Design Standard

Utility Metering

This section specifies the requirements for metering devices and other metering components associated with the measuring and reporting of utilities consumption.

Detailed specifications follow.

PART 1 GENERAL

1.1 WAGES Panel:

A. A Schneider Electric 9788TAMUWAGESHMI metering panel, of the appropriate input capacity, will be provided by the BAS Contractor, complete with all microprocessors, software, programming, point data base, trends, terminal strips, and regulated power supply with battery backup.

B. The WAGES panel will require temperature and flow sensor wiring from the panel to sensors located in the primary supply and return piping on the Chilled Water, Heating Hot Water, and Domestic Hot Water, to be included as part of the BAS Contractor’s responsibilities.

C. The WAGES panel will require flow meter wiring from Domestic Cold Water, Irrigation Water, and Steam. Provide all wiring from the flow tubes to the flow transmitter, and from the flow transmitters to the WAGES panel.

D. This WAGES panel will require a dedicated 110 volt, 20 amp, single phase standby electric circuit source.

E. This WAGES panel will require a category 6 Ethernet cable.

F. The WAGES system will require start-up & integration to the Campus Metering and Analytical Software, by the Schneider Electric Square D Vendor.

G. A meeting between the TAMU UES and the BAS contractor will be held as early as possible, prior to purchase of any material, to review the installation, integration, and finalize panel and wiring locations.

H. The WAGES panel is used only when campus chilled or heating water is servicing the facility. In the event that a building will receive Heating Hot Water (HHW) and Chilled Water (CHW) from the University thermal system, the building shall be required to have a common data collection point.
PART 2  CHILLED WATER, HEATING HOT WATER, DOMESTIC HOT WATER SUPPLY, DOMESTIC HOT WATER RETURN, DOMESTIC COLD WATER, AND IRRIGATION WATER FLOW TUBES AND TRANSMITTERS:

2.1 Acceptable Water Flow Meters and Remote Transmitters:


C. Siemens Mag 5100 W with MAG 5000/6000 Remote Transmitter.

2.2 The above Water Flow Meters and Remote Transmitters shall be, or equal/better to the specifications below:

A. The Flow Tube and Transmitter shall be calibrated to each other and shall be flow-calibrated and assigned a calibration factor at the factory. The calibration factor is entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

B. Accuracy: Includes the combined effects of linearity, hysteresis, repeatability, and calibration uncertainty. ±0.15% of rate ±1.0 mm/sec from 0.04 to 13 ft/s (0.01 to 4 m/s); above 13 ft/s (4 m/s), the system has an accuracy of at least ±0.2% of rate.

C. Each Flow Tube shall be sized specifically for the pipe and flow in which it is to be installed and to ensure flow velocity is within 2 to 20 ft./s.

D. A calibration certificate shall be provided from the manufacture.

E. Class 150 carbon steel flanges, Teflon (PTFE) or EDPM lining, and Type 316L stainless steel or Hastelloy C electrodes.

F. Transmitter: Remote Mounted Magnetic Flowmeter Transmitter with 115Vac/1ph/60hz power supply, Nema 4X enclosure, 4-20 ma output, battery backup totalizer, and local operator interface.

G. Ambient Temperature Limits: -20 to 140deg.f.

H. Humidity Limits: 0 to 95% RH to 120deg.f.

I. Safety Approvals: FM Class 1 Division 2 for non-flammable; CSA Class 1 Division 2.
PART 3 STEAM:

3.1 Acceptable Steam Flow Meters:

A. Rosemount 3051 SFP Integral Orifice Plate / Flowmeter MultiVariable Transmitter and Flowmeter.

B. Yokogawa Digital YEWFLO Multivariable DY-MV.

C. Siemens Sitrans FX300 Vortex Multivariable Flow Meter.

3.2 The above Steam Flow Meter shall be, or equal/better to the specifications below:

A. The Flow Meter and Transmitter shall be calibrated to each other and shall be flow-calibrated and assigned a calibration factor at the factory. The calibration factor is entered into the transmitter, enabling interchangeability of sensors without calculations or a compromise in standard accuracy.

