

## Metering Equipment Guidelines

### Overview

The University of New Mexico Facilities Management Utilities Division (FM-UT) manages and operates a District Energy System (DES) on the Main and North Campuses that provides the utilities listed in 2.1 below. FM-UT requires that any facility that connects to at least one of these DES utilities be provided with whole facility instrumentation and metering devices meeting this guideline sufficient to determine the consumption of the various utilities connected to the facility. Facilities that do not connect to the DES utilities may be required to meet this guideline based on the project scope and program.

The Energy Metering System (EMS) is a networked metering, monitoring, and verification system comprised of facility hardware, facility software, network equipment, EMS servers, and EMS software. This guideline includes the facility hardware and software, but the project budget must fund all components of installation including hardware, software, commissioning, and installation provided by FM-UT. FM-UT will provide the project manager with estimates of the cost of those items that are furnished by FM-UT and paid for by the project.

The facility is instrumented locally for each of the DES utilities to which it is connected. The instruments are wired to a Building Utilities Metering Panel (BUMP) furnished by FM-UT and paid for by the project. This panel contains a programmable logic controller and other hardware necessary to provide and display continuous historical and instantaneous metering of the facility. The BUMP reports data over the campus WAN on a secured network to the remote EMS servers where it is stored for management information and reporting purposes. The contractor(s) who provide the utility metering for the facility are required to coordinate with the FM-UT personnel and contractors to assure a complete working system.

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. This document covers the metering guidelines for typical UNM facility utility metering.
- B. The facility utilities to be metered are:
  - 1. Chilled Water
  - 2. Steam
  - 3. Condensate
  - 4. Natural Gas
  - 5. Domestic Water
  - 6. Electric

### PART 2 EQUIPMENT

#### 2.1 GENERAL REQUIREMENTS

- A. Contractors must submit a metering submittal separate from any other submittals that includes all meters.

- B. The exact location and arrangement of pipe upstream and downstream of the flow sensors shall be based on the manufacturer's recommendations, requirements, and specifications.
- C. Typical operating range design Information is as follows:
  - 1. Chilled Water
    - a. Temperature Range: 35-100 degree F
    - b. Pressure Range: 20-80 psig
  - 2. Steam
    - a. Temperature Range: 100-350 degree F
    - b. Pressure Range: 0-150 psig
  - 3. Condensate
    - a. Temperature Range: 100-350 degree F
    - b. Pressure Range: 0-50 psig
  - 4. Natural Gas
    - a. Pressure Range: 0-20 psig
  - 5. Domestic Water
    - a. Pressure Range: 0-120 psig
  - 6. Electric: as required by the building design, but generally transformed from primary 12.47 KV or 4160 V to 208/3p/4W or 480/3p/4W.
- D. All transmitters shall have the following characteristics with no exception (unless otherwise indicated within this guideline)
  - 1. Input power 24VDC or loop-powered where appropriate
  - 2. Output Signal: 4-20mA
- E. Each instrument shall be labeled with a brass tag secured to the instrument indicating calibration range, building number, and service
- F. Calibration label on instrument shall indicate last factory calibration date.
- G. All instrumentation shall be calibrated using local barometric pressure.
- H. Each instrument shall have a local readout installed in an easily accessible location irrespective of the actual instrument location.
  - 1. Each instrument shall transmit instantaneous (4-20ma) signals. Gas flow meters are an exception in which case pulse signals are acceptable. Instantaneous and totalization values will be displayed on the local readout.
- I. All in-line meters will be installed with a full size bypass with isolation valves on either side of the meter and one on the bypass.
- J. All instrumentation shall be rated to operate in an ambient temperature of 32 - 185 degrees F and calibrated for an altitude of 5200'.
- K. All transmitter enclosures shall be rated at a minimum of NEMA 4 with a minimum of two ¾" electrical hubs with plugs.

- L. All instrumentation shall be Hart-compatible.
- M. All wiring must be in conduit. Wiring to be 18ga twisted shielded pair. Conduit must be labelled.
- N. In general flowmeters will be one pipe size down from the installed pipe size.

