

Gas Measurement Fundamentals & Electronic Flow Meter Best Practices

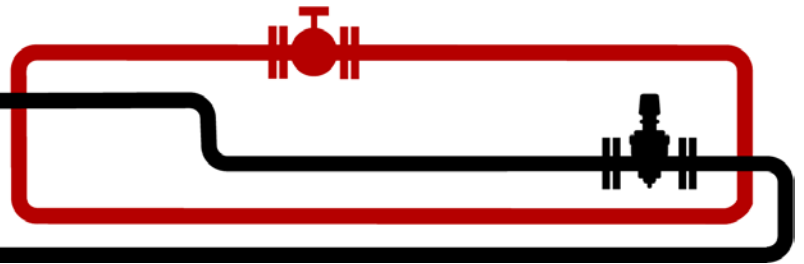
Gas Measurement Fundamentals (1.5 Days)

- I. Gas Measurement Fundamentals**
 - A. Natural Gas Chemistry
 - B. Physical Behavior
 - 1. Gas Laws
 - 2. Specific Gravity
 - 3. Gas and Liquid Density

- II. Units of Measurement**
 - A. Base Conditions
 - 1. Absolute, Gauge, and Atmosphere Pressure
 - 2. Temperature
 - 3. Contract Pressure Base
 - B. Standard Cubic Feet
 - C. Heating Valve
 - D. Mass

- III. Volume Determinations Measurement Devices**
 - A. Orifice Meter
 - 1. Primary Element
 - 2. Secondary Element
 - 3. Chart Calculations
 - 4. Measurement Problems
 - B. Gas Orifice Meter
 - 1. Basic Flow Equations
 - 2. Beta Ratio
 - 3. Basic Orifice Flow Factor
 - C. Positive Displacement Meters
 - 1. Rotary Meters
 - 2. Diaphragm Meter
 - 3. Flow Calculations
 - 4. Sample Problems





Electronic Flow Meter (EFM) Best Practices (2.5 Days)

I. Orifice Meter Test Procedures for Chart Recorders

- A. Introduction
- B. Test Equipment
- C. Documentation (Test Report)
- D. The Meter Test
- E. Completing the Test Report

II. Witnessing Meter Test Inspections

- A. Measurement Witnessing Checklist
 - 1. Before Calibration
 - 2. Take Gas Sampling Calibration
 - 3. Differential Pressure Device
 - 4. Static Pressure Device
 - 5. Resistance Temperature Detector (RTD)
 - 6. Orifice Plate
 - 7. After Calibration
 - 8. Paperwork

III. Charts and Chart Recorders

- A. Types of Charts
 - 1. L-10
 - 2. Square Root
- B. Recorders
 - 1. Pressure
 - 2. Temperature
 - 3. Calibration and Maintenance

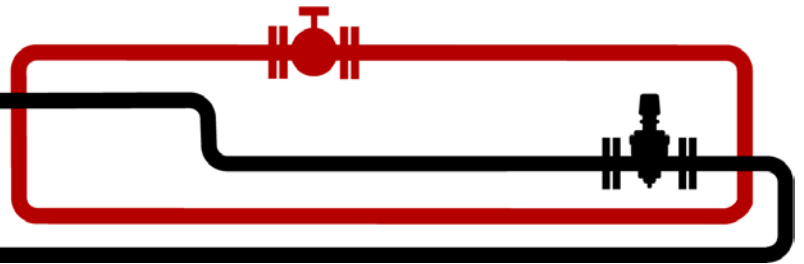
IV. Odorization

- A. Why Odorize?
 - 1. New London Accident History
 - 2. Federal Code (CFR 49 192.625)
- B. How Much is Enough?
 - 1. How to Measure
 - 2. What is LEL?
 - 3. What is Readily Detectable?
- C. Safety

V. Gas Sampling and Chromatographic Gas Analysis

- A. Introduction
- B. Sampling Methods
- C. Transportation
- D. Sample Preparation
- E. Chromatographic Gas Analysis





Electronic Flow Meter (EFM) Best Practices (cont.)

VI. Techniques of Gas Spot Sampling

- A. Payment
- B. Sample Point Location
- C. Sample Valves
- D. Sample Cylinders and Cylinder-Related Equipment
- E. Department of Transportation
- F. Spot Sampling Methods
 1. GPA Fill and Empty Method
 2. GPA Continuous Purge Method
 3. GPA Method for Taking Spot Sample in an Evacuated Cylinder or Standard Sample Cylinder Filled with an Inert Gas
 4. Drawing a Spot Sample Into a Constant Pressure (Sliding Piston) Sample Cylinder
 5. Installation of a Continuous Sampler
 6. Installation of an On-Stream Analyzing Device

VII. Moisture and H₂S Analyzers

- A. Introduction
- B. Operation
- C. Installation and Maintenance

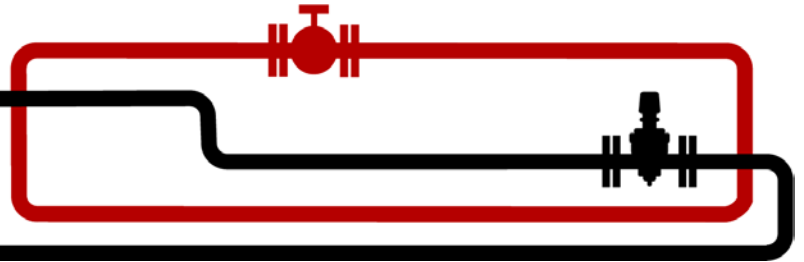
VIII. Inspecting Orifice Meters

- A. Importance of Inspecting a Meter
- B. Taking a Meter Out of Service
 1. Equipment and Materials Required
 2. Inspection
 - a. Physical Dimensions
 - b. Flange Faces
 - c. Flange Two-Bolt Level
 - d. Flange Tilt
 - e. Bad or Poorly Finished Welds
 - f. Communication between Tap Holes
 - g. Straightening Vane Location
 3. Tap Holes
 4. Orifice Plate Centering
 5. Tube Internal Diameter

IX. Meter Tube Inspection Sheets

- A. Importance of Inspection Reports
- B. How to Fill Out Meter Tube Inspection Reports
- C. Orifice Fitting Blank Plate Leakage Test





Electronic Flow Meter (EFM) Best Practices *(cont.)*

- X. **Gas Chromatograph (GC)**
 - A. What it is and Relation to Measurement
 - B. Operation and Internals
 - C. The Effects of Liquids
 - D. Maintenance
 - E. Online versus Portable

- XI. **Lab Procedures for Chromatographic Natural Gas**
 - A. Log-in Procedures
 - B. Sample Preparation
 - C. Gas Chromatography Procedures
 - D. Hexanes Plus BTU Analysis (GPA Method 2261)
 - E. Extended Gas Analysis (GPA Method 2286)
 - F. BTU History and Review Process
 - G. Cylinder Cleaning

- XII. **Flow Computers and Their Application**
 - A. Review of AGA 3 (Old vs. New)
 - B. Components of a Flow Computer
 - C. Sensing Elements
 - 1. Pressure
 - 2. Temperature
 - 3. Differential Pressure
 - 4. Multivariable Transmitters
 - D. Communication and Configuration
 - E. Power Supply and Consumption
 - 1. Solar Panels
 - 2. Maintenance Concerns
 - F. New Technologies

