INVITATION FOR BIDS
CCK-2493-20
Replace AHU #1 - BP #2
ADDENDUM # 2
06/12/2020

ATTENTION:  This is not an order.  Read all instructions, terms and conditions carefully.

IMPORTANT:  BID AND ADDENDUM MUST BE RECEIVED BY: 06/30/2020 @ 3:00 P.M. LEXINGTON, KY TIME

Bidder must acknowledge receipt of this and any addendum as stated in the Invitation for Bids.

1. Addendum 1 (dated 06/10/2020) stated that “CCK-2493-20 Specifications” had been revised and updated. However, that document was erroneously omitted when the addendum was posted.

2. Please use the following specifications attached, to complete your bid for submittal:
   - CCK-2493-20 Specifications - Revised

3. Update to Pre-Bid Meeting:  A pre-bid meeting will take place on 06/22/2020.
   Location: The group will meet near the Hospital Information Desk at the end of the pedestrian bridge leading from Parking Structure #8.
   Special Requirements – COVID19:  Individuals attending the pre-bid meeting will be required to wear a protective mask.  Individuals attending, will also be required to complete the “vendor screening” per the flyer that is attached as the last page on this addendum.

4. If you have any questions concerning any information listed on this addendum, please feel to reach out to Ken Scott at the number listed below.

OFFICIAL APPROVAL
UNIVERSITY OF KENTUCKY

________________________
Kenneth Scott 06/12/2020

Contracting Officer / (859) 257-9102

________________________________________
Typed or Printed Name

University of Kentucky
Purchasing Division
322 Peterson Service Building
Lexington, KY  40506-0005

An Equal Opportunity University
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SECTION 200100 - GENERAL PROVISIONS - MECHANICAL

1. GENERAL

A. The Advertisement for Bids, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub-Contractor's work. All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals to any part if for work, services, materials or equipment to be used on or applied to this project are hereby directed to familiarize themselves with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

B. Each Proposer shall also be governed by any unit prices and Addenda insofar as they may affect his part of the work or services.

C. The work included in this division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances and services necessary for the satisfactory installation of the complete and operating Mechanical System(s) indicated or specified in the Contract Documents.

D. Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied or intended in the drawings and/or specifications, shall be included as part of this Contract.

E. It is not the intent of this section of the specifications to make any Contractor, other than the General Contractor (or Construction Manager, if applicable), responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect (if applicable), then to the Engineer. Also, this section of the specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

F. It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

G. In general, and to the extent possible, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owners at least two weeks prior to the interruption of any services or utilities. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.

H. Definitions and Abbreviations

(1) Contractor - Any Contractor whether proposing or working independently or under the supervision of a General Contractor and/or Construction Manager and who installs any type of mechanical work (Controls, Plumbing, HVAC, Sprinkler, Gas Systems, etc.) or, the General Contractor.
(2) Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owners, Architect, other Engineers, etc. In this case: CMTA, Inc., Consulting Engineers.

(3) Architect - The Architect of Record for the project.

(4) Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.

(5) Provide - Furnish and install complete, tested and ready for operation.

(6) Install - Receive and place in satisfactory operation.

(7) Indicated - Listed in the Specifications, shown on the Drawings or Addenda thereto.

(8) Typical - Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.

(9) Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owners, etc.

(10) Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.

(11) OSHA - Office of Safety and Health Administration.

(12) KBC - Kentucky Building Code.

(13) The Project - All of the work required under this Contract.

(14) NEC - National Electrical Code.


(16) ASME - American Society of Mechanical Engineers.

(17) AGA - American Gas Association.

(18) SMACNA - Sheet Metal and Air Conditioning Contractors National Association.


(20) ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.

(21) NEMA - National Electrical Manufacturers Association.

(22) UL - Underwriters Laboratories.

(23) ADA - Americans with Disabilities Act.

(24) IMC - International Mechanical Code.

(26) IFGC - International Fuel Gas Code.

I. Required Notices:

(1) Ten days prior to the submission of a proposal, each proposer shall give written notice to the Engineer of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted. In the absence of such written notice, Proposers signify that they have included the cost of all required items in the proposal and that the Proposer will be responsible for the safe and satisfactory operation of the entire system.

2. INTENT

A. It is the intention of the Contract Documents to call for finished work, tested and ready for operation.

B. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

3. DRAWINGS AND SPECIFICATIONS

A. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The drawings are not intended to show every item which may be necessary to complete the systems. All proposers shall anticipate that additional items may be required and submit their bid accordingly.

B. The drawings and specifications are intended to supplement each other. No Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Proposer shall request a clarification not less than twelve days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

C. The drawings and specifications shall be considered to be cooperative and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

D. Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

E. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

F. Should conflict or overlap (duplication) of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

G. Unless dimensioned, the mechanical drawings only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions.
and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.

H. Each Proposer shall review all drawings including Architectural, Mechanical, Electrical, Fire Protection, etc., to insure that the work he intends to provide does not encroach a conflict with or affect the work of others in any way. Where such effect does occur it shall be the Proposer's responsibility to satisfactorily eliminate any such encroachment conflict or effect prior to the submission of his proposal. Each Proposer shall in particular insure that there is adequate space to install his equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.

I. Where on the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

K. Where on the Drawings or Addenda the word typical is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

L. Special Note: Always check ceiling heights indicated on Architectural Drawings and Schedules and insure that they may be maintained after all mechanical and electrical equipment is installed. Do not install equipment in the affected area until the conflict is resolved.

4. EXAMINATION OF SITE AND CONDITIONS

A. Each Proposer shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. Each Proposer shall also fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. His proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after bids are accepted.

5. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

A. When any Contractor requests approval of materials and/or equipment of different physical size, capacity, function, color, access, it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, electrical services, etc., from that indicated. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall remunerate them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineers does not in any way absolve the Contractor of this responsibility.
B. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of Paragraph (A) immediately preceding are met. Requested substitutions shall be submitted to the Engineer a minimum of twelve days prior to bids.

C. Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineers.

D. Each Proposer shall furnish along with his proposal a list of specified equipment and materials which he is to provide. Where several makes are mentioned in the specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not insure that the Engineers will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings is satisfactorily comparable to the items specified and/or indicated.

6. SUPERVISION OF WORK

A. The Contractor shall personally supervise the work for which he is responsible or have a competent superintendent, approved by the Engineers, on the work at all times during progress with full authority to act for him.

7. CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.

A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, water and/or sewer system development charge, etc., in connection with his work. He shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. He shall hire an independent Registered Engineer to witness installations and provide necessary certifications where required by utility companies, municipal agencies or others that have review authority. He shall also obtain all required certificates of inspection for his work and deliver same to the Engineers before request for acceptance and final payment for the work. Ignorance of Codes, Rules, Regulations, Laws, etc. shall not render the Contractor irresponsible for compliance. The Contractor shall also be versed in all Codes, Rules and Regulations pertinent to his part of the work prior to submission of a proposal. He shall obtain HVAC permit and submit all forms and pay all fees.

B. The Contractor shall include in his work, without extra cost, any labor, materials, services, apparatus and drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.

C. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.

D. All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters’ Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable. Where required by the Code and/or the Authority Having Jurisdiction, provide the services of a field labeling agency to provide a UL label for the entire system in the field under evaluation.
E. All plumbing work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Department of Health. Plumbing work shall not commence until such plans are in the hands of the Contractor.

F. All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Kentucky Building Code (KBC) and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association. Contractor shall secure a permit from the Division of HVAC. Final inspection certificate shall be provided by Contractor and a copy included in Operation and Maintenance Manuals.

G. Where minimum code requirements are exceeded in the Design, the Design shall govern.

H. The Contractor shall insure that his work is accomplished in accord with the OSHA Standards and that he conducts his work and the work of his personnel in accord with same.

I. All work relating to the handicapped shall be in accord with regulations currently enforced by the Department of Housing, Buildings and Construction, Commonwealth of Kentucky and the American Disabilities Act.

8. EQUIPMENT AND PIPING SUPPORT

A. Each piece of equipment, apparatus, piping, or conduit suspended from the structure or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc., as indicated or required by the Structural Engineer. This, in some instances, will require the Contractor to add an angle to a joist to transfer the load to a panel point. If in doubt, contact the Structural Engineer.

9. DUCT AND PIPE MOUNTING HEIGHTS

A. All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure.

10. COST BREAKDOWNS (SCHEDULE OF VALUES)

A. Within thirty days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

11. CORRECTION PERIOD

A. All equipment, apparatus, materials, and workmanship shall be the best of its respective kind. The Contractor shall replace all parts at his own expense, which are proven defective as described in the General Conditions. The effective date of completion of the work shall be the date of the Architect's or Engineer's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner
reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period, due to negligence of his operator or other employees. Refer to other sections for any special or extra warranty requirements.

B. It is further clarified that all required and specified warranties shall begin on the date of Substantial Completion, not at the time of equipment start-up.

C. All compressors shall have five year warranty.

12. COMPUTER-BASED SYSTEM SOFTWARE

A. For all equipment, controls, hardware, computer-based systems, programmable logic controllers, and other materials provided as a part of the work, software that is installed shall be certified in writing to the Engineer and Owner by the manufacturer and/or writer to be free of programming errors that might affect the functionality of the intended use.

B. Contractor shall provide all software required to back-up, restore, troubleshoot, program and install the system as part of this project at no extra cost to the University.

13. CHANGES IN MECHANICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

14. CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.

15. SURVEY, MEASUREMENTS AND GRADE

A. The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

C. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the contract documents, he shall promptly notify the Engineer and shall not proceed with this work until he has received instructions from the Engineer on the disposition of the work.

16. TEMPORARY SERVICES

A. The Contractor shall arrange any temporary water, electrical and other services which he may require to accomplish his work. Refer also to General and Special Conditions.

17. RECORD DRAWINGS

A. The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to
time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. Deliver these record drawings electronically in AutoCAD 2000 format along with the hand marked field set to the Engineer. Electronic bid drawings will be furnished to the Contractor for his use.

18. MATERIALS AND WORKMANSHIP

A. All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Proposer shall determine that the materials and/or equipment he proposes to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and this work shall be the responsibility of the Contractor. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Insure, through coordination, that no other Contractor seals off access to space required for equipment, materials, etc.

B. Materials and equipment, where applicable, shall bear Underwriters' Laboratories label where such a standard has been established.

C. Use extreme care in the selection of equipment and its installation to insure that noise and vibration are kept at a minimum. The Engineer's determination shall be final and corrections to such discrepancies shall be made at the cost of the Contractor.

D. Each length of pipe, fitting, trap, fixture and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.

E. All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a data plate indicating required horsepower, voltage, phase and amperage.

19. COOPERATION AND COORDINATION WITH OTHER TRADES

A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.

B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4” = 1'-0", clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. He shall make the necessary changes in his work to correct the condition without extra charge.

C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

20. QUALIFICATIONS OF WORKMEN
A. All mechanical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workman shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of Architect, Contractor, etc.

B. All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined and clarified under Kentucky State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.

C. All sheet metal, insulation and pipe fitting work shall be installed by workmen normally engaged or employed in these respective trades, except where only small amounts of such work are required and are within the competency of workmen directly employed by the Contractor involved.

D. All automatic control systems shall be installed by workmen normally engaged or employed in this type work, except in the case of minor control requirements (residential type furnaces, packaged HVAC equipment with integral controls, etc.) in which case, if a competent workman is the employee of this Contractor, he may be utilized subject to review of his qualifications by the Engineer and after written approval from same.

E. All special systems (Automatic Sprinkler Equipment, etc.) shall be installed only by workmen normally engaged in such services. Exception to this specification may only be made in writing by the Engineer.

F. All electrical work shall be installed only by competent workmen under direct supervision of a fully qualified Electrician.

21. CONDUCT OF WORKMEN

A. The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workman to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens or debilitating drugs on the job site is strictly forbidden.

22. PROTECTION OF EQUIPMENT

A. The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in soil, waste, vent and storm piping, ductwork, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at his own expense.

23. SCAFFOLDING, RIGGING AND HOISTING

A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

24. BROKEN LINES AND PROTECTION AGAINST FREEZING
A. No conduits, piping, troughs, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. If in doubt, contact the Engineer. Do not install piping across or near openings to the outside whether they are carrying static or moving fluids or not. Special Note: Insulation on piping does not necessarily insure that freezing will not occur.

25. CLEANING

A. The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish and debris caused by his operations; and at the completion of the work, shall remove all rubbish, debris, all of his tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

26. NOISE, VIBRATION OR OSCILLATION

A. All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at his expense.

B. All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means. Unitary equipment, such as small room heating units, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.

C. The Contractor shall provide supports for all equipment furnished by him. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineers.

27. ACCESSIBILITY

A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and hung ceilings for the proper installation of his work. He shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.
B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, etc.

C. The Contractor shall provide access panels for each concealed valve, control damper or other device requiring service as shown on engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work.

28. SMOKE AND FIRE PROOFING

A. The Contractor shall repair, fire and smoke stop all openings made in fire rated walls, chases, ceilings and floors in accord with the KBC. Patch all openings around ductwork and piping with appropriate type material to stop smoke at smoke walls and provide commensurate fire rating at fire walls, floors, ceilings, roofs, etc.

29. MOTORS

A. Motors shall be built in accordance with the latest standards of NEMA and as specified. Motors shall be tested in accordance with standards of A.S.A. C50, conforming to this and all applicable standards for insulation resistance and dielectric strength.

B. Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box, and N.E.C. required disconnecting means as specified or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

C. The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 26 of Specifications for further requirements related to installation of motors.

30. CUTTING AND PATCHING

A. The Contractor shall provide his own cutting and patching necessary to install his work. Patching shall match adjacent surfaces and shall be to the satisfaction of the Architect and Engineer.

B. No structural members shall be cut without the approval of the Engineer and all such cutting shall be done in a manner directed by him.

31. CURBS, PLATES, ESCUTCHEONS & AIR TIGHT PENETRATIONS

A. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

B. Seal all duct, pipe, conduit, etc., penetrations through walls and floors air tight. If wall or floor assembly is rated then use similarly rated sealing method.
32. WEATHERPROOFING

A. Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as approved by the Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

33. OPERATING INSTRUCTIONS, MAINTENANCE MANUALS AND PARTS LISTS

A. Upon completion of all work tests, the Contractor shall instruct the Owner or his representative(s) fully in the operations, adjustment and maintenance of all equipment furnished. The time and a list of representatives required to be present will be as directed by the Engineer. Turn over all special wrenches, keys, etc., to the owner at this time.

B. The Contractor shall furnish one (1) complete bound hard copy set and one (1) electronic copy for delivery to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs alone will not be acceptable for operating and maintenance instructions. All O&M manuals are to be organized using the Uniforat Standard for numbering.

C. The Contractor, in the instructions, shall include a preventive maintenance schedule for the principal items of equipment furnished under this contract and a detailed, parts list and the name and address of the nearest source of supply.

D. The Contractor shall frame under Lexan in the main mechanical room all temperature control diagrams and all piping diagrams.

34. PAINTING

A. In general, all finish painting shall be accomplished under the Painting Section of the specifications by the Contractor; however, unless otherwise specified under other sections of these specifications, the following items shall be painted:

(1) All exposed piping, valve bodies and fittings (bare and insulated), including hangers, platforms, etc.

(2) All mechanical equipment not factory finished. Aluminum and stainless steel equipment, motors, identification plates, tags, etc. shall not be painted. All rust and foreign matter shall be thoroughly removed from surfaces prior to painting. All baked enamel factory finish of equipment which may have been scratched or chipped shall be touched up with the proper paint as recommended and supplied by the manufacturer.

(3) All ductwork exposed in finished areas (bare and insulated), all grilles, diffusers, etc. not factory finished. Paint the inside surfaces of all interior duct surfaces visible from any register, grille or diffuser opening on all jobs; surfaces shall receive one (1) prime coat of Rustoleum 1225 red "galvinoileum" or other approved equivalent primer and rust inhibitor and one (1) coat of Rustoleum 1579 jet black "Speedy Dry" enamel or approved equivalent applied in accordance with the manufacturer's recommendations.

(4) All insulated piping, ductwork and equipment shall be properly prepared for painting by the Contractor where mechanical items are to be painted. In the case of externally insulated duct and pipe, the Contractor shall provide 6 oz. canvas jacket with fire retardant lagging. The jacket shall be allowed to dry properly before applying paint to avoid shrinking after painting and exposing unpainted surfaces.
The Contractor, at his option, may provide double wall ductwork in lieu of externally insulated ductwork with canvas jacket and lagging.

35. ELECTRICAL CONNECTIONS

A. The Contractor shall furnish and install all (1) temperature control wiring; (2) equipment control wiring and (3) interlock wiring. The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring thru starters, and shall furnish and install all required starters not factory mounted on equipment.

B. The Contractor shall, regardless of voltage, furnish and install all temperature control wiring and all associated interlock wiring, all equipment control wiring and conduit for the equipment that the Contractor furnishes. He may, at his option, employ at his own expense, the Electrical Contractor to accomplish this work.

C. After all circuits are energized and completed, the Contractor shall be responsible for all power wiring, and all control wiring shall be the responsibility of the Contractor. Motors and equipment shall be provided for current characteristics as shown on the drawings.

D. The Contractor shall furnish motor starters of the type and size required by the manufacturer for all equipment provided by him, where such starters are necessary. Starters shall have overloads for each phase.

36. FINAL CONNECTIONS TO EQUIPMENT

A. The Contractor shall finally connect to mechanical services, any terminal equipment, appliances, etc., provided under this and other divisions of the work. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer’s recommendations. If in doubt, contact the Engineers prior to installation.

37. REQUIRED CLEARANCE FOR ELECTRICAL EQUIPMENT

A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost.

38. INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

39. HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep
uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

40. ABOVE-CEILING AND FINAL PUNCH LISTS

A. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project:

(1) For review of above-ceiling work that will be concealed by tile or other materials well before substantial completion.
(2) For review of all other work as the project nears substantial completion.

B. When all work from the Contractor's punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.

41. INSTRUCTION PROGRAM

A. Program Structure: All training shall be provided by factory authorized representatives experienced in operation and maintenance procedures. Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows but not limited to:

(1) Motorized doors, including overhead coiling grilles, fire and smoke shutters, and automatic entrance doors.
(2) Fire-protection systems, including fire alarm, fire pumps and fire-extinguishing systems.
(3) Heat generation, including heat exchangers, feedwater equipment, pumps, steam distribution piping and water distribution piping.
(4) Refrigeration systems, including chillers, cooling towers, condensers, pumps and distribution piping.
(5) HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
(6) HVAC instrumentation and controls.
(7) Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
(8) Lighting equipment and controls.
(9) Communication systems, including intercommunication, surveillance, clocks and programming, voice and data and television equipment.
(10) Other Contractor furnished and installed systems and equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

(1) Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

(2) Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.

(3) Maintenance service agreements and similar continuing commitments. Emergencies: Include the following, as applicable:
   a. Emergency manuals.
   b. Instructions on meaning of warnings, trouble indications, and error messages.
   c. Instructions on stopping.
   d. Shutdown instructions for each type of emergency.
   e. Operating instructions for conditions outside of normal operating limits.
   f. Sequences for electric or electronic systems.
   g. Special operating instructions and procedures.

(4) Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
(5) Required sequences for electric or electronic systems.
Special operating instructions and procedures.

Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

(6) Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and re-assembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

C. PREPARATION

Assemble educational materials necessary for instruction, including documentation and training module.
Assemble training modules into a combined training manual.

1. Set up instructional equipment at instruction location.

D. INSTRUCTION

(1) Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

(2) Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

(3) Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season. Schedule training with Owner with at least 30 days' advance notice. A syllabus for each training session shall be provided at the time of scheduling. Each training session shall be given twice to cover multiple shifts – one in the morning and another in the afternoon.
(4) Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

(5) Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

E. DEMONSTRATION AND TRAINING VIDEO

(1) General: Engage a qualified commercial photographer to record demonstration and training video. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

a. At beginning of each training module, record each chart containing learning objective and lesson outline.

(2) Video Format: Provide high-quality DVD disk.

(3) Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

(4) Narration: Describe scenes on videotape by audio narration by microphone while videotape is recorded or by dubbing off-site. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

(5) Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video opposite the corresponding narration segment.

42. COORDINATION DRAWINGS AND RECORD DRAWINGS

A. COORDINATION as follows:

(1) Detailed electronic coordination drawings shall be required for this project and shall be led by the Mechanical Contractor. A specific line-item shall be included on the schedule of values by each Trade for “preparation of coordination drawings”. This line-item value shall be approved by the Engineer. The Engineer and the Engineer’s Field Inspector shall closely monitor progress and quality of the preparation of the electronic coordination drawings and may withhold pay requests as deemed appropriate.

(2) Coordination Drawings shall be provided on this project by each Trade (Mechanical, Fire Protection, Electrical). Drawings shall be 30 x 42 sheet size and shall be at ¼” scale and shall match the drawing setup as included in the Architectural Drawings. The Architect and Engineer will supply electronic drawings files of the Contract Documents upon the Contractor’s request and release.

(3) The basis for the Coordination Drawings shall be the sheet metal ductwork fabrication shop drawings and shall be prepared by the Mechanical Contractor. The Coordination Drawings shall indicate (1) systems above ceilings in finished areas, (2) systems supported from the structure in finished areas without ceilings, (3) systems in the mechanical rooms, and (4) all wall, roof, floor penetrations. These drawings shall be 3-D drawings and shall be able to be reviewed with a 3-D software system such as Revit or Navisworks. The contractor shall be responsible for organizing this information and presenting this to the owner for their review in the Kelly building on their Smartboard system.

(4) The sheet metal fabrication shop drawings shall be completed in a timely manner so as not to conflict with construction schedule and phasing plan. At the General Contractor’s discretion, these drawings shall be completed in phases to correspond with the project construction work sequencing. The Mechanical Contractor shall furnish an electronic copy of these ductwork shop drawings to all other Trades,
specifically the Fire Protection and Electrical and other Contractors as requested by the General Contractor for the purpose of including other trades work on the Coordination Drawings.

(5) Pre-Coordination Meetings with all necessary trades shall occur. During these meetings, the Contractors shall discuss locations/elevations where piping, conduits, cable trays, etc will be installed with respect to the sheetmetal fabrication drawings and other trades. The sheetmetal ductwork and gravity piping systems shall be given the first priority. Within 30 days of the meeting, each Trade shall provide the Mechanical Contractor electronic drawings of all of their systems (with elevation noted), coordinated with the ductwork and other trades for them to incorporate into the Coordination Drawings. Coordination Meetings shall then occur so that all conflicts can be resolved between Trades. All conflicts shall be resolved between all Trades at these Coordination Meetings and the Mechanical Contractor shall then amend the Drawings to include the Final Coordinated Work.

(6) It is realized that not all systems can be completely detailed. The coordination drawings shall include the following at a minimum:

   a. Ductwork routed in 6th floor mechanical room as indicated on the drawings. This shall be coordinated indicating the existing items which require relocation above the ceiling. This includes conduits, ductwork, piping etc.

   b. All new supply and outside ductwork in the sixth floor mechanical room.

   c. Multiple smaller piping/conduits hung on a common trapeze hanger.

   d. All wall, roof, floor penetrations.

(7) After completion of the Final Coordination Drawings, a Final Review with the all Trades shall occur to provide any final comments and approval by all Trades. Other interim coordination meeting will be required to insure successful coordination drawings. Any additional coordination items will be updated by the Mechanical Contractor. The Final Approved Coordination Drawings shall distributed electronically (on CD) to each Trade by the Mechanical Contractor. The Mechanical Contractor shall also furnish a complete 30x42 paper set of drawings to the jobsite main office and shall utilize them for updates of field conditions/deviations that occur during construction. Final Approved Coordination Drawings shall also be distributed to the General Contractor, Owner, Architect and Engineer for their Records. This process shall be completed prior to starting any work.

(8) Each Contractor shall insure that any deviations from the Coordination Drawings are recorded as they occur, in red erasable pencil on Coordination Drawings drawings kept at the jobsite. Upon completion of a particular phase, the Mechanical Contractor shall incorporate all field deviations into the Coordination Drawings to be utilized as Record Drawings. The Engineer shall review the Record Documents from time to time to insure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. The Record Drawings shall be distributed electronically (on CD) to the Construction Manager, Owner, Architect and Engineer for their Records.

43. COMMISSIONING

   A. Commissioning of the air handling unit, all exhaust fans, and all sequences of operation on the controls drawings will be conducted by CMTA and UK engineers. The mechanical contractor, controls contractor, and TAB contractor shall attend all commissioning activities and assist in commissioning activities to identify and correct deficiencies found as part of the commissioning process. The controls contractor and mechanical contractor shall be prepared to assist UK UEM and CMTA in ensuring than any equipment provided with an interface to UK Tridium is online and that all relevant points are correctly reporting through the interface.
SECTION 200200 - SCOPE OF THE MECHANICAL WORK

1. GENERAL

A. The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not necessarily limited to the following:

1. The Contractor shall be responsible for managing the schedule of construction and maintaining an accurate phasing plan. The Contractor shall lead progress meetings and keep detailed schedules utilizing a Scheduling Software and closely coordinate all outages with the owner in advance. Outage meetings shall be held regularly to discuss upcoming outages and their impacts. Ultimately, the Owner has the ability to approve or deny outage requests if they exceed approved durations or fall outside of acceptable time frames.

2. Rework of sprinkler system where required.

3. Complete relocation of existing water heaters and installation of new condensate pump and reheat pump, etc. prior to install of air handler. Refer to drawings.

4. Any structural bracing or supports. Refer to structural drawings.

5. All insulation associated with mechanical systems including temporary piping.

6. Complete heating, ventilation and air conditioning systems including the replacement of the scheduled air handling unit.

