UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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02/21

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USACE / NAVFAC / AFCEC / NASA	**UFGS-26 27 14.00 20 (February 2021)**

Preparing Activity: NAVFAC	**Superseding**
	UFGS-26 27 14.00 20 (February 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 26 27 14.00 20

ELECTRICITY METERING
02/21

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NOTE: Many Activities have, or are in the process of, converting to basewide metering systems.

This Navy guide specification covers the requirements for the installation of electricity meters suitable for billing, allocation of costs, and recording of data for energy management and control applications for Navy projects. This specification is intended to comply with the metering requirements of EPACT05.

Although a unified metering specification is under development, some Air Force projects may require use of Section 26 27 13.10 30 ELECTRIC METERS.

Coordinate with the Activity and provide specific requirements "to match existing systems" when necessary. If specifying proprietary products, insure that appropriate "Justification and Authorization (J & A)" documentation has been obtained by project manager and "proprietary language requirements" have been added to Division 1 as well as adding the following lines above the section number and title at the top of the first page of this section of the specifications:

"********
This specification section contains proprietary products.
**********"**

If there are any components (such as meters, housing, or current transformers) that will be Government Furnished Contractor Installed (GFCI), or Government Furnished Government Installed (GFGI), edit Division 1 and this specification section appropriately.

The following related guide specifications for power distribution equipment may contain outdated meter information. Avoid duplication and ensure

conflicting information has been removed from project documents.

- Section 26 12 19.10 THREE-PHASE, LIQUID-FILLED PAD-MOUNTED TRANSFORMERS
- Section 26 12 21 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS
- Section 26 11 13.00 20 PRIMARY UNIT SUBSTATIONS
- Section 26 11 16 SECONDARY UNIT SUBSTATIONS
- Section 26 23 00 LOW VOLTAGE SWITCHGEAR
--Section 26 24 13 SWITCHBOARDS

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: NOTE: To download UFGS Forms, Graphics, and Tables, go to: http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables
NOTE: This section utilizes the following sketches, details, and forms (Graphics), and are available in metric (SI) and U.S. Customary (IP) system dimensions. Sketch titles and style numbers are unchanged for both types. The metric values indicated are a conversion of the IP system dimensions.

Do not include this list of sketches, or the sketches themselves, in project specifications. Use sketches as details on drawings whenever possible.

SKETCH NUMBER	TITLE
E-M101	Form 9S - Typical Wye Configuration With Single-Ratio CT's and Without PT's
E-M102	Form 9S - Typical Wye Configuration With Dual-Ratio CT's and Without PT's
E-M103	Form 9S - Typical Wye Configuration With Multi-Ratio CT's and Without PT's

SKETCH NUMBER	TITLE
E-M104	Form 9S - Typical Wye Configuration With 10 Pole Test Switch
E-M105	Form 9S - Typical Delta Configuration Without PT's
E-M106	Form 2S - Typical
E-M107	Form 5S - Typical
E-M108	Form 6S - Typical
E-M110	Form 9S - Typical Wye Configuration With Single-Ratio CT's and With PT's
E-M111	Form 9S - Typical Wye Configuration With Dual-Ratio CT's and With PT's
E-M112	Form 9S - Typical Wye Configuration With Multi-Ratio CT's and With PT's
E-M113	Form 9S - Typical Delta Configuration With PT's
E-M201	Inside Meter Installation - Typical
E-M202	Outside Meter Installation on Wall - Preferred Distance to Gas Meter
E-M203	Outside Meter Installation on Wall - Acceptable Distance to Gas Meter
E-M204	Single Phase Self Contained Meters Residential Service: 0-600 Volts, Enclosed Installation
E-M205	Single Phase Self Contained Meters Residential Service: 0-600 Volts, Semi-Flush Installation
E-M206	Meter Cabinet Enclosure Clearances: 0-600 Volts

DETAILS	TITLE
PADMDE1	Pad-Mounted Transformer Detail
PADMDE2	Pad-Mounted Transformer Detail
PADMDE3	Pad-Mounted Transformer Detail
PADMDE4	Pad-Mounted Transformer Detail

DETAILS	TITLE
PADMDE5	Pad-Mounted Transformer Detail
PADMDE6	Pad-Mounted Transformer Detail

FORMS	TITLE
E-S1	Building Meter Installation Sheet Per Building
E-S2	Electricity Meter Installation Schedule - Large Project
E-S3	Electricity Meter Data Schedule - Large Project
E-S4	Sample Contract Data Requirements List (CDRL)- Blank
E-S5	Sample Contract Data Requirements List (CDRL)- Example

The Contract Data Requirements List (CDRL) can also be downloaded at http://www.dtic.mil/dtic/pdf/customer/STINFOdata/DD14231.pdf.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C12.1 ((2014; Errata 2016) Electric Meters - Code for Electricity Metering

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2013) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI	(2013) Energy Standard for Buildings Except Low-Rise Residential Buildings

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C37.90.1	(2013) Standard for Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
IEEE C57.13	(2016) Requirements for Instrument Transformers

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2017; Errata 2017) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60687	(1992) Alternating Current Static Watt-Hour Meters for Active Energy (Classes 0,2 S and 0,5 S)
IEC 62053-22	(2020) Electricity Metering Equipment (A.C.) - Particular Requirements - Part 22: Static Meters for Active Energy (Classes 0,2 S and 0,5 S)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C12.7	(2014) Requirements for Watthour Meter Sockets
ANSI C12.18	(2006; R 2016) Protocol Specification for ANSI Type 2 Optical Port
ANSI C12.20	(2015; E 2018) Electricity Meters - 0.1, 0.2, and 0.5 Accuracy Classes
NEMA C12.19	(2012) Utility Industry End Device Data Tables

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

****

NOTE: In this specification, special submittals are required for Contract Data Requirements List (CDRL). The CDRL submittals are indicated as bracketed options.

