

March 04, 2024

TITLE 38 ADDENDUM NO. 2

PROPOSAL FOR FURNISHING ALL LABOR, MATERIALS, EQUIPMENT, TRANSPORTATION, SUPERVISION, PERMITS, ETC. NECESSARY FOR NIRC BUILDING 29 - 1ST FLOOR CAGE AREA MODIFICATIONS, LOCATED ON THE UL LAFAYETTE CAMPUS, LAFAYETTE, LOUISIANA.

Due March 26, 2024, 2:00 PM Solicitation No. 24213

The following is to be made part of the original specifications as though issued at the same time and shall be incorporated integrally therewith. This addendum shall be acknowledged on the BID FORM when submitted to the Purchasing Department prior to the bid due date/time.

Item No. 1 – Change to the Specifications:

See attached Mechanical and Electrical specifications associated with Solicitation File Number 24213.

Item No. 2 – Change to the Specifications: Page 11 of 42 – MEDICAL REQUIREMENTS; Remove the following from the paragraph:

1. “The Contractor shall have all on-site technicians/crew members provide proof of Measles immunization or positive Measles Titer to the Center representative prior to entering the Facility. The Contractor shall also supply proof of a negative TB test every 6 months for all on-site technicians/crew members for the duration of the Contract. Failure to supply appropriate medical documentation will restrict the technician(s)/crew member(s) from entry onto the Center premises until such time as the requirements are satisfactorily met.”

Item No. 3 – Change to the Specifications: Page 11 of 42 – ENHANCED SECURITY CLEARANCE (CONTRACTORS); Add the following:

1. The contractor will be required to submit all background applications upon award of project. See attached “Enhanced Security Screening Notification and Authorization Form”.

Item No. 4 – Change to the Specifications: Page 40 of 42 – GENERAL REQUIREMENTS; Add the following:

1. SUPERVISION – General Contractor shall provide job supervision on site at all times during the duration of the project.

Item No. 5 – Change to the Specifications: Page 40 of 42 – GENERAL REQUIREMENTS; Add the following:

1. TEMPORARY SERVICES – General Contractor shall provide temporary lighting as required during the duration of the project. Owner shall provide power services.
2. TEMPORARY SERVICES – General Contractor shall provide temporary toilet facilities during the duration of the project. Employees will not be able to access facilities’ restrooms.

Item No. 6 – Change to the Specifications: Page 41 of 42 – GENERAL REQUIREMENTS; Revise the following:

1. CLEAN UP – Add the following to read, “All demolition material shall be removed off site unless otherwise indicated. Cage material is non-salvageable. Contractor shall provide adequate dumpsters to accommodate removal for duration of the project.” Coordinate with owner prior to disposal.



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Item No. 7 – Change to the Drawings: Cover Sheet:

1. Reference General Notes: Delete from Note A the following, “All work shall be staged to meet strict deadline of September 01, 2024, prior to cold weather season.” Add the following to read, “Contractor shall complete project within time as indicated in bid documents.”
2. Reference General Notes: Add Note E to read, “Owner shall clear and sanitized all areas of work prior to start of project. Access will be only allowed from the East and West ends of building.

Item No. 8 – Change to the Drawings: Sheet D1:

1. Replace Sheet D1 with revised drawing Sheet D1R, dated 03/02/24.

Item No. 9 – Change to the Drawings: Sheet D2:

1. Clarification. Hydraulic systems in Unit No. 1 to 8 and 14 to 21 shall be removed completely. Hydraulic system in Unit No. 9 to 13 shall remain.

Item No. 10 – Change to the Drawings: Sheet P1:

1. Clarification. All domestic water piping shall be galvanized. All fittings shall be “Mega Press” style fittings suitable for potable water usage.

This is a public works bid. The addendum **MUST** be acknowledged with your bid on the BID FORM. For questions related to bidding these projects, please contact the UL Lafayette Purchasing Department at bids@louisiana.edu or 337.482.2955.

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SECTION 23 05 00 - GENERAL PROVISIONS FOR HVAC

PART - 1 GENERAL

A. DIVISION OF SPECIFICATIONS`

1. For Bidder's convenience only, this Division of the Specifications is divided into the following parts:

23 05 00	GENERAL PROVISIONS FOR HVAC
23 05 03	BASIC MATERIALS AND METHODS FOR HVAC
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00	MECHANICAL INSULATION
23 30 00	AIR DISTRIBUTION FOR HVAC

B. GENERAL CONDITIONS

1. The General Conditions of the Architectural Specifications along with supplementary conditions, special conditions, information to bidders, and any other pertinent information and documents shall apply the same as if repeated herein. The contractor shall review Architectural General Conditions. Where the requirements of Architectural General Conditions and these specs conflict for the contractor, the most stringent shall be applied.
2. Mechanical subcontractor shall be the sole source responsible party to furnish and install the mechanical system. Mechanical contractor shall be properly licensed to perform this work.
3. Wherever the word contractor is mentioned in Division 23 of these specifications, it is intended to mean the Mechanical Contractor as appropriate. These are sub-contractors to the General Contractor who has the contract with the owner. It is the General Contractor who bears the responsibility to fulfill this part of the project (Division 23 – Mechanical) under the contract with the owner. The General Contractor shall be responsible for all costs associated with any and all bidding errors and omissions of the sub-contractor.

C. SCOPE OF WORK

1. Furnish labor, materials, and equipment necessary to provide and install the complete mechanical portion of this contract, including air conditioning, heating, and ventilating systems as called for herein and on accompanying drawings. Parts of the mechanical division may be bid separately or in combination at the contractor's option; however, it shall be the responsibility of the General Contractor to assure himself that all items

covered in the Mechanical Division have been included if he chooses to accept separate bids.

2. Contractor shall refer to the Architectural, Structural, Plumbing and Electrical drawings and install all equipment, piping, etc., to meet building and space requirements. **No equipment shall be bid on or submitted for approval if it will not fit in space provided or coordinated with other trades involved on the project.**
3. It is the intention of these Specifications that all mechanical systems shall be furnished complete with all necessary valves, controls, insulation, piping, devices, equipment, etc., necessary to provide a satisfactory installation in working order and in accordance with all Federal, State and Local codes and ordinances.
4. Contractor shall visit the site and acquaint himself thoroughly with all existing facilities and conditions which would affect his portion of the work. Failure to do so shall not relieve the contractor from the responsibility of installing his work to meet conditions.
5. Lack of coordination shall not be acceptable and shall not be a reason for poorly installed work or additional cost to this trade or others on the project. All associated extra cost shall be borne by the contractor. The General Contractor shall be responsible for all costs, time and liquidated damages associated with lack of coordination or poor coordination.

D. LOCAL CONDITIONS

1. Location and elevation of all services is based on information obtained from the Owner. However, this shall serve as a general guide only and the contractor shall visit the site and verify the location and elevation of this service to his own satisfaction in order to determine the amount of work required for the execution of the contract.
2. Contractor shall contact the various utility companies, determine the extent of their requirements, and cooperate with the utility company in reaching a finished product. Contractor shall pay charges by Utility Company for extensions, connections meter fees, street patching, etc.
3. In case major changes are required, this fact, together with the reasons therefore, shall be submitted to the Architect, in writing, not less than seven days before the date of bidding. Failure to comply with this requirement will make the contractor liable for any changes, additions, and expenses necessary for the successful completion of the project.

E. CUTTING AND PATCHING

1. Initial cutting and patching shall be the responsibility of the General Contractor with the Mechanical Contractor responsible for laying out and

marking any and all holes required for the reception of his work. No structural beams or joists shall be cut or thimble without first receiving the approval of the Architect/Engineer. After initial surfacing has been done, any further cutting, patching, and painting shall be done at this contractor's expense.

2. Cutting and patching shall be done in such a manner that the surrounding work will be restored to its original condition.
3. The HVAC piping shall be run in such a manner as to avoid conflicts with other trades. It may be necessary to penetrate beams, grade beams, footings, and foundations. Install thimbles as required and as approved by the Structural Engineer and Architect.

F. CODES AND STANDARDS

1. The entire mechanical work shall comply with the rules and regulations of the City, Parish and State in which this project is being constructed including the State Fire Marshal and State Board of Health. All modifications required by these authorities shall be made without additional charge to the Owners. The Mechanical Contractor shall report these changes to the Architect and secure his approval before work is started.
2. In addition to the codes mentioned, all mechanical work and equipment shall conform to the applicable portions of the following Specifications, codes and regulations:
 - a. American Society of Heating, Refrigeration and Air Conditioning Engineers
 - b. National Electric Code
 - c. National Fire Protection Association
 - d. American Society of Mechanical Engineers
 - e. Underwriters' Laboratories
 - f. American Gas Association
 - g. Energy Code for Commercial and High Rise Residential Buildings
 - h. International Energy Conservation Code
 - i. International Building Code
 - j. International Mechanical Code
 - k. SMACNA Guidelines
3. Materials, equipment and accessories installed under this contract shall conform to all rules, codes, etc., as recommended by National Associations governing the manufacturer, rating and testing of such materials, equipment and accessories. Materials shall be new and of the best quality and first class in every respect. Whenever directed by the Architect, contractor shall submit a sample for approval before proceeding.

4. Where laws or local regulations provide that certain accessories such as gauges, thermometers, relief valves and parts be installed on equipment, it shall be understood that such equipment be furnished complete with the necessary accessories whether or not called for in these Specifications.
5. Material and equipment furnished or installed as part of these construction documents shall be installed and operated in strict accordance with the respective manufacturer's guidelines for installation and operating instructions. The manufacturer's guidelines shall become part of the construction documents.

G. MINOR DEVIATIONS

1. Plans and detail sketches are submitted to limit, explain and define conditions, specified requirements, pipe sizes and manner of erecting work. Structural or other conditions may require certain modifications from the manner of installation shown and such deviations are permissible and shall be made as required, but, specified sizes and requirements necessary for satisfactory operation shall remain unchanged. It may be necessary to shift ducts or pipes or to change the shape of ducts and these changes shall be made as required. All such changes shall be referred to the Architect/Engineer for approval before proceeding. Extra charges shall not be allowed for these changes.
2. No structural beams or joists (concrete or steel) shall be cut or thimble without first receiving the approval of the Architect/Structural Engineer. After initial surfacing has been done, any further cutting, patching and painting shall be done at the Mechanical Contractor's own expense.
3. Contractor shall realize that the drawings could delve into every step, sequence or operation necessary for the completion of the project without drawing on the contractor's experience or ingenuity. However, only typical details are shown on the plans. In cases where the contractor is not certain about the method of installation of his work, he shall ask for details. Lack of details shall not be an excuse for improper installation. Submit installation shop drawings with manufacturer's details for review prior to installation.
4. In general, the drawings are diagrammatic, and the contractor shall install his work in a manner so that interferences between the various trades are avoided. In cases where interferences do occur, the Architect is to state which equipment, piping, etc., is to be relocated regardless of which item was first installed.
5. Materials and equipment furnished or installed as part of these construction documents shall be installed and operated in strict accordance with the respective manufacturer's guidelines for installation and operating instructions. The manufacturer's guidelines shall become part of the construction documents.

H. WORKMANSHIP

1. Workmanship shall be of highest grade; highest quality and all construction shall be done according to the best practice of the trade. Work shall be completed to satisfaction of the Architect/Engineer.

