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# VALVE SOLUTIONS FOR CHLOR-ALKALI PROCESS





**PRODUCTS PRODUCED BY THE CHLOR-ALKALI INDUSTRY  
ARE USED IN MANY AREAS OF OUR SOCIETY**

<b>Water</b>	<b>Household Disinfectant</b>	<b>Food</b>
<b>Healthcare</b>	<b>Energy &amp; Environment</b>	<b>Advanced Technology</b>
<b>Building &amp; Construction</b>	<b>Defense &amp; Law Enforcement</b>	<b>Transportation</b>



**GLOBAL MARKET**  
500+ Producers and 650+ Facilities

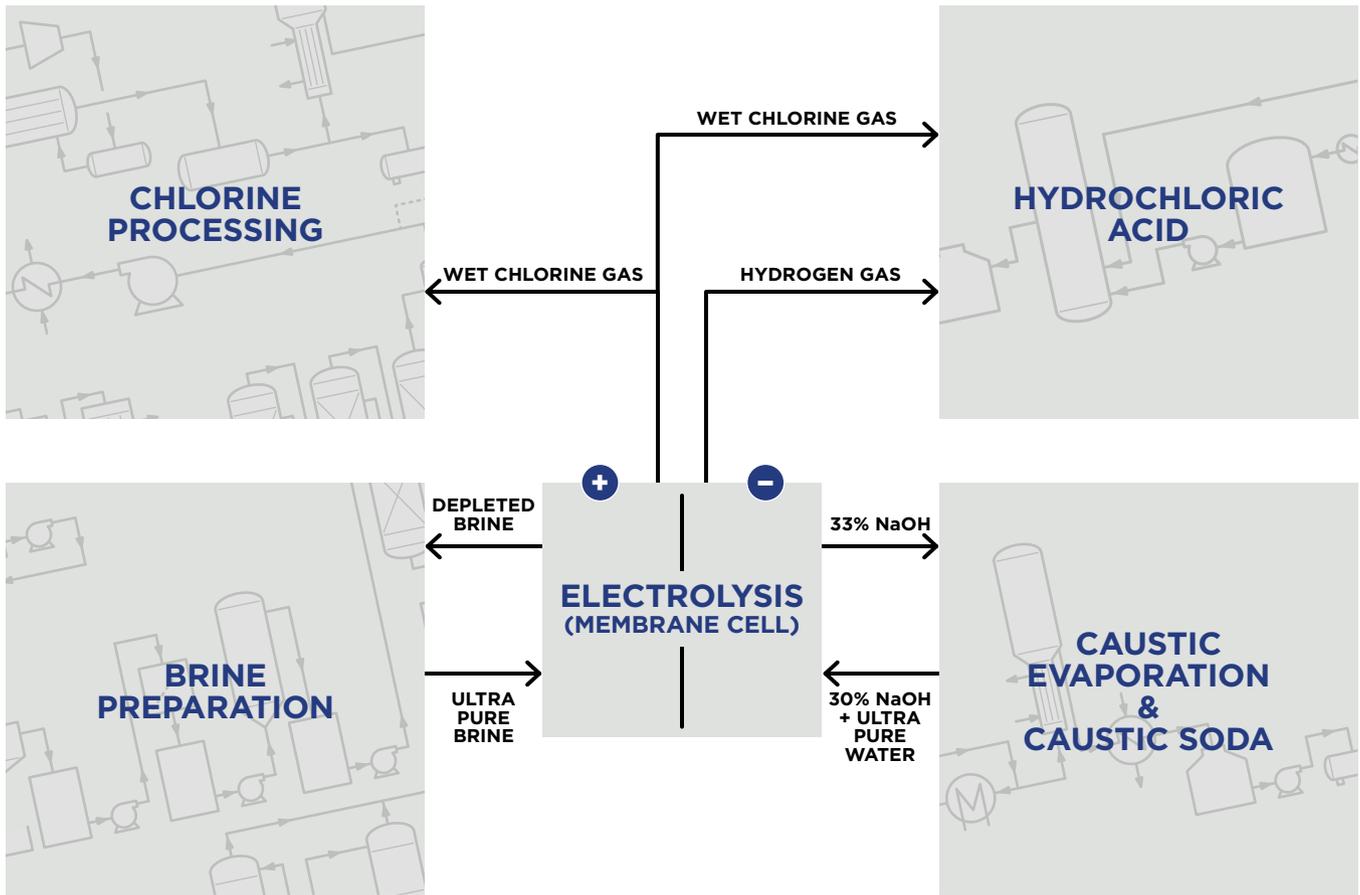
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**GLOBAL PRODUCTION CAPACITY**  
64 Million Short Tons per Year (58 Million Metric Tons per Year)

