Control Valve Sizing in Aspen Hysys

Example 1: Size the control valve with the following conditions. The control valve acts as PV and is installed at the outlet of a methanol plant inlet K.O. drum.

Parameter	Value	Unit
Flow	133000	Kg/hr
Fluid	Methane	
Fluid Package	PR	
Pressure 1	52.9	bara
Pressure 2	51	bara
Temperature	40	C

Size the control valve in both Aspen Hysys and Fisher and compare the input provision and results.

Sizing in Aspen Hysys

Steps to be taken:

1.Add Methane to component list

2.Select Peng-Robinson as fluid package

3.Enter simulation environment and provide the process data.

4.Select a control valve and connect stream 1 to its inlet while connect stream 2 to its outlet.

5.Specify the pressure drop in control valve based on given table.

6.Go to rating tab, select universal gas sizing, specify the opening to be 100%. Also specify the characteristic to be linear.

Note:

Valve characteristics

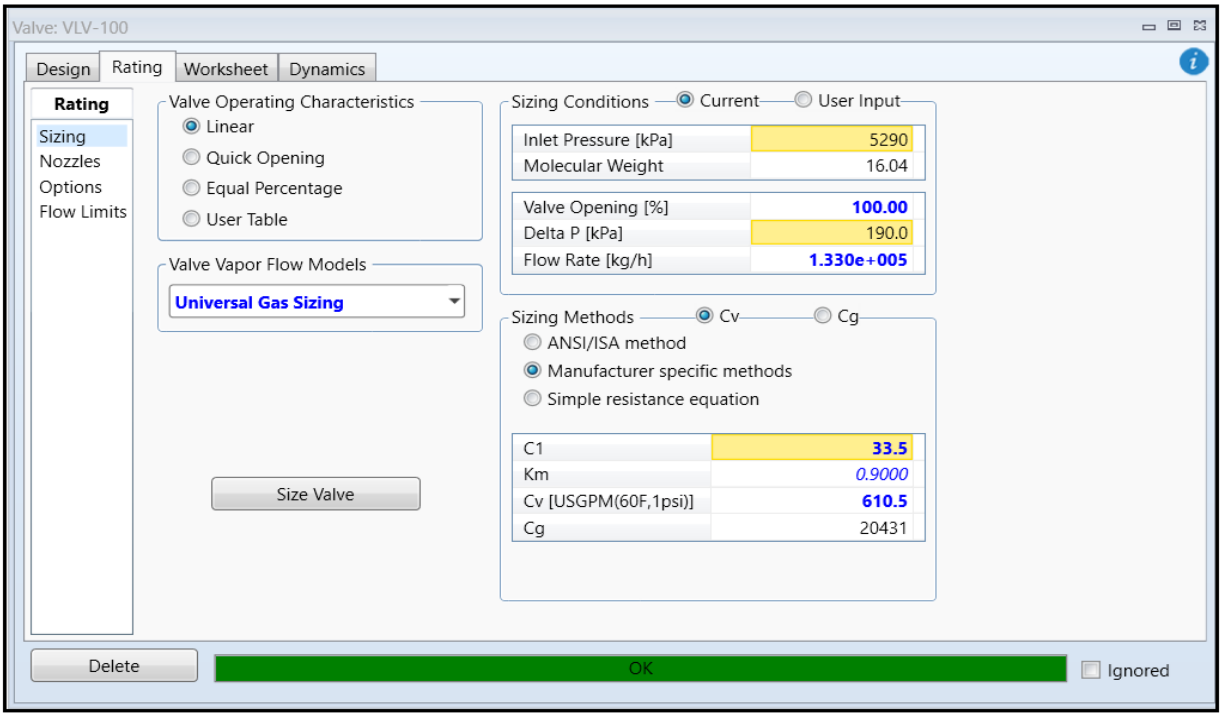
A unique and simple procedure for valve characteristic determination for almost all Chemical Plants.