I. COORDINATION

1. Coordinate work of the different trades to avoid interferences between mechanical and all other work. All piping, ductwork, etc., shall be installed in lines as required to accomplish this end whether or not shown on the plans.
2. There will be a certain amount of work which must be coordinated with the Owner. This contractor shall coordinate required work with the Owner through the General Contractor using procedures acceptable to the Architect and Owner. The contractor shall maintain documentation of coordinated work.
3. This contractor shall coordinate and confirm that all equipment requiring electric service will be adequately and properly serviced by Electrical Contractor. Any conflicts shall be brought to the attention of the Architect/Engineer prior to ordering the equipment. **VERIFY ALL VOLTAGES WITH THE ELECTRICAL PLANS AND ELECTRICAL CONTRACTOR.**
4. This contractor shall coordinate the space clearances required for the HVAC ductwork with the structure, ceilings, lights, etc. In some cases, due to space limitations, it may be necessary to re-size ductwork to meet the conditions of the project. **Any resizing required shall be part of this project and done without any additional cost to the Owner. DO NOT MAKE DUCTWORK WITHOUT COORDINATION. Avoid conflicts with other trades.**
5. This contractor shall coordinate the installation of HVAC piping with all parts of the structural foundation system and structural building systems. Provide sleeves through grade beams or concrete beams at all conflicts. All points of penetration of foundation shall be reviewed by the Architect/Engineer prior to rough-in. All sleeves shall be installed per instructions and details of the structural engineer.
6. All piping shall be run as high as possible with sleeves through concrete beams to avoid conflicts. This means the piping shall run in or through the structure unless approved otherwise by the Architect/Engineer.

J. REVIEW OF MATERIALS

1. Whenever manufacturers or trade names are mentioned in these plans or Specifications, the words "or approved equivalent" shall be assumed to follow whether or not so stated. Manufacturers or trade names are used to establish a standard of quality only and should not be construed to infer a preference. Equivalent products which meet the Architect's approval will be accepted; however, these requests for acceptance of products must be received by the Architect a minimum of ten days prior to bid date. Submission shall include manufacturer's name, model number, rating table and construction features. Upon receipt and checking of this submittal, the Architect will issue an addendum listing items which are approved as equivalent to those specified. The contractor shall base his bid solely on those items specified or included in the "Prior Approval Addendum" as no other item will be acceptable. Prior approval of a particular piece of equipment does not mean automatic final acceptance and will not relieve the contractor of the responsibility of assuring himself that this equipment is in complete accord with plans and Specifications and will fit into the space provided. Submit shop drawings on all items of equipment for approval as hereinafter specified.
2. Should a substitution or variation occur, the better quality or greater quantity of material or work shall be furnished. This also does not preclude other manufacturers if they meet the following criteria:
 - a. Product proposed for substitution shall be equal or superior to that specified in construction, efficiency, utility and function.
 - b. Physical size of substitute brand shall not be greater than space provided for it.
 - c. Profile of substitution shall be same concerning size, shape, indentations, recesses, etc.
 - d. Complete illustrations, specifications and description of substitution shall be submitted for approval.
 - e. Availability and proximity of manufacturer's service representative shall be factors considered in substitution approval.
 - f. Substitution and/or variations shall be reviewed and allowed when there is no change in cost to the project and shall be made at the discretion of the Engineer.

K. SHOP DRAWINGS

1. The General Contractor shall submit mechanical submittal in a timely manner as required to accommodate the construction schedule. The General Contractor and his sub-contractors shall bear all responsibility for any extra costs or delays to late submittals of shop drawings.
2. Drawings shall be presented in a clear and thorough manner.
3. Details shall be identified by reference to sheet detail, schedule or room numbers shown on contract and drawings.

4. Drawings shall contain the following information:
 - a. Date.
 - b. Number of the drawing or revision.
 - c. Name of project or facility.
 - d. Name of contractor and subcontractor.
 - e. Clear identification of contents and location of work.
5. Preparation:
 - a. Clearly mark each copy to identify pertinent products or models.
 - b. Show performance characteristics and capacities.
 - c. Show dimensions and clearances required.
 - d. Show wiring or piping diagrams and controls.
 - e. Show weights and mounting data.
 - f. Provide letter documentation confirming that all coordination with other trades effected have been done. This is especially necessary with the electrical requirements and rough-in requirements.
6. Manufacturer's standard schematic drawings and diagrams:
 - a. Modify drawings and diagrams to delete information which is not applicable to the work.
 - b. Supplement standard information to provide information specifically applicable to the work.
7. Office samples shall be of sufficient size and quantity to clearly illustrate:
 - a. Functional characteristics of the product, with integral related parts and attachment devices.
 - b. Full range of color, texture and pattern.
8. Equipment shop drawing shall be prepared by the contractor/supplier. These shop drawing shall include the manufacturer's performance data and installation manuals. In addition, the shop drawings shall show the installation specific to this project.
9. Assemble certificates, executed by each of the respective manufacturers, suppliers, and subcontractors.
10. All submittals shall be submitted prepaid and in ample time for review before installation.
11. Six (6) copies of each submittal shall be submitted to the Architect.
12. These shop drawings shall be supplied as part of this contractor's contract. Any drawings not approved shall be resubmitted until approved. **Submit all shop drawings at the same time. No separate items will be accepted.**

13. All materials installed in the work shall match the reviewed submittals. After a submission has been reviewed, no substitutions will be permitted without written approval by the Architect.
14. The Architect's/Engineer's review of shop drawings shall not relieve the contractor from the responsibility of incorrectly figured dimensions or any other errors that may be contained in these drawings. The omission from the shop drawings or specifications, even though approved by the Architect, shall not relieve the contractor from furnishing and erecting same.
15. Any delays caused by contractor not submitting shop drawings within a timely manner shall be the problem of the responsible subcontractor and the General Contractor.

L. MATERIALS

1. Work materials shall be new and the best of their respective kinds, and shall bear the label of NFPA, ASME Code, AGA, and UL where such standard has been established for the particular item of equipment used.

M. MATERIAL STORAGE

1. General: Provide space for storage of material and equipment at ground level. Roof surfaces shall not be used for storage of materials or equipment. Any storage within the building shall be approved by the Architect/Engineer prior to use of the space.
2. Exterior: Pipe, fitting, or other materials stored outside of building shall be set on wood or steel racks or platforms inside storage container units. All necessary provisions shall be made to keep water and debris away from such stored material. Ends of pipes and valves shall be kept sealed until used.
3. Warehousing: Equipment subject to rusting shall be kept warehoused until just prior to setting. If necessary the warehouse shall have climate controlled conditions.

N. GROUND AND CHASES

1. Contractor shall see that all required chases, sleeves, grounds, holes and accessories necessary for the installation of his work are properly built in as the work progresses; otherwise he shall bear the cost of providing them.

O. MACHINERY GUARDS

1. Contractor shall provide v-belt guards for each v-belt drive or other hazardous drive. Guard shall enclose the drive entirely and shall have a hole for taking tachometer reading.

P. SPECIAL TOOLS

1. Special tools required for proper operation or maintenance of any mechanical equipment provided under this contract shall be delivered to the Owner at the completion of the project.

Q. FILL AND CHARGES FOR EQUIPMENT

1. Fill and charge with materials or chemicals all devices or equipment as required to comply with the manufacturer's guarantee or as required for proper operation of the equipment.
2. This contractor shall flush systems as required per local and state jurisdictions and equipment/material manufacturer's guidelines (chlorination, chemical treatment, etc.).

R. EQUIPMENT IDENTIFICATION

1. Stenciling: All items of major mechanical equipment (pumps, AHUs, starters, valves, etc.) shall be neatly and clearly stenciled in letters not less than 1 inch high, with the same designation as appears on drawing. Location and color of such stenciling shall be appropriate for ready identification and/or as directed by the Architect. One set of compatible metal interlocking stencil letters and numbers shall be turned over to the Owner at the completion of the job. At contractor's option engraved plastic adhesive tags may be used. Tags used outdoors shall be listed for such use.
2. Pipe Coding: All piping, etc., both insulated and bare, shall be color coded with a general purpose pipe marker for interior locations and a 6 inch enamel painted band for exterior locations, and stenciled as to service and characteristics on the 10 foot centers and/or as directed. Directional arrows not less than 1/2 inch wide and not less than 6 inches long shall be permanently stenciled on each line at each stencil location. Stenciling shall be located such that it is clearly visible from floor or adjacent service platform. Coding shall be as per schedule approved by Owner through submittal to Architect. At contractor's option, pre-manufactured vinyl pipe labels and directional arrows may be used but shall be banded on either end to secure to pipe.
3. Valve tags shall be installed on all valves controlling building zones, areas, or equipment. Valve tags shall be 2 inch diameter brass stenciled with valve number. A framed list of valves with associated numbers, sizes and locations shall be mounted in the building as directed by Architect.

S. TEMPORARY USE OF EQUIPMENT

1. The permanent equipment installation shall not be used for temporary purposes by the contractor for temporary conditioning of the building during construction.
Contractor shall provide temporary dehumidification and drying equipment as required to maintain clean, dry air during construction.
2. Acceptable Use Without Specific Authorization: Temporary use shall not be construed to mean "bumping" of electric motors on equipment to verify rotation direction nor short time operation of systems for test purposes, operation of refrigeration and heating system for short periods to adjust controls and temperature regulation, or the operation of fans for air balance.

T. CLEANING AND ADJUSTING

1. Upon completion of his work, the contractor shall clean and adjust all equipment, controls, valves, etc. Clean all piping, ductwork, etc., and leave entire installation in good working order.

U. SERVICE

1. Inspect, clean and service air filters immediately prior to final acceptance of project.
2. Provide lubrication for operation of equipment until final acceptance of the equipment by the Owner. Protect bearings during installation and thoroughly grease steel shafts to prevent corrosion. Provide extended lubrication lines for parts requiring lubrication which are concealed or inaccessible.
3. Provide complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced condition, check the charge and modify it for proper operation as required.
4. Place mechanical systems in complete working order and clean and polish fixtures, equipment and materials thoroughly returning to "as new" condition prior to request for final review.
5. Remove excess material and debris. Clean out lines and fittings and adjust valves. Broom clean areas. Thoroughly clean ductwork inside and outside before grilles are installed.

V. PAINTING

1. This contractor shall obtain the services of a painting sub-contractor as part of contract with the General Contractor for all painting.

2. General: Except for standard factory finishes, all pipe, pipe covering, ducts, equipment, supports, hangers, etc., exposed inside and outside building or in equipment room shall be painted. This contractor shall prepare surface of material to receive first coat of paint. All subsequent coatings shall be prepared by Painting Subcontractor. Requirements covering paints, workmanship and preparation of surfaces as stated in Architectural Specifications shall govern. Color coding shall be approved by Architect (submit color sample). All submittals for review shall be through Architect.
3. Damage: Where standard equipment factory finishes have been damaged or scratched, the damaged area shall be repaired or replaced by the contractor to match the original finish.
4. Preparation: Thoroughly clean surfaces of all rust, scale, cement, and dirt from all equipment, piping or other work installed and leave ready for finish painting.
5. All exposed piping shall be painted. Paint with two (2) coats of paint. The color shall be industry standard color coding. Submit color code chart with sample color chips to Architect for review prior to starting work

W. FIRESTOPPING

1. Penetrations through rated construction shall be sealed with a material capable of preventing the passage of flames and hot gases when tested in accordance with ASTM-EB14.
2. Notify Architect for inspection of all completed fire and/or smoke barrier walls before any construction is installed that may conceal the firestopping material installation.
3. Access to random selected areas may be required by the architect at the time of final inspection should notification not be given.
4. Provide detailed instructive cutsheets of fire penetration sealing system (firestopping) used to the architect at the time of inspection. Random selective sampling by the contractor will be observed by the architect and State Fire Marshal.

X. NOISE VIBRATION

1. General: Take the utmost precautions in the installation of the equipment, piping, and duct systems to prevent noise and vibration transmission.
2. Isolation of equipment: Equipment that would tend to cause noise or vibration shall be isolated to prevent noise transmission to the building or to other equipment.

