REC 16-433

**WES Energy & Environment, LLC**
902 Market Street
Meadville, PA 16335
Office: (814) 336-1284

NHPUC 11APR'16PM1:09

April 7, 2016

Debra A. Howland
Executive Director
New Hampshire Public Utilities Commission
21 South Fruit Street, Suite 10
Concord, NH 03301-2429

**Re: Application for Class I Thermal Renewable Energy Source Eligibility for Canterbury Elementary School**

Dear Ms. Howland,

Enclosed is Shaker Regional School District's application for Class I Thermal Renewable Energy Source eligibility for Canterbury Elementary School. This facility completed its pellet boiler installation in fall 2015, has complied with best management practices, and has implemented a metering protocol to meet the metering rules as per PUC 2506.

WES E&E thanks the PUC staff for all their efforts in making the Thermal RECs in NH a reality, and is pleased to submit this application. Please do not hesitate to call either Shaker Regional School District or me with any questions or clarifications on the application.

Sincerely,

WES Energy and Environment, LLC

Daniel A. Wilson
Vice President

**Attachments:**

- Canterbury Elementary School TREC Application

# State of New Hampshire
# Public Utilities Commission

21 S. Fruit Street, Suite 10, Concord, NH 03301-2429

**DRAFT**

**APPLICATION FORM FOR**

## RENEWABLE ENERGY SOURCE ELIGIBILITY FOR CLASS I THERMAL SOURCES WITH RENEWABLE THERMAL ENERGY CAPACITY GREATER THAN 150,000 BTU/HR

*Pursuant to New Hampshire Administrative Code PUC 2500 Rules*

- Please submit one (1) original and two (2) paper copies of the completed application and cover letter* to:

  Debra A. Howland
  Executive Director
  New Hampshire Public Utilities Commission
  21 South Fruit Street, Suite 10
  Concord, NH 03301-2429

- Send an electronic version of the completed application and the cover letter electronically to executive.director@puc.nh.gov.

* The cover letter must include complete contact information and identify the renewable energy class for which the applicant seeks eligibility. Pursuant to PUC 2505.01, the Commission is required to render a decision on an application within 45 days of receiving a completed application.

If you have any questions please contact Barbara Bernstein at (603) 271-6011 or Barbara.Bernstein@puc.nh.gov.

**Only facilities that began operation after January 1, 2013 are eligible.**

Is this facility part of a Commission approved aggregation?

Yes X No ____

Aggregator's Company Name: WES Energy & Environment, LLC

Aggregator Contact Information: 902 Market St, Meadville, PA 16335 (814) 336-1284
dan@wesenergyandenvironment.com

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# Attachment Labeling Instructions

**Please label all attachments by Part and Question number to which they apply (e.g. Part 3-7). For electronic submission, name each attachment file using the Owner Name and Part and Question number (e.g. Pearson Part 3-7).**

# Part 1. General Application Information

Please provide the following information:

## Applicant

Name: Shaker Regional School District / SAU80

Mailing Address: 58 School Street

Town/City: Belmont State: NH Zip Code: 03220

Primary Contact: Douglas Ellis

Telephone: (603) 267-9223 x 5309 Cell: (603) 630-7309

Email Address: dellis@sau80.org

## Facility

Name: Canterbury Elementary School

Physical Address: 15 Baptist Road

Town/City: Canterbury State: NH Zip Code: 03224

If the facility does not have a physical address, the Latitude: _____ & Longitude _____

## Installer

Name: Froling Energy

Installer License Number: n/a

Mailing Address: 590 Hancock Road

Town/City: Peterborough State: NH Zip Code: 03458

Primary Contact: Mark Froling

Telephone: (603) 924-1001 Cell: n/a

Email Address: mark@frolingenergy.com

If the equipment was installed by the facility owner, check here: ☐

Note: The seller of the equipment was Froling Energy.

## Facility Operator

If the facility operator is different from the owner, please provide the following:

Name: _____

Facility Operator Telephone Number: _____

## Independent Monitor

Name: Adam Kohler, P.E.

Mailing Address: 306 Hall Road

Town/City: Barrington State: NH Zip Code: 03825

Primary Contact: Adam Kohler, P.E.

Telephone: use cell Cell: (603) 969-6459

Email Address: adam.kohlerandlewis@gmail.com

## NEPOOL/GIS Asset ID and Facility Code

***In order to qualify your facility's thermal energy production for RECs, you must register with the NEPOOL – GIS. Contact information for the GIS administrator follows:***

**James Webb**
**Registry Administrator, APX Environmental Markets**
224 Airport Parkway, Suite 600, San Jose, CA 95110
Office: 408.517.2174
jwebb@apx.com

Mr. Webb will assist you in obtaining a GIS facility code and an ISO-New England asset ID number.

GIS Facility Code # NON71500 Asset ID # n/a

1. Has the facility been certified under another non-federal jurisdiction's renewable portfolio standards?

Yes [ ] No [X]

If you selected yes, *please provide proof of certification in the form of an attached document as Attachment 1-1.*

*2. Attach any supplementary documentation that will help in classification of the facility as Attachment 1-9*

# Part 2. Technology Specific Data

## All Technologies

Fuel type (solar, geothermal, or biomass): biomass (wood pellets)

Rated Thermal Capacity (Btu/hr): 511,821 Btu/hr (0.15 MW)

Date of initial operation using renewable fuels: 10/16/2015

### Biomass

If a thermal biomass facility, provide proof of New Hampshire Department of Environmental Services approval that the facility meets the emissions requirements set forth in Puc 2500, as Attachment 2-1.

