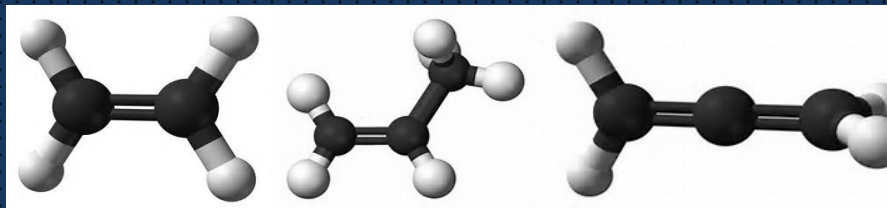




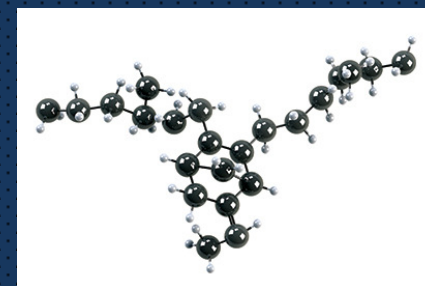
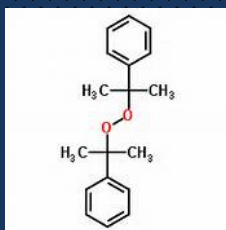
**PRINCE**  
RUBBER & PLASTICS CO., INC



# Clorosur X Technical Seminar

High Performance Elastomers and  
Plastics for the Electrochemical Industry

Presented by: Shane Fast  
Prince Rubber & Plastics Co., Inc.