3. Equipment Connections: Piping, conduit, or other connections to equipment shall be isolated. The contractor shall be responsible for the prevention of noise and vibration transmission through these connections to equipment.

Y. PERMITS, INSPECTIONS AND TESTS

1. Contractor shall obtain and pay for permits, fees, etc., for the installation, inspection, service connections, verifying location or construction of the work which are required by any authority and/or agencies having jurisdiction.

Z. TRAINING OF MAINTENANCE PERSONNEL

1. Contractor shall provide on the job training for Owner's personnel upon completion of the work including testing and adjustment. Minimum 12 hours of onsite training shall include maintenance checks, lubrication of components, adjustment of control set points, and troubleshooting techniques of the air conditioning unit.

AA. OPERATION AND MAINTENANCE INSTRUCTIONS

1. Provide Owner with four (4) copies of printed instructions indicating various pieces of equipment by name and model number complete with parts lists and maintenance and repair instructions. This information shall be bound in plastic covered notebooks. Submit the manuals to the Architect for approval.
2. Include all warranty certificates or statements in a separate section of the manuals. Provide all materials and test certificates for the final inspection.
3. Provide three (3) sets of DVDs of the operation and maintenance manuals.

BB. GUARANTEE

1. Contractor shall guarantee all materials, equipment and workmanship for a period of one year from the date of final acceptance of the project. This guarantee shall include furnishing of all labor and material necessary to make any repairs, adjustments or replacement of any equipment, parts, etc., necessary to restore the project to first class condition. This guarantee shall exclude only the changing or cleaning of filters.
2. If the contractor's office is in excess of a 50 mile radius of the project, he shall appoint a local qualified contractor to perform any emergency repairs or adjustments required during the guarantee period. The contractor appointed to provide emergency services shall be submitted to the Architect for his approval.

CC. WARRANTIES

1. Assemble warranties executed by each of the respective manufacturers, suppliers, and subcontractors into a warranty book and prepare a table of contents.
2. Two (2) original signed copies of each warranty are required.
3. Provide complete information for each item including:
 - a. Product and work item.
 - b. Local supplying firm or manufacturer's dealer, with name of principal, address and telephone number.
 - c. Scope of warranty.
 - d. Date of beginning of warranty.
 - e. Duration of warranty.
 - f. Provide information for Owner:
 - 1) Proper procedure to evoke the warranty in case of failure.
 - 2) Instances which might affect the validity of the warranty.
 - g. Contractor, name of responsible principal, address and telephone number.
 - h. All contractors and manufacturers equipment warranties shall start at the acceptance of the project by the Owner.
 - i. Provide owner with contact information for warranties which extend beyond one year.

DD. RECORD DRAWINGS

1. The Contractor shall obtain at his cost, two sets of black-line prints of the original bid documents by the Owner. One set shall be kept on the site with all information as referenced below and shall update same as the work progresses. The other set will be utilized to record all field changes to a permanent record copy for the Owner.
2. If the Contractor elects to vary from the Contract Documents and secures prior approval from the Owner for any phase of the work, he shall record in a neat and readable manner, ALL such variances on the black-line print in red. The original blue lines shall be returned to the Owner for documentation.
3. All deviations from sizes, locations, and from all other features of the installations shown in the Contract Documents shall be recorded.
4. In addition, it shall be possible using these drawings to correctly and easily locate, identify, establish sizes of all piping, directions, and the like, as well as other features of the work which will be concealed underground and/or in the finished building.

5. Locations of underground work shall be established by dimensions to columns, lines, or walls, locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.
6. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases, this may be by dimension. In others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. The Owner's decision in this matter will be final.
7. The following requirements apply to all "As-Built" drawings:
8. They shall be maintained at the Contractor's expense.
9. All such drawings shall be done carefully and neatly, and in a form approved by the Owner.
10. Additional drawings shall be provided as necessary for clarifications.
11. These drawings shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by the Owner; and when necessary, to establish clearances for other parts of the work.
12. "As-built" drawings shall be returned to the Owner upon completion of the work and are subject to approval of the Owner.

EE. MANUFACTURER'S DIRECTION

1. The mechanical contractor shall install and operate all equipment and materials in strict accordance with the manufacturer's installation and operating instructions. The manufacturer's instructions shall become part of the Contract Documents and shall supplement the Drawings and Specifications.
2. Store equipment in a clean, dry place protected from other construction. While stored, maintain factory wrapping or tightly cover and protect equipment against dirt, water, construction debris, chemical, physical, or weather damage, traffic, and theft.

FF. DEMOLITION

1. This contractor shall do all demolition as shown on the plans. The contractor shall make the areas ready for the new construction work. All demolition debris, piping, equipment, etc., shall be removed from the site by this contractor. All demolition work shall be scheduled through the General Contractor to prevent interruption of any existing services. Do not start any demolition which would interrupt the building operation without scheduling with the Owner (schedule through the General Contractor).
2. The Owner shall retain first salvage rights to anything within the demolition area. If the Owner selected an item to be retained, then this contractor shall remove it with care and deliver the item to the Owner

designated location on site. Anything not retained by the Owner shall become the property of the contractor and be removed from the site.

GG. MATERIALS CONTAINING HAZARDOUS SUBSTANCES OR COMPONENTS

1. This contractor shall not provide any material or component of equipment which contains asbestos, lead based paint or PCBs. The contractor shall provide certificates or manufacturer's statements/letters to show that the products and/or building materials do not contain asbestos, lead based paint or PCBs.
2. If any product or building material is found to contain asbestos, lead based paint or PCBs, the contractor shall bear all cost for removal, abatement, and disposal of materials in accordance with all state and federal regulations. The contractor shall install replacement materials to the satisfaction of the Architect at no additional cost to the project.
3. During the construction, if the contractor suspects that any material in the building contains or is a hazard material (asbestos, lead, PCB, mercury, etc.) work shall be stopped to prevent disturbance and the Owner shall be notified immediately.

END OF SECTION 23 05 00

SECTION 23 05 03 - BASIC MATERIALS AND METHODS FOR HVAC

PART - 1 GENERAL

A. DESCRIPTION

1. Type of piping for various systems shall be as specified herein.
2. All pipe shall be true and straight without sags or traps.

PART - 2 MATERIALS

A. PIPE FITTINGS

1. All pipe fittings shall be same as piping specified unless indicated otherwise.
2. Fittings for refrigerant piping and other copper lines shall be solder type wrought copper, Nibco or equivalent.

B. PIPE SPECIALTIES

1. Dielectric unions shall be used between copper and iron pipe.

C. PIPE HANGERS AND SUPPORTS

1. This contractor shall furnish and install all foundations and supports required for his equipment unless indicated otherwise on the drawings.
2. This contractor shall furnish and install all escutcheons, inserts, thimbles, hangers, etc., required for the proper support and installation of his equipment and piping. Cooperate with other trades in locating and placing these items.
3. Provide sleeves for all pipes passing through walls, floors, beams, etc. Sleeves passing through structural members shall be of cast iron or Schedule 40 steel pipe unless other material is approved by the Structural Engineer. Sleeves passing through nonstructural walls or floors shall be of Schedule 10 galvanized iron. Joints between sleeves and pipes passing through floors shall be made watertight with plastic materials. Where pipes pass through floors shall be made watertight with plastic materials. Where pipes pass through waterproofing membrane, flashing sleeves shall be installed.
4. Provide malleable iron split ring hangers with rod supports throughout. Strap hangers or wire will not be accepted. Maximum spacing of hangers for cast iron pipes shall be 5 feet; for other than soil, use 10 feet.

5. Provide galvanized iron shields between hangers and pipe covering.
6. Provide chrome plated brass escutcheons wherever pipes pass through floors, walls or ceilings in exposed or finished areas.
7. All piping projecting from chases shall be rigidly supported in the wall or chase. Loosely supported piping or accessories will not be accepted.

D. MOTORS STARTERS AND ELECTRICAL WORK

1. The Mechanical Contractor shall furnish to Electrical Contractor for installation, all motor starters, start-stop push buttons and pilot lights for each piece of motor driven equipment unless shown otherwise.
2. The Electrical Contractor shall install all motor starters, start-stop push buttons and pilot lights as furnished by the Mechanical Contractor. The Electrical Contractor shall do all power wiring required for the installation of all mechanical equipment including equipment interlocking power wiring, etc. Temperature control wiring shall be furnished and installed by the Mechanical Contractor. All work shall be done in accordance with the National Electrical Code requirements and with wiring workmanship, etc., as called for in the Electrical Specifications. The Mechanical Contractor shall provide approved wiring diagrams of all equipment, controls, etc., to the Electrical Contractor for his installation. Coordinate all work to provide a complete system in working order. All wiring shall be plenum rated.
3. All electrical equipment shall have UL label or ETL label and shall meet the standards of the National Electrical Code and NEMA.
4. Mechanical contractor shall provide and install all duct detectors. The electrical contractor shall provide and install all wiring/interlocks with fire alarm.

E. ACCESS PANELS

1. Furnish and install access panels where valves, dampers, etc., are concealed in walls, ceilings, floors or otherwise inaccessible. Panels shall be Milcor, Babcock, Larsen, MIFAB, Acudor, Nystrom or equivalent. All access panels shall be minimum 18 inches X 18 inches hinged with flush latch and lock. The panels shall be primed and painted color as selected by Architect. Frame flange shall be minimum 1-1/2 inches wide. Rated panels shall have U.L. rating for type wall or ceiling where located.
2. Access panels located in rated walls, floors, or ceilings shall be so rated and installed per manufacturer's recommendations to maintain rated integrity.

PART - 3 EXECUTION

A. PIPING

1. Perforated strap hangers shall not be allowed for any part of the hangers.
2. Piping shall be installed as indicated on the drawings. Pipe shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. Care shall be taken not to weaken structural portions of the building. Above ground piping shall be run parallel with the lines of the building unless otherwise shown or noted on the drawings. Service pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 1/2 inch between finished covering and other work and not 1/2 inch between finished covering on the different services.
3. Expansion and contraction of piping: Allowance for expansion and contraction shall be made throughout. Sufficient flexibility shall be provided for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that the piping will spring enough to allow for expansion without straining.
4. Joints: Tubing shall be cut square, and butts shall be removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard drawn tubing when making connections. Installation shall be made by competent workmen in accordance with manufacturer's recommendation. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints for soldered fittings shall be made with a noncorrosive paste flux and solid string of wire solder. Cored solder will not be permitted.
5. Pipe sleeve, hangers, and fixture supports: These items shall be furnished and set and the contractor shall be responsible for their proper and permanent location.
 - a. Pipe sleeves - Install sleeves for all pipes passing through footings, floors, and walls. Clearance between sleeves and pipe covering and/or pipes shall be approximately 1/4 inch. Construction shall not be cut except where approved by the Architect. Where cutting of construction is permitted, the construction shall be repaired to match its original condition. Sleeves shall not be installed in structural members except where indicated. Sleeves are not required for wall hydrants.
 - 1) Install sleeves for pipes that pass through walls. Sleeves that pass through walls shall be cut flush with surfaces. The space between sleeves and pipe or covering shall be sealed with graphite packing and synthetic rubber caulking compound.
 - 2) Install sleeves where pipes pass through waterproofing membrane. The sleeves shall be provided with an integral flashing flange or a clamping device to which a 4 pound lead flashing shield shall be clamped or

soldered. The shield shall extend 12 inches from the pipe and shall be thoroughly mopped into the membrane. The space between the sleeve and pipe shall be made watertight by inserting an oakum gasket, filling the remaining space with lead, and thoroughly caulking.

