

COURSE OVERVIEW IE0273
Process Control & Control Loops & PID Tuning

Course Title

Process Control & Control Loops & PID Tuning

Course Date/Venue

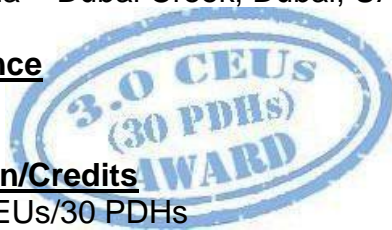
November 10-14, 2024/Markab Meeting Room,
 Al Bandar Rotana – Dubai Creek, Dubai, UAE

Course Reference

IE0273

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Description



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

This course is designed to provide an introduction to process control to engineers and other technical staff. It teaches the base fundamentals, as well as open and closed loop tuning methods. The course is developed with field tuning in mind, not control design.



The course will discuss the control fundamentals and terminology including the principles, control loop as well as the various types and right selection of control valve and describes the process control methods and characteristics of control valve.



It illustrates the different tuning rules available and explains the fundamentals of control systems, proper tuning of PID controllers, the concepts and application of feed forward control, auto tuning and new developments and troubleshooting tuning.

The various types of control valves, actuators and valve selection will also be discussed during the course.

Course Objectives

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

- Apply and gain a basic knowledge on process controller, control loop and PID tuning
- Discuss the control fundamentals and terminology including the principles, control loop as well as the various types and right selection of control valve
- Describe the process control methods and characteristics of control valve
- Illustrate the different tuning rules available and explain the fundamentals of control systems
- Demonstrate the proper tuning of PID controllers and the concepts and application of feed forward control
- Identify auto tuning and new developments and employ good practices and troubleshooting tuning
- Discuss the various types of control valves, actuators and valve selection

Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Howard Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides an overview of all significant aspects and considerations of process controller, control loop & valve tuning for engineers and other technical staff who are willing to learn more about single loop controllers, PID and tuning. The course explains the essence of feedback control without going in-depth into math.

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 Fee

US\$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Howard Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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: -


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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 **3.0 CEUs** (Continuing Education Units) or **30 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.

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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.

Accommodation

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

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. Barry Pretorius is a **Senior Instrumentation Engineer** with almost **45** years of extensive experience within the **Oil, Gas, Petrochemical, Refinery & Power** industries. His expertise widely covers in the areas of **Distributed Control System (DCS), DCS Operations & Techniques, Plant Control** and Protection Systems, **Process Control & Instrumentation, Cascade Control Loops, Split-Range Control Loops, Capacity Control & Other Advanced Control Schemes, Safety Instrumented Systems, Plant Automation** Operations & Maintenance, Programmable Logic Controller

(PLC), **Siemens PLC Simatic S7-400/S7-300/S7-200, PLC & SCADA** for Automation & Process Control, **Artificial Intelligence, Allen Bradley PLC** Programing and Hardware Trouble Shooting, **Schneider SCADA System, Wonder Ware, Emerson, Honeywell, Honeywell Safety Manager PLC, Yokogawa, Advanced DCS Yokogawa, Endress & Hauser,** Field Commissioning and Start up Testing Pre Operations, System Factory Acceptance Test (**FAT**), **FactoryLink ECS, Modicon 484, Rockwell Automation, System Site** Acceptance Test (**SAT**), **SCADA HMI & PLC Control Logic, Cyber Security** Practitioner, **Cyber Security** of Industrial Control System, **IT Cyber Security** Best Practices, **Cybersecurity** Fundamentals, **Ethical Hacking & Penetration Testing, Cybersecurity** Risk Management, **Cybersecurity** Threat Intelligence, **OT Whitelisting** for Better Industrial Control System Defense, **NESA** Standard and Compliance Workshop, **OT, Cyber Attacks** Awareness - **Malware/Ransom Ware / Virus /Trojan/ Phishing, Information Security Manager, Security System** Installation and Maintenance, Implementation, Systems Testing, Commissioning and Startup, **Foxboro DCS & Triconics, SIS** Systems, **Advanced DC Drives, Motion Control, Hydraulics, Pneumatics and Control Systems** Engineering, **Electrical & Automation Control Systems, HV/MV Switchgear, LV & MV Switchgears & Circuit Breakers, High Voltage Electrical Safety, LV & HV Electrical System, HV Equipment** Inspection & Maintenance, **LV Distribution Switchgear & Equipment, Electrical Safety, Electrical Maintenance, Transformers, Medium & High Voltage Equipment, Circuit Breakers, Cable & Overhead Line** Troubleshooting & Maintenance, **Electrical Drawing & Schematics, Voltage Distribution, Power Distribution, Filters, Automation System, Electrical Variable Speed Drives, Power Systems, Power Generation, Diesel Generators, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers, AC & DC Transmission, CCTV Installation, Data & Fire Alarm System, Evacuation Systems and Electrical Motors & Variable Speed Drives, & Control of Electrical and Electronic devices.**

