COURSE OVERVIEW ME0100-4D
Valve Technology
Selection, Installation, Upgrading, Inspection, Maintenance, Repair & Troubleshooting

Course Title
Valve Technology: Selection, Installation, Upgrading, Inspection, Maintenance, Repair & Troubleshooting

Course Reference
ME0100-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs

Course Date/Venue

Session(s)	Date	Venue
1	August 19-22, 2024	Club B Meeting Room, Ramada Plaza by Wyndham Istanbul City Center, Istanbul, Turkey
2	November 25-28, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt in the class will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Valve Selection, Installation & Maintenance. It covers the lubrication fitting and categorizing valves based on their function; the valve symbols, hydraulic pneumatic valves, motor, cylinders and directional control valves; the solenoid valve, typical valve and other valve designs; the various types of pressure control valves, check valves and control valve; and the characteristics of valve and control valve selection and sizing.

Further, the course will also discuss the control valve performance, process considerations, actuators and positioners; the fundamentals of pressure relief devices including the advantages and disadvantages of conventional valve and balanced bellows valve; the piston type pilot operated safety relief valve; the wetted area, heat absorption, vaporization rate and relief vent area; the causes of chatter, staggered PSV's and valve critical inspection, maintenance and testing; and the PRV repair and non-destructive testing including disc dismantling, assembly and disassembly.

During this interactive course, participants will learn the lapping procedure, grinding, assembly, valve sealing, installation, maintenance, troubleshooting and galling; the common valve problems, potential causes and water hammer; the valve testing and sealing, PRV adjustments, digital communications, cryogenic valves selection and proof testing and diagnostics; the characteristics of steam trap; and the online testing, calculation method, measurement method and visual inspection.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on valve selection, installation, upgrading, inspection, maintenance, repair and troubleshooting
- Identify lubrication fitting and categorize valves based on their function
- Discuss valve symbols, hydraulic pneumatic valves, motor, cylinders and directional control valves
- Recognize solenoid valve, typical valve and other valve designs
- Identify the various types of pressure control valves, check valves and control valve
- Describe the characteristics of valve and apply control valve selection and sizing
- Discuss control valve performance, process considerations, actuators and positioners
- Explain the fundamentals of pressure relief devices including the advantages and disadvantages of conventional valve and balanced bellows valve
- Recognize the piston type pilot operated safety relief valve as well as determine wetted area, heat absorption, vaporization rate and relief vent area
- Discuss the causes of chatter and staggered PSV's and apply valve critical inspection, maintenance and testing
- Carryout PRV repair and non-destructive testing including disc dismantling, assembly and disassembly
- Apply lapping procedure, grinding and assembly as well as valve sealing, installation, maintenance, troubleshooting and galling
- Identify the common valve problems, potential causes and water hammer
- Employ valve testing and sealing, PRV adjustments, digital communications, cryogenic valves selection and proof testing and diagnostics
- Discuss the characteristics of steam trap and apply online testing, calculation method, measurement method and visual inspection

Who Should Attend

This course provides an overview of all significant aspects and considerations of valve selection, installation, upgrading, inspection, maintenance, repair and troubleshooting for maintenance engineers, application engineers, inspection engineers, mechanical engineers, under-development engineers, electrical/electronics engineers, control systems and instrumentation engineers, production engineers, wellhead and drilling engineers and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations:-

