Thinking Ahead

Optimized mixproof valve cleaning process cuts CIP liquid costs by 90%

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Unique CIP liquid savings

Industries with hygienic fluid handling processes are looking to reduce resource consumption and make production more sustainable. Dairy, food, beverage, brewery, personal care and home care processes rely on Cleaning-in-Place (CIP) systems to ensure hygiene and safety. These systems circulate heated cleaning liquid throughout the process lines without requiring disassembly of any equipment – and they use vast quantities of water and cleaning agents every day.

Towards more sustainable production processes

The 17 Sustainable Development Goals of the United Nations call for sustainable cities and communities (SDG 11) and responsible production and consumption (SDG 12). Water conservation is important to these goals, and why reducing water consumption has become a major concern for manufacturers. Cost savings is a key driver, but by no means the only reason to conserve water.

Environmental impact is also a big concern and integral to sustainable business strategies for companies, large and small. However, many regions around the world – from California to the Middle East and from South Africa to India – are experiencing water shortages. Such water scarcity creates bottlenecks that impact production capacity.

Limited access to water will become even more of a challenge in the future. Over the next 30 years, the global population is set to grow by 30%, from 7.7 billion in 2019 to 9.8 billion in 2050. That's another two billion people on our planet who will need to eat, drink, and take care of their personal hygiene and their homes.

This puts enormous pressure on manufacturers to use resources wisely and to reduce water consumption during production. Cleaning process equipment, such as mixproof valves, can contribute significantly to reduced water use. Alfa Laval can help manufacturers realize substantial water savings – without compromising product hygiene or safety – by using Alfa Laval Unique Mixproof CP-3 valves with innovative ThinkTop control tops.

Figure 1. Alfa Laval Unique Mixproof CP-3 valve with the ThinkTop V70.

Reduce water consumption when cleaning mixproof valves

Using Alfa Laval Unique Mixproof CP-3 valves (Figure 1) enable you to select one of three methods to clean valve plugs, seals, seats and leakage chamber:

1. External cleaning, where an external Cleaning-in-Place (CIP) line is connected directly to the leakage chamber to rinse it.

2. Seat lift cleaning, where the independent movement of the upper plug enables simultaneous cleaning of the leakage chamber, the upper axial plug seal and the seat (Figure 2).

3. Seat push cleaning, where the independent movement of the lower plug enables simultaneous cleaning of the leakage chamber, the lower radial plug seal and the seat (Figure 3).

When it comes to hygiene and product safety, CIP liquid savings should by no means come at the expense of cleaning efficiency.

Alfa Laval recommends the seat lift cleaning method, which will clean the leakage chamber. More importantly, this method will address the challenges of keeping the axial seal in the mixproof valve clean. Depending on the type of product being processed and the way the plant is operated, the seat lift cleaning method can also be supported by the seat push cleaning method. Combining and optimizing these two cleaning methods can significantly reduce the amount of CIP liquids used, while at the same time achieving superior cleaning results.

The conventional way to clean most product residues in mixproof valves is to combine the seat lift and seat push cleaning methods. This typically requires the seat lift and seat push functions to take place between three and five times each. Each seat lift and seat push generally lasts about two to five seconds – and in some cases even longer.

Figure 2. Seat lift: The upper valve plug is raised off the seat thus cleaning plug seal, seat and leakage chamber through CIP flow.