2.2

2.3 CHILLED WATER METER FLOW METER AND TRANSMITTER

- A. Flow sensor and transmitter shall be Foxboro or prior approved equivalent meeting the following:
- B. Flow sensor shall be corrected mass-flow, flanged in-line “magpipe” electro- magnetic technology.
- C. Maximum pressure drop across meter assembly at maximum design flow: 1.0 psi.
- D. Accuracy:  $\pm 1.0\%$  of flow across full range for given pipe size.
- E. Minimum turndown ratio: 100:1.
- F. Insertion paddle wheel (e.g., Onicon) flowmeters are allowed with prior approval.

2.4 STEAM METER FLOW SENSOR AND TRANSMITTER

- A. Flow sensor and transmitter shall be Foxboro or prior approved equivalent meeting the following:
- B. Flow sensor shall be capable of mass flow (corrected for temperature and pressure), flanged in-line vortex-shedding technology, but shall be calibrated for volumetric flow (mass flow conversion and correction occurs in the BUMP).
- C. Maximum pressure drop across reduced-size meter assembly at maximum design flow: 5.0 psi.
- D. Accuracy:  $\pm 1.0\%$  of flow across full range for given pipe size.
- E. Minimum turndown ratio: 100:1.
- F. Flow Sensor Material: 316 Stainless Steel.
- G. Flanges and piping shall be of Class (generally 150 or 300) and Schedule (generally 40 or 80) matching that of the piping in which it is installed.

## 2.5 DOMESTIC WATER METER AND TRANSMITTER

- H. Flow sensor and transmitter shall be Turbo Badger Meter or prior approved equivalent meeting the following
- I. Flow sensor shall be in-line turbine type flow meter.
- J. Maximum pressure drop across reduced-size meter assembly at maximum design flow: 1.8 psi.
- K. Accuracy:  $\pm 1.5\%$  of flow across full range for given pipe size.
- L. The housing will be cast bronze with all internal pieces made of durable material such as thermoplastic or stainless steel. All bearings shall be self-lubricating.
- M. The domestic water meter will be provided with a strainer on the utility side of the meter. The strainer will be installed so as to allow ease of maintenance.
- N. Irrigation flow meters must meet the above requirements

## 2.6 NATURAL GAS METER

- A. Flow sensor and transmitter shall be American Meter Company or prior approved equivalent meeting the following
- B. Flow sensor shall be in-line diaphragm type flow meter.
- C. Maximum pressure drop across reduced-size meter assembly at maximum design flow of 2" W.G..
- D. Accuracy:  $\pm 1.0\%$  of flow across full range for given pipe size.
- E. The housing will be die-cast aluminum case. All bearings shall be oil-impregnated self-lubricating bearings. All seals shall be long-life grommet seals. The housing and all parts will be rated for outdoor.

## 2.7 ELECTRIC METER

- A. Meter shall be a Shark 200 with Ethernet card or prior approved equivalent meeting the following
- B. Electrical meter shall be installed in the main electrical distribution panelboard with local scrollable display.
  - 1. Where required by the project, additional submetering may be necessary on building branch circuits. All such meters shall meet this guideline.