The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **2.4 CEUs** (Continuing Education Units) or **24 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Craig Nilsen, CMRP, CRCMP, RCM3, is a **Senior Mechanical & Maintenance & Reliability Engineer** with over **30 years** of extensive experience within the **Manual Valves**, **Pressure Control Valves**, **Control Valve** Selection, **Valve Testing & Sealing**, **Oil** & **Gas**, **Refinery** and **Petrochemical** industries. His wide expertise includes **Maintenance Planning & Scheduling**, **Maintenance Planning Process**, **Maintenance Shutdown & Turnaround**, **Maintenance Audit** Best Practices, **Maintenance & Reliability** Management, **Reliability** Engineering, **Maintenance & Reliability** Best Practices, Reliability, Availability & Maintainability (**RAM**), **Root Cause** Analysis, **Maintenance** Process, **Reliability-Centered Maintenance** (**RCM**), **Reliability Engineering Analysis** (**RE**), **Root Cause Analysis** (**RCA**), **Asset Integrity Management** (**AIM**), **Reactive & Proactive** Maintenance, **Maintenance** Process, Work Task Prioritization, **Condition Monitoring**, **Mechanical Engineering**, Mechanical Manufacturing Engineering, Mechanical Engineering Design, Electro Technology, **Maintenance Planning**, **Spare Parts Planning & Inventory** Management, Computerized Maintenance Management Systems (**CMMS**), **Process Plant Shutdown & Turnaround**, **Maintenance Optimization** & Best Practices, **Reliability Centered Maintenance** Principles & Application, Efficient Shutdowns, Turnaround & Outages, **Process Plant Shutdown**, **Turnaround & Troubleshooting**, **Shutdown & Turnaround** Management, Optimizing Equipment Maintenance & Replacement Decisions, **Maintenance Management & Cost Control**, **Preventive & Predictive** Maintenance, Effective Reliability Maintenance & Superior Maintenance Strategies, **Integrity & Asset** Management, **Total Plant Reliability** Maintenance, **Vibration** Measurement, **Spare Parts & Materials** Management, **Mechanical & Rotating Equipment** Troubleshooting & Maintenance, **Rotating Equipment Reliability** Optimization, **Laser Alignment**, **Thermography**, **Risk Assessment**, Legal Liability, Construction Regulations, **Machine Vibration** Analysis, **Bag Filters** Operation & Troubleshooting, **Blower & Fan**, **Pumps**, **Valves**, **Bearings & Lubrication**, **Mechanical Seals**, **Mechanical Equipment** Maintenance, **Gearboxes**, **Shaft Alignment**, **Rotating Equipment**, **Preventive & Predictive Maintenance**, **Spare** Management and **Network Analysis**.

During his career life, Mr. Nilsen gained his practical and field experience through his various significant positions and dedication as the **Maintenance Engineer**, **Repair Shop Supervisor**, **Maintenance & Reliability Specialist**, **Maintenance Planner/Reliability Specialist**, **Senior Maintenance Planner/Condition Monitoring Specialist**, **Supply Chain Maintenance Planner**, **Technical Advisor**, **Senior Trainer/Lecturer**, **RCM3 Senior Consultant/Practitioner** and **Fitter & Turner** for Algorax (Pty) Limited.

Mr. Nilsen has a **National Higher Diploma** in **Mechanical Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Maintenance** and **Reliability Professional** (**CMRP**) from the Society of Maintenance & Reliability Professionals (**SMRP**), a **Certified Reliability Centered Management Professional** (**CRCMP**) from the International Organization of RCM Professionals (**IORCMP**), a **Certified Reliability Centered Maintenance 3** (**RCM3**) **Professional** from **Aladon**, **USA** and a **Qualified Fitter & Turner**. Moreover, he is an active member of the Society of Maintenance and Reliability Professionals (**SMRP**) and the South African Asset Management Association (**SAMA**). He has further delivered numerous trainings, courses, seminars, workshops and conferences internationally.

