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ENCYCLOPEDIA OF CHEMICAL ENGINEERING EQUIPMENT

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HEAT TRANSFER
MATERIALS HANDLING
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PROCESS PARAMETERS
REACTORS
SEPARATIONS: CHEMICAL
SEPARATIONS: MECHANICAL
TRANSPORT AND STORAGE
SAFETY
PHARMACEUTICALS
PETROLEUM REFINING

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Welcome to the
Visual Encyclopedia of Chemical Engineering Equipment

By Equipment Type:

Heat Transfer

Boilers
Chimneys
Condensers
Cooling Towers
Cryogenics
Flares
Furnaces & Kilns
Heat Exchangers
Refrigeration

Materials Handling

Batching
Hoppers
Mixers
Presses
Scales
Size Enlargement
Size Reduction
Tablet Coating

Logo



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Chemical engineering-Encyclopedias

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Brief History

The idea for the visual encyclopedia of chemical engineering equipment was born 32 years ago when the author was completing her undergraduate studies and realized that she didn't have a solid understanding of what chemical engineering equipment looked like or how it worked. When she began a faculty position in 1993, one of her first NSF grants (NSF DUE 9555125) supported the development of CD multimedia materials for the introductory chemical engineering course, including the Visual Encyclopedia of Chemical Engineering Equipment. The modules, developed largely by scores of chemical engineering undergraduate students, were included in a CD-ROM that accompanied the 3rd edition of Felder and Rousseau's Elementary Principles of Chemical Processes. The reactors portion

was included in the 4th edition of Fogler's Elements of Chemical Reaction Engineering. Many editions of the CD version of the Encyclopedia has been distributed by the CACHE Corporation through their website, cache.org, to faculty interested in implementing it into their courses. Companies have bought it And used it as part of their technician training, and individual students have requested copies of the CD as well.

Scope and Coverage

The encyclopedia includes following nine categories of equipments with different subcategories:

1. By Types:

Heat Transfer

Boilers
Chimneys
Condensers
Cooling Towers
Cryogenics
Flares
Furnaces & Kilns
Heat Exchangers
Refrigeration

Materials Handling

Batching
Hoppers
Mixers
Presses
Scales
Size Enlargement
Size Reduction
Tablet Coating

Process Parameters

Analyzers
Chromatography Columns
Colorimeters
Conductivity Meters
Detectors & Monitors
Flowmeters
Humidity Measurement
Level Measurement
pH Measurement
Pressure Measurement
Refractometers
Sight Flow Indicators
Spectrometers
Temperature Measurement
Turbidimeters
Viscometers

Polymer Processing

Blow Molding
Blown Film
Calendering
Extruders
Fiber Spinning
Injection Molding
Powder Coating
Rotational Molding
Thermoforming

Reactors

Batch
Continuous Stirred Tank Reactors
Fluidized Bed Reactors
Fixed Film
Moving Bed
Packed Bed Reactors
Plug Flow Reactors
Semi-Batch
Slurry
Tricklebed
Bioreactors
Chemical Vapor Deposition Reactors
Fuel Cells
Nuclear Reactors
Oxidizers
Catalysts

Separations: Chemical

Absorbers
Adsorbers
Biofilters
Crystallizers
Dehumidifiers
Distillation Columns
Dryers
Evaporators
Extractors
Humidifiers
Ion Exchange Columns
Membranes
Strippers

Separations: Mechanical

Centrifuges
Cyclones / HydroCyclones
Electrostatic Precipitators
Filters
Gravity Separators
Mist Eliminators
Screeners
Steam Traps
Thickeners / Clarifiers

Transport and Storage

Actuators
Aerators
Chlorinators
Compressors
Conveyors
Deluge Systems
Drums
Fans
Nozzles
Ozonators
Pipes
Pumps
Rupture Discs
Seals
Tanks
Turbines
Vacuum Pumps
Valves

2. By Application:

Safety

Pressure Relief
Temperature Control

Pharmaceuticals

Capsules
Creams
Injectables
Sprays
Syrups
Tablets

More than 100 kinds of equipment are covered.

