Process Control Valves and Actuators Sizing, Selection, Installation & Maintenance

Date		($)Fees	
15 December -19 December 2024	Kuala Lumpur	3500	Register Now

Why Choose this Training Course?

This training course has been designed to take all plant employees (regardless of their background knowledge), and build them up to be versatile and proficient in the use and operation of the various control valves, as well as the devices that are used to operate the control valves, themselves.

The training course has been designed to focus on applications and practical examples that would be deemed relevant, and the working environment of the delegates will be very carefully enquired about, so that all exercises remain work-related, for the delegates. This course intentionally has a 50-50 split between theoretical and practical work, in order to keep attention spans at optimum levels, as much as possible.

This training course will feature:

- Essentials and characteristics of control valves
- Actuators, positioners and other related hardware
- Sizing and selection, using various techniques
- Valve installation and maintenance
- PID Tuning methods used on processes, that make use of control valves

What are the Goals?

By the end of this training course, participants should be able to:

- Recognize and understand how a valve works
- Appreciate the different types of valves available
- Apply valve sizing techniques, using software and other methods of calculation
- Appraise the advantages and disadvantages of various types of positioners
- Experiment with correctly tuning a control valve

Who is this Training Course for?

This training course would primarily be aimed at people within the Instrumentation, Electrical, Mechanical, Process disciplines, who are actively involved in the utilization of valves (control or shut-off) and actuators, as

well as those people who have the additional responsibility of sizing the valves, and making a decision on the composition and make-up of the valve.

It would also be of great value to those individuals who either have a keen interest in the field, or who have to manage the people working on the various valves and actuators. (In this respect, one could think in terms of Process Control Engineers, Electrical Engineers, Mechanical Engineers, Industrial Engineers, Designers and the like.).

How will this Training Course be Presented?

The training course starts off from basics, and builds up to an advanced level, as far as control and using valves and actuators, are concerned. None-the-less, it is presented in such a way, that even total novices will feel comfortable from the very beginning. No-one is left behind, and the instructor takes pride in guiding all delegates along the way, with personal assistance, where required.

Delegates are encouraged to keep an open mind, and to ask as many questions as necessary, to ensure that maximum learning takes place. Preference will always be given to applications and examples that tie up with the SCADA processes encountered by the delegates.

Special Feature - Software Simulation

A software simulator, which has a 21-day limitation, will be provided. The purpose of this software is to better explain theoretical aspects relevant to the use of control valves. It will not be required after the workshop, as it will have served its purpose.

Delegates are encouraged to bring their own (non-Apple) laptops (but, please arrange this, in advance with your IT Department, as the software will need to be loaded onto these machines, and Administrator rights may have to be given).

The Course Content

Day One

- Understanding the purpose of a control valve

Practical – *Understanding how valves operate, linear vs rotary, and single-action*

- The principles of a control valve

Practical – *Why is it important to achieve stability, when making use of a control valve? Can this stability be demonstrated?*

- The various flow conditions that can be experienced, inside a control valve
- Dealing with pressure drops, inside a control valve

Practical – *Calculate a pressure drop that can be experienced*

- Understanding, and dealing with the various signals that are associated with control valves and actuators

Practical – *Converting from mA to percentage*

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Practical – *Working with voltage signals, that range from negative to positive*

Practical – *Dealing with, and understanding resolution, as can be expected, when sending a signal to a control valve*

- Laminar flow & Turbulent flow
- Reynolds numbers

Practical – *Reynolds number calculations*

- Understanding vortices and flow separation
- What happens to pressures and flows, in a liquid application, controlled by a valve?
- What happens to pressures and flows, in a gas application, controlled by a valve?

Practical – *Do an assortment of pressure conversions, either using tables, or else provided software*

- Understanding Cv, Choked flow, the vena contracta & Vapour pressure
- Flashing & Cavitation

Practical – *Dealing with cavitation and flashing in a real-world scenario*

- The requirements of a control valve
- The broad classification of control valves
- The classification of valves, by operation and by function
- Various hardware, associated with valves

Practical – *Labelling of a control valve, from a diagram*

- Cage valves, Split-body valves
- Globe valves, Needle valves
- Angled valves, Y-styled valves & 3-way valves

Practical – *Demonstrate how a valve can be utilised in an application, where there is combined feed forward and feedback control*

- Pinch valves & Gate valves
- Choke valves & Check valves
- Single-seated versus double-seated valves
- Balanced valves
- The principles of valve guiding

Practical – *Understanding the pressure drops that can be experienced, in pipelines that will contain control valves*

- Butterfly valves & Ball valves
- Rotary plug valves & Diaphragm valves

Practical – *Determining how long a tank will take to empty, should you need to fully open a control valve*

Day Two

- Pinch valves

Practical – *Choose the best valve to use, from a table, given specific criteria*

- Valve type selection, making use of a flow chart

Practical – *Choose the best valve to use, from a flow chart-type diagram, given specific criteria*

- Additional equipment, associated with valves

Practical – *Convert signals from current, to their respective pressure equivalents*

- Valves and how they fit into the greater scheme of P&ID diagrams

Practical – *Interpret a P&ID diagram, than contains a control valve*

Practical – *Design a P&ID diagram, for a loop containing a control valve, using specific criteria that has been provided*

- Leakage in valves

Practical – *Perform the amount of leakage that can be expected, based on criteria that has been provided*

