

CRANE[®]

brands you trust.



Solutions For The Chlor-Alkali Industry

CRANE[®]

Crane ChemPharma & Energy

www.cranecpe.com

CRANE ChemPharma & Energy: your business partner that offers trusted brands and flow solutions on a local level, worldwide.

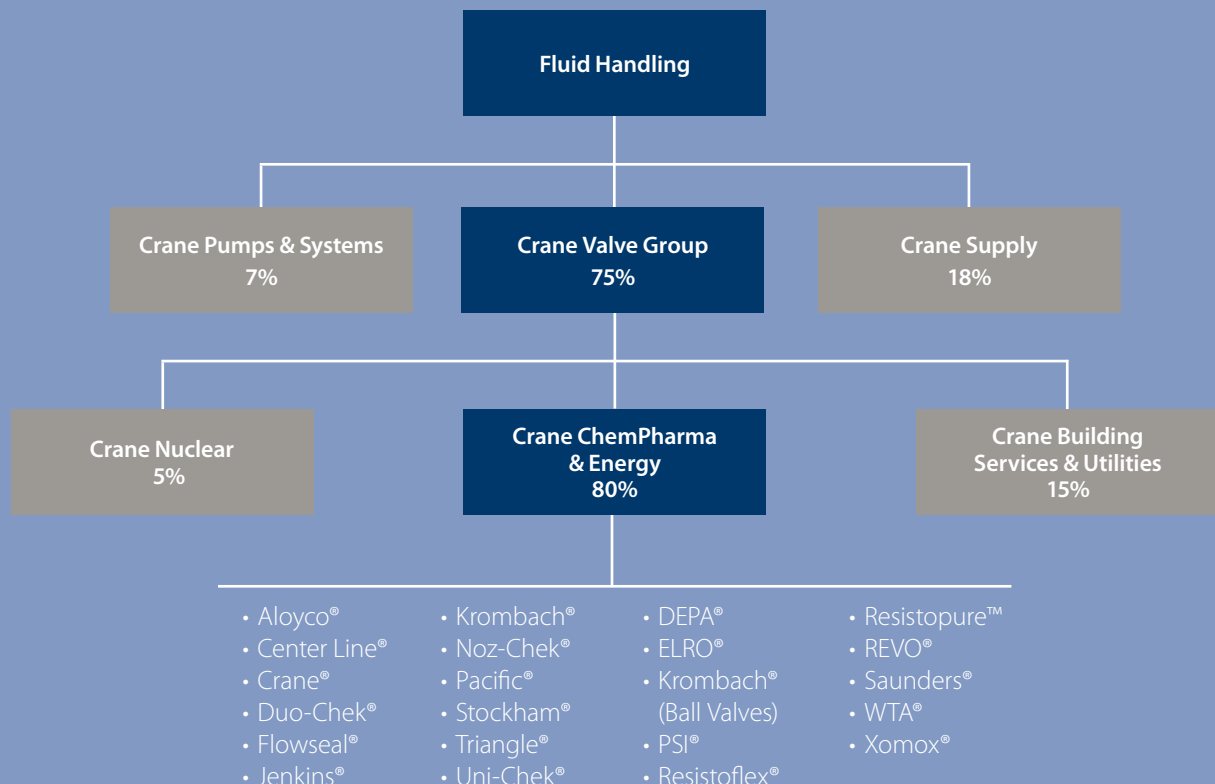
Together, we present our customers with a strong portfolio of proven products and complete fluid handling solutions within the chemical, biotechnology, pharmaceutical, mining, oil & gas, power and refining industries.

As one Crane ChemPharma & Energy Team, we offer innovative technology, financial stability, best practices, and we improve customer satisfaction by delivering a superior customer experience.



