3	FPT	AHU-404	JCT	4TH	2300	350	14	23	480	3	60	1380	2X 3/4	277	1	60
FPB-N-4-4	FPT	AHU-404	JCT	4TH	1780	270	14	17.8	480	3	60	1068	3/4	277	1	60
FPB-4-4NI	FPT	AHU-404	JCT	4TH	1590	240	12	9.06	480	3	60	954		277	1	60
VAV-4-20	VAV	AHU-404	JCT	4TH	1500	230	12									
VAV-4-21	VAV	AHU-404	JCT	4TH	120	20	4									
VAV-4-22	VAV	AHU-404	JCT	4TH	600	90	8									
VAV-4-23	VAV	AHU-404	JCT	4TH	360	50	5									
VAV-4-24	VAV	AHU-404	JCT	4TH	1500	230	12									
VAV-4-25	VAV	AHU-404	JCT	4TH	225	30	5									
VAV-4-26	VAV	AHU-404	JCT	4TH	380	60	5									
VAV-4-27	VAV	AHU-404	JCT	4TH	160	20	4									
FPB-4-9NI	FPT	AHU-404	JCT	4TH	600	90	8	3.42	277	1	60	350		277	1	60
FPE-4-10NI	FPT	AHU-404	JCT	4TH	1000	150	10	5.70	480	3	60	630		277	1	60
VAV-4-38	VAV	AHU-404	JCT	4TH	360	50	7	2.05	277	1	60	216		277	1	60
FPB-N-5-1	FPT	AHU-501	JCT	5TH	1600	240	14	9	277	1	60	960	3/4	277	1	60
FPB-N-5-2	FPT	AHU-501	JCT	5TH	1200	180	10	7	277	1	60	720	1/4	277	1	60
FPB-N-5-3	FPT	AHU-501	JCT	5TH	1380	210	12	8	277	1	60	828	1/2	277	1	60
FPB-N-5-4	FPT	AHU-502	JCT	5TH	850	130	10	5	277	1	60	510	1/4	277	1	60
FPB-N-5-5	FPT	AHU-502	JCT	5TH	1725	260	14	9	277	1	60	1035	3/4	277	1	60
FPB-N-5-6	FPT	AHU-502	JCT	5TH	1725	260	14	9	277	1	60	1035	3/4	277	1	60
FPB-N-5-7	FPT	AHU-502	JCT	5TH	850	130	10	5	277	1	60	510	1/4	277	1	60
FPB-N-5-8	FPT	AHU-502	JCT	5TH	1100	170	10	6	277	1	60	650	1/4	277	1	60
FPB-N-5-9	FPT	AHU-502	JCT	5TH	850	130	10	5	277	1	60	510	1/4	277	1	60
FPE-N-5-10	FPT	AHU-502	JCT	5TH	1825	270	14	10	277	1	60	1095	3/4	277	1	60
FPE-N-5-11	FPT	AHU-502	JCT	5TH	1650	250	14	10	277	1	60	990	3/4	277	1	60
FPE-N-5-12	FPT	AHU-503	JCT	5TH	1400	210	12	8	277	1	60	840	1/2	277	1	60
FPE-N-5-13	FPT	AHU-503	JCT	5TH	1790	270	14	10	277	1	60	1074	3/4	277	1	60
FPE-N-5-14	FPT	AHU-503	JCT	5TH	1225	180	10	7	277	1	60	735	1/4	277	1	60
FPE-N-5-15	FPT	AHU-503	JCT	5TH	850	130	10	5	277	1	60	510	1/4	277	1	60
FPE-N-5-16	FPT	AHU-503	JCT	5TH	850	130	10	5	277	1	60	510	1/4	277	1	60
FPE-N-5-17	FPT	AHU-503	JCT	5TH	1725	260	14	10	277	1	60	1035	3/4	277	1	60
FPE-N-5-18	FPT	AHU-503	JCT	5TH	1725	260	14	10	277	1	60	1035	3/4	277	1	60
FPE-N-5-19	FPT	AHU-503	JCT	5TH	850	130	10	5	277	1	60	510	1/4	277	1	60
FPE-N-5-20	FPT	AHU-504	JCT	5TH	1000	150	10	6	277	1	60	600	1/4	277	1	60
FPE-N-5-21	FPT	AHU-504	JCT	5TH	1380	210	12	8	277	1	60	828	1/2	277	1	60
FPE-N-5-22	FPT	AHU-504	JCT	5TH	990	150	10	6	277	1	60	594	1/4	277	1	60
FPE-N-5-23	FPT	AHU-504	JCT	5TH	1590	240	14	9	277	1	60	954	3/4	277	1	60
V-5-1	VAV	AHU-501	JCT	5TH	1145	170	10									
V-5-2	VAV	AHU-501	JCT	5TH	800	120	8									
V-5-3	VAV	AHU-501	JCT	5TH	1600	240	12									
V-5-4	VAV	AHU-501	JCT	5TH	1050	160	9									
V-5-5	VAV	AHU-501	JCT	5TH	800	120	8									
V-5-6	VAV	AHU-501	JCT	5TH	160	20	12									
V-5-7	VAV	AHU-501	JCT	5TH	500	80	5									
V-5-8	VAV	AHU-501	JCT	5TH	300	50	5									
V-5-9	VAV	AHU-502	JCT	5TH	620	90	7									
V-5-10	VAV	AHU-502	JCT	5TH	1600	240	12									
V-5-11	VAV	AHU-502	JCT	5TH	800	120	8									
V-5-12	VAV	AHU-502	JCT	5TH	940	140	9									
V-5-13	VAV	AHU-502	JCT	5TH	1800	270	12									
V-5-14	VAV	AHU-502	JCT	5TH	675	100	8									
V-5-15	VAV	AHU-502	JCT	5TH	675	100	8									
V-5-16	VAV	AHU-504	JCT	5TH	450	70	5									
V-5-17	VAV	AHU-503	JCT	5TH	450	70	5									
V-5-18	VAV	AHU-503	JCT	5TH	620	90	7									
V-5-19	VAV	AHU-503	JCT	5TH	600	90	7									
V-5-20	VAV	AHU-503	JCT	5TH	350	50	5									
V-5-21	VAV	AHU-503	JCT	5TH	825	120	9									
V-5-22	VAV	AHU-503	JCT	5TH	350	50	5									
V-5-23	VAV	AHU-504	JCT	5TH	550	80	7									
V-5-25	VAV	AHU-504	JCT	5TH	620	90	7									
V-5-26	VAV	AHU-504	JCT	5TH	1600	240	12									
V-5-27	VAV	AHU-504	JCT	5TH	800	120	8									
V-5-28	VAV	AHU-504	JCT	5TH	760	110	8									
V-5-29	VAV	AHU-504	JCT	5TH	600	90	7									
V-5-30	VAV	AHU-504	JCT	5TH	1600	240	12									
V-5-31	VAV	AHU-504	JCT	5TH	800	120	8									
V-5-32	VAV		JCT	5TH	550											

NOT FOUND ON FLOOR PLAN

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED

NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019
DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEDULES
DRAWING NO.
MC-601
ISSUED FOR BID

NOTES:
1. FURNISH VAV UNITS WITH ELECTRIC HEAT THERMAL CUT-OFF SAFETY DEVICES, ELECTRIC HEATER AIRFLOW SWITCH AND DISCONNECT SWITCH.
2. CONTROLS TO BE PROVIDED BY CONTROL CONTRACTOR AND FACTORY MOUNTED & CALIBRATED BY MANUFACTURER.
3. UNIT SHALL BE PROVIDED WITH AIRFLOW STATION/PICKUP AND LINED WITH 1" ECO-SHIELD LINER.
4. AN INTERNALLY LINE ELBOW ON THE PLENUM AIR INLET SHALL BE FIELD INSTALLED FOR FPU UNITS.
5. 1ST STAGE OF HEAT FOR ELECTRIC COIL IS UP TO 4.5 KW AND 2ND STAGE MORE THAN 4.5 KW.
6. UNITS TO BE PROVIDED WITH HANGERS/BRACKETS SUPPORTS AND ISOLATION VIBRATORS.
7. FURNISH FPU WITH ECM MOTORS AND SOUND ATTENUATOR.
8. NOISE CRITERIA LEVEL SHALL NOT BE MORE THAN 35 DB FOR FAN POWERED UNITS AND VAV BOXES.
9. THE FINAL INSTALLED EXTERNAL STATIC PRESSURE, EXCLUDING INDUCED AIR INLET/TERMINAL PRESSURE DROP, MAY VARY BETWEEN 0.2 AND 0.4. FINAL ADJUSTMENT SHALL BE MADE IN THE FIELD DURING TAB
10. THE CONTRACTOR SHALL PROVIDE ACCESS PANELS IN THE NON-ACCESSIBLE CEILINGS, WHERE THE VAV'S, ETC. ARE LOCATED, FOR MAINTAINING AND SERVICING THE UNITS

TITUS IS THE BASIS OF DESIGN FOR THE AIR TERMINAL UNITS. REFER TO SPECIFICATION FOR OTHER APPROVED/EQUAL MANUFACTURERS.

TYPE OF UNIT	MODEL #
FPU	DTDF
VAV	DESV

TERMINAL UNIT		LOCATION			AIR VALVE			ELECTRIC HEATING COIL					PARALLEL FAN			
					MAX	MIN CFM	INLET	KW	ELECTRIC DATA					ELECTRIC DATA		
NUMBER	TYPE	AHU	BLDG	FLOOR	CFM		SIZE		VOLTS	PHASE	HZ	FAN CFM	HP	VOLTS	PHASE	HZ
FPB-1-7-11	FPT	AHU-701	JCT	7TH	1040	156	12	10.5	480	3	60	500	1/3	277	1	60
FPB-1-7-12	FPT	AHU-701	JCT	7TH	1040	156	12	10.5	480	3	60	500	1/3	277	1	60
FPB-1-7-13	FPT	AHU-701	JCT	7TH	2100	326	16	20.1	480	3	60	1266	2X3/4	277	1	60
FPB-1-7-14	FPT	AHU-701	JCT	7TH	1620	240	14	17	480	3	60	972	3/4	277	1	60
FPB-1-7-15	FPT	AHU-701	JCT	7TH	1770	276	14	18.5	480	3	60	1062	3/4	277	1	60
VAV-7-40	VAV	AHU-701	JCT	7TH	1540	230	12									
VAV-7-41	VAV	AHU-701	JCT	7TH	120	20	4									
VAV-7-35	VAV	AHU-701	JCT	7TH	400	60	7									
VAV-7-36	VAV	AHU-701	JCT	7TH	500	80	7									
VAV-7-37	VAV	AHU-701	JCT	7TH	360	50	6									
VAV-7-30	VAV	AHU-701	JCT	7TH	600	90	8									
VAV-7-31	VAV	AHU-701	JCT	7TH	1540	230	12									
VAV-7-32	VAV	AHU-701	JCT	7TH	450	70	7									
VAV-7-33	VAV	AHU-701	JCT	7TH	225	30	5									
VAV-7-34	VAV	AHU-701	JCT	7TH	380	60	6									
VAV-7-25	VAV	AHU-701	JCT	7TH	180	30	4									
VAV-7-26	VAV	AHU-701	JCT	7TH	180	30	4									
VAV-7-27	VAV	AHU-701	JCT	7TH	380	60	6									
VAV-7-28	VAV	AHU-701	JCT	7TH	460	70	7									
VAV-7-29	VAV	AHU-701	JCT	7TH	225	30	5									
FPB-7-4-11	FPT	AHU-701	JCT	7TH	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-7-5-11	FPT	AHU-701	JCT	7TH	1590	240	12	9.06	480	3	60	954		277	1	60
FPB-7-6-11	FPT	AHU-701	JCT	7TH	600	90	6	3.42	277	1	60	360		277	1	60
FPB-N-7-6	FPT	AHU-701	JCT	7TH	1440	216	12	15	480	3	60	840	3/4	277	1	60
FPB-N-7-7	FPT	AHU-701	JCT	7TH	1340	210	12	15	480	3	60	828	3/4	277	1	60
FPB-N-7-8	FPT	AHU-701	JCT	7TH	880	130	10	9.5	480	3	60	528	1/3	277	1	60
FPB-N-7-9	FPT	AHU-701	JCT	7TH	1040	156	12	10.8	480	3	60	500	1/3	277	1	60
FPB-1-7-10	FPT	AHU-701	JCT	7TH	1140	170	12	11.9	480	3	60	560	1/3	277	1	60
FPB-7-3-11	FPT	AHU-701	JCT	7TH	1140	170	10	6.27	480	3	60	560		277	1	60
FPB-N-7-1	FPT	AHU-703	JCT	7TH	2070	310	16	21	480	3	60	1242	2X3/4	277	1	60
FPB-N-7-2	FPT	AHU-703	JCT	7TH	520	80	8	5.1	480	3	60	300	1/4	277	1	60
FPB-N-7-3	FPT	AHU-703	JCT	7TH	1740	260	14	18	480	3	60	1056	3/4	277	1	60
FPB-N-7-4	FPT	AHU-703	JCT	7TH	1140	170	12	11.8	480	3	60	696	1/3	277	1	60
FPB-N-7-5	FPT	AHU-703	JCT	7TH	1580	240	14	16.5	480	3	60	960	3/4	277	1	60
FPB-7-1-11	FPT	AHU-703	JCT	7TH	600	90	8	3.42	277	1	60	360		277	1	60
FPB-7-2-11	FPT	AHU-703	JCT	7TH	700	110	8	3.99	277	1	60	420		277	1	60
VAV-7-1	VAV	AHU-703	JCT	7TH	1040	156	10									
VAV-7-2	VAV	AHU-703	JCT	7TH	555	80	7									
VAV-7-3	VAV	AHU-703	JCT	7TH	600	90	8									
VAV-7-4	VAV	AHU-703	JCT	7TH	900	140	9									
VAV-7-5	VAV	AHU-703	JCT	7TH	400	60	7									
VAV-7-6	VAV	AHU-703	JCT	7TH	615	90	8									
VAV-7-7	VAV	AHU-703	JCT	7TH	400	60	7									
VAV-7-8	VAV	AHU-703	JCT	7TH	600	90	8									
VAV-7-9	VAV	AHU-703	JCT	7TH	1240	186	10									
VAV-7-10	VAV	AHU-703	JCT	7TH	600	90	7									
VAV-7-11	VAV	AHU-703	JCT	7TH	450	70	7									
FPB-1-8-11	FPT	AHU-801	JCT	8TH	1040	156	12	10	480	3	60	500	1/3	277	1	60
FPB-1-8-12	FPT	AHU-801	JCT	8TH	1040	156	12	10	480	3	60	500	1/3	277	1	60
FPB-1-8-13	FPT	AHU-801	JCT	8TH	1740	260	14	17.5	480	3	60	1050	3/4	277	1	60
FPB-1-8-14	FPT	AHU-801	JCT	8TH	1740	260	14	17.6	480	3	60	1056	3/4	277	1	60
VAV-8-1	VAV	AHU-801	JCT	8TH	1540	230	12									
VAV-8-2	VAV	AHU-801	JCT	8TH	120	20	4									
VAV-8-1	VAV	AHU-801	JCT	8TH	180	30	4									
VAV-8-2	VAV	AHU-801	JCT	8TH	380	60	6									
VAV-8-3	VAV	AHU-801	JCT	8TH	225	30	5									
VAV-8-4	VAV	AHU-801	JCT	8TH	450	70	7									
VAV-8-5	VAV	AHU-801	JCT	8TH	1540	230	12									
VAV-8-6	VAV	AHU-801	JCT	8TH	600	90	8									
VAV-8-7	VAV	AHU-801	JCT	8TH	360	50	6									
FPB-8-7-11	FPT	AHU-801	JCT	8TH	1040	240	12	9.06	277	1	60	954		277	1	60
FPB-8-11-11	FPT	AHU-801	JCT	8TH	1040	150	10	5.70	480	3	60	500		277	1	60
FPB-8-12-11	FPT	AHU-801	JCT	8TH	500	80	8	2.85	277	1	60	300		277	1	60
FPB-N-8-7	FPT	AHU-801	JCT	8TH	1560	230	14	16	480	3	60	936	3/4	277	1	60
FPB-N-8-8	FPT	AHU-801	JCT	8TH	1980	296	14	19.4	480	3	60	1140	3/4	277	1	60
FPB-N-8-15	FPT	AHU-801	JCT	8TH	1860	280	14	19	480	3	60	1116	3/4	277	1	60
VAV-8-3	VAV	AHU-801	JCT	8TH	1560	230	12									
VAV-8-4	VAV	AHU-801	JCT	8TH	120	20	4									
VAV-8-5	VAV	AHU-801	JCT	8TH	460	70	7									
VAV-8-6	VAV	AHU-801	JCT	8TH	225	30	5									
VAV-8-7	VAV	AHU-801	JCT	8TH	225	30	5									
VAV-8-8	VAV	AHU-801	JCT	8TH	460	70	7									
VAV-8-9	VAV	AHU-801	JCT	8TH	380	60	6									
VAV-8-0	VAV	AHU-801	JCT	8TH	180	30	4									

TERMINAL UNITS REPLACEMENT" NOT IN SCOPE OF WORK																
TERMINAL UNIT		LOCATION			AIR VALVE			ELECTRIC HEATING COIL					PARALLEL FAN			
					MAX	MIN CFM	INLET	KW	ELECTRIC DATA				ELECTRIC DATA			
NUMBER	TYPE	AHU	BLDG	FLOOR	CFM		SIZE		VOLTS	PHASE	HZ	FAN CFM	HP	VOLTS	PHASE	HZ
F-7-1	FPT	AHU-702	JCT	7TH	315	125	6	1.25	277	:	60	310	1/3	277	1	60
F-7-2	FPT	AHU-702	JCT	7TH	410	160	8	1.50	277	:	60	410	1/3	277	1	60
F-7-3	FPT	AHU-702	JCT	7TH	280	110	6	1.25	277	:	60	280	1/3	277	1	60
F-7-4	FPT	AHU-702	JCT	7TH	240	95	6	1.25	277	:	60	240	1/3	277	1	60
F-7-5	FPT	AHU-702	JCT	7TH	305	120	6	1.25	277	:	60	305	1/3	277	1	60
F-7-6	FPT	AHU-702	JCT	7TH	210	80	6	-	277	:	60	210	1/3	277	1	60
F-7-7	FPT	AHU-702	JCT	7TH	345	135	8	1.25	277	:	60	345	1/3	277	1	60
F-7-8	FPT	AHU-702	JCT	7TH	285	115	6	1.25	277	:	60	285	1/3	277	1	60
F-7-9	FPT	AHU-702	JCT	7TH	600	240	8	2.00	277	:	60	470	1/2	277	1	60
F-7-10	FPT	AHU-702	JCT	7TH	220	85	6	1.00	277	:	60	220	1/3	277	1	60
F-7-11	FPT	AHU-702	JCT	7TH	560	220	8	1.50	277	:	60	560	1/2	277	1	60
F-7-12	FPT	AHU-702	JCT	7TH	180	70	6	1.00	277	:	60	180	1/3	277	1	60

TERMINAL UNIT		LOCATION			AIR VALVE			ELECTRIC HEATING COIL					PARALLEL FAN			
					MAX	MIN CFM	INLET	KW	ELECTRIC DATA				ELECTRIC DATA			
NUMBER	TYPE	AHU	BLDG	FLOOR	CFM		SIZE		VOLTS	PHASE	HZ	FAN CFM	HP	VOLTS	PHASE	HZ
FPB-8-1-11	FPT	AHU-802	JCT	8TH	1590	240	12	9.06	480	3	60	954		277	:	50
FPB-8-2-11	FPT	AHU-802	JCT	8TH	1590	240	12	9.06	480	3	60	954		277	:	50
FPB-1-1-11	FPT	AHU-802	JCT	8TH	430	50	8	2.28	277	1	60	249		277	:	50
VAV-8-16	VAV	AHU-802	JCT	8TH	130	20	4									
VAV-8-17	VAV	AHU-802	JCT	8TH	130	20	7									
FPB-V-8-5	FPT	AHU-803	JCT	8TH	1280	270	14	18.1	480	3	60	1068	3/4	277	:	50
FPB-V-8-6	FPT	AHU-803	JCT	8TH	1565	230	14	16.:	480	3	60	939	3/4	277	:	50
FPB-V-8-9	FPT	AHU-803	JCT	8TH	1300	200	12	13.4	480	3	60	780	3/4	277	:	50
FPB-1-8-10	FPT	AHU-803	JCT	8TH	1200	180	12	12.4	480	3	60	720	1/3	277	:	50
VAV-8-18	VAV	AHU-803	JCT	8TH	1500	230	12									
VAV-8-19	VAV	AHU-803	JCT	8TH	120	20	4									
VAV-8-28	VAV	AHU-803	JCT	8TH	130	20	4									
VAV-8-29	VAV	AHU-803	JCT	8TH	380	50	6									
VAV-8-30	VAV	AHU-803	JCT	8TH	450	70	7									
VAV-8-31	VAV	AHU-803	JCT	8TH	225	30	5									
VAV-8-32	VAV	AHU-803	JCT	8TH	450	70	7									
VAV-8-33	VAV	AHU-803	JCT	8TH	225	30	5									
VAV-8-34	VAV	AHU-803	JCT	8TH	330	50	6									
VAV-8-35	VAV	AHU-803	JCT	8TH	130	30	4									
VAV-8-42	VAV	AHU-803	JCT	8TH	650	100	8									
VAV-8-43	VAV	AHU-803	JCT	8TH	375	50	6									
VAV-8-44	VAV	AHU-803	JCT	8TH	130	30	4									
FPB-8-5-11	FPT	AHU-803	JCT	8TH	1590	240	12	9.06	480	3	60	954		277	:	50
FPB-8-6-11	FPT	AHU-803	JCT	8TH	1590	240	12	9.06	480	3	60	954		277	:	50
FPB-8-2-11	FPT	AHU-803	JCT	8TH	760	110	6	4.27	480	3	60	459		277	:	50
FPB-8-8-11	FPT	AHU-803	JCT	8TH	830	120	10	4.56	480	3	60	489		277	:	50
FPB-V-8-1	FPT	AHU-804	JCT	8TH	1800	270	14	9.2	480	3	60	1080	1/3	277	:	50
FPB-V-8-2	FPT	AHU-804	JCT	8TH	1000	150	12	11.1	480	3	60	600	1/3	277	:	50
FPB-V-8-3	FPT	AHU-804	JCT	8TH	2000	250	14	20.1	480	3	60	1383	2X 3/4	277	:	50
FPB-V-8-4	FPT	AHU-804	JCT	8TH	1280	270	14	20.1	480	3	60	1068	3/1	277	:	50
VAV-8-20	VAV	AHU-804	JCT	8TH	1500	230	12									
VAV-8-21	VAV	AHU-804	JCT	8TH	120	20	4									
VAV-8-22	VAV	AHU-804	JCT	8TH	600	90	8									
VAV-8-23	VAV	AHU-804	JCT	8TH	330	50	6									
VAV-8-24	VAV	AHU-804	JCT	8TH	1500	230	12									
VAV-8-25	VAV	AHU-804	JCT	8TH	225	30	5									
VAV-8-26	VAV	AHU-804	JCT	8TH	380	50	6									
VAV-8-27	VAV	AHU-804	JCT	8TH	130	20	4									
VAV-8-38	VAV	AHU-804	JCT	8TH	330	50	7									
FPB-8-6-11	FPT	AHU-804	JCT	8TH	1590	240	12	9.06	480	3	60	954		277	:	50
FPB-8-9-11	FPT	AHU-804	JCT	8TH	600	90	8	3.42	277	1	60	360		277	:	50
FPB-1-10-11	FPT	AHU-804	JCT	8TH	1000	150	10	5.73	480	3	60	500		277	:	50
FPB-1-11-12	FPT	AHU-804	JCT	8TH	1000	150	12	8.5	480	3	60	500	1/3	277	:	50
FPB-1-11-13	FPT	AHU-804	JCT	8TH	1250	260	14	15.1	480	3	60	1053	3/1	277	:	50
FPB-1-11-14	FPT	AHU-804	JCT	8TH	1230	260	14	15.1	480	3	60	1038	3/1	277	:	50
FPB-1-11-15	FPT	AHU-804	JCT	8TH	1260	260	14	15.7	480	3	60	1055	3/1	277	:	50
FPB-1-2-11	FPT	AHU-901	JCT	8TH	630	90	8	3.42	277	1	60	369		277	:	50
FPB-1-2-12	FPT	AHU-901	JCT	8TH	2400	360	14	13.67	480	3	60	1440		277	:	50
FPB-1-2-13	FPT	AHU-901	JCT	8TH	735	110	8	5.13	480	3	60	441		277	:	50
FPB-1-2-14	FPT	AHU-901	JCT	8TH	1520	230	12	8.66	480	3	60	912		277	:	50
FPB-1-2-15	FPT	AHU-901	JCT	8TH	1360	160	10	5.01	480	3	60	536		277	:	50
FPB-1-2-16	FPT	AHU-901	JCT	8TH	435	70	6	2.66	277	1	60	279		277	:	50
FPB-V-9-7	FPT	AHU-902	JCT	8TH	930	160	10	8.3	480	3	60	552	1/3	277	:	50
FPB-V-9-8	FPT	AHU-902	JCT	8TH	1290	190	12	11.5	480	3	60	774	1/3	277	:	50
FPB-V-9-9	FPT	AHU-902	JCT	8TH	1000	170	12	9.9	480	3	60	569	1/3	277	:	50
FPB-1-9-10	FPT	AHU-902	JCT	8TH	1520	290	14	17.1	480	3	60	1152	3/1	277	:	50
FPB-1-9-11	FPT	AHU-902	JCT	8TH	2280	300	14	19.3	480	3	60	1218	2X 3/4	277	:	50
FPB-1-1-11	FPT	AHU-902	JCT	8TH	730	110	8	3.99	277	1	60	429		277	:	50
FPB-1-1-11	FPT	AHU-902	JCT	8TH	470	70	6	2.68	277	1	60	282		277	:	50
FPB-1-1-11	FPT	AHU-902	JCT	8TH	1680	250	12	9.57	480	3	60	1008		277	:	50
FPB-1-1-11	FPT	AHU-902	JCT	8TH	1200	180	10	5.88	480	3	60	720		277	:	50
FPB-1-1-11	FPT	AHU-902	JCT	8TH	530	80	6	2.05	277	1	60	216		277	:	50
FPB-1-1-11	FPT	AHU-902	JCT	8TH	1000	150	10	5.73	480	3	60	500		277	:	50
FPB-1-2-11	FPT	AHU-902	JCT	8TH	430	70	8	2.62	277	1	60	276		277	:	50
FPB-1-2-11	FPT	AHU-902	JCT	8TH	1800	240	12	9.1:	480	3	60	969		277	:	50
FPB-1-2-21	FPT	AHU-902	JCT	8TH	430	50	6	2.28	277	1	60	249		277	:	50
FPB-1-2-11	FPT	AHU-902	JCT	8TH	940	140	10	5.36	480	3	60	564		277	:	50
FPB-V-9-1	FPT	AHU-903	JCT	8TH	650	100	10	6.7	480	3	60	396	1/3	277	:	50
FPB-V-9-2	FPT	AHU-903	JCT	8TH	1235	260	14	16.5	480	3	60	1041	3/1	277	:	50
FPB-V-9-3	FPT	AHU-903	JCT	8TH	975	140	10	8.8	480	3	60	555	1/3	277	:	50
FPB-V-9-4	FPT	AHU-903	JCT	8TH	720	110	10	6.5	480	3	60	432	1/1	277	:	50
FPB-V-9-5	FPT	AHU-903	JCT	8TH	930	30	10	5.4	480	3	60	354	1/3	277	:	50
FPB-V-9-6	FPT	AHU-903	JCT	8TH	1345	200	12	12.1	480	3	60	807	3/1	277	:	50
FPB-3-1-11	FPT	AHU-903	JCT	8TH	930	140	10	5.11	480	3	60	549		277	:	50
FPB-3-2-11	FPT	AHU-903	JCT	8TH	530	80	6	2.86	277	1	60	309		277	:	50
FPB-3-3-11	FPT	AHU-903	JCT	8TH	690	100	8	3.99	277	1	60	414		277	:	50
FPB-3-4-11	FPT	AHU-903	JCT	8TH	470	70	6	2.68	277	1	60	282		277	:	50
FPB-3-5-11	FPT	AHU-903	JCT	8TH	1920	290	14	10.94	480	3	60	1152		277	:	50
FPB-3-6-11	FPT	AHU-903	JCT	8TH	440	70	6	2.5:	277	1	60	264		277	:	50
FPB-1-10-11	FPT	AHU-903	JCT	8TH	1160	170	10	5.01	480	3	60	696		277	:	50
FPB-1-1-11	FPT	AHU-903	JCT	8TH	530	80	6	2.96	277	1	60	312		277	:	50
FPB-1-1-11	FPT	AHU-903	JCT	8TH	1050	160	10	5.98	480	3	60	630		277	:	50
FPB-1-3-01	FPT	AHU-903	JCT	8TH	430	50	6	2.28	480	3	60	249		277	:	50
FPB-1-3-11	FPT	AHU-903	JCT	8TH	935	150	9	5.07	480	3	60	597		277	:	50
FPB-1-3-31	FPT	AHU-903	JCT	8TH	1375	210	10	7.88	480	3	60	825		277	:	50
FPB-1-3-11	FPT	AHU-903	JCT	8TH	1375	210	10	7.88	480	3	60	825		277	:	50

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED

NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEDULES

DRAWING NO.
MC-602

ISSUED FOR BID

AIR HANDLING UNITS SCHEDULE

EQUIP	BLDG	LOCATION	FLOOR	DWG NO.	TYPE	SA CFM	OA CFM	% OA CFM	HP	GPM	REQ. VALVE Cv @ 4 PSI	CONTROL
AHU-1	FCC	MECH ROOM NEXT TO W. REST	BASEMENT	MC-20B	VAV	10,145	1,470	14%	15	56.3	28.15	VFD
AHU-2	FCC	MECH ROOM NEXT TO W. REST	GROUND FLOOR	MC-20G	VAV	13,450	1,095	8%	15	72.8	36.40	VFD
AHU-3	FCC	MECH ROOM NEXT TO M.REST	GROUND FLOOR	MC-20G	VAV	11,630	870	7%	15	62.8	31.40	VFD
AHU-4	FCC	MECH ROOM NEXT TO W. REST	1st FLOOR	MC-201	VAV	12,550	900	7%	15	67.8	33.90	VFD
AHU-5	FCC	MECH ROOM NEXT TO M.RES"	1st FLOOR	MC-201	VAV	10,480	1,215	12%	15	51.4	25.70	VFD
AHU-6	FCC	MECH ROOM NEXT TO W. REST	2nd FLOOR	MC-202	VAV	10,400	1,695	16%	15	60.5	30.25	VFD
AHU-7	FCC	MECH ROOM NEXT TO M.RES"	2nd FLOOR	MC-202	VAV	12,265	1,300	11%	15	67.2	33.60	VFD
AHU-8	FCC	MECH ROOM NEXT TO W. REST	3rc FLOOR	MC-203	VAV	13,396	810	6%	15	76.4	38.20	VFD
AHU-9	FCC	MECH ROOM NEXT TO M.RES"	3rc FLOOR	MC-203	VAV	10,436	1,320	13%	15	59.8	29.90	VFD
AHU-10	FCC	MECH ROOM NEXT TO W. REST	4tr FLOOR	MC-204	VAV	13,755	1,605	12%	20	78.4	39.20	VFD
AHU-11	FCC	MECH ROOM NEXT TO M.RES"	4tr FLOOR	MC-204	VAV	12,535	1,545	12%	15	71.4	35.70	VFD
AHU-12	FCC	MECH ROOM NEXT TO W. REST	5tr FLOOR	MC-205	VAV	13,670	1,725	13%	15	75.9	37.95	VFD
AHU-13	FCC	MECH ROOM NEXT TO M.RES"	5tr FLOOR	MC-205	VAV	11,286	975	9%	15	69.3	34.65	VFD
AHU-14	FCC	MECH ROOM NEXT TO W. REST	6tr FLOOR	MC-206	VAV	12,860	1,215	9%	15	70.4	35.20	VFD
AHU-15	FCC	MECH ROOM NEXT TO M.RES"	6tr FLOOR	MC-206	VAV	12,073	1,125	9%	15	66.1	33.05	VFD
AHU-16	FCC	MECH ROOM NEXT TO W. REST	7tr FLOOR	MC-207	VAV	14,045	3,510	25%	20	84.3	42.15	VFD
AHU-17	FCC	MECH ROOM NEXT TO M.RES"	7tr FLOOR	MC-207	VAV	11,205	900	8%	15	61.3	30.65	VFD
AHU-18	FCC	MECH ROOM NEXT TO W. REST	8tr FLOOR	MC-208	VAV	14,045	1,260	9%	20	76.9	38.45	VFD
AHU-19	FCC	MECH ROOM NEXT TO M.RES"	8tr FLOOR	MC-208	VAV	10,330	1,015	10%	15	56.6	28.30	VFD
AHU-20	FCC	MECH ROOM NEXT TO W. REST	9tr FLOOR	MC-209	VAV	14,880	2,040	14%	20	82.6	41.30	VFD
AHU-21	FCC	MECH ROOM NEXT TO M.RES"	9tr FLOOR	MC-209	VAV	15,120	2,175	14%	20	83.9	41.95	VFD
AHU-22	FCC	MECH ROOM NEXT TO M.RES"	BASEMEN"	MC-20B	VAV	17,600			20	71.3	35.65	VFD
AHU-23	FCC	MECH ROOM NEXT TO W. REST	BASEMEN"	MC-20B	CV	7,940			5	44.1	22.0	VFD
AHU-6E	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	4,709			3	25.5	12.7	VFD
AHU-6W	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	5,177			3	28.0	14.0	VFD
AHU-8E	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	3,369			1.5	18.2	9.1	VFD
AHU-8C	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	3,295			1.5	16.2	8.1	VFD
AHU-8W	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	3,629			2	21.1	10.6	VFD
AHU-9E	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	2,073			1	11.4	5.7	VFD
AHU-9W	FCC	MECH ROOM	ATTIC	MC-20PT	VAV	2,379			1	13.6	6.8	VFD

AHU#	Air Handling Unit Location				VAV TERMINAL UNITS	VAV/CV Area Served		
	BLDG	LOCATION	FLOOR	DWG NO.		BLDG	FLOOR	DWG NO.
AHU-1	FCC	MECH ROOM NEXT TO W. REST	BASEMENT	MC-20B	P-B-1 TO P-B-9	FCC	BASEMENT	MC-20B
AHU-2	FCC	MECH ROOM NEXT TO W. REST	GROUND FLOOR	MC-20G	V-G-1 TO V-G-5, P-G-1 TO P-G-6	FCC	GROUND	MC-20G
AHU-3	FCC	MECH ROOM NEXT TO M.REST	GROUND FLOOR	MC-20G	V-G-8 TO V-G-11, P-G-7 TO P-G-14	FCC	GROUND	MC-20G
AHU-4	FCC	MECH ROOM NEXT TO W. REST	1st FLOOR	MC-201	V-1-1 TO V-1-3, V-1-12, P-1-1 TO P-1-8, P-1-15	FCC	1ST	MC-201
AHU-5	FCC	MECH ROOM NEXT TO M.REST	1st FLOOR	MC-201	V-1-4 TO V-1-7, V-1-13, P-1-9 TO P-1-18	FCC	1ST	MC-201
AHU-6	FCC	MECH ROOM NEXT TO W. REST	2nd FLOOR	MC-202	V-2-1 TO V-2-7, P-2-2 TO P-2-6	FCC	2ND	MC-202
AHU-7	FCC	MECH ROOM NEXT TO M.REST	2nd FLOOR	MC-202	V-2-8 TO V-2-14, P-2-7 TO P-2-13	FCC	2ND	MC-202
AHU-8	FCC	MECH ROOM NEXT TO W. REST	3rd FLOOR	MC-203	V-3-1 TO V-3-4, V-3-11, P-3-1 TO P-3-7	FCC	3RD	MC-203
AHU-9	FCC	MECH ROOM NEXT TO M.REST	3rd FLOOR	MC-203	V-3-5 TO V-3-10, P-3-8 TO P-3-14	FCC	3RD	MC-203
AHU-10	FCC	MECH ROOM NEXT TO W. REST	4th FLOOR	MC-204	V-4-1 TO V-4-7, P-4-1 TO P-4-6	FCC	4TH	MC-204
AHU-11	FCC	MECH ROOM NEXT TO M.REST	4th FLOOR	MC-204	V-4-8 TO V-4-15, P-4-7 TO P-4-14	FCC	4TH	MC-204
AHU-12	FCC	MECH ROOM NEXT TO W. REST	5th FLOOR	MC-205	V-5-1.1, V-5-1.2, V-5-2.1, V-5-2.2, V-5-3 TO V-5-6, P-5-1 TO P-5-8	FCC	5TH	MC-205
AHU-13	FCC	MECH ROOM NEXT TO M.REST	5th FLOOR	MC-205	V-5-7, V-5-8, V-5-9.1, V-5-9.2, V-5-10 TO V-5-13, P-5-3 TO P-5-15	FCC	5TH	MC-205
AHU-14	FCC	MECH ROOM NEXT TO W. REST	6th FLOOR	MC-206	V-6-1 TO V-6-7, P-6-1 TO P-6-7	FCC	6TH	MC-206
AHU-15	FCC	MECH ROOM NEXT TO M.REST	6th FLOOR	MC-206	V-6-8 TO V-6-14, P-6-8 TO P-6-14	FCC	6TH	MC-206
AHU-16	FCC	MECH ROOM NEXT TO W. REST	7th FLOOR	MC-207	V-7-1 TO V-7-5, P-7-1 TO P-7-7	FCC	7TH	MC-207
AHU-17	FCC	MECH ROOM NEXT TO M.REST	7th FLOOR	MC-207	V-7-6 TO V-7-13, P-7-8 TO P-7-14	FCC	7TH	MC-207
AHU-18	FCC	MECH ROOM NEXT TO W. REST	8th FLOOR	MC-208	V-8-1 TO V-8-5, P-8-1 TO P-8-6, V-B-13	FCC	8TH	MC-208
AHU-19	FCC	MECH ROOM NEXT TO M.REST	8th FLOOR	MC-208	V-8-6 TO V-8-12, P-8-7 TO P-8-11	FCC	8TH	MC-208
AHU-20	FCC	MECH ROOM NEXT TO W. REST	9th FLOOR	MC-209	P-9-1 TO P-9-10	FCC	9TH	MC-209
AHU-21	FCC	MECH ROOM NEXT TO M.REST	9th FLOOR	MC-209	P-9-11 TO P-9-18	FCC	9TH	MC-209
AHU-22	FCC	MECH ROOM NEXT TO M.REST	BASEMENT	MC-20B	NA	NA	NA	NA
AHU-23	FCC	MECH ROOM NEXT TO M.REST	BASEMENT	MC-20B	NA	NA	NA	NA

FAN COIL UNITS SCHEDULE

EQUIP	BLDG	LOCATION	TYPE	COIL	CAPACITY (CFM)
FCU-1	FCC	PENTHOUSE ELEVATOR ROOM	HORIZONTAL	CHW	1600
FCU-2	FCC	PENTHOUSE ELEVATOR ROOM	VERTICAL	CHW	1600

SUPPLY AND EXHAUST FANS SCHEDULE

EQUIP	BLDG	LOCATION	DWG NO.	CFM	HP	SERVICE	DUTY	CONTROL	MONITOR
EF-R-1	FCC	ROOF	MC-20FH	1,400	0.55	PENTHOUSE EXHAUST	BUSINESS HOURS	YES	YES
EF-R-2	FCC	ROOF	MC-20FH	332	0.33	PENTHOUSE EXHAUST	BUSINESS HOURS	YES	YES
EF-R-3	FCC	ROOF	MC-20FH	332	0.33	PENTHOUSE EXHAUST	BUSINESS HOURS	YES	YES
EF-R-4	FCC	ROOF	MC-20FH	1,487	0.5	PENTHOUSE EXHAUST	BUSINESS HOURS	YES	YES
EF-R-6	FCC	ROOF	MC-20FH			9TH FLOOR TOILETS	BUSINESS HOURS	YES	YES
EF-11	FCC	ROOF	MC-20FH	5,930	3	TOILET EXHUAST	BUSINESS HOURS	YES	YES
SF-A-1	FCC	ROOF	MC-20FH	38,000	5	STAIRWELL PRESSURIZATION	FA	NO	YES
SF-A-2	FCC	ROOF	MC-20FH	5,000	3	STAIRWELL PRESSURIZATION	FA	NO	YES
SF-21	FCC	BASEMENT MECHROOM	MC-10B	985	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-22	FCC	GROUND FLOOR MECH ROOM AHU-2	MC-10G	735	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-23	FCC	GROUND FLOOR MECH ROOM AHU-3	MC-10G	580	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-24	FCC	1SF FLOOR MECH ROOM AHU-4	MC-201	500	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-25	FCC	1SF FLOOR MECH ROOM AHU-5	MC-201	820	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-26	FCC	2NC FLOOR MECH ROOM AHU-5	MC-202	1,100	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-27	FCC	2NC FLOOR MECH ROOM AHU-7	MC-202	320	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-28	FCC	3RD FLOOR MECH ROOM AHU-8	MC-203	540	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-29	FCC	3RD FLOOR MECH ROOM AHU-9	MC-203	885	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-30	FCC	4TH FLOOR MECH ROOM AHU-10	MC-204	1,615	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-31	FCC	4TH FLOOR MECH ROOM AHU-11	MC-204	1,475	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-32	FCC	5TH FLOOR MECH ROOM AHU-12	MC-205	1,155	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-33	FCC	5TH FLOOR MECH ROOM AHU-13	MC-205	555	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-34	FCC	6TH FLOOR MECH ROOM AHU-14	MC-205	815	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-35	FCC	6TH FLOOR MECH ROOM AHU-15	MC-205	750	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-36	FCC	7TH FLOOR MECH ROOM AHU-16	MC-207	2,395	3/4	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-37	FCC	7TH FLOOR MECH ROOM AHU-17	MC-207	500	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-38	FCC	8TH FLOOR MECH ROOM AHU-18	MC-208	945	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-39	FCC	8TH FLOOR MECH ROOM AHU-19	MC-208	730	1/6	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-40	FCC	9TH FLOOR MECH ROOM AHU-20	MC-209	1,365	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES
SF-41	FCC	9TH FLOOR MECH ROOM AHU-21	MC-209	1,460	1/3	OUTSIDE AIR	BUSINESS HOURS	YES	YES

EXHAUST AND SUPPLY FANS THAT ARE NOT INCLUDED IN THIS PROJECT

EQUIP	BLDG	LOCATION	DWG NO.	CFM	HP	SERVICE
EF-1-1	FCC	1ST FLOOR	MC-201	810	016	CONFERENCE, STORAGE & COPY ROOMS
EF-1-2	FCC	1ST FLOOR	MC-201	810	016	CONFERENCE, STORAGE & COPY ROOMS
EF-2-1	FCC	2nd FLOOR	MC-202	500	016	CONFERENCE, STORAGE & COPY ROOMS
EF-2-2	FCC	2nd FLOOR	MC-202	700	016	CONFERENCE, STORAGE & COPY ROOMS
EF-2-3	FCC	2nd FLOOR	MC-202	390	015	CONFERENCE, STORAGE & COPY ROOMS
EF-3-1	FCC	3rd FLOOR	MC-203	520	016	CONFERENCE, STORAGE & COPY ROOMS
EF-3-2	FCC	3rd FLOOR	MC-203	810	016	CONFERENCE, STORAGE & COPY ROOMS
EF-3-3	FCC	3rd FLOOR	MC-203	380	018	CONFERENCE, STORAGE & COPY ROOMS
EF-4-1	FCC	4th FLOOR	MC-204	400	016	CONFERENCE, STORAGE & COPY ROOMS
EF-4-2	FCC	4th FLOOR	MC-204	500	016	CONFERENCE, STORAGE & COPY ROOMS
EF-4-3	FCC	4th FLOOR	MC-204	380	018	CONFERENCE, STORAGE & COPY ROOMS
EF-4-4	FCC	4th FLOOR	MC-204	380	018	CONFERENCE, STORAGE & COPY ROOMS
EF-5-1	FCC	5th FLOOR	MC-205	380	018	CONFERENCE, STORAGE & COPY ROOMS
EF-6-1	FCC	6th FLOOR	MC-206	650	016	CONFERENCE, STORAGE & COPY ROOMS
EF-6-2	FCC	6th FLOOR	MC-206	650	016	CONFERENCE, STORAGE & COPY ROOMS
SF-B-1	FCC	BASEMENT	MC-20B	1,500	033	COMPUTER ROOM

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SCHEDULES

DRAWING NO.
MC-620

ISSUED FOR BID

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NOTES:
1. FURNISH VAV UNITS WITH ELECTRIC HEAT, THERMAL CUT-OFF SAFETY DEVICES, ELECTRIC HEATER AIRFLOW SWITCH AND DISCONNECT SWITCH.
2. CONTROLS TO BE PROVIDED BY CONTROL CONTRACTOR AND FACTORY MOUNTED & CALIBRATED BY MANUFACTURER.
3. UNIT SHALL BE PROVIDED WITH AIRFLOW STATION/PICKUP AND LINED WITH 1" ECO-SHIELD LINER.
4. AN INTERNALLY LINE ELBOW ON THE PLENUM AIR INLET SHALL BE FIELD INSTALLED FOR FPU UNITS.
5. 1ST STAGE OF HEAT FOR ELECTRIC COIL IS UP TO 4.5 KW AND 2ND STAGE MORE THAN 4.5 KW.
6. UNITS TO BE PROVIDED WITH HANGERS/BRACKETS SUPPORTS AND ISOLATION VIBRATORS.
7. FURNISH FPU WITH ECM MOTORS AND SOUND ATTENUATOR.
8. NOISE CRITERIA LEVEL SHALL NOT BE MORE THAN 35 DB FOR FAN POWERED UNIT'S AND VAV BOXES.
9. THE FINAL INSTALLED EXTERNAL STATIC PRESSURE, EXCLUDING INDUCED AIR INLET FILTER PRESSURE DROP, MAY VARY BETWEEN 0.2 AND 0.4. FINAL ADJUSTMENT SHALL BE MADE IN THE FIELD DURING TAB
10. THE CONTRACTOR SHALL PROVIDE ACCESS PANELS IN THE NON-ACCESSIBLE CEILINGS, WHERE THE VAV'S, ETC. ARE LOCATED, FOR MAINTAINING AND SERVICING THE UNITS

TITUS IS THE BASIS OF DESIGN FOR THE AIR TERMINAL UNITS. REFER TO SPECIFICATION FOR OTHER APPROVED/EQUAL MANUFACTURERS.

