

ELECTRICAL SYSTEMS

8.1 OVERVIEW

A. General: This Part of the Narrative summarizes the scope of work for the Modular Village at Bay Pines VA Medical Center. The purpose is to provide the requirement for all electrical work required for the proper function of a Modular Village including lighting, power fire alarm and communications system, fittings and fixtures that will support the program requirements and compliment the architectural and interior designs as described here after. This statement documents the current design directions and serves as the basis for budget estimating and for furthering discussions of project goals and objectives.

B. Scope of Work for Electrical Systems

1. Provide outdoor pad-mount transformer next to the Modular Village. The location of the transformer is to be determined and to be coordinated with the VA facility engineer. Provide new feeder breaker in the existing 1200A MDP in Room 1G143 at building #106 and feeders for the new Transformer
2. Provide new 4" conduit for telephone/data and fire alarm system from telecommunication room 145 to the nearest hand hole as shown on drawings.
3. Provide a new 1200A, 208/120V 3 phase 4 wire Main Distribution Board for modular village (MDP-MV) in Room 113.
4. Total load should not exceed more 12.5VA per square feet.

C. Definitions

1. AIA: American Institute of Architects
2. ANSI: American National Standards Institute
3. ASTM: American Society for Testing and Materials
4. CABO: Council of American Building Officials
5. NFPA: National Fire Protection Association

8.2 PERFORMANCE SPECIFICATIONS.

A. Codes and Standards: The design of the electrical systems shall conform to the requirements of the following standards.

1. VA Design Manual PG-18-10 - Available on the WEB site: <http://www.cfm.va.gov/til/dManual.asp>
2. National Electrical Code (2008)
3. Occupational Safety and Health Administration (OSHA)
4. Life Safety Code (NFPA 101) – 2012 edition
5. Americans with Disabilities Act (ADA)
6. Underwriters Laboratories (UL)
7. National Electrical Manufacturer's Association (NEMA)
8. Institute of Electrical and Electronics Engineers (IEEE)
9. National Fire Protection Association (NFPA)
10. American National Standards Institute (ANSI)
11. Electronics and Telecommunications Industry Associations (EIA/TIA)

B. Illumination Levels: The Illuminating Engineering Society's Illuminance Selection Procedure is used for establishing target-maintained illumination levels throughout all areas. Specific influences of glare, task complexity, surface reflectance characteristics, ceiling brightness, and usage are addressed with this procedure.

1. Local codes take precedence when they dictate the use of alternative procedures or require minimum lighting levels for specific areas.
2. Following are Individual area illumination levels.

<u>Space</u>	<u>Illumination Level</u>
Storage/Utility Rooms	30 foot candles
Corridors	10 foot candles
Elect/Mech.	20 foot candle
Class Room	50 foot candles
Stairs	20 foot candles
Lobby/Circulation	10-20 foot candles
Library	30 foot candle

Offices (standard)	50 foot candles
Conference Room	50 foot candles
Toilets	30 foot candles
Work Room	50 foot candles
General Support	50 foot candles

C. Emergency Power Requirements: There is no emergency power available for this modular village.

1. The emergency Egress lighting, exit signs are to be supported by built in battery pack

8.3 QUALITY ASSURANCE

A. Submittals

1. Product Data for the following:
 - a. Transformer, conductors, Light fixtures, Distribution board ETC.
2. Operation and Maintenance Manuals for the following:
 - a. Transformer and Distribution Board
3. Record Documents for the following:
 - a. As-built drawings

B. Testing

1. Field Test: Submit certified copies of test reports.
 - a. Grounding

C. Maintenance Service Contracts

1. The installers, for each of the following, shall provide a 1-year service / maintenance contract with the initial installation. The contract will include.
 - a. Over all electrical installation including all electrical equipment for one year

D. O-and-M Demonstrations

1. The manufacturers and installers, for each of the following, shall provide training for and demonstrations of the manufacturer have required maintenance and adjustment procedures to Owner's personnel.
 - a. Transformer and Distribution Board
2. Provide a list of parts the manufacturer recommends be in Owner's stock.

8.4 BASIC MATERIALS

A. Basic Materials: Includes switches, raceways, wire and cables, boxes, wiring devices, cabinets and enclosures, electrical identification, and other materials required for the electrical system.

