

COURSE OVERVIEW IE0094
Validations & Proving of Custody Transfer
Meters of Oil and Gas

Course Title

Validations & Proving of Custody Transfer Meters of Oil and Gas

Course Reference

IE0094

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Date/Venue

Session(s)	Date	Venue
1	February 08-12, 2026	Tamra Meeting Room, Al Bandar Rotana Creek, Dubai UAE
2	April 12-16, 2026	Meeting Plus 9, City Centre Rotana, Doha Qatar
3	September 28-October 02, 2026	Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
4	November 29-December 03, 2026	Crowne Meeting Room, Crowne Plaza Al Khobar, KSA

Course Description



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



This course is designed to provide delegates with a detailed and up-to-date overview of Validations & Proving of Custody Transfer Meters of Oil and Gas. It covers the significance of custody transfer in oil and gas operations; the legal and financial implications of errors, regulatory frameworks and standards and the importance of accurate measurement in upstream and downstream operations; the various types of custody transfer meters, measurement standards and protocols as well as fluid properties and measurement; the uncertainty in measurements and common sources of errors; the importance in custody transfer processes; and the key parameters to monitor during validation, documentation and reporting requirements.



Further, the course will also discuss the flow calibration procedures and interpreting calibration results and adjustments; the proving techniques for different meters, performance verification and simulating measurement conditions; the meter proving systems, meter factor and its significance; the impact of operating conditions on meter factor; and the dynamic proving challenges and importance of compensating for temperature and pressure.

During this interactive course, participants will learn the real-time compensation techniques, standard temperature and pressure (STP) adjustments and tools and equipment for compensation validation; the routine maintenance schedules and procedures and calibration of proving systems; identifying wear and tear in prover components and preventive strategies to ensure system reliability; the common issues in custody transfer meters and root cause analysis for meter failures, data integrity and validation; the SCADA and other monitoring systems, integration of meters with digital tools and cybersecurity considerations in custody transfer systems; the comprehensive validation and proving reports; the key elements of a custody transfer report and archiving and data management practices including auditing and compliance documentation; the QA/QC programs in measurement systems and performance metrics for quality assurance; and the advances in meter technologies including regulatory updates and compliance.

Course Objectives

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

- Apply and gain an in-depth knowledge on validations and proving of custody transfer meters of oil and gas
- Discuss the significance of custody transfer in oil and gas operations including the legal and financial implications of errors, regulatory frameworks and standards and the importance of accurate measurement in upstream and downstream operations
- Identify the various types of custody transfer meters, measurement standards and protocols as well as fluid properties and measurement
- Calculate the uncertainty in measurements, identify the common sources of errors and minimize and correct errors
- Discuss the importance in custody transfer processes, key parameters to monitor during validation as well as documentation and reporting requirements
- Apply flow calibration procedures and interpret calibration results and adjustments
- Carryout proving techniques for different meters, performance verification and simulating measurement conditions
- Recognize meter proving systems, derive the meter factor and its significance, discuss the impact of operating conditions on meter factor, trend and analyze meter factor variations and adjust based on factor results
- Explain dynamic proving challenges and the importance of compensating for temperature and pressure
- Apply real-time compensation techniques, standard temperature and pressure (STP) adjustments and tools and equipment for compensation validation
- Carryout routine maintenance schedules and procedures, calibration of proving systems, identifying wear and tear in prover components and preventive strategies to ensure system reliability
- Analyze the common issues in custody transfer meters and apply root cause analysis for meter failures, data integrity and validation
- Recognize SCADA and other monitoring systems, integration of meters with digital tools and cybersecurity considerations in custody transfer systems

- Prepare comprehensive validation and proving reports, identify the key elements of a custody transfer report and apply archiving and data management practices including auditing and compliance documentation
- Implement QA/QC programs in measurement systems and apply performance metrics for quality assurance
- Discuss the advances in meter technologies including regulatory updates and compliance

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 validations and proving of custody transfer meters of oil and gas for metering technicians, instrumentation engineers, operations managers and supervisors, quality assurance/control specialists, regulatory compliance officers, project managers, maintenance engineers and technicians, flow measurement engineers, HSE (health, safety, and environment) managers, financial auditors, consultants, regulatory inspectors and other technical staff.

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.

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: -

- 
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.

