

Boardwalk Petrochemical Pipeline, LLC

Ethylene Measurement Procedures

A. General

1. Unit of Measurement: The unit of measurement of the Ethylene stream shall be one (1) Pound mass and the density of the Ethylene stream shall be determined using the IUPAC (88) density calculation or other industry accepted density calculation, as determined by Boardwalk Petrochemical Pipeline (BPP) in its discretion.
2. Delivery Pressure: The Delivery Point measurement station shall be capable of measuring the mass of Ethylene delivered hereunder in a gas phase 200 psi-700 psi and in a liquid phase 900 psi-1300 psi or at a pressure as later amended.
3. Flow Metering: The measurement station shall be operated, tested, and maintained and the mass of hydrocarbon streams calculated in accordance with the appropriate American Gas Association (AGA), American Petroleum Institute (API) MPMS Chapter and/or Gas Processors Association (GPA) document, or other industry accepted calculation standards as determined by BPP in its discretion.
4. Flow Computers: Flow computers shall be installed in accordance with API MPMS Chapter 21.2 for electronic inferred mass measurement, or other industry accepted flow computer installation standard as determined by BPP in its discretion.
5. Delivery Point: Delivery Point of product shall be at the outlet flange of the BPP meter station at the location designated.
6. Flow Meter Verification/Calibration: All verification and calibration, measurement will be made utilizing temperature and pressure at flowing line conditions.
7. Check Meters: Shipper, or its representative, may at its option and expense, install and maintain check measurement equipment which shall not interfere with the use of BPP's measurement equipment, or that of its designee for the Delivery Point described in paragraph A5 above.
8. Access to Equipment: Shipper, or its representative, shall have access during normal business hours, after reasonable notice has been provided to BPP, to the equipment of BPP's measurement station, or that of BPP's designees, but the reading, calibrating and adjusting thereof shall be done by the employees, agents, representatives or designees of BPP. Similarly, BPP shall have access during normal business hours, after reasonable notice has been provided to Shipper, to the equipment of Shipper's measurement stations, but the reading, calibrating, and adjusting thereof shall be done by the employees, agents or representatives of Shipper.
9. Meter Ticket: A meter ticket will be generated for the Delivery Point described in paragraph A5 above each Day. A "Day" is defined as a twenty-four (24) hour period beginning at midnight. The billing period is from midnight on the first Day of each month to midnight on the last Day of the same month.

10. Review of Measurement Data: BPP and Shipper personnel shall exchange measurement data on a timely basis in order to detect measurement discrepancies as they arise. In the event that Shipper and BPP measurement differ more than one (1) percent for two (2) or more Days in succession, both metering facilities will be examined and calibrated to determine whether either or both metering facilities are conforming to good measurement practice and/or operation.
11. Flow Meter Verification/Calibration Frequency: On a scheduled Day of each month, or at other mutually agreeable intervals, BPP or BPP's designee shall test and verify the accuracy of its measurement equipment in accordance with the appropriate referenced standards. BPP or its designee shall give Shipper notice of the date and time of each test sufficiently in advance (24 hours minimum) to permit Shipper to have a representative present to witness such test result. Calibration records of either BPP's or Shipper's measurement equipment shall be available for review by either Party.
12. Certification of Test Equipment: Certification and calibration records of BPP's and Shipper's applicable test equipment shall be maintained and made available for review by either Party.
13. Special Tests: Either Party to this Agreement may also request a special test of any measurement equipment at its cost and expense. In such event, the Parties shall cooperate to secure prompt verification of accuracy of the equipment.

B. Mass Measurement Calculations

1. Product: The quantity shall be measured and shall be calculated by mass measurement procedures in accordance with appropriate AGA Report, *API* MPMS Chapter, GPA standards and/or procedures or other industry accepted standards and/or procedures as determined by BPP in its discretion. The determination of the flowing density of the Ethylene stream shall be calculated by the flow computer using the IUPAC (88) density calculation.
2. Flow Calculation: For locations where orifice meters are used, the flow equation used for the orifice measurement calculation is as follows:

$$qm = N1 Cd (Ev) (Y)(d^2) \text{ sq. rt. } [(pt,p)(\Delta P)] \text{ Equation (1-2) of MPMS 14.3.1}$$

Where:

qm = mass flow rate.

N1 = unit conversion factor.

Cd = orifice plate coefficient of discharge.

d = orifice plate bore diameter calculated at flowing temperature (Tf)

ΔP = orifice differential pressure.

Ev = velocity of approach factor.

pt,p = Density of the fluid at flowing conditions, Pf, and Tf. (The flowing density

is to be calculated by the flow computer using the IUPAC density calculation.)