TYPE OF UNIT	MODEL #
FPU	DTQP
VAV	DESV

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL				PARALLEL FAN			
									ELECTRIC DATA				ELECTRIC DATA		
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE	KW	VOLTS	PHASE	HZ	FAN CFM	VOLTS	PHASE	HZ
P-B-1	FPT	AHU-1	FCC	BASEMENT	820	120	10	4.67	480	3	60	492	277	1	60
P-B-2	FPT	AHU-1	FCC	BASEMENT	1140	170	12	6.49	480	3	60	684	277	1	60
P-B-3	FPT	AHU-1	FCC	BASEMENT	400	60	8	2.28	277	1	60	240	277	1	60
P-B-4	FPT	AHU-1	FCC	BASEMENT	610	90	10	3.47	277	1	60	366	277	1	60
P-B-5	FPT	AHU-1	FCC	BASEMENT	1010	150	12	5.75	480	3	60	606	277	1	60
P-B-6	FPT	AHU-1	FCC	BASEMENT	500	80	8	2.85	277	1	60	300	277	1	60
P-B-7	FPT	AHU-1	FCC	BASEMENT	920	140	10	5.24	480	3	60	552	277	1	60
P-B-8	FPT	AHU-1	FCC	BASEMENT	520	80	8	2.96	277	1	60	312	277	1	60
P-B-9	FPT	AHU-1	FCC	BASEMENT	1250	190	12	7.12	480	3	60	750	277	1	60
P-G-1	FPT	AHU-2	FCC	GROUND FLOOR	1300	200	12	7.40	480	3	60	780	277	1	60
P-G-2	FPT	AHU-2	FCC	GROUND FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-G-3	FPT	AHU-2	FCC	GROUND FLOOR	1800	270	14	10.25	480	3	60	1080	277	1	60
P-G-4	FPT	AHU-2	FCC	GROUND FLOOR	1250	190	12	7.12	480	3	60	750	277	1	60
P-G-5	FPT	AHU-2	FCC	GROUND FLOOR	630	90	10	3.59	277	1	60	378	277	1	60
P-G-6	FPT	AHU-2	FCC	GROUND FLOOR	900	140	10	5.13	480	3	60	540	277	1	60
P-G-7	FPT	AHU-3	FCC	GROUND FLOOR	1400	210	12	7.97	480	3	60	840	277	1	60
P-G-8	FPT	AHU-3	FCC	GROUND FLOOR	1040	160	12	5.92	480	3	60	624	277	1	60
P-G-9	FPT	AHU-3	FCC	GROUND FLOOR	645	100	10	3.67	277	1	60	387	277	1	60
P-G-10	FPT	AHU-3	FCC	GROUND FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-G-11	FPT	AHU-3	FCC	GROUND FLOOR	660	100	10	3.76	277	1	60	396	277	1	60
P-G-12	FPT	AHU-3	FCC	GROUND FLOOR	660	100	10	3.76	277	1	60	396	277	1	60
P-G-13	FPT	AHU-3	FCC	GROUND FLOOR	1490	220	12	8.49	480	3	60	894	277	1	60
P-G-14	FPT	AHU-3	FCC	GROUND FLOOR	370	60	8	2.11	277	1	60	222	277	1	60
P-1-1	FPT	AHU-4	FCC	1st FLOOR	1600	240	14	9.11	480	3	60	960	277	1	60
P-1-2	FPT	AHU-4	FCC	1st FLOOR	800	120	12	4.56	480	3	60	480	277	1	60
P-1-3	FPT	AHU-4	FCC	1st FLOOR	1017	150	12	5.79	480	3	60	610.2	277	1	60
P-1-4	FPT	AHU-4	FCC	1st FLOOR	1245	190	12	7.09	480	3	60	747	277	1	60
P-1-5	FPT	AHU-4	FCC	1st FLOOR	1300	200	12	7.40	480	3	60	780	277	1	60
P-1-6	FPT	AHU-4	FCC	1st FLOOR	970	150	10	5.52	480	3	60	582	277	1	60
P-1-7	FPT	AHU-4	FCC	1st FLOOR	570	90	10	3.25	277	1	60	342	277	1	60
P-1-8	FPT	AHU-4	FCC	1st FLOOR	1070	160	12	6.09	480	3	60	642	277	1	60
P-1-9	FPT	AHU-5	FCC	1st FLOOR	1070	160	12	6.09	480	3	60	642	277	1	60
P-1-10	FPT	AHU-5	FCC	1st FLOOR	750	110	10	4.27	480	3	60	450	277	1	60
P-1-11	FPT	AHU-5	FCC	1st FLOOR	680	100	10	3.87	277	1	60	408	277	1	60
P-1-12	FPT	AHU-5	FCC	1st FLOOR	1020	150	12	5.81	480	3	60	612	277	1	60
P-1-13	FPT	AHU-5	FCC	1st FLOOR	1500	230	12	8.54	480	3	60	900	277	1	60
P-1-14	FPT	AHU-5	FCC	1st FLOOR	900	140	10	5.13	480	3	60	540	277	1	60
P-1-15	FPT	AHU-5	FCC	1st FLOOR	830	120	10	4.73	480	3	60	498	277	1	60
P-1-16	FPT	AHU-5	FCC	1st FLOOR	740	110	10	4.21	480	3	60	444	277	1	60
P-1-17	FPT	AHU-5	FCC	1st FLOOR	1000	150	12	5.70	480	3	60	600	277	1	60
P-1-18	FPT	AHU-5	FCC	1st FLOOR	360	50	8	2.05	277	1	60	216	277	1	60
P-1-19	FPT	AHU-4	FCC	1st FLOOR	800	120	12	4.56	480	3	60	480	277	1	60
P-2-1	FPT	AHU-6	FCC	2nd FLOOR	920	140	10	5.24	480	3	60	552	277	1	60
P-2-2	FPT	AHU-6	FCC	2nd FLOOR	1440	220	12	8.20	480	3	60	864	277	1	60
P-2-3	FPT	AHU-6	FCC	2nd FLOOR	600	90	10	3.42	277	1	60	360	277	1	60
P-2-4	FPT	AHU-6	FCC	2nd FLOOR	515	80	8	2.93	277	1	60	309	277	1	60
P-2-5	FPT	AHU-6	FCC	2nd FLOOR	876	130	10	4.99	480	3	60	525.6	277	1	60
P-2-6	FPT	AHU-6	FCC	2nd FLOOR	560	80	8	3.19	277	1	60	336	277	1	60
P-2-7	FPT	AHU-7	FCC	2nd FLOOR	730	110	10	4.16	480	3	60	438	277	1	60
P-2-8	FPT	AHU-7	FCC	2nd FLOOR	810	120	10	4.61	480	3	60	486	277	1	60
P-2-9	FPT	AHU-7	FCC	2nd FLOOR	630	90	10	3.59	277	1	60	378	277	1	60
P-2-10	FPT	AHU-7	FCC	2nd FLOOR	880	130	10	5.01	480	3	60	528	277	1	60
P-2-11	FPT	AHU-7	FCC	2nd FLOOR	1310	200	12	7.46	480	3	60	786	277	1	60
P-2-12	FPT	AHU-7	FCC	2nd FLOOR	880	130	10	5.01	480	3	60	528	277	1	60
P-2-13	FPT	AHU-7	FCC	2nd FLOOR	650	100	10	3.70	277	1	60	390	277	1	60
P-3-1	FPT	AHU-8	FCC	3rd FLOOR	1300	200	12	7.40	480	3	60	780	277	1	60
P-3-2	FPT	AHU-8	FCC	3rd FLOOR	1780	270	14	10.14	480	3	60	1068	277	1	60
P-3-3	FPT	AHU-8	FCC	3rd FLOOR	300	50	8	1.71	277	1	60	180	277	1	60
P-3-4	FPT	AHU-8	FCC	3rd FLOOR	1142	170	12	6.50	480	3	60	685.2	277	1	60
P-3-5	FPT	AHU-8	FCC	3rd FLOOR	1175	180	12	6.69	480	3	60	705	277	1	60
P-3-6	FPT	AHU-8	FCC	3rd FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-3-7	FPT	AHU-8	FCC	3rd FLOOR	1500	230	14	8.54	480	3	60	900	277	1	60
P-3-8	FPT	AHU-9	FCC	3rd FLOOR	530	80	8	3.02	277	1	60	318	277	1	60
P-3-9	FPT	AHU-9	FCC	3rd FLOOR	730	110	10	4.16	480	3	60	438	277	1	60
P-3-10	FPT	AHU-9	FCC	3rd FLOOR	440	70	8	2.51	277	1	60	264	277	1	60
P-3-11	FPT	AHU-9	FCC	3rd FLOOR	1600	240	14	9.11	480	3	60	960	277	1	60
P-3-12	FPT	AHU-9	FCC	3rd FLOOR	1000	150	10	5.70	480	3	60	600	277	1	60
P-3-13	FPT	AHU-9	FCC	3rd FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-3-14	FPT	AHU-9	FCC	3rd FLOOR	829	120	10	4.72	480	3	60	497.4	277	1	60
P-4-1	FPT	AHU-10	FCC	4th FLOOR	1150	170	12	6.55	480	3	60	690	277	1	60
P-4-2	FPT	AHU-10	FCC	4th FLOOR	1600	240	14	9.11	480	3	60	960	277	1	60
P-4-3	FPT	AHU-10	FCC	4th FLOOR	1040	160	12	5.92	480	3	60	624	277	1	60
P-4-4	FPT	AHU-10	FCC	4th FLOOR	620	90	10	3.53	277	1	60	372	277	1	60
P-4-5	FPT	AHU-10	FCC	4th FLOOR	640	100	10	3.65	277	1	60	384	277	1	60
P-4-6	FPT	AHU-10	FCC	4th FLOOR	780	120	10	4.44	480	3	60	468	277	1	60
P-4-7	FPT	AHU-11	FCC	4th FLOOR	560	80	8	3.19	277	1	60	336	277	1	60
P-4-8	FPT	AHU-11	FCC	4th FLOOR	780	120	10	4.44	480	3	60	468	277	1	60
P-4-9	FPT	AHU-11	FCC	4th FLOOR	680	100	10	3.87	277	1	60	408	277	1	60
P-4-10	FPT	AHU-11	FCC	4th FLOOR	535	80	8	3.05	277	1	60	321	277	1	60
P-4-11	FPT	AHU-11	FCC	4th FLOOR	1200	180	10	6.84	480	3	60	720	277	1	60
P-4-12	FPT	AHU-11	FCC	4th FLOOR	900	140	10	5.13	480	3	60	540	277	1	60
P-4-13	FPT	AHU-11	FCC	4th FLOOR	550	80	8	3.13	277	1	60	330	277	1	60
P-4-14	FPT	AHU-11	FCC	4th FLOOR	1140	170	12	6.49	480	3	60	684	277	1	60
P-5-1	FPT	AHU-12	FCC	5th FLOOR	450	70	8	2.56	277	1	60	270	277	1	60
P-5-2	FPT	AHU-12	FCC	5th FLOOR	980	150	10	5.58	480	3	60	588	277	1	60
P-5-3	FPT	AHU-12	FCC	5th FLOOR	730	110	10	4.16	480	3	60	438	277	1	60
P-5-4	FPT	AHU-12	FCC	5th FLOOR	1780	270	14	10.14	480	3	60	1068	277	1	60
P-5-5	FPT	AHU-12	FCC	5th FLOOR	1240	190	12	7.06	480	3	60	744	277	1	60
P-5-6	FPT	AHU-12	FCC	5th FLOOR	640	100	10	3.65	277	1	60	384	277	1	60
P-5-7	FPT	AHU-12	FCC	5th FLOOR	980	150	10	5.58	480	3	60	588	277	1	60
P-5-8	FPT	AHU-12	FCC	5th FLOOR	1080	160	12	6.15	480	3	60	648	277	1	60
P-5-9	FPT	AHU-13	FCC	5th FLOOR	1140	170	12	6.49	480	3	60	684	277	1	60
P-5-10	FPT	AHU-13	FCC	5th FLOOR	590	90	10	3.36	277	1	60	354	277	1	60
P-5-11	FPT	AHU-13	FCC	5th FLOOR	400	60	8	2.28	277	1	60	240	277	1	60
P-5-12	FPT	AHU-13	FCC	5th FLOOR	1080	160	12	6.15	480	3	60	648	277	1	60
P-5-13	FPT	AHU-13	FCC	5th FLOOR	1040	160	12	5.92	480	3	60	624	277	1	60
P-5-14	FPT	AHU-13	FCC	5th FLOOR	500	80	8	2.85	277	1	60	300	277	1	60
P-5-15	FPT	AHU-13	FCC	5th FLOOR	1050	160	12	5.98	480	3	60	630	277	1	60

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL				PARALLEL FAN			
									ELECTRIC DATA				ELECTRIC DATA		
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE	KW	VOLTS	PHASE	HZ	FAN CFM	VOLTS	PHASE	HZ
P-6-1	FPT	AHU-14	FCC	6th FLOOR	500	80	8	2.85	277	1	60	300	277	1	60
P-6-2	FPT	AHU-14	FCC	6th FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-6-3	FPT	AHU-14	FCC	6th FLOOR	500	80	8	2.85	277	1	60	300	277	1	60
P-6-4	FPT	AHU-14	FCC	6th FLOOR	580	90	10	3.30	277	1	60	348	277	1	60
P-6-5	FPT	AHU-14	FCC	6th FLOOR	620	90	10	3.53	277	1	60	372	277	1	60
P-6-6	FPT	AHU-14	FCC	6th FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-6-7	FPT	AHU-14	FCC	6th FLOOR	1290	190	12	7.35	480	3	60	774	277	1	60
P-6-8	FPT	AHU-15	FCC	6th FLOOR	720	110	10	4.10	480	3	60	432	277	1	60
P-6-9	FPT	AHU-15	FCC	6th FLOOR	900	140	10	5.13	480	3	60	540	277	1	60
P-6-10	FPT	AHU-15	FCC	6th FLOOR	520	80	8	2.96	277	1	60	312	277	1	60
P-6-11	FPT	AHU-15	FCC	6th FLOOR	500	80	8	2.85	277	1	60	300	277	1	60
P-6-12	FPT	AHU-15	FCC	6th FLOOR	600	90	10	3.42	277	1	60	360	277	1	60
P-6-13	FPT	AHU-15	FCC	6th FLOOR	650	100	10	3.70	277	1	60	390	277	1	60
P-6-14	FPT	AHU-15	FCC	6th FLOOR	555	80	8	3.16	277	1	60	333	277	1	60
P-7-1	FPT	AHU-16	FCC	7th FLOOR	1600	240	14	9.11	480	3	60	960	277	1	60
P-7-2	FPT	AHU-16	FCC	7th FLOOR	700	110	10	3.99	277	1	60	420	277	1	60
P-7-3	FPT	AHU-16	FCC	7th FLOOR	350	50	8	1.99	277	1	60	210	277	1	60
P-7-4	FPT	AHU-16	FCC	7th FLOOR	550	80	8	3.13	277	1	60	330	277	1	60
P-7-5	FPT	AHU-16	FCC	7th FLOOR	895	130	10	5.10	480	3	60	537	277	1	60
P-7-6	FPT	AHU-16	FCC	7th FLOOR	440	70	8	2.51	277	1	60	264	277	1	60
P-7-7	FPT	AHU-16	FCC	7th FLOOR	1320	200	12	7.52	480	3	60	792	277	1	60
P-7-8	FPT	AHU-17	FCC	7th FLOOR	630	90	10	3.59	277	1	60	378	277	1	60
P-7-9	FPT	AHU-17	FCC	7th FLOOR	500	80	8	2.85	277	1	60	300	277	1	60
P-7-10	FPT	AHU-17	FCC	7th FLOOR	470	70	8	2.68	277	1	60	282	277	1	60
P-7-11	FPT	AHU-17	FCC	7th FLOOR	520	80	8	2.96	277	1	60	312	277	1	60
P-7-12	FPT	AHU-17	FCC	7th FLOOR	520	80	8	2.96	277	1	60	312	277	1	60
P-7-13	FPT	AHU-17	FCC	7th FLOOR	1200	180	12	6.84	480	3	60	720	277	1	60
P-7-14	FPT	AHU-17	FCC	7th FLOOR	300	50	8	1.71	277	1	60	180	277	1	60
P-8-1	FPT	AHU-18	FCC	8th FLOOR	1000	150	10	5.70	480	3	60	600	277	1	60
P-8-2	FPT	AHU-18	FCC	8th FLOOR	1000	150	10	5.70	480	3	60	600	277	1	60
P-8-3	FPT	AHU-18	FCC	8th FLOOR	580	90	10	3.30	277	1	60	348	277	1	60
P-8-4	FPT	AHU-18	FCC	8th FLOOR	730	110	10	4.16	480	3	60	438	277	1	60
P-8-5	FPT	AHU-18	FCC	8th FLOOR	600	90	10	3.42	277	1	60	360	277	1	60
P-8-6	FPT	AHU-18	FCC	8th FLOOR	700	110	10	3.99	277	1	60	420	277	1	60
P-8-7	FPT	AHU-19	FCC	8th FLOOR	645	100	10	3.67	277	1	60	387	277	1	60
P-8-8	FPT	AHU-19	FCC	8th FLOOR	640	100	10	3.65	277	1	60	384	277	1	60
P-8-9	FPT	AHU-19	FCC	8th FLOOR	300	50	8	1.71	277	1	60	180	277	1	60
P-8-10	FPT	AHU-19	FCC	8th FLOOR	700	110	10	3.99	277	1	60	420	277	1	60
P-8-11	FPT	AHU-19	FCC	8th FLOOR	1050	160	12	5.98	480	3	60	630	277	1	60
P-9-1	FPT	AHU-20	FCC	9th FLOOR	730	110	10	4.16	480	3	60	438	277	1	60
P-9-2	FPT	AHU-20	FCC	9th FLOOR	1580	240	14	9.00	480	3	60	948	277	1	60
P-9-3	FPT	AHU-20	FCC	9th FLOOR	515	80	8	2.93	277	1	60	309	277	1	60
P-9-4	FPT	AHU-20	FCC	9th FLOOR	660	100	10	3.76	277	1	60	396	277	1	60
P-9-5	FPT	AHU-20	FCC	9th FLOOR	1280	190	12	7.29	480	3	60	768	277	1	60
P-9-6	FPT	AHU-20	FCC	9th FLOOR	140	20	6	0.80	277	1	60	84	277	1	60
P-9-7	FPT	AHU-20	FCC	9th FLOOR	800	120	10	4.56	480	3	60	480	277	1	60
P-9-8	FPT	AHU-20	FCC	9th FLOOR	700	110	10	3.99	277	1	60	420	277	1	60
P-9-9	FPT	AHU-20	FCC	9th FLOOR	500	80	8	2.85	277	1	60	300	277	1	60
P-9-10	FPT	AHU-20	FCC	9th FLOOR	700	110	10	3.99	277	1	60	420	277	1	60
P-9-11	FPT	AHU-21	FCC	9th FLOOR	970	150	10	5.52	480	3	60	582	277	1	60
P-9-12	FPT	AHU-21	FCC	9th FLOOR	700	110	10	3.99	277	1	60	420	277	1	60
P-9-13	FPT	AHU-21	FCC	9th FLOOR	600	90	10	3.42	277	1	60	360	277	1	60
P-9-14	FPT	AHU-21	FCC	9th FLOOR	1380	210	12	7.86	480	3	60	828	277	1	60
P-9-15	FPT	AHU-21	FCC	9th FLOOR	1350	200	12	7.69	480	3	60	810	277	1	60
P-9-16	FPT	AHU-21	FCC	9th FLOOR	1060	160	12	6.04	480	3	60	636	277	1	60
P-9-17	FPT	AHU-21	FCC	9th FLOOR	750	110	10	4.27	480	3	60	450	277	1	60
P-9-18	FPT	AHU-21	FCC	9th FLOOR	900	140	10	5.13	480	3	60	540	277	1	60

TERMINAL UNIT			LOCATION		AIR VALVE		
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE
V-G-1	VAV	AHU-2	FCC	GROUND FLOOR	1080	160	12
V-G-2	VAV	AHU-2	FCC	GROUND FLOOR	840	130	10
V-G-3	VAV	AHU-2	FCC	GROUND FLOOR	775	120	10
V-G-4	VAV	AHU-2	FCC	GROUND FLOOR	570	90	10
V-G-5	VAV	AHU-2	FCC	GROUND FLOOR	1020	150	12
V-G-6	VAV	AHU-2	FCC	GROUND FLOOR	700	110	10
V-G-8	VAV	AHU-3	FCC	GROUND FLOOR	875	130	10
V-G-9	VAV	AHU-3	FCC	GROUND FLOOR	700	110	10
V-G-10	VAV	AHU-3	FCC	GROUND FLOOR	1050	160	12
V-G-11	VAV	AHU-3	FCC	GROUND FLOOR	1260	190	12
V-1-1	VAV	AHU-4	FCC	1st FLOOR	1225	180	12
V-1-2	VAV	AHU-4	FCC	1st FLOOR	890	130	10
V-1-3	VAV	AHU-4	FCC	1st FLOOR	940	140	10
V-1-4	VAV	AHU-5	FCC	1st FLOOR	555	80	8
V-1-5	VAV	AHU-5	FCC	1st FLOOR	385	60	8
V-1-6	VAV	AHU-5	FCC	1st FLOOR	640	100	10
V-1-7	VAV	AHU-5	FCC	1st FLOOR	1090	160	12
V-1-9	VAV	AHU-5	FCC	1st FLOOR	430	60	8
V-1-10	VAV	AHU-4	FCC	1st FLOOR	MISSING ON SCHEDULE		8
V-2-1	VAV	AHU-6	FCC	2nd FLOOR	1210	180	12
V-2-2	VAV	AHU-6	FCC	2nd FLOOR	300	50	8
V-2-3	VAV	AHU-6	FCC	2nd FLOOR	675	100	10
V-2-4	VAV	AHU-6	FCC	2nd FLOOR	580	90	10
V-2-5	VAV	AHU-6	FCC	2nd FLOOR	975	150	10
V-2-6	VAV	AHU-6	FCC	2nd FLOOR	380	60	8
V-2-7	VAV	AHU-6	FCC	2nd FLOOR	820	120	10
V-2-8	VAV	AHU-7	FCC	2nd FLOOR	480	70	8
V-2-9	VAV	AHU-7	FCC	2nd FLOOR	918	140	10
V-2-10	VAV	AHU-7	FCC	2nd FLOOR	700	110	10
V-2-11	VAV	AHU-7	FCC	2nd FLOOR	630	90	10
V-2-12	VAV	AHU-7	FCC	2nd FLOOR	1175	180	12
V-2-13	VAV	AHU-7	FCC	2nd FLOOR	1075	160	12
V-2-14	VAV	AHU-7	FCC	2nd FLOOR	630	90	10
V-3-1	VAV	AHU-8	FCC	3rd FLOOR	840	130	10
V-3-2	VAV	AHU-8	FCC	3rd FLOOR	760	110	10
V-3-3	VAV	AHU-8	FCC	3rd FLOOR	730	110	10
V-3-4	VAV	AHU-8	FCC	3rd FLOOR	1000	150	10
V-3-5	VAV	AHU-9	FCC	3rd FLOOR	700	110	10
V-3-6	VAV	AHU-9	FCC	3rd FLOOR	910	140	10
V-3-7	VAV	AHU-9	FCC	3rd FLOOR	775	120	10
V-3-8	VAV	AHU-9	FCC	3rd FLOOR	725	110	10
V-3-9	VAV	AHU-9	FCC	3rd FLOOR	1125	170	12
V-3-10	VAV	AHU-9	FCC	3rd FLOOR	1150	170	12
V-3-11	VAV	AHU-8	FCC	3rd FLOOR	585	90	10
V-4-1	VAV	AHU-10	FCC	4th FLOOR	680	100	10
V-4-2	VAV	AHU-10	FCC	4th FLOOR	500	80	8
V-4-3	VAV	AHU-10	FCC	4th FLOOR	570	90	10
V-4-4	VAV	AHU-10	FCC	4th FLOOR	1120	170	12
V-4-5	VAV	AHU-10	FCC	4th FLOOR	1080	160	12
V-4-6	VAV	AHU-10	FCC	4th FLOOR	560	80	8
V-4-7	VAV	AHU-10	FCC	4th FLOOR	1150	170	12
V-4-8	VAV	AHU-11	FCC	4th FLOOR	400	60	8
V-4-9	VAV	AHU-11	FCC	4th FLOOR	890	130	10
V-4-10	VAV	AHU-11	FCC	4th FLOOR	1080	160	12
V-4-11	VAV	AHU-11	FCC	4th FLOOR	580	90	10
V-4-12	VAV	AHU-11	FCC	4th FLOOR	625	90	10
V-4-13	VAV	AHU-11	FCC	4th FLOOR	750	110	10
V-4-14	VAV	AHU-11	FCC	4th FLOOR	415	60	8
V-4-15	VAV	AHU-11	FCC	4th FLOOR	600	90	10
V-5-1.1	VAV	AHU-12	FCC	5th FLOOR	610	90	10
V-5-1.2	VAV	AHU-12	FCC	5th FLOOR	305	50	8
V-5-2.1	VAV	AHU-12	FCC	5th FLOOR	640	100	10
V-5-2.2	VAV	AHU-12	FCC	5th FLOOR	320	50	8
V-5-3	VAV	AHU-12	FCC	5th FLOOR	890	130	10
V-5-4	VAV	AHU-12	FCC	5th FLOOR	720	110	10
V-5-5	VAV	AHU-12	FCC	5th FLOOR	560	80	8
V-5-6	VAV	AHU-12	FCC	5th FLOOR	350	50	8
V-5-7	VAV	AHU-13	FCC	5th FLOOR	865	130	10
V-5-8	VAV	AHU-13	FCC	5th FLOOR	775	120	10
V-5-9.1	VAV	AHU-13	FCC	5th FLOOR	400	60	8
V-5-9.2	VAV	AHU-13	FCC	5th FLOOR	400	60	8
V-5-10	VAV	AHU-13	FCC	5th FLOOR	510	80	8
V-5-11	VAV	AHU-13	FCC	5th FLOOR	960	140	10
V-5-12	VAV	AHU-13	FCC	5th FLOOR	600	90	10
V-5-13	VAV	AHU-13	FCC	5th FLOOR	650	100	10
V-6-1	VAV	AHU-14	FCC	6th FLOOR	575	90	10
V-6-2	VAV	AHU-14	FCC	6th FLOOR	900	140	10
V-6-3	VAV	AHU-14	FCC	6th FLOOR	370	60	8
V-6-4	VAV	AHU-14	FCC	6th FLOOR	540	80	8
V-6-5	VAV	AHU-14	FCC	6th FLOOR	280	40	6
V-6-6	VAV	AHU-14	FCC	6th FLOOR	280	40	6
V-6-7	VAV	AHU-14	FCC	6th FLOOR	220	30	6
V-6-8	VAV	AHU-15	FCC	6th FLOOR	670	100	10
V-6-9	VAV	AHU-15	FCC	6th FLOOR	750	110	10
V-6-10	VAV	AHU-15	FCC	6th FLOOR	660	100	10
V-6-11	VAV	AHU-15	FCC	6th FLOOR	300	50	8
V-6-12	VAV	AHU-15	FCC	6th FLOOR	280	40	6
V-6-13	VAV	AHU-15	FCC	6th FLOOR	510	80	8
V-6-14	VAV	AHU-15	FCC	6th FLOOR	600	90	10
V-7-1	VAV	AHU-16	FCC	7th FLOOR	220	30	6
V-7-2	VAV	AHU-16	FCC	7th FLOOR	670	100	10
V-7-3	VAV	AHU-16	FCC	7th FLOOR	620	90	10
V-7-4	VAV	AHU-16	FCC	7th FLOOR	550	80	8
V-7-5	VAV	AHU-16	FCC	7th FLOOR	930	140	10
V-7-6	VAV	AHU-17	FCC	7th FLOOR	880	130	10
V-7-7	VAV	AHU-17	FCC	7th FLOOR	250	40	6
V-7-8	VAV	AHU-17	FCC	7th FLOOR	510	80	8
V-7-9	VAV	AHU-17	FCC	7th FLOOR	650	100	10
V-7-10	VAV	AHU-17	FCC	7th FLOOR	875	130	10
V-7-11	VAV	AHU-17	FCC	7th FLOOR	600	90	10
V-7-12	VAV	AHU-17	FCC	7th FLOOR	300	50	8
V-7-13	VAV	AHU-17	FCC	7th FLOOR	680	100	10
V-8-1	VAV	AHU-18	FCC	8th FLOOR	700	110	10
V-8-2	VAV	AHU-18	FCC	8th FLOOR	200	30	6
V-8-3	VAV	AHU-18	FCC	8th FLOOR	625	90	10
V-8-4	VAV	AHU-18	FCC	8th FLOOR	710	110	10
V-8-5	VAV	AHU-18	FCC	8th FLOOR	350	50	8
V-8-6	VAV	AHU-19	FCC	8th FLOOR	980	150	10
V-8-7	VAV	AHU-19	FCC	8th FLOOR	625	90	10
V-8-8	VAV	AHU-19	FCC	8th FLOOR	350	50	8
V-8-9	VAV	AHU-19	FCC	8th FLOOR	280	40	6
V-8-10	VAV	AHU-19	FCC	8th FLOOR	280	40	6
V-8-11	VAV	AHU-19	FCC	8th FLOOR	600	90	10
V-8-12	VAV	AHU-19	FCC	8th FLOOR	500	80	8
V-8-13	VAV	AHU-18	FCC	8th FLOOR	600	90	10

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED		
NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019
DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SCHEDULES
DRAWING NO.
MC-621
ISSUED FOR BID

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

EQUIP	BLDG	LOCATION	FLOOR	DWG NO.	SUPPLY FAN				RETURN FAN			OA CFM	% OA CFM	GPM
					TYPE	FAN No.	TOTAL SA CFM	HP/FAN	FAN No.	TOTAL RA	HP/FAN			
AHU-1	JCB	BASEMENT MECH	BASEMENT	MC-30B	VAV	2	90,000	75	2	70800	40	19,200	21%	860

ELECTRIC DUCT HEATER

SYMBOL	CFM	DUTY	KW	VOLTS	PHASE	STAGES
DH-B.1	19200	OA ASSOCIATED WITH AHU-1	400	480	3	8

SPLIT SYSTEM AIR CONDITIONING UNITS

MARK	TOTAL CFM	OA	COOLING				AREA SERVED	ELECTRIC DATA
			CAPACITY	D.B °F	W.B °F	OA D.B °F		
ACU-1	2200	-	65600	80	67	95	ELEV. METER ROOM	208V, 1Ø

AHU#	Air Handling Unit Location				VAV TERMINAL UNITS	VAV/CV Area Served		
	BLDG	LOCATION	FLOOR	DWG NO.		BLDG	FLOOR	DWG NO.
AHU-1	JCB	BASEMENT MECH	BASEMENT	MC-30B	P-B.1 TO P-B.13	JCB	BASEMENT	MC-30B
AHU-1	JCB	BASEMENT MECH	BASEMENT	MC-30B	P-G.1 TO P-G.30, P-G.31.1, P-G.31.2, P-G.32 TO P-G.35, P-G.36.1, P-G.36.2, P-G.37.1, P-G.37.2, P-G.38, P-G.39	JCB	GROUND	MC-30G
AHU-1	JCB	BASEMENT MECH	BASEMENT	MC-30B	P-1.1 to P-1.30	JCB	1ST	MC-301
AHU-1	JCB	BASEMENT MECH	BASEMENT	MC-30B	P-2.1 TO P-2.41 (NOT USED P-2.5, P-2.17, P-2-24)	JCB	2ND	MC-302
AHU-1	JCB	BASEMENT MECH	BASEMENT	MC-30B	P-3.1 TO P-3.32	JCB	3RD	MC-303

NOTES:

1. FURNISH VAV UNITS WITH ELECTRIC HEAT, THERMAL CUT-OFF SAFETY DEVICES, ELECTRIC HEATER AIRFLOW SWITCH AND DISCONNECT SWITCH.
2. CONTROLS TO BE PROVIDED BY CONTROL CONTRACTOR AND FACTORY MOUNTED & CALIBRATED BY MANUFACTURER.
3. UNIT SHALL BE PROVIDED WITH AIRFLOW STATION/PICKUP AND LINED WITH 1" FOIL FACED INSULATION.
4. AN INTERNALLY LINE ELBOW ON THE PLENUM AIR INLET SHALL BE FIELD INSTALLED FOR FPU UNITS.
5. 1ST STAGE OF HEAT FOR ELECTRIC COIL IS UP TO 4.5 KW AND 2ND STAGE MORE THAN 4.5 KW.
6. UNITS TO BE PROVIDED WITH HANGERS/BRACKETS SUPPORTS AND ISOLATION VIBRATORS.
7. FURNISH FPU WITH ECM MOTORS AND SOUND ATTENUATOR.
8. NOISE CRITERIA LEVEL SHALL NOT BE MORE THAN 35 DB FOR FAN POWERED UNITS AND VAV BOXES.
9. THE FINAL INSTALLED EXTERNAL STATIC PRESSURE, EXCLUDING INDUCED AIR INLET FILTER PRESSURE DROP, MAY VARY BETWEEN 0.2 AND 0.4. FINAL ADJUSTMENT SHALL BE MADE IN THE FIELD DURING TAB

TITUS IS THE BASIS OF DESIGN FOR THE AIR TERMINAL UNITS. REFER TO SPECIFICATION FOR OTHER APPROVED/EQUAL MANUFACTURERS.

TYPE OF UNIT	MODEL #
FPU	DTQP

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL				PARALLEL FAN					
									ELECTRIC DATA					ELECTRIC DATA			
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE (Ø)	KW	VOLTS	PHASE	HZ	FAN CFM	ESP "WC	HP	VOLTS	PHASE	HZ
P-B.1	FPT	AHU-1	JCB	BASEMENT	750	110	10	1	277	1	60	450	NOTE 1	1/4	277	1	60
P-B.2	FPT	AHU-1	JCB	BASEMENT	600	90	10	1	277	1	60	360	NOTE 1	1/4	277	1	60
P-B.3	FPT	AHU-1	JCB	BASEMENT	650	100	10	1	277	1	60	390	NOTE 1	1/4	277	1	60
P-B.4	FPT	AHU-1	JCB	BASEMENT	1400	210	12	2.25	277	1	60	840	NOTE 1	1/3	277	1	60
P-B.5	FPT	AHU-1	JCB	BASEMENT	660	100	10	2.36	277	1	60	396	NOTE 1	1/4	277	1	60
P-B.6	FPT	AHU-1	JCB	BASEMENT	1200	180	12	-			60	720	NOTE 1	1/3	277	1	60
P-B.7	FPT	AHU-1	JCB	BASEMENT	1150	170	12	1.79	277	1	60	690	NOTE 1	1/3	277	1	60
P-B.8	FPT	AHU-1	JCB	BASEMENT	590	90	10	0.81	277	1	60	354	NOTE 1	1/4	277	1	60
P-B.9	FPT	AHU-1	JCB	BASEMENT	650	100	10	0.92	277	1	60	390	NOTE 1	1/4	277	1	60
P-B.10	FPT	AHU-1	JCB	BASEMENT	350	50	8	1.14	277	1	60	210	NOTE 1	1/10	277	1	60
P-B.11	FPT	AHU-1	JCB	BASEMENT	400	60	8	0.8	277	1	60	240	NOTE 1	1/10	277	1	60
P-B.12	FPT	AHU-1	JCB	BASEMENT	500	80	8	1.22	277	1	60	300	NOTE 1	1/10	277	1	60
P-B.13	FPT	AHU-1	JCB	BASEMENT	450	70	8	1.68	277	1	60	270	NOTE 1	1/10	277	1	60
P-G.1	FPT	AHU-1	JCB	GROUND	350	50	8	3.8	277	1	60	210	NOTE 1	1/10	277	1	60
P-G.2	FPT	AHU-1	JCB	GROUND	950	140	10	6.8	480	3	60	570	NOTE 1	1/3	277	1	60
P-G.3	FPT	AHU-1	JCB	GROUND	400	60	8	1.4	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.4	FPT	AHU-1	JCB	GROUND	820	120	10	4.94	480	3	60	492	NOTE 1	1/4	277	1	60
P-G.5	FPT	AHU-1	JCB	GROUND	880	130	10	5.7	480	3	60	528	NOTE 1	1/3	277	1	60
P-G.6	FPT	AHU-1	JCB	GROUND	400	60	8	3.13	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.7	FPT	AHU-1	JCB	GROUND	700	110	10	3.67	277	1	60	420	NOTE 1	1/4	277	1	60
P-G.8	FPT	AHU-1	JCB	GROUND	420	60	8	2.06	277	1	60	252	NOTE 1	1/10	277	1	60
P-G.9	FPT	AHU-1	JCB	GROUND	400	60	8	1.45	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.10	FPT	AHU-1	JCB	GROUND	400	60	8	1.45	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.11	FPT	AHU-1	JCB	GROUND	400	60	8	2.75	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.12	FPT	AHU-1	JCB	GROUND	400	60	8	2.4	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.13	FPT	AHU-1	JCB	GROUND	210	30	6	1.52	277	1	60	126	NOTE 1	1/10	277	1	60
P-G.14	FPT	AHU-1	JCB	GROUND	540	80	8	4.5	480	3	60	324	NOTE 1	1/10	277	1	60
P-G.15	FPT	AHU-1	JCB	GROUND	600	90	10	3.8	277	1	60	360	NOTE 1	1/4	277	1	60
P-G.16	FPT	AHU-1	JCB	GROUND	600	90	10	3	277	1	60	360	NOTE 1	1/4	277	1	60
P-G.17	FPT	AHU-1	JCB	GROUND	650	100	10	4.21	480	3	60	390	NOTE 1	1/4	277	1	60
P-G.18	FPT	AHU-1	JCB	GROUND	800	120	10	4.75	480	3	60	480	NOTE 1	1/4	277	1	60
P-G.19	FPT	AHU-1	JCB	GROUND	800	120	10	4.75	480	3	60	480	NOTE 1	1/4	277	1	60
P-G.20	FPT	AHU-1	JCB	GROUND	350	50	8	3.33	277	1	60	210	NOTE 1	1/10	277	1	60
P-G.21	FPT	AHU-1	JCB	GROUND	750	110	10	6.56	480	3	60	450	NOTE 1	1/4	277	1	60
P-G.22	FPT	AHU-1	JCB	GROUND	250	40	6	2.58	277	1	60	150	NOTE 1	1/10	277	1	60
P-G.23	FPT	AHU-1	JCB	GROUND	950	140	10	8.1	480	3	60	570	NOTE 1	1/3	277	1	60
P-G.24	FPT	AHU-1	JCB	GROUND	1010	150	12	6.25	480	3	60	606	NOTE 1	1/3	277	1	60
P-G.25	FPT	AHU-1	JCB	GROUND	600	90	10	0.6	277	1	60	360	NOTE 1	1/4	277	1	60
P-G.26	FPT	AHU-1	JCB	GROUND	740	110	10	0.75	277	1	60	444	NOTE 1	1/4	277	1	60
P-G.27	FPT	AHU-1	JCB	GROUND	500	80	8	0.5	277	1	60	300	NOTE 1	1/10	277	1	60
P-G.28	FPT	AHU-1	JCB	GROUND	400	60	8	0.75	277	1	60	240	NOTE 1	1/10	277	1	60
P-G.29	FPT	AHU-1	JCB	GROUND	200	30	6		277	1	60	120	NOTE 1	1/10	277	1	60
P-G.30	FPT	AHU-1	JCB	GROUND	200	30	6		277	1	60	120	NOTE 1	1/10	277	1	60
P-G.31.1	FPT	AHU-1	JCB	GROUND	1250	190	12	1.2	277	1	60	750	NOTE 1	1/3	277	1	60
P-G.31.2	FPT	AHU-1	JCB	GROUND	570	90	10	0.6	277	1	60	342	NOTE 1		277	1	60
P-G.32	FPT	AHU-1	JCB	GROUND	470	70	8	0.5	277	1	60	282	NOTE 1	1/10	277	1	60
P-G.33	FPT	AHU-1	JCB	GROUND	600	90	10	1.25	277	1	60	360	NOTE 1	1/4	277	1	60
P-G.34	FPT	AHU-1	JCB	GROUND	600	90	10	1.25	277	1	60	360	NOTE 1	1/4	277	1	60
P-G.35	FPT	AHU-1	JCB	GROUND	300	50	8	-			60	180	NOTE 1	1/10	277	1	60
P-G.36.1	FPT	AHU-1	JCB	GROUND	1100	170	12	3.04	277	1	60	660	NOTE 1	1/3	277	1	60
P-G.36.2	FPT	AHU-1	JCB	GROUND	1100	170	12	3.04	277	1	60	660	NOTE 1	1/3	277	1	60
P-G.37.1	FPT	AHU-1	JCB	GROUND	1100	170	12	5.4	480	3	60	660	NOTE 1	1/3	277	1	60
P-G.37.2	FPT	AHU-1	JCB	GROUND	1100	170	12	5.4	480	3	60	660	NOTE 1	1/3	277	1	60
P-G.38	FPT	AHU-1	JCB	GROUND	650	100	10	2	277	1	60	390	NOTE 1	1/4	277	1	60
P-G.39	FPT	AHU-1	JCB	GROUND	650	100	10	2	277	1	60	390	NOTE 1	1/4	277	1	60
P-1.1	FPT	AHU-1	JCB	1ST	300	50	8	2.4	277	1	60	180	NOTE 1	1/10	277	1	60
P-1.2	FPT	AHU-1	JCB	1ST	600	90	10	1.8	277	1	60	360	NOTE 1	1/4	277	1	60
P-1.3	FPT	AHU-1	JCB	1ST	1170	180	10	4.58	480	3	60	702	NOTE 1	1/3	277	1	60
P-1.4	FPT	AHU-1	JCB	1ST	720	110	10	3.9	277	1	60	432	NOTE 1	1/4	277	1	60
P-1.5	FPT	AHU-1	JCB	1ST	250	40	6	1.7	277	1	60	150	NOTE 1	1/10	277	1	60
P-1.6	FPT	AHU-1	JCB	1ST	620	90	10	2.78	277	1	60	372	NOTE 1	1/4	277	1	60
P-1.7	FPT	AHU-1	JCB	1ST	760	110	10	3.32	277	1	60	456	NOTE 1	1/4	277	1	60
P-1.8	FPT	AHU-1	JCB	1ST	500	80	8	1.85	277	1	60	300	NOTE 1	1/10	277	1	60
P-1.9	FPT	AHU-1	JCB	1ST	600	90	10	2.2	277	1	60	360	NOTE 1	1/4	277	1	60
P-1.10	FPT	AHU-1	JCB	1ST	400	60	8	2.6	277	1	60	240	NOTE 1	1/10	277	1	60
P-1.11	FPT	AHU-1	JCB	1ST	1400	210	12	5.5	480	3	60	840	NOTE 1	1/3	277	1	60
P-1.12	FPT	AHU-1	JCB	1ST	650	100	10	4.1	480	3	60	390	NOTE 1	1/4	277	1	60
P-1.13	FPT	AHU-1	JCB	1ST	300	50	8	1.28	277	1	60	180	NOTE 1	1/10	277	1	60
P-1.14	FPT	AHU-1	JCB	1ST	320	50	8	3	277	1	60	192	NOTE 1	1/10	277	1	60
P-1.15	FPT	AHU-1	JCB	1ST	750	110	10	4.51	480	3	60	450	NOTE 1	1/4	277	1	60
P-1.16	FPT	AHU-1	JCB	1ST	750	110	10	4.51	480	3	60	450	NOTE 1	1/4	277	1	60
P-1.17	FPT	AHU-1	JCB	1ST	500	80	8	0.5	277	1	60	300	NOTE 1	1/10	277	1	60
P-1.18	FPT	AHU-1	JCB	1ST	780	120	10	2.5	277	1	60	468	NOTE 1	1/4	277	1	60
P-1.19	FPT	AHU-1	JCB	1ST	600	90	10	0.6	277	1	60	360	NOTE 1	1/10	277	1	60
P-1.20	FPT	AHU-1	JCB	1ST	400	60	8	0.33	277	1	60	240	NOTE 1	1/10	277	1	60
P-1.21	FPT	AHU-1	JCB	1ST	630	90	10	0.6	277	1	60	378	NOTE 1	1/4	277	1	60
P-1.22	FPT	AHU-1	JCB	1ST	450	70	8	0.42	277	1	60	270	NOTE 1	1/10	277	1	60
P-1.23	FPT	AHU-1	JCB	1ST	780	120	10	0.75	277	1	60	468	NOTE 1	1/4	277	1	60
P-1.24	FPT	AHU-1	JCB	1ST	915	140	10	0.75	277	1	60	549	NOTE 1	1/3	277	1	60
P-1.25	FPT	AHU-1	JCB	1ST	300	50	8	0.4	277	1	60	180	NOTE 1	1/10	277	1	60
P-1.26	FPT	AHU-1	JCB	1ST	875	130	10	0.75	277	1	60	525	NOTE 1	1/3	277	1	60
P-1.27	FPT	AHU-1	JCB	1ST	810	120	10	1.1	277	1	60	486	NOTE 1	1/4	277	1	60
P-1.28	FPT	AHU-1	JCB	1ST	620	90	10	1.25	277	1	60	372	NOTE 1	1/4	277	1	60
P-1.29	FPT	AHU-1	JCB	1ST	250	40	6	0.4	277	1	60	150	NOTE 1	1/10	277	1	60
P-1.30	FPT	AHU-1	JCB	1ST	350	50	8	0.6	277	1	60	210	NOTE 1	1/10	277	1	60