Crane ChemPharma & Energy is the global integration of trusted brands, including ALOYCO®, CENTER LINE®, COMPAG-NOZ®, CRANE®, DEPA®, DUO-CHEK®, ELRO®, FLOWSEAL®, JENKINS®, KROMBACH®, NOZ-CHEK®, PACIFIC VALVES®, RESISTOFLEX®, REVO®, SAUNDERS®, STOCKHAM®, TRIANGLE®, UNI-CHEK®, WTA®, and XOMOX®

Crane's Fluid Handling Business Segments



Solutions for the Chlor-Alkali Industry

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To Our Chlor-Alkali Customers:

Through extensive industry research, plant site interviews, and Voice of the Customer visits, our Crane ChemPharma & Energy team identified the problems you experience. We developed valve solutions that will meet your needs and perform reliably and consistently within your plants, with an extended life that will exceed your expectations.

To Our Channel Partners:

We have heard your requests for application-specific information and training. Our Crane ChemPharma & Energy team is equipped with knowledge about the Chlor-Alkali industry, manufacturing processes, and product solutions and we are ready to work with you to better serve end users.

Crane ChemPharma & Energy

Chlor-Alkali Industry Experience

The Crane ChemPharma & Energy Portfolio for the Chlor-Alkali Industry

With our portfolio of well-known brands, products, and services, Crane ChemPharma & Energy can meet the demanding needs of your Chlor-Alkali facility. The following pages will highlight common production issues, our wide-range of products and services that address those challenges, and the benefits each solution provides.

When you buy our products, you get much more than just valves and piping. Behind each Crane ChemPharma & Energy product is a highly energized team of professionals, including Engineering, Quality Assurance, Manufacturing, Customer Service, Sales, and Valve Services to name a few. This team will support you with completing the purchase, installation, best practices, and long-term maintenance.

Expect more from us!

Why buy from Crane ChemPharma & Energy?

Industry Focus: Crane ChemPharma & Energy is focused on key chemical industries. Our knowledge and understanding of the processes and challenges present in these industries enables us to develop solutions specific to their needs. Industry focus makes our superb customer focus possible.

Experience and History of Success: Our sales and support teams have knowledge and experience within operating plants as well as newly constructed facilities:

- Maintenance
- Grass roots projects
- Expansion projects
- Mercury Cell to Membrane Cell Conversions
- TDI/MDI

Crane ChemPharma & Energy valves and lined pipe can be found in Chlor-Alkali industries all over the world:

- North America
- South America
- Europe
- CIS
- India
- China
- Asia Pacific
- Middle East

Solutions: Crane ChemPharma & Energy offers valve and piping solutions for all areas of a Chlor-Alkali plant:

- Chlorine Processing
- Brine Preparation
- Hydrochloric Acid
- Caustic Soda
- Hydrogen Bleach Synthesis



Technical Member and Supplier of Euro Chlor Approved Process Valves

Xomox International GmbH & Co. OHG is a certified supplier and a member of Technical Correspondents of the Euro Chlor organization. WTA® valves are manufactured in compliance with Euro Chlor Specification and Chlorine Institute Pamphlet 6.

Chlor-Alkali Industry Overview

Industry Summary

Chlorine and caustic soda are produced by the electrolysis of an aqueous solution of sodium chloride (brine). They are both basic chemical industry building blocks. Applications include pharmaceuticals, chemical industry intermediates, and many end products such as polyvinyl chloride resins (PVC), soaps and detergents, and textiles. Primary concerns within a Chlor-Alkali plant include:

- Safety – prevention of injury related to leakage
- Environmental Protection – emissions reduction
- Lower Cost of Ownership – extended life and lower maintenance costs through corrosion resistant metals, packing, and linings



Valve and Piping Problems within Chlor-Alkali Production

The following pages describe problems faced by Chlor-Alkali plants. Crane ChemPharma & Energy valve and piping solutions, the products' specific features and benefits, and the process locations of these problems are also illustrated.

Next to each problem you will find a legend indicating the subprocess(es) in which the problem is commonly found:

Cl	Chlorine Processing
HCl	Hydrochloric Acid
B	Brine Preparation
C	Caustic Soda

Want to learn more?