### Solar Thermal

If a solar thermal facility, please provide the Solar Rating and Certification Corporation rating based on Mildly Cloudy C (kBtu/day): _____

### Geothermal

If a geothermal facility, please provide the following:

The coefficient of performance (COP): _____

The energy efficiency ratio of the system: _____

## Part 3. Metering and Measurement of Thermal Energy and REC Calculations

This section deals with the thermal metering system including methods for calculation and reporting useful thermal energy. **A copy of PUC 2506.04 of the RPS rules is included as Appendix A.**

Using the table below, identify the thermal metering system or custom components (e.g., heat meters, flow meters, pressure and temperature sensors) used to measure the useful thermal energy and enter the accuracy of measurement for the entire system:

| System or Component | Product name | Product Manufacturer | Model No. |
|---|---|---|---|
| (see attachment 3-1) | | | |
| | | | |
| | | | |
| | | | |
| Total System Accuracy (Percent) | | | |

*Attach component specification sheets (Accuracy, Operating Ranges) as Attachment 3-1.* X

*Attach a simple schematic identifying the location of each sensor that is part of the metering system as Attachment 3-2.* X

Check the applicable standard for meter accuracy prescribed in Puc 2506.04 among the six choices below (compliance with Puc 2506.04 shall be certified by a professional engineer licensed by the state of New Hampshire and in good standing):

*If the facility is a large thermal source using a liquid or air based system, check the method that applies:*

A. Installation and use of heat meters capable of meeting the accuracy provisions of European Standard EN 1434 published by CEN, the European Committee for Standardization. The heat meter shall have the highest Class flow meter that will cover the design flow range at the point of measurement and a temperature sensor pair of Class 5K or lower. [X]

B. Installation and use of meters that do not comply with European Standard EN 1434, provided that the manufacturers' guaranteed accuracy of the meters is ±5.0% or better, [ ]

C. Use of an alternative metering method approved pursuant to Puc 2506.06. [ ]

*If the facility is a large thermal source using a steam-based system, check the method that applies:*

D. Installation and use of meters with accuracy of ±3.0% or better. [ ]

E. Installation and use of meters with system accuracy that do not meet D but are ±5% or better. [ ]

F. Use of an alternative metering method approved pursuant to Puc 2506.06. [ ]

Please summarize the manufacturer's recommended methods and frequency for metering system calibration and provide reference for source document (e.g. owners/operators manual):

see attachment 3-3

REC Calculation Discount factor for meter accuracy (Enter 0 if no discount is required): 0 %

If the meters used to measure useful thermal energy comply with the accuracy of the European Standard EN 1434 for liquid systems or use of meters with accuracy of ±3.0% or better for steam systems enter zero, for all other systems enter the sum total of the manufacturer's guaranteed accuracy of the meters used or the accuracy of the alternative method approved pursuant to Puc 2506.06.

REC Calculation Discount factor for operating energy and thermal energy losses: 2 %

*Check the method used for determining the operating energy and thermal loss factor among the choices below:*

**Default Factor** 2%

- For sources using solar thermal technology, the discount factor shall be 3.0% of the useful thermal energy produced;
- For sources using geothermal technology, the discount factor shall be 3.6% of the useful thermal energy produced;
- For sources using thermal biomass renewable energy technology, the discount factor shall be

2.0% of the useful thermal energy produced.

**Actual Metering** ☐

- Include a simple schematic identifying the operating energy and thermal energy losses and placement of the meters.

## Interim Alternative Metering Method

Until such time as the Puc 2500 rule is finalized applicants may utilize an alternative method as described in the draft rule 2505.02(e)(2):

> *In lieu of the information required by Puc 2505.02 (d) (11) through (13), a thermal source may submit a detailed explanation of the methodology used to measure and calculate thermal energy and an attestation by a professional engineer that is licensed in New Hampshire and in good standing that the methodology for measuring useful thermal energy and calculating certificates is sound.*

# Part 4. Affidavits

## Owners Affidavit

The following affidavit must be completed by the owner attesting to the accuracy of the contents of the application pursuant to PUC 2505.02 (b) (14).

AFFIDAVIT

I, Maria M. Dreyer have reviewed the contents of this application and attest that it is accurate and is signed under the pains and penalties of perjury.

Applicant's Signature _____ Date April 6, 2016

Applicant's Printed Name Maria M. Dreyer

Subscribed and sworn before me this 6th Day of April (month) in the year 2016

County of Belknap State of New Hampshire

Debbie D Thompson

Notary Public/~~Justice of the Peace~~ Seal

My Commission Expires _____

DEBBIE D THOMPSON
Notary Public, State of New Hampshire
My Commission Expires March 6, 2019

## NH Professional Engineer Affidavit

AFFIDAVIT

I, Daniel A. Wilson attest that this facility meets the requirements of the thermal REC eligibility requirements of Puc 2500, including the thermal metering and measurement methodologies and standards and REC calculation methodologies.

Professional Engineer's Signature _____ Date 4/5/16

Professional Engineer's Printed Name Daniel A. Wilson

NH Professional Engineer License Number 13688

PE Stamp

STATE OF NEW HAMPSHIRE
DANIEL A. WILSON
No. 13688
LICENSED
PROFESSIONAL ENGINEER

Owner's Affidavit with Regard to Metering Equipment:

Shaker Regional School District (SAU80) commits to following the requirements of PUC 2506, and to maintaining the installed metering equipment per the manufacturer's recommendations.

Signed _____ Date April 6, 2016

Maria M. Dreyer, Superintendent

The State of New Hampshire
# DEPARTMENT OF ENVIRONMENTAL SERVICES

**Thomas S. Burack, Commissioner**

March 23, 2016

Mr. Charles R. Niebling
Innovative Natural Resource Solutions LLC
37 Old Pound Road
Antrim, NH 03440

**Re: Recommended Certification as a Class I Thermal Renewable Energy Source**
**Shaker Regional School District**
**Belmont & Canterbury, NH**

Dear Mr. Niebling:

In response to your request on behalf of Shaker Regional School District (SRSD), SAU80 for certification of six biomass (wood pellet) boilers located at the four public school facilities described below as a Class I thermal renewable energy source, the New Hampshire Department of Environmental Services (DES) recommends that the Public Utilities Commission (PUC) grant approval to SRSD as a Class I thermal renewable energy source eligible to generate renewable energy certificates. A summary of the facility description, DES's review of best management practices (BMP) requirements, and a recommendation for approval are presented below.

## Facility Description

**Facility Name:** SRSD
**Locations:** Canterbury Elementary School (one), Canterbury, NH
Belmont Elementary School (one), Belmont Middle School (two), and
Belmont High School (two), Belmont, NH
**Primary Fuel:** wood pellets
**Net Maximum Output:** 512,000 BTU/hr per boiler

## Emissions

By definition, *"Thermal biomass renewable energy technologies"*, requires units rated less than 3 MMBtu/hr gross heat input to meet best management practices (BMP) as established by DES for control of particulate matter (PM) and nitrogen oxides (NOx) emissions. DES herein establishes BMP as certifying that boiler tune-ups will be conducted annually in accordance with the report titled *Emission Controls for Small Wood-Fired Boilers* (Prepared for United States Forest Service, Western Forestry Leadership Coalition).

