PUMPS, VALVES, ACTUATORS, MOTORS, AND VARIABLE FREQUENCY DRIVES:
Selection, Applications, Operation, Troubleshooting, and Maintenance

17 – 21 NOVEMBER 2014, KUALA LUMPUR, MALAYSIA

Topics Covered
- Centrifugal Pumps
- Mechanical Seals
- Reciprocating and Rotary Pumps
- Troubleshooting of Pumps
- Selection and Maintenance of Pumps, Control Valves, Smart Instrumentation Actuators, Motors and Variable Frequency Drives

Expert Course Faculty Leader
Philip Kiameh
Course Overview

This seminar will provide a comprehensive understanding of the various types of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives including piston pumps, plunger pumps, rotary pumps, screw pumps, two- and three-lobe pumps, cam pumps, vane pumps, bellows-type metering pumps, diaphragm pumps, canned motor pumps, centrifugal pumps; linear and rotary valves, control valves; pneumatic, piston, electric, and electrohydraulic actuators; motors and variable frequency drives. This seminar will focus on maximizing the efficiency, reliability, and longevity of this equipment by providing an understanding of the characteristics, selection criteria, common problems and repair techniques, preventive and predictive maintenance.

This seminar is a MUST for anyone who is involved in the selection, applications, or maintenance of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives because it covers how this equipment operates, the latest maintenance techniques, and provides guidelines and rules that ensure the successful operation of this equipment. In addition, this seminar will cover in detail the basic design, operating characteristics, specification, selection criteria, advanced fault detection techniques, critical components and all preventive and predictive maintenance methods in order to increase reliability of the equipment and reduce the operation and maintenance cost.

This seminar will provide the following information for all reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives:

- Basic Design
- Specification
- Selection Criteria
- Sizing Calculations
- Enclosures and Sealing Arrangements
- Codes and Standards
- Common Operational Problems
- All Diagnostics, Troubleshooting, Testing, and Maintenance

Course Learning Outcomes

- **Equipment Operation**: Gain a thorough understanding of the operating characteristics of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives
- **Equipment Diagnostics and Inspection**: Learn in detail all the diagnostic techniques and inspections required of critical components of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives
- **Equipment Testing**: Understand thoroughly all the tests required for the various types of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives
- **Equipment Maintenance and Troubleshooting**: Determine all the maintenance and troubleshooting activities required to minimize the downtime and operating cost of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives
- **Equipment Repair and Refurbishment**: Gain a detailed understanding of the various methods used to repair and refurbish reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives
- **Efficiency, Reliability, and Longevity**: Learn the various methods used to maximize the efficiency, reliability, and longevity of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives
- **Equipment Sizing**: Gain a detailed understanding of all the calculations and sizing techniques used for reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives

- **Design Features**: Understand all the design features that improve the efficiency and reliability of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives

- **Equipment Selection**: Learn how to select reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives by using the performance characteristics and selection criteria

- **Equipment Enclosures and Sealing Methods**: Learn about the various types of enclosures and sealing arrangements used for reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives

- **Equipment Commissioning**: Understand all the commissioning requirements for reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives

- **Equipment Codes and Standards**: Learn all the codes and standards applicable for reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives

- **Equipment Causes and Modes of Failure**: Understand the causes and modes of failure of reciprocating, rotary, and centrifugal pumps, valves, actuators, motors, and variable frequency drives

- **System Design**: Learn all the requirements for designing different types of reciprocating, rotary, and centrifugal pumping systems, valves, actuators, motors, and variable frequency drives

**Who Should Attend**

- Engineers of all disciplines
- Managers
- Technicians
- Maintenance personnel
- Other technical individuals

**Your Expert Faculty: Philip Kiameh**

Philip Kiameh, M.A.Sc., B.Eng., D.Eng., P.Eng. (Canada) has been a teacher at University of Toronto and Dalhousie University, Canada for more than 23 years. In addition, Prof Kiameh has taught courses and seminars to more than four thousand working engineers and professionals around the world, specifically Europe and North America. Prof Kiameh has been consistently ranked as "Excellent" or "Very Good" by the delegates who attended his seminars and lectures.
Prof Kiameh wrote 5 books for working engineers from which three have been published by McGraw-Hill, New York. Below is a list of the books authored by Prof Kiameh:

5. Industrial Equipment (600 pages), Custom Publishing, University of Toronto, University of Toronto, University of Toronto Custom Publishing (1999).

