Industrial Diaphragm Valves

CRANE

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www.cranecpe.com
Pioneers in Diaphragm Valve Technology

P. K. Saunders invented the original diaphragm valve in 1928. Since then, we have developed our range through innovative design by using the latest materials technology and our extensive Polymers technology knowhow. As a result, Saunders diaphragm valves have gained an excellent reputation for versatility and reliability establishing a presence in every process industry sector.

Today, Saunders® is an international leader in the design, development and manufacturing of diaphragm valves. As part of Crane Co, a diversified global manufacturer of engineered industrial products, Saunders has a strong worldwide presence via dedicated sales companies and distribution partners.

History of Innovation
Saunders® has led the way in the development of the diaphragm valve to meet the ever increasing demands of industrial applications. These innovations have included the introduction of:

- First PTFE diaphragms
- First supplier of glass and fluorocarbon linings
- First non-bonded PTFE diaphragm
- First compact pneumatic actuators
- First 3 layer diaphragm for corrosive-gas applications
- First modified PTFE diaphragm
- Introduction of the XA diaphragm (resistant to both chemical and abrasive attack)

A Continuing Story of Success

Millions in service
Saunders diaphragm valves are used in every process industry. Millions of Saunders diaphragm valves are currently installed in process plants around the world and they are renowned for versatility and reliability.

Dependable operation
Engineers know they can trust Saunders Valves. They set the industry standard for dependable, consistent operation, even in the most adverse conditions with years of trouble-free performance.

Customer Service
Customers know they can depend on Saunders for after sales service and technical support from one of our many locally based sales associates and distribution partners.

The Science Inside
Saunders proudly develops and manufactures its polymer compounds, with more than 80 years of polymer technology. It is “The Science Inside” our valves which sets us apart.

Global Compliance
Saunders diaphragm valves are fully compliant to all global standards.

Key Diaphragm Valve Features

1. Full closure even with solids present
2. Only two wetted parts
3. Wide range of linings and diaphragms to suit most applications

Key Diaphragm Valve Benefits

1. Leak tight* by design
2. Minimal maintenance
3. Better resistance to corrosion/abrasion and longer life

*in accordance with standards MSS SP-88 and BS EN 12266-1

www.cranecpe.com
DIAPHRAGM VALVES KEY PRODUCTS

Type A Weir Design For Corrosive Media & Utilities
- Versatile & extensively used in Industrial applications
- Weir type can handle up to 15% solids (depending on process conditions)
- Perfect valve for on off or control applications on corrosive applications

Type KB & K Straight Through design for solids handling
- Smooth, straight-through design.
- High flow capacity.
- High solids content (up to 100%)
- Highly abrasive fluids

WFB For Marine and Fire Applications
- Weir type valve for fire fighting, tank cleaning or wash down on land or sea
- Guaranteed operation even after years of being static
- Fire tested diaphragm*

NX Check Valve
- Low pressure and vacuum duties
- Unidirectional full flow design
- Corrosion resistant linings

Actuation - Modular or Compact Actuators
- Three different actuators types that cover up to DN250
- Wide range of line and operating pressure options
- Conceived to withstand the most adverse conditions

In-house Manufacture of All Diaphragms
- Vulcanized layers with high strength woven reinforcement in elastomer-based diaphragms
- Range of PTFE-type diaphragms for critical applications
- Innovative compounding based on extensive polymer knowledge

* The whole fire hydrant valve has successfully undergone a high temperature resistance test (540°C for 20 minutes), BS 5041 Part 1, audited by a Lloyds Surveyor

“We are pleased to inform that we are using Saunders in our Runcorn chlor-alkali and chlorine derivatives plants. We are very satisfied with the product’s reliability, low maintenance costs and with the quality of the technical service. We hope to get the same support in all our future supplies/requirements.”
- INEOS ChlorVinyls (UK)

“We specified Saunders WFB 65mm nominal bore fire-mains hydrant valves for our ferries and cruise liners. Significant factors behind this choice are the excellent reliability and the low maintenance costs.”
- P&O Cruise (UK) Ltd

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DIAPHRAGM VALVES WHY DIAPHRAGM VALVES?

1. Corrosion Resistance
Saunders lined valves are the first choice for corrosion resistance applications. We offer an extensive range of linings and diaphragms to suit most applications. This wide choice of body lining and diaphragm materials provides an effective and economical solution to your application by avoiding the use of exotic alloys. Our extensive range of valve options include elastomer and fluoropolymer linings, designed especially to combat corrosion.

