



الهيئة السعودية للمهندسين
SAUDI COUNCIL OF ENGINEERS

**Measurement of Gas and Liquid Flow
Rates**

Workshop

From 10-14 of April 2010

Khobar, Saudi Arabia

Introduction:

The course will cover the key aspects of flow measurement and will describe the under mentioned meter types and their applications. This will enable the attendees to make informed decisions in selecting the most appropriate meter for their application, advantages, limitations, installations and maintenance.

Course Outline

Topics covered include:

Flow Measurement

- The velocity of the fluid
 - Pipe size
 - Friction due to contact with the pipe
 - The viscosity of the fluid
 - The specific gravity of the fluid
 - Fluid Condition
 - Velocity Profiles
 - **Laminar or Streamlined**
 - **Turbulent**
 - **Transitional**
 - Flow-straightening devices
 - Rate of flow
 - Total flow
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Pressure Measurement

- Types of pressure
- Pressure Units:
- Pressure Conversions
- primary measuring elements for the process pressure
 - Bourdon Tubes
 - C-type bourdon
 - Helical bourdon
 - Spiral bourdon
- Bellows Sensors
- Diaphragm Sensors
- Resonant-Wire Sensors
- Strain-Gauge Sensors
- Capacitance Pressure Sensors
- Spring-Loaded Piston Sensors

Pressure Sensor's protection

- Diaphragm Seals
- Throttling Devices
- Pressure-Limiting Valves

Pressure measurement devices

- Manometers
- Single limb or well-manometer:
- Inclined Manometer
- Manometric Error
- Pressure Gauges
- Selection of Pressure Gauge
- Gauge errors
- Pressure Transmitters
 - Suppressed zero
 - Elevated zero
- Pneumatic DP Cell

- Electronic DP cells
- Capacitance type
- Resonant (Vibrating) wire type
- Electric Pressure Switches
- Pneumatic Pressure Switches/Pressure Pilots
- Pneumatic Switching Valves
 - Operation
 - Adjustment

Temperature Measurement

- Heat Transfer
 - Convection
 - Conduction
 - Radiation
- Temperature Scales

Temperature Measuring Sensors

Thermometers

- a) Filled Thermometers
 - Operational Aspects
- b) Bimetallic Thermometers

Thermocouples

- Types of thermocouples
 - Type J
 - Type K
 - Type T
 - Type E
- Three Basic Types Of Thermocouple Assembly
- Extension cables
- Installation of compensating cables
- Thermocouple Circuit Flexibility
- Thermocouple reference tables

- Application notes
- Nickel-Chromium/Nickel-Aluminum Thermocouple reference Table
- Iron/Copper Nickel Thermocouple reference Table
- Copper/Copper Nickel Thermocouple reference Table

Resistance Temperature Detectors

- Pt100 – Resistance Vs Temperature table
- RTD/Thermocouple Comparison
- Thermistors
- Thermowells

Pyrometer

- Operational aspects

Burnout Protection

- Burnout Protection up Scale
- Burnout Protection down Scale

Temperature Transmitter

Flow meters with wetted non-moving parts

- Differential Pressure Flow meters
 - Orifice Plates
 - Orifice plates and holders
 - Orifice taps

Differential Pressure Measurement

- Flow indicator and recorders
- Relationship between Differential pressure and flow
 - Segmental and Eccentric orifice plates
 - Integral Orifice plate
- Venturi tube
- Pitot tube
- Variable Area Flow meter (Rotameter)
- Bluff body or Vortex shedding flow meter

Flow meters with wetted moving parts

- Turbine Flow meter
- Positive Displacement Flow meters

Obstruction less Flow Meters

- Magnetic flow meter

Mass Flow Measurement

- Microprocessor-Based Volumetric Flow meters
- Coriolis Flow Meters
- Thermal Mass Flow meters

Flow meters with sensors mounted externally

- Ultrasonic Flow meters
- Doppler-Effect Flow Meter

Flow Switches

Flow Glasses

- Troubleshooting of measurement equipment.
- Installation effects and Maintenance.
- Calibration and traceability.
- Measurement uncertainty.
- Selection of flow meter.
- Wet gas and multiphase flow

Course Instructor:



Hussein Ibrahim

Instrumentation Engineer

Professionally qualified Instrumentation Engineer with 20+ years extensive technical skills and proven experience in a wide variety of field instrumentations and control systems' implementation, reviewing, developing, modernization, maintaining and staff training with excellent analytical troubleshooting, solving problems, technical support, commissioning and start up for both onshore & offshore gas production facilities.

