



**COURSE OVERVIEW PE0221**  
**Operation of Process Equipment**

*Fired Heaters, Air Coolers, Heat Exchangers,  
Pumps, Compressors, Crude Desalter, Pressure Vessels & Valves*

**Course Title**

Operation of Process Equipment: *Fired Heaters, Air Coolers, Heat Exchangers, Pumps, Compressors, Crude Desalter, Pressure Vessels & Valves*

**Course Date/Venue**

January 20-24, 2025/TBA Meeting Room, London Marriott Hotel Regents Park, London, United Kingdom

**Course Reference**

PE0221

**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.***

The course is designed to provide delegates with a detailed and up-to-date overview on the operation of the hydrocarbon process equipment that includes fired heaters, air coolers, heat exchangers, pumps, compressors, crude desalter, pressure vessels and valves.

It covers the characteristics of crude oil and function of chemicals used in the process such as composition of petroleum, hydrocarbon properties, salt concentration and emulsions.

At the completion of the course, participants will be able to apply oil treating; dehydration and desalting; process and equipment operations; and employ the sequence of desalter plant start-up.

The course will also cover the different types and function of direct fired heaters; safety aspects; air coolers; heat exchangers; pumps; compressors; process vessels; valves; and troubleshooting of different equipment and processes.





## Course Objectives

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

- Apply proper techniques and procedures on the operation of the hydrocarbon process equipment such as fired heaters, air coolers, heat exchangers, pumps, compressors, crude desalter, pressure vessels and valves
- Enumerate the characteristics of crude oil and identify the function of chemicals used in the process such as composition of petroleum, hydrocarbon properties, salt concentration and emulsions
- Discuss oil treating, dehydration and desalting including the process and equipment operations
- Employ the sequence of desalter plant start-up and identify the different types and function of direct fired heaters including the safety aspects
- Differentiate the various types of air coolers, heat exchangers, pumps and compressors
- Describe the types and functions of process vessels and valves including the troubleshooting of different equipment and processes

## Exclusive Smart Training Kit - H-STK®



Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.

## Who Should Attend

This course provides an overview of all operational aspects of the hydrocarbon process equipment for engineers and other technical staff who are involved in the operation and troubleshooting of various process equipment including fired heaters, air coolers, heat exchangers, pumps, compressors, crude desalter, pressure vessels and valves. The course is also beneficial for design engineers and maintenance staff.

## 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.

## Accommodation

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




**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:

-  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.

-  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.

**Course Fee**

**US\$ 8,800** per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

In addition to the Course Manual, participants will receive an e-book “*Operator’s Guide to Rotating Equipment: An Introduction to Rotating Equipment Construction, Operating Principles, Troubleshooting and Best Practices*”, published by AuthorHouse.





### 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. Mervyn Frampton** is a **Senior Process Engineer** with over **30 years** of industrial experience within the **Oil & Gas, Refinery, Petrochemical** and **Utilities** industries. His expertise lies extensively in the areas of **Process Troubleshooting, Distillation Towers, Fundamentals of Distillation** for Engineers, **Distillation Operation and Troubleshooting, Advanced Distillation Troubleshooting, Distillation Technology, Vacuum Distillation, Distillation Column Operation & Control, Oil Movement Storage & Troubleshooting, Process Equipment Design, Piping Systems, Applied Process Engineering Elements, Process Plant Optimization, Revamping & Debottlenecking, Process Plant Troubleshooting & Engineering Problem Solving, Process Plant Monitoring, Catalyst Selection & Production Optimization, Operations Abnormalities & Plant Upset, Process Plant Start-up & Commissioning, Clean Fuel Technology & Standards, Flare, Blowdown & Pressure Relief Systems, Oil & Gas Field Commissioning Techniques, Pressure Vessel Operation, Gas Processing, Chemical Engineering, Process Reactors Start-Up & Shutdown, Gasoline Blending for Refineries, Urea Manufacturing Process Technology, Continuous Catalytic Reformer (CCR), De-Sulfurization Technology, Advanced Operational & Troubleshooting Skills, Principles of Operations Planning, Rotating Equipment Maintenance & Troubleshooting, Hazardous Waste Management & Pollution Prevention, Heat Exchangers & Fired Heaters Operation & Troubleshooting, Energy Conservation Skills, Catalyst Technology, Refinery & Process Industry, Chemical Analysis, Process Plant, Commissioning & Start-Up, Alkylation, Hydrogenation, Dehydrogenation, Isomerization, Hydrocracking & De-Alkylation, Fluidized Catalytic Cracking, Catalytic Hydrodesulphuriser, Kerosene Hydrotreater, Thermal Cracker, Catalytic Reforming, Polymerization, Polyethylene, Polypropylene, Pilot Water Treatment Plant, Gas Cooling, Cooling Water Systems, Effluent Systems, Material Handling Systems, Gasifier, Gasification, Coal Feeder System, Sulphur Extraction Plant, Crude Distillation Unit, Acid Plant Revamp and Crude Pumping. Further, he is also well-versed in HSE Leadership, Project and Programme Management, Project Coordination, Project Cost & Schedule Monitoring, Control & Analysis, Team Building, Relationship Management, Quality Management, Performance Reporting, Project Change Control, Commercial Awareness and Risk Management.**