7. Complete balancing of air and water systems.

8. All applicable services and work specified in Section 200100; General Provisions - Mechanical.

9. All specified or required support of control work (Via allowance from Bid Package #1).

10. Provide all required motor starters, etc. not provided under the electrical sections.

11. One-year guarantee of all mechanical equipment, materials and workmanship.

12. Thorough instruction of the owner’s maintenance personnel in the operation and maintenance of all mechanical equipment.

13. Thorough coordination of the installation of all piping, equipment and any other material with other trades to ensure that no conflict in installation.

14. Approved supervision of the mechanical work.

15. Cutting, patching, sleeving, concrete work, etc., required to construct the mechanical systems.
(16) Procurement of all required permits and inspections, including fees for all permits and inspection services and submission of final certificates of inspection to the Engineers (Plumbing, Boiler, HVAC, etc.).

(17) Factory start-up of all major equipment (including terminal HVAC equipment) and submission of associated factory start-up reports to the Engineer.

(18) Full Commissioning support of all major systems as detailed within the Controls drawings. (Both Mechanical Contractor, General Contractor and Controls Contractor must participate as required to fully commission all systems.)

END OF SECTION 200200
SECTION 200300 - SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS & TOOLS

1. GENERAL

A. The Contractor's attention is directed also to the General and Special Conditions and Section 200100 - General Provisions - Mechanical as well as to all other Contract Documents as they may apply to his work.

B. The Contractor shall prepare and submit to the Engineer, through the General Contractor and the Architect (where applicable) within thirty (30) days after the date of the Contract, all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter through University of Kentucky Ecomm.

C. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

D. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the General Contractor and the Architect (if applicable) to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

E. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

F. The Engineers review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for: adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project. Any items that differ from the Drawings or Specifications shall be flagged by the Contractor so the Engineer will be sure to see the item. Do not rely on the Engineer to “catch” items that do not comply with the Drawings or Specifications. The Contractor is responsible for meeting the Drawings and Specification requirements, regardless of whether or not something does not get caught by the Contractor or Engineer during shop drawing reviews.

G. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.

H. If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the drawings; and the Contractor shall be required to furnish all materials in accordance with this list.

I. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors. Color samples shall be furnished with the shop drawing submission for such equipment.
J. Shop Drawing Submittals

(1) All submittals for HVAC equipment shall include all information specified. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

(2) All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule.

(3) All items submitted shall be designated with the same identifying tag as specified on each sheet.

(4) Any submittals received in an unorganized manner without options listed and with incomplete data will be returned for resubmittal.

2. SHOP DRAWINGS

Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

(1) Air handling unit
(2) Controls
(3) Sheet Metal and Accessories
(4) Pipe Valves and Hydronic Accessories
(5) Piping Material and Accessories
(6) Insulation
(7) Hydronic Inline pumps
(8) Expansion tanks
(9) Exhaust Fans
(10) PRV’s, Traps, Safety Relief Valve and associated steam appurtenances.
(11) Steam Condensate Pump
(12) Initial Existing Water Heater Factory Check-out Report
(13) All Factory Startup Reports

SPECIAL NOTES:

(1) Upon substantial completion of the project, the Contractor shall deliver to the Engineers (in addition to the required Shop Drawings) one (1) complete hard copy and one (1) electronic copy of operation and maintenance instructions and parts lists for each item marked (1) above. These documents shall include at least:

(a) Detailed operating instructions
(b) Detailed maintenance instructions including preventive maintenance schedules.
(c) Addresses and phone numbers indicating where parts may be purchased.

(2) Shop drawings for the Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system.

Complete equipment list for use with SAP software and building data for use with Whitestone maintenance software in electronic spreadsheet format. Data is to be provided in Uniformat format with the information being provided either in aggregate totals or in individual locations as noted in a Uniformat Component List. Information is to be provided as follows (PPDMC will provide blank Excel spreadsheets in electronic form for use in compiling the information if desired):
1. All materials that require preventative maintenance (PM) are listed as Individual Locations. The equipment list is to be provided in Excel spreadsheet format.

2. Required maintenance procedure listing each work task in Excel spreadsheet format.

3. Required frequency of maintenance for the work tasks outlined above and included in the spreadsheet.

4. Listing of maintenance parts and items: i.e. filters, lubricants, etc. for each work task listed above.

5. Whitestone building information data is to be supplied in total quantities for items listed as Aggregate Totals. The provided information is to be in an Excel spreadsheet listing the following information: Uniformat Format Code, Component ID, Component Name, Unit of Measure, Quantity, and Installation Year.

3. SPECIAL WRENCHES, TOOLS, ETC.

   (1) The Contractor shall furnish, along with equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed under the Contract. Wrenches shall include necessary keys, handles and operators for valves, cocks, hydrants, etc. A reasonable number of each shall be furnished.

4. BALANCE REPORTS

   A. Upon substantial completion of the project, the Contractor shall submit to the Engineers two (2) bound hard copies and one (1) electronic copy of the Certified Air and Hydronic Balance Report.

5. SAP REQUIREMENTS

   A. The University is utilizing a SAP format for future maintenance requirements as such the Contractor shall provide the following:

      (1) Complete equipment list for use with SAP software in electronic spreadsheet format. Data is to be provided in Uniformat format with the information being provided for individual locations as noted in Attachment A – Uniformat Component List. Information is to be provided as follows (PPDMC will provide blank Excel spreadsheets in electronic form for use in compiling the information, if desired).

      (2) All materials that require preventative maintenance (PM) are listed in Attachment A. The equipment list is to be provided in Excel spreadsheet format and is to include the information listed in Attachment B.

      (3) Required maintenance procedure listing each work task in Excel spreadsheet format as shown in Attachment C.

      (4) Required frequency of maintenance for the work tasks outlines in 8.7.3.4.2 above and included in the Attachment C spreadsheet.

      (5) Listing of maintenance parts and items: i.e., filters, lubricants, etc. for each work task listed in 8.7.3.4.2 above.

END OF SECTION 200300
SECTION 200400 - DEMOLITION AND SALVAGE

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

2. DEMOLITION

   A. INTENT

      It is the intent of this section to completely remove all components of any existing mechanical system no longer in use that will be open to view in, or will interfere with the operations of the completed building, or which will, in any way, interfere with project construction. Components of the existing mechanical systems which do not meet the above criteria, may be abandoned in place in a safe, workmanlike, code approved manner.

      B. HVAC

         (1) Remove from the project area all piping not to be reused and hangers, specialties, etc. that are accessible or that become accessible during construction and/or interfere in any way with any part of the construction or would be exposed in the completed building.

         (2) Remove all temperature controls and related items that are accessible or become accessible during construction. All controllers shall be turned over to PPDMC Controls Division.

         (3) Remove all existing heating and ventilating equipment not indicated to be reused from the building.

         (4) The Contractor shall be responsible for the removal and/or relocation of any HVAC piping, equipment, fittings, valves, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Structural, Mechanical or Electrical Systems at no increase in the contract price.

         (5) Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where HVAC equipment is removed.

         (6) Unless otherwise noted, when removing equipment sitting on a concrete pad, also remove the concrete pad and patch and repair floor to match adjacent surfaces.

3. SALVAGE

   A. It is the intent of this section to deliver to the owner all components of any mechanical system which may be economically reused by him. Pay particular attention to any DDC control device which is to be removed. Any existing controllers should be salvaged and turned over to the owner. The Contractor shall make every effort to remove reusable components without damage and deliver them to a location designated by the Owner.

   B. Other items become the property of the Contractor and are to be removed from the site.
SECTION 201100 - SLEEVING, CUTTING, PATCHING AND REPAIRING

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. The Contractor shall be responsible for all openings, sleeves, trenches, etc., that he may require in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.

C. The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to go through; however, when this is not done, the Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Engineer. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

D. The Contractor shall notify other trades in due time where he will require openings or chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

E. The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly made good to the satisfaction of the Engineer.

F. All work improperly done or not done at all as required by the Mechanical Trades in this section, will be performed by the Contractor at the direction of the trade whose work is affected.

2. SLEEVES, PLATES AND ESCUTCHEONS

A. The Contractor shall provide and locate all sleeves and inserts required for his work before the floors and surface being penetrated are built, otherwise the Contractor shall core drill for pipes where sleeves and inserts were not installed, or where incorrectly located. Core drilling is the only acceptable alternative to sleeves. Do not chisel openings. Where sleeves are placed in exterior walls or in slabs on grade, the space between the pipe or conduit and the sleeves shall be made completely and permanently water tight.

B. Pipe that penetrates fire and/or smoke rated assemblies shall have sleeves installed as required by the manufacturer of the rating seal used.

C. At all other locations either pipe sleeves or core drilled openings are acceptable.

D. Where thermal expansion does not occur, the wall may be sealed tight to the pipe or insulation.

E. Insulation, that requires a vapor barrier (i.e., cold water or refrigerant piping, etc.), must be continuous through the sleeve/cored hole. For other piping, insulation may stop on either side of the sleeve.
F. Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints or Schedule 40 pipe. Sleeves in floors shall extend 1" above finished floor level.

G. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.

H. Escutcheon plates shall be provided for all pipes and conduit passing thru walls, floors and ceilings. Plates shall be nickel plated, of the split ring type, of size to match the pipe or conduit. Where plates are provided for pipes passing thru sleeves which extend above the floor surface, provide deep recessed plates to conceal the pipe sleeves.

3. CUTTING

A. All rectangular or special shaped openings in plaster, stucco or similar materials, including gypsum board, shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirement is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for grilles, diffusers, lighting fixtures, etc.

B. Mechanical, plumbing, and fire protection contractors shall coordinate all openings in new and existing masonry walls with the General Contractor; and, unless otherwise indicated on the Architectural drawings, provide lintels for all openings required for the work (Louvers, wall boxes, exhaust fans, etc.). Lintels shall be sized as follows:

(1) New Openings under 48" in width: Provide one 3-1/2"x3-1/2"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.

(2) New Openings 48" to 96" in width: Provide one 3-1/2"x6"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on either side.

(3) New Openings over 96" in width: Consult the Project Structural Engineer.

C. No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.

D. Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

4. PATCHING AND REPAIRING

A. Patching and repairing made necessary by work performed under this division shall be included as a part of the work and shall be done by skilled mechanics of the trade or trades for work cut or damaged, in strict accordance with the provisions herein before specified for work of like type to match adjacent surfaces and in a manner acceptable to the Engineer.

B. Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material satisfactory to maintain the rating integrity of the wall, floor or ceilings affected.
C. Where ducts penetrate fire rated assemblies, fire dampers shall be provided with an appropriate access door.

D. Piping passing through floors, ceilings and walls in finished areas, unless otherwise specified, shall be fitted with chrome plated brass escutcheons of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe around which it is installed.

E. Stainless steel collars shall be provided around all ducts, large pipes, etc., at all wall penetrations; both sides.

F. Where ducts, pipes, and conduits pass through interior or exterior walls, the wall openings shall be sealed air tight. This shall include sealing on both sides of the wall to insure air does not enter or exit the wall cavity. This is especially critical on exterior walls where the wall cavity may be vented to the exterior.

END OF SECTION 20 1100
SECTION 201300 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineers. All piping shall be installed straight and true, parallel or perpendicular to the building construction. Piping shall be installed so as to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers and other building openings.

C. All pipe shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on trapeze type hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted. Spacing of pipe supports shall not exceed eight feet for pipes up to 1-1/4 inches and ten feet on all other piping. Small vertical pipes (1 inch and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants. Insulated piping shall be supported on a rigid insulation block at each hanger so as to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. (Refer to Specifications Section entitled INSULATION-MECHANICAL.

D. Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other so as to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation.

E. In general, piping shall be installed concealed except in Mechanical, Janitor Rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur they shall be kept as close to walls as possible.

F. Installation of pipe shall be in such a manner as to provide complete drainage of the system toward the source. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be 1/2" size gate type with 3/4" hose thread end and vacuum breaker. Label each drain valve.

G. All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.

H. Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing; if in doubt, consult Engineer.

I. Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and sound practice.
J. Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineers.

K. Nipples shall be of the same material, composition and weight classification as pipe with which installed.

L. Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineers prior to submission of a bid proposal.

M. Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If necessary, contact Engineers.

N. Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.

O. Apply approved pipe dope (for service intended) to all male threaded joints. Pay particular attention to dope for fuel gas lines. The dope shall be listed for such use.

P. High points of closed loop hot water heating systems shall have manual or automatic air vents as indicated or required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.

Q. All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.

R. The entire domestic hot, cold and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules and Regulations for the State which the work is being accomplished in.

S. Provide expansion joints where shown on the plans and where required by good practice. Expansion joints shall be guided and anchored in accordance with the recommendations of the Expansion Joint Manufacturer's Association.

T. Where plastic pipe penetrates a fire rated assembly, it shall be replaced with a metal threaded adapter and a metal pipe per code.

U. Where piping penetrates interior or exterior walls, the wall shall be sealed air tight. Refer to the slewing, cutting, patching and repairing section of the specifications for additional requirements.

V. All piping to hydronic coils shall be full size all the way to the coil connection on the unit. If control valve is smaller than pipe size indicated, transition immediately before and after control valve. Also, if coil connection at unit is a different size than the branch pipe size indicated, provide transition at coil connection to unit. On 3-way valve applications, the coil bypass pipe shall be full size.

2. UNIONS AND FLANGES AND WELDED TEES

A. Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets and bolting. Gaskets for steam piping systems shall be flexitalic spiral wound type. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.
B. Dielectric insulating unions or couplings shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.

C. Tee connections for welded pipe shall be made up with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller.

3. SPECIFICATIONS STANDARDS

All piping and material shall be new, made in the United States and shall conform to the following minimum applicable standards:

A. Steel pipe; ASTM A-120, A-53 Grade A, A-53 Grade B.

B. Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.

C. Welding fittings; ASA B16.9.

D. Cast brass and wrought copper fittings; ASA B16.18.

E. Cast brass drainage fittings; ASA B16.23.

F. Solder; Handy and Harmon, United Wire and Supply; Air Reduction Co. or equivalent.

4. PITCH OF PIPING

All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:

A. Condensate Drain Lines From Cooling Equipment:

   Not less than 1/4 inch per foot in direction of flow.

B. High and Low-Pressure Steam Mains:

   One inch in 20 feet in direction of flow.

C. Steam Condensate Return Lines:

   One inch in 20 feet in direction of flow.

D. All Other Lines:

   Provide ample pitch to a low point to allow 100 percent drainage of the system.

5. APPLICATIONS

A. Fire Protection

   Refer to the Fire Protection System section of these specifications.
B. Hydronic Piping (Hot and Chilled Systems)

(1) 2-1/2" and Smaller: Type "L" hard copper tubing with wrought copper fittings and 95/5 solder. All chilled water piping shall be designed for 250# working pressure. Hot water piping shall be designed for 150 psig.

(2) 3" and Larger: Schedule 40 black steel pipe welded or flanged joints. All chilled water piping shall be designed for 250# working pressure. Hot water piping shall be designed for 150 psig.

(3) Special Notes:
   a. Dielectric unions shall be provided at all connections of dissimilar materials.
   b. Copper and steel piping shall not be mixed in the mechanical room.
   c. Piping shall meet all State Boiler Code requirements. Pay particular attention to welded pipe requirements for hot water systems.
   d. Takeoffs and branch piping to individual coils or heat pumps shall not be connected to the bottom of hydronic mains. Connection to mains shall be at the side of the main. Also refer to details on the drawings.

C. Soil, Waste and Vent Piping

(1) Service weight hubless cast iron with manufacturer's approved bands.

D. Steam and Condensate Return Piping

(1) 75 PSI - 150 PSI Steam Pressure: Steam and condensate return piping shall be Schedule 80 black steel pipe with 300 PSI fittings. All joints shall be welded or screw type. Screw fittings may be used for pipes 2" and smaller in size only. Welding neck flanges shall be used for connection to valves and flanged equipment. Weldolet and Threadolet fittings may be used for connecting branch pipe to mains where branch pipes are two pipe sizes smaller than the mains. Otherwise install welded tees.

(2) 1 PSI - 74 PSI Steam Pressure: Steam piping shall be Schedule 40 black steel with 150 PSI fittings. Condensate return piping shall be Schedule 80 black steel with 150 PSI fittings. All joints shall be welded or threaded screw type. Screw fittings may be used only for pipes 2" and smaller in size. Welding neck flanges shall be used for connection to valves and equipment. Threadolet or Weldolet fittings may be used for connecting branch pipes to mains where branch pipes are two pipe sizes smaller than the mains. Otherwise install welded tees.

(3) All gaskets for steam piping system flanged joints shall be flexitalic spiral wound type.

E. Low Pressure Steam Condensate
(1) 2” and smaller shall be Schedule 80 Black Steel with 300 lb. malleable iron, screwed fitting
and 150 lb. screwed bronze gate valves. 2-1/2” and larger shall be Schedule 80 Black Steel
with extra strong steel, welded with 150 lb. steel gate valves or 125 lb. flanged gate valves.

F. Domestic Cold, Hot and Recirculating Hot Water Piping (Above Slab)

(1) Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in
performance to 95/5. (Maximum lead content of solder and flux is 2%).

G. Water Heater Relief Line

(1) Type "M" copper tubing with sweat fittings and 95/5 solder.

END OF SECTION 201300
SECTION 201310 - WELDING

1. GENERAL

   A. All welding and soldering will require daily completion and submission of a Hot Work Permit. A copy of the permit shall be posted at the site of the hot work.

   B. Welds shall be of sound metal thoroughly fused to the base metal at all points, free from cracks and reasonably free from oxidation blow holes and non-metallic inclusions. No fins or weld metal shall project within the pipe and should they occur they shall be removed. All pipe beveling shall be done by machine. The surface of all parts to be welded shall be thoroughly cleaned free from paints, oil, rust or scale at the time of welding, except that a light coat of oil may be used to preserve the beveled surfaces from rust.

   C. Pipe and fittings shall be carefully aligned with adjacent parts and this alignment must be preserved in a rigid manner during the process of welding.

   D. Each Contractor shall be responsible for quality of welding done by his organization and shall repair or replace any work not done in accordance with specifications.

2. WELDING QUALIFICATIONS

   A. It is required that all welding of piping covered by this specification, regardless of conditions of service, be installed as follows:

      1) Pipe welding shall comply with the provisions of the latest revision of the applicable codes, whether ASME Boiler and Pressure Vessel Code, ASA Code for Pressure Piping, or such state or local requirements as may supersede codes mentioned above.

      2) Before any pipe welding is performed, submit to the Owner or his authorized representative, a copy of the welding procedure specifications, together with proof of its qualification as outlined and required by the most recent issue of the code having jurisdiction.

      3) Before any welder shall perform any pipe welding, submit to the Owner or his authorized agent the operator's qualification record in conformance with the provisions of the code having jurisdiction, showing that the operator was tested under the proven procedure specifications submitted.

      4) Standard Procedure Specifications and Welders qualified by the National Certified Pipe Welding Bureau shall be considered as conforming to the requirements of these specifications.

      5) “R” Stamp: Any welder performing modifications, repairs, etc. to boilers, pressure vessels, or other pressure retaining items shall have a current R stamp issued by the National Board of Boiler and Pressure Vessel Inspectors.

      6) “PP” Stamp: Any welder working with steam systems exceeding 15 PSIG shall have a current PP stamp issued by ASME.

3. MATERIALS

   A. Welding fittings shall conform to ASA B16.9; of the same materials, thickness, etc., as the pipe being jointed; see ASA B36.10.

END OF SECTION 201310
VALVES AND COCKS

SECTION 202100 - VALVES AND COCKS

1. GENERAL

   a. Each Mechanical Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

   b. Each Mechanical Contractor (and/or Sub-Contractors) shall provide all valves required to control, maintain and direct flow of all fluid systems indicated or specified. This shall include, but may not be limited to all valves of all types including balancing cocks, air cocks, lubricated plug cocks, packed plug cocks, special valves for special systems, etc., for all Mechanical Systems.

   c. All valves shall be designed and rated for the service to which they are applied.

   d. The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.

   e. Each type of valve shall be of one manufacturer, i.e., gate valves, one manufacturer, globe valves, one manufacturer, silent check valves, one manufacturer, etc.. The following valve manufacturers shall be acceptable: Lunkenheimer, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Bell & Gossett, Apollo.

   f. All valves shall comply with current Federal, State and Local Codes.

   g. All valves shall be new and of first quality.

   h. Valves above ceilings shall be identified in accordance with section 2020400. Provide access panels where valves are located above hard ceiling.

   i. All valves shall conform to University valve classification requirements. Refer to the following schedules:

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<th>VALVES 2.5&quot; AND SMALLER</th>
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<tr>
<td>SERVICE</td>
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<tr>
<td>Chilled Water</td>
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<tr>
<td>*Rated for 250 psig WOG working pressure</td>
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<tr>
<td>Domestic Hot, Recirculating, and Cold Water</td>
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<tr>
<td>Heating Hot Water</td>
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<td>Low and Medium Pressure Steam and Low and Medium Pressure Steam Condensate</td>
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<td>High Pressure Steam and High Pressure Steam Condensate</td>
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<td>** Designed for 500 deg F steam at 300 psig</td>
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<tr>
<th>VALVES LARGER THAN 2.5&quot;</th>
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<tr>
<td>SERVICE</td>
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<tr>
<td>Chilled Water</td>
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<td>*Valves with ANSI 125/150 bolt pattern may be used if flanges and valves meet the 250 psig WOG design pressure</td>
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### Domestic Hot, Recirculating, and Cold Water

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<td>High Pressure Steam and High Pressure Steam Condensate</td>
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<td><strong>Designed for 500 deg F steam at 300 psig (cast steel)</strong></td>
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#### TYPES AND APPLICATION - DOMESTIC WATER:

**a.** Check Valve (2" and under): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type, horizontal swing, renewable disc and rated for 150 psi working pressure.

**b.** Ball Valve (2.5" and under): Ball valve shall have bronze body, ball and reinforced, water tight seat. Valve shall be three piece, swing-out, construction to facilitate inspection and repair. Valve shall be "full-port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 180 degrees F water temperature and 150 psi working pressure. Ball Valve shall be a 3-piece ball valve. Soldered ball valves are not permitted.

**c.** Strainers (2" and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure, 250 psi for chilled water applications.

**d.** Strainers (2 ½ and larger): Watts 77F Series "Y" type strainer with semi-steel body and flanged ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with bolted cleanout and be rated for 200 psi working pressure, 250 psi for campus chilled water.

**e.** Pressure Reducing Valves: Watts #U5B water pressure reading valve with bronze body, bolted bonnet, integral stainless steel strainer and outlet water pressure gauge. Internal disc, diaphragm and stainless steel seat shall all be removable. Valve shall be rated for inlet water pressures up to 300 psi. Water pressure reducing valves shall be provided for all equipment where water pressure exceeds the equipment manufacturer’s ratings.

**f.** Vacuum Breakers: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.

**g.** Pressure Independent Calibrated Balancing Valves, NPS 2 and Smaller: Bell & Gossett “Circuit Setter” Model Circuit Sentry Flo-Setter or equal balancing valve. Brass body, removable differential pressure cartridge type, stainless steel spring, HNBR diaphragm, EDPM O-rings, 300-psig working pressure, 250 deg F maximum operating temperature, and having threaded ends. Valves shall have calibrated orifice or venturi, connections for portable differential pressure meter with integral seals, and be equipped with a memory stop to retain set position. Minimum flow rate of .18 GPM and .01 GPM precision.

#### TYPES AND APPLICATION – HYDRONIC WATER SYSTEMS (All Chilled Water Valves connected to the campus chilled water system shall be rated for 250 psig):

**a.** 3-4” Chilled water valves shall be resilient seated, lug style butterfly valves with bubble tight, bi-directional shutoff at 250 psig pressure. Ductile iron body with locking handle, lever operators, 150 ANSI bolt pattern.
b. 6” and up chilled water shall be resilient seated, lug style butterfly valves with bubble tight, bi-directional shutoff at 250 psig pressure. Ductile iron body with gear operator and hand wheels, 150 ANSI bolt pattern.

c. Heating hot water (HWS, HWR): shall be rated for 150 lb.

d. Gate Valve (2-1/2” and larger): Gate valve shall have cast iron body with cast iron bolted bonnet, non-rising stem, solid cast iron wedge and handwheel. Gate valve shall be rated for 200 psi working pressure (250 psi for chilled water valves). Threaded end valve allowed for sizes 3” or less only.

e. Check Valves (2” and less): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure (250 psi for chilled water).

f. Check Valves (2-1/2” and larger): Check valve shall have cast iron body and cast iron bolted bonnet the disc and seat ring shall be bronze. Check valve shall be horizontal swing with renewable seat and disc. Valve shall be rated for 200 psi working pressure (250 psi for chilled water). Threaded ends valve allowed for sizes 3” and less only.

g. Ball Valves (2” and under): Ball valve shall have bronze body, ball and reinforced, watertight seat. Valve shall be 3-piece, swing-out, construction to facilitate inspections and repair. Valve shall be "full port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure (250 psi for campus chilled water). Provide extended handles for all ball valves installed in a chilled water system.

h. Ball Valve (2-1/2” to 6”): Ball valve shall have a cast iron body, with Teflon fused solid ball, blow-out proof stainless steel stem, and reinforced Teflon seats. Valve shall be “full port” type and the handle shall only require a quarter turn to go from full open to full close. The handle shall be removable with a vinyl grip. Valve shall be rated for a 200 psi working pressure (250 psi for campus chilled water) and 350°F temperature. Valves installed in chilled water systems shall be insulated up to the handle to eliminate condensation. Extend the handle as required.

i. Strainers (2” and under): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure (250 psi for campus chilled water).

j. Strainers (2½” and larger): Watts 77F Series "Y" type strainer with semi-steel body and flanged ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with bolted cleanout and be rated for 200 psi working pressure (250 psi for campus chilled water).

k. Balancing Valve (4” and less): Balancing valve shall have bronze or cast iron body. Valves to have differential pressure readout ports across valve seat area with integral check valves. Valve shall be equipped with memory stop. Valves to have threaded ends for sizes 3” and less, flanged ends for larger sizes. Valve to be provided with performed molded insulation casing. Design working pressure and temperature to be 200 psi at 250 degrees F balancing valve shall be similar to Bell & Gossett Model CB. Provide with balancing valves, one (1) water gpm readout kit to be turned over to Owner which shall include a differential pressure meter with full scale overrange protection, hoses, readout probes, filters, carry and calculator. Valves shall be rated for 250 psi at 60 degrees F for campus chilled water.

l. Air Eliminator: Amtrol automatic air eliminator with cast iron body and bronze pilot. Unit to be rated for 150 psi working pressure and 250 degrees F working temperature (250 psi for campus chilled water). Pipe discharge to nearest floor drain.
m. Automatic Air Vent: Armstrong Model 79 automatic air vent for vertical mounting with brass body and polypropylene float. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature (250 psi for campus chilled water). Pipe discharge to nearest floor drain.