When used, include a completed DD Form 1423, Contract Data Requirements List with the project specifications. This form is essential to obtain delivery of all documentation. Each deliverable must be clearly specified, with both description and quantity required. A sample CDRL and an editable blank CDRL are included in the graphics list at the front of this specification, as Graphics ES-4 and ES-5.

The acquisition of all technical data, data bases and computer software items that are identified herein will be accomplished strictly in accordance with the Federal Acquisition Regulation (FAR) and

the Department of Defense Acquisition Regulation Supplement (DOD FARS).

Those regulations as well as the Services implementation thereof should also be consulted to ensure that a delivery of critical items of technical data is not inadvertently lost. Specifically, the Rights in Technical Data and Computer Software Clause DFARS 252.227-7013, and the Data Requirements Clause DOD FAR 52.227-7031, as well as any requisite software licensing agreements will be made a part of the CONTRACT CLAUSES or SPECIAL CONTRACT REQUIREMENTS. In addition, the appropriate DD Form 1423 Contract Data Requirements List (CDRL), will be filled out for each distinct deliverable data item and made a part of the contract. Where necessary, a DD Form 1664, Data Item Description, will be used to explain and more fully identify the data items listed on the DD Form 1423. It is to be noted that all of these clauses and forms are required to ensure the delivery of the data in question and that such data is obtained with the requisite rights to use by the Government.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES[, the CONTRACT CLAUSES and DD Form 1423]:

[Technical data packages consisting of technical data and computer software (meaning technical data which relates to computer software) which are specifically identified in this project and which may be defined/required in other specifications must be delivered strictly in accordance with the CONTRACT CLAUSES and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered must be identified by reference to the particular specification paragraph against which it is furnished. All submittals not specified as technical data packages are considered 'shop drawings' under the Federal Acquisition Regulation Supplement (FARS) and must contain no proprietary information and be delivered with unrestricted rights.

] SD-02 Shop Drawings

Installation Drawings; G[, [_____]]

SD-03 Product Data

Electricity Meters; G[, [_____]]

****

NOTE: Determine if a Technical Data Package will be required for electrical meters as described in the above note. If a Technical Data Package is required, include the bracketed option below.

****

[The most recent meter product data must be submitted as a Technical Data Package and must be licensed to the project site. Any software must be submitted on CD-ROM and [_____] hard copies of the software user manual must be submitted for each piece of software provided.

] Current Transformer; G[, [_____]]

[Potential Transformer; G[, [_____]]

] External Communications Devices; G[, [_____]]

[Configuration Software; G[, [_____]]

The most recent version of the configuration software for each type (manufacturer and model) must be submitted as a Technical Data Package and must be licensed to the project site. Software must be submitted on CD-ROM and [_____] hard copies of the software user manual must be submitted for each piece of software provided.

] SD-06 Test Reports

Acceptance Checks and Tests; G[, [_____]]

System Functional Verification; G[, [_____]]

Building Meter Installation Sheet, per Building; G[, [_____]]

Completed Meter Installation Schedule; G[, [_____]]

Completed Meter Data Schedule; G[, [_____]]

Meter Configuration Template; G[, [_____]]

Contractor must fill in the meter configuration template and submit to the Activity for concurrence.

Meter Configuration Report; G[, [_____]]

The meter configuration report must be submitted as a Technical Data Package.

SD-10 Operation and Maintenance Data

Electricity Meters and Accessories, Data Package 5; G[, [_____]]

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein.

SD-11 Closeout Submittals

System Functional Verification; G[, [_____]]

1.3 QUALITY ASSURANCE

****

NOTE: Select from the identified bracketed options

the information that is to be provided on the drawings. Delete the items not needed for the project. Determine if communications information will be addressed in the drawings for the metering project or as a separate documentation package. The level of detail required might vary with the project.

Identify the required electronic drawing format in the selection below.

****

1.3.1 Installation Drawings

Drawings must be provided in hard-copy and [_____] electronic format, and must include but not be limited to the following:

a. Wiring diagrams with terminals identified of [kilowatt] [advanced] meter, [current transformers,] [potential transformers,][protocol modules,][communications interfaces,][Ethernet connections,][telephone lines].[For each typical meter installation, provide a diagram.]

b. One-line diagram, including meters, [switch(es),][current transformers,][potential transformers,] [protocol modules,][communications interfaces,][Ethernet connections,][telephone outlets,][and fuses].[For each typical meter installation, provide a diagram.] Provide one-line diagram to the local Public Works department.

1.3.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for one year prior to bid opening. The one-year period must include applications of equipment and materials under similar circumstances and of similar size. The product, or an earlier release of the product, must have been on sale on the commercial market through advertisements, manufacturers catalogs, or brochures during the prior one-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.3.3 Material and Equipment Manufacturing Data

Products manufactured more than 1 year prior to date of delivery to site must not be used, unless specified otherwise.

