



SSTD-8070-0081-ELEC Revision D
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Space Administration
John C. Stennis Space Center
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COMPLIANCE IS MANDATORY

JOHN C. STENNIS SPACE CENTER FACILITY ELECTRICAL STANDARD

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Document History Log

Status/ Change/ Revision	Change Date	Originat or/ Phone	Description
Basic	12/14/01	Roy Worthy 8-1820	Initial release – supersedes SSC STD 50-008, Revision A, with the following changes: New document number and format per SPG 1400.1; Throughout the document, edits and rewrites for content changes, and English units of measure added in parentheses after metric units; Table of Contents changed to reflect text mods and reorganizations; 2.0 adds, deletes and changes per text references and changes in document numbering; 3.0 retitled and text added for Responsibilities; 4.3 title change 'Guide' to 'Regulations'; 5.1.1-b change allows NASA Technical Monitor to determine data format; 5.1.1-h added new for panel schedule and changed 'field engineer' to 'construction monitor'; 5.2-NOTE delete CFR ref and allow substitutions as approved by the NASA Technical Monitor; 5.3-g delete High-Voltage System Engineer and have requirements specified by the NASA Technical Monitor only; 5.4-a & -b delete refs to NEC tables; 5.6.1 change requirement from # 8 AWG to # 10 AWG; 5.6.2 delete subsection Fire Alarm Circuits and Wiring Color Codes and renumber subsequent subsections; 5.7 delete CFR ref; 5.7-f change # 8 AWG to # 10 AWG, delete 'solid' copper requirement, add 'for circuits over 250V' for spring tension connectors; 5.7-g add for split lug connectors if crimping not possible, add 'first with rubber' to double wrap requirement; 5.7-i delete ref to ANSI C37.20.1; 5.8.1-e delete 'control' and add 'unless approved by NASA Technical Monitor'; 5.8.2-h allow EMT on exterior installations if not subject to extreme weather, mechanical damage or hazardous areas; 5.8.2-i add that pull strings be weather resistant; 5.8.2-k add trace tape requirement; 5.8.3-a complete rewrite delete diameter and metallic tubing requirements; 5.8.3-b delete (Security and Fire Alarm Systems) and renumber all subsequent steps; 5.8.3-e add that pull strings be weather resistant; 5.9-NOTE delete ref to 29CFR1910; 5.9.3 limit copper winding requirement only to dry transformers >75 kVA; 5.9.5 change '2-2.5%' to 'two 2.5%'; 5.9.6-a change non-linear loads from 40% to 25% and change '2-2.5%' to 'two 2.5%'; 5.9.6-b last sentence put first, bold; 5.9.7 delete refs to NPA 70, ANSI/IEEE C2 and 29 CFR 1910; 5.10 Distribution Switchboards moved to 5.12; 5.18 Motors moved to 5.10; 5.11 reorganized and merged with previous sections 5.19 Motor Starters, 5.20 Manual Starter, and 5.21 Motor Control Schematic Wiring Diagram, and subsequent sections appropriately renumbered, with the following changes: 5.10-a delete refs to NEMA Std MG1-12.53 and IEEE 112; 5.10-c, -d, -e add footnote to consult with NASA Technical Monitor for substitutions if motor or power vary from specified ranges; 5.11.1-b apply padlock provision to all devices; 5.11.2-b change copper bus to plated copper bus; 5.11.5 text rearranged; 5.11.2-g delete '(ea.)' in two places; 5.12-h change copper to plated copper for busses rated 225 amps or higher with other bus materials approved by the NASA

