



## COURSE OVERVIEW PE0050 Elements of Applied Process Engineering

### Course Title

Elements of Applied Process Engineering

### Course Date/Venue

October 07-11, 2024/Fujairah Meeting Room,  
Grand Millennium Al Wahda Hotel, Abu Dhabi,  
UAE

### Course Reference

PE0050

### Course Duration/Credits

Five days/3.0 CEUs/30 PDHs

### Course Description

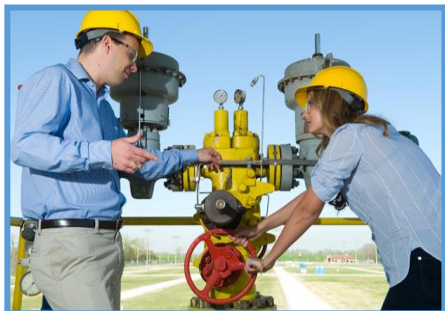


***This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.***

This course covers the application of chemical engineering theory to the practical demands of applied process engineering. The course will be presented in interactive format with many industrial examples and case studies. Participants will have the opportunity to solve sample problems with the help of the instructor.



The first part of the course will cover the basics of unit operations and the development of an effective process. Topics included are the preparation of process flow diagrams (PFDs) and P&IDs. These diagrams represent the organization and control of equipment in a petrochemical plant or refinery.



This is followed by the calculation of material flows and the concept of a material balance. Included are techniques on the sizing and evaluation of piping networks (including pipe segments, fittings, parallel piping systems, valves and controls equipment).

Pressure drop calculations are presented for a variety of systems – ordinary Newtonian liquids, vapors and mixed phase systems, reacting systems, packed beds and fluidized beds.



Next, the design and evaluation of major fluid flow equipment is presented. This includes pumps (all types) and compressors as well as fans, vacuum pumps, ejectors and educators. The associated drivers for these machines are discussed, especially steam turbines and the steam-power cycle found in all petrochemical plants and refineries. The materials portion of the course is followed by a presentation on energy balances and heat transfer equipment. Refrigeration energy balance, compressor selection, and power requirements are covered. Focus is on the cycles typically found in refineries and petrochemical plants, including cascaded and open systems.

In the next section of the class, materials of construction (MOC) are discussed and selection guidelines presented. Finally, heat transfer equipment selection, design and rating are discussed.

On completion of this course, participants will have the ability to understand and prepare PFDs and P&IDs, perform material/heat balance and fluid flow calculations. Participants will also be able to design, rate and select the major process equipment which accounts for most of the capital investment in refineries and petrochemical plants.

During the class, participants will be given detailed procedures and worksheets for performing the appropriate calculations. Many of the examples have been developed on EXCEL; these programs will be given to the participants on a CD. The tools provided should aid in the design and operation of chemical systems. This is an interactive course with numerous case studies and a CD with solved problems, worksheet and shortcut techniques.

### **Course Objectives**

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

- Apply and gain an in-depth knowledge on process engineering and discuss the chemical & physical aspects as well as the processes and process variables used in applied process engineering
- Prepare PFDs and P&IDs in a professional manner
- Perform material/heat balance and fluid flow calculations
- Acquire knowledge with the various process development including process sketch, diagrams and unit operations
- Employ the application of fluid dynamics specifically its piping system design and flow systems and determine the different flow equipment used in process engineering
- Enumerate heat transfer components by explaining the elements of energy balances, heat exchangers, air coolers and fired heaters
- Develop an understanding on mass transfer attributes including distillation, tray performance & constraints, humification and refrigeration
- Identify the different types of chemical reactors and describe petroleum processing reactions including hydro treating, catalytic reforming & hydro cracking
- Discuss the process control applied in process engineering and identify the various construction materials as well as the method of selecting the materials to be used
- Carryout process risk analysis particularly the various evaluation methods and HAZOP study

### **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, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

### **Who Should Attend**

This course provides an overview of the major elements of applied process engineering for process and project engineers as well as piping designers. The course will also be valuable as a refresher for experienced chemical engineers and those who are not familiar with some aspects of applied process engineering. Additionally, managers and supervisors who have no formal training in chemical engineering should find value in 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:-


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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.

