UCONN
UNIVERSITY OF CONNECTICUT

Utility Services Sub-Metering Design Standards

Office of University Planning, Design and Construction
and Facilities Operations
Established Date: June 2024

Table of Contents

1 Introduction

The intent of this document is to outline the site-specific requirements to facilitate the complete installation of utility service building sub-metering which addresses the needs of multiple stakeholders on campus. The University requires standardized metering system installations. The Designer is responsible for identifying in detail the design of alterations to an existing system or new system for competitive pricing.

All campus buildings larger than 20,000 gross square feet (GSF) provided utility services (Electric, Steam with Condensate Return, Chilled Water, Domestic Water, Reclaimed Water and Natural Gas) shall be equipped with utility service sub-metering. For buildings smaller than 20,000 GSF, if existing utility service sub-meters are installed, Projects shall retain/improve existing metering as requested by the University Representative in conjunction with Facilities Operations (FO). For existing buildings acquired by the University and/or existing conditions of buildings currently owned and operated by the University, the Project shall follow the standards as described below. If these standards cannot be met, a written reason for such shall be submitted to the University Representative who shall consult with FO prior to providing a written response to proceed with the non-standard design.

While quality and accuracy of equipment should remain consistent throughout a project, it is not generally the intent of this document to cover meters beyond those necessary to monitor building utility services. Meters installed strictly to meet LEED, High Performance Building Statutes, Energy Code or similar project requirements may not be best monitored by the campus metering SCADA system. The most appropriate way to monitor and provide the required data for these other reasons should be determined during project design. In principle, any modbus/OPC device could be brought into Powerlogic for long term storage, and generally this would be the right choice for electrical metering information, such as breaker communications. Mechanical systems not suitable for SCADA could be programmed in as well. Ensure all devices are identified on risers, and clearly identify which is a utility sub-meter, and which is not;

coordinate with the University Stakeholders during design to best meet project goals and provide clear bidding scopes.

1.1 General Requirements

Meter Installation Coordination

All meter installations shall be coordinated with FO to ensure the final meter installations are completed to this standard. Once meter and metering component installations are complete, FO shall commission the electric, steam, condensate return, chilled water, domestic and reclaimed water meter setups to ensure meters are programmed correctly to record the required parameters and meter systems are working properly. The Contractor will be responsible to correct any metering issues identified during the commissioning process. FO shall be available to provide further guidance as needed throughout the metering installation process.

Metering submittals for utility metering shall be reviewed by FO to ensure conformance and sizing for accurate registration of services. FO shall be the sole arbiter of equality of alternate products and at times make materials available to ensure safe, serviceable and accurate metering is installed.

Supervisory Control and Data Acquisition

Utility service meter data shall be logged into the University's GE IFIX Supervisory Control and Data Acquisition (SCADA) metering platform and stored in the existing OSIsoft PI Historian data server. Integration of utility sub-meters into SCADA and the PI Historian shall be completed by the FO. Integration shall commence upon completion of physical meter installation and information shall be provided to FO as needed. Avoid referring to this system as a "BMS" to eliminate confusion with building controls.

Data Monitoring

Under no circumstances shall the Building Management System (BMS) be utilized as a conduit for sub-metering data unless approved by FO. In some cases, old BMS interfaces have long become obsolete with software updates no longer being supported by the vendor resulting in continued security issues. In all cases, meters shall be accessible via Modbus/TCP with gateways suitable for use in a multi-master topology. Baud rates shall not necessarily use the minimal default 9,600 bits per second (bps) but be as fast as possible given the physical layout of the system not to exceed 57,600 bps. Serial links shall use 8-bit no parity and 1-stop bit frames (8N1 serial) and, when possible, 4-wire full duplex RS-485/422 serial communications. This topology shall provide access to direct reads of the meter registers. Under no circumstance shall in-direct measurements (i.e., pulse meters to integrators when the registers can be read directly if

properly specified) be taken that will not directly reconcile the display to the internal registers on the meter unless approved by FO.

The peripheral areas of the Storrs campus may not obtain utility services from the Central Utility Plant (CUP) and Cogeneration Facility (Cogen). In those areas, the private utilities (i.e., Eversource and CNG) associated with those locations will be responsible for any required metering. For buildings larger than 20,000 GSF serviced by the local utility (i.e., not the University 's CUP and Cogen), an output device to the University metering network may be required. The Project is responsible for obtaining, in writing, direction on properties larger than 20,000 GSF serviced by the local utility. Refer to the local Utility Providers enhanced metering services for more information on metering requirements. For Utility metering, additional raceway, such as to support phone lines, etc. for metering, may be required at the meter provisions. All University Eversource services typically fall under time of use rates which may require a plain old telephone service connection (POTS). All local Utility Provider meters shall be installed exterior to the building unless approved by User Occupants and FO for third party access to equipment via key provided to the utility company. This key shall not be a general-purpose mechanical key, but a key as approved by the University Locksmith to limit access to the specific area. Utility metering does not necessarily waive the need of sub-metering systems, coordinate during design.

Campus Network Communication

All meter devices shall communicate with the campus network via Modbus/TCP to log utility service meter data in the metering SCADA system. The Contractor will coordinate with FO to land data jack ports near to where the meter instrument will be located for Modbus/TCP communications to connect to the campus network. Once the data jack ports have been landed, the FO shall provide MAC addresses for the meter device to the University's Information Technology Services Department (ITS) for IP address assignments and connection to the University's network. Once the IP addresses have been assigned, the FO Instrument and Controls (I&C) Technicians shall complete the connection of the data jack ports to the metering devices. The FO shall program assigned meter tags into the University's SCADA metering platform and PI Historian data server. Electrical metering shall be installed into the Powerlogic system by Schneider Powerlogic certified Factory Technicians, with final integration to the SCADA system by FO Metering Department.

System Startup

In order to properly install Powerlogic electric meters and any communicating circuit breakers from any Vendor, Factory Startup and Integration Services must be procured by the Project directly with Schneider Electric Powerlogic factory certified technicians. No other third party will be provided access to the Powerlogic Servers to perform this task. All mechanical meter systems start-up and integration shall be completed by the FO.

Instrumentation Power Source

All mechanical meters (steam, condensate return, chilled water, domestic and reclaimed water), meter instrumentation enclosures shall have installed 120 VAC 20-amp power source. The Contractor shall land 120 VAC power source connection to the disconnect switch on the instrumentation enclosure to power all components inside the enclosure. This 120 VAC power source shall be on a separate designated electrical circuit. If separate meter enclosures are within 50 feet, the disconnect switches may be tied to one designated electrical circuit. These circuits shall not be used for non-meter applications.

For electric meters, power shall generally be obtained directly from the electrical gear from the fused voltage references to the meter. Factory Schneider enclosures have provisions to make this connection to an integral control power transformer. On Automatic Transfer Switch (ATS) applications the voltage reference shall come from the load side of the switch. In rare applications external control power sources may be needed, coordinate with meter engineering during design, in most cases external control power sources should not be utilized. Voltage transformers should be avoided as control power sources to the meters, except in socketed applications. In main-tie-main and similar complex service arrangements it may be appropriate to utilize the gear control power bus, especially when utilized A-B automated relays for stable power, care must be taken to bypass integral Control Power Transformers (CPT) in factory enclosures in those cases.

Instrumentation Wiring Requirements

For all mechanical meters (steam, condensate return, chilled water, domestic and reclaimed water), the Project shall run conduit from the meter sensors to the instrumentation enclosures. For steam meter, wiring connections are needed between differential pressure transmitter and Resistance Temperature Detector (RTD) to the flow computer inside the instrumentation enclosure. For condensate return and chilled water meters, wiring connections are needed between the meter flow transducers, supply and return RTD's and the instrumentation CPU. Extended wire connections greater than the length of the factory provided wire (typically around 25 feet) may require the installation of a J-box to complete the connection between the meter components and instrumentation CPU. For domestic and reclaimed water meters, wiring connections are needed between the meter body and the Ethermeter communication device inside the instrumentation enclosure. FO I & C Technicians shall pull the necessary wires and make all the final connections between the meter sensors and the instrumentation enclosures and CPU's.

Other Potential Meter Installations

All campus buildings with steam utility service have corresponding condensate return to the CUP and Cogen. Utility service sub-metering of condensate return will not be conducted at building locations unless otherwise directed. Future considerations to meter condensate return for larger energy and water-intensive buildings may be requested. The Designer shall obtain written

direction from the University Representative in conjunction with FO whether the Project will require this type of metering.

Similarly, utility service sub-metering of hot water will not be conducted at building locations unless otherwise directed. Future considerations to meter hot water will be made if metering hot water is needed to monitor heating for buildings that would otherwise be captured through metering steam. The Designer shall obtain written direction from the University Representative in conjunction with FO whether the Project will require this type of metering.

If condensate return or hot water utility service sub-metering is required, the meter installation shall follow the chilled water meter installation requirements described in Section 2.3 below with the exception of programming the meters to record BTUs instead of tons.

Meter Equipment Substitutions

Any meter equipment substitutions that result in a deviation of this standard shall be submitted for review and approval by the University Representative in conjunction with FO prior the completion of design and purchase of metering equipment.

Project Closeout Documentation

Refer to Project kickoff Closeout Check list for specific information to provide in a metering orientated collation of documents. In general, this would include any technical characteristic of the specific meters installed, such as min/max flow capacities, testing or factory certification information, networking information such as mac addresses or Modbus mapping of devices and register information, latest manuals for the devices and its instrumentation. Copies of the latest configuration tools for troubleshooting or providing basic local communications to the equipment with already configured network/Modbus configuration files for the specific equipment to allow direct connection to equipment to troubleshoot. In general, more information will be requested when FO has a less active role in commissioning the metering equipment, and more when vendors are used for startup.

2 Meter Installation Requirements

The Project shall implement the following design standards for the utility service building sub-meters noted below. Meter installation requirements are provided for electric, steam, chilled water, domestic water and reclaimed water utility service meters. The Project should consult the FO with any questions or concerns in implementing the utility service building sub-metering installations.

2.1 Electric Meters

The University uses the Schneider Electric Powerlogic platform to monitor demand, energy and power quality issues of our buildings and primary utility service. Administrative access to this server for the purposes of meter configuration will be provided only to Schneider Factory Service Technicians. Electrical meters shall be Schneider Powerlogic/ION 10 Amp meters minimally, being capable of withstanding 20A continuous input without damage, here-in referred to as Class 10 & 20, there are no equals. There is other meters FO may indicate for use below 400A services that are self-contained and more accurate for small loads, which will be coordinated through design. These may not be Schneider meters, but technology is still being reviewed so general guidance from FO will be coordinated during the design process. Final selection of the specific meter to use in each situation or service will be documented on the riser, their locations on the plans and as per FO for final type. Include the FO during switchgear submittal processes to ensure they are coordinated with electrical meters. Electrical meters may be allowed to be standalone but all parts up to the test switches must be fully coordinated with the switch/panel submittals.

The University has provided a detail for inclusion onto project plans as a standard detail documenting the requirements set out in this standard. The details may be scaled, and layers modified to accommodate CAD Standards but no change of notes shall be allowed. Any issues with the standard detail should be resolved during the design process so that modifications to the standard detail can be made for use by future projects. Provisions not considered in scope of a particular project, such as medium voltage metering, shall not be struck from the detail. Specifications should reference this plan detail directly. It is the intent of this standard to establish requirements for projects to install meters that are fully serviceable without taking service outages impacting building occupants for all but Current Transformer (CT) replacements. However, it is expected CTs will last the life of the service equipment. Due to OSHA, Arc Flash and the University's Electrical safety policies, it is required that all reasonable engineering controls be put in place to isolate disconnects, fusing and test switches from open exposed bussing and use selectively coordinated voltage reference protections that are current limiting and sized to clear at reasonably low instantaneous ranges.

Instrument Transformers

Instrument Transformers shall be ANSI C57.13 constructed and in styles marketed to and in use by utility companies, with enhanced accuracy ranges. Terms such as "revenue grade" or "utility grade" shall not be used to describe them in drawings nor specifications. CTs shall have accuracies of 0.15% from 1% the primary rating through the rating factor of the CTs and drive burdens of 0.5 ohm minimally. The ANSI designation would be 0.15SB0.5. However, the 1% of primary rating must be referenced in specifications as ANSI generally recognizes accuracies only to 10% of primary ratings and allows halving of accuracy below the primary rating. At present, only General Electric (GE) Revenue Sense and ABB AccuRange units are known to provide this level of accuracy. CTs for services or switchgear shall be installed within utility revenue compartments (CT compartments) meeting Eversource construction guides, but modified to provide a ground, the fused voltage references on terminals, and not use utility specific keysets. In most cases, panels will require external CT compartments unless care is given for suitable gutter and auxiliary trough space in non-service situations. There are many styles GE and ABB manufacturer that meet the accuracy ranges including high-temp models that work well on transformer secondary spades. The University is more concerned with accuracy and not having the limits of clearance through a CT window utilized than the specific type. The FO will provide some guidance during design, but the submittal process needs to determine the final selection of the specific unit. Generally, the University does not want ratios less than 600:5 employed and generally 10 Amp secondary currents are sought to maximize the potential for load in a good spot for load magnitude and angular resolution of currents. Under no circumstance should the secondary currents be expected to exceed 15 Amp. Situations such as four sets of 600MCM conductors through a GE JAK style CT should not be allowed. In all cases, the units come with serialized factory test documents that should be retained and shipped with the gear and delivered upon commissioning completion to the FO. The University reserves the right to require re-testing at the Contractor's expense for failing to provide factory test slips. In rare cases, these

test slips may be used by the FO to program the correction coefficients for insufficiently loaded services.

