Knife gate and slurry valves

In the second part of this two-part article (first part was published in the November, 2013 issue), we discuss the typical use and applications of these valves along with its markets and manufacturers worldwide.

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Usage & Applications

Knife gate and slurry valves are rarely used where conventional valve designs such as gate, globe, ball, plug or butterfly valves would work well. In particular, these designs are seldom used in services involving clean liquids or gases as their limitations far outweigh the advantages. However, where solids (free flowing powders), mixtures of liquids and solids, or solids and gases are involved, these valves provide superior functional features and service life compared to conventional valve designs.

Knife gate and slurry valves are predominantly used for shut-off/isolation services as "On/Off" valves. They are seldom used to throttle flow or as control valves as the media they handle are not suitable for throttling. However, few exceptions and some special designs do exist for these limited throttling applications. Major industrial sectors where these valves are applied are shown in Fig-5.

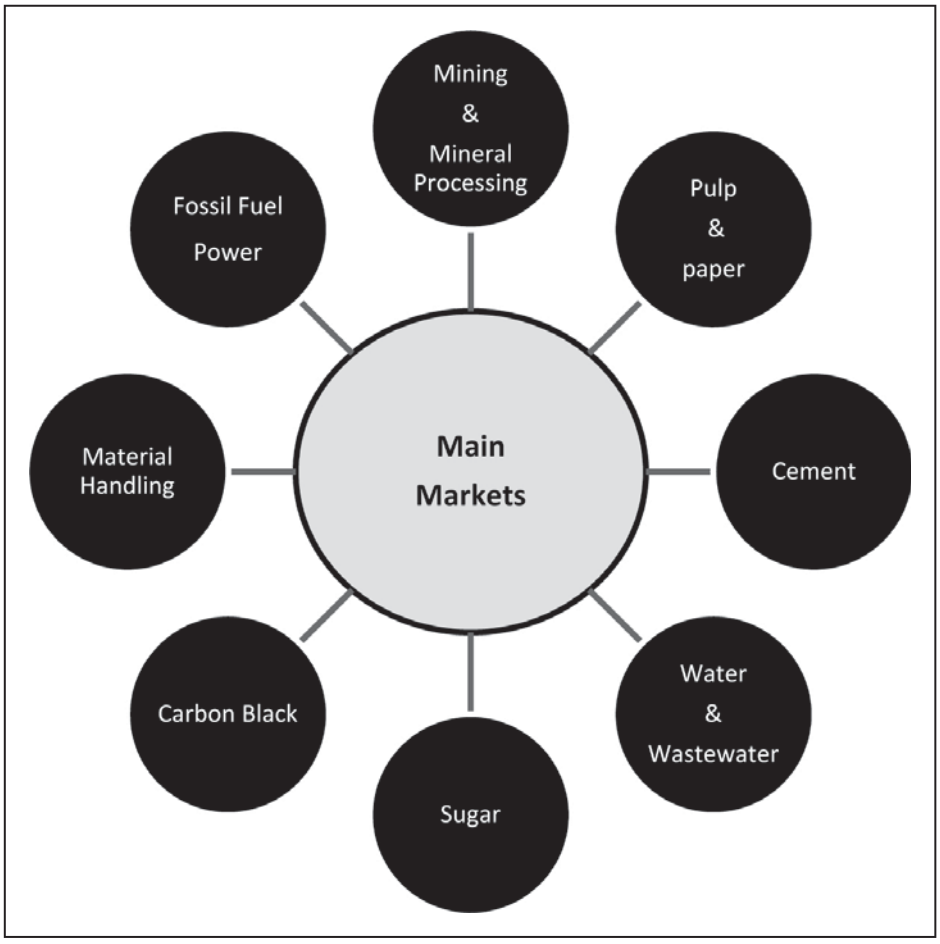

Fig 5 – Main markets for knife gate & slurry valves.

Media handled

Typical types of media where these valves are used:

Liquid + solid

These mixtures occur in a variety of industries and form the primary area of use for knife gate and slurry valves. The mixtures vary widely in composition and are usually referred to as sludge or slurry. Typically, sludge contains relatively soft solid components whereas slurry has harder and more abrasive solid components. The composition of the solid component may vary from very small percentages to as high as 70 percent. The solid component may be present in the form of very fine powder or as a mixture of fine powder and coarse lumps. Most of these media remain homogeneous only when kept agitated and mixed well; when kept still (as in stagnant pipes or vessels) they tend to settle and form separate solid and liquid layers. Many of them dewater and harden or cement if the liquid component drains off in the service. All these factors create challenges to the effective functioning of these valves.