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British Accreditation Council (BAC)

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

### Course Instructor(s)

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



**Mr. Robert Harvey, MSc (Cum Laude), BSc** is a **Senior Process & Chemical Engineer** with over **45 years** of in-depth industrial experience within the **Oil & Gas, Refinery, Petrochemical, Mining** and **Power** industries. His expertise widely covers in the areas of **Operations Abnormalities & Plant Upset, Fertilizer Manufacturing** Process Technology, **Fertilizer Storage** Management (Ammonia & Urea), **Petrochemical & Fertilizer Plants, Nitrogen Fertilizer Production, Petroleum Industry Process Engineering, Process Equipment Design & Troubleshooting, Process Equipment & Piping Systems, Fertilizer Manufacturing Process Technology, Production Management, Process Plant Optimization & Continuous Improvement, Production Process Optimization, Process Analyzers, Process Equipment Design, Vinyl Chloride Monomer (VCM) Manufacturing & Process Troubleshooting, Cement Manufacturing Process Technology & Standards, Process Equipment & Piping System, Process Plant Optimization & Continuous Improvement, Process Plant Performance & Efficiency, Troubleshooting Process Operations, Modern Aluminium Production Processes, Cement Kiln Process, Process Engineer Calculations, Steel Making Process, Process Diagrams Review, Process Hazard Analysis (PHA), Process Mapping, Strategical Process Control in Process Industry, Revamping & Debottlenecking, Pressure Vessel Operation, Heat Mass Balance, Distillation-Column Operation, & Troubleshooting, Debottlenecking, Unit Performance Optimization, Real Time Online Optimization, Operations Planning Optimization, Engineering Problem Solving, Bag Filters Operation & Maintenance, Chemical Reaction Engineering Application, Phosphatic Industry, Diammonium Phosphate, Monoammonium Phosphate, NPK, Troubleshooting Improvement, Production Management, Distillation-Column Operation & Troubleshooting, Monomer Handling Safety, Complex Operational Troubleshooting, Incident Root Cause Analysis & Corrective Action, Fertilizer Manufacturing, Continuous Improvement & Benchmarking, Energy Efficiency for Process Plants, Pressure Vessel Operation, Reactors & Storage Tanks, Dehydrating Columns, Heat & Material Balance, P&ID Reading & Interpretation, Detailed Engineering Design, HAZOP Leadership, Project HSE Review (PHSER), Safe Handling of Propylene Oxide & Ethylene Oxide, Safety in Process & Industrial Plants, Environmental Impact Assessment (EIA) and Effective Risk Assessment & HAZOP Studies. Further, he is also well versed in Feasibility Studies Analysis & Evaluation, Project Gate System Procedures, Change Management Skills, Change Management Strategy, Developing Commercial Contracts, Project Management Skills, Project Scheduling & Cost Control, FIDIC & Other Model Contracts, EPC & EPCM Contracts, Knowledge Management, Job Evaluation, Creative Problems Solving & Innovation Skills, Problem Solving & Decision Making, Strategic Planning & Creative Thinking and Mind Mapping.**

During his career life, Mr. Harvey has gained his practical and field experience through his various significant positions and dedication as the **Commercial Director, Manufacturing Director, Chief Operating Officer, Head Projects Division, Project Leader, Lead Technical Advisor/Consultant** and **Project Consultant** to various international companies such as the Trade and Industrial Policy Strategies (TIPS), PGBI Johannesburg, IDC Green Industries SBU/Arengo 316 Pty Ltd, Ferrum Crescent Limited, CEF Limited, Rio Tinto Alcan, Industrial Development Corporation of SA (IDC) and AECI Limited.

Mr. Harvey has **Master (Cum Laude)** and **Bachelor** degrees in **Chemical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)** and has delivered various trainings, seminars, conferences, workshops and courses globally.

### **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: Monday, 07<sup>th</sup> of October 2024**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0900	<b>Process Engineering</b> Process Engineering Overview
0900 – 0930	<b>Chemical &amp; Physical Principles</b> Dimensions & Units • Processes & Process Variables • Process Data Representation & Analysis
0930 – 0945	Break
0945 – 1100	<b>Chemical &amp; Physical Principles (cont'd)</b> Basic Chemical Calculations • Stoichiometry • Properties of Matter
1100 – 1230	<b>Process Development</b> Process Sketch • Block Diagram • Process Flow Diagrams (PFDs) • Piping & Instrumentation Diagrams (P & IDs) • Other Diagrams • Unit Operations
1230 – 1245	Break
1245 – 1400	<b>Fluid Dynamics</b> Static Fluids • Fluid Flow
1400 – 1420	<b>Revision &amp; Quiz</b>
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor (s) will Brief Participants about the Topics that were Discussed Today & Advice Them of the Topics to be discussed tomorrow
1430	Lunch & End of Day One