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**PRIMARY PRODUCTION CONCERNS**  
Safety | Environmental Protection | Lower Overall Cost of Ownership

**CHLOR-ALKALI PROCESS OVERVIEW (MEMBRANE)**



**THE PROCESS AND BENEFITS**

The **chlor-alkali process** starts with saturated brine — water with a high concentration (310 grams per liter) of dissolved salt (sodium chloride) at 180°F (82 °C). By comparison, sea water contains (35 grams per liter) of dissolved salt.

An **electrolytic reaction** then splits the saturated brine into **chlorine gas, hydrogen gas & caustic** (sodium hydroxide).

Three kinds of technologies are used to produce these products:

- > **Mercury cell** (almost obsolete)
- > **Diaphragm** (lower efficiency; higher costs to maintain)
- > **Membrane** (most energy efficient; replacing other technologies)

Common uses for the **chlorine molecule**:

- |                          |                               |
|--------------------------|-------------------------------|
| > Water purification     | > Advanced technology         |
| > Household disinfectant | > Building and construction   |
| > Food                   | > Defense and law enforcement |
| > Healthcare             | > Transportation              |
| > Energy and environment |                               |

Common end use applications for **caustic soda**:

- |                                       |                            |
|---------------------------------------|----------------------------|
| > Cooking wood chips in paper mills   | > Drain cleaners           |
| > Viscosity control of drilling mud   | > Detergents               |
| > Sanitizing equipment in food plants | > Bleaching & disinfection |
|                                       | > Weed killers             |
|                                       | > Water treatment          |

Common use for **hydrogen**:

- |                              |                                |
|------------------------------|--------------------------------|
| > Zero carbon emissions fuel | > Hydrogenation of fats & oils |
| > Nitrogenous fertilizers    | > Production of HCL            |

## ACRIS<sup>®</sup> VALVES SOLVE COMMON PROBLEMS IN CHLOR-ALKALI PROCESSES

- > LOW FLOW RATES
- > SHAFT LEAKAGE
- > SEAT LEAKAGE
- > SCALING
- > INTERNAL CORROSION
- > TORQUE INCREASE
- > ABRASION
- > RIGID LINER COLD FLOW
- > EROSION
- > PERMEATION
- > LINER FAILURE
- > OPERATIONS UNCERTAINTY

Acris<sup>®</sup> PFA lined butterfly and ball valves offer unsurpassed resistance to corrosion, permeation, and microbial contamination — for maximum purity and reliability, with minimal maintenance.

Engineered for bidirectional zero leakage shut/off, Acris<sup>®</sup> fully PFA lined butterfly and ball valves are the high performance solution for critical applications.

### AMRESIST ACRIS<sup>®</sup> PFA LINED BUTTERFLY VALVES

#### SPECIFICATIONS

##### Size Range

NPS 1 to 24 | DN 25 to 600

##### Temperature Range

-20°F to 320°F (-29°C to 160°C)

##### Pressure Rating

Up to 150 psi | Up to 10 bar

##### Body Style

Two-piece | Wafer, Lug

##### End of Line Service

Enables downstream dismantling at full working pressure, due to:

- > Wide elastomer backup liner secured in machined body groove
- > Oversized 17-4 stainless steel shaft
- > Flexible PFA liner