**Conclusion and Recommendation for Approval**

DES believes that SRSD currently meets, and annually will meet, the requirements to be certified as a Class I - New Biomass thermal renewable energy source. DES recommends that the PUC certify SRSD as a Class I thermal renewable energy source eligible to generate thermal renewable energy certificates, on the condition that SRSD annually certifies that BMP continue to be met.

Please submit a copy of this letter with SRSD's completed application for renewable energy source eligibility to the PUC. If you have any questions, please contact me at joseph.fontaine@des.nh.gov or (603) 271-6794.

Sincerely

Joseph T. Fontaine
Program Manager
Air Resources Division

# Part 3 Table

| Item | System or Component | Location | Product Name | Product Manufacturer | Model No. | Operating Range | Maximum Error |
|---|---|---|---|---|---|---|---|
| 1 | Temperature Sensor | TT1, TT2 | Solid State Temperature Sensor | Onicon | SYSTEM-10 | 32°F - 200°F | +/- 0.15°F ΔT accuracy<br>(+/- 2.78% of ΔT reading at 3K ΔT) |
| 2 | Flow Meter | FM1 | Dual Turbine Flow Meter | Onicon | F-1200 | 9 - 461 gpm | +/- 2.0% of reading |

**Total System Accuracy Calculation:**

Worst case error will occur at the minimum temperature difference and maximum expected flow. The sensors are qualified for a minimum temperature difference of 3K (5.4°F). The boiler circulator pumps are variable speed, and the maximum combined flow rate that has been observed is approximately 55 gpm. For the purposes of this calculation, 55 gpm is assumed to be the maximum flow rate. Assuming a supply temperature of 190.0°F and a return temperature of 184.6°F, the following will be the case when Btus are calculated according to the method specified in Attachment 3-2:

| | | | |
|---|---|---|---|
| Measured Value | 151,682 | Btu/hr | Includes measurement errors of +0.15°F ΔT and +2.0% for flow |
| Actual Value | 144,682 | Btu/hr | |
| **Worst Case Error (+/-)** | **4.84%** | | |

*Note: The 2% discount factor for parasitic load is not incorporated in the error calculation.*

**Assumptions:**

| | | |
|---|---|---|
| P of water at 184.45°F | 8.0859 | lb/gal |
| P of water at 184.60°F | 8.0854 | lb/gal |
| h of water at 184.45°F | 152.69 | Btu/lb |
| h of water at 184.60°F | 152.84 | Btu/lb |
| h of water at 190.0°F | 158.27 | Btu/lb |

*Note: P and h values are based on 44.7 psia, liquid phase.*

# Attachment 3-1 (Component Specification Sheets)

Attachments with accuracy and operating ranges are provided and organized by item number from the above table.

# • SYSTEM-10-MOD BTU METER •

## MODBUS RTU RS485 or MODBUS TCP/IP COMPATIBLE

ONICON INCORPORATED

UL LISTED
PROCESS CONTROL EQUIPMENT
3GF5

## DESCRIPTION

The System-10 BTU Meter provides highly accurate thermal energy measurement in chilled water, hot water and condenser water systems based on signal inputs from two matched temperature sensors (included) and any of ONICON's insertion or inline flow meters (ordered separately). The System-10-MOD provides energy, flow and temperature data on a local alphanumeric display and to the network via the MODBUS RTU RS485 or MODBUS TCP/IP communications adapter. An optional auxiliary input is also available to totalize pulses from another device and communicate the total directly to the network.

## APPLICATIONS

Chilled water, hot water and condenser water systems for:

- Commercial office tenant billing
- Central plant monitoring
- University campus monitoring
- Institutional energy cost allocation
- Performance/efficiency evaluations
- Performance contracting energy monitoring

## FEATURES

**MODBUS Compatible Serial Communications -** Provides complete energy, flow and temperature data to the control system through a single MODBUS RTU network connection, reducing installation costs.

**Simple Installation and Commissioning -** Factory programmed and ready for use upon delivery. All process data and programming functions are accessible via front panel display and keypad.

**Single Source Responsibility -** One manufacturer is responsible for every aspect of the energy measurement process ensuring component compatibility and overall system accuracy.

**N.I.S.T. Traceable Calibration with Certification -** Each Btu measurement system is individually calibrated using application specific flow and temperature data and is provided with calibration certificates.

**Precision Solid State Temperature Sensors -** Custom calibrated and matched to an accuracy better than ±0.15°F over calibrated range.

**Highly Accurate Flow Meters -** ONICON offers a wide variety of insertion and inline type flow measurement technologies including turbine, electromagnetic and vortex sensing. Each type offers unique advantages depending on the application. All ONICON flow meters are individually wet calibrated and designed to operate over a wide flow velocity range with accuracies ranging from ±0.2% to ±2.0% of rate depending on the model.

**Complete Installation Package -** All mechanical installation hardware, color coded interconnecting cabling and installation instructions are provided to ensure error-free installation and accurate system performance.

## ORDERING INFORMATION

The System-10 BTU Meter is sold complete with temperature sensors. Thermowell installation kits and flow meters are purchased separately.

| ITEM # | DESCRIPTION |
|---|---|
| SYSTEM-10-MOD | System-10 BTU Meter, MODBUS Compatible |
| SYSTEM-10-OPT8 | High temperature sensors (over 200°F) |
| SYSTEM-10-OPT9 | Add one analog output |
| SYSTEM-10-OPT10 | Add four analog outputs |
| **Choose from the following commonly used thermowell installation kits:** | |
| SYSTEM-10-OPT4 | Upgrade to outdoor thermowells (pair) |
| BTU-ST-INSTL32 | Brass kit for welded steel pipe (¾" - 5") |
| BTU-ST-INSTL52 | Brass kit for threaded steel pipe (¾" - 2½") |
| BTU-ST-INSTL34 | SS kit for welded steel pipe (¾" and up) |
| BTU-ST-INSTL36 | Brass kit for copper tube (¾" - 2") |
| BTU-ST-INSTL37 | Brass kit for copper tube (2½" - 3") |
| **Choose from the following flow meters:** | |
| F-1100/F-1200 | Insertion Turbine Flow Meter (1¼" - 72") |
| F-1300 | Inline Turbine Flow Meter (¾" - 1") |
| F-3000 Series | Inline Electromagnetic Flow Meter (¼" - 48") |
| F-3500 | Insertion Electromagnetic Flow Meter (3"- 72") |
| F-4200 | Clamp-on Ultrasonic Flow Meter (½" - 48") |
| F-2000 Series | Inline Vortex Flow Meter (½" - 12") |
| Refer to catalog for flow meter installation kits. Consult with ONICON for additional thermowell installation kit and flow meter options. | |

