KLM Technology Group

Practical Engineering Guidelines
for Processing Plant Solutions

Distillation Design, Operation, Control, Simulation, and Troubleshooting Course

Introduction

The success of every company depends of each employee's understanding of the business's key components. Employee training and development will unlock the companies' profitability and reliability. When people, processes and technology work together as a team developing practical solutions, companies can maximize profitability and assets in a sustainable manner.

Distillation is the most common separation technique and is energy intensive. Distillation can consume more than 50% of a process plant's operating energy cost. A way to improve an existing plant's operating cost or to reduce a new distillation system's operating cost is to improve the efficiency and operations by correct equipment selection, process optimization and control.

Course Objective

This course will guide the participates to develop key concepts and techniques to design, operate and troubleshoot a distillation system, with an introduction to simulation software. These key concepts can be utilized to make design and operating decisions. Training and development is an investment in future success - give yourself and your employees the keys to success.

Product recoveries, purities and energy utilization can be improved in most distillation systems. This cannot be achieved without first an understanding of distillation principles and design. These principles need to be understood in advance of designing, operating and trouble shooting a distillation column for the operator, designer, or problem solving to be effective.

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What You Can Expect To Gain;

- The operation, control and trouble shooting of a distillation columns and it's associated equipment,
- An overview of distillation, practical solutions as well as theory
- An understating of essential distillation concepts,
- Valuable practical insights for trouble free design and field proven techniques for commissioning, start up and shutdown of distillation operation.
- An introduction to process simulation software
- The fundamental knowledge of distillation control.
- To tailor your approach to specific design, analysis and trouble shooting problems.

Course Syllabus

This suggested course is a three to five days. The goal of the course would be to refresh the knowledge of those who have a basic understanding of distillation and process simulation software techniques and to build a foundation to those who are new to the distillation and process simulation software.

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Typical Course Outline

Day One

A. General Introduction

1. General Column Design

- The components of a distillation system, more than just a tower – it is a system of different components
- History of distillation
- Different types of distillation columns
- Differences among batch, flash, and multistage distillation process
- Relative advantages of tray and packed columns
- Steps in the process design

B. Thermodynamics and Equilibrium

1. Vapor Liquid Equilibrium

- Select the correct vapor-liquid equilibrium equation for your system
- Review vapor pressure and equilibrium diagrams
- Interpret mole fraction equilibrium curves, commonly called y-x diagrams
- Azeotropes and the challenges they create for distillation

2. Stages & Transfer Units Efficiencies

- Calculate the number of equilibrium stages using short cut methods
- Calculate minimum reflux and stages using graphical & analytical methods
- Determine number of theoretical stages needed in a distillation column

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3. Stage Efficiency

- Methods for determining efficiency
- Calculate an overall column efficiency for tray columns
- Calculate point and tray efficiencies, and their difference
- Calculate the number and height of transfer units for packing
- Effects on distillation column by changing amount of reflux and reflux temperature
- How flooding and foaming affects efficiencies and capacities

Day Two

Column Design

A. Tray Column Design

- The major design differences between tray types
- The operational limits for trays – operating window
- Size a distillation column for a given vapor and liquid rate

B. Packed Column Design

- The different types of packing and their characteristics
- The best type of packing for a given system
- Size a packed column diameter for a given vapor and liquid rate

C. Designing columns for fouling service

D. Designing columns for vacuum service

E. Designing Columns for improved operation and maintenance

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Day Three

Introduction to Simulation Software

A. Process Simulation Review

- Getting started with simulation software
- General simulation & flow sheeting techniques
- General component, thermodynamic & stream data requirements, enter basic input required for a simulation
- Unit operations: Columns, flashes, mixers, pumps, valves, heat exchangers, compressors, etc.

B. Workshops (which are mixed in the lectures)

1. Simulation of DePropanizer

   - Comparison of VLE
   - Choosing distillation device
   - Selection of stage efficiency

2. Simulation of Crude Tower

   - Comparison of VLE
   - Choosing distillation device
   - Selection of stage efficiency

3. Simulation of DeEthanizer

   - Comparison of VLE
   - Choosing distillation device
   - Selection of stage efficiency

4. Simulation of one of your plants towers

   - Comparison of VLE

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- Choosing distillation device
- Selection of stage efficiency

Day Four

A. Process Control

1. Distillation Column Control

- Functions of Process Control
- Characteristics of a Continuous Process
- Select appropriate composition and column pressure control schemes
- Process settings during column operation

2. Typical controlled and manipulated process variables

- Level
- Pressure
- Composition
- Temperature
- Flow

3. Controller Performance Criteria

- Final Control Elements
- Control Algorithms
- Open and closed loop tuning strategies

4. Feed Forward Control of an Ideal Process

- Feedback and Feed forward Control Loops

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Day Five

Troubleshooting

1. Introduction

   - Evaluate operation of a packed column
   - Evaluate operation of a tray column
   - Use tools to diagnosis problems

2. Installation

   - Common column installation mistakes
   - List tasks to insure a proper installation

3. Commissioning

   - Common start up problems and understand how to correct them

4. Utilizing Process Engineering Software for troubleshooting.

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Who Should Attend

- People who are making day to day decisions regarding operation, design, maintenance, and economics of process industry plants.
- An engineer or chemist who must troubleshoot and solve distillation problems in a plant, an engineering office or laboratory.
- Technical Engineers, Operating Engineers, Process Support Personnel, Chemist, and Managers
- Engineering graduates/technologists who will be using simulation software in their daily work.
- Technical Process engineers doing process design and optimization projects and studies that need who need advanced skills for more complex modeling tasks.
- Plant Operation Support Engineers checking plant performance under different operating conditions, and who are involved in design of new facilities or revamps of existing facilities.
- R&D engineers and researchers using process simulators for process synthesis, upgrade or modifications.
- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding of process safety.
- Other professionals who desire a better understanding of the subject matter.

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Prerequisites

- A background in chemical engineering or industrial chemistry
- Completed our “Introduction to Process Simulation Software” Course, and / or familiar with simulation software the time of the course

Schedule

This course can also be customized to your requirements at your site anywhere in the world. Please contact us about providing training at your site.

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