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			Technical Monitor and neutral bus fully rated; 5.12-l delete refs to ANSI/IEEE C2, NFPA 70, and 29 CFR 1926; 5.12-m add new to use main breakers when required by NEC; 5.13-b change same as in 5.12-h above; 5.13-h delete ref to NEC table; 5.14-d change copper to plated copper for busses rated 225 amps or higher; 5.14-k delete ref to NEC table; 5.14-s change single-phase panel boards from acceptable to unacceptable, unless approved by NASA Technical Monitor; 5.15.1-f change water fountain receptacle requirement from single to GFCI; 5.18-a delete ref to NEC Article 620-51; 5.18-b delete ref to NEMA spec KS1-1975; 5.20-a change NASA Facilities Engineering Division to NASA Technical Monitor; 5.20-c delete breakrooms & corridors, and list restrooms with the exceptions; 5.21-d delete ref to NFPA 101 paragraph 31-1.3.8; 5.21-e add new for auto test and diagnostic routine; 5.23-d delete refs to NEC Articles 645 & 685; 5.21-j add new for battery cell cabinet maintenance; 5.25 FIRE ALARMS delete all 9 subsections, change NOTE to paragraph format and add ref to NASA Std 8719.11; 5.26-a delete ref to NEC Article 250; 5.26-f delete ref to NEC 250-94; 5.26-n delete ref to IEEE Std 81; 5.27-e relax requirement for copper only by add of qualifiers and that all materials must be approved by the NASA Technical Monitor; 5.28-f change '10 pole switches' to '10-pole switches'; Appendix A adds, deletes and changes per text changes and edits.
A	12/29/06	James W. Hughes x 8-2304	Revalidated. Updated references and amended text to reflect proper references. Appendix A additions, deletions, and changes per text edits. Corrected typographical errors throughout document. Added Note in section 5.13 (k). Changed titles for signatures per NASA SSC organization changes.
B	06/12/08	Thomas Rich x 8-3946	NASA organization titles changed per organization change. Global change from NASA Tech Monitor to NASA Project Manager (PM). Administrative changes throughout document. Updated references. Divided section 2. Section 4.3: added reference to NFPA 780 and LPI-175. Section 4.5: added reference to OSHA 29 CFR 1910.147. Section 5.1.1 (f): deleted verbiage stating control equipment shall be date compliant for the year 2000 and beyond and manufacturer's submittal of cert of compliance forwarded to CEF. Section 5.2: deleted 5.2.1, 5.2.2, and 5.2.3. Section 5.3: (a) added verbiage for UL type MV-90 to be minimum, added statement for underground splices; (b) deleted requirement for markers every 200 meters and at each turn for underground ductbanks; (d) deleted option for 200-amp size; (g) changed requirement for wood poles to be approved by NASA PM. Section 5.6: added reference to NFPA 70 110.15 and 230.56. Section 5.6.1 (b): removed "Positive 28 V - Red with white stripe" and "Negative 28 V - Black with white stripe". Section 5.7: (i) deleted "Use No. 14 AWG, 300V stranded copper for all control wiring unless otherwise required"; (j) - added reference to SOI-8080-0007; added (k). Section 5.8.1: added statement to (a); (f) removed minimum requirement for 50% spare capacity for data acquisition raceways; (i) changed verbiage for acceptable ground conductors. Section 5.8.2: (c) added orange stain requirement; (d) deleted reference to "wrapped or coated rigid galvanized steel conduit"; (i) changed requirement for pull strings to be #14 AWG. Section 5.8.3: (e) changed requirement for pull

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			strings to be #14 AWG; (i) deleted requirement for the cross-section area of the conductors. Section 5.9.1: deleted reference to SpecsIntact Section. Section 5.9.2: replaced 120/240 V or 277 V with 480/277 V for secondary voltages, deleted reference to SpecsIntact Section. Section 5.9.4 - deleted verbiage and added reference to metering section (5.28). Section 5.11.3 (c) changed requirement from one N.C. and N.O. to two. Section 5.12 - added (n) and (o). Section 5.13: added (c); (h) changed 100' to 150'; (i) changed (6') to (6'-7"); added (o). Section 5.14: (h) changed from orange to orange triangle; (j) changed requirement for maximum distance; (l) changed distance. Section 5.15.1: (e) added reference to NFPA 70; (f) changed "GFCI receptacles" to "GFCI protection"; added (g). Section 5.15.5: changed orange to blue. Section 5.19: added (b); (c) added requirement for remote control/monitoring interface; added (k) and (l). Section 5.20: added (a), (e) added requirement for remote control/monitoring interface. Section 5.23 - added (a). Section 5.24 - added (e). Section 5.26: (b) changed limit of 5 ohms to range of 1-5 ohms; changed maximum of grounding system resistance from 1 ohm to 5 ohms; (f) changed requirement from "No. 12 AWG or larger"; (j) expanded requirement for providing test wells; (k) added reference to 5.26 (d); (n) added qualifying statement to first sentence, changed requirement for single rod electrodes from not exceeding 25 ohms to not exceeding 10, added statement for lightning protection systems resistance to true ground, changed resistance for control grounding systems from 5 ohms to 0.5 ohm maximum, deleted minimum distance requirement; added (o) and (p); (r) expanded to clarify isolation requirements. Section 5.27: (a) changed responsibility from ESD Design Branch to "facility requirements document"; (c) replaced AMCR 385-100 with NASA-STD-8719.12, replaced NSTS 07636 with CxP 70080; added (g), (h), (i), (j), (k), (l), (m), (n), and (o); (p) changed LPI to UL. Section 5.28: (a) added second statement; replaced (c); replaced (e); added (i). Section 5.29 - added verbiage for building automation system.
C	07/26/13	Kelly King x-2682	Five-year review; updated formatting and references; replaced references to SSC STD 50-002, SSC STD 99-006, and SSC STD 99-020 with SSTD-8070-0085-EMCS, SSTD-8070-0004-CONFIG, and SSTD-8070-0083-ELEC, respectively. Deleted note on "Deviations" under Applicability on Page 7. Added Attachment: EMI 09B307-05, E-502.
C-1	3/25/14	Kelly King x-2682	Added Panel Schedule Submittal and Phenolic Label Plate Request forms with new SSC numbers, and SORD 20000-E010, Procedure for Updating CEF Electrical Panel Schedule Database to reference section.
C-2	8/26/15	Carol Wolfram x-1164	Administrative change; correcting 5.0 references to 6.0 references in 6.3-f, 6.8.1-i, 6.11.2-c, 6.14-n, 6.19-a, and Appendix A.1.
C-3	02.16.16	Carol Wolfram x-1164	Administrative change. Replaced "FOSC" with "SACOM" throughout document.