For more information about the problems listed here and Crane ChemPharma & Energy's product solutions, contact your regional sales representative or visit our Website:

Crane ChemPharma & Energy Solutions: www.cranecpe.com/chempharma/solutions
 Product Technical Data: www.cranecpe.com/chempharma/products

Chlor-Alkali Process Overview

HCl HYDROCHLORIC ACID

Process: Compressed chlorine gas from Chlorine Processing is reacted with Hydrogen from the Electrolyser to form hydrochloric acid (HCl).

Typical Valves and Piping:

- Diaphragm Valves
- Lined Ball, Butterfly, Check, and Plug Valves
- PTFE-lined Stainless Steel Pipe
- Lined Pipe Accessories
- Bellows Sealed Globe Valves

Common Problems We Solve:

- Downstream Leakage
- External Emissions
- Internal Corrosion
- High Maintenance Costs
- Storage Transfer Hose Leakage

B BRINE PREPARATION

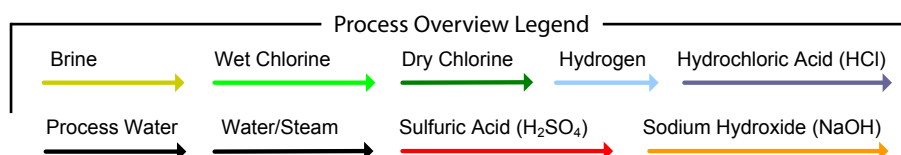
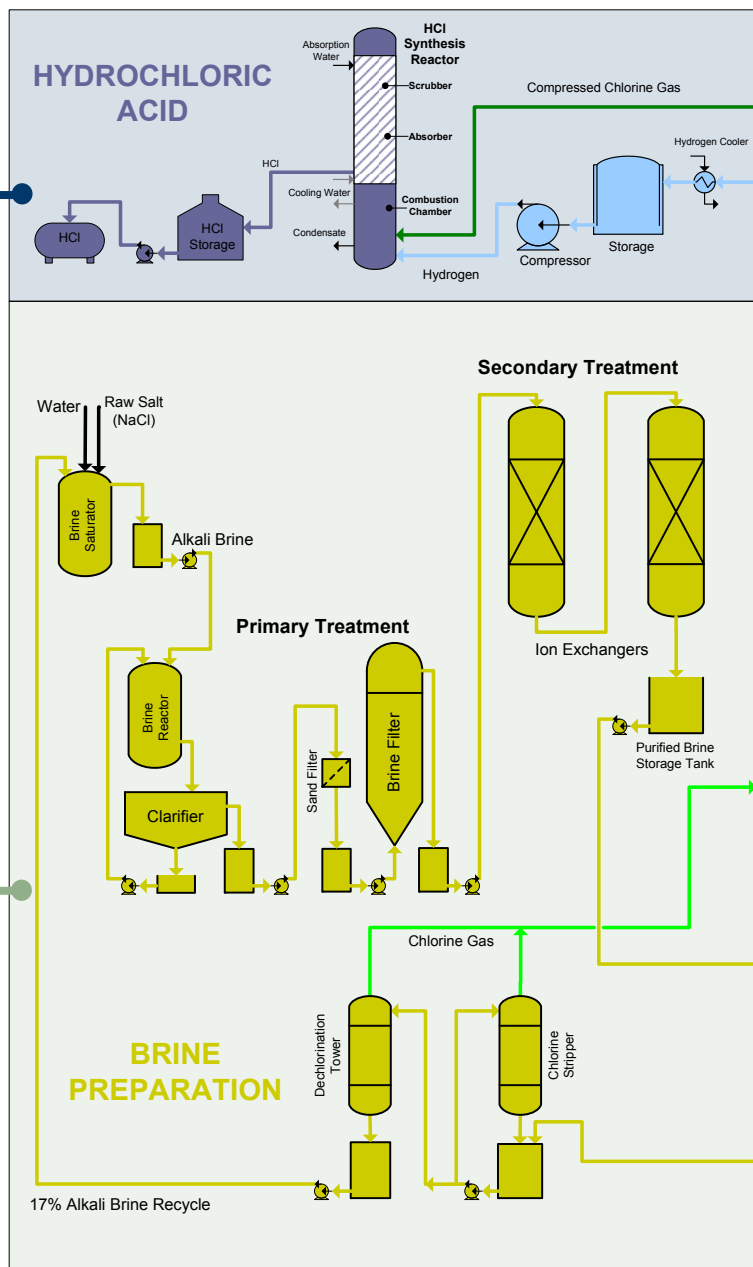
Process: Raw salt (NaCl) is used to create an aqueous sodium chloride solution, i.e. brine. Purified brine is sent to the Electrolyser and depleted brine returns to the Brine Handling area for reuse. Raw brine is treated, filtered, and sent through ion exchange.