NOTE 1. THE FINAL INSTALLED EXTERNAL STATIC PRESSURE, EXCLUDING INDUCED AIR INLET FILTER PRESSURE DROP, MAY VARY BETWEEN 0.2 AND 0.4. FINAL ADJUSTMENT SHALL BE MADE IN THE FIELD DURING TAB

TERMINAL UNIT			LOCATION		AIR VALVE			ELECTRIC HEATING COIL				PARALLEL FAN					
									ELECTRIC DATA					ELECTRIC DATA			
NUMBER	TYPE	AHU	BLDG	FLOOR	MAX CFM	MIN CFM	INLET SIZE	KW	VOLTS	PHASE	HZ	FAN CFM	ESP "WC	HP	VOLTS	PHASE	HZ
P-2.1	FPT	AHU-1	JCB	2ND	400	60	8	3.03	277	1	60	240	NOTE 1	1/10	277	1	60
P-2.2	FPT	AHU-1	JCB	2ND	400	60	8	2.1	277	1	60	240	NOTE 1	1/10	277	1	60
P-2.3	FPT	AHU-1	JCB	2ND	420	60	8	2	277	1	60	252	NOTE 1	1/10	277	1	60
P-2.4	FPT	AHU-1	JCB	2ND	470	70	8	3.3	277	1	60	282	NOTE 1	1/10	277	1	60
P-2.5	FPT	AHU-1	JCB	2ND	NOT USED												
P-2.6	FPT	AHU-1	JCB	2ND	530	80	8	2.22	277	1	60	318	NOTE 1	1/4	277	1	60
P-2.7	FPT	AHU-1	JCB	2ND	690	100	10	3.5	277	1	60	414	NOTE 1	1/4	277	1	60
P-2.8	FPT	AHU-1	JCB	2ND	410	60	8	3.5	277	1	60	246	NOTE 1	1/10	277	1	60
P-2.9	FPT	AHU-1	JCB	2ND	400	60	8	3.5	277	1	60	240	NOTE 1	1/10	277	1	60
P-2.10	FPT	AHU-1	JCB	2ND	800	120	10	1.7	277	1	60	480	NOTE 1	1/4	277	1	60
P-2.11	FPT	AHU-1	JCB	2ND	480	70	8	2.04	277	1	60	288	NOTE 1	1/10	277	1	60
P-2.12	FPT	AHU-1	JCB	2ND	480	70	8	1.62	277	1	60	288	NOTE 1	1/10	277	1	60
P-2.13	FPT	AHU-1	JCB	2ND	500	80	8	2.25	277	1	60	300	NOTE 1	1/10	277	1	60
P-2.14	FPT	AHU-1	JCB	2ND	490	70	8	3.5	277	1	60	294	NOTE 1	1/10	277	1	60
P-2.15	FPT	AHU-1	JCB	2ND	1170	180	12	6.18	480	3	60	702	NOTE 1	1/3	277	1	60
P-2.16	FPT	AHU-1	JCB	2ND	500	80	8	1.16	277	1	60	300	NOTE 1	1/10	277	1	60
P-2.17	FPT	AHU-1	JCB	2ND	NOT USED												
P-2.18	FPT	AHU-1	JCB	2ND	180	30	6	0.5	277	1	60	108	NOTE 1	1/10	277	1	60
P-2.19	FPT	AHU-1	JCB	2ND	480	70	8	2.25	277	1	60	288	NOTE 1	1/10	277	1	60
P-2.20	FPT	AHU-1	JCB	2ND	800	120	10	1.1	277	1	60	480	NOTE 1	1/4	277	1	60
P-2.21	FPT	AHU-1	JCB	2ND	280	40	8	0.6	277	1	60	168	NOTE 1	1/10	277	1	60
P-2.22	FPT	AHU-1	JCB	2ND	300	50	8	0.6	277	1	60	180	NOTE 1	1/10	277	1	60
P-2.23	FPT	AHU-1	JCB	2ND	140	20	6	0.33	277	1	60	84	NOTE 1	1/10	277	1	60
P-2.24	FPT	AHU-1	JCB	2ND	NOT USED												
P-2.25	FPT	AHU-1	JCB	2ND	500	80	8	1.15	277	1	60	300	NOTE 1	1/10	277	1	60
P-2.26	FPT	AHU-1	JCB	2ND	350	50	8	0.6	277	1	60	210	NOTE 1	1/10	277	1	60
P-2.27	FPT	AHU-1	JCB	2ND	600	90	10	3.23	277	1	60	360	NOTE 1	1/4	277	1	60
P-2.28	FPT	AHU-1	JCB	2ND	600	90	10	3.23	277	1	60	360	NOTE 1	1/4	277	1	60
P-2.29	FPT	AHU-1	JCB	2ND	750	110	10	3	277	1	60	450	NOTE 1	1/4	277	1	60
P-2.30	FPT	AHU-1	JCB	2ND	750	110	10	3	277	1	60	450	NOTE 1	1/4	277	1	60
P-2.31	FPT	AHU-1	JCB	2ND	800	120	10	3.47	277	1	60	480	NOTE 1	1/4	277	1	60
P-2.32	FPT	AHU-1	JCB	2ND	800	120	10	3.47	277	1	60	480	NOTE 1	1/4	277	1	60
P-2.33	FPT	AHU-1	JCB	2ND	920	140	10	2.75	277	1	60	552	NOTE 1	1/3	277	1	60
P-2.34	FPT	AHU-1	JCB	2ND	920	140	10	2.75	277	1	60	552	NOTE 1	1/3	277	1	60
P-2.35	FPT	AHU-1	JCB	2ND	800	120	10	3.12	277	1	60	480	NOTE 1	1/4	277	1	60
P-2.36	FPT	AHU-1	JCB	2ND	800	120	10	3.12	277	1	60	480	NOTE 1	1/4	277	1	60
P-2.37	FPT	AHU-1	JCB	2ND	700	110	10	2.6	277	1	60	420	NOTE 1	1/4	277	1	60
P-2.38	FPT	AHU-1	JCB	2ND	700	110	10	2.6	277	1	60	420	NOTE 1	1/4	277	1	60
P-2.39	FPT	AHU-1	JCB	2ND	600	90	10	3.06	277	1	60	360	NOTE 1	1/4	277	1	60
P-2.40	FPT	AHU-1	JCB	2ND	600	90	10	3.06	277	1	60	360	NOTE 1	1/4	277	1	60
P-2.41	FPT	AHU-1	JCB	2ND	600	90	10	1.25	277	1	60	360	NOTE 1	1/4	277	1	60
P-3.1	FPT	AHU-1	JCB	3RD	300	50	8	2.33	277	1	60	180	NOTE 1	1/10	277	1	60
P-3.2	FPT	AHU-1	JCB	3RD	670	100	10	3.45	277	1	60	402	NOTE 1	1/4	277	1	60
P-3.3	FPT	AHU-1	JCB	3RD	900	140	10	3.91	277	1	60	540	NOTE 1	1/3	277	1	60
P-3.4	FPT	AHU-1	JCB	3RD	670	100	10	3.67	277	1	60	402	NOTE 1	1/4	277	1	60
P-3.5	FPT	AHU-1	JCB	3RD	660	100	10	3.66	277	1	60	396	NOTE 1	1/4	277	1	60
P-3.6	FPT	AHU-1	JCB	3RD	350	50	8	2.82	277	1	60	210	NOTE 1	1/10	277	1	60
P-3.7	FPT	AHU-1	JCB	3RD	1050	160	12	5.64	480	3	60	630	NOTE 1	1/3	277	1	60
P-3.8	FPT	AHU-1	JCB	3RD	1050	160	12	5.72	480	3	60	630	NOTE 1	1/3	277	1	60
P-3.9	FPT	AHU-1	JCB	3RD	350	50	8	2.45	277	1	60	210	NOTE 1	1/10	277	1	60
P-3.10	FPT	AHU-1	JCB	3RD	1200	180	12	5.98	480	3	60	720	NOTE 1	1/3	277	1	60
P-3.11	FPT	AHU-1	JCB	3RD	1310	200	12	6.11	480	3	60	786	NOTE 1	1/3	277	1	60
P-3.12	FPT	AHU-1	JCB	3RD	400	60	8	1.56	277	1	60	240	NOTE 1	1/10	277	1	60
P-3.13	FPT	AHU-1	JCB	3RD	610	90	10	4.07	480	3	60	366	NOTE 1	1/4	277	1	60
P-3.14	FPT	AHU-1	JCB	3RD	780	120	10	4.51	480	3	60	468	NOTE 1	1/4	277	1	60
P-3.15	FPT	AHU-1	JCB	3RD	500	80	8	2.7	277	1	60	300	NOTE 1	1/10	277	1	60
P-3.16	FPT	AHU-1	JCB	3RD	660	100	10	5.07	480	3	60	396	NOTE 1	1/4	277	1	60
P-3.17	FPT	AHU-1	JCB	3RD	515	80	8	1.8	277	1	60	309	NOTE 1	1/4	277	1	60
P-3.18	FPT	AHU-1	JCB	3RD	960	140	10	3.11	277	1	60	576	NOTE 1	1/3	277	1	60
P-3.19	FPT	AHU-1	JCB	3RD	1200	180	12	2.7	277	1	60	720	NOTE 1	1/3	277	1	60
P-3.20	FPT	AHU-1	JCB	3RD	400	60	8	1	277	1	60	240	NOTE 1	1/10	277	1	60
P-3.21	FPT	AHU-1	JCB	3RD	640	100	10	1.4	277	1	60	384	NOTE 1	1/4	277	1	60
P-3.22	FPT	AHU-1	JCB	3RD	1050	160	12	2.55	277	1	60	630	NOTE 1	1/3	277	1	60
P-3.23	FPT	AHU-1	JCB	3RD	590	90	10	2	277	1	60	354	NOTE 1	1/4	277	1	60
P-3.24	FPT	AHU-1	JCB	3RD	320	50	8	0.5	277	1	60	192	NOTE 1	1/10	277	1	60
P-3.25	FPT	AHU-1	JCB	3RD	460	70	8	0.72	277	1	60	276	NOTE 1	1/10	277	1	60
P-3.26	FPT	AHU-1	JCB	3RD	760	110	10	2.11	277	1	60	456	NOTE 1	1/4	277	1	60
P-3.27	FPT	AHU-1	JCB	3RD	200	30	6	0.32	277	1	60	120	NOTE 1	1/10	277	1	60
P-3.28	FPT	AHU-1	JCB	3RD	310	50	8	0.75	277	1	60	186	NOTE 1	1/10	277	1	60
P-3.29	FPT	AHU-1	JCB	3RD	390	60	8	0.81	277	1	60	234	NOTE 1	1/10	277	1	60
P-3.30	FPT	AHU-1	JCB	3RD	410	60	8	1.1	277	1	60	246	NOTE 1	1/10	277	1	60
P-3.31	FPT	AHU-1	JCB	3RD	150	20	6	0.45	277	1	60	90	NOTE 1	1/10	277	1	60
P-3.32	FPT	AHU-1	JCB	3RD	220	30	6	0.92	277	1	60	132	NOTE 1	1/10	277	1	60

NOTE 1. THE FINAL INSTALLED EXTERNAL STATIC PRESSURE, EXCLUDING INDUCED AIR INLET FILTER PRESSURE DROP, MAY VARY BETWEEN 0.2 AND 0.4. FINAL ADJUSTMENT SHALL BE MADE IN THE FIELD DURING TAB

SUPPLY AND EXHAUST FANS SCHEDULE

EQUIP	BLDG	LOCATION	DWG NO.	TYPE	CFM	HP	SERVICE	DUTY	CONTROL	MONITOR
SF-R.1	JCB (CARNES)	ROOF	MC-30R	FCC	13,000	7.5	STAIRWELL PRESSURIZATION	FA	NO	YES
SF-R.2	JCB (CARNES)	ROOF	MC-30R	FCC	13,000	7.5	STAIRWELL PRESSURIZATION	FA	NO	YES
SF-R.3	JCB (CARNES)	ROOF	MC-30R	FCC	13,000	7.5	STAIRWELL PRESSURIZATION	FA	NO	YES
EF-R.1	JCB (CARNES)	ROOF	MC-30R	FCC	10,300	10	TOILET EXHAUST	BUSINESS HOUR	YES	YES
EF-G.1	JCB (CARNES)	CONF RM JG60	MC-30G	CEILING CABINET	800	1/8	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-G.2	JCB (CARNES)	COPY RM JG84	MC-30G	CEILING CABINET	380	1/10	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-1.1	JCB (CARNES)	CONF RM J163	MC-301	CEILING CABINET	500	1/8	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-1.2	JCB (CARNES)	CONF RM J114	MC-301	CEILING CABINET	300	1/10	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-1.3	JCB (CARNES)	COPY RM J144	MC-301	CEILING CABINET	380	1/10	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-2.1	JCB (CARNES)	CONF RM J231	MC-302	CEILING CABINET	500	1/8	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-3.1	JCB (CARNES)	CONF RM J383	MC-303	CEILING CABINET	600	1/8	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-3.2	JCB (CARNES)	COPY RM J313	MC-303	CEILING CABINET	380	1/10	GENERAL EXHAUST	BUSINESS HOUR	NO	NO
EF-3.3	JCB (CARNES)	COPY RM J353	MC-303	CEILING CABINET	380	1/10	GENERAL EXHAUST	BUSINESS HOUR	NO	NO

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED		
NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
DRAWN BY MT
CHECKED BY GBH/AYG
REVIEWED BY AYG/GBH
SCALE AS INDICATED
ISSUE DATE 11/18/2019
DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - SCHEDULES
DRAWING NO.
MC-630
ISSUED FOR BID

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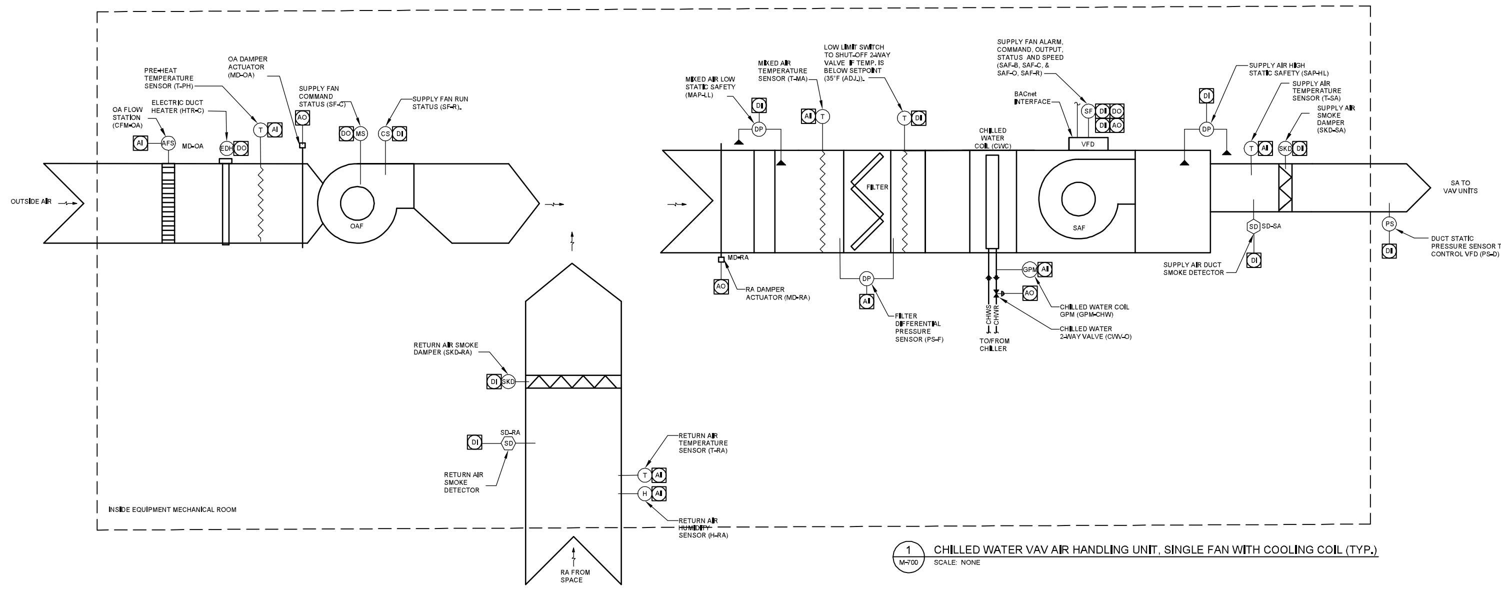

1 M-700 CHILLED WATER VAV AIR HANDLING UNIT, SINGLE FAN WITH COOLING COIL (TYP.)
SCALE: NONE

System: Variable Volume CHW AHU | AHUs-G01, G02, G03, G04, 101, 102, 103, 104, 201, 202, 203, 204, 301, 302, 303, 304, 401, 402, 403, 404

Point Description	Hardware Points AI	AC	DI	DO	Software Points Trend	Interval	Alarm	Show on Graphic	Point Notes	Part Number - Basis of Design
Supply Air Fan VFD Command (SAF-C)				•	•	COS	•	•	Control Relay output to VFD	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan VFD Bypass Status (SAF-B)			•			15 Min	•	•	Dry contact output from VFD	n/a
Supply Air Fan VFD Run Status (SAF-R)			•		•	COS	•	•	Dry contact output from VFD	n/a
Supply Air Fan VFD Speed Output (SAF-O)		•			•	15 Min		•	Analog control signal to VFD	n/a
Chilled Water 2-Way Control Valve (CWV-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator Control Signal	See Schedule
Chilled Water Coil GPM (GPM-CHW)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, or possible integration	n/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, or possible integration	n/a
Supply Air Smoke Damper (SKD-SA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Return Air Smoke Damper (SKD-RA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Differntial Pressure Sensor	VERIS PXPLX02S
Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Mixed Temp Sensor (T-MA)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDXX05S
Low Limit Mixed Air Temp Safety (T-LL)			•			COS	•	•	Manual Reset Lo-Cutout Temp Sensor	PENN A70HA-1C
Supply Air High Static Safety - (SAP-HL)			•			COS	•	•	Manual Reset Hi-Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
Mixed Air Low Static Safety - (MAP-LL)			•			COS	•	•	Manual Reset Lo-Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
Return Air Humidity Sensor (H-RA)	•				•	15 Min		•	Determine number of zones, or return air	VERIS HD2XVSX
RA Damper Actuator - (MD-RA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
OA Supply Fan Command (SF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
OA Supply Fan Run Status (SF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
OA Electric Duct Heater Stages (HTR-C)				•	•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
OA PreHeat Temp Sensor (T-PH)	•				•	15 Min		•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
OA Flow Station - (CFM-OA)	•				•	15 Min		•	Alternatively, can be a calculate value (SA-RA)	Refer to Drawing Note 6
OA Damper Actuator - (MD-OA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing

Chilled Water VAV Air Handling Unit, Single Fan with Cooling Coil and OA Fan with Electric Preheat

A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices, gauges and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the VFD/MCC.
5. All points shall be able to integrate to all trends, totalizations, etc., as applicable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop
1. The unit normally operates continuously with remotely capability for start/stop/scheduling functions.
2. Time scheduling shall include 7-day time of day programming, extended time period scheduling (holiday) and special event programming (one time override program).
3. The H.O.A. switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes. When the air handling unit is off, the outside damper shall be closed and the return damper open.
4. When the unit receives a start command, the outside air damper shall open to its minimum position, the associated outside air fan shall start, and the return damper shall open fully. The supply and return smoke dampers (where applicable) shall open and proof provided by their respective end switches. When the end switches prove open via hardwire interlock, the supply fan shall start at minimum speed.
5. Upon confirmation from the VFD that the supply fan is running, the fan shall modulate as indicated below for control and associated supply fan shall be energized.
6. If after a 60 second delay (adjustable) the fan does not provide status or the VFD provides an alarm condition, then the fan will be shut down, the outside damper will close, and the return damper will open. An alarm will be generated, and the unit will be locked out in software.

C. Airflow Control
1. Upon start-up of the supply fan, the BAS panel shall monitor the static pressure signal for the AHU system. The speed of the supply fan shall increase via hardwire connection to the respective VFD to maintain setpoint at the duct mounted static pressure sensors.
   a. The supply air fan speed shall be controlled to maintain the initial duct static pressure of 1.5 inches of water gauge minimum (adjustable).
2. The outside air dampers shall modulate to initially maintain a minimum level of fifteen percent (15%), adjustable, of the scheduled AHU air flow as indicated on AHU schedules (adjustable).
   a. In some instances, a single outside air supply fan serves more than on AHU. The OA CFM setpoint shall be adjusted to maintain that required to provide the required outside air for the AHUs served that are running.
   b. After the AHU has been running for 30 minutes, the outside air setpoint shall be adjusted to equal fifteen percent (15%), adjustable, of the supply fan CFM as determined by the sum of all VAV terminal units served by the AHU.
3. AHUs that have been designated for Demand Controlled Ventilation (DCV) shall have their minimum outside air flow setpoint reset based on measuring zone (or return air) carbon dioxide (CO2) and adjusting outside air volumes above minimum to maintain proper CO2 levels.
   a. AHUs that have a single return air CO2 sensor shall reset the outside air volume setpoint as required using a proportional integral derivative (PID) control routine to maintain the measured CO2 levels at 800 ppm or less. Vary the outside air of between the minimum value in 2.b above and the maximum scheduled OA CFM.
   b. AHUs that serve large areas such as courtrooms and jury assembly rooms shall follow the reset routine described in paragraph G.3.

D. Temperature Control
1. The discharge temperature sensor shall control the cooling valve to maintain discharge air temperature setpoint.
   a. On a rise in discharge air temperature above setpoint the cooling coil control valve will be modulated open. On a drop in discharge air temperature, the reverse sequence shall occur.
2. A duct temperature sensor in the outside air duct serving the AHUs common mixed air plenum shall control the electric duct heater to maintain outside air pre-heat temperature setpoint.
   a. Should the outside air temperature drop below setpoint, the electric pre-heat coil shall stage on to maintain outside air at 45 °F (adj.) using a PID control loop applied to the heating coil's multi-stages. On a rise in temperature above setpoint, the reverse shall occur, and heating shall be disabled.
   b. A mixed air low limit control shall override the control sequence above and stage the pre-heat coil on to maintain mixed air temperature is at 45 °F (adj.). During cold weather startup of the air handling unit the mixed air low limit override sequence shall also prevent nuisance tripping of the low limit temperature thermostats.

E. Filters
1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

F. Safety Interlocks, where applicable, see points list
1. The high discharge static pressure safety located on the discharge of the supply fan in the unit housing shall be set as scheduled for 1"w.c. above the total pressure rating of the supply fan as indicated on the AHU schedule. If the pressure setting is exceeded, the safety will trip and, via hardwire interlock to the supply fan's VFD, shutdown the fan. This safety shall operate in either hand or auto on the VFD's and shall be reset manually. If the supply fan is shut down by safety, the associated supply and exhaust fan(s) shall also be shut down.
2. The low suction static pressure safety located on the suction side of the supply fan in the unit housing shall be set as scheduled for 1"w.c. above the total pressure rating of the supply fan as indicated on the AHU schedule. If the pressure setting is exceeded, the safety will trip and, via hardwire interlock to the supply fan's VFD, shutdown the fan. This safety shall operate in either hand or auto on the VFD and shall be reset manually. If the supply fan is shut down by safety, the associated supply and exhaust fan(s) shall also be shut down.
3. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
4. Provide a low temperature thermostat (freeze stat) at the downstream section of the cooling coil which will stop the unit if the mixed air temperature falls below 38 °F (adj.) and an alarm shall be generated. The cooling coil control valve shall modulate to open.
5. System Fire/Smoke Dampers
   a. If the Fire/Smoke dampers associated with the unit are not 100% open after a 3 minute (adj.) delay after startup, an alarm will be generated.

G. Energy Conservation Measures
1. Air Handling Unit Static Pressure and Discharge Temperature Reset
   a. Static Pressure Reset shall be the primary energy conservation reset routine for air handling units.
      1) The static pressure reset routine shall permit a minimum duct static pressure of 0.5"w.c. (adj.) for all VAV AHUs during the cooling mode if all of the below mentioned criteria have been achieved. The supply VAV box damper position for all boxes serviced by this unit shall be monitored at 15 minute intervals (adj.) to determine the ability to automatically reset the supply static pressure setpoint for optimization.
         (a) The supply duct static pressure setpoint shall be reduced by 0.1"w.c. (adj.) if the damper position of the furthest open box is less than 85% (adj.).
         (b) The supply static pressure setpoint shall be increased by 0.1"w.c. (adj.) if the damper position of the furthest open box is greater equal to or greater than 90% (adj.).
      2) The reset routine alone should not cause any box to reach 100% open. If five or more boxes reach 100% open, the reset routine shall ramp the static pressure setpoint back to the starting static pressure setpoint over a 2 minute duration (adj.). An alarm shall be generated when the static pressure reaches the maximum allowable setting, and the reset routine shall be locked out in software. A manual reset shall be provided on the system graphic to allow the user to enable the routine again after the problem has been corrected.
   b. Discharge Air Temperature Reset shall be secondary to static pressure reset and shall not be enabled until the static pressure setpoint is at minimum and terminal units continue to experience overcooling, as measured by the terminal unit with the highest demand less than 50% open.
      1) The discharge air temperature reset routine shall provide a maximum discharge air temperature setpoint of 59 °F (adj.) for all VAV AHU's during the if all of the below mentioned criteria has been achieved. The calculation for change shall occur every 15 minutes (adj.). The supply VAV box damper position for all boxes serviced by this unit shall be monitored at 15 minute intervals for each AHU's DAT reset calculation. The highest unit discharge temperature which is able to satisfy all normally operating zones will be determined as follows:
         (a) The discharge air dewpoint temperature shall not exceed 55 °F (adj.).
         (b) The discharge air temperature will be increased if all normally operating zones have been satisfied for one hour, the duct static pressure reset is at minimum setpoint, and all VAV boxes are less than 75% open.
         (c) The discharge air temperature will be decreased if any normally operating zones is almost unsatisfied. A zone will be deemed almost unsatisfied if its box is more than 95% open. For zones with constant volume boxes, a zone will be deemed unsatisfied if the zone temperature is not maintained.
      2) If any VAV box cooling command reaches 100% for a 20 min duration a warning shall be generated, and the discharge temperature reset routine shall reverse until all VAV box cooling commands are less than or equal to 85% (adj.). If five or more VAV boxes reach 100% for a 20 min (adj.) duration an alarm shall be generated, and the reset routine shall reverse with the above mentioned temperature increments but with changes every 2 minutes (adj.) to the starting setpoint as scheduled and the reset routine shall be locked out in software. A manual reset shall be provided on the system graphic to allow the user to enable the routine again after the problem has been corrected.
   a. The BAS shall accumulate a list of zones that are almost unsatisfied and produce a weekly report listing these zones and the number of instances these zones were almost unsatisfied. This will allow the staff to investigate the zone and determine if airflow is choked or unsustainable loads have been placed in the zone.
2. CO2 Control for High Density Spaces
   The courtrooms and jury assembly rooms shall be supplied with combination space CO2 / Humidity / Temperature sensors at each terminal unit thermostat location. For terminal units associated with this Air Handling Unit that have a zone CO2 sensor, reset the AHU outside air setpoint upward based on high CO2 levels in the space.
   a. Reset the outside air volume setpoint using a proportional integral derivative (PID) control routine to maintain the measured CO2 levels at 800 ppm or less as measured at the zone sensor. Increase the AHU outside air setpoint from the minimum value in C.2.b above to a maximum of fifty percent (50%) of the associated terminal unit's maximum CFM.
   b. Where multiple terminal units with zone CO2 sensors are served by the same AHU, sum the additional outside air CFM requirements from each terminal unit to increase the AHU outside air setpoint.
   c. At no time should the reset routine exceed the AHU's scheduled maximum design outside air setpoint. As the CO2 level in the space decreases the reverse shall occur.
   d. If a space continues to require additional outside when the maximum design setpoint has been reached after a 30 minute delay, an alarm shall be generated.
3. Optimal Start, Morning Warmup and Cool Down
   a. Regardless if the unit is determined to run continuously, in the event that a schedule is implemented the unit shall be programmed to provide an Optimal Start/Stop routine which shall automatically ramp the building temperatures for the Optimal start and stop times to conserve energy while maintaining space temperature setpoints. Where applicable this strategy shall include but not be limited to incorporating terminal unit override for zones specifically associated to this AHU to help implement this routine.
   b. When the AHU is started prior to scheduled start time by the Optimal Start/Stop routine, the unit shall be considered to be in warm up or cool down mode. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
4. Setback Mode
   a. During Unoccupied Mode, if the average temperature of all zone sensors serving their respective AHU fall below their unoccupied heating setpoints by 2°F (adjustable), the associated AHU shall start in Setback Mode. AHU shall continue to run until the average temperature of all zone sensors is 1°F (adjustable) below the unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
5. Setup Mode
   a. During Unoccupied Mode, if the average temperature of all zone sensors serving their respective AHU rise above their unoccupied cooling setpoints by 2°F (adjustable), the associated AHU shall start in Set-up Mode. AHU shall continue to run until the average temperature of all zone sensors is 1°F (adjustable) above the unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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NO.	DESCRIPTION	DATE

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MECHANICAL CONTROLS - JUSTICE CENTER TOWER - SCHEMATICS
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ISSUED FOR BID

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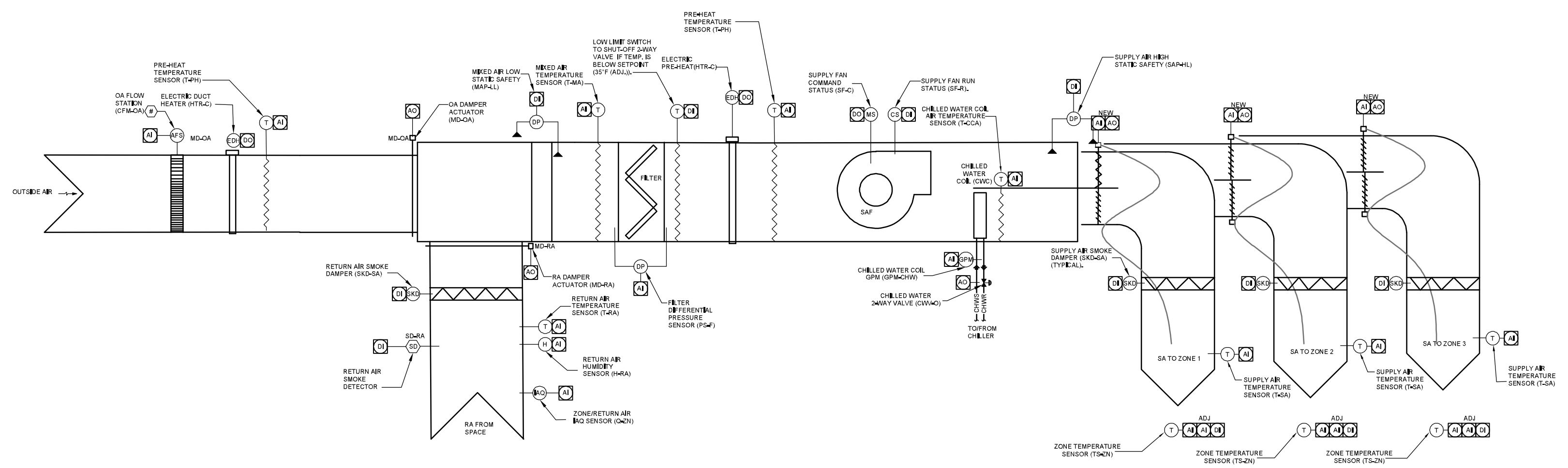

1 MC-701 MULTI ZONE AIR HANDLING UNIT DIAGRAM/SCHEMATIC (AHU-B1)
SCALE: NONE

System: Constant Volume MZ CHW AHU with Electric Duct Preheat | AHU - B1										
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Zone 1 Sensor, Temperature (TS-ZN)	•				•	15 Min	•	•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Zone 1 Sensor, Setpoint Adj (SP-ZN)	•				•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor
Zone 1 Sensor, Override[1] (OR-ZN)			•		•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor, or
Zone 1 Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Zone 1 Face & Bypass Actuator - (MD-OA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
Zone 2 Sensor, Temperature (TS-ZN)	•				•	15 Min	•	•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Zone 2 Sensor, Setpoint Adj (SP-ZN)	•				•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor
Zone 2 Sensor, Override[1] (OR-ZN)			•		•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor, or
Zone 2 Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Zone 2 Face & Bypass Actuator - (MD-OA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
Zone 3 Sensor, Temperature (TS-ZN)	•				•	15 Min	•	•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Zone 3 Sensor, Setpoint Adj (SP-ZN)	•				•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor
Zone 3 Sensor, Override[1] (OR-ZN)			•		•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor, or
Zone 3 Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Zone 3 Face & Bypass Actuator - (MD-OA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
Supply Air Fan Command (SAF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RI-1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan Run Status (SAF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Chilled Water 2-Way Control Valve (CWV-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator	See Schedule
Chilled Water Coil GPM (GPM-CHW)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Chilled Water Coil Air Temp Sensor (T-CCA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, or possible integration	n/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, or possible integration	n/a
Supply Air Smoke Damper (SKD-SA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Return Air Smoke Damper (SKD-RA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Differntial Pressure Sensor	VERIS PXPLX02S
Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Mixed Temp Sensor (T-MA)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
PreHeat Air Temp Sensor (T-PH)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Electric Duct Heater Stages (HTR-C)				•	•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	IDEC RI-1B-UAC24V SH1B-05 Pilot Series Relay
Low Limit Mixed Air Temp Safety (T-LL)			•			COS	•	•	Manual Reset Lo-Cutout Temp Sensor	PENN A70HA-1C
Supply Air High Static Safety - (SAP-HL)			•			COS	•	•	Manual Reset Hi-Cutout Pressure Sensor	CLEVELAND AFS-450-DSS
Mixed Air Low Static Safety - (MAP-LL)			•			COS	•	•	Manual Reset Lo-Cutout Pressure Sensor	CLEVELAND AFS-450-DSS
Return Air Humidity Sensor (H-RA)	•				•	15 Min	•	•	Determine number of zones, or return air	VERIS HD2XVSX
OA Damper Actuator - (MD-OA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
RA Damper Actuator - (MD-RA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
OA Supply Fan Command (OAF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RI-1B-UAC24V SH1B-05 Pilot Series Relay
OA Supply Fan Run Status (OAF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
OA PreHeat Air Temp Sensor (T-PH)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
OA Electric Duct Heater Stages (HTR-C)				•	•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	IDEC RI-1B-UAC24V SH1B-05 Pilot Series Relay
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing

Chilled Water Multizone Face & Bypass Air Handling Unit with Cooling Coil and Outdoor Air Preheat

A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the MCC.
5. All points shall be able to integrate to all trends, totalizations, graphics pages etc., as applicable.
6. All settings and set points shall be user adjustable without requiring a modification to the programming logic code.
7. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop
1. The unit normally operates continuously with remotely capability for start/stop/scheduling functions.
2. Time scheduling shall include 7-day time of day programming, extended time period scheduling (holiday) and special event programming (one time override program).
3. The H.O.A. switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes.
4. When AHU receives a start command, the outside air damper shall open to its minimum position, and the return damper shall open fully. The supply and return smoke dampers (where applicable) shall open and proof provided by their respective end switches. When the end switches prove open via hardwire interlock, the supply fan shall start.
   a. The zone face and bypass dampers shall modulate per the temperature control sequence.
   b. The outside air damper shall modulate to maintain outside air cfm requirements.
5. If after a 60 second delay (adjustable) the fan's current sensing switch does not provide status, then the fan will be shut down, the outside damper will close, and the return damper will open. An alarm will be generated, and the unit will be locked out in software.
6. When AHU is stopped (either manually, automatically during unoccupied mode, or from a safety function):
   a. Fans shall be de-energized, the minimum OADs shall close, and the RAD shall be 100% open.
   b. Building exhaust fans shall be commanded OFF when their assigned AHUs enter unoccupied mode, or by separate schedule.
   c. Exhaust dampers at exhaust fans shall be closed based on fan status.
   d. The dual temperature coil control valve shall close completely.
   e. The face and bypass damper shall open fully to bypass and be closed to coil face.

C. Setpoints:
1. Program temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 68°F @ 40°F outside ambient
      2) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F)
      1) 55°F @ 40°F outside ambient
      2) 80°F @ 80°F outside ambient
   c. Setpoint dead band (adjustable) shall be no less than 2°F
   d. Reset adjustments shall be no less than 3°F (adj.) per step
   e. Setpoints shall be field adjustable at a 0 to +/-1.5°F (adj.) offset from occupied active setpoints

D. Temperature Control
1. Zone Face and Bypass (F&B) Damper Control
   a. Zone temperature control shall use single setpoints per zone, as indicated in C.1.a during occupied periods, and C.1.b. during unoccupied periods.
   b. On a rise in temperature above setpoint, a direct acting PID control loop will modulate the face and bypass damper open to the cooling coil face (cold deck), on a fall in zone temperature, the reverse shall occur.
2. AHU Cooling Coil and Electric Heater Control
   a. A single proportional integral derivative (PID) control routine shall modulate the cooling coil valve and stage electric heat to maintain hot deck and cold deck setpoints to ensure simultaneous heating and cooling does not occurs.
   b. When the outside air temperature is above 45°F (adj.), the PID control loop will modulate the cooling coil control valve to maintain coil discharge air temperature at setpoint, initially 55°F (adj.).
   c. The AHU electric heater shall remain off when the cooling coil control valve is open.
   d. When the outside air temperature is below 40°F (adj.), the control valve will modulate closed and the PID control loop shall stage the AHU heater to maintain hot deck (coil bypass air) temperature at setpoint, initially 95°F, (adj.).
3. A duct temperature sensor in the outside air duct entering the AHUs shall control the electric duct heater to maintain outside air pre-heat temperature setpoint.
   a. Should the outside air temperature drop below setpoint, the electric pre-heat coil shall stage on to maintain outside air at 45 °F (adj.) using a PID control loop applied to the heating coil's multi-stages. On a rise in temperature above setpoint, the reverse shall occur, and heating shall be disabled.
   b. A mixed air low limit control shall override the control sequence above and stage the pre-heat coil on to maintain mixed air temperature is at 45 °F (adj.). During cold weather startup of the air handling unit the mixed air low limit override sequence shall also prevent nuisance tripping of the low limit temperature thermostats.

E. Filters
1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

F. Safety Interlocks, where applicable, see points list
1. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
2. Provide a low temperature thermostat (freeze stat) in the mixed air section of the air handling unit which will stop the unit if the temperature falls below 38 °F (adj.) and generate an alarm. The dual temperature coil control valve shall modulate open and pumping systems shall be started.
3. System Smoke, Fire/Smoke Dampers
   a. Where applicable, if Fire/Smoke dampers associated with the air handling unit are not 100% open after a 3 minute (adj.) delay after startup, generate an alarm.

G. Energy Conservation Measures
1. Air Handling Unit Discharge Temperature Reset
   a. Discharge Air Temperature Reset shall increase the cooling coil discharge air setpoint to maximize airflow across the cooling coil during lower load conditions.
      1) The discharge air temperature reset routine shall provide a maximum discharge air temperature setpoint of 59 °F (adj.) during cooling mode in 0.5 °F increments based on the F&B damper position indicating the greatest demand for cooling. The calculation for change shall occur every 10 minutes (adj.).
         (a) The discharge air temperature will be increased when the F&B damper that is most open to face is less than 35% (adj.) open to coil face.
         (b) The discharge air temperature will be decreased when the F&B damper that is most open to face is greater than 95% (adj.) open to coil face.
      2) Discharge Air Temperature Reset shall increase the heating air setpoint to reduce electrical consumption based on outdoor air temperatures
         (a) Adjust the hot deck temperature setpoint setpoint (°F) per reset schedule
            (i) 95°F @ 40°F outside ambient
            (ii) 105°F @ 20°F outside ambient
2. CO2 Control for High Density Spaces
   a. The minimum outside air flow setpoint shall be reset based on measuring return air carbon dioxide (CO2) and reducing or increasing outside air volumes to maintain proper CO2 levels FOR demand-controlled ventilation (DCV).
   b. Reset the outside air volume setpoint downward to a minimum of 30% of scheduled value using a proportional integral derivative (PID) control routine to maintain average CO2 levels at 800 ppm or less.
3. Optimal Start, Morning Warmup and Cool Down
   a. Regardless if the unit is determined to run continuously, in the event that a schedule is implemented the unit shall be programmed to provide an Optimal Start routine which shall automatically ramp the building temperatures for the Optimal start times to conserve energy while maintaining space temperature setpoints. Control systems shall start the AHUs according to optimum start SEQ rather than time schedule mode.
   b. When the AHU is started prior to scheduled start time by the Optimal Startp routine, the unit shall be considered to be in warm up or cool down mode. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open, associated exhaust fans and the dedicated outside air system shall remain off.
   c. Optimum start program shall be self-updating with adaptive, predictable, and self-tuning functions to respond to changing conditions without operator intervention.
   d. A building global outdoor air temperature sensor not associated with any AHU shall be used to provide OA temperature value and shall be used in the Warmup and Cool-Down sequence start timing.
   e. The program shall operate in both the heating and cooling seasons with individual self-tuning functions for each mode of operation.
   f. SEQ will compare the zone temperature to its setpoint at beginning of the scheduled occupied period and shall automatically adapt the heating or cooling response time for the next unoccupied period.
   g. The initial sequence starting time is 120 minutes (adj.) prior to occupancy and 30 (adj.) minutes prior to the unoccupied period.
4. Setback Mode
   a. During Unoccupied Mode, if any zone temperature falls below the unoccupied heating setpoints by 2°F (adjustable), the associated AHU shall start in Setback Mode. AHU shall continue to run until the zone temperature reaches the unoccupied setpoint. Other zones associated with the AHU shall modulate to maintain their respective unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open, associated exhaust fans and the dedicated outside air system shall remain off.
   c. Ensure a minimum run time per setback mode event of 30 minutes (adjustable) to minimize multiple starts.
5. Setup Mode
   a. During Unoccupied Mode, if any zone temperature rises above the unoccupied cooling setpoint by 2°F (adjustable), the associated AHU shall start in Setup Mode. AHU shall continue to run until the zone temperature reaches the unoccupied setpoint. Other zones associated with the AHU shall modulate to maintain their respective unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
   c. Ensure a minimum run time per setback mode event of 30 minutes (adjustable) to minimize multiple starts.
6. Occupant Override
   a. Provide an occupant override button in the selected space/area served by each AHU. A visual indication on the sensor shall provide occupant feedback when the system is in the override mode.
   b. When the air handling unit is in the unoccupied mode, pushing the override button will place the air handling unit and terminal units served by the AHU into the occupied mode for the programmed duration (60 minutes, adjustable, with a maximum limit of 2 hours).
   c. At the end of any override period, the system will revert to the scheduled mode in effect at that time.
   d. Daily override usage shall be calculated, logged and made available for enterprise energy reporting.

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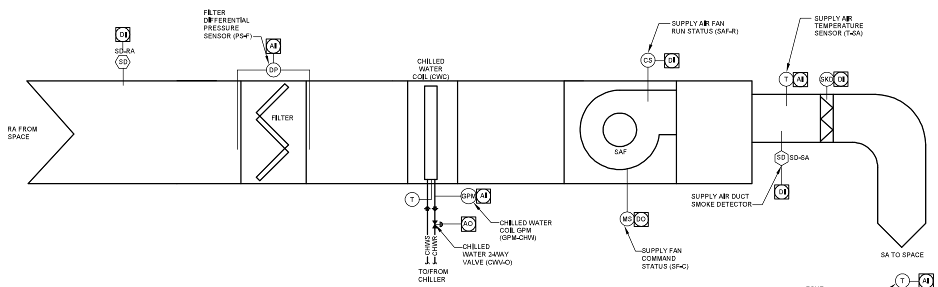


1 M-702 CHILLED WATER CAV AIR HANDLING UNIT, SINGLE FAN WITH COOLING COIL
SCALE: NONE

System: Constant Volume SZ CHW AHU | AHU - Carrier											
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Zone Sensor, Temperature (TS-ZN)	•				•	15 Min	•	•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Supply Air Fan Command (SAF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan Run Status (SAF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Chilled Water 2-Way Control Valve (CWV-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator	See Schedule
Chilled Water Coil GPM (GPM-CHW)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, or possible integration	n/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, or possible integration	n/a
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Differntial Pressure Sensor	VERIS PXPLX02S
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing

FCJC Single Zone Chilled Water CAV Air Handling Unit, Single Fan with Cooling Coil

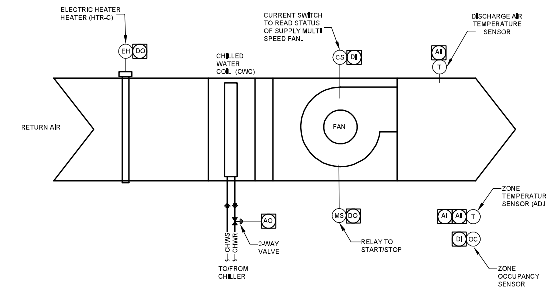
A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices, gauges and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the MCC.
5. All points shall be able to integrate to all trends, totalizations, etc., as applicable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop
1. The unit shall operate continuously with remote capability for manual start/stop functions.
2. The H.O.A. switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes.
3. When the unit receives a start command the supply fan shall start.
4. If after a 60 second delay (adjustable) the fan does not provide status, then the fan will be shut down, and an alarm will be generated.
5. Upon confirmation from the current status switch in the motor starter panel that the supply fan is running, zone temperature control shall be enabled.