As energy code requirements for metering sub-system loads increase, added space to house equipment within electrical rooms is becoming more necessary. The Design team shall coordinate with each other to ensure suitable space is available for the necessary meters and support equipment. All mechanical, electrical, and metering equipment shall be shown on the plans and elevations to ensure adequate circulation of equipment for required service clearances. It is generally acceptable for CT compartments to be above panels provided they are never installed above a concealed ceiling, nor have mechanical obstructions affecting direct access from a 6-foot ladder. CTs shall be installed in a cold-sequenced manner after a main breaker. For atypical situations involving more complex services such as main-tie-main arrangements with integral unit sub-stations, coordinate with FO to fully document deviations during design to ensure personal safety. CT compartments have proven invaluable in correcting issues of non-conformant gear easily in the field. Junction boxes are not CT Enclosures and should not be specified nor approved as such. Use of CT Enclosures may trigger utilizing bar style CTs from the typical window units most used on campus.

Potential Transformers (PTs) shall not be selected for regular utilization voltages seen on the campus unless warranted by extremely large fault currents. Refer to the University's detail drawing for more information. When necessary for use, all ratios shall be rational, such as using 288:120 units for 480V-Wye systems. PTs should generally not be used for controlling power to the meter. However, if used for power control, the PTs shall be proven to have sufficient burden capability of all driven units. PTs shall require primary and secondary fusing and separate disconnects for coordination/inrush purposes. Primary fuses may be time delay type.

Instrument Wiring

All disconnect devices, fuse blocks, test switches, etc. are required to come with terminal shrouds/covers and the like to protect against incidental contact, these are necessary safety components. Voltage references to meters should be made on the line side of main breakers utilizing UL98 listed disconnects and fused with 5-amp nominal Class J Fast Acting fuses using indicating pad lockable covers. On main-tie-main arrangements it is required to provide a line side of main voltage reference to properly meter operation of the service with open ties. CT wiring shall be made with independent, color coded and labeled wiring for the positive and negative terminals from each CT. CTs shall be bonded to ground at the CTs to ensure there is a single whip to lift when injection testing the service and the ground may never inadvertently be removed from a terminal point. Independent color-coded wiring is necessary to easily visually trace the metering circuits and confirm proper termination of wiring. Wiring manufacturers using a single-color wire for everything in the switch gear is unacceptable.

Voltage reference and CT wiring shall terminate to a protected Test Switch with clear cover as manufactured by Milbank #TS10-0110C-WC with final termination to the meter directly from the

load side of the test switch. Wiring from CTs shall be free of intermediate blocks and terminals where crossing of wires is likely to occur or where shortcuts such as using a single X2 negative lead is employed. Voltage reference wiring shall generally be #12 Copper and CT wiring shall be #10 Copper. Voltage reference wiring shall always include a ground conductor and neutral wiring.

All metering provisions shall be housed in a fully enclosed, fully barriered compartment of the switch gear, fully accessible by hinged doors and not exposed to bussing, line side feeders, branch feeders or the same. Under no circumstance shall raceway nor meter enclosures be used as junction boxes, nor be used to route from gear to an external test switch provision. The meter enclosure shall be the terminal device on a run of raceway and be fully replicable without outages by external test switch means and voltage reference disconnects inclusive of replacing the entire meter enclosure.

The University's three-line schematic shall be required in specifications to be sent to manufactures as the wiring diagram for customer metering. In no case shall the Contractor be relieved of ensuring conformance with the University's three-line schematic design requirements. The Contractor/Manufacture is required to meet the requirements and provide the required level of safety and serviceability or be held to correct at no additional cost to the University.

Meter Types and General Selection Guidelines

Meter types are generally coordinated with use of buildings with highly analytic functional meters utilized in buildings with loads that are susceptible or otherwise vulnerable to transients or poor quality of power. Projects should consider upgrading legacy metering when main services otherwise are to remain. The Designer is responsible for obtaining final approval of meters by FO. Note: the series is more important than how the meter may be housed within its enclosure. For example, while PM8240 has been indicated, PM8243 with a remote display is acceptable and is the unit in the normal factory enclosure. However, it is critical to use specific part numbering not just series as many meters have drastically different capabilities across their series. All meters shall include a local display for configuration and viewing summary data and in all cases, this should be a remote mount display such that the meter is not directly attached to the hinged enclosure door. These meters are available from Schneider in enclosures with ancillary supports and control power provisions in enclosures matching the environmental ratings of the space. Coordinate with FO for exterior applications such as parking lots during design. Other options exist, or in some cases, standard Eversource accepted type 9S meter sockets can be used with socketed versions of some of these meters or acceptable University determined equals. In some cases, the University will prefer to provide the metering itself especially for any socketed style meter. In some cases, it is acceptable for Schneider to construct enclosures that have multiple meters. In those cases, it is required that they be specified as having independent voltage reference capability as well as control power consideration.

- ION 9000 Series Meters; type 92040, are the most sophisticated available units at this time, with options for sub-cycle transient analysis offered. They are Class 20 meters, with gigabytes of internal logging. These meters should generally be used in projects such as Research Science labs and similar, generally having equipment that is most susceptible to issues with incoming power quality. The 92040 variant includes a 7" touch screen remote display, care must be taken when reviewing submittals as they indicate a 92030 with a 7" display with optical port, not the boxed 92040 when ordering discrete components.

- PM8240 ION Series Meters; type PM8243, are general purpose meters offering decent power quality functionality, and are likely to be the most utilized units in projects. They are Class 10 meters but can indefinitely carry 20A with presumed loss of accuracy per Schneider. They should not be used where >10 Amp CT secondary current are expected. Devices downstream of an ION 9000 would generally be this style, or for general purpose academic buildings, dorms, athletic facilities, etc.

- PM5560 Powerlogic Series Meters; type PM5563RD, are generally for residential class, simple monitoring, and offer little to no power quality information nor offer much ability to configure internal logging. They are Class 10 meters, but can indefinitely carry 20A, with presumed loss of accuracy. They should not be used where >10 Amp CT secondary current are expected. This meter may be utilized for non-critical sub-metering applications such as lighting panels necessary for LEED verification and similar purposes, or in light duty residential apartments using light duty mechanical systems. The University has found in most cases it is more cost effective to utilize an ION 8650 B or C socketed meter, than a PM5560 Series device. These meters are native modbus and do support Bacnet so they can offer some advantages over socketed devices. Generally, these may be utilized on Ag Structures such as barns or Utility Pump houses with enclosed conditioned electrical rooms, or to replace existing obsolete Energy Meter type meters in residential applications, they should not generally be specified for main services.

- ION 8650 Series Socketed Meters; types 8650A, 8650B, 8650C are highly flexible, fully programmable meters that range from power quality measurement capabilities somewhere between the 9000 and 8000 series devices (A style), to near none (C style). The meters are Class 20 meters, fully rated for outdoor unconditioned space use, and the longest available warranties. They are available in many industry standard meter forms but Form 9S using a 13-terminal meter socket, Milbank #UC7445-O-311-NOE preferred for wye services is most common. If it is determined the University will provide, install and program the meter, the Designer shall specify an appropriately sized meter socket to be provided by the Contractor.

- LoRaWan or similar Self-Contained Meters for services 400A or less, is a state of the art, AMI technology that will help eliminate the issues of 400A or less instrument transformer services where there is never enough load for the metering to see anything but noise, or

power quality issues that may not exist. These kinds of solutions are being used in select situations for Form 16S wye services 200A or less and may become more prevalent. To meet the expanding requirements of the Energy Code they may prove the most cost-effective solution in the long run. As these meters are not currently available by Schneider in any format, modbus or LoRa any use of these meters will likely require coordination with FO for startup/commissioning.

Communicating Circuit Breakers

All switchgear lineups are required to have fully communicating circuit breakers and shall be wired out to an integral Ethernet gateway in fully enclosed and barriered support cubicle in the gear. All necessary auxiliary power supplies and support features will be provided to allow full communications to the breakers and full function of the trip unit displays independent of any load or open/close status on the breaker. The trip unit's manufacturer shall include the software necessary to configure pull data and download event information from the unit's Ethernet gateway. This shall include a pre-programmed network file for the gear with all modbus and type information pre-configured for Owner confirmation of function. They shall provide or work with Schneider to create the Modbus ION Translator files necessary to Integrate with Power Monitoring Expert Modbus Importer for metering. The Modbus mapping templates shall be open for extension by the owner and is not required to map the entirety of the Modbus register space. However, it shall be complete enough to provide for a highly functional parity to Micrologic trip units so Vista diagrams may be customized for them. Trip units must provide minimally Voltages (Van, Vbn, Vcn, Vab, Vbc, Vca, LLavg, LNavg), currents (Ia, Ib, Ic, Iavg), demands and Instantaneous values of power (kVA, kW, kVAR), energies (kVARh, kVAH, kWh bi-directional registers preferred) and frequency logged for them to meet this standard.

When available, the trip unit wear indication registers or battery life shall be configured for logging as well as device operations like trip counts, angular measures of voltage and current, and harmonic distortions per phase and/or collectively for currents, phases and measures like crest factored. Real time measures necessary to provide information on a Vista diagram will make available trip unit status, trip settings, etc. to map a complete as possible Micrologic experience with the non-Schneider breaker. The implementer of the translator file shall work with FO to ensure ION measurement selection is clear, defaulting in general to how Micrologic measures of the same would map to ION handles. These translators will be provided to the Owner and without restrictions for the Owner to extend on their own. It is not necessary to configure downloading internal logs of non-Schneider trip units, but software shall be provided to perform this task. The modbus register, to measure, to ION Handle information, in hex and decimal, shall be recorded in a spread sheet to document all information made available in the integration for future use by Owner in producing future OPC mapping drivers as found necessary by Facility Operations.

It is encouraged to use communicating breakers for LEED and or Energy Code metering purposes instead of IT-rated metering equipment. Long Modbus chains should be avoided, with Ethernet

drops to each metered provision, but within common panel's individual Modbus chains to a single common Ethernet gateway is acceptable.

General Specifications Guidance for Power Monitoring Divisions

The University has coordinated programming standards, meter templates and logging parameters with Schneider which can be found on the University's server. When metering involves only Powerlogic devices, specifications shall provide for Factory Startup and Integrations Services to be purchased and instruct the programming to be done per the most current University Metering Design Standards and as directed by FO. The basic services may be defined as confirmation of proper wiring, registration, and ratios at startup; installing to Powerlogic system and confirming real-time availability; and creation of Vista diagrams for ease of access to metering components. It is unnecessary to define units of measure, time intervals, etc., except when defining performance equals for communicating circuit breakers as outlined within the Breaker Communication section. All ION meters in use have pre-defined templates and will be provided to certified Schneider Factory Technicians to use or model for new versions of firmware as it arises. If the conditions require specific special measurements, coordinate with FO during design as Schneider will configure the meters to the University's defined requirements.

For reference, to illustrate the typical information housed in the Powerlogic system or internal meter logs:

The following measurements shall be recorded, on a bi-directional basis, and with min/max/avg logging for each relevant parameter for three years of internal logs:

1. Phase voltages, Line to Neutral Voltages, and 3-phase averages
2. Phase and Line current, and their 3-phase averages
3. Real, Apparent, and Reactive Powers, Instantaneous and 15-minute Demands
4. Real, Apparent, and Reactive energies
5. True (inclusive of harmonics) Power Factors on the phases and 3-phase average
6. Displacement (60hz Principal) Power Factors on the phase and 3-phase Average
7. Frequencies, and when capable the max/min over the 15-minute interval
8. harmonic disturbances, in I THD and V THD, crest factors, transformer loss estimates

The following features shall be enabled:

1. transient waveform captures for current and voltage disturbances
2. Alarming on under/over voltages
3. Alarming on 80% of nominal breaker (or feeder when undersized) ampacity
4. Alarming on case-by-case manner to monitor User equipment as needed

All meters will be named as directed by FO and require the building's 4- or 5-digit code to complete. Building Codes are assigned by University Planning Design and Construction (UPDC) for new construction or otherwise known for renovations. In either case, UPDC should be consulted to obtain when questions arise. The Designer shall not include in the specifications new metering server systems, extensions of service contracts nor expansions of licensing. Similarly, it is not necessary to ask for MS-DOS compatible computer systems with modems or dot matrix printers to be provided to support the Powerlogic system. In most cases, it is

recommended to keep things simply specified surrounding the University's metering system. Coordinate early with FO for specifying electrical and metering components.