B. Raceways: Electrical Metallic Tubing (EMT), rigid steel, and intermediate steel conduit systems complete with outlets, connections, couplings, and fitting for the installation of electrical conductors. All conduit systems, including armored clad, metal clad and flexible conduits, to form a continuous ground system.

1. Minimum Conduit Sizes:
 - a. Homeruns: 3/4-inch
 - b. Other: 1/2-inch
 - c. Telecom conduits from outlets: 1.25-inch
2. Conduit for below grade uses: non-metallic, Schedule 80 PVC
3. Conduit for exposed exterior locations, floor penetrations and concrete slabs on grade: Rigid galvanized Steel.

C. Wires and Cables

1. 600 Volt conductors are copper, #12 AWG minimum with type THWN, THHN, or XHHW insulation Branch circuit and feeder conductors installed in raceway with a grounding conductor. Conductors, including system neutrals shall be color coded and labeled at each junction or outlet box.
2. Run no more three (3) phases per raceway.

D. Boxes

1. Power and communication raceway systems shall be interconnected with metal boxes.

2. Outlet boxes shall be non-gangable, 4 inches square, 2-1/8 inches deep, with one or two gang square corner extension rings.
3. Provide junction and pull-boxes as required and install to maintain accessibility to cover.
4. Do not mount outlet boxes back-to-back.
5. Secure boxes to framing, supplemental framing or other structurally stable member; do not support boxes from conduit or mechanical systems.

E. Wiring Devices:

1. Receptacles: Receptacles shall be of specification grade 125V, 20A, 2-pole 3-wires grounding system, NEMA 5-20R.
2. Switches: Switches shall be 125V, 20A.
3. Device plates shall be impact resistant nylon and ivory in color.⁷
4. Normal devices are Ivory color.
5. Provide 2- Duplex Receptacles in each office near the computer (Refer Furniture Plan) and library support area.
6. Provide 4- Duplex Receptacles in Conference room and control room,
7. Provide 3- Duplex Receptacles in Reception area.
8. Provide 3- Duplex Receptacles in break room, Minor Simulation Room, Group Video Room
9. Provide 1- Duplex Receptacles in each Utility Room.
10. Provide 3- Duplex Receptacles in library work area.
11. Provide 1- Duplex Receptacles in corridor for every 40'.
12. Provide 1- Duplex Receptacle (GFI-WP) outside every 25'
13. Provide 12- Duplex Receptacles in library area.
14. Provide – 7 Quad Receptacles in each class room and Simulation Room.
15. Provide – 1 Duplex Receptacle (GFI) in each toilet near the basin and each break room above the counter.
16. Provide – 1 Duplex Receptacle (GFI) dedicated circuit in each break room above the counter.
17. Provide – 1 Duplex Receptacle dedicated circuit and 1 Duplex Receptacle in each copy room above the counter.
18. Provide two (2) switches in each office and work room.
19. Provide 2/3/4 way switch in each corridors where multiple entrance are available.
20. Provide 2-way switches in each door location of rooms where there is more than one doors for the room.
21. Provide single switch in all other room near swing side of the doors.
22. Provide Occupancy sensor Dual Technology type in each room.
23. Provide power for instant toilet heaters.
24. Provide power connection to the electronic faucet and valves
25. Provide power for electrical water cooler.
26. Provide power to the HVAC system in each module.
27. Provide power to the modular furniture as required per manufacturer requirement.

F. Cable Support System: Cable hook system including hooks 6" above the ceiling at 36" on center along the corridor for selected communication systems.

1. Cable hooks system to convert to conduit system through rated walls and into rooms off corridors.

G. Electrical Identification

1. Nameplates to identify equipment on normal power shall have 1/4-inch tall white letters on black background and equipment on Emergency power shall have 1/4-inch tall white letters on a red background.
2. Provide 3/4-inch vinyl tape inside normal power light switch and receptacle coverplates to identify panel and circuit.
3. Provide adhesive label tape on the outside of Emergency power light switch and receptacle coverplates to identify panel and circuit.
4. Conductors: color coded and labeled.
5. All nameplates, warning signs, labeling and coverplates shall comply with industrial standard.

8.5 BUILDING SERVICES

A. Normal Service: The electrical service to the Modular Village shall be fed from existing 1200A Panel "MDP" in Building #106.

1. Provide new underground service feeders from the existing 1200A Panel "MDP" building #106 to new transformer located near Modular Village.