Course Fee

Istanbul	**US$ 5,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	**US$ 4,500** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Lubrication Fitting Identification*** *Bearing Lubrication Fitting ● Packing Injection Fitting ● Drain Port/Cavity Lube Port ● Seal Sealant Injection Port*
0900 – 0930	***Valves can be Broadly Categorized Based on their Function as*** *Stop (Isolation) Valves ● Regulating Valves ● Back-Flow Prevention Valves ● Pressure-Relief Valves*
0930 – 0945	*Break*
0945 – 1015	***Working Fluid*** *Liquid ● Gas ● Solids*
1015 – 1100	***Manual Valves*** *Classification of Valve on their Operating Way ● Valve Symbols ● Rotating Valves ● Plug Valves ● Ball Valves ● Butterfly Valves ● Glove Valves ● Gate Valves ● Diaphragm Valve Components ● Diaphragm Valve Action ● Flexible Valves ● Pinch Valves ● Solenoid Valve ● Foot Valve ● Vave Characterization*

1100 – 1130	***Hydraulic Pneumatic Valves*** *Fixed Displacement Hydraulic Pump ● Variable Displacement Hydraulic Pump*
1130 – 1200	***Motors*** *Pneumatic Motor ● Rotary Actuator*
1200 – 1230	***Cylinders*** *Single Acting Cylinder ● Double Acting Cylinders*
1230 – 1245	*Break*
1245 – 1315	***Cylinders with Cushions*** *Single Fixed Cushion ● Double Fixed Cushion ● Single Adjustable Cushion ● Double Adjustable Cushion*
1315 – 1345	***Directional Control Valves*** *Electro-Hydraulic Servo Valve ● Manual Control ● Electrical Control ● Flow Control Valve*
1345 - 1420	***What is a Coil & How Does it Work?*** *How Does a Solenoid Valve Work ● Style ● Type ● Design ● Operators ● Actuator Control*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0800	***Typical Valve*** *Poppet Valves ● Spool Valves ● Spool Types ● Disc Seals*
0800 – 0830	***Other Valve Designs*** *Pressure Switches ● Logic "or"/"and" Shuttle Valve ● Flow Regulator ● Banjo Flow Regulator ● Quick Exhaust Valve ● Solenoid Valves ● Principle of Operation ● What Causes Solenoids to Fail*
0830 - 0900	***Pressure Control Valves*** *Types of Pressure Control Valves ● Pressure Relief Valve (PRV) ● Complete Circuit ● Direct Relief Valve Performance ● Pilot Operated Relief Valve ● Unloading Valve ● Sequence Valve ● Pressure-Reducing Valve ● Counterbalance Valve ● Safety Valve ● How Failures Occur in Hydraulics Systems ● Root Cause of Hydraulic Failures ● Known Best Maintenance Practices ''Hydraulics''*
0900 - 0930	***Check Valves*** *Operational Detail ● The Main Types of Check Valves ● Selection Criteria*
0930 – 0945	*Break*
0945 – 1030	***Control Valve Types*** *Rotary Valves ● Butterfly Valves ● Eccentric Disk Valves ● Bidirectional Tightness ● Eccentric Rotary Plug Valves ● Ball Valves ● Plug Valves ● Linear Valves ● Globe Valves ● Cage Valves*
1030 – 1100	***Control Valve Theory*** *Definition of a Control Valve ● Types of Energy ● What Happens Inside a Control Valve ● Choked Flow ● Cavitation ● Flashing*
1100 – 1130	***Characteristics & Trim*** *Valve Characteristics ● Application Examples ● Cavitation Control ● Anti – Cavitation Trim ● High Pressure Drop Applications ● Low Noise Trim ● Diffuser*

