Basic Measurement
(Instructor-Led Training)

Course Description

This Course introduces basic measurement principles and systems used in the oil and gas flow measurement industry.

Course Prerequisites

- GTA Web-Based Training
    - Statistics and Uncertainty

Course Objectives

Upon completion of this course, the student will have received instruction designed to assist him/her in the following:

- Describe fundamental measurement principles and the two measurement systems used (English and Metric).
- Identify precision mechanical measurement devices and explain their proper use.
- List common electrical measurement equipment and describe their proper use.

Course Outline

1. Measurement Principles and Units of Measurement
    a. Principles of Measurement
    b. Accuracy and Precision
    c. English Measurement System
    d. Pressure Measurement
    e. Metric Measurement System
2. Precision Measurement Instruments
    a. Introduction to Measurement
        i. Tolerance
        ii. Linear Dimensions
        iii. Scales
    b. Measurement Systems
        i. English System
        ii. Metric System
        iii. Rounding Off Values
        iv. Using Steel Rules
    c. Calipers and Dividers
        i. Vernier Calipers
        ii. Dial Calipers
    d. Fixed, Feeler, and Thread Pitch Gauges
    e. Mechanical and Dial Indicators
        i. AGD Specifications
        ii. Selecting the Right Model
        iii. Minimum Graduation Value
        iv. Size
        v. Range Per Revolution and Total Range
    f. Setting Up the Dial Indicator
        i. Sources of Error of Dial Indicators
            1. Clearance in Teeth Mesh of the Internal Mechanism

2. Imperfect Gear Form of the Internal Mechanism
3. Clearance of the Spindle with its Guide
4. Clearance of Bearings and Wear of Internal Mechanism
5. Applications of Dial Indicators

g. Bench Comparator, Dian Snap, Dial Depth, and Bore Indicators Gauges
h. Test Indicators
    i. Accuracy and Precision of Test Indicators
    ii. Applications of Mechanical Test Indicators
i. Torque Wrenches
    i. Measuring Torque
j. Metric Conversion: Pound Foot to Newton Meter
    i. Torque Wrench Design and Construction, Range, Adapters, and Extensions
    ii. Gear Head Torque Multipliers
    iii. Torque Wrench Use
        1. Hand Inspection Torque
        2. Dynamic Installation Torque
k. Micrometers
    i. Types of Micrometers
    ii. Micrometer Head
    iii. Reading Decimal Scales
    iv. Depth, Inside, and Outside Micrometers
        1. Using the Outside Micrometer
    v. Calibration
        1. Taking Measurements

3. Electrical Measuring Instruments
    a. Analog Meters
    b. Meter Sensitivity
    c. Analog Voltage Meters (Voltmeters) and Resistance Meters (Ohmmeters)
        i. Series Resistance and Shunt Resistance Measurement
        ii. Ohms Adjust

iii. Analog Ammeter
    1. Circuit Loading
    2. Simpson 270 Multimeter

d. Proper Use

e. Making Measurements
    i. Measuring DC and AC Voltages
    ii. Measuring Decibels
    iii. Direct Current Measurements
    iv. Zero Ohms Adjustment
    v. Measuring Resistance

f. Digital Meters
    i. Basic Operation
    ii. Input Signal Conditioners
        1. A/D Converter
        2. Control and Display
        3. Data Output Unit (DOU)
    iii. Fluke Model 87 Multimeter
        1. Input Alert™ Feature
        2. Power-Up Options
        3. Automatic Power-Off
    iv. Making Measurements
        1. Measuring AC and DC Voltage
        2. Measuring Resistance
        3. Using Conductance for High Resistance or Leakage Tests
        4. Measuring Capacitance

g. Testing Electronic Components
    i. Checking Diodes and Transistors
    ii. Megger
    iii. Insulation Characteristics
    iv. Applications

h. New Installation Checking
    i. Troubleshooting Tool
    ii. Predictive/Preventive Maintenance Tool
    iii. Guard System
    iv. Scales
        1. Megger Tests
        2. Short-Time Test
        3. Timed Resistance Test
i. Dielectric Absorption Ratio
j. Megger Precautions
k. Clamp-On Ammeter
l. Normal and Surge Current Measurements
m. Normal and Surge Voltage Measurements

Recommended Resources

- GTA Basic Measurement Participant Guide
- GTA Basic Measurement Instructor Presentation.
- Internet sites related to basic industrial measurement and measurement equipment.
- Textbooks or other publications related to basic industrial measurement and measurement equipment.