



COURSE OVERVIEW IE0035-4D

Liquid & Gas Flowmetering & Custody Measurement

Multiphase, Ultrasonic & Loss Control

Course Title

Liquid & Gas Flowmetering & Custody Measurement: *Multiphase, Ultrasonic & Loss Control*

Course Date/Venue

Session 1: September 02-05, 2024/Club B Meeting Room, Ramada Plaza by Wyndham Istanbul City Center, Istanbul, Turkey
Session 2: December 09-12, 2024/Al Aziziya Hall, The Proud Hotel Al Khobar, Al Khobar, KSA



Course Reference

IE0035-4D



Course Duration/Credits

Four days/2.4 CEUs/24 PDHs

Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide delegates with a detailed and up-to-date overview of liquid and gas flowmetering and custody measurement covering multiphase, ultrasonic and loss control.



Participants will be able to select and calibrate an ultrasonic flowmeter for the required application and deal with related operational and measurement concern; choose the correct flowmeter or combination of flowmeters for a particular multiphase application and be able to resolve any ensuing problems in relation to unreliability or inaccuracy of flowmeter readings; and compare the performances of existing multiphase meters such as Agar, Weatherford, Roxar, Schlumberger and Haimo.



The course will also cover the different types, methods and techniques used in custody transfer; the various pipeline meter considerations; systematic techniques in leak detection and loss control during custody transfer; and the various API standards applicable to flowmetering and custody measurement.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply an in-depth knowledge and skills in liquid and gas multiphase and single-phase flowmetering, ultrasonic flowmetering, custody measurement and loss control of petroleum products
- Select and calibrate an ultrasonic flowmeter for the required application and deal with related operational and measurement concerns
- Choose the correct flowmeter or combination of flowmeters for a particular multiphase application and be able to resolve any ensuing problems in relation to unreliability or inaccuracy of flowmeter readings
- Compare the performances of existing multiphase meters such as Agar, Weatherford, Roxar, Schlumberger and Haimo and recognize their importance in flowmetering
- Determine the different types, methods and techniques used in custody transfer and understand the various pipeline meter consideration
- Employ systematic techniques in leak detection and loss control during custody transfer and list the various API standards applicable to flowmetering and custody measurement

Who Should Attend

This course is intended for instrumentation, inspection, control, custody, metering and process engineers and other technical staff. Further, the course is suitable for piping engineers, pipelines engineers, mechanical engineers, operations engineers, maintenance engineers, plant/field supervisors & foreman and loss control coordinators.

Course Fee

Istanbul	US\$ 5,000 per Delegate + VAT . This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Al Khobar	US\$ 4,500 per Delegate + VAT . This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation


Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations:-


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The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units (CEUs)** in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **2.4 CEUs** (Continuing Education Units) or **24 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

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British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.



Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Dr. Alaa Abdel Kerim, PhD, MSc, BSc, is a Senior Electrical & Instrumentation Engineer with over 35 years of extensive experience in the Power, Petrochemical, Refinery, Oil and Gas industries. He specializes in DCS, PLC, SCADA, HMI, Automation System, Process Control & Instrumentation, Hydrocarbon, Level & Flow Measurements, Analytical Instrumentation, Field Control Elements, Control Loop Operation, Data Acquisition & Transmission, Electronics Technology, Power Systems Control, Power Systems Security, Power Transmissions, Power Generation, Electrical Substations and MV/LV Electrical System.

During his career life, Dr. Alaa has been practically and academically involved in different **Power System and Instrumentation international companies and Universities** as a **Senior Professor & Consultant, Instrumentation Engineer and Electrical Engineer**. His recent practical applications experience includes the design, supply, installation, operation of full **DCS, SCADA, PLC, HMI Automation System** for **Sumid Line Petroleum, Siemens USA, AREVA USA** to name a few. His experience also includes electrical coordination, protection level adjustments and electrical testing.

Dr. Alaa has a **PhD** degree in **Electrical Engineering** from the **Technical University of Gdansk, Poland** and has **Master** and **Bachelor** degrees in **Electrical Machine & Power Engineering** from **Cairo University** and **Helwan University**, respectively. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings and workshops worldwide.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.





Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0915	Flowmetering Overview Introduction to Pipeline Flowmetering with Highlighted Problem Areas
0915 – 1000	Flow Measurement Accuracy Flow Measurement Uncertainty • Repeatability & Reproducibility • Basic Statistics (Average & Standard Deviation) • Calibration Graphs
1000 – 1015	Break
1015 – 1100	Fluid Mechanics of Pipe Flows Laminar Flows & Turbulent Flows • Pipe Velocity Distributions • Worked Examples • Pipe Fitting Losses
1100 – 1130	DVD on Flow Measurement
1130 – 1215	Differential Pressure Type Flowmeters Orifice Meters • Critical Flow Element • Venturi Meters • Flow Nozzles • Variable Area Meters • Pitot Tubes & Pitot Static Tubes • Target Flowmeters
1215 – 1230	Break
1230 – 1315	Displacement, Rotary-Inferential & Fluid-Oscillatory Flowmeters Helical Gear Meter • Nutating Disc Meter • Piston Meter • Rotary Meter • Turbine Flowmeters • Vortex Shedding Meters
1315 - 1345	Electromagnetic, Coriolis Mass & Miscellaneous Flowmeters AC & Pulsed DC Types • Cross Correlation Methods • Tracer Methods • Weighing Methods • Velocity Profile Integration Techniques • Laser Doppler Systems
1345 – 1420	Ultrasonic Flowmeters–Basic Principles General • Transit Time • Doppler • Beam Configuration • Clamp-On Type • Insertion Type
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

Day 2

0730 – 0830	Video Presentation 3 Beam Ultrasonic Flowmeter
0830 - 0930	Ultrasonic Flowmeters–Main Types Elster – Instrument • Emerson – Daniel • Panametrics – Sentinel • Sick – Mairhack • Krohne • FMC – Smith Meters • Typical Specification • Future Trends
0930 – 0945	Break





0945 – 1030	Ultrasonic Flowmeters–Sizing & Selection Sizing Notes • Practical Example • Selection Guidelines • Typical Specification
1030 - 1115	Flowmeter Calibration Methods for Liquid Flowmeters • Use of Pipe Provers • Methods for Gas Flowmeters • Methods for Ultrasonic Flowmeters • Critical Flow Nozzle
1115 - 1215	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
1215 – 1230	Break
1230 – 1315	Introduction to Multiphase Flows Mixture Density • Gas Velocity • Homogeneous Flows • Slip • Superficial Phase Velocities • Velocity Ratio • Void Fraction
1315 - 1345	Flow Patterns in Two & Three-Phase Flows Stratified Flows • Slug Flows • Bubble Flows • Annular Flows • Churn Flows • Transitions
1345 – 1420	Flow Pattern Maps Horizontal Flows & Vertical Flows
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3

0730 – 0815	Effect of Flow Patterns on Multiphase Flow Measurement Velocity Differences between Gas & Liquid Phases • Velocity Differences between-n Oil & Water Phases
0815 – 0900	Modelling of Multiphase Flows Pressure Drop, Mixing & Density Measurement • Errors
0900 - 0930	Phase Distribution Effects on Measurement Continuous Phase, Viscosity, Single Phase Meters in Multiphase Flows
0930 – 0945	Break
0945 – 1030	Multiphase Meter Operating Principles & Classification Velocity Measurement • Phase Fraction
1030 - 1115	Descriptions of Existing Multiphase Meters Agar • Weatherford • Roxar • Schlumberger • Haimo
1115 - 1215	Industrial In-depth Presentation by a Major Manufacturer of Multiphase Meters Detailed Technology • Performance Specification • Field Installation • Calibration & Testing
1215 – 1230	Break
1230 – 1315	Multiphase Flowmeter Accuracy Uncertainties in Individual Phase Flowrates • Origins of Uncertainties • Expression of Multiphase Meter Accuracy
1315 - 1345	Verification of Multiphase Flow Meters during Operation Baseline Monitoring • Self Checking/Self Diagnostics • Two Meters in Series • Mobile Test Units • Tracer Techniques • Injection • Sampling • Reconciliation





1345 – 1420	Level Measurement Main Types • Buoyancy Tape Systems • Hydrostatic Pressure • Ultrasonic Measurement • Radar Measurement • Vibration Switches • Electrical Measurement • Installation Considerations • Impact on the Control Loop • The Future
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