*11451 Belcher Road South, Largo, FL 33773 • USA • Tel +1 (727) 447-6140 • Fax (727) 442-5699*
*www.onicon.com • sales@onicon.com*

# SYSTEM-10 MOD BTU METER SPECIFICATIONS



ONICON INCORPORATED

**CALIBRATION**

Flow meters and temperature sensors are individually calibrated followed by a complete system calibration.
Field commissioning is also available.

**ACCURACY**

Differential temperature accuracy ±0.15°F over calibrated range
Computing nonlinearity within ±0.05%

**PROGRAMMING**

Factory programmed for specific application
Field programmable via front panel interface

**MEMORY**

Non-volatile EEPROM memory retains all program parameters and totalized values in the event of power loss.

**DISPLAY**

Alphanumeric LCD displays total energy, total flow, energy rate, flow rate, supply temp. and return temp.
Alpha: 16 character, 0.2" high; Numeric: 8 digit, 0.4" high

**OUTPUT SIGNALS**

**Network Interface:**

Protocol: MODBUS RTU
Connection: RS485: 2-wire (half duplex)
TCP/IP: 10 Base T, 10 Mbps, RJ45 Connection
Baud Rate for RS485: 9600, 19200, 38400, 57600 and 115200

**Partial MODBUS Holding Register List:**

| NAME | Available Units |
|---|---|
| Total Energy | Btu, kW-hrs & ton-hrs |
| Energy Rate | Btu/hr, kW & tons |
| Total Flow | Gallons, liters & meters$^3$ |
| Flow Rate | gpm, gph, mgd, l/s, l/m, l/hr & m$^3$/hr |
| Supply & Return Temperature | °F and °C |
| Operating Mode | Single, Dual or Bi-directional |
| Mode Status | Heating/Cooling or Forward/Reverse Flow |
| Auxiliary Input Total | Not Applicable |
| Energy Total Reset | Not Applicable |
| Flow Total Reset | Not Applicable |
| Auxiliary Total Reset | Not Applicable |

**Isolated solid state dry contact for energy total:**

Contact rating: 100mA, 50V
Contact duration: 0.5, 1, 2, or 6 seconds

**Optional analog Output(s) (4-20 mA, 0-10 V or 0-5 V):**

One or four analog output(s) available for flow rate, energy rate, supply/return temps or delta-T.

**LIQUID FLOW SIGNAL INPUT**

0-15 V pulse output from any ONICON flow meter.

**TEMPERATURE SENSORS**

Solid state sensors are custom calibrated using N.I.S.T. traceable temperature standards.
Current based signal (mA) is unaffected by wire length.

**TEMPERATURE RANGE**

Standard liquid temperature range: 32° to 200°F
Optional extended temperature ranges available.
Ambient temperature range: -20° to 140°F

**MECHANICAL**

**Electronics Enclosure:**

Standard: Steel NEMA 13, wall mount, 8"x10"x4"
Optional: NEMA 4 (Not UL listed)
Approximate weight: 12 lbs

**Temperature Sensor Thermowell Kits:**

Thermowells and other kit components vary by fluid type, fluid temperature, pipe material and pipe size. Commonly used kits are listed on the previous page. Contact ONICON for additional thermowell kit options, including hot tap installation kits for retrofit installations.

**ELECTRICAL**

**Input Power*:**

Standard: 24 VAC 50/60 Hz, 500 mA
Optional: 120 VAC 50/60 Hz, 200 mA
230 VAC, 50 Hz, 150 mA

*Based on Btu meters configured for network connection without the optional analog outputs

**Internal Supply:**

Provides 24 VDC at 200 mA to electronics and flow meter

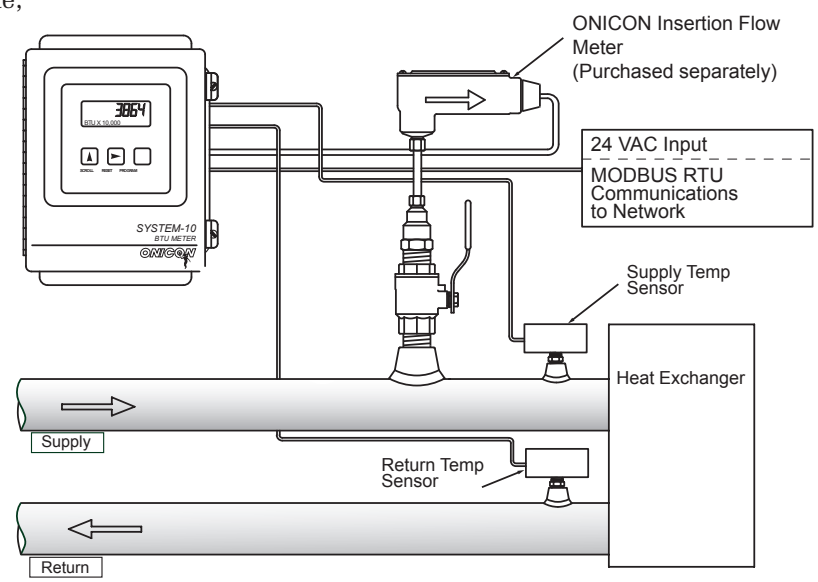
**Wiring:**

Temperature signals: Use 18-22 ga twisted shielded pair
Flow signals: Use 18-22 ga shielded - see flow meter specification sheet for number of conductors

Note: Specifications are subject to change without notice.

## TYPICAL INSTALLATION

Insertion turbine flow meter shown. Any ONICON flow meter may be used with the System-10 BTU Meter. Consult with ONICON for additional flow meter types.