In our 85<sup>th</sup> Year

**Panacea<sup>®</sup>**  
Solutions for  
Technology in  
Chlor-Alkali Cell  
Accessory Parts

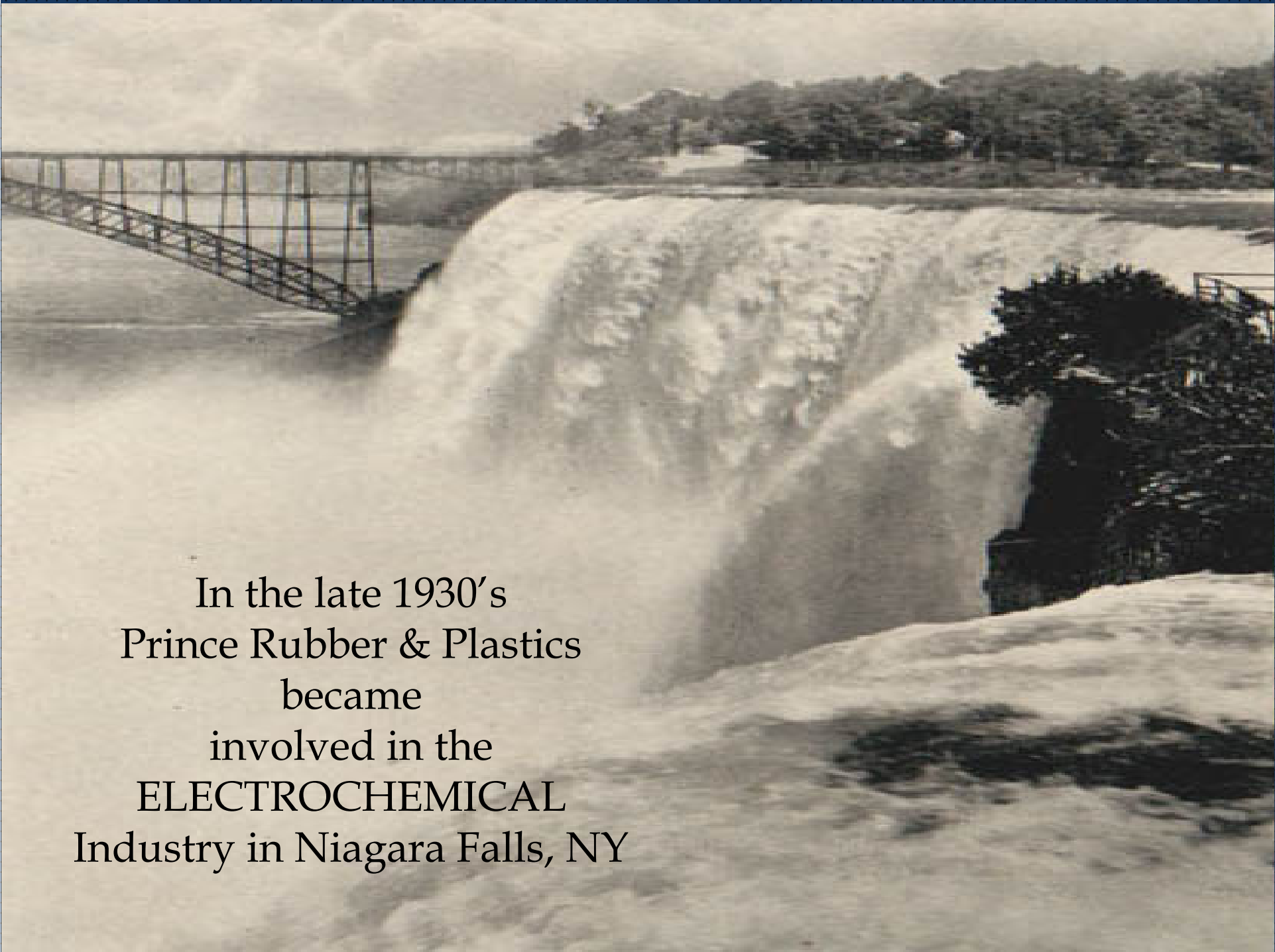


**Headquarters:** Buffalo, New York, USA

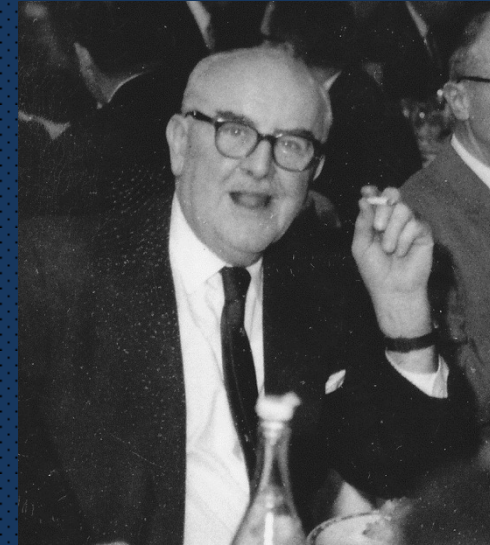
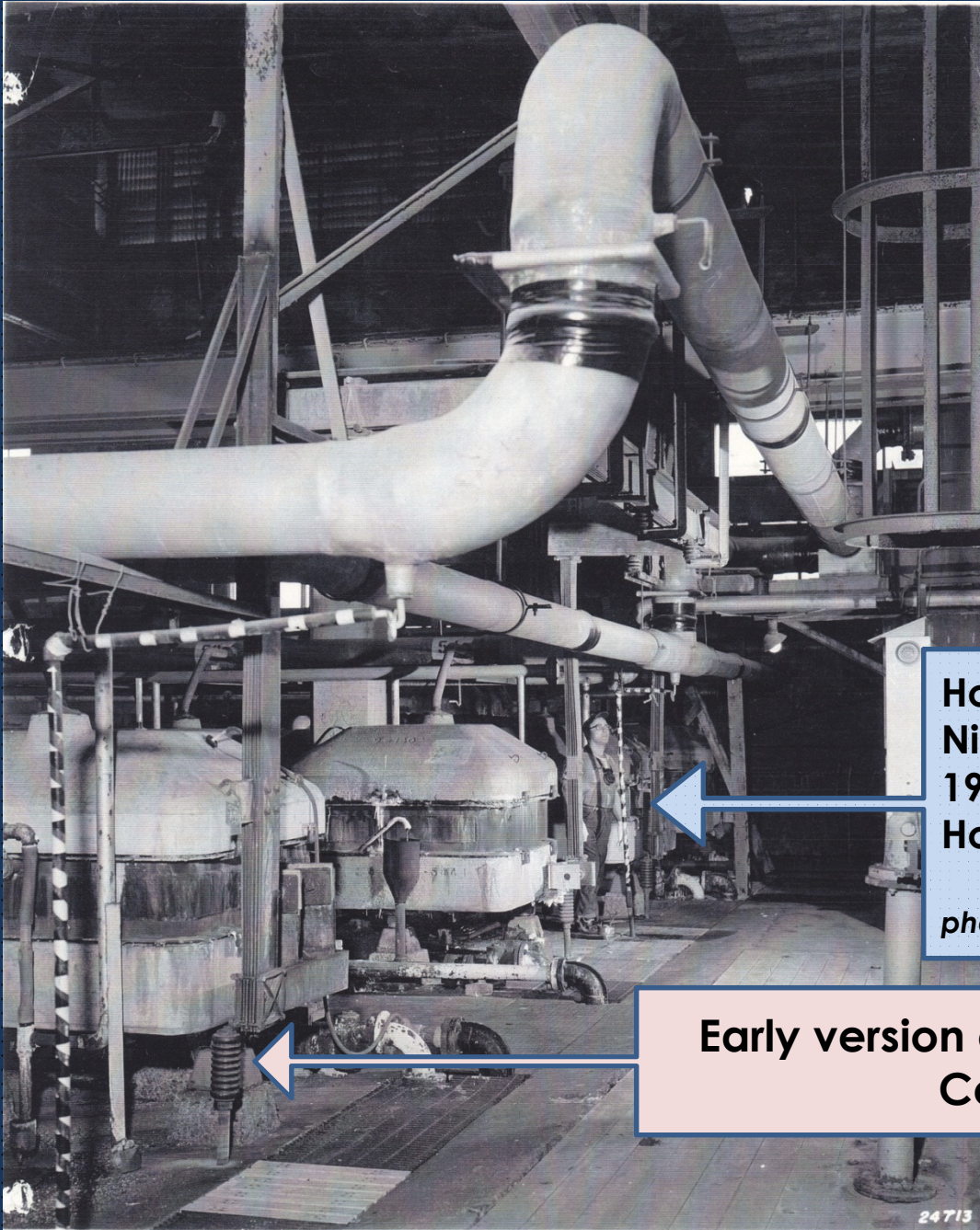
**Southern Division:**  
Baton Rouge, LA, USA