Prof. Kiameh has received the following awards:

1. The first "Excellence in Teaching" award offered by the Professional Development Center at University of Toronto (May, 1996).
2. The "Excellence in Teaching Award" in April 2007 offered by TUV Akademie (TUV Akademie is one of the largest Professional Development centre in world, it is based in Germany and the United Arab Emirates, and provides engineering training to engineers and managers across Europe and the Middle East).
3. Awarded graduation “With Distinction” from Dalhousie University when completed Bachelor of Engineering degree (1983).

Prof. Kiameh performed research on power generation equipment with Atomic Energy of Canada Limited at their Chalk River and Whiteshell Nuclear Research Laboratories. He also has more than 30 years of practical engineering experience with Ontario Power Generation (formerly, Ontario Hydro - the largest electric utility in North America).

While working at Ontario Hydro, Prof. Kiameh acted as a Training Manager, Engineering Supervisor, System Responsible Engineer and Design Engineer. During the period of time that Prof Kiameh worked as a Field Engineer and Design Engineer, he was responsible for the operation, maintenance, diagnostics, and testing of gas turbines, steam turbines, generators, motors, transformers, inverters, valves, pumps, compressors, instrumentation and control systems. Further, his responsibilities included designing, engineering, diagnosing equipment problems and recommending solutions to repair deficiencies and improve system performance, supervising engineers, setting up preventive maintenance programs, writing Operating and Design Manuals, and commissioning new equipment. Later, Prof Kiameh worked as the manager of a section dedicated to providing training for the staff at the power stations. The training provided by Prof Kiameh covered in detail the various equipment and systems used in power stations.

Professor Philip Kiameh was awarded his Bachelor of Engineering Degree "with distinction" from Dalhousie University, Halifax, Nova Scotia, Canada. He also received a Master of Applied Science in Engineering (M.A.Sc.) from the University of Ottawa, Canada. He is also a member of the Association of Professional Engineers in the province of Ontario, Canada.

**Special Feature**

Each delegate will receive a copy of the following books and manual written by the instructor:

1. Excerpt of the relevant chapters from the “POWER PLANT EQUIPMENT OPERATION AND MAINTENANCE GUIDE” published by McGraw-Hill in 2012 (800 pages)
2. Excerpt of the relevant chapters from the “ELECTRICAL EQUIPMENT HANDBOOK” published by McGraw-Hill in 2002 (600 pages)
3. Practical Manual (200 pages)
5 Day Course Outline

Day 1 - Pump Categories, and Centrifugal Pumps, Centrifugal Pump Mechanical seals, Positive Displacement Pumps, Troubleshooting of Pumps, Pump Selection

- Pump Categories: Dynamic (Centrifugal) and Positive Displacement (Reciprocating and Rotary)
- Maintenance Recommended for Centrifugal Pumps
- Vibration Analysis and Predictive Maintenance
- Centrifugal Pump Mechanical Seals, Basic Components, Seal balance, Face Pressure, Pressure-Velocity, Power Consumption, Temperature Control
- Seal Lubrication/Leakage, Single Inside Pusher Seal, Classification of Seals by Arrangements, Classifications of Seals by Design, Materials of Construction
- Applications, Types of Mechanical Seals, Common Failure Modes of Seals, Seal Refurbishment, Gland Plates and Piping Arrangements
- Installation and Troubleshooting of Mechanical Seals

Day 2 – Positive Displacement Pumps, Troubleshooting of Pumps, Pump Selection, Pumping System Calculations, Diagnostics of Pumping Systems

