**COURSE OVERVIEW IE0605**

# Advanced Gas Metering & Gas Chromatography Systems

*Principles, Operation, Calibration, and Data Integration*

## Course Title

Advanced Gas Metering & Gas Chromatography Systems: *Principles, Operation, Calibration, and Data Integration*


## Course Date/Venue

October 26-30, 2026/TBA Meeting Room, Al Bandar Rotana - Creek, Dubai, UAE

## Course Reference

IE0605

## Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

## Course Description

***This practical and highly-interactive course includes practical sessions and exercises where participants will visit the laboratory and they will be introduced to various lab instruments and gas chromatography process. Practical sessions will be performed using one of the lab equipment in order to apply the theory learnt in the class.***

This course is designed to provide participants with a detailed and up-to-date overview of Advanced Gas Metering & Gas Chromatography Systems: Principles, Operation, Calibration, and Data Integration. It covers the principles of gas flow measurement including gas properties, flow characteristic essentials and differential pressure, volumetric and mass flow measurement; the metering technologies, system components and configuration and design and installation practices; and the error sources and measurement uncertainty including operation of gas metering systems.

Further, the course will also discuss the preventive and predictive maintenance, calibration of gas flow meters, laboratory calibration and data verification; the maintenance and reliability in metering, advanced diagnostics, digital communication, remote monitoring and data acquisition; the fundamentals of gas chromatography; and the GC system components and operation, GC calibration and quality assurance.

During this interactive course, participants will learn the preventive maintenance of GC systems, GC data analysis and application in custody transfer and process measurement; the data management and reporting, supervisory systems for gas measurement, regulatory and fiscal compliance and communication protocols; linking measurement systems to business processes; and the operational auditing and error investigation.

## Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an advanced knowledge and the principles, operation, calibration, and data integration of gas metering and gas chromatography systems
- Discuss the principles of gas flow measurement including gas properties, flow characteristic essentials and differential pressure, volumetric and mass flow measurement
- Apply metering technologies, system components and configuration and design and installation practices
- Recognize error sources and measurement uncertainty including operation of gas metering systems
- Carryout preventive and predictive maintenance, calibration of gas flow meters and laboratory calibration and data verification
- Employ maintenance and reliability in metering, advanced diagnostics and digital communication and remote monitoring and data acquisition
- Discuss the fundamentals of gas chromatography and apply GC system components and operation, GC calibration and quality assurance
- Implement preventive maintenance of GC systems, GC data analysis and application in custody transfer and process measurement
- Apply data management and reporting, supervisory systems for gas measurement, regulatory and fiscal compliance and communication protocols
- Link measurement systems to business processes and apply operational auditing and error investigation

## 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 all significant aspects and considerations of gas and liquid measurement technologies, operation, calibration and gas chromatography for measurement engineers and technicians, instrumentation and control engineers, process engineers, calibration and metrology personnel, operations and maintenance staff, laboratory technicians, quality assurance and compliance officers and supervisors and managers.

## 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:

**(1) Mr. John Swinley** is a **Senior Consultant** with over **30 years** of industrial experiences in **Chromatography and Spectroscopy**. His expertise widely covers in the areas of **Vacuum** technology & **Vacuum** Pump Systems, **Gas Chromatography Techniques & Troubleshooting**, **Gas Analyzer**, **Laboratory** Instrument Calibration, **Chromatography** Data System, Isotope Ratio Mass Spectrometry, Vacuum Technology, **Spectroscopic** Techniques, Capillary GC, **Gas Analysis**, **Analytical Laboratory Audit**, **Transformer Oil Gas** Analysis, Natural & Refinery Gas Analysis, **Varian Gas Chromatography** Operation & Maintenance, **Agilent ChemStation** Operation, **GC Device Prevention & Maintenance**, **Process Analyzer**, Modern **Chemical Laboratory**, **Analytical Instrumentation**, Equipment Calibration, **GC Troubleshooting** & User Maintenance, **GC/MS Technology & Problem Solving**, Online **Gas Analyzer**, **GC/MS Mass Spectra** Interpretation, **Laboratory Equipment** Maintenance, Separation Technology, **Natural Gas Testing & Analysis** and **Natural & Refinery Testing**. He is currently involved in method development and optimization in nuclear energy, power generation and petrochemical industries wherein he troubleshoots instrument problems and introduce comprehensive GC applications for on-line analysis in petrochemistry.