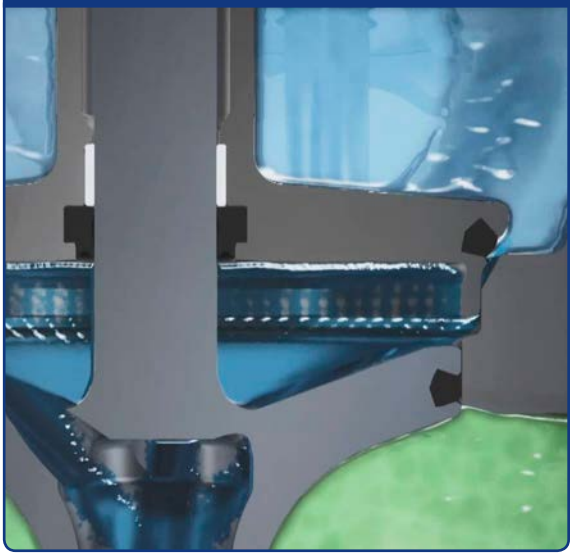
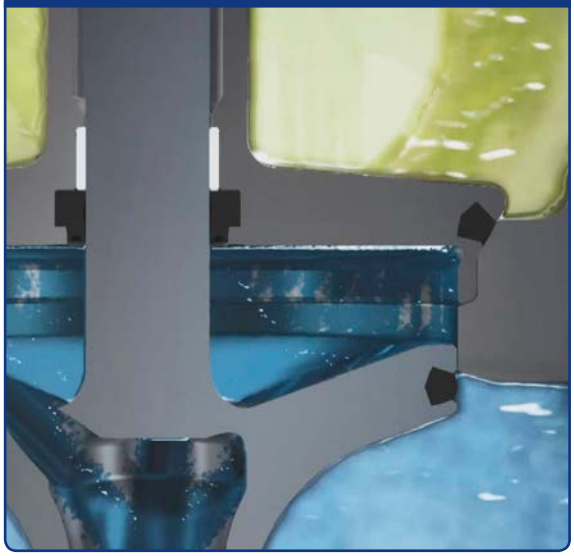


Figure 3. Seat push: The lower plug is pushed downwards thus cleaning the plug seal, seat and leakage chamber through CIP flow.



Burst seat cleaning delivers up to 90% savings in CIP liquid costs

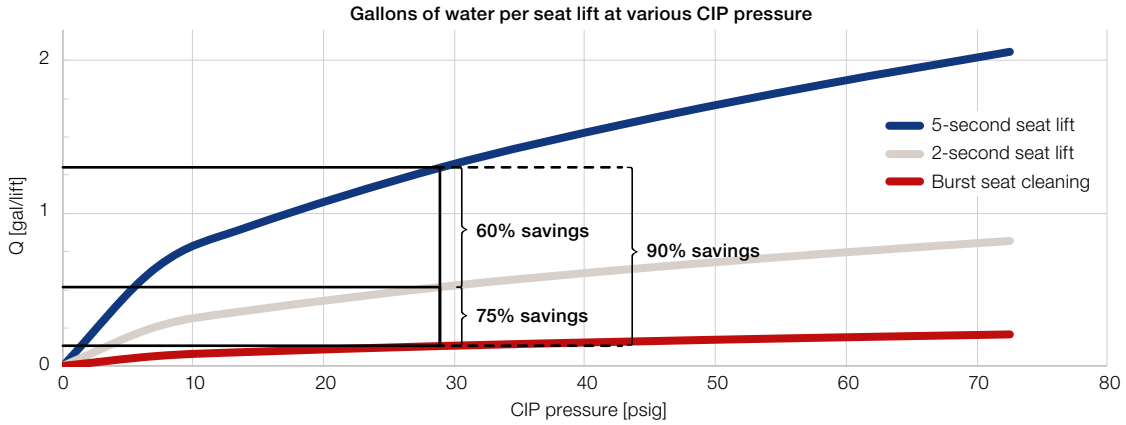
Imagine saving millions of gallons of water and reducing the annual cost of your cleaning agents. These savings are possible by using Alfa Laval Unique Mixproof CP-3 valves and the innovative burst seat cleaning function available on the Alfa Laval ThinkTop V70 valve control unit (Figure 5).

Burst seat cleaning provides exceptional cleaning of double-seat mixproof valves while reducing the amount of CIP liquids used during cleaning procedures. During burst seat cleaning, the seat quickly opens and closes, allowing a highly effective burst of CIP liquid to clean the surface during seat lift. The difference in pressure forces the CIP liquid through the narrow opening in the valve. This creates high shear forces that contribute to achieving the highest possible cleaning efficiency compared to simply allowing the CIP liquid to flow over the seat for a given period of time. During the initial movement of a seat lift or seat push, the shear stress of the CIP liquid on valve surface is at its highest. In the following fractions of a second, the flow becomes laminar, which significantly reduces shear and cleans the valve less efficiently.

