JBLM 26 27 13.10 30
ELECTRICAL METERS
07 Sep, 2022
Revision 8

Purpose:

a. The purpose of the following specification is to achieve meter equipment compatibility with the Army Metering Program pursuant to Public Law 109-58, Section 103 of the Energy Policy Act of 2005. This does not replace the Unified Facility Guide Specifications on metering; additional technical and installation requirements and applicable references may be located there as needed. This specification provides guidance to meet the minimum requirements for metering as established by public law and Army policy. The intent is for all advanced meters to report their data to an installation-centric energy reporting and management system such as an Enterprise Energy Data Reporting System (EEDRS) and Metering Data Management System (MDMS) Installation Level front end. This approach is consistent with UFC 3-400-01, Energy Conservation. Paragraph 2-5, Meters, states: "All meters shall be connected to a base wide energy and utility monitoring and control system directly." The advanced meters must provide data at least daily and measure at least hourly consumption of electricity in fifteen minute intervals.

b. General Theory of Operation: Utility Meters are installed to monitor electricity, gas, water, and steam usage. These meters are connected to a Field Control Network - via Modbus RTU over RS 485. They communicate over this field control network to a device which connects the field control network to an internet protocol (IP) network, and then over this IP network to an "Installation Level Front End", generally an existing Enterprise Energy Data Reporting System/Energy Monitoring and Control System (EEDRS/EMCS). At the EEDRS the information from the meter is provided to the graphical user interface (and other functionality) that is part of the EEDRS for use by installation personnel (such as DPW and energy managers) and is also logged and stored in a Structured Query Language (SQL) database. This SQL database may be the database regularly used by the EEDRS or a separate SQL database installed specifically for this purpose. On a regular basis the MDMS Gateway, located in the DMZ of the installation (outside the inner firewall) retrieves data from the SQL database and sends it to the MDMS Server.

Notes:

1) In some cases electric meters may be connected directly to an IP network, but this is considered a non-standard approach.(NOT UTILIZED AT JBLM)

2) The approach detailed above is used for other (non-electrical) metering also, but generally only total consumption is measured for non-electricity meters, and non-electricity meters may provide a pulse output that is measured by a controller on the network in lieu of being connected to the network themselves.

c. The means for meter data transmission using open-protocols such as ANSI/CEA 709.1b and Modbus RTU over Government owned transport media (LAN, telephone carrier, wireless, radio, microwave, or power line carrier, etc.) will be site specific and subject to the approval of the Network Enterprise Center (NEC). These specifications provide the flexibility needed to support the various data transmission system alternatives in addition to meeting the minimum standards for energy consumption data recording and reporting. A key element for success will be integrating these systems with the Army's Information Technology (IT) networks supported by Network Enterprise Centers (NEC).

Applicability: These requirements apply to all Army meters for use on facilities that meet the size and energy-consumption selection criteria regardless of the funding source and method of procurement (i.e. Military Construction Army (MCA) projects, Utility Privatization contracts, Energy Savings and Performance Contracts, or Sustainment Modernization and Repair projects).

Definitions:

a. Advanced Metering Data Management System Installation Level front end. This term as used in the specification refers to the system that will collect, manage, and display the meter data for the local energy manager. It may be a new system or it may consist of the existing Legacy UMCS/EMCS and its associated building level controllers that have been upgraded with the necessary hardware/software as required. The intent of the Army Metering Program is to provide the metering data to the local engineering staff first within the building automation system that can execute application programs to affect savings, and then transmit to the Enterprise Meter Data Management System, when activated.

b. Advanced Meters. For this specification, Advanced Meters are those that have the capability to measure and record interval data (at least hourly for electricity), and communicate the data to a remote location in a format that can be easily integrated into an advanced meter data management system. Most advanced meters offer additional features which may be attractive to system owners.

References:

a. UFGS 26 27 13.10 30, ELECTRIC METERS prepared by the Air Force

b. UFGS 26 27 14.00 20, ELECTRICITY METERING prepared by the Navy

Although these are listed as Unified in the Construction Criteria Base the preparing activity has focused on their specific requirements that may not fulfill the Army's needs. However, as this Mandatory Center of Expertise (MCX) guidance is not intended to provide the level of detail for contract requirements, the designer should refer to these as needed and include the detail for

completeness. The Navy specification has some excellent drawings/sketches that are useful. The goal is to create a truly unified Metering Specification in FY13.

c. Additional documentation required and available as separate electronic media files at: http://www.hnd.usace.army.mil/umcs/umcs_resources.aspx

1. Enterprise Energy Data Reporting System Security Functional Architecture Ver3.4.doc (Paragraph 2.1.a)
2. Advanced Meter Points List.xls (paragraph 3.3.2)
3. I3A Technical Criteria Feb 2010.pdf (paragraph 2.3.a)

d. JBLM Design Standards

Any updates to the metering specifications referenced in this document will be available in their current form in the JBLM Design Standards.

1. JBLM Specific Advanced Metering Specifications
2. JBLM Utilities Metering Manual

GENERAL OUTLINE

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1.0 INSTALLATION LEVEL FRONT END COMPUTER

1.1 MODBUS or BACnet Open Protocol. Where no existing EEDRS/EMCS can satisfy the Advanced Metering Data Management System Installation Level requirements the design shall include a MODBUS or BACnet Based Open System Host for the front end data management system. The MODBUS Based Open System Host shall be installed in accordance with Specification UFGS 25 10 10 Utility Monitoring and Control System (UMCS) Front End and ensure compatibility with installed JBLM EEDRS Front End. The MODBUS Based UMCS System Host requires building TP/FT-10 data communication infrastructure for meter connectivity. UFGS 23 09 23 provides guidance on the communication media.

1.2 Meter Data Schema. The metering data shall be stored per the defined schema and set in a full version Microsoft SQL data base for future retrieval by others to a site Meter Data Management System (MDMS) Gateway that will report to an Enterprise Army Meter Data Management System. The Microsoft SQL data base may be an entirely separate SQL data base dedicated to meter data only or native to the Host EEDRS/Metering Front end.

a. Define in the following format: /BLCx/Buildingy_Meterz_point_15

Where:

BLC is the building level controller used. It shall be a Java Application Control Engine (JACE).
x is the building number containing the BLC
y is the building number containing the meter
z is the meter number within the building
point is the name of the measured variable:
KW for electrical demand/power
KWH for electrical energy
PF_AVG for power factor
PULSE_aaa for a consumption meter, aaa refers to the input designation. Contractor shall provide the necessary point name mapping and conversion information.
Others as required
The _15 indicates that these values came from 15 minute history data.