What is critically important is to stress conformance to the University's tree-line metering schematic and its importance in providing safe to service and without unnecessary outages maintenance of metering equipment. Require the Contractor is to provide as-built one-line schematics showing communications addressing and gear layouts, accurate instrument transformer ratios, etc. be provided to Commissioning Personnel, including the University. The University reserves the right to turn on and test proper wiring of any meter ahead of planned Schneider factory services to avoid wasting Technician time due to issues with meter wiring since this will not affect warranties. Should the system not be safe and fully functioning as the specifications outline, all costs associated with corrections to the system shall be at the Contractor's expense. Due to continued supply chain issues, treat any and all metering/CTs are long lead time items and thus shall require submittal submissions, their approvals and orders placed early on at the on-set of the work.

Construction Documents

The Designer shall include within the Construction Documents, risers which specifically show the instrument transformer locations as well as their desired ratios and call out the type of meter to use. Plan and elevation views shall show CT Enclosures, meter locations, sockets, etc. Make clear on the drawings that all metered loads will require field verification by FO to ensure conformance and final locations of equipment.

Commissioning

To commission meters it is required to have the CT Test Slips and specific ratios used at each location, as-built/red-lined risers of gear with communicating breakers, all communicating breaker Modbus addressing information, and all devices having active UConn network connections. All passwords used to access GWs and do configuration shall be provided to troubleshoot issues. Meter loading equipment such as temporary resistive heating equipment or formal load banks shall be required to ensure proper registration and vectoral registration of current is in phase and sequence with voltage. Contractors shall be required to provide this to ensure not less than 10% of the primary rating of the CT can be loaded onto the service. Pre-configured OEM tools/network files will be available to confirm breaker communications agree with any onscreen breaker displays, the Modbus reads, and the breaker OEM software reads are all in agreement, and that any Modbus addressing issues have been resolved prior to Powerlogic Technicians arriving on site. Contractors will provide basic internet, access to the UConn network and suitable workspace for Field Technicians laptops & their power supplies and laying out drawings about the main service(s), and reasonable accommodations for the same in other downstream metered loads rooms. Commissioning shall be coordinated with FO, and it is typical for Powerlogic Graphics screens to lag the initial field startup verification work, especially when there are large quantities of meters or breakers in a system.

Services provided by External Utility Companies

When connected to Eversource power, coordinate revenue metering with the Eversource Design Technician and/or their Meter Service Department in conjunction with their latest published Information and Requirements Handbook published by Eversource. Powerlogic metering may still be required but must not be sealed within the Utility Companies sealed IT compartments nor interfere in anyway with their revenue metering equipment. All Eversource Meter sockets shall be installed outside the building with a raceway to the building phone system for meter communications. Coordinate further if the building's load is anticipated to be scheduled for a time of use rate by Eversource. Refer to the Information and requirements Booklet published by Eversource for specific requirements. Coordinate with other utility service providers in a similar fashion using their policies and procedures when in UI, Groton or any other electrical distribution companies service territory.

Refer to Section 3.0 below for FO sub-metering standard drawing details.

2.2 Steam Meters

Steam utility service sub-meters shall be installed at the building service entrance and will utilize differential pressure technology at a serviceable location preferably not to exceed 6 feet above the ground as measured from the top of the meter assembly. If multiple service entrances or multiple steam sub-meters are required in a single building, the multiple sub-meters will be summed together to obtain a building level steam measurement. If more than one building steam service is included with the steam service entrance for a given building, the other buildings' steam service will be subtracted to obtain the individual building service measurement. Installations may require modification of the steam pipe to allow for metering of this utility service. Designers shall incorporate all required installation requirements based on the conditions to ensure a complete installation at no additional cost to the University.

In-line meters shall be installed at the building service entrance locations. Insertion type meters are not acceptable for steam metering of utility services at the building service entrance. For horizontal steam pipe configurations, the meter differential transmitter shall be installed below the steam line. For vertical steam pipe configurations, the meter differential transmitter can be mounted in any location around the circumference of the pipe but requires a special adapter manifold to allow for "water head". If possible, transmitters should be directly mounted to the meter manifold location. Transmitter remote mounts may be used with 316 stainless steel tubing. Ensure the selected meter location is accessible and allow for adequate clearance for the manifold and transmitter as required by the meter manufacturer instructions. Therefore, the meter installation:

- Shall not be installed in a confined space;
- Access must not be hindered by surrounding mechanical, electrical, plumbing or HVAC ducting or equipment. Recommended to have at least 18 inches of clearance;
- Preferably access to the equipment should not require using a ladder greater than 6 feet above the ground; and
- Shall not have blowdown provisions installed above sensitive equipment that could be damaged by bursts of steam.

Steam meters shall be selected and sized to meet the minimum required turndown ratio of 15:1 relative to a building's steam design capacity. Meter sizing shall be reviewed and approved by the FO. Steam meter installation and setup shall comply with the manufacturer's instructions, including minimum pipe diameters before and after the meter, as required. Steam meters shall be provided with compensating temperature (deg. F) and pressure (psi) sensors.

Isolation valves shall be installed upstream, in the same room, and downstream of the steam meter and with full incoming pipe diameter bypass with isolation valve installed around the steam meter for maintenance purposes.

A proper steam meter installation shall consist of the following devices on a 65 PSIG system:

- A local 1/2 inch or 3/4-inch Thread-o-let with a 0-100 PSI pressure gauge with a siphon and snubber must be installed after the first isolation valve but before the meter body on the incoming steam header to monitor steam pressure into the building. A shutoff valve shall be installed to allow the pressure gauge to be serviced;
- Upstream 0-160 PSIG pressure transmitter with digital display and serviceable built in snubber, accompanied with a steam rated isolation valve, piston siphon, 2-valve manifold with vent, and transmitter manufacturer specific mounting bracket;
- Steam meter body shall consist of a flow conditioning element and a meter sensor thermowell with RTD rated for a minimum of 400°F. A shutoff valve shall be installed to allow the pressure gauge to be serviced;
- If applicable, a downstream transmitter setup may be required and should be discussed with FO.
- For vertical meter orientations, a Parker M3-889S adapter must be installed in line with the differential transmitter.
- For systems not on the standard 65 PSIG steam supply, coordination with FO is required to properly specify system needs; and,
- Steam separator or strainer is desired prior to the meter body.

A removable insulation jacket shall be installed by the FO and wrapped around the steam meter location after installation is complete for maintenance purposes.

Acceptable manufacturer for steam meters is as follows:

- Veris (Differential Pressure – Accelabar);

Acceptable manufacturers for transmitters are as follows:

- Rosemount;
- Autrol;
- Siemens.

The Designer shall specify the steam flow computer to be installed inside an instrumentation enclosure to calculate steam mass flow rate (lbs/hour) and accumulated thermal energy (unless otherwise specified by FO, accumulated thermal energy units will be in lbs). The steam flow computer will be programmed following manufacturer's instructions based on a building's steam design capacity and steam pipe size. For most locations on campus, the flow computer shall be programmed in "Saturated Steam" mode only requiring temperature compensation for the calculation. For locations near a steam tunnel, the flow computer must be programmed in "Super-Heated Steam" mode utilizing both temperature and pressure compensation for the calculation.

Acceptable steam flow computer manufacturers are as follows:

- KEP (Model ES762);
- Rosemount;
- Yokogawa.

FO shall provide the meter instrumentation enclosure to mount at a location selected by the FO. FO I & C Technicians will install the enclosure at the selected location. The instrumentation enclosure shall include:

- 24 VDC power supply;
- Surge protection;
- Modbus/TCP communication device;
- Mass flow computer provided by the Project;
- 120 VAC power source disconnect switch; and
- Ether cable to connect communication device to IT data jack port.

All wall mounted enclosures and meter peripherals shall be mounted not to exceed 6 feet from floor and be free of obstacles for serviceability. The instrumentation enclosure door must be able to open at least 90 degrees to allow the components inside the enclosure to be serviced.
The 120 VAC power source will have a disconnect switch installed on the outside of the enclosure. If the 120 VAC disconnect switch is not readily and easily accessible to the meter location, a lockage disconnect switch must be installed.

Refer to Section 3.0 below for FO sub-metering standard drawing details.

2.3 Chilled Water Meters

Chilled water utility service sub-meters shall be installed at the building service entrance on the primary loop and shall utilize ultrasonic technology at an elevation preferably not to exceed 6 feet off the finished floor as measured to the top of the meter assembly. The meter flow transducers will be installed on the outside of the pipe (i.e., Non-Invasive pipe installation) and, therefore, do not require bypass provisions around the meter location. Ensure the selected meter location is accessible and allow for adequate clearance for the flow transducer and temperature probe assemblies as required by the meter manufacturer instructions. The entire contact surface of the temperature probes must always rest on the chilled water pipe. Ensure the selected meter location is accessible and allow for adequate clearance for the sensors and instrumentation enclosure as required by the meter manufacturer instructions. Therefore, the meter installation:

- Shall not be installed in a confined space;
- Access must not be hindered by surrounding mechanical, electrical, plumbing or HVAC ducting or equipment. Recommended to have at least 18 inches of clearance; and,
- Preferably access should not require using a ladder greater than 6 feet above the ground.

These meters shall monitor and transmit flow (GPM), supply and return line temperature (deg. F), cooling demand (Tons) and accumulated thermal energy (ton-hrs).

Acceptable chilled water meter manufacturer is as follows:

- Emerson-Rosemount-Flexim (Ultrasonic: Dual Channel Fluxus 721, or latest acceptable model with temperature compensated BTU measurement with matched pair 1,000-ohm RTD's with system accuracy no less than 1%); including all mounting hardware and PermaLok tracks (with complete spare PermaLok tracks for calibrations)

Installation and setup of meters shall comply with the manufacturer's instructions, including minimum pipe diameters before and after the meter, as required. For horizontal chilled water pipe configurations, select a measuring point where transducers can be mounted on the side of the pipe allowing the sound waves to propagate in the pipe horizontally. For vertical chilled water pipe configurations, select the measuring location where the medium flows upward. Refer to Section 3.0 for specific design guidance on transducer installation parameters for various scenarios.

All wall mounted enclosures and meter peripherals shall be mounted not to exceed 6 feet from floor and be free of obstacles for serviceability. The instrumentation enclosure door must be able to open at least 90 degrees to allow the components inside the enclosure to be serviced.

The 120 VAC power source will have a disconnect switch installed on the outside of the enclosure. If the 120 VAC disconnect switch is not readily and easily accessible to the meter location, a lockage disconnect switch must be installed.

The Designer shall specify that the Contractor shall provide the flow transducers, RTD's and instrumentation CPU to FO I & C Technicians who will install. In addition, removable insulation jackets shall be installed by the FO and wrapped around the flow transducers and RTD's after the meter installation is complete for maintenance purposes. The flow transducer and temperature probes must be sufficiently insulated from the surrounding environment.

Refer to Section 3.0 below for FO sub-metering standard drawing details.

2.4 Domestic and Reclaimed Water Meters

Domestic and reclaimed water utility service sub-meters shall be in-line meters installed at the building service entrance on the primary line and shall utilize either positive displacement, differential pressure or velocity technology. Meters shall not be installed on secondary lines. Insertion type meters are not acceptable for metering of utility services at the building service entrance. These meters shall monitor domestic or reclaimed water flow rate (GPM) and accumulated flow (gallons) for high and low flow conditions. Single meters with two registers for high and low flow are acceptable. If bypass lines are installed around the main meter location, a meter shall also be installed on the bypass line. The main and bypass meters shall be labeled appropriately.

Meters shall utilize solid state absolute encoder Automatic Meter Reading / Advanced Metering Infrastructure (AMR/AMI used interchangeably herein) style meters with integral accumulators and hardwired communications using ANSI serial format. AMR style registers using FCC licensed or unlicensed radio communications shall not be specified. Pulse meters connected to BMS, or similar components are not acceptable. Meter registers shall follow AMI three-wire serial Standard C707-05 for remote hardwired reads of 8-digit resolution minimally and shall be installed with C707-05 compatible Modbus/TCP interfaces reporting the accumulator and reporting flow. Flow may be derived from the accumulator but the accumulator in general shall not be derived from the flow via pulse counting or similar. Registers shall require no external power to operate but may include integral batteries having a nominal life of 10 years minimally. Registers will be considered defective if serial and visual reads are not consistent with each other.

Acceptable manufacturers for meters and registers are as follows:

- Neptune utilizing E-Coder Plus compatible register, 8-digit serial remote read, Ethermeter for accumulator and flow Modbus/TCP reporting. Note one Ethermeter supports two-meter registers for high/low flow. Contact manufacturer for other compatible gateways

to the Scadametrics Ethermeter. SCADA gateway must support AWWA C707-05 communications and 8-digit minimal read resolution.