END OF SECTION 202100
SECTION 202110 - ACCESS TO VALVES, EQUIPMENT, FILTERS, ETC.

1. GENERAL

   A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

   B. All mechanical equipment shall be installed in a manner which allows ready access to all components requiring service, adjustments, shutoff, etc.

   C. Filters shall be accessible, removable and replaceable without disconnecting mounting brackets, piping, wiring, etc.

   D. All oil cups, grease cups, grease fittings, etc. shall be accessible without disassembly of equipment, piping, ductwork, etc. (Extended oilers or grease fittings may be required).

   E. Provide access doors or panels for all equipment, valves, dampers, filters, fire dampers, etc. in concealed spaces not otherwise provided with suitable access. (Lay-in ceilings shall be considered acceptable access; splined or drywall ceilings shall not).

   F. All valves, unions, strainers, cleanouts, and test points shall be accessible.

   G. Access panels in lay-in ceilings shall be marked with lamacoid plates to indicate location of equipment, filters, valves, etc.

   H. Access panels in fire rated walls shall bear the same rating as the wall.

2. ACCESS DOORS

   Refer to Sheet Metal and Flexible Duct section of the specifications.

END OF SECTION 202110
1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. Work under this section shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.

C. Application of insulation materials shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use. Insulation shall be applied by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineers shall be removed and properly installed at the expense of the Contractor.

2. MANUFACTURERS

A. Insulation shall be as manufactured by Manville, Knauf, Owens-Corning, Armacell or other approved equivalent. Insulation sundries and adhesives shall be as made by Benjamin Foster, Childers, Vimasco or approved equivalent.

3. FIRE RATINGS AND STANDARDS

A. Insulations, jackets and facings shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50.

B. Adhesives, mastics, tapes and fitting materials shall have component ratings as listed above.

C. All products and their packaging shall bear a label indicating above requirements are not exceeded.

D. Duct linings shall meet the Erosion Test Method in compliance with UL Publication No. 181.

4. GENERAL APPLICATION REQUIREMENTS

A. Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.

B. All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted.

C. "Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as "exposed".
D. Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced as directed by the Engineer.

E. Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples thru the jacket. NO EXCEPTIONS!

F. All insulation shall be installed with joints butted firmly together.

G. The Contractor shall insure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

5. PIPING SYSTEMS

A. GENERAL

1) Bevel insulation and jacket at all points where insulation terminates at unions, flanges, valves and equipment. Note: Applies to hot water lines only; cold water lines require continuous insulation.

2) Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to insure no condensation drip or collection.

3) Factory molded fittings may be installed in lieu of built-up fittings. Jackets to be the same as adjoining insulation. Insulated fittings must have same or better K factors than adjoining straight run insulation.

4) Valves, flanges and unions shall only be insulated when installed on piping whose surface temperature will be at or below the dew point temperature of the ambient air.

5) Insulation shall not extend through fire and smoke walls. A UL-listed penetration system shall be used for each fire or smoke wall penetration in accordance with KBC. Materials used such as caulk, sleeves, etc. shall be manufactured by 3M, Hilti, or equal.

6. INSULATION SHIELDS

A. Metal insulation shields are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>SHIELD GAUGE</th>
<th>SHIELD LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; AND LESS</td>
<td>20</td>
<td>12&quot;</td>
</tr>
<tr>
<td>2 1/2&quot; TO 4&quot;</td>
<td>18</td>
<td>12&quot;</td>
</tr>
<tr>
<td>5&quot; TO 10&quot;</td>
<td>16</td>
<td>18&quot;</td>
</tr>
<tr>
<td>12&quot; AND GREATER</td>
<td>14</td>
<td>24&quot;</td>
</tr>
</tbody>
</table>
7. INSULATION MATERIAL (FOR THE FOLLOWING SYSTEMS)

1) Domestic Cold Water
   a. Piping 3” or less – use 1” thick insulation.
   b. Piping 4” or greater – use 1” thick insulation.

2) Domestic 110°F Hot Water and 110°F Recirculating Hot Water.
   a. Piping 1 ½” or less – use 1 ½” thick insulation.
   b. Piping 2” or greater – use 2” thick insulation.

3) Hydronic Chilled/Hot Water.
   a. Piping 1 ½” or less – use 1 ½” thick insulation.
   b. Piping 2” or greater – use 2” thick insulation.

4) High Pressure Steam and/or High Temperature Hot Water (306°F-450°F)
   a. 1” and less pipe size: 1 ½” thick
   b. 1 ¼” thru 1 ½” pipe size: 2” thick
   c. 2” thru 4” pipe size: 3” thick
   d. 5” and larger pipes: 3 ½” thick

5) Medium Pressure Steam and Medium Temperature Hot Water (251°F-305°F)
   a. 1” and less pipe size: 1 ½” thick
   b. 1-1/4” thru 1-1/2” pipe size: 2” thick
   c. 2” thru 4” pipe size: 3” thick
   d. 5” and larger pipes: 3 ½” thick

6) Low Pressure Steam (201°F-250°F)
   a. 1 ½” or less pipe size: 1 ½” thick
   b. 1 ½” and larger pipe sizes: 3” thick

7) Steam Condensate
   a. 1 ½” and less pipe size: 1 ½” thick
   b. 2” and larger pipe size: 3” thick
NOTES:

Insulate all surfaces not requiring constant access.

Provide removable insulation for surfaces requiring periodic access.

Insulate all surfaces creating a burn hazard.

Exposed piping in any room and all piping in boiler or mechanical rooms shall have an 8 ounce canvas jacket applied over the fiberglass factory ASU/SSL jacketing to further protect the insulation from abuse. This jacketing must be properly applied with lagging adhesive, such that the outer surface is smooth and free of wrinkles. The canvas jacketing in all mechanical areas and areas without ceilings are to be prepared by painting, and then painted color by architect. All chilled water piping insulation shall be completely sealed so that a perfect vapor barrier is achieved.

8. DUCTWORK SYSTEMS

A. GENERAL

1) Duct sizes indicated are the net free area inside clear dimensions.

2) Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to insure no condensation drip or collection. The backs of all supply diffusers, plenums, grilles, etc. shall be insulated only if indicated by details on the drawings.

3) All flexible duct connections on insulated ductwork shall be externally insulated.

9. EXTERNAL INSULATION

A. All Supply Air Duct and Mixed air Plenum inlet to air handler.

1) Rectangular: 1" rigid fiberglass industrial board with foil scrim kraft vapor barrier facing or PSK facing, 6.0 PCF density, K=.22 @ 75°F. Owens/Corning type 705. Provide 6 oz. canvas jacket with fire retardant lagging.

END OF SECTION 202200
SECTION 202300 - THERMOMETERS AND OTHERS, MONITORING INSTRUMENTS

1. GENERAL

   A. The Contractor shall include all thermometers, pressure gauges and/or compound gauges at the locations indicated.

2. THERMOMETERS AND PRESSURE GAUGES

   A. All thermometers and gauges shall be readable from a standing position on the floor.

   B. Thermometers shall be linear, alcohol filled, graduated in 1°F. Or less and shall have adequate range for service intended.

   C. Pressure gauges shall be Bourdon Type, circular, 3” face, black letters on white face graduated in 2 PSI or less and shall have adequate range and shall be manufactured for service intended. Provide with pig tail connectors and gauge cocks.

   D. Pressure gauges and thermometers subject to vibration shall be mounted remotely away from vibrating pipe surface, etc., with flexible tubing.

   E. Mount thermometers in approved wells and install with thermal grease. Do not make direct contact of base with fluid in pipe.

   F. Gauges and thermometers shall be Marsh, Marshalltown, Weksler or equivalent.

3. Provide, when indicated on the plans, on the inlet and outlet of each terminal unit, a “Pete’s Plug” or equivalent pressure/temperature test station. Furnish two (2) matching thermometers and pressure gauges to the owner upon project completion.

END OF SECTION 202300
SECTION 202400 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

1. GENERAL

A. The Contractor’s attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

2. VALVE TAGS AND CHARTS

A. All valves must have labels, both a tag on the valve and on the ceiling grid. All labels for valves must be on ceiling grid (see UK’s standard for lettering below). When valves are located at a piece of equipment such as shut-off valves at a VAV box with a reheat coil, only label the equipment location.

B. UK’s Standard for Standard Lettering:
   Attach Seton-Ply Discs to ceiling grid under equipment or to access doors in non-accessible ceiling.

<table>
<thead>
<tr>
<th>EQUIPMENT: COLOR:</th>
<th>ENGRAVES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve Yellow</td>
<td>V.</td>
</tr>
<tr>
<td>Fire Damper Black</td>
<td>F.D.</td>
</tr>
<tr>
<td>Smoke Damper Black</td>
<td>SM.D.</td>
</tr>
<tr>
<td>Volume Damper Black</td>
<td>V.D.</td>
</tr>
<tr>
<td>Terminal Unit Red</td>
<td>T.</td>
</tr>
<tr>
<td>Variable Volume Unit Red</td>
<td>V.V.</td>
</tr>
<tr>
<td>Heating Coil Blue</td>
<td>H.C.</td>
</tr>
<tr>
<td>Cabinet Unit Heater Red</td>
<td>C.H.</td>
</tr>
</tbody>
</table>

3. PIPING IDENTIFICATION

A. GENERAL

(1) All exposed piping installed shall be labeled according to the color coding chart hereinafter specified. In addition, provide stenciled markers and arrows indicating direction of flow on all piping installed under this Contract after the piping has been painted. Markers and arrows shall be painted on the piping using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. At the Contractor’s option, Setmark or equivalent manufactured marking system may be substituted for field marking. In areas where the piping and ductwork is exposed and painted black, the piping/ductwork shall be labeled with white lettering and shall only be labeled entering and leaving the exposed area. All other piping and ductwork shall be labeled on 10 foot intervals and when ever it enters a room. The following table describes the size of the color field and size of the identification letter which shall be used for pipes of different outside pipe diameters.

<table>
<thead>
<tr>
<th>OUTSIDE DIAMETER OF PIPE OR COVERING</th>
<th>LENGTH OF COLOR FIELD</th>
<th>SIZE OF LETTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCHES</td>
<td>INCHES</td>
<td>INCHES</td>
</tr>
<tr>
<td>3/4 TO 1-1/4</td>
<td>8</td>
<td>1/2</td>
</tr>
<tr>
<td>1-1/2 TO 2</td>
<td>8</td>
<td>3/4</td>
</tr>
<tr>
<td>2-1/2 TO 6</td>
<td>12</td>
<td>1-1/4</td>
</tr>
<tr>
<td>8 TO 10</td>
<td>24</td>
<td>2-1/2</td>
</tr>
</tbody>
</table>
(2) “Concealed”, where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. “Exposed” shall mean that piping or equipment is not “concealed” as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered as “exposed”.

B. PAINTING

(1) Paint all equipment and metal surfaces which are not factory finished (and all damaged or rusted surfaces) in high grade rust proofing machinery enamel. Pay particular attention to flanges, valves, unions, etc., where condensation may collect.

(2) Paint all piping in the mechanical room. Paint exposed pipe (whether insulated or bare) and exposed surfaces (tanks, etc.).

(3) Piping:
All plumbing and mechanical piping must be color coded and labeled, including sprinkler lines, every 15 feet above a ceiling system and every 10 feet in an open mechanical room. Piping shall be labeled at least once in every room it enters.

<table>
<thead>
<tr>
<th>UNIVERSITY OF KENTUCKY STANDARD COLOR CODING FOR MECHANICAL PIPING</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF SERVICE</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>High Pressure steam and return (over 76 psig)</td>
</tr>
<tr>
<td>Medium pressure steam and return (21 psig to 75 psig)</td>
</tr>
<tr>
<td>Low pressure steam and return (0 psig to 20 psig)</td>
</tr>
<tr>
<td>Domestic cold water</td>
</tr>
<tr>
<td>Domestic hot water</td>
</tr>
<tr>
<td>Medium temperature hot water &amp; return (300F or less)</td>
</tr>
<tr>
<td>Reheat supply &amp; return</td>
</tr>
<tr>
<td>Chilled water supply &amp; return</td>
</tr>
<tr>
<td>Condenser water supply &amp; return</td>
</tr>
<tr>
<td>Safety valve vents</td>
</tr>
<tr>
<td>Cast iron soil &amp; waste vents</td>
</tr>
<tr>
<td>Vacuum Piping</td>
</tr>
<tr>
<td>Air (steel pipe)</td>
</tr>
<tr>
<td>Roof leaders</td>
</tr>
<tr>
<td>Natural gas</td>
</tr>
<tr>
<td>Condensate pump discharge</td>
</tr>
<tr>
<td>Sump pump discharge</td>
</tr>
<tr>
<td>Fire suppression/sprinkler</td>
</tr>
</tbody>
</table>
IDENTIFICATIONS, TAGS, CHARTS, ETC.

system

Notes: *Color and number are from the Sherwin Williams System 4000 color selection guide dated 1999.

C. Water heaters, storage tanks, heat exchangers, etc., shall be painted light gray.

D. In mechanical rooms, piping shall be labeled every 10 feet.

4. EQUIPMENT IDENTIFICATION

A. All equipment shall be labeled with a lamacoid plate in accordance with UK standards.

5. DUCTWORK IDENTIFICATION

A. All ductwork shall be identified as to the service of the duct and direction of flow. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can.

END OF SECTION 202400
SECTION 202500 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Provisions - Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified in this section.

B. Each Contractor's attention is also directed to Section 20 1300, Pipe, Pipe Fittings and Pipe Support.

C. This section includes, but is not limited to, furnishing and installing dampers, supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work.

D. Power driven anchors and expansion anchors shall be permitted only when permission is granted in writing by the Architect and Engineer.

2. MATERIALS AND EQUIPMENT

A. Hangers, Clamps, Attachments, Etc.:

<table>
<thead>
<tr>
<th>SIZE</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pipe Rings</td>
<td>2&quot; pipe and smaller</td>
</tr>
<tr>
<td>2. Pipe Clevis</td>
<td>2-1/2&quot; pipe and larger</td>
</tr>
<tr>
<td>3. Pipe Clevis</td>
<td>All</td>
</tr>
<tr>
<td>4. Rise Clamps</td>
<td>All</td>
</tr>
<tr>
<td>5. Beam Clamps and Attachments</td>
<td>All</td>
</tr>
<tr>
<td>6. Brackets</td>
<td>All</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>7. Concrete Inserts</td>
<td>All</td>
</tr>
<tr>
<td>8. Concrete Fasteners</td>
<td>All</td>
</tr>
<tr>
<td>9. Ceiling</td>
<td>All</td>
</tr>
<tr>
<td>10. Rod Attachments</td>
<td>All</td>
</tr>
<tr>
<td>11. U-Bolts</td>
<td>All</td>
</tr>
<tr>
<td>12. Welded Pipe Saddles</td>
<td>All</td>
</tr>
<tr>
<td>13. Pipe Roll</td>
<td>All</td>
</tr>
<tr>
<td>14. Protection Saddle</td>
<td>All</td>
</tr>
<tr>
<td>16. Miscellaneous Steel</td>
<td>All</td>
</tr>
<tr>
<td>17. Concrete Channel Inserts</td>
<td>All</td>
</tr>
<tr>
<td>18. Adjustable Spot Insert</td>
<td>All</td>
</tr>
</tbody>
</table>

3. INSTALLATION
A. Unless otherwise specifically indicated or hereinafter specified in the specifications, all supporting, hanging and anchoring of piping, ductwork, equipment, etc., shall be done by each trade as is necessary for completion of the work and shall be as directed in the following paragraphs:

(1) Supporting and hanging shall be done so that excessive load will not be placed on any one hangers so as to allow for proper pitch and expansion of piping. Hangers and supports shall be placed as near as possible to joints, turns and branches.

(2) For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer. Utilize beam clamps for fastening to steel joists and beams and expansion anchors in masonry construction. When piping is run in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger.

(3) Trapeze hangers shall be supported by steel rods of sufficient diameter to support piping from joists or concrete construction. Where desired or required, piping may be double mounted on trapeze hangers. Where conditions permit, trapeze hangers may be surface mounted on exposed joists by means of approved beam clamps, or to concrete construction by means of approved adjustable inserts or expansion anchors.

(4) Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross steel joists.

(5) Piping shall not be supported by the equipment to which it is connected. Support all piping so as to remove any load or stress from the equipment.

(6) Where piping, etc., is run vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum and an approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.

(7) Where piping is run along walls, knee braced angle frames or pipe brackets with saddles, clamps, and rollers (where required) mounted on structural brackets fastened to walls or columns shall be used.

(8) Support all ceiling hung equipment, with approved vibration isolators.

(9) Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.

(10) Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.

(11) All insulated piping shall be supported with clevis type and/or pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.

(12) Under no conditions will perforated band iron or steel wire driven hangers be permitted.

(13) In general, support piping at the following spacing:
a. Steel and copper piping - 8 foot intervals for piping 3" and smaller; 10 foot intervals for larger piping.

b. Where the manufacturer of the pipe has more strict guidelines, the manufacturer’s recommendations shall be followed.

(14) All-thread rods supporting strut hangers shall be cut within 1/2" of the bottom of the strut.

END OF SECTION 202500
SECTION 202600 - MECHANICAL/ELECTRICAL VIBRATION CONTROL

1. GENERAL

A. RELATED DOCUMENTS

(1) Drawings and general provisions of the Contract, including General and Supplementary Conditions, General Mechanical Provisions and Division 1 Specifications Sections, apply to this section.

B. MANUFACTURERS

(1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:

- Mason Industries
- Vibration Eliminator Co., Inc.
- Vibration Isolation Co., Inc.
- Kinetics Noise Control
- Vibration Management Corporation - Vimco

C. SUMMARY

(1) This Section includes vibration isolators for mechanical and electrical equipment, duct and piping systems.

- Drawings and calculation
- Installation supervision

D. SUBMITTALS

(1) Product Data: Indicate types, styles, materials, and finishes for each type of isolator specified. Include load deflection curves.

2. PRODUCTS

A. VIBRATION ISOLATORS

(1) Rubber Isolator Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements, with encapsulated top-and baseplates. Factory drilled and tapped top plate for bolted equipment mounting. Factory-drilled baseplate for bolted connection to structure. Color-code to indicate capacity range.

(2) Restraint Spring Isolators: Vertically restrained, freestanding, laterally stable, steel open-spring-type isolators.

(3) Housing: Welded steel or ductile iron. Factory-drilled baseplate for bolting to structure and bonded to a 1/4-inch-(6mm) thick, rubber isolator pad attached to the baseplate underside. Provide adjustable equipment mounting and leveling bolt.

(4) Outside Spring Diameter: Not less than 80 percent of the compressed height of spring at rated load.

(5) Minimum Additional Travel: 50 percent of the required deflection at rated load.
(6) Lateral Stiffness: More than 0.8 times the rated vertical stiffness.

(7) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

(8) Finishes: Baked enamel for metal components on isolators for interior use. Hot-dip galvanized for metal components on isolators for exterior use.

(9) Vertical Limit Stops: Where required or shown, provide resilient vertical limit stops to prevent spring extension due to wind loads or when weight is removed.

(10) Rubber Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to formed-steel housings with threaded connections for hanger rods. Color-code to indicate capacity range.

(11) Spring Hangers: Combination spring and elastomeric hanger with coil spring and elastomeric insert in compression.

(12) Frame: Formed steel, fabricated for connection to threaded rods and to allow for 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

(13) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

(14) Minimum Additional Travel: 50 percent of the required deflection at rated load.

(15) Elastomeric Element: Molded, oil-resistant rubber or neoprene.

(16) All-directional acoustical pipe anchor shall consist of two sizes of steel tubing separated by a minimum ½” thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction.

(17) Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor should be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping anchors shall be attached to the structural slab using stud wedge anchors.

(18) Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that was “rolled up” to create the thread. The stud anchor shall also have a safety shoulder, which fully support the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying its allowable loads.

(19) Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have evaluation report number from the I.C.B.O. Evaluation Service, Inc. verifying to its allowable loads.

3. EXECUTION

A. INSTALLATION
(1) Install and anchor vibration- and sound-control products according to manufacturer’s written instructions and authorities having jurisdiction.

(2) Isolate duct as follows:

a. Provide spring and neoprene hanger or floor spring mount on all duct discharge runs for a distance of 50’ from the connected equipment. Spring deflection shall be a minimum of 0.75”.

b. Provide precompressed spring and neoprene hanger or floor spring mount on all duct runs having air velocity of 1000 fpm or more. Spring deflection shall be a minimum of 0.75”.

END OF SECTION 202600
1. GENERAL

   A. The General Conditions, Instructions to Bidders, Section 200100, and other Contract Documents are a part of this specification and shall be binding on all Mechanical Contractors. It shall be each Contractor's responsibility to apprise himself of all information pertinent to his work prior to submitting his proposal. No adjustments will be made in this Contract which is a result of failure to comply with this requirement.

   B. The Engineer, or his authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these specifications or required by others. Any leaks or imperfections found shall be corrected and a new tests run to the satisfaction of the Engineer or his authorized representative. Upon completion of a test, a written approval of that part of the work will be given to the Contractor. Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow his work to be furred-in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

2. HEATING, VENTILATING AND AIR CONDITIONING

   A. The test and balance of this system shall be by a contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services. The test and balance contractor shall report all deficiencies to the engineer.

   B. The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test of not less than one hundred pounds and shall be proven tight after a twenty-four (24) hour test.

3. All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating and control valves shall be adjusted. Excessive noise or vibration shall be eliminated. Provide all start-up documents to Designer prior to any test and balance services.

4. System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.

5. All fan belts shall be adjusted for proper operation of fans.

6. All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.

7. For the purpose of placing the heating, ventilating and air conditioning system in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, Volume Six (2002), for air and hydronic systems as published by the Associated Air Balance Council. The following systems shall be test and balance:

   1) Balance new air handler – provide complete static pressure profile through new unit. Assist controls contractor in setting control discharge pressure for air handler.
   2) Balance new exhaust fan.
   3) Balance new domestic hot water recirculating pump
   4) Balance hot water coil freeze protection pump.

   H. Provide a preliminary test report to the mechanical engineer immediately after the system is air balanced, or any initial phases are balanced. This report may be hand written. Anticipate visiting the site again after the
The engineer has reviewed the report. The engineer may request up to 5 additional static pressure measurements for any air handling system to help resolve any balancing deficiencies. Include five additional static pressure measurements for each exhaust air system.

I. The Test and Balance agency shall provide lifts, scaffolding, etc. as required to balance devices in areas with high ceilings such as gymnasiums, auditoriums, atriums, cupolas, etc. The Test and Balance agency may coordinate with the General Contractor or Mechanical Contractor to arrange for these items to be provided to access high devices, however, it is emphasized the Contractor is finally responsible for providing the means required to balance all devices.

J. Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

K. Test and Balance agency is to provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor will purchase and install all sheaves and belts as required. This includes new and existing equipment.

L. Four (4) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.

M. The Contractor shall provide and coordinate his work in the following manner:

(1) Provide sufficient time before final completion date so that tests and balancing can be accomplished.

(2) Provide immediate labor and tools to make corrections when required without undue delay.

N. The Contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing.

O. The test and balance contractor shall be present during the Engineer’s final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

P. Automatic Flow Control Balance Valves

(1) Verify that each installed automatic flow control device matches the GPM indicated on the drawings.

(2) Verify that the actual pressure at each automatic flow control device is within the pressure limits specified by the valve manufacturer.

(3) Include documentation of the above information for each control device in the final balance report.

END OF SECTION 203100
SECTION 230200 - HVAC EQUIPMENT AND HYDRONIC SPECIALTIES

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Conditions-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. The Contractor shall provide in complete working order the following heating, ventilation and air conditioning equipment located as indicated and installed, connected and placed in operation in strict accordance with the manufacturer's recommendations. All equipment shall be factory painted and, where applicable, factory insulated and shall, where such standards exist, bear the label of the Underwriters Laboratory.

C. Each subcontractor shall be responsible for their own completion of System Verification Checklists/Manufacturer’s Checklist.

D. Factory startup is required for all HVAC equipment. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians and shall complete and submit start-up reports/checklists. This shall include air handling units, chillers, VFDs, etc.

E. All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90 and/or International Energy Conservation Code 2006, whichever is more stringent.

F. Installation of all heating, ventilating and air conditioning systems shall be performed by a master HVAC contractor licensed in the state the work will be performed.

G. Note to Suppliers and Manufacturers Representative furnishing proposals for equipment for the project:

   (1) Review the Controls Section of these Specifications (if applicable) to determine controls to be furnished by the equipment manufacturer, if any. The Contractor shall provide all controls with equipment unless specifically listed otherwise.

