

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. The work under this Division shall consist of all labor, materials, equipment, and services necessary and required to complete all work as shown on the Drawings and in the Specifications (Contract Documents) and as inferable from the Drawings and Specifications.
- B. Related Sections: Sections in Divisions 26, 27, and 28 contain requirements that relate to this Section and/or are governed by the requirements of this Section.
- C. Project Overview - ARK1 Clarksville Data Center:
 - 1. This specification applies to the ServerFarm ARK1 facility, a 72 MW greenfield data center with two stories and 12 data halls (6 per floor), each supporting 6 MW of IT load.
 - 2. Design Life: 25 years
 - 3. Availability Target: 99.982% (Uptime Institute Tier III compliant)
 - 4. IT Load Density: 40 kW/rack at 90% occupancy (44.4 kW nominal per rack)

1.2 REFERENCES

- A. Comply with the following codes, standards, and regulations. Where conflicts exist between referenced standards and these specifications, the more stringent requirement shall apply.
- B. Codes and Regulations:
 - 1. NFPA 70 (NEC) - National Electrical Code, 2017 Edition
 - 2. NFPA 70E - Standard for Electrical Safety in the Workplace, Current Edition
 - 3. NFPA 75 - Standard for the Fire Protection of Information Technology Equipment, Current Edition
 - 4. NFPA 110 - Standard for Emergency and Standby Power Systems, Current Edition
 - 5. NFPA 780 - Standard for the Installation of Lightning Protection Systems, Current Edition
 - 6. OSHA - Occupational Safety and Health Administration Standards
 - 7. IBC 2021 - International Building Code with Arkansas State Amendments
 - 8. 2009 IECC - International Energy Conservation Code (lighting minimum)
 - 9. Local and State codes and regulations

C. IEEE Standards:

1. IEEE 142 - Grounding of Industrial Power Systems (Green Book)
2. IEEE 1584-2018 - Guide for Performing Arc-Flash Hazard Calculations
3. IEEE 3006.1 - Recommended Practice for Power Systems Analysis
4. IEC 60255 - Measuring Relays and Protection Equipment
5. IEEE C2 - National Electrical Safety Code

D. Data Center Industry Standards:

1. ANSI/BICSI 002-2024 - Data Center Design and Implementation Best Practices
2. TIA-942-B - Telecommunications Infrastructure Standard for Data Centers
3. Uptime Institute Tier III Requirements for Concurrent Maintainability
4. ASHRAE TC 9.9 - Thermal Guidelines for Data Processing Environments
5. FM Global DS 5-32 - Data Centers and Related Facilities

E. Testing and Installation Standards:

1. NETA ATS - Acceptance Testing Specifications
2. NETA MTS - Maintenance Testing Specifications
3. NECA 1 - Standard for Good Workmanship in Electrical Construction

F. Material and Cable Standards:

1. ANSI - American National Standards Institute
2. ANSI C84.1 - Electric Power Systems and Equipment - Voltage Ratings
3. ASTM - American Society for Testing and Materials
4. NEMA - National Electrical Manufacturers Association
5. UL - Underwriters Laboratories, Inc.
6. ICEA S-94-649 - Medium Voltage Cable Standards

1.3 ARK1 ELECTRICAL SYSTEM OVERVIEW

A. Primary Power Source:

1. Interim Power: Bloom Energy Solid Oxide Fuel Cells (SOFC) during utility substation construction
2. Future: Utility substation connection (when available)

B. Power Architecture - 7-to-Make-6 Configuration:

1. Each building served by 7 circuits: 6 primary circuits + 1 reserve circuit
2. Primary circuits: 17.76 MW capacity each

3. Reserve circuit: 2.5 MW normal operation (admin loads), 20.5 MW failover capacity
4. Per-building N+1 redundancy with concurrently maintainable reserve

C. IT Power Architecture - Single-Cord with BBU:

1. Single-corded IT loads with rack-level Battery Backup Units (BBU)
2. No facility-level IT UPS systems
3. BBU provides 30-90 seconds ride-through during ATS transfers
4. BBU is tenant (Meta) furnished equipment

D. CDU UPS System:

1. Cooling Distribution Units (CDUs) retain dedicated UPS backup
2. CDU UPS capacity: 200 kW per power block
3. Critical blocks: 2 UPS units per block (36 blocks × 2 = 72 units)
4. Reserve blocks: 1 UPS unit per block (6 blocks × 1 = 6 units)
5. Admin block UPS: 500 kVA

