

## Control Valve Sourcebook — Chemical Unit Operations

## Centrifuge

Торіс		Pa	ge
I	How It Operates		2
II	Where are Centrifuges Used		2
	Centrifuge Application Review		3



# Centrifuge

### **Other Names**

concentrator, decanter, separator

### I. How It Operates

A centrifuge is a piece of equipment driven by an electric motor that utilizes centrifugal force to separate substances by density. The separation process begins with a mixture containing a light and heavy phase entering the centrifuge bowl. The mixture may contain gas, liquid, solid, or any combination of those phases. Under the action of centrifugal force, particles with the greatest density separate out along the radial direction. Therefore, heavier particles collect along the outside of the centrifuge. Lighter particles move toward the center.

Centrifuges are utilized in industry to provide a faster and more effective separation method versus traditional settling tanks. Settling tank designs become very large when attempting to guickly clarify mixtures with similar densities. Utilizing centrifugal force over gravity alone, centrifuges can separate varying mixtures with great accuracy to achieve high quality and throughput.

Centrifuges can be operated vertically or horizontally. Vertical bowls are commonly referred to as separators. Horizontal bowls are commonly referred to as decanters. Separators are designed specifically for liquid mixtures with low solid content. They can effectively separate liquid mixtures at the same time as removing solids. Decanters are utilized when high proportions of solids are present in the feed.

### II. Where are Centrifuges Used?

- Chemical
- Biofuels separation of thin stillage from solids
- Catalyst recovery
- Oilseed removal of gums and soaps from oil
- Phosphoric acid separation of acid and gypsum

#### Food and Beverage

- Beer - wort separation or pre-clarification



Figure 1. Milk Processing Plant with Centrifuges



Figure 2. Phosphoric Acid Process Flow Diagram

- Dairy cream separation and milk separation
- Fruit juice pulp separation
- Wine clarifying and stabilizing tartrate
- Life Sciences
  - Pharmaceutical enzyme concentration after fermentation
- Oil and Gas
  - Crude oil dehydration purifying crude oil
  - Slop oil treatment recovery of oil from waste streams

### III. Centrifuge Application Review

### Backpressure Control Valve

Since centrifuges are used in many processes, control valve selection is dependent on the process fluid being separated. However, maintaining a consistent back pressure on the liquid discharge line is essential to successful operation regardless of the type of centrifuge or fluid. By maintaining a consistent pressure, the heavy/light phase interface is held constant inside the centrifuge bowl. Figure 2 shows the phosphoric acid process utilizing both a separator and decanter type centrifuge and associated backpressure control valve. Any disruption to the upstream or downstream process can affect the interface position. When a disruption occurs, a portion of the heavy phase may be discharged with the light, and vice versa depending upon the disruption. An underperforming control valve can contribute to these issues. This inconsistency may result in the heavy phase plugging or damaging equipment. Additionally, the loss of light phase separation may cause time consuming reprocessing resulting in poor operational efficiency.

#### Typical process conditions:

- P1/P2 = dependent on process design
- T= dependent on process design
- Q = dependent on process design
- Corrosion and/or erosion concerns depending upon process fluid

#### Typical valve selection:

- Low flow rates, clean fluids: NPS 1 to NPS 4 Fisher<sup>®</sup> EZ, ED, ET or GX valve
- High flow rates: NPS 1 to NPS 8 Fisher Vee-Ball™ valve
- Viscous or dirty fluid: NPS 1 to NPS 8 Fisher V500 valve
- Materials of construction: dependent upon process design, may require stellite or ceramic trim materials

f http://www.Facebook.com/FisherValves
http://www.Twitter.com/FisherValves

#### **Emerson Process Management**

Marshalltown, Iowa 50158 USA Sorocaba, 18087 Brazil Chatham, Kent ME4 4QZ UK Dubai, United Arab Emirates Singapore 128461 Singapore www.Fisher.com



http://www.LinkedIn.com/groups/Fisher-3941826

To find the Emerson sales contact in your area, scan or click the QR code.



© 2014 Fisher Controls International LLC. All rights reserved.

Fisher and Vee-Ball are marks owned by one of the companies in the Emerson Process Management business unit of Emerson Electric Co. Emerson Process Management, Emerson, and the Emerson logo are trademarks and service marks of Emerson Electric Co. All other marks are the property of their respective owners.

The contents of this publication are presented for informational purposes only, and while every effort has been made to ensure their accuracy, nothing herein is to be construed as a warranty or guarantee, express or implied, regarding the products or services described herein or their use, performance, merchantability or fitness for a particular purpose. Individual results may vary. All sales are governed by our terms and conditions, which are available upon request. We reserve the right to modify or improve the designs or specifications of our products at any time without notice. Responsibility for proper selection, use and maintenance of any product or service remains solely with the purchaser and end user.



