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NAVFAC PTS-G40 (September 2022)  
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Preparing Activity: NAVFAC SUPERSEDING PTS-G40 (December 2018)  
  
PERFORMANCE TECHNICAL SPECIFICATION  
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SECTION G40  
  
SITE ELECTRICAL UTILITIES  
09/22

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NOTE: This section is intended to be used as a guide and contains requirements that are common to many different types of facilities; however, not all requirements and equipment items will be applicable to all projects. In addition, there may be special requirements for a particular project that are not addressed at all. The RFP preparer may have to incorporate additional information to address these special requirements in this PTS and corresponding Part 3 ESR. If the RFP preparer chooses to delete building elements that are not required for the project, do not change the remaining Uniformat paragraph designations (example - A102001). Uniformat designations are unique to the products they are assigned to. However, the subparagraph numerical extensions (example - 1.2 or a,b,c) of the Uniformat designations may change if subparagraphs are deleted.  
  
This guide specification is formatted utilizing Uniformat II, an industry recognized standard, ASTM E 1557. When the RFP preparer chooses to add a paragraph that does not apply to an existing building element already included in the specification, refer to the Uniformat/WBS located on the NAVFAC Design-Build Website for a listing of Uniformat II designations and definitions.  
  
NOTE: The RFP preparer may view or hide the criteria notes in this PTS section by modifying the WORD preferences for "Hidden text". To view the criteria notes, choose "File" then "Option". Click "Display" then check the "Hidden text" box under "Always show these formatting marks on the screen". In the same section, check the box for "Print hidden text" under "Printing options" to print the criteria notes.  
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NOTE: The Table of Contents is intended for navigation purposes only for the RFP writer and should not show up in the printed document.  
  
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**G40 GENERAL**

RFP Part 3 including the Engineering System Requirements (ESR) provide project specific requirements. The RFP Part 4, Performance Technical Sections (PTS) provide generalized technical requirements that apply to multiple facility types and include more requirements than are applicable to any one project. Therefore, only the RFP Part 4 requirements that apply to the project and further define the RFP Part 3 project specific requirements are required.

**G40 1.1 NARRATIVE**

This section covers installations exterior to the facility outside the five foot line. See PTS Section D50, *Electrical*, for continuation of systems inside the five foot line, into and inside the building.

**G40 1.2 ELECTRICAL DESIGN GUIDANCE**

Provide the design and installation in accordance with the following references. This Performance Technical Specification (PTS) adds clarification to the fundamental requirements contained in the following Government Standards. The general requirements of this PTS section are located in PTS Section Z10, *General Performance Technical Specification*.

When all product Quality Control information is included in the Unified Facility Criteria (UFC) and there are requirement options identified in the ESR, then the Uniformat Level 4 titles (and possible subtitles) are included without repetition of requirements. One example of this is G401008, GROUNDING SYSTEMS.

**G40 1.2.1 Government Standards**

UNIFIED FACILITIES CRITERIA (UFC)

|  |  |
| --- | --- |
| UFC 1-200-01 | General Building Requirements (A reference in this PTS section to UFC 1-200-01 requires compliance with the Tri-Service Core UFCs that are listed therein, which includes the following significant UFC(s): UFC 3-501-01, Electrical Engineering) |
| UFC 1-200-02 | High Performance and Sustainable Building Requirements |
| UFC 3-570-02N | Electrical Engineering Cathodic Protection |

UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFGS)

|  |  |
| --- | --- |
| UFGS 26 11 13.00 20 | Primary Unit Substation |
| UFGS 26 11 16 | Secondary Unit Substations |
| UFGS 26 12 19.10 | Three-Phase, Liquid-Filled Pad-Mounted Transformers |
| UFGS 26 12 21 | Single-Phase Pad-Mounted Transformers |
| UFGS 26 13 00 | SF6/High-Firepoint Fluids Insulated Pad-Mounted Switchgear |
| UFGS 26 23 00 | Low-Voltage Switchgear |
| UFGS 26 24 13 | Switchboards |
| UFGS 26 27 14.00 20 | Electricity Metering |
| UFGS 26 56 00 | Exterior Lighting |
| UFGS 33 71 01 | Overhead Transmission and Distribution |
| UFGS 33 71 02 | Underground Electrical Distribution |
| UFGS 33 82 00 | Telecommunications Outside Plant (OSP) |

**G40 1.3 QUALITY ASSURANCE**

Submit qualifications, certifications, and Test Plans indicated herein 45 calendar days prior to the expected date of execution. Notify the Contracting Officer 14 calendar days prior to all testing. Submit test results within 7 calendar days of completion of testing.