During his career life, Mr. Swinley worked with several companies and institutions occupying numerous positions such as being the **Director**, **Product Manager**, **Product Specialist** and **Research Assistant** from the University Witwatersrand, G.D. Searle, SMM Instruments, Wirsam Scientific, Perkin Elmer SA, Scientific Group, Scientific Supply Services and Chromatography Consultants.

Mr. Swinley has a **Bachelor** degree in **Applied Mathematics and Physics** and a **Diploma** in **Industrial Electronics**. Further, he is a **Certified Instructor/Trainer** and has published a book “Practical Gas Analysis by Gas Chromatography” in 2019. He was awarded as the “Chromatographer of the year” by the ChromSA and has delivered numerous trainings, courses, workshops, seminars and conferences internationally.

**AND,**

**(2) 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**, **Gas Flow** Measurement, **Gas Metering** Systems, **Testing & Calibration of Energy Meters**, **DCS & ESD** System Architecture, **Distributed Control System**, **DCS** & **SCADA**, Distributed Control System (**DCS**) Selection & Troubleshooting, **ETAP-Power System Analysis**, **Flow Measurement** Foundation, **Hydrocarbon** Measurement & Sampling, **Gas Dosiers** Preparation, **Gas/Liquid Fuel** Measurement, **Instrumentation Measurement & Control System**, **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 Practice**s, **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.

## 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 Program

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

***Day 1:*** ***Foundations of Gas Flow Measurement***

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|---|---|
| *0730 – 0800* | *Registration & Coffee* |
| *0800 – 0815* | *Welcome & Introduction* |
| *0815 – 0830* | ***PRE-TEST*** |
| *0830 – 0900* | ***Principles of Gas Flow Measurement***<br>*Gas Properties and Flow Characteristic Essentials • Differential Pressure, Volumetric, and Mass Flow Measurement • Mechanical versus Electronic Devices* |
| *0900 - 0930* | ***Overview of Metering Technologies***<br>*Turbine, Ultrasonic, Vortex, Coriolis Meters • Selection Criteria for Gas Meters* |
| *0930 – 0945* | *Break* |
| *0945 – 1030* | ***System Components & Configuration***<br>*Transmitters, Flow Computers, SCADA/DCS Integration • System Accuracy and Repeatability* |
| *1030 – 1130* | ***Design & Installation Practices***<br>*Skid Design, Piping Layout, Installation Best Practices* |
| *1130 – 1215* | ***Error Sources & Measurement Uncertainty***<br>*Error Types, Calibration Drift, Environmental Impacts • Data Correction and Compensation* |
| *1215 – 1230* | *Break* |

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|---|---|
| 1230 – 1330 | ***Operation of Gas Metering Systems***<br>*Start-up, Shutdown Procedures, Diagnostics • Reading/Interpreting Metering Data, Safety Precautions* |
| 1330 – 1420 | ***Preventive & Predictive Maintenance***<br>*Sensor Inspection, Troubleshooting Failures • Reliability-Centered Maintenance, Documentation* |
| 1420 – 1430 | ***Recap***<br>*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: Advanced Metering Operation, Calibration, and Error Control**