2. Abrasion Resistance
Saunders polymer technology provides superior abrasion resistance. The KB straight through valve will handle up to 100% solids and with the use of a soft rubber diaphragm, will still give tight shut-off, in accordance with standards MSS SP-88 and BS EN 12266-1.

3. Leak Tight*
On pressure and vacuum services, Saunders diaphragm valves operate and close *100% leak tight, in accordance with standards MSS SP-88 and BS EN 12266-1, even after thousands of operations, reducing processing and handling costs, by eliminating emissions normally associated with other valve designs.

4. Operating mechanism not in contact with line media
All working parts of the valves are isolated from the line media and positive closure is obtained even on frequent cycling or with entrained particulates in the line unlike other valve types.

5. Easy Maintenance
Three part design allows maintenance and actuator retrofitting without removing the valve body from the pipeline. Overall this results in lower cost of ownership compared to other valve types.

6. Suitable for Control
Throttling and control characteristics are enhanced by a streamlined flow path that is cavity free and provides excellent flow control capabilities.

7. Cost Effective
The body remains in the pipeline during service and it takes only minutes to change a diaphragm, resulting in significant down time savings at site.

8. Valve usable in any Position Self Drain
The Saunders valve can be installed in any position without affecting its operation. However, we recommend installation to be at least 6 times the pipe diameter from bend or pump (10 times the pipe diameter if the valve is used for control).
Saunders offers a comprehensive range of diaphragm valves for any industry. They encompass the full spectrum of corrosive and abrasive applications that require reliable valve operation. Easily maintained to ensure many years of trouble free operations, Saunders diaphragm valves have become a standard in industries such as chemical production, mining, water treatment, fertilizers and marine to name a few.

*in accordance with standards MSS SP-88 and BS EN 12266-1

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**DIAPHRAGM VALVES COMPARISON**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Diaphragm</th>
<th>Ball</th>
<th>Butterfly</th>
<th>Globe</th>
<th>Gate</th>
<th>Lubricated Plug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leak tight* shut-off against gases, liquids and solids</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>Resistance to abrasion and erosion</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>Wide choice of materials to match service conditions</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Non-turbulent friction loss</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Low fluid friction loss</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>Resistance to corrosion</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Vacuum capability</td>
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<td><img src="#" alt="Yellow" /></td>
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<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Maintenance — in-line servicing, low cost spares</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>High purity</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
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<tr>
<td>Control applications</td>
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<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Red" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>On/off applications</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Red" /></td>
</tr>
<tr>
<td>Temperature range</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
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<tr>
<td>Pressure range</td>
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<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
<tr>
<td>Weight/size ratio</td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Yellow" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
<td><img src="#" alt="Green" /></td>
</tr>
</tbody>
</table>

* Suitable | ![Green](#) | ![Yellow](#) | ![Red](#) | Not Suitable |
Saunders lined diaphragm valves are the best option to handle these media.

Saunders KB valves are ideally designed for applications requiring a combination of corrosion and abrasion resistance, reliability and long service life.

The best solution for a wide range of water, air and gas applications.

**CORROSIVE**

- Chloro-Alkali
- Sulphuric Acid
- Hydrochloric Acid
- Nitric Acid
- Aromatics
- Effluent Treatment
- Potable Water
- Pulp and Paper
- Organics
- Toxic Fluids
- Iron and Steel
- Fine Chemicals

**ABRASIVE**

- Fertilizer
- Titanium Dioxide
- Phosphate
- Copper Mining
- Gold Mining
- Sand
- Coal Slurry
- FGD
- Cement
- Ceramics
- Sewage
- Sugar

**GENERAL APPLICATIONS**

- Water demineralization
- Marine
- Vegetable Oils
- Paints
- Fire Fighting
- Tanning
- Oil Production
- Automotive
- Gaseous effluents
- Fuels
- Food & Beverage
- Waste Water
- HVAC
- Compressed air and gases