E. Power Flow Path:

1. Bloom SOFC → MV Switchgear (34.5 kV) → Step-Down Transformer (3750/3000 kVA) → LV Switchgear/ATS (480Y/277V) → PDU (1000 kVA) → 400A NATS → 400A Busway → Racks (with BBU)

1.4 MEDIUM VOLTAGE SYSTEM REQUIREMENTS

A. System Parameters:

1. Voltage Class: 34.5 kV (nominal), 33-36 kV operating range
2. Configuration: 3-phase, 60 Hz, solidly grounded wye
3. Grounding Method: Solidly grounded per NEC 250.4, IEEE 142

B. MV Duct Bank Configuration:

1. Circuits per duct bank: 3
2. Conduit size: 6-inch Schedule 40 PVC
3. Spare capacity: 100% (1 spare per active circuit)
4. Ground conductor: 4/0 AWG bare copper
5. Maximum conduits per wall: 48 (per NEC 110.34(A))
6. Minimum manhole size: 6 ft L × 10 ft W
7. Working clearance: 4 ft (per NEC 110.34(A))
8. Horizontal bend radius: Minimum 60 inches (centerline) for 6-inch conduit

9. Vertical bend radius: Minimum 48 inches for risers
10. Reserve circuit separation: Completely independent routing - no reserve circuits in same duct bank or manhole as primary circuits

C. MV Feeder Cable Specification:

1. Voltage rating: 35 kV
2. Insulation type: EPR, MV-105, 133% insulation level (LVL)
3. Conductor: Copper, single-conductor, compact stranded
4. Shield: Copper tape shield (no concentric neutral)
5. Installation: Underground in duct bank
6. Ampacity: Per NEC Table 310.15(B)(2)(i) at 90°C

D. MV Splicing and Terminations:

1. All 35 kV splices in manholes/vaults: Fully insulated, dead-front 900 A T-body terminations on wall-mounted stainless steel 900 A junction bars
2. Spare ports: One spare port permitted per junction bar set with insulated bushing caps
3. Test points: All MV terminations shall have captive test points for standardized MV test probes
4. Fire protection: Each 3-phase cable set shall be individually fire-taped and glass-taped over full exposed length

E. Surge Protection:

1. All MV equipment shall have elbow-type, disconnectable metal-oxide varistors (MOVs)
2. MOV connections via equipment bushings or 200 A bushing insert on 900 A T-body terminations

1.5 LOW VOLTAGE SYSTEM REQUIREMENTS

A. Transformer Specifications:

Type	Quantity	Rating	Configuration
Critical	36	3750/3000 kVA	34.5 kV to 480Y/277V Delta-Wye
Reserve	6	3750/3000 kVA	Backup for primary blocks
Admin	1	2500 kVA	Admin/house loads
Total	43	–	–

B. Transformer Requirements for Harmonic Loads:

1. Minimum K-rating: K-13 (harmonic-tolerant)
2. Derating: 10-15% capacity reduction under harmonic loading from GPU/AI loads

3. Neutral sizing: 100% neutral conductor minimum for harmonic current

C. Power Distribution Units (PDUs):

1. Critical power blocks: 2 PDUs per block, 1000 kVA each (72 units total)
2. Reserve power blocks: 2 PDUs per block, 1000 kVA each (12 units total)
3. Building total: 84 PDUs
4. Transformation: 480V to 415Y/240V

D. Automatic Transfer Switches (ATS):

1. Critical IT Load ATS: 1600 A, bypass-isolation type (~72 units)
2. MUPS Load ATS: 400 A, bypass-isolation type (~36 units)
3. Total building ATS: ~108 units

1.6 TRANSFER INHIBIT CONTROL SYSTEM

A. Purpose: Prevent simultaneous transfers that would exceed reserve capacity.

B. Transfer Inhibit Rules:

1. Critical IT ATS (1600 A): No more than two (2) 1600 A ATS may transfer to the reserve block simultaneously
2. MUPS ATS (400 A): No more than one (1) 400 A MUPS ATS may transfer to the reserve block simultaneously
3. Additional transfers inhibited until active transfer/retransfer is complete

C. Independent Control Domains:

1. Critical IT ATS and MUPS ATS operate as separate control domains
2. Independent inhibit logic prevents excessive load steps on reserve block

