

Rubber Lined Ball sector valves - A sustainable solution to the challenge of handling abrasive fluids in mining applications



Abstract

This paper describes experiences made in typical mining applications where abrasive media are common and considered as a challenge to manage. This paper highlights the issue by introducing the reader to three different applications, listed below. Each described application is followed by an evaluation of the installed Rubber Lined Ball Sector valve performance in abrasive media applications. The experiences and conclusions drawn from this paper can be used in other industries where abrasive media is controlled, e.g. the Pulp- and Paper-, chemical- and power and heat generation industry.

1. Iron ore dressing plant 2. Zinc ore dressing plant 3. Dressing plant for complex ores (Copper, Lead and Zinc)

Background

Controlling abrasive fluids is known to be a challenge for any industrial application. All valve technologies have pros' and cons', and they need to be evaluated in the light of the media to be controlled. The main ratios to be taken into account are purchase cost, installation cost and most importantly when it comes to abrasive media; the cost for maintenance.

The KSG valve is a rubber lined valve that offers extended resistance to wear and tear in the valve for slurries, gravel, powder, iron ore and other highly abrasive media. The natural rubber design, applied on the ball sector and in the valve house gives a valve with very long life time in any situation with maintained throttling and isolating characteristics. The KSG was developed in the beginning of the 1970's together with mining companies in Sweden. When a high end control or a long life isolating valve is needed for tough media the Ramén KSG valve can be used in wafer and flanged design.

Challenge

Prior to the development and use of rubber lined valves, the standard solution found in mining operations handling abrasive media were stainless steel or iron cast valves. This proved to be an inefficient solution, both technically as well as financially. To provide an example Ramén, at several occasions in mining operations, installed a standard stainless steel ball sector valve type KS size 150 mm, with hard chromium faced ball sector and stellite inlet cover ring and seat ring. When inspecting the valves approximately 40 days after the installation, water leaked through the body. The water was leaking through a hole just in the middle of the body and additionally, the inlet cover ring, ball sector and seat ring were badly worn.

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1. Iron ore dressing plant



Application 1

Throttling of deposit from thickener.

- Flow 120-240 m³/h with 10–30% solids
- Grain size about 1 mm
- Inlet pressure - 0.8 bar
- Pressure drop 0.8 bar

Measures and results

Soft natural rubber are in certain cases much more resistant than steel, a soft rubber lined size 150 mm was installed in exactly the same service.

The valve was then taken out for inspection after 6 months (after 4 months continuous service), and absolutely no damages from wearing were observed. Several other valve technologies had been tested e.g. rubber pinch valve, lined butterfly valves etc. in the same service and none had lasted more than about 2 months.

Application 2

Throttling control of water to magnetic separator where iron is separated from granite.

- Flow 90 m³/h with 12–15 g solids/liter
- Inlet pressure - 2 bar
- Pressure drop 2 bar

Measures and results

Two (2) years after installation the KSG rubber lined valve was taken out of service. The rubber was beginning to come loose from the sector but the valve was in very good condition even after 2 years. Experiences made have established the KSG valve design as the preferred valve technology in severe services and replaced other valve technologies e.g pinch valves.

2. Zinc ore dressing plant

Application

Hand operated valve for throttling the outlet from rubber lined centrifugal pump.

- Flow with 35% solids
- Grain size about 0.5 mm
- Inlet pressure - 1 bar
- Pressure drop 1 bar

Measures and results

A rubber lined valve size 100 mm was installed. After 4 weeks the steel tube in outlet from the valve was worn out and replaced with a rubber lined one. After 12 weeks the valve was inspected. Condition of the valve was very near that of a new unused valve.



KSG-80

3. Dressing plant for complex ores (Copper, Lead and Zinc)

Application

Throttling control of deposit from so called sulphur-thickener.

- Flow with 40% solids
- Grain size 90% smaller than 0.177 mm
- 50% smaller than 0.044 mm
- Inlet pressure - 0.5 bar
- Pressure drop 0.5 bar

Measures and results

Rubber lined valve size 100 mm was installed. After 18 weeks it was inspected. The valve was worn on the flange surface in the outlet, obviously because of wrong flange size, which were 80 instead of 100 mm. The important thing was, however, that the throttling orifice, built by outlet ring and ball sector hole was completely unaffected. Flange and tube size in outlet was changed into 100 mm.

KSG valves are also used on sand slurry with electric actuator mounted for position adjusting type-throttling control. The KS type with hard chromed ball sector and stellite seat in sizes DN 25 – DN 100 are used for control of lime water or grinding water to flotation cells.

Conclusions

Since the development of the Ball Sector Valves in 1968 and the KSG in 1973 Ramén Ball Sector Valves have been used successfully in thousands of installations in mining and other industries for controlling abrasive media with outstanding ratios for purchase cost, installation cost and mostly important the cost for maintenance and replacements.



KSG-80 with a pneumatic actuator and a positioner for control

Facts Principle of the Ball Sector Valve

The ball sector valve consists of a hemispherical shell – the ball sector – that is held securely in the valve body using two large bearing stems. Part of the hemispherical shell is used for isolating, while the other has a hole with a diameter corresponding to about 80% of the nominal size of the valve. The ball sector is turned through about 90° from fully open to closed.

The shape of the opening cross section changes from completely round to elliptical in this case. This practically round shape for the flow opening reduces the risk of blockage when small control settings are made. The valve characteristic maintains almost the same percentage value with constant differential pressure. The modified equal percentage operating characteristic (in operation, the differential pressure increases as the valve closes) combined with the out-standing rangeability of 300:1 mean that the valve can be used for most control tasks. The special connection of the valve body ensured that the differential pressure on the valve has little effect on the actuating torque. Ball sector valves are used as isolating and control valves for fluids, gases, turbid media and sludge, especially in the pulp and paper and chemical industry. Abrasive slurries of iron ore, coal, lime and fly ash are also controlled with this type of valve. -*Chemie Technik, 2004:1*

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