C. Zone Temperature Control
1. A single proportional integral derivative (PID) control routine shall be used to modulate the chilled water valve to maintain setpoint.
   a. Zone temperature shall be measured at the space sensor in the zone.
   b. The controller shall control to maintain space temperature.
2. Program temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 68°F @ 20°F outside ambient
      2) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F) - 85°F
   c. Unoccupied Heating Temperature Setpoint (°F) - 60°F
   d. Setpoint dead band (adjustable) shall be no less than 2°F

D. Filters
1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

E. Safety Interlocks, where applicable, see points list
1. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
2. System Fire/Smoke Dampers
   a. If the Fire/Smoke dampers associated with the unit are not 100% open after a 3 minute (adj.) delay after startup, an alarm will be generated.



2 MC-702 FAN COIL UNIT FLOW DIAGRAM/SCHEMATIC
SCALE: NONE

System: FCU-1-1 thru FCU-1-9 & FCU-2-1 thru FCU-2-9											
Point Description	Point Function	Hardware Points				Software Points				Show on Graphic	Notes / Device
		AI	DI	AO	DO	AV	BV	Trend	Interval		
Zone Sensor, Temperature	Temperature Monitoring	•						•	15 min	•	Wall Mounted Temperature Sensor
Zone Sensor, Setpoint Adjust	Occupant Setpoint Adjust	•						•	15 min	•	Slide adjust input integral to sensor
FCU Discharge Air Temp Sensor	Temperature Monitoring	•						•	15 min	•	Duct Temperature Sensor downstream of heater
Supply Air Fan Command	Optimized Scheduling				•			•	COS	•	Control Relay contact output to fan starter
Supply Air Fan Run Status	Equipment Monitoring		•					•	15 min	•	Current sensing status switch in fan starter
CHW Contrl Valve	Temperature Control			•				•	16 min	•	New Valve and Actuator, 0-10v
Electric Heater Stages (HTR-C)	Temperature Control				•			•	15 min	•	Control Relay contact output to fan starter

Two Pipe Cooling Coil Fan Coil Unit

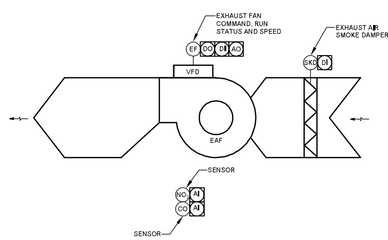
A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. Provide wall mounted BACnet networked thermostat with System ON/OFF, Auto HEAT/COOL changeover and FAN SPEED switches where required by the equipment being controlled.
4. All points shall be able to integrate to all trends, totalizations, graphics pages etc., as applicable.
5. All settings and set points shall be user adjustable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop/Scheduling
1. Provide individual FCU scheduling capability.
   a. The unit normally operates continuously with remote capability for start/stop/scheduling functions.
   b. The base personnel responsible for the facility will provide the hours of occupancy.
2. The unit shall run according to a user definable time schedule in the following modes:
   a. Occupied Mode
   b. Unoccupied Mode
3. When FCU is stopped (either manually at the thermostat or automatically during unoccupied mode):
   a. Fan shall be de-energized.
   b. The cooling coil control valve shall close completely.
   c. The heating coil control valve shall close completely.
4. When FCU is started (either manually at the thermostat or automatically during occupied modes):
   a. Fan shall be energized and run continuously.
   b. Fan speed shall be selected by the thermostat's fan speed selection switch.
   c. Heating and cooling control valves shall modulate per the temperature control sequence.
5. If after a 60 second delay (adjustable) the fan's current sensing switch does not provide status, then the fan will be shut down and an alarm will be generated.

C. Setpoints:
1. Program temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 68°F @ 40°F outside ambient
      2) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F)
      1) 55°F @ 40°F outside ambient
      2) 80°F @ 80°F outside ambient
   c. Setpoint dead band (adjustable) shall be no less than 2°F
   d. Reset adjustments shall be no less than 3°F (adj.) per step
   e. Setpoints shall be field adjustable at a 0 to +/-1.5°F (adj.) offset from occupied active setpoints

D. Temperature Control
1. The thermostat's zone temperature sensor shall control the cooling valve and the heating valve in sequence to maintain zone air temperature setpoint. Ensure simultaneous heating and cooling does not occur.
2. The cooling mode shall be enabled when the zone temperature rises above setpoint plus half of the dead band. The heating mode shall be enabled when the zone temperature falls below setpoint minus half of the dead band. The FCU shall remain in cooling or heating modes until conditions initiate a cooling or heating mode change.
3. Cooling Mode
   a. In the cooling mode, a rise in zone temperature above setpoint shall cause the cooling coil control valve to be modulated open to maintain setpoint. On a fall in zone temperature, the reverse sequence shall occur.

E.



3 M-702 EXHAUST FANS MONITOR & CONTROL DIAGRAM
SCALE: NONE

System: Parking Garage Supply and Exhaust Fans[1] |EF-1A THRU EF-1D										
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Zone Sensor, Carbon Monoxide (CO-ZN)[2]	•				•	15 min	•	•	Wall Mounted Networked CO Gas Detection Sens	VERIS GWNP - AG01 Sensor, BACnet protocol
Zone Sensor, Nitrogen Dioxide (NO_2-ZN)[2]	•				•	15 min	•	•	Wall Mounted Networked NO_2 Gas Detection Sens	VERIS GWNP - AG02 Sensor, BACnet protocol
Exhaust Fan Command (ExF-C)				•	•	COS	•	•	Control Relay output to VFD	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Exhaust Fan Run Status (ExF-R)			•		•	COS	•	•	Dry contact output from VFD	n/a
Exhaust Fan VFD Speed Output (ExF-O)		•			•	15 min	•	•	Analog control signal to VFD, ECM Motor 0-10V	n/a

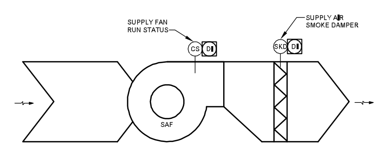
Note 1: Locations for EF-1A thru EF-1D refer to MC-10PE

Note 2: BACnet network gas detection sensors, locate per plans sheet MC-10PE & MC-10PW

PARKING GARAGE EXHAUST FANS EF-1A, EF-1B, EF-1C, AND EF-1D

A. TOXIC GAS DETECTION CONTROL SEQUENCE:

FANS FURNISHED WITH VFDS OPERATE THROUGH THE BAS TO MAINTAIN SAFE LEVELS OF CARBON MONOXIDE (CO) AND NITROGEN DIOXIDE (NO_2) MEASURED BY SENSORS AS SHOWN ON SHEETS MC-10PW AND MC-10PE.
1. MAINTAIN SAFE LEVELS FOR AVERAGE READINGS FROM NEW CO AND NO_2 SENSORS LOCATED IN THE GARAGE AREA.
   a. THERE SHALL BE A MINIMUM OF FIVE NEW SENSORS PROVIDED.
2. EXHAUST FAN RUNTIME SHALL BE CALCULATED BY THE BAS AND USED TO STAGE EXHAUST FANS FOR EQUAL RUNTIME.
   a. UNDER NORMAL OPERATION WITH NO SENSORS REPORTING ALARM CONDITIONS, ONE FAN SHALL ALWAYS BE SCHEDULED TO RUN.
   b. CONFIRM VALUES WITH T&B, GARAGE AREA SERVED IS 20,000 SF, MINIMUM VENTILATION REQUIREMENT IS 1000 CFM.
   c. ENERGIZE THE FAN WITH THE LEAST RUN HOURS TO RUN CONTINUOUSLY.
   d. ON A WEEKLY ROTATION, CYCLE FANS TO ENERGIZE THE FAN WITH THE LEAST RUN HOURS ON.
   e. CYCLE THE CURRENT FAN IN OPERATION OFF.
3. EACH GAS DETECTION SENSOR WILL BE NETWORKED USING BACNET MS/TP TO REPORT CO AND NO_2 LEVELS INTO THE BAS.
   a. EACH GAS DETECTION SENSOR WILL HAVE ITS FAN RELAY OUTPUT CONNECTED TO THE BAS DDC CONTROLLER.
   b. FAN RELAYS WILL BE PROGRAMMED TO REPORT CO / NO_2 WARNING ALARM LEVELS.
   c. FAN RELAYS WILL ENERGIZE WHEN CO / NO_2 LEVELS RISE ABOVE SETPOINT, INITIALLY 25 PPM (ADJ.).
   d. FAN RELAYS WILL DE-ENERGIZE WHEN CO / NO_2 LEVELS FALL BELOW SETPOINT, INITIALLY 0.2 PPM (ADJ.).
4. ADDITIONAL EXHAUST FANS SHALL STAGE ON WHEN THE BAS DETECTS FAN RELAYS HAVE BEEN ACTIVATED.
   a. OF THE THREE AVAILABLE FANS, ENERGIZE THE FAN WITH THE LOWEST RUNTIME VALUE WHEN A ONE GAS SENSOR FAN RELAY HAS BEEN DETECTED ON.
   b. OF THE TWO AVAILABLE FANS, ENERGIZE THE FAN WITH THE LOWEST RUNTIME VALUE WHEN TWO GAS SENSOR FAN RELAYS HAVE BEEN DETECTED ON.
   c. ENERGIZE THE REMAINING FAN WHEN THREE GAS SENSOR FAN RELAYS HAVE BEEN DETECTED ON.
5. ONCE ENERGIZED, EXHAUST FANS SHALL RUN CONTINUOUSLY AT A MINIMUM SPEED TO MAINTAIN 0.05 CFM PER SQUARE FOOT VENTILATION.
   a. ONCE ALL FOUR FANS HAVE BEEN ENERGIZED, THE DDC SHALL INCREASE THE FAN SPEED OF ALL FOUR FANS EQUALLY BY 5% SPEED EVERY 2 MINUTES, (ADJ.) UNTIL MAXIMUM FAN SPEED HAS BEEN ACHIEVED.
   b. FANS SHALL REMAIN ON UNTIL ALL FAN RELAYS ARE OFF INDICATING SAFE CO / NO_2 LEVELS.
6. WHEN THE BAS DETECTS ALL FAN RELAYS ARE OFF, FAN SPEED SHALL BE DECREASED BY 5% SPEED EVERY 2 MINUTES, (ADJ.), UNTIL MINIMUM FAN SPEED HAS BEEN ACHIEVED.
   a. WHEN FAN SPEED HAS REACHED MINIMUM SPEED, FANS SHALL BE CYCLED OFF IN REVERSE ORDER
7. AN ALARM WILL BE GENERATED AT THE BAS IF CO LEVELS EXCEED 50 PPM OR NO_2 LEVELS EXCEED 5 PPM.



4 M-702 SMOKE CONTROL SUPPLY FAN MONITOR ONLY DIAGRAM
SCALE: NONE

System: Smoke Supply Fans | SF-1 THRU SF-4										
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Supply Fan Run Status (SF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Spit Core Current Switch
Supply Fan Fire/Smoke Damper (FD-SF)			•						Confirm Interlock operation	Verify existing

Note 1: Locatons for SF-1 thru SF-4 refer to MC-110

Note 2: Equipment status may also be obtained from Fire Alarm System BACnet interfce at contractor's discretion

SUPPLY FANS BEING MONITORED ONLY

A. CONTROL SEQUENCE:

FANS SHALL OPERATE AS CONTROLLED BY THEIR RESPECTIVE SYSTEM OTHER THAN BAS. MONITOR STATUS OF THE FAN AND SHOW ON THE BAS GRAPHIC ON FLOOR PLANS AND IN A TABLE. SMOKE SUPPLY FANS SHALL ALARM AT THE BAS IF THEIR STATUS SHOWS "ON".

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FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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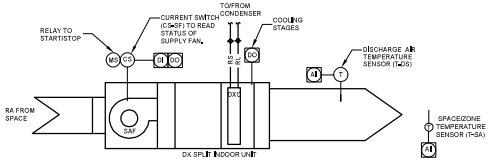


1 MC-703 DX SPLIT UNIT FLOW DIAGRAM/SCHEMATIC

SCALE: NONE

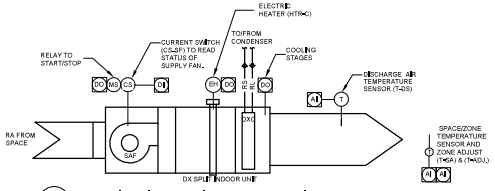
System: DX Split System: ACU-2, thru ACU-6 & ACU-9 thru ACU-14												
Point Description	Point Function	Hardware Points				Software Points					Show on Graphic	Notes / Device
		AI	DI	AO	DO	AV	BV	Trend	Trend Interval			
Fan Start / Stop	Optimized Scheduling				•						•	Control Relay
Fan Run Status	Equipment Monitoring		•					•	15 min		•	Current Sensing Switch
Cooling Stages	Temperature Control				•			•	15 min		•	Control Relay, 1 per stage
Discharge Air Sensor	Temperature Monitoring	•						•	15 min		•	Duct Temperature Sensor
Zone Temperature	Temperature Monitoring	•						•	15 min		•	Zone Temperature Sensor
Zone Setpoint Adjust	Occupant Comfort Adjust	•						•			•	Zone Thermostat Adjust

DX SPLIT SYSTEMS COOLING:

EACH DX SPLIT SYSTEM SHALL BE CONTROLLED BY A SEPARATE DIGITAL SPACE THERMOSTAT/SENSOR. THE SPACE SENSOR SHALL ENABLE AND DISABLE THE SYSTEM BASED ON THE SPACE TEMPERATURE SETPOINT (ADJUSTABLE). THE BAS SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SUPPLY FAN OPERATION (ON/OFF).

OCCUPIED OPERATION:

1. COOLING - SPACE TEMPERATURE SENSOR ENERGIZES AHU FAN AND CU WHEN THE SPACE TEMPERATURE REACHES 80 DEG.F. FAN CONTINUES TO RUN AND CU DE-ENERGIZED WHEN SPACE TEMPERATURE IS MET (75 DEG.F (ADJ.).



2 MC-703 DX SPLIT UNIT FLOW DIAGRAM/SCHEMATIC

SCALE: NONE

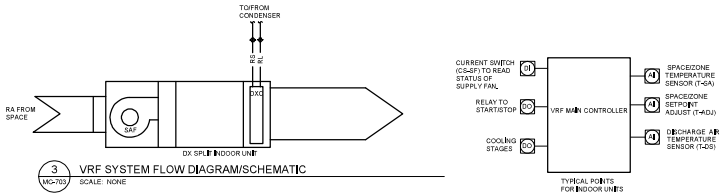
System: DX Split System: ACL-1, ACU-7 & ACU-8												
Point Description	Point Function	Hardware Points				Software Points					Show on Graphic	Notes / Device
		AI	DI	AO	DO	AV	BV	Trend	Trend Interval			
Fan Start / Stop	Optimized Scheduling				•						•	Control Relay
Fan Run Status	Equipment Monitoring		•					•	15 min		•	Current Sensing Switch
Cooling Stages	Temperature Control				•			•	15 min		•	Control Relay, 1 per stage
Heating Stages	Temperature Control				•			•	15 min		•	Control Relay, 1 per stage
Discharge Air Sensor	Temperature Monitoring	•						•	15 min		•	Duct Temperature Sensor
Zone Temperature	Temperature Monitoring	•						•	15 min		•	Zone Temperature Sensor
Zone Setpoint Adjust	Occupant Comfort Adjust	•									•	Zone Thermostat Adjust

DX Split System Air Conditioning (AC) Unit with Electric Heat

EACH DX SPLIT SYSTEM SHALL BE CONTROLLED BY A SEPARATE DIGITAL SPACE THERMOSTAT/SENSOR. THE SPACE SENSOR SHALL ENABLE AND DISABLE THE SYSTEM BASED ON THE SPACE TEMPERATURE SETPOINT (ADJUSTABLE). THE BAS SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SUPPLY FAN OPERATION (ON/OFF).

OCCUPIED OPERATION:

1. COOLING - SPACE TEMPERATURE SENSOR ENERGIZES AHU FAN AND CU WHEN THE SPACE TEMPERATURE REACHES 80 DEG.F. FAN CONTINUES TO RUN AND CU DE-ENERGIZED WHEN SPACE TEMPERATURE IS MET (75 DEG.F (ADJ.).
2. HEATING - IN THE HEATING MODE, A FALL IN ZONE TEMPERATURE BELOW SETPOINT SHALL CAUSE THE ELECTRIC COIL TO STAGE ON TO MAINTAIN SETPOINT. ON A RISE IN ZONE TEMPERATURE, THE REVERSE SEQUENCE SHALL OCCUR.



3 MC-703 VRF SYSTEM FLOW DIAGRAM/SCHEMATIC

SCALE: NONE

System: VRF System											
Point Description	Point Functor	Hardware Points				Software Points					Show on Graphic	Notes / Device
		AI	DI	AO	DO	AV	EV	Trend	Trend Interval			
Fan Start / Stop	Optimized Scheduling				•	•					•	Control Relay
Fan Run Status	Equipment Monitoring		•					•	15 min		•	Current Sensing Switch
Cooling Stages	Temperature Control				•			•	15 min		•	Control Relay, 1 per stage
Discharge Air Sensor	Temperature Monitoring	•						•	15 min		•	Duct Temperature Sensor
Zone Temperature	Temperature Monitoring	•						•	15 min		•	Zone Temperature Sensor
Zone Setpoint adjust	Occupant Comfort Adjust	•									•	Zone Thermostat Adjust

VRF System Unit

THE SPACE SENSOR SHALL ENABLE AND DISABLE THE SYSTEM BASED ON THE SPACE TEMPERATURE SETPOINT (ADJUSTABLE). THE BAS SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SUPPLY FAN OPERATION (ON/OFF).

OCCUPIED OPERATION:

1. COOLING - SPACE TEMPERATURE SENSOR ENERGIZES AHU FAN AND CU WHEN THE SPACE TEMPERATURE REACHES 80 DEG.F. FAN CONTINUES TO RUN AND CU DE-ENERGIZED WHEN SPACE TEMPERATURE IS MET (75 DEG. F (ADJ.).
2. HEATING - IN THE HEATING MODE, A FALL IN ZONE TEMPERATURE BELOW SETPOINT SHALL CAUSE THE UNIT TO SWITCH TO HEATING MODE TO MAINTAIN SETPOINT. ON A RISE, IN ZONE TEMPERATURE, THE REVERSE SEQUENCE SHALL OCCUR.

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FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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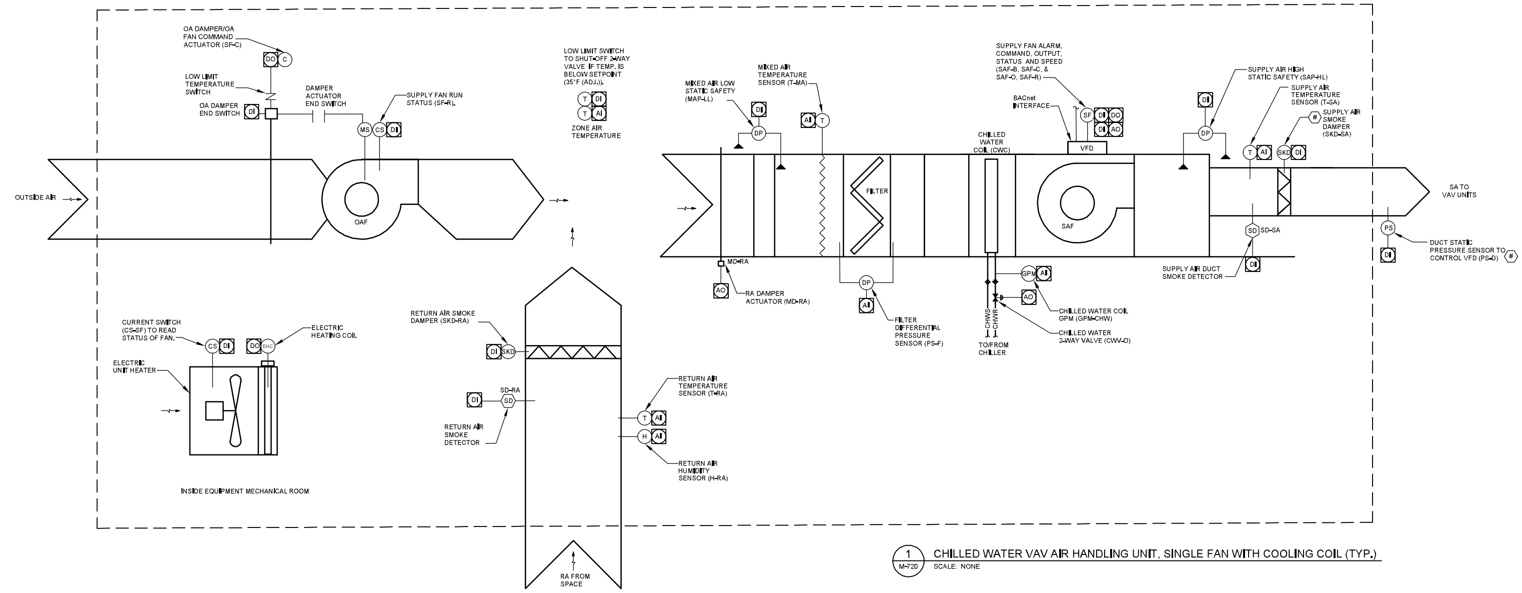

1 M-720 CHILLED WATER VAV AIR HANDLING UNIT, SINGLE FAN WITH COOLING COIL (TYP.)

SCALE: NONE

System: Variable Volume CHW AHU | AHUs-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

Point Description	Hardware Points				Software Points			Show on	Point Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm	Graphic		
Supply Air Fan VFD Command (SAF-C)				•	•	COS	•	•	Control Relay output to VFD	IDEC FH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan VFD Bypass Status (SAF-B)			•			15 Min	•	•	Dry contact output from VFD	n/a
Supply Air Fan VFD Run Status (SAF-R)			•		•	COS	•	•	Dry contact output from VFD	n/a
Supply Air Fan VFD Speed Output (SAF-O)		•			•	15 Min		•	Analog control signal to VFD	n/a
Chilled Water 2-Way Control Valve (CWV-C)		•			•	15 Min		•	New PI-CHW Valve and Actuator Control Signal	See Schedule
Chilled Water Coil GPM (GPM-CHW)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, or possible integration	n/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, or possible integration	n/a
Supply Air Smoke Damper (SKD-SA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Return Air Smoke Damper (SKD-RA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Diffential Pressure Sensor	VERIS PXPLX02S
Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Return Air Humidity Sensor (H-RA)	•				•	15 Min		•	Duct %RH Sensor	VERIS HD2XVSX
Mixed Temp Sensor (T-MA)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDXX05S
Low Limit Mixed Air Temp Safety (T-LL)			•			COS	•	•	Manual Reset Lo-Cutout Temp Sensor	PENN A70HA-1C
Supply Air High Static Safety - (SAP-HL)			•			COS	•	•	Manual Reset Hi-Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
RA Damper Actuator - (MD-RA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
OA Supply Fan Command (SF-C)				•	•	COS	•	•	Control Relay to Fan Starter, interlock from damper	IDEC FH1B-UAC24V SH1B-05 Pilot Series Relay
OA Supply Fan Run Status (SF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
OA Damper Actuator - (MD-OA)				•	•	15 Min		•	New damper actuator - interlock with fan starter	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
OA Damper Actuator - (MD-OA)			•			COS		•	Damper /Actuator Position End Switch	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
MA Electric Unit Heater (EUH-C)				•	•	COS		•	Control Relay(s) output to Mech Room Unit Heater	IDEC FH1B-UAC24V SH1B-05 Pilot Series Relay
Electric Unit Heater Run Status (HTR-R)			•		•	COS		•	Current Sensing Switch at Heater	VERIS H-608 Adjustable Split Core Current Switch
Zone Air Temperature Sensor	•				•	15 Min		•	Wall mounted 10k Thermistor Temperature Sensor	VERIS TED51
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing

Chilled Water VAV Air Handling Unit, Single Fan with Cooling Coil and OA Fan, Electric Unit Heater Preheat

A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices, gauges and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the VFD/MCC.
5. All points shall be able to integrate to all trends, totalizations, etc., as applicable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop
1. The unit normally operates continuously with remotely capability for start/stop/scheduling functions.
2. Time scheduling shall include 7-day time of day programming, extended time period scheduling (holiday) and special event programming (one time override program).
3. The H.O.A. switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes. When the air handling unit is off, the outside damper shall be closed and the return damper open.
4. When the unit receives a start command, the outside air damper shall open to its minimum position, the associated outside air fan shall start, and the return damper shall open fully. The supply and return smoke dampers (where applicable) shall open and proof provided by their respective end switches. When the end switches prove open via hardwire interlock, the supply fan shall start at minimum speed.
5. Upon confirmation from the VFD that the supply fan is running, the fan shall modulate as indicated below for control and associated supply and exhaust fans shall be energized.
6. If after a 60 second delay (adjustable) the fan does not provide status or the VFD provides an alarm condition, then the fan will be shut down, the outside damper will close, and the return damper will open. An alarm will be generated, and the unit will be locked out in software.

C. Airflow Control
1. Upon start-up of the supply fan, the BAS panel shall monitor the static pressure signal for the AHU system. The speed of the supply fan shall increase via hardwire connection to the respective VFD to maintain setpoint at the duct mounted static pressure sensors.
   a. The supply air fan speed shall be controlled to maintain the initial duct static pressure of 1.5 inches of water gauge minimum (adjustable).
2. The outside air dampers shall fully open and outside air supply fan shall start.
   a. The BAS command shall be to open the OA damper.
   b. A hardwired interlock from the OA damper aux contact shall be wired to a start/stop relay in the fan starter.
   c. A current status switch in the fan starter shall provide proof of outside air damper and fan operation.
3. These AHUs do not provide for Demand Controlled Ventilation (DCV).

D. Temperature Control
1. The discharge temperature sensor shall control the cooling valve to maintain discharge air temperature setpoint.
   a. On a rise in discharge air temperature above setpoint the cooling coil control valve will be modulated open. On a drop in discharge air temperature, the reverse sequence shall occur.
2. A zone temperature sensor in the mixed air duct entering the AHUs from the mechanical room air plenum shall control the room electric unit heater to maintain mixed air pre-heat temperature setpoint.
   a. Should the room air temperature drop below setpoint, the electric unit heater coil shall stage on to maintain setpoint at 45 °F (adj.) using a two position on/off control loop. On a rise in temperature above setpoint, the reverse shall occur, and heating shall be disabled. The control logic shall use a plus or minus 2°F (adj.) dead band for stable operation.
   b. Should the room air temperature drop below 40°F (adj.), the outside air fan shall be stopped, the damper shall close, and an alarm shall be generated.

E. Filters
1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

F. Safety Interlocks, where applicable, see points list
1. The high discharge static pressure safety located on the discharge of the supply fan in the unit housing shall be set as scheduled for 1"w.c. above the total pressure rating of the supply fan as indicated on the AHU schedule. If the pressure setting is exceeded, the safety will trip and, via hardwire interlock to the supply fan's VFD, shutdown the fan. This safety shall operate in either hand or auto on the VFD's and shall be reset manually. If the supply fan is shut down by safety, the associated supply and exhaust fan(s) shall also be shut down.
2. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
3. Provide a low temperature thermostat (freeze stat) in the mechanical room which will stop the unit if the mixed air temperature falls below 38 °F (adj.) and an alarm shall be generated. The cooling coil control valve shall modulate to open.
4. System Fire/Smoke Dampers
   a. If the Fire/Smoke dampers associated with the unit are not 100% open after a 3 minute (adj.) delay after startup, an alarm will be generated.

G. Energy Conservation Measures
1. Air Handling Unit Static Pressure and Discharge Temperature Reset
   a. Static Pressure Reset shall be the primary energy conservation reset routine for air handling units.
      1) The static pressure reset routine shall permit a minimum duct static pressure of 0.5"w.c. (adj.) for all VAV AHUs during the cooling mode if all of the below mentioned criteria have been achieved. The supply VAV box damper position for all boxes serviced by this unit shall be monitored at 15 minute intervals (adj.) to determine the ability to automatically reset the supply static pressure setpoint for optimization.
         (a) The supply duct static pressure setpoint shall be reduced by 0.1"w.c. (adj.) if the damper position of the furthest open box is less than 85% (adj.),
         (b) The supply static pressure setpoint shall be increased by 0.1"w.c. (adj.) if the damper position of the furthest open box is greater equal to or greater than 90% (adj.),
      2) The reset routine alone should not cause any box to reach 100% open. If five or more boxes reach 100% open, the reset routine shall ramp the static pressure setpoint back to the starting static pressure setpoint over a 2 minute duration (adj.). An alarm shall be generated when the static pressure reaches the maximum allowable setting, and the reset routine shall be locked out in software. A manual reset shall be provided on the system graphic to allow the user to enable the routine again after the problem has been corrected.
   b. Discharge Air Temperature Reset shall be secondary to static pressure reset and shall not be enabled until the static pressure setpoint is at minimum and terminal units continue to experience overcooling, as measured by the terminal unit with the highest demand less than 50% open.
      1) The discharge air temperature reset routine shall provide a maximum discharge air temperature setpoint of 59 °F (adj.) for all VAV AHU's during the if all of the below mentioned criteria has been achieved. The calculation for change shall occur every 15 minutes (adj.). The supply VAV box damper position for all boxes serviced by this unit shall be monitored at 15 minute intervals for each AHU's DAT reset calculation. The highest unit discharge temperature which is able to satisfy all normally operating zones will be determined as follows:
         (a) The discharge air dewpoint temperature shall not exceed 55 °F (adj.).
         (b) The discharge air temperature will be increased if all normally operating zones have been satisfied for one hour, the duct static pressure reset is at minimum setpoint, and all VAV boxes are less than 75% open.
         (c) The discharge air temperature will be decreased if any normally operating zones is almost unsatisfied. A zone will be deemed almost unsatisfied if its box is more than 95% open. For zones with constant volume boxes, a zone will be deemed unsatisfied if the zone temperature is not maintained.
      2) If any VAV box cooling command reaches 100% for a 20 min duration a warning shall be generated, and the discharge temperature reset routine shall reverse until all VAV box cooling commands are less than or equal to 85% (adj.). If five or more VAV boxes reach 100% for a 20 min (adj.) duration an alarm shall be generated, and the reset routine shall reverse with the above mentioned temperature increments but with changes every 2 minutes (adj.) to the starting setpoint as scheduled and the reset routine shall be locked out in software. A manual reset shall be provided on the system graphic to allow the user to enable the routine again after the problem has been corrected.
   a. The BAS shall accumulate a list of zones that are almost unsatisfied and produce a weekly report listing these zones and the number of instances these zones were almost unsatisfied. This will allow the staff to investigate the zone and determine if airflow is choked or unsustainable loads have been placed in the zone.
2. Optimal Start, Morning Warmup and Cool Down
   a. Regardless if the unit is determined to run continuously, in the event that a schedule is implemented the unit shall be programmed to provide an Optimal Start/Stop routine which shall automatically ramp the building temperatures for the Optimal start and stop times to conserve energy while maintaining space temperature setpoints. Where applicable this strategy shall include but not be limited to incorporating terminal unit override for zones specifically associated to this AHU to help implement this routine.
   b. When the AHU is started prior to scheduled start time by the Optimal Start/Stop routine, the unit shall be considered to be in warm up or cool down mode. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
3. Setback Mode
   a. During Unoccupied Mode, if the average temperature of all zone sensors serving their respective AHU fall below their unoccupied heating setpoints by 2°F (adjustable), the associated AHU shall start in Setback Mode. AHU shall continue to run until the average temperature of all zone sensors is 1°F (adjustable) below the unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
4. Setup Mode
   a. During Unoccupied Mode, if the average temperature of all zone sensors serving their respective AHU rise above their unoccupied cooling setpoints by 2°F (adjustable), the associated AHU shall start in Set-up Mode. AHU shall continue to run until the average temperature of all zone sensors is 1°F (adjustable) above the unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

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REVISIONS / ISSUED

NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
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DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SCHEMATICS

DRAWING NO.
MC-720

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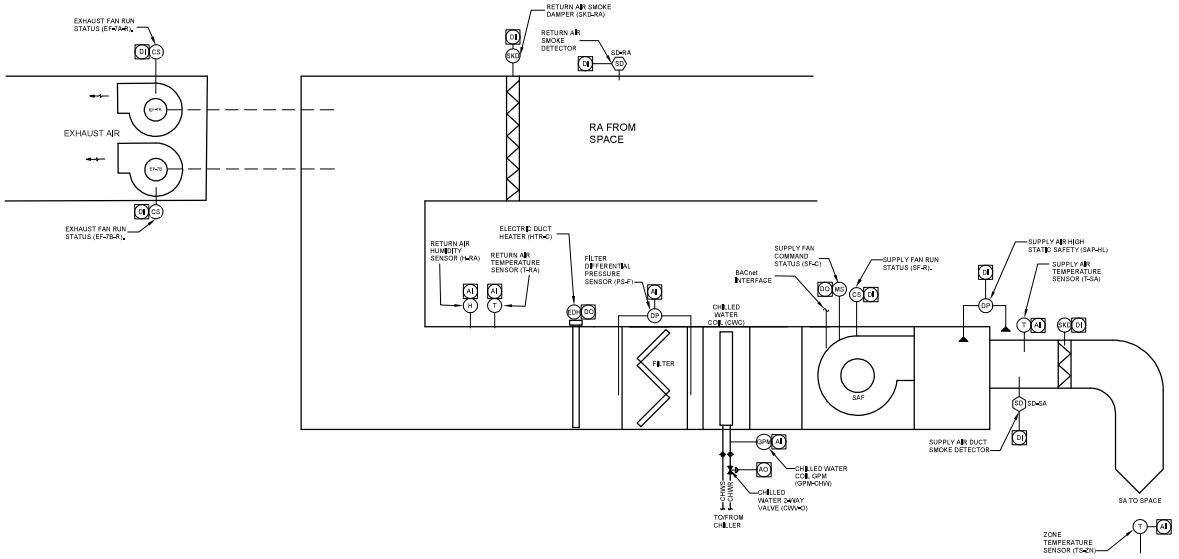

1 M-721 CHILLED WATER CAV AIR HANDLING UNIT
SCALE: NONE

System: Single Zone Constant Volume CHW A-HU-22											
Point Description	Hardware Points				Software Points			Show in		Point Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm	Graphic			
Supply Air Fan Command (SAF-C)				●	●	COS	●	●		Control Relay output to VFD	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan Run Status (SAF-R)			●		●	COS	●	●		Dry contact output from VFD	n/a
Chilled Water 2-Way Control Valve (CWV-O)		●			●	15 Min		●		New PI-CHW Valve and Actuator Control Signal	See Schedule
Chilled Water Coil GPM (GPM-CHW)	●				●	15 Min		●		New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Supply Air Duct Smoke Detector (SD-SA)			●				●	●		Dry contact from SD, or possible integration	n/a
Return Air Duct Smoke Detector (SD-RA)			●				●	●		Dry contact from SD, or possible integration	n/a
Supply Air Smoke Damper (SKD-SA)			●					●		Damper Position End Switch	KE.E TS-470 Damper End Switch
Return Air Smoke Damper (SKD-RA)			●					●		Damper Position End Switch	KE.E TS-470 Damper End Switch
Filter Differential Pressure Sensor - (PS-F)	●				●	15 Min	●	●		Filter Differential Pressure Sensor	VERIS PXPLX02S
Return Air Temp Sensor (T-RA)	●				●	15 Min	●	●		Duct RTD Temperature Sensor	VERIS TFECR02
Electric Duct Heater Stages (HTR-C)				●	●	COS		●		Control Relay(s) output to Duct Heater Multi-Stage	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Temp Sensor (T-SA)	●				●	15 Min	●	●		Duct RTD Temperature Sensor	VERIS TFECR02
Supply Air High Static Safety - (SAP-HL)			●			COS	●	●		Manual Reset Hi Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
Return Air Humidity Sensor (H-RA)	●				●	15 Min		●		Duct %RH sensor return air	VERIS HD2XVSX
Zone Sensor, Temperature (TS-ZN)	●				●	15 Min	●	●		Wall Mounted 10K Thermister Temperature Sensor	VERIS TED51
Exhaust Air Flow Station - (CFM-EA)	●				●	15 Min		●		Alternaively, can be a calculate value (SA-RA)	
Exhaust Fan 7A Run Status (ExF-R)			●		●	COS	●	●		Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Exhaust Fan 7B Run Status (ExF-R)			●		●	COS	●	●		Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Supply Fan Fire/Smoke Damper (FD-SF)										Confirm interlock operation	Verify existing

FCJC Single Zone Chilled Water CAV Air Handling Unit

A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices, gauges and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the MCC.
5. All points shall be able to integrate to all trends, totalizations, etc., as applicable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop
1. The unit shall operate continuously with remote capability for manual start/stop functions.
2. The H-O-A switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes.
3. When the unit receives a start command the supply fan shall start.
4. If after a 60 second delay (adjustable) the fan does not provide status, then the fan will be shut down, and an alarm will be generated.
5. Upon confirmation from the current status switch in the motor starter panel that the supply fan is running, zone temperature control shall be enabled.

C. Zone Temperature Control
1. A single proportional integral derivative (PID) control routine shall be used to modulate the chilled water valve to maintain setpoint.
   a. Zone temperature shall be measured at the space sensor in the zone.
   b. The controller shall control to maintain space temperature.
2. Programs temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 68°F @ 20°F outside ambient
      2) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F) - 85°F
   c. Unoccupied Heating Temperature Setpoint (°F) - 60°F
   d. Setpoint dead band (adjustable) shall be no less than 2°F

D. Filters
1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

E. Safety Interlocks, where applicable, see points list
1. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
2. System Fire/Smoke Dampers
   a. If the fire/smoke dampers associated with the unit are not 100% open after a 3 minute (adj.) delay after startup, an alarm will be generated.

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DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SCHEMATICS

DRAWING NO.
MC-721

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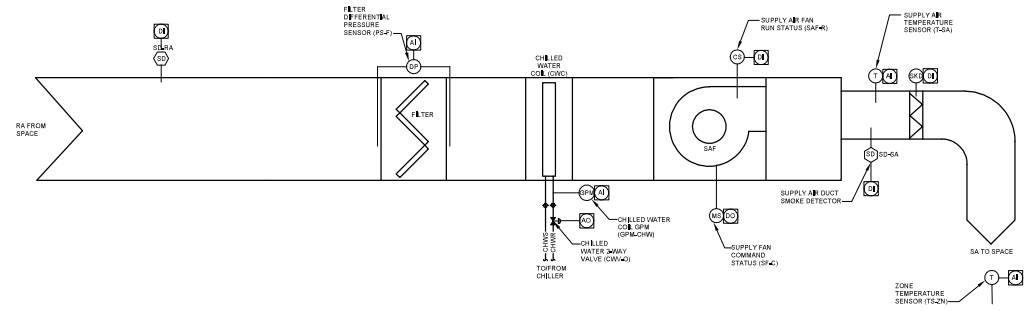


1 M-722 CHILLED WATER CAV AIR HANDLING UNIT, SINGLE FAN WITH COOLING COIL
SCALE: NONE

System: Constant Volume SZ CHW AHU | 1HU - 23										
Point Descrption	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AC	DI	DO	Trend	Interval	Alarm			
Zone Sensor, Temperature -TS-ZN)	•				•	15 Min	•	•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Supply Air Fan Command (SAF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan Run Status (SAF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Chilled Water 2-Way Control Valve (CWV-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator	See Schedule
Chilled Water Coil GPM (GPM-CHW)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Chilled Water Coil Air TempSensor (T-CCA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, or possible integration	n/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, or possible integration	n/a
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Differntial Pressure Sensor	VERIS PXPLX02S
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing
Building Main Power Energy Meter	•				•	15 Min		•	BACnet Energy Meter and CTs on MDP, Typical three meters	DENT POWERSCOUT 3037 or ACUVIM BN BACnet Meter

FCIC Single Zone Chilled Water CAV Air Handling Unit, Single Fan with Cooling Coil

A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices, gauges and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the M/C.
5. All points shall be able to integrate to all trends, totalizations, etc., as applicable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop
1. The unit shall operate continuously with remote capability for manual start/stop functions.
2. The H.O.A. switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes.
3. When the unit receives a start command the supply fan shall start.
4. If after a 60 second delay (adjustable) the fan does not provide status, then the fan will be shut down, and an alarm will be generated.
5. Upon confirmation from the current status switch in the motor starter panel that the supply fan is running, zone temperature control shall be enabled.

C. Zone Temperature Control
1. A single proportional integral derivative (PID) control routine shall be used to modulate the chilled water valve to maintain setpoint.
   a. Zone temperature shall be measured at the space sensor in the zone.
   b. The controller shall control to maintain space temperature.
2. Program temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 68°F @ 20°F outside ambient
      2) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F) - 85°F
   c. Unoccupied Heating Temperature Setpoint (°F) - 60°F
   d. Setpoint dead band (adjustable) shall be no less than 2°F

D. Filters
1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

E. Safety Interlocks, where applicable, see points list
1. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
2. System Fire/Smoke Dampers
   a. If the Fire/Smoke dampers associated with the unit are not 100% open after a 3 minute (adj.) delay after startup, an alarm will be generated.

Two Pipe Cooling Coil Fan Coil Unit

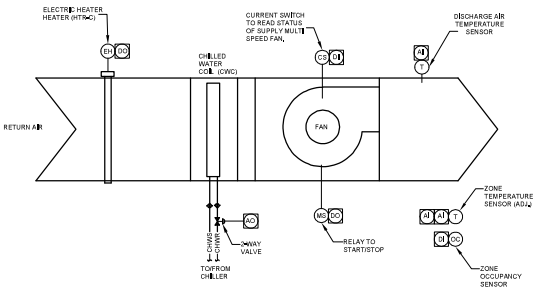
A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. Provide wall mounted BACnet networked thermostat with System ON/OFF, Auto HEAT/COOL changeover and FAN SPEED switches where required by the equipment being controlled.
4. All points shall be able to integrate to all trends, totalizations, graphics pages etc., as applicable.
5. All settings and set points shall be user adjustable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop/Scheduling
1. Provide individual FCU scheduling capability.
   a. The unit normally operates continuously with remote capability for start/stop/scheduling functions.
   b. The base personnel responsible for the facility will provide the hours of occupancy.
2. The unit shall run according to a user definable time schedule in the following modes:
   a. Occupied Mode
   b. Unoccupied Mode
3. When FCU is stopped (either manually at the thermostat or automatically during unoccupied mode):
   a. Fan shall be de-energized,
   b. The cooling coil control valve shall close completely.
4. When FCU is started (either manually at the thermostat or automatically during occupied modes):
   a. Fan shall be energized and run continuously.
   b. Fan speed shall be selected by the thermostat's fan speed selection switch.
   c. Cooling control valves shall modulate per the temperature control sequence.
5. If after a 60 second delay (adjustable) the fan's current sensing switch does not provide status, then the fan will be shut down and an alarm will be generated.

C. Setpoints:
1. Program temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F)
      1) 80°F @ 80°F outside ambient
   c. Setpoint dead band (adjustable) shall be no less than 2°F
   d. Reset adjustments shall be no less than 3°F (adj.) per step
   e. Setpoints shall be field adjustable at a 0 to +/-1.5°F (adj.) offset from occupied active setpoints

D. Temperature Control
1. The thermostat's zone temperature sensor shall control the cooling valve in sequence to maintain zone air temperature setpoint. The cooling mode shall be enabled when the zone temperature rises above setpoint plus half of the dead band.
2. Cooling Mode
   a. In the cooling mode, a rise in zone temperature above setpoint shall cause the cooling coil control valve to be modulated open to maintain setpoint. On a fall in zone temperature, the reverse sequence shall occur.

E.



2 M0-722 FAN COIL UNIT FLOW DIAGRAM/SCHEMATIC
SCALE: NONE

System: FCU-3 & FCU-4										
Point Description	Point Function	Hardware Points				Software Points			Show on Graphic	Notes / Device
		AI	DI	AO	DO	AV	BV	Trend	Interval	
Zone Sensor, Temperature	Temperature Monitoring	•						•	15 min	•	Wall Mounted Temperature Sensor
Zone Sensor, Setpoint Adjust	Occupant Setpoint Adjust	•							15 min	•	Slide adjust input integral to sensor
FCU Discharge Air Temp Sensor	Temperature Monitoring	•						•	15 min	•	Duct Temperature Sensor downstream of heater
Supply Air Fan Command	Optimized Scheduling				•			•	COS	•	Control Relay contact output to fan starter
Supply Air Fan Run Status	Equipment Monitoring		•					•	15 min	•	Current sensing status switch in fan starter
CHW Contrl Valve	Temperature Control			•				•	16 min	•	New Valve and Actuator, 0-10v
Electric Heater Stages (HTR-C)	Temperature Control				•			•	15 min	•	Control Relay contact output to fan starter

Two Pipe Cooling Coil Fan Coil Unit

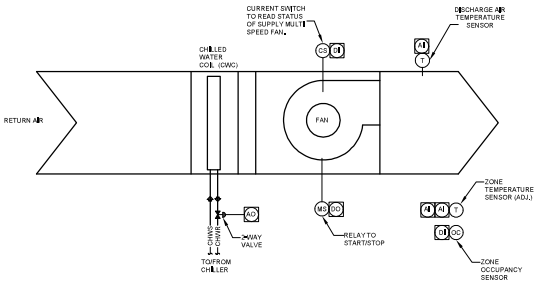
A. General
1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. Provide wall mounted BACnet networked thermostat with System ON/OFF, Auto HEAT/COOL changeover and FAN SPEED switches where required by the equipment being controlled.
4. All points shall be able to integrate to all trends, totalizations, graphics pages etc., as applicable.
5. All settings and set points shall be user adjustable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop/Scheduling
1. Provide individual FCU scheduling capability.
   a. The unit normally operates continuously with remote capability for start/stop/scheduling functions.
   b. The base personnel responsible for the facility will provide the hours of occupancy.
2. The unit shall run according to a user definable time schedule in the following modes:
   a. Occupied Mode
   b. Unoccupied Mode
3. When FCU is stopped (either manually at the thermostat or automatically during unoccupied mode):
   a. Fan shall be de-energized,
   b. The cooling coil control valve shall close completely.
   c. The heating coil control valve shall close completely.
4. When FCU is started (either manually at the thermostat or automatically during occupied modes):
   a. Fan shall be energized and run continuously.
   b. Fan speed shall be selected by the thermostat's fan speed selection switch.
   c. Heating and cooling control valves shall modulate per the temperature control sequence.
5. If after a 60 second delay (adjustable) the fan's current sensing switch does not provide status, then the fan will be shut down and an alarm will be generated.