Note also that the building level controller name, /JACEx/, may be automatically pre-pended by EEDRS host. The future Meter Data Management System (MDMS) Gateway will repackage the required data into a Comma Separated Value (CSV) file form for transmission to the MDMS Enterprise Server.

b. Provide the following meter data:

PWR-TOT	Real Power (Total)
KWH-TOT	Total KWH (Total Energy)
PWR-DEMAND-PEAK	Historical Peak Demand Power
PWR-DEMAND	Demand Power
VOLT-A	Rms Voltage For Phase A
VOLT-B	Rms Voltage For Phase B
VOLT-C	Rms Voltage For Phase C
AMP-A	Rms Current For Phase A
AMP-B	Rms Current For Phase B
AMP-C	Rms Current For Phase C
HZ-AVG	Average Line Frequency
PF-AVG	Average Power Factor
PH-D	Phasor Diagram

1.3 Meter Identification and Location Data. Contractor shall populate the sample information document shown in the table below and display and store at Installation Level Front End Computer.

Fort Sample Electric Meter Information							
Bldg No.	**Bldg Name**	**Bldg Sqft**	**Category Code**	**Meter Name**	**Commodity Type**	**Area served by meter (sqft)**	**Reimbursable (Y/N)**
71	EXCH MAIN STORE	74,053	74053	0001E00071EMON	Electricity	74,053	y
01440 HAAF	HEALTH CLINIC	49,679	55010	0033E1440HEMON	Electricity	49,679	N
2905	OPEN STR INST	40,264	45210	0034E02905EMON	Electricity	40,264	N
4541	VEH MAINT SHOP	32,648	21410	0035E04541EMON	Electricity	32,648	N
06007 HAAF	ARMY LODGING	43,732	72010	0038E6007HEMON	Electricity	43,732	N
7560	DEPENDENT SCH	31,040	73046	0043E07560EMON	Electricity	31,040	y
7742	CO HQ BLDG	30,000	14185	0044E07742EMON	Electricity	30,000	N
10501	CSMS/MATES	31,093	21419	0045E10501EMON	Electricity	31,093	y
10531	CSMS/MATES	34,843	21419	0046E10531EMON	Electricity	34,843	Y

1.4 Storage of Metered Data. The Advanced Metering Data Management System Installation Level Front End shall store all required meter data for a minimum of two years.

1.5 Workstation Display

a. System shall display all mandatory metering data (electricity, water, gas and steam) upon request in an organized and easily readable format. Data shall be displayed in no less than 15 minutes intervals.

b. Final install of front end equipment shall, at minimum, display accurate data readings for each meter in a text format. Display capability shall include multiple graphical formats such as data vs. time (minutes, hours, days, weeks, months, and year) comparison between metered data from two or more meters and other standard meter data. Site specific graphics shall be created that display the required metered value, meter location, meter serial number and building square footage served by that meter. In addition, contractor shall differentiate by an asterisk on the graphic display those meters that were not installed by the Army Metering Program.

c. Contractor shall provide two hardcopies and two copies on electronic media (DVD or CD) of detailed instructions for customization and integration of additional display features that are not prepared at the time of final install.

1.6 Energy Reports. The Installation Level Front End Computer shall be configured to provide monthly energy reports that show:

a. Specific building kWh and max kW use and time and day the max occurred.

b. A building's monthly kWh and max monthly kW with history over the previous 24 months. Include Heating Degree-Days (HDD) and Cooling Degree-Days (CDD) for each month.

c. Summary of what all buildings are using on an installation relative to their square footage (energy consumption density) as a function of kWh and kW peak; when meters are available include the Natural Gas (NG) and water usage including their maximum rate of use for that month. Include HHD and CDD.

d. A bar chart showing the 24 month history of what the installation is using total (kWh, KW peak, NG, and water) and the energy density based on square footage of metered buildings. Include HDD and CDD for each month.

e. A bar chart showing dollar cost for the commodities from the chart above over a 24 month period. Include HDD and CDD for each month.

f. A dirty dozen list of the buildings using the highest energy based on square footage, occupancy rates, hours of use, and a factor coefficient to decrease the rating for high energy density demand type missions. This mission coefficient shall be the same for the same type of mission and applied the same on every installation.

2.0 COMMUNICATIONS

2.1 Between Meters and Installation Level Front End

a. The communications medium shall be compatible with the Installation Level Front End Computer and the Enterprise Energy Reporting Data System (EERDS) Security Functional Architecture available as separate electronic media: Enterprise Energy Data Reporting System Security Functional Architecture.doc. The installation of wire, fiber optic cable, wireless network equipment, network switches, and media converters is required where existing communications infrastructure is non-existent to support communications between the buildings to be metered and the nearest base network access point. If fiber optic cable is required, coordinate with the site NEC for installation guidance and sizing (24 strand is preferred). All IP, Ethernet, or wireless communication design and implementation plans shall be approved by the site NEC.

b. Building Level Controller (BLC) shall be a Java Application Control Engine utilizing Tridium Niagara software and MODBUS protocol and shall have the following. Minimum of 128 MB of memory, TWO 101100 Mb Ethernet port, TWO RS-485 serial ports configured for Modbus, one RS-232 serial port, and one BacNet port.

BLC can be installed in a dedicated cabinet or co-located within the Primary Electrical Meter cabinet that meets the following criteria:

(1) Outdoor/exterior devices shall be rated for operation and storage from minus 40 degrees C to plus 70 degrees C or better and 5 to 100% relative humidity (RH) (non-condensing). Exterior meters shall be provided with or installed within a NEMA 4 enclosure. Enclosures shall be NEMA 4X for coastal and corrosive environments. When ambient temperature extremes exceed the rating above, provide enclosures with heat strips to maintain operable temperatures. Enclosures shall be lockable (key lock) for information security issues.

(2) Indoor/interior devices shall be rated for operation and storage from 0 degrees C to plus 50 degrees C or better and 5 to 90% relative humidity (non-condensing). Interior meters or meters located in mechanical rooms shall be provided with or installed within a NEMA 12 lockable enclosure.

BLC cabinet or co-located cabinet shall contain, at the minimum, the following, DIN rail for component mounting, surge protection device for BLC, overcurrent protection device for BLC power supply, single 15 amp 120VAC receptacle, terminal blocks for signal cable connection. BLC shall be powered by a dedicated circuit.

c. Radio Frequency (RF) transceivers shall be DoD/NETCOM approved and have an existing J/F (joint format)12 number. This is the identification number assigned to a system after the Application for Equipment Frequency Allocation (DD form 1494) is approved, for example, J/F 12/6309 (sometimes called the J-12 number).Contractor shall be responsible for obtaining installation Frequency Manager/Officer and host nation approval.

c. Coordinate with the Activity and provide specific requirements "to match existing systems" when necessary. Contractor shall verify that the electricity meter installed on any building site is compatible with the post-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 setup the meters described by this specification. New software tools different from the meter programming methods currently used by post personnel shall require separate approval for use. Contractor shall verify that the metering system installed on any building site is compatible with the facility-wide or post-wide communication and meter reading protocol system.