<table>
<thead>
<tr>
<th>Type</th>
<th>Applications</th>
<th>Body/Lining</th>
<th>Diaphragm</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Strong Acids</td>
<td>ETFE, PVDF, PFA, Glass (1)</td>
<td>PTFE-based diaphragms</td>
</tr>
<tr>
<td>C</td>
<td>Fine Chemicals and Chlor-alkali</td>
<td>Wide range of Rubbers, Glass (2) or Plastic linings</td>
<td>Fluoroelastomer, Chlorosulphonated polyethylene or PTFE-based diaphragm</td>
</tr>
<tr>
<td>C/A</td>
<td>Mineral processing</td>
<td>Butyl, Soft rubber</td>
<td>Butyl, Natural rubber and the Ultimate XA (3)</td>
</tr>
<tr>
<td>C/A</td>
<td>Gypsum (FGD)</td>
<td>Butyl</td>
<td>Butyl &amp; Ultimate XA</td>
</tr>
<tr>
<td>C/A</td>
<td>Titanium dioxide</td>
<td>Glass, Butyl, Soft rubber</td>
<td>Butyl, Natural rubber</td>
</tr>
<tr>
<td>C/A</td>
<td>Fertilizers</td>
<td>Butyl, Polychloroprene</td>
<td>Butyl, Polychloroprene and The Ultimate XA (3)</td>
</tr>
<tr>
<td>C/A</td>
<td>Paper Pulp</td>
<td>Glass, Halar, Butyl</td>
<td>EPM, Butyl, Polychloroprene and the Ultimate XA (3)</td>
</tr>
<tr>
<td>A</td>
<td>China clay</td>
<td>Butyl, Soft rubber</td>
<td>Natural rubber, Polychloroprene</td>
</tr>
<tr>
<td>G</td>
<td>Water demineralization, desalination, and sewage treatments units</td>
<td>Hard rubber, soft rubber, Butyl</td>
<td>EPM, Butyl, Polychloroprene, Butadiene Acrylonitri-trile</td>
</tr>
<tr>
<td>G</td>
<td>Marine and fire fighting (4)</td>
<td>SG Iron and Gunmetal</td>
<td>Chlorosulphonated polyethylene (Kevlar reinforced)</td>
</tr>
<tr>
<td>G</td>
<td>HVAC and Utilities (Air, water and gas lines) (5)</td>
<td>Screwed/Flanged unlined valves in iron, stainless steel or gun metal</td>
<td>EPM, Butyl, Polychloroprene</td>
</tr>
</tbody>
</table>

C = Corrosive, A = Abrasive, G = General Applications

(1) Glass is not suitable for applications hydrofluoric acid and applications with high thermal amplitude or thermal cycling
(2) Chemical etching may occur when in contact with hydrofluoric acid and alkali. Please contact Saunders for precise recommendations.
(3) The Ultimate XA Diaphragm was specially developed for highly corrosive and abrasive applications.
(4) Used primarily as water hydrant valves.
(5) Used in copper or stainless steel piping in water, oxygen and other gases.
At Saunders we apply rigorous quality control measures at every manufacturing step of our polymer materials. For many years we have developed our expertise and accumulated experience in the production of our own diaphragms and valve linings. As a result, our valves can handle the most challenging fluids with total security. The name Saunders is synonymous with innovation, continuous product development and high standards of quality control.

Diaphragm Construction

- Appropriate choice of the finest raw materials and fabric reinforcements.
- Diaphragms constructed with multi-layers of rubber and reinforcement for maximum performance and durability.
- Studs attached with bonding adhesive and mechanical anchorage.
- Dual sealing ribs (across the weir and around the diaphragm periphery) for enhanced leak tight sealing capabilities and lower closure torque.
- Optimised thickness of diaphragms for superior flexing properties.

PTFE Diaphragm

Two-piece diaphragm construction - PTFE face, with reinforced rubber backing - to increase pressure rating and durability.
Saunders® Data Sheets

CDs are available for fast and accurate detailed information on the industrial valve range Saunders® has to offer. Contact your local sales office or distributor for details on how to order your CD.

The electronic data manual contains over 100 individual technical data sheets to assist you with the selection of the valve.

QUALITY STATEMENTS AND APPROVALS

CERTIFIED QUALITY FROM CRANE FLOW SOLUTIONS

- Quality Management system registered to ISO 9001 standard in which our R & D and manufacturing process are optimized to maintain our product quality and service.
- TÜV-Merkrblatt HPO Qualification for our product manufacturing and certification.
- International product approval from authorities such as Bureau Veritas, Lloyds.
- Polymer/Rubber materials certified as meeting the requirements of FDA, USP & WRAS.

QUALITY ASSURANCE APPROVALS

BS EN ISO 9001

TÜV AD-MERKBLATT HPO

TNO CERTIFICATION 3A cGMP USP 23

PRODUCT AND SYSTEM APPROVALS EXAMPLES

- ISO 9001
- PED 97/23/EC
- WRAS (Water Regulations Advisory Scheme)
- Lloyds Register of Shipping
- Bureau Veritas
- ATEX Directive (94/9/EC)
- Food & Drug Administration (FDA)
- United States Pharmacopeia (USP)
- Registro Italiano Navale (RINA)
DIAPHRAGM VALVES TYPE A (WEIR)