1130 – 1200	***Control Valve Selection*** *Decision Criteria ● Materials of Construction ● Valve Characteristics ● Actuator Considerations ● Price Comparison ● Selection Guidelines ● Application Comparisons ● Computer Sizing Programme*
1200 – 1230	***Control Valve Sizing*** *General ● Valve Coefficient (CV) ● ISA Sizing Equation ● Simplified Sizing Equation ● Comparison of Valve Types ● Turndown versus Rangeability*
1230 – 1245	*Break*
1245 – 1315	***Installed Gain as a Control Valve Sizing Criteria*** *Control Valve Characteristics ● Inherent Characteristic ● Installed Characteristic & Gain ● Selecting the Right Pump*
1315 – 1345	***Control Valve Performance*** *Process Variability ● Dead Time ● Actuator / Positioner Design ● Valve Response Time ● Valve Type & Characterisation ● Valve Sizing*
1345 – 1420	***Process Considerations*** *End Connections ● Face to Face Criteria ● Materials Selection ● Modes of Failure ● Leakage Rates ● International Standards*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0800	***Actuators & Positioners*** *Types of Actuators ● Linear Actuators ● Rotary Actuators ● Actuator Forces ● Positioners ● Fail Safe Systems*
0800 – 0830	***Accessories*** *Auxiliary Handwheels ● Pressure Regulators ● Lock-Up Valves ● ON-OFF Valve ● Position Transmitters ● Volume Booster ● Limit Switches ● Solenoid Valves*
0830 - 0930	***Fundamentals of Pressure Relief Devices*** *What is the Hazard? ● What are Relief Events? ● Potential Lines of Defense ● What is a Relief System? ● Why Use a Relief System? ● Pressure Relief Devices ● Pressure Terminology ● Superimposed Back Pressure ● Built-Up Back Pressure ● Code Requirements ● Relief Design Methodology ● Locating Reliefs – Where? ● Choosing Relief Types ● General Types of Safety Relief Valve Design ● Conventional Spring Loaded Safety Relief Valve ● Advantages/Disadvantages Conventional Valve ● Balanced Bellows Spring Loaded Safety Relief Valve ● Advantages/Disadvantages Balanced Bellows Valve*
0930 – 0945	*Break*
0945 – 1015	***Valve Critical Inspections*** *Valve Maintenance ● What is Preventative Maintenance? ● When to Use Preventative Maintenance & Predictive Maintenance ● Objectives of an Inspection Job ● PRV Repair Flow Chart ● Inspector's Role ● Measurement & Test Equipment ● Inspection Methods ● PRV Spindle Inspection Points ● Disk & Nozzle Inspection ● PRV Guide & Disc Holder ● PRV Spring Inspection Points ● Spring Rate ● 900 Series Disc Criteria Data Sheet ● 6000 Series ● Sample Traveler ● Critical Inspection*

1015 – 1045	***PRV Repair & Non-Destructive Examination*** *Pressure Relief Valve Repair ● Critical Parts ● Nozzle & Disc ● Spring ● Adjusting Ring ● Parts Providing Alignment ● Lifting Devices ● Safety Valve to Repair*
1045 – 1115	***Check Tools*** *Designated Use ● V-Block ● Dismantling Instructions for Type 526 API ● Disc Disassembly with Sealing Plate ● Removing the Studs from the Body ● Execution ● Measures & Facing Profile ● Surface Quality ● Nondestructive Examination ● Preparation for Valve Assembly ● Assembly of Type 526 ● Assembly of Disc Assembly ● Assembly of the Adjusting Screw ● Adjusting the Set Pressure ● Body and Bonnet Connection*
1115 - 1145	***Lapping, Grinding & Assembly*** *Surface Quality ● Lapping Objectives ● Two Critical Elements of PRV Operation ● Purpose of Lapping ● Balance of Lapping ● Ring Laps ● Lapping Materials ● Cleanliness ● Lap Selection ● Nozzle Seat Width ● PRV Lapping Procedure ● Glass Plate ● Technical Requirements ● Technical Illustration ● Monocrystalline Diamond Powder ● Designated Use ● Technical Requirements ● Technical Illustration ● Re-Lapping with a Glass Plate ● Re-Lapping the Nozzle and the Disc ● PRV Bearing Points ● Assembly Objectives ● Assemblers Responsibility ● Assembly Operation ● Sample Traveler*
1145 - 1230	***Valve Sealing Solutions*** *National Emission Standards for Equipment Leaks ● Valve Sealing Solutions ● Non- Asbestos Valve Sealing System ● Electric Power Research Institute (EPRI) ● Causes of Valve Leakage ● Volume Loss ● Valve Design ● Packing Material ● Pressure & Temperature ● Temperature Cycling ● Valve Actuation ● Horizontally Mounted Valves ● Valve Condition ● Pitting ● Maintenance Practices ● Gland Packing ● Second Service Category ● Liveload ● Balancing Control and Low Emissions*
1230 – 1245	*Break*
1245 - 1315	***Operational Issues*** *General Review ● Installation ● Maintenance ● Troubleshooting ● Corrosion ● Galling*
1315 - 1345	***Common Valve Problems*** *Water Hammer Effects ● High Noise Levels ● Noise Attenuation ● Fugitive Emissions*
1345 - 1420	***Control Valve Failures Potential Causes*** *Physical Failures ● Velocity Problems ● Erosion by Cavitation ● Erosion By Abrasion ● Noise ● Vibration*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

