Plastic materials for the use of chlor-alkali Industry
COMPANY PROFILE

Thermoplastic Valves

- PVC, CPVC, PE, PP, PVDF, E-CTFE & PDCPD
- Ball Valves (1/2” - 6”)
- Butterfly Valves (1 1/2” - 48”)
- Diaphragm Valves (1/2” - 10”)
- Check Valves (1/2” - 12”)
- Globe Valves (1/2” - 4”)
- Gate Valves (1/2” - 14”)
- Y strainers (1/2” - 4”)
- Electric & Pneumatic Act.

Thermoplastic Piping Systems

- Polyethylene - PE (1/2” - 98”)
- Polypropylene - PP (1/2” - 38”+)
- PVDF (1/2” - 12”+)
- E-CTFE (1/2” - 4”+)
- PFA (1/2” - 1”)
- Single & Double-Wall
- Leak Detection

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THERMOPLASTIC MATERIALS

- Materials that melts when heat.
- They became processable at certain temperature.
- Mainly 2 different process
  - Injection Molding – Valves
  - Extrusion Process – Pipes
- Thermoplastics advantages
  - Chemically Resistant
  - Better corrosion resistance characteristics
  - Lightweight
  - Lower material and installation cost that metal system (average)
- Thermoplastics restrictions
  - Temperature Range
  - Pressure Rating
## THERMOPLASTIC MATERIALS

<table>
<thead>
<tr>
<th>Name</th>
<th>Make-up</th>
<th>Temp.</th>
<th>Pressure</th>
<th>Joining</th>
<th>Strength</th>
<th>Weakness</th>
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</thead>
<tbody>
<tr>
<td><strong>Vinyl:</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>PVC</td>
<td>C-HH/C-HCl</td>
<td>140°F / 40°F</td>
<td>150psi?</td>
<td>Solvent</td>
<td>Low Cost</td>
<td>Joints</td>
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<tr>
<td>CPVC</td>
<td>9% &gt; Cl</td>
<td>190°F / 40°F</td>
<td>150psi?</td>
<td>Solvent</td>
<td>Low Cost</td>
<td>Joints</td>
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<tr>
<td><strong>Olefin:</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>PE</td>
<td>C-HH/C-HH</td>
<td>140°F / -40°F</td>
<td>230psi</td>
<td>Fusion</td>
<td>Many</td>
<td>Unreinforced</td>
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<tr>
<td>PP</td>
<td>C-HH/C-HH₃</td>
<td>210°F / 15°F</td>
<td>150psi</td>
<td>Fusion</td>
<td>Many</td>
<td>Unreinforced</td>
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<td><strong>Fluoropolymer:</strong></td>
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<tr>
<td>PTFE</td>
<td>C-FFFF</td>
<td>450°F</td>
<td>-</td>
<td>-</td>
<td>Resistance</td>
<td>High Cost</td>
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<tr>
<td>PVDF</td>
<td>C-FFFH</td>
<td>284°F / -40°F</td>
<td>230psi</td>
<td>Fusion</td>
<td>Resistance</td>
<td>High Cost</td>
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<tr>
<td>E-CTFE</td>
<td>PE-Cl-PTFE</td>
<td>334°F / -100°F</td>
<td>150psi</td>
<td>Fusion</td>
<td>Resistance</td>
<td>High Cost</td>
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<tr>
<td>PFA</td>
<td>F₂C-O</td>
<td>450°F</td>
<td>150psi</td>
<td>Fusion</td>
<td>Resistance</td>
<td>High Cost</td>
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</table>
THERMOPLASTIC MATERIALS

Diaphragm Valve ½ to 2 inch

Diaphragm Valve 2-½ to 4 inch
## Chemical Resistance

<table>
<thead>
<tr>
<th>Type of Service</th>
<th>PE</th>
<th>PP</th>
<th>PVDF</th>
<th>E-CTFE</th>
<th>PFA</th>
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<tbody>
<tr>
<td>Strong Alkalies</td>
<td>+</td>
<td>+</td>
<td>X</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Weak Alkalies</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Strong Acids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Weak Acids</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Organic Solvents</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Strong Oxidative Agents</td>
<td>X</td>
<td>X</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Sodium Hypochlorite</td>
<td>+</td>
<td>X</td>
<td>X</td>
<td>+</td>
<td>+</td>
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<tr>
<td>Sodium Hydroxide</td>
<td>+</td>
<td>+</td>
<td>X</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
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</tbody>
</table>
Advanced PE Piping Systems

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Advanced PE Piping System

Anti-Leak Technology

Advanced PE (PE100RC)
Cell Classification PE445584C per ASTM D3350
A resin system developed for infrastructure piping applications
that handles difficult chemical applications.