Kind of Information

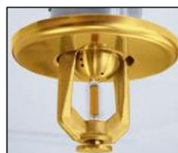
For each type of equipment the Encyclopedia provides students with information in the following areas: General Information, Equipment Design, Usage Examples, Advantages /Disadvantages, and References.

❖ Example 1. : General Information on Water deluge systems

GENERAL INFORMATION

Water is the most naturally abundant and widely used extinguishing substance. It extinguishes fire by cooling.

There are three main types of water deluge systems, components of which are shown below. From left to right, they are: fine water spray systems, sprinkler systems, and water spray systems.



(Copyright Minimax GmbH & Co. KG, Bad Oldesloe, Germany)

The general information portion of the Water Deluge Systems section, shown in above figure, gives a general overview of the types of systems that exist.

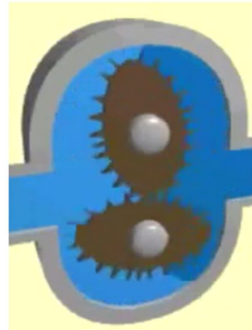
❖ The Equipment Design portion of each section includes key information about how the equipment works.

Example 2. :Equipment Design of the Oval Gear and Impeller Flowmeter

OVAL GEAR & IMPELLER

GENERAL INFORMATION/EQUIPMENT DESIGN

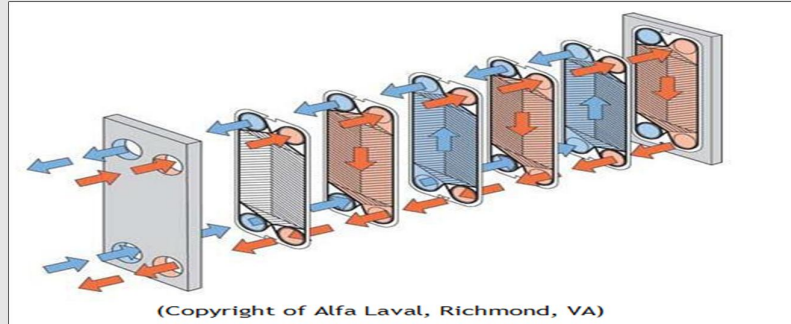
Oval gear meters and impeller meters, shown below, operate in the same manner, but differ in the shape of the gears. Fluid flowing through the measuring chamber causes the gears to turn, displacing an exact volume of fluid. A magnetic or mechanical device counts the number of turns, determining the volumetric flowrate.



The Equipment Design portion of the Oval Gear and Impeller Flowmeter section, for example, shown in above Figure, includes an animation developed in-house to show how oval gears measure flowrates.

❖ The Equipment Design portion can also include graphics and photographs of actual chemical engineering equipment, as show in following two figures, from the Equipment Design portion of the Plate and Frame Heat Exchangers section.

Example 3. :Diagrams and photographs in the Equipment Design Portion of the Plate and Frame Heat Exchangers section.



The pictures shown below are examples of double wall heat exchangers.

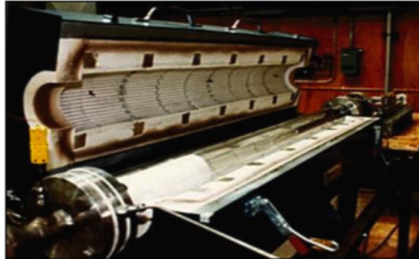


❖ The Usage Examples portion shows the equipment in actual use, such as the Plug Flow Reactor Usage Example portion shown in next figure.

Example 4. :Usage Examples portion of Plug Flow Reactors section.