The Designer of Record is responsible for approving the submittals listed below.

**G40 1.3.1 Qualified Testing Organization**

Engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and equipment listed in paragraph entitled "Acceptance Tests and Inspections" herein. Organization must be independent of the supplier, manufacturer, and installer of the equipment. The organization must be a first tier subcontractor.

a. Submit name and qualifications of organization. Organization must have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The organization must have a calibration program, and test instruments used must be calibrated in accordance with NETA ATS.

b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments must be performed by an engineering technician, certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

**G40 1.3.2 NEC Qualified Worker**

Provide in accordance with NFPA 70. Qualified Workers are allowed to be assisted by helpers on a 1 to 1 ratio, provided such helpers are registered in recognized apprenticeship programs. Submit a certification confirming NEC Qualified Worker requirements.

**G40 1.3.3 Qualified Medium Voltage Electrician**

All workers on medium voltage electrical crews must have 5 years experience working medium voltage systems on similar projects involving the same or higher voltage.

**G40 1.3.4 Qualified Cable Splicer (Medium Voltage Cable)**

The cable splicer/terminator must have a certification from the National Cable Splicing Certification Board (NCSCB) in the field of splicing and terminating shielded medium voltage (5 kV to 35 kV) power cable using pre-manufactured kits (pre-molded, heat-shrink, cold-shrink). Submit proof of certification for the individuals that will be performing cable splicer and termination work 30 days before splices or terminations are to be made.

**G40 1.3.5 Qualified PV Installer**

Installation of photovoltaic systems must be performed by experienced and trained installers. At minimum the PV installation supervisor must hold a "PV Installer Certification" as issued by the North American Board of Certified Energy Practitioners or hold a Certified Solar Roofing Professional (CSRP) credential issued by RISE "Roof Integrated Solar Energy Inc".

**G40 1.3.6 Qualified Cable Splicer (Telecommunications)**

Certification must include the training, and experience of the individual on specific type and classification of telecommunications cable to be provided under this contract.

**G40 1.3.7 Qualified Cable Installer and Splicer (Fiber Optic Cable)**

Certification must include the training, and experience of the individual on specific type and classification of Fiber Optic media to be provided under this contract.

**G40 1.3.8 Qualified Fiber Optic (FO) Cable Manufacturer**

The FO media manufacturer must have a minimum of 3 years experience in the manufacturing, assembly, and factory testing of FO media that complies with RUS REA Bull 1753F-601 (PE-90). Manufacturer must provide a list of customers with 3 years of maintenance logs documenting experience with government customers.

**G40 1.3.9 Material Standards**

Ensure service support and provide manufacturer's nameplate in accordance with PTS Section Z10, *General Performance Technical Specification*.

**G40 1.3.9.1 Warning Labels**

Each enclosure of electrical equipment, including substations, pad-mounted transformers, pad-mounted switches, pad-mounted sectionalizing termination cabinets, and switchgear, must have a warning label identifying the enclosure as 1) containing energized electrical equipment and 2) an arc flash hazard. Provide arc flash warning labels in accordance with UFC 3-560-01, *Electrical Safety, O & M*.

**G40 1.3.10 Factory Testing**

The Government reserves the right to witness all factory testing. The manufacturer's calibration program must ensure that all test instruments are maintained within rated accuracy.

**G40 1.3.11 Electrical System Startup and Testing**

Submit test plans for approval. Tailor test plans to the systems provided.

The test plan must list make and model and provide functional description of the test instruments and accessories and must describe the setup of the tests to be conducted. Test instruments must be capable of measuring and recording or displaying test data at a higher resolution and greater accuracy than specified for the equipment's performance.

**G40 1.3.11.1 Factory Trained Engineer**

Provide a factory trained engineer to supervise start-up and testing as required in referenced specifications.

**G40 1.3.11.2 Performance Verification Testing**

Perform in-service demonstration that all circuits and devices are in operating condition. Tests must confirm that each item of control equipment will function not less than five times. Provide all necessary test equipment, tools, fuel, load banks, labor, and materials for testing. As a minimum, test all systems in accordance with manufacturer's recommendations. Additional testing requirements for the various systems are described with those systems, hereinafter. Assure that all test instruments are maintained within rated accuracy. Dated calibration labels must be visible on all test equipment.

Submit a separate electrical field test plan in accordance with manufacturer's recommendations and that conforms to NETA ATS for each piece of Electrical Distribution Equipment and System requiring Performance Verification Testing.