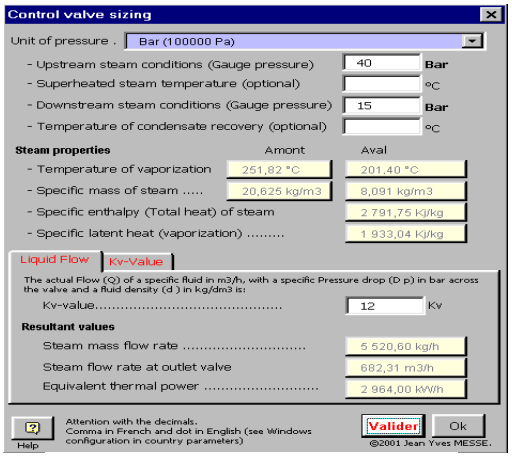
Day 4

0730 – 0800	***Water Hammer*** *Where Water Hammer Occurs ● Conditions Causing Water Hammer ● Hydraulic Shock ● Thermal Shock ● Differential Shock ● Unsteady Flow in Pipes ● Water Hammer Phenomenon in Pipelines ● Some Typical Damages ● Propagation of Water Hammer Pressure Wave ● Analysis of Water Hammer Phenomenon*
0800 - 0845	***Valve Testing & Sealing*** *Testing Objectives ● ASME Requirements ● PRV Testing & Adjustments ● Testing & Sealing ● Definition of Set Pressure ● Liquid Test – Definition of Open ● PRV Set Pressure on Liquid ● Above Opening Pressure ● Maximum Overpressure 110% of Set Pressure ● Air Test PRV ● Reaction Force ● ASME Code Requirement for PRV Seat Tightness Testing ● API 527 ● PRV Adjustments ● Two Ring/One Ring Design Ring Setting Chart ● Sealing Adjustments ● Sample Traveler ● Field Testing Advice ●* ***Auxiliary Lifting Devices*** *On Site Safety Valves Testing Schedule ● Safety Valves Test Schedule for Boilers*
0845 – 0930	***Field Communications*** *Analogue Signals ● Digital Communications ● Fieldbus Technologies*
0930 – 0945	*Break*
0945 – 1015	***Cryogenic Valves*** *Selection of Cryogenic Valves ● Material Considerations ● Standards & Testing*
1015 – 1045	***Fire Safe Valves*** *Requirements ● Sealing & Leakage ● Design ● Standards & Testing ● Examples*
1045 – 1115	***Strainers*** *Y-Type Strainers ● Basket Type Strainers ● Strainer Screens*
1115 – 1145	***Proof Testing & Diagnostics*** *Safety Instrumented Systems (An Overview) ● Proof Testing ● Partial Valve Stroking ● Diagnostics*
1145 – 1230	***Steam Traps*** *Characteristics of Steam ● Steam Trap ● Typical Steam Generation-Distribution-Recovery Diagram ● Mechanical Steam Traps ● Inverted Bucket Steam Traps ● Float & Thermostatic Steam Traps ● Thermostatic Steam Traps ● Bimetallic Steam Traps ● Bellows Steam Traps ● Thermodynamic Steam Traps ● Disc Type Steam Traps ● Orifice Type Steam Traps ● Steam Trap Surveys: Methods-Frequency ● Methods of Detection ● Recommended Steam Trap Survey Frequency ● Rules of Thumb When Conducting Steam Trap Projects*
1230 – 1245	*Break*
1245 – 1315	***Online Testing*** *Pressures' Scales ● Calculation's Method ● Measurement's Method ● Calculation's Example ● Graph's Example ● Graph Analysis ● Fully Explosion Proof Equipment ● Equipment Used ● Visual Inspection ● Test Report ● Some Fluids with which We Worked ● Online Safety Valve Testing ● Approved Technology ● Certified Contractor ● Advantages of the on Line Safety Valve Testing ● Correct Sizing of the Outline Line*