B. Accuracy: ±1%

C. Long Term Stability: 10-year stability

D. Warranty: 15-year limited warranty

E. Measurements Available: Mass, Volumetric, and Energy Flow, Totalized Flow, Differential Pressure, Static Pressure (Gage and Absolute), Process Temperature


G. Output: 4-20 mA

H. A calibration certificate shall be provided from the manufacture

I. Meter must be installed per the manufactures specifications and must be field verified by campus personnel. Approval from the campus must be obtained before sizing the flow meter to ensure it is within allowable flow ranges.

PART 4 TEMPERATURE SENSORS AND THERMOWELLS:

4.1 Acceptable Immersion Temperature Sensors and Thermowells:

A. Dwyer Series TTE Explosion Proof RTD Temperature Probe with Dwyer Series W 316 Stainless Steel Thermowells.

B. Rosemount

C. Honeywell
4.2 The above Immersion Temperature Sensors shall be equal/better to the specifications below:

A. Temperature Sensor: RTD using a Pt1000, or Pt 100.
B. Output Temperature Ranges: User selectable any range between -30 to 250 deg.f. with minimum span of 40 deg.f.
D. Accuracy: Transmitter: +/- 0.1% F.S. Probe: +/- 0.3% F.S.
E. Thermal Drift Effects: +/-0.02% deg.C max
F. Response Time: 250 ms.
G. Wetted Materials: 316 Stainless Steel.
H. Process Connection: ½” male NPT.
I. Conduit Connection: ½” female NPT.
J. Probe Length: 2” to 18” depending on model
K. Pressure Limits: 2000 PSI.
L. Power Requirements: 10 to 35 VDC.
M. Output Signal 4-20mA
N. Display: 2 lines X 8 character LCD.
O. Enclosure Rating: NEMA 4X (IP66) and explosion proof for Class I, Groups B, C, D; Class II, Groups E, F, G; Class III.
P. Agency Approvals: FM, CE

4.3 Thermowells shall be equal/better to the specifications below:

A. Hardware: 316SS Sheath
B. Taper/Bore: Straight/0.260
C. Inside Threads: ½ NPSF
D. Process Connections: ½” NPT
E. Mounting: Threaded
F. Lag: None
G. Sheath O.D. Base/Taper: ½” Straight
H. Length: From 4” to 24” as needed to fit Temperature sensor length required for tip of probe to be in center of piping
PART 5  ELECTRICAL METERING SPECIFICATIONS

5.1 SUMMARY

A. This section provides information on acceptable electric meters and associated devices for metering electrical systems and components, including Current Transformers (CT’s) Potential Transformers (PT’s), Fuse Blocks, Fuses, Shorting Blocks, enclosures, Ethernet Communications, meter capabilities, and integration into the Campus Metering Software.

B. Refer to the Construction Documents for meter locations.

5.2 WORK INCLUDED

A. The Electrical Contractor will provide Electric Meters of the type and capabilities required to meter all electrical power serving the project.

5.3 ELECTRICAL METERING

A. Acceptable Manufacturers:
   1. Schneider Electric Series PM-8 or ION-8600A with Ethernet Communication
   2. Eaton Power Xpert Meter Series
   3. General Electric

B. The Electric Meter shall be equal/better to the specifications below:

1. The electric meter shall be capable of Ethernet communication and integration into the Schneider Power Monitoring Expert (PME) Server Software.

2. All Electric Meters shall be UL 508 Listed, CSA approved, and have CE marking. They shall also have certified revenue accuracy as per ANSI C12.20 and IEC 60687 class 0.5S or better.

3. The Electric Meter shall be calibrated as a system and be accurate to +/- 1% from 5 % to 100 % of the rated current over a temperature range of 0-60° C. No annual recalibration by users shall be required to maintain these accuracy's.

4. The Electric Meter shall be UL and cUL Listed per 7207. The meter module shall be rated for an operating temperature range of 0°C to 60°C.