- Reciprocating Pumps, Piston Pumps, Plunger Pumps, Rotary Pumps, Screw Pumps, Two- and Three-Lobe Pumps
- Cam Pumps, Vane Pumps, Bellows-Type Metering Pumps
- Diaphragm Pumps
- Canned Motor Pumps, Seal-less Pump Motors
- Pump Maintenance, Inspection, Overhaul, Diagnoses of Pump Troubles
- Troubleshooting of Centrifugal Pumps
- Troubleshooting of Rotary Pumps
- Troubleshooting of Reciprocating Pumps
- Water Hammer
- Bearings
- Used Oil Analysis
- Pump Selection
- Pumping System Calculations
- Workshop: Design and selection of Different Pumping Systems for the Oil and Gas Industry, and the Power Generation Industry
- Vibration Analysis and Predictive Maintenance
- Diagnostics of Pumping Systems
- Pump Drivers

Day 3 – Intelligent (Smart) Transmitters, Controllers, Sizing and Selection of Control Valves, and Positioners

- Smart Systems
- Intelligent (Smart) Transmitters
- Microprocessor-Based Transmitters (Smart Transmitters)
- Smart (Intelligent) Pressure Transmitters
- Advantages of Intelligent Instrumentation
- Comparison Between Intelligent and Non-Intelligent Instrumentation
- Stand-Alone Controllers
- Self-Tuning, Sequencing, and Networking
- HART Protocol
- Valve selection
- Linear valves
- Rotary valves
- Valve selection considerations
- Valve maintenance
- Basics of valve design (seats and seals)
- Sealing the valve stem
- Leakless valves, Valve materials
- Preventing valve material failure
- Nonmetallic valves
- General categories of control valves
- Rangeability, end connections, shutoff capability
- Valve sizing
- Choked flow
- Gas and steam sizing
- Sizing and selection of control valves and actuators
- Information required to select a control valve
- Control valve body materials
- Control valve trim material
- Pressure-temperature ratings for all control valve materials
- Class designation and PN numbers for control valves
- Face-to-face dimensions of most types of control valves
- Wear and galling resistance of control valve material
- Control valve seat leakage classification
- Control valve trim material temperature limit
- Service temperature limitations for control valve elastomers
- Ambient temperature corrosion information for most fluids used in control valves
- Control valve elastomer information
- Compatibility of elastomer material with control valve fluids
- Control valve flow characteristics
- Selection of control valve flow characteristic
- Control valve sizing
- Sizing valves for liquid applications
- Detailed calculations for sizing valves liquid applications
- Liquid sizing sample problem
- Sizing valves for compressible fluids
- Compressible fluid sizing sample problem No. 1
- Compressible fluid sizing sample problem No. 2
- Sizing coefficients for single-ported globe style valve bodies
- Sizing coefficients for rotary shaft valves

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Day 4 – Actuator for Compressible and Non-Compressible Fluids, Control Valve Flashing, Cavitation and Noise Control, Control System Troubleshooting and Diagnostics

- Actuator sizing
- Packing friction
- Actuator force calculations
- Rotary actuator sizing
- Torque equations
- Breakout torque
- Dynamic torque
- Maximum rotation
- Non-destructive test procedures
- Magnetic Particle (surface examination)
- Liquid penetrant (surface) examination
- Radiographic (volumetric) examination
- Ultrasonic (Volumetric) examination
- Cavitation and flashing
- Choked flow causes flashing and cavitation
- Valve selection for flashing service
- Valve selection for cavitation service
- Noise prediction
- Aerodynamic and hydrodynamic
- Noise control
- Noise summary
- Packing selection
- Packing selection guidelines for sliding-stem valves
- Packing selection guidelines for rotary valves
- Control valve selection process
- Control valve cavitation
- Control valve noise
- Pneumatic actuators
- Piston actuators
- Electric actuators
- Hydraulic actuators
- Positioners
- Live loading
- Diagnostic testing of control loops
- Air-operated valves diagnostics
- Motors-operated valves diagnostics