2.2 Between Installation Level Front End and Enterprise MDMS System

a. Standard naming convention within EEDRS to identify metering shall be used. That naming convention is as follows: Installation_Site_Building Number, Type Equipment_Meter Name_Type Meter.

1) Installation- JBLM

2) Site- one of the following, M=McChord, L=Lewis, Y=Yakima, V=Veterans Administration.

3) Building number, Type equipment- those facilities assigned a numerical designator shall display 6 digits. For facilities or equipment that do not have an assigned designator, the following applies, PS=Power Stand, CT=Cell Tower, CE=Communication Equipment.

4) Meter Name- Designates number of meters of that type in a facility.
5) Type Meter- the following applies, E=Electrical, G=Gas, W=Water, S= Steam.

Typical EEDRS Electrical Meter name will appear as follows: JBLM_L_002012_M1_E. Typical EEDRS Electrical Meter name for non-assigned numerical designator will appear as follows: JBLM_L_002012CT_M1_E.

See Paragraph 1.2. The MDMS Contractor shall execute a retrieval of the data in the Microsoft SQL data base. The MDMS Contractor shall format the meter data to include the site specific information that uniquely identifies the installation (Fort Carson, Fort Hood, etc.). IPSec tunneling may be used to securely transport data. There will be a gateway between the Installation Level EEDRS Server and the Enterprise MDMS.

2.3 Information Assurance Requirements

a. The process and related requirements to attain certification and accreditation for metering systems are under revision. Any standard procedure issued as part of this specification will likely need modification soon. The DoD Information Assurance guidance (DoDI 8500 series) and UFGS 25 10 10, Utility Monitoring and Control System are being rewritten and have major revisions that affect communication protocol and security engineering. Once those changes get published and implemented, some standard procedures can be set. However, authoritative guidance does exist to shape architectural templates and influence the design process for the Installation Information Infrastructure Architecture (I3A) for Army installations. This document is Technical Criteria for the Installation Information Infrastructure Architecture and is available at the website noted in References, paragraph c.

b. The Information Assurance and Security Engineering Directorate (IASED) in Fort Huachuca, AZ, is conducting testing and hardening for a limited number of metering host configurations that may assist in final IA certification and accreditation documents. As the documentation is created for individual systems there exist opportunities to leverage this knowledge to engineer a metering system that will more easily be approved by the NEC.

c. Networthiness: The contractor shall provide and prepare documentation as required by AR 25-1 and submit a request for a Certificate of Networthiness (CoN). Networthiness certification is required before connecting hardware/software to the Army Enterprise Network. The selection of system components from the Defense Information Systems Agency (DISA) Approved Products List is required, when available. There is also a list of preapproved software that identifies those that have CoNs. The Contractor shall coordinate all Networthiness efforts with the appropriate installation NEC as well as higher NETCOM headquarters. When issued and certified, the Contractor shall comply with the applicable IATO (Interim Authority to Operate) configuration stand-up guide.

d. In the eyes of a security engineer, IP meters have been regarded as vulnerable and assumed to create a higher risk to the defense in depth architecture. This unfortunately denies the use of a powerful device that has the advantage of web based services and time stamps. The IP meter

interface also offers a more robust transfer of data and the ability to remotely reset counters. This risk assessment is subject to change as testing is completed.

e. While in the design and planning stage, contact the Army Metering Program-AMC for the most recent update on metering system configurations and their affect on information assurance.

f. All Meters, Building Level Controllers, RF devices and media converters must be on the Most current JBLM Specific APL AMP Tested Building Level Device List.

3.0 METERS

Note: Reimbursable facilities/customers that require metering devices which exceed the requirements detailed in this specification shall be installed per written request as approved and provided in pre-proposal documentation.

3.1 Environmental Tolerances of Metering Devices

a. Power Meters:

(1) Outdoor/exterior devices shall be rated for operation and storage from minus 40 degrees C to plus 70 degrees C or better and 5 to 100% relative humidity (RH) (non-condensing). Exterior meters shall be provided with or installed within a NEMA 4 enclosure. Enclosures shall be NEMA 4X for coastal and corrosive environments. When ambient temperature extremes exceed the rating above, provide enclosures with heat strips to maintain operable temperatures. Enclosures shall be lockable (key lock) for information security issues.

(2) Indoor/interior devices shall be rated for operation and storage from 0 degrees C to plus 50 degrees C or better and 5 to 90% relative humidity (non-condensing). Interior meters or meters located in mechanical rooms shall be provided with or installed within a NEMA 12 lockable enclosure.

b. Water Meter Operating Temperatures: 0 degrees C to plus 50 degrees C or better. Water Meter Humidity Operating Range: 5% to 90% RH (non-condensing).

When above frost line and exterior mounting is required, consider the local ambient temperature extremes and protect from freezing with insulated, moisture proof enclosures and heat tracing as required.

c. Gas Meter Operating Temperatures: minus 40 degrees C to plus 70 degrees C.
Gas Meter Humidity Operating Range: 5% to 90% RH (non-condensing).

d. Steam Meter Ambient Operating Temperatures: minus 40 degrees C to plus 80 degrees C.
Steam Meter Medium Operating Temperatures: minus 40 degrees C to plus 240 degrees C.
Humidity Operating Range: 5% to 90% RH (non-condensing)

e. All interior meters and/or remote interface displays shall be provided with or installed within a NEMA 12 enclosure.

3.2 Smart Meter Capability

a. All meters as installed shall provide smart meter capabilities, either as a single product, or as installed in conjunction and collocated with another product such that the combined installation provides smart meter capabilities.

b. Meters that do not provide factory smart capabilities shall provide a pulse output for interfacing to a smart meter. The minimum and maximum pulse rate and pulse width of the receiving digital input device and software, i.e., electric meter, digital input card on the UMCS or any other accumulator shall be determined by the contractor. The contractor shall provide pulse rate convertors if required. Depending on the product used, relay isolation may be required when connecting to the Input/Output (I/O) device. In addition, the contractor shall determine and eliminate false triggers caused by distance or routing near other voltage sources. It is strongly advised to adhere to the manufacturers' recommendations and industry practices and install isolation relays as field conditions dictate.