**Canadian Division:**  
Industrial Plastics Canada Limited  
Fort Erie, Ontario, Canada

A black and white photograph of Niagara Falls. The water is cascading over a rocky ledge, creating a large plume of white mist. To the left, a metal truss bridge spans across the river. In the background, there are trees and some buildings on a hillside. The overall scene is industrial and natural.

In the late 1930's  
Prince Rubber & Plastics  
became  
involved in the  
**ELECTROCHEMICAL**  
Industry in Niagara Falls, NY



Prince Rubber & Plastic Co., Inc.  
Founder, Sidney W. Prince

**Hooker Chemical Site in  
Niagara Falls, NY circa  
1940's with  
Horace Hooker**

*photo taken by Sidney W. Prince*

**Early version of Chlor-Alkali  
Cells**

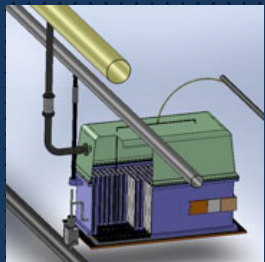
**Hooker "S" Cell: Concrete  
Cell Head – Graphite Anode**

Across ALL Processes,  
Prince has extensive  
experience:

Mercury

Diaphragm

Membrane



Diaphragm Cell

Membrane Cell

Prince Supports the advancements of  
Chlor-Alkali Technology

# PRINCE RUBBER & PLASTICS, CO., INC.

## chlor-alkali products utilized in the world

Membrane Technology

Diaphragm Technology

Mercury Technology



Argentina Australia Belgium Brazil Canada Chile China Columbia Dominican Republic Finland  
France Germany Great Britain Hong Kong India Indonesia Ireland Italy Mexico Netherlands  
New Zealand Norway Pakistan Portugal Puerto Rico Saudi Arabia Singapore South Africa  
South Korea Spain Switzerland Taiwan Thailand United States Venezuela

# Currently in regular production:

- 4-6 Specialty EPDM compounds.
- 2 Specialty Fluoroelastomers.
- 1 Specialty high temperature thermoplastic.
- 1 Specialty high temperature thermoset plastic.
- 4-5 Fluoroplastic variations.