   (2) Review the section of these specifications entitle: REQUIRED SHOP DRAWINGS, DESCRIPTIVE LITERATURE, MAINTENANCE MANUALS, PARTS LISTS, SPECIAL KEYS, TOOLS, ETC., and provide all documents called for therein.

   (3) Ensure that the equipment which you propose to furnish may be installed, connected, placed in operation and easily maintained at the location and in the space allocated for it.

   (4) Determine from the Bid Documents the date of completion of this project and insure that equipment delivery schedules can be met so as to allow this completion date to be met.

   (5) Where manufacturers’ temperature controls are specified, they shall be in full compliance with International Mechanical Code Section 606 including automatic smoke shut down provisions.

   (6) Provide factory start-up on site by a factory representative (not a third party contractor) for all HVAC equipment, including pumps, VFDs, air handlers, etc. Submit factory start-up reports to the Engineer.
(7) Provide general orientation training to the Owner. Training shall occur only when the systems are complete and 100% functional. All training shall be videotaped. Refer to Section 15000 for training session requirements.

(8) Review the Section on Motor Starters and Electrical Requirements for Mechanical Equipment.

(9) Requirements for motors controlled by variable frequency drives:
   a. All motors shall be inverter duty rated.
   b. Motors less than 100 HP in size shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer’s instructions. These shall be factory mounted and installed on the exterior of the motor to allow for visual inspection. Ground motor frame per manufacturer’s instructions. Install kit in strict accordance with manufacturer’s instructions.

(10) All condensate producing equipment shall be provided with a condensate trap as recommended by the equipment manufacturer.

(11) Provide a complete air tight enclosure with opening door that seals air tight for all filters on air moving equipment.

(12) All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

2. EQUIPMENT

A. QUALIFICATIONS
   (1) Manufacturer shall be a company specializing in the design and manufacture of commercial / industrial custom HVAC equipment. Manufacturer shall have been in production of custom HVAC equipment for a minimum of 5 years.
   (2) Each unit shall bear an ETL or UL label under UL Standard 1995 indicating the complete unit is listed as an assembly. ETL or UL listing of individual components, or control panels only, is not acceptable.
   (3) Manufacturer shall have at least 10 unique installations of fan array (minimum 4 fans in fan array) air handling units.

B. WARRANTY
   (1) The complete unit shall be covered by a parts and labor warranty issued by the manufacturer covering the first year of operation. This warranty period shall start upon substantial completion.

C. ACCEPTABLE MANUFACTURERS
   (1) Provide custom air handling units as manufactured by:
      a. Climatecraft
      b. CES Group (Governair, HuntAir, etc.)
      c. York Custom
HVAC EQUIPMENT 230200-3

D. GENERAL

(1) Furnish and install where shown on the plans, custom air handling unit construction features as specified below. The units shall be provided and installed in strict accordance with the specifications. All units shall be complete with all components and accessories as specified. Any exceptions must be clearly defined. The contractor shall be responsible for any additional expenses that may occur due to any exception made.

(2) Air handler shall be a "Knockdown" / "Site Built" unit and all components shall be made such that it can fit through a standard double door. The contractor shall coordinate the exact spatial parameters and coordinate their approach with the existing loading dock and pathway to the site. It shall be the contractors and unit manufacturer's responsibility to confirm component sizing such that the unit can be installed in the location indicated. All components shall be protected during shipment.

a. The unit shall be tested by a certified testing agency on site after completion by the contractor. All testing shall be the responsibility of the unit manufacturer. Provide all testing equipment and instrumentation needed for the testing.

b. The manufacturer shall provide a full time on site construction supervisor during the entire unit assembly process. The supervisor shall manage the unit assembly and provide a lead contact for project meetings, owner/engineer/general contractor relations and answer questions from associated trades.

(3) Please note that all filter sizes and filter clips must conform to University of Kentucky Standards. This information shall be detailed explicitly on the shop drawing submittal and coordinated with UK Engineer during shop drawings.

   1. HEPA Filter Clips: Camfil Magnaframe II with swing bolts
   2. Pre and Final Filter Clips: Camfil C78 Series

E. ON SITE/FACTORY TESTING AND QUALITY CONTROL

(1) Factory Tests: The fans shall be factory run tested to ensure structural integrity and proper RPM. All electrical circuits shall be tested to ensure correct operation before shipment of unit. Units shall pass quality control and be thoroughly cleaned prior to shipment.

(2) On Site Leak Testing: The unit manufacturer shall provide an on site leak test after the unit has been constructed. This shall be performed by a certified company in accordance with AMCA Standard 210. The cabinet shall be tested at 1.5 times the static pressure of differential static pressure across the cabinet exterior walls) for both the high and low pressure sides. Cabinet leakage shall not exceed 0.5% of design airflow. All supply and return air openings shall be sealed. The air shall then be pumped into the unit until the appropriate operating pressures are achieved. Air flow measurements shall be performed in compliance with AMCA Standard 210. The unit shall also be tested to show that the specified airflow is produced at the specified static pressure for both supply and return fans.

(3) On Site Panel Deflection Testing: The unit manufacturer shall provide a deflection test on one unit at 8” of differential static pressure across the cabinet exterior walls. A deflection limit of L/200 will be demonstrated at this time. “L” is defined as the height panel on the side of the unit. Measurements shall be at midpoint of “L” along the vertical seam of the largest panel on
one side.
Height of panel = H x (.005) = inches deflection allowed

a. The manufacturer shall notify contractor and/or owner 10 days prior to test for witnessing. Owner’s representative shall select one unit to be tested at the time of release. A written test report shall be prepared by the manufacturer and issued to the Owner’s representative. This test shall be performed when the factory leak test is performed.

(4) Block-off Testing: Manufacturer shall provide block off on-site testing of unit. The supply fan shall be run at full speed, the outside air dampers shall be closed. The dampers and internal walls shall not permanently deflect beyond the L/200 standard described above. If dampers or internal walls deflect, the manufacturer shall repair and strengthen components and retest.

(5) Acoustic Requirements: The equipment manufacturer shall furnish calculations showing the estimated sound power levels at the supply and, return connections, as well as unit casing radiation for each air conditioning unit. Calculations shall be based on fan sound power levels which were determined in accordance with AMCA Standard 300 and 301. These shall meet or exceed the sound power levels indicated on the drawings. Sound data from a single fan or group of fans shall not be acceptable. Sound calculation shall calculate resultant sound valves entering or leaving the unit.

(6) Basin Leakage Testing: The basin shall be tested for leakage. The base sections shall be filled with 2” of water and must hold for for 24” hours. Any leaks shall be repaired and the basin re-tested.

F. UNIT CONSTRUCTION

(1) Provide factory-fabricated field erected air handling unit with capacity as indicated on the schedule. Units shall have overall dimensions as indicated and fit into the space available with adequate clearance for service as determined by the Engineer. Units shall be completely assembled in the factory before being palletized and shipped to site. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by the contractor. The manufacturer/contractor shall assure the unit can fit in the mechanical room with all required current spatial limitations.

(2) Unit manufacturer shall provide certified ratings conforming to the latest edition of AMCA 210, 310, 500 and ARI 410. All electrical components and assemblies shall comply with NEMA standards. Unit internal insulation must have a flame spread rating not over 25 and smoke developed rating no higher than 50 complying with NFPA 90A, “Standard for the Installation of Air Conditioning and Ventilating Systems.” Units shall comply with NFPA 70, “National Electrical Code,” as applicable for installation and electrical connections of ancillary electrical components of air handling units. Tags and decals to aid in service or indicate caution areas shall be provided. Electrical wiring diagrams shall be attached to the control panel access doors. Operation and maintenance manuals shall be furnished with each unit. Units shall be UL or ETL listed.

(3) Unit Base - Floor: Unit perimeter base shall be completely welded and fabricated using heavy gauge structural steel tubing. (C-Channel cross supports shall be welded to perimeter base steel tubing and located on maximum 24 IN centers to provide support for internal components. Base rails shall include lifting lugs welded to perimeter base at the corner of the unit or each section if de-mounted. Entire base frame is to be painted with a phenolic coating for long term corrosion resistance. Internal walk-on floor shall be 10 gauge aluminum tread plate and shall be
turned up the wall 4” and welded. Caulk joints are not acceptable. The outer sub-floor of the unit shall be made from 20 gauge galvanized steel. The 4 IN double wall floor shall be insulated. Floor seams shall be gasketed for thermal break and sealed for airtight / watertight construction. Single wall floors with glued and pinned insulation and no sub floor are not acceptable.

4. The base and unit frame shall be painted with a lacquer resisting gray phenolic corrosion inhibitive primer. All drain pans shall be stainless steel IAQ type and have a rigid 12 IN wide safety tread plate walk bridge stretched across the unit width. Walk bridge shall be of the same material type and thickness as the unit floor. The walk bridge and support system shall be suspended above the drain pan (not in contact with the drain pan bottom) and shall be easily removable for drain pan cleaning. A galvanized steel liner shall be attached to the underside of the unit base and cross members, ensuring that the floor insulation is completely encapsulated.

5. All gasket and necessary assembly hardware shall ship loose with unit. Junction boxes with a factory supplied numbered terminal strip shall be supplied for field wiring.

6. Unit Casing – The construction of the air handling unit shall consist of a (1 x 2) steel frame with formed 16 gauge G-90 galvanized steel exterior casing panels. The exterior casing panels shall be attached to the gasketed (1 x 2) steel frame with corrosion resistant fasteners.

7. All casing panels shall be completely removable from the unit exterior without affecting the unit’s structural integrity. (Units without framed type of construction shall be considered, provided the exterior casing panels are made from 14 gauge galvanized steel, maximum panel center lines are less than 20 inches and deflection is less than L/200 @ 8 IN positive pressure).

8. The air handling unit casing shall be of the “no-through-metal” design. The casing shall incorporate insulating thermal breaks as required so that, when fully assembled, there’s no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide necessary support to limit casing deflection to L/200 of the narrowest panel dimension. If panels cannot meet this deflection, additional internal reinforcing is required.

9. All panel seams shall be caulked and sealed for an airtight unit. Leakage rates shall be less than 0.5% at 8 IN W.C. Note: If manufacturer cannot provide thermal break (no through metal) and or removable exterior panel construction it must be noted as an exception on the bid.

a. As an option to steel panels, all panels may be double wall all-aluminum construction with minimum 0.040 IN exterior and interior skin thicknesses. Interior finish to be smooth, mill finish; exterior finish to be a low-reflective textured mill finish. Each panel shall contain an integral frame or be properly supported by a structural framing system. Panel shall have continuous tight seal at the interior and exterior skins completely encapsulating the insulation.

10. Insulation - Entire unit (walls, roof, doors, and floor) to be insulated with a min 3” thick insulation. The insulation shall have a minimum effective thermal resistant ® of 20 and a noise reduction coefficient (NRC) of 0.70 / per inch thick (based on a type "A" mounting). Insulation shall meet the erosion requirements of UL 181 facing the air stream and fire hazard classification of 25/50 (per ASTM-84 and UL 723 and CAN/ULC S102-M88). All insulation edges shall be encapsulated within the panel. All perforated sections shall have Tuf-Skin or equal insulation with black acrylic coating as manufactured by Johns Manville or approved equal. Panels shall be insulated with minimum 3-PCF high density polyisocyanurate foam insulation. Fiberglass insulation in panels shall not be acceptable.
(11) Access Doors - The unit shall be equipped with a solid double wall insulated, hinged access doors as shown on the plans. The doorframe shall be extruded aluminum with a built in thermal break barrier and full perimeter gasket. The door hinge assembly shall be die cast zinc with stainless steel pivot mechanism, completely adjustable. There shall be a minimum of two heavy duty handles per door. Provide ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors. Note: If manufacturer cannot provide thermal break door design it must be noted as an exception on the bid.

a. Access doors in the fan section shall be provided with a 10 x 10 dual thermal pane safety glass window. Provide sufficient test ports to be able to measure DP across each section.

1) Provide IAQ drain pans in segments as indicated on the schedule. IAQ drain pans shall comply with ASHRAE Standard 62-2007, Section 5.

a) The IAQ pans shall be triple sloped, positive draining stainless steel pan. Pan design shall ensure that water drains freely from the pan whether the fan is in operation or stagnant. P-Trap guidelines shall be affixed to the unit. P-Trap components shall be provided and installed by the jobsite contractor.

b) Coat IAQ drain pans with a anti-microbial coating to reduce microbial growth contaminating the air stream.

c) Drain connection shall be located at the lowest point(s) of the pan, per ASHRAE 62-2007 Section 5. Drain connection shall be of like material as liner, draining to one side of the unit.

d) IAQ drain pan shall allow visual inspection and physical cleaning, including underneath coils, without removal of the coil.

G. UNIT COMPONENT DESCRIPTION

(1) Fan Array:

a. The fan array shall consist of multiple, direct driven, arrangement 12 plenum fans spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air way tunnel cross section and components contained therein. The Fan array shall be constructed per AMCA requirements for the duty specified, (Class I, II, or III). All fans shall be selected to deliver design air flow at the specified operating TSP at the specified motor speed and as scheduled. The Fan array shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan’s peak static pressure producing capability at the specified fan speed.

b. All motors shall be IEEE inverter duty, premium efficiency TEAO T-frame motors selected at the specified operating voltage, RPM, and efficiency as specified or scheduled elsewhere. Each motor shall be provided with an AEGIS bearing protection ring to prevent Electrical Discharge Machining (EDM) damage to the motor bearings.

c. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, category BV-2.5, Grade 1.0 with peak to peak deflection equal to or less than 0.8 mil at the design operating speed for the fan/motor cartridge.

1) The Discharge and Inlet bare fan sound power levels for each individual octave band shall NOT exceed the values specified or scheduled for the Fan array.

2) Each fan motor shall be individually wired to a unit mounted control panel. Wire sizing shall be determined, and installed, in accordance with applicable NEC standards. All VFD’s to be provided by the Controls sub-contractor and are not part of this bid.

3) Motor Current Sensors for each individual motor, factory wired to terminal strip(s) for field connection By Others to BAS/BMS interfaces.

4) Fan array shall be sized such that the unit is capable of producing 100% of scheduled airflow at design static pressure after losing one fan. Selection showing this shall be included in the submittal.

5) Fan motors shall not exceed 15 hp.
6) Provide hoisting system internal to unit to be able to remove one complete fan/motor assembly.
7) Provide one blank off plate per unit that allows service personal to prevent re-entrainment of air through a non-functional fan.
8) Each fan shall be test run at their operating speed or at the maximum RPM for the particular fan’s construction class prior to shipment. The fans are to be balanced and records maintained of the readings in the axial, vertical, and horizontal direction on each of the fan’s bearings. Final peak velocity measurements shall not exceed 0.1 in/sec.
9) Coordinate minimum quantities of supply fans with the schedule indicated on the drawings.

d. Fan Array Electrical:
1) Provide a complete electrical system required to run the Fan array system including all equipment, material, electrical enclosure and electrical components. All electrical conduit and wiring shall be installed to allow the complete remove of the wall panel. Horizontal conduit along side walls is not permitted. **VFDs to be provided by controls contractor.**
2) Fan array Electrical designs shall be in accordance with the NEC, UL 508A, and Local Codes.

e. Motor Circuit Protection:
1) All motors in the Fan array shall be provided with individual Motor Protection for thermal overload protection. All motor circuit protectors shall be located in main enclosure.
2) If required by design, all motor circuit protectors shall be mounted and located in a remote motor circuit protector panel as needed that is separate from the main enclosure. Motor circuit protector enclosure must be located and mounted at a minimal distance from motors in the Fan array.

f. Fan Array Control:
1) As required by system design, one Variable Frequency Drive for normal operation and a second Variable Frequency Drive for Redundant Backup operation shall be provided by the controls sub-contractor.

H. HEAT TRANSFER COILS – WATER COIL

(1) All coil assemblies shall be leak tested under water at 315 PSIG and PERFORMANCE is to be CERTIFIED under ARI Standard 410. Coils exceeding the range of ARI standard rating conditions shall be noted.
(2) Cooling coils shall be mounted on stainless steel support rack to permit coils to slide out individually from the unit. Provide intermediate drain pans on all stacked cooling coils. The intermediate pan shall drain to the main drain pan through a copper downsput. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. All fins shall be continuous within the coil casing to eliminate carryover inherent with a split fin design. Fins are die formed Plate type.
(3) Headers are to be seamless copper with die formed tube holes.
(4) Connections shall be male pipe thread (MPT) Schedule 40 Red Brass with 1/8" vent and drain provided for complete coil drainage. All coil connections shall be extended to the exterior of the unit casing by the manufacturer. Coils shall be suitable for 250 PSIG working pressure. Intermediate tube supports shall be supplied on coils over 44 IN fin length with an additional support every 42" multiple thereafter. Grooved pipe connections are acceptable.
(5) Water coils shall have the following construction:
   Standard 5/8 IN:
(6) 5/8 IN o.d. x 0.035" wall copper tube with .028 return bends.
(7) .010 IN aluminum fins
I. Filters - Provide filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the unit. Face loaded pre and final filters shall have Type 8 frames as manufactured by AAF, FARR or equal. Side service filter sections shall include hinged access doors on both sides of the unit. Internal blank-offs shall be provided by the air unit manufacturer as required to prevent air bypass around the filters. The filters shall be as manufactured by Farr, Purolator, AAF or equal. Filters shall be in compliance with ANSI/UL 900 – Test Performance of Air Filters.

(1) Filter Gauge: Each Filter bank shall be furnished with: (Magnehelic / Photohelic) filter gauge with a 4 3/4 IN OD white static pressure dial with black figures and zero pointer adjustment. / Dwyer Series 2000 Air filter gauge Dwyer Mark 25 Inclined manometer (DWYER 250 AF).

(2) Flat Racks - Filter racks shall be completely factory assembled and designed for industrial applications. Filter racks shall be fabricated from no less than 16 gauge galvanized steel. Filter racks shall be applied in low efficiency filter applications and will be upstream accessible. Upstream access filter racks shall have one central access cover per row of filters centered in the unit for easy access. Filter racks over 72 IN in length shall require an angle center reinforcement support. Filter racks shall be designed for a maximum of 500 fpm, or meet or exceed the area specified in the mechanical schedule.

(3) Medium Efficiency Pleated Filters - Filters shall be 2 IN thick, 30% efficient. Filter media shall be 100% synthetic. The filter shall have an average efficiency of 25-30% and an average arrestance of 90-92%. The filters shall be listed as Class II under UL Standard 900. Filters shall be tested per ASHRAE Standard 52-76. The effective media shall not be less than 4.6 square feet of media per 1.0 square foot of filter face area, and shall contain not less than 15 pleats per linear foot. Initial resistance at 500 fpm approach shall not exceed 0.28 IN wg. Filters shall be 24”x24” or 12”x24” only. Filter clips shall be Camfil Farr Type C-78-2 or similar.

(4) High Efficiency Rigid Filters - Filters shall be 4 IN deep high performance, pleated, totally rigid and totally disposable type. Each filter shall consist of high density glass fiber media; media support grid, contour stabilizers and enclosing frame. Filter media shall be laminated to a non-woven synthetic backing to form a lofted filter blanket. The filter media shall have an average efficiency of 95%. The media support shall be a metal grid with an effective open area of not less than 95%. The metal grid shall be bonded to the filter media to eliminate the possibility of media oscillation and media pull-away. The metal grid shall be formed in such a manner that it affects a tapered radial pleat design. The grid shall be designed to support the media both vertically and horizontally. Filters shall be listed Class II under UL Standard 900. Filters shall be tested per ASHRAE Standard 52.1-76. Contour stabilizers shall be permanently installed on both entering air and exit air sides of the filter media pack to ensure that the tapered radial pleat configuration is maintained throughout the life of the filter. The filter shall be capable of withstanding a 10 IN wg pressure drop without noticeable distortion of the media pack. The enclosing frame shall be constructed of galvanized steel. It shall be constructed and assembled in such a manner that a rigid and durable enclosure for the filter pack is affected. The periphery of the filter pack shall be continuously bonded to the inside of the enclosing frame, thus eliminating the possibility of air bypass. The enclosing frame shall be equipped with protective diagonal support members on both the entering air and air exit sides of the filters. Filters shall be 24”x24” or 12”x24” only. Filter Clip shall be AAF type L-40 or similar.

(5) Control Dampers – Industrial grade control dampers meeting the following construction standards: Frame shall be minimum 8” deep x 2” flanged 14 gage, galvanized steel channel. Blades shall be double skin airfoil design, maximum 8” wide and minimum 16 gage galvanized steel. Axles shall be minimum 1/2” diameter plated steel rod. Bearing shall be stainless steel sleeve pressed into frame. Oil impregnated bronze or synthetic bearings are not acceptable. Linkage shall be located in jam out of airstream and constructed of minimum 10 gage steel clevis arms with 3/16” x 3/4” plated steel tie bars pivoting on 3/8” diameter stainless steel pivot.
pins with lock type retainers. Submittal data must include leakage, pressure drop and maximum pressure data based on AMCA Standard 500 testing. Data shall be for full range of damper sizes. Data from one size sample test is not acceptable. Damper shall be Ruskin model CD80AF1 Control Damper.

a. Provide air foil double T hinges opposed blade damper.
b. Braced and sized to withstand (+/-) 12 inches w.g.
c. Maximum leakage shall be 8 CFM per square foot at 48”x48” size.
d. Damper shall be provided with operator.
e. Provide additional structure as required to meet deflection criteria.

J. ELECTRICAL POWER AND CONTROLS

(1) All electrical and automatic control devices not previously called out or listed below are to be furnished and installed in the field by OTHERS. All electrical conduit and wiring shall be installed to allow the complete remove of the wall panel. Horizontal conduit along side walls is not permitted.

(2) All wiring and electrical connections shall be of copper wires, copper bus bars, and copper fittings throughout, except internal wire of the control transformer may be aluminum, if copper termination is provided. Identify power supply terminals with permanent markers. The maximum temperature of terminals shall not exceed 167°F (75°C) when the equipment is tested in accordance with its rating.

(3) The unit shall feature a mounted permanent nameplate displaying at a minimum the manufacturer, serial number, model number, date of manufacture, and current and voltage readings. The unit must have an ETL or UL Listing and bear the appropriate mark.

(4) Provide permanent schematic and connection wiring diagrams indicating how the unit motors, starters, controls, etcetera are wired. The controls diagram shall follow recognized industry standards and shall feature line and terminal numbers.

(5) The unit shall bear warning alerting personnel of arc flash hazard and the need for PPE.

(6) Conduit shall consist of a combination of EMT or flexible metal conduit as required. Liquidtite flexible metal conduit may be used outside the air tunnel for wet locations. Electrical connection boxes shall be galvanized steel with knockouts. In wet locations the connection boxes shall be Nema 4 epoxy coated.

(7) Unit Convenience Features
a. Each access section shall be equipped with a vapor-proof 64 watt vapor proof fluorescent light fixtures with low temperature ballast for service.
b. Each light shall have its own light switch mounted adjacent to the access door.
c. Furnish a 120 volt GFI duplex convenience outlet on the exterior of each unit.
d. Lights, switches and outlets shall be wired through a transformer and external light disconnect. Lights shall be wired to remain functional whether the main power disconnect is in the on or off position.

K. BIPOLAR IONIZATION AIR PURIFICATION SYSTEM

(1) This section describes the design, performance and installation of a bipolar ionization air purification system intended for use on this project. Ionization units shall be supplied to provide between 500 and 1500 positive and negative ions per cubic centimeter in the areas served.

(2) Quality Assurance
a. The pollutant reduction bipolar ionization system shall be a product of an established manufacturer with a minimum of five (5) years of continuous operation in the USA. Technologies that do not operate through a gas disassociation process like UV lights, powered particulate filters, and/or polarized media filters, will not be considered.
b. A qualified representative from the manufacturer shall be available to inspect the installation of the pollutant reduction system to ensure installation in accordance with manufacturer’s recommendation. Manufacturer shall have local representation that is qualified to support the installation of the systems and provide ongoing service after installation.

c. The air purification system products shall be UL certified for Standards 867 and 1995 and specifically tested and passed UL 2043 to insure a plenum rating. Products with UL certifications for residential applications only will not be accepted. Product nameplates must match the UL certified manufacturer’s name.

(3) Approved Manufacturers
a. Plasma Air International is the basis for design
b. GSP Plasma Solutions

(4) Performance Criteria
a. The bipolar ionization system shall be capable of controlling gas phase contaminants generated from human occupants.
b. Capable of reducing static space charges.
c. Capable of reducing common VOC’s encountered in heavy contaminant load applications.
d. Equipment shall be capable of performing in non-condensing atmospheres at temperatures up to 140°F.

(5) Equipment Requirements
a. The bipolar ionization units shall include all power supplies, ion generating tubes, gaskets, indicators, switches, fuses, and accessories necessary for safe and efficient operation.
b. All components of ionization units specified above shall be self-contained in one enclosure. For units that are mounted inside an AHU or plenum, separate ionization units and associated power generators will not be accepted due to safety concerns and penetrating AHU casing with line voltage power.
c. All exposed metallic parts of ionization tubes shall be stainless steel.
d. Ionization units shall be suitable for duct mounting or air handling unit plenum mounting.
e. Ionization Tubes shall be UL listed and bear the UL mark.
f. Secondary voltage on power generators shall not exceed voltage higher than 2,900 volts. Transformers utilizing secondary voltage of 3,000 volts or higher shall not be acceptable.
g. Each ion generator shall be separately fused and include: an on/off service switch; indicating lamps for power available and ionization on; a five-position ion level selector switch; and a relay with isolated low voltage contacts to indicate unit status.
h. The electrical power wiring to the ionization units shall be detachable without the use of tools to facilitate servicing of the equipment. Quick release system shall utilize a screw down coupler. Systems utilizing metallic latches are not acceptable due to corrosion and inoperability over time.
i. Ionization unit output shall be user adjustable from approximately 50 to 100%. There shall be a minimum of six levels of adjustment.