1. Use Equal Percentage if the valve functions as FV or TV

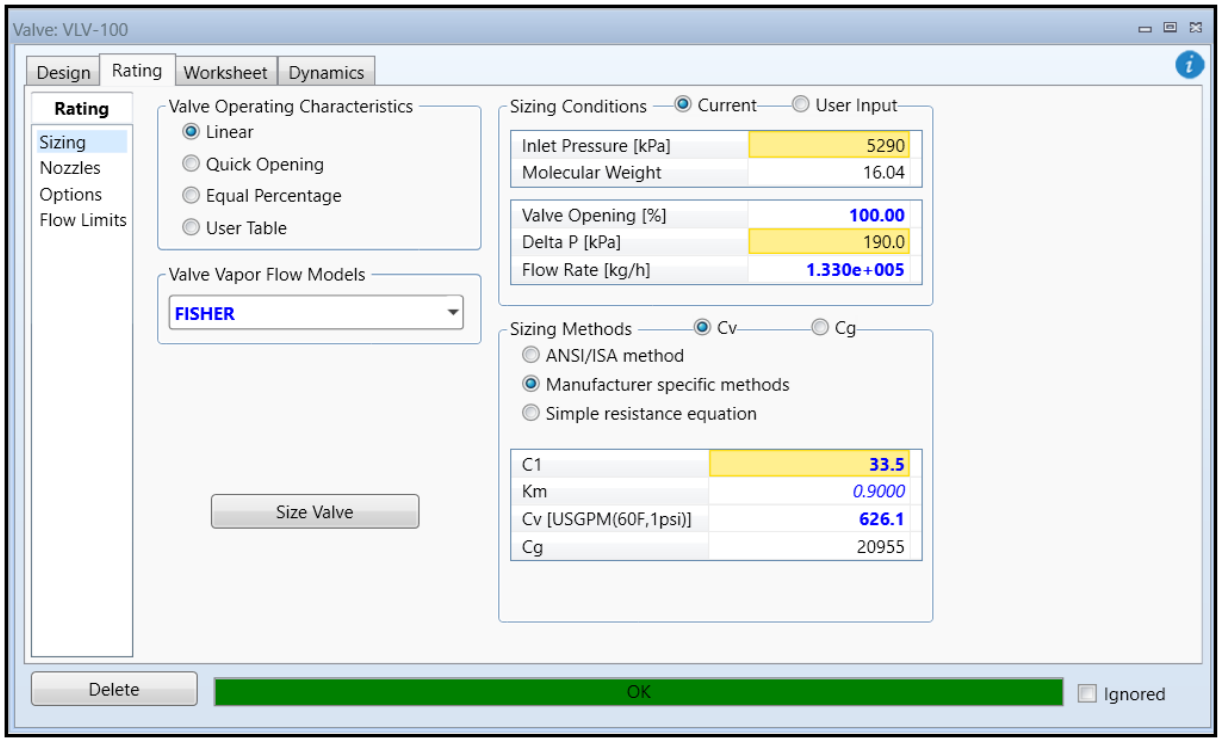
2. Use Linear if the valve functions as PV or LV

3. Use Linear if there is Split Range Control

Note: Due to process demands, above rules might not apply to some situations.