8.6 DISTRIBUTION SYSTEM

A. Electrical Distribution Equipment: Section includes switchboards, distribution panels and associated equipment.

1. Manufacturer of distribution equipment shall be Square D, General Electric and Cutler-Hammer or approved equal.
2. Provide one (1) 350A, 480V, 3-Pole Breaker in the spare space of the existing 1200A switchboard MDP in room #1G143 in building #106.
3. Run 1 sets of 4-600KCMIL+1/0 GRD in 4" PVC Schedule 40 concrete encased duct bank (24" below ground) from Building #106 to the New 225KVA transformer located outside the Modular village as shown.
4. Provide feeders for each Panel provide with each module from the MDP-MV as shown on sheet EP-801.

B. Transformer: New Pad mounted 225KVA 480V Primary Delta, 208/120V Secondary Wye NEMA 3R rated with weather shield.

C. Normal Power Distribution Board: The Main Distribution Board shall with 1200A, 208/120V 3 phase 4 wire +GRD system with 1200A main, 20-90A 2 Pole outgoing breakers, 4-2 Pole space and 1-60A 3 pole breaker for TVSS system in electrical room of the 12 Module Section. Refer onel line diagram for additional information

D. Surge Suppression: Transient voltage surge suppression (TVSS) will be provided in the main Distribution board.

1. Modular design MOV's, individually fused, mounted in main switchboard.

E. Grounding: Ground conductive raceways and enclosures for electrical systems in compliance with National Electrical Code; form a continuous and permanent grounding system. Provide ground conductor run with all phase conductors of branch and feeder circuits.

1. Service Ground: Provide grounding electrode near the transformer and Connect ground conductor electrode to the nearest existing ground electrode system and to water service piping.
2. Ground Electrode System: System of ground rods and ground ring set below grade, connect with ground conductor to main electrical room, ground bus.
3. Electrical room ground bus: 1 inch wide drilled and tapped copper bus mounted on insulators.
4. Cconnect the grounding to the following: Wter Pipe, building structure etc.

F. Electrical Branch Circuit Panelboards: Branch circuit Panelboards with molded case circuit breakers,

1. Panelboards: Each Module shall be provided with a 100A, 2-Pole, 3-wire + GRD system with 90A main breaker and 1-30A 2-Pole, 10-20 1-pole out-going breakers.
 - a. Ground bus in all panels
 - b. Engraved nameplates
2. Overcurrent Protective Devices: Thermal magnetic molded case circuit breakers will be normally rated at 22,000 AIC at 240V. Circuit breakers provided with over-center toggle type mechanisms with trip indication. Multi-pole breakers shall be common trip. Circuit breakers rated 100A or less to be fixed trip.
3. Overcurrent Devices Added to Existing Panels: Interrupting capacity not less than existing lowest rated device. Match existing manufacturer and type.

G. Circuit Breakers: Circuit breakers installed in Panelboards, Distribution Board or individual enclosures for feeder circuits:

1. Molded Case Circuit Breakers: Thermal magnetic molded case circuit breakers shall be with adjustable trip settings for circuit breakers larger than 100A and fixed trip rating for the breakers 100A or less.

8.7 LIGHTING

A. Lighting Systems: Includes lamps, luminaires, and luminaires' accessories for interior and exterior lighting systems and control.

