COURSE OVERVIEW IE0340
Metering & Custody Transfer System Operations

Course Title
Metering & Custody Transfer System Operations

Course Reference
IE0340

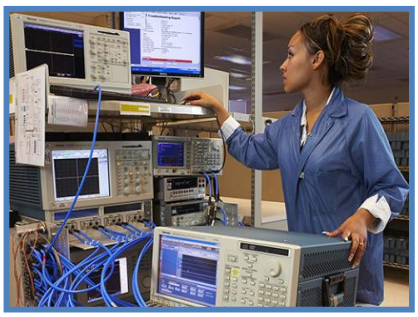
Course Date/Venue
Session 1: January 27-31, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: August 24-28, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Duration/Credits
Five days/3.0 CEUs/30 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.

The course covers the concept of Metering & Custody Transfer System Operations. It is divided into 5 modules:-



Module 1: Accuracy & Process Measurement
This module covers basic definitions, such as viscosity, repeatability, cavitation etc.; flow profiles and the effects on measurement; volumetric and mass flow rate.

Accuracy is important in terms of uncertainty of measurement; calibration; technical specifications and process requirements.

Flow Measurement including orifice plate and DP transmitter; multi-beam ultrasonic flowmeter; Coriolis mass meter; turbine meters amongst others.

Level Measurement, traditional methods such as capacitance and hydrostatic techniques are covered together with more modern technologies such as ultrasonic and radar measurements.

Module 2: Custody Transfer & Fiscal Flow Metering

This module examines the requirements of OIML R117; the subject of Custody Transfer in detail terms; flow calibration, dynamic and static; types of calibration rigs and calibration systems plus prover systems.

Module 3: Terminal & Pipeline Systems

Included in this module are, terminal tank gauging; Lease Automatic Custody Transfer (LACT); sediment and water considerations; operational issues and associated equipment. Pipeline considerations including paraffin content; pipeline pressure and process characteristics. Truck custody transfer, marine and aviation, on-loading and off loading etc.

Module 4: Monitoring and Controlling Losses

Loss control systems – an applied approach – model based system; leak detection / leak testing. Case studies of marine applications; measurement surveys and measurement reports. Multi-phase flowmetering and applications.

Module 5: API Standards and Flowmeter Selection

API measurement standards and volume correction tables; temperature compensation; SG versus API gravity; net volume calculation exercise. Guidelines for flowmeter selection.

Course Objectives

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

- Apply proper knowledge and skills in metering and custody transfer system operations
- Identify the terminologies and classification of fluid mechanics and be aware of the accuracy requirements and specifications for custody measurement and loss control
- Discuss the different types, selection & installation of flow measurement and level measurement
- Aware of the basic overview of OIML Recommendation R117 including its requirements and operation
- Identify the various types of flow calibration and meter provers and discuss its application
- Explain in detail the different types, methods and techniques used in custody transfer and list the equipments used in its operation
- Discuss pipeline meter considerations employed for liquid petroleum products
- Employ leak detection for liquid petroleum products
- Gain in-depth knowledge on loss control system and illustrate proper monitoring and controlling production losses
- Discuss the API Standards as applied to basic custody measurement
- Identify the proper selection and cost consideration of flow meters

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of the major aspects of metering & custody transfer system operations for engineers and other technical staff who are in charge of custody measurement and loss control for petroleum products in oil/gas fields, gas plants, export facilities, refineries, marine terminals or bulk storage plants. Engineers, shift supervisors and other technical staff involved in meter proving and calibration will benefit from this course.

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 Fee

US$ 5,500 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: -

- 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 **3.0 CEUs** (Continuing Education Units) or **30 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.