3.2.1 Communication Protocol and Methods. Meters shall communicate via either Modbus RTU, ANSI/CEA-709.1b or ASHRAE-135 (BACnet) protocols to the existing or new Enterprise Energy Data Reporting System Installation Level Front End (EEDRS Host). In locations where a legacy EEDRS system currently exists, equipment installed shall be compatible with the existing EEDRS architecture.

3.2.2 Pulse Input Data Port Interface

a. Meters shall have a data port connection compatible with the selected protocol which communicates to the existing or new Advanced Metering Data Management System Installation Level front end. The meter's interface must be compatible with the conditions at any given site. Analog current loops shall not be used.

b. Auxiliary data ports. Unless otherwise specified, smart meters shall have a minimum of four pulse inputs for incorporation of other external meter data. An integral or external 5 VDC power supply shall also be required.

3.2.3 Data Storage and Trend Logs

a. Unless otherwise specified, the meter must be capable of providing and storing 15 minute interval data for 20 distinct points for minimum of 30 days to non-volatile memory. The measured energy consumption shall be retained in non-volatile memory. The maximum demand and time of maximum demand shall be stored in non-volatile memory and can be reset.

b. Field Interface Tool: Contractor shall provide a field interface tool with the compatible software to extract stored trend data and logs from meters. This is a separate hand-carried device that directly connects with the meter at the installed site.

3.2.4 Meter display. Meters that are required to display data shall provide face plate configurable menus to select the desired data for display. Display requirements may be met with the installation of a local display panel connected to the meter. All collected data shall be capable of display.

3.3 Electric Meter

3.3.1 Requirements

a. The meters must comply with the applicable requirements of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 189.1. Where conflicts occur between this guidance and the ASHRAE standard, ASHRAE 189.1 shall prevail.

b. Power Systems: Meters shall be designed for multifunction electrical measurement on either single or 3 phase power systems. Meter shall support the power configuration as identified at site specific government facilities: single phase (120 or 240 volt); 3 Phase, 3 Wire Delta; 3 Phase, 4 Wire Delta; 3 Phase, 4 Wire Wye (2.5 Element); 3 Phase, 4 Wire Wye (3.0 Element). For three phase application voltage range is 208 – 600V. All meters shall be UL 508 Listed, CSA approved, have CE marking, and meet safety standards UL 1244 or UL 1010-1.

3.3.2 Mandatory measured variables: See Electric Meter points list: Advanced Meter Points List.xls for details and additional requirements. Points list assumes a 4 wire delta power configuration. Modify to match site specific requirements.

PWR-TOT	Real Power (Total)
KWH-TOT	Total KWH (Total Energy)
PWR-DEMAND-PEAK	Historical Peak Demand Power
PWR-DEMAND	Demand Power
VOLT-A	Rms Voltage For Phase A
VOLT-B	Rms Voltage For Phase B
VOLT-C	Rms Voltage For Phase C
AMP-A	Rms Current For Phase A
AMP-B	Rms Current For Phase B
AMP-C	Rms Current For Phase C
HZ-AVG	Average Line Frequency
PF-AVG	Average Power Factor
PH-D	Phasor Diagram

Optional Measured values:

PWR-A	Real Power For Phase A
PWR-B	Real Power For Phase B
PWR-C	Real Power For Phase C
HZ-A	Frequency For Phase A
HZ-B	Frequency For Phase B
HZ-C	Frequency For Phase C
KVA-TOT	Total Kva
KVA-A	Kva For Phase A
KVA-B	Kva For Phase B
KVA-C	Kva For Phase C
KVAR-TOT	Total Reactive Power
KVAR-A	Reactive Power For Phase A
KVAR-B	Reactive Power For Phase B
KVAR-C	Reactive Power For Phase C
KVARH-TOT	Total Kvarh (Total Reactive Energy)
KVARH-A	Kvarh (Total Reactive Energy) For Phase A
KVARH-B	Kvarh (Total Reactive Energy) For Phase B
KVARH-C	Kvarh (Total Reactive Energy) For Phase C
PF-A	Power Factor For Phase A
PF-B	Power Factor For Phase B
PF-C	Power Factor For Phase C

3.3.3 Accuracy

a. System Accuracy: System accuracy for the meter product devices including instrument transformers shall not exceed plus or minus 1.5% as calculated using the Root Sum Square (RSS) method and assuming normal distribution.

b. Meter Accuracy: Meter certification shall be IEEE/ANSI C12.20, Accuracy class 0.5% or the meter shall be calibrated with National Institute of Standards and Technology (NIST) traceable standards to an accuracy of 0.5% or better.

c. For reimbursable tenants meter certification shall be NEMA/ANSI C12.20, Accuracy class 0.2%.

d. Electrical meters shall include a Meter display that can display all recorded values.

3.3.4 Surge Protection: Meters shall comply with IEEE/ANSI C37.90.1, Standard surge withstand capability (SWC) tests for relays and relay systems associated with electric power apparatus and IEEE C62.41.

3.3.5 Instrumentation (CTs and PTs)

a. Current transformers (CTs) sized properly so that the meter secondary of the transformer shall output current to ensure at least a plus or minus 0.6% accuracy of current when measured between 10% and 90% of full amperage range.

b. CTs shall not exceed 5 amps on the secondary side.

c. Burden on CTs shall not exceed rated burden for the accuracy class.

d. CTs shall be provided in solid or split core configurations.

e. CTs shall be provided in the appropriate ranges to meet the service entrance amperage requirements.

f. CTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

g. CTs shall be provided that are rated for the appropriate matching frequency of the power generation (60 Hertz CONUS and 50 Hertz OCONUS where applicable).

h. Current sensors shall not be used.

i. Voltage or Potential Transformers (PTs) sized properly so that the meter secondary of the transformer shall output voltage to ensure at least a plus or minus 0.6% accuracy of voltage when measured from zero to the IEEE/ANSI C57.13 or IEC 185 specified standard burden, at the specified standard burden power factor, and at any value from 90% to 110% of rated voltage.

j. PTs shall be revenue grade and certified per IEEE/ANSI C57.13 or IEC 185.

k. Burden on PTs shall not exceed rated burden for accuracy class.