Y = Expansion Factor.

3. Time Basis: Mass measurement shall be calculated on a Daily basis by determining the necessary readings at the designated time on one Day and those same readings at the designated time on the previous Day.

C. **Meter Verification/Calibration**

1. Meter Verification/Calibrations: All the meter instrumentation (DP, PT, and TT) shall be verified/calibrated and physically inspected at the beginning of the delivery and a minimum of every thirty (30) Days during the delivery. Necessary repairs to the metering equipment and replacement shall be made when the equipment does not meet the required standards provided in the appropriate AGA Report, *API* MPMS Chapter, GPA standards.
2. Errors less than the stated equipment accuracy as published by the equipment manufacturer: If the meter verification/calibration deviates less than stated equipment accuracy from one scheduled calibration to the next, no adjustments are required.
3. Errors more than the stated equipment accuracy as published by the equipment manufacturer and less than twice the stated equipment accuracy: If the meter verification/calibration deviates more than the stated equipment accuracy and less than twice the stated equipment accuracy, then the effective date of the adjustment shall be the date on which an event occurred which is known to have changed the measurement, or if such date is not known, then the effective date is determined as defined in “Mass Corrections”, Section D below. If the measurement deviation falls between the stated equipment accuracy and less than twice the stated equipment accuracy, then it shall be the decision of the concerned field parties as to the scope and corrective action taken, if any.
4. Errors more than twice stated equipment accuracy: Any deviation greater than twice the stated equipment accuracy are not acceptable, and immediate steps shall be taken to effect the required maintenance or repairs.

D. **Mass Corrections**

1. If, upon calibration tests, the meter does not meet requirements given in Section C, above, then any previous recording of such equipment shall be corrected for any period, which is known or agreed upon. In case the period is not known or agreed upon, such correction shall apply to one-half (½) the total mass measured since the date of the last calibration. However, this correction shall not exceed sixteen (16) Days. If, upon calibration tests, the meter does meet requirements given in Section C, above, and no Mass Correction is made, then: (i) the measured Mass shall be deemed to be correct, (ii) any system gains or losses associated with such measurement shall be credited or debited, as applicable, to BPP’s inventory account, and (iii) title to any Ethylene making up system gains will vest in BPP, and title to any Ethylene delivered to Shipper from system inventory resulting in system losses will vest in Shipper.

E. **Correction of Errors**

1. Measuring equipment found to be registering inaccurately or out of service should be

adjusted to read accurately and/or placed in service immediately. For any error not known or agreed upon for the period in which the meter was inaccurate or out of service, the mass of the stream shall be estimated and agreed by the Parties by use of the following methods in order of preference:

- a. By using the registration of any check measuring equipment of Shipper, if installed and properly operating.
- b. By using any measurement equipment which BPP may have in the flowing stream if agreed upon by Shipper.
- c. By using any measurement equipment which Shipper may have in the flowing stream if agreed upon by the Parties involved.

F. Appropriate AGA Report, APLMPMS Chapter, GPA standards Technical Publications

1. Revisions to such AGA, MPMS, and GPA publications shall apply to computations and operation of measurement stations but shall not be construed to require major modifications to, or replacement of, said equipment.
2. Following is the current list of publications referenced in this Exhibit:
 - a. Orifice Metering
API Manual of Petroleum Measurement Standards (MPMS), American Petroleum Institute, Washington D.C.:
 - (1) Chapter 1, *Vocabulary*, Second Edition
 - (2) Chapter 14 Section 3, *Natural Gas Fluids Measurement*, Section 3, *Concentric Square-Edged Orifice Meters*. Part 1, 2, 3 and 4
 - (3) Chapter 14, *Natural Gas Fluids Measurement*, Section 7, *Mass Measurement of Natural Gas Liquids*
 - b. Flow Computer
 - (1) Chapter 21, *Flow Measurement using Electronic Metering Systems*. Part 2 – Addendum - Inferred Mass.
 - c. Coriolis Metering
 - (1) Measurement of Liquid Hydrocarbons by Coriolis Meters
 - d. Standards of American Gas Association (AGA):
 - (1) *Orifice Metering of Natural Gas, Report No. 3, Parts 1, 2, 3, and 4*
 - (2) Measurement of Gas Hydrocarbons by Coriolis Meters, Report No. 11
 - e. Standards of the Gas Processors Association (GPA), Tulsa, Oklahoma:
 - (1) GPA Standard 8182-84, *Tentative Standard for the Mass Measurement of Natural Gas Liquids*
 - f. Density Determination
 - (1) International Union of Pure and Applied Chemistry (IUPAC) density tables for ethylene.