During his career life, Mr. Frampton held significant positions as the **Site Engineering Manager, Senior Project Manager, Process Engineering Manager, Project Engineering Manager, Construction Manager, Site Manager, Area Manager, Procurement Manager, Factory Manager, Technical Services Manager, Senior Project Engineer, Process Engineer, Project Engineer, Assistant Project Manager, Handover Coordinator and Engineering Coordinator** from various international companies such as the **Fluor Daniel, KBR South Africa, ESKOM, MEGAWATT PARK, CHEMEPIC, PDPS, CAKASA, Worley Parsons, Lurgi South Africa, Sasol, Foster Wheeler, Bosch & Associates, BCG Engineering Contractors, Fina Refinery, Sapref Refinery, Secunda Engine Refinery** just to name a few.

Mr. Frampton has a **Bachelor's degree in Industrial Chemistry** from **The City University in London**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Trainer/Assessor** by the **Institute of Leadership & Management (ILM)** and has delivered numerous trainings, courses, workshops, conferences and seminars 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: Monday, 20<sup>th</sup> of January 2025**

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	<b>PRE-TEST</b>
0830 – 0930	<b>Characteristics of Crude Oil</b> Composition of Petroleum • Hydrocarbon Gases Properties
0930 – 0945	Break
0945 – 1100	<b>Characteristics of Crude Oil (cont'd)</b> Salts Concentration • Emulsions • Function of Chemicals Used in the Process
1100 – 1230	<b>Oil Treating, Dehydration &amp; Desalting</b> Emulsion Formation & Breaking • Vertical & Horizontal Theater Operation • Electrostatic Theatre Design/Operation • The Desalting Process/Equipment • Emulsion Treating
1230 – 1245	Break
1245 – 1420	<b>Oil Treating, Dehydration &amp; Desalting (cont'd)</b> Separators – Free Water Knockout • Hetear Theatres – Other Treating Methods • Chemical – Electrical – Crude Oil Coolers (Heat Exchangers) • Control Valves Principles • Pumps Operation • Air Compressor Operation
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day One

**Day 2: Tuesday, 21<sup>st</sup> of January 2025**

0730 – 0930	Sequence of Desalter Plant Start-up
0930 – 0945	Break
0945 – 1100	Sequence of Desalter Plant Start-up (cont'd)
1100 – 1230	<b>Direct-Fired Heaters</b> Design Considerations – Process & Combustion
1230 – 1245	Break
1245 – 1420	<b>Direct-Fired Heaters (cont'd)</b> Control System
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Two

**Day 3: Wednesday, 22<sup>nd</sup> of January 2025**

0730 – 0930	<b>Air Coolers</b> Types – Forced and Induced Air • Key Operational Considerations
0930 – 0945	Break
0945 – 1100	<b>Air Coolers (cont'd)</b> Air vs Water Cooling • Troubleshooting
1100 – 1230	<b>Heat Exchangers</b> Types • Shell-and-Tube
1230 – 1245	Break
1245 – 1420	<b>Heat Exchangers (cont'd)</b> Heat Transfer Relation
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Three