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D	4/29/16	Thomas Rich x 8-3946	Format and grammatical changes made. Updated references and acronyms. Revised cover sheet to require approval from NASA SSC Center Operations Design & Construction Project Management Division, with concurrence from NASA SSC Center Operations Directorate Operations and Maintenance Division, NASA SSC Engineering & Test Directorate, and NASA SSC Safety and Mission Assurance. Updated acronyms and references. 6.1.1-b General Requirements: Added requirement for arc flash hazard analyses. 6.1.1-c: Deleted “Ensure that the primary feeder has adequate spare capacity to supply the added load imposed by the proposed project.” 6.1.3: Specified 2013 version of Microsoft Project. 6.13.-k and 6.14-m: Revised panelboard description to read as follows: “Panelboards served by uninterrupted power supplies (UPSs) shall be clearly marked with minimum 12.7mm (1/2-inch) high white lettering on black background.”
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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) provides guidelines for the design, construction, modification, and maintenance of electrical systems at SSC.

NOTE: This standard may be supplemented by project requirements from the customer(s) and the National Aeronautics and Space Administration (NASA) SSC Center Operations Directorate as well as the Project Management and Operations and Maintenance divisions. Engineering and Test Directorate (E&TD) electrical requirements are provided in SREF-8060-0001.

2.0 APPLICABILITY

This SSTD is applicable to:

- SSC and its contractors in regard to electrical systems including but not limited to: Power generation and distribution, lighting, uninterruptible power sources, security, fire alarm, lightning protection, grounding, bonding, metering, DC power, and communications networks.
- The customers for electrical design and construction, including but not limited to: Facility occupants, system users, NASA SSC E&TD, the maintenance organization, and the funding organization.
- All organizations and/or individuals responsible for facilities design and construction and/or the use of electricity at SSC. They shall incorporate the information outlined in this SSTD into their designs and electrical installations.

3.0 REFERENCED AND APPLICABLE DOCUMENTS

All references are assumed to be the latest version unless otherwise indicated.

42 U.S.C. 6834	<i>Federal Building Energy Efficiency Standards</i>
ASTM C1089	<i>Standard Specification for Spun Cast Pre-stressed Concrete Poles</i>
IEEE 81	<i>Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System</i>
IEEE 112	<i>Standard Test Procedure for Polyphase Induction Motors and Generators</i>
IEEE 142	<i>IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems</i>
IEEE 386	<i>Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V</i>