The following items identify specific test requirements. Additional test requirements are contained in the applicable UFGS.

a. Cable – Test cable in accordance with the manufacturer's recommendations and NETA ATS. Adhere to precautions and limits as specified in the applicable NEMA/ICEA Standard for the specific cable.

b. Grounding - Test ground systems in accordance with the manufacturer's recommendations and NETA ATS.

c. Site Lighting - Contractor's Quality Control (CQC) representative must perform a field survey of site lighting systems in accordance with IESNA for acceptance. Show that the lighting system operates in accordance with the user’s requirements and is in accordance with designed levels. Provide certification that the measured lighting levels conform to the design requirements.

d. Telecommunications wiring - Test all cables in accordance with industry standards.

**G40 1.3.11.3 Acceptance Tests and Inspections**

The Qualified Testing Organization must provide the Acceptance Tests and Inspections test plan and procedures and perform the acceptance tests and inspections. Test methods, procedures, and test values must be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph entitled "Field Quality Control" of each applicable specification section. Tests identified as optional in NETA ATS are not required unless otherwise specified. Place equipment in service only after completion of required tests and evaluation of the test results have been completed. Contractor must supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing.

Specific test requirements are contained in the UFGS for equipment.

**G40 1.4 DESIGN SUBMITTALS**

Submit design submittals in accordance with PTS Section Z10, *General Performance Technical Specifications*, Part 2 Section 01 33 10.05 20, *Design Submittal Procedures*, FC 1-300-09N, *Navy and Marine Corps Design Procedures*, and UFC 3-501-01, *Electrical Engineering*.

In addition, UFGS sections listed below or in the body of the PTS text are to be used by the Designer of Record (DOR) as a part of the design submittal. If the UFGS products or systems are applicable to the project, the DOR must edit these referenced UFGS sections and submit them as a part of the design submittal specification. Edit the specification sections in accordance with the limitations stated in PTS Section Z10, *General Performance Technical Specifications*.

UFGS 26 11 13.00 20, *Primary Unit Substation*

UFGS 26 11 16, *Secondary Unit Substations*

UFGS 26 12 19.10, *Three-Phase, Liquid-Filled Pad-Mounted Transformers*

UFGS 26 12 21, *Single-Phase Pad-Mounted Transformers*

UFGS 26 13 00, *SF6/High-Firepoint Fluids Insulated Pad-Mounted Switch Gear*

UFGS 26 23 00, *Low-Voltage Switchgear*

UFGS 26 24 13, *Switchboards*

UFGS 26 27 14.00 20, *Electricity Metering*

UFGS 26 56 00, *Exterior Lighting*

UFGS 33 71 01, *Overhead Transmission and Distribution*

UFGS 33 71 02, *Underground Electrical Distribution*

UFGS 33 82 00, *Telecommunications Outside Plant (OSP)*

**G40 1.4.1 Sustainable Design Submittal**

Submit sustainable design submittals in accordance with Part 2 UFGS Section 01 33 29, *Sustainability Requirements and Reporting*.

**G40 1.5 CONSTRUCTION SUBMITTALS**

Submit construction submittals in accordance with PTS Section Z10, *General Performance Technical Specifications*. In addition to the PTS Section Z10 requirements, the Designer of Record (DOR) must approve the following construction submittals as a minimum:

OMSI Information for Electrical Equipment (if OMSI Manual for the entire project is not already required); all "G" item submittals listed in the submittals of the specifications sections identified in the Design Submittals paragraph above; and all "G" item submittals listed for Government Surveillance in Part 2 Section 01 33 00.05 20, *Construction Submittal Procedures*.

Provide certification that all adjustable protective device settings have been set in accordance with the coordination study for the as-built equipment and configuration.

**G40 1.5.1 Sustainable Construction Submittal**

Submit sustainable construction submittals in accordance with Part 2 UFGS Section 01 33 29, *Sustainability Requirements and Reporting*.

**G4010 ELECTRICAL DISTRIBUTION**

**G401001 SUBSTATIONS**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*   
NOTE: When dry-type transformers are required or when biodegradable less- flammable liquid filled transformers with ratings greater than 1500 kVA at 480Y/277 volts or 750 kVA at 208Y/120 volts, or at values not provided in the transformer loss tables, RFP writer ;must contact NAVFAC Atlantic Code CIEE at (757) 322-4277. CIEE will contact transformer manufacturers to obtain and provide the values at the point of diminishing returns based on the energy cost at the location. Include record of correspondence with CIEE and manufacturers as part of basis of design or design calculations submittal.   
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When secondary unit substations are required, the Designer of Record must utilize UFGS Section 26 11 16, *Secondary Unit Substations*, UFGS Section 26 23 00, *Low-Voltage Switchgear*, and UFGS Section 26 24 13, *Switchboards*, for the project specification, and must submit the edited specification section as a part of the design submittal for the project.