- 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. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **35 years** of extensive experience in the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Water** & **Utilities**. He specializes in **Fire Fighting** System Instrumentations, **Fire Protection** System, **Fire & Gas Detection** & Alarm System, **Instrumentation Protection Devices** Maintenance & Testing, **Protection Devices** Troubleshooting, Water **Meter Calibration**, Liquid & Gas Flowmetering & **Meter Calibration**, **Testing & Calibration of Energy Meters**, **DCS & ESD** System Architecture, **Distributed Control System**, **DCS** & **SCADA**, Distributed Control System (**DCS**) Selection & Troubleshooting, Advanced **DCS Yokogawa**, **Yokogawa CENTUM VP DCS**, **Modern Distributed Control System** (**DCS**) **& Process Instrumentation**, **Cyber Security** of Industrial System, **DCS System** (**Honeywell**), **DCS Experion** System, **DCS Siemens Telepherm XP**, **Relay Coordination Using ETAP Software**, **Power System Study on ETAP**, **ETAP-Power System Analysis**, **Flow Measurement** Foundation, **Hydrocarbon** Measurement & Sampling, **Gas Dosiers** Preparation, **Gas/Liquid Fuel** Measurement, **Instrumentation Measurement & Control System**, **Flow** Measurement, **Pressure** Measurement, **Level & Temperature** Measurement, **Measurement Devices & Control System**, **Instrumentation & Control** Systems, **Control System** Orientation, Uninterruptible Power Supply (**UPS**) **Battery Charger**, **Industrial UPS Systems Construction & Operation**, **Test Lead-Acid & Ni-cad Battery Systems**, **Hazards & Safe Work Practices**, **Transformer** Operational Principles, Selection & Troubleshooting; **HV & LV Transformers**, **Control Valves & Actuators**, **Electrical Safety**, **Protection Relay Application**, **Maintenance & Testing**, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces, Alerting Techniques, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, **Load Forecasting**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators**, **Generator Protection**, **GE Gas Turbines**, PLC, SCADA, DCS, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, SIS, SIL, ESD, **Alarm Management** Systems, **Energy** Management System, Engine Management System, Bearing & Rotating Machine, Fieldbus Systems and Fiber Optics Technology. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority** and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Instrumentation & Control Engineer**, **Fire Protection Engineer**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Instrumentation & Control Instructor**, **Project Coordinator**, **Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like **ETAP**, Load Management Concepts, **PLC** Programming, Installation, Operation and Troubleshooting, **AC Drives** Theory, Application and Troubleshooting, Industrial Power Systems Analysis, AC & DC **Motors**, Electric Motor **Protection**, **DCS SCADA**, **Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality** Standards, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer** and **Switchgear** Application, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics**, **Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD**, **Master's** & **Bachelor's** degree in **Electrical Engineering** from the **University of Wisconsin Madison**, **USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), an active member of IEEE and ISA as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability.

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 – 0900	***Introduction*** *Objectives of the Workshop • Workshop Content*
0900 – 0930	***Fluid Mechanics*** *Terminology • Flow Profiles • The Measurement of Flow • Flowmeter Classification*
0930 – 0945	*Break*
0945 – 1230	***Accuracy*** *Preview • Basic Requirements • Response • Uncertainty • Process Specification • Technical Specification • Accuracy Specifications*
1230 – 1245	*Break*
1245 – 1415	***Flow Measurement*** *Industrial Flowmeter Types • Basic Flow Theory • Differential Pressure Flowmeters • Oscillatory Flow Measurement • Positive Displacement Meters • Turbine Meters • Magnetic Flowmeters • Ultrasonic Flowmeters • Doppler Flowmeters • Vortex Shedding • Coriolis Meters • Flowmeter Selection*
1415 – 1420	***Video Presentation*** *Coriolis Mass Flowmeter*
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 – 0845	***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*
0845 – 0930	***Video Presentation*** *Radar Level Measurement*
0930 – 0945	*Break*
0945 – 1030	***OIML Recommendation R117*** *Introduction • Scope • General Requirements • Field of Operation • Accuracy Classes • Case Example • API MPMS Chapter 5.8*
1030 – 1045	***Video Presentation*** *Ultrasonic Flowmeter*
1045– 1115	***Flow Calibration*** *General • Trends in Calibration • Types of Calibration Test Rigs • In Situ Calibration • Turbine Meters • Review*

1115– 1130	***Video Presentation*** *Flow Calibration*
1130 – 1230	***Meter Provers*** *Definitions • Main Types • Maintenance • Problems*
1230 – 1245	*Break*
1245 – 1420	***Proving of a Turbine Meter*** *Interactive Video Presentation*
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 – 0915	***Terminal Custody Transfer*** *Introduction • Methods of Tank Calibration • Tank Gauging Techniques Tank Management Systems*
0915 – 0930	***Video Presentation*** *Tank Gauging System*
0930 – 0945	*Break*
0945 – 1100	***Lease Automatic Custody Transfer*** *Introduction • System Requirements • Operation • Equipment • Conclusions • Appendix*
1100 – 1230	***Truck Custody Transfer*** *Introduction • Truck Types • Typical Equipment • Other Considerations • Performance • New Developments*
1230 – 1245	*Break*
1245 – 1420	***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*
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 – 0930	***Leak Detection*** *Introduction • API 1130 • A Theoretical or Practical Approach • Real Time Transient Model • Practical Example • Results • Conclusions*
0930 – 0945	*Break*
0945– 1100	***Loss Control Systems*** *Introduction • Custody Transfer Sampling • Case Studies • Examples of Delivery Malpractice*
1100 – 1230	***Monitoring and Controlling Production Losses*** *Introduction • General • Types of Leaks • Meter Proving • Conclusions*
1230 – 1245	*Break*
1245 – 1415	***Multiphase Metering*** *Introduction to Multi-phase Flowmetering • Multi-phase Flow • Measurement Principles*