- b. Threaded pipe - Support pipes at 7 foot intervals.
 - c. Copper tubing - Support tubing at not more than 5 foot intervals. Hangers for copper tubing except where protective shields are installed shall have proper size rings to suit outside diameter of tubing and the hangers or supports shall be copper or copper plated at contact surfaces.
 - d. Underground piping - Lay pipe on a firm bed for its entire length, except where support is otherwise provided.
 - e. Vertical piping - Supports shall be at each floor. Horizontal piping Hangers and supports shall be installed at locations not more than 3 feet from the end of each run out. A hanger shall be installed not over 1 foot from each change in direction of piping.
6. Unions: Make connections to equipment and branch mains with unions. Provide nonconducting type connections wherever jointing dissimilar metals in open systems. Brass adapters and valves are acceptable.

END OF SECTION 23 05 03

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART - 1 GENERAL

A. RELATED DOCUMENTS

1. All Division 23 Specification Sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.

B. SCOPE OF WORK

1. The Mechanical Contractor shall obtain the services of an independent test and balance company which specializes in the testing and balancing of heating, ventilating and air conditioning (HVAC) systems to test, adjust and balance all HVAC systems in the building(s). These services shall not be provided by the installing mechanical contractor on the project but shall be a direct subcontractor of the mechanical contractor.
 - a. Agency shall provide proof of having successfully completed at least five projects of similar size and scope. Work by this Agency shall be done under direct supervision of a qualified Heating and Ventilating Technician employed by Agency.
 - b. Instruments used by Agency shall be accurately calibrated and maintained in good working order.
 - c. If requested, conduct tests in presence of Engineer.
 - d. Agency shall be approved in writing by Engineer. Mechanical Contractor shall not be permitted to do this work. Submit qualifications for review.
2. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these Specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. Refer to Plumbing Division 22 for additional work required of Air System Test and Balance agency.
3. Representatives of the test and balance company shall visit the job site to review the installation. After each site visit, the test and balance company shall report to the Architect any items that are not installed properly, are missing from the Contract Documents or items that are required to enable him to perform the testing and balancing of the HVAC systems as per normal standard practice. After review, the Architect shall instruct the contractor to implement the recommendations at no additional cost to the Owner if these items were specified in the original scope of the project.
4. Upon completion of the HVAC system installation, the test and balance company

shall perform all testing and balancing with the full cooperation of the contractor and his subcontractors. The contractor shall make changes and/or adjustments to the HVAC system components that are required by the test and balance company to accomplish proper balancing. The TAB agency shall not supply or install any materials or balancing devices such as pulleys, drives, belts, etc. All of this work by the contractor shall be performed at no additional cost to the Owner.

5. **Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two (2) copies of air balancing test report.**
6. The test and balance report shall be submitted to the Architect for review by his Mechanical Engineer. If the Mechanical Engineer agrees with the report, he shall sign it and return it to the Architect. If he does not concur with the report, he shall meet with the Test and Balance Company to determine what needs to be done to obtain a properly balanced system.
7. After the Mechanical Engineer signs the testing and balancing report, the Test and Balance Company shall supply four (4) copies of the final and complete report to the Architect for inclusion in the Operation and Maintenance Manuals.
8. The items requiring testing, adjusting, and balancing include (but are not restricted to) the following:
9. AIR SYSTEMS:
Variable Volume Fan Powered Box
Branch and Main Ducts
Diffusers, Registers, Grilles,
Electric Strip Heaters
(Air Temperatures)

C. SCHEDULING

1. Contractor shall award test and balance contract to approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.

D. DEFINITIONS, REFERENCES, STANDARDS

1. All work shall be in accordance with the latest edition of the Associated Air Balance Council (AABC) National Standards or the latest standards of the National Environmental Balancing Bureau (NEBB). If these contract documents set forth more stringent requirements than the AABC National Standards or the NEBB Standards, these contract documents shall prevail.

E. QUALIFICATIONS

1. Agency Qualifications: The TAB agency shall be a current member of the AABC, NEBB or TABB.
2. Prior to working on this project, the technicians shall attend training provided by the manufacturer of the various equipment on this project on the specific aspects of balancing the equipment. Include letters or certificates from the manufacturer on attendance and satisfactory completion of the factory training. These certifications may be used for continuing education. At a minimum, the technicians shall receive training from the air distribution equipment manufacturer, air terminal unit manufacturer, air unit manufacturer, pump manufacturer, air cooled chiller manufacturer and temperature controls manufacturer. This should be done prior to any equipment start-ups.
3. Although acceptable to be bidding the project the TAB agency shall provide qualifications and certifications to provide the required services.

F. SUBMITTALS

1. Qualifications: The TAB agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency's test and balance engineer or technician certificate.
2. Procedures and Agenda: The TAB agency shall submit the TAB procedures and agenda proposed to be used.
3. Sample Forms: The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards or the NEBB Standards.
4. Submit continuing education training on each lead technician working on the project.

G. TAB PREPARATION AND COORDINATION

1. Shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work shall be provided when available and no later than 30 days prior to the start of TAB work.
2. System installation and equipment startup shall be witnessed by the TAB agency. The TAB Agency's final Test and Balance shall begin when all factory start-ups are complete.
3. The building control system (BCS) contractor shall provide and install the control

system, including all temperature, pressure and humidity sensors. These shall be calibrated for accurate control. If applicable, the BCS contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution. The BCS contractor shall provide all necessary software to the TAB Agency at no additional cost.

4. All test points, balancing devices, identification tags, etc., shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.
5. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.
6. If, upon commencing the work, the TAB contractor finds that the systems are not ready, or if a dispute occurs as to the readiness of the systems, the TAB contractor may request an inspection to be made by the Designer's Mechanical Engineer. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for testing and balancing. Items that are determined to be not ready for testing and balancing shall be completed by the Mechanical Contractor and placed in operational readiness before TAB services are again requested.

H. TAB REPORTS

1. Final TAB Report: The TAB agency shall submit the final TAB report for review by the Engineer. On plans provided, all outlets, devices, HVAC equipment, etc., shall be identified, along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC or NEBB "National Project Performance Guaranty" assuring that the project systems were tested, adjusted and balanced in accordance with the project Specifications and AABC or NEBB National Standards.
2. Submit four (4) copies of the final TAB report to the Architect for inclusion in the Operation and Maintenance Manuals.

PART - 2 INSTRUMENTATION

- A. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC or NEBB National Standards.

PART - 3 EXECUTION

- A. GENERAL

1. Mechanical Contractor shall put heating, ventilating, and cooling systems and equipment into full operation and continue their operation during each working day of testing and balancing.
2. Air Balance and Testing Agency shall perform tests specified, compile test data, and submit four (4) copies of complete test data to contractor for forwarding to Engineer for evaluation and approval.
 - a. Approved copies of report shall be bound in Operations and Maintenance manuals.
3. System shall be completely balanced and all reports submitted to Engineer prior to prefinal inspection.
4. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC or NEBB National Standards. Adjustment tolerances shall be + or -10 percent unless otherwise stated.
5. Equipment settings, including manual damper quadrant positions, valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.
6. All information necessary to complete a proper TAB project and report shall be per AABC or NEBB standards unless otherwise noted. The descriptions of work required, as listed in this section, are a guide to the minimum information needed.
7. TAB contractor shall cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. Upon completion, patch insulation, ductwork and housings using materials identical to those removed. Seal insulation to reestablish integrity of the vapor barrier.
8. TAB work shall include additional inspection and adjustment of components during the season following the initial balance to include re- balance of any items influenced by seasonal changes or as directed by the Owner.

B. AIR SYSTEMS

1. TESTING PROCEDURE
Air Balance and Testing Agency shall perform following tests and balance system in accordance with following requirements. Perform the following tests at high and low speeds of multi-speed systems and single speed system.
 - a. **Make periodic inspections of the installation of the systems. Provide**

reports of each inspection. Inspections should be monthly when ductwork installation begins. Coordinate and verify the installation of all balancing dampers, fire dampers, etc.

- b. Smoke test or pressure test each low pressure steel duct system to test for air tightness. Use zinc chloride smoke candles or titanium tetrachloride ampules (sticks) to generate smoke.
 - 1) If ducted systems leak, do not continue with air balance. Report findings to Engineer in writing and begin testing again after Mechanical Contractor has repaired ducts or applied duct sealers.
 - 2) If ducted systems appear air tight, proceed with air balance procedure as outlined below.
 - 3) Include in air balance report a letter indicating smoke testing has been accomplished and a report of findings regarding airtightness of each ducted system.
 - 4) Maximum leakage loss shall not exceed 2 percent. If losses are greater, the Mechanical Contractor shall correct the leakage, then the test and balance agency shall retest the ductwork.
- c. Test and adjust blower rpm to design requirements.
- d. Test and record motor full load amperes.
- e. Make Pitot Tube traverse of main supply and return and obtain design cfm.
- f. Test and record system static pressures, suction, and discharge.
- g. Test and adjust system for design cfm air.
- h. Test and adjust system for design cfm outside air.
- i. Test and record entering air temperatures (db heating and cooling).
- j. Test and record entering air temperatures (wb cooling).
- k. Test and record leaving air temperatures (db heating and cooling).
- l. Test and record leaving air temperatures (wb cooling).
- m. Adjust main supply and return air ducts to proper design cfm.
- n. Adjust zones to proper design cfm, supply and return.
- o. Test and adjust each diffuser, grille, and register to within 10 percent of design requirements.
- p. Identify each diffuser, grille, and register to location and area.
- q. Identify and list size, type, and Manufacturer of diffusers, grilles, registers, and testing equipment. Use Manufacturer's rating on equipment to make required calculations.
- r. In readings and tests of diffusers, grilles, and registers, include required fpm velocity and test fpm velocity and required cfm and test cfm after adjustments.
- s. In cooperation with Mechanical Contractor, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.
- t. Adjust diffusers, grilles, and registers to minimize drafts.
- u. Verify the calibration of temperature control devices, thermostats, etc.
- v. Verify all control sequences with specifications.
- w. Include manufacturer's performance data with reports.
- x. Schedule three (3) inspections to verify original test and balance of systems within 90 days of acceptance by Owner. Make opposite season adjustment and

inspection of systems at one year after acceptance by Owner. Submit reports after each inspection. Submit schedule as part of initial report. Submit schedules as part of initial report.

2. Where systems supplied to job site provides over 5 percent more air than schedule requirements, rooms supplied by that system shall have their supply air quantities increased by the ratio of the actual total air quantity supplied to the minimum air quantity required by the schedule.
3. The TAB agency shall verify that all ductwork, splitters, extractors, dampers, grilles, registers, and diffusers have been installed per design, are functional and set full open. Any leakage in the ductwork shall be repaired prior to the test. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards or NEBB Standards:
 - a. Fans
 - 1) Fan Speeds--Test and adjust fan RPM to achieve design cfm requirements.
 - 2) Current and Voltage--Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
 - 3) Pitot-Tube Traverse--Perform pitot-tube traverse of the main ducts to obtain total CFM. If a pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet.
 - 4) Static Pressure--Test and record system static pressure, including the static pressure profile of each fan.
 - b. Zone, Branch, and Main Ducts
 - 1) Adjust ducts to within design cfm requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
 - c. Diffusers, Registers, and Grilles
 - 1) Tolerances--Test, adjust, and balance each diffuser, grille, and register to within 10 percent of design requirements. Minimize drafts.
 - 2) Identification--Identify the type, location, and size of each grille, diffuser and register. This information shall be recorded on air outlet data sheets.

C. ADDITIONAL TAB SERVICES

1. Job Site Inspections:

During construction, the TAB agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems. The TAB agency shall submit a written report of each inspection to the Architect.

