



**Allen & Hoshall**  
engineers-architects-surveyors

**TECHNICAL SPECIFICATIONS**

**FOR**

**MEDIUM VOLTAGE CAPACITOR BANK REPLACEMENT**

**PROJECT NO. 19-1423-30**

**MEMPHIS-SHELBY COUNTY**

**AIRPORT AUTHORITY**



**ALLEN & HOSHALL  
ARCHITECTS ENGINEERS  
1661 INTERNATIONAL DRIVE  
MEMPHIS, TENNESSEE  
38120**

**JOB NO. 63233  
Date: NOVEMBER 06, 2024**

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FOR  
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MEMPHIS INTERNATIONAL AIRPORT  
MEMPHIS, TENNESSEE

MSCAA NO. 19-1423-30

11/06/24

TECHNICAL SPECIFICATIONS

I hereby certify that the Specifications: Division 16 were prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Tennessee.



Robert T. Herd

Date: 11/06/24

Reg. No. 22646



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NON-TECHNICAL SPECIFICATIONS**

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DOCUMENT 00015  
LIST OF DRAWINGS

The following is a list of Contract Drawings which this contract is to be based. These drawings are entitled MEDIUM VOLTAGE CAPACITOR BANK REPLACEMENT – PROJECT NO. 19-1423-30 – MEMPHIS SHELBY COUNTY AIRPORT AUTHORITY and dated 11/06/24 with revision dates (if any), as noted. They will be supplemented by additional shop and dimensional drawings of materials and equipment and other drawings where specified.

| <u>Drawing<br/>Number</u> | <u>Sub-Title</u>                      | <u>Revision<br/>Date</u> |
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| E4.00                     | EXISTING ONE-LINE DIAGRAM             |                          |
| E4.01                     | EXISTING CAPACITOR BANK DRAWING NO. 1 |                          |
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**SECTION 16010**  
**GENERAL PROVISIONS, ELECTRICAL**

**PART 1           GENERAL**

**1.1       SECTION INCLUDES**

- A. Basic Electrical requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.
- B. General and procedural requirements for work specified under Sections of Division 16 shall be as required herein.

**1.2       RELATED SECTIONS**

- A. DIVISION 16 - ELECTRICAL.
- B. Section 16050 - BASIC MATERIALS AND METHODS, ELECTRICAL.

**1.3       CONTRACTOR'S RESPONSIBILITY**

- A. Contractor agrees to assume responsibility for liability, workmanship, and quality of materials concerning work sublet to others. Before contract is sublet, submit in writing the names of proposed subcontractor and obtain written approval therefor.

**1.4       CODES AND FEES**

- A. All work shall be installed in accordance with the applicable provisions of the local codes, the National Electrical Code, and the National Electrical Safety Code.
- B. All electrical materials shall have Underwriters' approval where applicable, and shall be so labeled where UL labeling is customary.
- C. All electrical equipment shall conform to applicable NEMA Standards whether specified hereinafter or not, and to other applicable Standards which may be specified hereinafter.
- D. The Contractor shall be responsible for obtaining local permits, payment of fees and notification for inspection by code authorities consistent with the schedule of work.

**1.5       ACCURACY OF DATA AND DRAWINGS**

- A. Drawings and Data: Electrical drawings are generally diagrammatic, and where not dimensioned or detailed, indicate approximate locations and general arrangements of electrical work. All electrical work offsets, rises, and fittings are not necessarily shown; however, provide these as required by the conditions involved.

**1.6       EQUIPMENT LISTS, SHOP DRAWINGS, SAMPLES AND SUBMITTALS**

- A. Submit under provisions of Section 01330 and General Conditions.
- B. Submit to the Engineer for approval, within 30 days after receipt of Notice to Proceed with the work, a complete list of materials, equipment and accessories proposed for use, including complete descriptions and specifications of any proposed substitutions, manufacturer's shop drawings, and roughing-in work. Submit five (5) copies of all items for approval and furnish additional copies if required for installation purposes.