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| 0730 – 0830 | ***Calibration Fundamentals***<br>*Importance and Standards, Traceability (ISO/IEC 17025) • Primary versus Secondary Calibration Methods* |
| 0830 - 0930 | ***Calibration of Gas Flow Meters***<br>*Setup and Procedure for Turbine, Ultrasonic and Coriolis Meters • Comparison Techniques, Zero Flow, and Linearity Verification* |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***Laboratory Calibration & Data Verification***<br>*Calibration Rigs, Correction Factors, Recording, and Verification* |
| 1100 – 1145 | ***Practical Demonstration/Case Studies***<br>*Data Interpretation, Troubleshooting Calibration Issues* |
| 1145 - 1215 | ***Maintenance & Reliability in Metering***<br>*Scheduling, Spare Parts Management, Best Practices* |
| 1215 – 1230 | *Break* |
| 1230 – 1330 | ***Advanced Diagnostics & Digital Communication***<br>*Supervisory Integration, Smart Transmitters • HART, Modbus, Digital Protocols* |
| 1330 – 1420 | ***Remote Monitoring & Data Acquisition***<br>*Automated Flow Control, Remote Diagnostics* |
| 1420 – 1430 | ***Recap***<br>*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: Principles & Practice of Gas Chromatography (GC)**

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|---|---|
| 0730 – 0830 | ***Fundamentals of Gas Chromatography***<br>*Principle of Operation, Separation, Detection • Columns, Injectors, Detectors, Carrier Gases* |
| 0830 – 0930 | ***GC System Components & Operation***<br>*Installation, Configuration, Sampling Methods • Emerson GC Example Overview* |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***GC Calibration & Quality Assurance***<br>*Calibration Gases, Reference Standards • Baseline, Detector Tuning, Troubleshooting* |
| 1100 – 1145 | ***Preventive Maintenance of GC Systems***<br>*Scheduled Checks, Cleaning, Performance Issues* |
| 1145 - 1215 | ***GC Data Analysis***<br>*Chromatograms, Component Identification, Quantitative Analysis* |

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| 1215 – 1230 | *Break* |
| 1230 – 1330 | ***Application in Custody Transfer & Process Measurement***<br>*Fiscal Role of GC, Linking Results to Metering* |
| 1330 – 1420 | ***Group Exercise: Data Analysis Scenarios*** |
| 1420 – 1430 | ***Recap***<br>*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: Data Management, Integration & Compliance***

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| 0730 – 0830 | ***Data Management & Reporting***<br>*Linking GC and Metering Data, Energy Content Calculation* |
| 0830 – 0930 | ***Supervisory Systems for Gas Measurement***<br>*SCADA/DCS, Remote Monitoring Concepts* |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***Regulatory & Fiscal Compliance***<br>*National/International Standards Overview* |
| 1100 – 1145 | ***Best Practice Reviews***<br>*Operational Checklists, QA/QC for Gas Measurement* |
| 1145 - 1215 | ***Communication Protocols***<br>*Practical Examples and Troubleshooting* |
| 1215 – 1230 | *Break* |
| 1230 – 1330 | ***Linking Measurement Systems to Business Processes***<br>*Reporting, Auditable Trail, Error Tracking* |
| 1330 – 1420 | ***Open Forum: Troubleshooting & "Ask the Expert"*** |
| 1420 – 1430 | ***Recap***<br>*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: Integration, Case Studies & Wrap-Up***