**MADE in the USA**

PFA LINED  
17-4 STAINLESS STEEL  
SHAFT AND DISC

OPTIONAL  
TITANIUM GRADE 7  
SHAFT AND DISC

### AMRESIST ACRIS<sup>®</sup> PFA LINED BALL VALVES

#### SPECIFICATIONS

##### Size Range

NPS ½ to 6 | DN 15 to 150

##### Temperature Range

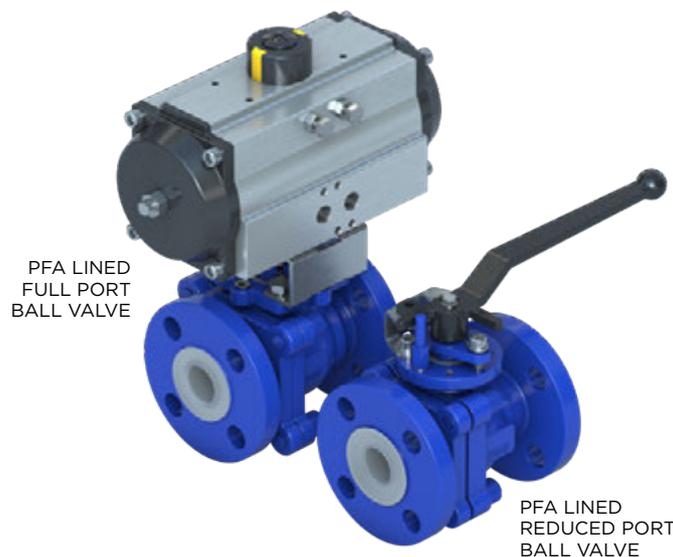
-49°F to 400°F (-45°C to 204°C)

##### Pressure Rating

Up to 250 psi | Up to 17 bar

##### End Connections

Two-piece | Flanged



PFA LINED  
FULL PORT  
BALL VALVE

PFA LINED  
REDUCED PORT  
BALL VALVE

**PROBLEM | LOW FLOW RATES**

**POSSIBLE EFFECTS**

- > Lower pump efficiency
- > Lower production output
- > Engineering design requires larger lines
- > Increased construction costs
- > Higher line velocity
- > Increased erosion

**LOW FLOW RATES | SOLVED**

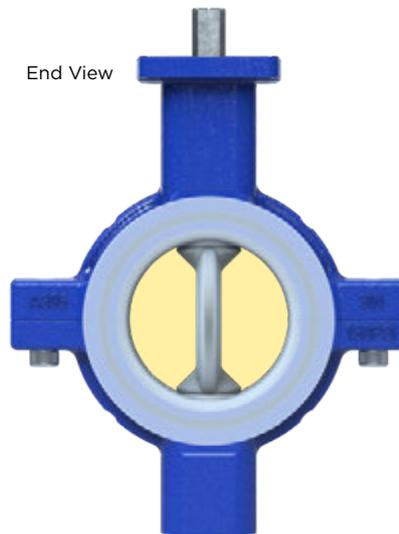
**High Strength Core**

- > A high strength 17-4 stainless steel, one-piece shaft-disc is at the core of the PFA disc.
- > The high strength core allows for a low-profile, high-flow disc design.

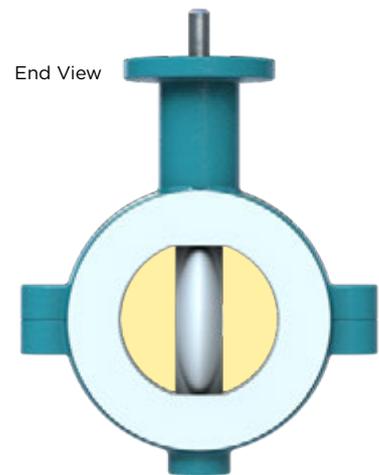
**High-Flow Design Benefits**

The high-flow design offers many benefits, such as:

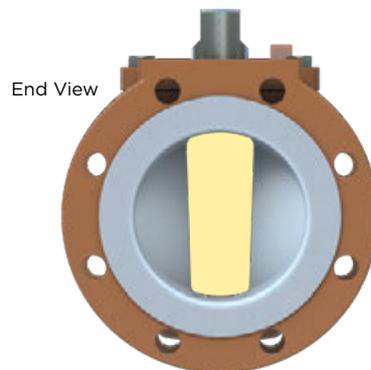
- > Increased pump efficiency.
- > Increased production.
- > Lower line velocity.
- > Lowers erosion effects.
- > May allow the use of smaller line sizes.