#### **Day 2: Tuesday, 08<sup>th</sup> of October 2024**

0730 – 0930	<b>Fluid Dynamics (cont'd)</b> Piping Systems Design • Complex Flow Systems • Miscellaneous Flow Systems
0930 – 0945	Break
0945 – 1100	<b>Flow Equipment</b> Fluid Flow Equipment Drivers & Power Cycles • Compressible Flow Piping – Safety & Control
1100 – 1230	<b>Flow Equipment (cont'd)</b> Pumps, Basic Concepts, Cavitation • Compressors • Fans • Agitation & Mixing • Filtration
1230 – 1245	Break
1245 – 1400	<b>Heat Transfer</b> Energy Balances • Heat Exchangers Overview
1400 – 1420	<b>Revision &amp; Quiz</b>
1420 – 1430	<b>Recap</b> Using this Course Overview, the Instructor (s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be discussed tomorrow
1430	Lunch & End of Day Two



**Day 3: Wednesday, 09<sup>th</sup> of October 2024**

0730 – 0930	<b>Heat Transfer (cont'd)</b> Heat Exchangers Design • Shell & Tube Heat Exchangers (TEMA Type)
0930 – 0945	Break
0945 – 1100	<b>Heat Transfer (cont'd)</b> Air Coolers • Fired Heaters
1100 – 1230	<b>Mass Transfer</b> Physical Behavior Pure Components
1230 – 1245	Break
1245 – 1400	<b>Mass Transfer (cont'd)</b> Distillation
1400 – 1420	<b>Revision &amp; Quiz</b>
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three

**Day 4: Thursday, 10<sup>th</sup> of October 2024**

0730 – 0930	<b>Mass Transfer (cont'd)</b> Calculation Methods • Trays Performance & Constrains, Tray Efficiency
0930 – 0945	Break
0945 – 1100	<b>Mass Transfer (cont'd)</b> Crude Unit Optimization • Packing, Trays versus Packing Comparison • Humification & Refrigeration
1100 – 1230	<b>Chemical Reactors</b> Petroleum Processing Reactions
1230 – 1245	Break
1245 – 1400	<b>Chemical Reactors (cont'd)</b> Kinetics • Reactor Types
1400 – 1420	<b>Revision &amp; Quiz</b>
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Four

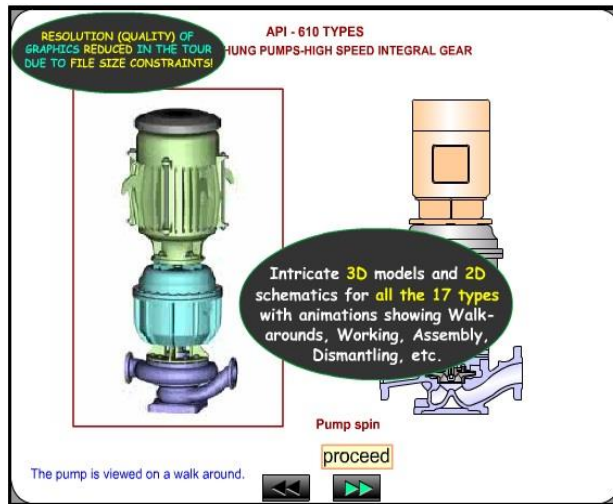
**Day 5: Friday, 11<sup>th</sup> of October 2024**

0730 – 0930	<b>Process Control</b> PID Controllers • Feedback, Feed Forward & Cascade Controls • DCS Advanced Control
0945 – 1100	<b>Materials of Construction</b> Selection Criteria • Construction Materials • Code & Standards to Avoid Catastrophes
1100 – 1230	<b>Materials of Construction (cont'd)</b> Material Selection (Ferrous Material, Non Ferrous Material, others) • Corrosion Considerations
1230 – 1245	Break
1245 – 1300	<b>Process Risk Analysis</b> Risk Priority Matrix • Evaluation Methods • HAZOP Study
1300 – 1345	<b>Q &amp; A Discussion</b>
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