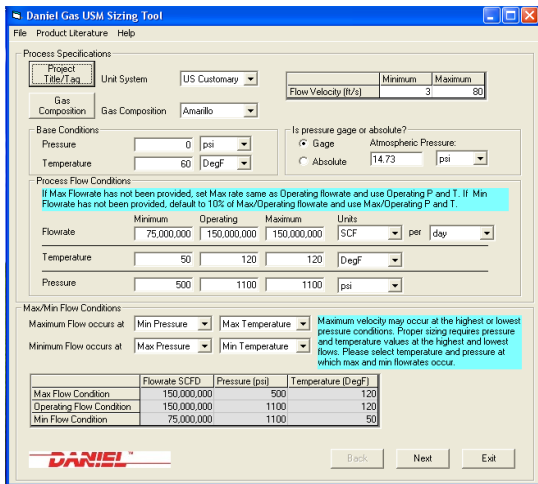
Day 4

0730 – 0815	OIML Recommendation R117 General Requirements • Field of Operation • Accuracy Classes • Case Example • API MPMS Chapter 5.8
0815 – 0845	Terminal Custody Transfer Methods of Tank Calibration • Tank Gauging Techniques • Tank Management Systems
0845 – 0930	Video Presentation Tank Gauging System
0930 – 0945	Break
0945 – 1030	Lease Automatic Custody Transfer System Requirements • Operation • Equipment • Conclusions • Appendix
1030 - 1115	Truck Custody Transfer Truck Types • Typical Equipment • Other Considerations • Performance • New Developments
1115 - 1215	Pipeline Meter Considerations Flow in a Pipeline. • Pipeline Installation Considerations • DP Transmitters • Multi-Port Averaging Pitot • Oscillatory Flow Measurement • Ultrasonic Flow Measurement • Mass Flow Measurement
1215 – 1230	Break
1230 – 1315	Leak Detection & Loss Control System API 1130 • A Theoretical or Practical Approach • Real Time Transient Model • Practical Example • Results • Custody Transfer Sampling • Case Studies
1315 - 1345	API Standards API Gravity • Classification of Grades • Temperature Measurement • Measuring the Suspended S&W Content • Calculating Net Volume
1345 – 1400	Course Conclusion Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

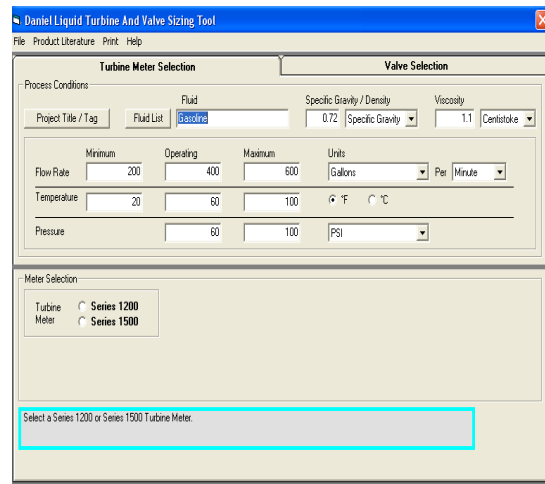


Simulators (Hands-on Practical Sessions)

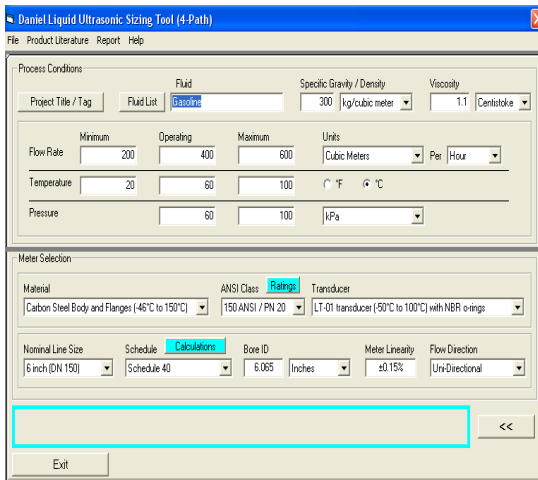
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art “Gas Ultrasonic Meter Sizing Tool”, “Liquid Turbine Meter and Control Valve Sizing Tool”, “Liquid Ultrasonic Meter Sizing Tool” and “Orifice Flow Calculator” simulators.



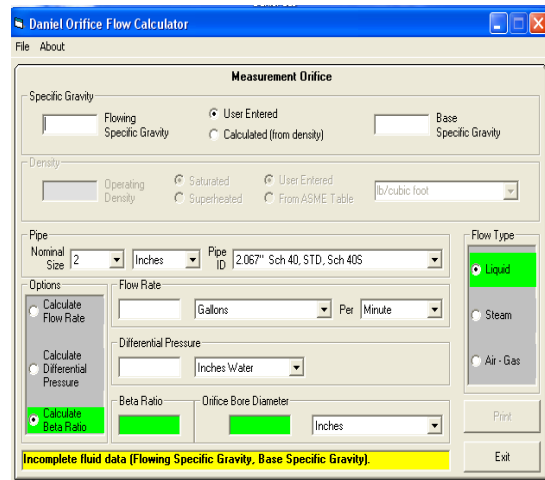
Gas Ultrasonic Meter (USM) Sizing Tool Simulator



Liquid Turbine Meter and Control Valve Sizing Tool Simulator



Liquid Ultrasonic Meter Sizing Tool Simulator



Orifice Flow Calculator Simulator

Course Coordinator

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