1. Lamps: Fluorescent lamps shall be energy saving 4100 degree Kelvin, T-8 rapid start. Compact fluorescent shall be 4100 degree color lamps in recessed downlights.
2. Luminaire Accessories:
 - a. Ballast: Ballast's shall be equipped with fuse. Ballast's for fluorescent lamps shall be high frequency electronic type. By-Level fixture shall be provided with ballast suitable for by level switch.
 - b. Lenses: Lenses shall be 100% virgin acrylic .125" thick.
 - c. Parabolic Louvers: Parabolic aluminum louvers shall be with semi-specular anodized finish.
3. Lighting System Basic Materials: Fixtures in general will be specified for the type of ceiling and application. Necessary fittings, hangers, brackets, flanges, boxes, and outlets provided for a complete system.
 - a. Minimum conductor size is #12AWG.
 - b. Green insulated ground conductors should run with all circuits.
4. Exit and Egress Light Fixture:
 - a. Exit light Fixtures shall be LED type with built-in battery pack.
 - b. Emergency Egress Light Fixtures shall be with built-in battery pack.
5. Interior Luminaires: Fluorescent fixtures will be used throughout at 120V.
6. Exterior Lighting: Light fixtures at the exit doors and walkways between two groups of modules shall be wall mounted and suitable for outdoor for wet location use.
7. Lighting Design Description: Below is a brief summary of the proposed lighting design itemized by space.
 - a. Corridors: Recessed 2' x 4', 2-32 W T8 lamps fluorescent fixtures with acrylic lenses which will provide ambient lighting.
 - b. Public Toilets: Wall mounted 2', 1-17W T8 lamps fluorescent lights on top of mirrors and recessed 26W compact fluorescent lensed downlights will provide the ambient lighting in other areas.
 - c. Office Rooms: Recessed 2' x 4', 3-32 W T8 lamp fluorescent fixtures with Parabolic Aluminum Louvers will provide ambient lighting. These fixtures shall be suitable for By-Level switching.
 - d. Library and Resource Rooms: Recessed 2' x 4', 3-32W T8 lamp fluorescent fixtures with Parabolic Aluminum Louvers will provide ambient lighting.
 - e. Conference Rooms: Recessed 2' x 4', 3-32W T8 lamp fluorescent fixtures with Parabolic Aluminum Louvers will provide ambient lighting.
 - f. Minor Sims/Group Video Rooms: Recessed 2' x 4', 3-32W T8 lamp fluorescent fixtures with Parabolic Aluminum Louvers will provide ambient lighting. These fixtures shall be suitable for By-Level switching.
 - g. Main Sims/Class Rooms: Recessed 2' x 4', 3-32W T8 lamp fluorescent fixtures with Parabolic Aluminum Louvers will provide ambient lighting. These fixtures shall be suitable for By-Level switching.

8.8 FIRE ALARM

A. Fire Alarm System: Provide local fire alarm panel in the Telephone closets and connect to the existing Hospital multiplex addressable Fire alarm system. The fire alarm system will be designed to provide modern smoke and fire detection systems. Fire alarm detection and initiation devices will be addressable. Fire alarm detection devices will be intelligent. Additional features include:

1. Speaker/strobe lights shall be provided in corridor, conference room, library/resource room, class room, control room, group video room, minor Sims Room and Toilets shall be ADA complaint.
2. Provide area smoke detectors in corridors and as required per NFPA 72.
3. Provide Fire Alarm Pull Station in each exit Door.
4. Fire Alarm System will be installed in conduit.
5. Manufacturer shall be: Similar to the existing system at the main building.

8.9 VOICE/DATA SYSTEMS

A. Voice/Data Telephone System: Provide conduit and outlet box system for installation of the voice/data communication system cabling and outlets. Provide all cabling and outlets installed terminating back to the associated telecom room within the space.