2. Duct Leakage Testing:
The Installing Contractor shall isolate and seal sections of ductwork for testing. The pressurization fan and test apparatus shall be connected to the test section and the test performed. The test pressure required and the amount of duct to be tested shall be described by the engineer in the appropriate duct classification section. All testing shall be based on one test per section.
3. Verification of HVAC Controls:
 - a. The TAB agency shall be assisted by the building control Systems Contractor in verifying the operation and calibration of all HVAC and temperature control systems. The following tests shall be conducted:
 - b. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freeze stats, and other safety devices.
 - c. Verify that all controlling instruments are calibrated and set for design operating conditions.
4. Temperature Testing: To verify system control and operation, a series of three (3) temperature tests shall be taken at approximately 2 hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than 2 degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods.
5. TAB Report Verification: At the time of final inspection, the TAB agency may be required to recheck, in the presence of the Owner's representative, specific and random selections of data, air quantities, and air motion recorded in the certified report. Points and areas for recheck shall be selected by the Owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, will not exceed 10 percent of the total number tabulated in the report.

END OF SECTION 23 05 93

SECTION 23 07 00 - MECHANICAL INSULATION

PART - 1 GENERAL

A. DESCRIPTION

PART - 2 MATERIALS

A. AIR CONDITIONING DUCTWORK

1. All supply duct shall be internally lined.

B. INSULATION BANDS

C. FLANGES, VALVES AND FITTINGS

PART - 3 INSTALLATION

- A. Provide clearance for installation of insulation and for access to valves, air vents, drains and unions.
1. Insulation Installation:
 - a. Do not install covering before piping has been tested and approved.
 - b. Ensure piping surface is clean and dry prior to installation.
 - c. Ensure insulation is dry before and during application.
 - d. Insulation shall be continuous through walls, floors and ceiling. Pack around pipes with fire proof self-supporting insulation material, fully sealed.
 - e. Insulate fittings and valves. The end of the insulation shall be fitted with a metal escutcheon plate with set screw or taped neatly with pressure sensitive fiberglass reinforcing cloth.
 - f. All joints shall be sealed with 3 inch wide fiberglass reinforcing cloth with pressure sensitive adhesive.
 - g. Pipe insulation at Hangers and Supports: Pipe insulation at hanger and support shall be protected with a half circular shield of the size of the insulation and 12 inches long constructed from 20 gauge galvanized steel. The shield shall be held in place with the fiberglass reinforcing cloth and pressure sensitive adhesive. Where pipes pass through walls, ceiling and floor in finished areas, escutcheon plates shall be installed to encompass pipe and insulation. Escutcheon plates shall be chromed brass or stainless steel and shall be either solid or the clamp on split type.
 - h. Painting of fiberglass pipe jacket is not required. Piping shall be painted colors as standard in this facility.

END OF SECTION 23 07 00

SECTION 23 30 00 - AIR DISTRIBUTION FOR HVAC

PART - 1 GENERAL

A. GENERAL

1. Furnish and install all ducts for Air Conditioning, Heating, and Ventilating Systems as shown on the plans and as may be required to provide complete system. Ductwork shall be complete with grilles, vanes, flashings, hangers, flexible connections, splitters, manual dampers, fresh air inlets, louvers, reinforcing angles, etc. All ductwork shall be concealed and insulated as hereinafter specified.

B. COORDINATION

1. The General Contractor and Mechanical Contractor shall coordinate the space clearances required for ductwork with the structure, ceilings, lights, sprinklers, etc. In some cases, due to space limitations, it may be necessary to re-size ductwork to meet the conditions of the project. Any re-sizing required shall be part of this project and done without any additional cost to the project. DO NOT MAKE DUCTWORK WITHOUT COORDINATION.

PART - 2 MATERIALS

A. DUCT HANGERS AND SUPPORTS

1. All ductwork shall be properly braced to prevent rattling, breathing, or other unnecessary noise. No sharp edges or obstructions shall project into air stream.

B. LOW PRESSURE DUCTWORK

1. All ductwork shall be galvanized steel and shall be of gauges and construction as recommended by ASHRAE Guide and Data Book and SMACNA guidelines. Gauges are as follows with longest side governing.

Dimension of longest side Sheet Metal Gauge	Low Pressure Ductwork
0"-12"	26 gauge
13"-30"	24 gauge
31"-54"	22 gauge
55"-84"	20 gauge

2. Low pressure ductwork shall be all exhaust ducts, return air ducts, fresh air ducts and supply ducts.
3. Joints and reinforcing shall be as per ASHRAE Guide and Data Book and all slips shall be installed without edge of internal part of slip facing downstream.
4. Construction standard of Article 110, of the National Board of Fire Underwriters Bulletin 90, latest edition, shall apply throughout.
5. Flashings shall be of sheet copper and shall be furnished and installed around all outside openings used for ducts of fans and wherever required. Roof flashings shall extend at least 8 inches above roof.
6. All ducts shall be straight and true and installed in a neat and workmanlike manner.
7. All edges shall be straight and true and all bends shall be made with veined turns. Where long radius turns cannot be used, the contractor shall use square turns and use air splitters spaced not more than 3 inches center to center, and of a length so air will be properly distributed over ducts.
8. All ducts shown are metal to metal dimensions.
9. Mastic shall be applied to both male and female connections (all seams and joints) to make all duct joints air tight (applies to all ductwork; round or rectangular). Surplus mastic shall be removed. Tape and re-mastic joints if necessary. Mastic (hard-cast or equivalent duct sealer: tape not acceptable) shall be applied to the joints during assembly so that sealant is on all mating surfaces of the joint.

C. DUCT LINERS

1. Ductwork shall be lined with 1 inch thickness black neoprene coated glass fiber duct lining, where specified on plans. Lining material to be as made by Knauf, Johns Manville, Owens Corning or approved equivalent. Sheet Metal Contractor shall exercise care in cutting and fitting lining material to interior of duct. Cuts should be sharp and clean with joints and fits tight. Lining material is to be applied by buttering on back and edges of sheets with 1/8 inch FC-104 or equivalent, waterproof duct lining cement, cement applied with serrated trowel or similar tool so a grooved application of cement results. Lining material shall be treated with an anti-microbial growth agent compliant with ASTM C1338, G21, G22.
2. Lining material is to be further secured in place with sheet metal screws or grip nail fasteners automatic machine installed (no magnetic hammer) on 12 inch to 18 inch centers. These screws shall run from outside of duct through lining material and into rectangular sheet metal caps held in place against inside face of lining material.

D. FILTERS--PRIMARY

E. DUCT ACCESSORIES

1. Dampers of the fusible link operated type shall be provided in all ductwork passing through floor or fire walls.
2. Provide quadrant or adjustable splitters and mark shaft to give position of splitter damper in duct.
3. Provide vanes behind every supply grille or diffuser. Splitters shall be provided where shown on plans and where located in concealed non-accessible space provided Young Regulators to operate splitter. Vanes shall be Tuttle and Bailey "Ducturns", Barber-Coleman, Uniflo, or equivalent. Shop fabricated vanes will be acceptable. All dampers shall be constructed of 14 gauge steel.

F. GRILLES AND DIFFUSERS

1. Ceiling supply outlets, unless otherwise indicated on plans shall be Anemostat/Waterloo, Metalaire, Krueger, Titus, Price, Nailor or approved equal. Outlets shall be mounted tight to the construction and shall have frame suitable for type of ceiling used unless otherwise noted.
2. Return air grilles shall be as manufactured by Anemostat/Waterloo, Krueger, Metalaire, Titus, Price, Nailor or approved equivalent and shall be of style called for on plans.
3. All supply outlets shall have sponge rubber gaskets.
4. All grilles, diffusers, and registers shall be of sizes indicated on plans or scheduled on drawings.
5. Unless otherwise shown on drawings, all grilles installed in the ceiling shall be furnished with white baked-on enamel finish.

G. PRE-INSULATED FLEXIBLE DUCT

1. Flexible duct shall be rated for a maximum pressure of 16 inches (4-10 inches I.D.) or 10 inches (12-16 inches I.D.) water column positive pressure and 2 inches water column maximum negative pressure and 6000 FPM maximum velocity and listed by Underwriters Laboratories, Inc. under UL Standard 181 as a Class 1 air duct complying with NFPA Standards 90A and 90B. Flexible air duct shall be factory-

made and composed of an inner duct of woven and coated fiber glass fabric providing an air seal and permanently bonded to coated steel wire helix, a fiber glass insulating blanket with minimum R-6.0 value (minimum 2 inch thickness) and low permeability outer vapor barrier of fiberglass reinforced metalized film laminate. Flexible air ducts shall be Thermaflex MK-C or Flexmaster type 4M. Maximum installed length shall not exceed 3 feet-0 inches without approval.

PART - 3 INSTALLATION

A. DUCTS

1. Ductwork shall be constructed and installed as follows:
 - a. Straight and smooth on inside with joints neatly finished unless otherwise directed.
 - b. Duct panels through 48 inch dimension having acoustic duct liner need not be Cross broken or beaded.
 - c. Cross break unlined ducts and duct panels larger than 48 inches or bead 12 inches on center.
 - d. Securely anchor ducts to building structure with specified duct hangers attached with screws.
 - e. Brace and install ducts so they shall be free of vibration under all conditions of operation.
 - f. Ducts shall not bear on the top of structural member.
 - g. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on Drawings.
 - h. Properly flash where ducts protrude above roof.
 - i. Install internal ends of slip joints in direction of flow. Make joints air tight using specified duct sealer.
2. Install flexible duct connections to each air handling unit.
3. Provide each take-off with an adjustable volume damper to balance that branch.
 - a. Anchor dampers securely to duct.
 - b. Install dampers in main ducts within insulation.
 - c. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened.
 - d. Where concealed ceiling damper regulators are installed, provide a cover plate.
4. Install grilles, registers, and diffusers.

B. AIR TURNS

1. Permanently installed, consisting of curved metal blades or vanes arranged to

permit air to make abrupt turn without appreciable turbulence, in elbows of supply and above ground return ductwork.

2. Air turns shall be quiet and free from vibration when system is in operation.

END OF SECTION 23 30 00

SECTION 26 01 00 – ELECTRICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The General Conditions and all pertinent sections are part of this specification, and the Contractor shall consult them in detail in instruction pertaining to this work. He shall consult all other sections of the specifications to determine if he is required to perform any work related to that particular section.

1.2 SCOPE OF WORK

- A. The work contemplated under this specification comprises the furnishing of all labor and material required and necessary for the complete installation of electrical wiring in conduit for lighting control and power from existing panelboards to each ultimate outlet hereinafter specified and/or shown on the accompanying drawings. Said work shall be done in accordance with the latest edition of the National Electrical Code, NFPA codes and all local codes and ordinances. The specifications are intended to describe a complete workable system and bidders shall report any discrepancies or omissions preventing such workability prior to the time of the bids are submitted.
- B. The work covered by this specification shall be shown on plans and called for herein, and shall be comprised generally of the following:
 - 1. Furnish and install all conduit and wiring raceways, conductors, disconnects, panels, etc.
 - 2. Furnish and install feeders and branch circuits.
 - 3. Furnish and install service to all mechanical devices.
 - 4. Furnish and install light fixtures, power outlets, and all other electrical devices shown on plans.
- C. All equipment installed by this contractor shall be installed in strict accordance with instructions of the manufacturer.
- D. He shall install his work to meet existing conditions as found at the building site.
- E. The Electrical Contractor shall refer to the Architectural and Structural details for information in regard to the Architectural details. His work shall be done in strict accordance with local and state ordinances governing this class of work.

1.3 REJECTED WORK AND MATERIALS

- A. Should contractor introduce any materials different from those called for and described in specifications are shown on plans, it must on notification from the engineers, be immediately removed from building or premises.

1.4 SHOP DRAWINGS

- A. Before proceeding with work and/or within thirty (30) days award of the General Contract for this work, the Electrical Contractor shall furnish to the Architect/Engineer, complete shop and working drawings of such apparatus, equipment, controls insulation, etc. to be provide in this

project. These drawings shall give dimensions, weights, mounting data, performance curves, and other pertinent information. Shop drawings to be submitted as listed below.