USAGE EXAMPLES

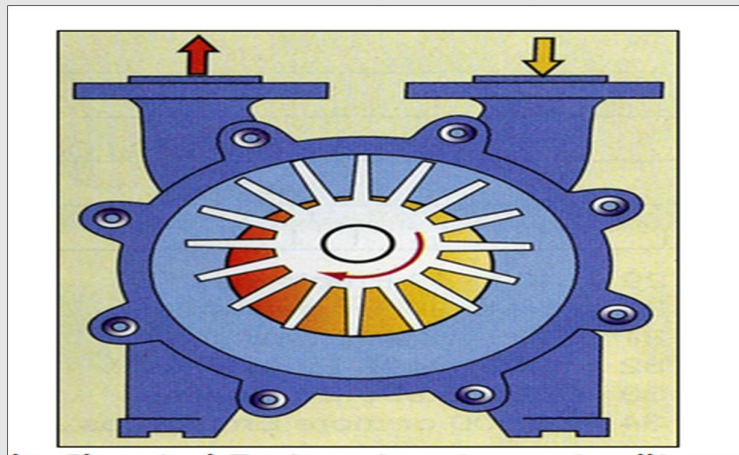
Plug flow reactors have a wide variety of applications in either gas or liquid phase systems. Common industrial uses of tubular reactors are in gasoline production, oil cracking, synthesis of ammonia from its elements, and the oxidation of sulfur dioxide to sulfur trioxide. Pictured below is a tubular reactor used in research on the oxidation of nitrogen compounds. It reaches temperatures of 800 - 1100° C.



(Copyright Robert Hesketh, Rowan University, Glassboro, NJ)

❖ The Advantages/Disadvantages portion gives pros and cons of that type of equipment compared to others. In the next figure, for example, the advantages and disadvantages of roots vacuum pumps are shown, which could be compared to those of other types of vacuum pumps.

Example 5. :Advantages/Disadvantages portion of Roots Vacuum Pumps section



ADVANTAGES

- Able to achieve high vacuum levels and handle large flow rates
- Relatively low noise level
- Available in small sizes suitable for laboratory applications
- High compression ratios per stage
- Reliable

DISADVANTAGES

- Sensitive to contamination
- High service requirement
- Intolerance for liquid slugs
- Need to select a compatible lubricant
- Low tolerance for fouling
- Limited materials of construction

In this encyclopedia, for each piece students can see photographs, drawings, animations, and videos that demonstrate what the equipment looks like and how it works. Advantages and disadvantages of various types of equipment are also included, as well as visuals of installed equipment. At the last of the entry, there is a list of references and name of the developers of the equipments.

Special Features

At the heart of the Encyclopedia are photographs of actual equipment, schematics, and animations showing how the equipment works, and pictures and descriptions of applications of the equipment in a wide variety of areas. The encyclopedia is an excellent resource for faculty who are not familiar with equipment to acquaint themselves with the operation of chemical engineering equipment in preparing for teaching a course. In addition, the schematics, photographs and videos can be incorporated into lecture slides to make their lectures come to life. For example, when the author taught the Mass and Heat Transfer course she found the Encyclopedia an invaluable source of graphics and animations.

Arrangement Pattern

The names of the equipments are arranged alphabetically.

Example.1:

Arrangement of main categories

Heat Transfer
Materials Handling
Polymer Processing
Process Parameters
Reactors
Separations: Chemical
Separations: Mechanical
Transport and Storage

Example. 2:

Arrangement of subcategories under “Transport and Storage”

Actuators
Aerators
Chlorinators
Compressors
Conveyors
Deluge Systems
Drums
Fans
Nozzles
Ozonators
Pipes
Pumps
Rupture Discs
Seals
Tanks
Turbines
Vacuum Pumps
Valves

Comparable Tools

- Enggcyclopedia
(<http://www.enggcyclopedia.com/>)
- Enggpedia
(<http://www.enggpedia.com/>)
- Wiley Encyclopedia of Electrical and Electronics Engineering
(<http://onlinelibrary.wiley.com/book/10.1002/047134608X>)
- New World Encyclopedia : Engineering
(<http://www.newworldencyclopedia.org/entry/Engineering>)
- Engineering and Technology History Wiki
(<http://ethw.org/>)
- DiracDelta.co.uk
science and engineering encyclopedia
(<http://www.diracdelta.co.uk/>)
- Online Britannica
(<https://www.britannica.com/technology/engineering>)

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