- C. The meter shall be capable of measuring current and voltage on all phases including neutral. Meter shall be rated for 60 Hz power.
- D. All shorting blocks will be provided with the meter. Shorting blocks shall be capable of being remotely located within the electrical equipment.
- E. The meter will be provided with matching CT's and any required PT's for a complete installation. All CT's will be removable for ease of maintenance.
- F. Accuracy:  $\pm .075\%$  of full-scale reading.
- G. Meter sampling will be zero blind rate 128 samples/cycle.
- H. Meter shall be able to provide up to 63<sup>rd</sup> harmonic content of current.
- I. Meter shall be able to provide waveform capture of a minimum of 3 cycles at 128 samples/cycle.
- J. The meter will have the following data capable of being transmitted to an Ethernet switch via the Ethernet card:
  1. All Phase Currents (A, B, C, N in Amps)
  2. All Phase-Phase and Phase-Neutral Voltages (in Volts)
  3. KW Demand (KW)
  4. Accumulated Power (Megawatt-hours)
  5. Harmonic Content, (A, B, C, N in Percent)
- K. Meter will have the following alarm capable of being transmitted to the Ethernet switch
  1. All Phase Faults (A, B and C)
  2. All Phase Voltage spikes
  3. Meter General Alarm
- L. Meter shall comply with UL 508.
- M. Output communication of the meter shall be Modbus over IP via the Ethernet card.
- N. The electric meter does not necessarily connect directly connect to the BUMP. Rather it can connect to the nearest Ethernet switch via Cat 5/6 cable (to match the building standard).
  1. The Ethernet switch is that for the PPD Utilities VPN, usually located in a UNM-IT wiring closet (TR). Depending on equipment locations the Ethernet switch within the BUMP may be used instead.
- O. Solar PV system metering
  1. Solar PV systems will have a submeter matching the electric meter specifications.
  2. In addition, solar PV systems will be equipped with an Egauge 3 series meter with an independent Ethernet connection to the nearest

TR.

## 2.8 TEMPERATURE SENSOR, TRANSMITTER AND WELL

- A. Sensor, well and transmitter shall be Rosemount, Foxboro, or prior approved equivalent.
- B. Temperature sensor shall be well type 3-wire, platinum, 1000 ohm RTD.
- C. The sensor shall include well. Temperature wells shall be constructed of Type 304 stainless steel to the proper depth, with 3/4" NPT pipe connections, and extension neck for insulated lines. Wells shall be furnished with screw plug attached to wells with chain to keep dirt out when not in use. 3/4" thread-o-lets shall be welded to the pipe to receive wells.
- D. Accuracy:  $\pm 0.075\%$  of calibrated span.
- E. Minimum Update Rate: 20 times per second.
- F. Individual well type temperature sensors and transmitters will be provided for:
  - 1. Chilled Water Return
  - 2. Chilled Water Supply
  - 3. Steam
  - 4. Condensate

## 2.9 PRESSURE SENSOR AND TRANSMITTER

- A. Sensor and transmitter shall be Foxboro.
- B. Minimum Update Rate: 20 times per second.
- C. Meet NFPA 70 501-5.
- D. Pressure assembly shall include appropriate tap, stop valve, snubber, and block and bleed valve along with sensor.
- G. Individual pressure sensors and transmitters will be provided for:
  - 1. Chilled Water Return
  - 2. Chilled Water Supply
  - 3. Steam