Typical Valves and Piping:

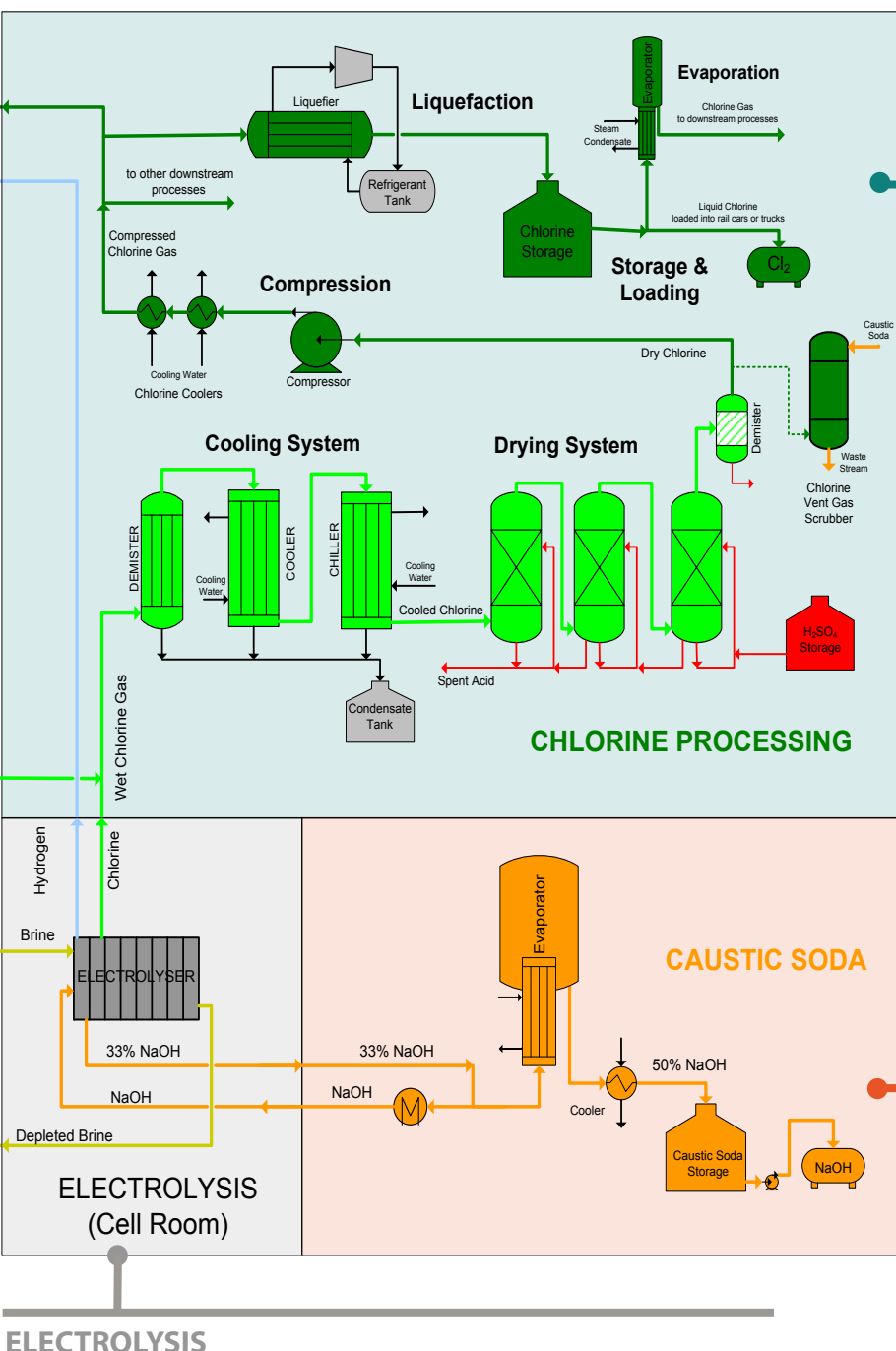
- Diaphragm Valves
- Lined Plug, Butterfly, and Ball Valves
- Plastic-lined Stainless Steel Pipe (Used throughout most of the brine area.)
- Lined Pipe Accessories
- Bellows Sealed Globe Valves