**Day 4: Thursday, 23<sup>rd</sup> of January 2025**

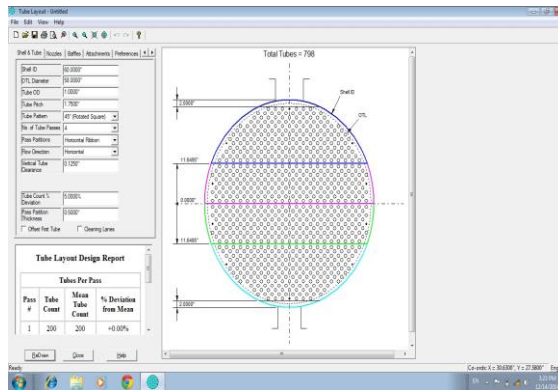
0730 – 0930	<b>Pumps</b> Development of Static and Dynamic Head in the Operating Volume of Pumps for Efficiency and Control Operation • The Affinity Laws as Tools for Efficient Operation • Pump Auxiliaries
0930 – 0945	Break
0945 – 1100	<b>Pumps (cont'd)</b> Wear Components • Canned Motor and Magnetic Drive Pumps • High Speed/Low Flow Pumps • Servicing and Condition Monitoring
1100 – 1230	<b>Compressors</b> Types, Styles and Configurations of Centrifugal and Axial Compressors • Construction Features • Mode of Operation
1230 – 1245	Break
1245 – 1420	<b>Compressors (cont'd)</b> Compressor Auxiliaries and Support Systems • Analyse Operating Curves for Surge, Stall and Choke • Define Appropriate Equipment for Safe Operation
1420 – 1430	<b>Recap</b>
1430	Lunch & End of Day Four

**Day 5: Friday, 24<sup>th</sup> of January 2025**

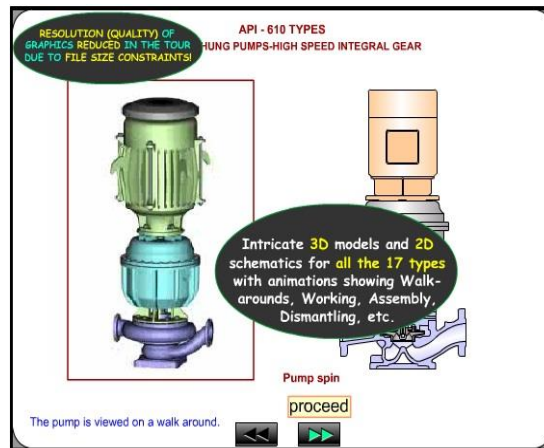
0730 – 0930	<b>Process Vessels</b> Types and Functions • Safety Aspects
0930 – 0945	Break
0945 – 1100	<b>Valves</b> Valve Theory • Valve Types • Applications • Function • Operation • Troubleshooting
1100 – 1230	<b>Troubleshooting of Different Equipment &amp; Processes</b>
1230 – 1245	Break
1245 – 1345	<b>Troubleshooting of Different Equipment &amp; Processes (cont'd)</b>
1345 – 1400	<b>Course Conclusion</b>
1400 – 1415	<b>POST-TEST</b>
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course

**Simulator (Hands-on Practical Sessions)**

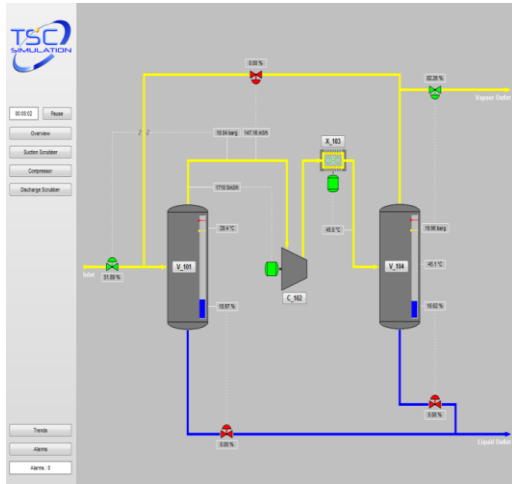
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art simulators “Heat Exchanger Tube Layout”, “Centrifugal Pumps and Troubleshooting Guide 3.0”, “SIM 3300 Centrifugal Compressor”, “CBT on Compressors”, “Valve Sizing Simulator”, “Valve Simulator 3.0”, “Valvestar 7.2 Simulator”, “PRV<sup>2</sup>SIZE Simulator”, “ASPEN HYSYS V12.1 Simulator” and “ThermoSysPro”.