- Sensus Omni T2 series, or similar AWWA C707-05 compatible AMR meter register, with Ethermeter SCADA gateway like the Neptune meters described above.

- Utility Grade AMR meter with C707-05 compatible serial AMR read registers having 8-digit resolution minimally may be acceptable, with Ethermeter SCADA gateway like the Neptune meters described above. The University utilizes Connecticut Water Company for service, and we have strong desire to utilize meters they can service, support and test for us.

Installation and setup of meters shall comply with the manufacturer's instructions, including minimum pipe diameters before and after the meter, as required. Combined low flow and high flow meters with corresponding registers shall be installed for larger volumes that are highly variable. Other water meter configurations may only require a single meter and register. These meters shall be selected and sized to meet the minimum turndown ratio of 15:1 relative to the building's domestic or reclaimed water design capacity. Isolation valves shall be installed upstream and downstream of the meter for maintenance purposes. For velocity turbine-type high flow meter installations, a strainer shall be installed ahead of the meter location to prevent damage to the meter. Strainers are not required for other water meter technologies. Meters shall be installed before the backflow preventers. Meter registers shall be installed in an upright position. Ensure the selected meter location is accessible and allow for adequate clearance for meter assemblies as required by the meter manufacturer instructions and specific in the plumbing design standard. Therefore, the meter installation:

- Shall not be installed in a confined space;
- Access must not be hindered by surrounding mechanical, electrical, plumbing or HVAC ducting or equipment. Recommended to have at least 18 inches of clearance; and,
- Preferably access should not require using a ladder greater than 6 feet above the ground.

The FO shall provide the meter instrumentation enclosure to mount at a location selected by the FO. FO I & C Technicians will install the enclosure at the selected location. The instrumentation enclosure shall include:

- Ethermeter communication devices (Dual meter input or single meter (Hi/Lo flow); AMR protocol converter to Modbus/TCP) provided by the Project;
- 24 VDC Power supply;
- Power input (2A fuse block, 10A circuit breaker, distribution);
- Jack Knife switch for individual meter isolation;
- Meter terminals;
- 120 VAC power source disconnect switch; and
- Ether cable to connect communication device to IT data jack port.

All wall mounted enclosures and meter peripherals shall be mounted not to exceed 6 feet from floor and be free of obstacles for serviceability. The instrumentation enclosure door must be able to open at least 90 degrees to allow the components inside the enclosure. The 120 VAC power source will have a disconnect switch installed on the outside of the enclosure. If the 120 VAC disconnect switch is not readily and easily accessible to the meter location, a lockage disconnect switch must be installed.

3 Facilities Operations Sub-Metering Standard Drawing Details

This Section provides the project design standard drawing details for the following utility service sub-metering installations:

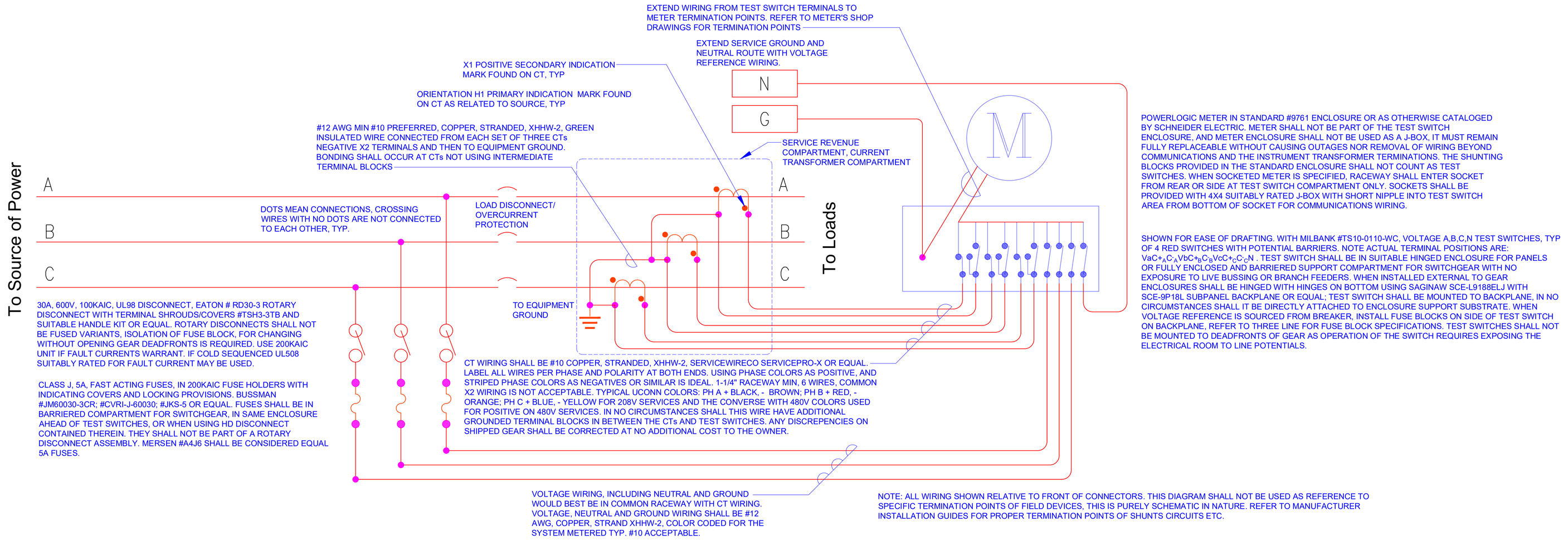
- Electric Meters;
- Steam Meters; and,
- Chilled Water Meters.

If condensate return and/or hot water utility service sub-metering is requested by FO, the Designer should refer to the chilled water meter drawing details for those type of installations.

Attachments: SK-1 Meter Wiring Drawing
Veris Horizontal and Vertical Installation Detail
Transmitter Detail
Veris Meter Length Detail
Flow Profiles

END OF APPENDIX

CONTACT METER ENGINEERING IF THERE ARE QUESTIONS.



POWERLOGIC METER IN STANDARD #9761 ENCLOSURE OR AS OTHERWISE CATALOGED BY SCHNEIDER ELECTRIC. METER SHALL NOT BE PART OF THE TEST SWITCH ENCLOSURE, AND METER ENCLOSURE SHALL NOT BE USED AS A J-BOX, IT MUST REMAIN FULLY REPLACEABLE WITHOUT CAUSING OUTAGES NOR REMOVAL OF WIRING BEYOND COMMUNICATIONS AND THE INSTRUMENT TRANSFORMER TERMINATIONS. THE SHUNTING BLOCKS PROVIDED IN THE STANDARD ENCLOSURE SHALL NOT COUNT AS TEST SWITCHES. WHEN SOCKETED METER IS SPECIFIED, RACEWAY SHALL ENTER SOCKET FROM REAR OR SIDE AT TEST SWITCH COMPARTMENT ONLY. SOCKETS SHALL BE PROVIDED WITH 4X4 SUITABLY RATED J-BOX WITH SHORT NIPPLE INTO TEST SWITCH AREA FROM BOTTOM OF SOCKET FOR COMMUNICATIONS WIRING.

SHOWN FOR EASE OF DRAFTING. WITH MILBANK #TS10-0110-WC, VOLTAGE A,B,C,N TEST SWITCHES, TYP OF 4 RED SWITCHES WITH POTENTIAL BARRIERS. NOTE ACTUAL TERMINAL POSITIONS ARE: $VaC_{+2}C_{-2}VbC_{+3}C_{-3}VcC_{+5}C_{-5}N$. TEST SWITCH SHALL BE IN SUITABLE HINGED ENCLOSURE FOR PANELS OR FULLY ENCLOSED AND BARRIERED SUPPORT COMPARTMENT FOR SWITCHGEAR WITH NO EXPOSURE TO LIVE BUSSING OR BRANCH FEEDERS. WHEN INSTALLED EXTERNAL TO GEAR ENCLOSURES SHALL BE HINGED WITH HINGES ON BOTTOM USING SAGINAW SCE-L9188ELJ WITH SCE-9P18L SUBPANEL BACKPLANE OR EQUAL; TEST SWITCH SHALL BE MOUNTED TO BACKPLANE, IN NO CIRCUMSTANCES SHALL IT BE DIRECTLY ATTACHED TO ENCLOSURE SUPPORT SUBSTRATE. WHEN VOLTAGE REFERENCE IS SOURCED FROM BREAKER, INSTALL FUSE BLOCKS ON SIDE OF TEST SWITCH ON BACKPLANE, REFER TO THREE LINE FOR FUSE BLOCK SPECIFICATIONS. TEST SWITCHES SHALL NOT BE MOUNTED TO DEADFRONTS OF GEAR AS OPERATION OF THE SWITCH REQUIRES EXPOSING THE ELECTRICAL ROOM TO LINE POTENTIALS.

OWNER'S ELECTRICAL METERING SCHEMATIC - SCALE: NONE

3-LINE SCHEMATIC NOTES:

1. ANY REFERENCE TO SWITCHGEAR SHALL BE ALSO READ AS SWITCHBOARD, AND ANY LOAD TO BE METERED. ANY DEVICE THAT CANNOT HAVE SUITABLE BARRIERS, SHALL BE PRESUMED TO REQUIRE AN EXTERNAL CT ENCLOSURE AS MANUFACTURED BY MILBANK, COORDINATE WITH OWNER/ENGINEER. ALL STYLES OF SWITCHGEAR SHALL HAVE CT COMPARTMENTS. ALL CURRENT TRANSFORMER COMPARTMENTS, SOMETIMES REFERENED TO AS UTILITY REVENUE SECTIONS SHALL CONFORM TO EVERSOURCE REQUIREMENTS, BUT MODIFIED AS INDICATED BELOW. JUNCTION BOXES AND SIMILAR WILL NOT BE CONSIDERED CT ENCLOSURES.
2. IT IS ALWAYS PREFERRED TO MAKE VOLTAGE REFERENCE TAPS AHEAD OF MAIN BREAKERS, "HOT-SEQUENCED"; FOR MAIN-TIE-MAIN IT IS NECESSARY TO MONITOR EACH SOURCE APPROPRIATELY. CTS SHALL BE INSTALLED AFTER THE OVER-CURRENT PROTECTION FOR METERED LOAD 'COLD-SEQUENCED'
3. MANY FORMS OF ISOLATION EQUIPMENT WILL MEET INTENT OF DESIGN, BUT IN ALL CASES THE VOLTAGE REFERENCE DISCONNECT SHALL BE PAD-LOCKABLE IN AN UNDEFEATABLE MANNER USING DISCONNECT MOUNTED FIXED PAD LOCKING ACCESSORIES. EVEN WHEN TAP DISCONNECTS ARE CIRCUIT BREAKERS ADDITIONAL FAST BLOW FUSES ARE REQUIRED.
4. INSTRUMENT TRANSFORMERS SHALL BE ANSIIEEE C57.13 RATED MADE AND MARKETED TO REGULATED UTILITY COMPANIES BY COMPANIES KNOWN TO BE ENGAGED IN ACTIVE SALES TO REGULATED UTILITY COMPANIES. INSTRUMENT TRANSFORMERS SHALL BE AFFIXED TO GEAR USING ANSI STYLE MOUNTING PROVISIONS. CURRENT TRANSFORMERS SHALL BE COLD-SEQUENCED UNLESS APPROVED BY OWNER. THEY SHALL NOT BE INSTALLED IN A MANNER BEHIND DRAW-OUT SPADES WHERE DISMANTLING OR RACKING OUT BREAKERS IS NECESSARY TO VERIFY NAMEPLATE INFORMATION, INTEGRAL FACTORY TERMINAL SHUNTING, AND PROPER WIRING.
5. VOLTAGE TRANSFORMERS SHALL NOT BE UTILIZED FOR LOW VOLTAGE SERVICES, UNLESS UNUSUALLY HIGH OR FAULT CURRENTS WELL OVER 100KAIC, COORDINATE WITH OWNER WHEN SUCH CONCERNS ARISE. IF USED VTs SHALL BE RATED 0.3% ACCURACY FOR WMXY ANSI BURDENS, AND SHALL NOT BE USED TO DRIVE CONTROL POWER TO THE METER. CURRENT TRANSFORMERS SHALL BE GE REVENUESENSE SERIES, OR EQUAL. EQUALITY SHALL MEAN 0.15% ACCURATE FROM 1% OF THE PRIMARY CT RATING THROUGH ITS RATING FACTOR, SOMETIMES REFERRED AS EXTENDED RANGE, AND NOT LESS THAN B-0.5 BURDEN CLASS. THE OWNER SHALL DETERMINE EQUIVALENCE OF PROPOSED EQUIPMENT. GENERALLY ALL RATIOS SHALL BE SET BASED UPON 10A SECONDARY CURRENT CAPABLE METERS, UNLESS NOTED, AND MAY BE BAR OR WINDOW STYLE AS NECESSARY TO MOUNT BY SWITCHGEAR MANUFACTURER. WHEN INSTALLED WITHIN TRANSFORMERS/UNIT SUB-STATION EQUIPMENT HIGH TEMPERATURE JAB-0S STYLE UNITS SHALL BE PROVIDED AND MOUNTED TO BUS/LUGS. FOR 3200AMP OR LARGER SERVICES WHERE REVENUESENSE UNITS DO NOT HAVE FULL RANGE AT THE RATING FACTOR ABB CLC-S ACCURANGE SERIES CURRENT TRANSFORMERS SHALL BE USED. ABB ACCURANGE CURRENT TRANSFORMERS HAVING 0.15% ACCURANCY FROM 1% THROUGH THE RATING FACTOR ARE CONSIDERED EQUAL TO THE GE REVENUSENSE CTs. CURRENT TRANSFORMERS SHALL GENERALLY BE SIZED TO DRIVE 10A SECONDARIES AT FULL LOAD, BUT SHALL NOT DRIVE MORE THAN 15A IN ANY CIRCUMSTANCE. SECONDARIES SHALL NOT DRIVE GREATER THAN 10A FOR PM8000 SERIES METERS. COORDINATE FINAL RATIO'S AND TYPES WITH OWNER DURING SUBMITTAL PROCESS.
6. FOR SWITCHGEAR, THE MANUFACTURER SHALL PROVIDE ALL COMPONENTS REQUIRED UP TO TEST SWITCH, AND PROVIDE JUMPERS AT THE OUTPUT LUGS OF THE TEST SWITCHES TO SHUNT THE CTs. FOR PANELBOARDS, COORDINATION SHALL BE MADE TO ENSURE AUXILIARY GUTTER SPACE AS NEEDED IS PROVIDED TO MOUNT CTs. IT SHALL ALWAYS BE ACCEPTABLE TO PROVIDE A FULL INSTRUMENT TRANSFORMER ENCLOSURE AS APPROVED FOR USE BY EVERSOURCE. FOR FIELD WIRED APPLICATIONS THE ELECTRICIAN SHALL COORDINATE EQUIPMENT LAYOUT WITH OWNER, ALL COMPONENTS SHALL REMAIN READILY ACCESSIBLE. NOTE GE CTs ARE FACTORY SHUNTED WITH TERMINAL BLOCKS, THE TERMINAL COVERS MUST BE PROVIDED, AND IT IS RECOMMENDED TO UNSHUNT THEM PRIOR TO SHIPPING AS THE TERMINAL COVERS WILL INSTALL BACKWARDS WHEN SHUNTING ON THE CT. MANUFACTURERS MAY ELECT TO HAVE THEIR FIELD SERVICE TECHS COMPLETE WIRING DURING GEAR COMMISSIONING SERVICES.
7. UNDER NO CIRCUMSTANCE SHALL TEST SWITCHES BE INSTALLED ON DEAD FRONT COVERS UNLESS SUITABLY SIZED COVERS ALLOW SWITCHES TO BE OPENED (SHUNTED), WITH THE COVER FULLY RE-INSTALLED. NO SUCH SWITCHES ARE KNOWN BY THE OWNER TO EXIST.
8. BARRIERED METER COMPARTMENTS MAY ALSO INCLUDE METER FUSING, BREAKER COMMUNICATION EQUIPMENT, AND THE LIKE, BUT SHALL HAVE ISOLATION DISCONNECTS INSTALLED IN SEPARATE BARRIERS OR ON THE DEADFRONTS TO ISOLATE ALL SOURCES OF POTENTIAL FROM COMPARTMENT. CURRENT TRANSFORMERS SHALL NOT BE CONSIDERED SOURCES OF POTENTIAL IN THIS CONTEXT AND SHALL NEVER BE FUSED. THE TAPS UTILIZED MAY ALSO POWER ADDITIONAL SUPPORT POWER, BUT SHALL BE INDEPENDENTLY SWITCHABLE AND SHALL IN NO WAY INHIBIT THE FUNCTION NOR CAUSE THE ACTION OF TRIP UNITS, REVERSE ROTATION PROTECTION OR THE LIKE, OR OTHER COMMUNICATION PROVISIONS, ETC. TRIP-UNIT/CONTROL POWER SUPPLIES AND THE LIKE SHALL BE INSTALLED IN A SEPARATE COMPARTMENT FROM METERING TEST SWITCHES, AND FUSING. VOLTAGE SENSE WIRING FROM BREAKERS SHALL NOT BE TIED INTO AND PART OF VOLTAGE REFERENCE SOURCES FOR METERING. FULL ISOLATION OF POTENTIALS TO METERS VIA DISCONNECT SHALL BE POSSIBLE WITHOUT LOSS OF ANY OTHER SWITCHGEAR FUNCTION TO ALLOW FOR COMPLETE LIVE SERVICE METER REPLACEMENTS, INCLUDING PERIODS OF TIME ISOLATING AND WAITING FOR REPLACEMENT METER COMPONENTS TO ARRIVE.
9. WHEN METER SOCKET SET METERS ARE SPECIFIED THE WIRING TO THE TEST SWITCH IS SUBSTANTIALLY SIMILAR TO SCHEMATIC NOTE. PROVIDE EVERSOURCE APPROVED IT RATED SOCKETS MILBANK #UC7445-O-311-NOE OR EQUAL AS FOUND IN THE LATEST EVERSOURCE INFORMATION AND REQUIREMENTS BOOKLET FOR NEW SERVICES. THE TEST SWITCH IN THE SOCKET SHALL SUFFICE, NO ADDITIONAL TEST SWITCHES ARE REQUIRED.
10. INSTRUMENT TRANSFORMER WIRING SHALL BE IN A SINGLE 1-1/4" CONDUIT MINIMUM. IT MAY BE INSTALLED WITHIN SLABS, BUT SHALL BE SURFACE MOUNTED ON WALLS TO ALLOW FUTURE SWAPPING BETWEEN ENCLOSURE AND SOCKETED STYLE METERS BY OWNER DURING MAINTENANCE REPLACEMENTS. RACEWAY SHALL UTILIZE RACEWAY/CHASE NIPPLES AS NEEDED TO ENTER DIRECTLY INTO CT ENCLOSURES WITHOUT THE NEED OF OPENING CROWN GUTTERS TO PULL WIRING. FROM CT TO METER INPUT SHALL NOT EXCEED FIFTY CIRCUIT FEET.
11. ETHERNET SHALL NEVER BE DIRECTLY BROUGHT INTO ELECTRICAL GEAR WITHOUT AN INTERMEDIATE DATA JACK EXTERIOR TO THE GEAR FOR ISOLATION BETWEEN OWNER'S VARIOUS SERVICE DEPARTMENTS. ALL DATA JACKS SHALL BE READILY ACCESSIBLE. ALL DATA JACKS SHALL BE PER UNIVERSITY ITS STANDARDS AND IDENTIFIED PER THEIR STANDARDS.
12. VARIOUS COMPONENTS MAYBE UTILIZED TO ACHIEVE THE INTENT OF THIS SCHEMATIC, PROPOSED METHODS SHALL BE INCLUDED WITH PANEL/SWITCHBOARD SUBMITTALS. IN NO CIRCUMSTANCE WILL DEVIATIONS FROM WIRING BE ACCEPTED, IN ALL CASES ALL X2 WIRING MUST BE INDEPENDENT PER PHASE, AND NO TEST SWITCH' TERMINAL BLOCK SHALL BE USED FOR BONDING INSTRUMENT TRANSFORMERS. THE EQUIPMENT GROUND FROM CTs SHALL BE LABELED "METERING GROUND, DO NOT DISCONNECT" ANY DEVIATION FOUND BY OWNER IN GEAR SHALL BE CORRECTED AT NO ADDITIONAL COST TO THE OWNER, AND THE CORRECTION SHALL BE TIMELY NOT CAUSING PROJECT DELAY PREVENTING FULL METERING CAPABILITY PRIOR TO OWNER OCCUPANCY OF ANY FORM TO THE SERVICE.
13. WHEN SERVICE IS DERIVED FROM UTILITY CO SYSTEM CIRCUITS, AND UTILITY COMPANY METERING IS REQUIRED, OWNER METERING, WHEN SPECIFIED, SHALL NOT BE PLACE COMMON TO THE UTILITY METERING PROVISIONS. UTILITY METERING PROVISIONS SHALL BE AS REQUIRED BY UTILITY CO SERVING THE GEAR.
14. MEDIUM VOLTAGE METERING SHALL UTILIZE SIMILAR INTENT, BUT UTILIZE ABB ACCURANGE EQUIPMENT WHENEVER POSSIBLE, AND UTILIZE ANSI STANDARD MEANS OF ISOLATING VOLTAGE TRANSFORMERS WITH CURRENT LIMITING PRIMARY PROTECTIONS. EXTENDED RANGE COMBINATION VT/CT UNITS LIKE THE ABB CVC-110ER ARE ACCEPTABLE FOR USE. FULL SHOP DRAWINGS SHALL BE PROVIDED FOR REVIEW BY OWNER. METERING IN THIS CONTEXT SHALL NOT MEAN PLC BASED PROTECTION AND CONTROLS THAT ALSO PROVIDE OPERATING CONDITIONS, WHEN POSSIBLE THEY SHOULD UTILIZE ENHANCED EXTENDED RANGE EQUIPMENT, BUT ULTIMATELY SHALL BE SELECTED FOR RELAYING. WHEN CT ACCURACY IS REDUCED OR UNOPTIMALLY RANGED TO ACCOMMODATE PROTECTIONS IT SHALL NOT BE CONSIDERED METERING EQUIPMENT FOR THE PURPOSE OF CONTRACT EXECUTION. VTs MAY BE UTILIZED TO DRIVE CONTROL POWER IF BURDENS ARE PROVEN TO NOT AFFECT ACCURACY, PROVIDE CALCULATIONS WITH SUBMITTALS.
15. ELECTRICAL METERS PROVIDED BY THE PROJECT SHALL INCLUDE SCHNEIDER POWERLOGIC FACTORY STARTUP AND INTEGRATION SERVICES TO THE EXISTING POWERLOGIC MONITORING SYSTEM. METERS PROVIDED BY THE OWNER WILL GENERALLY BE OWNER COMMISSIONED. COORDINATE INSTALLATION OF AND COMMISSIONING OF METERING EQUIPMENT WITH OWNER. THEY SHALL BE SCHNEIDER POWERLOGIC / ION EQUIPMENT, THERE IS NO EQUAL, UNLESS NOTED OTHERWISE. NO THIRD PARTY STARTUP AND INTEGRATION SERVICES ARE ACCEPTABLE.
16. THE MANUFACTURER SHALL PROVIDE THE SERIALIZED FACTORY TEST SLIPS FROM ALL INSTRUMENT TRANSFORMERS PROVIDED DEMONSTRATING CONFORMANCE TO ANSI C57.13 AND THE IT CORRECTION FACTORS. IN THE EVENT THESE TEST SLIPS ARE MISPLACED THEY SHALL BE REPRODUCED/RE-TESTED AT NO COST TO THE OWNER, ALL TESTING TO BE DONE BY THE INSTRUMENT MANUFACTURE IN THE NORMAL MANNER THEY TEST INSTRUMENT TRANSFORMERS. PROVIDE THESE SLIPS TO THE OWNER DURING UNCRATING/SETUP DURING THE INITIAL INSPECTION BY OWNER, PRIOR TO ENERGIZING TO ALLOW VERIFICATION BY OWNER.
17. ANY MANUFACTURER EXCEPTIONS TAKEN TO THE REQUIRED OWNERS METER WIRING, OR REQUIRED BARRIERED COMPARTMENTS, CT ACCURACY, ETC ARE HEREBY REJECTED BY OWNER. THE MANUFACTURER SHALL BE REQUIRED CORRECT DEFICIENCIES AT NO ADDITIONAL COST TO THE OWNER. METERING PROVISIONS SHALL BE INSTALLED PRIOR TO ENERGIZING SERVICES. UNDER NO CIRCUMSTANCES SHALL ADDITIONAL COST BE BORN BY THE OWNER TO ACCOMMODATE CONTRACTOR SCHEDULE IF DELAYS IN INSTALLING METERING OCCUR, AND PROVISIONAL ALLOWANCE OF DEVIATIONS AFFORDED BY THE OWNER DO NOT RELEASE THE CONTRACTOR FROM ULTIMATELY PROVIDING THE REQUIRED METERING SYSTEMS AND COMPONENTS. METERING INSTALLED WITHIN SWITCHGEAR FROM THE FACTORY, SHALL BE RELOCATED TO REMOTE MOUNTED, AT NO ADDITIONAL COST TO THE OWNER. THE OWNER WILL REVIEW PROPOSED ACCOMMODATIONS DURING SUBMITTALS FOR CASE SPECIFIC INSTANCE, ANY ACCOMMODATION APPROVED BY THE OWNER SHALL NOT INCUR ADDITIONAL COST TO THE OWNER, NOR SHALL REFUSAL TO ACCEPT DEVIATION.
18. SPECIFIED CTS ARE ANSI RATED, IF MANUFACTURER WILL NOT INSTALL ON BUSSING THEN CT ENCLOSURES SHALL BE PROVIDED BY MANUFACTURER AT NO ADDITIONAL COST TO THE OWNER AS REQUIRED EQUIPMENT TO UTILIZE THEIR EQUIPMENT IN A FULLY UL LISTED MANNER AS DETERMINED BY THEIR INTERNAL ENGINEERING PRACTICES THE SAME WAY A NORMAL UTILITY METERED WOULD BE UTILIZED.
19. WHEN CT ENCLOSURES ARE PROVIDED IN SWITCHGEAR THEY SHALL CONFORM TO THE REQUIREMENTS OF EVERSOURCE WITH THE FOLLOWING MODIFICATIONS. THE ENCLOSURE DOOR LOCKSETS SHALL NOT UTILIZE EVERSOURCE SPECIFIC KEYS. WITHIN THE ENCLOSURE THE VOLTAGE REFERENCE TAPS SHALL BE TERMINATED TO TERMINAL BLOCKS, INCLUSIVE OF NEUTRAL AND GROUND. THE NUETRAL MAY USE THE STANDARD PROVISION, THE GROUND SHALL ACCEPT NOT LESS THEN TWO FIELD TERMINATION POINTS FOR USE TO BOND THE CTS AND EXTEND GROUND TO METER. ALL TERMINALS SHALL BE SIZED TO ACCOMMODATE #10 COPPER WIRING SIMILAR TO PHOENIX TERMINAL BLOCKS WITH MECHANICAL SCREW TERMINAL PROVISIONS. THE EQUIPMENT MAY BE MOUNTED TO THE VT MOUNTING BAR, BUT IN NO CIRCUMSTANCE SHALL ANY EQUIPMENT BE MOUNTED ON THE ENCLOSURE DOORS. WHEN UTILIZING VTS DISCONNECTS SHALL BE PROVIDED ON THE PRIMARIES WITH PRIMARY AND SECONDARY FUSING, UTILIZE SHAFT OPERABLE DISCONNECTS WITH DOOR MOUNTED OPERATING HANDLES, COORDINATE WITH OWNER DURING SHOP SUBMITTALS OR DURING BID AS RFI. WHEN CT ENCLOSURES ARE PROVIDED FOR LOADS OTHER THAN SWITCHGEAR, THEY SHALL BE SIMILARLY RATED WITH SIMILAR KEYS AS ABOVE, BUT VOLTAGE TAPS SHOULD BE PROVIDED VIA EXTERNAL MEANS. UTILIZE EXTERNAL HD DISCONNECT FROM VT TAP POINTS OR BREAKER FROM PANEL/LOAD SERVED AND PROVIDE EXTERIOR TEST SWITCH PROVISIONS.
20. COORDINATE INSTALLATION AND COMMISSIONING WITH UCONN METER SHOP.
21. ALL METER WIRING SHALL BE COLOR CODED AS INDICATED, USE OF SINGLE COLOR WIRE WITH PRINTED LABELING IS NOT ACCEPTABLE. DO NOT USE TERMINAL BLOCKS BETWEEN CURRENT TRANSFORMERS AND TEST SWITCH. THE METERING CONDUCTORS SHALL BE VISUALLY TRACEABLE FROM THE CTS TO THE TEST SWITCH, AND TO THE METER. CONNECTION POINTS SHALL BE FACTORY LABELED, AND NOT REQUIRE SHOP DRAWINGS TO DECIPHER.