Common Problems We Solve:

- Particulate Abrasion
- Valves Jamming
- Internal Corrosion
- Scaling/Downstream Leakage



Chlor-Alkali Process Overview



ELECTROLYSIS

Electrolysis is the decomposition of chemical compounds by means of electrical energy. In the Electrolyser, chlorine gas (Cl_2), sodium hydroxide (NaOH), and the by-product hydrogen gas (H_2) are produced by the electrolysis of an aqueous solution of sodium chloride (NaCl). Mercury Cell, Membrane Cell, and Diaphragm Cell are the primary technologies for electrolysis.

CI CHLORINE PROCESSING

Process: Chlorine gas generated in the Electrolyser is cooled, dried, and compressed. It is sent either to the Hydrochloric Acid area or is liquefied and sent to storage for sale or for downstream processes.

Typical Valves and Piping:

- Diaphragm Valves
- Lined Butterfly, Ball, and Plug Valves
- Bellows Sealed Globe Valves
- Wet Chlorine: Lined
- Dry Chlorine: Carbon Steel Pipe
- Lined Pipe Accessories
- Lined Transfer Hoses

Common Problems We Solve:

- External Emissions
- Downstream Leakage
- Lining Permeation
- Maintenance Difficulty
- Temperature Cycling
- Storage Transfer Hose Leakage

C CAUSTIC SODA

Process: Caustic soda (sodium hydroxide, NaOH) is generated in the Electrolyser. A portion of this stream is recycled to the electrolyser while the rest is further concentrated and sent to storage.

Typical Valves and Piping:

- Stainless Steel
- Alloy 20 or Nickel Piping (Depending on the media concentration.)
- Lined Plug and Butterfly Valves
- Sleeve Plug Valves

Common Problems We Solve:

- External Leakage
- Scaling/Downstream Leakage
- High Temperature Corrosion

Downstream Leakage Problems and Solutions

Downstream leakage can be caused by internal corrosion, seats damaged by abrasion, complete valve closure prevented by deposits, seat wear over time, and uni-directional seal designs.

Corrosion

Cl HCl B C

- Line media corrodes metallic valve components resulting in an inability to maintain shutoff.

SOLUTIONS:

Saunders® Diaphragm Valves



- Working parts are isolated from line media by the diaphragm
- Only 2 parts are in contact with line media

XOMOX® Lined Products



- Fully lined ball, plug, and butterfly valves
- Absence of wetted parts protects against corrosion
- Lined accessories also available: strainers, sight glasses, check valves, poppets

Resistoflex® Lined Pipe and Fittings



- PTFE, PVDF, PFA, and polypropylene linings provide excellent protection against corrosion

WTA® Bellows Sealed Globe Valves



- Internals made from stainless steel or Hastelloy® materials provide excellent protection against corrosion

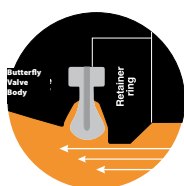
Downstream Leakage Problems and Solutions

Abrasion

B

C

- Line media erodes metallic valve components resulting in in-line leakage.