C. Setpoints:
1. Program temperature setpoints
   a. Occupied Active Temperature Setpoint (°F) per reset schedule
      1) 68°F @ 40°F outside ambient
      2) 74°F @ 80°F outside ambient
   b. Unoccupied Cooling Temperature Setpoint (°F)
      1) 55°F @ 40°F outside ambient
      2) 80°F @ 80°F outside ambient
   c. Setpoint dead band (adjustable) shall be no less than 2°F
   d. Reset adjustments shall be no less than 3°F (adj.) per step
   e. Setpoints shall be field adjustable at a 0 to +/-1.5°F (adj.) offset from occupied active setpoints

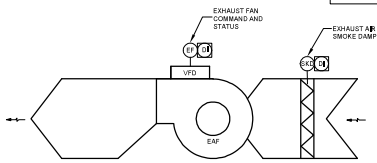
D. Temperature Control
1. The thermostat's zone temperature sensor shall control the cooling valve and the heating valve in sequence to maintain zone air temperature setpoint. Ensure simultaneous heating and cooling does not occur.
2. The cooling mode shall be enabled when the zone temperature rises above setpoint plus half of the dead band. The heating mode shall be enabled when the zone temperature falls below setpoint minus half of the dead band. The FCU shall remain in cooling or heating modes until conditions initiate a cooling or heating mode change.
3. Cooling Mode
   a. In the cooling mode, a rise in zone temperature above setpoint shall cause the cooling coil control valve to be modulated open to maintain setpoint. On a fall in zone temperature, the reverse sequence shall occur.

E.

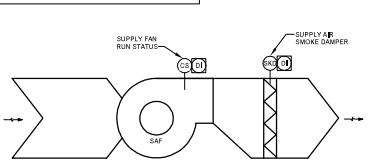


3 MC-722 FAN COIL UNIT FLOW DIAGRAM/SCHEMATIC (NO HEAT)
SCALE: NONE

System: FCU-1 & FCU-2										
Point Description	Point Function	Hardware Points						Software Points		Show on Grap ic	Notes / Device
		AI	DI	AO	DO	AV	BV	Trend	Interval	
Zone Sensor, Temperature	Temperature Monitoring	•						•	15 min	•	Wall Mounted Temperature Sensor
Zone Sensor, Setpoint Adjust	Occupant Setpoint Adjust	•							15 min	•	Slide adjust input integral to sensor
FCU Discharge Air Temp Sensor	Temperature Monitoring	•						•	15 min	•	Duct Temperature Sensor downstream of heater
Supply Air Fan Command	Optimized Scheduling				•			•	COS	•	Control Relay contact output to fan starter
Supply Air Fan Run Status	Equipment Monitoring		•					•	15 min	•	Current sensing status switch in fan starter
CHW Contrl Valve	Temperature Control			•				•	16 min	•	New Valve and Actuator, 0-10v
Electric Heater Stages (HTR-C)	Temperature Control				•			•	15 min	•	Control Relay contact output to fan starter



4 M-722 EXHAUST FANS MONITOR & CONTROL DIAGRAM
SCALE: NONE



5 M-722 SMOKE CONTROL SUPPLY FAN MONITOR ONLY DIAGRAM
SCALE: NONE

System: Smoke Supply Fans | SF-A1, SF-A2 SPF-1 & SPF-2									
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Supply Fan Run Status (SF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Supply Fan Fire/Smoke Damper (FD-SF)			•						Confirm Interlock operation	Verify existing

Note 1: Locations for SF-A1, SF-A2 refer to MC-20PH, SPF-1 & SPF-2 refer to MC-20B

Note 2: Equipment status may also be obtained from Fire Alarm System BACnet interface at contractor's discretion

System: Exhaust Fan | EF-R.1 thru EF-R-4, EF.R-6 AND EF-11									
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Exhaust Far Run Status (ExF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Exhaust Far Fire/Smoke Damper (FD-SF)			•						Confirm Interlock operation	Verify existing

Note 1: ..ocations for EF-R.1 thru EF-R-4, EF-R-6 AND EF-11 refer to MC-20PH

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SCALE AS INDICATED
ISSUE DATE 11/18/2019

DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SCHEMATICS

DRAWING NO.
MC-722

ISSUED FOR BID

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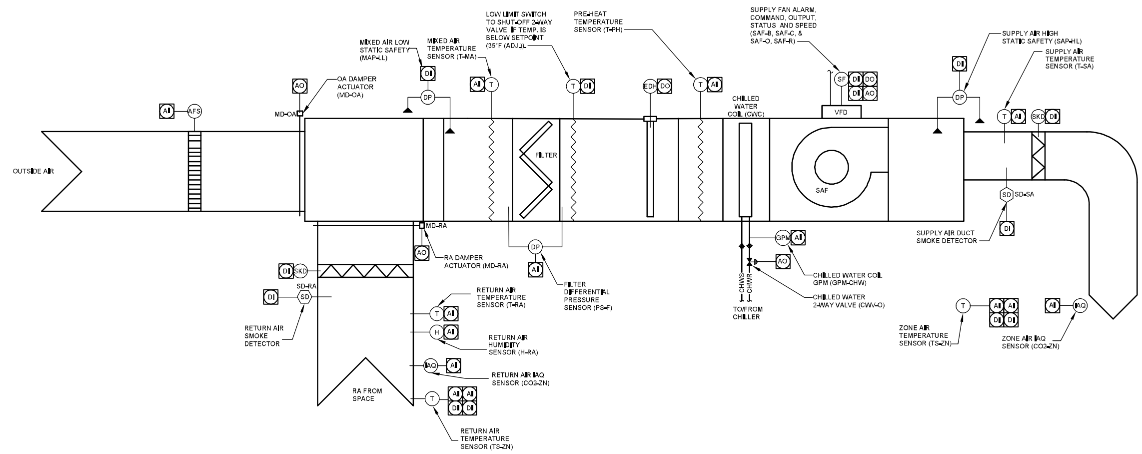

System: Single Zone (Courtroom) Variable Volume CHW AHU with Electric Duct Preheat | AHUs-6E, 6W, 8E, 8C, 8W, 9E, 9W										
Point Description	Hardware Points				Software Points			Show on Graphic	Point Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Supply Air Fan VFD Command (SAF-C)				•	•	COS	•	•	Control Relay output to VFD	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan VFD Bypass Status (SAF-B)			•			15 Min	•	•	Dry contact output from VFD	r/a
Supply Air Fan VFD Run Status (SAF-R)			•		•	COS	•	•	Dry contact output from VFD	r/a
Supply Air Fan VFD Speed Output (SAF-O)		•			•	15 Min		•	Analog control signal to VFD	r/a
Chilled Water 2-Way Control Valve (CWV-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator Control Signal	See Schedule
Chilled Water Coil GPM (GPM-CHW)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Electric Duct Heater Stages (HTR-C)				•	•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, or possible integration	r/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, or possible integration	r/a
Supply Air Smoke Damper (SKD-SA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Return Air Smoke Damper (SKD-RA)			•					•	Damper Position End Switch	KELE TS-470 Damper End Switch
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Differntial Pressure Sensor	VERIS FXPLX02S
Mixed Temp Sensor (T-MA)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
PreHeat Air Temp Sensor (T-PH)	•				•	15 Min		•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor	VERIS TFECR02
Low Limit Mixed Air Temp Safety (T-LL)			•			COS	•	•	Manual Reset Lo-Cutout Temp Sensor	PENN A70HA-1C
Supply Air High Static Safety - (SAP-HL)			•			COS	•	•	Manual Reset Hi-Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
Mixed Air Low Static Safety - (MAP-LL)			•			COS	•	•	Manual Reset Lo-Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
Return Air Humidity Sensor (H-RA)	•				•	15 Min		•	Duct %RH sensor, return air	VERIS HD2XVSX
Return Air IAQ Sensor (Q-ZN)	•				•	15 Min	•	•	Duct CO2 sensor, return air	VERIS CWE (Wall) or VERIS CDE (Duct)
Zone Air IAQ Sensor (Q-ZN)	•				•	15 Min	•	•	Duct CO2 sensor, zone air	VERIS CWE (Wall) or VERIS CDE (Duct)
Zone Air Humidity Sensor (H-ZN)	•				•	15 Min		•	Duct %RH sensor, zone air	VERIS HD2XVSX
OA Damper Actuator - (MD-OA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
RA Damper Actuator - (MD-RA)		•			•	15 Min		•	New damper actuator	BELIMO LMB/NMB/AMB/GMB24-SR Actuator
OA Flow Station - (CFM-OA)	•				•	15 Min		•	Alternatively, can be a calculate value (SA-RA)	Refer to Drawing Note 6
Exhaust Fan Command (ExF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Exhaust Fan Run Status (ExF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Supply Fan Command (SF-C)				•	•	COS	•	•	Control Relay output to Fan Starter	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Fan Run Status (SF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing

1 (M-723) CHILLED WATER SINGLE ZONE VAV AIR HANDLING UNIT, SINGLE FAN ELECTRIC PREHEAT WITH COOLING COIL (TYP.)

SCALE: NONE

FCGC SINGLE ZONE CHILLED WATER VAV AIR HANDLING UNIT, SINGLE FAN ELECTRIC PREHEAT WITH COOLING COIL

A. GENERAL
1. PROGRAMS AND SEQUENCES INDICATED OR IMPLIED HEREIN SHALL BE PROVIDED.
2. PROVIDE ALL I/O POINTS INDICATED ON THE CONTROL DIAGRAM AND AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATION.
3. ALL WIRE TERMINALS, DEVICES, GAUGES AND WIRES SHALL BE IDENTIFIED WITHIN THE PANELS.
4. DAMPERS AND END SWITCHES SHALL BE INTERLOCKED SUCH THAT THEY WILL OPERATE PER THE SEQUENCE BELOW IN EITHER AUTO, HAND OR OFF ON THE VFD/MCC.
5. ALL POINTS SHALL BE ABLE TO INTEGRATE TO ALL TRENDS, TOTALIZATIONS, ETC., AS APPLICABLE.
6. ALL ALARMS AS INDICATED ON THE DIAGRAMS IN THE SEQUENCE OF OPERATION SHALL BE GENERATED TO THE APPROPRIATE SERVER/WORKSTATIONS.

B. START/STOP
1. THE UNIT NORMALLY OPERATES CONTINUOUSLY WITH REMOTELY CAPABILITY FOR START/STOP/SCHEDULING FUNCTIONS.
2. TIME SCHEDULING SHALL INCLUDE 7-DAY TIME OF DAY PROGRAMMING, EXTENDED TIME PERIOD SCHEDULING (HOLIDAY) AND SPECIAL EVENT PROGRAMMING (ONE TIME OVERRIDE PROGRAM).
3. THE H.O.A. SWITCH SHALL BE KEPT IN THE "AUTO" POSITION. "HAND" AND "OFF" POSITIONS SHALL BE UTILIZED FOR MAINTENANCE PURPOSES. WHEN THE AIR HANDLING UNIT IS OFF, THE OUTSIDE DAMPER SHALL BE CLOSED AND THE RETURN DAMPER OPEN.
4. WHEN THE UNIT RECEIVES A START COMMAND, THE OUTSIDE DAMPER SHALL OPEN TO ITS MINIMUM POSITION WITH RETURN DAMPER TRACKING IN OPPOSITE ACTION. THE SUPPLY AND RETURN SMOKE DAMPERS (WHERE APPLICABLE) SHALL OPEN AND PROOF PROVIDED BY THEIR RESPECTIVE END SWITCHES. WHEN THE END SWITCHES PROVE OPEN VIA HARDWIRE INTERLOCK, THE SUPPLY FAN SHALL START AT MINIMUM SPEED, 50% (ADJ.).
5. IF AFTER A 60 SECOND DELAY (ADJUSTABLE) THE FAN DOES NOT PROVIDE STATUS OR THE VFD PROVIDES AN ALARM CONDITION, THEN THE FAN WILL BE SHUT DOWN, THE OUTSIDE DAMPER WILL CLOSE, AND THE RETURN DAMPER WILL OPEN. AN ALARM WILL BE GENERATED, AND THE UNIT WILL BE LOCKED OUT IN SOFTWARE.
6. UPON CONFIRMATION FROM THE VFD THAT THE SUPPLY FAN IS RUNNING, THE FAN SHALL MODULATE AS INDICATED BELOW FOR CONTROL AND EXHAUST FANS SHALL BE ENERGIZED.
7. THE OUTSIDE AIR DAMPERS SHALL MODULATE IN UNISON WITH THE RETURN DAMPER MODULATING IN OPPOSITE ACTION TO PROVIDE A MINIMUM OUTSIDE AIR FLOW SETPOINT AS INDICATED ON AHU SCHEDULES (ADJUSTABLE).

C. ZONE TEMPERATURE CONTROL
1. A SINGLE PROPORTIONAL INTEGRAL DERIVATIVE (PID) CONTROL ROUTINE SHALL BE USED TO MODULATE THE AHU FAN, CHILLED WATER VALVE AND STAGE ELECTRIC HEAT TO MAINTAIN SETPOINT.
   a. ZONE TEMPERATURE SHALL BE MEASURED AT THE SPACE SENSOR IN THE ZONE AND IN THE RETURN AIR DUCT.
   b. THE CONTROLLER SHALL CONTROL TO EITHER THE MAXIMUM OF SPACE OR RETURN AIR TEMPERATURE, THE AVERAGE OF THE SPACE AND RETURN AIR TEMPERATURE, OR EITHER THE SPACE OR RETURN TEMPERATURE AS SELECTED BY THE OPERATOR.
2. PROGRAM TEMPERATURE SETPOINTS
   a. OCCUPIED ACTIVE TEMPERATURE SETPOINT (°F) PER RESET SCHEDULE
      1) 68°F @ 20°F OUTSIDE AMBIENT
      2) 74°F @ 80°F OUTSIDE AMBIENT
   b. UNOCCUPIED COOLING TEMPERATURE SETPOINT (°F) - 85°F
   c. UNOCCUPIED HEATING TEMPERATURE SETPOINT (°F) - 60°F
   d. SETPOINT DEAD BAND (ADJUSTABLE) SHALL BE NO LESS THAN 2°F
3. THE CONTROLLER OUTPUT SHALL MODULATE FROM 0% TO 100% WHERE 0% REPRESENTS FULL DEMAND FOR HEATING AND 100% REPRESENTS FULL DEMAND FOR COOLING. THE AHU FAN, CHILLED WATER VALVE AND HEAT STAGING SHALL OPERATE USING THE FOLLOWING SEQUENCE:
   a. AT 100% DEMAND FOR COOLING, THE VFD SHALL BE AT 100% AND THE CHILLED WATER VALVE SHALL MAINTAIN SUPPLY AIR TEMPERATURE SETPOINT OF 55° F (ADJ.). AS ZONE TEMPERATURE FALLS BELOW SETPOINT, THE VFD SHALL MODULATE FROM 100% AIRFLOW TO 50% AIRFLOW (CFM) AS THE CONTROLLER OUTPUT RANGES FROM 100% TO 55%.
   b. THE CHILLED WATER VALVE SHALL MODULATE TO MAINTAIN SUPPLY AIR TEMPERATURE AT SETPOINT.
      1) SUPPLY AIR SETPOINT SHALL BE RESET WHEN THE AHU VFD SPEED IS AT MINIMUM (50% SPEED) AND THE CONTROLLER OUTPUT FALLS BELOW 55%. REFER TO ENERGY CONSERVATION MEASURES, PARAGRAPH F.1.
      2) WHEN THE CONTROLLER OUTPUT FALLS BELOW 45%, THE CHILLED WATER VALVE SHOULD BE FULLY CLOSED.
   c. ON A FURTHER DROP IN CONTROLLER OUTPUT BELOW 45%, THE HEATING SHALL STAGE ON. AS THE CONTROLLER OUTPUT RANGES FROM 45% TO 0%, THE HEATING SHALL STAGE FROM MINIMUM TO MAXIMUM IN EQUAL STEPS AND THE VFD SHALL MODULATE FROM 50% AIRFLOW TO 100% AIRFLOW.
   d. ON A RISE IN CONTROLLER OUTPUT, THE REVERSE SEQUENCE SHALL OCCUR.
   e. OTHER THAN FOR LOW LIMIT MIXED AIR TEMPERATURE CONTROL, HEAT SHALL NOT BE ALLOWED TO OPERATE WHEN THE CHILLED WATER VALVE IS OPEN.
4. PRE-HEAT SEQUENCE FOR LOW LIMIT CONTROL
   a. A MIXED AIR LOW LIMIT CONTROL SHALL OVERRIDE THE HEAT CONTROL SEQUENCE IF THE MIXED AIR TEMPERATURE FALLS BELOW 45 °F (ADJ.). DURING COLD WEATHER STARTUP OF THE AIR HANDLING UNIT THE MIXED AIR LOW LIMIT SEQUENCE SHALL ALSO PREVENT NUISANCE TRIPPING OF THE LOW LIMIT TEMPERATURE THERMOSTATS.
5. HUMIDITY OVERRIDE
   a. IF AT ANY TIME DURING THE ZONE TEMPERATURE CONTROL SEQUENCE ABOVE THE RETURN AIR RELATIVE HUMIDITY RISES ABOVE 65% (ADJ.), THE CHILLED WATER VALVE CONTROL SHALL BE OVERRIDDEN TO CONTROL SUPPLY AIR TEMPERATURE TO 55°F. THE ZONE TEMPERATURE CONTROL ROUTINE SHALL RESUME WHEN THE RETURN AIR RELATIVE HUMIDITY FALLS BELOW 55%.

D. FILTERS
1. THERE SHALL BE AN ANALOG DIFFERENTIAL PRESSURE SENSOR FOR EACH INDIVIDUAL FILTER BANK WITHIN THE AHU.
2. AN ALARM SHALL BE GENERATED WHEN THE PRESSURE ACROSS THE FILTER BANK RISES ABOVE THE DIRTY FILTER SETPOINT AS INDICATED ON THE AHU FILTER SCHEDULES (ADJUSTABLE).

E. SAFETY INTERLOCKS, WHERE APPLICABLE, SEE POINTS LIST
1. THE HIGH DISCHARGE STATIC PRESSURE SAFETY LOCATED ON THE DISCHARGE OF THE SUPPLY FAN IN THE UNIT HOUSING SHALL BE SET AS SCHEDULED FOR 1"W.C. ABOVE THE TOTAL PRESSURE RATING OF THE SUPPLY FAN AS INDICATED ON THE AHU SCHEDULE. IF THE PRESSURE SETTING IS EXCEEDED, THE SAFETY WILL TRIP AND, VIA HARDWIRE INTERLOCK TO THE SUPPLY FAN'S VFD, SHUTDOWN THE FAN. THIS SAFETY SHALL OPERATE IN EITHER HAND OR AUTO ON THE VFD'S AND SHALL BE RESET MANUALLY. IF THE SUPPLY FAN IS SHUT DOWN BY SAFETY, THE ASSOCIATED SUPPLY AND EXHAUST FAN(S) SHALL ALSO BE SHUT DOWN.
2. THE LOW SUCTION STATIC PRESSURE SAFETY LOCATED ON THE SUCTION SIDE OF THE SUPPLY FAN IN THE UNIT HOUSING SHALL BE SET AS SCHEDULED FOR 1"W.C. ABOVE THE TOTAL PRESSURE RATING OF THE SUPPLY FAN AS INDICATED ON THE AHU SCHEDULE. IF THE PRESSURE SETTING IS EXCEEDED, THE SAFETY WILL TRIP AND, VIA HARDWIRE INTERLOCK TO THE SUPPLY FAN'S VFD, SHUTDOWN THE FAN. THIS SAFETY SHALL OPERATE IN EITHER HAND OR AUTO ON THE VFD AND SHALL BE RESET MANUALLY. IF THE SUPPLY FAN IS SHUT DOWN BY SAFETY, THE ASSOCIATED SUPPLY AND EXHAUST FAN(S) SHALL ALSO BE SHUT DOWN.
3. ENSURE THAT WHEN SMOKE IS DETECTED BY THE SUPPLY OR RETURN DUCT SMOKE DETECTORS, THE SUPPLY FAN SHALL SHUT "OFF", THE SUPPLY AND RETURN (WHERE APPLICABLE) SMOKE ISOLATION DAMPER SHALL CLOSE, AND AN ALARM SHALL BE GENERATED. AHU SUPPLY FAN AND ASSOCIATED SUPPLY AND EXHAUST FANS SHALL RESTART, AND UNIT ISOLATION DAMPERS SHALL OPEN WHEN FIRE ALARM CIRCUIT IS RESET.
4. PROVIDE A LOW TEMPERATURE THERMOSTAT (FREEZE STAT) AT THE DOWNSTREAM SECTION OF THE COOLING COIL WHICH WILL STOP THE UNIT IF THE PREHEAT DISCHARGE TEMPERATURE FALLS BELOW 38 °F (ADJ.) AND AN ALARM SHALL BE GENERATED. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO OPEN.
5. SYSTEM FIRE/SMOKE DAMPERS
   a. IF THE FIRE/SMOKE DAMPERS ASSOCIATED WITH THE UNIT ARE NOT 100% OPEN AFTER A 3 MINUTE (ADJ.) DELAY AFTER STARTUP, AN ALARM WILL BE GENERATED.

F. ENERGY CONSERVATION MEASURES
1. AIR HANDLING UNIT SUPPLY AIR TEMPERATURE RESET
   a. WHEN THE AHU VFD SPEED IS AT MINIMUM (50% SPEED) AND THE ZONE TEMPERATURE CONTROL PID FALLS BELOW 55%, THE SUPPLY AIR TEMPERATURE SETPOINT SHALL BE RESET TO MINIMIZE OVERCOOLING THE ZONE.
      1) THE SUPPLY AIR TEMPERATURE RESET ROUTINE SHALL PROVIDE A MAXIMUM SUPPLY AIR TEMPERATURE SETPOINT OF 65 °F (ADJ.) DURING COOLING MODE IN 0.5 °F INCREMENTS BASED ON ZONE TEMPERATURE DEVIATION FROM ZONE SETPOINT. THE CALCULATION CHANGE SHALL OCCUR EVERY 10 MINUTES (ADJ.).
         (a) THE SUPPLY AIR TEMPERATURE SETPOINT WILL BE INCREASED WHEN THE ZONE TEMPERATURE FALLS MORE THAN 2 °F (ADJ.) BELOW ZONE SETPOINT.
         (b) THE SUPPLY AIR TEMPERATURE SETPOINT WILL BE INCREASED WHEN THE ZONE TEMPERATURE RISES ABOVE ZONE SETPOINT.
   b. THE SUPPLY AIR TEMPERATURE RESET ROUTINE SHALL BE DISCONTINUED WHEN THE AND THE SUPPLY AIR SETPOINT RETURNED TO 55 °F SHOULD ZONE HUMIDITY RISE ABOVE 60% OR THE AHU VFD SPEED RISE ABOVE 65%.
2. CO2 CONTROL FOR HIGH DENSITY SPACES
   a. THE MINIMUM OUTSIDE AIR FLOW SETPOINT SHALL BE RESET BASED ON MEASURING RETURN AIR CARBON DIOXIDE (CO2) AND REDUCING OR INCREASING OUTSIDE AIR VOLUMES TO MAINTAIN PROPER CO2 LEVELS FOR DEMAND-CONTROLLED VENTILATION (DCV).
   b. RESET THE OUTSIDE AIR VOLUME SETPOINT DOWNWARD TO A MINIMUM OF 30% OF SCHEDULED VALUE USING A PROPORTIONAL INTEGRAL DERIVATIVE (PID) CONTROL ROUTINE TO MAINTAIN AVERAGE CO2 LEVELS AT 800 PPM OR LESS.
3. OPTIMAL START, MORNING WARMUP AND COOL DOWN
   a. REGARDLESS IF THE UNIT IS DETERMINED TO RUN CONTINUOUSLY, IN THE EVENT THAT A SCHEDULE IS IMPLEMENTED THE UNIT SHALL BE PROGRAMMED TO PROVIDE AN OPTIMAL START/STOP ROUTINE WHICH SHALL AUTOMATICALLY RAMP THE BUILDING TEMPERATURES FOR THE OPTIMAL START AND STOP TIMES TO CONSERVE ENERGY WHILE MAINTAINING SPACE TEMPERATURE SETPOINTS. WHERE APPLICABLE THIS STRATEGY SHALL INCLUDE BUT NOT BE LIMITED TO INCORPORATING TERMINAL UNIT OVERRIDE FOR ZONES SPECIFICALLY ASSOCIATED TO THIS AHU TO HELP IMPLEMENT THIS ROUTINE.
   b. WHEN THE AHU IS STARTED PRIOR TO SCHEDULED START TIME BY THE OPTIMAL START/STOP ROUTINE, THE UNIT SHALL BE CONSIDERED TO BE IN WARM UP OR COOL DOWN MODE. THE AHU SHALL FOLLOW NORMAL ITS STARTUP SEQUENCE EXCEPT THAT THE OUTSIDE AIR DAMPERS SHALL REMAIN CLOSED, THE RETURN AIR DAMPER SHALL REMAIN FULLY OPEN AND ASSOCIATED SUPPLY AND EXHAUST FANS SHALL REMAIN OFF.
   c. DURING THE COOL DOWN MODE, OUTSIDE AND RETURN AIR ENTHALPY CONDITIONS SHALL BE VERIFIED. IF ECONOMIZER MODE IS ENABLED, THE OUTSIDE AIR DAMPERS SHALL FOLLOW THE ECONOMIZER SEQUENCE AND THE COOL DOWN MODE SHALL BE OVERRIDDEN.
4. SETBACK MODE
   a. DURING UNOCCUPIED MODE, IF THE ZONE TEMPERATURE FALLS BELOW THE UNOCCUPIED HEATING SETPOINTS BY 2°F (ADJUSTABLE), THE AHU SHALL START IN SETBACK MODE. AHU SHALL CONTINUE TO RUN UNTIL THE ZONE TEMPERATURE REACHES THE UNOCCUPIED SETPOINT.
   b. THE AHU SHALL FOLLOW NORMAL ITS STARTUP SEQUENCE EXCEPT THAT THE OUTSIDE AIR DAMPERS SHALL REMAIN CLOSED, THE RETURN AIR DAMPER SHALL REMAIN FULLY OPEN AND ASSOCIATED SUPPLY AND EXHAUST FANS SHALL REMAIN OFF.
5. SETUP MODE
   a. DURING UNOCCUPIED MODE, IF THE ZONE TEMPERATURE RISES ABOVE THE UNOCCUPIED COOLING SETPOINTS BY 2°F (ADJUSTABLE), THE AHU SHALL START IN SET-UP MODE. AHU SHALL CONTINUE TO RUN UNTIL THE ZONE TEMPERATURE REACHES THE UNOCCUPIED SETPOINT.
   b. THE AHU SHALL FOLLOW NORMAL ITS STARTUP SEQUENCE EXCEPT THAT THE OUTSIDE AIR DAMPERS SHALL REMAIN CLOSED, THE RETURN AIR DAMPER SHALL REMAIN FULLY OPEN AND ASSOCIATED SUPPLY AND EXHAUST FANS SHALL REMAIN OFF.
   c. DURING THE SETUP MODE, OUTSIDE AND RETURN AIR ENTHALPY CONDITIONS SHALL BE VERIFIED. IF ECONOMIZER MODE IS ENABLED, THE OUTSIDE AIR DAMPERS SHALL FOLLOW THE ECONOMIZER SEQUENCE.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED		
NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
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DRAWING TITLE
MECHANICAL CONTROLS - FULTON COUNTY COURTHOUSE - SCHEMATICS

DRAWING NO.
MC-723

ISSUED FOR BID

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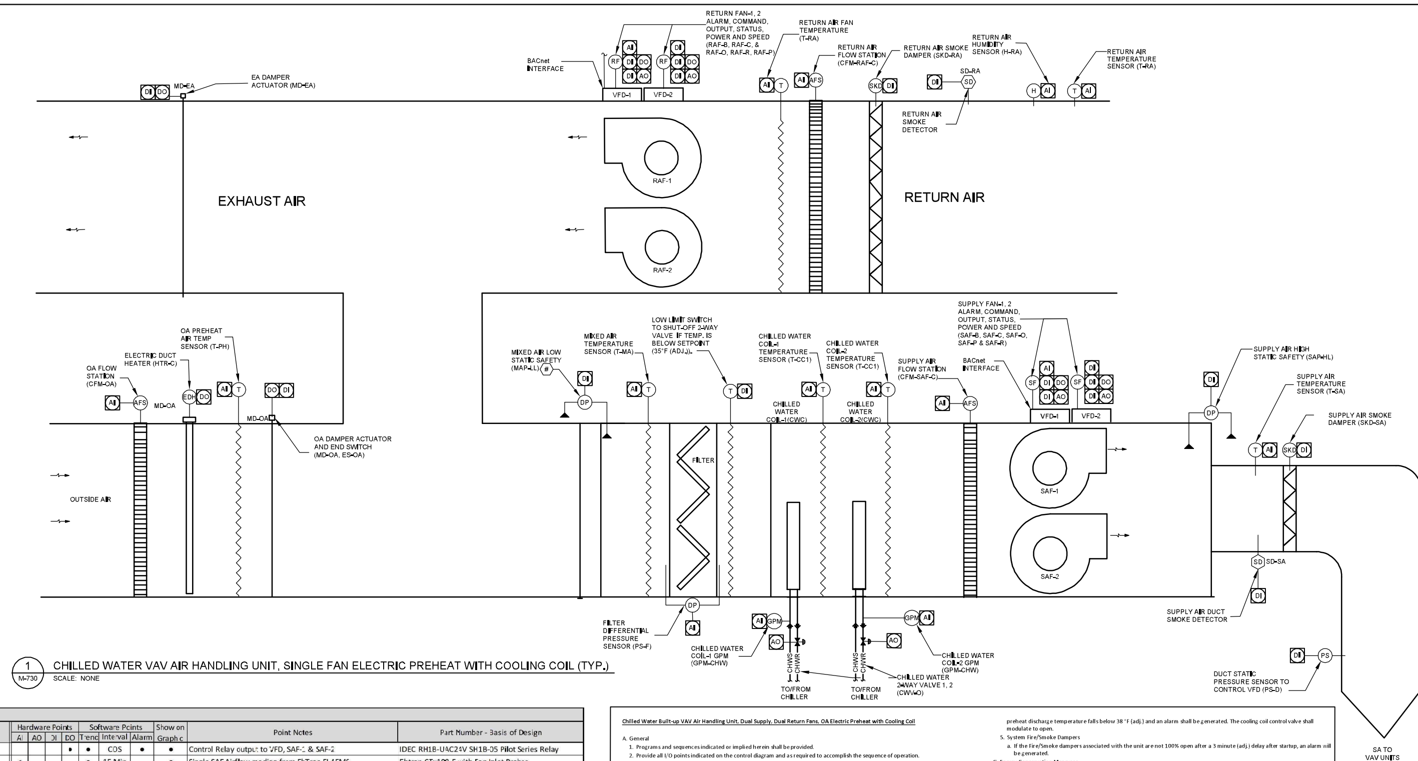

1 M-730 CHILLED WATER VAV AIR HANDLING UNIT, SINGLE FAN ELECTRIC PREHEAT WITH COOLING COIL (TYP.)
SCALE: NONE

System: Variable Volume CHW AHU | AHU-1

Point Description	Hardware Points AI	AO	DI	DO	Software Points Trend	Interval	Alarm	Show on Graphic	Point Notes	Part Number - Basis of Design
Supply Air Fan-1,2 VFD Command (SAF-C)				•	•	COS	•	•	Control Relay output to VFD, SAF-1 & SAF-2	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Supply Air Fan-1,2 Flow Station - (CFM-SA)	•				•	15 Min		•	Single SAF Airflow reading from EbTron FI AFMS	Ebtron GTx108-F with Fan Inlet Probes
Supply Air Fan-1,2 Inlet Temperature - (T-MA)	•				•	15 Min		•	Single SAF Inlet Temperature reading from EbTron FI AFMS	Ebtron GTx108-F with Fan Inlet Probes
Supply Air Fan-1 VFD Speed Output (SAF-C)		•			•	15 Min		•	Analog control signal to VFD, SAF-1	n/a
Supply Air Fan-2 VFD Speed Output (SAF-C)		•			•	15 Min		•	Analog control signal to VFD, SAF-2	n/a
Supply Air Fan-1 VFD Bypass Status (SAF-B)			•			15 Min	•	•	Dry contact output from VFD, SAF-1	n/a
Supply Air Fan-2 VFD Bypass Status (SAF-B)			•			15 Min	•	•	Dry contact output from VFD, SAF-2	n/a
Supply Air Fan-1 VFD Power (SAF-P)	•				•	COS	•	•	Dry contact output from VFD, SAF-1	n/a
Supply Air Fan-2 VFD Power (SAF-P)			•		•	COS	•	•	Dry contact output from VFD, SAF-2	n/a
Supply Air Fan-1 VFD Run Status (SAF-R)			•		•	COS	•	•	Dry contact output from VFD, SAF-1	n/a
Supply Air Fan-2 VFD Run Status (SAF-R)			•		•	COS	•	•	Dry contact output from VFD, SAF-2	n/a
Return Air Fan-1,2 VFD Command (RAF-C)				•	•	COS	•	•	Control Relay output to VFD, RAF-1 & RAF-2	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
Return Air Fan-1,2 Flow Station - (CFM-RA)	•				•	15 Min		•	Single RAF Airflow reading from EbTron FI AFMS	Ebtron GTx108-F with Fan Inlet Probes
Return Air Fan-1,2 Inlet Temperature - (T-RA)	•				•	15 Min		•	Single RAF Inlet Temperature reading from EbTron FI AFMS	Ebtron GTx108-F with Fan Inlet Probes
Return Air Fan-1 VFD Speed Output (RAF-O)		•			•	15 Min		•	Analog control signal to VFD, RAF-1	n/a
Return Air Fan-2 VFD Speed Output (RAF-O)		•			•	15 Min		•	Analog control signal to VFD, RAF-2	n/a
Return Air Fan VFD Bypass Status (RAF-B)			•			15 Min	•	•	Dry contact output from VFD, RAF-1	n/a
Return Air Fan VFD Bypass Status (RAF-B)			•			15 Min	•	•	Dry contact output from VFD, RAF-2	n/a
Return Air Fan-1 VFD Power (RAF-P)	•				•	COS	•	•	Dry contact output from VFD, SAF-1	n/a
Return Air Fan-2 VFD Power (RAF-P)			•		•	COS	•	•	Dry contact output from VFD, SAF-2	n/a
Return Air Fan VFD Run Status (RAF-R)			•		•	COS	•	•	Dry contact output from VFD, RAF-1	n/a
Return Air Fan VFD Run Status (RAF-R)			•		•	COS	•	•	Dry contact output from VFD, RAF-2	n/a
Chilled Water 2-Way Control Valve-1 (CV1-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator Control Signal	See Schedule
Chilled Water Coil-1 GPM (GPM-CV1)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Chilled Water Coil-1 Temperature Sensor (T-CC1)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Chilled Water 2-Way Control Valve-2 (CV2-O)		•			•	15 Min		•	New PI-CHW Valve and Actuator Control Signal	See Schedule
Chilled Water Coil-2 GPM (GPM-CV2)	•				•	15 Min		•	New PI-CHW Valve and Actuator Feedback Signal	See Schedule
Chilled Water Coil-2 Temperature Sensor (T-CC2)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Supply Air Duct Smoke Detector (SD-SA)			•				•	•	Dry contact from SD, Qty as required	n/a
Return Air Duct Smoke Detector (SD-RA)			•				•	•	Dry contact from SD, Qty as required	n/a
Supply Air Smoke Damper (SKD-SA)			•					•	Damper Position End Switch, Qty as required	KELE TS-470 Damper End Switch
Return Air Smoke Damper (SKD-RA)			•					•	Damper Position End Switch, Qty as required	KELE TS-470 Damper End Switch
Filter Differential Pressure Sensor - (PS-F)	•				•	15 Min	•	•	Filter Differential Pressure Sensor	VERIS PXPLX02S
Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	RA Fan Inlet Temp Readings from EbTron	n/a
Return Air Humidity Sensor (H-RA)	•				•	15 Min		•	Duct %RH Average Sensor Readings from Floor Sensors	n/a
Mixed Temp Sensor (T-MA)	•				•	15 Min	•	•	SA Fan Inlet Temp Readings from EbTron	n/a
Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Average Static Pressure Readings from Floor Sensors	n/a
Low Limit Mixed Air Temp Safety (T-LL)			•			COS	•	•	Manual Reset Lo-Cutout Temp Sensor	PENN A70HA-1C
Supply Air High Static Safety - (SAP-HL)			•			COS	•	•	Manual Reset Hi-Cutout Pressure Sensor	CLEVELAND AFS-460-DSS
OA Damper Actuator - (MD-OA)				•	•	15 Min		•	New damper actuator - interlock with fan starter	BELIMO LME/NMB/AMB/GMB24-SF Actuator
OA Damper Actuator End Switch - (ES-OA)			•			COS		•	Damper /Actuator Position End Switch	BELIMO LME/NMB/AMB/GMB24-SF Actuator
OA Electric Duct Heater Stages (HTR-C)				•	•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	IDEC RH1B-UAC24V SH1B-05 Pilot Series Relay
OA PreHeat Air Temp Sensor (T-PH)	•				•	15 Min	•	•	Duct Averaging RTD Temperature Sensor	VERIS TAHC2
EA Damper Actuator - (MD-EA)				•	•	15 Min		•	New damper actuator - interlock with fan starter	BELIMO LME/NMB/AMB/GMB24-SF Actuator
EA Damper Actuator End Switch - (ES-EA)			•			COS		•	Damper /Actuator Position End Switch	BELIMO LME/NMB/AMB/GMB24-SF Actuator
Supply Fan Fire/Smoke Damper (FD-SF)									Confirm Interlock operation	Verify existing

Chilled Water Built-up VAV Air Handling Unit, Dual Supply, Dual Return Fans, OA Electric Preheat with Cooling Coil

A. General

1. Programs and sequences indicated or implied herein shall be provided.
2. Provide all I/O points indicated on the control diagram and as required to accomplish the sequence of operation.
3. All wire terminals, devices, gauges and wires shall be identified within the panels.
4. Dampers and end switches shall be interlocked such that they will operate per the sequence below in either auto, hand or off on the VFDs.
5. All points shall be able to integrate to all trends, totalizations, etc., as applicable.
6. All alarms as indicated on the diagrams in the sequence of operation shall be generated to the appropriate server/workstations.

B. Start/Stop

1. The unit normally operates continuously with remotely capability for start/stop/scheduling functions.
2. Time scheduling shall include 7-day time of day programming, extended time period scheduling (holiday) and special event programming (one time override program).
3. The H.O.A. switch shall be kept in the "auto" position. "Hand" and "Off" positions shall be utilized for maintenance purposes. When the air handling unit is off, the outside damper shall be closed and the return damper open.
4. When the unit receives a start command, the outside damper shall open. The supply and return smoke dampers (where applicable) shall open and proof provided by their respective end switches. When the end switches prove open via hardwire interlock, the supply and return fans shall start.
5. Both supply fans shall always start simultaneously at minimum speed to ensure either fan does not operate in reverse direction.
6. Both return fans shall always start simultaneously at minimum speed to ensure either fan does not operate in reverse direction.
7. Upon confirmation from the VFDs that all supply and return fans are running, the fan shall modulate as indicated below for proper airflow and static pressure control, and the associated supply and exhaust fans shall be energized.
8. If after a 60 second delay (adjustable) the fan does not provide status or the VFD provides an alarm condition, then all fans will be shut down, the outside damper will close, and the return damper will open. An alarm will be generated, and the unit will be locked out in software.

C. Supply and Return Fan Airflow Control

1. Upon start-up of the supply and return fans, the BAS panel shall monitor the static pressure signals for the AHU system. The speed of the supply fan shall increase via hardwire connection to the respective supply fan VFDs to maintain setpoint at the duct mounted static pressure sensors located on the floors.
   a. The BAS shall monitor static pressure on each floor of the JCB. The average static pressure and the minimum static pressure values shall be calculated and provided to the AHU controller.
   b. The supply air fan speed shall be controlled by modulating the fan VFDs using a PID control loop to maintain the initial duct static pressure of 1.5 inches of water gauge minimum (adjustable) on the floor with the highest demand (lowest static pressure reading).
   c. The supply fan airflow volume in CFM shall be read by the DDC from the fan inlet mounted air flow measuring stations. This reading shall be used for fan tracking and outside air control by modulating the return air fans based on return fan air volume setpoint.
2. The outside air volume requirements shall be maintained by keeping a percentage offset between the supply and return fan total air volumes.
   a. The return air fan speed shall be controlled modulating the fan VFDs using a PID control loop to maintain the return air fan total air volume, cfm, equal to the supply air total volume less twenty one percent (21%), adjustable.
   b. Determine the outside air volume, in cfm, as the mathematical difference between the supply and return fan air volumes, and present on the user interface, as well as trend logging.
3. For Demand Controlled Ventilation (DCV), reset the outside air flow offset setpoint by measuring individual floor return air carbon dioxide (CO2) and reducing or increasing the supply and return fan percentage air volume offset to maintain proper CO2 levels.
   a. Reset the supply and return fan percentage air volume offset setpoint downward to a minimum of fifteen percent (15%), adjustable, using a proportional integral derivative (PID) control routine to maintain average CO2 levels at 800 ppm or less on the floor with the highest CO2 reading.

D. Temperature Control

1. The averaging temperature sensor in the common supply air stream shall control the cooling valves to maintain discharge air temperature setpoint.
   a. The two cooling coil control valves shall be modulated using a PID control loop in a cascade fashion to maintain discharge air setpoint.
   b. On an initial rise in discharge air temperature above setpoint, the primary cooling coil control valve will be modulated open.
   c. When the primary cooling coil control valve reaches fifty percent (50%) open, adjustable, and the discharge air temperature continues to rise above setpoint, the secondary cooling coil control valve will be modulated open.
   d. On a continued rise in discharge air temperature above setpoint, both cooling coil control valves will be modulated open with an offset between them. Once the primary cooling coil control valve reaches 100% open, the secondary cooling coil control valve will continue to open until it reaches 100% open.
   e. On a fall in discharge air temperature below setpoint, the opposite shall occur.
   f. The BAS operator shall have the ability to select and change which cooling coil control valves are primary and secondary at any time.
2. An averaging temperature sensor in the outside air duct entering the AHU shall control the electric duct heater to maintain outside air pre-heat temperature setpoint.
   a. Should the outside air temperature drop below setpoint, the electric pre-heat coil shall stage on to maintain outside air at 45 °F (adj.) using a PID control loop applied to the heating coil's multi-stages. On a rise in temperature above setpoint, the reverse shall occur, and heating shall be disabled.
   b. A mixed air low limit control shall override the discharge control sequence and stage the pre-heat coil on to maintain mixed air temperature is at 45 °F (adj.). During cold weather startup of the air handling unit the mixed air low limit override sequence shall also prevent nuisance tripping of the low limit temperature thermostats.

E. Filters

1. There shall be an analog differential pressure sensor for each individual filter bank within the AHU.
2. An alarm shall be generated when the pressure across the filter bank rises above the dirty filter setpoint as indicated on the AHU filter schedules (adjustable).

F. Safety Interlocks, where applicable, see points list

1. The high discharge static pressure safety located on the discharge of the supply fan in the unit housing shall be set as scheduled for 1"w.c. above the total pressure rating of the supply fan as indicated on the AHU schedule. If the pressure setting is exceeded, the safety will trip and, via hardwire interlock to the supply fan's VFD, shutdown the fan. This safety shall operate in either hand or auto on the VFD's and shall be reset manually. If the supply fan is shut down by safety, the associated supply and exhaust fan(s) shall also be shut down.
2. The low suction static pressure safety located on the suction side of the supply fan in the unit housing shall be set as scheduled for 1"w.c. above the total pressure rating of the supply fan as indicated on the AHU schedule. If the pressure setting is exceeded, the safety will trip and, via hardwire interlock to the supply fan's VFD, shutdown the fan. This safety shall operate in either hand or auto on the VFD and shall be reset manually. If the supply fan is shut down by safety, the associated supply and exhaust fan(s) shall also be shut down.
3. Ensure that when smoke is detected by the supply or return duct smoke detectors, the supply fan shall shut "off", the supply and return (where applicable) smoke isolation damper shall close, and an alarm shall be generated. AHU supply fan and associated supply and exhaust fans shall restart, and unit isolation dampers shall open when fire alarm circuit is reset.
4. Provide a low temperature thermostat (freeze stat) at the downstream section of the cooling coil which will stop the unit if the preheat discharge temperature falls below 38 °F (adj.) and an alarm shall be generated. The cooling coil control valve shall modulate to open.
5. System Fire/Smoke Dampers
   a. If the Fire/Smoke dampers associated with the unit are not 100% open after a 3 minute (adj.) delay after startup, an alarm will be generated.