- C. Submission material and all shop drawings for the various items of equipment shall be marked with the respective mark number or identification of the equipment shown on the drawings or specified. The shop drawings shall list all ratings, capacities, accessories, and other pertinent data to show that the proposed item is as called for and as specified.
- D. Shop drawings shall show sizes and details of required concrete and steel machine foundation, locations of anchor bolts, physical dimensions of equipment, capacity characteristics of equipment, and all other work pertinent to details. Steel racks or stands for electrical apparatus shall be furnished and installed as part of the electrical work.

### **1.7 QUALITY CONTROL**

- A. Comply with Division 0.
- B. Qualifications: Where specific qualifications are specified in individual specification section, provide required data with Subcontractor list.

### **1.8 GUARANTEE**

- A. Comply with Division 0.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION**

### **3.1 EQUIPMENT INSTALLATION**

- A. Install all equipment in accordance with applicable manufacturer's drawings and recommendations.
- B. Identification of circuits and equipment: Identification designations shall correspond to those indicated on electrical drawings and as specified in corresponding articles describing the equipment.

### **3.2 ALTERATIONS AND ADDITIONS TO EXISTING ELECTRICAL WORK**

- A. Make alterations and additions to existing electrical work as indicated, and as required to accommodate new construction and to clear all interferences therewith. This includes disconnecting, removing, relocating, rerouting, extending, reworking, reconnecting, or otherwise altering existing electrical work as required, whether indicated on the drawings or not.
- B. Remove all accessible existing above-ground conduits and all other accessible existing electrical items which are not required for operation of the completed project; and remove all conductors from inaccessible existing conduits which are not required for operation of the completed project; all unless otherwise indicated or otherwise approved.

### **3.3 CONTINUITY OF EXISTING ELECTRICAL SERVICE, AND SALVAGED EXISTING ELECTRICAL MATERIALS.**

- A. Arrange all electrical work to interfere as little as possible with Owner's normal operations. Do not interrupt existing electrical service at any time without submitting an Outage Request Permit and getting the Owner's prior approval. After an electrical service interruption has been made, make all necessary connections and alterations, and restore electrical service as quickly as possible. At no extra cost to Owner, provide temporary electrical connections and other electrical work as required to maintain continuity of electrical service. This paragraph applies only to those areas which will be occupied or otherwise used by Owner prior to project completion.

- B. Promptly haul away from Owner's premises all electrical materials and electrical equipment which are removed from existing electrical system and are neither indicated nor required to be reused in the completed project, EXCEPT as otherwise specified below.
  - 1. Owner may select certain removed existing electrical materials and electrical equipment and retain them for his future use. Before removing any existing electrical materials and electrical equipment, determine from Owner which of these materials and equipment (if any) he desires to retain. Remove all Owner-selected electrical materials and electrical equipment without unnecessary damage thereto, and safely store them at locations designated by Owner.

### **3.4 TEST, INSPECTIONS, ADJUSTMENTS, AND CLEANUP**

- A. Other wiring, 600 volts and less: Make insulation tests with a "Megger", demonstrate that neither short circuits nor ground faults exist, and that wiring complies with NEC. Provide test reports to Engineer and Owner.
- B. Furnish suitable testing equipment, give the Engineer and all applicable authorities ample advance notice of all proposed tests and readiness of work for inspections, and conduct each test in their presence, as approved. Do not conceal electrical work until all necessary inspections have been made and all required tests have been approved by the Owner's Representative and all applicable authorities.
- C. Put entire electrical system in operation, test all equipment, remedy all defects, and make all necessary adjustments. Demonstrate that the entire system functions satisfactorily, as specified, as indicated, and as approved.
- D. After electrical system has been tested and before any field painting is commenced, clean up all electrical work thoroughly. Remove all foreign matter which has accumulated in all fixtures, equipment, and enclosures. Clean and polish all other surfaces that are not to be painted so that they present a new and acceptable appearance.