Solid (Powders)

Primary use with powders are to extract materials from storage vessels like silos. This application is used across a wide variety of industries.

Solid (Powders) + Gas

Primarily these applications involve pneumatic conveying systems where powders are transported; these also occur across many industries.

Gas

Some of the knife gate valve designs can handle high temperatures as well as thermal cycling better than other valve designs. Exhaust gas heat regeneration and carbon black processing are typical sectors with such services.

Examples of typical media that knife gate and slurry valves handle are:

- Paper pulp
- Raw sewage
- Raw water
- Ore slurry
- Molasses
- Coal-air mixture

- Ash slurry
- Powders
- Process slurry
- Cement
- Fly ash
- Tar sands slurry
- Carbon Black
- Black & Green liquor
- Rock phosphate slurry
- Recycle paper

Usage of these valves may also be classified broadly as per the severity of the service as - **Light** (Pulp & Paper, Water & Wastewater, Sugar, Gravity-fed silo isolation), **Medium** (Mining & mineral processing, Fossil Power, Cement, Pneumatic conveying) or **Severe** (Mining & mineral processing, coal burner isolation, digester blow down, cementing slurry handling).
A list of prominent markets for knife gate and slurry valves worldwide is shown in Table-2.

Flow direction

Most industrial valve designs permit use with pressure/flow from either direction. However proper use of uni-directional knife gate valves needs careful consideration of orientation. For most liquid, sludge / slurry or gas applications, the recommended flow direction is with fluid pressure acting on the gate to push the gate towards the seat (pressure-assisted sealing). Using the valve in the opposite direction would cause excessive leakage and/or premature failure, particularly when used with abrasive media. However, in use as hopper isolation valves for powders under gravity flow, a reverse orientation (seat facing away from flow when valve is open) is preferred as it minimises the chance of powder accumulation in the seating area. There are also a number of application situations where bi-directional shut-off capability is essential. Traditionally the market was dominated by uni-directional designs, but nowadays bi-directional valves are being used more often, particularly in some sectors, e.g. mining. Now, you might think this suggests a bi-directional valve to be a better choice as it can be

Table – 2 Geographical distribution of important markets for knife gate & slurry valves

Region	Country	Mining & Mineral Processing	Water & Wastewater	Pulp & Paper	Fossil Fuel Power	Cement	Carbon Black	Sugar	Material Handling	OEM
Asia	India	×		×	×	×	×		×	
	Indonesia	×		×	×	×	×		×	
	Lao PDR	×								
	Thailand			×		×	×			
	Vietnam	×		×						
	Mangolia	×								
	China	×		×	×	×	×		×	×
Australasia	Australia	×	×	×	×			×	×	
	New Zealand		×	×						
	Papua & New Guinea	×								
Africa	South Africa	×		×		×		×	×	×
	Egypt					×	×		×	
	Zambia	×								
	DR Congo	×								
	Zimbabwe	×								
	Ghana	×								
Americas	USA	×	×	×	×	×	×	×	×	×
	Canada	×	×	×						
	Chile	×		×						
	Brazil	×		×	×	×			×	
Europe	UK		×	×	×	×			×	×
	Sweden		×	×						×
	Finland		×	×						×
	Germany		×							×
	Russia and CIS countries	×	×	×	×	×			×	

used in either situation, but that is not the case. Uni-directional knife gate valves, with the "knife" edge gate, offer superior functional reliability by cutting through debris and providing positive closure with most media, which the typical bi-directional designs cannot. Therefore a judicious choice between the two types is to be made by the user depending on the specific application requirements.

Service temperature

Another aspect to consider is that all bi-directional valves that offer seat tightness employ elastomer seating and have an inherent limitation on the maximum service temperature that they can withstand. The limit would depend on the elastomer used and usually the maximum is provided by viton or PTFE, which is around 200°C. Uni-directional knife gate valves, on the other hand, can have metal-to-metal seating and can –with appropriate gland packing material– be used at elevated temperatures, going up as high as 800°C.

Manufacturers

Currently, there are over a hundred manufacturers of these valves worldwide who can be segmented into the following major groups – typical manufacturers in each category are listed in Table-3 and Table-4 lists most of the worldwide brands.

