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Gas Measurement Fundamentals Certification

Curriculum

Equip Yourself with Knowledge

With the gas industry facing a looming skilled workforce shortage, there has never been a greater need for companies to invest in their workforce. There is no time for you or your employees to make mistakes or learn by trial and error. Speed up the learning process by enhancing on-the-job training.

Gas Certification Institute (GCI) offers a unique mix of classroom and hands-on instruction that will prepare you with a thorough grounding in the theory and practice of gas measurement operations.

The program consists of seven related courses, over nine days of instruction, exercises and testing. We recommend that students have a prerequisite of a basic two-year degree in electronics, instrumentation or equivalent, or two years of equivalent work experience.

With this training certification in hand, you can be confident that you're ready to work in the field of gas measurement.

Gas Measurement Fundamentals Certification

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

Why You Should Take This Course:
- Understand the importance of measurement for control and custody applications.
- Identify components of gas.
- Comprehend gas laws and the effect on gas measurement.
- Understand the relationship of primary and secondary elements in gas measurement.
- Identify various types of meters used in gas measurement.
- Calculate gas measurement using volume and gas quality data.
- Examine sample problems of gas calculations and resolutions.
- Determine factors that can affect gas measurement and alter accuracy.

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. Control of Pulsation-Induced Measurement Error
- A. What is Pulsation?
  1. Definition
  2. Field Causes
- B. Measurement Effects on Primary Element
  1. Square Root Error (SRE)
  2. How to Calculate SRE
  3. Gas Contract Limits
  4. Industry Standards
  5. How to Measure SRE
  6. How to Reduce Pulsation-Induced SRE Error
- C. Measurement Effects on Secondary Element
  1. Gauge Line Error (GLE)
  2. How to Calculate GLE
  3. How to Measure GLE
  4. How to Reduce Pulsation-Induced GLE Error

V. Gas Sampling and Chromatographic Gas Analysis

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

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. 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

VIII. 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

IX. 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

X. 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

XI. 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

Why You Should Take This Course:

- Understand the importance of electronic flow meters in gas measurement, including orifice, turbine and positive displacement meters.
- Gain knowledge of electronic flow meters best practices.
- Examine the proper operation and maintenance of chart recorders.
- Understand the role of orifice meters in gas measurement and importance of correct measurement procedures.
- Recognize the importance of testing and witnessing and the proper procedures to conduct a test.
- Understand the procedure for taking a meter out of service.
- Explain importance of meter tube inspections.
- Examine control of pulsation-induced measurement error and the effects on measurement.
- Understand the federal regulations involved with the Department of Transportation.
- Recognize the importance of analysis (gas quality) in relation to electronic flow meters.
- Examine techniques of gas spot sampling.
- Explain methods for gas sampling and chromatographic gas analysis.
- Review lab procedures for chromatographic natural gas.
- Gain knowledge of GPA 2261 and 2286 and the relation to chromatography.
- Discuss applications for flow computers.

Flow Measurement – Ultrasonic, Turbine, Coriolis, Vortex and Insertion Meters
(1 Day)

I. Ultrasonic Meters
- A. Theory
- B. Application
- C. Operation
- D. Sizing and Selection
- E. Standards (API, AGA, and others)

II. Turbine Meters
- A. Theory
- B. Application
- C. Operation
- D. Sizing and Selection
- E. Standards (API, AGA, and others)

III. Coriolis, Vortex and Insertion Meters
- A. Theory
- B. Application
- C. Operation
- D. Sizing and Selection
- E. Standards (API, AGA, and others)

Transmitters, Calibration and Flow Computer (EFM) Hands On
(1 Day)

I. Transmitters
- A. Differential Pressure
- B. Static Pressure
- C. Temperature

II. Calibration
- A. General
- B. Zero Adjustments
  1. Non-Hazardous Locations
  2. Hazardous Locations
- C. Span Adjustment
- D. Calibration Procedure
- E. Range Adjustment
- F. Linearity Adjustment
- G. Damping Adjustment

III. Service
- A. General
- B. Troubleshooting
- C. Disassembly
  1. Sensor Module
  2. Transmitter (Wet End)
  3. Transmitter (Electronics Housing)
- D. Assembly
  1. Preliminary
  2. Sensor Module to Electronics
  3. Housing
  4. Electronic Housing
  5. Transmitter (Wet End)
- E. Parts Interchange

IV. Flow Computer (EFM)

Why You Should Take This Course:
- Employ proper safety practices during installation, calibration and maintenance procedures.
- Select and operate test equipment to measure electrical properties and calibration instruments.
- Describe transmitters.
- Learn the difference between temperature, pressure, differential and how they affect gas measurement.
- Explain other various electronic devices, including pulse generators for turbine meters, pulse duration telemeters (quantimers), signal isolators and I-P converters.
- Exercises in calibration, including zero adjustments, span adjustments calibration procedure, range adjustment, linearity adjustment and damping adjustment.
- Understand troubleshooting, disassembly, assembly and parts interchange for electronic instrumentation.

Pressure Regulators and Control Valves
(1 Day)

I. Pressure Regulators
- A. Essential Elements
- B. Types of Regulators
- C. Sizing and Selection
- D. Maintenance

II. Control Valves
- A. Valve Operators
  1. Pneumatically Operated
  2. Electric Operated
  3. Safety Considerations
- B. Valve Positioners
  1. Purpose
  2. Theory
  3. Safety Considerations
- C. Valve Characteristics
  1. Flow Characteristic
  2. Flow Style
  3. Effective Type of Trim
  4. Cavitation and Noise
- D. Relief Valves

Gas Chromatograph, Meter Run and Samplers Hands On
(1 Day)

I. Meter Run Inspection
- A. Meter Tube Mic
- B. Repair Senior Fittings (Building and Breaking Down)

II. Sampling Systems

III. Gas Chromatography

Moisture and H2S Analyzers and Odorization
(0.5 Day)

I. Moisture and H2S Analyzers
- A. Introduction
- B. Operation
- C. Installation and Maintenance

II. 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?
  4. Safety