**G401002 TRANSFORMERS**

When transformers are required, the Designer of Record must utilize UFGS Section 26 12 19.10, *Three-Phase, Liquid-Filled Pad-Mounted Transformers*, UFGS Section 26 12 21, *Single-Phase Pad Mounted Transformers*, or UFGS Section 33 71 01, *Overhead Transmission and Distribution*, for the project specification, and submit the edited specification section as a part of the design submittal for the project.

**G401003 SWITCHES, CONTROLS AND DEVICES**

When switches or control devices are required, the Designer of Record must utilize UFGS Section 26 13 00, *SF6/High-Firepoint Fluids Insulated Pad Mounted Switchgear*, or UFGS Section 33 71 01, *Overhead Transmission and Distribution*, for the project specification, and submit the edited specification section as a part of the design submittal for the project.

**G401004 OVERHEAD ELECTRIC CONDUCTORS**

Power line conductors must be strung in accordance with manufacturer's standard sag and tension recommendations.

**G401005 TOWERS, POLES, CROSSARMS AND INSULATORS**

Wood poles must comply with ANSI 05.1 and RUS 1728F-700. Pressure treat poles in accordance with AWPA C1 and AWPA C4 as referenced in RUS 1728F-700. The quality of each pole must be ensured with "WQC" (wood quality control) brand on each piece or by an approved inspection agency report. Do not use creosote treated poles, lodgepole pine, and western larch pine poles.

Concrete poles must comply with ANSI loadings for distribution poles.

Determine the size of poles required, class, height and other data, to meet requirements of the pole line. Provide wood, steel, or fiberglass crossarms in accordance with industry and local standards. Insulators, cutouts and associated equipment must be determined by the Designer of Record to meet system requirements.

**G401006 UNDERGROUND ELECTRIC CONDUCTORS**

Route underground cables to minimize splices. Cable pulling tensions must not exceed the maximum pulling tension recommended by the cable manufacturer. Medium voltage cable termination must be suitable for the location installed and meet IEEE Std. 48 Class 1 requirements.

**G401007 DUCTBANKS, MANHOLES, HANDHOLES AND RACEWAYS**

Concrete manholes and handholes to be standard type precast concrete. Composite/Fiberglass handholes must be polymer concrete reinforced with a heavy weave fiberglass reinforcing. Provide manholes and handholes with load ratings suitable for the location installed.

**G401008 GROUNDING SYSTEMS**

**G401009 METERING**

When metering is required the Designer of Record must utilize UFGS section 26 27 14.00 20 for the project specification and submit the edited specification section as part of the design submittal for the project.

**G401010 CATHODIC PROTECTION SYSTEMS**

Provide cathodic protection systems in accordance with UFC 3-570-02N.

**G401011 EQUIPMENT REQUIREMENTS FOR COASTAL AND HIGH HUMIDITY AREAS**

**G4020 SITE LIGHTING**

**G402001 EXTERIOR LIGHTING FIXTURES AND CONTROLS**

Comply with ANSI/ASHRAE/IES 90.1 for all exterior lighting applications and controls. Comply with UFC 3-530-01 for reduction of light pollution.

Provide SPD at panelboards that include circuits feeding exterior lighting systems.

Coordinate the design and luminaire selection with the landscape designer. Such coordination must ensure the location of poles do not conflict with tree locations.

When exterior lighting is required the Designer of Record must utilize UFGS section 26 56 00 for the project specification and submit the edited specification section as part of the design submittal for the project.

**G402002 SPECIAL SECURITY LIGHTING SYSTEM**

**G402003 OTHER AREA LIGHTING**

**G402004 LIGHTING POLES**

Poles must meet International Building Code for street lighting poles, and AASHTO loadings for highway and sports lighting poles taking into account the effective projected areas of the luminaries provided. Provide direct set or anchor-base type poles designed for use with underground supply conductors.

**G402005 UNDERGROUND ELECTRIC CONDUCTORS**

Provide in accordance with Paragraph G401006.

**G402006 DUCTBANKS, MANHOLES AND HANDHOLES**

Provide handholes and underground conduits for site lighting in accordance with Paragraph G401007.