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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 **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:



Mr. Barry Pretorius (Burgert Pretorius) is a **Senior Electrical & Instrumentation Engineer** with almost **30** years of extensive experience within the **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise widely covers in the areas of **Distributed Control System (DCS), DCS Operations & Techniques, Plant Control and Protection Systems, Process Control & Instrumentation, Liquid & Gas Flowmetering, Custody Measurement, Ultrasonic Flowmetering, Loss Control, Loss Control & Multiphase Flowmetering, Custody Measurement & Loss Control, Gas Measurement, Cascade Control Loops, Split-Range Control Loops, Capacity Control & Other Advanced Control Schemes, Safety Instrumented Systems, Plant Automation Operations & Maintenance, Programmable Logic Controller (PLC), Siemens PLC Simatic S7-400/S7-300/S7-200, PLC & SCADA for Automation & Process Control, Artificial Intelligence, Allen Bradley PLC Programming and Hardware Trouble Shooting, Schneider SCADA System, Wonder Ware, Emerson, Honeywell, Honeywell Safety Manager PLC, Yokogawa, Advanced DCS Yokogawa, Endress & Hauser, Field Commissioning and Start up Testing Pre Operations, Fire & Gas Detection System, System Factory Acceptance Test (FAT), FactoryLink ECS, Modicon 484, Rockwell Automation, System Site Acceptance Test (SAT), SCADA HMI & PLC Control Logic, Cyber Security Practitioner, Cyber Security of Industrial Control System, IT Cyber Security Best Practices, Cybersecurity Fundamentals, Ethical Hacking & Penetration Testing, Cybersecurity Risk Management, Cybersecurity Threat Intelligence, OT Whitelisting for Better Industrial Control System Defense, NESA Standard and Compliance Workshop, OT, Cyber Attacks Awareness - Malware/Ransom Ware / Virus /Trojan/ Phishing, Information Security Manager, Security System Installation and Maintenance, Implementation, Systems Testing, Commissioning and Startup, Foxboro DCS & Triconics, SIS Systems, Advanced DC Drives, Motion Control, Hydraulics, Pneumatics and Control Systems Engineering, Electrical & Automation Control Systems, HV/MV Switchgear, LV & MV Switchgears & Circuit Breakers, High Voltage Electrical Safety, LV & HV Electrical System, HV Equipment Inspection & Maintenance, LV Distribution Switchgear & Equipment, Electrical Safety, Electrical Maintenance, Transformers, Medium & High Voltage Equipment, Circuit Breakers, Cable & Overhead Line Troubleshooting & Maintenance, Electrical Drawing & Schematics, Voltage Distribution, Power Distribution, Filters, Automation System, Electrical Variable Speed Drives, Power Systems, Power Generation, Diesel Generators, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers, AC & DC Transmission, CCTV Installation, Data & Fire Alarm System, Evacuation Systems and Electrical Motors & Variable Speed Drives, & Control of Electrical and Electronic devices.**

During Mr. Pretorius's career life, he has gained his practical experience through several significant positions and dedication as the **Technical Director, Automation System's Software Manager, Site Manager, Senior Lead Technical Analyst, Project Team Leader, Automation Team Leader, Automation System's Senior Project Engineer, Senior Project & Commissioning Engineer, Senior Instrumentation & Control Engineer, Electrical Engineer, Project Engineer, Pre-Operations Startup Engineer, PLC Specialist, Radio Technician, A.T.E Technician** and **Senior Instructor/Trainer** from various companies like the **ADNOC Sour Gas, Ras Al Khair Aluminum Smelter, Johnson Matthey Pty. Ltd, Craigcor Engineering, Unitronics South Africa Pty (Ltd), Bridgestone/Firestone South Africa Pty (Ltd)** and **South African Defense Force**.

Mr. Pretorius's has a **Bachelor of Technology in Electrical Engineering (Heavy Current)**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)**, received numerous awards from various institutions and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Course Fee

