

# FACILITIES STANDARD

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NAME: Building Utilities Metering Standard  
NUMBER: 15965

ORIGINAL DATE: 10-27-97  
REVISION DATE: 04-23-03

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## **PURPOSE:**

1. The general purpose of each Facilities Standard is to provide minimal criteria for construction materials at University facilities regarding code compliance, warranty, approved products, execution and uniformity.
2. To protect the health and safety of patients, visitors, students, faculty and staff, in addition to protecting non-project UAB property, all construction must be in accordance with: NFPA 241 safeguarding construction, alteration and demolition operations; Standard Building Code, Chapter 33, regarding site work, demolition and construction; NFPA 101 Life Safety Code.
3. Construction safety is the responsibility of the contractor in accordance with the regulations and codes of the agency having jurisdiction, and according to the guidelines adapted by OSHA.
4. The **Building Utilities Metering Standard** establishes a series of guidelines for specifying this particular item on any construction project at the University. ***This Facilities Standard is not to be regarded as a specification.***
5. The purpose of this metering system is four-fold:
  - a) Provide a means for internal cost allocation of utility consumption.
  - b) Provide for verification of utility company charges.
  - c) Provide the only means of building consumption measurement of some utilities (e.g. electricity and chilled water from the Central Utilities).
  - d) Provide Energy Management with a way to identify cost containment and increases or reduction in consumption.

**GENERAL:**

1. Each new building or building expansion, or special application shall have metering requirements discussed with Energy Management. **Unless specifically approved otherwise in writing by UAB Energy Management, all utilities will be measured by the internal UAB-owned metering system.** Normal utilities in each building to be monitored are: Chilled Water, Electricity, Steam, Natural Gas, Domestic Water, and Domestic Water for Sewer Credits.
2. Each utility will use the specified metering equipment and schemes as primary measuring devices and will electrically transmit the signal to the specified multifunction electronic controller. The multifunction controller will be tied into the overall campus-wide metering system through an RS485 4-wire/fiber optic Ethernet data highway. (Coordinate with the Energy Management Department for the data highway path).
3. Plans with detailed drawings and specifications 75% complete, must be submitted during the design phase to the UAB Energy Management Department for review and for final review before bid. Submittal documents for equipment to be installed in the metering system shall be submitted to Energy Management for review also when received by the Design Engineer.
4. In addition to the Design Engineer, UAB Energy Management must agree in writing that proposed substitutions are equal as related to the sensor and transmitters in the following standards. Components that do not meet or exceed the accuracy of components listed herein will not be accepted.
5. The UAB Energy Management *Metering Identification Form*, included at the end of this standard, shall be completed by the UAB Project Manager, after coordination with the building occupants and the Office of Space Planning, to assure that all utilities that need to be metered are identified and metered correctly.
6. Electrical meters, in conjunction with the controller, will indicate real power, reactive power, energy consumption, and peak demand synchronized with the utility company. In cases where more than one billing entity or building will be served from one utility company meter, a meter that provides a contact closure at the end of the billing period shall be requested from the utility company.

## **PRODUCTS:**

### **1. Electrical**

- a) Transducer  
Watt/Var, Rochester Instrument Systems  
Model #WV30P1E0C5XA-F60W0Z0 or approved equal.  
Output to be: 4-20 mA DC
- b) Instrument Transformers:  
ANSI 0.3 metering accuracy class. Choose a rating factor for CT's of 4 whenever possible. Choose the smallest CT ratio possible without exceeding the rating factor of the CT. Use wire gage size as recommended by the manufacturer.
- c) Test Switches:  
States type C3-410-E SMR. Type MTS acceptable only if space is limited.

### **2. Steam**

- a) Steam Flow Meter:  
Yokogawa Model #YFI0 (meter size #) – AGS (wafer type when size permits) A-S3S3\*E /FMF or approved equal.
- b) Temperature:  
RTD sensor: Precision Measurements 100 ohm, 0.1% IEC 751/DIN 43760, Class A, spring-loaded, with NUN 3". Model # 7-X-S-S-Length in inches-B-NUN3-C-SP or approved equal.  
  