### **3.5 PROTECTION AND CLEANING**

- A. Work shall be protected at all times. Conduit openings shall be closed with caps or plugs until permanent connections are made. Fixtures and equipment shall be covered, if necessary, to protect against dirt, water, chemical or mechanical damage or defacement. The installation of fixtures liable to damage shall be coordinated with installing UL fire protective barriers and ceiling systems.
- B. Electrical equipment rooms shall be cleaned up prior to energizing equipment and shall not be used for storage or other purposes after power is applied to the electrical equipments.

### **3.6 OPERATING INSTRUCTIONS**

- A. Furnish the services of a competent individual(s) to instruct the Owner's personnel in the proper operation and maintenance of all equipment, for a period of not less than two working days.
- B. Furnish and deliver to the Owner three sets of operating instructions for all equipment installed under this contract, including shop drawings, piping diagrams, wiring diagrams, maintenance recommendations and information concerning replacement parts.

### **3.7 OPERATION AND MAINTENANCE DATA**

- A. To aid the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding products incorporated into the Work, furnish and deliver the data described in this Section and in pertinent other Sections of these Specifications.

- B. Related work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
  2. Required contents of submittals also may be amplified in pertinent other Sections of these Specifications.
- C. Submit two copies of a preliminary draft of the proposed Manual or Manuals to the Architect/Engineer for review and comments.
- D. Unless otherwise directed in other Sections, or in writing by the Architect/Engineer, submit three copies of the final Manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.
- E. In preparing data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the extent needed for communicating the essential data.
- F. Where instruction Manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provisions of this Section.
- G. Format:
1. Size: 8-1/2" x 11"
  2. Paper: White bond, at least 20 lb weight
  3. Text: Neatly written or printed
  4. Drawings: 11" in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
  5. Binding: Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the Manual; 3-ring binders will be acceptable; all binding is subject to the Architect/Engineer's approval.
  6. Measurements: Provide all measurements in U. S. standard units such as feet-and-inches, lbs, and cfm.
  7. Copies: Two (2) copies of the manuals shall be submitted.
- H. Provide front and back covers for each Manual, using durable material approved by the Architect/Engineer, and clearly identified on or through the cover with at least the following information:
- OPERATING AND MAINTENANCE INSTRUCTIONS  
 ( \_\_\_\_\_ )  
 (Name and address of Work \_\_\_\_\_ )  
 ( \_\_\_\_\_ )  
 (Name of Contractor \_\_\_\_\_ )  
 ( \_\_\_\_\_ )  
 (General subject of this Manual \_\_\_\_\_ )  
 ( Space for signature of \_\_\_\_\_ )  
 (Architect/Engineer and approval date \_\_\_\_\_ )
- I. Contents: Include at least the following:
1. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency information regarding the installation.
  2. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and reassembly.
  3. Complete nomenclature of all parts of all equipment.
  4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
  5. Copy of all guarantees and warranties issued.
  6. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.

7. Such other data as required in pertinent Sections of these Specifications.
  8. The above information is required for all major pieces of equipment.
- J. Final: Complete the Manuals in strict accordance with the approved preliminary drafts and the Architect/Engineer's review comments.
- K. Revisions:
1. Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of the Manual with the Architect/Engineer.
  2. If the Contractor is required by the Architect/Engineer to revise previously approved Manuals, compensation will be made as provided for under "Changes" in the General Conditions.

END OF SECTION

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**SECTION 16050**  
**BASIC MATERIALS AND METHODS, ELECTRICAL**

**PART 1           GENERAL**

**1.1           SECTION INCLUDES**

- A.   Equipment and materials used in the work shall be in accordance with the contract documents; of the best quality and grade for the use intended; shall be new and unused; and shall be the manufacturer's latest standard or current model for which replacement parts are readily available.
- B.   Work shall be installed under the constant supervision of a qualified superintendent and by skilled and qualified electricians. Requirements set forth in MSCAA's Design Guide: Construction Standards regarding the qualifications of an acceptable crew must be met also.
- C.   All apparatus and equipment shall be installed and connected in accordance with the best engineering practices and in accordance with the manufacturer's recommendations. All auxiliary wiring, relays, contactors, controllers, and electrical connections of any description recommended by the manufacturer and required for the proper operation of all items of equipment furnished under this contract shall be furnished and installed complete.
- D.   Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements.