1.4 MAINTENANCE

1.4.1 Additions to Operation and Maintenance Data

In addition to requirements of Data Package 5, include the following on the actual electricity meters and accessories provided:

a. A condensed description of how the system operates

b. Block diagram indicating major assemblies

c. Troubleshooting information

d. Preventive maintenance

e. Prices for spare parts and supply list

1.5 WARRANTY

The equipment items and software must be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment and software on a regular and emergency basis during the warranty period of the contract.

1.6 SYSTEM DESCRIPTION

1.6.1 System Requirements

Electricity metering, consisting of meters and associated equipment, will be used to record the electricity consumption and other values as described in the requirements that follow and as shown on the drawings. Communication system requirements are contained in a separate specification section as identified in paragraph COMMUNICATIONS INTERFACES.

1.6.2 Selection Criteria

****

NOTE: Select a bracketed option below if it is intended that the new meter system be compatible with the existing system components.

****

Metering components and software are part of a system that includes the physical meter, data recorder function and communications method. Every building site identified must include sufficient metering components to measure the electrical parameters identified and to store and communicate the values as required.

[Contractor must verify that the electricity meter installed on any building site is compatible with the base-wide metering system with respect to the types of meters selected and the method used to program the meters for initial use. Software and meter programming tools are necessary to set up the meters described by this specification. New software tools different from the meter programming methods currently used by base personnel will require an Authority to Operate (ATO) by Command Information Office at the Enterprise level..

][Contractor must verify that the metering system installed on any building site is compatible with the facility-wide or base-wide communication and meter reading protocol system.

]PART 2 PRODUCTS

2.1 ELECTRICITY METERS AND ACCESSORIES

****

NOTE: When an activity has a metering system installed, provide meters to match. Coordinate with

the project manager and include proprietary specification information.

Metering features that are unique to a building should be listed in a schedule either in this specification or on accompanying drawings. See Graphic ES-2 for a sample "Metering System Schedule".

****

****

ACTIVITY	CURRENT AMI CONTRACTOR	EXISTING METER TYPE	COMM METHOD	COMMENTS
Naval Base Ventura County	Schneider Electric	ION 8600	Note 1	Ion Enterprise Data Acquisition System (DAS) Software
NAVFAC SW	Schneider Electric	ION 8600	Note 2	StruxureWare Power Monitoring Expert Software
NAVFAC SE	Schneider Electric	ION 8600	Note 1	StruxureWare Power Monitoring Expert Software
NAVFAC NW	Schneider Electric	ION 8600C/ 8650C/ PM 8000	Note 3	StruxureWare Power Monitoring Expert Software
Naval District Washington	Electro Industries	NEXUS 1272	Note 1	Communicator EXT Pro Software
NAVFAC HI	Electro Industries	Shark 270/ ION 8650C	Note 1	Communicator PQA (JBPHH), Ion Setup (PMRF) [both meter configuration software]
NAVFAC ML	Electro Industries	NEXUS 1272	Note 1	Communicator EXT Pro Software
NAVFAC FE	Schneider Electric	ION 8600C/ 8650C	Note 1	Communicator EXT Pro Software
NAVFAC MA	Schneider Electric	ION 8600C/ 8650C	Note 1	Communicator EXT Pro Software
NAVFAC EURAFCENT	Schneider Electric	ION 8650C/ PM 8000	Note 3	ION Enterprise DAS Software
Note 1: Combination radio mesh with fiber optic links.				

ACTIVITY	CURRENT AMI CONTRACTOR	EXISTING METER TYPE	COMM METHOD	COMMENTS
Note 2: Radio mesh. WinPM, similar to Ion enterprise with a wrap interface.				
Note 3: Combination radio mesh with fiber optic links. Includes some existing copper infrastructure.				

****

****

NOTE: One example of a specification paragraph is provided below for the case in which the meter is programmed using government-owned equipment. If this type of paragraph is used, develop wording applicable to the specific project.

****

Provide meter(s) and connect the meter(s) to the existing AMI DAS. The contractor must use the existing government laptop computers to configure the meter using existing software loaded on the computer. The contractor will not be allowed to modify any software or add any additional software to the computer. Alternatively, the government will configure the meter(s), which must be compatible with the existing system, using existing software. Contractor must insure that the meter(s) will transmit the specified data to the DAS. The current meters being used by [_____] are: [ION 8600C] [ION 8650C] [PM 8000] [SHARK 270] [NEXUS 1272] [_____].

2.1.1 Physical and Common Requirements

****

NOTE: This specification is designed for projects where multiple metering systems will be installed as part of the same project. It is expected that different buildings may have different metering systems depending on the metering system that can be installed economically for any specific building and that meets the needs of the facility analysis and billing system.

This specification has been developed for 60-Hz applications. Designer must review and provide additional modifications necessary for 50-Hz use.

Sub-metering (versus single-metering at a facility) is not specifically addressed and the specification will require modification to address unique sub-metering requirements.

If the "Two-Way Automatic Communications System (TWACS)" is used for communications, this system has additional wire size and fuse requirements. The use of TWACS might limit the maximum voltage provided at each meter. Edit this specification to address these unique needs.

Class 320 meters are not allowed by this specification.

Define the configuration that is required to be initially programmed into each meter. If possible, define a standard programming profile and identify any exceptions to that profile.

****

a. Provide metering system components in accordance with the Metering System Schedule shown [in this specification][on the drawings]. Provide Meter configuration template.

