Orifice Meters
(Instructor-Led Training)

Course Description

This course covers orifice flow meters, their operating theory, and considerations for installation, maintenance and operation.

Course Prerequisites

- GTA Web-Based Training
  - Core WBT
  - Statistics and Uncertainty
  - Gas Properties I
  - Gas Properties II
- GTA Instructor-Led Training
  - Measurement Systems

Course Objectives

Upon completion of this course, the student will have received instruction designed to assist him/her in the following:

- Explain why accurate orifice measurement is important.
- Describe AGA 3 (API 14.3).
- Briefly describe how orifice measurement is performed.
- Explain the gas laws used in orifice measurement.
- Explain the continuity of flow as it applies to gas flow.
- Define laminar flow and turbulent flow as they apply to gas flow.
- Describe the Reynolds Number as it applies to gas flow.
- Describe and explain the primary and secondary elements' functions in orifice measurement.
- Describe common problems encountered with flow measurement using orifice plates.
- Describe the parameters to check when performing meter tube inspections.

Course Outline

1. Importance of Gas Measurement
2. American Gas Association (AGA)-3 Overview
    a. AGA Report 3
    b. Parts 1 thru 4
3. Orifice Measurement Theory
    a. Orifice Measurement
    b. Gas Law Review
        i. Boyle's Law
        ii. Charles Law
        iii. Ideal Gas Law
    c. Continuity of Flow (Conservation of Mass)
        i. Flow Characteristics
            1. Laminar Flow
            2. Turbulent Flow
        ii. Reynolds Number
        iii. Bernoulli's Equation
4. Measurement Components
    a. Orifice Elements
    b. Meter Tube, Length, and Diameters
    c. Selection of Pipe
    d. Orifice Plate-Holding and Positioning Device
    e. Flanged Fitting
    f. Single-Chamber Orifice Plate Holder (Simplex)
    g. Single-Chamber Orifice Fitting (Junior)
    h. Dual-Chamber Orifice Fitting (Senior)
    i. Orifice Plate
        i. Orifice Plate Faces
        ii. Orifice Plate Seal Rings
        iii. Orifice Plate Bore Edge

iv. Orifice Plate Bore and Roundness
v. Orifice Plate Care and Maintenance

j. Taps
i. Flange Taps
ii. Corner Taps
iii. Vena Contracta Taps
iv. Radius Taps
v. Pipe Taps

k. Straightening Vanes (Tube Bundle)
l. Flow Conditioners

5. Flow Measurement Pitfalls
a. Common Orifice Meter Problems
i. Orifice Plate Installed Backward
ii. Orifice Plate Edge Sharpness
iii. Notches or Groves on the Sharp Edge
iv. Bent or Warped Orifice Plate
v. Rough Orifice Plate
vi. Grease Deposits on the Orifice Plate
vii. Liquid Film on the Orifice Plate and in the Meter Tube
viii. Free Liquids
ix. Meter Tube Roughness
x. Protrusions in Meter Tube
xi. Acoustic Noise
xii. Bias Error
b. Reynolds Number
c. Compressible Fluid Flow
d. Differential Pressure Range
e. Pulsating Flow and Flow Noise
f. Square Root Error
6. Meter Tube Inspections

a. Inspection Best Practices

b. Practice Meter Tube Inspection

Recommended Resources

- GTA Orifice Meters Participant Guide
- GTA Orifice Meters Instructor Presentation.
- AGA Reports 3, 5, and 8.
- Internet sites and textbooks related to orifice meters.