## 2.10 BUILDING UTILITY METERING PANEL CONNECTION REQUIREMENTS

- A. Provide a separate 120VAC, 20 A, GFCI, isolated, surge-

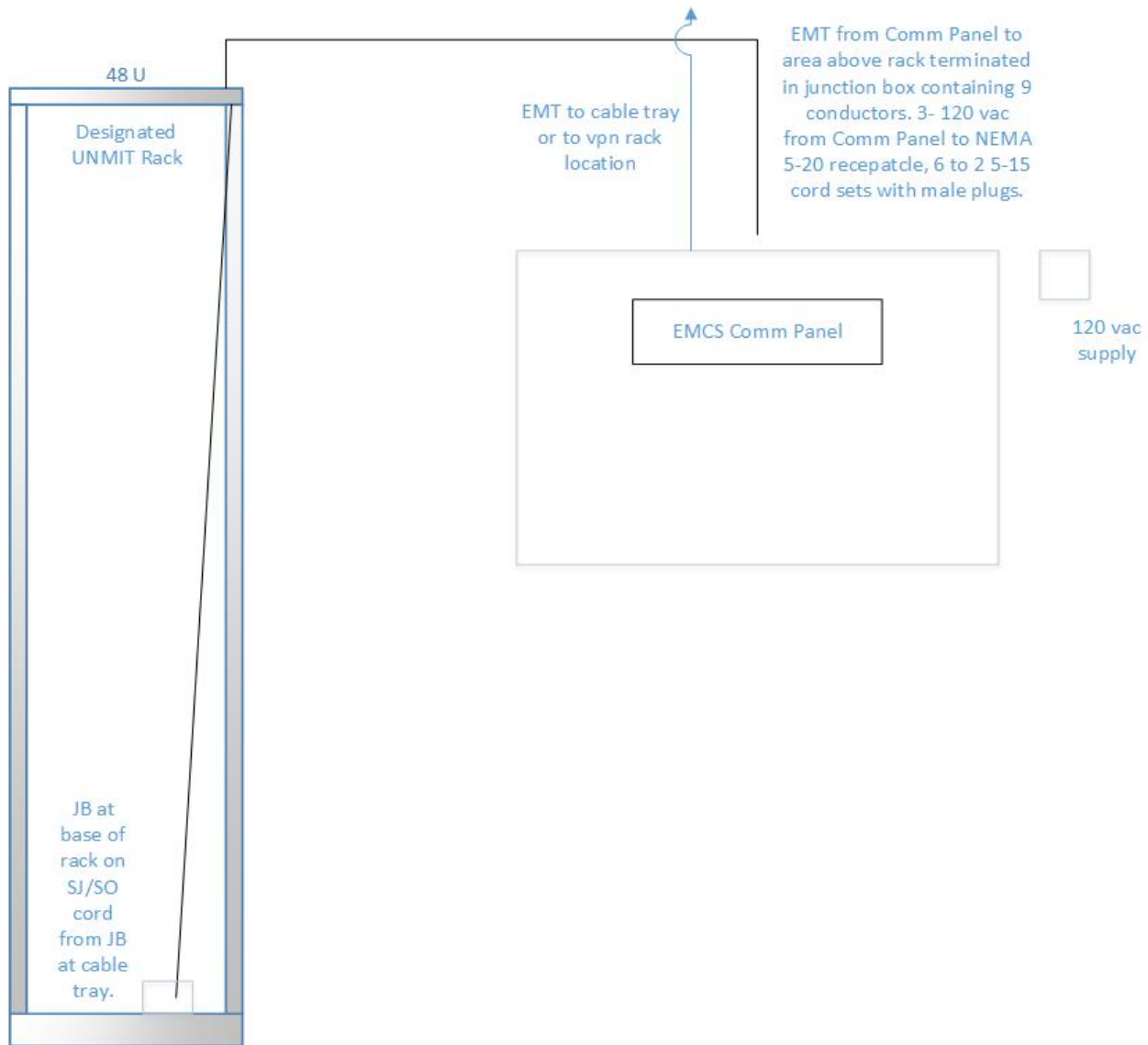
suppressed emergency-powered circuit for the BUMP and another for the auxiliary EMCS panel.

- B. Provide a UNM network connection from the ITS closet to the BUMP.

## 2.11 NETWORK EQUIPMENT AND RACKS

- A. Provide sufficient space and power in the ITS network closet racks for the VPN firewall and FieldServer devices.
- B. Provide location and a power per 2.9 above for auxiliary EMCS panel in ITS closet.
- C. UNM-IT closet installation- approximately 6U of space at bottom of rack that does not contain patch panels, typically rack #3 or #4, see diagram.

D. UMN-IT closet installation diagram (typical)-



PART 3 – EXECUTION

3.1 BUMP and EMCS COMM PANEL INSTALLATION:

- A. All terminations shall be wired and installed in separated gutter located above the designated BUMP location meeting the facility construction specifications for combined power and instrumentation wiring. The building contractor shall leave six (6) feet of coiled wire for each termination at the BUMP.
- B. All wiring shall be color-coded and tagged with sufficient information to determine the instrument to which it is connected.
- C. When so notified by the project manager that the installation is complete, and it is safe for the BUMP to be installed by the project.



- D. The contractor shall coordinate, cooperate, and provide all necessary assistance during the commissioning and startup of the facility metering system by FM-UT.
- E. Although not necessarily part of the contractor's scope, the project must also coordinate, cooperate, and provide all necessary assistance during the integration, commissioning and startup of the facility metering system connection to the campus EMS.

F. BUMP installation diagram