Specialized

These manufacturers only have a few or even just the one design. They do, however, have significant reputations in the niche market segment they cater to. Their designs are usually unique or patented and may also involve specially developed manufacturing techniques. Specialized materials and/or processes often are utilized for the production of these valves. Depending on the manufacturer, the range of available sizes may be limited.

Industry-focused

These companies operate with a certain industrial segment or segments in mind and produce valves to service them. They may have a wide range but still may not have designs or capabilities for supplying to other sectors.

Table – 3 A selection of manufacturers in different groups

Specialized
Clarkson – *Abrasive slurry valves*
Delta, Murray Latta – *High pressure abrasive slurry valves*
Redler-Stock – *Coal burner Isolation valves*
Sistag-Wey – *Bi-directional valves for high pressure slurry*
Newcon – *Lined gate valves*
Stainless Steel Valve Co – *Digester capping valves*

Industry focused
Ebro, Erhard, AVK, VAG – *Water & Wastewater*
Lohse, Stafsjo, Velan – *Pulp & Paper*
Dual, Fabri, Flowrox, Insamcor – *Mining*

Wide Spectrum
Pentair, DeZURIK, Orbinox , VAAS

Secondary
Redler-Stock – *Primary business – material handling systems*
Okumura, Fouress, ABO – *Primary business -butterfly valves*
Jash – *Primary business – Sluice gates & penstocks*

Volume
Linuo, Guanli, Kosen, Lixin/Risson, Vango from China
Zubi, CMO from Spain, **Tecofi** from France

Contract
Manufacturers of distributor brands such as **ERIKS, Econosto**

Table – 4 Knife gate & slurry valve brands

ABO	eDART	Icon	OKM	Technegate
A-C Valve	Elite	Hyunwoo	Orbinox	Tecofi
Anval	Erhard	Insamcor	Proinval	Terofox
Asteknik	Everlasting	Isogate	Quingdao	TJ
Atval	Expert	IVC	RedValve	Townley
AVK	Fabri	Jash	Regent Hitech	Trueline
BDK	Favra	KDV	Rhinoflex	Turnflo
Bidapro	Floec	Keckley	RIENZI	UCC
Burbach	Flowrox	Kempster	Risson	UVC
Challenger	Flowsteer	Keros	Rovalve	VAA
Clarkson	Flowtek	Keystone	RX	VAAS
Coperion	FNW	KOLINK	SCI	VAG
Coreline	Fouress	Kosen	SK Valve	Valterra
CYL	GEFA	L&M	SKG	VANGO
Davis	Guanli	Linuo	SlurryFlo	Velan
Delta	Herbe	Lohse	Stafsjo	Vortex
DeZURIK	Hifly	LVC	Stock	VTM
DMN	Hilton	Microfinish	Sureflow	Vtork
DSMATERIAL	HMA Valveco	Murray Latta	Surya	Watergates
Dual	HP	NewCon	SVC	Wey
Ebro	HY-Performance	Niagara	TCV	Zubi

Wide Spectrum

These manufacturers offer a wide range of valves and can usually meet most market requirements from their own range. Many of them operate globally and have a wide base across the world with multiple plants located in different countries; they also have sales and support networks in many countries.

Secondary

These are manufacturers who primarily focus on other types of valves or equipment but also have a limited range of knife gate or slurry valves in their portfolio. While the brand is well regarded, the company itself may not be focusing much on this range and may mostly use these to offer a wider product range.

Volume

Manufacturers who produce one or few generic designs in volumes in a medium range of sizes and offer the most economical choices fall in this category. Usually the brands are not widely known and may have little to differentiate from others in the segment.

Contract

Many large trading houses typically have valves produced on contract. Manufacturers for such companies often produce large volumes of good quality unbranded designs (mostly generic) at economical prices.

Future

As market requirements evolve, the demand for more sophisticated designs grows. One area in which new designs are being added is high pressure bi-directional valves, as pumping pressures in many industries keep increasing. Better gland sealing technologies are another area of focus for companies as concerns of industrial emissions increase worldwide.

About the author

S. Vijayakrishnan retired as President from VAAS Industries, one of the world's leading manufacturers of knife gate valves and slurry valves from India. In a career spanning over 20 years with the company, he was, at different stages, responsible for marketing, sales, product development, application engineering and operations management. He holds a Ph.D in Chemical Engineering from IIT, Madras and lives in Chennai, India. He now works as an independent consultant on marketing, industrial valves and…android smartphones.

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