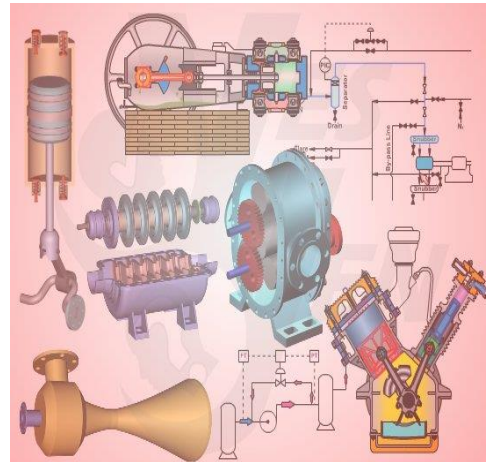
**Heat Exchanger Tube Layout Simulator**



**Centrifugal Pumps and Troubleshooting Guide**



**SIM 3300 Centrifugal Compressor**



**CBT on Compressors**

**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**

	Amont	Aval
Temperature of vaporization	251,82 °C	201,40 °C
Specific mass of steam	20,825 kg/m <sup>3</sup>	8,091 kg/m <sup>3</sup>
Specific enthalpy (Total heat) of steam	2 791,75 kJ/kg	
Specific latent heat (vaporization)	1 933,04 kJ/kg	

**Liquid Flow** | Kv-Value

The actual Flow (Q) of a specific fluid in m<sup>3</sup>/h, with a specific Pressure drop (D p) in bar across the valve and a fluid density (d) in kg/dm<sup>3</sup> is:

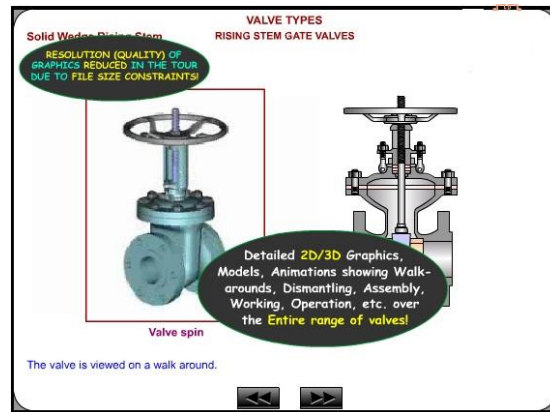
Kv-value: 12 Kv

**Resultant values**

Steam mass flow rate	5 520,60 kg/h
Steam flow rate at outlet valve	682,31 m <sup>3</sup> /h
Equivalent thermal power	2 964,00 kW/h

Attention with the decimals. Comma in French and dot in English (see Windows configuration in country parameters) | Valider | Ok | Help

**Valve Sizing Simulator**



**Valve Simulator 3.0**

**Valvestar 7.2 Simulator**

File Edit View Medium Spring Valve Documentation Tools Help

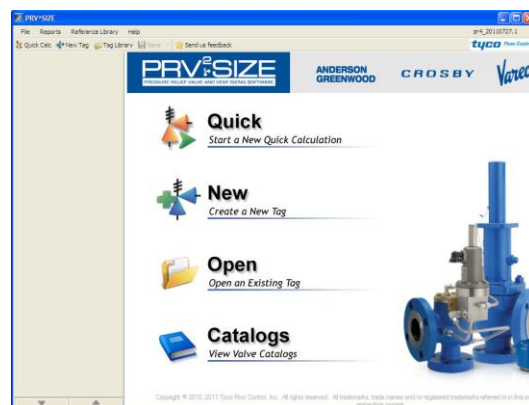
Projects: Create new using wizard... File case