1.7 BLOOM ENERGY SOFC REQUIREMENTS

A. Minimum Load Requirements:

1. Primary circuit minimum threshold: 25% of AI/IT loads
2. Threshold value: 5.125 MW (25% × 20.5 MW)
3. Primary base load: 5.76 MW (non-AI, stable mechanical loads)
4. Reserve circuit (normal): Admin load 2.5 MW - exempt from minimum (stable, non-cyclical)

B. Load Stability:

1. Bloom SOFC requires stable, predictable loads

2. Cyclical or rapidly varying loads must be managed through controls
3. Coordinate all load additions/removals with Bloom operational requirements

1.8 POWER QUALITY REQUIREMENTS

A. Power Quality Standards:

Parameter	Target	Reference
Voltage THD	< 5%	ANSI C84.1 Range A
Current THD	< 20%	Data center typical
Voltage Regulation	± 5%	At PDU secondary terminals
Frequency Stability	± 0.5 Hz	Nominal 60 Hz

B. Harmonic Mitigation for GPU/AI Loads:

1. GPU-intensive IT loads generate 30-50% THD
2. Transformer rating: K-13 minimum
3. Input filtering: Recommend harmonic mitigation at PDU input
4. Cable sizing: Size for neutral current; 3-phase conductors + 100% neutral minimum

1.9 GROUNDING AND BONDING

A. System Grounding - 34.5 kV:

1. Method: Solidly grounded wye per NEC 250.4(A)(1)
2. Ground wire: 4/0 AWG bare copper minimum in MV cables
3. Grounding electrode: Per NEC 250.50-250.66; metal underground duct recommended
4. Resistance target: $\leq 5 \Omega$ (single electrode system)

B. Equipment Grounding - 480Y/277V:

1. Equipment ground: Copper conductor sized per NEC Table 250.122
2. Conductor insulation: Green or bare copper
3. Grounding path: Back to main service ground via metallic equipment
4. Continuity verification: $< 0.1 \Omega$ end-to-end per NFPA 70E

C. Surge and Transient Protection:

1. MV feeders: Surge arresters at transformer primary
2. Control circuits: Transient voltage surge suppressors (TVSS)
3. Communications: Isolation transformers and fiber optics where feasible

4. Building structure: Grounding for lightning protection per NFPA 780

1.10 CONDUIT COLOR CODING SYSTEM

A. All low voltage conduit shall be color coded as follows:

Color	System
Blue	BMS (Building Management System)
Green	Ground
Purple	EPMS (Electrical Power Monitoring System)
Yellow	Security
Red	Fire Protection/Alarm
Bare/Gray	Power

1.11 SUBMITTALS

- A. All shop drawings and manufacturer's literature shall conform to the requirements set forth in the General Conditions. The Contractor shall verify the compliance of all shop drawings with the requirements of the Contract Documents. The Contractor shall certify that the shop drawings comply with the requirements of the Contract Documents. Any deviation from the specified items shall be clearly marked and brought to the engineer's attention as deviations. No equipment shall be purchased prior to receiving written approval.
- B. Shop drawings shall include descriptive data, manufacturer's ratings and application recommendations, cuts, diagrams, drawings, test reports, performance curves and such other information or samples as may be required by the Owner to judge compliance with the requirements of the Contract and suitability to the application. Items on the list shall be clearly identified as to proposed application. Approval of materials and equipment will be based on manufacturer's published ratings. Shop drawings shall clearly indicate the requirements for this specific project only.
- C. Each item shall be clearly identified as to proposed application. Where items of specified material and equipment are assembled to make up a larger apparatus, submit for approval the manufacturer's or fabricator's assembly shop drawings. Such drawings shall include dimensions and all essential details of arrangement, construction, assembly, and connections. Wiring diagrams for special signal and control systems furnished under this Section shall also be submitted for approval. When directed by the Owner, submit in approved form for the record a Certificate of Compliance with a cited code or standard for the materials and equipment designated. Such certificates may be accepted in lieu of samples. Any materials, fixtures or equipment submitted for approval that are not in accordance with the Specifications requirements may be rejected. Any shop drawings marked "Make Correction Noted", "Revise and Resubmit" or "Rejected" shall be revised and resubmitted until accepted with "No Exception Taken".
- D. As part of the coordination work required, prepare installation drawings for all equipment rooms. It is intended that these drawings be used to coordinate the work of the various trades and to clarify details of proposed assembly, erection, and installation.