1. Panels/Panelboards/Switchboards.
2. Disconnects.
3. Lighting Fixtures.
4. Conduit Fittings.
5. Electrical Devices.

- B. The contractor may be required to submit shop drawings on any other material he supplies in construction of this project. These drawings shall be submitted at time requested by Architect/Engineer.

1.5 ADDITIONS AND CHANGES

- A. The accompanying drawings show approximate location of feeders, branch circuits, light and power circuits, etc. Complete and accurate details in regard to locations of outlets, apparatus, etc. from location shown shall be made before roughing-in and without additional cost to the owner.

1.6 STANDARDS AND WORKMANSHIP

- A. All material shall be new and listed by UL as conforming to its standards. Work shall be executed in a workmanship manner and present a neat, finished appearance when completed.

1.7 PRIOR APPROVAL AND DRAWINGS

- A. Whenever manufacturers or trade names are mentioned in these plans or specifications, the words "or approved equivalent" shall be assumed to follow whether or not so stated. Manufacturers or trade names are used to establish a standard of quality only and should not in any way be construed to infer a preference. Equivalent products which meet the Engineer's approval will be accepted, however these products must be submitted to the Engineer a minimum of ten (10) days prior to bid date. Submission shall be included manufacturer's name, model number, rating table and construction features. Upon receipt and checking of this submittal, the Architect will issue an addendum listing items which are approved as equivalent to those specified. The Contractor shall base his bid solely on the items specified or included in the "Prior Approval Addendum" as no other items will be acceptable. Prior approval of a particular piece of equipment does not mean automatic final acceptance and will not relieve the Contractor of the responsibility of assuring himself that this equipment is in complete accord with plans and specifications and will fit into the space provided. Submit shop drawings on all items of equipment for approval as hereinafter specified. The Engineer's approval of shop drawings shall not relieve the Contractor from the responsibility of incorrectly figured dimensions or any other error that may be contained in these drawings. The omissions from the shop drawings, or

specifications, even though approved by the Engineer, shall not relieve this Contractor from furnishing and erecting same.

- B. All prior approvals must be submitted to purchasing as indicated in the front end specifications.

1.8 GAURANTEE

- A. The Contractor for this work shall be required to keep the work installed by him in repair and perfect working order for one (1) year from date of completion and final acceptance; said guarantee shall be based on defective materials and substandard workmanship. Contractor shall furnish, free of cost to owner, all materials and labor necessary to comply with this guarantee.

1.9 LAWS, PERMITS AND INSPECTIONS

- A. This contractor shall at his own cost obtain all necessary permits, pay all legal feed and charges and comply with all building and safety laws, ordinances and regulations relating to the building and the public health and safety, including NEC, NFPA, IBC, AND OSHA.
- B. Pay any and all fees required by local electric utility company to obtain electrical services outlined.

1.10 TESTS

- A. After installation is complete and at such time as the Engineers may direct, Contractor shall conduct an operating test for approval. Equipment shall be demonstrated to operate in accordance with requirements of this specification. The test shall be performed in the presence of Engineers. Contractor shall furnish all instruments and personnel required for the test.

1.11 CUTTING AND PATHNG

- A. Contractor shall do all cutting and patching where necessary at his own expense with approval of the Engineers as to cutting of any structural beams or joists, but all patching shall be done by crafts whose work is involved. After initial surfacing has been done, all further cutting, patching, and painting shall be done at this contractor's expense.

1.12 SAFETY PRECUATIONS

- A. Contractor shall furnish and place proper guards for prevention of accidents. He shall provide and maintain any other necessary construction required to secure safety of life or property, including maintenance of sufficient lights during all night hours to secure such protection.
- B. Temporary electrical services shall be provided by electrical contractor during construction and shall be maintained in perfect condition. Frayed, loose or opened connections shall not be used for temporary services. The Electrical Contractor shall use only equipment in first class working conditions for construction services. Contractor shall not use electrical services at existing area for construction unless otherwise authorized by owner.

1.13 SUPERVISION

- A. Contractor shall personally, or through an authorized and competent representative, constantly supervise the work done from beginning to completion and final acceptance. To the best of his ability, he shall keep the same foreman and workmen throughout the project duration. During the progress of work, it shall be subject to inspection by the representatives of the Engineers, and at these times, the contractor shall furnish the required information.

1.14 INSERTS AND OPENINGS.

- A. Contractor shall furnish and install all inserts and hangers required to support conduit, cables, wireways, disconnect switches, etc.

1.15 OPENINGS THROUGH WALLS AND FLOORS

- A. Provide all slots, sleeved holes, and other openings necessary through walls and floors, and through any other parts of the structure. Where conduits pass through walls which are intended as rated fire walls, leave-outs, penetrations, or sleeves shall be sealed so as not to interfere with the rating of the wall.

1.16 BACKFILLING

- A. Contractor shall be responsible to backfill any trenches for electrical runs under the building, paving, or any area of the site by backfilling the bottom of the trench-up to the top of the conduit with sand, then placing compact fill in 6" layers using power tamping equipment.

1.17 RECORD DRAWINGS

- A. The Contractor shall be provided with a set of prints of the original bidding documents by the Architect. The Contractor Shall then have a set of sepia (reproducible plans) made.
- B. If the Contractor elects to vary from the contract documents and secures approval from the Architect for any phase of work, he shall record in a neat and readable manner, ALL such variances on the print in red. These changes shall be then transferred to the permanent set (sepia) at the completion of the job. Both the sepia and the original print shall be returned to the Engineer for documentation.
- C. All deviations from sizes, locations and from all other features of the installations shown in the Contract Documents shall be recorded.
- D. In addition, it shall be possible using these drawings to correctly and easily locate, identify and establish sizes of all piping, directions, and the like, as well as other features of work which will be concealed underground and/or in the finished building. Locations of underground work shall be established by dimensions to columns, lines, or walls, locating all turns, etc., and by properly referenced centerline.
- E. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases, this may be dimensions. In others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. Architect's/Engineer's decision in this matter will be final.
- F. The following requirement apply to all "record" drawings:
 - 1. The shall be maintained at the contractor's expense.

2. All such drawing shall be done carefully and neatly and, in a form, approved by the Engineer.
3. Additional drawings shall be provided as necessary for clarification.
4. They shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by Engineer and when necessary, to establish clearances for other parts of the work.
5. "Record" drawings shall be returned to the Architect/Engineer upon completion of the work and are subject to approval of the Engineer.
6. The Contractor shall refer to the Architectural section under "RECORD DRAWINGS" for further requirement and procedures.

END OF SECTION 26 01 00

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 1. Raceways.
 2. Building wire and connectors.
 3. Supporting devices for electrical components.
 4. Electrical identification.
 5. Electricity-metering components.
 6. Concrete equipment bases.
 7. Electrical demolition.
 8. Cutting and patching for electrical construction.
 9. Touchup painting.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquid tight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
 - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished.
 - 1. Coordinate installation and connection of exterior underground utilities and services, including provision for electricity-metering components.
 - 2. Comply with requirements of authorities having jurisdiction.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Specification Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 PRODUCT

- A. EMT: ANSI C80.3, zinc-coated steel, with compression fittings.
- B. FMC: Zinc-coated steel.
- C. IMC: ANSIC80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.

- F. Raceway Fittings: Specifically designed for the raceway type with which used.

2.2 CONDUCTORS

- A. Conductors, No. 10 AWG and Smaller: Solid copper.
- B. Conductors, larger than No. 10 AWG: Standard copper.
- C. Insulation: Thermoplastic, rated at 75 deg C minimum.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

2.3 SUPPORTING DEVICES.

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs.
- D. Slotted-Steel Channel Supports: Comply with Specification Section "Metal Fabrications" for slotted channel framing.
 - 1. Channel Thickness: Selected to suit structural loading.
 - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Nonmetallic Channel and Angle Systems: Structural-grade, factor-formed, glass-fiber-resin channels and angles with 9/16-inch-diameter holes at maximum of 8 inches o.c., in at least one surface.
 - 1. Fittings and Accessories: Products of the same manufacturer as channels and angles.
 - 2. Fittings and Accessory Material: Same as channels and angles, except metal items may be stainless steel.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- H. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- I. Expansion Anchors: Carbon-steel wedge or sleeve type.
- J. Toggle Bolts: All-steel springhead type.

- K. Powder-Driven Threaded Studs: Heat-treated steel.

2.4 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A 13.1, NFPA 70, and these specifications.
- B. Raceway and Cable Labels: Comply with ANSI A 13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
 - 1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
 - 2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather, and chemical resistant coating.
 - 3. Color: Black letters on orange background.
 - 4. Legend: Indicates voltage.
- C. Colored Adhesive marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.
- D. Underground Warning Tape: Permanent, bright colored, continuous printed, vinyl tape with the following features:
 - 1. Not less than 5 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend that indicates type of underground line.
- E. Tape Markers for Wire: Vinyl or vinyl-coated, self-adhesive, wraparound type with preprinted numbers and letters.
- F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suite coding scheme.
- G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminated punch or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.
- H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finished signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- I. Exterior Warning and Caution Signs: comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.
- J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws, or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.5 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section “Cast-in-Place Concrete.”
- B. Concrete: 4000-psi, 28-day compressive strength as specified in Division 3 Section “Cast-in-Place Concrete.”

2.6 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer’s paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommend by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Temperature ratings of all equipment lugs and terminations shall be compatible with those of the wire or cable per NEC 110-14(C) and 110-40 as applicable.
- B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange, and install components and equipment to provide the maximum possible headroom.
- C. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.3 RACEWAY APPLICATION

- A. Use the following raceways for outdoor installations:

1. Exposed: IMC or Rigid Steel.
2. Concealed: IMC or Rigid Steel.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment: LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

B. Use the following raceways for indoor installation:

1. Exposed: EMT.
2. Concealed: EMT.
3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
4. Damp or Wet Locations: IMC.
5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.4 RACEWAY AND CABLE INSTALLATION

- A. Concealed raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceways runs above water and steam piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- F. Install raceways below slab foundations and leave at least 6-inch bury depth below vapor barrier. Compact as per specifications in 6-inch layers using power tamping equipment.
- G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel monofilament plastic line with no less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.
- H. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install FMC in wet or damp locations. Install separate ground conductor across flexible connections.
- J. Set floor boxes level and rim after installation to fit flush to finish floor.

3.5 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS.

- A. Feeders: Type THHN/THWN insulated conductors in raceway.
- B. Underground Feeders and Branch Circuits: Type THWN.
- C. Branch Circuits: TYPE THHN/THWN insulated conductors in raceway, 3/4" minimum conduit when raceways below grade.
- D. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1,2, and 3, unless otherwise indicated.

3.6 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- B. Install wiring at outlets with at least 8-inches of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.7 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Selection of Supports: Comply with manufacturer's written instructions.
- D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four: minimum of 200-lb design load.

3.8 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.

- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.
- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
 - 1. Wood: Fasten with wood screws or screw-type nails.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.9 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designation used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout project.

- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:
 - 1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.
- G. Color-code 208/120 volt system secondary service feeder and branch-circuit conductors throughout the secondary electrical system as follows:
 - 1. Phase A: Black.
 - 2. Phase B: Red.
 - 3. Phase C: Blue.
 - 4. Neutral: White.
- H. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- I. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.10 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Specification Section "Firestopping."

3.11 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Specification Section "Cast-in-Place Concrete."

