



COURSE OVERVIEW IE0340

Custody Measurement, Fiscal Flow Metering, Meter Calibration, Uncertainty Calculations & Loss Control of Petroleum Products

Course Title

Custody Measurement, Fiscal Flow Metering, Meter Calibration, Uncertainty Calculations & Loss Control of Petroleum Products

Course Date/Venue

October 04-08, 2026/Musandam Meeting Room, Royal Tulip Muscat Hotel, Muscat, Oman

Course Reference

IE0340

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 custody transfer, fiscal flow metering, meter calibration, uncertainty calculations and loss control of petroleum products. 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/Outcomes & Benefits for the Participants

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

- Apply proper knowledge and skills in custody measurement, fiscal flow metering, meter calibration, uncertainty calculations and loss control of petroleum products
- 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 custody measurement, fiscal flow metering, meter calibration, uncertainty calculations and loss control of petroleum product 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.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Accommodation

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

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.



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

Haward's certificates are accredited by the following international accreditation organizations: -

-  British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

-  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.



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 **30 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 Teleperm 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: Sunday, 04th of October 2026

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: Monday, 05th of October 2026

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: Tuesday, 06th of October 2026

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: Wednesday, 07th of October 2026

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 & 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 <i>Multiphase Metering</i>
1420 – 1430	Recap <i>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</i>
1430	<i>Lunch & End of Day Four</i>

Day 5: Thursday, 08th of October 2026

0730 – 0930	API Standards <i>Introduction • API Gravity • Classification of Grades • Temperature Measurement • Measuring the Suspended S & W Content • Calculating Net Volume • Conclusions</i>
0930 – 0945	<i>Break</i>
0930 – 0945	Flowmeter Selection & Costs <i>Initial Considerations • Meter Selection • Process Considerations • Cost Considerations</i>
0945 – 1100	Case Study – Proving of LPG Meters <i>Introduction • Properties of LPG • Equipment • Benefits</i>
1100 – 1230	Addendums <i>Ultrasonic Gas Flowmeter • Custody Transfer Contracts • Other Subjects</i>
1230 – 1245	<i>Break</i>
1245 – 1345	Review & Wrap-up Session
1345 – 1400	Course Conclusion <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course</i>
1400 – 1415	POST-TEST
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>



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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