****

NOTE: The bracketed option below allows the selection of whether to use or replace existing meter bases.

Meter bases should be inspected if they are to be re-used. The second bracketed option requires an assessment of their physical condition before use.

For existing panelboard, switchboard, and switchgear installations, provide the same style meter. A direct replacement with a similar configuration can minimize the need for a design change and avoid clearance issues inside the enclosure.

The designer must have concurrence from the Activity and should exercise caution if changing an existing installation to a socket arrangement using a Form 9S adaptor kit. This can reduce the number of unique meters styles to maintain for spares, but can also cost more during the initial installation and can result in inadequate clearances within the equipment and the exterior.

****

b. [Replace all existing meter bases. For socket arrangements, use meter and base form of 9S unless installation-specific limitations require the use of a different form type. For panelboards, switchboards, and switchgear, match the existing installation with the new meter base.][Existing meter bases can be re-used if they are electrically functional, in physically good condition, and show no signs of corrosion on the electrical contacts. If the existing meter base is usable, the meter base determines meter form factor. If a new meter is being installed, use meter and base form factor of 9S unless installation-specific limitations require the use of a different form type.][If use of a socket adaptor arrangement has been approved by the activity, contractor must verify that all clearances are met and doors are able to be properly closed.]

****

NOTE: Select the bracketed option below if the meter will be installed in an enclosure. A stainless steel enclosure might be necessary for coastal or high humidity areas.

****

[c. Meter must have NEMA [3R] [3R stainless steel] enclosure for surface mounting with bottom or rear penetrations.

] d. Surge withstand capability must conform to IEEE C37.90.1.

****

NOTE: Modify the color scheme below if the activity uses a different identification system. This color scheme is for metering wiring only and does not match the color coding requirements for power conductors.

Wire labeling is also an acceptable approach to identification. If wire labeling is selected, modify the color scheme listed below to identify the label information for each wire.

****

e. Use #12 SIS (XHHW, or equivalent) wiring with ring lugs for all meter connections. Color code and mark the conductors[as follows:

(1) Red - Phase A CT - C1
(2) Orange - Phase B CT - C2
(3) Brown - Phase C CT - C3
(4) Gray with white stripe - neutral current return - C0
(5) Black - Phase A voltage - V1
(6) Yellow - Phase B voltage - V2
(7) Blue - Phase C voltage - V3
(8) White - Neutral voltage

]

****

NOTE: The electricity meters covered by this section are intended for low voltage applications and should be capable of receiving input nominal voltages of 120 to 480 volts. This section assumes that the available low voltage will be used as the meter supply. Potential transformers are not required.

If new medium voltage applications are planned, then include potential transformer requirements as part of the associated switchgear specification. If this section is applied to an existing installation, then use the bracketed options below to establish the potential transformer requirements.

****

2.1.2 Potential Transformer Requirements

a. Meter must be capable of connection to the service voltage phases and magnitude being monitored. If the meter is not rated for the service voltage, provide suitable potential transformers to send an acceptable voltage to the meter.

b. Voltage input must be optically isolated to 2500 volts DC from signal and communications outputs. Components must meet or exceed IEEE C37.90.1.

****

NOTE: Fusing is required to provide circuit protection and to minimize arc flash levels. Include bracketed option if pull-out type arrangement is required.

****

c. Provide [a pull-out type fuse block containing] one fuse per phase, Class RK type, to protect the voltage input to the meter. Size fuses as recommended by the meter manufacturer. Fusing must either be inside the secondary compartment of the transformer or inside the same enclosure as the CT shorting device.

****

NOTE: Select the following bracketed option if potential transformers will be used to transform 480 volt inputs to 120 volts.

****

[d. Potential transformers will be used to convert 480 volt inputs to 120 volts for the locations shown on the metering schedule. Potential transformers must be rated indoor or outdoor, as required for the specific application. Voltage rating must provide 120 volts, wye-connected, 3 phase, 4 wire, [60 Hz][50 Hz], insulation class, 600 volts. Potential transformers BIL must be 10 kV and must have an accuracy class of 0.3 at burdens w, x, and y. Thermal rating must be 500 VA.

]

****

NOTE: The following paragraphs are necessary only for medium voltage applications.

****

[e. The Contractor must be responsible for determining the actual voltage ratio of each potential transformer for medium voltage applications. Transformer must conform to IEEE C57.13 and the following requirements.

(1) Type: Dry type, of two-winding construction.

(2) Weather: Outdoor or indoor rated for the application.

(3) Frequency: Nominal [60 Hz][50 Hz].

(4) Accuracy: Plus or minus 0.3 percent at [60 Hz][50 Hz].

f. Potential transformers installed inside switchgear and panels must be rated for interior use. Voltage rating must provide 120 volts, wye-connected, 3 phase, 4 wire, [60 Hz][50 Hz], insulation class, 600 volts. Potential transformers BIL must be a minimum of 10 kV, and have an insulation class and BIL rating that equals or exceeds the ratings of the associated switchgear. Potential transformers must have an accuracy class of 0.3 at burdens w, x, and y. Thermal rating must be 500 VA. Potential transformers must be accessed from the front and mounted in a metering section.