3.3.6 Disconnects and Shorting Blocks

a. The appropriate metering accessories, terminal blocks, shorting blocks, and fuses shall be built into each enclosure and the enclosure shall have an appropriate grounding termination point per standard industry practices. Disconnect wiring blocks shall be provided between the current transformer and the meter where 5 AMP current transformers are used. A shorting mechanism shall be built into the wiring block to allow the current transformer wiring to be changed between shorting block and meter without removing power to the transformer. The wiring blocks shall be located where they are accessible without the necessity of disconnecting power to the transformer. For multi-ratio current transformers, provide a shorting block from each tap to the common lead. The shorting mechanism must be capable of carrying the current of each current transformer so that the electric meter can be safely removed from the circuit for testing or repair. Low voltage, 0-5 volt current sensors are exempt from the shorting block requirement.
In those installations where the meter enclosure is to be located outside of an electrical panel or switchgear the CT's shall have an additional readily accessible shorting device located within the panel or switchgear. The potential conductors to the meter shall also be fused, utilizing an

additional finger safe fuse block, protected at 15 amps. Fuse block to be readily accessible and located within the panel or switchgear

b. Voltage-monitoring circuits shall be equipped with disconnect switches to isolate the meter base or socket from the voltage source.

c. Short circuit protection for each power supply circuit or measuring voltage circuit entering the enclosure must be included in the enclosure. This shall be appropriately sized to protect equipment and personnel should an accidental short occur during maintenance inside the enclosure. Fuses or breakers with appropriate UL ratings shall be used. Fuse type and rating shall be depicted on the As-Built drawings.

d. Switching mechanisms adequate to de-energize all power supply and voltage circuits entering the enclosure must be included in the enclosure. If a breaker is utilized for the short circuit protection that can fulfill this function, no additional hardware will be required.

3.3.7 Metering of Electrical Vehicle Charging Stations

a. All Electrical Vehicle Charging Stations (EVCS), to include those used in charging of Government Owned Electrical Vehicles (GEV) and/or Privately Owned Electrical Vehicles (PEV), that derive electrical power from an electrical service located within a facility, shall be fed from the facility main distribution panel to a dedicated distribution sub-panel that serves only those charging stations. The feed conductors for the dedicated Electrical Vehicle Charging Station distribution sub-panel shall be monitored by an approved Advanced Electrical Meter as set forth in Sections 3.3 through 3.3.6 and shall be connected to the JBLM EEDRS as described in this specification. If the facility has an existing connected and functioning EEDRS presence the new, approved Advanced Electrical Meter shall be integrated into the existing facility EEDRS.

b. All Electrical Vehicle Charging Stations (EVCS), to include those used in charging of Government Owned Electrical Vehicles (GEV) and/or Privately Owned Electrical Vehicles (PEV), that derive electrical power from an electrical service that serves only those charging stations shall have an Electrical Vehicle Charging Station main distribution panel that shall be monitored by an approved Advanced Electrical Meter as set forth in Sections 3.3 through 3.3.6 and shall be connected to the JBLM EEDRS as described in this specification.

c. All Electrical Vehicle Charging Stations (EVCS), to include those used in charging of Government Owned Electrical Vehicles (GEV) and/or Privately Owned Electrical Vehicles (PEV), that derive electrical power from a photovoltaic source that serves only those charging stations shall be monitored by an approved Advanced Electrical Meter as set forth in Sections 3.3 through 3.3.6 and shall be connected to the JBLM EEDRS as described in this specification.

3.4 Gas Meter

3.4.1 Requirements

a. As Natural Gas is a Privatized Utility at JBLM, Gas Metering and G.E. Chatterbox will be determined and provided by Puget Sound Energy,

b. Gas distribution equipment shall be installed in accordance with all applicable federal, state and local codes and regulations. Gas distribution equipment shall be installed in conformance with the manufacturer's recommendations and applicable sections of American Society of Mechanical Engineers (ASME) B31.8, American Gas Association (AGA) XR0104 and 49 CFR 192. Gas distribution equipment installed in areas where they will be subject to damage shall be protected by appropriate physical barriers (i.e. bollards).

c. Natural Gas Meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application.

Quantity Measured: Cubic Feet of Natural Gas

Accuracy: plus or minus 1% of scale.

Resolution: minimum of 100 cubic feet of gas

Measurement Configuration: Natural Gas service to a building. For buildings that already have a gas meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a natural gas meter already exists but does not have a pulse output, install raceway and shielded RS485 cabling to the building advanced electrical meter and a G.E. Chatterbox at the gas meter. If the existing gas meter will not accept a pulse kit or if no meter exists a new natural gas meter shall be installed, also requiring installation of raceway and shielded RS485 cabling to the building advanced electrical meter.

3.4.2 Gas Meter Types

a. Provide gas meters for the natural gas service line to the building. Natural gas meters shall be the Diaphragm, Rotary, or for high volume applications Turbine type with pulse output chosen to meet the specific application. Temperature, pressure and heating value compensation must be made to measure actual amount and value of gas moving through a meter.

3.4.3 Valves and Regulators

a. Valves shall be suitable for shutoff or isolation service and shall conform to the following: Steel valves 1-1/2 inches and smaller installed above ground shall conform to ASME B16.34, carbon steel, socket weld or threaded ends with handwheel or wrench operator. Steel valves 2 inches and larger installed above ground shall conform to American Petroleum Institute (API) Spec 6D, carbon steel, buttweld or flanged ends, with handwheel or wrench operator.

b. Valves and pressure regulators are necessary at all points where pressure reduction or regulation is required by the user. Install a shut-off valve upstream of the regulator and both upstream and downstream of the meter. Provide a gas meter bypass line with a lockable valve for buildings with critical service.

c. Service Line Regulators. Pressure regulators for individual service lines shall have ferrous bodies. Regulator shall be capable of reducing distribution line pressure to pressures required for users. Regulators shall be provided where gas will be distributed at pressures in excess of 10 inches of water column. Pressure relief shall be set at a lower pressure than would cause unsafe operation of any connected user. Regulator shall have single port with orifice diameter no greater than that recommended by the manufacturer for the maximum gas pressure at the regulator inlet. Regulator valve vent shall be of resilient materials designed to withstand flow conditions when pressed against the valve port. Regulator shall be capable of regulating downstream pressure within limits of accuracy and shall be capable of limiting the buildup of pressure under no-flow conditions to 50 percent or less of the discharge pressure maintained under flow conditions. Regulator shall have a self contained service regulator. Regulator pipe connections shall not exceed 2 inch size.

3.4.4 Gas Meter Installation

a. Meters shall be installed in accordance with ASME B31.8. Permanent gas meters shall be installed with provisions for isolation and removal for calibration and maintenance, and shall be suitable for operation in conjunction with an energy monitoring and control system.

3.4.5 Connections

a. Connections to Publicly or Privately Operated Gas Utility Lines: The contractor shall include all materials for the connections to the existing gas lines. Final connections and the turning on of gas shall be made by the utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of gas lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new gas lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish to the Contracting Officer a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Gas Lines: Provide the name and location of the utility or operating agency of the existing gas lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing gas lines in accordance with approved procedures. Reactivation of any existing gas lines will only be done by the Government. The Contractor's Connection Plan shall be submitted to the Contracting Officer and approved prior to making any connections to existing gas lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made.