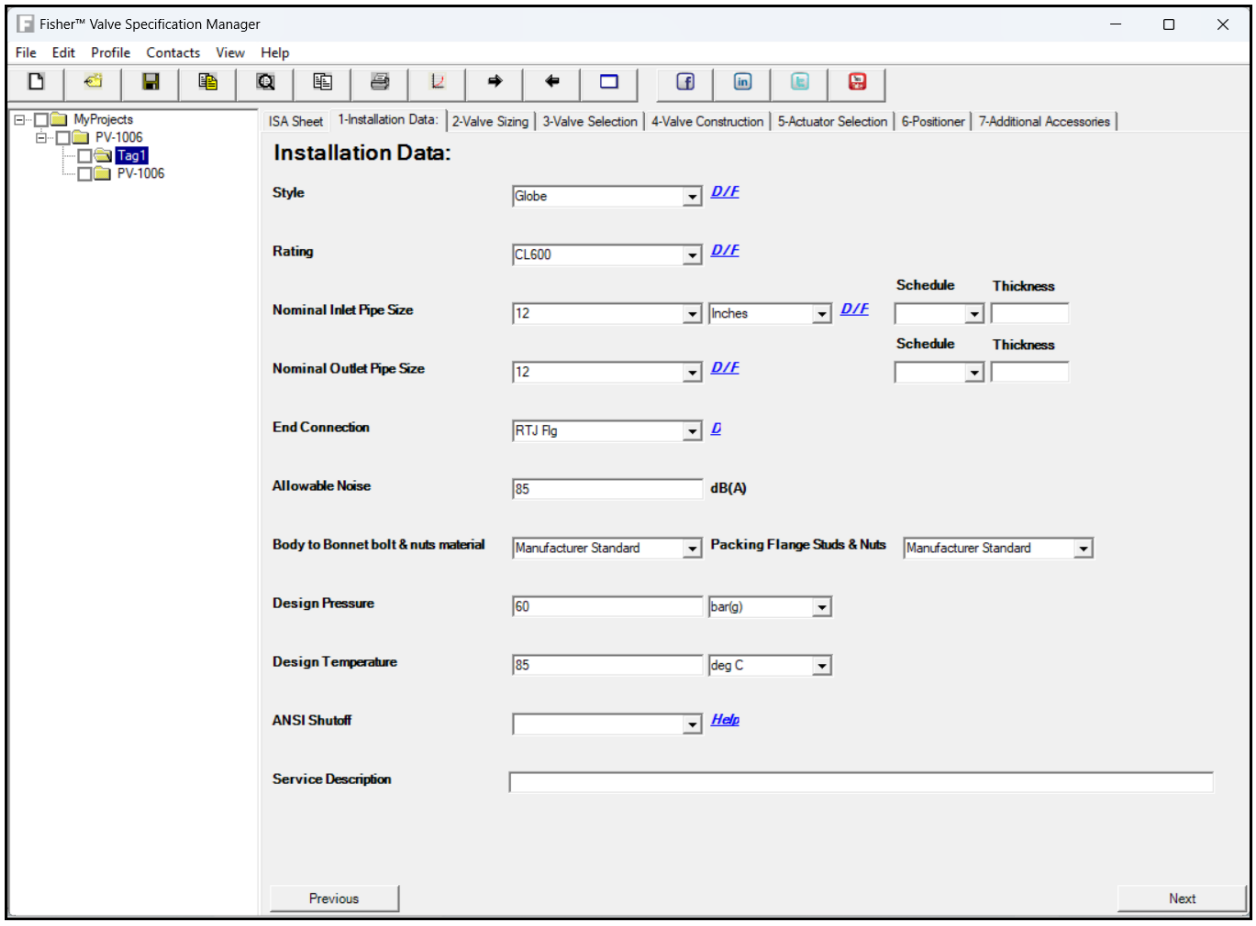


Now select Fisher as vapor flow model and size valve again.