**1.2           RELATED SECTIONS**

- A.   DIVISION 16 - ELECTRICAL.
- B.   Section 16010 - GENERAL PROVISIONS, ELECTRICAL.

**1.3           SUBMITTALS**

- A.   Submit under provisions of Section 01330.

**1.4           NOT USED.**

**PART 2           PRODUCTS**

**2.1           HANGERS, SUPPORTS, AND SLEEVES**

- A.   Securely attach all hangers, supports, and devices to the building structure with anchors suitable for the types of building construction involved. Provide all necessary pipe, angle iron, "Unistrut", "Kindorf", or other suitable steel auxiliary supports for the electrical work.
- B.   Hangers or supports for conduits and raceways shall be standard conduit or raceway straps, or other suitable clamping devices. Trapeze hangers may be used for groups of suspended horizontal conduits, with each conduit clamped to each trapeze bar. Perforated strap iron hangers will not be permitted.
- C.   Maximum hanger or support spacings for all conduits shall be as required by the Codes.
- D.   Adequately support all boxes, gutters, panelboards, switches, starters, fixtures, and other devices, and equipment. Where supporting method is indicated or detailed, provide supports accordingly; OTHERWISE, supports shall be as required by the Codes, and as approved.

- E. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction, where electrical items are not installed prior to concrete placing and masonry laying. Sleeves through concrete walls, concrete columns, and concrete beams shall be IPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all exposed conduits passing through floors (except slabs on ground) where water on floor can pass through the opening shall be galvanized IPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below. Other sleeves may be sheet metal or plastic.

## **2.2 CONDUIT AND FITTINGS, EXCEPT UNDERGROUND DUCTS**

- A. Conduits: These shall be zinc coated rigid steel, zinc coated steel electrical metallic tubing (hereinafter referred to as "thin wall conduit") or ANSI Specification C80.5 rigid aluminum, as applicable. In each case where the conduit type is indicated, specified, or required by the Codes, install only the indicated, specified, or Code required type; OTHERWISE, conduit usage shall be as follows:
  1. In contact with ground: rigid steel coated with bituminous compound conduit.
  2. For supporting fixture, outlet boxes, and other devices and equipment which are not directly anchored to the building structure: rigid steel or rigid aluminum conduit, with all joints and connections threaded.
  3. Zinc-coated rigid steel or rigid aluminum conduit shall be used to route medium voltage cables.
  4. All other locations: thin wall, rigid steel or rigid aluminum conduit, as applicable.
  5. Do not install aluminum conduit underground, in contact with ground, or embedded in concrete.
- B. Conduit Fittings: For metallic conduit, fittings shall be zinc coated steel, cast aluminum, or cast zinc. All fittings exposed to weather shall be weatherproof type.
- C. Installation:
  1. General: ream ends of all conduits after cutting. Prior to wire pulling, keep all open conduit ends plugged, and swab out all trapped conduits in which water or moisture has collected. Where conduits are concealed in walls, install these conduits so that the exposed wall faces will not be marred.
  2. Conduit routing, general: see TYPE OF SYSTEM, WIRING METHOD hereinbefore for locations where concealed and exposed conduits are required and/or permitted. Where conduit routings are detailed or dimensioned install conduits accordingly; OTHERWISE, install concealed conduits with the shortest practicable path, and install all exposed conduits in straight, level, and plumb lines, parallel with or at right angles with beams, walls, ceilings, and other building lines.

## **2.3 PULL BOXES, JUNCTION BOXES, AND WIRING GUTTERS**

- A. General: Pull boxes, junction boxes, and wiring gutters shall be of the types and minimum sizes indicated, or as required for the conditions involved where types and sizes are not indicated. Before installation, check proposed locations of boxes and gutters with the architectural, structural, and mechanical drawings, and locate each box and gutter so that it will be accessible in the finished project.