ACRIS® LOW-PROFILE DISC  
ALLOWS HIGHER FLOW RATES.



LARGE DISC PROFILE  
OF COMPETITORS  
LOWERS FLOW RATES.



TYPICAL PLUG VALVES HAVE HIGHER  
FLOW RESTRICTIONS, RESULTING IN  
LARGER VALVES TO ACHIEVE  
REQUIRED FLOW RATES.

## PROBLEM | SHAFT LEAKAGE

### POSSIBLE EFFECTS

- > Shaft & bearing corrosion
- > Higher valve torque required
- > Loss of fine process control
- > Difficulty operating valve
- > Shaft breakage
- > Inability to isolate equipment
- > Inability to perform maintenance
- > Operations uncertainty
- > Unscheduled down time
- > More frequent shutdowns
- > Personnel safety/exposure
- > Recordable releases
- > Regulatory fines
- > Required use of exotic metal shaft/disc

### SHAFT LEAKAGE | SOLVED

#### Acriseal™ Stem Sealing System

Precision engineered for reliable, maintenance-free service, the Acriseal three-step stem sealing system provides unmatched sealing for long term zero leakage performance.

#### Primary Seal (1)

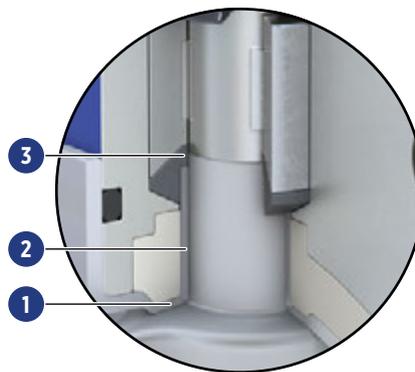
The primary seal is created by the spherically molded PFA body liner and matching disc hub interface. The energized backup liner maintains tight contact pressure for consistent shutoff in high cycle applications.

#### Secondary Seal (2)

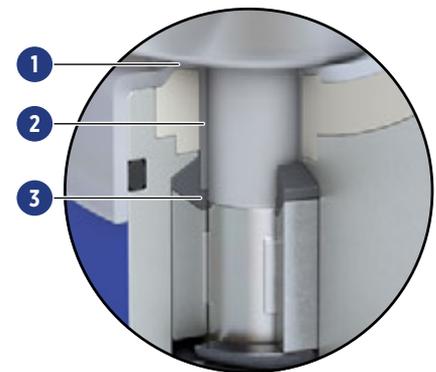
An independent secondary seal is formed by the extended body and disc liners. The flexible PFA body liner extends into the stem cavity and the disc liner envelops the stem. The resulting protective sleeve eliminates potential leak paths for fugitive emissions and shields internal components from contact with the media. This feature works in conjunction with the tertiary safety seal to ensure compliance with ISO 15848-1 standards for fugitive emissions.

#### Safety Seal (3)

The third sealing mechanism is a graphite filled PTFE safety seal. Completely isolated from the process media by the extended disc liner, and energized by a coil spring, the safety seal self-adjusts for changes in temperature and wear to ensure absolute zero leakage shutoff of corrosive and ultra pure process media.