G. Energy Conservation Measures

1. Air Handling Unit Static Pressure and Discharge Temperature Reset
   a. Static Pressure Reset shall be the primary energy conservation reset routine for air handling units.
      1) The static pressure reset routine shall permit a minimum duct static pressure of 0.5"w.c. (adj.) for all VAV AHUs during the cooling mode if all of the below mentioned criteria have been achieved. The supply VAV box damper position for all boxes serviced by this unit shall be monitored at 15 minute intervals (adj.) to determine the ability to automatically reset the supply static pressure setpoint for optimization.
         (a) The supply duct static pressure setpoint shall be reduced by 0.1"w.c. (adj.) if the damper position of the furthest open box is less than 85% (adj.),
         (b) The supply static pressure setpoint shall be increased by 0.1"w.c. (adj.) if the damper position of the furthest open box is greater equal to or greater than 90% (adj.),
      2) The reset routine alone should not cause any box to reach 100% open. If five or more boxes reach 100% open, the reset routine shall ramp the static pressure setpoint back to the starting static pressure setpoint over a 2 minute duration (adj.). An alarm shall be generated when the static pressure reaches the maximum allowable setting, and the reset routine shall be locked out in software. A manual reset shall be provided on the system graphic to allow the user to enable the routine again after the problem has been corrected.
   b. Discharge Air Temperature Reset shall be secondary to static pressure reset and shall not be enabled until the static pressure setpoint is at minimum and terminal units continue to experience overcooling, as measured by the terminal unit with the highest demand less than 50% open.
      1) The discharge air temperature reset routine shall provide a maximum discharge air temperature setpoint of 59 °F (adj.) for all AHU's during cooling mode in 0.5 °F increments if all of the below mentioned criteria has been achieved. The calculation for change shall occur every 15 minutes (adj.). If any one of the criteria is not met then the reset routine shall decrease the discharge air temperature setpoint in the reverse fashion to and not below the discharge air temperature. Only the VAV boxes served by the individual units shall be monitored for the basis of each AHU's calculations. The highest unit discharge temperature which is able to satisfy all normally operating zones will be determined as follows:
         (a) The discharge air dewpoint temperature shall not exceed 55 °F (adj.).
         (b) The discharge air temperature will be increased if all normally operating zones have been satisfied for one hour, the duct static pressure reset is at minimum setpoint, and all VAV boxes are less than 75% open.
         (c) The discharge air temperature will be decreased if any normally operating zones is almost unsatisfied. A zone will be deemed almost unsatisfied if its box is more than 95% open. For zones with constant volume boxes, a zone will be deemed unsatisfied if the zone temperature is not maintained.
         (d) Normally operating zones will be determined as follows: The BAS will poll the setpoints for each zone every 15 minutes and store that value until the next cycle. If the setpoint has been changed by more than 1 °F, the zone will be labeled as not normal. The operator will also have the ability to flag zones permanently as not normal.
      2) If any VAV box cooling command reaches 100% for a 20 min duration a warning shall be generated, and the discharge temperature reset routine shall reverse until all VAV box cooling commands are less than or equal to 85% (adj.). If five or more VAV boxes reach 100% for a 20 min (adj.) duration an alarm shall be generated, and the reset routine shall reverse with the above mentioned temperature increments but with changes every 2 minutes (adj.) to the starting setpoint as scheduled and the reset routine shall be locked out in software. A manual reset shall be provided on the system graphic to allow the user to enable the routine again after the problem has been corrected.
   c. The BAS shall accumulate a list of zones that are almost unsatisfied and produce a weekly report listing these zones and the number of instances these zones were almost unsatisfied. This will allow the staff to investigate the zone and determine if airflow is choked or unsustainable loads have been placed in the zone.
2. Optimal Start, Morning Warmup and Cool Down
   a. Regardless if the unit is determined to run continuously, in the event that a schedule is implemented the unit shall be programmed to provide an Optimal Start/Stop routine which shall automatically ramp the building temperatures for the Optimal start and stop times to conserve energy while maintaining space temperature setpoints. Where applicable this strategy shall include but not be limited to incorporating terminal unit override for zones specifically associated to this AHU to help implement this routine.
   b. When the AHU is started prior to scheduled start time by the Optimal Start/Stop routine, the unit shall be considered to be in warm up or cool down mode. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
   c. During the cool down mode, outside and return air enthalpy conditions shall be verified. If economizer mode is enabled, the outside air dampers shall follow the economizer sequence and the cool down mode shall be overridden.
3. Setback Mode
   a. During Unoccupied Mode, if the average temperature of all zone sensors serving their respective AHU fall below their unoccupied heating setpoints by 2°F (adjustable), the associated AHU shall start in Setback Mode. AHU shall continue to run until the average temperature of all zone sensors is 1°F (adjustable) below the unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
4. Setup Mode
   a. During Unoccupied Mode, if the average temperature of all zone sensors serving their respective AHU rise above their unoccupied cooling setpoints by 2°F (adjustable), the associated AHU shall start in Set-up Mode. AHU shall continue to run until the average temperature of all zone sensors is 1°F (adjustable) above the unoccupied setpoint.
   b. The AHU shall follow normal its startup sequence except that the outside air dampers shall remain closed, the return air damper shall remain fully open and associated supply and exhaust fans shall remain off.
   c. During the setup mode, outside and return air enthalpy conditions shall be verified. If economizer mode is enabled, the outside air dampers shall follow the economizer sequence.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED		
NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002
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CHECKED BY GBH/AYG
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DRAWING TITLE
MECHANICAL CONTROLS - JUSTICE CENTER BUILDING - SCHEMATICS

DRAWING NO.
MC-730

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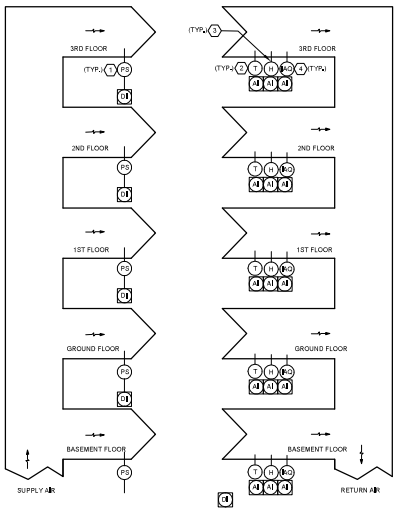
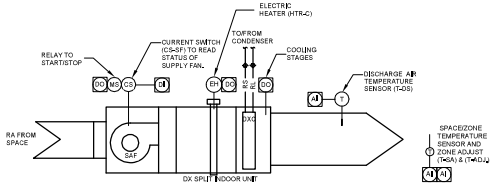


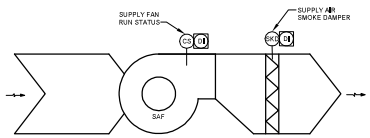
1 M-731 DUCT RISER DIAGRAM AND CONTROLS
SCALE: NONE

System: JCB Floor Monitoring and Control | AHU-1 Floor Supply / Return Duct Riser System										
Point Description	Hardware Points				Software Points		Show on Graphic	Point Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Basement Floor Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDX0C5S
Basement Floor Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor leaving floor at chase	VERIS CDLSH-TJ Combo Sensor
Basement Floor Return Air Humidity Sensor (H-RA)	•				•	15 Min	•	•	Duct Humidity Sensor leaving flow at chase	VERIS CDLSH-TJ Combo Sensor
Basement Floor Return Air Quality (CO2-RA)	•				•	16 Min	•	•	Duct Carboon Dioxide Sensor leaving floor atchase	VERIS CDLSH-TJ Combo Sensor
Ground Floor Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDX0C5S
Ground Floor Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor leaving floor at chase	VERIS CDLSH-TJ Combo Sensor
Ground Floor Return Air Humidity Sensor (H-RA)	•				•	15 Min	•	•	Duct Humidity Sensor leaving flow at chase	VERIS CDLSH-TJ Combo Sensor
Ground Floor Return Air Quality (CO_2-RA)	•				•	16 Min	•	•	Duct Carboon Dioxide Sensor leaving floor atchase	VERIS CDLSH-TJ Combo Sensor
First Floor Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDX0C5S
First Floor Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor leaving floor at chase	VERIS CDLSH-TJ Combo Sensor
First Floor Return Air Humidity Sensor (H-RA)	•				•	15 Min	•	•	Duct Humidity Sensor leaving flow at chase	VERIS CDLSH-TJ Combo Sensor
First Floor Return Air Quality (CO_2-RA)	•				•	16 Min	•	•	Duct Carboon Dioxide Sensor leaving floor atchase	VERIS CDLSH-TJ Combo Sensor
Second Floor Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDX0C5S
Second Floor Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor leaving floor at chase	VERIS CDLSH-TJ Combo Sensor
Second Floor Return Air Humidity Sensor (H-RA)	•				•	15 Min	•	•	Duct Humidity Sensor leaving flow at chase	VERIS CDLSH-TJ Combo Sensor
Second Floor Return Return Air Quality (CO_2-RA)	•				•	16 Min	•	•	Duct Carboon Dioxide Sensor leaving floor atchase	VERIS CDLSH-TJ Combo Sensor
Third Floor Duct Static Pressure Sensor - (PS-D)	•				•	15 Min	•	•	Static Pressure Sensor 2/3 downstream	VERIS PXDX0C5S
Third Floor Return Air Temp Sensor (T-RA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor leaving floor at chase	VERIS CDLSH-TJ Combo Sensor
Third Floor Return Air Humidity Sensor (H-RA)	•				•	15 Min	•	•	Duct Humidity Sensor leaving flow at chase	VERIS CDLSH-TJ Combo Sensor
Third Floor Return Return Ar Quality (CO2-RA)	•				•	16 Min	•	•	Duct Carboon Dioxide Sensor leaving floor atchase	VERIS CDLSH-TJ Combo Sensor



4 MC-731 DX SPLIT UNIT FLOW DIAGRAM/SCHEMATIC
SCALE: NONE

System: DX Split System: ACU-1& ACU-2											
Point Description	Point Function	Hardware Points				Software Points				Show on Graphic	Notes / Device
		AI	DI	AO	DO	AV	BV	Trend	Trend Interval		
Fan Start / Stop	Optimized Scheduling				•					•	Control Relay
Fan Run Status	Equipment Monitoring		•					•	15 min	•	Current Sensing Switch
Cooling Stages	Temperature Control				•			•	15 min	•	Control Relay, 1 per stage
Heating Stages	Temperature Control				•			•	15 min	•	Control Relay, 1 per stage
Discharge Air Sensor	Temperature Monitoring	•						•	15 min	•	Duct Temperature Sensor
Zone Temperature	Temperature Monitoring	•						•	15 min	•	Zone Temperature Sensor
Zone Setpoint Adjust	Occupant Comfort Adjust	•								•	Zone Thermostat Adjust



2 M-731 SMOKE CONTROL SUPPLY FAN MONITOR ONLY DIAGRAM
SCALE: NONE

System: Smoke Supply Fans | SF-R1 THRU SF-R3										
Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend	Interval	Alarm			
Supply Fan Run Status (SF-R)			•		•	COS	•	•	Current Sensing Switch in Fan Starter	VERIS H-608 Adjustable Split Core Current Switch
Supply Fan Fire/Smoke Damper (FD-SF)			•						Confirm Interlock operation	Verify existing

Note 1: Locations for SF-R1 thru SF-R3 refer to MC-110

Note 2: Equipment status may also be obtained from Fire Alarm System BACnet interface at contractor's discretion

SUPPLY FANS BEING MONITORED ONLY

A. CONTROL SEQUENCE:

FANS SHALL OPERATE AS CONTROLLED BY THEIR RESPECTIVE SYSTEM OTHER THAN BAS. MONITOR STATUS OF THE FAN AND SHOW ON THE BAS GRAPHIC ON FLOOR PLANS AND IN A TABLE. SMOKE SUPPLY FANS SHALL ALARM AT THE BAS IF THEIR STATUS SHOWS "ON".

DX Split System Air Conditioning (AC) Unit with Electric Heat

EACH DX SPLIT SYSTEM SHALL BE CONTROLLED BY A SEPARATE DIGITAL SPACE THERMOSTAT/SENSOR. THE SPACE SENSOR SHALL ENABLE AND DISABLE THE SYSTEM BASED ON THE SPACE TEMPERATURE SETPOINT (ADJUSTABLE). THE BAS SHALL MONITOR THE SUPPLY AIR TEMPERATURE AND SUPPLY FAN OPERATION (ON/OFF).

OCCUPIED OPERATION:

1. COOLING - SPACE TEMPERATURE SENSOR ENERGIZES AHU FAN AND CU WHEN THE SPACE TEMPERATURE REACHES 80 DEG. F. FAN CONTINUES TO RUN AND CU DE-ENERGIZED WHEN SPACE TEMPERATURE IS MET (75 DEG. F (ADJ.).
2. HEATING - IN THE HEATING MODE, A FALL IN ZONE TEMPERATURE BELOW SETPOINT SHALL CAUSE THE ELECTRIC COIL TO STAGE ON TO MAINTAIN SETPOINT. ON A RISE IN ZONE TEMPERATURE, THE REVERSE SEQUENCE SHALL OCCUR.

ALARMS AND TREND LOGS

BAS SHALL BE PROGRAMMED TO INCLUDE POLLING AND CHANGE-OF-VALUE TREND LOGS FOR ALL INPUTS, OUTPUTS AND VARIABLES. ALARMS SHALL BE PROVIDED FOR ALL CRITICAL POINTS INCLUDING THE FOLLOWING:

A. SUPPLY FAN FAILURE.
B. SUPPLY AIR TEMP. MORE THAN 65° F. (ADJ.).

DRAWING NOTES

1 DUCT STATIC PRESSURE SENSOR LOCATED AT 2 / 3 DUCT WORK TO CONTROL VFD (PS-D)
2 RETURN AIR TEMPERATURE SENSOR (T-RA)
3 RETURN AIR HUMIDITY SENSOR (H-RA)
4 ZONE/RETURN AIR IAQ SENSOR (CO2N)

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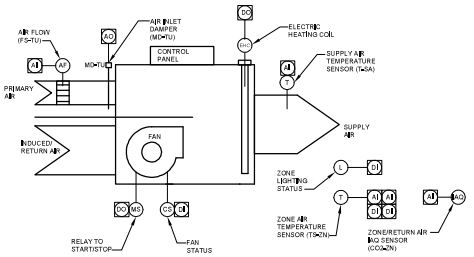
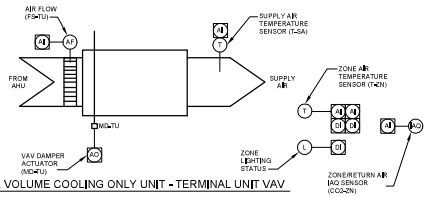


1 M-740 FAN POWERED VARIABLE VOLUME UNIT - TERMINAL UNIT FPU

SCALE: NONE



2 M-740 VARIABLE VOLUME COOLING ONLY UNIT - TERMINAL UNIT VAV

SCALE: NONE

System: Fan Powered Variable Volume Unit, Parallel Fan Configuration - Terminal Unit FPU

Point Description	Hardware Points				Software Points			Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	Trend[3]	Interval	Alarm			
Zone Sensor, Temperature (TS-ZN)	•				•	15 Min	•	•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Zone Sensor, Setpoint Adj (SP-ZN)	•				•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor
Zone Sensor, Override[1] (OR-ZN)			•		•	COS		•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor, or
Zone Sensor, Air Quality[1] (CO_2-ZN)	•				•	15 Min		•	Wall Mounted Carbon Dioxide Sensor	n/a - integral to sensor temp sensor
Zone Air Humidity Sensor (H-ZN)	•				•	15 Min		•	Duct %RH sensor, zone air	VERIS HD2XVSX
Zone Sensor, Occupancy[1] (OC-ZN)			•		•	COS		•	Aux contact from local lighting occupancy sensor	n/a - integral to sensor, by others
Terminal Unit Supply Air Temp Sensor (T-SA)	•				•	15 Min	•	•	Duct RTD Temperature Sensor downstream of heater	VERIS TIDDR10
Terminal Unit Damper Actuator - (MD-TJ)		•			•	15 Min		•	Terminal Unit integral damper actuator	n/a - integral to TxU controller, factory mounted
Terminal Unit Flow Station - (FS-TU)	•				•	15 Min	•	•	Terminal Unit integral flow array and sensor	n/a - integral to TxU, factory installed and piped
Fan Starter (FAN-C)				•	•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	n/a - integral to TxU, factory wired
Fan Run Status (FAN-R)			•		•	COS		•	Control Relay(s) output to Duct Heater, Multi-Stage	VERIS 1-300 low-trip split core current switch
Electric Duct Heater Stages (HTR-C)				•	•	15 Min		•	Control Relay(s) output to Duct Heater, Multi-Stage	n/a - integral to TxU, factory wired
Zone Lighting Status (LS-ZN)[2]			•			COS		•	Current Sensing Switch on Lighting Circuit	n/a - Current Switch furnished by others

Note 1 - Use either Zone Override button OR Zone Occupancy Sensor, select locations only. See Schedule

Note 2 - Future implementation of current switch on select lighting circuits, TxU controller shall reserve spare input and programming

Note 3 - Refer to plans for locations, required in all courtrooms and jury assembly rooms only

Note 4 - Data trends shall be 24 hour rolling history stored locally on the terminal unit controller

FC/C VAV TERMINAL UNIT, PARALLEL FAN POWERED (FPU)

A. SETPOINTS AND AIRFLOW SETTINGS:

1. PROGRAM TEMPERATURE SETPOINTS
   a. OCCUPIED ACTIVE TEMPERATURE SETPOINT (°F) PER RESET SCHEDULE
      1) 68°F @ 20°F OUTSIDE AMBIENT
      2) 74°F @ 80°F OUTSIDE AMBIENT
   b. UNOCCUPIED COOLING TEMPERATURE SETPOINT (°F) – 85°F
   c. UNOCCUPIED HEATING TEMPERATURE SETPOINT (°F) – 60°F
   d. SETPOINT DEAD BAND (ADJUSTABLE) SHALL BE NO LESS THAN 2°F
2. PROGRAM ALL VAV TERMINAL UNIT FLOW SET POINTS PER SCHEDULE
   a. COOLING MAXIMUM FLOW SETPOINT (CFM)
   b. COOLING MINIMUM FLOW SETPOINT (CFM)
   c. HEATING FLOW SETPOINT (CFM)

B. OCCUPIED CONTROL SEQUENCE

OCCUPIED AND UNOCCUPIED MODE SHALL BE DETERMINED BY THE ASSOCIATED AHU SCHEDULE UNLESS A LOCAL OCCUPANCY SENSOR IS INSTALLED. REFER TO LOCAL LIGHTING INTERFACE SEQUENCE.

1. **HEATING MODE:**
   a. WHEN ZONE TEMPERATURE IS LESS THAN THE ACTIVE SETPOINT MINUS HALF THE DEAD BAND, THE HEATING MODE SHALL BE ENABLED.
   b. THE FPU FAN WILL BE ENERGIZED AS 1ST HEATING STAGE.
   c. THE ZONE DAMPER SHALL MODULATE TO MAINTAIN MINIMUM FLOW SETPOINT
   d. THE ZONE ELECTRIC HEATING COIL SHALL STAGE USING PID OUTPUT MAINTAIN ACTIVE TEMPERATURE SETPOINT.
      1) 1ST STAGE OF HEAT SHALL ENERGIZE AT 50% HEATING DEMAND AND DE-ENERGIZE AT 0% HEATING DEMAND
      2) 2ND STAGE OF HEAT SHALL ENERGIZE AT 100% HEATING DEMAND AND DE-ENERGIZE AT 50% HEATING DEMAND
   e. THE FPU FAN WILL DE-ENERGIZED WHEN THE COOLING MODE IS ENABLED.
2. **COOLING MODE:**
   a. WHEN ZONE TEMPERATURE IS GREATER THAN THE ACTIVE SETPOINT PLUS HALF OF THE DEAD BAND, THE COOLING MODE SHALL BE ENABLED.
   b. THE ZONE DAMPER SHALL MODULATE USING PID OUTPUT BETWEEN COOLING MINIMUM AIRFLOW AND COOLING MAXIMUM AIRFLOW TO MAINTAIN ACTIVE TEMPERATURE SETPOINT.
   c. THE FAN AND ELECTRIC HEATING STAGES SHALL BE OFF.

C. UNOCCUPIED CONTROL SEQUENCE

1. VAV UNITS SHALL CONTROL TO THEIR UNOCCUPIED HEATING OR COOLING SETPOINTS DURING UNOCCUPIED PERIODS.
2. WHEN THE AHU IS STARTED DURING SETBACK OR SETUP MODE, THE VAV UNIT SHALL FOLLOW THE RESPECTIVE COOLING OR HEATING MODE SEQUENCE.
3. SELECT VAV ZONES SHALL HAVE A LOCAL PUSHBUTTON OVERRIDE. WHEN ACTIVATED THE VAV ZONE SHALL CONTROL TO THE ACTIVE TEMPERATURE SETPOINT FOR A MINIMUM OF 4 HOURS. (ADJUSTABLE).

D. LOCAL LIGHTING INTERFACE SEQUENCE:

1. SELECT VAV ZONES SHALL HAVE A LOCAL OCCUPANCY SENSOR. THESE ZONES SHALL TRACK THE OCCUPANCY SENSOR STATUS FOR OCCUPIED AND UNOCCUPIED MODE AND CONTROL TO THE APPROPRIATE SEQUENCE.
2. SELECT ZONES SHALL HAVE A LIGHTING STATUS SWITCH. THESE ZONES SHALL TRACK THE STATUS SWITCH FOR OCCUPIED AND UNOCCUPIED MODE AND CONTROL TO THE APPROPRIATE SEQUENCE.

System: Cooling Only Variable Volume Unit - Terminal Unit VAV

Point Description	Hardware Points				Software Points						Show on Graphic	Notes	Part Number - Basis of Design
	AI	AO	DI	DO	AV	BV	Trend[3]	Interval	Alarm				
Zone Sensor, Temperature (TS-ZN)	•						•	15 Min	•		•	Wall Mounted 10K Thermistor Temperature Sensor	VERIS TED51
Zone Sensor, Setpoint Adj (SP-ZN)	•						•	COS			•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor
Zone Sensor, Override[1] (OR-ZN)			•				•	COS			•	Wall Mounted 10K Thermistor Temperature Sensor	n/a - integral to sensor, or
Zone Sensor, Air Quality[1] (CO_2-ZN)	•						•	15 Min			•	Wall Mounted Carbon Dioxide Sensor	n/a - integral to sensor temp sensor
Zone Air Humidity Sensor (H-ZN)	•						•	15 Min			•	Duct %RH sensor, zone air	VERIS HD2XVSX
Zone Sensor, Occupancy[1] (OC-ZN)			•				•	COS			•	Aux contact from local lighting occupancy sensor	n/a - integral to sensor, by others
Terminal Unit Supply Air Temp Sensor (T-SA)	•						•	15 Min	•		•	Duct RTD Temperature Sensor downstream of heater	VERIS TIDDR10
Terminal Unit Damper Actuator - (MD-TU)		•					•	15 Min	•		•	Terminal Unit integral damper actuator	n/a - integral to TxU controller, factory mounted
Terminal Unit Flow Station - (FS-TU)	•						•	15 Min			•	Terminal Unit integral flow array and sensor	n/a - integral to TxU, factory installed and piped
Zone Lighting Status (LS-ZN)[2]			•				•	COS			•	Current Sensing Switch on Lighting Circuit	n/a - Current Switch furnished by others

Note 1 - Use either Zone Override button OR Zone Occupancy Sensor, select locations only. See Schedule

Note 2 - Future implementation of current switch on select lighting circuits, TxU controller shall reserve spare input and programming

Note 3 - Refer to plans for locations, required in all courtrooms and jury assembly rooms only

Note 4 - Data trends shall be 24 hour rolling history stored locally on the terminal unit controller

FC/C VAV TERMINAL UNIT, COOLING ONLY WITHOUT FAN (VAV)

A. SETPOINTS AND AIRFLOW SETTINGS:

1. PROGRAM TEMPERATURE SETPOINTS
   a. OCCUPIED ACTIVE TEMPERATURE SETPOINT (°F) PER RESET SCHEDULE
      1) 68°F @ 20°F OUTSIDE AMBIENT
      2) 74°F @ 80°F OUTSIDE AMBIENT
   b. UNOCCUPIED COOLING TEMPERATURE SETPOINT (°F) – 85°F
   c. SETPOINT DEAD BAND (ADJUSTABLE) SHALL BE NO LESS THAN 2°F
2. PROGRAM ALL VAV TERMINAL UNIT FLOW SET POINTS PER SCHEDULE
   a. COOLING MAXIMUM FLOW SETPOINT (CFM)
   b. COOLING MINIMUM FLOW SETPOINT (CFM)

B. OCCUPIED CONTROL SEQUENCE

OCCUPIED AND UNOCCUPIED MODE SHALL BE DETERMINED BY THE ASSOCIATED AHU SCHEDULE UNLESS A LOCAL OCCUPANCY SENSOR IS INSTALLED. REFER TO LOCAL LIGHTING INTERFACE SEQUENCE.

1. **COOLING MODE:**
   a. THE ZONE DAMPER SHALL MODULATE USING PID OUTPUT BETWEEN COOLING MINIMUM AIRFLOW AND COOLING MAXIMUM AIRFLOW TO MAINTAIN ACTIVE TEMPERATURE SETPOINT.

C. UNOCCUPIED CONTROL SEQUENCE

1. VAV UNITS SHALL CONTROL TO THE UNOCCUPIED COOLING SETPOINT DURING UNOCCUPIED PERIODS.
2. WHEN THE AHU IS STARTED DURING SETUP MODE, THE VAV UNIT SHALL FOLLOW THE COOLING MODE SEQUENCE.
3. SELECT VAV ZONES SHALL HAVE A LOCAL PUSHBUTTON OVERRIDE. WHEN ACTIVATED THE VAV ZONE SHALL CONTROL TO THE ACTIVE TEMPERATURE SETPOINT FOR A MINIMUM OF 4 HOURS. (ADJUSTABLE).

D. LOCAL LIGHTING INTERFACE SEQUENCE:

1. SELECT VAV ZONES SHALL HAVE A LOCAL OCCUPANCY SENSOR. THESE ZONES SHALL TRACK THE OCCUPANCY SENSOR STATUS FOR OCCUPIED AND UNOCCUPIED MODE AND CONTROL TO THE APPROPRIATE SEQUENCE.
2. SELECT ZONES SHALL HAVE A LIGHTING STATUS SWITCH. THESE ZONES SHALL TRACK THE STATUS SWITCH FOR OCCUPIED AND UNOCCUPIED MODE AND CONTROL TO THE APPROPRIATE SEQUENCE.

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FULTON COUNTY

FULTON COUNTY JUSTICE CENTER BUILDING AUTOMATION SYSTEM UPGRADE AND TERMINAL UNIT REPLACEMENT

STAMP

REVISIONS / ISSUED

NO.	DESCRIPTION	DATE

SLK PROJECT NO. 2019002

DRAWN BY MT

CHECKED BY GBH/AYG

REVIEWED BY AYG/GBH

SCALE AS INDICATED

ISSUE DATE 11/18/2019

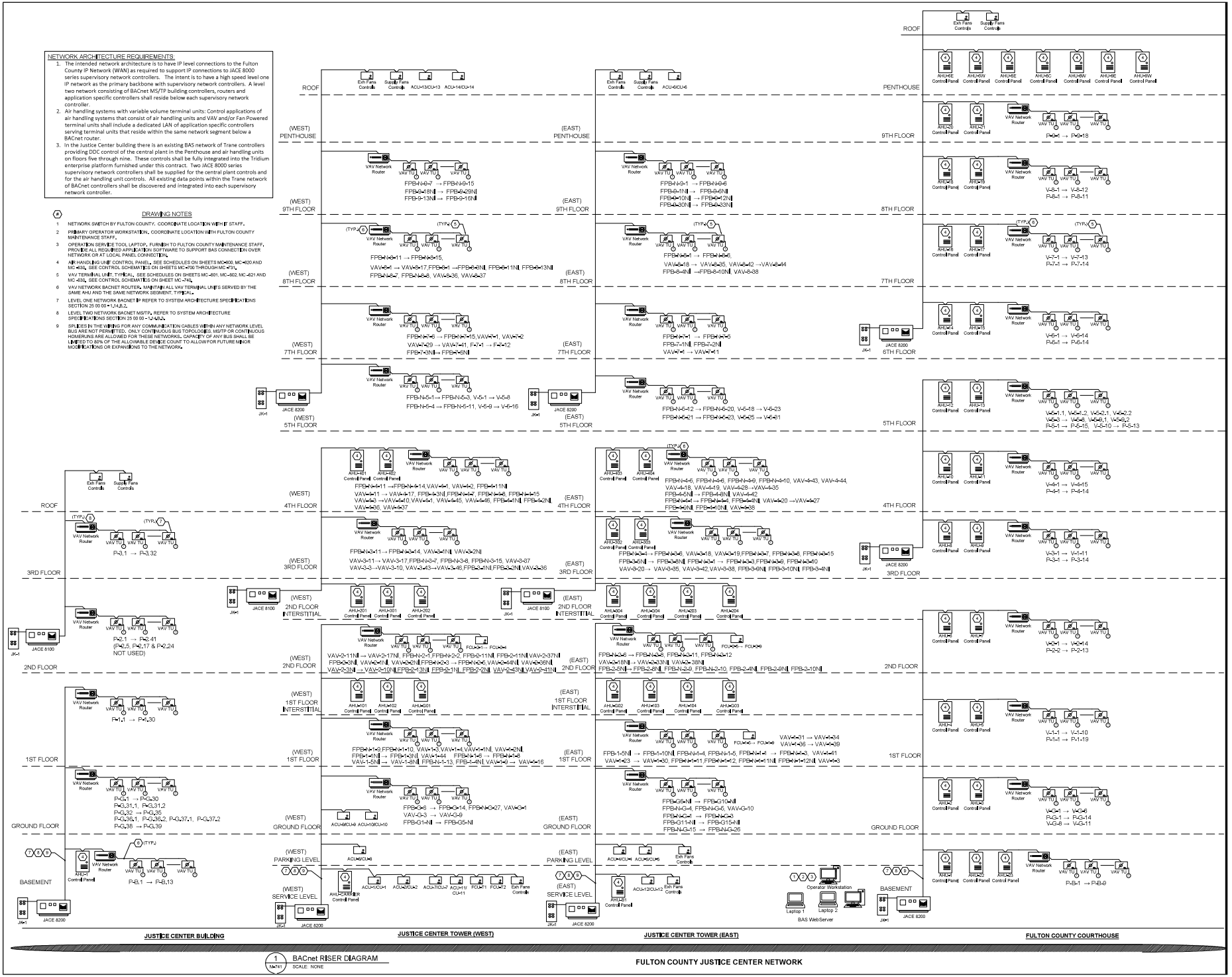
DRAWING TITLE

MECHANICAL CONTROLS - JUSTICE CENTER COMPLEX - SCHEMATICS

DRAWING NO.

MC-740

ISSUED FOR BID



1 BACnet RISER DIAGRAM
M-741 SCALE: NONE

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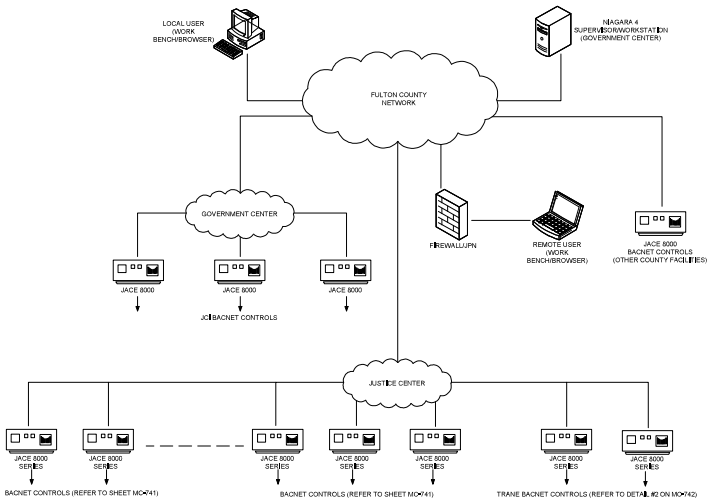


1 MC-742 FULTON COUNTY ENTERPRISE NETWORK BAS LAYOUT
SCALE: NONE

REVISE THE EXISTING TRANE DDC CHILLER PROGRAMMING TO ENSURE THE FOLLOWING ARE INCLUDED:

A. PRIMARY AND SECONDARY CHWS TEMPERATURE RESET SEQUENCE

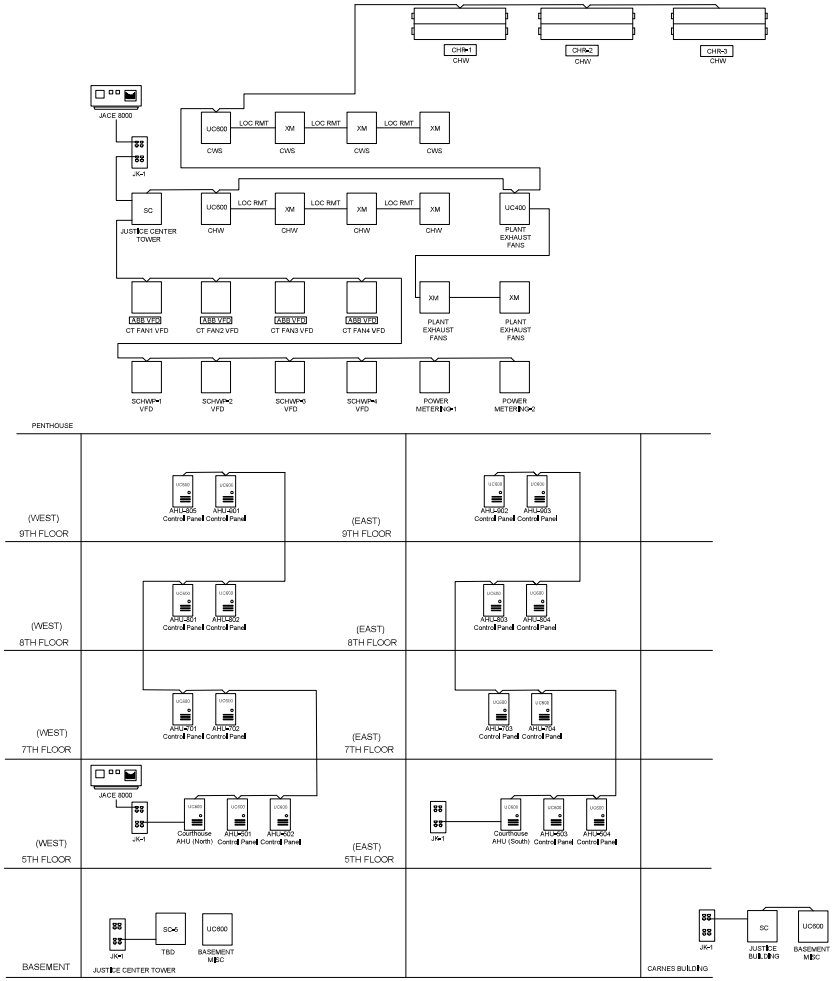
1. PROVIDE PRIMARY CHWS TEMPERATURE RESET SUCH THAT THE CHILLER CHWS SETPOINT IS RESET TO MAINTAIN SECONDARY CHWS TEMPERATURE AT SETPOINT FOR VARYING PRIMARY / SECONDARY GPM RELATIONSHIPS.
   a. A REVERSE-ACTING PI CONTROL LOOP WITH A SETPOINT OF EQUAL TO THE SECONDARY CHWS TEMPERATURE SETPOINT WILL RESET THE PRIMARY CHWS SETPOINT ISSUED BY THE BAS TO THE CHILLERS THROUGH THE CHILLER GATEWAY. ALL CHILLERS WILL OPERATE ON USING THE SAME CHWS TEMPERATURE SETPOINT.
   b. THE INITIAL PRIMARY CHWS TEMPERATURE SETPOINT SHALL BE SET TO 45°F WITH A SETPOINT RANGE OF 42°F TO 48°F.
2. PROVIDE SECONDARY CHWS TEMPERATURE RESET SUCH THAT THE BUILDING SECONDARY CHWS SETPOINT VARIES BASED ON OUTSIDE AIR WET BULB CONDITIONS (OAWB).
   a. SECONDARY CHWS SETPOINT SHALL BE SET AT 44°F WHEN THE OAWBT IS 70°F AND VARY LINEARLY TO 48°F WHEN THE OAWBT IS 45°F.
   b. THE INITIAL SECONDARY CHWS TEMPERATURE SETPOINT SHALL BE SET TO 45°F WITH A SETPOINT RANGE OF 44°F TO 48°F.
3. BOTH RESET ROUTINES WILL UPDATE EVERY FIFTEEN MINUTES TO ALLOW FOR STABILITY IN THE SECONDARY PUMPING ROUTINES WITH NO MORE THAN 0.5°F CHANGE PER UPDATE.

B. BUILDING DIFFERENTIAL PRESSURE RESET SEQUENCE

1. THE BUILDING DIFFERENTIAL PRESSURE RESET OBJECTIVE IS TO ALWAYS HAVE AT LEAST ONE AHU COOLING COIL VALVE (CCV) 90 PERCENT OPEN SO THE SCHWPS OPERATE AT THE LOWEST SPEED AND PRESSURE POSSIBLE TO SATISFY THE CURRENT LOAD. VALVE POSITION OF ALL AHU CCVS FROM EACH BUILDING WILL BE TRANSMITTED TO THE SECONDARY CHW PUMPS CONTROLLER.
2. A DIRECT-ACTING PI CONTROL LOOP WITH A SETPOINT OF 90 PERCENT WILL RESET THE CHW DIFFERENTIAL PRESSURE SETPOINT BETWEEN THE MAXIMUM AND MINIMUM PRESSURE RANGE BASED ON THE MOST OPEN AHU CCV PERCENT OPEN VALUE. THE LOOP AND ASSOCIATED AHU CCV VALUES WILL UPDATE NO MORE FREQUENT THAN EVERY 5 MINUTES. WHEN THE MOST OPEN VALVE IS BETWEEN 85 PERCENT AND 95 PERCENT, THE PI LOOP RESET SHALL HOLD ITS CURRENT SETPOINT.
3. THE MAXIMUM PRESSURE SETPOINT IS THE PRESSURE REQUIRED TO PROVIDE FULL COIL FLOW TO ALL AHUS SIMULTANEOUSLY. THE MINIMUM PRESSURE SETPOINT IS THE PRESSURE THAT CORRELATES TO THE MINIMUM ALLOWED PUMP SPEED.

C. ADDITIONAL CHILLER FEATURES

1. DO NOT CALL FOR CHILLERS ENABLE THEN DISABLE MORE THAN THREE TIMES IN A 12 HOUR PERIOD (MANAGE BY BAS).
2. CHILLERS SHALL NOT CYCLE ON AND OFF MORE THAN ONCE IN A 1 HOUR PERIOD (MANAGE BY CHILLER CONTROL PANEL).
3. ALARM ON CHILLER FAILURE. FAILURE ALARMS MUST BE MANUALLY RESET. SEE OTHER ALARM MODES IN CHILLER OPERATOR'S MANUAL. PRESENT ALL ALARMS CREATED BY CHILLER CONTROLS AND ALL SHUTDOWN CONDITIONS BY CHILLER CONTROLS TO BAS IN THEIR FULL DESCRIPTION (CHILLER NUMERIC CODE IS NOT ACCEPTABLE).
4. DEMAND LIMITING: DEMAND LIMITING SETPOINT ADJUSTMENT MAY BE MADE THROUGH BAS. THE DEMAND LIMIT (IN SUM OF ALL CHILLERS KW), WHEN MET WILL DELAY THE START OF THE NEXT CHILLER FOR 1 HOUR (ADJUST-ABLE).
5. THE BAS WILL MONITOR KW, CALCULATE THE LOAD ON THE CHILLER USING EVAPORATOR CHW FLOW AND TEMPERATURE DIFFERENTIALS AND TREND REAL-TIME CHILLER EFFICIENCY. THESE VALUES WILL BE REPRESENTED ON THE CHILLER GRAPHIC ALONG WITH OTHER CHILLER DATA.
6. INCORPORATE MAINTENANCE MANAGEMENT NOTIFICATIONS. REFER TO THE MAINTENANCE MANAGEMENT SOFTWARE SECTION OF THESE SEQUENCES.



2 MC-742 TRANE CONTROLS RISER DIAGRAM
SCALE: NONE

INTEGRATION OF TRANE DDC BACNET DATA INTO NIAGARA PLATFORM:

1. THIS CONTRACTOR SHALL SPECIFICALLY BE REQUIRED TO FULLY INTEGRATE THE EXISTING TRANE BAS CONTROLS RECENTLY INSTALLED IN AREAS OF THE FULTON COUNTY JUSTICE CENTER TOWER, PARTICULARLY THE CENTRAL PLANT AND AIR HANDLING SYSTEMS ON FLOORS FIVE THROUGH NINE.
2. FURNISH AND INSTALL THE REQUIRED NUMBER OF JACE NETWORK CONTROLLERS TO DISCOVER ALL DATA THROUGH BACNET INTEGRATION.
3. IT WILL BE THIS CONTRACTOR'S RESPONSIBILITY TO EXPOSE ALL TRANE DATA THAT MAY OR MAY NOT BE CURRENTLY EXPOSED VIA BACNET IN ORDER TO SATISFY THE REQUIREMENT OF THIS PROJECT.
4. DISCOVER ALL BACNET DATA FROM THE TRANE DDC BACNET CONTROLLERS AND CREATE NIAGARA OBJECTS WITHIN THE JACE SUPERVISORY NETWORK CONTROLLERS.
5. ENSURE THAT ALL ENERGY AND WATER METERING IS INCLUDED IN THE DISCOVERED DATA POINTS.

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Exhibit H
Purchasing Forms

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STATE OF GEORGIA
COUNTY OF FULTON

FORM A: GEORGIA SECURITY AND IMMIGRATION CONTRACTOR AFFIDAVIT AND AGREEMENT

By executing this affidavit, the undersigned contractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services[1] under a contract with **[insert name of prime contractor]** Control Concepts LLC on behalf of **Fulton County Government** has registered with and is participating in a federal work authorization program*,[2] in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

The undersigned further agrees that, should it employ or contract with any subcontractor(s) in connection with the physical performance of services to this contract with **Fulton County Government**, contractor will secure from such subcontractor(s) similar verification of compliance with O.C.G.A. 13-10-91 on the Subcontractor Affidavit provided in Rule 300-10-01-.08 or a substantially similar form. Contractor further agrees to maintain records of such compliance and provide a copy of each such verification to the **Fulton County Government** at the time the subcontractor(s) is retained to perform such service.

47231
EEV/Basic Pilot Program* User Identification Number

Control Concepts LLC div of Combat Systems USA (Southeast) Inc.
BY: Authorized Officer of Agent (Insert Contractor Name)

Sales Assistant
Title of Authorized Officer or Agent of Contractor

Dawn Ingram
Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me this 29th day of [illegible], 2020

Notary Public: [signature]

County: FORSYTH

Commission Expires: 5/2/21

TRACI VANVALKENBURG NOTARY PUBLIC FORSYTH COUNTY GEORGIA EXPIRES MAY 2, 2021

[1] O.C.G.A. § 13-10-90(4), as amended by Senate Bill 160, provides that "physical performance of services" means any performance of labor or services for a public employer (e.g., Fulton County) using a bidding process (e.g., ITB, RFQ, RFP, etc.) or contract wherein the labor or services exceed $2,499.99, except for those individuals licensed pursuant to title 26 or Title 43 or by the State Bar of Georgia and is in good standing when such contract is for service to be rendered by such individual.

[2] *[Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603].

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STATE OF GEORGIA
COUNTY OF FULTON

FORM B: GEORGIA SECURITY AND IMMIGRATION SUBCONTRACTOR AFFIDAVIT

By executing this affidavit, the undersigned subcontractor verifies its compliance with O.C.G.A. 13-10-91, stating affirmatively that the individual, firm or corporation which is engaged in the physical performance of services[3] under a contract with **[insert name of prime contractor]** _____behalf of **Fulton County Government** has registered with and is participating in a federal work authorization program*,[4] in accordance with the applicability provisions and deadlines established in O.C.G.A. 13-10-91.

48783
_____
EEV/Basic Pilot Program* User Identification Number

_____
BY: Authorized Officer of Agent
(Insert Subcontractor Name)

LISA SHUMATE
VICE PRESIDENT
_____
Title of Authorized Officer or Agent of Subcontractor

_____
Printed Name of Authorized Officer or Agent

Sworn to and subscribed before me,

This 29 day of July, 2020

_____
(Notary Public) (Seal)

ANGELA JENKINS NOTARY PUBLIC GWINNETT COUNTY, GA

Commission Expires: 04-18-22
(Date)

[3]O.C.G.A.§ 13-10-90(4), as amended by Senate Bill 160, provides that "physical performance of services" means any performance of labor or services for a public employer (e.g., Fulton County) using a bidding process (e.g., ITB, RFQ, RFP, etc.) or contract wherein the labor or services exceed $2,499.99, except for those individuals licensed pursuant to title 26 or Title 43 or by the State Bar of Georgia and is in good standing when such contract is for service to be rendered by such individual.

[4]*[Any of the electronic verification of work authorization programs operated by the United States Department of Homeland Security or any equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, pursuant to the Immigration Reform and Control Act of 1986 (IRCA), P.L. 99-603].