- E. When indicated in these Specifications or on the Drawings, or when directed by the Owner, installation drawings shall be submitted for approval. Any installation drawing may be submitted to the Owner for comment and approval when an installation condition or problem arises which the Contractor wishes the Owner to review. All installation drawings submitted for review will be considered and treated as shop drawings and the requirements pertaining to shop drawings shall govern.
- F. Refer to all other Division 26 sections for components for which shop drawings shall be submitted.
- G. Detail Drawings of fabrication and installation of supports and anchorage for electrical items.
- H. ARK1-Specific Submittals:
 - 1. Protective relay coordination study per IEEE 3006.1
 - 2. Arc flash hazard analysis per IEEE 1584-2018
 - 3. Short-circuit study with fault current calculations
 - 4. Transfer inhibit control logic diagrams
 - 5. Bloom SOFC interface and coordination documentation
 - 6. EPMS system architecture and point list
 - 7. Grounding system design with resistance calculations

1.12 WORKMANSHIP

- A. All work performed shall be "first class work" in every respect. The work shall be performed by mechanics skilled in their respective trades, who shall at all times be under the supervision of competent persons.
- B. Work that is slipshod, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade, or to the Engineer or Owner, for "first class work" will not be acceptable and must be corrected to "first class work".
- C. In addition to the materials specified elsewhere, furnish, and install all other miscellaneous items necessary for the completion of the work to the extent that all systems be complete and operative.
- D. All work under this Section shall be performed in cooperation with the work performed under all other Sections of the Specifications on the Project in order to avoid interferences and to secure the proper installation of all work. Review the Drawings and Specifications covering the work to be performed under all Sections, so that the relation and extent of the work of this Section with respect to the work of all other Sections is understood.

1.13 REGULATIONS AND CERTIFICATES

- A. All work under this Section shall comply with the applicable requirements of NFPA 70 (National Electrical Code), 2017 Edition, as adopted by the State of Arkansas, other codes, laws, regulations, and standards of all local and State authorities. Where references are

made to laws, codes, regulations and standards, these documents, including the latest revisions and amendments thereto in effect as of the date of Bid Opening, shall form part of these Specifications.

B. For mission-critical data center areas, work shall additionally comply with:

1. NFPA 75 requirements for protection of IT equipment
2. NFPA 110 requirements for emergency and standby power systems
3. Uptime Institute Tier III requirements for concurrent maintainability
4. ANSI/BICSI 002-2024 data center design best practices
5. TIA-942-B telecommunications infrastructure requirements

1.14 EXPEDITING THE WORK

- A. Cooperate with all other subcontractors on the project. This Division shall be responsible for prompt delivery of all materials and equipment and for the installation of all work under this Division, at a time and in a manner that will ensure that there will be no delay in the construction schedule.
- B. Verify all conditions on the job which may affect the installation of the work and become familiar with applicable local and State regulations. Any discrepancies or interferences shall be reported immediately to the Owner. Additions to the Contract Price will not be allowed when they are due to the failure to carefully inspect existing conditions.

1.15 PROTECTION OF THE WORK

- A. All work, materials, and equipment, whether incorporated into the building or not, shall be protected from damage due to moisture, dirt, plaster, concrete or from carelessness. Make all attempts to cover equipment with plastic sheathing when work area is going to generate moisture, dust or debris.
- B. All material and equipment which is damaged, including installed work, shall be repaired or replaced to the satisfaction of the Owner.
- C. After work is completed, all work, equipment, shall be cleaned of all construction dirt. All waste and debris resulting from the electrical installation shall be removed from the site and disposed of in a legal manner.

1.16 FINAL INSPECTION

- A. Conduct a final inspection for completeness of all work installed under this Division of the Specification after the installation has been completed; the testing hereinafter specified has been performed; and test reports have been submitted to the Owner.
- B. During the conduct of the final inspection prior to acceptance testing, have present a representative of the various manufacturers and representatives of the manufacturers of other equipment as directed by the Owner.

1.17 QUALITY CONTROL AND ACCEPTANCE TESTING

- A. Provide Quality Control Performance Tests and Acceptance Testing for all systems, devices and equipment installed or wired under this Division. Tests shall be performed to the satisfaction of the Owner and the Owner's Representative. For acceptance testing requirements, refer to Division 1 Section "Quality Requirements".
- B. Testing shall comply with NETA ATS (Acceptance Testing Specifications) requirements.