3.4.6 Pressure and Leak Tests

a. Prior to returning the gas line back to service it shall be tested in accordance with ASME B31.8. Test pressures should recognize the weakest component of each system tested for the actual pressure, the maximum allowable operating pressure, and the gas supplier's maximum operating pressure. The test pressure will be 150 percent of the maximum operating pressure or 50 pounds per square inch gauge (psig), whichever is greater. However, the maximum test pressure must not be more than three times the design pressure of the pipe. The service lines shall be tested after modifications and before being placed in service using air as the test medium. Prior to testing the system, the interior shall be blown out, cleaned and cleared of all foreign materials. All meters, regulators, and controls shall be removed before blowing out and cleaning and reinstalled after clearing of all foreign materials.

b. Testing of gas service lines shall be done with due regard for the safety of employees and the public during the test. Persons not working on the test operations shall be kept out of the testing area while testing is proceeding. The test shall be made on the system as a whole or on sections that can be isolated. The test shall continue for at least 24 hours from the time of the initial readings to the final readings of pressure and temperature. The initial test readings of the instrument shall not be made for at least 1 hour after the pipe has been subjected to the full test pressure, and neither the initial nor final readings shall be made at times of rapid changes in atmospheric conditions. The temperatures shall be representative of the actual trench conditions. There shall be no indication of reduction of pressure during the test after corrections have been made for changes in atmospheric conditions in conformity with the relationship $T(1)P(2)=T(2)P(1)$, in which T and P denote absolute temperature and pressure, respectively, and the numbers denote initial and final readings. During the test, the entire system shall be completely isolated from all compressors and other sources of air pressure. Each joint shall be tested by means of soap and water or an equivalent nonflammable solution prior to backfilling or concealing any work. The testing instruments shall be approved by the Contracting Officer. All labor, materials and equipment for conducting the tests shall be furnished by the Contractor and shall be subject to inspection at all times during the tests. The Contractor shall maintain safety precautions for air pressure testing at all times during the tests.

3.5 Water Meter

3.5.1 Requirements:

a. The water meters must comply with the applicable requirements of IgCC, International Green Construction Code, 2018. Where conflicts occur between this guidance and the IgCC, International Green Construction Code, 2018 shall prevail.

b. In addition to the requirements listed below Water Meters shall be in accordance with UFGS SECTION 33 11 00. Water Meters shall be the turbine, propeller, or displacement type with pulse output chosen to meet the specific application (pipe size, flow, pressure, etc.). Water

Meters shall be manufactured by Neptune, SeaMetrics, Badger Meter Inc., DLJ, or approved equal. The location of meters and meter boxes shall be shown on the as built drawings. The meters shall be centered in the boxes to allow for reading and ease of removal or maintenance.

Quantities Measured: Gallons of Water (pulse for every 10 gallons)

Accuracy: 1.5% of scale.

Resolution: 1 Gallons per Minute (GPM)

Measurement Configuration: Water Supply to a building. For buildings that already have a water meter with a pulse output, ensure that the pulse output is connected to the building advanced electrical meter. For buildings where a water meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output to the building advanced electrical meter. If the existing meter will not accept a pulse kit or if no meter exists, a new water meter shall be installed, also requiring a pulse output to the building advanced electrical meter.

3.5.2 Water Meter Types

a. Turbine Type Meters: Turbine type meters shall conform to American Water Works Association (AWWA) C701 Class I or Class II depending on the application. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local EEDRS. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

b. Propeller Type Meters: Propeller type meters shall conform to AWWA C704. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder-type remote register designed in accordance with AWWA C707 but must be compatible with the local EEDRS. Meters shall comply with the accuracy and capacity requirements of AWWA C704.

c. Displacement Type Meters: Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in U.S. gallons. Meters in sizes 1/2 through 1 inches shall be frost-protection design as required by the local environmental conditions. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local EEDRS. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

d. Compound Type Meters: Compound type meters shall conform to AWWA C702 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. The main casing shall be tapped for field testing purposes. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local EEDRS. Meters shall comply with the accuracy and capacity requirements of AWWA C702.

e. Fire Service Type Meters: Provide Fire Service Type Meters as required by the Installation. Unless specifically Identified, Fire Service type meters shall not be required. If so identified, Fire service type meters shall be proportional type or turbine type conforming to AWWA C703 and shall be furnished with strainers. The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. The meter shall be equipped with a coordinating register. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct-reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707 but must be compatible with the local EEDRS. Meters shall comply with the accuracy and capacity requirements of AWWA C703. When turbine type main line meters are used, the meter shall be supplied with a separate check valve, as a unit.

3.5.3 Water Meter Installation

a. Meter Boxes: Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid suitable for vehicle wheel loads. Boxes set in sidewalks, not subject to vehicular traffic, shall be concrete with cast iron lid and cast iron meter reader lid. Plastic boxes and lids can be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

b. Dielectric Fittings: Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

3.5.4 Valves

a. Gate Valves Smaller than 3 Inch in Size: Gate valves that are smaller than 3 inch in size shall meet Manufacturers Standardization Society (MSS) SP-80, Class 150 and have a solid wedge, non-rising stem. Valves shall have flanged or threaded end connections, with a union on

one side of the valve. Provide hand wheel operators. Valves shall open by counterclockwise rotation of the valve stem.

b. Gate Valves 3 Inch Size and Larger: Gate valves 3 inch size and larger shall meet AWWA C500 or UL 262 and be of one manufacturer. Valves shall be AWWA C500, non-rising stem type with double-disc gates or UL 262, inside-screw type with operating nut, split wedge or double disc type gate, and designed for a hydraulic working pressure of 175 psi. Valves shall open by counterclockwise rotation of the valve stem.

3.5.5 Connections

a. Connections to Privately Operated Water Utility Lines: Contractor shall provide materials for the connections to the existing water lines. Final connections and the turning on of water shall be made by the Utility. The Contractor shall notify the Utility Sales Officer, in writing, 10 days before final connections and turning on of water lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new water lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish a certification by the Operating Agency/Utility Company that all Utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Water Lines: Provide the name and location of the utility or operating agency of the existing water lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing water lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted to the Contracting Officer and approved prior to making any connections to existing water lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing water lines will only be done by the Government.

3.5.6 Disinfection: Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying non-potable water is not required. Chlorinating materials shall conform to the following: Chlorine, Liquid: AWWA B301, Hypochlorite, Calcium and Sodium: AWWA B300.