(6) Equipment Application
a. Each air handling unit shall include the required number of ion generators sized to that air handling unit airflow capacity. Each ion generator shall be a Plasma Air Model 51F with 5 ionization tubes and a nominal ionization capacity to treat 5,000 CFM and a Plasma Air Model 51E with 5 ionization tubes and a nominal ionization capacity to treat 4,000 CFM.
b. Electrical power to the ion generators shall be interrupted when the airflow is less than 100 fpm or when access doors to the ionization plenum are opened. Additional controls such as field mounted pressure switches or control relays shall be included as part of the ionization
equipment scope.

c. All single- and two-tube mounted applications shall include a mounting frame with integral pressure differential switch permanently attached to the duct with sheet metal screws. Ionization units shall be attached to the mounting frame with machine screws. These units shall be so designed that power must be disconnected prior to removal of the unit. Loose pressure differential switches will not be acceptable for single- and two-tube applications.

d. A remote monitoring panel shall be provided at each air-handling unit and shall include: 16-gauge galvanized steel, NEMA 3R enclosure, and permanently attached engraved name plates. All internal components shall be UL recognized. For each ion generator within the air handling unit provide: on/off switch, “trouble” and “normal” indicating lamp, form C contacts to interface with BMS to alert service required.

e. Ion generators shall be installed on stationary front service racks. The rack assemblies shall be factory fabricated and painted or powder coated. Interconnecting wiring shall carry voltage no higher than the primary source to the remote panel.

(7) Electrical Requirements.

a. Ionization units shall be available for 120 and/or 230 volt applications.

b. The maximum power required for multi tube ionization units shall be 50 watts.

c. The electrical contractor shall provide a junction box with single outlet within 4 feet of the ionization equipment.

(8) Control Option

a. Manufacturer to provide option for duct mounted IAQ device that will sense air quality levels and adjust the ionization output accordingly to insure proper ion levels. Controls shall be adjustable and controller status indicating space air quality levels shall be web viewable via computers, pads or smart phones, etc.

L. FAN MOTOR REMOVAL TROLLEY SYSTEM

(1) Provide unit with I beam trolley system inside of fan section. Provide on exterior of unit a cantilever beam with swing arm that shall handle a minimum lifting weight of 250 lbs. Swing angle of swing arm shall be 200 degrees.

M. **ADD ALTERNATE**: COONEY “FREEZE BLOCK” CHILLED WATER COIL

(1) Provide an add-alternate price in bid for Cooney “freeze block” type chilled water coil according to the following specifications:

(2) Provide a fluid coil with Cooney Freeze Block Technology. Coil shall be manufactured with an expansion relief header that is brazed into each and every return bend.

(3) A combination relief valve that operates by pressure and temperature, (designed to re-seat after activation) shall be affixed to the expansion relief header to protect the coil during freezing conditions.

(4) The pressure relief set point to be 200 psi.

(5) The temperature relief set point to be 35 degrees.

(6) All Freeze Block Valves shall be situated above a drain pan.

(7) The coils shall be manufactured utilizing:

a. Tubes:

1) 1/2 inch diameter copper tubes – a minimum tube wall thickness of 0.025”.
2) 5/8 inch diameter copper tubes – a minimum tube wall thickness of 0.020”.
3) Return bend wall thickness to match or exceed tube wall thickness
4) Hairpin return bends not permitted

(8) All coils equipped with Cooney Freeze Block Technology to be installed inside of any air handling unit must be equipped with access doors at all relief valve locations. These access doors must be large enough to perform any and all necessary maintenance to the relief valve sections of the coil.

(9) All pressure boundary joints to be brazed by personnel certified to ASME Section IX

(10) Coils to be cleaned using a solvent degreasing method, either submerged or vapor, using perchloroethylene or similar solvent.

(11) This technology shall be wind tunnel, climate room and field tested with a minimum of 5 years of industry usage.

(12) Smart Coil Specification Data
a. Provide fluid or steam coil with Cooney Freeze Block Technology
b. An adapter will be attached to the bottom of every Cooney Freeze Block relief valve.
c. Material designed to handle temperatures from -40F to 300F
d. Material must be non-conductive
e. Adapter will house a conductivity sensor designed to sense when the Cooney Freeze Block relief valve discharges during a freezing event
f. Must be designed to only sense water from valve discharge and not from environment
g. Must not hold water after valve deployment
h. Sensor is wired to the supplied control box terminal strip
i. Control box to allow an input voltage range of 85 – 305 VAC single phase
j. Output through a relay switch to the Building Automation System and/or Air handling unit controls
k. BAS (Building Automation System) to then be programmed to perform, but not limited to, the following sequence of operations:
l. Turn off power to the fan
m. Close Outside Air Dampers
n. Open control valve to preheat coil (steam or hot water) – where applicable
o. Send alarm to control center to notify maintenance personnel

N. CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

(1) Manufacturers:
a. Armstrong Pumps Inc.
b. Aurora Pump; Division of Pentair Pump Group.
c. Bell & Gossett; Div. of ITT Industries.
d. Patterson Pump Co.; a Subsidiary of The Gorman-Rupp Co.

(2) Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 250-psig minimum working pressure and a continuous water temperature of 200 deg F.
(3) Pump Construction:

a. Casing: Radially split, cast iron, with, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.

b. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.

c. Pump Shaft: Steel, with copper-alloy shaft sleeve.

d. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.

e. Pump Bearings: Permanently lubricated ball bearings.

f. Motor: Single speed, with permanently lubricated ball bearings, unless otherwise indicated; and rigidly mounted to pump casing. Comply with requirements in Division 15 Section "Motors."

1) Motor horsepower shall be non-overloading over the full range of the pump curve.

O. CONDENSATE PUMP

(1) Furnish and install according to drawings and manufacturer’s instructions the quantity of DSS-MU DUPLEX condensation pump(s) as shown on the drawings. Each unit shall consist of (1) stainless steel receiver, (2) water pumps, (1) level transmitter, electrical controls and accessories.

(2) The condensate receiver shall be made out of stainless steel for years of service. The receiver shall be equipped with: (1) inlet strainer, (1) level transmitter with temperature sensor, (2) pressure gauges for pump discharge, and (2) lifting eyes (on receivers 21 gallon and larger). The receiver size shall be as shown on the drawings.

(3) The cast iron basket inlet strainer with vertical self-cleaning bronze screen shall be provided for the receiver inlet.

(4) The centrifugal water pumps shall be top mounted on the receiver. The pump shall be of the two stage design with the stainless steel axial flow first stage impeller coupled to the second stage impeller by a compression coupling and drive pin. The axial flow first stage impeller shall be mounted in a suction column with stainless steel bearing supports and water lubricated silicon bearings. The entire suction column shall be threaded and be replaceable as a complete assembly. The drive shaft to the axial flow impeller shall be stainless steel. The second stage enclosed bronze impeller shall be bronze fitted to the cast iron case by a renewable bronze wearing ring. Mechanical shaft seals shall be rated for 250°F service. Each pump shall be close coupled to an industry standard motor available “off the shelf.” Pump capacity, motor HP and RPM, electrical characteristics, and receiver size shall be as shown on the drawings.

(5) The pump manufacturer shall furnish, mount on the pump unit, and wire a U.L. labeled NEMA control cabinet with hinged door, containing:

(6) 2 Combination magnetic starters (each having 3 overload relays) with circuit breakers and cover interlock for lock-out tag-out capability

a. 1 Shipco Model SLC programmable logic controller

b. 1 Full-color touchscreen display

c. 1 Removable control mounting plate

d. 1 Numbered terminal strip

(7) The Shipco SLC programmable logic controller shall consist of:
a. Nema 4x, 4" Color Touch Screen SLC will contain: Auto-off- Selector switch with push to test button per pump; Alternation controller up to (3) pumps; Lead-off - Lag switch to override Alternation with manual controller, if more than one pump; Run Timer(s) push to reset; Green run light per pump; Red Fault light per pump with aux. contact on each starter for status; Grey Inactive light per pump; Alarm ledger which logs any irregular operating conditions; 24 volt Fused Primary & Secondary Transformer; Control Circuit Disconnect switch; BacNet and Modbus Communications with Shield wiring of 24 volt circuits.
b. A Nema 4x level transmitter needs to be used in lieu of any float switches for pump control and alarms to achieve the full potential of the SLC along with a temperature transmitter for data collection and maximum benefit.
c. An alarm button with silencing relay needs added into control panel.
d. When using an SLC with Shipco transmitters for level and temperature, High Water Level point indicates overflow; Low water level point indicates leaking tank; High Water Temperature point (indication of trap failures in system or changes); High Water Temperature Cut-off or shut-off point to protect pump(s) from cavitation; A constant water level could be monitored from a level transmitter and ease of adjustment. (Leads to condensate pumping back as quick and as hot as possible to save money).

(8) Required Features:

a. An optional Solenoid valve with the SLC having a provision to add cooling water to maintain operating temperature.
b. Each pump control circuit shall be completely independent of the other. The PLC shall (1) change the operating sequence automatically after each cycle, (2) provide simultaneous operation under peak load conditions, and (3) operate the second pump automatically, should the active pump or its control fail.
c. The unit shall have a float switch assembly NEMA 4 to turn on a high water alarm mounted in control panel with bell, light and silencing relay with dry contacts to access the building management system alarm.
d. The entire pump package will be U.L. labeled when a control panel is furnished.
e. A control circuit transformer for each circuit shall be provided when the motor voltage is three phase or code requires 115 volt controls. All factory installed wiring shall be numbered for easy identification and the numbers shall coincide with those shown on the wiring diagrams.
f. The unit shall have a single point power connection.
g. The manufacturer shall furnish a certified pump performance test. The pump manufacturer shall furnish complete elementary and connection wiring diagrams, piping diagrams, and installation and operation instructions.

P. FACTORY START-UP REPORTS

(1) Provide factory start-up on site by a factory representative (not a third party contractor) for all HVAC equipment, including pumps, VFD’s, air handlers, etc. Submit factory start-up reports to the Engineer. The Mechanical Contractor and the Controls Contractor shall have a representative on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action taken shall be submitted to Engineer.

(2) The current project includes the relocation of two existing water heaters. The contractor shall have a full factory check-out of the existing water heaters conducted prior to commencing any work to relocate water heater. A report of this check-out shall be submitted to the engineer/owner for review with any pre-existing deficiencies noted in the factory report. Upon successful relocation, a factory startup will be completed for each water heater with the startup report submitted to the owner/engineer for review.
At a minimum, the report submitted to the Engineer shall include the following data:

Air Handling Units
a. Verify economizer operation
b. Verify operating per sequence of control
c. Discharge air temperature sensor calibration
d. Discharge static pressure
e. Dirty filter differential pressure switch function
f. Outside air temperature sensors calibration
g. Return air temperature sensor calibration
h. Airflow monitoring station calibration
i. VFD response to pressure sensors or other DDC input
j. Smoke detection shut down
k. Freeze protection sequence
l. Fan bearings lubrication
m. Fan not vibrating
n. Fan motor volts / amps
o. Check drive belt tension
p. Check sheave alignment
q. Coils clean
r. Dampers operating properly
s. Filters clean
t. Fan rotation direction

Pumps
a. Verify operating per sequence of control
b. Discharge pressure
c. VFD response to pressure sensors or other DDC input
d. Verify all integral sensors
e. Record pump speed/level settings.

Water Heaters
a. Verify proper operation of water heaters in the new location.
b. Verify sequence of operation under load.
c. Verify all control valves, PLC, etc is working correctly.

END OF SECTION 230200
SECTION 231200 - SHEET METAL AND FLEXIBLE DUCT

1. GENERAL

A. The Contractor's attention is directed to the General and Special Conditions, General Requirements-Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section and which are hereby made a part of the work specified herein.

B. This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's HVAC Duct Construction Standards, Metal and Flexible, and its subsequent addenda. HVAC duct systems shall be fabricated and installed in accordance with the SMACNA duct construction standards (SMACNA-HVAC and SMACNA-Seismic) including Appendix B of the Seismic Restraint Manual Guidelines for Mechanical Systems. These references and plate numbers shall be used by the Engineer for required sheet metal thicknesses and final acceptance of methods of fabrication, hanging, accessories, etc. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.

2. PRESSURE VENTS

A. Provide a pressure relief vent in the supply air ductwork at each air handling unit. It shall be located between the fan outlet and the first manual or automatic (i.e., fire, fire smoke, or any motorized) damper or closure device. It shall be sized to relieve the duct air pressure below the rated pressure construction of the ductwork and above the working pressure of the fan. Provide a vacuum relief vent in the return and/or outside air ductwork at each air handling unit. It shall be located between the air handling unit casing and the first manual or automatic damper or closure device. It shall be sized to relieve the duct vacuum below the rated construction of the ductwork and above the working negative pressure of the fan. Automatic fan shutdown upon damper closure shall not be an acceptable protection for either overpressure or vacuum conditions. All duct relief dampers shall be of the automatic resetting type unless otherwise noted.

3. FILTER RACKS

A. If separate filter grilles are specified for an HVAC unit the Contractors shall remove any unit mounted filters and blank off the unused filter access opening with sheet metal and seal air tight.

4. WALL PENETRATIONS

A. Where ducts penetrate interior or exterior walls, the walls shall be sealed air tight. Refer to the sleeving, cutting, patching and repairing section of the specifications for additional requirements.

5. PROTECTION DURING CONSTRUCTION

A. All ductwork openings shall be covered during construction to prohibit dust and dirt from entering the installed ductwork, air handling unit, terminal devices, etc. Provide temporary filters on all return grilles and duct openings if the units are running prior to the building being satisfactorily cleaned. The Contractor shall pay for duct cleaning if precautionary measures are not taken.

6. LOW VELOCITY DUCTWORK

A. General (Low Velocity)
1. Double turning vanes shall be installed in all square turns and in any other locations indicated.

2. Provide "spin-in" type fittings for all round ducts serving supply air diffusers where the duct branches off the rectangular duct main. The spin-in fitting shall not penetrate farther than 40% into the duct width.

3. Cross-break all ducts where any duct section dimension or length is 18" or larger.

4. Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.

5. Splitter dampers shall be provided in all rectangular supply air duct tees. Damper blade operator shall extend a minimum two inches thru the insulation.

6. Unless otherwise dimensioned on the drawings, all diffusers, registers and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc.

7. Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from perlins or other weak structural members where no additional weight may be applied. If in doubt, consult the structural engineer.

8. Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.

9. All ductwork connections, fittings, joints, etc., shall be sealed. Seal with "Duct Seal 321". Apply per manufacturer's recommendations.

10. Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.

11. All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.

12. Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, coils, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

13. Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.
(14) The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.

(15) Locate all supply, return and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.

(16) All fans and other vibrating equipment shall be suspended by independent vibration isolators.

B. Materials (Low Velocity)

(1) Ductwork, plenums and other appurtenances shall be constructed of the following:
   
   
   b. Exposed ductwork in finished spaces such as gymnasiums, etc., shall be dual wall ductwork with a perforated liner. Refer to the High Velocity Duct Section for construction.

(2) Ductwork, plenums and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the IMC and SMACNA HVAC Duct Construction Standards - Metal and Flexible, or as follows whichever is more stringent.

<table>
<thead>
<tr>
<th>DIA., INCHES</th>
<th>ROUND DUCT GAUGE</th>
<th>WIDTH, INCHES RECTANGULAR DUCT GAUGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 TO 12</td>
<td>26</td>
<td>UP TO 12</td>
</tr>
<tr>
<td>12 TO 18</td>
<td>24</td>
<td>13 TO 30</td>
</tr>
<tr>
<td>19 TO 28</td>
<td>22</td>
<td>31 TO 54</td>
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<tr>
<td>29 TO 36</td>
<td>20</td>
<td>55 TO 84</td>
</tr>
<tr>
<td>37 TO 52</td>
<td>18</td>
<td>85 AND ABOVE</td>
</tr>
</tbody>
</table>

(3) Flexible ductwork which is uninsulated shall be corrugated aluminum. Use flexible ductwork only where indicated. No sections shall be greater than four feet in length. Ductwork shall be UL rated and in accordance with IMC.

(4) Insulated Flexible Duct (Use Only Where Indicated)

   a. Owens/Corning or equivalent, 1 ½” thick fiberglass insulation; flexible liner; with aluminum pigment vinyl vapor barrier facing. Insulated flexible duct shall meet Fire Hazards Standards of NFPA 90A and IMC, flame spread not to exceed 25, smoke develop and fuel contributed not to exceed 50 when tested in accordance with ASTM-E84. Minimum R-value of 6.0, tested in accordance with ASTM C177.71. Flexible duct may be used only for runouts and no sections shall be more than four feet in length.
b. When flexible duct is located in areas where it will be visible because the ceiling allows views to
the ductwork above, the flexible duct shall be black. The black color shall be factory coloring and
not field applied.

c. Flexible duct shall not be used in areas where there is no ceiling.

C. Miscellaneous (Low Velocity)

(1) Flexible Connectors: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA
Pamphlet No. 90-A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.

(2) Turning Vanes: Barber-Colman, Titus, Waterloo, or equivalent; fabricated as recommended by
SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be
double blade type.

(3) Air Extractors: Metalaire Model 102-1 Carnes, Titus, Barb-Air or approved equivalent. Provide with
operating hardware by Ventfabrics, Inc. Operator shall extend two inches from duct to allow for
external insulation, where required. Regulator shall seal operator shaft air tight. Install hardware as
recommended by manufacturer.

(4) Splitter Damper: Splitter damper shall be constructed of 16 gauge galvanized steel. Provide with
operating hardware by Ventfabrics, Inc. to include damper blade bracket, ball joint bracket and
operator shaft. Operator shall extend two inches from duct to allow for external insulation, where
required. Regulator shall seal operator shaft air tight. Install hardware as recommended by
manufacturer.

(5) Access Doors; In Ductwork: In ducts where indicated or where required for serving equipment,
fabricated according to SMACNA recommendations and be equivalent to those manufactured by Air
Balance, Vent Products or other approved equivalent. Provide a hinged access door in duct adjacent to
to all fire, smoke and control dampers for the purpose of determining position. Access doors shall also be
provided on each side of duct coils (water, electric, steam, etc.), and downstream side of VAV boxes
and CAV boxes. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise
install as large an access door as height permits by 16" in length. All access doors shall be double cam
access doors. Piano hinged is not acceptable.

(6) Access Doors; In Ceilings or Walls: Titus, Krueger, Milcor or approved equivalent with key locks.

a. In mechanical, electrical or service spaces. 14 gauge aluminum brushed satin finish, 1” border.

b. In finished areas.
14 gauge primed steel with 1” border. To accept the architectural finishes specified for the space.

Provide where required to access equipment, dampers, valves, filters, etc.

(7) Volume Dampers (Rectangular): Ruskin, Model MD35 or Empco, Air Balance; Louvers and
Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air volume dampers. Frames
shall be 4" x 1 "x 16 gauge galvanized steel. Blades shall be 16 gauge galvanized steel, maximum of
6" wide. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 1"
high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide
permanent mark on dial regulator to mark air balance point.
(8) Volume Dampers (Round): Ruskin, Model MDRS25 or, Empco, Air Balance; Louvers and Dampers, Titus, Carnes, Cesco/Advanced Air, Creative Metals, United Air Round Damper. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20 gauge steel, 7” long. Damper blades shall be 20 gauge galvanized steel. Axle shall be 3/8” diameter steel. Provide with Ventfabrics 1” high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

7. HIGH VELOCITY DUCTWORK

A. Application (High Velocity)

(1) All supply air ductwork installed in contract shall be considered High Velocity duct and installed per the following specification. All supply air ductwork shall be rated for 6” External Static Pressure.

B. General (High Velocity)

(1) Provide flexible connectors at inlet and outlet of air handling equipment to accommodate a minimum of three times the operating pressure of the system.

(2) Duct dimensions indicated are required inside clear dimensions.

(3) All ductwork connections, fittings, joints, etc., shall be sealed. Seal with Hardcast "DT" tape and Hardcast "RTA-50" adhesive installed in strict accordance with manufacturers recommendations.

(4) Ductwork shall be installed per SMACNA Medium or High Pressure Manual, whichever is applicable. (Latest Edition shall apply.)

(5) All hanger straps shall be 18 ga. minimum with reinforcement angles installed in strict accordance with SMACNA. Flat oval ducts shall be installed with 2"x2"x1/4" angles on top and bottom ducts 18” wide and larger. Use 1"x1"x3/16" angles on ducts under 18” wide.

(6) Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA or the duct manufacturer, and/or as indicated. Test openings shall be placed at the discharge of all air handling units and at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

(7) Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall. Provide an approved access panels at each fire damper located and sized so as to allow hand reset of each fire damper. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. Where access doors are installed in insulated ductwork, the access door shall be the insulated type.

C. Materials (High Velocity Single Wall)

(1) All round and oval high velocity ductwork shall be United McGill "Uni-Seal" or "Uni-Weld" ductwork or Semco, Dixie, Eastern Sheet Metal, Langdon, or approved equivalent as required by pressure rating of the system.
(2) Ductwork shall be spiral, lock-seam type and be constructed of galvanized steel. Any ductwork exposed to view shall have paint grip finish for painting by Contractor. Ductwork shall be constructed of the following minimum gauges:

<table>
<thead>
<tr>
<th>DIAMETER (Or Equivalent Round Diameter For Oval Ducts)</th>
<th>METAL THICKNESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-14 Inches</td>
<td>26 Ga.</td>
</tr>
<tr>
<td>15-26 Inches</td>
<td>24 Ga.</td>
</tr>
<tr>
<td>27-36 Inches</td>
<td>22 Ga.</td>
</tr>
<tr>
<td>37-50 Inches</td>
<td>20 Ga.</td>
</tr>
<tr>
<td>52-60 Inches</td>
<td>18 Ga.</td>
</tr>
</tbody>
</table>

All duct fittings shall be fabricated by duct manufacturer. Duct fittings shall be minimum 20 gauge. All fittings shall be a minimum of one gauge heavier than the pipe size.

D. Miscellaneous (High Velocity)

(1) Flexible Connectors: Duro-Dyne, Ventfabrics, U.S. Rubber or equivalent; conforming to NFPA Pamphlet No. 90-A or IMC, whichever is more stringent; neoprene coated glass fabric; 30 oz. for high velocity ducts secured with bolted angles.

(2) Access Doors; In Ceilings and Walls: Titus, Krueger, Milcor or approved equivalent; 14 gauge aluminum brushed satin finish; 1" border; all doors are to be furnished and installed by the Mechanical Contractor. Provide with required to access air distribution equipment, dampers, etc., unless specified in architectural portion of the specifications.

(3) Access Doors; In Ductwork: All access doors in round or oval high velocity ductwork shall be screw and gasketed type. Screws shall be maximum 4 inches on centers. Access door sizes shall be as follows:

<table>
<thead>
<tr>
<th>Duct Diameter</th>
<th>Opening Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4 inches</td>
<td>4&quot; x 10&quot;</td>
</tr>
<tr>
<td>5-6 inches</td>
<td>6&quot; x 10&quot;</td>
</tr>
<tr>
<td>7-24 inches</td>
<td>10&quot; x 16&quot;</td>
</tr>
<tr>
<td>26-36 inches</td>
<td>16&quot; x 16&quot;</td>
</tr>
<tr>
<td>Over 36 inches</td>
<td>16&quot; x 22</td>
</tr>
</tbody>
</table>

END OF SECTION 231200
SECTION 250100 - MOTOR STARTERS AND OTHER ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

1. MOTOR STARTERS-GENERAL

A. Where motor starters are required for mechanical equipment they are to be the responsibility of the Contractor furnishing the equipment as outlined herein.

B. Motor starters shall be furnished by the Equipment Supplier with his equipment. Coordinate all requirements for starters with equipment suppliers and other trades.

C. Motor starters shall be NEMA style. I.E.C.-style starters are not to be provided. Their sizing and installation shall be coordinated with the equipment manufacturer's requirements and in accordance with the National Electrical Code.

D. Unless otherwise noted, provide combination starter/disconnects for all equipment requiring a starter.

2. ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. All mechanical equipment shall be provided for single point electrical connection unless specifically noted to the contrary. Refer to schedules and other sections of these specifications for further requirements. It is the responsibility of the Contractor to coordinate the electrical characteristics of all equipment with the electrical provisions indicated on the Contract Documents. The Contractor shall notify the Engineer in writing ten calendar days prior to bid of any discrepancy so a written clarification by Addendum may be made. If such notice is not given, the Contractor shall be responsible for any and all costs or delays associated with any changes required. Specification of equipment characteristics made during review of shop drawings shall not relieve the Contractor of this responsibility.

B. The equipment manufacturer shall provide internally mounted fuses with his equipment, as required, to comply with the U.L. listing on the equipment name plate. (i.e., hermetically sealed compressors or equipment with name plate data that recommends or requires fuse protection.) See also, National Electrical Code, Article 440, and other applicable sections of the N.E.C.

C. It is the Contractor's responsibility to furnish and install fusible or non-fusible disconnect switches or circuit breakers for disconnecting means as required by the Code for all electrically powered equipment. All power wiring from source, thru disconnecting means and motor starters to motor terminals or equipment junction box is to be furnished and installed by the Contractor. Each separate contractor engaged for the project shall coordinate with all other trades to ensure all necessary equipment and labor is included for fully functioning mechanical systems, installed per code requirements. Unless otherwise notes, provide combination starter/disconnects for all equipment requiring a starter.