Use this page to specify a type and size of a vessel, its head design, the height of a medium in the vessel along with other related

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 <sub>c</sub>	m <sup>2</sup>
Exposed surface area of the vessel, entered	A <sub>e</sub>	m <sup>2</sup>
Vessel wall temperature	T <sub>w</sub>	°C
Set pressure	P	bar-g
Temperature	T	°C
Normal operating gas pressure	P <sub>n</sub>	bar-g
Normal operating gas temperature	T <sub>n</sub>	°C
Coefficient of discharge	K <sub>d</sub>	0.875
Minimum value of Factor "F"	F <sub>min</sub>	0.025
Minimum required mass flow	W	kg/h
Minimum required effective discharge area	A	m <sup>2</sup>

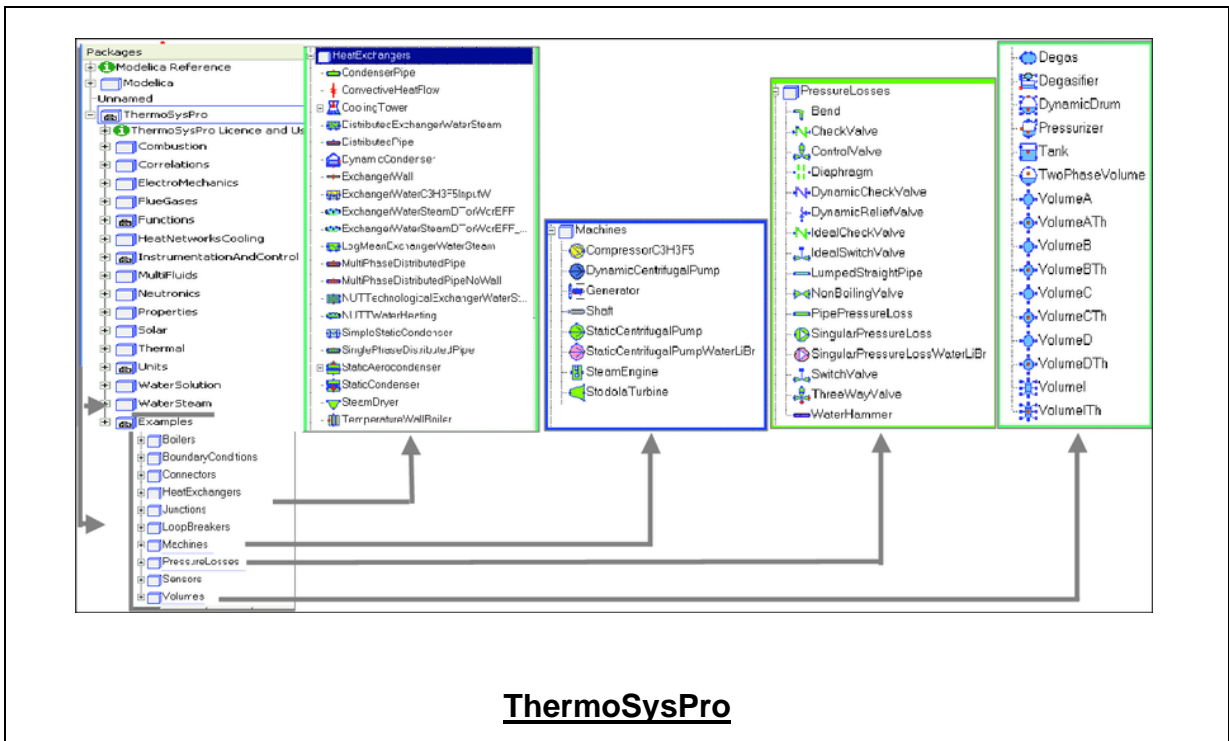
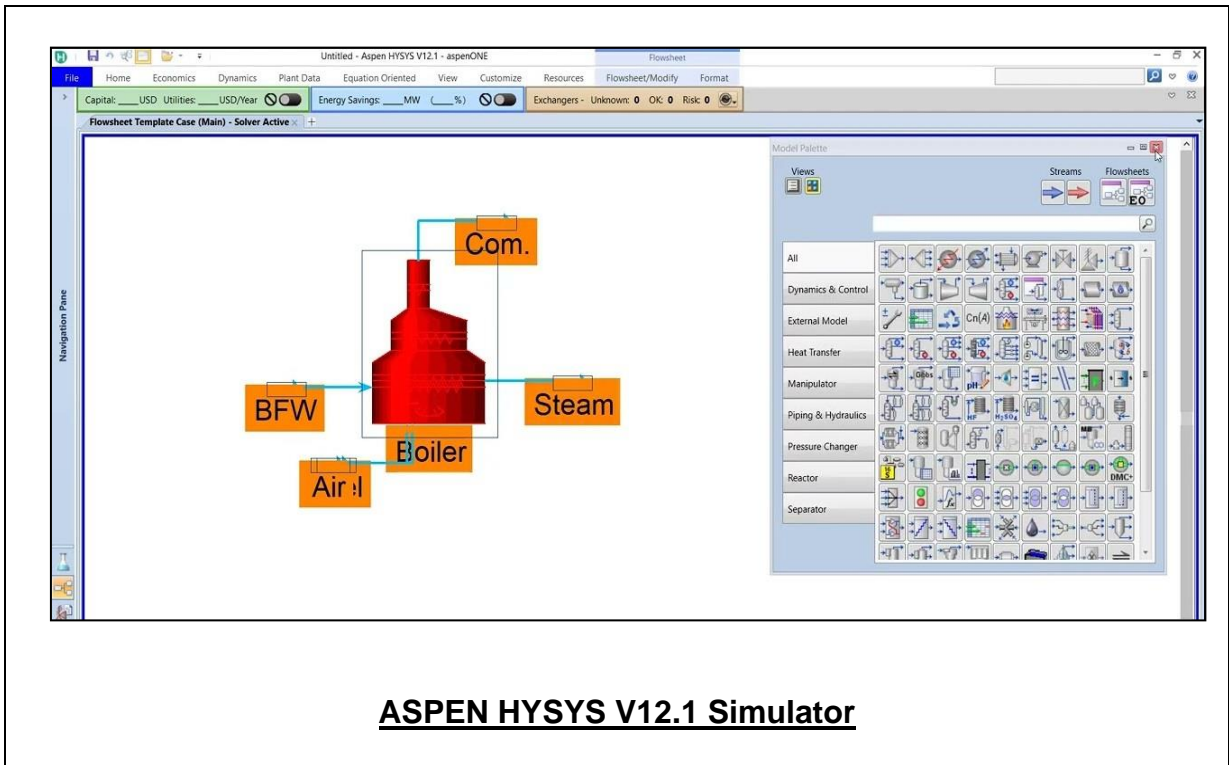
Help | Back | Next | Finish | Cancel

**Valvestar 7.2 Simulator**



**PRV<sup>2</sup>SIZE Simulator**

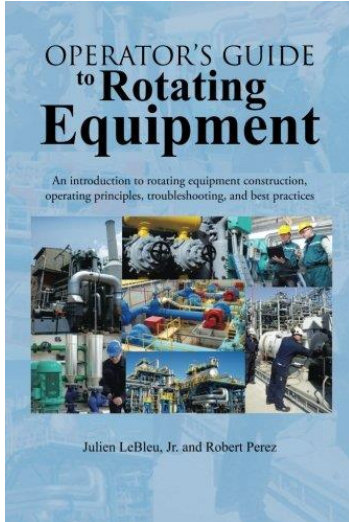






**Book(s)**

As part of the course kit, the following e-book will be given to all participants:



**Title** : Operator's Guide to Rotating Equipment:  
An Introduction to Rotating Equipment  
Construction, Operating Principles,  
Troubleshooting and Best Practices

**ISBN** : 978-1-49690-868-1

**Authors** : Julien LeBleu  
Robert Perez

**Publisher** : AuthorHouse

**Course Coordinator**

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