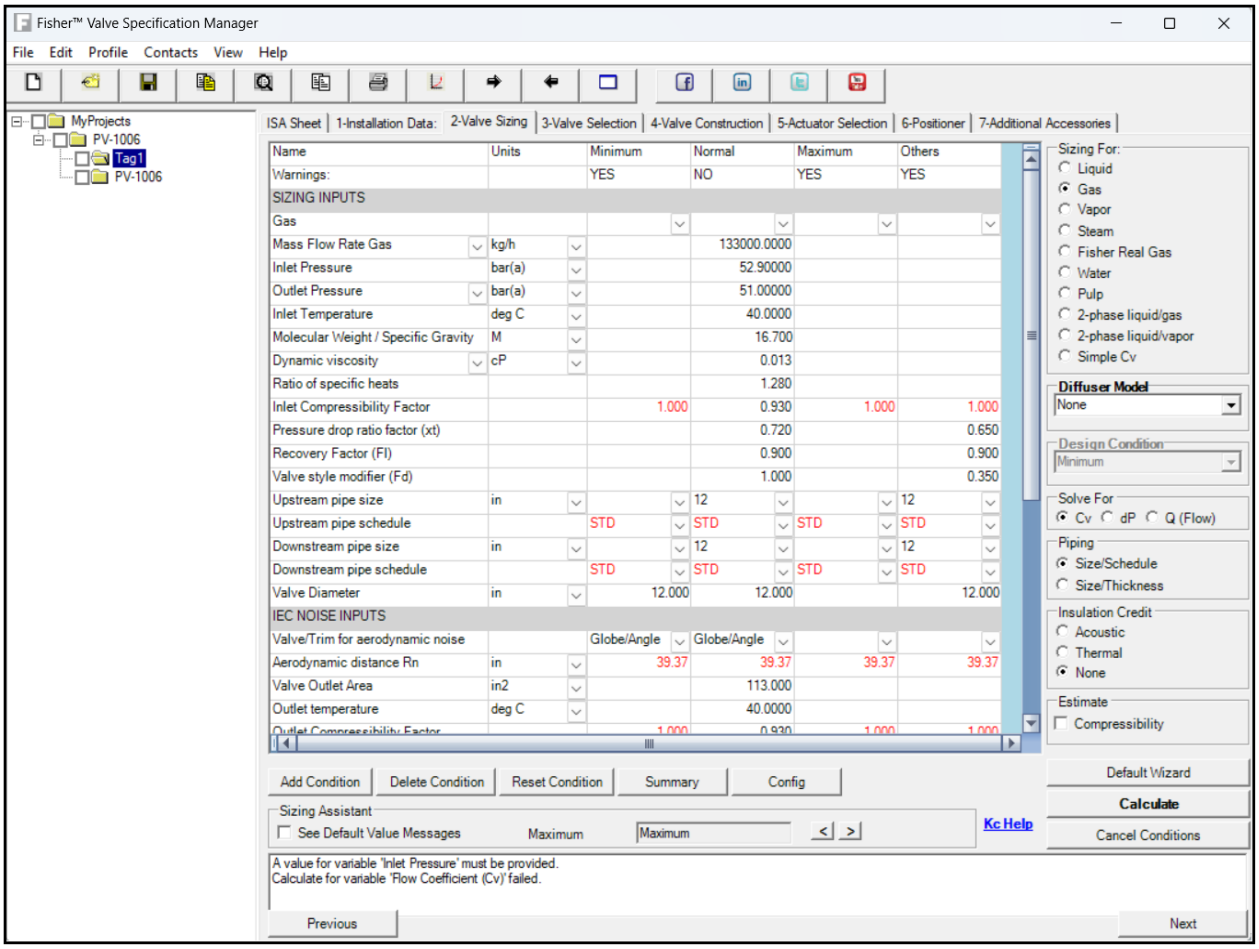


Sizing in Fisher FSM

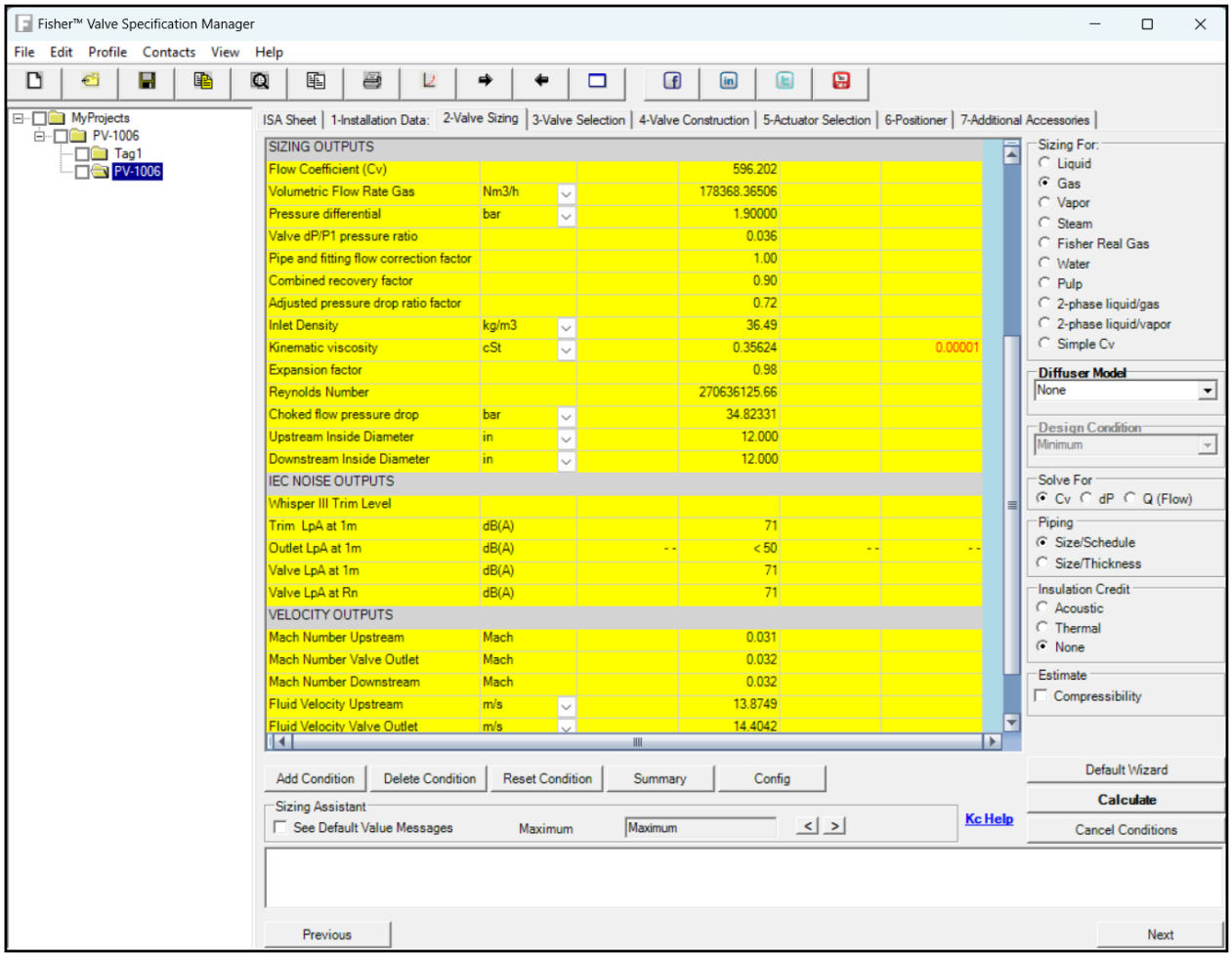
1.Data entry



2.Process data entry



3.FSM Output


Fisher™ Valve Specification Manager
File Edit Profile Contacts View Help
MyProjects
PV-1006
Tag1
PV-1006
ISA Sheet | 1-Installation Data: | 2-Valve Sizing | 3-Valve Selection | 4-Valve Construction | 5-Actuator Selection | 6-Positioner | 7-Additional Accessories
SIZING OUTPUTS
Flow Coefficient (Cv) 596.202
Volumetric Flow Rate Gas Nm3/h 178368.36506
Pressure differential bar 1.90000
Valve dP/P1 pressure ratio 0.036
Pipe and fitting flow correction factor 1.00
Combined recovery factor 0.90
Adjusted pressure drop ratio factor 0.72
Inlet Density kg/m3 36.49
Kinematic viscosity cSt 0.35624 0.00001
Expansion factor 0.98
Reynolds Number 270636125.66
Choked flow pressure drop bar 34.82331
Upstream Inside Diameter in 12.000
Downstream Inside Diameter in 12.000
IEC NOISE OUTPUTS
Whisper III Trim Level
Trim LpA at 1m dB(A) 71
Outlet LpA at 1m dB(A) -- < 50 -- --
Valve LpA at 1m dB(A) 71
Valve LpA at Rn dB(A) 71
VELOCITY OUTPUTS
Mach Number Upstream Mach 0.031
Mach Number Valve Outlet Mach 0.032