Day 5 – Induction Motors, Maintenance of Motors, and Variable Frequency Drives

- Induction motor construction, rotor slip, electrical frequency of the rotor, losses and the power flow diagram, induction motor torque-speed characteristics, variation of the torque-speed characteristics, starting induction motors, induction motor starting circuits
- Speed control of induction motors, speed control by changing the line frequency, speed control by changing the line voltage, speed control by changing the rotor resistance, solid-state induction motor drives, motor protection, induction generator, induction generator operating alone, induction motor ratings
- Characteristics of Motors, enclosures and cooling methods, failures in three-phase stator windings, predictive maintenance, motor troubleshooting, diagnostic testing of motors, repair and refurbishment of ac induction motors
- Power Electronics components, rectifier circuits, filtering rectifier output, pulse circuits, voltage variation by ac phase control, inverters, pulse-width modulation (PWM) inverters
- Variable speed (frequency) drives, principles of ac variable speed drives, inverters, insulated gate bipolar transistors (IGBT’s), pulse-width modulated inverters, input power converter (rectifier), output IGBT inverter, magnetic breaking, regeneration, transients, harmonics, power factor and failures, common failure modes, thyristor failures and testing, IGBT switching transients, cabling details for ac drives, motor bearing currents, selection criteria for variable speed drives, maintenance, common failure modes, motor application guidelines
Courses Available

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Frequently Asked Questions (FAQs)

1. Does PowerEdge have other programmes than those listed?
   We have more than 200 programmes that we are capable of running. All we need is for you to contact us and request for the preferred programme and we will able to develop it.

2. Where is PowerEdge based?
   PowerEDGE is headquartered in Singapore but we run our training programmes in different venues around Asia.

3. What does PowerEdge do?
   We are a Power & Utilities Training Specialist.

4. Can this course be done in our city?
   It absolutely can. Get in touch with us to request for a training programme to be carried out in your city.

5. Can you reduce the price of our preferred course?
   While our price has been reduced before it is even launched, we are always happy to help you with further discounts.

6. Can you change the dates of the course?
   If you have a special requested date, let us know and we will arrange another session for you.

7. Who are the companies that will be participating?
   This varies from a diversity of Power Operators, Regulators, Financiers, to Vendors in the Power & Utilities industry.

8. Where is the venue for the course?
   We usually engage a 4 to 5 star hotel meeting room to ensure the comfort of our participants.

9. How many delegates should we expect for each course?
   This varies from 15 to 20 participants. Class sizes are kept small to allow trainers to focus better on each participant.

10. What are the different payment modes?
    We accept Visa/MasterCard, cheques, bank transfers and cash on site.

11. Is accommodation included when I sign up for a course?
    Accommodation is not included in the course fee but we are always happy to advise on available accommodations.

12. Can I get a cheaper accommodation through PowerEdge?
    We will be pleased to help you negotiate a better rate with hotels.

13. Is lunch provided during the course?
    We provide lunch and 2 tea breaks every day during our training programmes.

14. Are the training materials included once I have signed up for a course?
    Yes, training and course materials are included in the course fee.

15. Will there be a certificate for the course?
    Yes, there will be a certificate of participation upon completion of a course.

16. Who are PowerEdge trainers?
    They are expert consultants and practitioners with many years of experience in the subject matter that they deliver on.

17. Are PowerEdge trainers competent?
    We have received numerous favourable feedbacks on our trainers from past participants.

18. Can PowerEdge assist with Visa travel applications?
    We can assist in advising you on the relevant procedure(s) and embassies/consulates that provide Visa for travel purposes.

19. Can we purchase training materials without attending a course?
    Unfortunately this option is not available as training materials are specially developed for courses.

20. Can course content be tweaked to cater to our needs?
    Of course! Just let us know your request and we will get the trainer to assist in carrying it out.
VEN (7) days prior to the training course you will receive a 100% credit will be credited to a future POWEREDGE PTE LTD event. This credit will be available for up to one year from the date of issuance. For cancellations received seven (7) days or less prior to an event (including day), you may substitute delegates.

CANCELLATIONS & SUBSTITUTIONS

Payment is due in full at the time of registration. Full payment is mandatory for event attendance. I agree to PowerEdge Pte Ltd. payment terms.

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