# “EPDM Rubber” Basics

- Terpolymer of ethylene, propylene, and diene.
- Vulcanized and reinforced to improve physical properties.
- EPDM & Elastomers are not standardized.
- Numerous “EPDM” manufacturers.
- Rubber producers develop formulation based on requirements.



# General Comparison of Curatives for High Performance EPDM



# 6962 Special Peroxide Cured EPDM

## Physical Properties

### Representative Physical Properties

	ASTM	Mandrel Made	Press-Cured & Molded
Compound		6962M	6962
Hardness, Shore "A"	D2240	62 ± 5	60 ± 5
Ultimate Tensile, psi	D412	1900	1800
Elongation, %	D412	350	350
Compression Set 70 hrs @ 212°F	D395(B)	25%	25%

# Advancements in Technology

- EPDM Polymer Advancements
  - Polymerization methods
  - Catalysts
- Fluoroplastics
  - Contain fluorine bonds on polymer chains
  - PTFE, PFA, FEP, ECTFE, PVDF, others
- Combining Rubber & Plastics
  - Firms typically specialize in one or other
  - Prince has always been involved in both

# Fluoroelastomers

- 1475: TFE-P Copolymer
- No hexafluoropropylene or vinylidene fluoride
- $75 \pm 5$  Durometer Shore "A"
- High Temps 400°F Operating, 600°F short term
- Excellent Compression Set
- Excellent Chemical Resistance

# Fluoroplastics

- High temperature capability
- Excellent resistance to cracking
- Excellent all-around chemical resistance
- Permeation resistant
- Weld capable (important in some cases)
- Prince is capable of bonding fluoropolymers to rubber products

# Examples: Prince Plastic/Rubber Products

- Mark III HB fluoroplastic/Special 6962 Special EPDM Grid Protectors
- PT70-M fluoroplastic/Special 69 Series EPDM pipe flange gaskets.
- Fluoroplastic protected Special 69 Series EPDM anode membrane cell, and chlorate cell gaskets.
- Fluoroplastic protected 6962 Special EPDM diaphragm cell anode post gaskets.