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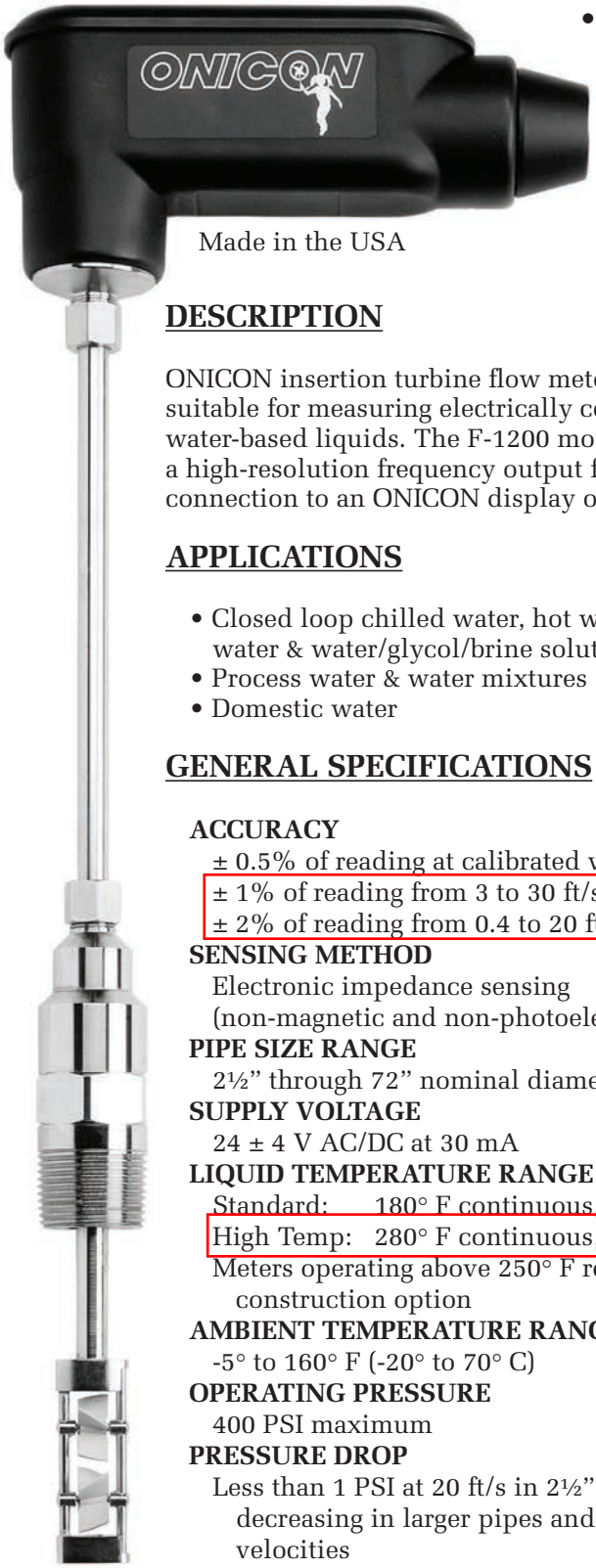


# • F-1200 DUAL TURBINE •
## INSERTION FLOW METER
## FREQUENCY OUTPUT

ONICON INCORPORATED

Made in the USA

## DESCRIPTION

ONICON insertion turbine flow meters are suitable for measuring electrically conductive water-based liquids. The F-1200 model provides a high-resolution frequency output for connection to an ONICON display or Btu meter.

## APPLICATIONS

- Closed loop chilled water, hot water, condenser water & water/glycol/brine solutions for HVAC
- Process water & water mixtures
- Domestic water

## GENERAL SPECIFICATIONS

**ACCURACY**
± 0.5% of reading at calibrated velocity
± 1% of reading from 3 to 30 ft/s (10:1 range)
± 2% of reading from 0.4 to 20 ft/s (50:1 range)

**SENSING METHOD**
Electronic impedance sensing
(non-magnetic and non-photoelectric)

**PIPE SIZE RANGE**
2½" through 72" nominal diameter

**SUPPLY VOLTAGE**
24 ± 4 V AC/DC at 30 mA

**LIQUID TEMPERATURE RANGE**
Standard: 180° F continuous, 200° F peak
High Temp: 280° F continuous, 300° F peak
Meters operating above 250° F require 316 SS construction option

**AMBIENT TEMPERATURE RANGE**
-5° to 160° F (-20° to 70° C)

**OPERATING PRESSURE**
400 PSI maximum

**PRESSURE DROP**
Less than 1 PSI at 20 ft/s in 2½" pipe, decreasing in larger pipes and lower velocities

**OUTPUT SIGNALS PROVIDED**
Frequency Output
0 – 15 V peak pulse, typically less than 300 Hz

(continued on back)

## CALIBRATION

Every ONICON flow meter is wet calibrated in our flow laboratory against primary volumetric standards that are directly traceable to N.I.S.T. A certificate of calibration accompanies every meter.

## FEATURES

**Unmatched Price vs. Performance -** Custom calibrated, highly accurate instrumentation at very competitive prices.

**Excellent Long-term Reliability -** Patented electronic sensing is resistant to scale and particulate matter. Low mass turbines with engineered jewel bearing systems provide a mechanical system that virtually does not wear.

**Industry Leading Two-year "No-fault" Warranty -** Reduces start-up costs with extended coverage to include accidental installation damage (miswiring, etc.) Certain exclusions apply. See our complete warranty statement for details.

**Simplified Hot Tap Insertion Design -** Standard on every insertion flow meter. Allows for insertion and removal by hand without system shutdown.

**OPERATING RANGE FOR COMMON PIPE SIZES**
**0.17 TO 20 ft/s**
±2% accuracy begins at 0.4 ft/s

| Pipe Size (Inches) | Flow Rate (GPM) |
|---|---|
| 2½ | 2.5 - 230 |
| 3 | 4 - 460 |
| 4 | 8 - 800 |
| 6 | 15 - 1,800 |
| 8 | 26 - 3,100 |
| 10 | 42 - 4,900 |
| 12 | 60 - 7,050 |
| 14 | 72 - 8,600 |
| 16 | 98 - 11,400 |
| 18 | 120 - 14,600 |
| 20 | 150 - 18,100 |
| 24 | 230 - 26,500 |
| 30 | 360 - 41,900 |
| 36 | 510 - 60,900 |

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## F-1200 SPECIFICATIONS (cont.)