Architect/Engineer

BRIAN McKEON PE
ELECTRICAL ENGINEER

REVISIONS

Mark	Date	Description
0	8/20/19	FOR USE BY PROJECTS
1	12/12/19	FIXED NOTE NUMBERING REPEATS
2	1/20/21	CLARIFICATIONS CT ENCLOSURES
3	10/18/22	CORRECT ISSUES FROM PROJECTS
4	4/21/24	CLARIFICATIONS FOR STANDARDS

UNIVERSITY OF CONNECTICUT
FACILITIES OPERATIONS
STORRS, CONNECTICUT
http://www.fo.uconn.edu

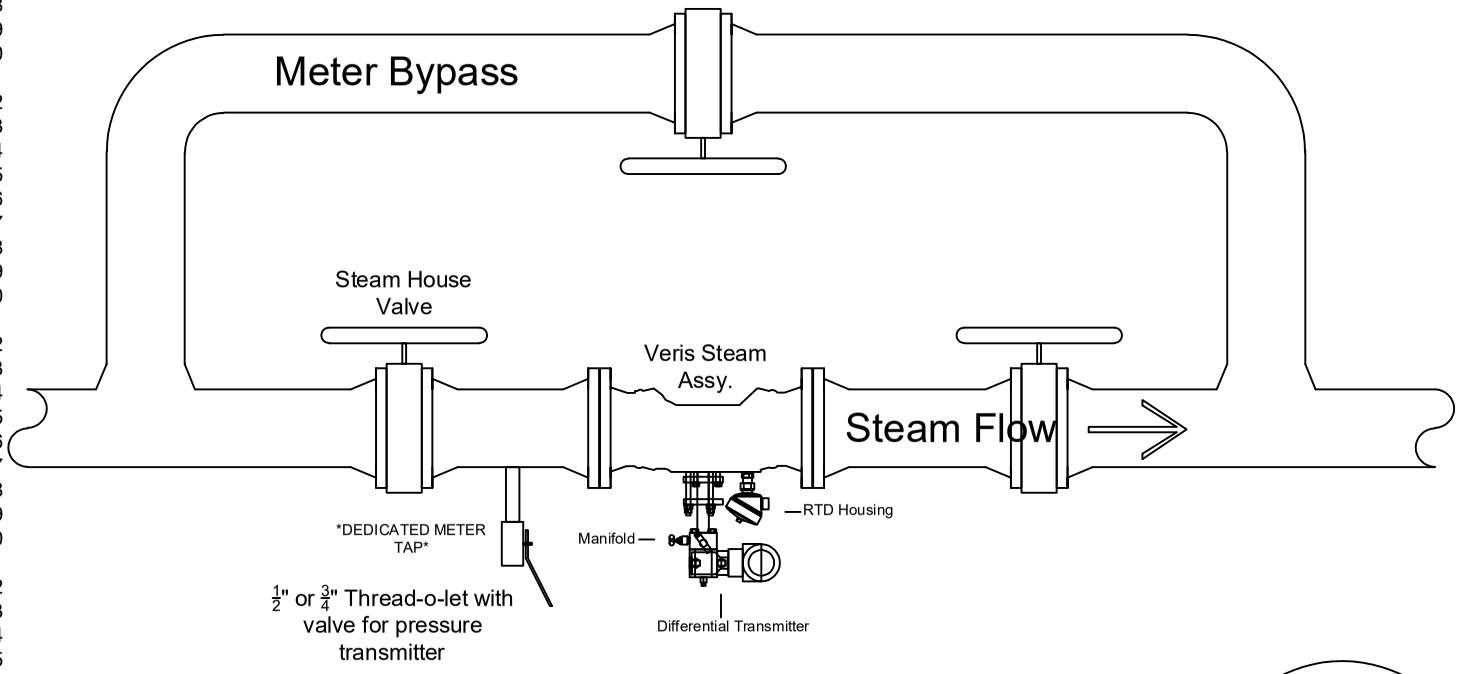
Drawing Title: ELECTRICAL METERING THREE LINE SCHEMATIC

Date: 4/21/24
Scale: NTS
Drawn by: BMM
Approved by: ---
Drawing No.: SK-1

Project: OWNER'S METER WIRING

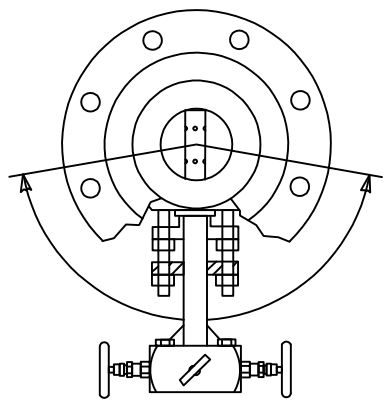
Project No.: -
CAD File No.:

Horizontal Install Guidelines



For **Horizontal** Installs the following must be adhered:

1. As much as possible, meter sensors must be installed with sensor below the meter at 6 O'Clock position (See Diagram). Deviations can be made but permissions must be granted on a case by case basis, as this affects accuracy of metering parameters.
2. Meter must be installed directly downstream of main isolation valve.
3. Meter must not be obstructed.
4. See STEAMMETER-2 DWG for transmitter assembly details.

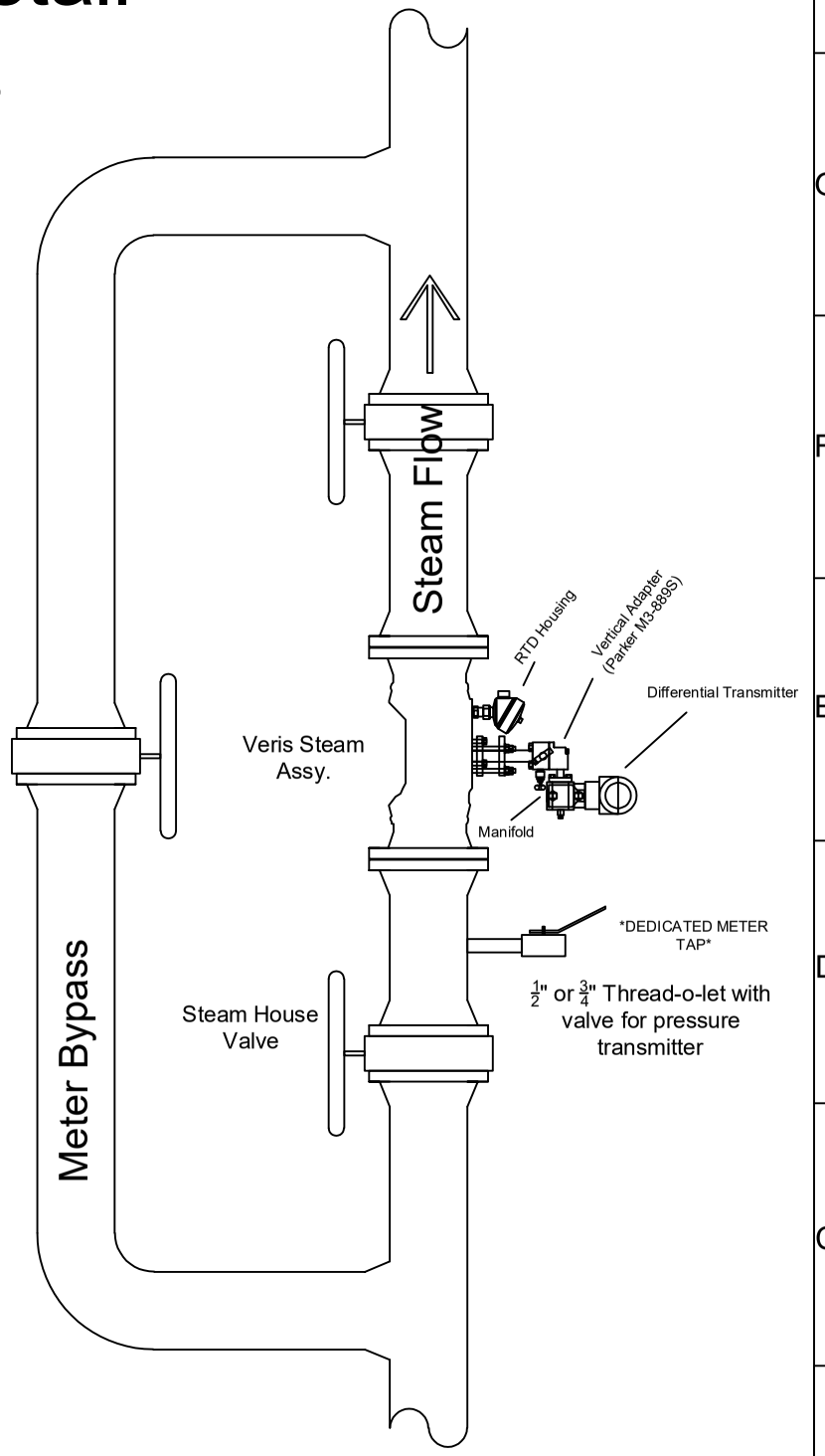


*Required Orientation 160 degrees

Vertical Install Guidelines

For **Vertical** Installs the following must be adhered:

1. Flow must be in an upwards direction
2. Meter must be installed directly downstream of main isolation valve.
3. Meter sensor orientation is not specific.
4. Meter must not be obstructed, and must be serviceable from multiple directions.
5. See STEAMMETER-2 DWG for transmitter assembly details.