Mach Number Downstream Mach 0.032
Fluid Velocity Upstream m/s 13.8749
Fluid Velocity Valve Outlet m/s 14.4042
Sizing For:
Liquid
Gas
Vapor
Steam
Fisher Real Gas
Water
Pulp
2-phase liquid/gas
2-phase liquid/vapor
Simple Cv
Diffuser Model
None
Design Condition
Minimum
Solve For
Cv dP Q (Flow)
Piping
Size/Schedule
Size/Thickness
Insulation Credit
Acoustic
Thermal
None
Estimate
Compressibility
Add Condition
Delete Condition
Reset Condition
Summary
Config
Default Wizard
Calculate
Cancel Conditions
Sizing Assistant
See Default Value Messages
Maximum
Maximum
Kc Help
Previous
Next

Result comparison

CV	Value
CV by Universal Gas Sizing	610
CV by Fisher in Aspen Hysys	626.1
CV by Fisher in FSM	596.2

Example 2

1.Operating Condition

Flowrate	8700 kg/hr.
Inlet Pressure	5.3 barg
Outlet Pressure	4.6 barg
Inlet Temperature	48 C
Liquid Specific Gravity	0.99
Dynamic Viscosity	0.563 cP
Vapor Pressure	-0.9 barg
Critical Pressure	220 barg
Recovery Factor	0.9
Valve Style Modifier	1
Cavitation Coefficient	1
Upstream Pipe Size	3 in
Upstream Pipe Schedule	80
Downstream Pipe Size	3 in
Downstream Pipe Schedule	80
Valve Diameter	1.5 in