**MATERIAL**

Wetted metal components:

Standard: Electroless nickel plated brass

Optional: 316 stainless steel

**ELECTRONICS ENCLOSURE**

Standard: Weathertight aluminum enclosure

Optional: Submersible enclosure

**ELECTRICAL CONNECTIONS**

3-wire for frequency output

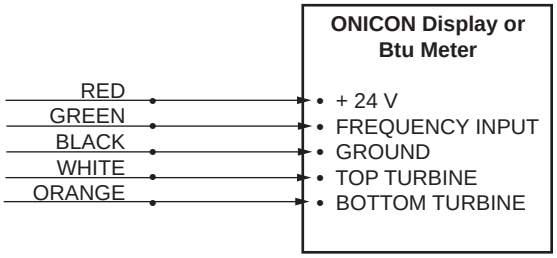
Standard: 10' of cable with ½" NPT conduit connection

Optional: Indoor DIN connector with 10' of plenum rated cable

## F-1200 WIRING INFORMATION

| WIRE COLOR | DESCRIPTION | NOTES |
|---|---|---|
| RED | (+) 24 V AC/DC supply voltage, 30 mA | Connect to power supply positive |
| BLACK | (-) Common ground (Common with pipe ground) | Connect to power supply negative |
| GREEN | (+) Frequency output signal: 0-15 V peak pulse | Signal for ONICON display or Btu meter |
| **DIAGNOSTIC SIGNALS** | | |
| ORANGE | Bottom turbine frequency | These signals are for diagnostic purposes - connect to local display or Btu meter |
| WHITE | Top turbine frequency | |

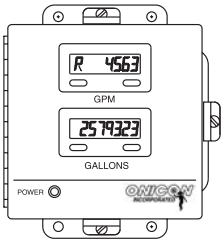
## F-1200 WIRING DIAGRAM



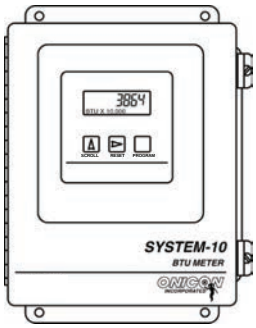

***NOTE:***

***1. Black wire is common with the pipe ground (typically earth ground).***

## ALSO AVAILABLE




*Display Modules*



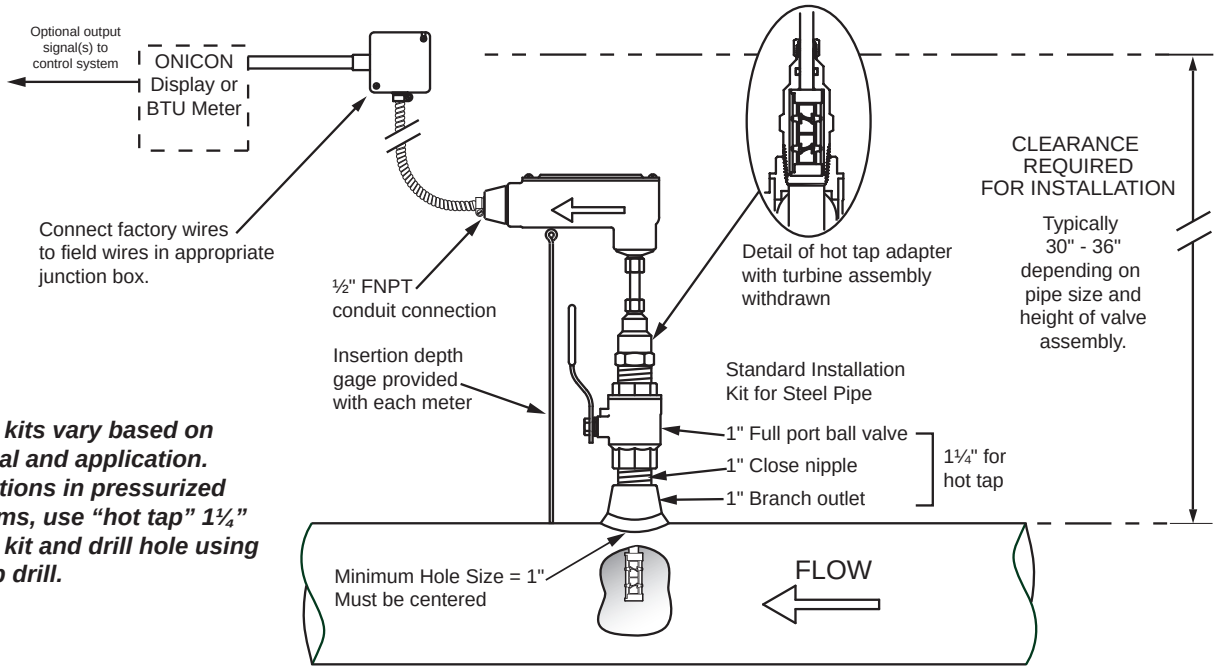

*Btu Measurement Systems*

## TYPICAL METER INSTALLATION

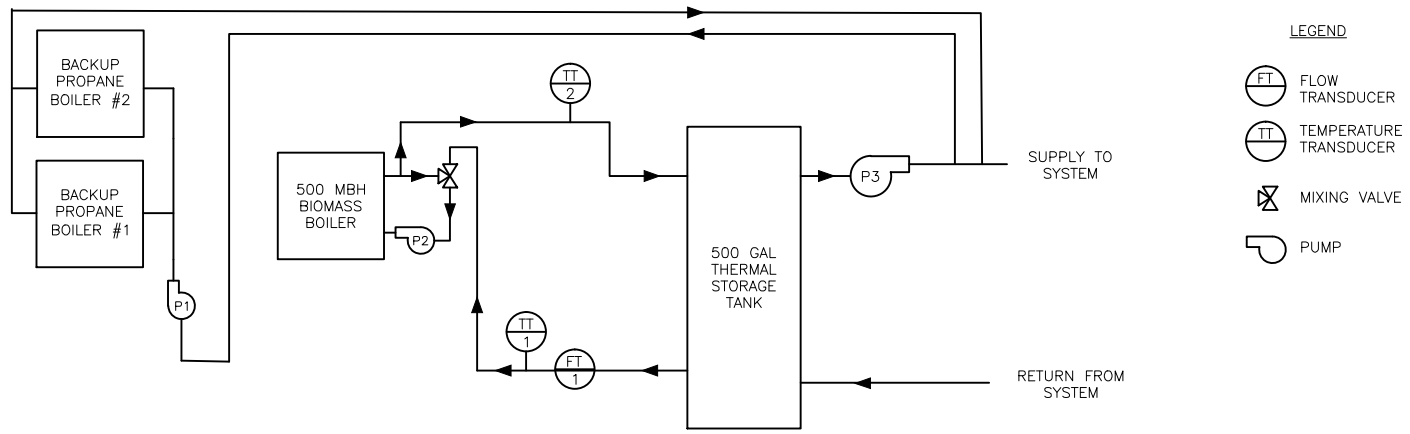
(New construction or scheduled shutdown)