# PRINCE

RUBBER & PLASTICS CO., INC

**Advanced Technology  
in Chlor-Alkali  
Cell Accessory Parts**

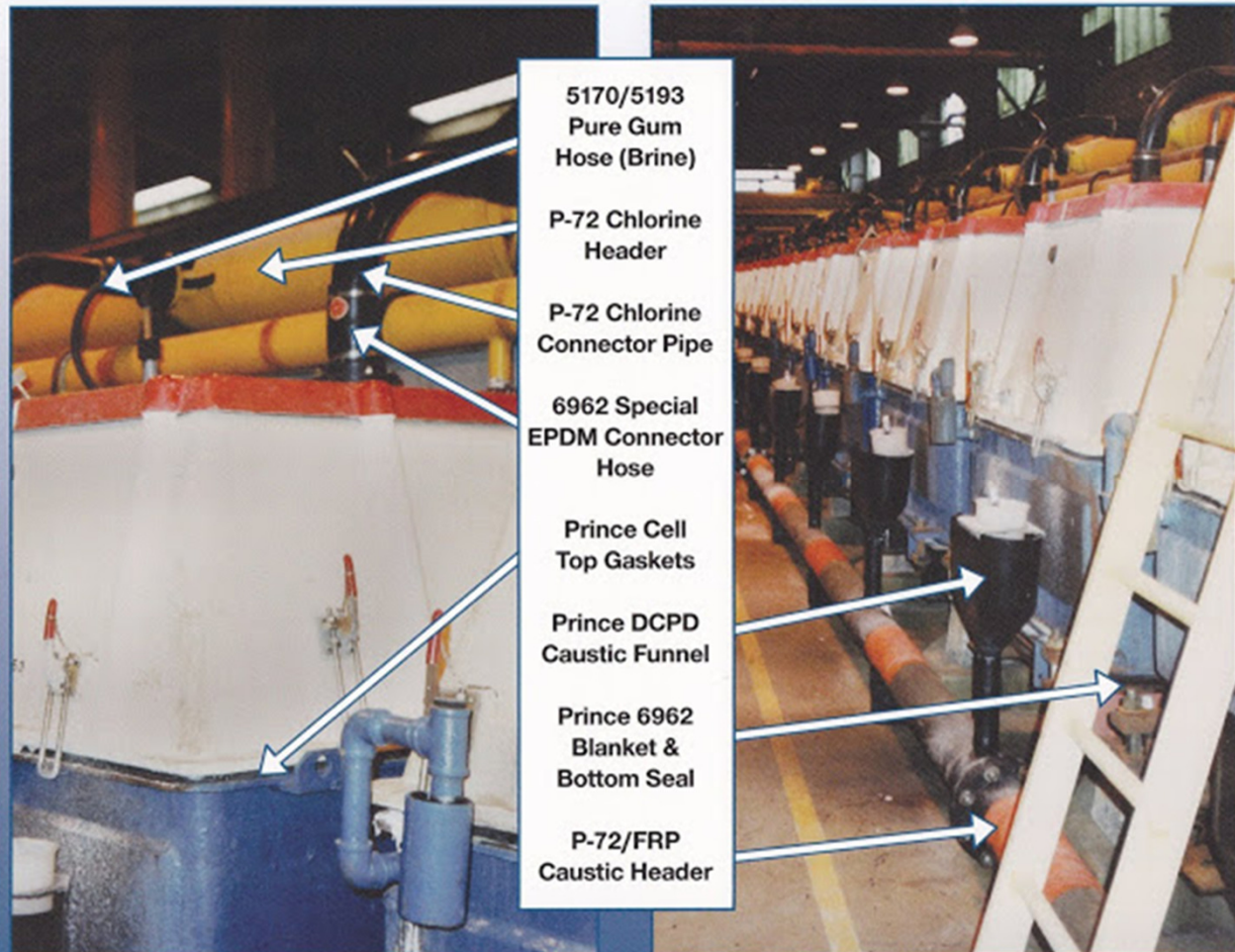


## Diaphragm Cell Parts

- |                            |                           |
|----------------------------|---------------------------|
| Grid Covers                | Brine Tubing              |
| Cell Gasketing             | Cell Connector Pipes      |
| Cell Top and Bottom Seals  | Rubber Stopper Gaskets    |
| Flexible Sleeve Connectors | Caustic Funnel Assemblies |
| Bellows                    | Cell Circuit Piping       |
| Anode Spacers              |                           |

Buffalo, New York • Baton Rouge, Louisiana USA  
Fort Erie, Canada

# Diaphragm Cell Parts



- 5170/5193  
Pure Gum  
Hose (Brine)
- P-72 Chlorine  
Header
- P-72 Chlorine  
Connector Pipe
- 6962 Special  
EPDM Connector  
Hose
- Prince Cell  
Top Gaskets
- Prince DCPD  
Caustic Funnel
- Prince 6962  
Blanket &  
Bottom Seal
- P-72/FRP  
Caustic Header

Prince Rubber & Plastics Co., Inc. Buffalo, NY, Baton Rouge, LA, USA

# Mercury Cell Parts



## Chlor-Alkali Cell Circuit(s) Piping

- P-72 for Hot, Wet Chlorine, Hydrogen, Sodium Hydroxide, Potassium Hydroxide, Brine, Condensate
- Special Molded DCPD Sections
- Special Configuration Brine Flow Control Piping

**PRINCE**  
RUBBER & PLASTICS CO., INC



## Flexible Covers

- Fluoroplastic F230LP Long Life
- 6760 Special EPDM

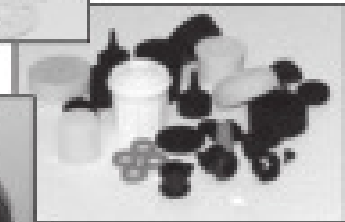


## "Panacea"<sup>®</sup> Cell Gaskets

- "68" Series Fabricated and Extruded Special Designs

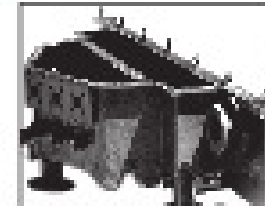
## Rubber Stoppers and Stopper Gaskets

- For Chlorine Dogleg Connections, Brine Feed Tube Connections, Sight Tube Connections, and Other Applications



## "Panacea"<sup>®</sup> Anode Seals

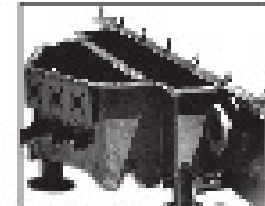
- "68" Series Special EPDM, Die Cut, Fabricated, and Molded Fluoroplastic "Armored" "68" Series