3.5.7 Tests and Inspections

a. Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer or Contracting Officer's Representative will conduct field inspections and witness field tests. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing, except that water and electric power needed for field tests will be furnished by the Government. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the approved Performance Work Statement.

b. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage shall be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), plastic pipe joints, flanged joints and screwed joints.

c. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For pressure test, use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system. Hold this pressure for not less than 2 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.6 Steam Meter

3.6.1 Requirements

a. The steam meters must comply with the applicable requirements of IgCC, International Green Construction Code, 2018 . Where conflicts occur between this guidance and the Contruction Code, IgCC, International Green Construction Code, 2018 shall prevail.

b. In addition to the requirements listed below Steam Meters shall be in accordance with UFGS SECTION 33 63 23. The vortex type or orifice plate type are recommended. Ensure that the flow meter selected meets the requirements for the specific application based on steam type (wet, saturated or superheated), flow rate, and operating conditions. Steam Meters shall be manufactured by Onicon Incorporated, Sierra Instruments, NICE Instrumentation, Inc., or approved equal.

Quantities Measured: Pounds of Steam

Accuracy: 2.0% of scale.

Resolution: 1 pound of steam

Measurement Configuration: Steam Supply to a building. For buildings that already have a steam meter with a pulse output, ensure that the pulse output is connected to a data gathering device (i.e. electric meter). For buildings where a steam meter already exists but does not have a pulse output, add a pulse kit to the existing meter and tie the output into the building advanced electrical meter. If the existing meter will not accept a pulse

kit or if no meter exists, a new steam meter shall be installed, also requiring a pulse output to the building advanced electrical meter.

c. Steam Flow Meters: Meter shall be for minimum working pressure of ASME Class 150 with steel pressure chambers or ASME Class 250 with cast-iron pressure chambers. Provide meter in horizontal pipe between two ASME B16.5 welding neck flanges. Provide rotary type meter for flow integration. Working parts shall be stainless steel. Steam flow shall cause rotation of a rotor assembly at a speed directly proportional to the rate of steam flow, as controlled by a damping liquid. The rotational speed of the rotor assembly shall be reduced by gearing in the damping liquid chamber. Final drive to the exterior counter shall be by driving magnets; stuffing box shall not be allowed. Counter shall be enclosed in a dust-tight cast-aluminum housing attached to, but easily removable from the meter. For steam pipe main sizes 4 inches and smaller, provide meter directly in the steam piping. For steam pipe main sizes larger than 4 inches, provide meter in shunt bypass piping with two ASME B16.5 Class 300 welding neck orifice flanges in the steam pipe main. In the shunt bypass piping, provide two flanged gate valves calibrated by the meter manufacturer. In the steam pipe main, provide 0.125 inch thick stainless steel orifice plate sized to suit meter capacity between two ASME B16.5 Class 300 welding neck orifice flanges. Provide pressure and temperature compensated devices to automatically and continuously correct steam flow meter readings for steam pressure and temperature variations.

3.6.2 Steam Meter Types: Steam flow is measured with several types of flow meters: Differential pressure-based (orifice plates, flow nozzles, venturi tubes, and averaging pitot tubes), vortex, Coriolis, and ultrasonic.

a. Vortex Meter: Vortex flow meters are flow sensors that detect the frequency of vortices shed by a bluff body placed in a flow stream. The frequency of the vortices is proportional to the flow velocity.

b. Orifice Plate: Orifice Plate flow meters are differential producing type orifice plate with a circular hole for insertion into the steam piping between two ASME B16.5 Class 300 welding neck orifice flanges. Orifice plate shall be Type 304 stainless steel. Furnish to the Contracting Officer a dimensional report and flow versus differential curve with accuracy of plus or minus one percent over a 5 to 1 flow range. Orifice flanges shall have at least two radially-drilled and tapped holes for metering and two jack screws.

c. Turbine Flowmeter: As a substance moves through a pipe, it acts on the vanes on a turbine to get it to spin. The rate of spin is measured to find out the speed of the flow.

d. Pitot Tube Flowmeter: The Pitot Static tube measures the total pressure (or impact pressure) at the nose of the Pitot tube and the static pressure of the gas stream at side ports. The difference of these pressures, i.e. the dynamic or velocity pressure varies with the square of the gas velocity.

3.6.3 Steam Meter Installation

a. Connections to Publicly or Privately Operated Steam Utility Lines: Contractor shall provide materials for the connections to the existing steam lines. Final connections and the turning on of steam supply shall be made by the Utility. The Contractor shall notify the Contracting Officer, in writing, 10 days before final connections and turning on of steam supply lines. The Contractor shall make necessary arrangements with the Utility for tie in and activation of new steam lines. Only the Operating Agency/Utility Company may reactivate the system after tie in. The Contractor shall furnish to the Contracting Officer a certification by the Operating Agency/Utility Company that all utility work has been satisfactorily completed.

b. Connection to Government Owned/Operated Steam Lines: Provide the name and location of the utility or operating agency of the existing steam lines. Show on the drawings, the location of valves to be operated for existing system deactivation. The Contractor shall provide connections to the existing steam lines in accordance with approved procedures. The Contractor's Connection Plan shall be submitted and approved prior to making any connections to existing steam lines. This plan shall include the Operating Agency's required procedures which may be obtained from the Contracting Officer. The Contractor shall notify the Contracting Officer, in writing, 10 days before connections to existing lines are to be made. Reactivation of any existing steam supply lines will only be done by the Government.

c. Demolition: Remove materials so as not to damage materials which are to remain. Replace existing work damaged by the Contractor's operations with new work of the same construction.

d. Cleaning of Piping: Keep the interior and ends of new piping and existing piping affected by the Contractor's operations, cleaned of water and foreign matter during installation by using plugs or other approved methods. When work is not in progress, securely close open ends of pipe and fittings to prevent entry of water and foreign matter. Inspect piping before placing into position.

e. Adjustments: Upon completion of the work, furnish the services of a competent technician regularly employed by the manufacturer of the flow meter to make the necessary adjustments to place the steam flow meter in operation and to conduct performance tests which demonstrate that the flow measuring equipment is functioning. Install the steam flow meter in accordance with manufacturer's recommendations.

