ABLE Instruments & Controls Limited

Natural Gas Measurement Uncertainty

Course Code: FM001B, 2 day Instructor-Led

Venue: ABLE Training Centre, Dyce, Aberdeen

This course is offered in association with:

ABLE Training - Education and Certification

Official Curriculum

Introduction

Elements of this syllabus are subject to change.

This training course is based on CEESI's (www.ceesi.com) 40+ years of experience in the operation of gas and liquid flow calibration facilities. This experience includes the measurement of pressure, temperature, gas composition, and mass as well as the operation of data acquisition systems. The material is example based, the fundamental concepts are taught by exploring a variety of real world applications. The necessary statistical concepts are reinforced based on numerical simulation.

Audience

This course is suitable for those who would like an in depth understanding of natural gas measurement uncertainty.

It is particularly suitable for:

- Metering Engineers
- Process Engineers
- Senior Instrument Engineers

Course Objectives

To provide delegates with the following:

- knowledge of step by step method for performing an uncertainty analysis
- attain a good understanding of Statistical process control (SPC) techniques for instrument calibration and uncertainty
- become familiar with Youden analysis in the identification of uncertainty sources
- to provide example analysis of the instruments and components that make up a larger uncertainty analysis

Prerequisites

This course requires that students meet the following prerequisites:

- Delegates should have a good understanding of flow metering and be familiar with measurement uncertainty.

Course Materials

The student kit includes a comprehensive workbook for this class.

Course Outline

The course material is divided into four parts:

Part 1:

The primary objective for the first day is the presentation of a step by step method for performing an uncertainty analysis. This is accomplished with extensive detail based on three independent examples. In parallel, the statistical concept of the standard deviation is introduced and developed based on computer simulation. While the step by step method is based on the new “ISO GUM” it is also applicable to the older method.

Part 2:

Statistical process control (SPC) has long been recognized as a valuable tool in manufacturing operations. The application of SPC techniques to instrument calibration and uncertainty is discussed in Part 2. Three examples that progressively become more complex, are used to teach this subject. Two are based on pressure transducers, the third is based on flowmeter calibration. Techniques are discussed that monitor the state of control, define components of uncertainty, and identify long and short term random effects.

Part 3:

The third part consists of a variety of shorter subjects. Youden analysis aids in the identification of uncertainty sources. Risk management involves the uncertainty issues associated with defining pass/fail criteria. Traceability includes uncertainty components associated with calibration. Other subjects include correlation, regression, and uncertainty intervals.

Part 4:

Part 4 provides example analyses of the instruments and components that make up a larger uncertainty analysis. Instrumentation includes pressure transducers, flowmeters, voltmeters and electronic counters. The discussion includes comparisons between instrumentation with different performance specifications. This part of the course also includes uncertainty associated with equations of state.