## DCPD Molded End Boxes, Siderails

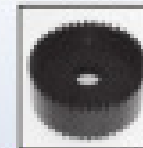
## "Panacea"<sup>®</sup> Hose Connectors

- "68" Series Special EPDM, "51" Series Special Pure Gum for Hot, Wet Chlorine, Hydrogen, Brine, Caustic
- Fluoroplastic Flexible F230LP and Other (FEP, PTFE, etc.)
- "Panacea"<sup>™</sup> Mark II Series (Plastic) Chlorine Transfer Hose



## Caustic Interrupters

- P-72, PTFE, DCPD



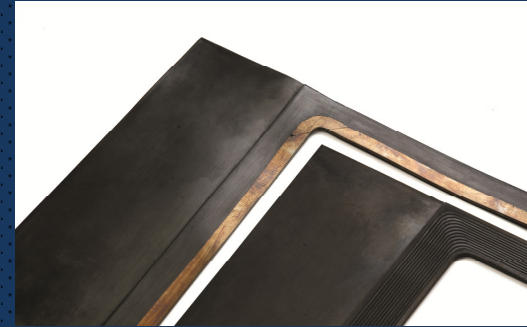
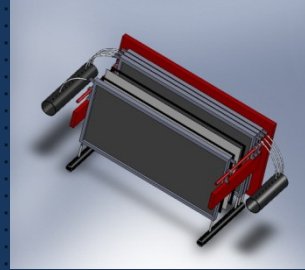
## Chlorine and Hydrogen Connector Pipes

- Special P-72 Thermoformed Sections for Chlorine, Hydrogen Cell-to-Header Piping





# Membrane Cell Parts



Replacement Frame  
Gaskets

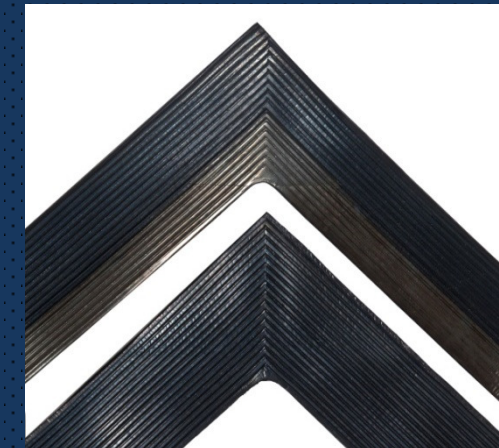
Header Systems

Fluoroplastic Connecting  
Hoses and Hose Gaskets

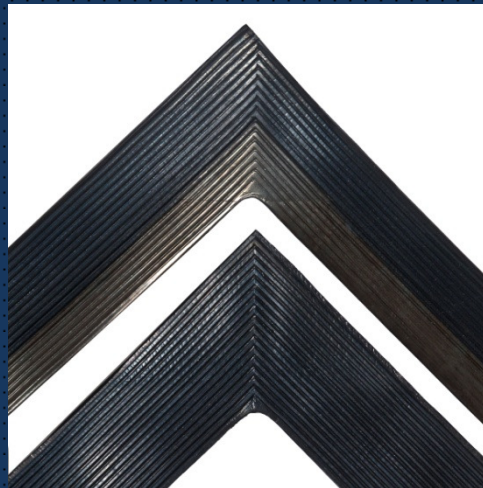
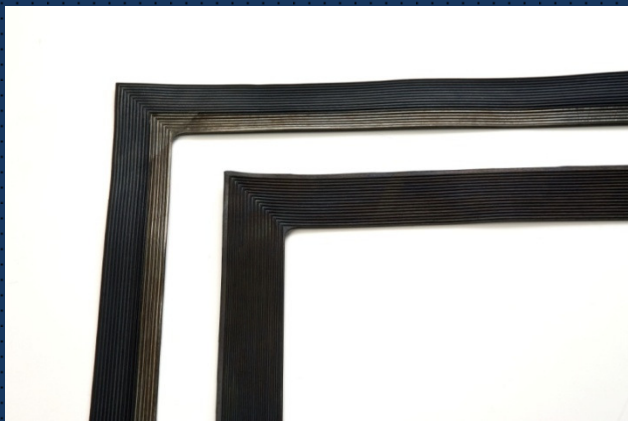




As technological advancements are made in the production of Chlorine, Prince works with chlor alkali manufactures to improve cell part life, performance and reliability.