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IEEE C2	<i>National Electrical Safety Code</i>
IEEE C37.20.1	<i>Metal-Enclosed Low-Voltage Power Circuit Breaker Switchgear</i>
IEEE C57	<i>Distribution, Power, and Regulating Transformers</i>
IEEE C57.110	<i>Recommended Practice for Establishing Liquid-Filled and Dry-Type Transformer Capability When Supplying Nonsinusoidal Load Currents</i>
IEEE C57.12.20	<i>Standard for Overhead Type Distribution Transformers, 500 kVA and Smaller: High Voltage, 34 500 V and Below; Low Voltage, 7970/13 800Y V and Below</i>
IEEE C62.11	<i>Standard for Metal-Oxide Surge Arresters for AC Power Circuits</i>
LPI-175	<i>Standard for the Design-Installation-Inspection of Lightning Protection Systems</i>
MIL-HDBK-419A	<i>Military Handbook: Grounding, Bonding and Shielding for Electronic Equipments and Facilities</i>
NASA-STD-8719.11	<i>Safety Standard for Fire Protection</i>
NASA-STD-8719.12	<i>Standard for Explosives, Propellants, and Pyrotechnics</i>
NEC Article 250	<i>Grounding and Bonding</i>
NEC Article 384	<i>Switchboards and Panelboards</i>
NEC Article 500	<i>Hazardous (Classified) Locations</i>
NEC Article 645	<i>Information Technology Equipment</i>
NEC Article 685	<i>Integrated Electrical Systems</i>
NEMA Standard MG1-12.53	<i>Motors and Generators</i>
(a), (b)	
NFPA 70	<i>National Electrical Code</i>
NFPA 70 110.15	<i>High-Leg Marking</i>
NFPA 70 230.56	<i>Service Conductor with the Higher Voltage to Ground</i>
NFPA 70E	<i>Handbook for Electrical Safety in the Workplace</i>
NFPA 72	<i>National Fire Alarm and Signaling Code</i>
NFPA 101	<i>Life Safety Code</i>
NFPA 780	<i>Standard for the Installation of Lightning Protection Systems</i>
NPR 8715.3	<i>NASA General Safety Program Requirements</i>
NPR 8820.2	<i>Facility Project Requirements</i>
NSTS 07636	<i>Lighting Protection, Test and Analysis Requirements</i>
OSHA 29 CFR 1910	<i>Occupational Safety and Health Standards</i>
OSHA 29 CFR 1910.147	<i>Control of Hazardous Energy (Lockout/Tagout)</i>
OSHA 29 CFR 1910.269	<i>Electric Power Generations, Transmission, and Distribution</i>
OSHA 29 CFR 1926	<i>Safety and Health Regulations for Construction</i>
SREF-8060-0001	<i>NASA SSC E&TD Electrical Systems Design and Installation Guide for Measurement, Monitor, and Control Systems (MM&CS)</i>
SCWI-8500-0026-ENV	<i>NASA SSC Environmental Resources Document</i>
SOI-8080-0007	<i>SSC Test Site Drawings</i>
SORD 20000-E010	<i>Procedure for Updating CEF Electrical Panel Schedule Database</i>

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SpecsIntact	<i>SSC Guide Construction Specifications</i>
SPR 1400.1	<i>Document Preparation, Numbering and Management</i>
SPR 1440.1	<i>Records Management Program Requirements</i>
SPR 8715.1	<i>Safety and Health Procedural Requirements</i>
SSC Form 886	<i>Panel Schedule Submittal</i>
SSC Form 903	<i>Phenolic Label Plate Request</i>
SSTD-8070-0001-CONFIG	<i>Facilities Engineering Documentation Standard</i>
SSTD-8070-0002-CONFIG	<i>SSC Facilities Drafting Manual</i>
SSTD-8070-0004-CONFIG	<i>Preparation of Construction Specifications</i>
SSTD 8070-0005-CONFIG	<i>Preparation, Review, Approval and Release of SSC Standards (SSTDs)</i>
SSTD-8070-0083-ELEC	<i>Standard for the 13.8 kV Distribution System</i>
SSTD-8070-0085-EMCS	<i>Lighting Design, Operation and Maintenance Standard for Energy Conservation</i>
SSTD-8070-0138-ELEC	<i>SSC Arc Flash Standard</i>
UL 96A	<i>Installation Requirements for Lightning Protection Systems</i>
UL 1561	<i>Safety Dry-Type General Purpose and Power Transformers</i>

4.0 RESPONSIBILITIES

- a. Users of this SSTD shall comply with its requirements, ensure use of the correct version of this SSTD and the documents it references, and inform the appropriate organization of needed changes in accordance with SSC Standard SSTD-8070-0005-CONFIG.
- b. Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this SSTD shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 GENERAL REQUIREMENTS

5.1 Physical Security

Site and project specific electrical security requirements will be developed with the advice and assistance of the NASA Security Office.