]2.1.3 Current Transformer Requirements

a. Current transformer must be installed with a rating as shown in the schedule.

b. Current transformers must have an Accuracy Class of 0.3 (with a maximum error of plus/minus 0.3 percent at 5.0 amperes) when operating within the specified rating factor.

c. Current transformers must be solid-core, bracket-mounted for new installations using ring-tongue lugs for electrical connections. Current transformers must be accessible and the associated wiring must be installed in an organized and neat workmanship arrangement. Current transformers that are retrofitted onto existing switchgear busbar can be a busbar split-core design.

d. Current transformers must have:

****

NOTE: Include the bracketed option below only if medium voltage current transformers are used for the electricity metering covered by this specification.

****

(1) Insulation Class: All 600 volt and below current transformers must be rated 10 KV BIL.[Current transformers for 2400 and 4160 volt service must be rated 25 KV BIL.]

(2) Frequency: Nominal [60 Hz][50 Hz].

(3) Burden: Burden class must be selected for the load.

(4) Phase Angle Range: 0 to 60 degrees.

e. Meter must accept current input from standard instrument transformers (5A secondary current transformers).

f. Current inputs must have a continuous rating in accordance with IEEE C57.13.

****

NOTE: Single-ratio current transformers (CTs) are specified below and are based on a per-meter application. Dual-ratio or multi-ratio CTs are only allowed if future requirements are expected to change the load demand.

This specification will require additional editing if dual-ratio or multi-ratio CTs are used.

****

g. Provide one single-ratio current transformer for each phase per power transformer with characteristics listed in the following table.

****

NOTE: This specification uses the CT rating factor and requires 55 degrees C as the basis for selection. Many CTs are installed outdoors; relying on the CT 30 degrees C rating is not appropriate for these installations.

Select the appropriate CT ratio, continuous-thermal-current rating factor (RF) at 55

degrees C (versus 30 degrees C which was used for previous guidance) and ANSI Metering Accuracy Class values based on transformer kVA size and secondary voltage. The basis for the 55 degrees C value is to allow for CT heating effects and higher ambient temperatures during operation.

The rating factor establishes the minimum electrical current range that will meet the CT accuracy rating. The CT should meet its accuracy requirement for measured current between 10 percent of the CT ratio and the rating factor multiplier applied to the CT ratio.

Example #1: for a 500 kVA transformer at 208 volts - select 1200:5, 1.33, 0.3 - B-0.5. For this selection, the CT should be accurate within its specifications for an input current between 10 percent to 133 percent of the rating, or 120 to 1,600 amperes. The transformer full-load current rating is 1,388 amperes.

Example #2: for a 150 kVA transformer at 480 volts - select 200:5, 2.0, 0.3 - B-0.1. For this selection, the CT should be accurate within its specifications for an input current between 10 percent to 200 percent of the rating, or 20 to 400 amperes. The transformer full-load current rating is 180 amperes.

The table below lists the minimum allowed rating factor. Some manufacturers might be capable of higher rating factors.

	VOLTS					
	208			240		
kVA	CT Ratio	RF	Meter Class	CT Ratio	RF	Meter Class
75	200:5	2.0	0.3 thru B-0.1	200:5	2.0	0.3 thru B-0.1
112.5	200:5	2.0	0.3 thru B-0.2	300:5	2.0	0.3 thru B-0.2
150	300:5	2.0	0.3 thru B-0.2	400:5	2.0	0.3 thru B-0.2
225	400:5	2.0	0.3 thru B-0.2	600:5	2.0	0.3 thru B-0.5
300	500:5	1.5	0.3 thru B-0.5	1200:5	1.5	0.3 thru B-0.5
500	1200:5	1.33	0.3 thru B-0.5	2000:5	1.33	0.3 thru B-0.9
750	2000:5	1.0	0.3 thru B-0.9	3000:5	1.0	0.3 thru B-1.8

	VOLTS					
	480			600		
kVA	CT Ratio	RF 55 C	Meter Class	CT Ratio	RF 55 C	Meter Class
75	100:5	2.0	0.3 thru B-0.1	100:5	2.0	0.3 thru B-0.1
112.5	200:5	2.0	0.3 thru B-0.1	100:5	2.0	0.3 thru B-0.1
150	200:5	2.0	0.3 thru B-0.1	200:5	2.0	0.3 thru B-0.1
225	200:5	2.0	0.3 thru B-0.1	200:5	2.0	0.3 thru B-0.1
300	300:5	2.0	0.3 thru B-0.2	300:5	2.0	0.3 thru B-0.2
500	600:5	1.5	0.3 thru B-0.5	600:5	1.5	0.3 thru B-0.5
750	800:5	1.33	0.3 thru B-0.5	800:5	1.33	0.3 thru B-0.5
1000	1200:5	1.33	0.3 thru B-0.5	1200:5	1.33	0.3 thru B-0.5
1500	1500:5	1.33	0.3 thru B-0.9	1500:5	1.33	0.3 thru B-0.9
2000	2000:5	1.0	0.3 thru B-0.9	2000:5	1.0	0.3 thru B-0.9
2500	3000:5	1.0	0.3 thru B-1.8	3000:5	1.0	0.3 thru B-1.8

NOTE: 2. Incorporate the appropriate values in a table similar to the one shown below.
****

Single-Ratio Current Transformer Characteristics				
kVA	Sec. Volt	CT Ratio	RF	Meter Acc. Class
[500]	[208Y:120]	[1200:5]	[1.33]	[0.3 thru B0.05]
[750]	[480Y:277]	[800/5]	[1.33]	[0.3 thru B0.05]

2.1.4 Meter Requirements

****
NOTE: If J&A documentation has been obtained, use the first bracketed option below and fill in the manufacturer and complete model number that defines the intended meter characteristics. Otherwise select the second bracketed option below and edit the general list of meter characteristics.
****

[Notwithstanding any other provision of this contract, meters must be

[_____]; no other product will be acceptable. All meters must meet NAVFAC Cyber Security Requirements.