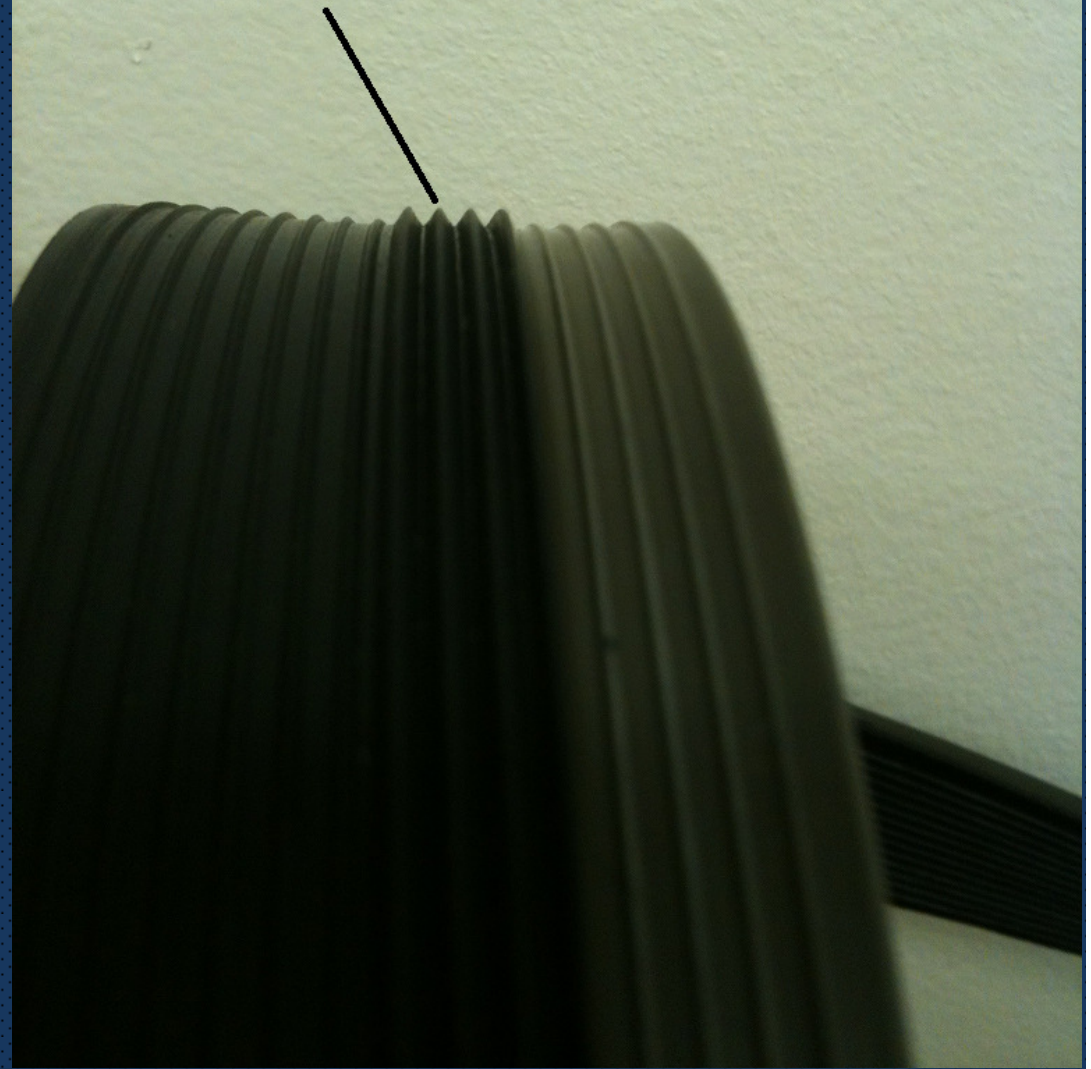
# Membrane Replacement Frame Gaskets



**A recent upgrade  
feature of this  
particular gasket**

Raised sealing faces  
limit the area of  
contact of the gasket  
to the frames, thereby  
increasing the sealing  
force in this area when  
utilizing the same  
clamping force, and  
helping extend the  
seal life of the gasket.