- Calculation of seat leakage rates
- Equal percentage characteristics

Practical – *Understanding the equal percentage characteristics of a control valve*

- Linear valve characteristics

Practical – *Understanding the linear characteristics of a control valve*

- Quick opening valve characteristics

Practical – *Choosing the right characteristic, for various control scenarios and strategies that can be encountered*

- Inherent versus installed characteristics

Practical – *Visually see how the inherent characteristics can be altered, into installed characteristics, when a valve is installed in the field*

- Manually sizing a control vale, for a liquid application

Practical – *Do all of the calculations, to come up with a control valve, that can be used in a specific application*

Day Three

- Understanding valve sizing software, what it can do, and what you can achieve

Practical – *Making use of computer software, to size a control valve for a liquid application*

Practical – *Making use of computer software, to size a control valve for a gas application*

- Actuators, and how they fit into the greater scheme of control valves
- Pneumatic actuators
- Diaphragm pneumatic actuators
- Piston pneumatic actuators
- Rotary vane pneumatic actuators
- Electric actuators
- Hydraulic actuators
- Benchset and stroking of a control valve

Practical – *How anti-reset windup can be a useful tool, with control valve applications. Delegates will work through a simulator, explaining this out in meticulous detail*

- The purpose of a valve positioner

Practical – *Understanding what a valve positioner does, and how it will affect the operation of a control valve*

- Using SMART positioners
- Cavitation, within a control valve
- Cavitation control trims
- Disc stacks, used for cavitation control
- Other examples of devices used for cavitation control
- Dealing with noise in a valve

Practical – *Dealing with the issue of noise (as presented in a signal to the control valve), as well as the effects of a sticky valve, and how to counteract this*

- Making use of low-noise cages
- Making use of diffuser plates
- Gas diffuser silencers
- Sonic chokes
- Choosing the best form of noise limitation
- Materials that are used, in the construction of various valves

Practical – *Making use of a table, choose the best material to use on a control valve*

- Dealing with corrosion and erosion

Practical – *Making use of a table, evaluate the various corrosive effects that you may encounter, whilst using control vales*

- Control valve maintenance
- Backlash, inside a valve
- Stiction as found in some valves

Practical – *Making use of a table, evaluate whether your valve is going to be subject to noise / other damage, as a result of cavitation*

- Pressure relief devices
- Safety Instrumented System (SIS) valves
- The PID controller, as used with various control valves

Practical – *Understanding the AUTO / MANUAL aspects of a controller, which will operate on a loop that has a control valve*

Practical – *The size of a control valve can cause significant changes to the Gain of the Process. This exercise calculates the Gain of a Process, for a specific control valve*

Practical – *Understanding the effects of Dead Time, on a control valve, and determining what this Dead Time is*

Day Four

- Selecting the right controller action for a control valve (as some valves fail in the OPEN position, whereas others fail in the CLOSED position)

Practical – *Choose the appropriate action that will be required, given a number of scenarios that the delegates will encounter*

- Understanding the Proportional Band Percent / Gain option, of a PID controller which will be used to operate a control valve

Practical – *Experimenting with the P settings of a controller, understanding what the advantages and disadvantages are, and becoming fully comfortable with how changes will influence the operation of the control valve*

- Understanding the Reset / Integral option, of a PID controller which will be used to operate a control valve

Practical – *Experimenting with the I settings of a controller, understanding what the advantages and disadvantages are, and becoming fully comfortable with how changes will influence the operation of the control valve*

- Combining various aspects, such as PI control, when operating a control valve

Practical – *Experiment with a process, which has both adjustable P and I settings, and how this will affect the operation of a control valve*

- Understanding the Rate / Derivative option, of a PID controller which will be used to operate a control valve

Practical – *Experimenting with the D settings of a controller, understanding what the advantages and disadvantages are, and becoming fully comfortable with how changes will influence the operation of the control valve*

- How to tune a PID controller, by making use of an open-loop tuning methodology, when you are working with a control valve that operates on a self-regulating process

Practical – *Using the Ziegler-Nichols open-loop tuning methodology*

- How to tune a PID controller, by making use of a closed-loop tuning methodology, when you are working with a control valve that operates on an integrating process

Practical – *Using the Ziegler-Nichols closed-loop tuning methodology*

- Non-formalised (and therefore well suited to times when you do not have access to a calculator / computer) methods of tuning a controller, for a control valve out in the field

Practical – *Making use of a Trial and error methodology, in the closed loop strategy*

Practical – *Making use of a Trial and error methodology, in the open loop strategy*

Day Five

- Control valves that can be used, in cascade loops

- Control valves that can be used in ratio-control loops

Practical – *Experimenting with a control valve, that has been placed inside a cascade loop*

- Dealing with control valves, which are subject to long dead times, and how to get around this

Practical – *Experimenting with a control valve, that has been placed inside a ratio-control loop*

- Dealing with a control valve that has been installed in a process, which responds in a non-linear fashion, and which has different Process Gains in different regions

Practical – *Coming up with a practical, useable solution, when excessive dead time is present in a loop that contains a control valve*

- Making use of a PLC, to implement the required control of a control valve

Practical – *Making use of a PLC simulator, get a control valve to work, using ON / OFF strategies*

Practical – *Demonstrate the PID blocks, used on a PLC, to control a control valve out in the field*

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