1.18 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.
- B. Storage: Materials stored at the project site which become soiled with construction dirt, concrete or earth work shall be removed from the site and replaced with new. Do not install soiled material.
- C. Cleaning: Clean wipe the interior of all conduit, pullboxes and panel board backboxes before proceeding with wiring.
- D. Generally, do not install damaged, broken, or marred material or products; replace with new. On long delivery items that are damaged in shipping or storage, field repair these items and temporarily install them in the interim until replacement items have arrived. Replace the damaged items when the replacement item has arrived.

1.19 SEQUENCING AND SCHEDULING

- A. Coordinate installation with other building components and the work of other trades.
- B. Coordinate connection of electrical services to equipment of other trades and Divisions.
- C. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.
- D. Coordinate delivery and setting of all equipment that require concrete pads, with Division 2, 3, and 26.
- E. Prior to the commencement of the work of other Divisions, mark the area of all electrical distribution equipment and inform the other trades of required clearances. Designate the area equal to the footprint of the electrical equipment, from the top of the equipment to the structural ceiling above as dedicated electrical space. Inform all trades not to interlope this area. This applies to all distribution boards, switchgear, and panelboards.

1.20 PROJECT CONDITIONS

- A. This is a Tier III mission-critical data center facility. All electrical work shall be designed and installed to support concurrent maintainability requirements, allowing any component to be removed from service for maintenance without impacting IT operations.

- B. Environmental conditions for electrical equipment in data hall areas shall comply with ASHRAE TC 9.9 recommendations.
- C. Electrical room maximum temperature: 77°F (25°C); minimum temperature: 70°F (21.1°C).

1.21 DRAWINGS AND SPECIFICATIONS

- A. The Electrical Drawings are to be considered schematic only and do not necessarily show the exact location and details of the work to be installed. It shall be the responsibility of the Contractor to provide the work in conformity with the requirements of these Specifications, the applicable codes, regulations and standards, and the best trade practices meeting with the approval of the Owner.
 - 1. If any departures from the Drawings are deemed necessary, details of such departures and the reasons therefor shall be submitted immediately to the Owner for approval.
 - 2. If any conflicts or discrepancies are found to exist on the Drawings, in the Specifications or between the Drawings and the Specifications, assume the most expensive option and include such costs in his Bid.
 - 3. It shall be understood that the Owner reserves the right to change the location of equipment and apparatus to a reasonable extent as building conditions may dictate, without extra cost to the Owner.
- B. Locations of lighting fixtures, outlets, panels, devices, and other equipment are approximately correct, but are subject to such revision as may be found necessary or desirable at the time work is installed in consequence of increase or reduction in the number of outlets, to meet field conditions, to coordinate with modular requirements of ceilings, to simplify work, or for other legitimate causes.
- C. Architect's Drawings of the building shall be examined to ascertain whether any changes have been made since Electrical Drawings were completed. Caution shall be exercised with reference to location of panels, outlets, switches, etc. and precise and definite locations shall be approved by the Owner before proceeding with installation. It shall be distinctly understood that the Drawings show only general run of conduit and approximate location of outlets.
- D. Any significant changes in location of outlets, cabinets, etc., found necessary to meet field conditions, shall be brought to the immediate attention of the Owner and written approval must be obtained before such alterations are made.
- E. The Drawings generally do not indicate the quantity of wires of conduit for branch circuit wiring. Provide the correct wire size and quantity of wires installed of proper size as required by the indicated circuiting, control wire diagrams, if any, specified voltage drop or maximum distance limitations and applicable requirements of NFPA 70 (NEC), 2017 Edition. Show branch circuit and feeder wiring and conduit runs on the record drawings.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. General: All equipment shall be the capacity and types specified and as shown in the Contract Documents and shall be the listed manufacturers and model numbers unless otherwise noted.
- B. All equipment, materials, devices and accessories shall be in full compliance with all State, city and local codes and laws and shall comply with the NFPA, ANSI, NEMA, and shall be UL listed and labeled for the application.
- C. Equipment installed in data center environments shall be suitable for continuous operation under conditions specified in ASHRAE TC 9.9.
- D. ARK1-Specific Equipment Summary (Per Building):

Equipment	Installed	Prepared Space	Total
Transformers (3750/3000 kVA)	42	–	42
Transformer (2500 kVA Admin)	1	–	1
Generators (4063 kVA / 3250 kW)	14	28	42 (future)
Generator (2500 kW Admin)	1	–	1
UPS (CDU – Critical, 200 kW)	42	–	42
UPS (CDU – Reserve, 200 kW)	6	–	6
UPS (Admin, 500 kVA)	1	–	1
PDU (1000 kVA)	84	–	84
ATS (1600 A Critical IT)	72	–	72
ATS (400 A MUPS)	36	–	36
Fan Wall (29.5 kW w/ ATS)	192	–	192
Chiller (328.4 kW)	84	–	84
CHW Pump (75 HP)	24	–	24

