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IE205:
Liquid & Gas Flow Metering & Custody Measurement:
Multiphase, Ultrasonic & Loss Control

Training Description:

This intensive training course is designed to provide delegates with a detailed and up-to-date overview of liquid and gas flowmetering and custody measurement.

Participants will be provided with knowledge and skills to determine and assess flow measurement accuracy and fluid mechanics of pipe flows; distinguish the difference among differential pressure type flowmeters, displacement, rotary inferential and fluid oscillatory flowmeters, electromagnetic, coriolis mass flowmeters and ultrasonic flowmeters.

The course will discuss how to define and classify the types, terms and problems of multiphase flow measurement; determine the basic concepts of multiphase flows and multiphase flowmeters; measure within the acceptable accuracy and the different types, selection and installation of flow measurement and level measurements and implement OIML Recommendation R117 including its requirements and operation.

The course will also cover the various types of flow calibration, metering system and provers including static and dynamic measurement, meter proving, prover loop and custody transfer; practice tank measurement and calibration methods and calculations of quantities; discuss meter and prover troubleshooting, electronics, overall measurement uncertainty and proving of LPG meters.

Finally, the course will explain in details the different types, methods, and techniques used in lease automatic custody transfer and truck custody transfer as well as list the equipment used in each operation; pipeline meter considerations employed for liquid petroleum products; and employ systematic techniques in leak detection, loss control, monitor and control production losses as well as list the various API standards applicable to flowmetering and custody measurement.

Training Objectives:

By the end of the training, participants will be able to:

- ✓ Apply an in-depth knowledge and skills in liquid and gas flowmetering and custody measurement
- ✓ Determine and assess flow measurement accuracy and fluid mechanics of pipe flows
- ✓ Distinguish the difference among differential pressure type flowmeters, displacement, rotary-inferential and fluid oscillatory flowmeters, electromagnetic, coriolis mass flowmeters and ultrasonic flowmeters
- ✓ Define and classify the types, terms and problems of multiphase flow measurement
- ✓ Determine the basic concepts of multiphase flows and multiphase flowmeters
- ✓ Measure within the acceptable accuracy and discuss the different types, selection and installation of flow measurement and level measurements
- ✓ Implement OIML Recommendation R117 including its requirements and operation
- ✓ Distinguish the various types of flow calibration, metering system and provers including static and dynamic measurement, meter proving, prover loop and custody transfer
- ✓ Practice tank measurement and calibration methods and calculations of quantities
- ✓ Discuss meter and prover troubleshooting, electronics, overall measurement uncertainty and proving of LPG meters

- ✓ Explain in detail the different types, methods, and techniques used in lease automatic custody transfer and truck custody transfer as well as list the equipment used in each operation
- ✓ Discuss pipeline meter considerations employed for liquid petroleum products
- ✓ Employ systematic techniques in leak detection, loss control, monitor and control production losses as well as list the various API standards applicable to flowmetering and custody measurement

Training Designed for:

This course is intended for instrumentation, inspection, control, custody, metering and process engineers and other technical staff. Piping engineers, pipelines engineers, mechanical engineers, operations engineers, maintenance engineers, plant/field supervisors and foremen and loss control coordinators will also benefit from the practical approach of this course.

Training Program:

DAY ONE:

- ❖ Pre-Test
- ❖ Flowmetering Overview
  - Introduction to Pipeline Flowmetering with Highlighted Problem Areas
- ❖ Flow Measurement Accuracy
  - Flow Measurement Uncertainty
  - Repeatability and Reproducibility
  - Basic Statistics (Average and Standard Deviation)
  - Calibration Graphs
- ❖ Fluid Mechanics of Pipe Flows
  - Laminar Flows and Turbulent Flows
  - Pipe Velocity Distributions
  - Worked Examples
  - Pipe Fitting Losses
- ❖ DVD on Flow Measurement
- ❖ Differential Pressure Type Flowmeters
  - Orifice Meters
  - Critical Flow Element
  - Venturi Meters
  - Flow Nozzles
  - Variable Area Meters
  - Pitot Tubes and Pitot Static Tubes
  - Target Flowmeters
- ❖ Displacement, Rotary–Inferential & Fluid–Oscillatory Flowmeters
  - Helical Gear Meter
  - Nutating Disc Meter
  - Piston Meter
  - Rotary Meter
  - Turbine Flowmeters
  - Vortex Shedding Meters

- ❖ Electromagnetic, Coriolis Mass & Miscellaneous Flowmeters
  - AC & Pulsed DC Types
  - Cross Correlation Methods
  - Tracer Methods
  - Weighing Methods
  - Velocity Profile Integration Techniques
  - Laser Doppler Systems
- ❖ Recap

DAY TWO:

- ❖ Ultrasonic Flowmeters
  - Doppler Type
  - Time-of -Flight Type
  - Clamp-on Type
  - Applications
  - Advantages & Disadvantages
- ❖ Video Presentation
  - 3 Beam Ultrasonic Flowmeter
- ❖ Introduction to Multiphase Flow Measurement
  - Description of Multiphase Flows, Definitions of Various Associated Terms, Flow Pattern Classification, Flow Regimes, Multiphase Measurement Problems, Multiphase Meter Classification
- ❖ Basic Concepts of Multiphase Flows & Multiphase Flowmeters
  - Response of Single-Phase Flowmeters in Multiphase Flows, Wet Gas Flow Measurement, Application of Two Flowmeters for Multiphase Flows
- ❖ Measurement Considerations, Flow Conditioners & Operational Issues
  - Basic Requirements
  - Response
  - Uncertainty
  - Instrument Specification
  - Accuracy Specifications
  - Fully Developed Pipeline Flow
  - Test Results
  - Types of Flow Conditioners
  - Contamination
  - Control Valve Noise
  - Signal Quality
  - On-Line Monitoring
- ❖ Recap

DAY THREE:

- ❖ Level Measurement
  - Main Types
  - Buoyancy Tape Systems
  - Hydrostatic Pressure

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- Ultrasonic Measurement
- Radar Measurement
- Vibration Switches
- Electrical Measurement
- Installation Considerations
- Impact on the Control Loop
- The Future

❖ Video Presentation
- Radar Level Measurement

❖ OIML Recommendation R117
- Introduction
- Scope
- General Requirements
- Field of Operation
- Accuracy Classes
- Case Example
- API MPMS Chapter 5.8

❖ Flow Calibration
- General
- Trends in Calibration
- Types of Calibration Test Rigs
- In Situ Calibration
- Turbine Meters
- Review

❖ Video Presentation
- Flow Calibration

❖ Tank Calibration Methods
- Introduction
- Methods of Tank Calibration
- Tank Gauging Techniques
- Tank Management Systems

❖ Video Presentation
- Tank Gauging System

❖ Tank Measurement Methods
❖ Calculations of Quantities
❖ Recap

DAY FOUR:

❖ Metering System & Provers
- Definitions
- Main Types
- Maintenance
- Problems

❖ Proving of a Turbine Meter
- Interactive Video Presentation

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- Automatic Sampling
- Prover Calibration Methods: Calculations and Uncertainties
- Prover Calibration Methods: Practical Exercises
  - Meter Proving
  - Prover Loop
  - Prover Loop Calibration
  - Field Calibration by Water Draw
  - Walk-Through Types of Provers
  - Calculation Exercises
  - Problem-Solving Exercises
- Meter and Prover Troubleshooting/ Overall Measurement Uncertainty 1215
- Case Study – Proving of LPG Meters
  - Introduction
  - Properties of LPG
  - Equipment
  - Benefits
- Practical Sessions
  - This hands-on and includes simulator software, real-life case studies, videos and exercises

DAY FIVE:

- Lease Automatic Custody Transfer
  - Introduction
  - System Requirements
  - Operation
  - Equipment
  - Conclusions
  - Appendix
- Truck Custody Transfer
  - Introduction
  - Truck Types
  - Typical Equipment
  - Other Considerations
  - Performance
  - New Developments
- Pipeline Meter Considerations
  - Introduction
  - Flow in a Pipeline
  - Pipeline Installation Considerations
  - DP Transmitters
  - Multi-Port Averaging Pitot
  - Oscillatory Flow Measurement
  - Ultrasonic Flow Measurement
  - Mass Flow Measurement
- Leak Detection
  - Introduction

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- API 1130
- A Theoretical or Practical Approach
- Real Time Transient Model
- Practical Example
- Results
- Conclusions

❖ Loss Control Systems
- Introduction
- Custody Transfer Sampling
- Case Studies
- Examples of Delivery Malpractice

❖ Monitoring and Controlling Production Losses
- Introduction
- General
- Types of Leaks
- Meter Proving
- Conclusions

❖ API Standards
- Introduction
- API Gravity
- Classification of Grades
- Temperature
- Measurement
- Measuring the Suspended S & W Content
- Calculating Net Volume
- Conclusions

❖ Course Conclusion
❖ Post-Test and Evaluation

Training Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course if required and as per the client's request."

Practical sessions will be organized during the course for participants to practice the theory learnt. Participants will be provided with an opportunity to carryout various exercises using the-art "Gas Ultrasonic Meter Sizing Tool", "Liquid Turbine Meter and Control Valve Sizing Tool", "Liquid Ultrasonic Meter Sizing Tool" and "Orifice Flow Calculator" simulators.

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

As per the course location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

For training registrations or in-house enquiries, please contact:

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