D. Final electrical connection of equipment shall be verified for proper voltage requirements in conjunction with the motor nameplate patch and actual wiring configuration. Any costs associated with damage to appliances motors, equipment, etc., connected to incorrect supply voltage shall be borne by the Contractor.

E. Refrigeration condensing units with internal compressors shall be furnished with integral starter. The Contractor is to furnish and install a fusible disconnecting mains with fuses sized to motor nameplate requirements. Coordinate wiring, mounting and style of disconnect switch at unit in field.

F. All interlock or other control wiring, unless specifically noted otherwise, is the responsibility of the Contractor.
G. All equipment shall be suitably enclosed. All enclosures for equipment shall be rated and approved for the environment in which it operates. (i.e., NEMA 1, NEMA 3R, NEMA 7, NEMA 12, etc.) Verify the requirement with the installation condition if not indicated on the plans.

H. Observe the following standards for manufacturers of equipment and selection of components.

   (1) Starters, control devices and assemblies: NEMA, U.L. - (I.E.C. style not acceptable)

   (2) Enclosures for electrical equipment: NEMA, U.L.

   (3) Enclosed switches: NEMA, U.L.

   (4) All electrical work, generally: National Electrical Code

   (5) All electrical work in industrial occupancies: J.I.C. standards

   (6) All electrical components and materials: U.L. listing required.

I. Where required, the Contractor is to provide mounting rails or channels to install starters with code-
required clearances. Framing shall be solidly anchored by welding expansion shields in masonry or other approved anchorage. Frames are to be constructed of steel angles or premanufactured channel systems such as Unistrut, Kindorf or B-Line Company. Framing material shall be pre-finished with corrosion-resistant material or painted with two coats corrosion-resistant oil-based enamel.

3. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 1/2 H.P OR LESS

   A. This section describes requirements for small mechanical equipment such as (but not limited to) package terminal heating/cooling units, (water source heat pumps, etc.) VAV boxes, unit heaters, vertical and horizontal unit ventilators, exhaust fans, in-line fans, fan coil units, cabinet heaters and the like.

   B. Small equipment with motor(s) of 1/2 H.P., single phase or less are generally not required to be furnished with NEMA-style starter(s), unless otherwise noted.

   C. For such equipment, provide integral contactor or horsepower-rated relay where controlled by thermostat or other type of switch. Contactors or relays shall be as recommended by the manufacturer of the equipment, suitable for the service duty.

   D. Provide transformer within unit as required to derive low voltage A.C. for thermostat control or derive from temperature controls panel, if available.

   E. Provide internal fusing for unit motor and other loads in fuse block or in-line fuseholder. See also Article 2-B, this Section.

   F. Where externally-mounted disconnecting means is required and would be impractical, unsightly or inappropriate in the judgment of the Engineer, disconnects shall be located within the unit. These disconnects may be fusible H.P.-rated snap switches or manual starters with overload elements, as required. Locate this and other electrical equipment within enclosure where easily accessible behind access panel or door on unit, and as acceptable to the electrical inspector or local authority having jurisdiction. Refer to mechanical equipment schedules for further information.

   G. Where fractional horsepower duplex pumps such as water circulators, sump pumps, etc. are provided, they shall be provided with alternators, cordsets, etc., as required for a complete installation.
4. REQUIREMENTS FOR MECHANICAL EQUIPMENT, 3/4 H.P. OR LARGER

A. This section describes requirements for mechanical equipment such as (but not limited to) exhaust fans, larger air handling units, cooling tower fans, water source heat pumps, chilled or hot water pumps, D.X. roof-top units, air compressors and the like.

B. Provide premium efficiency motors.

C. Equipment provided with motor(s) of 3/4 H.P. and larger, single or three-phase are required to be furnished with starters suitable for the load(s) specified. It is recommended that starters be furnished integrally with or mounted on equipment for field wiring by the Contractor. Where starters are furnished separate from equipment, furnish templates or rough-in diagrams to the appropriate contractor for his use in installation.

D. All starters shall be size 0 minimum. They shall be constructed and tested in accord with latest edition of NEMA standards. All starters shall be across-the-line magnetic type, unless indicated otherwise. On motors of 20 H.P. or greater rating, the supplier shall provide starters capable of limiting inrush currents. These shall be of the wye-delta, reduced voltage open-transition type, or electronic controlled, as required. Do not utilize closed transition starters unless specifically indicated.

E. Magnetic starters shall be furnished with the following characteristics and accessories as a minimum. See other sections of these specifications and mechanical schedules for further requirements.

   (1) Contacts shall be silver-alloy, double-break type. Contacts shall be replaceable without removal of wiring or removal of starter from enclosure. Number of contacts shall be as required for service indicated. Contacts shall be gravity dropout type, positive operation.

   (2) Coil voltage shall be 120 volts, A.C., 60 HZ or less, as required to suit control systems available voltages. Coils shall be of molded construction, rated for continuous duty. Provide coil clearing contact as required.

   (3) Provide control transformer of adequate K.V.A. as required on all starters with line-to-line voltages higher than 120 volts A.C. Provide fuse block and slow-blow fuse to protect control transformer per NEMA, N.E.C. and U.L.

   (4) Provide hand-off-auto selector switch in face of starter, wired into hand and off switch positions. Auto position (if needed) to be field wired as indicated on plans or schedules for automatic control. Provide a green run pilot light.

   (5) Provide NEMA Class 20 resettable overload relays, accurately sized to the motor nameplate rating of the motor served and the temperature differential between motor and controller. Overloads shall be easily replaceable, and resettable without opening enclosure, via a push button or similar means. Class 10 or Class 30 overloads may be used, depending on the type of anticipated service.

   (6) Provide at least one N.O. and one N.C. auxiliary contact (field-convertible to opposite operation) with each starter. Refer to mechanical details or schedules for additional requirements, if any. All starters shall have space for two additional single-pole contacts.

   (7) All starters shall be thru-wiring type.

   (8) Provide phase failure sensing relay to open starter coil circuit (on loss of one or more phases) on all three-phase starters controlling motors of 15 H.P. or larger.
(9) Provide power factor correction capacitors on motors of 15 H.P. or larger where predicted power factor based on manufacturer's data will fall below 0.90%. Capacitors shall be of the unit-cell type, in single enclosure with discharge resistors and tank overpressure circuit interrupter for safety.

5. REQUIREMENTS FOR WIRING

A. All wiring, including controls, interlock, miscellaneous power, sensors, thermostats, etc., shall be installed in metallic raceway systems that are in compliance with all Division 26 requirements of these Specifications, unless specifically noted otherwise. Open cabling systems will only be permitted where specifically permitted within the Division 26 Specifications and if less than 50 volts A.C. peak-to-peak or 50 volts maximum D.C.

B. Where open cabling is permitted, it shall be installed with proper support as specified in the Division 26 Specifications.

C. Where open cabling is permitted, and installed in environmental air plenum (return, relief, supply, etc.), the materials installed shall be in compliance with N.E.C. Articles 700, 725, 770 (for fiber optic), 780 and 800.

D. Where open cabling is permitted, it shall only be installed open in accessible spaces. Where concealed in walls, it shall be routed through raceways to outlet boxe(s) for the terminal device.

6. INVERTER DUTY MOTORS

A. Motors which are controlled by variable frequency drive shall be:

   (1) NEMA MG-1 Part 31 rated for Inverter Duty.

   (2) Furnished with shaft grounding kit:

      a. Motors shall be furnished with shaft grounding kit, Aegis SGR Bearing Protection Ring or equal. One shaft grounding ring and related hardware shall be provided on drive end or non-drive end of motor per manufacturer’s instructions. Ground motor frame per manufacturer’s instructions. Install kit in strict accordance with manufacturer’s instructions.

END OF SECTION 250100
PART 1 - GENERAL

1.1 The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each of his Sub Contractor's work. Each Contractor is directed to familiarize himself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

1.2 Each Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect his part of the work.

1.3 The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.

1.4 Any materials, labor, equipment or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting his bid, it shall be understood that the Contractor has included the cost of all required items in his bid, and that he will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

1.5 It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.

1.6 This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

1.7 It is the intent of this Contract to deliver to the Owners a "like new" project once work is complete. Although plans and specifications are complete to the extent possible, it shall be responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials to be installed by other trades without additional cost to the Owner.

1.8 In general, and to the extent possible, all work shall be accomplished without interruption of the existing facilities' operations. Each Contractor shall advise the Architect, Owner and Engineer in writing at least one week prior to the deliberate interruption of any services. The Owners shall be advised of the exact time that interruption will occur and the length of time the interruption will occur. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed. Contractor will not be entitled to additional compensations due to work stoppage mandated by unscheduled interruption.

1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of his own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation.
to the Owner, except where otherwise provided for in the contract for the work. The contractor shall abide by the requirements on the Special Conditions and the University’s outage request program.

1.10 Definitions:

1.10.1 Prime Contractor - The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.

1.10.2 Electrical Contractor - Any Contractor whether bidding or working independently or under the supervision of a General Contractor, that is: the one holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, underground or overhead electrical, etc.

1.10.3 Electrical Sub-Contractor - Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.

1.10.4 Engineer - The Consulting Mechanical-Electrical Engineers either consulting to the Owner, Architect, other Engineers, etc.

1.10.5 Architect - The Architect of Record for the project, if any.

1.10.6 Furnish - Deliver to the site in good condition.

1.10.7 Provide - Furnish and install in complete working order.

1.10.8 Install - Install equipment furnished by others in complete working order.

1.10.9 Contract Documents - All documents pertinent to the quality and quantity of all work to be performed on the project. Includes, but not limited to: Plans, Specifications, Addenda, Instructions to Bidders, (both General and Sub-Contractors), Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Construction Manager's Assignments, Architect's Supplemental Instructions, Periodical Payment Requests, etc.

1.11 Note: Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an attempt to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor or Construction Manager holding the prime contract, unless otherwise provided herein.

PART 2 - INTENT

2.1 It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word “provide” is used, it shall mean "furnish and install complete and ready for use."

2.2 Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.

PART 3 - ELECTRICAL DRAWINGS AND SPECIFICATIONS

3.1 The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for approval before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.
3.2 The drawings and specifications are intended to supplement each other. No Contractor or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

3.3 The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

3.4 This Contractor shall make all his own measurements in the field and shall be responsible for correct fitting. He shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.

3.5 The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where he considers such adjustments desirable in the interest of concealing work or presenting a better appearance.

3.6 Each Contractor shall evaluate ceiling heights called for on Architectural Plans. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.

3.7 Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.

3.8 The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small and large scale drawings, the larger scale drawings shall take precedence.

3.9 The Electrical Contractor and his Sub Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.

3.10 Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

3.11 Special Note: Always check ceiling heights indicated on Drawings and Schedules and insure that these heights may be maintained after all mechanical and electrical equipment is installed. If a conflict is apparent, notify the Engineer in writing for instructions.

PART 4 - EXAMINATION OF SITE AND CONDITIONS

4.1 Each Contractor shall inform himself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully
examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of his work.

4.2 Each Contractor shall fully acquaint himself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in his work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work shown on the drawings and conditions at the site, and shall report in writing to the Engineer ten days prior to bid, any apparent omissions or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

4.3 The Electrical Contractor is required to provide a coordination set of drawings on this project. It is the responsibility of the Electrical Contractor to provide coordination data to the collaborative effort for the electrical, telecommunication, and low-voltage systems. See Divisions 25, 27, & 28 for additional information.

PART 5 - EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS

5.1 When any Contractor requests review of substitute materials and/or equipment, and when under an approved formal alternate proposal, it shall be understood and agreed that such substitution, if approved, will be made without additional cost regardless of changes in connections, spacing, service, mounting, etc. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor’s expense. Special Note: Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.

5.2 References in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. Each Contractor, in such cases, may, at his option, use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Engineer is equivalent to that specified, provided the provisions of paragraph (A) immediately preceding are met. Substitutions shall be submitted to the Engineer a minimum of ten days prior to bid date for approval to bid in written form thru addenda or other method selected by the Engineer. If prevailing laws of cities, towns, states or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

5.3 Wherever any equipment and material is specified exclusively only such items shall be used unless substitution is accepted in writing by the engineers.

5.4 Each Contractor shall furnish along with his proposal a list of specified equipment and materials which he proposes to provide. Where several makes are mentioned in the Specifications and the Contractor fails to state which he proposes to furnish, the Engineer shall have the right to choose any of the makes mentioned without change in price.

PART 6 - SUPERVISION OF WORK

6.1 Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act for him in matters related to the project.

PART 7 - CODES, RULES, PERMITS, FEES, REGULATIONS, ETC.
7.1 The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, and other costs including utility connections or extensions, in connection with his work. As necessary, he shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver same to the Engineer before request for acceptance and final payment for the work.

7.2 Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

7.3 The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus or drawings required in order to comply with all applicable laws, ordinances rules and regulations, whether or not shown on drawings and/or specified.

7.4 All materials furnished and all work installed shall comply with the current edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.

7.5 All material and equipment for the electrical systems shall bear the approval label, or shall be listed by the Underwriters' Laboratories, Incorporated. Listings by other testing agencies may be acceptable with written approval by the Engineer.

7.6 All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the State Fire Marshal, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.

7.7 The Contractor shall insure that his work is accomplished in accord with OSHA Standards and any other applicable government requirements.

7.8 Where conflict arises between any code and the plans and/or specifications, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at his own expense. The provisions of the codes constitute minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

PART 8 - COST BREAKDOWNS

8.1 Within thirty days after acceptance of the Contract, each Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted.

PART 9 - GUARANTEEs AND WARRANTIES

9.1 Each Contractor shall unconditionally guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to be the best of its respective kind and shall replace all parts at his own expense, which fail or are deemed defective within one year from final acceptance of the work by the Engineer. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Engineer as being substantially complete.
9.2 Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer, such as generators, engines, batteries, transformers, etc., shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

PART 10 - INSPECTION, APPROVALS AND TESTS

10.1 Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect his installation to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.

10.2 The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.

10.3 The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when he anticipates commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

10.4 Inspections shall be scheduled for rough as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to cover all roughing-in without fail. Report of each such inspection visit shall be submitted to the Architect, Engineer and the Contractor within three days of the inspection.

10.5 Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

10.6 Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

10.7 The Contractor shall test all wiring and connections for continuity and grounds before equipment and fixtures are connected, and when indicated or required, demonstrate by Megger Test the insulation resistance of any circuit or group of circuits. Where such tests indicate the possibility of faulty insulation, locate the point of such fault, pull out the defective conductor, replacing same with new and demonstrate by further test the elimination of such defect.

PART 11 - CHANGES IN ELECTRICAL WORK

REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 12 - CLAIMS FOR EXTRA COST

REFER TO GENERAL AND SPECIAL CONDITIONS.
PART 13 - SURVEYS, MEASUREMENTS AND GRADES

13.1 The Contractor shall lay out his work and be responsible for all necessary lines, levels, elevations and measurements. He must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from his failure to do so.

13.2 The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.

13.3 Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, he shall notify the Engineer thru normal channels of job communication and shall not proceed with his work until he has received instructions from the Engineer.

PART 14 - TEMPORARY USE OF EQUIPMENT

14.1 The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without cost, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.

14.2 Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

PART 15 - TEMPORARY SERVICES

15.1 The Contractor shall arrange for temporary electrical and other services which he may require to accomplish his work. In the absence of other provisions in the contract, the Contractor shall provide for his own temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in his bid.

PART 16 - RECORD DRAWINGS

16.1 The Contractor shall insure that any deviations from the design are being recorded daily or as necessary on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches and other appurtenances important to the maintenance and safety of the Electrical System. Deliver these record drawings to the Engineer at the completion of the work.

PART 17 - MATERIALS AND WORKMANSHIP

17.1 All electrical equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
17.2 All conduit and/or conductors shall be concealed in or below walls, floors or above ceilings unless otherwise noted. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.

17.3 All materials, where applicable, shall bear Underwriters' Laboratories label or that of another Engineer-approved testing agency, where such a standard has been established.

17.4 Each length of conduit, wireway, duct, conductor, cable, fitting, fixture and device used in the electrical systems shall be stamped or indelibly marked with the maker's mark or name.

17.5 All electrical equipment shall bear the manufacturer's name and address and shall indicate its electrical capacity and characteristics.

17.6 All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.

PART 18 - QUALIFICATIONS OF WORKMEN

18.1 All electrical contractors bidding this project must have been a licensed company for a minimum of three years to qualify to bid this project. Individual employee experience does not supersede this requirement.

18.2 All subcontractors bidding the electrical work must have completed one project of 70% subcontract cost size and two projects of 50% subcontract cost size.

18.3 All electrical work shall be accomplished by qualified workmen competent in the area of work for which they are responsible. Untrained and incompetent workmen as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any workman and unqualified or incompetent workmen shall refrain from work in areas not satisfactory to him. Requests for relief of a workman shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.

18.4 All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 19 - CONDUCT OF WORKMEN

19.1 The Contractor shall be responsible for the conduct of all workmen under his supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden.

PART 20 - COOPERATION AND COORDINATION BETWEEN TRADES

20.1 The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Mechanical, Structural and other pertinent Drawings, to the end that complete coordination between trades will be effected.
20.2 Refer to Coordination Among Trades, Systems Interfacing and Connection of Equipment Furnished by Others section of these Specifications for further coordination requirements.

PART 21 - PROTECTION OF EQUIPMENT

21.1 The Contractor shall be entirely responsible for all material and equipment furnished by him in connection with his work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All rough-in conduit shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor.

PART 22 - SMOKE AND FIRE PROOFING

22.1 The Contractor shall not penetrate rated fire walls, ceilings or floors with conduit, cable, bus duct, wireway or other raceway system unless all penetrations are protected in a code compliant manner which maintains the rating of the assembly. Smoke and fire stop all openings made in walls, chases, ceiling and floors. Patch all openings around conduit, wireway, bus duct, etc., with appropriate type material to smoke stop walls and provide needed fire rating at fire walls, ceilings and floors. Smoke and fire proofing materials and method of application shall be approved by the local authority having jurisdiction.

22.2 Contractor to provide heat detectors in the area of construction with complete fire detection until fire alarm system is operational and construction is complete.

PART 23 - QUIET OPERATION, SUPPORTS, VIBRATION AND OSCILLATION

23.1 All work shall operate under all conditions of load without any objectionable sound or vibration, the performance of which shall be determined by the Engineer. Noise from moving machinery or vibration noticeable outside of room in which it is installed, or annoyingly noticeable noise or vibration inside such room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor (or Contractors responsible) at his expense.

23.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports suitable for the purpose of minimizing noise and vibration transmission, and shall be isolated from external connections such as piping, ducts, etc., by means of flexible connectors, vibration absorbers or other approved means. Surface mounted equipment such as panels, switches, etc., shall be affixed tightly to their mounting surface.

23.3 The Contractor shall provide supports for all equipment furnished by him using an approved vibration isolating type as needed. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. No work shall depend on the supports or work of unrelated trades unless specifically authorized in writing by the Architect or Engineer.

PART 24 - FINAL CONNECTIONS TO EQUIPMENT

24.1 The roughing-in and final connections to all electrically operated equipment furnished under this and all other sections of the contract documents or by others, shall be included in the Contract and shall consist of furnishing all labor and materials for connection. The Contractor shall carefully coordinate with equipment suppliers, manufacturer’s representatives, the vendor or other trades to provide complete electrical and dimensional interface to all such equipment (kitchen, hoods, mechanical equipment, panels, refrigeration equipment, etc.).
PART 25 – NOT USED

PART 26 - ACCESSIBILITY

26.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of his work. He shall cooperate with the General Contractor (or Construction Manager) and all other Contractors whose work is in the same space, and shall advise each Contractor of his requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.

26.2 The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.

26.3 Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work.

26.4 Access Doors; in Ceilings or Walls:

In mechanical, electrical, or service spaces:

14 gauge aluminum brushed satin finish, 1" border.

In finished areas:

14 gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.

In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

PART 27 - ELECTRICAL CONNECTIONS

27.1 The Contractor shall furnish and install all power wiring complete from power source to motor or equipment junction box, including power wiring through starters. The Contractor shall install all starters not factory mounted on equipment. Unless otherwise noted, the supplier of equipment shall furnish starters with the equipment. Also refer to Division 15 of Specifications, shop drawings and equipment schedules for additional information.

27.2 All control, interlock, sensor, thermocouple and other wiring required for equipment operation shall be provided by the Contractor. All such installations shall be fully compliant with all requirements of Division 16 regardless of which trade actually installs such wiring. Motors and equipment shall be provided for current and voltage characteristics as indicated or required. All wiring shall be enclosed in raceways unless otherwise noted.

27.3 Each Contractor or sub-contractor, prior to bidding the work, shall coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other contractors or sub-contractors, to ensure all needed wiring is provided in the Contract. Failure to make such coordination shall not be justification for claims of extra cost or a time extension to the Contract.
PART 28 - MOTORS

28.1 Each motor shall be provided by the equipment supplier, installer or manufacturer with conduit terminal box and N.E.C. required disconnecting means as indicated or required. Three-phase motors shall be provided with external thermal overload protection in their starter units. Single-phase motors shall be provided with thermal overload protection, integral to their windings or external, in control unit. All motors shall be installed with NEMA-rated starters as specified and shall be connected per the National Electrical Code.

28.2 The capacity of each motor shall be sufficient to operate associated driven devices under all conditions of operation and load and without overload, and at least of the horsepower indicated or specified. Each motor shall be selected for quiet operation, maximum efficiency and lowest starting KVA per horsepower as applicable. Motors producing excessive noise or vibration shall be replaced by the responsible contractor. See Division 15 of Specifications for further requirements and scheduled sizes.

PART 29 - CUTTING AND PATCHING

29.1 Unless otherwise indicated or specified, the Contractor shall provide cutting and patching necessary to install the work specified in this Division. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accord with the Architect's standards for such work, as applicable.

29.2 No structural members shall be cut without the approval of the Structural Engineer and all such cutting shall be done in a manner directed by him.

PART 30 - SLEEVES AND PLATES

30.1 Each Contractor shall provide and locate all sleeves and inserts required for his work before the floors and walls are built, or shall be responsible for the cost of cutting and patching required where sleeves and inserts were not installed, or where incorrectly located. Each Contractor shall do all drilling required for the installation of his hangers. Drilling of anchor holes may be prohibited in post-tensioned concrete construction, in which case the Contractor shall request approved methods from the Architect and shall carefully coordinate setting of inserts, etc., with the Structural Engineer and/or Architect.

30.2 Sleeves shall be provided for all electrical conduit passing thru concrete floor slabs and concrete, masonry, tile and gypsum wall construction. Sleeves shall not be provided for piping running embedded in concrete or insulating concrete slabs on grade, unless otherwise noted.

30.3 Where sleeves are placed in exterior walls below grade, the space between the pipe or conduit and the sleeves shall be packed with oakum and lead, mechanical waterstop or other approved material and made completely water tight by a method approved by the Engineer and/or Architect.

30.4 Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of pipe. Check floor and wall construction finishes to determine proper length of sleeves for various locations; make actual lengths to suit the following:

30.4.1 Terminate sleeves flush with walls, partitions and ceiling.

30.4.2 In areas where pipes are concealed, as in chases, terminate sleeves flush with floor.

30.4.3 In all areas where pipes are exposed, extend sleeves ½ inch above finished floor, except in rooms having floor drains, where sleeves shall be extended 3/4 inches above floor.

30.5 Sleeves shall be constructed of 24 gauge galvanized sheet steel with lock seam joints for all sleeves set in concrete floor slabs terminating flush with the floor. All other sleeves shall be constructed of galvanized steel pipe unless otherwise indicated on the drawings.
30.6 Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction. Fire and smoke stop all sleeves in a manner approved by the local authority having jurisdiction or per prevailing codes.

PART 31 - WEATHERPROOFING

31.1 Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.

31.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 32 - OPERATING INSTRUCTIONS

32.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating his systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or his representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.

32.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer of typewritten and/or blueprinted instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.

32.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART 33 - SCAFFOLDING, RIGGING AND HOISTING

33.1 The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. Remove same from premises when no longer required.

PART 34 - CLEANING

34.1 The Contractor shall, at all times, keep the area of his work presentable to the public and clean of rubbish caused by his operations; and at the completion of the work, shall remove all rubbish, all of his tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible or all damage from fire which originates in, or is propagated by, accumulations of his rubbish or debris.

34.2 After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.
PART 35 - PAINTING

35.1 Each fixture device, panel, junction box, etc., that is located in a finished area shall be provided with finish of color and type as selected or approved by the Architect or Engineer. If custom color is required, it shall be provided at no additional cost to the Owner. All other equipment, fixtures or devices located in finished or unfinished areas, that are not required to have or are provided with finish color or coating shall be provided in a prime painted condition, ready to receive finish paint or coating. All galvanized metal in finished areas shall be properly prepared with special processes to receive finish paint as directed and approved by the Architect.

PART 36 - INDEMNIFICATION

36.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 37 - HAZARDOUS MATERIALS

37.1 The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of his work, insure that his workers are aware of this potential and what they are to do in the event of suspicion. He shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

37.2 CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.

37.3 If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise him immediately.

37.4 The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

PART 38 – ABOVE-CEILING AND FINAL PUNCH LISTS

38.1 The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least two stages of the project.

38.1.1 For review of the above-ceiling work that will be concealed by tile or other materials well before substantial completion.
38.1.2 For review of all other work as the project nears substantial completion.

38.2 When all work form the Contractor’s punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven days prior to the proposed date. After all corrections have been made from the Engineer’s punch list, the Contractor shall review and initial off on each item. This signed-off punch list and all work prior to the ceilings being installed and at the final punch list review.