2.2 MATERIAL

- A. Provide all materials required for a complete and proper installation.
- B. In addition to the materials specified elsewhere, all other miscellaneous items necessary for the completion of the work shall be furnished and installed by the Contractor to the extent that all systems be complete and operative.
- C. All material and equipment furnished under this Division shall be new and listed and/or labeled by the Underwriters' Laboratories, Inc. for the application, unless otherwise

specified herein. Materials, material sizes and methods of construction not specified shall be at least equal to or better than the standards listed by the Underwriters' Laboratories, Inc. and/or requirements of the laws, regulations and codes mentioned hereinafter.

2.3 SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items and fasteners are designed to provide secure support from the building structure for electrical components.
1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
 2. Material: Nonconductive structurally rated fiberglass for equipment and materials connected to any isolated ground plane.
 3. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated.
 4. Cut ends of support should be finished the same as the material.
 5. Stainless steel shall be installed with stainless steel compatible tools.
- B. Steel channel supports have 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Fittings and accessories mate and match with channels and are from the same manufacturer.
- C. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, fiber glass-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Fittings and accessories mate and match with channels or angles and are from the same manufacturer.
 2. Fitting and Accessory Material: Same as channels and angles, except metal items may be stainless steel.
- D. 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.
- E. Sheet-Metal Sleeves: 0.0276-inch or heavier galvanized sheet steel, round tube, closed with welded longitudinal joint.
- F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored 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.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

2.4 TOUCHUP PAINT

A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.

B. For Non-Equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.

C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Inspection: Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Verify that the work of this Division may be completed in strict accordance with all pertinent codes and regulations, the approved shop drawings, and the manufacturer's recommendations.

B. Discrepancies: In the event of discrepancy, immediately notify the Owner. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

C. Do not install work without approved shop drawings.

D. Should the Contractor proceed without submittals and approvals of submittals, any costs incurred to correct problems that could have been corrected in the shop drawing or coordination drawings shall be the responsibility of the Contractor.

E. All work performed shall be first class work in every respect. The work shall be performed by mechanics skilled in their respective trades, who shall always be under the supervision of competent persons.

F. Work that is slipshod, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade, or to the Engineer or Owner, for "first class work" will not be acceptable and must be corrected to "first class work".

G. All work under this Section shall be performed in cooperation with the work performed under all other Sections of the Specifications on the Project to avoid interferences and to secure the proper installation of all work. Review the Drawings and Specifications covering the work to be performed under all Sections, so that the relation and extent of the work of this Section with respect to the work of all other Sections is understood.

3.2 INSTALLATION OF EQUIPMENT

- A. Interferences: Avoid interference with structure, and with the work of other trades, preserving adequate headroom and clearing all doors and passageways to the approval of the Owner.
- B. Inspection: Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, that all items function properly, and that all adjustments have been made.
- C. Fabricate, test, assemble and install all material, equipment, and systems in accordance with the requirements of the following:
 - 1. NFPA 70 (NEC), 2017 Edition - National Electrical Code
 - 2. NFPA 70E - Standard for Electrical Safety in the Workplace
 - 3. NFPA 75 - Standard for the Fire Protection of Information Technology Equipment
 - 4. NFPA 110 - Standard for Emergency and Standby Power Systems
 - 5. IEEE 142 - Grounding of Industrial Power Systems
 - 6. IEEE 1584-2018 - Arc Flash Hazard Calculations
 - 7. Occupational Safety and Health Administration (OSHA)
 - 8. American National Standards Institute (ANSI)
 - 9. Underwriters' Laboratories, Inc. (UL)
 - 10. NECA 1 - Standard for Good Workmanship in Electrical Construction
- D. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
- E. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.
- F. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations. This is critical for Tier III concurrent maintainability requirements.
- G. Give right of way to raceways and piping systems installed at a required slope.
- H. Install motor control equipment and other equipment furnished under other Divisions. Include the mounting and wiring by this Division in accordance with the Specification Sections of the Division that is furnishing the equipment.
- I. Anchor all floor mounted electrical equipment to the floor or equipment pad at each corner of each section of the equipment. Provide seismic bracing as specified elsewhere.