RTD Well: Precision Measurements Model # 3/4"-260R-U=-(length in inches) T=3"-Brass.  
  
RTD Transmitter: loop powered, Ronan Model #X54-235L – (100 ohm platinum) – Temperature range to match steam temperature range in °F.
- c) Pressure:  
Foxboro-Invensys Model # IGP-10 or approved equal.

### 3. Natural Gas:

a) Flow Meter

Positive displacement (diaphragm or rotary vane type) or with pulse output, American Meter or approved equal. Meter type to be determined based on flow range, accuracy requirements, and meter size. Utility Company meter pulse output will be used where available. Meter must be AGA approved and certified for custody transfer.

### 4. Chilled Water:

a) Flow Meter

Accuracy and repeatability of +/- 1% of the reading over a flow range of 1 to 19 FPS is required. Minimum acceptable turndown is 16 to 1. Onicon meters require a 6-point calibration to meet the accuracy requirement. All power to the meter must be furnished from the metering panel.

Insertion type turbine meter: Onicon or EMCO. (This applies to pipe sizes 4" and larger) Mechanical assisted insertion and removal must be part of the meter. Insertion meters that require greater than 20 lbs. of force to insert due to static pressure, will be furnished with a device to assist insertion of the meter included as part of the meter.

On pipe sizes less than 4", Danfoss Mag meters are acceptable. These meters will be installed with a bypass line and full line size isolation valves to allow for repair or service without affecting building operation.

b) Temperature Sensors:

RTDs: Precision Measurements 1000 ohm, .06% IEC 751/DIN 43760, Class A, spring-loaded, Model # 7-X-S-S- (length in inches)-B-NUN3-C-SP with NUN 3" or approved equal.

RTD Wells: Precision Measurements Model # 3/4"-260R-U--(length in inches) T=3"-Brass.

RTD Transmitters: Loop powered, Ronan Model X54-235L- (1000-ohm platinum) °F-B or approved equal. Supply transmitters will have a 40 to 60 degree range and return transmitters will have a 40 to 80 degree range.

**5. Domestic Water Meter:**

- a) Inline turbine meter, Hersey or AMCO (or approved equal) with contact closure transmitter. Signals from the Utility Company meters are preferred when available. The Birmingham Water Works has allowed dry contact assemblies to be added to their meters in the past. Meter must be American Water Works Association approved and certified for custody transfer. Meter must be approved by the Birmingham Water Works for sewer credit installations.

**6. Metering Data Acquisition Unit**

- a) Controller:  
ABB multi-channel microprocessor-based programmable controller. The controller P.N. is 53MC5422A25BBXXDXFXX. This controller is required to work with the existing metering system, no substitutions.

Signal Connections:

Via multi-conductor cord sets connected to terminal boards for panel mounting. Appropriate length cables to be specified when ordering.

Fiber Optic Modem:

Blackbox model # ME-540A-ST.

Power Supply:

Apocian 24V DC Model # A24H – (specify amps)

**EXECUTION:**

**General Construction**

1. All metering components shall be accessible to personnel from no taller than an eight foot ladder. Metering installed above that accessible from an eight foot ladder shall have a catwalk and ladder system installed. Location of metering components shall not be situated as to cause interference with occupant workspaces when maintenance activities are required.
2. All conduits will be marked according to UAB's Color Standard 16011.
3. All signal circuits will use Belden 9318 or Belden 9365 or equal. All RS-485 communications between buildings shall be over dual mode 62.5 micron fiber optic

- cable. Within a building, communications shall be over Belden 8760 (or equal) between metering cabinets.
4. All signal wiring will cross line voltage wiring at a 90-degree angle or be no closer than 12 inches from power circuits.
  5. Signals that can be provided from Utility company meters are preferred.
  6. Fuse all potential transformer leads to test switches in accordance with NEC.
  7. All equipment shall be mounted and wired to provide ease in troubleshooting, calibrating, and testing.
  8. Careful attention shall be given to metering circuits to minimize burdens on instrument transformers and to maximize metering system accuracy.
  9. Electrical metering transducers shall be mounted integrally in the switchgear-metering compartment, if available, or in a separate enclosure, NEMA (equivalent to Hoffman type 12 and 13 (size)) or approved equal, with continuous piano hinge on door, screw type door clamp and padlock hasp, and subpanel. All wiring within the panel is to be in Panduit type wireway or equivalent. Panel is to be properly finished, primed, and painted gray.
  10. Shorting blocks shall be used as appropriate and necessary for intermediate junctions between current transformers and test switches.
  11. Wherever there is risk of opening the secondary of a current transformer, signage shall be mounted to warn personnel accordingly. Sign shall read similar to:  
  