5.2 Environmental, Safety And Health (ES&H)

The safety and health of employees and the public, as well as mitigation of environmental impact, take precedence over function, cost or expediency. ES&H facility performance objectives shall comply with applicable provisions of the latest edition of SCWI-8500-0026-ENV and SPR 8715.1.

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5.3 Codes, Standards, And Regulations

The design and installation of electrical systems shall comply with the current edition of NPR 8820.2, NFPA 70, NFPA 780, LPI-175, UL 96, IEEE C2, and the Occupational Safety and Health Act (OSHA) 29 CFR 1910 and 29 CFR 1926. Applicable standards of the American National Standards Institute (ANSI), American Society for Testing and Material (ASTM), Illuminating Engineering Society (IES), National Electrical Manufacturers Association (NEMA), Institute of Electrical and Electronics Engineers (IEEE), Insulated Power Cable Engineers Association (IPCEA), National Fire Protection Association (NFPA), and Underwriters Laboratory (UL) reflect current electrical industry standard practice and should be used for establishing quality of materials and equipment. All of the aforementioned documents shall be applied to all sections of this SSTD, whether cited specifically or not.

5.4 Operation And Maintenance

The design, equipment selection, and construction of the electrical systems shall consider anticipated operation and maintenance requirements as defined by approved requirements document. Apparatus and system connections shall be of simple and straightforward design to facilitate both normal and emergency functions of operating and maintenance personnel. All electrical equipment shall include provisions for lockout devices in accordance with OSHA 29 CFR 1910.147.

Note: To ensure accurate and timely numbering/labeling of facility electrical equipment and update of the Computerized Maintenance Management System (CMMS), all new facility electrical equipment and the CMMS tag numbers of all removed facility electrical equipment, shall be reported to the Synergy Achieving Consolidated Operations and Maintenance (SACOM) Real Property Specialist.

5.5 Drawings And Specifications

- a. The approved drawings and specifications are contract documents and shall be prepared to complement each other. Every attempt shall be made to ensure that drawings and specifications are not in conflict.
- b. SSC Construction Specifications will be made available at SSC. The designer shall edit the specifications based upon the requirements for each design. The designer is responsible for removing portions of the specifications that do not apply to his or her design and editing the specification to comply with this standard. (Refer to SSTD-8070-0004-CONFIG.) **Note: Specifications are not to be construed as design standards.**
- c. Drawings and specifications are to be prepared in accordance with SSTD-8070-0001-CONFIG and SSTD-8070-0002-CONFIG. Standard symbols for electrical drawings are contained in SSTD-8070-0002-CONFIG.

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- d. Provisions for tag and lockout per OSHA 29 CFR 1910.147 shall be specified in applicable subsections of all construction and procurement specifications.

6.0 ELECTRICAL DESIGN AND CONSTRUCTION GUIDANCE

Electrical loads and requirements shall be estimated for 5-year load projections. Facilities shall be designed accordingly and in compliance with applicable codes, taking into account operation and maintenance requirements.

NOTE: A dedicated electrical equipment room shall be provided in every project, except for modification projects where power can be supplied from an existing electrical equipment room. Avoid installing electrical equipment in places such as hallways and stair landings to provide an unimpeded means of egress as required by NFPA 101. Size electrical equipment rooms and arrange equipment to provide adequate clear space for maintenance, inspection, and repair or replacement. Size the electrical equipment room based on the actual or maximum possible dimensions of all electrical equipment that will be installed in the room. Provide at least one general purpose receptacle in each electrical equipment room.

6.1 Requirements Documents

An approved requirements document is required prior to beginning the technical design process for all electrical designs, including those that are part of a larger design. Incorporate all requirements identified in the latest revision of the requirements document.

For the purposes of this standard, new or revised requirements documents shall be approved by NASA SSC Center Operations, Operations & Maintenance Division and NASA SSC Safety and Mission Assurance (S&MA), the funding organization, the designing organization, the Operating and Maintenance (O&M) organization, and the end user of the facility or system. For the purposes of this standard, requirements documents are not required to be in any specific format.