3.6.4 Piping Tests

a. Provide piping modifications that facilitates acceptance testing such as piping which includes flanges at appropriate locations for flanged blanks to be installed for testing. Include requirements for how the modified piping shall be pressure tested and also specify which pipe sections or equipment that will be pressure tested in the shop if absolutely necessary.

b. Before final acceptance of the work, test each system as in service to demonstrate compliance with contract requirements. Before insulation is applied, hydrostatically test each piping system at not less than 225 psig in accordance with ASME B31.1, with no leakage or reduction in gage pressure for 2 hours. The Contractor shall flush and clean piping before

placing into operation. Flush piping at a minimum velocity of 8 feet per second. Correct defects in work provided by Contractor and repeat tests until work is in compliance with contract requirements. Furnish potable water, electricity, instruments, connecting devices, and personnel required for the tests.

4.0 EXECUTION

a. Installation: Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. Provide new equipment and materials unless indicated or specified otherwise. Specific installation instructions are located in each meter section above. All current, power, and voltage circuit termination points for wires entering the meter or enclosure must be clearly marked, to avoid installation error and simplify future identification of wires for maintenance purposes. These identifying markings shall be reflected on the As-Built drawings.

b. Scheduling of Work and Outages

(1) Installation of current transformers and potential transformers shall require that power be disconnected from the transformer and/or building. No "hot work" allowed unless prior Government approval is granted.

(2) The Contract Clauses shall govern regarding permission for power outages, scheduling of work, coordination with Government personnel, and special working conditions.

(3) Building Schedule Concurrence Agreement: The contractor shall submit to the Contracting Officer’s Representative (COR) a list of buildings with approved, scheduled utility outages prior to beginning any meter installation. The approval authority for outages is the local Public Work engineering office.

(4) Monthly Status Report: The contractor shall report the number of installed meters and the associated building number by the tenth of each month to the Huntsville Corps of Engineers Project Manager. Major equipment installation, servers, network installation, and software installation shall be included in the report.

c. Field Applied Painting

Where field painting of enclosures is required to correct damage to the manufacturer's factory-applied coatings, provide manufacturer's recommended coatings and apply in accordance with manufacturer's instructions.

d. Field Quality Control

Prior to system acceptance, the Contractor shall demonstrate and confirm the meter is properly wired and displaying correct and accurate electrical, gas, steam or water use values. The Contractor shall demonstrate to the Government that the actual flow or power utilized by the meter is calculated and displayed correctly and accurately on the local display or host and/or

software. The meter installation being verified will be a sample selected by the Government. This demonstration shall utilize suitable test equipment connected to the service being metered. For electrical service the test equipment shall be capable of displaying instantaneous 3-Phase values of Voltage, Current, Phase Power Factor and/or Phase Angle, Volt Amperes, Watts, and Vars. Other meter types shall be tested for output values per their respective requirements. All test equipment shall have verified calibration within the past six months. All test equipment shall be furnished by the contractor. All safety measures for connectivity to an energized source shall be followed as outlined in the most recent version of Safety Manual EM 385-1-1, Section 11B. Connectivity to an energized source is contingent on approval from the local site Safety Officer and designated Project Manager. Depending on the quantity of meters installed this requirement may be removed with the written permission of the Government. The Contractor shall provide to the Government advance notice of 10 working days prior to the scheduled dates for testing.

e. Cleanup

Upon completion of the installation all debris and surplus materials resulting from the work shall be removed.

5.0 TRAINING

The Contractor shall conduct a training course for meter configuration, operation, and maintenance of the system as specified. The training shall be oriented for all components and systems installed under this contract. Training manuals shall be delivered for [_x_] trainees with two additional copies delivered for archiving at the project site. The Contractor shall furnish all audiovisual equipment and all other training materials and supplies. A training day is defined as eight hours of classroom instruction, including two 15-minute breaks and excluding lunchtime, Monday through Friday, during the daytime shift in effect at the project site. For guidance in planning the required instruction, the Contractor shall assume that attendees have a high school education or equivalent, and are familiar with utility systems. Approval of the planned training schedule shall be obtained from the Government at least 30 days prior to the training.

Training: The course shall be taught at the project site within thirty days after completion of the installation for a period of one [_x_] day(s). A maximum of [_x_] personnel will attend the course. The training shall include:

a. Physical layout of each piece of hardware.
b. Meter configuration, troubleshooting and diagnostics procedures.
c. Repair instructions.
d. Preventive maintenance procedures and schedules.
e. Testing and calibration procedures.

6.0 Existing EEDRS connected metering equipment

(a) Where there are existing JACE's, RF units, electrical, gas and water meters installed, those devices are to be retained according to the following conditions and exceptions.

(b) Where there is an Advanced EEDRS Electrical Meter that is external to an MDP or switchgear, said meter to be retained and re-used. In the event that a facilities electrical service capacity is increased or decreased, new CT's shall be installed that meet the requirements of paragraph 3.3.5 and the electrical meter shall be reprogrammed to accept the new CTs.
(c) Where there is an Advanced EEDRS Electrical Meter that is internal to an MDP or switchgear, and a new MDP or switchgear is to be installed said meter to be retained and re-used. In the event that a facilities electrical service capacity is increased or decreased, new CT's shall be installed that meet the requirements of paragraph 3.3.5 and the electrical meter shall be reprogrammed to accept the new CTs. Meter to be installed in factory provided metering section which shall have all of the equipment described in paragraph 3.3.6
(d) Where an existing Gas meter with existing pulse kit is to be retained, the contractor shall install new pathway and cabling from the pulse kit to the EEDRS JACE location or the Electrical meter location, depending on where the Gas pulse unit is currently connected. If a new or larger Gas service is to be installed, the ratio of the new pulse shall be the same as the old pulse kit and shall be connected to the appropriate EEDRS device.
(e) Where an existing Water meter with existing pulse kit is to be retained, the contractor shall install new pathway and cabling from the pulse kit to the EEDRS JACE location or the Electrical meter location, depending on where the Water pulse unit is currently connected. If a new or larger Water service is to be installed, the ratio of the new pulse shall be the same as the old pulse kit and shall be connected to the appropriate EEDRS device.
(f) Where there is an existing EEDRS JACE, it shall be kept powered for the duration of the work being performed. If the JACE enclosure is to be removed, it shall be repowered, while in storage, no later than 4 hours after removal. Temporary cord and plug is acceptable. Pathway and Cat6 cabling shall be provided by the contractor to reconnect JACE to JBLM network switch.
(g) Where there is an existing EEDRS RF unit and antenna, every effort to leave said unit and antenna in place shall be taken. In the event that relocation is necessary, the contractor will be responsible to provide the same type and quality RF cabling from the new location of the RF unit to the new location of the antenna. Antenna location must be approved through JBLM Department of Public Works, Engineering Services Division, Utility Sales Officer.

For more information, please contact:
Advanced Metering Program
Utilities Branch, Engineering Services Division
Department of Public Works
JBLM, WA.

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