2.Results

Here is the result of Fisher FSM

SIZING OUTPUTS					
Flow Coefficient (Cv)			12.256		
Application Ratio			0.113		
Pressure differential	bar		0.70000		
Valve dP/P1 pressure ratio			0.111		
Choked flow pressure drop	bar		4.99952		
Cavitation Pressure Drop	bar		6.12210		
Liquid critical pressure drop ratio factor			0.95		
Pipe and fitting flow correction factor			0.99		
Combined recovery factor			0.89		
Kinematic viscosity	cSt	1.000	0.569	1.000	1.000
Upstream Inside Diameter	mm		73.66		
Downstream Inside Diameter	mm		73.66		
Volumetric Flow Rate Liquid	m3/h		8.7971		
Reynolds Number			357087.08		
Inlet Density	kg/m3		989.84		
NOISE OUTPUTS					
Sound Pressure at 1m	dB(A)		< 50		
VELOCITY OUTPUTS					
Fluid Velocity Upstream	m/s		0.5732		
Fluid Velocity Downstream	m/s		0.5732		

Calculated CV	12.25
Pipe Size	3 inches
Valve Size	1.5 inches
Noise	<50 dB(A)

Appendix A

Condition / Valve Type	ΔP very high	Solid	V very high	CV high	Crystallization	Large Flow with low ΔP	Tight Shut-off up to 4 inch	Tight Shut-off above 4 inch	Standard
Angle	✓	✓	✓						
Butterfly						✓		✓	
Ball				✓	✓		✓		
Globe									✓

EXAMPLES

Ex. 1 : A condensate with pressure drop of 40 bar across valve in flashing state requires a flow control valve to regulate the flow

Valve Type : Angle

Trim Type : EQ%

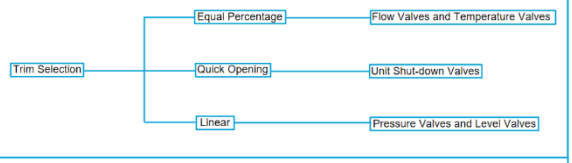
Material : A217 WC9

Ex. 2 : Natural Gas with pressure drop of 2 bar across valve requires a pressure control valve to regulate the pressure.

Valve Type : Globe

Trim Type : Linear

Material : A216 WCB

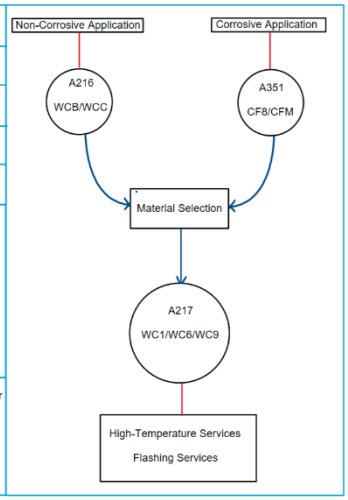


Ex. 3 : A unit shut-down valve shall be installed with adjacent piping size of 3 inch for an application in which we have water + dissolved CO2.

Valve Type : Ball Valve

Trim Type : Quick Opening

Material : A351 CF8



Appendix B

About us

Educational Institute for Equipment and Process Design or EIEPD is a leading training platform which have been providing specialized courses and trainings in process and general engineering to engineers around the globe.

At EIEPD we aim to empower process engineering community in different ways including:

1.Provision of Free Videos

2.Provision of Free Webinar

3.Specialized online Courses and Trainings

4.In-Person Trainings

5.Project Consultancy

6.Funding Free Graduation Programs

We at EIEPD are glad that you have started your journey with us. We make and keep our promise to upgrade your competency in process engineering beyond your expectation.

With EIEPD, everything is simple!

Mohammadreza Behrouzi

The Founder and Instructor at EIEPD

Featured Course

If you are eager to boost your knowledge in detailed engineering design for different equipment including control valves, pumps, heat exchangers, air coolers, separators, PSVs, we highly recommend the following course which starts from basic and upgrade you to a professional level.

The course provides detailed instruction upon different equipment using references and software. To see what is covered in this course, please check out the following link:

https://eiepd.com/courses/detailed-engineering-design

If you are unable to register via this link and rather decide to register locally, here are our registered representatives:

Countries	. Representatives	Contact
India	Mr. Yunus Khaleel	+91 87924 53950
Nigeria	Mr. Epegu Natty	+234 816 881 7181
Pakistan	Mr. Mohammad Safdar	+92 301 6943632

Indonesia	Malaysia	Saudi Arabia	EIEPD Representative
Qatar	UAE	Iraq	
Turkey	Algeria	Egypt	
Tunisia	Canada	UK	+20 15 56611209
Ghana	Bolivia	Venezuela	

You can also contact us through EIEPD Email:

training@eiepd.com

Here is EIEPD Platform address for further information:

eiepd.com