During Mr. Pretorius's career life, he has gained his practical experience through several significant positions and dedication as the **Technical Director, Automation System's Software Manager, Site Manager, Senior Lead Technical Analyst, Project Team Leader, Automation Team Leader, Automation System's Senior Project Engineer, Senior Project & Commissioning Engineer, Senior Instrumentation & Control Engineer, Project Engineer, Pre-Operations Startup Engineer, PLC Specialist, Radio Technician, A.T.E Technician** and **Senior Instructor/Trainer** from various companies like the **ADNOC Sour Gas, Ras Al Khair Aluminum Smelter, Johnson Matthey Pty. Ltd, Craigcor Engineering, Unitronics South Africa Pty (Ltd), Bridgestone/Firestone South Africa Pty (Ltd)** and **South African Defense Force.**

Mr. Pretorius's has a **Bachelor of Technology in Electrical Engineering (Heavy Current).** Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)**, received numerous awards from various institutions and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

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: Sunday, 10th of November 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Control Fundamentals Terminology • Principles of Control • Basic Control Loop
0930 – 0945	Break
0945 – 1100	Control Fundamentals (cont'd) Advanced Control Loop • Control Algorithm • Control System
1100 – 1215	Control Valve Types Butterfly • Eccentric • Rotary Plug • Ball • Plug • Linear Valves • Globe • Cage • Double Port
1215 – 1230	Break
1230 – 1420	Control Valve Types (cont'd) How to Select the Right Valve?
1420 – 1430	Recap
1430	Lunch & End of Day One

Day 2: Monday, 11th of November 2024

0730 – 0930	Process Control Methods Open Loop • Process Behaviour • Time Lags • Selection of Type of Controller • Proportional
0930 – 0945	Break
0945 – 1100	Process Control Methods (cont'd) Integral • Derivative • Feedback • Cascade • Ratio • Feed Forward
1100 – 1215	Control Valve Characteristics Selection of Flow Characteristics • Sizing Steps • Classification
1215 – 1230	Break
1230 – 1420	Control Valve Cavitation • Flashing • Noise
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3: Tuesday, 12th of November 2024

0730 – 0930	Different Tuning Rules Available Overshoot • Lambda Tuning • Trial Tuning
0930 – 0945	Break
0945 – 1100	Different Tuning Rules Available Cohen Coon Tuning • Process Controlability • Suggestions & Rules of Thumb
1100 – 1215	Fundamentals of Control Systems On-Off Control • Cascade • Ratio • FF • FB
1215 – 1230	Break

1230 – 1420	Fundamentals of Control Systems (cont'd) <i>Prop. Band • Integral • Derivative • Direct/Reverse</i>
1420 – 1430	Recap
1430	Lunch & End of Day Three

Day 4: Wednesday, 13th of November 2024

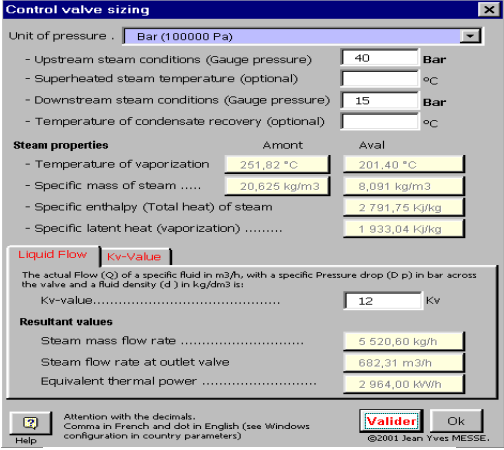
0730 – 0930	Tuning of PID Controllers <i>Open Loop • Ziegler Nichols</i>
0930 – 0945	Break
0945 – 1100	Tuning of PID Controllers (cont'd) <i>Continuing Cycling Method • Response Lags • Closed Loop Control</i>
1100 – 1215	VIDEO Presentation <i>Control Tuning</i>
1215 – 1230	Break
1230 – 1420	Concepts & Application of Feed Forward Control
1420 – 1430	Recap
1430	Lunch & End of Day Four

Day 5: Thursday, 14th of November 2024

0730 – 0930	Auto Tuning & New Developments
0930 – 0945	Break
0945 – 1100	Good Practices & Troubleshooting Tuning
1100 – 1215	Good Practices & Troubleshooting Tuning (cont'd)
1215 – 1230	Break
1230 – 1345	Types of Control Valves, Actuators & Valve Selection
1345 – 1400	Course Conclusion
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

Simulator (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 simulators “Valve Sizing Software”, “Valve Software 3.0”, “Valvestar 7.2 Software” and “PRV2SIZE Software”.