## Raised Sealing Faces



# Panacea® Replacement Membrane Cell Gasket Systems Advancements

- Each Frame Gasket Type is designed specifically for that technology
- In some cases, Prince fluoroplastic armors more of the gasket than others
- Prince uses a continuous fluoroplastic armoring method
- Prince can incorporate an EPDM “Skin” over the fluoroplastic film
- Prince has improved the sealing design on certain gaskets
- Prince has improved the fastening or bonding of fluoroplastic

# Gasket Life: Main Factors



Stress, erosion

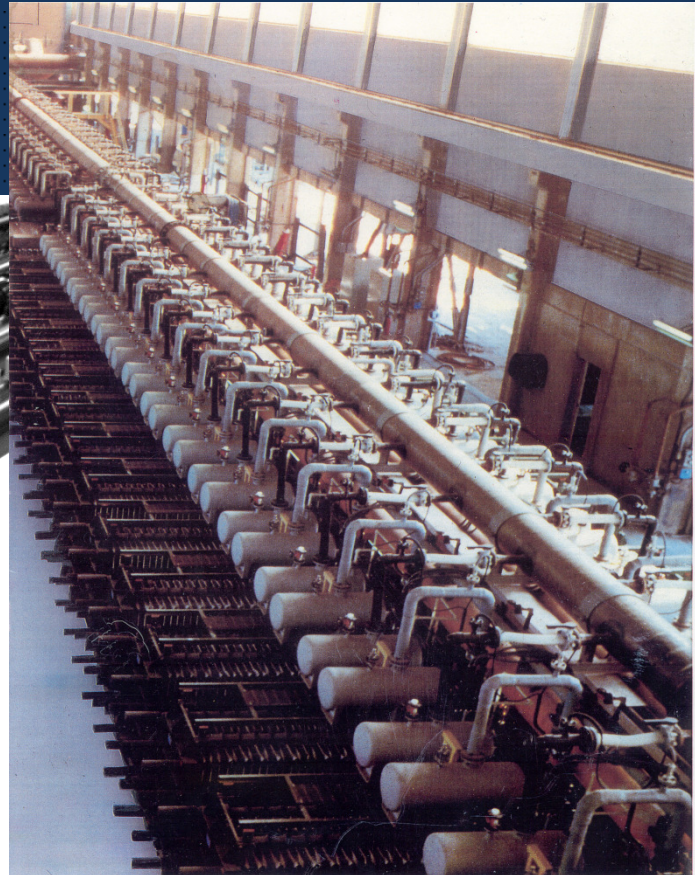
Too hot, too cold

Incompatible, impurities

# Prince: Thermoformed Fluoropolymer Connector Hoses



# P-72 Styrene Co-Polymer Pipe and Header Systems





**“Panacea”<sup>®</sup> Cell Accessory Parts**

# PRINCE RUBBER & PLASTICS CO., INC

Solutions for Technology in Chlor-Alkali Cell Accessory Parts

## Membrane Cell Process

### Membrane Cell Gasketing



For BITAC<sup>®</sup> Type Electrolyzers



For DD350<sup>™</sup> Type Electrolyzers



For FM21/1500<sup>™</sup> Type Electrolyzers



For Lurgi<sup>™</sup> Type

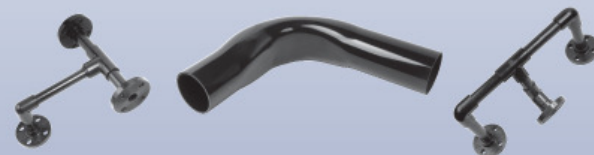


For MGC/Ext<sup>™</sup> Type Electrolyzers



For ML32<sup>™</sup> Type Electrolyzers

### P-72 Process Piping



**“Panacea”<sup>®</sup> Advanced Replacement Gasketing**

**P-72 Piping Systems**

**Molded Extruded & Machined Parts**

Serving the Chlor-Alkali Industry Worldwide



[www.princerp.com](http://www.princerp.com)

Buffalo, New York USA • Baton Rouge, Louisiana USA • Fort Erie, Canada

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**“Panacea”<sup>®</sup> Cell Accessory Parts**

THANK YOU FOR YOUR TIME AND ATTENTION