][Electricity meters must include the following features:

a. Meter must comply with ANSI C12.1, NEMA C12.19, and ANSI C12.20 and must match existing AMI meter system at the installation and be the newest version with ATO.

b. Meter sockets must comply with ANSI C12.7.

****
NOTE: Select the following bracketed industry standards if applicable for an OCONUS application.
****

[c. Meter must comply with IEC 62053-22, certified by a qualified third party test laboratory.

d. Meter must comply with IEC 60687 certified by a qualified 3rd party test laboratory.

] e. Provide socket-mounted or panel mounted meters as indicated on the meter schedule.

[(1) Panel-mounted meters must be semi-flush, back-connected, dustproof, draw-out switchboard type. Cases must have window removable covers capable of being sealed against tampering. Meters must be of a type that can be withdrawn through approved sliding contacts from fronts of panels or doors without opening current-transformer secondary circuits, disturbing external circuits, or requiring disconnection of any meter leads. Necessary test devices must be incorporated within each meter and must provide means for testing either from an external source of electric power or from associated instrument transformers or bus voltage.

]

****
NOTE: The default design is a Class 20, transformer rated meter. If the measured or expected load is less than 200 amperes, Class 200 meters can be used for direct current reading without current transformers. Specify the location of these meters.
****

f. Meter must be a Class 20, transformer rated design.

[g. Use Class 200 meters for direct current reading without current transformers for applications with an expected load less than 200 amperes, where indicated.

] h. Meter must be rated for use at temperature from minus 40 [_____] degrees Centigrade to plus 70 [_____] degrees Centigrade.

i. The meters must have an electronic demand recording register and must be secondary reading as indicated. The register must be used to indicate maximum kilowatt demand as well as cumulative or continuously cumulative demand. Demand must be measured on a block-interval basis and must be capable of a 5 to 60 minute interval and initially set to

a 15-minute interval. It must have provisions to be programmed to calculate demand on a rolling interval basis. Meter readings must be true RMS.

j. The meter electronic register must be of modular design with non-volatile data storage. Downloading meter stored data must be capable via an [optical][USB] port. Recording capability of data storage with a minimum capability of 89 days of 15 minute, 2 channel interval data. The meter must be capable of providing at least 2 KYZ pulse outputs (dry contacts). Default initial configuration (unless identified otherwise by base personnel) must meet NAVFAC CIRCUITS Call for Consistency document located on the NAVFAC CIRCUITS Portal and must be:

(1) First channel - kWh
(2) Second channel - kVARh
(3) KYZ output #1 - kWh
(4) KYZ output #2 - kVARh

k. All meters must have identical features available in accordance with this specification. The meter schedule identifies which features must be activated at each meter location.

l. Enable switches for Time of Use (TOU), pulse and load profile measurement module at the factory.

m. Meter must have an optical port on front of meter. Optical device must be compatible with ANSI C12.18.

n. Meters must be 120-480 volts auto ranging.

****
NOTE: Include the bracketed option below only if potential transformers are used.
****

o. Provide blank tag fixed to the meter faceplate for the addition of the meter multiplier, which will be the product of the current transformer [and potential transformer]ratio and will be filled in by base personnel on the job site. The meter's nameplate must include:

(1) Meter ID number.
(2) Rated voltage.
(3) Current class.
(4) Metering form.
(5) Test amperes.
(6) Frequency.
(7) Catalog number.
(8) Manufacturing date.

p. On switchboard style installations, provide switchboard case with disconnect means for meter removal incorporating short-circuiting of current transformer circuits.

q. Meter covers must be polycarbonate resins with an optical port and reset. Backup battery must be easily accessible for change-out after removing the meter cover.

r. The normal billing data scroll must be fully programmable. The normal

billing data scroll requirements provided in the CIRCUITS Call for Consistency Document located on the NAVFAC CIRCUITS Portal. Data scroll display must include the following.

(1) Number of demand resets.
(2) End-of-interval indication.
(3) Maximum demand.
(4) New maximum demand indication.
(5) Cumulative or continuously cumulative.
(6) Time remaining in interval.
(7) Kilowatt hours.

s. The register must incorporate a built-in test mode that allows it to be tested without the loss of any data or parameters. The following quantities must be available for display in the test mode:

(1) Present interval's accumulating demand.
(2) Maximum demand.
(3) Number of impulses being received by the register.

t. Pulse module simple I/O board with programmable ratio selection.

u. Meters must be programmed after installation via an [optical][USB] port. Optical display must show TOU data, peak kWh, semi-peak kWh, off peak kWh, and phase angles.

v. Self-monitoring to provide for:

(1) Unprogrammed register.
(2) RAM checksum error.
(3) ROM checksum error.
(4) Hardware failure.
(5) Memory failure.
(6) EPROM error.
(7) Battery status (fault, condition, or time in service).

w. Liquid crystal alphanumeric displays, 9 digits, blinking squares confirm register operation. Six Large digits for data and smaller digits for display identifier.

x. Display operations, programmable sequence with display identifiers. Display identifiers must be selectable for each item. Continually sequence with time selectable for each item.

y. The meters must support three modes of registers: Normal Mode, Alternate Mode, and Test Mode. The meter also must support a "Toolbox" or "Service Information" (accessible in the field) through an optocom port to a separate computer using the supplied software to allow access to instantaneous service information such as voltage, current, power factor, load demand, and the phase angle for individual phases.