The Alfa Laval ThinkTop V70 with the burst seat cleaning function is the world's first valve control unit that uses the plug position of the valve as a control function for seat lift and seat push. Using the valve's plug position to initiate cleaning maximizes the valve actuation speed thereby producing the most efficient seat lift or seat push, while simultaneously reducing CIP liquid waste. Better yet, enabling the burst seat cleaning function does not require PLC reprogramming; it also does not compromise the surveillance and feedback of the seat lift or push functions.

Over the past decade, most processing plants have optimized the time it takes to conduct a mixproof valve seat lift or seat push function, which generally lasts between two and five seconds. This reduces CIP liquid costs as well as the cost of wastewater treatment. With the burst seat cleaning function, the Alfa Laval ThinkTop V70 can increase these savings by another 75% compared to a timer-based seat lift or seat push that last two seconds and by 90% compared to a five-second seat lift or seat push (Figure 4).

Figure 4. Burst seat cleaning reduces CIP liquid costs by up to 90%.



A single burst, or one seat lift, takes less than a second but is sufficient to clean low fat content product from the valve.

Requirements for achieving optimal CIP liquid savings

Achieving the optimal CIP liquid savings could involve a reevaluation of the number of seat lift and seat push functions performed. However, the following conditions concerning the valve system are important:

- The valves must have very fast-acting actuators that require small air volumes to perform seat lift and seat push cleaning operations. In addition, solenoid valves must be mounted inside the control unit to ensure fast activation.
- The valves must have fixed and known flow coefficient (Cv) values for the seat lift and seat push functions. The Cv value is the number of gallons per minute (GPM) that pass through a fully open valve at a pressure drop of 1 psi across the entire valve. If the Cv value is unknown, the information can be obtained from the valve supplier.

Because the Alfa Laval Unique Mixproof CP-3 valve fulfills these requirements, realizing significant savings in water and cleaning agents is possible. In addition, the fixed Cv values and a defined metal-to-metal stop for the seat lift and seat push movement make it possible to validate the cleaning program for the entire installation by inspecting a single valve after a given number of seat lifts.

The assumption is that the CIP system is in satisfactory working condition and that there is continuous flow at sufficient pressure. The compressed air capacity must also be sufficient to ensure increased valve activation frequency.

Figure 5. Alfa Laval ThinkTop V70.

Environmental and financial impact

Achieving the sustainable management and efficient use of natural resources by 2030 is one of the targets of the UN Sustainable Development Goals.

Significant savings in water and cleaning agents have a positive impact on the environmental footprint of the plant as well as a positive impact on plant profitability. Using less water for the cleaning process translates into a big reduction in the cleaning agents used and in the amount of electricity required to achieve superior cleaning results. It also means that there is less effluent that requires wastewater treatment.

To verify the fast payback times and calculate the potential CIP liquid savings, Alfa Laval has developed a sophisticated tool called Alfa Laval Joules to analyze and quantify efficiency improvements.

To get started, contact Alfa Laval today.

Alfa Laval in brief

Alfa Laval is a leading global provider of specialized products and engineered solutions.

Our equipment, systems and services are dedicated to helping customers to optimize the performance of their processes. Time and time again.

We help our customers to heat, cool, separate and transport products such as oil, water, chemicals, beverages, foodstuffs, starch and pharmaceuticals. Our worldwide organization works closely with customers in almost 100 countries to help them stay ahead.

How to contact Alfa Laval

Up-to-date Alfa Laval contact details for all countries are always available on our website at www.alfalaval.com

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For more than 15 years, Morten has worked with all types of valves and automation for the food, beverage, dairy and pharmaceutical industries. He has vast experience with and in-depth knowledge about hygienic valves, where best to use them in various applications and in different industries, and how to optimize process performance and plant operations using the right valve technology. Over the past decade, Morten has taken part in more than 30 product development projects involving hygienic fluid handling equipment. Morten holds a Bachelor of Commerce degree in Marketing and Technical Design from the International Business Academy in Randers, Denmark. He is based in Kolding, Denmark.
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