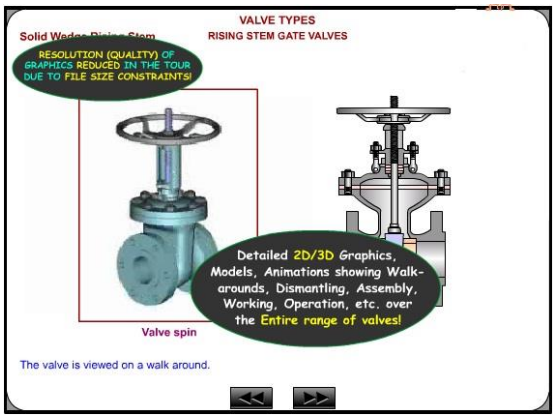
1315 – 1345	***Valves for Control of Steam Flow Rate*** *What Do the Valves Do? ● No Load Vs Full Load ● Mounting of Valves ● Why are So Many Valves Used? ● The Full Load Conditions ● Three Important Parameters ● Pressure Ratio ● Steam Path ● Main Steam System ● Full Load Conditions: A Case Study ● Variation of Initial Pressure, Main Steam Temperature, Reheat Steam Temperature & Condenser Vacuum ● The Loss with the Exit Velocity ● Condenser Pressure Ratio*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulators (Hands-on Practical Sessions)

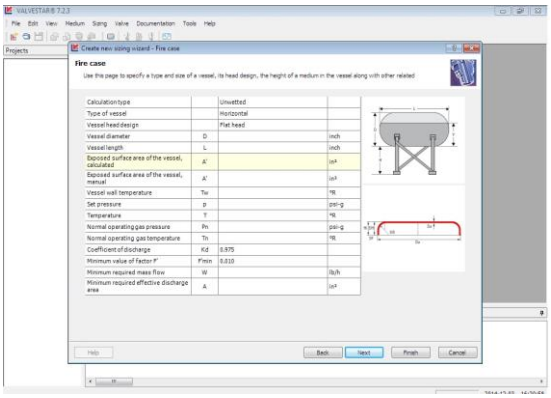
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art "Valve Sizing Software", "Valve Software 3.0", "Valvestar 7.2 Software" and "PRV²SIZE Software".



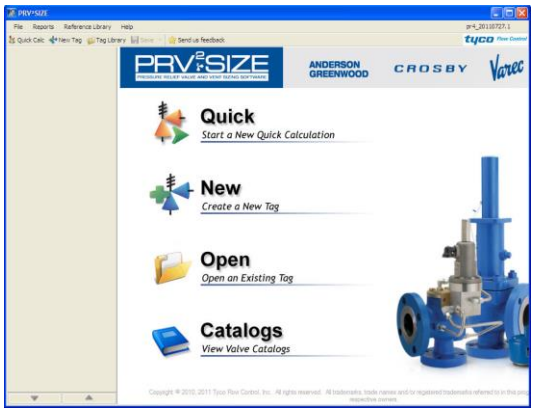
Valve Sizing Software



Valve Software 3.0



Valvestar 7.2 Software



PRV²SIZE Software

Course Coordinator

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