6.1.1 General Requirements

- a. As a minimum, design shall be in accordance with the latest issue of the National Electrical Code (NEC), OSHA 29 CFR 1910, Section 340 of the 42 U.S.C. 6834, and as specified herein or in the requirements document. Incorporate any additional and/or more stringent requirements specified herein or in the requirements document.
- b. For all electrical designs that have XFMR $\geq 125\text{kVA}$ and $< 240\text{V}$ or XFMR $\geq 15\text{kVA}$ and $\geq 240\text{V}$, permanently installed generators or Motor $> 50\text{ HP}$, and all battery banks of 8 or more where the short circuit current is $\geq 4\text{kADC}$, perform an arc flash hazard assessment and other design calculations as required by the NASA Project Manager (PM).
 1. An arc flash hazard analysis shall be performed by, or under the direction of, an electrical engineer who has completed formal commercial training in

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- power system analysis and arc flash hazard analysis and who has significant commercial experience in performing same.
 2. Arc flash hazard analyses developed for SSC shall be reviewed and approved by SACOM's electrical engineering lead to be considered delivered and complete.
 3. Data shall be submitted to the NASA PM in SKM Power Tools for Windows or other electronic format as approved by the NASA PM.
 4. Final approved copies of this data shall be submitted to Central Engineering Files (CEF).
 5. All electrical modifications shall comply with SSTD-8070-0138-ELEC.
- c. The SSC Fire Department and NASA SSC S&MA shall be invited to participate in all design reviews that include fire protection systems.
 - d. The SSC High-Voltage System Engineer shall be invited to participate in all design reviews that include the high voltage distribution system.
 1. The SSC High-Voltage System Engineer shall be required to concur with all designs that affect the high-voltage distribution system.
 2. Concurrence shall be provided by signature on drawings and specifications prior to approval and construction.
 - e. All electrical equipment shall be UL listed.
 - All electrical equipment shall conform to Factory Mutual (FM) standards as applicable.
 - Exceptions shall be approved by the PM.
 - f. All electrical designs shall provide an updated panel schedule (if affected) with the design package.
 1. The latest panel board schedule can be provided from CEF and should be compared with the panel schedule in the field (if available). If there are differences of a significant nature or no field schedule is available, inform the Contracting Officer's Technical Representative, NASA PM or the FOSC construction monitor for resolution.
 2. Once this work has been completed, the contractor or shops performing the work shall ensure this updated panel schedule is installed in/on the panel board and the panel schedule is returned to CEF.

6.1.2 Drawings

Drawings of existing facilities will be made available at SSC, but they should not be interpreted as "as built" conditions. The designer is responsible for the accuracy of the drawings based on field verification and the latest information available.

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6.1.3 Design and Construction Implementation Plan

As a minimum for all projects, a Gantt chart in Microsoft Project format is required. For all projects with a projected design value more than \$5,000, an integrated schedule, in Microsoft Project (2013 version) format, is required. This integrated schedule shall include, as a minimum, all electrical tasks from funds request to project completion and activation.

6.1.4 Design and Construction Cost Estimate

Design and construction cost estimates shall be calculated for all electrical projects in sufficient detail to generate a schedule of values that includes, as a minimum, major electrical equipment items, miscellaneous electrical material, and labor.

6.2 Enclosures

All enclosures shall be suitable for the environment and classification, and shall comply with OSHA requirements. Substitutions must be approved by NASA PM.

6.3 Exterior Utility Services

Note: Primary service at SSC is supplied from NASA's overhead distribution system at 13.8 kV, delta configuration. Please refer to SSTD-8070-0083-ELEC for detailed design information. Taps for 13.8 kV primary facility service may be routed underground for aesthetics.

- a. For underground primary feeder cable, use single conductors, copper, 15 kV ungrounded, copper tape shielded, 133% insulation level, UL type MV-105 as a minimum with ethylene-propylene rubber (EPR) insulation to include a polyvinyl chloride (PVC) jacket.
 1. Primary circuits shall be sized No. 1/0 or 500 MCM, depending upon the design load requirements. Taped splices are not acceptable at SSC. Underground splices and terminations are not allowed.
 2. Terminations:
 - Shall be above grade; and,
 - Shall land on end point apparatuses, SF₆ switches, or termination cabinets.
 - Stacking dead break terminations is not allowed unless approved by the SSC High Voltage System Engineer.
- b. Install primary and secondary feeders in underground concrete-encased ducts. Use 150mm (6-inch) ducts minimum for 500-MCM circuits, and 100mm (4-inch) ducts minimum for 1/0 circuits. Separate underground ducts from steam, condensate, hot water, chilled water lines, and gas lines. Any below ground splices shall be approved by the NASA PM per IEEE 386.