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Selecting the Right Slurry Valve for the Job

A quick look at valve diversity in some industries that have really “gnarly” processes

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From the abrasive bitumen found in the Canadian oil sands, to the acidic and flammable solutions common in chemical plants, to the scaling-prone mixtures sitting in agricultural processing facilities, valves are used to start, stop and control a wider range of slurry compositions than ever before.

Slurry valves have a critical role in optimizing the operating time of the processes in which they are employed. Select the right slurry valve for the application, and plants are able to experience extended uptimes that allow for increased production, contributing positively to the company’s bottom line.

On the flip side, selecting the wrong slurry valve for the application can mean reduced production and increased maintenance in the form of operational and replacement costs. Not all slurry valves are created equal, and valve selection can make or break production goals for companies that use slurries in their processes.

So how do you know what characteristics to look for in a valve?

Let’s take a quick look at some unique valve applications from the last 20 years. And, by the way, the last 20 years constitute 20 years of valve innovation.



Diammonium phosphate production includes processes that are scaling-prone in the extreme. Valves are used for pump isolation in phosphate slurry service.

Mining and Hydrocarbon Engineering

Many applications in the wide-ranging fields of mining and hydrocarbon engineering require unique and well-differentiated valves — ones that can withstand intense abrasion and extreme pressures.

Take, for example, the various valves used in bitumen extraction in the Canadian oil sands. Hydro-transport slurries carrying bitumen ore from the mining pits to extraction plants include large, jagged stones as well as coarse sand and clay. The bitumen itself has a density similar to cold molasses, so it requires heat and extremely high pressures to transport it long distances to the extraction plants that in some cases are miles from where the ore is removed from the ground.

In these scenarios, the most common valves used are heavy-duty knife gate valves, fitted with sharp blades to cut through sticky bitumen. They often include specially-designed scrapers engineered to automatically remove bitumen from gates as part of opening and closing. The valve gates are constructed of hardened materials such as 17-4PH stainless steel and also frequently feature abrasion-resistant coatings like tungsten carbide to extend their uptime.

For example, At ITT Engineered Valves, the Fabri-Valve HD line of heavy-duty knife-gate valves can withstand abrasive, high-pressure oil sands slurries. The HD valve features a carbon steel body with ANSI B16.34 wall thickness and ANSI B16.5/B16.47 full face flanges. The body has a double-replaceable seat configuration that provides bi-directional shutoff.

Other specifications of interest include dual replaceable seats, easily field-replaceable and interchangeable from one side to the other. Seats are hard-faced with chrome carbide on the port inner diameter and seat face. The HD valve's stuffing box is machined for tight tolerances, improving packing sealing performance and positive gate alignment. Six rows of resilient cored packing with internal live-loading in combination with two gate scrapers provide superior sealing and increased packing life.

Another mining application where specialized valves are required occurs in concentrator plants. In circumstances where precious metals like copper, lead, zinc and molybdenum are mined in the form of raw ore and then concentrated, actuating the flow often becomes important — especially in the later stages of refining.

For this, push-through valves fitted with special abrasion and impact-resistant sleeves are often used. These synthetic sleeves need to be comprised of elastomers — most commonly, natural rubber. Alternate sleeve materials for use in specialized applications in the concentrator plants, such as froth flotation, are constructed of materials that won't break down during prolonged exposure to the

hydrocarbon enriched slurries running through them. Highly concentrated slurries also require non-discharging valves so precious product is not discharged to the ground or localized drains.

ITT Engineered Valves' Fabri-Valve 33 PTA and 33 PTD slurry valves have a push-through design where opposing elastomeric sleeves are compressed against each, using axial forces from attached pipe flanges. In the open position the sleeves seal against each other, providing the pressure barrier. During the closing stroke the gate of the valve is pushed downward and separates the sleeves as it transitions from the open to closed position.

Agricultural Fertilizer Processing

Due to the unique nature of its slurries, agricultural fertilizer production needs valves that can withstand everything from scale build-up to hot-acid flushing.

Take for example, the phosphate production common in the southeastern United States, where diammonium phosphate, an essential ingredient for plant growth, is produced from the phosphate found in marine fossils. The processes involved in the production of diammonium phosphate include some of the most scaling-prone slurries in modern processing.

As the scale is continuously deposited on the pipe walls and valves, the flow path of the valuable slurry is constricted. Every few weeks, the pipes and valves are back-flushed with hot acid to reclaim as much of the full diameter of pipe cross-surface as possible and restore optimal flow levels. Valves used in these applications often have to be inspected after only a few weeks of operation and, if necessary, be cleaned or repaired. Bonded slide gate valves are often used to break through heavy scaling and maintain positive shutoff and are constructed of materials that can stand up to the hot acid.

The Fabri-Valve F133 is a bi-directional soft-seated, slide-gate valve for on/off service in heavy and scaling slurries. The seats are able to self-gasket and are compatible with raised or flat-faced, lined or unlined flanges. A containment bonnet attached to the bottom flange captures any discharge during cycling.

Another unique agricultural processing application when it comes to valves is potash, a form of water soluble potassium found in many agricultural fertilizers.