1. Follow all Electronics and Telecommunications Industry Associations (EIA/TIA) installation guidelines.

2. All horizontal data cabling shall be CMP (plenum rated) Category 6A rated UTP cabling.
3. Provide voice/data connection to the system furniture.
4. Voice/data outlets will be 4-11/16 inch square boxes with a single gang ring and a 1.25 inch conduit bushed to the communications cable hook system in the corridor. Provide a 1.25 inch conduit stubbed (& bushed) into accessible ceiling space in areas where the cable hook system is not located.
5. Typical Voice/Data outlets shall be the following:
 - a. Type A (typically utilize this standard unless noted as a different type). 2-gang j-box with 1-gang wallplate that has (2 blue data jacks on bottom, 1 black phone jack in top left, 1 blank).
 - b. Type B. 2-gang j-box with 1-gang wallplate that has (2 blue data jacks on bottom, 2 blank on top).
 - c. Type C. 2-gang j-box with 1-gang wallplate that has (2 blue data jacks on bottom, 1 blue data jack on top left, 1 blank on top).
 - d. Type D. 1-gang j-box with 1-gang stainless steel wall phone wallplate that has (1 black phone jack).
6. Provide 1-Type A Voice/Data outlet in each office rooms (all rooms that aren't storage, corridors or mentioned below shall be considered office rooms) near the computer location (refer to the Furniture Plan)
7. Provide 1-Type A Voice/Data outlet in each wall of the following rooms:
 - a. Conference room,
8. Provide 1-Type A Voice/Data outlet in the 2 longer walls, and 1-Type B data outlet in the 2 shorter walls of the following rooms:
 - a. Main Simulation Room (coordinate with equipment layout)
 - b. Work Room
9. Provide 1-Type A Voice/Data outlet in the teacher wall (near teacher's desk), and 1-Type C data outlet in all other walls of the following rooms:
 - a. Classroom
10. Provide 1-Type A Voice/Data outlet and 1-Type C data outlet within each of the following rooms:
 - a. Control Room (coordinate with equipment layout)
 - b. SIM Minor room (coordinate with equipment layout)
 - c. Group/Video
11. Provide 1-Type A Voice/Data outlet in one wall, and 1-Type B data outlet in the opposit wall of the following rooms:
 - a. Conf/Break
 - b. Break
12. Provide 1-Type A Voice/Data outlet at each workstation within the following rooms:
 - a. Work Area Open
13. Provide 2-Type A Voice/Data outlets within the following rooms:
 - a. Reception
 - b. Room Training
14. Provide 1-Type D Voice outlet near door and 1-Type B data outlet within each of the other walls following rooms:
 - a. Copy
15. Provide 1-Type A Voice/Data outlet and 6-Type C data outlets for the following rooms:
 - a. Library/Resource
16. Data service - Utilize 24 strand of OM4 multi-mode fiber optic cabling and 12 strand of OM1 multi-mode fiber optic cabling to the telecom rooms. The network backbone connectivity will be capable of 10Gps with future 40Gps and 100Gps capability. See riser diagram.
17. Voice service - Provide 100 pair of Cat3 service cabling back to the main building with 50 pair Cat 3 where needed – see riser diagram.
18. Telecom Rooms (TR)
 - a. The door shall be 7'-6" minimum in height and 3'-6" wide. There must be no ceiling (exposed) in the TRs and the doors must open out.
 - b. Provide (3) standard 19" 2-post data racks per room. Provide (2) 6" wide x 10" deep vertical cable managers per rack.
 - c. Provide 18"W ladder rack at 9'-0" around the perimeter of the room and directly above the data racks (waterfall down to lower level tray over racks).
 - d. Provide a minimum of (4) 48 port patch panels and (6) 2U horizontal cable managers per room and terminate all voice/data horizontal cabling within these patch panels.

- e. Provide a Telephone Terminal cabinet in communication rooms. Provide 66 block within the Telephone Terminal Cabinet for the voice service cabling and patch from the 66 block on the wall to the rack for any voice outlets.
- f. Rack mount all security equipment capable of being rack mounted.
- g. Voice/data equipment rooms shall be provided with $\frac{3}{4}$ " void free plywood backboards (painted light gray) on at least two full walls mounted at 24" AFF to the bottom and 10' AFF to the top.
- h. Security Equipment dedicated wall space. Provide the following as a minimum:
 - 1) Security/CCTV power supply for exterior cameras.
 - 2) Intercom control panel(s)
 - 3) Access Control reader panel(s)
 - 4) 4"x4" hinged cover (front) wireway/trough mounted horizontally at 30" AFF
 - 5) 6"x6" hinged cover (front) wireway/trough mounted horizontally at 9'-0" AFF (with vertical wireway up to the ladder rack in the room).

8.6 SECURITY SYSTEMS

ACCESS CONTROL:

Devices, equipment, cabling and programming will be provided under the scope of this project to tie back to the existing FIPS compliant system on campus. Data cabling will be provided between card reader panels (backbone) as well as multi-pair cabling to devices from card reader as required.

All cables to the devices will be plenum rated (minimum) and run in the same pathways as the telecom cabling in a separate j-hook system to the device. Conduit will be provided for stubs, inaccessible locations and exposed locations only. Conduit will be used within the wall for all door connections. Coordinate with campus police for exact system requirements.

For fit-out purposes, anticipated Card Reader locations include:

- Mechanical, Electrical and Telecom rooms.
- Doors to enter the Simulator and Control Room.
- Doors to Classroom.
- Exterior doors.

CCTV CAMERAS:

All cameras will be a network based IP based CCTV system to tie back to the existing system. Devices, equipment, cabling and programming will be provided under the scope of this project. The new Network Video Recorders (NVR) will be provided in the larger TR. The network video storage will be on the SAN or provided under this project as a new dedicated RAID array network storage (Size to be determined).

Voice/Data cabling will be provided for all cameras. Interior fixed mount IP cameras will be utilized with 2.0 megapixel quality resolution (minimum). Exterior IP cameras will be utilized (if any exterior cameras are required) with 768x494 resolution (minimum). All cameras will be monitored at the existing Security Operations Center on campus. Coordinate with campus police for exact system requirements.