SOLUTIONS:

XOMOX® High Performance Butterfly Valves and Sleeved Plug Valves

- HPBV: Retainer ring protects seat from abrasion
- SPV: No body cavities where flow media can accumulate and damage sealing surfaces
- SPV: 360° port lips protect sleeve from abrasion



Saunders® Diaphragm Valves

- Working parts are isolated from line media by the diaphragm
- Linear operation assures seal even if diaphragm indicates signs of wear



WTA® Bellows Sealed Globe Valves

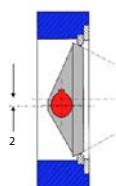
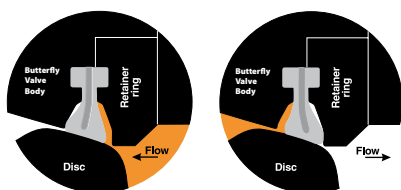
- The multi-wall, fully-flushed stainless steel bellows acts as the primary seal. This flushed system keeps the bellows clean and free from any particles settling into the fins of the bellows.

Downstream Leakage Problems and Solutions

Bi-directional Sealing

CI HCI

Bi-directional sealing is especially critical in any dry chlorine lines where leakage can introduce moisture and lead to rapid corrosion of piping system components.



SOLUTIONS:

XOMOX® High Performance Butterfly Valves

- Leakage protection is provided regardless of direction of flow
- Double eccentric design allows uninterrupted seal

XOMOX® Sleeved Plug Valves and Lined Plug Valves

- Full circumferential in-line seal design provides upstream and downstream sealing
- Severe Service Valve (SSV) has additional protection against external leakage (SSV shown on the right)

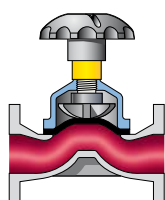
WTA® Bellows Sealed Globe Valves

- Leakage protection in closed position due to WTA's hardfacing with two different materials for seat (Stellite® 21) and plug (Stellite® 6)
- A plug that is harder than the seat is always supplied to ensure a tight, leakage-free closure and a repolishing function of the seat over the course of its lifetime.

Scaling

B C

Solids within the media build on the sealing surfaces. Valves must shut against these solids in the line and thus are not able to achieve complete closure.



SOLUTIONS:

Saunders® Diaphragm Valves

- Pocketless flow to prevent build up on sealing surfaces
- Diaphragm movement breaks scale

Downstream Leakage Problems and Solutions



XOMOX® Sleeved Plug Valves

- 360° port lips provide a self-cleaning action to remove scaling



WTA® Bellows Sealed Globe Valves

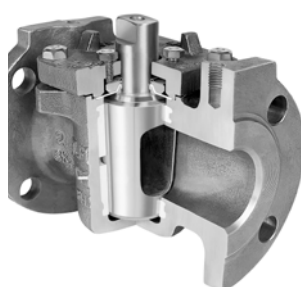
- The multi-wall, fully-flushed stainless steel bellows acts as the primary seal. This flushed system keeps the bellows clean and free from any particles settling into the fins of the bellows
- Tight shut-off through the seat with "Zero Leakage" (*per class A, DIN EN 12266 – 0 bubbles per minute)

Seat Wear

CI
HCI
B
C

Normal valve operation can wear the valve seat and reduce its sealing ability.

SOLUTIONS:



XOMOX® Sleeved Plug Valves

- Seating surfaces are protected by the plug when the valve is in the open or closed position
- Bolts in the top cover provide quick and easy adjustment to secure the seat seal
- Two independent sealing systems provide double protection against in-line leakage



WTA® Bellows Sealed Globe Valves

- WTA® uses two different materials to hardface the seat (Stellite® 21) and the plug (Stellite® 6)
- A plug that is harder than the seat is always supplied to ensure a tight, leakage-free closure and a repolishing function of the seat over the course of its lifetime.

External Emissions Problems and Solutions

External leakage can be caused by corrosion of wetted valve components (especially in the case of inappropriate media/lining combinations), insufficient sealing systems, thermal cycling, and an inability to conduct “preventive leak detection.”