3.12 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.13 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
 - 1. Raceways.
 - 2. Building wire and connectors.
 - 3. Supporting devices for electrical components.
 - 4. Electrical identification.
 - 5. Electricity-metering components.
 - 6. Concrete bases.
 - 7. Cutting and patching for electrical construction.
 - 8. Touchup painting.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.
 - 1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
 - 2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
 - 3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
 - 4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
 - 5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.14 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Specification Section "Painting."
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.15 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 00

SECTION 26 05 19 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where paragraph titles below introduce lists, the following requirements apply for product selection.
 - 1. Manufacturers: Subject to compliance with requirements, provided products by the manufacturer specified.

2.2 CONDUCTORS AND CABLES

- A. Manufacturers:
 - 1. American Insulated wire Corp.: a Leviton company.
 - 2. General Cable Corporation.
 - 3. Southwire Company.
 - 4. AFC Cables
 - 5. Kaf Tech Cables
 - 6. Burndy Corp.
- B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

- C. Conductor Material: Copper, solid conductor for No. 10 AWG and smaller, stranded for no. 8 AWG and larger.
- D. Conductor Insulation Types: Type THHN-THWN complying with NEMA WC 5.

2.3 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Feeders below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- G. Branch Circuits below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.
- I. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable in raceway.
- J. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- K. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."
- F. Seal around cables penetrating fire-rated elements according to Specification Section "Through-Penetration Firestop Systems."
- G. Identify and color-code conductors and cables according to Division 16 Section "Electrical Identification."
- H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 8 inches of slack.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.4 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Data: For the following:
 - 1. Ground rods.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- D. Field Test Reports: Submit written test reports to include the following.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed test and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 1. Comply with UL 467.
- C. Comply with NFPA 70: for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

- D. Comply with NFPA 780 and UL 96 when interconnection with lighting protection systems.

PART 2 - PRODUCTS

2.1 MANUFACTURES

- A. Manufactures: Subject to compliance with requirements, provide products by on of the following:
 - 1. Grounding Conductors, Cables, Connectors, and Rods.
 - a. Apache Grounding/Erico Inc.
 - b. Boggs, Inc.
 - c. Chance/Hubell
 - d. Copperweld Corp.
 - e. Dossert Corp.
 - f. Erico Inc.: Electrical Group.
 - g. Framatome Connectors/Burndy Electrical.
 - h. Galvan Industries, Inc.
 - i. Ideal Industries, Inc.
 - j. ILSCO.
 - k. Kearney/Cooper Power Systems.
 - l. Korn's: C.C. Korn's Co.: Division of Robroy Industries.
 - m. Lyncole XIT Grounding.
 - n. O-Z/Gedney Co.: a business of the EGS Electrical Group.
 - o. Raco, Inc.; division of Hubell.
 - p. Salisbury; W.H. Salisbury & Co.
 - q. Superior Grounding Systems, Inc.
 - r. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."
- B. Material: Copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.
- E. Grounding Electrode Conductors: Stranded cable.
- F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.
- G. Bare Copper conductors: Comply with the following:
 - 1. Solid Conductors: ASTM B3.
 - 2. Assembly of Stranded Conductors: ASTM B8.
 - 3. Tinned Conductors: ASTM B33.

H. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare (uninsulated) copper tape, braided bare (uninsulated) copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

I. Grounding Bus: Bare (uninsulated), annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

- A. Listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Sectional type; copper-clad steel.
 1. Size: 3/4 by 120 inches in diameter.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Use only copper conductors for both insulated and bare (uninsulated) grounding conductors in direct contact with earth, crushed stone, and similar materials.
- B. In raceways, use insulated equipment grounding conductors.
- C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
- D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.
- F. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
- G. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.

3.2 EQUIPMENT GROUNDING CONDUCTORS

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.
- C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
- D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connect to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panel board grounding terminal. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- H. Signal and Communication Systems: for telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum uninsulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 12 slot copper grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

- I. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.3 INSTALLATION

A. Ground Rods:

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

- C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

- E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

- G. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

- H. Proposed location by contractor for Engineer review in counterpoise shop drawings.

3.4 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
 2. Make connections with clean, bare (clean) metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare (uninsulated) grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare (uninsulated) grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted-and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing

- natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More Than 1000 kVA: 3 ohms.
 - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
 - e. Manhole Grounds: 10 ohms.
 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.6 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION 26 05 26

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with, ANSI C2, NFPA 70, OSHA, and authorities having jurisdiction.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1, and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

- A. Comply with NFPA 70, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage and service.
- B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.
- C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick.
 2. Compounded for permanent direct-burial service.
 3. Embedded continuous metallic strip or core.
 4. Printed legend indicating type of underground line.
- D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- E. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch thick aluminum sheet, with stamped or embossed legend and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- F. Plasticized Card-stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.

2.2 NAMEPLATES AND SIGNS

- A. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
- B. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength: 50 lb minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: According to color-coding.
- B. Paint: Formulated for the type of surface and intended use.
1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Install painted identification according to manufacturer's written instructions and as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime surfaces using type of primer specified for surface.
 - 3. Apply one intermediate and one finish coat of enamel.
- E. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
 - 1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
 - 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunication System: Green and yellow.
- F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- G. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent including voltage.
 - 4. Paint fire alarm junction box covers red.
- H. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

- I. Color-Coding of Secondary Phase Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:
 - 1. 208/120-V Conductors:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral White
 - 2. 480/277-V Conductors:
 - a. Phase A: Yellow.
 - b. Phase B: Brown.
 - c. Phase C: Orange.
 - d. Neutral Gray
 - 3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
- J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 - 1. Legend: 1/4-inch- steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 - 2. Tag Fasteners: Nylon cable ties.
 - 3. Band Fasteners: Integral ears.
- K. Apply identification to conductors as follows:
 - 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 - 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 - 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- L. Apply warning, caution, and instruction signs as follows:
 - 1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated

- instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- M. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- high lettering on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures.
 2. Access doors and panels for concealed electrical items.
 3. Electrical switchgear and switchboards.
 4. Disconnect switches.
 5. Enclosed circuit breakers.
 6. Power transfer equipment.
 7. Contactors.
 8. Remote-controlled switches.
 9. Dimmers.
 10. Control devices.
 11. Transformers.
 12. Battery racks.

END OF SECTION 26 05 53

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
 - 2. Single- and double-pole snap switches and dimmer switches.
 - 3. Device wall plates.
 - 4. Pin and sleeve connectors and receptacles.
 - 5. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One of each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provided products by one of the following:
 - 1. Wiring Devices:
 - a. Hubbell Incorporated; Wiring Device-Kellems.
 - b. Leviton Mfg. Company Inc.
 - c. Pass Seymour/Legrand; Wiring Devices Div.
 - 2. Multioutlet Assemblies:
 - a. Hubbell Incorporated; Wiring Device-Kellems,
 - b. Wiremold Company (The).

2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: (Leviton 5362 or approved equal). Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
- B. Straight-Blade: Heavy -Duty grade.
- C. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty grade, with integral NEMA WD6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter. (Leviton Model # GFNT2 or approved equal.)
- D. Isolated Ground Receptacle: Straight blade, Heavy Duty grade, duplex receptacle, with equipment grounding contacts connected only to the green grounding screw terminal of device and with inherent electrical isolation from mounting strap. (Leviton Model #5362-IG or approved equal.)
 - 1. Devices: Listed and labeled as isolated-ground receptacles.

2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.
- E. TVSS Receptacles: Straight blade, NEMA WD6, Configuration 5-20R, with integral TVSS in line to ground, line to neutral, and neutral to ground.
1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp level rating of 500 volts and minimum single transient pulse energy dissipation of 140 J line to neutral, and 70 J line to ground and neutral to ground.
 2. Active TVSS Indication: Visual only with light visible in face of device to indicate device is “active” or “no longer in service.”
 3. Identification: Distinctive marking on face of device to denote TVSS-type unit.
- F. USB Receptacles: See site plan symbol schedule.
- G. Tamper Resistant: Leviton TBR 20.

2.3 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SWITCHES (Leviton Models 1221-2, 1222-2, 1223-2 and 1224-2 or approved equal.)

- A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- B. Snap Switches: Heavy -Duty grade, quiet type.
- C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
1. Switch 20A, 120/277 Volts AC.
 2. Receptacle: NEMA WD6, Configuration 5-15R.
- D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
 2. LED Lamp Dimmers: Modular, 277V, 50 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Wet Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.6 MULTIOUTLET ASSEMBLIES

- A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- B. Raceway Material: Metal, with manufacturer's standard finish.
- C. Wire: No. 12 AWG.

2.7 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Owner/Engineer.
 - 2. TVSS Devices: Blue.
 - 3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies' level, plumb, and square with building lines.
- B. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.
- C. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.
- D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification."
 - 1. Receptacles: Identify panelboard and circuit number form which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated use those specified in UL 486A and UL 486B

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 51 19 – LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior solid-state luminaires that use LED technology
 - 2. Lighting fixture supports.
 - 3. Exit signs.
- B. Related Sections include the following:
 - 1. Section 26093 “Lighting Control Devices” for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See “Luminaire.”
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light Emitting Diode
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture scheduled, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of fixture, including dimensions and verification of indicated parameters.
 - 2. Fluorescent and high-intensity-discharge ballasts.
 - 3. Lamps.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

- C. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals. In addition to items specified in Specification Section "Operation and Maintenance Data," include the following:

- 1. Catalog data for each fixture. Include the diffuser, ballast, and lamps installed in that fixture.

1.4 INFORMATION SUBMITTAL

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace component of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period for all LED Fixtures: Five(5) years from date of Substantial Completion.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.9 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of minimum 80 CCT at 4000K (See Fixture Schedule).
- F. Rated lamp life of 50,000 hours minimum or equal to specified fixtures which is more.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 277 Volt, 1 phase, 60hz.
 - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.2 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.
- D. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

E. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless different thickness is scheduled.
 - b. UV stabilized.
2. Glass: Annealed crystal glass, unless otherwise indicated.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports, and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: Soft temper, zinc-coated, 12 gage.
- E. Wires For Humid Spaces: Annealed stainless steel, 12 gage.
- F. Rod Hangers: 3/16-inch- minimum diameter, cadmium-plated, threaded steel rod.

2.5 FINISHES

- A. Fixtures: Manufacturers' standard, unless otherwise indicated.
1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Luminaire Installation: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- C. Install lamps in each luminaire.
- D. Suspended Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Continuous Rows: Suspend from cable.
- E. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- F. Identify systems components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260533 "Electrical Identification".

3.2 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Verify normal operation of each fixture after installation.
- C. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal.
- D. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 26 51 19

**UNIVERSITY OF LOUISIANA AT LAFAYETTE
NEW IBERIA RESEARCH CENTER**
ENHANCED SECURITY SCREENING NOTIFICATION AND AUTHORIZATION FORM

<i>To be completed by the department prior to being given to the applicant:</i>	
Department	
Position Title	

<i>Applicant Information (Complete the following information as accurately as possible. Please print or type.)</i>			
Last Name	First Name	Middle Name	
Other names known by:			
Social Security Number	Date of Birth	Male or Female	
Driver's License Number	State of Issue	Email Address:	
Current Street Address:		Apt. No.	Number of years at this address:
City	State	Zip	
Previous Address:		Apt. No.	
City	State	Zip	

READ THE FOLLOWING STATEMENTS CAREFULLY BEFORE SIGNING THIS AUTHORIZATION
--

I authorize the University of Louisiana at Lafayette, New Iberia Research Center or its designees to investigate all statements contained in this authorization.