The following parameters shall be adhered to per UConn FO Metering Standard:

1. Meters should be installed with by-pass design wherever possible. Not all applications can support this.
2. Meters must capture all building services, therefore installation must be directly after main isolation valves.
3. Thread-O-Lets shall be installed prior to meter, to allow for a pressure transmitter to capture pre meter pressures due to pressure drop.
   - 3.1. Preferrably within 24 inches of meter body.
4. Thread-O-Lets shall be either 1/2" or 3/4", and must be accompanied by a nipple and steam rated isolation valve. Valve shall not be buried in insulation therefore nipple must be at length that allows clearance.
5. Meter assembly (all electronics included) must have acceptable clearances to allow for preventative maintenance and calibration. Recommended to have at least 18 inches of clearance.
6. Meters shall be installed at a workable height.
7. Meters shall not be installed in obstructed piping arrangements.
8. Orientation is very specific, and meters must be ordered as such. Deviation from meter orders is not acceptable
   - 8.1. When ordering meter, horizontal or vertical orientation must be specified.
   - 8.2. Vertical installations require adapter M3-889S (Parker) in order to protect the transmitter.
9. Meters shall not be insulated with fiberglass insulation, customized blankets are required to be installed. All Electronics must be in atmosphere and not buried in insulation.
10. Use of a steam separator or strainer prior to meter is desired however is not shown here.

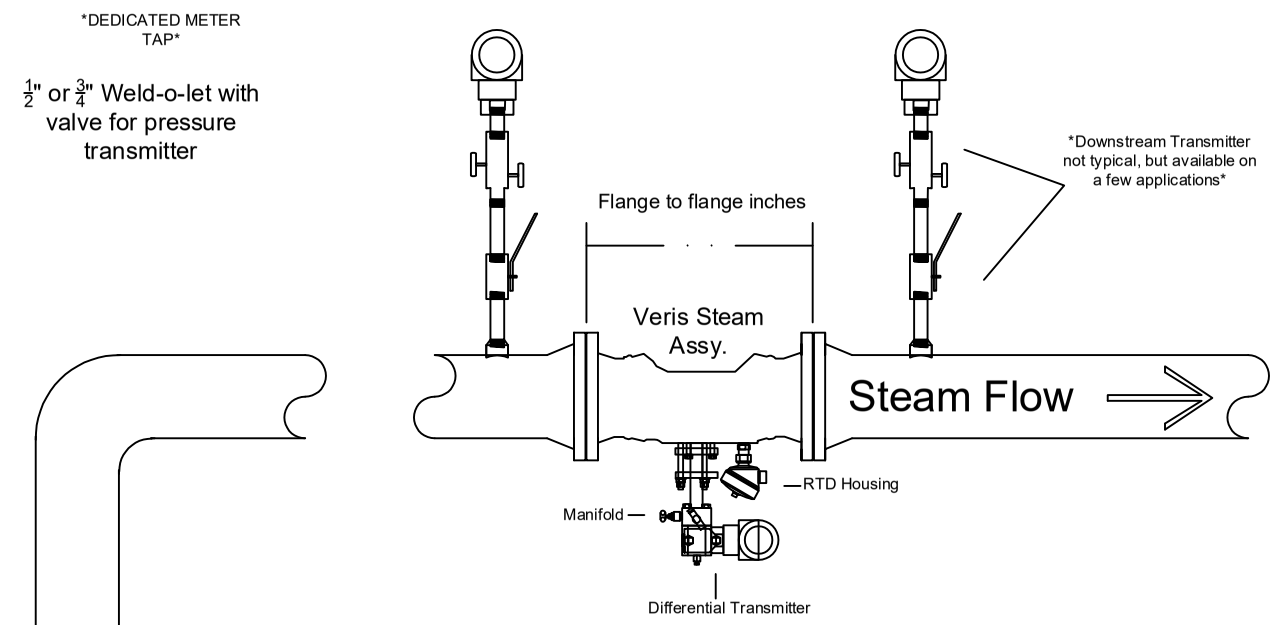
REVISIONS

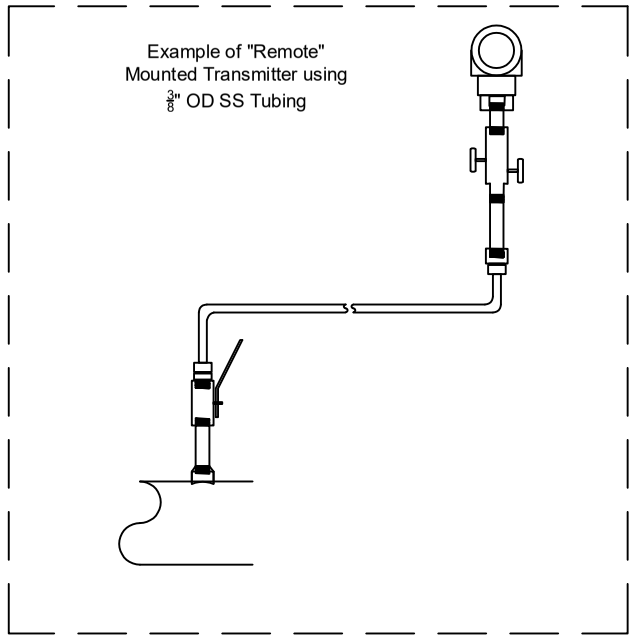
REV.	DATE	DESCRIPTION	APPROVALS
0	3-29-24	Initial Document	RJN

UNIVERSITY OF CONNECTICUT
FACILITIES OPERATIONS – UTILITIES
STORRS, CONNECTICUT

Drawing Title: METERING VERIS DETAIL	Date: 03/29/2024
	Scale: None
Project: Building Metering Description of installation methods for horizontal and vertical installs and necessary parameters.	Drawn by: Roger Nadeau
	Approved by:
	Drawing No.: STEAMMETER-1
CAD File Location: Sharepoint:\\FacilitiesOperations\Energy Conservation & Metering_Building Sub-Metering Program_App H - Meter Installation Information\Meter Design Standards\Meter Drawings	Revision No.: 0

REVISIONS			
REV.	DATE	DESCRIPTION	APPROVALS
0	3-22-24	Initial Document	RJN



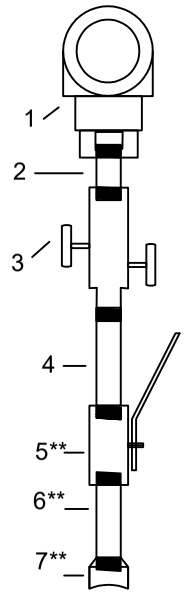


Transmitter Assembly

1. Transmitter (0-160 PSIG)
2. 1/2" x 1 1/2" SS316 Nipple
3. 2-Way Manifold
4. Piston Siphon
5. 1/2" - 300 PSIG (x2) Steam Rated Valve
6. 1/2" x 4" Sch80 Nipple
7. 1/2" Thread-o-let

***If a 3/4" Weld-o-let is prefered, we would reduce Primary Valve to 1/2". All instrumentation is 1/2" NPT.

Typically Metering takes over after valve install.



For **Horizontal** Installs the following must be adhered:

1. As much as possible, meter sensors must be installed with sensor below the meter at 6 O'Clock position (See below Diagram). Deviations can be made but permissions must be granted on a case by case basis.
2. Meter must be installed downstream of main isolation valve.
3. Meter must not be obstructed.

UNIVERSITY OF CONNECTICUT
FACILITIES OPERATIONS – UTILITIES
STORRS, CONNECTICUT

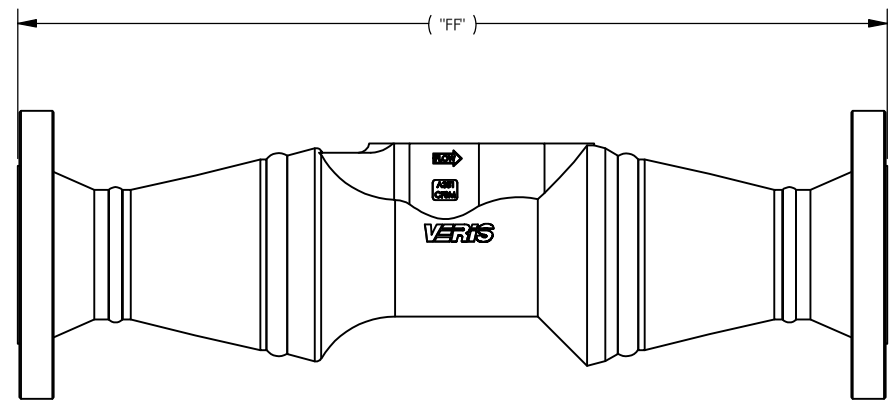
Drawing Title METERING Transmitter Detail	**Date** 03/22/2024
	Scale None
Project Building Metering Guidance on installation requirements for pressure transmitter and assembly.	**Drawn by** Roger Nadeau
	Approved by
	Drawing No. STEAMMETER-2
CAD File Location Sharepoint:\\FacilitiesOperations\Energy Conservation & Metering_Building Sub-Metering Program_App H - Meter Installation Information\Meter Design Standards\Meter Drawings	**Revision No.** 0

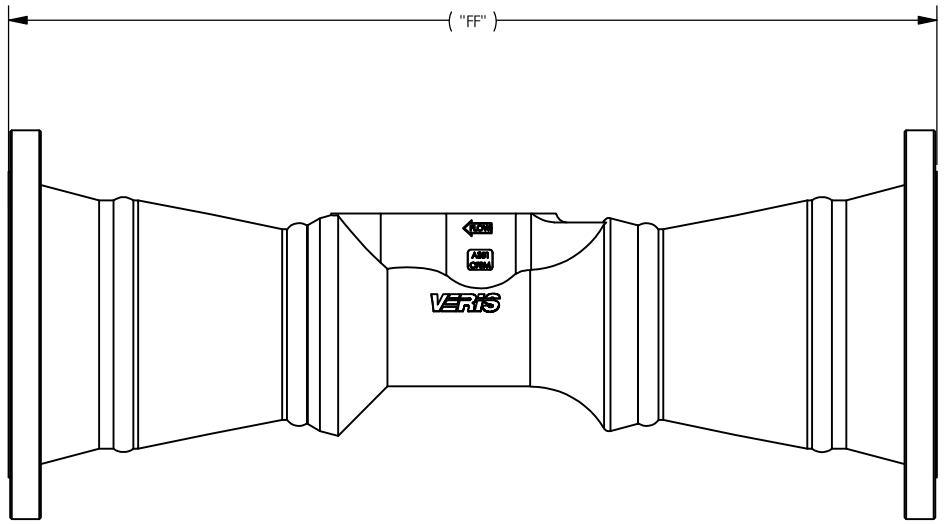
REVISIONS			
REV.	DATE	DESCRIPTION	APPROVALS
0	3-22-24	Initial Document	RJN

BODY SIZE & RED/EXP SIZE	FLANGE SIZE AND RATING	FACE TO FACE "FF"
1" R010.75	.75" 150LB	15.125.25 ±
	.75" 300LB	15.500.25 ±
	.75" 600LB	16.000.25 ±
1" E0101.5	1.5" 150LB	16.875.25 ±
	1.5" 300LB	17.375.25 ±
	1.5" 600LB	18.000.25 ±
1" E0102	2" 150LB	18.000.25 ±
	2" 300LB	18.500.25 ±
	2" 600LB	19.250.25 ±
2" R0201	1" 150LB	18.375.25 ±
	1" 300LB	18.875.25 ±
	1" 600LB	19.375.25 ±
2" R0201.25	1.25" 150LB	18.500.25 ±
	1.25" 300LB	19.125.25 ±
	1.25" 600LB	19.750.25 ±
2" R0201.5	1.5" 150LB	18.875.25 ±
	1.5" 300LB	19.375.25 ±
	1.5" 600LB	20.000.25 ±
2" E0202.5	2.5" 150LB	20.500.25 ±
	2.5" 300LB	21.000.25 ±
	2.5" 600LB	21.750.25 ±
2" E0203	3" 150LB	20.500.25 ±
	3" 300LB	21.250.25 ±
	3" 600LB	22.000.25 ±
2" E0204	4" 150LB	22.00.25 ±
	4" 300LB	22.750.25 ±
	4" 600LB	24.500.25 ±
3" R0302	2" 150LB	20.180.25 ±
	2" 300LB	20.680.25 ±
	2" 600LB	21.430.25 ±
3" R0302.5	2.5" 150LB	20.680.25 ±
	2.5" 300LB	21.180.25 ±
	2.5" 600LB	22.680.25 ±
3" E0304	4" 150LB	22.180.25 ±
	4" 300LB	22.930.25 ±
	4" 600LB	24.680.25 ±
3" E0305	5" 150LB	25.180.25 ±
	5" 300LB	25.930.25 ±
	5" 600LB	27.680.25 ±
3" E0306	6" 150LB	26.180.25 ±
	6" 300LB	26.930.25 ±
	6" 600LB	28.930.30 ±
4" R0402	2" 150LB	22.050.25 ±
	2" 300LB	22.550.25 ±
	2" 600LB	23.300.25 ±
4" R0402.5	2.5" 150LB	22.550.25 ±
	2.5" 300LB	23.050.25 ±
	2.5" 600LB	24.550.25 ±
4" R0403	3" 150LB	22.550.25 ±
	3" 300LB	23.300.25 ±
	3" 600LB	24.050.25 ±
4" E0405	5" 150LB	26.050.25 ±
	5" 300LB	26.800.25 ±
	5" 600LB	28.550.25 ±
4" E0406	6" 150LB	27.050.25 ±
	6" 300LB	27.800.25 ±
	6" 600LB	29.800.30 ±