**2.4 NOT USED.**

**2.5 NOT USED.**

**2.6 NOT USED**

**2.7 NOT USED.**

**2.8 NOT USED.**

**2.9 NOT USED.**

**2.10 NOT USED.**



**PART 3 EXECUTION****3.1 INSTALLATION**

- A. Run exposed conduit, trays, and other wireways parallel to the principal parts of the building.
- B. Conduits and other raceways shall be kept as close as possible to ceilings, walls, columns, etc., and shall be installed in such an orderly manner as to take up a minimum of space and allow a maximum of headroom.
- C. Provide templates, layouts drawings, and supervision to ensure correct placement of anchors and conduit projecting in concrete.
- D. Qualifications: Where specific qualifications are specified in individual specification section, provide required data with Subcontractor list.

**3.2 TYPE OF SYSTEM, WIRING METHOD**

- A. Electrical system characteristics: These shall be as indicated. In addition, whether indicated or not, provide low voltage (less than 120 volts) wiring for controls and other purposes, as required for the complete electrical system.
- B. Enclosures: Regardless of voltage or use, install wiring in conduits and metal or other enclosures, unless otherwise indicated or otherwise specified.
- C. Unfinished Areas: Install above-floor conduits exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impractical, in mechanical and electrical equipment rooms, manufacturing areas, warehouse or storage areas, and other unfinished areas.

**3.3 GROUNDING**

- A. Ground electrical equipment and conductors as required by NEC and other applicable electrical codes.
  - 1. All metallic cable sheaths, cable shields, metal conduit, transformer cases, cabinets and pedestals shall be made electrically secure to form a continuous system and shall be grounded.
  - 2. All conduits shall have code sized green equipment grounding conductors with diameter based on the largest circuit in each conduit.

**3.4 NOT USED.**

END OF SECTION

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**SECTION 16170  
GROUNDING AND BONDING**

**PART 1           GENERAL**

**1.1       SECTION INCLUDES**

- A. Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:
  - 1. Grounding cables.
  - 2. Installation of grounding system.
  - 3. Field testing of grounding electrodes.

**1.2       RELATED SECTIONS**

- A. Section 16010 - GENERAL PROVISIONS, ELECTRICAL.
- B. Section 16050 - BASIC MATERIALS AND METHODS, ELECTRICAL.

**1.3       SUBMITTALS**

- A. Submit under provisions of Section 01330.
- B. Submit shop drawings for final approval.
- C. Clearly detail shapes, general construction, and installation details.
- D. Submit manufacturer's installation instructions.

**PART 2           PRODUCTS**

**2.1       GROUNDING CABLES**

- A. Materials:
  - 1. Grounding conductors shall be tinned soft drawn annealed copper, size and type as follows:
    - a. All other grounding required minimum No. 4 AWG solid soft drawn annealed unless otherwise specified.
- B. Joints and splices: Make these with suitable copper compression connectors. Leave enough wire slack to permit at least one splice or joint to be remade in case of damage.

**2.2       INSTALLATION OF GROUNDING SYSTEM**

- A. Underground Distribution:
  - 1. Ground:
    - a. On site, outdoor electrical equipment to driven ground rods.
    - b. Interrupted metallic raceways, with ground conductors connected to metallic raceway at each end.
      - (1) Metallic raceways.
      - (2) Hardware.
      - (3) Grounding conductors.
      - (4) Metallic raceways.
      - (5) Hardware.
      - (6) Ground conductors.

**PART 3 EXECUTION****3.1 FIELD TESTING OF GROUNDING ELECTRODE**

- A. The existing grounding conductor network surrounding the existing concrete pad shall have a resistance to ground test performed. The test shall be made with a self-contained direct reading meter such as "Vibroground" or "Groundohmer".
- B. The maximum resistance to ground shall not exceed 25 ohms with all grounding leads disconnected from the electrode at temperatures above 32 degrees Fahrenheit and soil moisture content above 20 percent.
- C. If the resistance to ground of the existing electrode exceeds 25 ohms install additional grounding electrodes as necessary to obtain the specified resistance. Additional electrodes shall be minimum 3/4 inch diameter by eight foot in length, copper-clad steel.

END OF SECTION