**G402007 GROUNDING SYSTEMS**

**G4030 SITE COMMUNICATION AND SECURITY**

**G403001 TELECOMMUNICATIONS SYSTEMS**

**G403002 CABLE TV SYSTEMS (CATV)**

**G403003 CABLES AND WIRING**

Provide underground copper cable pair in accordance with RUS 345-67. Provide aerial cable in accordance with RUS 345-67 except that it must be suitable for aerial installation and must be Figure 8 distribution wire with 6,000 pound (26,700 N) Class A galvanized steel or 6,000 pound (26,700 N) aluminum-clad steel strand. Screen-compartmental core cable must be filled cable meeting the requirements of RUS 345-67. Fiber optic media must meet all performance requirements of EIA/TIA-568-A and the physical requirements of ICEA S 87-640 and EIA/TIA-598-A.

**G403004 DUCTBANKS, MANHOLES AND HANDHOLES**

Provide in accordance with paragraph G401007.

**G403005 TOWERS, POLES AND STANDS**

Provide in accordance with paragraph G401005.

**G403006 TV CAMERAS AND MONITORS**

**G403007 ELECTRONIC SECURITY SYSTEM (ESS)**

**G403008 OTHER COMMUNICATION AND ALARM**

**G403009 GROUNDING SYSTEMS**

**G403010 INDUSTRIAL CONTROL SYSTEMS (ICS)**

**G4090 OTHER ELECTRICAL UTILITIES**

**G409007 PHOTOVOLTAIC ENERGY SYSTEM**

When a photovoltaic system is required, provide a grid tied, photovoltaic system, including structural support system, crystalline photovoltaic panels, combiner boxes, and inverters. The Designer of Record must utilize UFGS Section 26 31 00 for the project specification, and submit the edited specification section as a part of the design submittal for the project.

**G409007 1.1 CODES AND STANDARDS**

Provide PV system hardware and services that meet or exceed all applicable local, State and utility requirements, conform to the applicable codes and standards, and have passed the listing and qualification tests, listed below. (Comply with the most recent version of each document).

a. IEEE 1262 "Recommended Practice for Qualification of Photovoltaic Modules".

b. PowerMark certification for PV modules.

c. IEEE Standard 928-1986, Recommended Criteria for Terrestrial Photovoltaic Power Systems (PV system performance criteria).

d. IEEE 1547 Standard for Interconnecting Distributed Resources with Electric Power Systems.

e. Underwriters Laboratories 1741 (UL Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources).

f. Underwriters Laboratories 1703 (UL Standard for Listing Photovoltaic Modules).

g. Certification of PV Equipment: All PV modules, inverters, and electrical components are required to be listed or recognized by an appropriate and recognized United States Safety Laboratory (for example: UL or ETL).

**G409007 1.2 PHOTOVOLTAIC APPLICATION ANALYSIS**

Provide a comprehensive "Photovoltaic Application Analysis" with a detailed description of system, application, site shading conditions and expected kW output of the photovoltaic application. Utilize the Solmetric Suneye or the Solar Pathfinder shading analyzers to analyze the effects of the existing site shading conditions. Include estimated PV output in kWh per year in the analysis.

**G409007 1.3 TECHNICAL REQUIREMENTS**

Work responsibilities include at a minimum: system design, equipment selection, and PV system installations. Provide system individually capable of providing peak power output of at least proposed PV system size, 208 or 480 volt, 3-phase, 4-wire power.

The final System configuration must allow automatic operation without operator intervention. Design system and specify equipment to minimize maintenance requirements. System must include metering that is integrated with current AMI network (Advanced Metering Infrastructure) and planned energy metering projects.

Locate inverter(s) disconnects and associated electrical equipment in an area that is accessible, weather-protected, and secure from vandalism and personal injury.

Mount disconnects and over current devices in approved boxes, enclosures, or panel boards. Provide DC rated disconnects and switches when used in DC applications. Bond metal enclosures and boxes to the grounding conductor.

At a minimum, electrical meters must capture the following data on individual system performance (minimum solar irradiance, DC power, AC real power, AC current, AC voltage, and power factor (recommend ION 8600 for AC); ambient air temperature, PV cell temperature, kW, and kWh). This data must be captured at hourly intervals for a minimum one year. Units of temperature, power, and current must be in Fahrenheit, Watts, and Amps respectively.

Transformers, if required, must have a minimum efficiency based on factory test results of not less than the efficiency indicated in 10 CFR 431, Subpart K, paragraph 431.196(b). Transformers must be housed in NEMA 4X enclosures.

Mounting structures must be corrosion resistant to marine environment.

Provide permanent plaque or directory at each building service and power source identifying all other building services and power sources.

-- End of Section --