3.3 CLOSING-IN OF UNINSPECTED WORK

- A. General: Do not allow or cause any of the work of this Division to be covered up or enclosed until it has been inspected, tested, and approved by the Owner's representative and by all other authorities having jurisdiction.
- B. Uncovering: Should any of the work of this Division be covered up or enclosed before it has been completely inspected, tested, and approved, do all things necessary to uncover all such work. After the work has been completely inspected, tested, and approved, provide all materials and labor necessary and make all repairs necessary to restore the work to its original and proper condition at no additional cost to the Owner.

3.4 COOPERATION WITH OTHER TRADES

- A. Do all things necessary to cooperate with other trades in order that all systems in the work may be installed in the best arrangements.
- B. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

3.5 CLEANING

- A. It is the intent of these Specifications that all work, including the inside of equipment, be left in a clean condition. All construction dirt shall be removed from material and equipment. The job site shall be left in a clean condition at the end of each workday.
- B. For data hall and critical infrastructure areas, cleaning shall comply with data center construction cleanliness protocols as specified in ANSI/BICSI 002-2024.

3.6 COMPLETENESS

- A. It is the intent of these Specifications to provide a complete system. All material and equipment shall be installed properly. All material and equipment shall be adjusted so that it is operating as designed, to the satisfaction of the Owner.

3.7 ELECTRICAL SUPPORTING METHODS

- 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. Conform to manufacturer's recommendations for selecting supports.
- E. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200 lb. minimum design load.

- F. Seismic bracing shall be provided in accordance with IBC 2021 and ASCE 7 requirements for the project location.

3.8 CUTTING AND PATCHING

- A. Cut, channel, chase and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.
- C. Obtain written approval from the Owner and Structural Engineer prior to cutting or coring:
 - 1. Structural members including beams, columns, and load-bearing walls
 - 2. Post-tensioned or pre-stressed concrete elements
 - 3. Fire-rated assemblies
 - 4. Vapor barriers or waterproofing membranes
- D. For penetrations through fire-rated assemblies, provide UL-listed firestopping systems to restore the original fire rating. Document all firestop installations per Division 07 requirements.
- E. Core drilling in data hall areas shall be coordinated to minimize dust and debris. Provide appropriate containment and HEPA filtration during coring operations in operational areas.
- F. Coordinate all penetrations with the architectural and structural drawings. Provide sleeves for all penetrations through concrete and masonry construction.

3.9 TOUCHUP PAINTING

- A. Thoroughly clean damaged areas and provide primer, intermediate and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3.10 TESTING OF LOW VOLTAGE CIRCUIT BREAKERS

- A. All circuit breakers with 200 ampere and larger trip settings shall be primary injection current tested to ensure both the electronic and mechanical aspects of the breaker are functioning. Test all breakers that are provided under this project (by this Division and all other Divisions) or that are being modified in this project including spare breakers that are being used to feed new loads. All testing shall be performed on-site after the equipment has been set in its final location. All testing shall be in accordance with NETA ATS testing practices.
- B. All testing shall be documented, certified, and submitted for record to the owner and owner's representative.
- C. At the completion of testing, set breaker to recommended time curve settings per the coordination study.

- D. All testing listed above shall be by a certified third-party testing agency acceptable to the owner, engineer, and commissioning agent.

3.11 ARC FLASH HAZARD ANALYSIS

- A. Per NEC Article 110.16 and NFPA 70E, an Arc Flash Hazard Analysis shall be performed for all circuits ≥ 50 V and ≥ 100 VA.

B. Study Requirements:

1. Study scope: All MV and LV equipment fed from Bloom/generators
2. Calculation method: IEEE 1584-2018 (or later)
3. Working distance: 18 inches from energized parts (typical for switchgear)
4. Equipment labels: Arc flash label showing available incident energy (cal/cm^2) and PPE category

C. Electrical Safety Practices:

1. Lockout/Tagout (LOTO): Per OSHA 1910.147; energy isolation before work
2. Qualified worker training: Per NFPA 70E for electricians working on ≥ 50 V circuits
3. Arc flash PPE: Category and FC level per arc flash study
4. Maintenance access: 4 ft working clearance per NEC 110.34(A) in all electrical rooms