Areas of Expertise

- Distributed control systems
- Safety Instrumented System
- Wellhead control systems
- Sequential control
- Gas turbine control systems
- Vibration monitoring
- Technical support/Liaison
- HSE Awareness/development
- Computer literacy
- Programmable logic controllers PLC
- Control valves and actuators
- Regulatory control
- Boiler & heater control
- Compressors control systems
- Fire & Gas detection
- Budgeting/ monitoring & controlling
- Permit to work & Risk assessment
- Emergency shutdown system
- Analogy / digital Field
- Burner management system BMS
- Pressure relief valves
- Surge control valves
- Upgrading & modernization
- Staff training & development
- Team building and leadership

Professional Development

Bachelor of Education Faculty of Electronics Engineering, Industrial Electronics
1984

May

With final grade very good and excellent in project

Certifications

professional and various, local & overseas, training courses have supplemented my extensive hands on instrumentation & control systems experience with DCS, PLC, valve sizing /selections, installation & maintenance, Microprocessor concept and technology II, Opto electronics photonics, gas turbine control/ maintenance and operations, turbo compressor set routine maintenance/ operations and

troubleshooting, general English program, Microprocessor and industrial control, Modern management performance and human re-engineering, Problem analysis and decision making, strategic planning & the four rules of leadership.

Professional Experience & Significant Achievements

Training

Tri-star Middle East:

The following courses for engineers have been provided for Petrocanada staff, operations and instrumentation engineers in Syria:

Aug-Oct, 2009

DCS, PLC and SCADA
Industrial Gas Turbine
power generation control system

Egyptian Training Center

The following courses have been provided at Egyptian Training Centre (ETC)

▪ 2007_2009

- Basic and advanced PLC's
- Emergency Shutdown Systems (ESD)
- Flow, Level, Pressure & Temp. measurements.

Assistance Manager

Nov 2007 -

present

Belayim Petroleum Company

Managing a team of 36 technical staff focused on instrumentations and control systems for both on shore and off shore gas production facilities, planning, developing, supervising and controlling that instrumentation activities are performing in such a way to meet company goals for plant regularity and safety.

Planning & coordinating hot change over to new Plant Integrated Control Systems, without interruption to normal operation and compromising plant safety.

Providing technical support for operations and maintenance

- Promoted (based on previous performance) as assistance manager overseeing system development and ensuring successful performance for plant instrumentation and control systems,
- Supervised upgrading for No. 3 gas turbine to MARK VI retrofit control system.
- Planned, coordinated and performed upgrading for control system (APACS+) of LTS trains.
- Reviewed & developed the supply specifications for the new DCS & ESD which are required to upgrade the existing systems
- Ensure that instrumentation activities are performed in accordance to HSE and IMS

SCE 10-14 of April 2010 Workshop/ Measurement of Gas and Liquid Flow Rates

Department manager
2007

Sep 1998 _ Nov

Belayim Petroleum Company

- Managed (15-20 staff) all aspects relating to site technical systems and achieved effective and innovative maintenance procedures for on shore and off shore production facilities
- Reviewed and improved vendor documents for (Baltim North) off shore platform
- Successfully achieved Commissioning and start up for the above platform on time
- Managed all staff related issues and ensured that team members are fully trained and motivated
- Delivered a safe and healthy working environment for all staff
- Monitored and managed all aspects relating to future development
- Ensured the proper update and availability of the documents/ drawings/ equipment data sheets
- Ensured the availability of adequate tools, equipment, spare parts and manpower to perform all instrument maintenance activities in the plant as per manufacturer's documents and procedures
- Performed bids technical evaluation and award recommendations
- Assisted in system reviews and ensured that Field Support was fully up to date
- Coordinated various upgrades whilst establishing and developing relationships with 3rd party service providers and technical support
- Provided all technical support for operations divisions.
- Preparation and development of permit to work and risk assessment

Section head
1998

Jan 1995 _ Sep

Bleayim Petroleum Company

- Performed preventive & corrective maintenance activities based on CMMS
- Provided technical services to operations and maintenance divisions
- Successfully completed commissioning and start up for Baltim East Platform
- Prepared the weekly and monthly report to the management
- Ensured that instrumentation activities are performed in accordance with HSE and IMS
- Spare parts activities
- Troubleshooting / solving problems and repairing.
- Budgeting
- Bids technical evaluations and award recommendations

Instrumentation Engineer

Aug, 1987 _ Jan,

1995

Belayim Petroleum Company

- Installation, Calibration, testing / loop checking
- Troubleshooting, fault finding / repairing
- Solving problems
- Spare parts activities
- Pre commissioning / Commissioning / start up
- Control system tuning / configurations
- Regulatory control – tuning – cascade – split range
- sequence programming

Reference:

- Eng. Giancarlo Franzon
Eni
Field manager