Control valve sizing

Unit of pressure: Bar (100000 Pa)

Upstream steam conditions (Gauge pressure): 40 Bar

Superheated steam temperature (optional): °C

Downstream steam conditions (Gauge pressure): 15 Bar

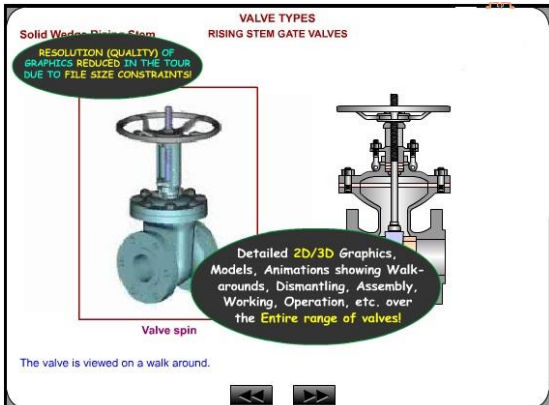
Temperature of condensate recovery (optional): °C

Steam properties	Amount	Aval
Temperature of vaporization	251,82 °C	201,40 °C
Specific mass of steam	20,625 kg/m ³	8,091 kg/m ³
Specific enthalpy (Total heat) of steam	2 791,75 kJ/kg	
Specific latent heat (vaporization)	1 933,04 kJ/kg	

Liquid Flow: Ky-Value: 12 Kv

Resultant values:

- Steam mass flow rate: 5 520,60 kg/h
- Steam flow rate at outlet valve: 682,31 m³/h
- Equivalent thermal power: 2 964,00 kW/h



VALVE TYPES
RISING STEM GATE VALVES

RESOLUTION (QUALITY) OF GRAPHICS REDUCED IN THE TOUR DUE TO FILE SIZE CONSTRAINTS!

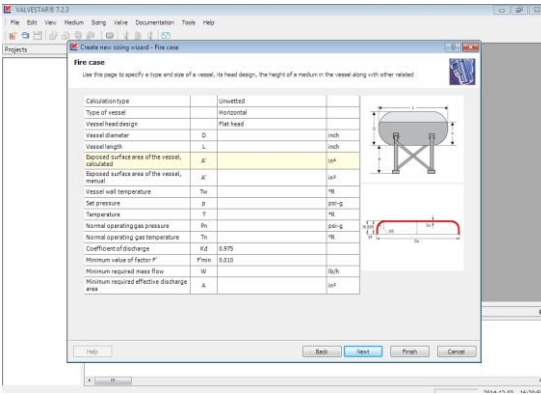
Valve spin

Detailed 2D/3D Graphics, Models, Animations showing Walk-arounds, Dismantling, Assembly, Working, Operation, etc. over the Entire range of valves!

The valve is viewed on a walk around.

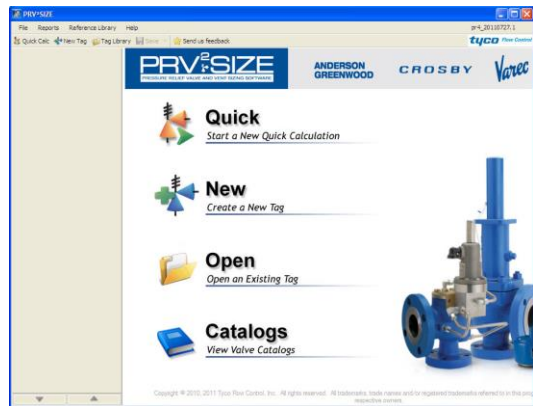
Valve Sizing Software

Valve Software 3.0



Valvestar 7.2 Software

Calculation type	Unsettled	
Type of vessel	Horizontal	
Vessel head design	Flat head	
Vessel diameter	D	inch
Vessel length	L	inch
Exposed surface area of the vessel, calculated	A _c	sq
Exposed surface area of the vessel, manual	A _m	sq
Vessel wall temperature	T _w	°F
Set pressure	P	psig
Temperature	T	°F
Normal operating gas pressure	P _n	psig
Normal operating gas temperature	T _n	°F
Coefficient of discharge	K _d	0,875
Minimum value of factor P ²	P _{min}	0,03
Minimum required mass flow	W	lb/h
Minimum required effective discharge area	A	sq



PRV²SIZE Software

Quick: Start a New Quick Calculation

New: Create a New Tag

Open: Open an Existing Tag

Catalogs: View Valve Catalogs

Course Coordinator

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