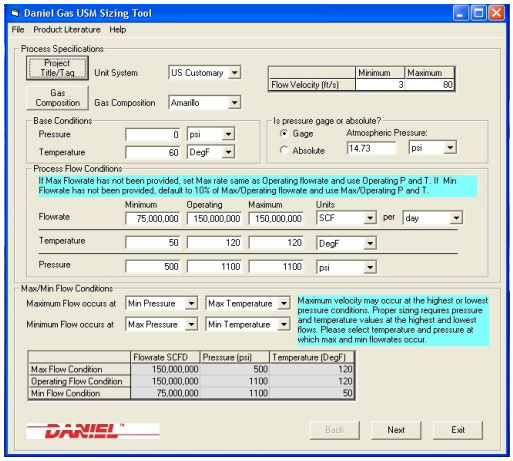
1415 – 1420	***Video Presentation*** *Multiphase Metering*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

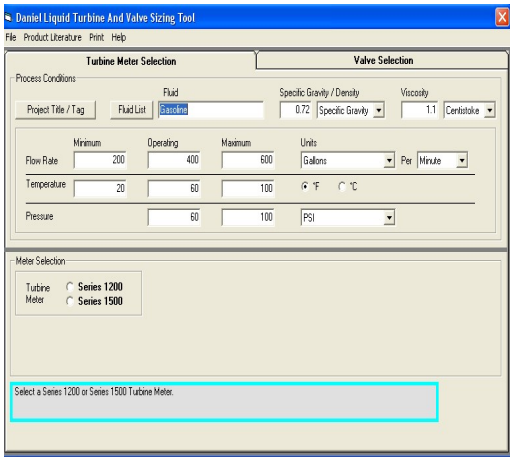
0730 – 0930	***API Standards*** *Introduction • API Gravity • Classification of Grades • Temperature Measurement • Measuring the Suspended S & W Content • Calculating Net Volume • Conclusions*
0930 – 0945	*Break*
0930 – 0945	***Flowmeter Selection and Costs*** *Initial Considerations • Meter Selection • Process Considerations • Cost Considerations*
0945 – 1100	***Case Study – Proving of LPG Meters*** *Introduction • Properties of LPG • Equipment • Benefits*
1100 – 1230	***Addendums*** *Ultrasonic Gas Flowmeter • Custody Transfer Contracts • Other Subjects*
1230 – 1245	*Break*
1245 – 1345	***Review & Wrap-up Session***
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)

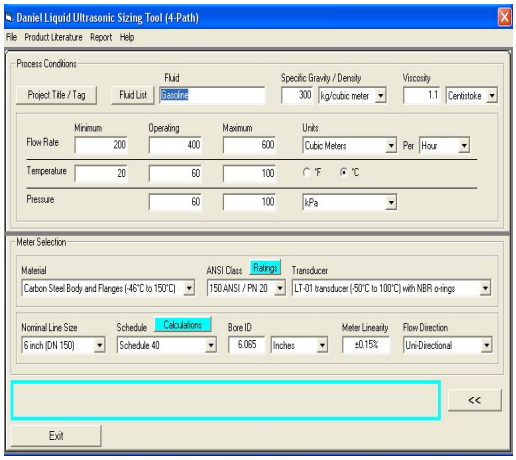
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art "Gas Ultrasonic Meter Sizing Tool", "Liquid Turbine Meter and Control Valve Sizing Tool", "Liquid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



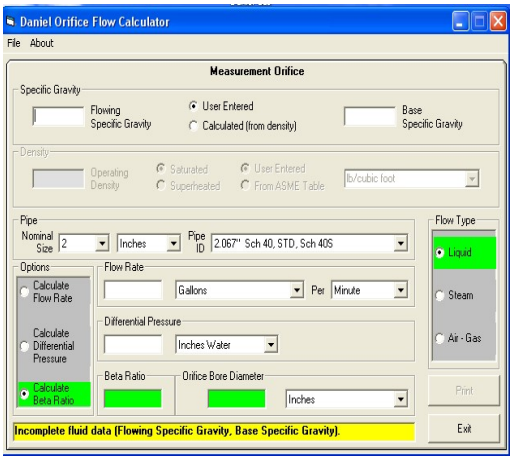
Gas Ultrasonic Meter (USM) Sizing Tool Simulator



Liquid Turbine Meter and Control Valve Sizing Tool Simulator



Liquid Ultrasonic Meter Sizing Tool Simulator



Orifice Flow Calculator Simulator

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org