**WARNING:** Current transformer secondary leads. **DO NOT** disconnect C.T. leads without first shorting the C.T. secondary.
  12. No potential lead voltage to the transducers above 120V line-to-ground is acceptable.
  13. Inline flow meters must be installed with upstream and downstream shutoff valves at each end of the metering run and a full-size bypass line with a shutoff valve. Valves should be rising stem gate valves or full port ball valves.
  14. All flow meters must be installed in a straight pipe designed according to the manufacturer's instructions. If this is not possible, alternatives must be discussed with UAB's Department of Energy Management.

15. All flow meter sizes shall be selected based on anticipated full operating load flow being 75-90% of the meter maximum rating at the given pressure.
16. If the flow meter size is smaller than the line size (usually), the reducers must be on the meter sides of the shutoff valves, such that the shutoff valves are the line size.
17. Install the steam pressure tap and temperature upstream of the upstream shutoff valve or downstream of the downstream shutoff valve.
18. Thermowells should be installed with tips at the center of the pipe on 4" and larger pipes. On 3" pipes, the well should be installed at a 45° angle from centerline of pipe pointing upstream per UAB Department of Energy Management standard. On smaller pipes, install well in elbows per UAB Department of Energy Management standard.
20. Install the steam pressure transmitter with a wetleg loop.
21. Obtain approval of all instrument sizing and calibrations from the UAB Department of Energy Management to assure consistent applications. Anticipated full load and minimum information must be given to the UAB Energy Management at this time.
22. Insertion flow meter shall be installed through a full port Crane ball valve (or approved equal) for isolation. Meter should be installed preferably within a 45° angle from top vertical pipe. The meters must never be installed below horizontal.
23. Install the chilled water flow meter in the return line whenever possible.
24. Install the chilled water RTD well at least 10 pipe diameters downstream of the flow meter (outside of the meter run).
25. **METERING DATA ACQUISITION UNIT** - Make of instrument must be as specified in order to insure compatibility with the existing system. This instrument will be mounted in a NEMA 12 (equivalent to Hoffman type) enclosure or approved equal with the instrument face approximately 60 inches from the floor. All internal wiring will be in Panduit or approved equal with line voltage and signal voltage separated and grounded per NEC. All connections to this panel will be in sealtight conduit with and feed into the panel from the bottom.
26. Training on the operation of metering components and location of meters and routing of conduit shall be provided by the contractor.
27. Verification, accuracy, and correct operation of all metering components shall be verified by the design engineer prior to job closeout. Sufficient detail shall be

provided by the design engineer to allow the contractor to completely and accurately separate utilities between billing entities.

- 28. Whenever a new tap to any utility is made, contact the UAB Department of Energy Management so that an evaluation can be made of the effect on existing metering.
- 29. All installed metering components shall have certificates of calibration traceable to NIST submitted to Energy Management before job closeout.
- 30. See the following pages for the UAB Energy Management Metering/Sub-metering requirements form.

See Attachment "A"

**END OF STANDARD**

Prepared by: \_\_\_\_\_  
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ATTACHMENT A

**University of Alabama at Birmingham**  
**Department of Energy Management**

**Metering/Sub-metering Requirements for**  
**New Construction and Major Renovations: Identification Form (rev. 1-29-03)**

**To: UAB Campus and Hospital Project Managers.**

The purpose of this form is to correctly identify needs for utility metering/sub-metering as early in the project as possible. The early identification allows Energy Management to properly plan and assure metering is installed consistent with institutional needs associated with utilities use. All utilities provided to new buildings will be installed so that usage is collected automatically by the Energy Management Metering System for each entity requiring separate billing in the building. This includes all parking decks.