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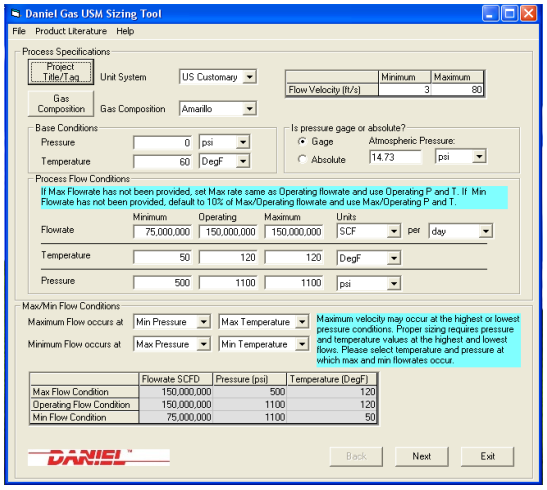
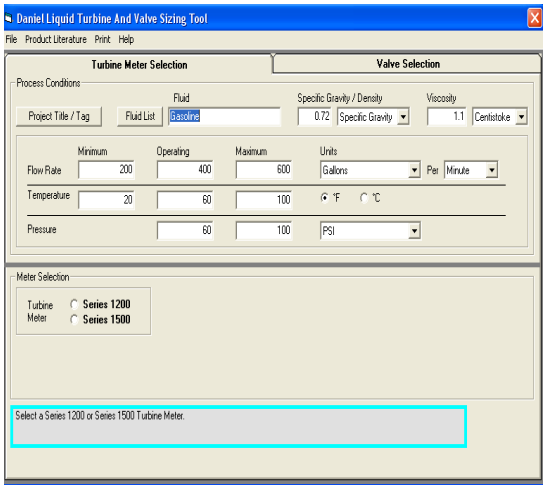
| 0730 – 0830 | ***Advanced Integration Scenarios***<br>*Real-World Case Studies, Emerson and Multi-Vendor Environments* |
| 0830 – 0930 | ***Operational Auditing & Error Investigation*** |
| 0930 – 0945 | *Break* |
| 0945 – 1100 | ***Practical Data Analysis Session***<br>*Review/Analyze Sample Field and Lab Datasets (Guided)* |
| 1100 – 1245 | ***Summary of Best Practices***<br>*Key Takeaways and Action Planning* |
| 1245 – 1300 | *Break* |
| 1300 – 1345 | ***Participant Presentations/Feedback***<br>*Sharing Learning, Ideas for Future Improvements* |
| 1345 – 1400 | ***Course Conclusion***<br>*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* |

## Simulator (Hands-on Practical Sessions)

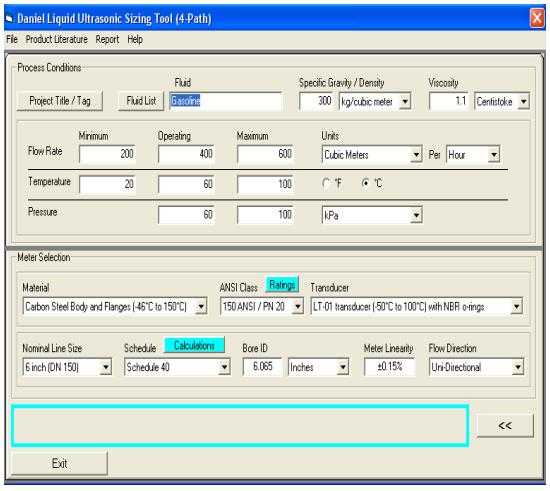
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators "Gas Ultrasonic Meter Sizing Tool", "Liquid Turbine Meter and Control Valve Sizing Tool",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



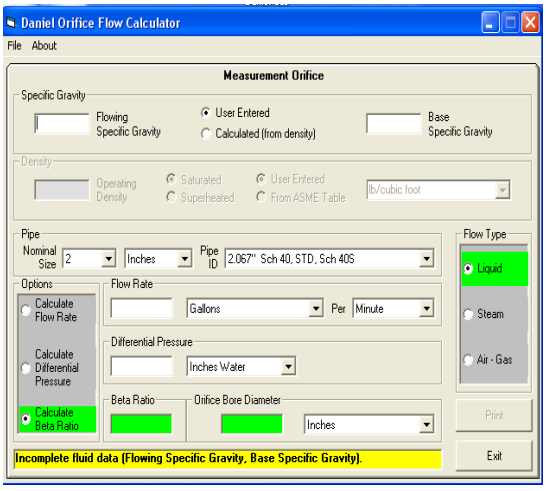

**Gas Ultrasonic Meter (USM) Sizing Tool Simulator**




**Liquid Turbine Meter and Control Valve Sizing Tool Simulator**




**Liquid Ultrasonic Meter Sizing Tool Simulator**




**Orifice Flow Calculator Simulator**

**Practical Sessions/Site Visit**

Site visit will be organized during the course for delegates to practice the theory learnt:-


**Course Coordinator**

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