UPPER SHAFT SEALING



LOWER SHAFT SEALING

**PROBLEM | SEAT LEAKAGE**

**POSSIBLE EFFECTS**

- > **Chemical cross contamination**
- > **Brine cross contamination**
- > **Untreated brine feed into electrolyzer**
- > **Reduced membrane efficiency**
- > **Lower electrolyzer output**
- > **Lower NaOH, H<sub>2</sub> and Cl<sub>2</sub> production**
- > **Inability to isolate equipment**
- > **Inability to perform maintenance**
- > **Operations uncertainty**
- > **Unscheduled down time**
- > **More frequent shutdowns**

**SEAT LEAKAGE | SOLVED**

**Reliable Upstream/Downstream Sealing**

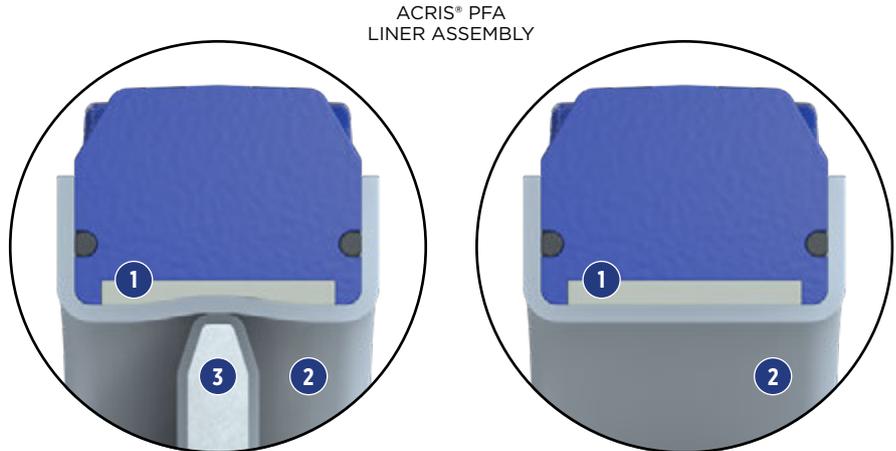
The elastomer backing (1) compresses the flexible PFA lining (2) around the leading edge of the disc (3) to provide zero leakage for many years of service.

**Flexible PFA Liner**

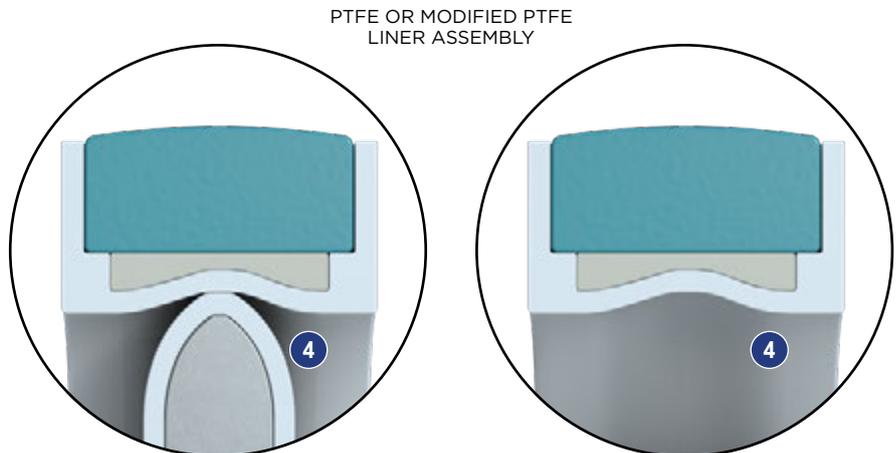
The PFA liner (2) remains flexible, never becoming stiff & rigid. This is in contrast to PTFE & Modified PTFE liners (4), which are usually thick sinterings — resulting in a stiff liner, unable to give tight shutoff over a long period of time.

**Elastomer Backup Liner**

The wide elastomer backup liner (1) in the ACRIS® valve rests in a machined body groove, which is essential in providing tight shutoff for end of line service at full pressure. This has enabled the ACRIS® to be used for pump & vessel isolation, as well as many other difficult services.



Flexible liner returns to original shape, resulting in long-term reliable sealing.



Rigid liner retains shape of disc, resulting in unreliable sealing.