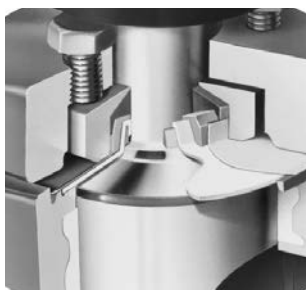
Inadequate Sealing Systems

CI HCI

Hazardous media can reach the environment through various potential leak paths. These include the valve stem, flange leaks, and permeation of valve and pipe lining.

SOLUTIONS:

XOMOX® Sleeved Plug Valves



- Two independent sealing systems provide increased protection against atmospheric leakage
- Optional tertiary top seal increases leakage protection
- Bolts in the top cover provide quick and easy adjustment to secure the seat seal

Saunders® Diaphragm Valves



- Working parts are isolated from line media by the diaphragm and the valve is emission-less by design

WTA® Bellows Sealed Globe Valves



- Superior safety sealing system with multiple bellows, gland packing, metal back seat, and cover gasket for fugitive emissions protection



External Emissions Problems and Solutions



Resistoflex® Lined Pipe and Fittings

- Lining thickness meets or exceeds ASTM F1545 standards
- Custom shapes and branches to reduce potential leak points
- Up to 3 bends possible per spool which reduces flanges



HIF



Resistoflex® Pipe and Flange Connections

- High Integrity Flange (HIF) allows a virtually leak-free joint to be installed between any section of piping
- Eliminates the need to re-torque (virtually maintenance free)
- CONQUEST® coupling connections allow for flangeless pipe



External Emissions Problems and Solutions

Permeation

wet
Cl

In wet chlorine applications, chemical molecules can permeate through valve or pipe lining and become trapped between the lining and the metal body. These trapped molecules can either escape to the atmosphere or can build up pressure and cause pipe failure.



SOLUTIONS:

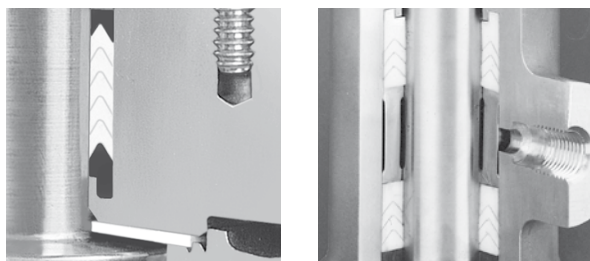
Resistoflex®ATL

- Resistoflex®ATL is the most cost effective solution for resolving permeation issues in severe service applications.
- Resistoflex®ATL PTFE reduces permeation rates by up to 60% when exposed to aggressive chemical elements at high temperatures

Thermal Cycling

dry
Cl

As process temperatures fluctuate between high and low extremes, delayed seal "rebound" can create an external leak path.



SOLUTIONS:

XOMOX® Sleeved Plug Valves

- Patented "shrink seal" negates the effect of thermal cycling (XP design shown on the left)
- Severe Service Valve (SSV) also has additional stem shrink seal (SSV design shown on the right)



Resistoflex® Pipe and Flange Connections

- High Integrity Flange (HIF) force distribution rings and bellville washers negating the effects of thermal cycling



WTA® Bellows Sealed Globe Valves

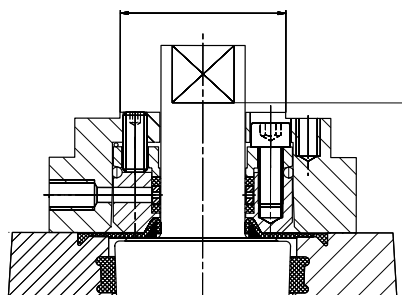
- The tongue and groove sealing system supports exceptional sealing negate the effects of thermal cycling
- Tight sealing on the top flange bonnet is essential to fugitive emissions protection, while multiple features are required to prevent emissions around the packing material

External Emissions Problems and Solutions

Leak Monitoring

CI HCI

Leak detection is a key aspect of emissions prevention.