38.3 If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

END OF SECTION 260501
H-1 Air Handler Replacement – BP#2
UK Project No. 2529.0
University of Kentucky    Lexington, Kentucky 05/14/20

SECTION 260502 - SCOPE OF THE ELECTRICAL WORK

PART 1 - GENERAL

1.1 Each Electrical Contractor's attention is directed to Section 260501 - General Provisions, Electrical, and all other Contract Documents as they apply to his work.

1.2 Refer to the front-end documents for Electrical and Integrated Technology Form of Proposal. Any discrepancies between Sections are to be forwarded to the purchasing agent, architect, and engineer for consideration.

PART 2 - SCOPE OF THE ELECTRICAL WORK

2.1 The Electrical work for this project includes all labor, materials, equipment, fixtures, and related items required to completely demolish, install, test, place in service and deliver to the Owner complete electrical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include, but is not limited to the following:

2.1.1 Selective demolition of existing electrical systems and light fixtures.

2.1.2 All conduits, conductors, outlet boxes, fittings, etc. (NOTE: Conduit is to be colored per UK Standards – Reference Section 260533).

2.1.3 All switchgear, distribution panels, disconnect switches, fuses, starters, etc.

2.1.4 Replacement of existing breakers and rework of existing distribution panels.

2.1.5 Fault Current Coordination Study and recertification of panels with labels.

2.1.6 Replacement of existing light fixtures with new LED type.

2.1.7 Electrical connection to all electrically operated equipment furnished and/or installed by others. This includes but is not limited to mechanical equipment and low-voltage systems.

2.1.8 Inspection of electrical system by licensed Electrical Inspector.

2.1.9 Functional grounding system.

2.1.10 Paying all necessary fees and cost for permits, inspections, work, etc.

2.1.11 Expansion of existing fire alarm system and interfacing to new detection and annunciation devices as required per NFPA. Includes new supply and return duct detectors for each new air handler.

2.1.12 Telecommunication connection (including all cabling, terminations, faceplates, patch cords, and coordination with UK CNS) for HVAC control panel(s). All telecommunication system work is to comply with UK CNS Standards (available at https://www.uky.edu/cpmd/design-standards/divisions-20---29---facility-services-subgroup )

2.1.13 Rework of existing fire alarm system to allow selective removal and new installation of duct detectors.

2.1.14 Coordination of electrical distribution layout of panels, VFD’s, or disconnects to allow code required accessibility and prevent duct or piping from being located directly over equipment.

END OF SECTION 260502
PART 1 - SHOP DRAWINGS

1.1 Each Contractor shall submit to the Architect and/or Engineer, within thirty days after the date of the Contract, one set of shop drawings and/or manufacturer's descriptive literature on all equipment required for the fulfillment of his contract via constructware. Each shop drawing and/or manufacturer's descriptive literature shall have proper notation indicated on it and shall be clearly referenced so the specifications, schedules, light fixture numbers, panel names and numbers, etc., so that the Architect and/or Engineer may readily determine the particular item the Contractor proposes to furnish. All data and information scheduled, noted or specified by hand shall be noted in color red on the submittals. The Contractor shall make any corrections or changes required and shall resubmit for final review as requested. Review of such drawings, descriptive literature and/or schedules shall not relieve the Contractor from responsibility for deviation from drawings or specifications unless they have, in writing, directed the reviewer's attention to such deviations at the time of submission of drawings, literature and manuals; nor shall it relieve them from responsibility for errors or omissions of any nature in shop drawings, literature and manuals. The term "as specified" will not be accepted.

1.2 If the Contractor fails to comply with the requirements set forth above, the Architect and/or Engineer shall have the option of selecting any or all items listed in the specifications or on the drawings, and the Contractor will be required to provide all materials in accordance with this list.

1.3 Review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

1.4 The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

1.5 No cutting, fitting, rough-in, connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractors concerned. It shall be each Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. Each Contractor shall coordinate with all the other Contractors having any connections, roughing-in, etc., to the equipment, to make certain proper fit, space coordination, voltage and phase relationships are accomplished.

1.6 In accord with the provisions specified hereinbefore, shop drawings, descriptive literature and schedules shall be submitted on each of the following indicated items as well as any equipment or systems deemed necessary by the Engineer:

**Power Equipment**
- Panelboards.
- Circuit breakers.
- Disconnect switches.

**Systems**
- Fire Alarm
PART 2 - SPECIAL WRENCHES, TOOLS AND KEYS

2.1 Each Contractor shall provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances installed by him. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, emergency generators, alarm pull boxes and panels, etc. At least two of any such special wrench, keys, etc. shall be turned over to the Architect prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Engineer.

PART 3 - FIRE ALARM SHOP DRAWINGS

3.1 The contractor and equipment supplier shall submit to the Architect and/or Engineer, fire alarm device shop drawings complete with catalog cuts, descriptive literature and complete system wiring diagrams for their review prior to submittal to the governing authority for their review. Contractor shall be responsible for approval of fire alarm drawings by all governing authorities as required.

PART 4 - MAINTENANCE AND OPERATION MANUALS

4.1 Upon substantial completion of the project, the Electrical Contractor shall deliver, (via Constructware) to the Engineers (in addition to the required Shop Drawings) one complete copy of operation and maintenance instructions and parts lists for all equipment provided. These documents shall at least include:

4.1.1 Detailed operating instructions.

4.1.2 Detailed maintenance instructions including preventive maintenance schedules.

4.1.3 Addresses and phone numbers indicating where parts may be purchased.

END OF SECTION 260503
PART 1 - GENERAL

1.1 The Contractor shall be responsible for all openings, sleeves, trenches, etc. that he may require in floors, roofs, ceilings, walls, etc. and shall coordinate all such work with the General Contractor and all other trades. He shall determine and coordinate any openings which he is to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the responsible Contractor.

1.2 The Contractor shall plan his work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for conduit, conductors, wireways, etc. to go through; however, when this is not done, this Contractor shall do all cutting and patching required for the installation of his work, or he shall pay other trades for doing this work when so directed by the Architect. Any damage caused to the buildings by the workmen of the responsible Contractor must be corrected or rectified by him at his own expense.

1.3 The Contractor shall cut holes in casework, equipment panels, etc. (if any), as required to pass pipes in and out.

1.4 The Contractor shall notify other trades in due time where he will require openings of chases in new concrete or masonry. He shall set all concrete inserts and sleeves for his work. Failing to do this, he shall cut openings for his work and patch same as required at his own expense.

1.5 Openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe cut with a masonry saw.

1.6 Cast iron sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking with lead and oakum between pipe and sleeve for waterproofing.

1.7 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter.

1.8 Sleeves passing through roof or exterior wall or where there is a possibility of water leakage and damage shall be caulked water tight for horizontal sleeves and flashed and counter-flashed with lead (4 lb.) or copper and soldered to the piping, lapped over sleeve and properly weather sealed.

1.9 All rectangular or special shaped openings in plaster, stucco or similar materials including gypsum board shall be framed by means of plaster frames, casing beads, wood or metal angle members as required. The intent of this requirements is to provide smooth even termination of wall, floor and ceiling finishes as well as to provide a fastening means for lighting fixtures, panels, etc. Lintels shall be provided where indicated over all openings in bearing walls, etc.

1.10 No cutting is to be done at points or in a manner that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Architect.

1.11 The Contractor shall be responsible for properly shoring, bracing, supporting, etc. any existing and/or new construction to guard against cracking, settling, collapsing, displacing or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements, shall be promptly and properly made good to the satisfaction of the Architect.

1.12 All work improperly done or not done at all as required by the Electrical trades in this section will be performed by others. The cost of this work shall be paid for by the Contractor who is in non-compliance with the Contract.

END OF SECTION 260504
SECTION 260505 - DEMOLITION, RESTORATION AND SALVAGE

PART 1 - GENERAL

1.1 Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division A Specification Sections to apply to work specified in this section.

PART 2 - DESCRIPTION OF WORK

2.1 This section covers all demolition, restoration and salvage required to perform the electrical work indicted on the drawings, specified and/or as required to complete the project. It is the intent of this section of work to remove all existing electrical equipment, materials, etc. which are not required for the completed building and to restore any and all finished surfaces to their original type and conditions. To accomplish these requirements, the Contractor(s) shall, at his own expense, engage the services of others already performing finish work on this project. All work shall be completed to the satisfaction of the Architect/Engineers whose decisions shall be final. This requirement shall apply to all restoration work whether indicated or specified.

2.2 All adjacent areas need to remain in operation and services to other areas need to be maintained during demolition.

2.3 Schedule all demotion and any outages affecting other areas with owner.

2.4 Provide and maintain temporary partitions and/or dust barrier per owners dust control plan.

PART 3 - ELECTRICAL

3.1 Where electrical fixtures, equipment or other materials are removed and/or relocated, all abandoned conduit and conductors shall be removed in exposed areas. In concealed areas removed as indicated and patch all openings.

3.2 The Contractor shall be responsible for the removal and/or relocation of any electrical equipment, fixtures, devices, appurtenances, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical, Electrical, Structural or Fire Protection Systems whether indicated or not.

PART 4 - REPAIR

4.1 Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall and floors where electrical equipment is removed.

PART 5 – SALVAGE

5.1 It is the intent of this section to deliver to the Owner all components of any electrical system which may be economically reused by him. The Contractor shall make every effort to remove reusable components without damage.

PART 6 - LAMP DISPOSAL

6.1 Contractor shall be responsible for the careful removal of all lamps and fluorescent tubes without breakage from existing lighting fixtures.

6.2 Lamps removed from fluorescent, metal halide, mercury vapor, and sodium fixtures that do not have green end caps shall be placed by the Contractor in cardboard boxes. The Contractor shall label each box with type and quantity of lamps in each box and seal the box. Boxes shall be properly disposed of.
6.3 Broken, fluorescent, metal halide, mercury vapor, and sodium lamps without green end caps shall be immediately and carefully cleaned up by the Contractor and placed in a 55 gallon steel drum. The Contractor shall properly dispose of.

6.4 All lamps and tubes with green end caps as well as incandescent lamps shall be disposed of by the Contractor in his dumpster. Green end cap lamps and broken lamps shall not be placed in any box designated for recycling lamps.

END OF SECTION 260505
SECTION 260508 - COORDINATION AMONG TRADES, SYSTEMS INTERFACING AND CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

PART 1 - COORDINATION

1.1 The Contractor is expressly directed to read the General Conditions and all sections of these specifications for all other trades and to study all drawings applicable to his work, including Architectural, Plumbing Fire Protection, Mechanical and Structural drawings, to the end that complete coordination between trades will be affected. Each Contractor shall make known to all other contractors the intended positioning of materials, raceways, supports, equipment and the intended order of his work. Coordinate all work with other trades and proceed with the installation in a manner that will not create delays for other trades or affect the Owner's operations.

1.2 Special attention to coordination shall be given to points where raceways, fixtures, etc., must cross other ducts or conduit, where lighting fixtures must be recessed in ceilings, and where fixtures, conduit and devices must recess into walls, soffits, columns, etc. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.

1.3 The Contractor shall be responsible for coordination with all trades to insure that they have made provision for connections, operational switches, disconnect switches, fused disconnects, etc., for electrically operated equipment provided under this or any other division of the specifications, or as called for on the drawings. Any connection, circuiting, disconnects, fuses, etc. that are required for equipment operation shall be provided as a part of this contract.

1.4 If any discrepancies occur between accompanying drawings and these specifications and drawings and specifications covering other trade's work, each trade shall report such discrepancies to the Architect far enough in advance so that a workable solution can be presented. No extra payment will be allowed for relocation of fixtures, devices, conduit, and equipment not installed or connected in accordance with the above instructions.

1.5 In all areas where air diffusers, devices, lighting fixtures and other ceiling-mounted devices are to be installed, the Mechanical Trade(s) and the Electrical Trade and the General Trades shall coordinate their respective construction and installations so as to provide a combined symmetrical arrangement that is acceptable to the Architect and Engineer. Where applicable, refer to reflected ceiling plans. Request layouts from the Architect or Engineer where in doubt about the potential acceptability of an installation.

1.6 In addition to requirements associated with Coordination Drawings and Record Drawings, the contractor shall include in their costs the time and expertise required for multiple BIM coordination meetings held by the contractor to furnish a fully integrated BIM that all designers, contractors and owners can review. This shall be conducted by the General Contractor, however, if they do not have the expertise this will be administered by the design team utilizing the 3-D Model required in the contract documents.

1.7 Contractor is to provide all necessary measures to ensure cleanroom remains functional and certification is not compromised.

PART 2 - INTERFACING

2.1 Each Electrical Trade, Specialty Controls Trade, Mechanical Trade and the General Trades, etc., shall insure that coordination is effected relative to interfacing of all systems. Some typical interface points are (but not necessarily all):

2.1.1 Connection of all controls to equipment.
2.1.2 Electrical power connections to electrically operated (or controlled) equipment.

2.1.3 Electrical provisions for all equipment provided by other trades or suppliers within this contract.

2.1.4 Contractor is to provide conduit whips and back boxes as needed to power systems furniture.

PART 3 - CONNECTION OF EQUIPMENT FURNISHED BY OTHERS

3.1 Each Contractor shall make all connections to equipment furnished by others, whenever such equipment is shown on any part of the drawings or mentioned in any part of the Specifications, unless otherwise specifically specified hereinafter.

3.2 All drawings are complementary, one trade of the other. It is the Contractor's responsibility to examine all drawings and specifications to determine the full scope of his work. The project Engineers have arranged the specifications and drawings in their given order solely as a convenience in organizing the project, and in no way shall they imply the assignment of work to specific trades, contractors, subcontractors or suppliers.

3.3 Supervision to assure proper installation, functioning and operation shall be provided by the Contractor furnishing the equipment or apparatus to be connected.

3.4 Items indicated on the drawings as rough-in only (RIO) will be connected by the equipment supplier or Owner, as indicated. The Contractor shall be responsible for rough-in provisions only as indicated. These rough-ins shall be in accord with the manufacturer's or supplier's requirements.

3.5 For items furnished by others, relocated, or RIO, the Contractor shall obtain from the supplier or shall field determine as appropriate, the exact rough-in locations and connection sizes for the referenced equipment.

3.6 The Contractor shall be responsible for coordinating with the General and all other trades, as necessary, to determine any and all final connections that he is to make to equipment furnished by others.

END OF SECTION 260508
SECTION 260519 - CONDUCTORS, IDENTIFICATIONS, SPLICING DEVICES AND CONNECTORS

1. GENERAL

A. This section of the Specifications covers all of the electrical power, lighting, and control power (line voltage) conductors, but does not include communications, data or signal system conductors, which are specified separately in these specifications.

B. All conduits installed without conductors shall have a 200 lb. test nylon string installed for future use, tied off securely at each end.

C. No more than 40% conduit fill is permitted for any conduit system, including video, intercom, data, power or other signal circuits unless specifically indicated otherwise on the plans.

D. Lighting circuits: No more than five conductors shall be installed in conduit except for switch legs and travelers in multi-point switching arrangements.

E. Receptacle circuits: If multiple circuits are pulled in a single homerun, a dedicated neutral shall be provided for each phase conductor. In these cases, a maximum of seven conductors are permitted in a single conduit. Conductors shall be derated per N.E.C.

F. Intentional or unintentional painting of exposed low voltage or line voltage cabling is prohibited. The contractor shall ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades. The contractor shall review the painting requirements for all disciplines and shall provide cabling protection as required. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, the contractor shall provide alternate options for cable colors and shall provide submittals for such cabling to engineer for approval.

2. MATERIALS

A. CONDUCTORS

(1) All conductors shall be 98% conductive annealed copper unless otherwise noted, UL listed and labeled.

(2) Lighting and receptacle branch circuits shall be not less than No. 12 copper wire or of the sizes shown on the drawings with Type THW, THHN or THWN insulation. All feeder circuits shall be Type THW or THWN of the size as shown on the Contract Drawings. THHN wiring shall only be installed in overhead, dry or damp locations. THWN or THW wiring shall be used for all circuits pulled in underground or other wet locations.

(3) Conductors No. 10 and smaller sizes of wire shall be solid. Conductors No. 8 and larger sizes shall be stranded.

(4) Conductors for fire alarm wiring shall be stranded and in full compliance with N.E.C. 760. All fire alarm conductors shall be installed within conduit and enclosed junction boxes.

(5) All wire on the project shall be new, in good condition, and shall be delivered in standard coils or reels.

(6) The color of the wire shall be selected to conform with Section 210-5 of the latest edition of the National Electrical Code. Refer also to Color Coding in these specifications.
CONDUCTORS, IDENTIFICATIONS, SPLICING DEVICES AND CONNECTORS

(7) All equipment grounding conductors shall have green color insulation or if larger than #8, shall be taped for two inches, green color at every termination and pullbox access point.

(8) Conductors used for motor connections and connections to vibrating or oscillating equipment shall be extra flexible.

(9) Conductors for main ground from neutral bus, equipment grounding bus, building steel, grounding grid and main cold water pipe connection shall be bare copper.

(10) All conductors shall be identified by color code and by means of labels placed on conductors in all junction boxes and at each terminal point with Brady, Ideal, T & B or approved equivalent labels indicating source, circuit No. or terminal No.

(11) Branch wiring and feeder conductors that are greater than 100' in length shall be increased at least one size to compensate for voltage drop. All circuits shall be installed and sized for a maximum 2% voltage drop. As calculated using 80% of the supply breaker rating as the load. Adjust conductors and conduit size accordingly for actual field installed conditions.

B. SPLICING DEVICES & CONNECTORS

(1) Splicing devices for use on No. 14 to No. 10 AWG conductors shall be pressure type such as T & B "STA-KON", Burndy, Reliable or approved equivalent.

(2) Wire nuts shall be spring pressure type, insulation 600V, 105°C insulation, up to #8 size. Greater than #6 Cu shall be a compression type connection, 600V insulation, cold shrink tubing, taped to restore full insulation value of the wire being spliced.

(3) Pressure crimp-applied ring type (or fork with upturned ends) terminations shall be employed on motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using No. 10 AWG or smaller conductors.

(4) Splices, where necessary, shall be made with hydraulically-set "Hy-press" or equivalent crimped connectors. All splices shall be insulated to the full value of the wiring insulation using a cold-shrink kit or the equivalent in built-up materials.

(5) Large connectors (lugs) at terminals shall be mechanical type, hex-head socket or crimp-on style, installed per the manufacturer's recommendations.

(6) Exterior underground connections made between bare ground wires or to ground rods shall be exothermically welded, "Cadweld" or equivalent.

(7) The use of split-bolt clamps will be permitted in wireways at service entrance only. Torque to 55 foot-pounds or as recommended by manufacturer.

(8) No aluminum conductors shall be used.

3. INSTALLATION

A. The pulling of all wires and cable on this project shall be performed in strict compliance with applicable sections of the National Electrical Code. No conductor entering or leaving a cabinet or box shall be deflected in such a manner as to cause excess pressure on the conductor insulation. Conductors shall only be installed after insulating bushings are in place.
B. The radius of bending of conductors shall be not less than eighteen times the outside diameter of the conductor insulation or more, if recommended by the manufacturer.

C. Conductors installed within environmental air plenums shall be per N.E.C. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Also provide plenum-rated tie-wraps where plastic straps or other supports, etc., are installed in plenum areas.

D. Conductors for isolated power systems shall be installed in as short a run of conduit as practicable. No pulling soap shall be used on conductors in isolated power systems.

E. Where conductors are installed in industrial facilities, they shall be per J.I.C. standards.

F. Maximum permissible pulling tensions, as recommended by the manufacturer for any given type of cable or wire installed shall not be exceeded. Utilize special remote readout equipment as required to ensure compliance. Use particular caution when installing twisted pair data cable or fiber optic cables -- forces permitted for pulling in are typically very low for these cable types.

G. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 6 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable secured to wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.

H. Where multiwire branch circuits are allowed the phases and neutral shall be wire-tied together in the panelboard and in all pull boxes.

4. COLOR CODING DISTRIBUTION VOLTAGE CONDUCTORS, 600 VOLT OR LESS

A. Conductors to be color coded as follows:

   (1) 120/208 Volt Conductors
       Phase A - Black
       Phase B - Red
       Phase C - Blue
       Neutral - Solid White or White with tracer stripe to match phase conductor

   (2) Control Wiring - Red, or as indicated.

   (3) Conductors within enclosures that may be energized when enclosure disconnect is off - yellow, or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.

   (4) D.C. Wiring - Positive - Light Blue
       Negative - Dark Blue

END OF SECTION 260519
SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 All metallic conduit, raceways, wireways, supports, cabinets and equipment shall be grounded in accordance with the latest issue of the National Electrical Code, as shown on the Contract Drawings and in accord with the requirements of the local authority having jurisdiction, as applicable.

1.2 The size of the equipment shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings.

1.3 Grounding bus and non-current carrying metallic parts of all equipment and raceway systems shall be securely grounded by connection to common ground.

PART 2 - MATERIALS

2.1 Ground wires and cables shall be of the AWG sizes shown on the Contract Drawings or shall be sized in accord with the prevailing codes. All ground wires and cables shall be copper.

2.2 Other bonding clamps or fittings in above ground locations shall be as manufactured by O.A. Co., T & B, Burndy, or approved equivalent.

PART 3 - INSTALLATION

3.1 All grounding conductors shall be protected from mechanical injury and shall be rigidly supported. Where grounding conductors are run through flexible conduit and through panelboard switchboard or motor control center feeders, they shall be securely bonded to such conduit thru the use of grounding bushings at the entrance and exit. All connection of equipment shall be made with an approved type of solderless connection and same shall be bolted or clamped to equipment or conduit.

3.2 All equipment grounding conductors to lighting fixtures, devices, receptacles, electric heaters, furnace and other equipment not exceeding No. 8 AWG in size shall be green colored Type "THWN".

3.3 Equipment ground connections to GFI circuit breakers shall be carried and bonded to each outlet on the circuit. Provide a separate equipment grounding conductor with green color insulation.

3.4 Resistance to the grounding at the service entrance equipment shall be in accordance with the N.E.C. for style of construction and shall not exceed five ohms as measured by the described testing method.

3.5 All circuits shall have a separate grounding conductor, except as otherwise noted.

3.6 When grounding systems are completely installed and all grading in the area of the service grounding electrode has been completed up to finish elevations, perform a fall-of potential or other approved test to determine actual system resistance to earth. Report results to the Engineer in writing. Refer to testing provisions in this section of specifications.

3.7 The Contractor shall ensure that the ground return path thru building structural steel or other means is electrically continuous back to the service grounding electrode and is of adequate capacity and impedance to carry the maximum expected fault or other current. Where no electrically continuous steel building frame is available, the Contractor shall provide a properly sized ground bar and ground conductor routed back to the main facility ground bus.

3.8 Where a building's steel frame is made electrically discontinuous by masonry breaks (as at firewalls, etc.), the Contractor shall provide an accessible thermically welded bonding jumper of #500MCM copper to bond the building steel frame sections together, making the entire steel frame electrically continuous. The
installation of these bonding jumpers shall be reviewed by the Engineer prior to their being covered by construction.

3.9 Grounding connections shall never be made to fire protection, natural gas, flammable gas or liquid fuel piping, except where specifically indicated on the plans.

3.10 Where dielectric fittings are utilized in piping systems, the piping system shall not be utilized as a ground path. Bonding jumpers shall not be utilized to bridge over such fittings. Piping systems shall not be utilized as ground paths except where specifically required by codes in the case of water piping.

END OF SECTION 260526
SECTION 260531 - CABINETS, OUTLET BOXES AND PULL BOXES

PART 1 - GENERAL

1.1 This section of the specifications covers all electrical outlet boxes and pull boxes.

1.2 Continuous runs of conduit shall have pull boxes at least each eighty-five (85) feet of run, or as near as possible to that limit.

1.3 Comply with requirements in Division 17, Division 28.

PART 2 - MATERIALS & INSTALLATION

2.1 Outlet & Pull Boxes:

2.1.1 Cabinets for lighting and power, telephone, pull boxes, outlet boxes, or any other purposes specified or shown on the Contract Drawings, shall be constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing. Box assembled with sheet metal screws will not be accepted. Pull boxes shall include all boxes used to reduce the run of conduit to the required number of feet or bends, supports, taps, troughs, and similar applications and shall also be constructed as specified above.

2.1.2 All boxes for NEMA 1 and 1A application shall be provided with knockouts, as necessary, or shall be cut in the field by approved cutting tools which will provide a clean, symmetrically cut opening. All boxes, except panelboards, shall be provided with code gauge fronts with hex head or pan head screw fasteners. Fronts for panelboards shall be as specified for panelboards.

2.1.3 Ceiling outlet boxes shall be galvanized steel, 4" octagonal, not less than 2 1/8" deep, with lugs or ears to secure covers, and those for use with ceiling lighting fixtures shall be fitted with 3/8" fixture studs fastened to the back of the boxes, where applicable. Provide adequate support with at least a 2 x safety factor for the anticipated fixture weight.

2.1.4 Special size concealed outlet boxes for clocks, speakers, alarms, TV, etc., shall be provided by the manufacturer of the equipment.

2.1.5 The location of outlets, as shown on the drawings, shall be considered as approximate only. It shall be incumbent upon this Contractor to study the general building drawings, with relation to spaces surrounding each outlet, in order to make his work fit the work of others and in order that when the devices or fixtures are installed, they will be symmetrically located and will not interfere with any other work or equipment. Any change in fixture or layout shall be coordinated with and approved by the Engineer before this change is made. Regardless of the orientation shown on the drawings, all devices shall be easily accessible when installed.

2.1.6 All outlets, pull boxes, junction boxes, cabinets, etc., shall be sized per the current edition of the National Electrical Code.

2.2 Outlet boxes and junction or pull boxes shall be threaded for rigid-threaded conduit, dust-tight vapor-tight or weatherproof as required for areas other than for NEMA 1 or 1A application. These shall be as manufactured by Crouse-Hinds, Appleton, Killark, or approved as equivalent.