While the potassium slurries are primarily water, they often contain very high chloride levels. To increase the saturation of salts and potassium in the water, it's often transported at very high pressures, with temperatures exceeding 400 degrees Fahrenheit. In these applications, valve seals have to stand up to heat and pressure demands, so they are often made of Viton® or Aflas®.

Construction materials such as Hastelloy® or Inconel® are of ultimate importance to resist chloride stress corrosion cracking.

Chemical Engineering

The world of chemical engineering, with applications ranging from food and pharmaceutical processing to the treatment and transport of hazardous materials, implies a broad range of unique valve requirements.

For example, one unique slurry-transport application involves a superfine powder called titanium dioxide, which is bright white and often used in paint and other home products such as vinyl siding. It is incredibly abrasive, due to its jagged particulate state, which is crystalline and cubic, tetragonal or orthorhombic in shape. Imagine solid crystals that are very hard, flowing suspended in high-density slurry. These slurries are essentially liquid sand paper.

Components of titanium dioxide transport systems made of ordinary metals often require frequent replacement. Non-customized valves might be changed weekly or multiple times per week when a plant is operating at full production. That's why replaceable hard-faced seats and Inconel gates are often recommended for isolation when it comes to these slurries. This can extend uptimes and triple or quadruple the amount of time between replacements.

The Fabri-Valve F134 bonneted knife-gate valve is used for use in difficult services to provide high-cycle stem sealing and superior stem seal containment. The cylindrical packing around the stem provides a tighter, easier-to-maintain stem seal. Bonneted valves are available with an optional metal backseat on the stem. In addition, the valve can be supplied with a gate wiper and purge ports in the bonnet to minimize movement of material into the bonnet.



Valve is used for isolation of hydroclones that classify or separate particles present in nickel slurry

In pulp and paper processing, recycling is one of the most difficult valve applications. It is the first step in the production of secondary fiber for papermaking. Producing clean fiber means the proper removal of contaminants like staples, wire and other trash. Valves that perform for years in other applications may last only a few weeks due to the erosion created in the cleaning process.

To meet these uncompromising tasks, easily replaceable seats, hardened alloy gate materials and flush ports to withstand the rigors in the recycling and reject portions of paper processing are necessary.

To address the specific service problems found in recycle and rejects service, the Fabri-Valve C42 is configured to minimize the effects of the following service problems: physical damage of the sealing surfaces (gate and seat) due to wire, staples and other debris, resulting in unacceptable sealing degradation; clogging due to accumulation of wire, staples or other debris that is compacted into the bottom of the valve, resulting in failure of the valve to close completely and excessive leakage; and poor packing performance due to damage of the gate surface, abrasion and high cyclic conditions.

Fabri-Valve C42 solves these problems with its tough material components. The seat is protected on both the ID and face by a heavy overlay of special impact-resistant alloy. The gate is precision ground from a very hard corrosion-resistant alloy. Together they provide an effective, durable shear to cut through wire, staples and other debris.

Power Plant Systems

The power industry, with its high heats and unique ash, as well as its limestone and gypsum slurries, requires valves that aren't often found elsewhere. Hot ash and fluids rich in chlorides pose unique problems for plant engineers.

As a result of the combustion implicit, coal-burning power plants require ash removal from the exhaust gasses before they are treated and released to the atmosphere. This ash includes both dense bottom ash and powdery fly ash. Several methods exist to capture and transport both types of ash waste, which is heavily abrasive by nature.

The valves used to control ash flow, whether conveyed in slurry form or by pneumatic conveyance often require hardened gate materials including ceramic overlays. Valves used in ash applications frequently need to have specific built-in features, such as chest liners designed to inhibit ash buildup in the chest area of the valve. Additionally, these valves often feature seal materials like Aflas, which can withstand temperatures up to 400 F. At ITT Engineered Valves, we often recommend Fabri-Valve C37 or C67 customized valves for these applications.

Finally, one last unique valve requirement in power plants occurs immediately after the flue gas desulfurization process. Exhaust generated by coal fuel-burning plants must be scrubbed before emission, and this means treatment with wet slurries of alkaline sorbent — usually limestone — which reacts with the sulphur in the exhaust gases and creates gypsum. This waste gypsum must be removed after scrubbing. It is transported via slurries for dewatering and disposal.

These limestone and gypsum slurries are often very corrosive and can result in rapid wear and tear for valves and other system components. Isolation valves must be coated in urethane and feature specialized gate materials to protect them from rapid breakdown.

Looking around at various growth industries like power, agricultural engineering and mining, it's clear that, as processes and systems improve, more specialized slurry valves are playing critical roles in these systems. ITT Engineered Valves has been developing specialty valves for difficult applications like these for over 60 years.

ITT Engineered Valves is focused on extending uptimes and aiding bottom line growth for our partners by delivering highly customized valves to meet the most rigorous and unique needs in the marketplace. We specialize in building better valves when the ones currently deployed simply aren't getting the job done. If you have a special valve need, ITT Engineered Valves would love to help you tackle it.

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