BODY SIZE & RED/EXP SIZE	FLANGE SIZE AND RATING	FACE TO FACE "FF"
4" E0408	8" 150LB	29.100.30 ±
	8" 300LB	29.850.30 ±
	8" 600LB	32.100.30 ±
6" R0603	3" 150LB	28.550.30 ±
	3" 300LB	29.300.30 ±
	3" 600LB	30.050.30 ±
6" R0604	4" 150LB	29.050.30 ±
	4" 300LB	29.800.30 ±
	4" 600LB	31.550.30 ±
6" R0605	5" 150LB	30.050.30 ±
	5" 300LB	30.800.30 ±
	5" 600LB	32.550.30 ±
6" E0608	8" 150LB	32.100.30 ±
	8" 300LB	32.850.30 ±
	8" 600LB	35.100.30 ±
6" E0610	10" 150LB	34.100.30 ±
	10" 300LB	35.350.30 ±
	10" 600LB	38.600.35 ±
8" R0804	4" 150LB	31.350.30 ±
	4" 300LB	32.100.30 ±
	4" 600LB	33.850.30 ±
8" R0805	5" 150LB	32.350.30 ±
	5" 300LB	33.100.30 ±
	5" 600LB	34.850.30 ±
8" R0806	6" 150LB	32.350.30 ±
	6" 300LB	33.100.30 ±
	6" 600LB	35.100.30 ±
8" E0810	10" 150LB	35.400.30 ±
	10" 300LB	36.650.38 ±
	10" 600LB	39.900.38 ±
8" E0812	12" 150LB	38.400.38 ±
	12" 300LB	39.650.38 ±
	12" 600LB	42.150.38 ±
10" R1006	6" 150LB	36.100.38 ±
	6" 300LB	36.850.38 ±
	6" 600LB	38.850.38 ±
10" R1008	8" 150LB	37.150.38 ±
	8" 300LB	37.900.38 ±
	8" 600LB	40.150.38 ±
10" E1012	12" 150LB	40.150.38 ±
	12' 300LB	41.400.38 ±
	12" 600LB	43.900.38 ±
10" E1014	14" 150LB	51.150.38 ±
	14" 300LB	52.400.38 ±
	14" 600LB	54.650.38 ±
12" R1208	8" 150LB	41.170.38 ±
	8" 300LB	41.920.38 ±
	8" 600LB	44.17038 ±
12" R1210	10" 150LB	41.170.38 ±
	10" 300LB	42.420.38 ±
	10" 600LB	45.670.38 ±
12" E1214	14" 150LB	53.170.38 ±
	14" 300LB	54.420.38 ±
	14" 600LB	56.670.38 ±
12" E1216	16" 150LB	55.170.38 ±
	16" 300LB	56.670.38 ±
	16" 600LB	59.670.38 ±

REVISIONS			
REV.	DESCRIPTION	DRAWN	DATE
A	FIRST DRAFT	AO	05/03/2016





Details provided by Armstrong Veris

UNLESS OTHERWISE SPECIFIED	VERIS Flow Measurement Group	ACCELABAR DIMENSIONS
DIMENSIONS ARE IN INCHES	armstronginternational.com/veris	FACE TO FACE
TOLERANCES: .X ±.03 .XX ±.010 .XXX ±.005 X° ±3°	6315 Monarch Park Place Niwot, CO 80503 USA Phone: (303) 652-8550 Fax: (303) 652-8552	DATE: 5/3/2016 DWG. NO. SUB-8107 SCALE: NTS REV: A PAGE 1 OF 1

UNIVERSITY OF CONNECTICUT
FACILITIES OPERATIONS – UTILITIES
STORRS, CONNECTICUT

Drawing Title: METERING VERIS DETAIL	Date: 03/29/2024
	Scale: None
Project: Building Metering Veris meter lengths.	Drawn by: Roger Nadeau
	Approved by
	Drawing No.: STEAMMETER-3
CAD File Location: Sharepoint:\\FacilitiesOperations\Energy Conservation & Metering_Building Sub-Metering Program_App H - Meter Installation Information\Meter Design Standards\Meter Drawings	Revision No.: 0

Transducer Install Guidelines for Various Scenarios

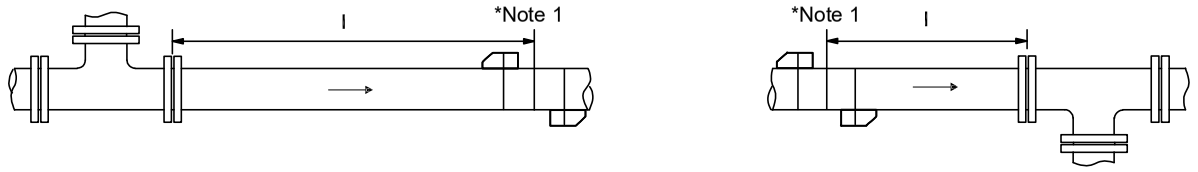
REVISIONS			
REV.	DATE	DESCRIPTION	APPROVALS
0	3-29-24	Initial Document	RJN

Recommended distance from disturbance sources
D = nominal pipe diameter at the measuring point, l = recommended distance

Disturbance source: Tee

Supply line: l ≥ 50 D

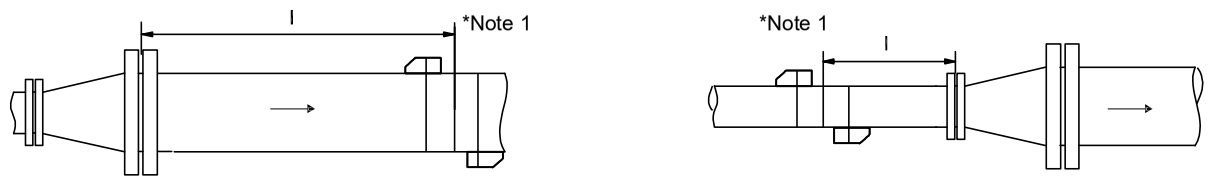
Return line: l ≥ 10 D



Disturbance source: Diffuser

Supply line: l ≥ 30 D

Return line: l ≥ 5 D

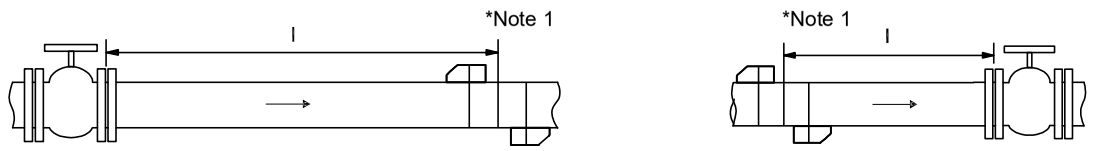


Disturbance source: Valve

*This is for any valve not considered 100% Open I.E.: Control Valves, Mixing Valves
PLACEMENT AFTER BUILDING ISOLATION VALVE IS ACCEPTABLE

Supply line: l ≥ 40 D

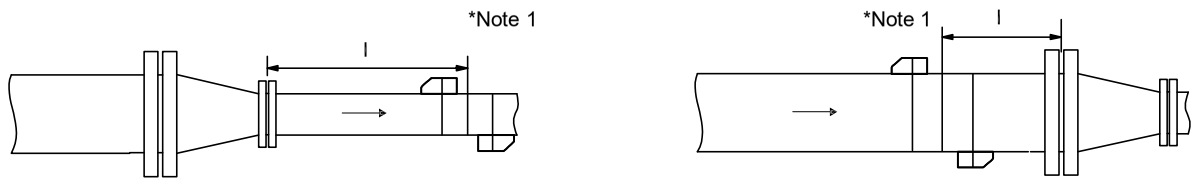
Return line: l ≥ 10 D



Disturbance source: Reducer

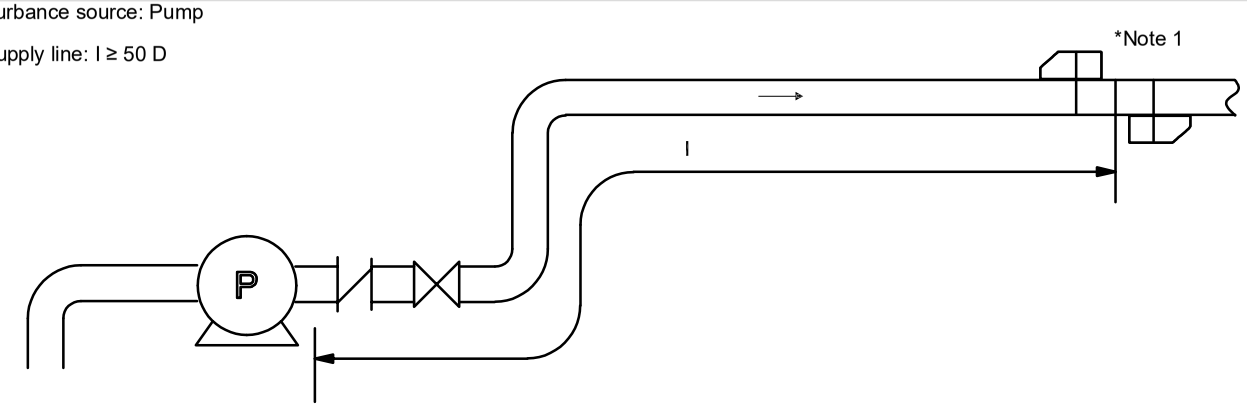
Supply line: l ≥ 10 D

Return line: l ≥ 5 D



Disturbance source: Pump

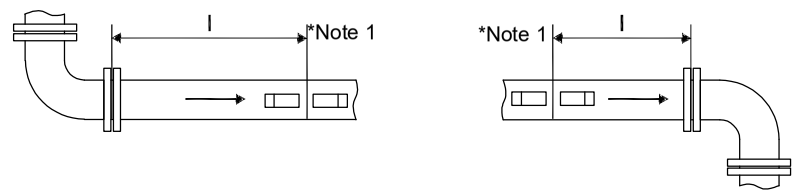
Supply line: l ≥ 50 D



Disturbance source: 90° Elbow

Supply line: l ≥ 40 D

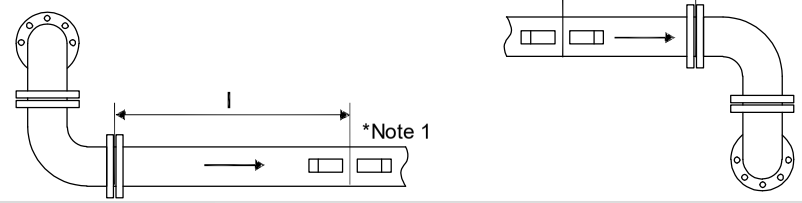
Return line: l ≥ 5 D



Disturbance source: 2 x 90° elbows on different planes

Supply line: l ≥ 40 D

Return line: l ≥ 5 D



Disturbance source: Less Than 90° bends.

Per discussions with flow profile Engineers:

- Under NO circumstances should an ultrasonic transducer be placed after any setup deviated from this sheet.
- Under NO circumstances should an ultrasonic transducer be placed before any setup deviated from this sheet.
- Should no alternative be available, exploration of dual or quad beam setups should be explored and tested prior to permanent installation of metering.
- It is at the discretion of the UConn Metering Shop that these scenarios be engineered out due to inability to provide flow profiles to adequately measure sources repeatedly and consistently with alternate measuring standards.

*Note 1

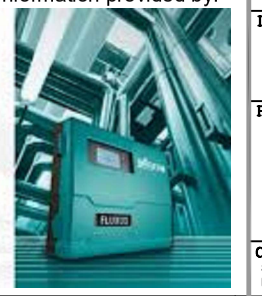
Regardless of image details the following shall apply:

1. Transducers shall be mounted on Horizontal Lines at the 3 O'Clock and 9 O'Clock positions
2. Transducers shall be mounted on Vertical lines in the Positive Flow Up position, any direction as long as they are maintainable.

Information provided by:

EMERSON

FLEXIM
when measuring matters



UNIVERSITY OF CONNECTICUT
FACILITIES OPERATIONS – UTILITIES
STORRS, CONNECTICUT

Drawing Title: METERING Flow Profiles	Date: 03/29/2024
	Scale: None
Project: Building Metering Guidance on Transducer Installation Parameters	Drawn by: Roger Nadeau
	Approved by:
	Drawing No.: CHWMETER-1
CAD File Location: Sharepoint:\\FacilitiesOperations\Energy Conservation & Metering_Building Sub-Metering Program_App H - Meter Installation Information\Meter Design Standards\Meter Drawings	Revision No.: 0