Dubai	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.
Doha	US\$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Abu Dhabi	US\$ 5,500 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\$ 5,500 per Delegate + VAT . This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), 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 course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 - 0800	<i>Registration & Coffee</i>
0800 - 0815	<i>Welcome & Introduction</i>
0815 - 0830	PRE-TEST
0830 - 0930	Introduction to Custody Transfer <i>Definition & Significance in Oil & Gas Operations • Legal & Financial Implications of Errors • Regulatory Frameworks & Standards (API, ISO) • Importance of Accurate Measurement in Upstream & Downstream Operations</i>
0930 - 0945	<i>Break</i>
0945 - 1030	Types of Custody Transfer Meters <i>Overview of Turbine, Coriolis, Ultrasonic, & Positive Displacement Meters • Applications & Suitability for Oil & Gas • Advantages & Limitations of Each Meter Type • Commonly Used Technologies in LUKOIL Operations</i>
1030 - 1145	Measurement Standards & Protocols <i>API MPMS (Manual of Petroleum Measurement Standards • ISO Standards Relevant to Custody Transfer. • Local Iraqi & International Regulations • Harmonizing Operations with Global Standards</i>
1145- 1245	Fluid Properties & Measurement <i>Influence of Pressure, Temperature, & Density on Measurements • Handling Crude Oil Versus Natural Gas Measurements • Viscosity & Its Effect on Meter Performance • Real-World Examples of Property Variations During Transfer</i>
1245 - 1300	<i>Break</i>



1300 – 1345	Measurement Uncertainty & Error Sources Definition & Calculation of Uncertainty in Measurements • Common Sources of Errors (Installation, Calibration, Wear) • Minimizing & Correcting Errors • Case Studies of Error Impact in Custody Transfer
1345 - 1420	Hands-On Session: Familiarization with Custody Transfer Systems Overview of a Typical Custody Transfer Station • Inspection of Meter Components • Basic Operation Principles & Troubleshooting • Q&A Session to Address Participant Queries
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	Overview of Meter Validation Definition & Objectives of Validation • Importance in Custody Transfer Processes • Key Parameters to Monitor During Validation • Documentation & Reporting Requirements
0830 - 0930	Flow Calibration Procedures Purpose & Frequency of Flow Calibration • Master Meter Method & its Implementation • Prover Loop Systems: Piston & Ball Prover Methods • Interpreting Calibration Results & Adjustments
0930 – 0945	Break
0945 – 1045	Proving Techniques for Different Meters Proving Turbine & Ultrasonic Meters • Special Considerations for Coriolis Meter • Static & Dynamic Proving Techniques • Comparison of Real-Time Versus Batch Proving Methods
1045 – 1245	Performance Verification Key Performance Indicators (KPIs) for Custody Meters • Verifying Repeatability & Linearity • Simulated versus Actual Flow Verification • Case Studies: Diagnosing Validation Failures
1245 – 1300	Break
1300 – 1345	Simulating Measurement Conditions Influence of Pressure, Temperature, & Flow Rate Changes • Real-World Challenges & Mitigation Strategies • Testing Meters in Simulated versus Live Conditions • Role of Diagnostic Tools in Validations
1345 - 1420	Practical Demonstration Participants Conduct a Validation Exercise • Interpretation of Validation Data • Troubleshooting Common Issues During Validation • Group Discussion & Feedback
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 – 0830	Basics of Meter Proving Systems Types of Provers (Small Volume, Bi-Directional, Master Meters) • Design & Operation Principles • Installation Requirements & Best Practices • Challenges & Solutions in Prover Applications
0830 - 0930	Meter Factor Calculation & Analysis Deriving the Meter Factor & Its Significance • Impact of Operating Conditions on Meter Factor • Trending & Analyzing Meter Factor Variations • Adjustments Based on Factor Results
0930 – 0945	Break
0945 – 1045	Dynamic Proving Challenges Proving Under Fluctuating Flow Conditions • Handling Multiphase Flows in Oil & Gas • Preventing Errors During Dynamic Proving • Advanced Diagnostic Techniques for Troubleshooting
1045 – 1245	Temperature & Pressure Compensation Importance of Compensating for Temperature & Pressure • Real-Time Compensation Techniques • Standard Temperature & Pressure (STP) Adjustments • Tools & Equipment for Compensation Validation
1245 - 1300	Break
1300 - 1330	Proving System Maintenance & Calibration Routine Maintenance Schedules & Procedures • Calibration of Proving Systems • Identifying Wear & Tear in Prover Components • Preventive Strategies to Ensure System Reliability
1330 – 1420	Field Exercise: Advanced Meter Proving Participants Practice Advanced Proving Methods • Analyzing & Correcting Proving Errors • Group Presentation of Findings • Open Discussion on Field Challenges
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 – 0830	Common Issues in Custody Transfer Meters Identifying & Diagnosing Common Meter Issues • Impact of Wear, Fouling, & Vibration on Accuracy • Real-World Examples & Solutions • Case Studies of Troubleshooting Errors
0830 - 0930	Root Cause Analysis for Meter Failures Framework for Conducting Root Cause Analysis (RCA) • Tools & Techniques for RCA (Ishikawa, 5 Whys • Implementing Corrective Actions • Best Practices for Preventing Recurrence
0930 – 0945	Break
0945 – 1045	Data Integrity & Validation Importance of Accurate Data in Custody Transfer • Validating Measurement Data Against Standards • Using Software Tools for Data Validation • Case Studies of Data Integrity Failures
1045 – 1245	Digital Systems in Custody Transfer Overview of SCADA & Other Monitoring Systems • Integration of Meters with Digital Tools • Cybersecurity Considerations in Custody Transfer Systems • Future Trends: IoT & AI in Measurement