2.2.1 NEMA 1 or 1A outlet boxes or pull or junction boxes shall be as manufactured by Appleton, Steel City, T & B, or approved equivalent.
1. Outlet boxes for switches, receptacles, etc., concealed in walls shall be galvanized steel, 4 11/16” x 4 11/16” x 2 1/8” deep with plaster cover for the number of devices as required and to be flush with finished wall. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or other masonry which will not be covered with plaster or in walls covered by wood wainscot or paneling, deep sectional masonry boxes shall be used and they shall be completely covered with the plates or lighting fixtures. This Contractor shall cooperate with the brick layers, block layers and carpenters to insure that the outlet boxes are installed straight and snugly in the walls. Receptacles shall be set vertically in walls.

2. Outlet boxes for data/telephone locations shall be no smaller than 5” x 5” x 2 7/8” with a double gang plaster ring and integral wire management, unless otherwise noted on the drawings. Randl 5-square series or equal.

2.2.2 Boxes for more than two devices shall be for number of devices required and shall be one piece. No ganging of single switch boxes will be allowed.

2.2.3 Outlets provided shall have only the holes necessary to accommodate the conduit at the point of insulation and shall be rigidly secure in position. Boxes with knockout removed and openings not used shall be replaced or provided with a listed knockout closure.

2.2.4 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

PART 3 - SPECIAL NOTICE

3.1 Openings for conduit entrance in cabinets and boxes shall be prefabricated, punched, drilled and/or reamed. The use of a cutting torch for this purpose is prohibited.

END OF SECTION 260531
SECTION 260533 - RACEWAYS AND FITTINGS

PART 1 - GENERAL

1.1 This section is intended to specify the raceways, conduit, conduit fittings, hangers, junction boxes, splice boxes, specialties and related items necessary to complete the work as shown on the drawings and specified herein.

1.2 This section specifies basic materials and methods and is a part of each Division 16 Section that implies or refers to electrical raceways specified therein.

1.3 The types of raceways specified in this section include the following:

1.3.1 Steel electrical metallic tubing (E.M.T.)
1.3.2 Rigid galvanized steel conduit (G.R.S.)
1.3.3 Intermediate metal conduit (I.M.C.).
1.3.4 Flexible metal conduit.

1.4 All raceways, as listed in 1.3. above and otherwise specified herein shall be provided in compliance with UK standards.

1.5 Horizontal conduit shall not be installed directly from the side of one junction box to another junction box. The conduit needs to be either installed vertically to each box or from the junction box bottoms at a level lower than 12 inches AFF. See sketch

1.6 Conduit and raceways, as well as supporting inserts in contact with or enclosed in concrete shall comply with the latest edition of all A.C.I. standards and the equipment manufacturer's recommendations for such work.

1.7 The decision of the Engineer shall be final and binding in any case where a question or inquiry arises regarding the suitability of a particular installation or application of raceways, supports or materials, if other than outlined herein.
1.8 Minimum size of conduit shall be 3/4” trade size for power and 1” for phone / data / tv unless otherwise noted on the drawings. All conduit and raceways shall be sized for the number of conductors contained, in accord with the latest edition of the National Electrical Code or any other applicable standards.

1.9 The installer of raceway systems shall avoid the use of dissimilar metals within raceway installations that would result in galvanic-action corrosion.

1.10 Color

Conduit in major renovations and new construction in Medical Center buildings shall follow the following coloring scheme:

- Life Safety Branch – Yellow
- Critical Branch – Orange
- Normal Branch – White
- Equipment Branch – Silver
- Fire Alarm System – Red
- Controls – Green
- Data - Blue

PART 2 - MATERIALS

2.1 STEEL ELECTRICAL METALLIC TUBING

2.1.1 Electrical metallic tubing, (E.M.T.) of corrosion-resistant steel construction shall be permitted for concealed installation in dry interior locations. Electrical metallic tubing shall not be installed in concrete slabs or where exposed to physical damage. Electrical metallic tubing shall be permitted for exposed work in mechanical and electrical rooms and other exposed structure areas where not subjected to physical damage, as determined by the Engineer.

2.2 RIGID GALVANIZED STEEL CONDUIT

2.2.1 Rigid galvanized steel conduit shall be used where subject to physical damage for exposed work in mechanical spaces, within factory or other industrial work areas, for exposed fit-up work on machinery, for exposed exterior damp or wet location work, in hazardous atmospheres, in exterior underground locations where installed beneath roadways, where ells occur in underground P.V.C. conduits, or where turning out of concrete encased duct banks, and at other locations as specifically called out on the drawings.

2.3 FLEXIBLE METAL CONDUIT

2.3.1 Flexible conduit may be used where permitted by NEC and these specifications. It shall be constructed of steel. It shall be installed with connectors designed for the purpose. All flexible metal conduit shall be installed as a single piece. No joints shall be installed. Flexible conduit shall not be used in wet or dusty locations or where exposed to oil, water or other damaging environments. An equipment grounding conductor or bonding jumper shall be used at all flexible conduit installations. Flexible metal conduit shall not be used in lengths over six feet. Flexible metal conduit shall not be used in telephone, fire alarm, intercom, security, and other communication systems.

2.4 RACEWAY FITTINGS

2.4.1 Raceway fittings (or condulets) shall be of gray iron, malleable iron or heavy copper-free cast aluminum. They shall be furnished in proper configurations, avoiding excessive plugged openings. Any openings that are left shall be properly plugged. All coverplates shall be gasketed with neoprene or similar approved materials, rated for the environment.
2.4.2 Where required, raceway fittings shall be provided in explosion-proof configurations rated for the atmosphere. Place conduit seal off fittings at each device in accord with applicable codes. Seal off fittings shall be packed with wadding, and poured with an approved non-shrink sealing compound.

2.4.3 Where conduit transitions in a run from a cold to a warm environment, (such as at a freezer, refrigerator or exterior wall) seal off fittings shall be placed on the warm side immediately at the boundary to prevent migration of condensation within raceway systems.

2.4.4 Expansion fittings shall be provided at all locations where conduits or other raceways cross over expansion joints. Provide copper ground bonding jumpers across expansion fittings.

2.4.5 Conduit bodies, junction boxes and fittings shall be dust tight and threaded for dusty areas, weatherproof for exterior locations and vapor tight for damp areas. Conduit fittings shall be as manufactured by Crouse Hinds, Appleton, Killark or approved equivalent. All surface mounted conduit fittings as with "FS", "FD", "GUB" Types etc., shall be provided with mounting hubs.

2.4.6 Where lighting fixtures, appliances or wiring devices are to be suspended from ceiling outlet boxes, they shall be provided with 3/4" rigid conduit pendants. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and No. 14 gauge steel locking ring. Provide safety chain between building structure and ballast housing of light fixtures for all fixtures, appliances or devices greater than 10 lbs weight. Fixtures shall be installed plumb and level.

2.4.7 Fittings for threaded raceways shall be tapered thread with all burrs removed, reamed ends and cutting oil wiped clean.

2.4.8 Fittings for E.M.T. conduit shall be of the compression type on all conduits 2” and smaller. Conduit stops shall be formed in center of couplings. All EMT connectors and couplings shall be of formed steel construction. Setscrew or compression connectors may be used for 2-1/2” and larger conduit.

2.4.9 Indentation or die-cast fittings shall not be permitted in any raceway system.

2.4.10 Compression type fittings shall be utilized for EMT conduit installed in damp or dusty locations, or where otherwise indicated.

2.4.11 All conduit fittings shall be securely tightened. All threaded fittings shall engage seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.

2.5 SUPPORTS AND HANGERS

2.5.1 Supports and hangers shall be installed in accord with all applicable codes and standards. They shall be corrosion - resistant, galvanized or furnished with an equivalent protective coating. All electrical raceways shall be hung independently from the building structure with U.L. listed and approved materials. Hangers and supports depending from the support systems of other trades work shall not be permitted, except with specific approval in writing from the Engineer. The use of tie wire for support or fastening of any raceway system is prohibited. Perforated metal tape shall not be used for raceway support.

2.5.2 No raceway shall be installed on acoustic tile ceiling tees, or in any location that will impair the functioning, access or code-required clearances for any equipment or system.

2.5.3 Supports for raceways shall be of materials compatible with the raceway, of malleable iron, spring steel, stamped steel or other approved material. Die-cast fittings are not permitted for supports.

2.5.4 The installing contractor shall provide all necessary supports and braces for raceways, in a rigid and safe installation, complying with all applicable codes.
2.5.5 Individual conduits run on building walls or equipment shall be secured by one hole galvanized malleable iron or stamped steel pipe strap or "minerallac" 2-piece straps. The straps are to be anchored by an approved means such as expansion anchors, toggle bolts, through bolts, etc. Where required by codes or other standards, provide spacers behind mounting clamps to space conduits off walls.

2.5.6 Individual conduits run on building steel shall be secured by means of clamp supports similar and equal to those manufactured by the C.C. Korn Company, Elcen Co., B-Line or approved equivalent. Provide korn clamps, bulb tee clamps, flange clamps, beam clamps, "minerallacs", etc.

2.5.7 Where feasible, vertical and/or horizontal runs of conduit shall be grouped in common hangers on "trapezes" of channel stock as manufactured by "Unistrut" or equivalent, 1-5/8" minimum depth. Utilize conduit clamps appropriate to the channel.

2.5.8 Channel strut systems for supporting electrical equipment or raceways shall be constructed of 16 gauge minimum hot dip galvanized steel with 9/16" diameter holes on 8" centers, with finish coat of paint as manufactured by Unistrut, B-Line, Kindorf, or approved equivalent.

2.5.9 The minimum diameter of round all-thread steel rods used for hangers and supports shall be 1/4", 20 threads per inch. All-thread rod shall be furnished with a corrosion-resistant finish.

2.5.10 Welding directly on conduit or fittings is not permitted.

2.5.11 Provide riser support clamps for vertical conduit runs. Riser support clamps shall be of heavy gauge steel construction. Install riser support clamps at each floor level penetration, or as otherwise required.

2.5.12 Provide conduit cable support clamps for vertical conductor runs as required or indicated on plans. Clamps to be insulating wedging plug, with malleable iron support ring. Install within properly sized and anchored junction box.

2.5.13 Spring steel clips and fittings such as those manufactured by HITT-Thomas, Caddy-Erico, or approved equivalent, with black oxide finish are permitted in any indoor dry location for concealed work, where acceptable to the local authority having jurisdiction.

2.6 FIRESTOPPING MATERIALS

2.6.1 All conduits, and cables penetrating fire rated floors and walls must be firestopped. Firestopping assembly must be UL listed. All corridor walls, storage room walls and mechanical room walls are to be considered on hour fire rated. The second floor slab shall also be considered one hour rated.

2.6.2 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type. (i.e., one hour fire rated gypsum wall board with insulated metal pipe penetration.)

2.6.3 3M fire protection products are listed below. Equivalent products may be submitted if they are UL listed.

2.6.4 The manufacturer of the firestopping materials must provide on site training for the contractor. The training session shall demonstrate to the contractors the proper installation techniques for all the firestopping materials. The training session shall be four hours minimum. Contact the Engineer prior to conducting this training session.

2.6.5 Firestopping materials to include but not limited to the following:

2.6.5.1 3M fire barrier FS-195 wrap/strip.
2.6.5.2 3M fire barrier CP 25 caulk.
2.6.5.3 3M fire barrier MP moldable putty.
2.6.5.4 3M fire barrier RC-1 restricting collar with steel hose clamp.
2.6.5.5 3M fire barrier damming materials.
2.6.5.6 3M fire barrier CS-195 composite sheet.
2.6.5.7 3M fire barrier fire dam 150 caulk.
2.6.5.8 Steel sleeves.

PART 3 - INSTALLATION

3.1 Horizontal runs of conduit between outlet boxes shall not be permitted.

3.2 This Contractor shall lay out and install all conduit systems so as to avoid any other service or systems, the proximity of which may prove injurious to the conduit, or conductors which it confines. All conduit systems, except those otherwise specifically shown to the contrary, shall be concealed in the building construction or run above ceilings. Size of all conduit shall conform to Table No. 1, Chapter 9, of the National Electrical Code, unless otherwise shown on the Contract Drawings.

3.3 No conduit shall be installed in or below poured concrete slabs except with permission of the architect or engineer. Conduit shall be held at least 6" from flues or hot water pipes.

3.4 All exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. All conduit shall have supports spaced not more than eight feet apart.

3.5 Conduit shall be installed in such a manner so as to insure against collection of trapped condensation. All runs of conduit shall be arranged so as to be devoid of traps. Trapped conduit runs shall be provided with explosion proof drains at low points. Runs of conduit between junctions shall not have more than the equivalent of three 90° bends.

3.6 Junction boxes shall be installed so that conduit runs will not exceed 85', or as shown on the Contract Drawings.

3.7 Stub out as many spare conduits as possible via knockouts from flush-mounted panelboards into the nearest accessible area for future use. Provide suitable closures for these stubs. Identify each stub with a suitable hang tag.

3.8 Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of latest edition of the N.E.C., and NECA "Standard of Installation", complying with recognized industry practices.

3.9 Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.

3.10 Level and square raceway runs, and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.

PART 4 - SPECIALTIES

4.1 All EMT terminations at junction boxes, panels, etc. shall be made with case hardened locknuts and appropriate fittings, with insulated throat liners. Insulating terminations shall be manufactured as a single unit. The use of split sleeve insulators is not permitted.

4.2 All rigid conduit, except main and branch feeders, shall have heavy fiber insulating bushings reinforced with double locknuts. All branch and main feeders shall have insulated bushings with grounding lugs and
shall be bonded to enclosures with appropriately sized copper jumpers, except at pad mounted transformers. Bonding jumpers shall be installed as required by the N.E.C. and other applicable codes.

4.3 All conduit stubbed through floor during construction shall have openings protected with plastic caps approved for this purpose. Connections on both ends of all flexible conduit shall be equivalent to Thomas and Betts, Ideal, Appleton, Efcor, or approved equivalent, rated for the environment.

4.4 All pulling lines left in open conduit systems shall be non-metallic, left securely tied off at each end.

4.5 Where spare raceways terminate in switchboards or motor control centers a fishtape barrier shall be provided.

END OF SECTION 260533
SECTION 260553 - IDENTIFICATIONS

PART 1 – GENERAL

1.1 Equipment, disconnect switches, special device plates, and similar materials shall be clearly marked as to their function and use. Markings shall be applied neatly and conspicuously to the front of each item of equipment with 1/2" black lamacoid plate (or equivalent) with white letters 1/4" high.

1.2 The Contractor shall provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic card holders in each panel.

1.3 Branch circuit panelboards and switch gear shall be provided with a black lamacoid plastic plate with 1/2" white letters for panel designation and 1/4" white letters showing voltage and feeder information. Branch circuit switches shall be designated as to function. Panelboard and switchgear labels shall indicate the source they are fed from, and the circuit number at that source. Clearly indicate the exact label legend to be furnished with each panelboard and switchgear on the shop drawings for each item of equipment prior to submission of shop drawings.

EXAMPLE:

![Panel Label Example]

1.4 Where branch circuit panelboards and switchgear are connected to an emergency source, the lamacoid plate shall be red, and the word "emergency" shall be incorporated into the legend. In health care applications, the NEC - designated branch (life safety, critical or equipment branch) shall also be incorporated into the legend, all in ¼" letters. Also provide similar plates and legends for automatic transfer switches, as appropriate.

1.5 Lamacoid plates shall be located at center of top of trim for branch circuit panels, switch gear, and centered at side for branch circuit switches. Fasten with self-tapping stainless steel screws or other approved method.

1.6 All nomenclature on lamacoid labeling shall be per University of Kentucky Standards as shown below:

1.6.1 Any label that belongs to equipment within the emergency power subsystem shall be RED with white lettering. All other labels shall be BLACK with white lettering. Additionally, all labels will have at least two lines—one designating the component name and the other designating the component’s power source. In the case of a component with multiple feeds, there shall be separate line for each power source component name.

1.6.2 UK PPDMC Equipment Naming Convention:

**Format:**
The components will be labeled using the following format:

ID: Building/Floor/Room/System/Subsystem/Component
Fed from: Building/Floor/Room/System/Subsystem/Component/
Each field has a specified number of characters and is defined as follows:

Building (4 numeric characters) => the building number, as defined by the university, in which the system is in.

Floor (2 characters) => the floor on which the component is located; use "0G" for the ground floor and "SB" for the sub-basement.

Room (up to 5 capitalized characters) => the room in which the component is located; if component is in a corridor use "CORR".

System (up to 3 capitalized characters) => the system to which the component belongs (in this case it will be EDS for electrical distribution system).

Subsystem (up to 3 capitalized characters) => the subsystem to which the component belongs (in this case it will be Normal (N) or Emergency (E)).

Component (up to 5 capitalized alpha and/or numeric characters) => the component sequence number given to the component to distinguish it from other components in the system.

Examples:

A typical distribution panel on the second floor of the main hospital in room H-201 might be labeled 0293/02/H201/EDS/N/P-1.

A motor control center in the penthouse of the Combs building might be labeled 0096/04/PH/EDS/N/MCC-1.

A breaker on the main switchboard in N-19 might be labeled as 0293/07/PH/EDS/N/MCC2 for the load designation and 0293/0G/N19/EDS/N/SWBD3/BKR-3 for the source designation.

NOTE: The component identification number, or sequence number, is just a simple numbering of similar equipment on the same floor numbered from left to right as seen on the electrical distribution riser diagram provided by the architects. Therefore, it is important to note the building and floor when referring to a component to determine its location. If the components to be labeled are existing equipment or new equipment in an existing building, the component sequence number should be obtained from the appropriate electrical systems supervisor. If the equipment is being installed as part of a new building construction project, then the contractor may determine the sequence numbers.

16.4.1

<table>
<thead>
<tr>
<th>Equipment Description</th>
<th>Equipment Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning Units</td>
<td>ACU-x</td>
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<tr>
<td>Air Handler Units</td>
<td>AHU-x</td>
</tr>
<tr>
<td>Backflow Preventor</td>
<td>BFP-x</td>
</tr>
<tr>
<td>Chilled Water Pump</td>
<td>CHW/PMP-x</td>
</tr>
<tr>
<td>Chillers</td>
<td>CHL-x</td>
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<tr>
<td>Compactor</td>
<td>CPT-x</td>
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<tr>
<td>Condensate Pump</td>
<td>CND/PMP-x</td>
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<tr>
<td>Control Air Compressor</td>
<td>CA/CMP-x</td>
</tr>
<tr>
<td>Conveyor</td>
<td>CNV-x</td>
</tr>
<tr>
<td>Critical Branch Automatic Transfer Switch</td>
<td>C/ATS-x</td>
</tr>
<tr>
<td>Critical Branch Distribution Panel</td>
<td>C/DP-x</td>
</tr>
<tr>
<td>Critical Branch Motor Control Ctr</td>
<td>C/MCC-x</td>
</tr>
<tr>
<td>Critical Branch Panel</td>
<td>C/P-x</td>
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<tr>
<td>Critical Branch Switchboard</td>
<td>C/SWBD-x</td>
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<tr>
<td>Critical Branch Switchgear</td>
<td>C/SWGR-x</td>
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<tr>
<td>Critical Branch Transformer</td>
<td>C/T-x</td>
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<tr>
<td>Domestic Cold Water Pump</td>
<td>DCW/PMP-x</td>
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<tr>
<td>Domestic Hot Water Pump</td>
<td>DHW/PMP-x</td>
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<td>Dumb Waiters</td>
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<td>Emergency Switchgear</td>
<td>E/SWGR-x</td>
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<td>HTX-x</td>
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<td>Hot Water Heater</td>
<td>HWH-x</td>
</tr>
<tr>
<td>Laboratory Air Compressor</td>
<td>LA/CMP-x</td>
</tr>
<tr>
<td>Laboratory Vacuum Pump</td>
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<td>Normal Power Motor Control Ctr</td>
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<tr>
<td>Reheat Pump</td>
<td>RHT/PMP-x</td>
</tr>
<tr>
<td>Tube System Transfer Station</td>
<td>TUBE/STN-x</td>
</tr>
<tr>
<td>Variable Speed Drive</td>
<td>VSD-x</td>
</tr>
</tbody>
</table>

END OF SECTION 260553
SECTION 262400 - ELECTRICAL DISTRIBUTION EQUIPMENT

1. GENERAL

   A. All electrical distribution equipment shall be dead front UL listed for the purpose and application. All equipment shall meet or exceed all applicable requirements of the National Electrical Code (N.E.C.). Any device or component, i.e., switchboard, panel, breaker, switch, etc., used as service entrance equipment, shall be listed for use at 100% of the rated capacity.

2. EXISTING PANELS

   A. Existing power distribution switchboards and panel board are by Square D. Any device installed in an existing panel is to be by the same manufacturer.

3. BRANCH PANELBOARDS

   A. This section covers lighting and power panelboards (refer to schedules, notes on Drawings and the Electrical One-Line Diagram, of the Contract Drawings).

   B. All panelboards shall be of the circuit breaker type, and shall be of one manufacturer.

   C. Branch panelboards shall be as indicated on the drawings and as specified herein. The lighting panelboards shall be of the dead-front, quick-make, quick-break, plug-in circuit breaker type, with trip indicating and trip free handles. All circuits shall be clearly and properly numbered and shall be provided with thermal magnetic protection. The panelboards shall be enclosed in code gauge, galvanized steel cabinets with smooth finished hinged doors without visible external fasteners and heavy chrome locks. Locks shall all be keyed alike. Each door shall have a directory card inside, covered with a plastic shield, filled in with black india ink or typewritten with circuit numbers and description indicated. Room numbers shall be coordinated with final room numbers as selected by Owner -- not numbers on Contract Documents.

   Special Note: The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme, unless the Contractor is directed to do so by the Architect or Engineer.

   Special Note: Panels are to have hinged trims in addition to hinged panel doors per UK Standards.

   D. Branch panelboards shall be surface or flush mounted as indicated on the Contract Drawings.

   E. Circuit breakers for 120/208 volt systems shall be of 10,000 A.I.C. RMS symmetrical rating unless otherwise indicated on the Contract Drawings.

   F. All main bus and connections thereto in branch panelboards shall be copper. All bus bars shall extend full length of panelboards.

   G. All circuit breakers used to switch lights shall be SWD (switching duty) rated and U.L. listed for the purpose.

   H. Where required by the National Electrical Code, provide branch arc-fault circuit interrupters (A.F.C.I.’s) in branch panelboards, whether indicated on the panel schedule or not. They shall be U.L. listed, latest edition.
I. Where branch circuit breakers feed hermetically, sealed compressor for cooling or refrigeration equipment, provide U.L. listed H.A.C.R.-style circuit breakers.

J. Where branch circuit breakers are indicated or required to be ground-fault circuit-interrupting type (G.F.C.I.), they shall have test and reset buttons and be U.L. listed, latest edition. Do not share neutrals with other circuits. Provide G.F.C.I. breakers or G.F.I. receptacles where device is located within 6' of plumbing or indicated by manufacturer's equipment device serves.

K. Where branch circuit breakers are feeding H.I.D. (high-intensity-discharge) loads, they shall be rated and listed for such loads. Provide proper circuit breaker whether indicated on panel schedules or not.

L. Arc Flash Hazard warning labels shall be affixed to all panelboards in accordance with Article 110.16 of the National Electrical Code.

M. Panels shall be Square "D", G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent. Existing Motor Control Center is by Siemens.

N. Lockable breakers shall be provided for all breakers serving all HVAC equipment, Plumbing equipment, and kitchen appliances.

O. Top fed panels are to be fed from the top and bottom fed panels are to be fed from the bottom. No feeders are to be routed in the side gutters.

P. All new panels shall have a hinged cover.

4. INSTALLATION INSTRUCTIONS

A. Panelboards with circuit breakers installed before the building has been finished and cleaned shall be masked.

B. All dust and debris shall be removed from the panels before they are energized and placed in service.

C. All panelboard fronts shall be omitted until final punch list inspection is made. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

5. SAFETY SWITCHES

A. Provide heavy duty safety switches as a final disconnecting means as required by NEC and/or as indicated on the Contract Drawings.

B. All safety switches shall be NEMA Type 1, NEMA 3R, NEMA 4 stainless steel, NEMA 12, or as required by the operating environment, Heavy Duty Type HD, UL listed.

C. All safety switches shall have switch blades that are fully visible in the "OFF" (open) position with the door open.

D. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

E. Switch mechanism shall be quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to
three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

F. Arc Flash Hazard warning labels shall be affixed to all switches in accordance with Article 110.16 of the National Electrical Code.

G. Switches shall be as manufactured by Square D., G.E., Siemens, Eaton/Cutler-Hammer or approved equivalent.

END OF SECTION 262400
Safety is one of UK HealthCare’s top priorities. UK Healthcare is monitoring events surrounding COVID-19, and we are following the Centers for Disease Control and Prevention guidelines to ensure the safety of all who enter our facility and to minimize the risk of transmission.

To protect the health of the people we serve, upon entering UK Healthcare facilities, we are requiring all vendors to screen electronically prior to entry.

**DO ANY OF THE FOLLOWING APPLY?**
- Fever 100.0 or greater (self-reported)
- New Cough (not associated with seasonal allergies)
- New Muscle Aches/Pain
- New Shortness of Breath
- New Sore Throat (not associated with seasonal allergies)
- Vomiting or Diarrhea
- Loss of Taste or Smell

Please use the QR code to complete the vendor / non-university of Kentucky employee screening prior to entering any UK facility.

**Masks are also required prior to entry. Please attempt to bring a mask with you. If you do not have one you can obtain one at any main visitor/patient entry point.**

THANK YOU FOR YOUR PATIENCE AND UNDERSTANDING.