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Form C: OFFEROR'S DISCLOSURE FORM AND QUESTIONNAIRE

1. Please provide the names and business addresses of each of the Offeror's firm's officers and directors.

   For the purposes of this form, the term "Offeror" means an entity that responds to a solicitation for a County contract by either submitting a proposal in response to a Request for Proposal or a Request for Qualification or a Bid in response to an Invitation to Bid. Describe accurately, fully and completely, their respective relationships with said Offeror, including their ownership interests and their anticipated role in the management and operations of said Offeror.

   Todd Hughes
   3550 North Parkway, Suite 100
   Cumming, GA 30040
   Todd Hughes is the President of CCI. He is a direct employee of the LLC. Todd's role will be a consultant and overview of project execution.

2. Please describe the general development of said Offeror's business during the past five (5) years, or such shorter period of time that said Offeror has been in business.

   CCI has experienced healthy growth over the last 5 years. In addition To continuing to provide services to existing customers (some for Over 20 years). We have many new clients added to our portfolio. Our DELTA offerings have continued success and CCI has 10-20% Growth in revenue per year and increased O/I.

3. Please state whether any employee, agent or representative of said Offeror who is or will be directly involved in the subject project has or had within the last five (5) years: (i) directly or indirectly had a business relationship with Fulton County; (ii) directly or indirectly received revenues from Fulton County; or (iii) directly or indirectly receives revenues from the result of conducting business on Fulton County property or pursuant to any contract with Fulton County. Please describe in detail any such relationship.

   None

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LITIGATION DISCLOSURE:

Failure to fully and truthfully disclose the information required, may result in the disqualification of your bid or proposal from consideration or termination of the Contract, once awarded.

1. Please state whether any of the following events have occurred in the last five (5) years with respect to said Offeror. If any answer is yes, explain fully the following:

   (a) whether a petition under the federal bankruptcy laws or state insolvency laws was filed by or against said Offeror, or a receiver fiscal agent or similar officer was appointed by a court for the business or property of said Offeror;

   Circle One: YES NO

   (b) whether Offeror was subject of any order, judgment, or decree not subsequently reversed, suspended or vacated by any court of competent jurisdiction, permanently enjoining said Offeror from engaging in any type of business practice, or otherwise eliminating any type of business practice; and

   Circle One: YES NO

   (c) whether said Offeror's business was the subject of any civil or criminal proceeding in which there was a final adjudication adverse to said or Offeror, which directly arose from activities conducted by the business unit or corporate division of said Offeror which submitted a bid or proposal for the subject project. If so please explain.

   Circle One: YES NO

2. Have you or any member of your firm or team to be assigned to this engagement ever been indicted or convicted of a criminal offense within the last five (5) years?

   Circle One: YES NO

3. Have you or any member of your firm or team been terminated (for cause or otherwise) from any work being performed for Fulton County or any other Federal, State or Local Government?

   Circle One: YES NO

4. Have you or any member of your firm or team been involved in any claim or litigation adverse to Fulton County or any other federal, state or local government, or private entity during the last three (3) years?

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Circle One: YES NO

5. Has any Offeror, member of Offeror's team, or officer of any of them (with respect to any matter involving the business practices or activities of his or her employer), been notified within the five (5) years preceding the date of this offer that any of them are the target of a criminal investigation, grand jury investigation, or civil enforcement proceeding?

Circle One: YES NO

If you have answered "YES" to any of the above questions, please indicate the name(s) of the person(s), the nature, and the status and/or outcome of the information, indictment, conviction, termination, claim or litigation, the name of the court and the file or reference number of the case, as applicable. Any such information should be provided on a separate page, attached to this form and submitted with your proposal.

NOTE: If any response to any question set forth in this questionnaire has been disclosed in any other document, a response may be made by attaching a copy of such disclosure. (For example, said Offeror's most recent filings with the Securities and Exchange Commission ("SEC") may be provided if they are responsive to certain items within the questionnaire.) However, for purposes of clarity, Offeror should correlate its responses with the exhibits by identifying the exhibit and its relevant text.

Disclosures must specifically address, completely respond and comply with all information requested and fully answer all questions requested by Fulton County. Such disclosure must be submitted at the time of the bid or proposal submission and included as a part of the bid/proposal submitted for this project. Disclosure is required for Offerors, joint venture partners and first-tier subcontractors.

Failure to provide required disclosure, submit officially signed and notarized documents or respond to any and all information requested/required by Fulton County can result in the bid/proposal declared as non-responsive. This document must be completed and included as a part of the bid/proposal package along with other required documents.

[SIGNATURES ON NEXT PAGE]

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Under penalty or\f perjury, I declare that I have examined this questionnaire and all attachments hereto, if applicable, to the best of my knowledge and belief, and all statements contained hereto are true, correct, and complete.

On this 24th day of February, 2021

Control Concepts LLC 2-24-21
(Legal Name of Proponent) (Date)

(Signature of Authorized Representative) (Date)

President
(Title)

Sworn to and subscribed before me,

This 24th day of February, 2021

(Notary Public) (Seal)

Commission Expires May 11, 2021
(Date)

DAWN INGRAM NOTARY PUBLIC GEORGIA CHEROKEE COUNTY, GA EXPIRES MAY 11, 2021

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FORM D: GEORGIA PROFESSIONAL LICENSE CERTIFICATION

NOTE: Please complete this form for the work your firm will perform on this project.

Contractor's Name: Control Concepts LLC

Performing work as: Prime Contractor ✓ Subcontractor/Sub-Consultant _____

Professional License Type: Low Voltage General

Professional License Number: LVG104876

Expiration Date of License: 8-31-2021

I certify that the above information is true and correct and that the classification noted is applicable to the Bid for this Project.

Signed: Dawn Ingram

Date: 8-10-2020

(ATTACH COPY OF LICENSE)

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

STATE OF GEORGIA
BRAD RAFFENSPERGER, Secretary of State
Georgia Construction Industry Licensing Board
LICENSE NO. LVG104876
Donald Todd Hughes

161 Sugar Lake Dr
Canton GA 30115

Low Voltage-General

EXP DATE - 08/31/2021 Status: Active
Issue Date: 07/31/1997

A pocket-sized license card is below. Above is an enlarged copy of your pocket card.

Please make note of the expiration date on your license. It is your responsibility to renew your license before it expires. Please notify the Board if you have a change of address.

Wall certificates suitable for framing are available at cost, see board fee schedule. To order a wall certificate, please order from the web site – www.sos.state.ga.us/plb.

Please refer to Board Rules for any continuing education requirements your profession may require.

Georgia State Board of Professional Licensing
237 Coliseum Drive
Macon GA 31217
Phone: (478) 207-2440
Toll Free: (844) 753-7825
www.sos.state.ga.us/plb

Donald Todd Hughes
161 Sugar Lake Dr
Canton GA 30115

STATE OF GEORGIA
BRAD RAFFENSPERGER, Secretary of State
Georgia Construction Industry Licensing Board
License No. LVG104876
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Canton GA 30115

Low Voltage-General

EXP DATE - 08/31/2021 Status: Active
Issue Date: 07/31/1997

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Exhibit I

Office of Contract Compliance Forms

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

Control Concepts
3550 North Pkwy, Suite 100
Cumming, GA 30040
Ofc: (770) 888-0181
Fax: (770) 888-0186

Equal Business Opportunity Plan (EBO Plan)

Vision

For Control Concepts LLC/Comfort Systems to be the employer of choice for minority and female talent in the mechanical, controls and electrical construction industry in the communities we serve.

Goal

To thoughtfully increase representation of diverse talent at all levels of the organization

Why Focus on Diversity and Inclusion?

1. Attract a Broader Pool of Candidates
   - Increasing diversity can make company more appealing to potential new employees
2. Reduced Turnover
   - Employees who feel represented and included are more likely to feel satisfied, leading to higher retention.
3. Foster Innovation
   - Teams with different skills, life experiences, and cultural backgrounds are more likely to develop fresh, new ideas

Control Concepts LLC always seeks opportunities to attract/hire/retain minorities as well as work with qualified minority contractors. For the Fulton County Judicial Center project, we reviewed this list of Contractors that had attended the pre-bid meeting. The review considered potential competitors that could create a conflict of interest as we pursued the project. CCI determined that Shumate Mechanical would be an ideal partner for this project. Not only were they more than qualified to complete the mechanical portion of the work, Shumate is a certified WBENC (Women's Business Enterprise National Council). We have included a copy of their certificate.

Control Concepts constantly evaluates potential qualified minority suppliers/vendors. The selection process involves confirmation that the supplier's product is acceptable per the project contract documents and specifications plus is within the project budget.

For more information, please contact our HR Manager, Ms. Terri Davidson.

E: terri.davidson@comfortsystemsusa.com

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WBENC
WOMEN'S BUSINESS ENTERPRISE NATIONAL COUNCIL
JOIN FORCES. SUCCEED TOGETHER.

hereby grants

National Women's Business Enterprise Certification

to

Shumate Mechanical LLC

who has successfully met WBENC's standards as a Women's Business Enterprise (WBE).
This certification affirms the business is woman-owned, operated and controlled and is valid through the date herein.

WBENC National WBE Certification was processed and validated by Greater Women's Business Council, a WBENC Regional Partner Organization.

Certification Granted: September 30, 2008
Expiration Date: September 30, 2021
WBENC National Certification Number: 2005111240

Authorized by Roz Lewis, President & CEO Women's Business Center

GREATER WOMEN'S BUSINESS COUNCIL

NAICS: 238220
UNSPSC: 72151200, 72151207

Great Lakes Women's Business Council
Women's Business Council Southwest
Women's Business Development Center
WBEA
WBECEAST
WBECFLORIDA
WBECORV
WBECPACIFIC
WBECSOUTH
WBECWEST

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

EXHIBIT A – PROMISE OF NON-DISCRIMINATION

"Know all persons by these presents, that I/We (Todd Hughes), President, Control Concepts LLC div of Comfort Systems USA (Southeast)

Name / Title / Firm Name

Hereinafter "Company", in consideration of the privilege to bid on or obtain contracts funded, in whole or in part, by Fulton County, hereby consent, covenant and agree as follows:

1) No person shall be excluded from participation in, denied the benefit of, or otherwise discriminated against on the basis of race, color, national origin or gender in connection with any bid submitted to Fulton County for the performance of any resulting there from,

2) That it is and shall be the policy of this Company to provide equal opportunity to all businesses seeking to contract or otherwise interested in contracting with this Company without regard to the race, color, gender or national origin of the ownership of this business,

3) That the promises of non-discrimination as made and set forth herein shall be continuing in nature and shall remain in full force and effect without interruption,

4) That the promise of non-discrimination as made and set forth herein shall be made a part of, and incorporated by reference into, any contract or portion thereof which this Company may hereafter obtain,

5) That the failure of this Company to satisfactorily discharge any of the promises of non-discrimination as made and set forth herein shall constitute a material breach of contract entitling the Board to declare the contract in default and to exercise any and all applicable rights and remedies, including but not limited to cancellation of the contract, termination of the contract, suspension and debarment from future contracting opportunities, and withholding and/or forfeiture of compensation due and owning on a contract; and

6) That the bidder shall provide such information as may be required by the Director of Purchasing & Contract Compliance pursuant to Section 102.436 of the Fulton County Non-Discrimination in Purchasing and Contracting Policy.

NAME: Todd Hughes **TITLE:** President

SIGNATURE: Todd Hughes

ADDRESS: 3550 North Parkway, Suite 100
Cumming, GA 30040

PHONE NUMBER: 770-888-0181 **EMAIL:** thughes@intreo.com

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

EXHIBIT C - SCHEDULE OF INTENDED SUBCONTRACTOR UTILIZATION

If the bidder/proposer intends to subcontract any portion of this scope of work/service(s), this form **must be** completed and **submitted with the bid/proposal.** All prime bidders/proposers **must** submit Letter(s) of Intent (Exhibit D) for all subcontractors who will be utilized under the scope of work/services prior to contract execution.

Prime Bidder/Proposer Company Name Control Concepts LLC

ITB/RFP Name & Number: Fulton County Judicial Center Complex DDC Conversion Project Phase II RFP 20RFP041620K-CRB

1. My firm, as **Prime** Bidder/Proposer on this scope of work/service(s) **is NOT**☒, **is**☐ a minority or female owned and controlled business enterprise. ☐**African American (AABE)**☐**; Asian American (ABE);** ☐ **Hispanic American (HBE);** ☐**Native American (NABE);** ☐ **White Female American (WFBE); **If yes, please attach copy of recent certification.** (Check the appropriate box/es)

2. This information below must be completed and submitted with the bid/proposal if a **joint venture (JV)** approach is to be undertaken. Please provide JV breakdown information below and attach a copy of the executed Joint Venture Agreement.

JV Partner(s) information:

Business Name (a.)		**Business Name** (b.)		**Business Name** (c.)	
% of JV		**% of JV**		**% of JV**	
Ethnicity		**Ethnicity**		**Ethnicity**	
Gender		**Gender**		**Gender**	
Phone#		**Phone#**		**Phone#**	

3. Sub-Contractors (including suppliers) to be utilized in the performance of this scope of work/service(s), if awarded, are:

SUBCONTRACTOR NAME: Shumate Mechanical
ADDRESS: 2805 Premiere Pkwy, Duluth, GA 30097

EMAIL ADDRESS: mmatia@shumatemech.com PHONE: 678-584-0880
CONTACT PERSON: Michael Matia
ETHNIC GROUP*: WBENC COUNTY CERTIFIED** 2005111240
WORK TO BE PERFORMED: Conditioned Air Non-Restricted
DOLLAR VALUE OF WORK: $ 3,431,474.40 PERCENTAGE VALUE: 49 %

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SUBCONTRACTOR NAME: Stanton Electric
ADDRESS: 4850 Spout Springs Road, Buford, GA 30519

EMAIL ADDRESS: jerry@stanton@electric.com PHONE: 770-904-6492
CONTACT PERSON: Jerry Stanton
ETHNIC GROUP*: COUNTY CERTIFIED**
WORK TO BE PERFORMED: Electrical
DOLLAR VALUE OF WORK: $ 1,275,398.00 PERCENTAGE VALUE: 18 %

SUBCONTRACTOR NAME:
ADDRESS:

EMAIL ADDRESS: PHONE:
CONTACT PERSON:
ETHNIC GROUP*: COUNTY CERTIFIED**
WORK TO BE PERFORMED:
DOLLAR VALUE OF WORK: $ PERCENTAGE VALUE: %

SUBCONTRACTOR NAME:
ADDRESS:

EMAIL ADDRESS: PHONE:
CONTACT PERSON:
ETHNIC GROUP*: COUNTY CERTIFIED**
WORK TO BE PERFORMED:
DOLLAR VALUE OF WORK: $ PERCENTAGE VALUE: %

SUBCONTRACTOR NAME:
ADDRESS:

EMAIL ADDRESS: PHONE:
CONTACT PERSON:
ETHNIC GROUP*: COUNTY CERTIFIED**
WORK TO BE PERFORMED:
DOLLAR VALUE OF WORK: $ PERCENTAGE VALUE: %

***Ethnic Groups: African American (AABE); Asian American (ABE); Hispanic American (HBE); Native American (NABE); White Female American (WFBE); **If yes, please attach copy of recent certification.**

Total Dollar Value of Subcontractor Agreements: ($) 4,688,872.40

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Total Percentage of Subcontractor Value: (%)

CERTIFICATION: The undersigned certifies that he/she has read, understands and agrees to be bound by the Bid/Proposer provisions, including the accompanying Exhibits and other terms and conditions regarding sub-contractor utilization. The undersigned further certifies that he/she is legally authorized by the Bidder/Proposer to make the statement and representation in this Exhibit and that said statements and representations are true and correct to the best of his/her knowledge and belief. The undersigned understands and agrees that if any of the statements and representations are made by the Bidder/Proposer knowing them to be false, or if there is a failure of the intentions, objectives and commitments set forth herein without prior approval of the County, then in any such event the Contractor's acts or failure to act, as the case may be, shall constitute a material breach of the contract, entitling the County to terminate the Contract for default. The right to so terminate shall be in addition to, and in lieu of, any other rights and remedies the County may have for other defaults under the contract.

Signature: _____ **Title:** Business Development Manager

Business or Corporate Name: **Control Concepts LLC**

Address: **3550North Parkway, Suite 100, Cumming, GA 30040**

Telephone: (770) 888-0181

Fax Number: (770) 888-0186

Email Address: jboston@intreo.com

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

Exhibit J

Risk Management Insurance Provisions Forms

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 7/29/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
USI Southwest
9811 Katy Freeway, Suite 500
Houston TX 77024

CONTACT NAME: Dalton Goetzinger
PHONE (A/C, No, Ext): 713-490-4600 **FAX (A/C, No):** 713-490-4700
E-MAIL ADDRESS: comfort.systems@usi.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Catlin Specialty Insurance Company	15989
INSURER B : Zurich American Insurance Company of IL	27855
INSURER C : National Union Fire Ins Pittsburgh, PA	19445
INSURER D : Allied World Assurance Company, Ltd.	19489
INSURER E : New Hampshire Insurance Company	23841
INSURER F : AIU Insurance Company	19399

INSURED COMFOSYS
Control Concepts LLC
3550 N. Parkway #100
Cumming, GA 30040

COVERAGES **CERTIFICATE NUMBER:** 1607461177 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
C	X **COMMERCIAL GENERAL LIABILITY**	Y	Y	GL6862455	11/1/2019	11/1/2020	EACH OCCURRENCE	$ 7,500,000
	[ ] CLAIMS-MADE [X] OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 7,500,000
	X Contractual Liab						MED EXP (Any one person)	$ 10,000
	X XCU Included						PERSONAL & ADV INJURY	$ 7,500,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 15,000,000
	[ ] POLICY [X] PRO-JECT [ ] LOC						PRODUCTS - COMP/OP AGG	$ 15,000,000
	OTHER:							$
C C C	**AUTOMOBILE LIABILITY**	Y	Y	CA5320313 CA5320314 CA5320315	11/1/2019 11/1/2019 11/1/2019	11/1/2020 11/1/2020 11/1/2020	COMBINED SINGLE LIMIT (Ea accident)	$ 7,500,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	[ ] ALL OWNED AUTOS [ ] SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	X HIRED AUTOS X NON-OWNED AUTOS						PROPERTY DAMAGE (Per accident)	$
								$
D	X **UMBRELLA LIAB** X OCCUR	Y	Y	03120751	11/1/2019	11/1/2020	EACH OCCURRENCE	$ 10,000,000
	EXCESS LIAB [ ] CLAIMS-MADE						AGGREGATE	$ 10,000,000
	[ ] DED X RETENTION $ 10,000							$
E E F E	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	Y	WC017515953 WC020608512 WC020608513 WC017515954	11/1/2019 11/1/2019 11/1/2019 11/1/2019	11/1/2020 11/1/2020 11/1/2020 11/1/2020	X PER STATUTE [ ] OTH-ER	
							E.L. EACH ACCIDENT	$ 7,000,000
							E.L. DISEASE - EA EMPLOYEE	$ 7,000,000
							E.L. DISEASE - POLICY LIMIT	$ 7,000,000
B A	Installation/Builders Risk Professional/Pollution			CPP017374606 CEO744642002	11/1/2019 11/1/2019	11/1/2020 11/1/2020	7,500,000/5,000,000 10,000,000	Per Claim/Agg

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Certificate Holder is included as Additional Insured (except as respects coverage afforded by the Workers Compensation and Professional policies) and is granted a Waiver of Subrogation as required by written contract, but only for liability arising out of the Operations of the Named Insured. This insurance certified herein will apply as Primary and Non- Contributory as required by written contract. No policy will permit cancellation or modification without thirty (30) days prior written notice to the Certificate Holder. Umbrella is Follow Form.

WC020608514 Effective 11/01/2019-11/01/2020
American Home Assurance Company NAICS 19380
CA
See Attached...

CERTIFICATE HOLDER

Fulton County Government
Attn: Purchasing Department
130 Peachtree Street, S.W.
Suite 1168
Atlanta GA 30303-3459

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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AGENCY CUSTOMER ID: COMFOSYS

LOC #:

ADDITIONAL REMARKS SCHEDULE

AGENCY USI Southwest	**NAMED INSURED** Control Concepts LLC 3550 N. Parkway #100 Cumming, GA 30040
POLICY NUMBER	
CARRIER / **NAIC CODE**	**EFFECTIVE DATE:**

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 **FORM TITLE:** CERTIFICATE OF LIABILITY INSURANCE

Per Statute
E.L. Each Accident $7,000,000
E.L. Disease Ea Employee $7,000,000
E.L. Disease Policy Limit $7,000,000

WC020608515 Effective 11/01/2019-11/01/2020
Illinois National Insurance Co. NAICS 23817
FL
Per Statute
E.L. Each Accident $7,000,000
E.L. Disease Ea Employee $7,000,000
E.L. Disease Policy Limit $7,000,000

WC020608563 Effective 11/01/2019-11/01/2020
The Insurance Company of the State of Pennsylvania NAICS 19429
CO
Per Statute
E.L. Each Accident $7,000,000
E.L. Disease Ea Employee $7,000,000
E.L. Disease Policy Limit $7,000,000

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Insurance and Risk Management Provisions
HVAC Services

The following is the minimum insurance and limits that the Contractor/Vendor must maintain. If the Contractor/Vendor maintains broader coverages and/or higher limits than the minimum shown below, Fulton County Government requires and shall be entitled to coverage for the higher limits maintained by the Contractor/Vendor.

It is Fulton County Government's practice to obtain Certificates of Insurance from our Contractors and Vendors. Insurance must be written by a licensed agent in a company licensed to write insurance in the State of Georgia. Respondents shall submit with the bid/proposal evidence of insurability satisfactory to Fulton County Government as to form and content. Either of the following forms of evidence is acceptable:

- A letter from an insurance carrier stating that upon your firm/company being the successful Bidder/Respondent that a Certificate of Insurance shall be issued in compliance with the Insurance and Risk Management Provisions outlined below.
- A Certificate of Insurance complying with the Insurance and Risk Management Provisions outlined below (Request for Bid/Proposal number and Project Description must appear on the Certificate of Insurance).
- A combination of specific policies written with an umbrella policy covering liabilities in excess of the required limits is acceptable to achieve the applicable insurance coverage levels.

Any and all Insurance Coverage(s) and Bonds required under the terms and conditions of the contract shall be maintained during the entire length of the contract, including any extensions or renewals thereto, and until all work has been completed to the satisfaction of Fulton County Government. Evidence of said insurance coverages shall be provided on or before the inception date of the Contract.

Accordingly the Respondent shall provide a certificate evidencing the following:

1. **WORKERS COMPENSATION/EMPLOYER'S LIABILITY INSURANCE – STATUTORY (In compliance with the Georgia Workers Compensation Acts and any other State or Federal Acts or Provisions in which jurisdiction may be granted)**

Employer's Liability Insurance	BY ACCIDENT - EACH ACCIDENT	$500,000.
Employer's Liability Insurance	BY DISEASE - POLICY LIMIT	$500,000.
Employer's Liability Insurance	BY DISEASE - EACH EMPLOYEE	$500,000.

2. **COMMERCIAL GENERAL LIABILITY INSURANCE (Including contractual Liability Insurance)**

Bodily Injury and Property Damage Liability	Each Occurrence	-	$1,000,000
(Other than Products/Completed Operations)	General Aggregate	-	$2,000,000
Products\Completed Operations	Aggregate Limit	-	$2,000,000
Personal and Advertising Injury	Limits	-	$1,000,000
Damage to Rented Premises	Limits	-	$100,000

3. **BUSINESS AUTOMOBILE LIABILITY INSURANCE**
   Bodily Injury & Property Damage Each Occurrence - $1,000,000
   (Including operation of non-owned, owned, and hired automobiles).

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4. **UMBRELLA LIABILITY**
   (In excess of Auto GL and Employers Liability) Each Occurrence - $1,000,000

Professional liability insurance is required when (consultants, engineers, individuals and other businesses provide professional services on contracted projects. The minimum requirements are: .

5. **PROFESSIONAL LIABILITY in the Contractors Profession**
   Per Occurrence or Claim/Aggregate - $3,000,000/$3,000,000
   Policy shall be kept in force and uninterrupted for a period of three (3) years beyond policy expiration. If coverage is discontinued for any reason during this three (3) year term, Contractor/vendor must procure and evidence full Extended Reporting period (ERP) coverage.

Certificates:

Contractor/Vendor shall provide written notice to Fulton County Government immediately if it becomes aware of or receives notice from any insurance company that coverage afforded under such policy or policies shall expire, be cancelled or altered. Certificates of Insurance are to list Fulton County Government, its' Officials, Officers and Employees as an Additional Insured (except for Workers Compensation and Professional Liability) using ISO Additional Insured Endorsement form CG 20 10 (11/85) version, its equivalent or on a blanket basis.

The Contractor/Vendor insurance shall apply as Primary Insurance before any other insurance or self-insurance, including any deductible, non-contributory, and Waiver of Subrogation provided in favor of Fulton County Government.

Additional Insured under the General Liability, Auto Liability, Umbrella Policies (with exception of Workers Compensation), with no Cross Suits exclusion.

If Fulton County Government shall so request, the Respondent, Contractor or Vendor will furnish the County for its inspection and approval such policies of insurance with all endorsements, or confirmed specimens thereof certified by the insurance company to be true and correct copies.

Such certificates and notices shall be sent to:

Fulton County Government
Attn: Purchasing Department
130 Peachtree Street, S.W.
Suite 1168
Atlanta, Georgia 30303-3459

Important:

The obligations for the Contractor/Vendor to procure and maintain insurance shall not be constructed to waive or restrict other obligations. It is understood that neither failure to comply not r full compliance with the foregoing insurance requirements shall limit or relieve the Contractor/Vendor from any liability incurred as a result of their activities/operations in conjunction with the Contract and/or Scope of Work.

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

USE OF PREMISES

Contractor/Vendor shall confine its apparatus, the storage of materials and the operations of its workers to limits/requirements indicated by law, ordinance, permits and any restrictions of Fulton County Government and shall not unreasonably encumber the premises with its materials (where applicable).

PROTECTION OF PROPERTY

Contractor/Vendor will adequately protect its own work from damage, will protect Fulton County Government's property from damage or loss and will take all necessary precautions during the progress of the work to protect all persons and the property of others from damage or loss.

Contractor/Vendor shall take all necessary precautions for the safety of employees of the work and shall comply with all applicable provisions of the Federal, State and local safety laws and building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where work is being performed.

Contractor/Vendor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of its employees, Fulton County Government employees and the public and shall post all applicable signage and other warning devices to protect against potential hazards for the work being performed (where applicable).

THE RESPONDENT ACKNOWLEDGES HAVING READ, UNDERSTANDING, AND AGREES TO COMPLY WITH THE ABOVE STATEMENTS, AND IS AUTHORIZED TO SIGN CONTRACTS ON BEHALF OF THE RESPONDING COMPANY.

COMPANY: Control Concepts LLC SIGNATURE: Todd Hughes

NAME: Todd Hughes TITLE: President

DATE: 2-24-21

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

IN WITNESS THEREOF, the Parties hereto have caused this Contract to be executed by their duly authorized representatives as attested and witnessed and their corporate seals to be hereunto affixed as of the day and year date first above written.

OWNER:

FULTON COUNTY, GEORGIA

DocuSigned by:
Robert L. Pitts
14E1B4AA5F6A44A...

Robert L. Pitts, Chairman
Fulton County Board of Commissioners

CONTRACTOR:

Control Concepts, LLC

DocuSigned by:
Todd Hughes
A3E317394843481...

Todd Hughes President

Please select Attest or Notary from checkbox

Attest X Notary

ATTEST:

DocuSigned by:
Tonya R. Grier
EEC476C4837648D...

Tonya R. Grier
Interim Clerk to the Commission

(Affix County Seal)

ATTEST:

Secretary/
Assistant Secretary

(Affix Corporate Seal)

APPROVED AS TO FORM:

DocuSigned by:
Denual Stewart
2277A2CEF73F4E4...

Office of the County Attorney

ATTEST:

NameTraci Van valkenburg

Notary Public

County: Forsyth

Commission Expires: 05/2/21

(Affix Notary Seal)

DocuSigned by:

APPROVED AS TO CONTENT:

DocuSigned by:
Joseph Davis
6E6566173E2143F...

Joseph Davis Director

Real Estate and Asset Management

Please select RCS or RM from the checkbox

X RCS RM

ITEM#: 2021-0134 **RCS:** 2/17/2021 **RECESS MEETING**	**ITEM#:** _____ **RM:** _____ **REGULAR MEETING**

Insurance Certificate to be attached

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 10/16/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER
USI Southwest
9811 Katy Freeway, Suite 500
Houston TX 77024

CONTACT NAME: Dalton Goetzinger
PHONE (A/C, No, Ext): 713-490-4600 **FAX (A/C, No):** 713-490-4700
E-MAIL ADDRESS: comfort.systems@usi.com

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Old Republic Insurance Company	24147
INSURER B : Allied World Assurance Company, Ltd.	19489
INSURER C : Zurich American Insurance Company of IL	27855
INSURER D : Catlin Specialty Insurance Company	15989
INSURER E :	
INSURER F :	

INSURED COMFOSYS
Control Concepts LLC
3550 N. Parkway #100
Cumming, GA 30040

COVERAGES **CERTIFICATE NUMBER:** 191676666 **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X **COMMERCIAL GENERAL LIABILITY** [ ] CLAIMS-MADE [X] OCCUR X Contractual Liab X XCU Included GEN'L AGGREGATE LIMIT APPLIES PER: [ ] POLICY [X] PRO-JECT [ ] LOC [ ] OTHER:	Y	Y	MWZY31586120	11/1/2020	11/1/2021	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG [ ]	$ 10,000,000 $ 10,000,000 $ 10,000 $ 10,000,000 $ 15,000,000 $ 15,000,000 $
A	**AUTOMOBILE LIABILITY** X ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS X HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY [ ]	Y	Y	MWTB31586220	11/1/2020	11/1/2021	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) [ ]	$ 10,000,000 $ $ $ $
B	X **UMBRELLA LIAB** [X] OCCUR **EXCESS LIAB** [ ] CLAIMS-MADE [ ] DED [X] RETENTION $ 10,000	Y	Y	03120751	11/1/2020	11/1/2021	EACH OCCURRENCE AGGREGATE [ ]	$ 7,500,000 $ 7,500,000 $
A	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** Y / N ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	Y	MWC31586020	11/1/2020	11/1/2021	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 10,000,000 $ 10,000,000 $ 10,000,000
C D	Installation Floater Professional/Pollution			CPP017374607 CEO744642003	11/1/2020 11/1/2020	11/1/2021 11/1/2021	$10,000,000 $10,000,000	Per Occurrence Per Claim/Agg

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)
Certificate Holder is included as Additional Insured (except as respects coverage afforded by the Workers Compensation & Professional policies) and is granted a Waiver of Subrogation as required by written contract, but only for liability arising out of the Ongoing & Completed Operations of the Named Insured. This insurance certified herein will apply as Primary and Non-Contributory as required by written contract. No policy will permit cancellation or modification without thirty (30) days prior written notice to the Certificate Holder. Umbrella is Follow Form.

CERTIFICATE HOLDER

Fulton County Government
Attn: Purchasing Department
130 Peachtree Street, S.W.
Suite 1168
Atlanta GA 30303-3459

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

PRIMARY AND NONCONTRIBUTORY – OTHER INSURANCE CONDITION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
LIQUOR LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

The following is added to the **Other Insurance** Condition and supersedes any provision to the contrary:

Primary And Noncontributory Insurance

This insurance is primary to and will not seek contribution from any other insurance available to an additional insured under your policy provided that:

(1) The additional insured is a Named Insured under such other insurance; and

(2) You have agreed in writing in a contract or agreement that this insurance would be primary and would not seek contribution from any other insurance available to the additional insured.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 25 04 05 09

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED LOCATION(S) GENERAL AGGREGATE LIMIT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Designated Location(s):
THE LOCATIONS AS SPECIFIED IN THE WRITTEN CONTRACTS OR AGREEMENTS
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

A. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under Section **I** – Coverage **A,** and for all medical expenses caused by accidents under Section **I** – Coverage **C,** which can be attributed only to operations at a single designated "location" shown in the Schedule above:

1. A separate Designated Location General Aggregate Limit applies to each designated "location", and that limit is equal to the amount of the General Aggregate Limit shown in the Declarations.

2. The Designated Location General Aggregate Limit is the most we will pay for the sum of all damages under Coverage **A,** except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard", and for medical expenses under Coverage **C** regardless of the number of:

a. Insureds;

b. Claims made or "suits" brought; or

c. Persons or organizations making claims or bringing "suits".

3. Any payments made under Coverage **A** for damages or under Coverage **C** for medical expenses shall reduce the Designated Location General Aggregate Limit for that designated "location". Such payments shall not reduce the General Aggregate Limit shown in the Declarations nor shall they reduce any other Designated Location General Aggregate Limit for any other designated "location" shown in the Schedule above.

4. The limits shown in the Declarations for Each Occurrence, Damage To Premises Rented To You and Medical Expense continue to apply. However, instead of being subject to the General Aggregate Limit shown in the Declarations, such limits will be subject to the applicable Designated Location General Aggregate Limit.

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B. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under Section **I** – Coverage **A,** and for all medical expenses caused by accidents under Section **I** – Coverage **C,** which cannot be attributed only to operations at a single designated "location" shown in the Schedule above:

1. Any payments made under Coverage **A** for damages or under Coverage **C** for medical expenses shall reduce the amount available under the General Aggregate Limit or the Products-completed Operations Aggregate Limit, whichever is applicable; and

2. Such payments shall not reduce any Designated Location General Aggregate Limit.

C. When coverage for liability arising out of the "products-completed operations hazard" is provided, any payments for damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard" will reduce the Products-completed Operations Aggregate Limit, and not reduce the General Aggregate Limit nor the Designated Location General Aggregate Limit.

D. For the purposes of this endorsement, the **Definitions** Section is amended by the addition of the following definition:

"Location" means premises involving the same or connecting lots, or premises whose connection is interrupted only by a street, roadway, waterway or right-of-way of a railroad.

E. The provisions of Section **III** – Limits Of Insurance not otherwise modified by this endorsement shall continue to apply as stipulated.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 25 03 05 09

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED CONSTRUCTION PROJECT(S) GENERAL AGGREGATE LIMIT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Designated Construction Project(s):
THE PROJECTS AS SPECIFIED IN THE WRITTEN CONTRACTS OR AGREEMENTS
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

A. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under Section **I** – Coverage **A,** and for all medical expenses caused by accidents under Section **I** – Coverage **C,** which can be attributed only to ongoing operations at a single designated construction project shown in the Schedule above:

1. A separate Designated Construction Project General Aggregate Limit applies to each designated construction project, and that limit is equal to the amount of the General Aggregate Limit shown in the Declarations.

2. The Designated Construction Project General Aggregate Limit is the most we will pay for the sum of all damages under Coverage **A,** except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard", and for medical expenses under Coverage **C** regardless of the number of:

a. Insureds;

b. Claims made or "suits" brought; or

c. Persons or organizations making claims or bringing "suits".

3. Any payments made under Coverage **A** for damages or under Coverage **C** for medical expenses shall reduce the Designated Construction Project General Aggregate Limit for that designated construction project. Such payments shall not reduce the General Aggregate Limit shown in the Declarations nor shall they reduce any other Designated Construction Project General Aggregate Limit for any other designated construction project shown in the Schedule above.

4. The limits shown in the Declarations for Each Occurrence, Damage To Premises Rented To You and Medical Expense continue to apply. However, instead of being subject to the General Aggregate Limit shown in the Declarations, such limits will be subject to the applicable Designated Construction Project General Aggregate Limit.

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B. For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under Section **I** – Coverage **A,** and for all medical expenses caused by accidents under Section **I** – Coverage **C,** which cannot be attributed only to ongoing operations at a single designated construction project shown in the Schedule above:

1. Any payments made under Coverage **A** for damages or under Coverage **C** for medical expenses shall reduce the amount available under the General Aggregate Limit or the Products-completed Operations Aggregate Limit, whichever is applicable; and

2. Such payments shall not reduce any Designated Construction Project General Aggregate Limit.

C. When coverage for liability arising out of the "products-completed operations hazard" is provided, any payments for damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard" will reduce the Products-completed Operations Aggregate Limit, and not reduce the General Aggregate Limit nor the Designated Construction Project General Aggregate Limit.

D. If the applicable designated construction project has been abandoned, delayed, or abandoned and then restarted, or if the authorized contracting parties deviate from plans, blueprints, designs, specifications or timetables, the project will still be deemed to be the same construction project.

E. The provisions of Section **III** – Limits Of Insurance not otherwise modified by this endorsement shall continue to apply as stipulated.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 10 12 19

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – OWNERS, LESSEES OR CONTRACTORS – SCHEDULED PERSON OR ORGANIZATION

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s)	Location(s) Of Covered Operations
All Persons Or Organizations As Required By Contract Or Agreement	The Locations As Specified In The Written Contracts Or Agreements
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. **Section II – Who Is An Insured** is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

However:

1. The insurance afforded to such additional insured only applies to the extent permitted by law; and
2. If coverage provided to the additional insured is required by a contract or agreement, the insurance afforded to such additional insured will not be broader than that which you are required by the contract or agreement to provide for such additional insured.

B. With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

1. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.

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C. With respect to the insurance afforded to these additional insureds, the following is added to **Section III – Limits Of Insurance:**

If coverage provided to the additional insured is required by a contract or agreement, the most we will pay on behalf of the additional insured is the amount of insurance:

1. Required by the contract or agreement; or

2. Available under the applicable limits of insurance;

whichever is less.

This endorsement shall not increase the applicable limits of insurance.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 37 12 19

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED – OWNERS, LESSEES OR CONTRACTORS – COMPLETED OPERATIONS

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART

SCHEDULE

Name Of Additional Insured Person(s) Or Organization(s)	Location And Description Of Completed Operations
All Persons Or Organizations As Required By Contract Or Agreement	The Locations As Specified In The Written Contracts Or Agreements
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

A. **Section II – Who Is An Insured** is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the Schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

However:

1. The insurance afforded to such additional insured only applies to the extent permitted by law; and

2. If coverage provided to the additional insured is required by a contract or agreement, the insurance afforded to such additional insured will not be broader than that which you are required by the contract or agreement to provide for such additional insured.

B. With respect to the insurance afforded to these additional insureds, the following is added to **Section III – Limits Of Insurance:**

If coverage provided to the additional insured is required by a contract or agreement, the most we will pay on behalf of the additional insured is the amount of insurance:

1. Required by the contract or agreement; or

2. Available under the applicable limits of insurance;

whichever is less.

This endorsement shall not increase the applicable limits of insurance.

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POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 24 04 12 19

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US (WAIVER OF SUBROGATION)

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART
ELECTRONIC DATA LIABILITY COVERAGE PART
LIQUOR LIABILITY COVERAGE PART
POLLUTION LIABILITY COVERAGE PART DESIGNATED SITES
POLLUTION LIABILITY LIMITED COVERAGE PART DESIGNATED SITES
PRODUCTS/COMPLETED OPERATIONS LIABILITY COVERAGE PART
RAILROAD PROTECTIVE LIABILITY COVERAGE PART
UNDERGROUND STORAGE TANK POLICY DESIGNATED TANKS

SCHEDULE

Name Of Person(s) Or Organization(s):
All Persons Or Organizations As Required By Contract Or Agreement
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

The following is added to Paragraph **8. Transfer Of Rights Of Recovery Against Others To Us** of **Section IV – Conditions:**

We waive any right of recovery against the person(s) or organization(s) shown in the Schedule above because of payments we make under this Coverage Part. Such waiver by us applies only to the extent that the insured has waived its right of recovery against such person(s) or organization(s) prior to loss. This endorsement applies only to the person(s) or organization(s) shown in the Schedule above.

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THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

EARLIER NOTICE OF CANCELLATION, NONRENEWAL OR MATERIAL CHANGE IN COVERAGE TO THE FIRST NAMED INSURED

SCHEDULE

Reasons:	**Number of Days Notice**
Nonpayment Of Premium:	10 Days
Cancellation For Any Other Reason:	90 Days
Nonrenewal (When We Do Not Renew):	90 Days
Material Change In Coverage:	90 Days

For any reasons described in the Schedule above, for which the Number of Days Notice is completed, we will provide notice to the first Named Insured as follows:

A. NONPAYMENT OF PREMIUM

For nonpayment of premium, the advance number of days required for notice of cancellation as provided in the **CONDITIONS** section of this insurance or as amended by the applicable state cancellation endorsement applicable to this insurance, is increased to the Number of Days Notice shown in the Schedule above.

B. EARLIER NOTICE OF CANCELLATION OTHER THAN NONPAYMENT OF PREMIUM

For any statutorily permitted reason for cancellation other than nonpayment of premium, the advance number of days required for notice of cancellation, as provided in the **CONDITIONS** section of this insurance, or as amended by the applicable state cancellation endorsement applicable to this insurance, is increased to the Number of Days Notice shown in the Schedule above.

C. EARLIER NOTICE OF NONRENEWAL (WHEN WE DO NOT RENEW)

For any statutorily permitted reason the advance number of days required for notice of nonrenewal (When We Do Not Renew), as provided in the **CONDITIONS** section of this insurance, or as amended by the applicable state nonrenewal (When We Do Not Renew) endorsement applicable to this insurance, is increased to the Number of Days Notice shown in the Schedule above.

D. MATERIAL CHANGE IN COVERAGE

For any material change in coverage that reduces or restricts the insurance provided by this policy, we will provide the first Named Insured with at least the Number of Days Notice shown in the Schedule above.

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IL 10 (12/06) OLD REPUBLIC INSURANCE COMPANY

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

AMENDMENT OF GENERAL AGGREGATE LIMIT DESIGNATED CONSTRUCTION PROJECT(S) AND DESIGNATED LOCATION(S)

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE FORM

SCHEDULE

$ 15,000,000 **Ultimate General Aggregate Limit**

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

If endorsement(s) CG 25 03 - Designated Construction Project(s) General Aggregate Limit and/or endorsement CG 25 04 - Designated Location(s) General Aggregate Limit is (are) made a part of the policy, the following provisions apply to the insurance provided by this policy and supercede any provision(s) to the contrary:

A. The Designated Construction Project General Aggregate Limit (CG 25 03) and Designated Location General Aggregate Limit (CG 25 04) are subject to the Ultimate General Aggregate Limit shown in the Schedule.

B. The Ultimate General Aggregate Limit shown in the Schedule is the most we will pay for the sum of all damages under the Designated Construction Project General Aggregate Limit and Designated Location General Aggregate Limit.

C. **SECTION III - LIMITS OF INSURANCE** provisions not otherwise modified by this endorsement shall continue to apply as stipulated.

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POLICY NUMBER:

COMMERCIAL AUTO
CA 04 44 10 13

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

WAIVER OF TRANSFER OF RIGHTS OF RECOVERY AGAINST OTHERS TO US (WAIVER OF SUBROGATION)

This endorsement modifies insurance provided under the following:

AUTO DEALERS COVERAGE FORM
BUSINESS AUTO COVERAGE FORM
MOTOR CARRIER COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

This endorsement changes the policy effective on the inception date of the policy unless another date is indicated below.

Named Insured: Comfort Systems USA, Inc.

Endorsement Effective Date: 11/01/20

SCHEDULE

Name(s) Of Person(s) Or Organization(s):
All Persons Or Organizations As Required By Contract Or Agreement
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.

The **Transfer Of Rights Of Recovery Against Others To Us** condition does not apply to the person(s) or organization(s) shown in the Schedule, but only to the extent that subrogation is waived prior to the "accident" or the "loss" under a contract with that person or organization.

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IL 10 (12/06) OLD REPUBLIC INSURANCE COMPANY

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

EARLIER NOTICE OF CANCELLATION, NONRENEWAL OR MATERIAL CHANGE IN COVERAGE TO THE FIRST NAMED INSURED

SCHEDULE

Reasons:	**Number of Days Notice**
Nonpayment Of Premium:	10 Days
Cancellation For Any Other Reason:	90 Days
Nonrenewal (When We Do Not Renew):	90 Days
Material Change In Coverage:	90 Days

For any reasons described in the Schedule above, for which the Number of Days Notice is completed, we will provide notice to the first Named Insured as follows:

A. NONPAYMENT OF PREMIUM

For nonpayment of premium, the advance number of days required for notice of cancellation as provided in the **CONDITIONS** section of this insurance or as amended by the applicable state cancellation endorsement applicable to this insurance, is increased to the Number of Days Notice shown in the Schedule above.

B. EARLIER NOTICE OF CANCELLATION OTHER THAN NONPAYMENT OF PREMIUM

For any statutorily permitted reason for cancellation other than nonpayment of premium, the advance number of days required for notice of cancellation, as provided in the **CONDITIONS** section of this insurance, or as amended by the applicable state cancellation endorsement applicable to this insurance, is increased to the Number of Days Notice shown in the Schedule above.

C. EARLIER NOTICE OF NONRENEWAL (WHEN WE DO NOT RENEW)

For any statutorily permitted reason the advance number of days required for notice of nonrenewal (When We Do Not Renew), as provided in the **CONDITIONS** section of this insurance, or as amended by the applicable state nonrenewal (When We Do Not Renew) endorsement applicable to this insurance, is increased to the Number of Days Notice shown in the Schedule above.

D. MATERIAL CHANGE IN COVERAGE

For any material change in coverage that reduces or restricts the insurance provided by this policy, we will provide the first Named Insured with at least the Number of Days Notice shown in the Schedule above.

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THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

PRIMARY AND NONCONTRIBUTORY – OTHER INSURANCE CONDITION

This endorsement modifies insurance provided under the following:

AUTO DEALERS COVERAGE FORM
BUSINESS AUTO COVERAGE FORM
MOTOR CARRIER COVERAGE FORM

With respect to coverage provided by this endorsement, the provisions of the Coverage Form apply unless modified by the endorsement.