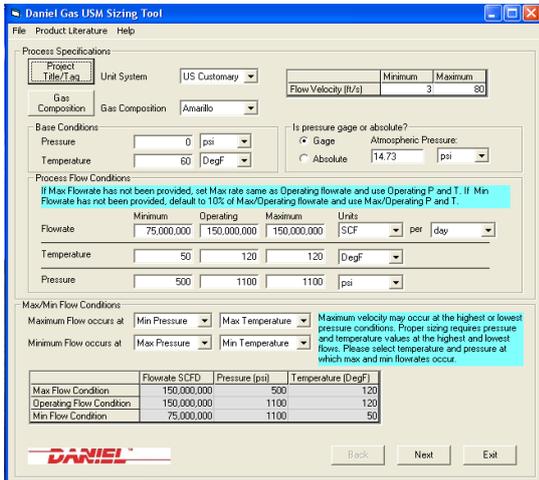
1245 - 1300	Break
1300 - 1330	Reporting & Documentation <i>Preparing Comprehensive Validation & Proving Reports • Key Elements of a Custody Transfer Report • Archiving & Data Management Practices • Auditing & Compliance Documentation</i>
1330 - 1420	Practical Session: Troubleshooting Simulated Issues <i>Group Exercise on Simulated Meter Issues • Developing Solutions & Presenting Finding • Peer Feedback & Discussion</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	Lunch & End of Day Four

Day 5

0730 - 0830	Quality Assurance in Custody Transfer <i>Implementing QA/QC Programs in Measurement Systems • Performance Metrics for Quality Assurance • Auditing & Benchmarking Systems • Role of Third-Party Inspections</i>
0830 - 0930	Case Studies in Custody Transfer <i>Real-World Examples of Successful & Failed Custody Transfers • Lessons Learned & Best Practices • Application to LUKOIL Operations • Interactive Discussion on Case Scenarios</i>
0930 - 0945	Break
0945 - 1245	Emerging Technologies <i>Advances in Meter Technologies (Smart Meters, Non-Intrusive Methods) • Role of AI & Machine Learning in Custody Transfer • Predictive Maintenance for Custody Meters • Industry Outlook for 2030 & Beyond</i>
1245 - 1300	Break
1300 - 1345	Regulatory Updates & Compliance <i>Latest Updates in API & ISO Standards • Iraqi Regulatory Framework Developments • Ensuring Compliance with Evolving Regulations • Future Implications for LUKOIL Operations</i>
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	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.



Daniel Gas USM Sizing Tool

Process Specifications

Unit System: US Customary

Gas Composition: Amalrod

Flow Velocity (ft/s): Minimum 3, Maximum 80

Base Conditions: Pressure 0 psi, Temperature 60 DegF

Process Flow Conditions

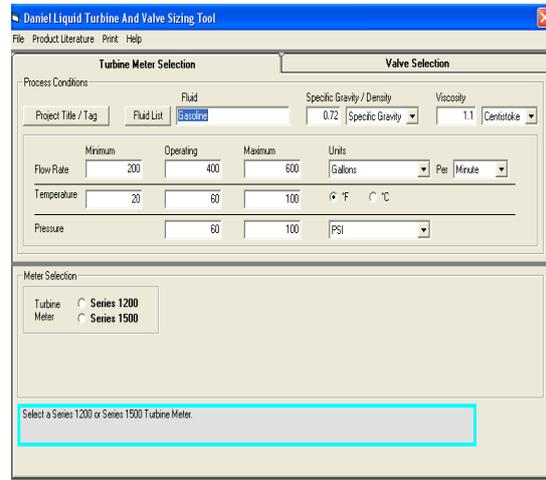
Flowrate: Minimum 75,000,000, Operating 150,000,000, Maximum 150,000,000 SCF per day