****
NOTE: Determine the desired warranty period and update the bracketed option below.
****

z. Meter must have a standard [4] [_____]-year warranty.

]2.1.5 Disconnect Method

****

NOTE: The standard design must include a 10-pole safety disconnect. This permits meter removal without service interruption and includes shorting type wiring blocks so that CTs are not inadvertently open circuited.

The options for the disconnecting wiring blocks requires approval by the authority having jurisdiction and would only be used when installing a meter system using individual components rather than an integrated switch.

****

a. Provide a 10-pole safety disconnect complete with isolation devices for the voltage and current transformer inputs, including a shorting means for the current transformers.

[b. Disconnecting wiring blocks must be provided between the current transformer and the meter. A shorting mechanism must be built into the wiring block to allow the current transformer wiring to be changed without removing power to the transformer. The wiring blocks must be located where they are accessible without the necessity of disconnecting power to the transformer.

c. Voltage monitoring circuits must be equipped with disconnect switches to isolate the meter base or socket from the voltage source.[Provide fuse protection in accordance with paragraph VOLTAGE REQUIREMENTS.]

]2.1.6 Installation Methods

****

NOTE: Pad-mounted transformers have proven to be very reliable over a long life span. Installing one meter on the outside of the secondary wiring compartment has become the standard installation for military facilities resulting in minimal maintenance. However, to prevent additional compromise of the transformer enclosure integrity, if more than one meter is required for a location or service, add a separate free-standing unistrut frame with each meter in its own enclosure or use commercial meter pedestals for each meter.

Meters may be installed on the sides of buildings. Installing meters inside of a building and behind locked doors has proven to be a burden for meter readers in some instances and is not recommended.

****

a. Transformer Mounted ("XFMR" in Metering Systems Schedule). Meter base must be located outside on the secondary side of the pad-mounted transformer.

b. Stand Mounted Adjacent to Transformer ("STAND" in Metering Systems Schedule). Meter base must be mounted on a structural steel pole approximately 1.2 meters 4 feet from the transformer pad. This can be

used for multiple meters associated with a single transformers.

****

NOTE: Provide a drawing to show details for building mounting and routing conduit and wires. Typical detail drawings are referenced at the beginning of this specification.

****

c. Building Mounted ("BLDG" in Metering Systems Schedule). Meter base must be mounted on the side of the existing building near the service entrance.

d. Panel Mounted. ("PNL" in Metering Systems Schedule). Meter must be mounted where directed.

e. Commercial meter pedestal ("PED" in Metering Systems Schedule).

2.2 COMMUNICATIONS INTERFACES

****

NOTE: The default metering condition is to provide two-way communication with an existing DAS, if installed at the Activity already. If a DAS is not installed or is outdated (inadequate), then coordinate with the activity to determine if a new DAS should be provided as part of the contract. If a new DAS is determined to be necessary, edit the requirements below as needed to identify the DAS requirements. New meters must connect to the Control Systems Platform Enclave at the regional level.

The communications requirements must be determined for each location and are not addressed by this specification. A hardwired or optical connection is preferred. Possible communications options include:

RS-232
RS-485
Optical port
Ethernet (RJ-45)
Fiber-optic ST connection
RF (Wireless) Module
Power line carrier and
LTE radio

Determine the communications requirements for the metering system and modify the paragraph below as necessary to define the selected communication system.

****

Meter must have two-way communication with the existing data acquisition system (DAS). Provide a communications interface utilizing [_____].[Refer to Section [_____] for the communication interface requirements for these meters.]

Provide interfacing software if a meter is used that is different than the

existing meters at the Activity to ensure compatibility within the metering system.

****
NOTE: Determine the connections requirements for the AMI network and modify the paragraph below as necessary to provide equipment for the system. This could be as simple as providing a fiber optic link to the closest connection point or could be more extensive and requires close coordination with the Activity.
****

Connect to the AMI network utilizing [_____].

****
NOTE: Determine what modifications need to be done to the existing DoD Information Assurance Certification and Accreditation Process (DIACAP) to maintain accreditation. Check with the local Command Information Officer (CIO) for the latest requirements.
****

[Provide [_____].

][2.3 SPARE PARTS

****
NOTE: Spare parts are not normally included as part of the construction contract or on contracts involving a small number of meters. On large projects, involving ten or more meters, the following may be an example of spare parts requirements.
****

Provide the following spare parts:

a. Power Meter - two for each type used with batteries.

b. Communications interface - one for each type used.

]2.4 METERING SYSTEM SCHEDULE

****
NOTE: A schedule of meters and their associated requirements are preferentially included on a separate drawing. As an alternate, the required tabular information can be provided below. In each case, identify the characteristics for the specific meter and communications method for each building.
****

[_____]

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations must conform to ASHRAE 90.1 - IP, ASHRAE 90.1 - SI IEEE C2, NFPA 70 (National Electrical Code), and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise.

****

NOTE: Remove the following section if existing condition surveys are not required. If an existing condition survey is not required as part of the installation, the metering system schedule should address any unique requirements for each installation.