- Acceptable to install in vertical pipe
- Position meter anywhere in upper 240° for horizontal pipe

Horizontal Run Pipe




***NOTE:***
***Installation kits vary based on pipe material and application.***
***For installations in pressurized (live) systems, use "hot tap" 1¼" installation kit and drill hole using a 1" wet tap drill.***




| ID | Mfg. | Series | M/N | Max. Flow (gpm) |
|---|---|---|---|---|
| P2 | Grundfos | Magna3 | 40-80 | 55 |

Note: Maximum flow is based on recorded data.

**Calculation Narrative for Delivered Thermal Energy to Canterbury Elementary School from Biomass System**

The basis for the calculation of the renewable energy delivered to the system is the measurement of the energy added to the water as it passes through the biomass boiler. Equations 1, 2, and 3 show the proposed method for calculating useful delivered energy.

Q = ( QS - QR ) * 0.98 * t Equation 1

QS = hS * FR * PR Equation 2

QR = hR * FR * PR Equation 3

Where:

- **QS (Btu/hr)** Energy in water supplied from the biomass pellet boiler to the buffer tank as determined by direct measurement of temperature, assuming that the mass flow rate of the water in the supply line leaving the boiler is equal to the mass flow rate of the water returning to the boiler.
- **QR (Btu/hr)** Energy in water returned to the biomass pellet boiler from the buffer tank, as determined by direct measurement of water flow and temperature.
- **FR (gal/hour)** is the water flow measured by the flow meter FT-1 on the return from the buffer tank.
- **PR (lb/gal)** is the density of water at the water flow meter FT-1 on the return from the buffer tank. This density is determined based on temperature measurement at sensor TT-1.
- **hS and hR (Btu/lb)** are specific enthalpies at the supply (TT-2) and return (TT-1) locations respectively. The temperature values are used to develop the enthalpies based on IAPWS steam tables.
- **t (hr)** is time in hours. Where readings are taken more frequently, the values are converted to hourly averages.
- The factor of 0.98 accounts for the 2% reduction in REC generation for parasitic load (discount factor).

**Accuracy**

The metering and recording equipment meets the requirements set forth by EN1434-1 for accuracy class 5K as called for by PUC 2506.04(e)(1), and thus, no discount factor must be taken for equipment accuracy. Parasitic load is not measured, and the 2% discount factor is taken by the owner as shown in Equation 1.

# Part 3 Table (for ease of reference, same as previous table with Attachment 3-1)

| Item | System or Component | Location | Product Name | Product Manufacturer | Model No. | Operating Range | Maximum Error |
|---|---|---|---|---|---|---|---|
| 1 | Temperature Sensor | TT1, TT2 | Solid State Temperature Sensor | Onicon | SYSTEM-10 | 32°F - 200°F | +/- 0.15°F ΔT accuracy (+/- 2.78% of ΔT reading at 3K ΔT) |
| 2 | Flow Meter | FM1 | Dual Turbine Flow Meter | Onicon | F-1200 | 9 - 461 gpm | +/- 2.0% of reading |

# Attachment 3-3 (Manufacturer's Recommendations for Maintenance and Calibration)

| Item | System or Component | Recommendation | Manufacturer's Information Included |
|---|---|---|---|
| 1 | Temperature Sensor | see attached documents | yes |
| 2 | Flow Meter | | yes |

ONICON
FLOW AND ENERGY MEASUREMENT

January 7th, 2016

To Whom It May Concern,

ONICON does not recommend specific service intervals as most ONICON products do not require periodic maintenance.

ONICON does offer general recommendations for calibration intervals. These recommendations are not intended to supersede local regulatory requirements or those of any governing body associated with product approvals (e.g. NIST, AWWA, etc.). Actual calibration intervals should be determined by the organization responsible for the measurement based on the above mentioned requirements and the specific requirements of the application. As a general rule, it is appropriate to say that the more important the data obtained from the instrument, the shorter the period between calibrations.

Typical calibration intervals for non-moving parts flow sensors and temperature sensors are ≤ 7 years.

Typical calibration intervals for moving parts flow sensors are every 2-3 years. Is it typical that when a moving parts flow meter is used with a System-10 energy meter, the temperature sensors are also returned to ONICON for calibration at this same interval, so that the complete energy meter can be recalibrated as well.

The calibration interval for moving parts meters could be extended by periodically inspecting and cleaning the meter. ONICON can provide a Tech Note which explains how to perform this preventative maintenance.

Regards,

Ken Elander
ONICON Product Manager

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*www.onicon.com • sales@onicon.com*

# TECH-NOTES

## ONICON TURBINE FLOW METERS
**F-1100/F-1200/F-1300/FB-1200 Series**

### CLEANING AND MAINTENANCE

Cleaning Materials

If you would like to clean the turbine flow meters on site, we recommend the following cleaning agents, tools and methods be used. Selection of the best cleaning agent depends on what type of dirt or debris is being cleaned off of the flow meter.

- A soft bristle tooth brush can be used to gently scrub dirt and deposits from the turbine assembly.
- Fine point tweezers can be used to remove fibers, thread tape, pipe dope, etc from the turbine shafts and bearings.
- Soap and water. A good degreasing soap such as dish washing liquid works well on dirt. Avoid gritty hand soaps that might leave grit in the turbine bearings.
- White Vinegar. Works well dissolving calcium buildup, is inexpensive and biodegradable.
- Lime-A-Way or CLR. These cleaners are for removal of water deposits on faucets, etc and are readily available. They work well for cleaning dirt and scale buildup from the flow meter.
- Muriatic Acid. (Also called Hydrochloric Acid, HCL) This can be used to remove extremely heavy mineral deposits. Use a mixture of 1 part acid to 9 parts water. Do not use a stronger acid mix. Soak the affected area in the solution for one to five minutes depending on how dirty the meter is. Then rinse thoroughly with clean water. We suggest only using Muriatic acid as a last resort due to the hazards involved in handling it.