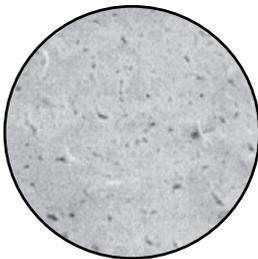
**ADVANTAGES OF AMRESIST ACRIS<sup>®</sup> PFA LINER MATERIAL**

**PFA MATERIAL**

- > Starts as pellets.



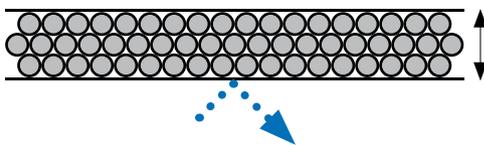
- > Melted and molded, forming mechanical + chemical bond.
  - > Dense material is spared of voids and air pockets.



10,000X magnification shows minimal voids or air pockets.



- > Dense material creates effective barrier to chemical migration and cold flowing.



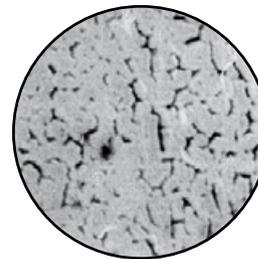
Cross-section of PFA material.

**PTFE MATERIAL**

- > Starts as powder.



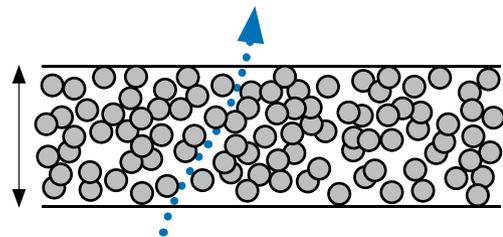
- > Mechanically formed (sintered), not melted.
  - > Porous material is filled with air channels and pockets.



10,000X magnification shows significant voids and air pockets.



- > Porous material creates less effective barrier to chemical migration and cold flowing.



Cross-section of PTFE material.

**AMRESIST ACRIS<sup>®</sup> RESULTS**

- > PFA liner is inherently more flexible than PTFE & Modified PTFE.
- > Flexible PFA liner will never take a permanent set.
- > Maintains tight shutoff.

**COMPETITOR RESULTS**

- > PTFE & Modified PTFE liners are thick and rigid.
- > Rigid liners will take a permanent set impression from the disc edge.
- > Less effective shutoff.

# CHLOR-ALKALI PROCESS VALVE SOLUTIONS

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## ACTUATORS BY AMRESIST



**C SERIES**  
Aluminum Body (Standard Sizes)

**SPECIFICATIONS**

**Torque Output Range (Double Acting)**  
55 to 42,859 lbf-in  
6 to 4,842 N m



**B SERIES**  
Aluminum Body (Large Sizes)

**SPECIFICATIONS**

**Torque Output Range (Double Acting)**  
13,506 to 1,565,201 lbf-in  
1,526 to 176,844 N m



**AA SERIES**  
Stainless Steel Body

**SPECIFICATIONS**

**Torque Output Range (Double Acting)**  
55 to 55,883 lbf-in  
6 to 6,314 N m

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## CONTROL ACCESSORIES BY AMRESIST



**VALVE STATUS MONITORS**  
Sentinel VPT



**POSITIONERS**  
Series 760 P/E



**GEAR OPERATORS**  
Series XHW

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## CONTROL ACCESSORIES BY BRAY



**POSITIONERS**  
Series 6A



**PROXIMITY SENSORS**  
Series 54



**VALVE STATUS MONITORS**  
Series 5A, 5B, 5C



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DISCOVER HOW ACRIS® VALVES INCREASE RELIABILITY AND REDUCE  
TOTAL COST OF OWNERSHIP FOR YOUR CRITICAL APPLICATIONS.

VISIT [AMRESIST.COM](https://www.amresist.com) TO LEARN MORE ABOUT  
PRODUCTS AND LOCATIONS NEAR YOU.

## HEADQUARTERS

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