A. The following is added to the **Other Insurance** Condition in the Business Auto Coverage Form and the **Other Insurance – Primary And Excess Insurance Provisions** in the Motor Carrier Coverage Form and supersedes any provision to the contrary:

This Coverage Form's Covered Autos Liability Coverage is primary to and will not seek contribution from any other insurance available to an "insured" under your policy provided that:

1. Such "insured" is a Named Insured under such other insurance; and

2. You have agreed in writing in a contract or agreement that this insurance would be primary and would not seek contribution from any other insurance available to such "insured".

B. The following is added to the **Other Insurance** Condition in the Auto Dealers Coverage Form and supersedes any provision to the contrary:

This Coverage Form's Covered Autos Liability Coverage and General Liability Coverages are primary to and will not seek contribution from any other insurance available to an "insured" under your policy provided that:

1. Such "insured" is a Named Insured under such other insurance; and

2. You have agreed in writing in a contract or agreement that this insurance would be primary and would not seek contribution from any other insurance available to such "insured".

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THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

ADDITIONAL INSURED

This endorsement modifies insurance provided under the following:

BUSINESS AUTO COVERAGE FORM
MOTOR CARRIER COVERAGE FORM

SCHEDULE

Name of Person(s) or Organization(s):

All Persons Or Organizations As Required By Contract Or Agreement

With respect to **COVERED AUTOS LIABILITY COVERAGE**, **Who Is An Insured** is changed with the addition of the following:

Each person or organization shown in the Schedule for whom you are doing work is an “insured". But only for "bodily injury" or "property damage" that results from the ownership, maintenance or use of a covered "auto" by:

1. You;

2. an "employee" of yours; or

3. anyone who drives a covered "auto" with your permission or with the permission of one of your "employees".

However, the insurance afforded to the person or organization shown in the Schedule shall not exceed the scope of coverage and/or limits of this policy. Not withstanding the foregoing sentence, in no event shall the insurance provided by this policy exceed the scope of coverage and/or limits required by the contract or agreement.

PCA 001 10 13

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OLD REPUBLIC INSURANCE COMPANY

WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY INSURANCE POLICY

EARLIER NOTICE OF CANCELATION OR NONRENEWAL PROVIDED BY US

SCHEDULE

Number of Days' Notice of Cancellation Non-payment of Premium	Number of Days' Notice of Cancellation Reasons Other Than Non-payment of Premium or Nonrenewal	State(s) Applicable
10	90	STATES IN ITEM 3.A.

Number of Days' Notice of Nonrenewal	State(s) Applicable
90	STATES IN ITEM 3.A.

A. For any statutorily permitted reason for cancellation, the number of days required for notice of cancellation, as provided in the Cancellation Condition or as amended by an applicable state cancellation endorsement, is increased to the number of days shown in the Schedule.

B. For any statutorily permitted nonrenewal, the number of days required for notice of nonrenewal as amended by an applicable state endorsement is increased to the number of days shown in the Schedule.

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WORKERS COMPENSATION AND EMPLOYERS LIABILITY INSURANCE POLICY **WC 00 03 01 A**

POLICY NUMBER: MWC 315860 20

ALTERNATE EMPLOYER ENDORSEMENT

This endorsement applies only with respect to bodily injury to your employees while in the course of special or temporary employment by the alternate employer in the state named in Item 2 of the Schedule. Part One (Workers Compensation Insurance) and Part Two (Employers Liability Insurance) will apply as though the alternate employer is insured. If an entry is shown in Item 3 of the Schedule the insurance afforded by this endorsement applies only to work you perform under the contract or at the project named in the Schedule.

Under Part One (Workers Compensation Insurance) we will reimburse the alternate employer for the benefits required by the workers compensation law if we are not permitted to pay the benefits directly to the persons entitled to them.

The insurance afforded by this endorsement is not intended to satisfy the alternate employer's duty to secure its obligations under the workers compensation law. We will not file evidence of this insurance on behalf of the alternate employer with any government agency.

We will not ask any other insurer of the alternate employer to share with us a loss covered by this endorsement.

Premium will be charged for your employees while in the course of special or temporary employment by the alternate employer.

The policy may be canceled according to its terms without sending notice to the alternate employer.

Part Four (Your Duties If Injury Occurs) applies to you and the alternate employer. The alternate employer will recognize our right to defend under Parts One and Two and our right to inspect under Part Six.

SCHEDULE

1. **ALTERNATE EMPLOYER** **ADDRESS**
   ON FILE WITH COMPANY

2. **STATE OF SPECIAL OR TEMPORARY EMPLOYMENT**
   ON FILE WITH COMPANY

   THIS FORM IS NOT APPLICABLE IN TX

3. **CONTRACT OR PROJECT**
   ON FILE WITH COMPANY

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POLICY NUMBER: **MWC 315860 20**

WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule. (This agreement applies only to the extent that you perform work under a written contract that requires you to obtain this agreement from us.)

This agreement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

SCHEDULE

AS REQUIRED BY CONTRACT OR AGREEMENT

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WORKERS COMPENSATION AND EMPLOYERS LIABILITY INSURANCE POLICY **WC 04 03 06 (Ed. 04-84)**

POLICY NUMBER: **MWC 315860 20**

WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT - CALIFORNIA

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule. (This agreement applies only to the extent that you perform work under a written contract that requires you to obtain this agreement from us.)

You must maintain payroll records accurately segregating the remuneration of your employees while engaged in the work described in the Schedule.

The additional premium for this endorsement shall be 0 % of the California workers' compensation premium otherwise due on such remuneration.

SCHEDULE

PERSON OR ORGANIZATION	JOB DESCRIPTION
AS REQUIRED BY CONTRACT OR AGREEMENT	

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TEXAS WAIVER OF OUR RIGHT TO RECOVER FROM OTHERS ENDORSEMENT

This endorsement applies only to the insurance provided by the policy because Texas is shown in Item 3.A. of the Information Page.

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule, but this waiver applies only with respect to bodily injury arising out of the operations described in the Schedule where you are required by a written contract to obtain this waiver from us.

This endorsement shall not operate directly or indirectly to benefit anyone not named in the Schedule.

The premium for this endorsement is shown in the Schedule.

Schedule

1. ( ) Specific Waiver
   Name of person or organization

   (X) Blanket Waiver
   Any person or organization for whom the Named Insured has agreed by written contract to furnish this waiver.

2. Operations:

3. Premium:
   The premium charge for this endorsement shall be 0 percent of the premium developed on payroll in connection with work performed for the above person(s) or organization(s) arising out of the operations described.

4. Advance Premium: **INCLUDED**

This endorsement changes the policy to which it is attached and is effective on the date issued unless otherwise stated.
(The information below is required only when this endorsement is issued subsequent to preparation of the policy.)

Endorsement Effective 11/01/2020 Policy No. MWC 315860 20 Endorsement No.

Insured **COMFORT SYSTEMS USA, INC** Premium $ **INCL.**

Insurance Company **OLD REPUBLIC INSURANCE COMPANY**

Countersigned By Gary Nieo

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POLICY NUMBER: **MWC 315860 20**

UTAH WAIVER OF SUBROGATION ENDORSEMENT

This endorsement applies only to the insurance provided by the policy because Utah is shown in Item 3.A. of the Information Page.

We have the right to recover our payments from anyone liable for an injury covered by this policy. We will not enforce our right against the person or organization named in the Schedule. (This agreement applies only to the extent that you perform work under a written contract that requires you to obtain this agreement from us.)

This agreement shall not operate directly or indirectly to benefit anyone not named in the Schedule. Our waiver of rights does not release your employees' rights against third parties and does not release our authority as trustee of claims against third parties.

Schedule

AS REQUIRED BY CONTRACT OR AGREEMENT

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ALTERNATE EMPLOYER ENDORSEMENT

This endorsement applies only with respect to bodily injury to your employees while in the course of special or temporary employment by the alternate employer in the state named in the schedule. Part One (Workers Compensation Insurance) and Part Two (Employers Liability Insurance) will apply as though the alternate employer is insured.

Under Part One (Workers Compensation Insurance) we will reimburse the alternate employer for the benefits required by the workers compensation law if we are not permitted to pay the benefits directly to the persons entitled to them.

The insurance afforded by this endorsement is not intended to satisfy the alternate employer's duty to secure its obligations under the workers compensation law. We will not file evidence of this insurance on behalf of the alternate employer with any government agency.

We will not ask any other insurer of the alternate employer to share with us a loss covered by this endorsement.

Premium will be charged for your employees while in the course of special or temporary employment by the alternate employer.

The policy may be canceled according to its terms without sending notice to the alternate employer.

Part Four (Your Duties If Injury Occurs) applies to you and the alternate employer. The alternate employer will recognize our right to defend under Parts One and Two and our right to inspect under Part Six.

SCHEDULE

ALTERNATE EMPLOYER	ADDRESS	STATE OF SPECIAL OR TEMPORARY EMPLOYMENT
ON FILE WITH COMPANY		TX

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ENDORSEMENT #018

This endorsement, effective 12:01 a.m., November 1, 2020, forms a part of Policy No. CEO744642002 issued to COMFORT SYSTEMS USA, INC. by Indian Harbor Insurance Company.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

MANUSCRIPT ENDORSEMENT - CANCELLATION NOTIFICATION TO OTHERS

This endorsement modifies insurance provided under the following:

PA/CE Plus: Professional Activities/Complete Execution + Pollution (Occurrence)

PROFESSIONAL & POLLUTION LIABILITY FOR CONSTRUCTION CONTRACTORS AND CONSTRUCTION SUPPORT SERVICES PROVIDERS

In consideration of the premium charged, it is hereby understood and agreed that in the event coverage is cancelled for any statutorily permitted reason, other than non-payment of premium, advance written notice will be mailed or delivered to person(s) or entity(ies) according to the notification schedule shown below:

Name of Person(s) or Entity(ies)	Mailing Address	Number of Days Advanced Notice of Cancellation
All entities as required per schedule on file with broker to be provided at time of cancellation.		Per requirement (no less than 30 days)
Wake County And Wake County Board Of Education	Facilities Building 1429 Rock quarry Road, Suite 116 Raleigh, NC 27610	30
Bank Of The Ozarks, LVS II SPE XXI LLC	333 Commerce Green Blvd Sugar Land, TX 77478	30
Dianna Wong Architecture *Interior Design, Inc.	333 Commerce Green Blvd Sugar Land, TX 77478	30
E.E. Reed Construction, LP	333 Commerce Green Blvd Sugar Land, TX 77478	30
John Kirksey Associates, Inc.	333 Commerce Green Blvd Sugar Land, TX 77478	30
Keating Khang LLC	333 Commerce Green Blvd Sugar Land, TX 77478	30
Thor Equities LLC	333 Commerce Green Blvd Sugar Land, TX 77478	30
Thor Kirby 1, LLC	333 Commerce Green Blvd Sugar Land, TX 77478	30
Thor Kirby 3 Group, LLC	333 Commerce Green Blvd Sugar Land, TX 77478	30
Wake County Board of Education Re: Lynn Road Elementary School 1601 Lynn Road Raleigh, NC 27607	1429 Rock Quarry Road, Suite 116 Raleigh, NC 27610	30
R.R. Simmons Design & Construction, LLC Attn: Insurance Coordinator	13112 Telecom Drive	30
Little River Elementary and Durham Public Schools Board of Construction & Capital Planning RE: Little River	2011 Hamlin Road Durham, NC 27704	30

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Re: Little River Elementary School-Chiller Replacement Project		
McCarthy Building Companies	P.O. Box 100085-73 Duluth, GA 30096	30
RR Simmons Construction Corporation Attn: Insurance Coordinator	13112 Telecom Drive Tampa, FL 33675	30
RR Simmons Design Construction Attn: Insurance Coordinator	13112 Telecom Drive Tampa, FL 33675	30

Any failure of the Company to so notify the person(s) or entity(ies) listed above will in no way serve as, or be deemed, a violation or breach of the Company's duties or obligations under this Policy or otherwise.

All other terms, conditions and exclusions of this policy remain unchanged.

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b. this coverage shall expire at the end of the **Policy Period** or within ninety (90) days of such formation or acquisition of the entity, whichever is earlier, unless you submit written notice to us providing detailed information concerning the newly formed or acquired entity, confirmed by us by endorsement, and provided that you pay any applicable additional premium requested by us;

7. Any **Insured** with regard to its participation in a legal entity including a limited liability company or joint venture, but only to the extent of the **Insured's** legal liability for its rendering of **Professional Activities and Duties** and/or **Contracting Activities** under the respective legal entity or joint venture;
8. With regard to Section 1: What We Cover D.1., the **Client**, but only:
   a. if the you are required to include the **Client** as an additional **Insured** in a written contract in effect during the **Policy Period** and signed by the you prior to the first commencement of the **Pollution Condition**; and
   b. with respect to the **Client**'s vicarious liability resulting from your **Contracting Activity**.
9. With regard to Section 1: What We Cover D.1., all persons or organizations, other than a **Client**, as required by a written contract executed by the **Named Insured**, but only for:
   a. a **Pollution Condition** caused by your **Contracting Activity**; and
   b. the vicarious liability of the person or organization that results from the performance of your **Contracting Activity**

   provided that such written contract is signed by the **Named Insured** prior to the commencement of the **Pollution Condition**.

Insured Contract **L.** means that part of any written contract or written agreement under which you assume the Tort Liability of another party to pay compensatory damages for **Bodily Injury** or **Property Damage**, to a third person or organization, provided that such written contract or written agreement is signed by you prior to the **Bodily Injury** or **Property Damage**. Tort Liability means a liability that would be imposed by law in the absence of any contract or agreement.

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Declarations and Representations **G.** By acceptance of this policy, you agree that the statements and information contained in the Application and other supplemental materials submitted to us are: (a) true and correct; (b) such statements and information are material to our underwriting of this policy; and (c) that this policy has been issued by us in reliance upon the truth and correctness of such statements and information.

Design Professional's Insurance **H.** The **Insured** shall require that each **Design Professional** under written contract to it evidence professional liability insurance.

Headings **I.** The descriptions in the headings of this policy are solely for convenience and form no part of the terms and conditions of this policy.

Inspection and Audit **J.** We will be permitted, but not obligated, to examine, audit, monitor and inspect on a continuing basis any of the **Insured's** books, records, services, properties and activities at any time, as far as they relate to the subject matter of this policy.

Neither our right to examine, audit, monitor and make inspections, or the actual undertaking thereof, or any report thereon, neither constitutes an undertaking to determine or warrant that property or operations are safe, healthful or conform to acceptable engineering practice or are in compliance with any law, rule or regulation. Any inspections will be coordinated through your broker or agent.

We may modify, amend or delete any of the terms and conditions of this policy including the right to charge additional premium and the right to cancel, rescind or void this policy, if our examination, audit, monitoring or inspection reveals any material risk, hazard or condition that was not previously disclosed by any **Insured** in the Application or supplemental materials, or which deviates from the information disclosed in the Application or supplemental materials.

Limitation of Liability **K.** Under Protective Loss Coverage, the **Insured** shall not accept any limitation of liability from a **Design Professional** other than to insurance proceeds, without our express written consent.

Other Insurance **L.** Where other valid and collectible insurance is available to the **Insured**, in addition to **Design Professional's Insurance**, our obligations to the **Insured** are as follows:

1. This insurance is excess over any other valid and collectible insurance, whether such other insurance is stated to be primary, contributory, excess, contingent or otherwise.
2. This insurance is excess over any other valid and collectible insurance available to the **Insured** under a project specific insurance policy, contractor-controlled insurance program, owner-controlled insurance program, consolidated (wrap-up) insurance program or any other similar insurance or program, whether such other insurance or program is stated to be primary, contributory, excess, contingent or otherwise.
3. This insurance is excess over any other valid and collectible **Design Professional's Insurance** whether such other insurance is stated to be primary, contributory, excess, contingent or otherwise.

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4. Under Section 1: What We Cover: D. Pollution Loss Coverage only, when the **Named Insured** is required by contract, agreement, or permit to include any person or entity as an additional insured, such coverage shall be provided on a primary and non-contributory basis.

Severability **M.** Except with respect to the Limits of Liability and the Self-Insured Retention Amount, and any rights or duties specifically assigned in this policy to you, this insurance applies: (a) as if each **Named Insured** were the only **Named Insured**; and (b) separately to each **Insured** against or by whom a **Claim** is made.

Misrepresentation, concealment, breach of condition or violation of any duty under this policy by one **Insured** shall not prejudice the interest or coverage of another **Insured** under this policy.

Sole Agent **N.** You will act on behalf of all **Insured(s)** for the payment or return of premium, receipt and acceptance of any endorsement issued to form a part of this policy, giving and receiving notice of cancellation or non-renewal and the exercise of the rights provided in Section 6: Extended Reporting Period, B. Optional Extended Reporting Period.

Subrogation **O.** In the event of any payment under this policy, we will be subrogated to all of the **Insured's** rights of recovery against any person or organization and the **Insured** will execute and deliver instruments and papers and do whatever else is necessary to secure such rights. The **Insured** will do nothing at any time to prejudice our subrogation rights.

However, we waive our right(s) of recovery against any person or organization included in the definition of an **Insured** or against the **Insured's Clients**, if prior to a **Professional Liability Claim**, a waiver of subrogation was so required and accepted under a specific contractual undertaking by the **Insured**.

Under Section 1: What We Cover: D. Pollution Loss Coverage, we waive our right(s) of recovery against any person or organization included in the definition of an **Insured** or against the **Insured's Clients** if prior to the **Pollution Claim**, a waiver of subrogation was required and accepted under a specific contractual undertaking by the **Insured**.

Territory **P.** Coverage granted under this policy will apply anywhere in the world, to the extent permitted by law.

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ENDORSEMENT #027

This endorsement, effective 12:01 a.m., November 1, 2020 forms a part of Policy No. CEO744642002 issued to COMFORT SYSTEMS USA, INC. by Indian Harbor Insurance Company.

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

MANUSCRIPT ENDORSEMENT - AMENDMENT TO OTHER INSURANCE CONDITION

This endorsement modifies insurance provided under the following:

PA/CE Plus: Professional Activities/Complete Execution + Pollution (Occurrence)

PROFESSIONAL & POLLUTION LIABILITY FOR CONSTRUCTION CONTRACTORS AND CONSTRUCTION SUPPORT SERVICES PROVIDERS

In consideration of the premium charged, it is hereby understood and agreed that Paragraph 4. of Condition **L., Other Insurance** of **SECTION 7: CONDITIONS** is amended to include the following:

Other Insurance L. 4. Under Section 1: What We Cover: D. Pollution Loss Coverage only shall be provided on a primary basis; and also on a non-contributory basis when the **Named Insured** is required by contract, agreement, or permit to include any person or entity as an additional insured.

All other terms, conditions and exclusions of this policy remain unchanged.

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forth in Item 6. of the Declarations. At the beginning of the **Policy Period,** you must pay us the Advance Premium shown in Item 6. of the Declarations.

When this policy expires or if it is cancelled, we will compute the earned premium for the time this policy was in force. If this policy is subject to audit adjustment, the actual exposure base will be used to compute the earned premium. If the earned premium is greater than the Advance Premium, you will promptly pay us the difference. If the earned premium is less than the Advance Premium, we will return the difference to you. But in any event, we will retain the Minimum Premium as shown in Item 6. of the Declarations for each twelve months of the **Policy Period.**

N. **Separation of Insureds**

Except with respect to the Limits of Insurance of this policy and rights or duties specifically assigned to the first **Named Insured** designated in Item 1. of the Declarations, this insurance applies:

1. as if each **Named Insured** were the only **Named Insured;** and

2. separately to each **Insured** against whom claim is made or **Suit** is brought.

O. **Transfer of Rights of Recovery**

1. If any **Insured** has rights to recover all or part of any payment we have made under this policy, those rights are transferred to us. The **Insured** must do nothing after loss to impair these rights and must help us enforce them.

2. Any recoveries will be applied as follows:

   a. any person or organization, including the **Insured,** that has paid an amount in excess of the applicable Limits of Insurance of this policy will be reimbursed first;

   b. we then will be reimbursed up to the amount we have paid; and

   c. lastly, any person or organization, including the **Insured** that has paid an amount over which this policy is excess is entitled to claim the remainder.

   Expenses incurred in the exercise of rights of recovery will be apportioned among the persons or organizations, including the **Insured,** in the ratio of their respective recoveries as finally settled.

3. If, prior to the time of an **Occurrence**, you waive any right of recovery against a specific person or organization for injury or damage as required under an **Insured Contract**, we will also waive any rights we may have against such person or organization

P. **Transfer of Your Rights and Duties**

Your rights and duties under this policy may not be transferred without our written consent. If you die or are legally declared bankrupt, your rights and duties will be transferred to your legal representative, but only while acting within the scope of duties as your legal representative. However, notice of cancellation sent to the first **Named Insured** designated in Item 1.A. of the Declarations and mailed to the address designated in Item 1.B. of the Declarations of this policy will be sufficient notice to effect cancellation of this policy.

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F. **Insured** means:

1. the **Named Insured**;

2. if you are designated in the Declarations as:

   a. an individual, you and your spouse are **Insureds**, but only with respect to the conduct of a business of which you are the sole owner;

   b. a partnership or joint venture, you are an **Insured**. Your members, your partners, and their spouses are also **Insureds**, but only with respect to the conduct of your business;

   c. a limited liability company, you are an **Insured**. Your members are also **Insureds**, but only with respect to the conduct of your business. Your managers are **Insureds**, but only with respect to their duties as your managers;

   d. an organization other than a partnership, joint venture or limited liability company, you are an **Insured**. Your executive officers and directors are **Insureds**, but only with respect to their duties as your officers or directors. Your stockholders are also **Insureds**, but only with respect to their liability as stockholders;

   e. a trust, you are an **Insured**. Your trustees are also **Insureds**, but only with respect to their duties as trustees;

3. your employees other than your executive officers (if you are an organization other than a partnership, joint venture or limited liability company) or your managers (if you are a limited liability company), but only for acts within the scope of their employment by you or while performing duties related to the conduct of your business;

4. your volunteer workers only while performing duties related to the conduct of your business;

5. any person (other than your employee or volunteer worker) or organization while acting as your real estate manager;

6. your legal representative if you die, but only with respect to duties as such. That representative will have all your rights and duties under this policy;

7. any person or organization, other than the **Named Insured,** included as an Additional Insured under **Scheduled Underlying Insurance,** but not for broader coverage than would be afforded by such **Scheduled Underlying Insurance.**

Notwithstanding any of the above:

a. no person or organization is an **Insured** with respect to the conduct of any current, past or newly formed partnership, joint venture or limited liability company that is not designated as a **Named Insured** in Item 1. of the Declarations; and

b. no person or organization is an **Insured** under this policy who is not an **Insured** under applicable **Scheduled Underlying Insurance.** This provision shall not apply to any organization set forth in the definition of **Named Insured** in subparagraphs J. 2 and 3.

G. **Insured Contract** means that part of any contract or agreement pertaining to your business under which any **Insured** assumes the tort liability of another party to pay for **Bodily Injury** or **Property Damage** to a third person or organization. Tort liability means a liability that would be imposed by law in the absence of any contract or agreement.

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Endorsement No:
This endorsement, effective: 11/01/2020
(at 12:01 A.M. standard time at the address of the **Named Insured** as shown in Item 1. B. of the Declarations)
forms a part of Policy No: 03120751

by: Allied World National Assurance Company

AMENDMENT TO DEFINITION OF INSURED – ADDITIONAL INSURED PRIMARY AND NON-CONTRIBUTORY WHERE REQUIRED BY CONTRACT

It is agreed that this policy is amended as follows:

Section **VI. DEFINITIONS**, Paragraph F. **Insured** is amended to include the following additional provision:

Any person or organization for whom you are performing operations when you and such person or organization have agreed in writing in a contract or agreement that such person or organization is an additional **Insured** on your policy, but only if such person or organization is included under the coverage provided by **Scheduled Underlying Insurance**. Such person or organization is an additional **Insured** only with respect to liability arising out of **Your Work** at the location designated. Coverage afforded to these additional **Insured** parties will be primary to, and non-contributory with, any other insurance available to that person or organization where required of you by written contract or agreement.

The above provision does not apply to liability arising out of the sole negligence of such person or organization for its own acts or omissions or those of its employees or anyone else acting on its behalf.

All other terms and conditions of this policy remain unchanged.

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Bond No. 9372171

PAYMENT BOND

"County:" means Fulton County Government; a political subdivision of the State of Georgia (hereinafter called the "Owner").

"Project:" means **#20RFP041620K-CRB, Fulton County Judicial Center Complex DDC Conversion Project – Phase II**

"Principal:" Control Concepts, LLC (hereinafter called the "Principal")
3550 North Parkway, Suite 100
Cumming, GA 30040

Type of Organization ("X" one): _____ Individual
_____ Partnership
_____ Joint Venture
__X__ Corporation

"Surety:" (Name and Business Address)

Fidelity and Deposit Company of Maryland
1299 Zurich Way
Schaumburg, IL 60196

_____
duly authorized by the Commissioner of Insurance of the State of Georgia to transact surety business in the State of Georgia.

"Contract:" Agreement between Principal and Owner, dated 10th day of March, 2021, regarding performance of Work relative to the Project.

"Penal Sum:" [100% of contract amount] SIX MILLION EIGHT HUNDRED TWENTY NINE THOUSAND EIGHT HUNDRED SEVENTY FIVE & 00/100 ($6,829,875.00)

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal and Surety hereto, as named above, are held and firmly bound to the Owner in the above Penal Sum for the payment of which well and truly to be made we bind ourselves, executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal and the Owner entered into a certain written Contract identified above, which is incorporated herein by reference in its entirety (hereinafter called the "Contract"), for construction-type services for the Project identified above;

NOW, THEREFORE, the conditions of this obligation are such that if the Principal shall promptly make payment of all persons working on or supplying labor or materials or equipment for the performance of said work, this obligation shall be void; otherwise of full force and effect.

1. A "Claimant' shall be defined herein as any subcontractor, person, party, partnership, corporation or the entity furnishing labor, services or materials used, or reasonably required for use, in the performance of the Contract, without regard to whether such labor, services or materials were sold, leased or rented, and without regard to whether such Claimant is or is not in privity of contract with the Principal or any subcontractor performing work on the Project, including, but not limited to, the following labor, services, or materials: water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.

2. In the event a Claimant files a lien against the property of the Owner, and the Principal fails or refuses to satisfy or remove it promptly, the Surety shall satisfy or

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remove the lien promptly upon written notice from the Owner, either by bond or as otherwise provided in the Contract.

3. The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in the payment terms, and any other amendments in or about the Contract and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and amendments.

4. The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment or modifications to the Contract, so as to bind the Principal and Surety, jointly and severally, to the full payment of any Claimant under the Contract, as amended or modified, provided only that the Surety shall not be liable for more than the penal sum of the Bond, as specified in the first paragraph hereof.

5. This Bond is made for the use and benefit of all persons, firms, and corporations who or which may furnish any materials or perform any labor for or on account of the construction-type services to be performed or supplied under the Contract, and any amendments thereto, and they and each of them may sue hereon.

6. No action may be maintained on this Bond after one (1) year from the date the last services, labor, or materials were provided under the Contract by the Claimant prosecuting said action.

7. This Bond is intended to comply with O.C.G.A. Section 13-10-1, and shall be interpreted so as to comply with the minimum requirements thereof. However, in the event the express language of this Bond extends protection to the Owner beyond that contemplated by O.C.G.A. Section 13-10-1 and 36-91-1, *et seq.*, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

IN WITNESS WHEREOF, the Principal and Surety have hereunto affixed their corporate seals and caused this obligation to be signed by their duly authorized representatives this 10TH day of March, 2021

PRINCIPAL: Control Concepts, LLC

Todd Hughes
President/Vice President (Sign)

Todd Hughes
President/Vice President (Type or Print)

Attested to by:

Secretary/Assistant Secretary (Seal)

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SURETY: Fidelity and Deposit Company of Maryland

By: Adrianne Scalera
Attorney-in-Fact (Sign)

Adrianne Scalera, Attorney-In-Fact
Attorney-in-Fact (Type or Print)

XXXXXXXXXXXXXXXXXXXX (Seal)
Secretary/Assistant Secretary
WITNESS AS TO SURETY

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LIMITED LIABILITY COMPANY ACKNOWLEDGEMENT

State of Georgia
County of Forsyth

On this 10th day of March **2021** before me Personally came

Todd Hughes to me known to be the individual who executed the foregoing instrument, and who, being duly sworn by me, did depose and say that he/she is (are) President of
(Member/Manager)

Control Concepts LLC a
(Limited Liability Company)

Limited Liability Company, and that he/she has authority to sign the same and acknowledge that he/she executed the same as the act and deed of said Limited Liability Company.

Todd Hughes
(Signature)

Traci VanValkenburg
(Notary)

TRACI VAN VALKENBURG NOTARY PUBLIC FORSYTH COUNTY GEORGIA EXPIRES MAY 2, 2021

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

CORPORATE ACKNOWLEDGMENT

Form 152

State of New Jersey
County of Union

On this 10th **day of** March **, 2021 before me personally came ADRIANNE SCALERA, to me known, who, being by me duly sworn, did depose and say that she resides in SHREWSBURY, NEW JERSEY that she is the ATTORNEY-IN-FACT of the** Fidelity and Deposit Company of Maryland **the corporation described in and which executed the above instrument; that she knows that seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that she signed her name thereto by like order.**

(SEAL)

Kathleen M Cristiano

KATHLEEN M. CRISTIANO
NOTARY PUBLIC OF NEW JERSEY
MY COMMISSION EXPIRES NOVEMBER 16, 2023

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THE FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
1299 Zurich Way Schaumburg, IL 60196

Statement of Financial Condition
As Of December 31, 2019

ASSETS

Bonds		$ 255,279,821
Stocks		21,280,401
Cash and Short Term Investments		2,878,421
Reinsurance Recoverable		25,356,035
Federal Income Tax Recoverable		140,480
Other Accounts Receivable		20,383,843
TOTAL ADMITTED ASSETS		$ 325,319,001

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 795,381
Ceded Reinsurance Premiums Payable		43,024,327
Remittances and Items Unallocated		0
Payable to parents, subs and affiliates		0
Securities Lending Collateral Liability		0
TOTAL LIABILITIES		$ 43,819,708
Capital Stock, Paid Up	$ 5,000,000	
Surplus	276,499,293	
Surplus as regards Policyholders		281,499,293
TOTAL		$ 325,319,001

Securities carried at $164,223,431 in the above statement are deposited with various states as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of market quotations for all bonds and stocks owned, the Company's total admitted assets at December 31, 2019 would be $322,248,132 and surplus as regards policyholders $288,428,424.

I, LAURA J. LAZARCZYK, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2019.

Laura J Lazarczyk
Corporate Secretary

State of Illinois
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 25th day of February, 2020.

Daryl Joiner
Notary Public

DARRYL JOINER
OFFICIAL SEAL
Notary Public - State of Illinois
My Commission Expires 2/24/2022

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Secretary of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 10th day of March, 2021.

Brian M Hodges

By: Brian M. Hodges
Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT A COMPLETE DESCRIPTION OF THE CLAIM INCLUDING THE PRINCIPAL ON THE BOND, THE BOND NUMBER, AND YOUR CONTACT INFORMATION TO:

Zurich Surety Claims
1299 Zurich Way
Schaumburg, IL 60196-1056
www.reportsfclaims@zurichna.com
800-626-4577

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ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Illinois, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Illinois (herein collectively called the "Companies"), by **Robert D. Murray, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Kathleen M. CRISTIANO, Joseph DOBKOWSKI, JR., Adrianne SCALERA and John Dougherty HUNTER, all of Westfield, New Jersey**, EACH, its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: any and all bonds and undertakings, and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 13th day of January, A.D. 2020.

ATTEST:
ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

By: Robert D. Murray
Vice President

By: Dawn E. Brown
Secretary

State of Maryland
County of Baltimore

On this 13th day of January, A.D. 2020, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **Robert D. Murray, Vice President and Dawn E. Brown, Secretary** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Constance A. Dunn, Notary Public
My Commission Expires: July 9, 2023

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Bond No. 9372171

PERFORMANCE BOND

"County:" means Fulton County Government; a political subdivision of the State of Georgia (hereinafter called the "Owner").

"Project:" means **#20RFP041620K-CRB, Fulton County Judicial Center Complex DDC Conversion Project – Phase II**

"Principal:" Control Concepts, LLC (hereinafter called the "Principal")
3550 North Parkway, Suite 100
Cumming, GA 30040

Type of Organization ("X" one):
_____ Individual
_____ Partnership
_____ Joint Venture
__X__ Corporation

"Surety:" (Name and Business Address)
Fidelity and Deposit Company of Maryland
1299 Zurich Way
Schaumburg, IL 60196

duly authorized by the Commissioner of Insurance of the State of Georgia to transact surety business in the State of Georgia.

"Contract:" Agreement between Principal and Owner, dated 10th day of March, 2021, regarding performance of Work relative to the Project.

"Penal Sum:" [100% of contract amount] SIX MILLION EIGHT HUNDRED TWENY NINE THOUSAND EIGHT HUNDRED SEVENTY FIVE AND 00/100 ($6,829,875.00)

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal and Surety hereto, as named above, are held and firmly bound to the Owner in the above Penal Sum for the payment of which well and truly to be made we bind ourselves, our executors, administrators, successors and assigns, jointly and severally.

WHEREAS, the Principal and the Owner entered into a certain written Contract identified above, which is incorporated herein by reference in its entirety (hereinafter called the "Contract"), for construction-type services for the Project identified above;

NOW, THEREFORE, the conditions of this obligation are such that if the Principal shall faithfully and fully comply with, perform and fulfill all of the undertakings, covenants, conditions and all other of the terms and conditions of said Contract, including any and all duly authorized modifications of such Contract, within the original term of such Contract and any extensions thereof, which shall include, but not be limited to any obligations created by way of warranties and/or guarantees for workmanship and materials which warranty and/or guarantee may extend for a period of time of one year beyond completion of said Contract, this obligation shall be void; otherwise, of full force and effect.

Whenever the Principal shall be, and declared by the Owner to be, in default under the Construction-Type Contract, the Surety shall promptly remedy the default as follows:

1. Complete the Contract in accordance with its terms and conditions; or, at the sole option of the Owner,

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2. Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by the Surety and the Owner of the lowest responsible bidder, arrange for a contract between such bidder and Owner and make available as the work progresses (even though there should be a default or succession of defaults under the Contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which the Surety may be liable hereunder, the penal sum set forth in the first paragraph hereof, as may be adjusted, and the Surety shall make available and pay to the Owner the funds required by this Paragraph prior to the payment of the Owner of the balance of the contract price, or any portion thereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by the Owner to the Contractor under the Contract, and any amendments thereto, less the amount paid by the Owner to the Contractor; or, at the sole option of the Owner,

3. Allow Owner to complete the work and reimburse the Owner for all reasonable costs incurred in completing the work.

In addition to performing as required in the above paragraphs, the Surety shall indemnify and hold harmless the Owner from any and all losses, liability and damages, claims, judgments, liens, costs and fees of every description, including reasonable attorney's fees, litigation costs and expert witness fees, which the Owner may incur, sustain or suffer by reason of the failure or default on the part of the Principal in the performance of any or all of the terms, provisions, and requirements of the Contract, including any and all amendments and modifications thereto, or incurred by the Owner in making good any such failure of performance on the part of the Principal.

The Surety shall commence performance of its obligations and undertakings under this Bond promptly and without delay, after written notice from the Owner to the Surety.

The Surety hereby waives notice of any and all modifications, omissions, additions, changes, alterations, extensions of time, changes in payment terms, and any other amendments in or about the Contract, and agrees that the obligations undertaken by this Bond shall not be impaired in any manner by reason of any such modifications, omissions, additions, changes, alterations, extensions of time, change in payment terms, and amendments.

The Surety hereby agrees that this Bond shall be deemed amended automatically and immediately, without formal or separate amendments hereto, upon any amendment to the Contract, so as to bind the Principal and the Surety to the full and faithful performance of the Contract as so amended or modified, and so as to increase the penal sum to the adjusted Contract Price of the Contract.

No right of action shall accrue on this Bond to or for the use of any person, entity or corporation other than the Owner and any other obligee named herein, or their executors, administrators, successors or assigns.

This Bond is intended to comply with O.C.G.A. Section 36-91-1 et seq., and shall be interpreted so; as to comply with; the minimum requirements thereof. However, in the event the express language of this Bond extends protection to; the Owner beyond that contemplated by O.C.G.A. Section 36-91-1 et seq. and O.C.G.A. Section 13-10-1, as amended, or any other statutory law applicable to this Project, then the additional protection shall be enforced in favor of the Owner, whether or not such protection is found in the applicable statutes.

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IN WITNESS WHEREOF, the Principal and the Surety have caused these presents to be duly signed and sealed this 10th day of March, 2021.

PRINCIPAL: Control Concepts, LLC

Todd Hughes
President/Vice President (Sign)

Todd Hughes
President/Vice President (Type or Print)

Attested to by:

Secretary/Assistant Secretary (Seal)

SURETY: Fidelity and Deposit Company of Maryland

By: Adrianne Scalera
Attorney-in-Fact (Sign)

Adrianne Scalera, Attorney-In-Fact
Attorney-in-Fact (Type or Print)

END OF SECTION

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LIMITED LIABILITY COMPANY ACKNOWLEDGEMENT

State of Georgia
County of Forsyth

On this 10th day of March 2021 before me Personally came Todd Hughes to me known to be the individual who executed the foregoing instrument, and who, being duly sworn by me, did depose and say that he/she is (are) President (Member/Manager) of Control Concepts LLC (Limited Liability Company) a Limited Liability Company, and that he/she has authority to sign the same and acknowledge that he/she executed the same as the act and deed of said Limited Liability Company.

Todd Hughes
(Signature)

(Notary)

TRACI VAN VALKENBURG NOTARY PUBLIC FORSYTH COUNTY GEORGIA EXPIRES MAY 2, 2021

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CORPORATE ACKNOWLEDGMENT

Form 152

State of New Jersey
County of Union

On this 10th **day of** March **, 2021 before me personally came ADRIANNE SCALERA, to me known, who, being by me duly sworn, did depose and say that she resides in SHREWSBURY, NEW JERSEY that she is the ATTORNEY-IN-FACT of the** Fidelity and Deposit Company of Maryland **the corporation described in and which executed the above instrument; that she knows that seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation, and that she signed her name thereto by like order.**

(SEAL)

Kathleen M Cristiano

KATHLEEN M. CRISTIANO
NOTARY PUBLIC OF NEW JERSEY
MY COMMISSION EXPIRES NOVEMBER 16, 2023

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

THE FIDELITY AND DEPOSIT COMPANY

OF MARYLAND
1299 Zurich Way Schaumburg, IL 60196

Statement of Financial Condition
As Of December 31, 2019

ASSETS

Bonds		$ 255,279,821
Stocks		21,280,401
Cash and Short Term Investments		2,878,421
Reinsurance Recoverable		25,356,035
Federal Income Tax Recoverable		140,480
Other Accounts Receivable		20,383,843
TOTAL ADMITTED ASSETS		$ 325,319,001

LIABILITIES, SURPLUS AND OTHER FUNDS

Reserve for Taxes and Expenses		$ 795,381
Ceded Reinsurance Premiums Payable		43,024,327
Remittances and Items Unallocated		0
Payable to parents, subs and affiliates		0
Securities Lending Collateral Liability		0
TOTAL LIABILITIES		$ 43,819,708
Capital Stock, Paid Up	$ 5,000,000	
Surplus	276,499,293	
Surplus as regards Policyholders		281,499,293
TOTAL		$ 325,319,001

Securities carried at $164,223,431 in the above statement are deposited with various states as required by law.

Securities carried on the basis prescribed by the National Association of Insurance Commissioners. On the basis of market quotations for all bonds and stocks owned, the Company's total admitted assets at December 31, 2019 would be $322,248,132 and surplus as regards policyholders $288,428,424.

I, LAURA J. LAZARCZYK, Corporate Secretary of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing statement is a correct exhibit of the assets and liabilities of the said Company on the 31st day of December, 2019.

Laura J Lazarczyk
Corporate Secretary

State of Illinois
City of Schaumburg } SS:

Subscribed and sworn to, before me, a Notary Public of the State of Illinois, in the City of Schaumburg, this 25th day of February, 2020.

Daryl Joiner
Notary Public

DARRYL JOINER
OFFICIAL SEAL
Notary Public - State of Illinois
My Commission Expires 2/24/2022

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ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND
POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That the ZURICH AMERICAN INSURANCE COMPANY, a corporation of the State of New York, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, a corporation of the State of Illinois, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND a corporation of the State of Illinois (herein collectively called the "Companies"), by **Robert D. Murray, Vice President**, in pursuance of authority granted by Article V, Section 8, of the By-Laws of said Companies, which are set forth on the reverse side hereof and are hereby certified to be in full force and effect on the date hereof, do hereby nominate, constitute, and appoint **Kathleen M. CRISTIANO, Joseph DOBKOWSKI, JR., Adrianne SCALERA and John Dougherty HUNTER, all of Westfield, New Jersey**, EACH, its true and lawful agent and Attorney-in-Fact, to make, execute, seal and deliver, for, and on its behalf as surety, and as its act and deed: any and all bonds and undertakings, and the execution of such bonds or undertakings in pursuance of these presents, shall be as binding upon said Companies, as fully and amply, to all intents and purposes, as if they had been duly executed and acknowledged by the regularly elected officers of the ZURICH AMERICAN INSURANCE COMPANY at its office in New York, New York., the regularly elected officers of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at its office in Owings Mills, Maryland., and the regularly elected officers of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at its office in Owings Mills, Maryland., in their own proper persons.

The said Vice President does hereby certify that the extract set forth on the reverse side hereof is a true copy of Article V, Section 8, of the By-Laws of said Companies and is now in force.

IN WITNESS WHEREOF, the said Vice-President has hereunto subscribed his/her names and affixed the Corporate Seals of the said **ZURICH AMERICAN INSURANCE COMPANY, COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and FIDELITY AND DEPOSIT COMPANY OF MARYLAND**, this 13th day of January, A.D. 2020.

ATTEST:
ZURICH AMERICAN INSURANCE COMPANY
COLONIAL AMERICAN CASUALTY AND SURETY COMPANY
FIDELITY AND DEPOSIT COMPANY OF MARYLAND

By: Robert D. Murray
Vice President

By: Dawn E. Brown
Secretary

State of Maryland
County of Baltimore

On this 13th day of January, A.D. 2020, before the subscriber, a Notary Public of the State of Maryland, duly commissioned and qualified, **Robert D. Murray, Vice President and Dawn E. Brown, Secretary** of the Companies, to me personally known to be the individuals and officers described in and who executed the preceding instrument, and acknowledged the execution of same, and being by me duly sworn, deposeth and saith, that he/she is the said officer of the Company aforesaid, and that the seals affixed to the preceding instrument are the Corporate Seals of said Companies, and that the said Corporate Seals and the signature as such officer were duly affixed and subscribed to the said instrument by the authority and direction of the said Corporations.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my Official Seal the day and year first above written.

Constance A. Dunn, Notary Public
My Commission Expires: July 9, 2023

DocuSign Envelope ID: 55100CAA-E2D7-47EF-B657-7653FE80D11B

EXTRACT FROM BY-LAWS OF THE COMPANIES

"Article V, Section 8, Attorneys-in-Fact. The Chief Executive Officer, the President, or any Executive Vice President or Vice President may, by written instrument under the attested corporate seal, appoint attorneys-in-fact with authority to execute bonds, policies, recognizances, stipulations, undertakings, or other like instruments on behalf of the Company, and may authorize any officer or any such attorney-in-fact to affix the corporate seal thereto; and may with or without cause modify of revoke any such appointment or authority at any time."

CERTIFICATE

I, the undersigned, Secretary of the ZURICH AMERICAN INSURANCE COMPANY, the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY, and the FIDELITY AND DEPOSIT COMPANY OF MARYLAND, do hereby certify that the foregoing Power of Attorney is still in full force and effect on the date of this certificate; and I do further certify that Article V, Section 8, of the By-Laws of the Companies is still in force.

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the ZURICH AMERICAN INSURANCE COMPANY at a meeting duly called and held on the 15th day of December 1998.

RESOLVED: "That the signature of the President or a Vice President and the attesting signature of a Secretary or an Assistant Secretary and the Seal of the Company may be affixed by facsimile on any Power of Attorney...Any such Power or any certificate thereof bearing such facsimile signature and seal shall be valid and binding on the Company."

This Power of Attorney and Certificate may be signed by facsimile under and by authority of the following resolution of the Board of Directors of the COLONIAL AMERICAN CASUALTY AND SURETY COMPANY at a meeting duly called and held on the 5th day of May, 1994, and the following resolution of the Board of Directors of the FIDELITY AND DEPOSIT COMPANY OF MARYLAND at a meeting duly called and held on the 10th day of May, 1990.

RESOLVED: "That the facsimile or mechanically reproduced seal of the company and facsimile or mechanically reproduced signature of any Vice-President, Secretary, or Assistant Secretary of the Company, whether made heretofore or hereafter, wherever appearing upon a certified copy of any power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the corporate seals of the said Companies, this 10th day of March, 2021.

By: Brian M. Hodges
Vice President

TO REPORT A CLAIM WITH REGARD TO A SURETY BOND, PLEASE SUBMIT A COMPLETE DESCRIPTION OF THE CLAIM INCLUDING THE PRINCIPAL ON THE BOND, THE BOND NUMBER, AND YOUR CONTACT INFORMATION TO:

Zurich Surety Claims
1299 Zurich Way
Schaumburg, IL 60196-1056
www.reportsfclaims@zurichna.com
800-626-4577