***IMPORTANT SAFETY NOTE! READ CAREFULLY BEFORE HANDLING ACID!***

> *Muriatic acid can cause severe irritation or burns to the skin and eyes. Use caution when handling acid.*
> *When handling acid, wear face and eye protection and protective gloves which are rated for exposure to acid.*
> *NEVER add water into acid! Serious injury could result. Always add the acid into the water.*
> *Acid vapor may irritate the respiratory tract. Avoid breathing acid vapor and use only in a well ventilated area.*
> *Never mix acid with any other chemicals.*
> *Neutralize spilled acid using Sodium Bicarbonate*
> *Muriatic acid is classified as a hazardous waste and should be disposed of according to the manufacturer's recommendations.*

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# TECH-NOTES

**Page 2: Cleaning and Maintenance – Continued**

- Never use any petroleum based lubricants (such as WD-40, machine oil, etc.) on the flow meter. Petroleum based lubricants will damage the flow meter's o-ring seals.

Cleaning Procedures for F-1100/F-1200/FB-1200 Series Meters:

- Disassembly of the flow meter turbine assembly is not recommended during field cleaning because some parts are easily damaged and if not correctly reassembled, flow meter calibration will be adversely affected. If the flow meter cannot be cleaned adequately without disassembly, we recommend returning the flow meter to Onicon for factory cleaning and maintenance.

- If difficult to remove mineral deposits and excessive dirt are present, place enough cleaning solution in a container to cover the entire turbine assembly and place the meter in the container to soak. Normally, soaking in vinegar, CLR or Lime-A-Way for between 5 minutes and a few hours will be adequate to loosen the dirt. (If using Muriatic Acid and water solution, soak only for 1 to 5 minutes maximum.)

- If you are going to immediately begin cleaning the flow meter or after a period of soaking, put some of the cleaning solution or soap on a small brush and lightly brush around the ends of the turbines and exposed bearings and shaft. Also brush the turbine support brackets.

- Use a cloth or paper towel and cleaner to clean the meter stem and hot tap adaptor. Slide the hot tap adaptor up and down on the meter stem so you can clean the stem under it.

- After cleaning the flow meter, rinse thoroughly to remove all cleaner and dirt from the meter stem and turbine assembly. You can put the turbine assembly under a running faucet and turn it back and forth to cause the turbines to rotate in opposite directions to flush dirt out of the bearings. Run water up into the inside of the hot tap adaptor to flush out dirt and cleaner. Use a wire brush to clean pipe dope or thread tape out of the threads on the hot tap adaptor and flush with water to rinse. *Use caution not to get water in or on the black electronics housing of the meter.*

- Then, with the turbines exposed, blow the excess water off of the turbine assembly, hold the flow meter so the turbines are as a ship's propeller would be and blow gently on the turbines to see if they turn freely. If not, re-clean again. If they spin freely, the turbine assembly has been successfully cleaned. (Note: The meter will not generate a flow signal unless the turbine is in water.)

- Apply a small amount of silicone grease to the meter stem and slide the hot tap adaptor up and down to lubricate the o-ring seal in the hot tap adaptor and reinstall the flow meter in the pipe.

# TECH-NOTES

**Page 3: Cleaning and Maintenance – Continued**

Cleaning Procedures for F-1300 Series Flow Meters:

- Because the F-1300 series meters are in-line type, access to the turbine assembly is not possible without removing the turbine assembly from the meter brass body.
- Removing the turbine assembly is difficult and if not correctly installed by damage the assembly or adversely affect the meter calibration.
- We recommend that cleaning should be done without removing the turbine assembly from the meter body. If you feel that you must remove the turbine assembly, please contact Onicon for assistance.
- Use a flashlight to visually inspect the turbine for debris, dirt or damage.
- Use tweezers to remove any foreign material stuck or wrapped in the turbine.
- Back flush water through the flow meter brass body to wash out smaller debris and dirt. (Use care not to get water in or on the black electronics housing of the meter.
- To remove additional dirt, place the flow meter body in a shallow pan and fill to the top of the body opening with cleaner. Let the meter soak for between 5 minutes and a few hours. (If using Muriatic Acid and water solution, soak only for 1 to 5 minutes maximum.)
- Flush clean water through the meter body in both forward and reverse direction to flush out dirt and cleaner.
- Use a wire brush to clean pipe dope or thread tape out of the body threads and flush with water to rinse.
- Blow any excess water out of the meter body. Then blow air through the meter body to see if the turbine spins freely. If not try cleaning again. (Note: The meter will not generate a flow signal unless the turbine is in water.)

**Maintenance:**

In clean, closed loop flow applications, turbine flow meters should not require frequent maintenance. A suggested interval for inspection and/or replacement of bearing components is dependent upon flow velocity, percentage of run time, and water quality.

In applications which contain more dirt or debris, the flow meter should be initially inspected at regular intervals to determine the amount and type of dirt buildup on the turbine assembly. Based on the results of these inspections, a regular cleaning interval and procedure can be developed.

**Factory Available Services:**

ONICON offers factory cleaning and recalibration service for all models of ONICON turbine flow meters at our Service Department in Clearwater Florida.

This *Basic Maintenance and Calibration* service includes the following:

- Disassembly, cleaning and inspection of the meter's turbine assembly

# TECH-NOTES

**Page 4: Cleaning and Maintenance – Continued**

- Replacement of turbines, bearings, shafts and o-rings.
- Inspection and testing of circuit boards and wiring
- Calibration in a volumetric flow loop calibration system which has been calibrated traceable to the National Institute of Standards and Technology. (N.I.S.T)
- A calibration certificate is provided which contains specific calibration data and states that the flow meter has been calibrated against an N.I.S.T traceable standard.
- Cost for this service is $115.00 per turbine flow meter plus shipping.

If you would like to ship the flow meter in for this service, please contact us at (727) 447-6140 to schedule the service and obtain a repair tracking number for the shipment.

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