Temperature: 50, 120, 120 DegF

Pressure: 500, 1100, 1100 psi

	Flowrate SCFD	Pressure (psi)	Temperature (DegF)
Max Flow Condition	150,000,000	500	120
Operating Flow Condition	150,000,000	1100	120
Min Flow Condition	75,000,000	1100	50

Gas Ultrasonic Meter (USM) Sizing Tool Simulator



Daniel Liquid Turbine And Valve Sizing Tool

Process Conditions

Fluid: Gasoline

Specific Gravity / Density: 0.72

Viscosity: 1.1 Centistoke

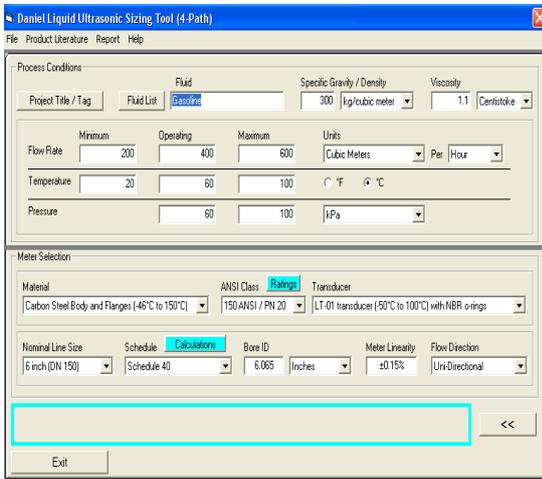
Flow Rate: Minimum 200, Operating 400, Maximum 600 Gallons Per Minute

Temperature: 20, 60, 100 F / C

Pressure: 60, 100 PSI

Meter Selection: Turbine Meter Series 1200, Series 1500

Liquid Turbine Meter and Control Valve Sizing Tool Simulator



Daniel Liquid Ultrasonic Sizing Tool (4-Path)

Process Conditions

Fluid: Gasoline

Specific Gravity / Density: 300 kg/cubic meter

Viscosity: 1.1 Centistoke

Flow Rate: Minimum 200, Operating 400, Maximum 600 Cubic Meters Per Hour

Temperature: 20, 60, 100 F / C

Pressure: 60, 100 kPa

Meter Selection

Material: Carbon Steel Body and Flanges (-45°C to 150°C)

ANSI Class: Ratings

Transducer: LT-01 transducer (50°C to 100°C) with NBR o-rings

Nominal Line Size: 6 inch (DN 150)

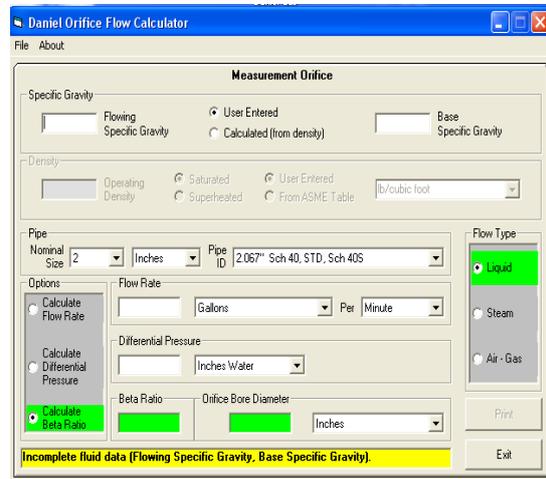
Schedule: Schedule 40

Bore ID: 6.065 Inches

Meter Linearity: ±0.15%

Flow Direction: Uni-Directional

Liquid Ultrasonic Meter Sizing Tool Simulator



Daniel Orifice Flow Calculator

Measurement Orifice

Specific Gravity: Flowing Specific Gravity, Base Specific Gravity

Density: Operating Density, Saturated Density, Superheated Density

Pipe: Nominal Size 2 Inches, Pipe ID 2.067" Sch 40 STD, Sch 40S

Flow Type: Liquid, Steam, Air - Gas

Options: Calculate Flow Rate, Calculate Differential Pressure, Calculate Beta Ratio

Flow Rate: Gallons Per Minute

Differential Pressure: Inches Water

Beta Ratio: Orifice Bore Diameter

Incomplete fluid data (Flowing Specific Gravity, Base Specific Gravity)

Orifice Flow Calculator Simulator

Course Coordinator

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