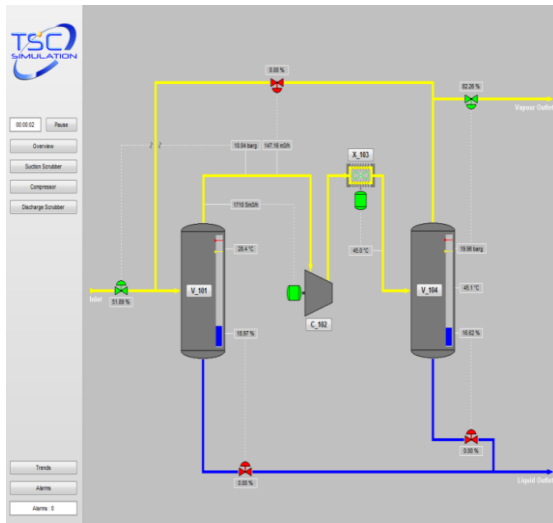


**Simulator (Hands-on Practical Sessions)**

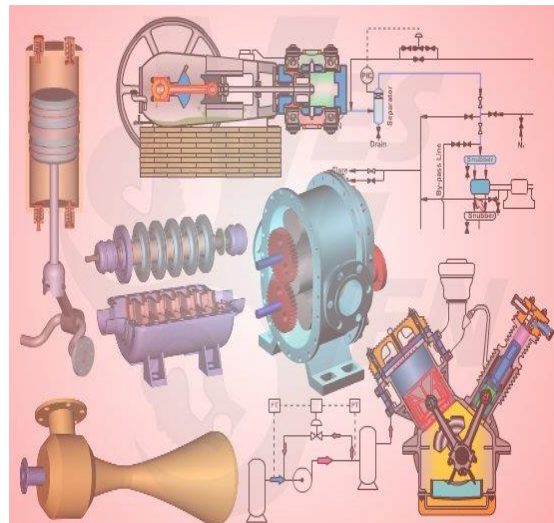
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor”, “CBT on Compressors”, “Steam Turbines & Governing System CBT”, “Heat Exchanger Tube Layout”, “Gas Ultrasonic Meter (USM) Sizing Tool”, “Liquid Turbine Meter and Control Valve Sizing Tool”, “Liquid Ultrasonic Meter Sizing Tool” and “Orifice Flow Calculator” simulator.