Please fill out the following information as completely as possible for each area of the building. Please refer any questions to Brad Gwin with UAB Energy Management at (205) 975-7140 and fax completed form to (205) 975-5080.

**Area 1:**

**Building/Project Name:**

\_\_\_\_\_

**Project Number:**

\_\_\_\_\_

**Area to be metered:** \_\_\_\_\_

**Approx. Area Gross Sq.Ft.** \_\_\_\_\_

**Metering Required: (Place an X in the appropriate squares for all utilities that will be provided to Area 1.)**

**Chilled Water**     

**Comments:** \_\_\_\_\_

\_\_\_\_\_

**Steam**                     

**Comments:** \_\_\_\_\_

\_\_\_\_\_

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**Natural Gas**

**Comments:** \_\_\_\_\_

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**Electricity**

**Comments:** \_\_\_\_\_

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**Domestic Water**

**Comments:** \_\_\_\_\_

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**Domestic Water**

(For Sewer Credits)

**Comments:** \_\_\_\_\_

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Metering/Sub-metering Requirements for New Construction: Identification Form (rev. 1-29-03)

**Area 1:**

**Architect & Phone:**

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**Mechanical Engineer & Phone:** \_\_\_\_\_

**Electrical Engineer & Phone:** \_\_\_\_\_

**Mech. Contractor & Phone:** \_\_\_\_\_

**Elec. Contractor & Phone:** \_\_\_\_\_

**Controls Contractor & Phone:** \_\_\_\_\_

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**Area 2:**

**Building/Project Name:** \_\_\_\_\_

**Project Number:** \_\_\_\_\_

**Area to be metered:**  
\_\_\_\_\_

**Approx. Area Gross Sq.Ft.**  
\_\_\_\_\_

**Metering Required: (Place an X in the appropriate squares for all utilities that will be provided to Area 2.)**

**Chilled Water**        
**Comments:** \_\_\_\_\_  
\_\_\_\_\_

**Steam**                        
**Comments:** \_\_\_\_\_  
\_\_\_\_\_

**Natural Gas**                
**Comments:** \_\_\_\_\_  
\_\_\_\_\_

**Electricity**                  
**Comments:** \_\_\_\_\_  
\_\_\_\_\_

**Domestic Water**          
**Comments:** \_\_\_\_\_  
\_\_\_\_\_

**Domestic Water**

**(For Sewer Credits)**

**Comments:** \_\_\_\_\_

**Architect & Phone:** \_\_\_\_\_

**Mechanical Engineer & Phone:** \_\_\_\_\_

**Electrical Engineer & Phone:** \_\_\_\_\_

**Mech. Contractor & Phone:** \_\_\_\_\_

**Elec. Contractor & Phone:** \_\_\_\_\_

**Controls Contractor & Phone:** \_\_\_\_\_

Metering/Sub-metering Requirements for New Construction: Identification Form (rev. 1-29-03)

**Area 3:**

**Building/Project Name:** \_\_\_\_\_

**Project Number:** \_\_\_\_\_

**Area to be metered:** \_\_\_\_\_

**Approx. Area Gross Sq.Ft.**

\_\_\_\_\_

**Metering Required: (Place an X in the appropriate squares for all utilities that will be provided to Area 3.)**

**Chilled Water**     

**Comments:** \_\_\_\_\_

\_\_\_\_\_

**Steam**             

**Comments:** \_\_\_\_\_

\_\_\_\_\_

**Natural Gas**     

**Comments:** \_\_\_\_\_

\_\_\_\_\_

**Electricity**       

**Comments:** \_\_\_\_\_

\_\_\_\_\_

**Domestic Water**  

**Comments:** \_\_\_\_\_

\_\_\_\_\_

**Domestic Water**  

**(For Sewer Credits)**

**Comments:** \_\_\_\_\_

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**Architect & Phone:** \_\_\_\_\_

**Mechanical Engineer & Phone:** \_\_\_\_\_

**Electrical Engineer & Phone:** \_\_\_\_\_

**Mech. Contractor & Phone:** \_\_\_\_\_

**Elec. Contractor & Phone:** \_\_\_\_\_

**Controls Contractor & Phone:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**UAB Project Manager**