SOLUTIONS:

XOMOX® Sleeved Plug Valves

- Optional leak monitoring port can detect leakage before it reaches the atmosphere



WTA® Bellows Sealed Globe Valves

- Extended body design covers the entire bellows surface which enables ease of access and visual inspection of bellows for timely and cost effective service

Transfer Hose Leakage

CI HCI C

Loading and unloading facilities are a key problem area for external leakage. Transfer hoses often require frequent maintenance or replacement.



SOLUTIONS:

Resistoflex® Lined Hoses

- Designed specifically for chlorine service
- Monel or Hastelloy C276 fittings assure corrosion resistance at hose ends
- PTFE lining resists corrosion better than a convoluted metal hose
- Seamless vacuum formed, heavy wall PTFE liner
- Kynar (PVDF) braid

External Emissions Cont'd

Problems and Solutions

Abrasion and Corrosion - External Leak Path

Cl

HCl

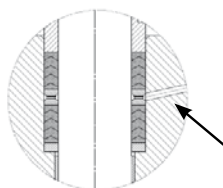
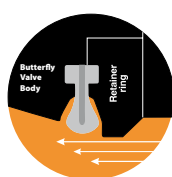
B

C

Abrasive and corrosive media can attack valve components resulting in an external leak path.

SOLUTIONS:

XOMOX® High Performance Butterfly Valves



- All wetted parts available in Titanium for maximum corrosion resistance (Note: Titanium is for wet chlorine only)
- Retainer ring protects against abrasion
- Live-loaded double packing with optional leak monitoring port

XOMOX® Lined Valves and Accessories



- Fully lined butterfly, ball and plug valves offer unparalleled corrosion resistance to all chemicals encountered in the chlor-alkali process under 400°F.
- XOMOX® lined check valves provide equipment protection including the XLC, the first bubble tight ball check valve with Class A leak rate.
- Lined accessories include PFA lined sight glass with borosilicate safety glass view ports and sample valves with cavity minimized design.



WTA® Bellows Sealed Globe Valves

- Bonnet flange, tongue and groove design with cam profiled PTFE gasket
- Tight sealing between the body and bonnet extends the valve's lifetime
- Cam profiled gasket works as a multiple seal

General Problems Problems and Solutions

Valve Jams

B C

Deposits can form on the valve components and create difficulty in operation. Especially in larger valves, operating torques can become substantial.



SOLUTIONS:

Saunders® Diaphragm Valves

- Linear motion means no break-in or break-out torque. Rolled thread should not seize or gall. Spindles are protected from the environment throughout their travel. Actuators are also protected throughout their travel.
- See also "Scaling" solutions on Page 9

XOMOX® High Performance Butterfly Valves

- Double offset means much lower operating torques
- Smaller torque also means a smaller actuator

WTA® Bellows Sealed Globe Valves

- The multi-wall, fully-flushed stainless steel bellows acts as the primary seal. This flushed system keeps the bellows clean and free from any particles settling into the fins of the bellows

Frequent or Extended Downtime High Cost of Valve Repair and Replacement

CI HCI B C

Valve repair often involves a production shutdown. Whether it is for scheduled or emergency maintenance, downtime decreases the profitability of a plant. In demanding services, the frequency and cost of repairing and replacing valves and their components can easily add up and significantly increase operating costs.

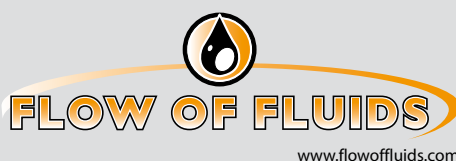


SOLUTION: All ChemPharma & Energy Products

- Features that provide solutions to Chlor-Alkali manufacturing problems give Crane ChemPharma & Energy products an extended valve life and lowers the customer's overall cost of ownership
- Extended downtime can be avoided through quick and easy valve repair features
- Crane ChemPharma & Energy worldwide after sales and service team can support turnaround needs

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