**Centrifugal Pumps and Troubleshooting Guide 3.0**

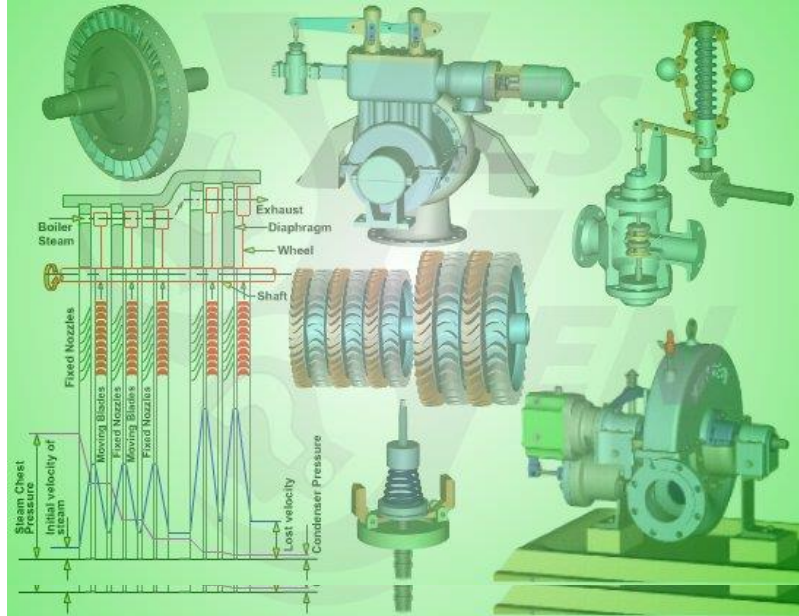


**SIM 3300 Centrifugal Compressor Simulator**

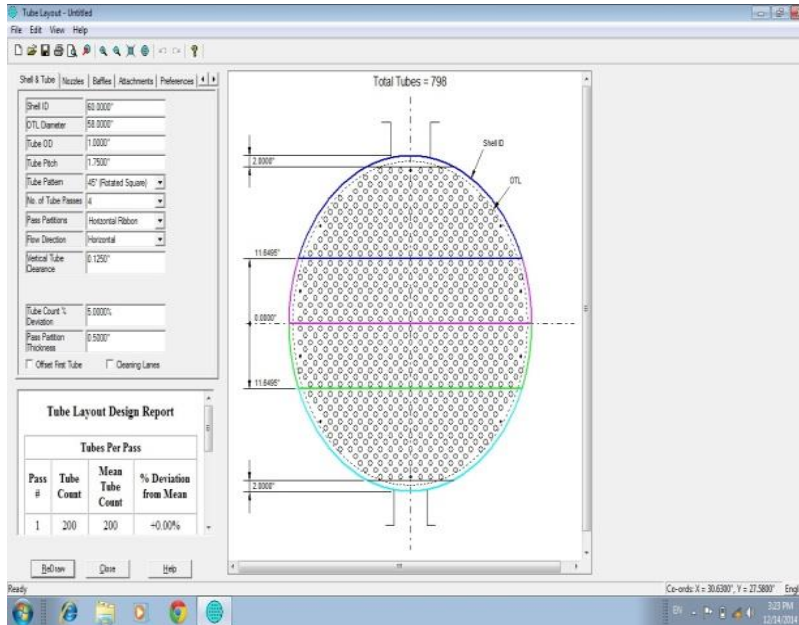


**CBT on Compressors**

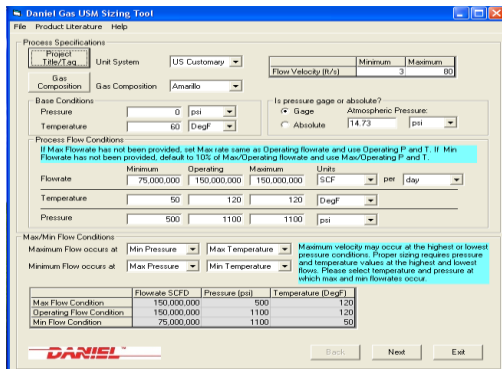




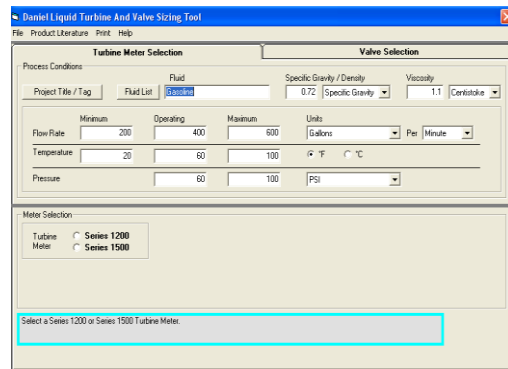
**Steam Turbines & Governing System CBT**



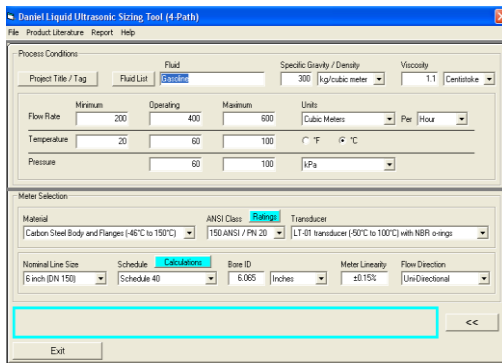
**Heat Exchanger Tube Layout**



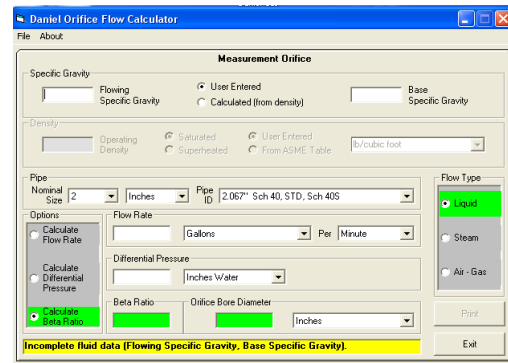
**Gas Ultrasonic Meter (USM) Sizing Tool Software**



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



**Liquid Ultrasonic Meter Sizing Tool Software**



**Orifice Flow Calculator Software**

**Course Coordinator**

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