I authorize and request any and all of my former employers and any other person, firm, or corporation to furnish any and all information requested by the University of Louisiana at Lafayette, New Iberia Research Center (UL NIRC) or its designees concerning my job performance, suitability for employment, educational verification, social security number verification, prior employment verification, professional license verification, motor vehicle driving records, criminal history, job qualifications, and personal background information and I hereby release each such employer or other person, firm, or corporation from any liability by reason of furnishing the requested information. I understand that prior to being offered employment by UL NIRC, I must undergo an Enhanced Security Screening. As such, I specifically authorize UL NIRC to thoroughly investigate my background information, which investigation may include a check of my connections to animal rights groups and/or activists, analysis of my CV/Application, a search of the DEA Controlled Substance Act (CSA) Registration Database, and a terrorist check. In addition, should I become employed by UL NIRC, I understand that over the course of my employment, I will be required to undergo periodic re-evaluations of my Enhanced Security Screening. As such, I specifically authorize UL NIRC to reinstate the background and/or security checks identified above over the course of my employment, as they deem necessary. I understand that UL NIRC may utilize an outside firm or firms to assist it in checking such information, and I specifically authorize such an investigation by information services and outside entities of UL NIRC's choice.

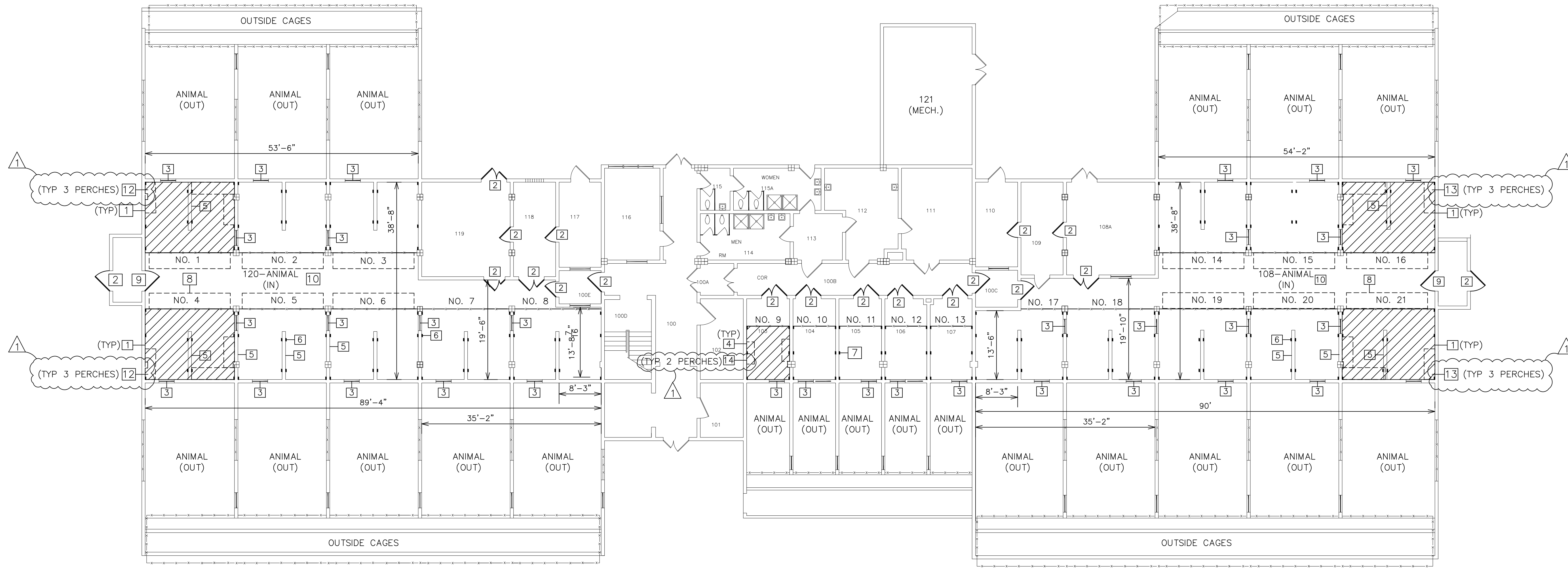
In addition, if I should become employed by UL NIRC, I expressly authorize UL NIRC to release information about my job performance, job qualifications, and suitability for employment to any person who may request such information, and I expressly UL NIRC from any liability for disclosing such information.

I understand that any misrepresentation or omission of fact contained in this Enhanced Security Screening Notification and Authorization Form is cause for rejection or immediate dismissal if I should become employed. I also understand that I may withhold my permission and that in such a case, no investigation will be done, and my application for employment will not be processed further. Finally, I understand that the completion of this employment authorization does not indicate that there are positions available and does not obligate UL NIRC to offer me a position if positions are available.

All offers of employment are conditional, subject to satisfactory results of the University of Louisiana at Lafayette's Pre-Employment Screening, UL NIRC's Enhanced Security Screening, reference checks, pre-employment alcohol and drug tests, and production of documents sufficient to demonstrate identity and authorization to work.

Applicant Signature: _____ Date: _____

Notice to Applicants: By signing this document, you are certifying that the information you have provided is truthful and complete. Falsification of information may result in denial of employment.



KEYNOTES NOTES:

- 1 - REMOVE EXISTING METAL CAGE SYSTEM IN ITS ENTIRETY INCLUDING ALL SUPPORTS, MESH, AND BRACKETS. HOT WORK ALLOWED IN SPACE. GRIND BRACKETS FLUSH WITH CHANNEL SUPPORT. (TYPICAL UNIT NO. 1 TO 8 AND 14 TO 21).
- 2 - REMOVE EXISTING DOOR IN ITS ENTIRETY INCLUDING FRAME, STOPS, CLOSURES (IF APPLICABLE). INSTALL OWNER PROVIDE DOOR AS PER SHEET A1.
- 3 - EXISTING CHUTE DOOR AND FRAME SYSTEM TO REMAIN.
- 4 - REMOVE EXISTING METAL CAGE SYSTEM IN ITS ENTIRETY INCLUDING ALL SUPPORTS, MESH, AND BRACKETS. HOT WORK ALLOWED IN SPACE. GRIND DOWN FLUSH WITH WALL BRACKETS. (TYPICAL UNIT NO. 9 TO 13).
- 5 - EXISTING METAL CHANNEL ON TOP OF WALL TO REMAIN. (TYPICAL UNIT NO. 1 TO 8 AND 14 TO 21).
- 6 - REMOVE EXISTING 3"x6" ANGLE IRON BRACKET FLUSH WITH EXISTING CHANNEL WALL CAP AND/OR BRACE. (TYPICAL UNIT NO. 1 TO 8 AND 14 TO 21).
- 7 - REMOVE EXISTING WALL SUPPORT FLUSH WITH CONCRETE BLOCK WALL. (TYPICAL UNIT NO. 9 TO 13).
- 8 - REMOVE EXISTING ALUMINUM CHUTE SYSTEM AND REINSTALL WITH NEW CAGE SYSTEM OPENING. COORDINATE WITH FENCE CONTRACTOR FOR LOCATION OF OPENINGS IN NEW CAGE SYSTEM. (TYPICAL UNIT NO. 1 TO 8 AND 14 TO 21).
- 9 - REMOVE EXISTING STEEL MESH DOOR COMPLETE WITH HINGES. GRIND EXISTING SUPPORTS TO EXISTING CHANNEL FRAME OPENING. CONTRACTOR SHALL CLEAN, PRIME AND PAINT EXISTING CHANNEL FRAME.
- 10 - REMOVE ALL INTERIOR PAINT FROM CONCRETE WALLS, FLOORS, AND CEILINGS INCLUDING CONCRETE SUPPORT BEAMS. GENERAL CONTRACTOR SHALL SEAL ALL EXPOSED CONCRETE. (TYPICAL UNIT NO. 1 TO 8 AND 14 TO 21). OPTION TO USE BEAD BLASTING, SAND BLASTING OR GRINDING. NO CHEMICALS ALLOWED. REFER TO PHOTOS 1 AND 2 FOR FINISHING REQUIREMENTS.
- 11 - PROVIDE SECURITY FENCING WITH MESH SCREEN DURING CONSTRUCTION TO LIMITED ACCESS. COORDINATE EXACT LOCATION WITH OWNER PRIOR TO CONSTRUCTION.
- 12 - CONTRACTOR SHALL REMOVE EXISTING PERCHES FOR PAINT REMOVAL AND REINSTALL. (TYPICAL UNIT NO. 1 TO 8).
- 13 - CONTRACTOR SHALL REMOVE EXISTING PERCHES AND SALVAGE TO OWNER. (TYPICAL UNIT NO. 14 TO 21).
- 14 - CONTRACTOR SHALL REMOVE EXISTING PERCHES FOR PAINT REMOVAL AND REINSTALL. (TYPICAL UNIT NO. 9 TO 13).

BUILDING 29-1ST FLOOR DEMOLITION PLAN (ARCHITECTURAL)
SCALE: 3/32"=1'-0"

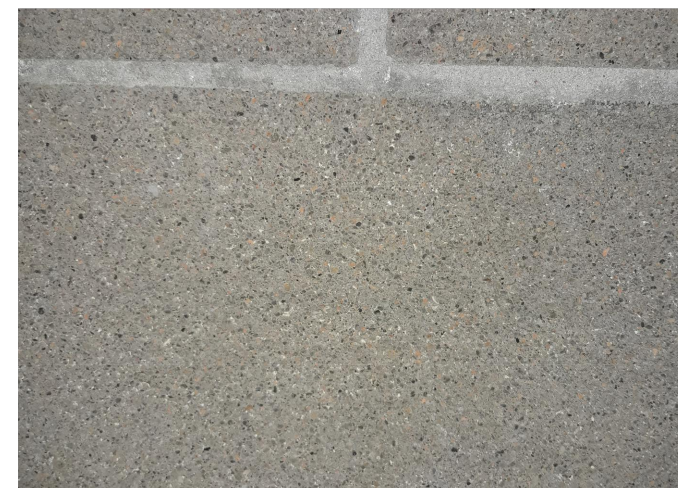


PHOTO-1 (WALL FINISH DEMO REQUIREMENTS)

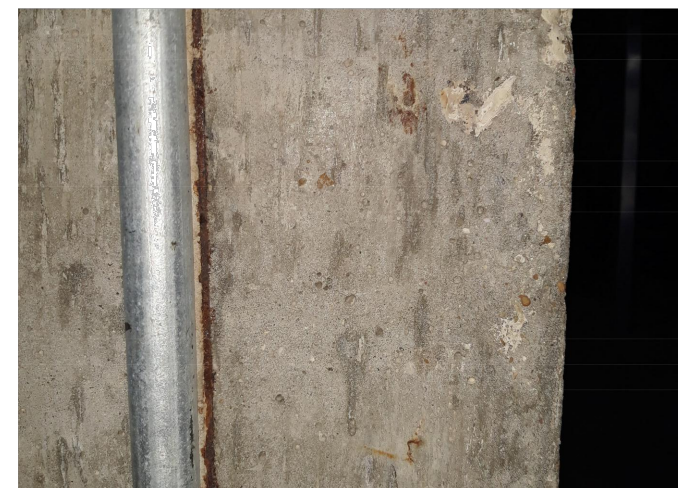


PHOTO-2 (CEILING AND COLUMN FINISH DEMO REQUIREMENTS)



BUILDING 29-1ST FLOOR NEW PLAN (SECURITY FENCING)
SCALE: NONE

GENERAL NOTES		
NO.	REVISIONS:	DATE:

**NEW IBERIA RESEARCH CENTER
BUILDING 29-1ST FLOOR CAGE AREA MODIFICATIONS**

UL FACILITY MANAGEMENT
THE UNIVERSITY OF LOUISIANA AT LAFAYETTE
P.O. BOX 43668
LAFAYETTE, LOUISIANA 70505



PROJECT NO:	SHEET:
DATE: FEB. 2024	D1R
SCALE: 3/32" = 1' - 0"	

REVISION NO. 1 - 03/02/24