

COURSE ANNOUNCEMENT

Announcing a comprehensive course on the flow measurement of liquids and gases to be presented:

Jubail Intercontinental Hotel, April 17-21

Yanbu Holiday Inn, April 24-28

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COURSE DESCRIPTION

The course covers the major technologies in current use for the measurement of gas and liquid flowrates. The discussion of each meter technology will include operating principles, typical performance, advantages and limitations, installation and maintenance. Unique real world experience based on 40 years of calibration and consulting history adds considerable value to these discussions. Detailed descriptions of the agenda topics are attached to the current announcement.

WHO SHOULD ATTEND

The course agenda is designed for engineers and senior technicians working in the petrochemical fields.

YOUR INSTRUCTOR

The course will be taught by Mr. Thomas Kegel, Senior Staff Engineer with CEESI (Colorado Engineering Experiment Station, Inc.). Mr. Kegel has 25 years of experience in flow measurement research, product development, calibration, testing, training and consulting. His current responsibilities at CEESI include new facility development, special test programs and engineering support of measurement processes. Consulting clients include major corporations in the energy, automotive, process and aerospace industries. As developer of the CEESI training program, Kegel has nearly 20 years of training experience. He holds Bachelor and Masters degrees in Mechanical Engineering.

TO REGISTER

E-Mail: reg2@guisac.com
See attached registration form
Fax: +966 3 356 0393
Mobile: +966 500086560
Tel: +966 3 356 0606

COURSE FEE

US\$2800 per student includes:

- an extensive set of printed notes
- daily lunch
- morning and afternoon coffee and tea

Hotel accommodations are not included

ATTENDANCE

LIMITED

to 25 students

CANCELLATION POLICY

prior to three weeks: 75% refundable
prior to two weeks: 50% refundable
prior to one week: 25% refundable



AGENDA

DAY 1	Introduction Positive Displacement Meter Turbine Meter Flow Profile Installation Effects
DAY 2	Gas and Liquid Properties Pressure Measurement Temperature Measurement Flow Computers Measurement System Design
DAY 3	Orifice Meter Other DP Meter Designs Ultrasonic Meter
DAY 4	Coriolis Meter Vortex Meter Thermal Mass Meter Rotameter Calibration and Traceability
DAY 5	Measurement Uncertainty Wet Gas Multiphase Flow

AGENDA NOTES

Gas And Liquid Applications

Most of the agenda items integrate the discussion to include both gas and liquid applications. This enables similarities and differences to be highlighted.

Introductory and Advanced Subjects

The agenda is designed to include both introductory and advanced subjects throughout. The sequence of agenda items for the first two days is specifically selected to provide the introductory level student a structured introduction to flow measurement. When flow meter hardware (ie coriolis, vortex, ultrasonic ...) is discussed, the material begins at a fundamental level and slowly builds to include more advanced topics. The material selected for the final day is more advanced in nature.

Flow Profile

When fluid flows along a pipe, the velocity becomes non-uniform due to viscosity. The resulting flow profile interacts with the meter to affect the measurement. This lecture discusses parameters that effect the flow profile.

Installation Effects

The conditions in the field are often different that those present when a meter is calibrated. Such differences, often called installation effects, can result in changes in meter performance. Installation effects include flow profile, vibration, ambient temperature and flow pulsation. This lecture provides a general discussion of the potential sources of and solutions to various installation effects.

Gas and Liquid Properties

Several different gas and liquid properties are required in flow measurement. The measured volumes are corrected to standard conditions based on densities. The performance of meters can depend on viscosity and the speed of sound. This section of the agenda presents the equations used to calculate the various properties. Also included is a discussion of some "ancillary measurements" including gas composition, water in oil and liquid density.

Pressure and Temperature Measurement

Measurements of flowing pressure and temperature are required to calculate gas and liquid properties. This lecture begins with a review of the basics and concludes with a discussion of advanced topics unique to flow measurement.



AGENDA NOTES

Meter Hardware

Lectures devoted to the different types of meter hardware (ultrasonic, coriolis, etc.) make up much of the agenda. Each lecture begins with a description of the basic operating principle. The relevant industry standards are described and interpreted. Applicable installation effects are discussed. The operating equations are presented, often with numerical examples. When available, calibration and test data are used to describe performance issues.

Measurement System Design

Measurement system design elements include the meter(s), piping and ancillary instruments. This lecture describes typical industry practice.

Flow Computer

Recent advances in flow measurement include dedicated flow computer technology. This lecture describes industry standards for the use of flow computers.

Calibration and Traceability

Typical industry practice involves calibrating liquid meters on-site and gas meters in a laboratory. This lecture reviews the details of the written standards and explores the similarities and differences between the two approaches.

Measurement Uncertainty, Wet Gas and Multiphase Flow

These advanced level lectures provide introductions to the subjects.