****

[3.1.1 Existing Condition Survey

The Contractor must perform a field survey, including inspection of all existing equipment, resulting clearances, and new equipment locations intended to be incorporated into the system and furnish an existing conditions report to the Government. The report must identify those items that are non-workable as defined in the contract documents. The Contractor must be held responsible for repairs and modifications necessary to make the system perform as required.

3.1.1.1 Existing Meter Sockets

In some cases, the existing meter sockets will have to be replaced to accommodate the new electrical meters. An existing socket is considered unacceptable for any of the following conditions:

a. It is a non-ANSI form factor meter socket.

b. It is weathered beyond the point of being safe to reuse.

c. It is installed incorrectly, such as a non-weather resistant enclosure installed outdoors.

d. It is not the correct form factor for the existing electrical service.

3.1.1.2 Existing Installations

As part of the existing condition survey, the following applies for installations with existing meters:

****

NOTE: Coordinate with the activity for the desired re-use or disposition of existing PTs.

****

a. Replace any meters that do not comply with this section.

b. If CTs are installed, verify that they comply with this section. If they do not comply, replace them with CTs that comply with this section. One CT per phase is required for wye-connected systems.

[c. If potential transformers are installed on low-voltage systems, remove the PTs as part of the installation.

] d. Install disconnect switches as specified in this section.

][3.1.2 Scheduling of Work and Outages

****
NOTE: Installation of current transformers and potential transformers will require that power be disconnected from the transformer and building. Provide coordination steps for the work and require the Contractor to perform the work after normal hours. Coordinate with Division 1 Sections.
****

The Contract Clauses must govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.[_____]

]3.1.3 Configuration Software

The standard meter must include the latest available version of firmware and software. Meter must either be programmed at the factory or must be programmed in the field. Meters must have a password that must be provided to the contracting officer upon project completion. When field programming is performed, turn field programming device over to the Contracting Officer at completion of project. When interfacing software is used for a meter that is different than the existing meters in use at the Activity, turn the software over to the Contracting Officer at completion of the project.

3.2 FIELD QUALITY CONTROL

****
NOTE: Apply 100 percent checks for smaller projects. Use random sampling of acceptance checks and tests for large projects. If no problems are identified in the acceptance checks and tests of the random sample, then the results would be accepted. If problems are identified in the acceptance checks and tests of the random sample, then an additional random sample would be selected for verification.
****

Perform the following acceptance checks and tests on all installed meters.

3.2.1 Performance of Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

a. Meter Assembly

****
NOTE: The following requirements are derived from NETA ATS and have been modified for this specification.

****

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specifications and approved shop drawings.

(b) Inspect physical and mechanical condition. Confirm the meter is firmly seated in the socket, the socket is not abnormally heated, the display is visible, and the ring and seal on the cover are intact.

(c) Inspect all electrical connections to ensure they are tight. For Class 200 services, verify tightness of the service conductor terminations for high resistance using low-resistance ohmmeter, or by verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method.

(d) Record model number, serial number, firmware revision, software revision, and rated control voltage.

(e) Verify operation of display and indicating devices.

(f) Record password and user log-in for each meter.

(g) Verify grounding of metering enclosure.

(h) Set all required parameters including instrument transformer ratios, system type, frequency, power demand methods/intervals, and communications requirements. Verify that the CT ratio and the PT ratio are properly included in the meter multiplier or the programming of the meter. Confirm that the multiplier is provided on the meter face or on the meter.

(i) Provide building meter installation sheet, per building for each facility. See example Graphic E-S1.

[(j) Provide the completed meter installation schedule for the installation if multiple meters are to be used. See example Graphic E-S2

][(k) Provide the completed meter data schedule for the installation if multiple meters are to be used. See example Graphic E-S3.

] (2) Electrical tests.

(a) Apply voltage or current as appropriate to each analog input and verify correct measurement and indication.

(b) Confirm correct operation and setting of each auxiliary input/output feature including mechanical relay, digital, and analog.

(c) After initial system energization, confirm measurements and indications are consistent with loads present.

(d) Make note of, and report, any "Error-Code" or "Caution-Code" on the meter's display.

(3) Provide meter configuration report.

b. Current Transformers

(1) Visual and mechanical inspection.

(a) Compare equipment nameplate data with specification and approved shop drawings.

(b) Inspect physical and mechanical condition.

(c) Verify correct connection, including polarity.

(d) Inspect all electrical connections to ensure they are tight.

(e) Verify that required grounding and shorting connections provide good contact.

(2) Electrical Tests.

Verify proper operation by reviewing the meter configuration report.

****
NOTE: Include the following inspections and tests if potential transformers are included within the scope of the project.
****

[c. Potential Transformers

(1) Visual and mechanical inspection.

(a) Verify potential transformers are rigidly mounted.

(b) Verify potential transformers are the correct voltage.

(c) Verify that adequate clearances exist between the primary and secondary circuit.

(2) Electrical Tests.

(a) Verify by the meter configuration report that the polarity and phasing are correct.

]3.2.2 System Functional Verification

Verify that the installed meters are working correctly in accordance with the meter configuration report:

a. The correct meter form is installed.

b. All voltage phases are present.

c. Phase rotation is correct.

d. Phase angles are correct.

e. The new meter accurately measures power magnitude and direction, and can communicate as required by paragraph COMMUNICATIONS INTERFACES.

-- End of Section --