For fit-out purposes, anticipated CCTV Camera locations include:

- Building entrances and exits.

INTERCOMS:

Devices, equipment, cabling and programming will be provided under the scope of this project. The new audio IP based intercoms will be locally used for door release. The video from the camera will be provided to the nurse station that also has the master station for the door release. Voice/Data cabling shall be provided for all intercoms to be an IP based intercom system. Coordinate with campus police for exact system requirements. For fit-out purposes, anticipated intercom locations include:

- Entrances to all building with master station at the reception.

8.7 AUDIO/VISUAL SYSTEMS

A. Master Antenna Television (MATV) (Coaxial Cabling) System

1. The existing location of the MATV System Headend (source equipment) is within Building 100.
2. Devices, cabling and programming will be provided under the scope of this project.
3. The existing campus distribution system is a tap & trunk coaxial system with 2-tiered horizontal cabling and with fiber backbone. Provide new ½" backbone cabling back to the nearest MATV trunk within building 100. Provide all splitters, amplifiers, taps, etc.. for a complete system that provides signal levels of +6dB at each outlet. Every outlet must support both analog video distribution and HD digital video distribution. Consideration should be made to using only IPTV distribution for flexibility.
4. All source program equipment is anticipated to be existing to remain.
5. All horizontal cables shall be plenum rated (minimum) and supported using the j-hook system and separate j-hooks. Conduit will be provided for stubs, inaccessible locations and exposed locations only.
6. Every TV outlet will have both a Coaxial F-type connector & a Data jack for future IPTV programming/controls.
7. TV Outlets - 1-gang j-box with 1-gang wallplate that has (1 blue data jack and one coax F-type connector). Provide outlet mounted at 65" AFF or as per TV mounting requirements.
8. Provide 1-TV outlet within each of the following rooms (coordinate locations within room):
 - a. Classroom
 - b. Group/Video
 - c. Break Rooms
 - d. Conference & Conference/Break
 - e. Control Room
 - f. Simulation Room Main

B. Conference/Break Room #129 & Group Video Rooms #142 & 143

1. The conference room shall have a 55" flat panel HDTV screen as an auxiliary display with a wall-plate HDMI, mini-stereo, audio, Displayport & VGA input under the display. The speakers on the display will be utilized for audio. Provide conduit and junction boxes as required for wall outlet to accommodate this system (typically 1-1/4" conduit or larger). Provide recessed service box for the TV and provide adjustable mount with bottom of screen at 4'-2". Coordinate location with furniture layout.

C. Conference Room #124

1. The conference room shall have a 70" flat panel HDTV screen as an auxiliary display with a wall-plate HDMI, mini-stereo, audio, Displayport & VGA input under the display or at lectern. The speakers on the display will be utilized for audio. Provide conduit and junction boxes as required for wall outlet to accommodate this system (typically 1-1/4" conduit or larger). Provide recessed service box for the TV and provide adjustable mount with bottom of screen at 4'-2". Coordinate location with furniture layout.

D. Classroom #144

1. The conference room shall have a 70" touchscreen flat panel HDTV screen as an auxiliary display with a wall-plate HDMI, mini-stereo, audio, Displayport & VGA input under the display or at teacher desk. The speakers on the display will be utilized for audio. Provide conduit and junction boxes as required for wall outlet to accommodate this system (typically 1-1/4" conduit or larger). Provide recessed service box for the TV and provide adjustable mount with bottom of screen at 4'-2". Coordinate location with furniture layout.

8.8 ELECTRICAL TESTING

A. Performance testing of equipment and system installation and operation shall be carried by an accredited testing firm in conformance with criteria by the International Electrical Testing Association.

B. **Quality Assurance:** Compliance with the standards and associations of the industry including UL, IEEE, NEMA, NFPA, NBFU, ICEA, ASTM, OSHA, NESC, ANSI, ETL, NETA, where applicable. The testing firm will be a qualified independent testing agency.

C. **Electrical Equipment and Systems Tested:** Perform test on equipment and systems listed, tabulate data and submit with equipment submittal (factory) or acceptance checkout (contractor).

1. Electrical switchboards Factory certification
2. Electrical equipment including panels, transformers, motor control centers Factory certification
3. Cables (600V) Insulation and continuity

4. Motors Phase, rotation, characteristics
5. Automatic Transfer Switches All functions
6. Grounding Resistance
7. Fire Alarm System per NFPA

End of Part 8