5. The Electric Meter shall directly accept any voltage input from 120-480 VAC.

6. The Meter shall be internally isolated to 2000 VAC

7. The Meter case isolation shall be 600 VAC

8. When connected via the network to the Campus PME Server Software, the Meter shall provide logging, trending, and alarming information.
9. The Electric Meter shall provide, at minimum, the following metered values:
   a. Real Power (kW), three-phase total
   b. Real Energy (kWh), three phase total
   c. Current, per phase & three-phase total
   d. Voltage, per phase & three-phase total, phase-to-phase & phase-neutral
   e. Real Power (kW), per phase & three-phase total
   f. Reactive Power (kVAR), three phase total
   g. Apparent Power (kVA), three phase total
   h. Power Factor, per-phase & three-phase total
   i. Real Energy (kWh), three phase total
   j. Real Power Demand (kWd) readings, three phase total, present & peak

10. All setup parameters required by the Electric Meter shall be stored in nonvolatile memory and retained in the event of a control power interruption.

11. The Electric Meter may be applied in three-phase, three- or four-wire systems as well as single phase.

12. The Electric Meter shall be capable of collecting wave form.

13. The current and voltage signals shall be digitally sampled at a rate high enough to provide true rms accuracy to the 63rd harmonic (fundamental of 60 Hz).

14. The Electric Meter shall provide continuous sampling at a minimum of up to 128 samples/cycle, simultaneously on all voltage and current channels in the meter.

15. The Electric Meter shall provide a monthly minimum and maximum for the values it collects.

16. For each min/max value listed above, the Power Meter shall record the following attributes: Date/Time of the min/max value, Min/Max. Value, Phase of recorded Min/Max (for multi-phase quantities).

17. The Electric Meter shall include the calculation of the harmonic magnitudes and angles for each phase voltage and current through the 31st harmonic.

18. The Electric Meter shall provide steady state waveform captures of the voltage and current channels. Waveform capture shall be for 3 cycles and is initiated manually using PME software.

19. The Electric Meter shall capture, and store in internal non-volatile memory, 128 digitally sampled data points for each cycle of each phase voltage. The number of waveform captures stored onboard the circuit monitor is configurable and shall be dependent on the amount of memory available.
20. The Electric Meter shall transmit the waveform samples over the network to the personal computer workstation for display, archival, and analysis.

21. All waveforms must reflect actual circuit performance. Waveforms synthesized or composed over time shall not be acceptable.

22. The Electric Meter shall supply 1 digital input and 1 digital solid state output/KY pulse output as standard.

23. The Electric Meter shall be capable of operating a solid state KY output relay to provide output pulses for a user definable increment of reported energy. Minimum relay life shall be in excess of one billion operations. The standard KY output shall operate up to 240 volt AC, 300 volt DC, 96mA max, and provide 3750 volt rms isolation.

24. The Electric Meter shall provide for onboard data logging. Each Power Meter shall be able to log data, alarms and events, and waveforms. The Meter shall offer at a minimum 800kB of on-board nonvolatile memory.

C. The Electrical Contractor will furnish and install all components but not limited to all Conduit, wire, CT’s, PT’s, fuse blocks and fuses, shorting blocks, Ethernet gateways, communication wiring between meters, remote displays, and all enclosure panels.

D. Submit for approval, appropriate product data cut-sheets for all material/components intended for use prior to beginning work.

E. All Electric Meters to be installed, calibrated and adjusted by trained instrument technicians. The Electrical Contractor will be responsible for all work performed by their subcontractors.

F. Submit engineering/wiring drawings and receive approval prior to beginning work. These drawings shall be submitted in a timely manner to provide sufficient time to review drawings so as not to hold up the project.

G. The Electrical Metering field panels will be located in electrical rooms as shown on the drawings.

H. When needed, power to each electric meter enclosure shall be provided from a breakered, 20 amp dedicated circuit on emergency power having an insulated ground wire from the power panel ground buss wired to the duplex receptacle.