3.12 PROTECTIVE RELAY COORDINATION

A. Feeder Protection - MV Circuits:

1. Relay type: Multifunctional digital relay (IEC 60255-compliant)
2. Functions: Phase overcurrent, ground overcurrent, voltage, frequency
3. CT ratio: Per fault current calculation
4. PT ratio: $34.5 \text{ kV} \div 120\text{V}$ (288:1)
5. Coordination time: 0.3-0.5 seconds (inverse time curve)

B. Overcurrent Coordination:

1. Primary objective: Selective tripping to isolate faults without affecting healthy circuits
2. Zone Selective Interlock (ZSI): Required between main and section breakers
3. Arc flash assessment: Per NFPA 70E and NEC 110.16

C. Generator Protection Settings:

1. Overvoltage: 120% (delayed)
2. Undervoltage: 80% (delayed)
3. Overfrequency: 110%

4. Underfrequency: 95%
5. Reverse power: Anti-motoring enabled
6. Ground fault: Per NEC 250.20(B) (~5 A sensitivity)

D. Synchronization and Paralleling (Generator with Bloom):

1. Voltage matching: Within 10%
2. Frequency synchronization: ± 0.2 Hz
3. Phase angle alignment: $\pm 10^\circ$
4. Automatic synchronizer relay required

3.13 ELECTRICAL POWER MONITORING SYSTEM (EPMS)

A. A standalone Electrical Power Monitoring System shall monitor all major electrical equipment including:

1. Incoming Bloom SOFC service
2. MV distribution (34.5 kV)
3. 480-volt power distribution equipment
4. Automatic Transfer Switches (ATS)
5. Uninterruptible Power Supply (UPS) systems
6. Power Distribution Units (PDUs)

B. Monitored Parameters:

1. Voltage (line-to-line, line-to-neutral)
2. Current (per phase and neutral)
3. Power (kW, kVA, kVAr)
4. Power factor
5. Frequency
6. Harmonic distortion (THD)
7. Energy consumption (kWh)

C. EPMS Communication:

1. Modbus TCP/IP for power meter and sensor data acquisition
2. Integration with BMS system
3. Real-time trending and alarm capability

3.14 MISSION-CRITICAL SYSTEMS REQUIREMENTS

- A. All electrical systems serving data hall loads shall be designed and installed to support Uptime Institute Tier III concurrent maintainability requirements.
- B. Redundant power distribution paths shall be physically separated to prevent single points of failure.
- C. All electrical equipment in the critical power path shall be accessible for maintenance without requiring shutdown of IT loads.
- D. Labeling and identification shall comply with Section 26 05 53 and ANSI/BICSI 002-2024 requirements for mission-critical facilities.
- E. Emergency and standby power systems shall comply with NFPA 110 requirements for Level 1 systems.

3.15 ARK1 COMMISSIONING REQUIREMENTS

A. Landlord Commissioning Scope:

The Landlord shall commission all electrical systems from Bloom source through PDU secondary terminals, including:

System	Testing
Bloom SOFC	Fuel cell operation, stability, load response
MV Distribution	Insulation resistance, protective relay coordination, arc flash study
Transformers	Oil sampling, insulation test, load test, thermal imaging
Generators	Load bank test, paralleling simulation, fuel system verification
ATS Units	Transfer time measurement, synchronization verification, load transfer
UPS Systems (CDU)	Battery load test, runtime verification, transfer to battery
EPMS	Meter calibration, data accuracy verification, system integration
Grounding/Bonding	Ground resistance, continuity testing per IEEE 80

B. Commissioning Levels:

1. Level 1 (CxA): Design review, equipment delivery, installation QA
2. Level 2 (CxB): Functional testing, system verification, documentation review
3. Level 3 (CxC): Integrated systems testing, performance validation
4. Level 4 (CxD): Post-occupancy performance monitoring and optimization

C. Protective Relay Coordination Study:

Before energization, verify:

1. Fault levels: Short-circuit study per IEEE 3006.1
2. Relay settings: Coordination curves reviewed for selectivity
3. Transient stability: Load step response (power factor correction, harmonic impact)
4. Arc flash energy: NFPA 70E study with equipment labeling

D. Documentation Requirements:

1. As-built drawings: Final one-line diagrams with equipment nameplate data, protective relay settings and coordination curves, grounding and bonding diagram with resistance measurements, cable schedules with installation verification
2. Manuals and O&M documents: Equipment manufacturer manuals, operation procedures (LOTO, normal/emergency operations, troubleshooting), maintenance schedules and warranty documentation
3. Training records for Operations staff

END OF SECTION 26 05 00

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