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Advanced PE Piping System

Polyethylene PE

- Old classifications: LDPE, MDPE, HDPE
- New classification based on ISO - MRS (minimum required strength) standards – long-term loaded pipes at 20 C for 50 years
- First generation: PE 32, 40, 63 (expressed in bar)
- Second generation: PE 80 - PE3408 in the USA
- Third generation: PE 100 – PE4710 in the USA
- Fourth generation: Advanced PE
Advanced PE Piping System

FNCT ISO 16770 - Olefins

Full Notch Creep Test

- Notched piece
- Solution: 2% Arkopal N-100 @ 80°C
- Requirement: > 8,760 hours @ 80°C
- Weight
- Load = 4 N/mm² (580 psi)
## Advanced PE Piping System

### FNCT ISO 16770 - Olefins

<table>
<thead>
<tr>
<th>Material Class</th>
<th>Minimum Standard</th>
<th>Average Results</th>
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</thead>
<tbody>
<tr>
<td>PE 63</td>
<td>~ 30 Hours</td>
<td>7.5 Hours (2 samples)</td>
</tr>
<tr>
<td>PE 80</td>
<td>100 Hours</td>
<td>114 Hours (3 samples)</td>
</tr>
<tr>
<td>PE 100</td>
<td>300 Hours</td>
<td>533 Hours (5 samples)</td>
</tr>
<tr>
<td>Advanced PE</td>
<td>8,760 Hours (1 year)</td>
<td>14,648 Hours (2 samples)</td>
</tr>
</tbody>
</table>
Advanced PE Piping System

Glued or threaded systems

Painted CPVC for visual identification
Advanced PE Piping System

Fusion Joining – Highest Integrity

Socket Fusion

Butt Fusion

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Advanced PE Piping System

Chem Proline® for Chemical Service

- Single and double wall piping
- Leak detection
- Valves: PVC, CPVC, PP, PVDF & ECTFE
- Socket, butt and electrofusion joining
- NSF/ANSI 61-G
- UV protection
Advanced PE Piping System

Chemical Feed Applications

- Many Compatible Chemicals
- pH range from 1 - 14
- Chlorine gas - No
- Ozone - No
- Chlorine dioxide - No
- Sulfuric acid – No
- Resistance Chart
- References

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Chem Proline - 25% Sodium Hypochlorite

- Chlor-Alkali Plant US
- PVC-FKM Flanged Ball Valves
- Chemproline Pipes
Advanced PE Piping System

Installed Costs

- PVC/CPVC
- Chem Proline®
- LS
- Titanium
- HALAR®

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Polypropylene - Pro Line PP-R

- Pro 150 (150 psi)
- Pro 45 (45 psi)
- Pro Vent
- DuoPro, PolyFlo PP D/C
- BV, BFV, Dia. Valves, Check Valves

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PVDF - Super Proline

- 230 psi & 150 psi
- Vent Grade
- BV, BFV, Dia. Vlvs., Check Valves
- DuoPro D/C
E-CTFE - Halar Ultra Proline

- 150 psi
- Butt Fusion Only
- Ball Valves
- Duo Pro D/C
Air Pro - PE100 Compressed Air/Gas

- 230 psi
- Socket & Butt Fusion
- Ball Valves
Pro Vent - PE, PP, PVDF

- PE100 - 3" - 48"
- PP-R - 2" - 48"
- PVDF - 2" - 16"
- Damper Valves
PolyFlo - PE & PP Co-Extruded D/C

- 150psi X 100psi
- 1” X 1 ½”, 2” X 3”, 4” X 6”
- Unitary Design

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DuoPro - PP, PVDF, E-CTFE D/C

- Many Configurations
- Pressure or Drainage
- Cable or Probe L/D
- Butt Fusion
Ti - Diaphragm Valve

• Specifically designed for processing chlorines and chlorates in chlor-alkali and caustic soda production plants.
• Superior corrosion protection is achieved by offering a palladium-titanium diaphragm insert that connects the diaphragm to the valve compressor via a palladium-titanium stem connection joint.
• Light weight and corrosion resistant titanium bolts, nuts, washers, studs and body inserts sandwich the diaphragm between the body and bonnet creating a reliable seal.
EL-PVDF Material

- To meet the latest customer requirements, Asahi/America has developed a new thermoplastic corrosion resistant valves in EL – PVDF Material.
- The purpose of the EL-PVDF material is to prevent the generation of blistering or cracking that can occur in conventional PVDF during electrolysis production.
- EL-PVDF has been designed to achieve 2-5 times the normal life expectancy when compared to conventional PVDF in electrolysis applications.
- Offering
  - Diaphragm Valves - ½" to 4".
  - Swing Check Valves - 2", 3" & 4".
EL-PVDF Diaphragm Valve

- Diaphragm valve for Aggressive Brine Service Applications.
- Constructed of EL-PVDF and EL-PTFE for the purpose of preventing the generation of blisters and stress cracks.
- The diaphragm and compressor inserts are made of Palladium Titanium to prevent environmental stress cracks.
- The new valve is designed specifically for Electrolysis plants and brine service applications with high-temp & high-pressure conditions.
EL-PVDF Swing Check Valve

- Swing Check valve for use in electrolysis plants in high temperature sodium hypochlorite, chlorine gas, brine, and hydrofluoric acid applications.
- Valves that are continually exposed to near maximum material working temperature limits for extended periods of time, especially in the production of chlorine, are the intended application target.
- Typical applications include, chlorine manufacturers, steel pickling lines, pulp and paper manufacturing, etc.
EL-PVDF Valves

Fail Condition Body
- Blister

Fail Condition Diaphragm
- Blister

Field Test EL-PVDF

Peeling off

Cracks
Chlor Alkali Applications

Thank You