I. The project shall provide a dedicated Ethernet network connection between the Electrical Meters and the Campus Metering Software. The Electrical Contractor is responsible for coordinating the network drop(s) required for integration to the Campus Metering Software and will not receive final payment for the project until the Metering system is fully integrated and accepted by TAMU Utilities & Energy Services (UES).

J. Provide electrical on-line graphics for electrical service showing the location of all electric meters. All graphics shall be compatible with existing campus metering software. Coordinate and provide Electrical graphics that are acceptable to TAMU.
Utilities & Energy Services (UES). See section 1.10 below for more information.

K. All wiring external to the switchgear shall be in conduit (3/4” minimum). All active Ethernet switches, hubs, and routers required for the communication between BAS panels shall be Electrical Contractor-provided and installed. The conduit/wiring system required for electric metering shall be a complete, separate, independent system. Conduit sharing with other unrelated electrical systems is not permitted. All conduit shall enter electrical enclosures from the bottom of the panel or enclosure.

L. The electrical metering will require start-up & integration to the Campus Metering Software, by the Schneider Electric Square D Vendor. A meeting between the TAMU UES and the Electrical Contractor will be held as early as possible, prior to purchase of any material, to review the installation and finalize panel and wiring locations.

5.4 RELATED WORK

A. If the Electrical Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

5.5 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals:

1. Three (3) copies of the Operation and Maintenance Manuals, As-Built Electric Metering Drawings, and As-Built Electrical On-Line Drawings, shall be provided to the Utilities & Energy Services upon completion of the project. The entire Operation and Maintenance Manual, As-Built Electric Metering Drawings, and As-Built Electrical On-Line Drawings, shall be furnished on Compact Disc media, and include the following for the Electric Meters provided:

   a. Table of contents

   b. As-built system Electrical record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.

   c. Manufacturer’s product data sheets or catalog pages for all products including software.

   d. Archive copy of all site-specific databases and sequences.

   e. Electrical Metering network diagrams.

   f. Interfaces to all third-party products and work by other trades

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.
5.6 ELECTRICAL METERING WIRING

A. All wiring and conduit shall be installed in accordance with related Specification Section Division 26, Electrical.

B. All wiring in mechanical rooms, electrical rooms, inaccessible areas, or located in areas exposed to occupant view shall be run in conduit (3/4” minimum). Conduit fill limit shall not exceed 40% in any portion of the conduit system.

C. All wiring shall be labeled at both ends and at any spliced joint in between. Wire shall be tagged using a system similar to the Panduit P1 Self Laminating System that utilizes a thermal transfer (or equivalent) printer with a minimum font size of Arial 10. In addition to tagging at electric meter end and at spliced joints, a tag shall be placed 6 inches after entering each Meter enclosure. Identification and tag information shall be included in engineering/wiring submittal which must be submitted for Owner approval prior to beginning work. Each electrical meter enclosure shall include a paper wiring document, in a clear sleeve permanently attached to the inside door that shows the name of each wire and what terminal they are connected to.

5.7 SYSTEM VERIFICATION – PROCEDURE TO BE FOLLOWED

A. Provide minimum 2 week written notice for all inspections.

B. Prior to energizing any electrical switchgear or Main Distribution Panel, and upon completion of all mounting and terminations, and wiring into and out of the electric meter and enclosures the TAMU Project Inspector & UES representative shall inspect and approve this work. The Electrical Contractor shall make his representative(s) available and coordinate with the TAMU Project Inspector & UES representative during this inspection process. At the successful conclusion of this inspection, the Electrical Contractor shall provide a written report stating all work is complete. Electrical Contractor, General Contractor and TAMU Project Inspector & UES representative shall sign. This should be filed with Project Commissioning/ Startup documents.

C. Upon such approval, the Electrical Contractor shall be allowed to energize the electrical systems approved.

D. Included with the electrical meters system, create and provide the following electrical metering graphics including, but not limited to:

   1. Main Electrical System One-Line Drawing showing all electrical meter locations