Original Saunders Design

- Hand wheel sized for comfortable grip and easy operation
- Lubricated for long life, and protected from dust, dirt, moisture and atmospheric contaminants
- Yellow valve indicator provides visual indication of the position of the valve
- Compressor provides support to the diaphragm in all positions, improving the life of the diaphragm
- Reinforced diaphragms give long life and leak free operation
- Different lining options available to handle all kind of fluids
- Wide range of body materials available
- Diaphragm replaceable with valve inline
- Paint finish resists environmental attack
- Wide choice of diaphragm materials which isolates all bonnet working parts from the line fluid
- Screwed, Flanged or Welded end connections to various international standards

Saunders A type: the valve of choice to handle highly corrosive media
## Glass Lining

**Used in many different applications, including strong acids or alkali. Very high corrosion and abrasion resistance within a wide range of temperature. Note that glass is not suitable for applications where thermal cycling occurs. (Blue colour)**

### Corrosion & Chemical Resistance

**Graph showing the comparison of different linings in terms of corrosion and chemical resistance.**

### Abrasion Resistance

**Graph showing the abrasion resistance of different linings.**

- **PFA** - Perfluoroalkoxy
- **ETFE** - Ethylene Tetrafluoroethylene
- **PP** - Polypropylene
- **PVDF** - Polyvinylidene Fluoride
- **HRL** - Hard Rubber (Ebonite)
- **Butyl** - Isobutylene Isoprene
- **Soft Rubber** - Polyisoprene (Natural Rubber)

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### Plastic Lining

- **PFA** - Perfluoroalkoxy - Excellent suitability for concentrated strong acids at high temperature, aromatics, aliphatic and chlorinated solvents. (White colour)
- **ETFE** - Ethylene Tetrafluoroethylene - Suitable for strong acids, salts in water, solvents at medium temperature. ETFE has the highest abrasion resistance of all the Fluorocarbon linings. (Red colour)
- **PP** - Polypropylene - Economic solution for mineral acids, salts in water, water and effluent treatment chemicals. (Light grey colour)
- **PVDF** - Polyvinylidene Fluoride - Suitable for mineral acids, salts in water, water and effluent treatment, additionally it is the best solution for Chlorine gas wet or in water. (Black colour)

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### Rubber Lining

- **HRL** - Hard Rubber (Ebonite) - Used for salts in water, dilute acids, de-ionised water, plating solutions and potable water. HRL has better chemical resistance than SRL. (Black colour)
- **Butyl** - Isobutylene Isoprene - Great for corrosion & abrasion slurries, and acidic slurries. Additional applications are salts in water, diluted acids and alkali and lime. (Black colour)
- **Polychloroprene** - Polyisoprene - Perfect solution for a combination of abrasive slurries containing hydrocarbons, sludge oils and also seawater. (Black colour)
- **Soft Rubber** - Polyisoprene (Natural Rubber) - High abrasion resistance on powders, abrasive slurries, clays, coal dust, dry fertilizers, gypsum, as well as titanium dioxide and sewage. (Red colour)

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### Lined Options – Flanged only

<table>
<thead>
<tr>
<th>Lining</th>
<th>Body Material</th>
<th>Size</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFA*</td>
<td>SG Iron</td>
<td>(1/2” - 6”) (DN15-DN150)</td>
<td>-10°C to 175°C</td>
</tr>
<tr>
<td>ETFE*</td>
<td>SG Iron</td>
<td>(1/2” - 6”) (DN15-DN150)</td>
<td>-10°C to 175°C</td>
</tr>
<tr>
<td>PVDF*</td>
<td>SG Iron</td>
<td>(3/4” - 6”) (DN20-DN150)</td>
<td>-10°C to 130°C</td>
</tr>
<tr>
<td>PP*</td>
<td>SG Iron</td>
<td>(3/4” - 6”) (DN20-DN150)</td>
<td>-10°C to 85°C</td>
</tr>
<tr>
<td>Isobutylene Isoprene (Butyl)</td>
<td>Cast Iron</td>
<td>(3/4” - 14”) (DN20-DN350)</td>
<td>-10°C to 110°C</td>
</tr>
<tr>
<td>Polyethylene Isoprene (Butyl)</td>
<td>Cast Steel</td>
<td>(3/4” - 14”) (DN20-DN350)</td>
<td>-10°C to 110°C</td>
</tr>
<tr>
<td>Polyethylene Isoprene (Butyl)</td>
<td>SG Iron*</td>
<td>(3/4” - 14”) (DN20-DN350)</td>
<td>-10°C to 110°C</td>
</tr>
<tr>
<td>Hard Rubber (Ebonite)</td>
<td>Cast Iron</td>
<td>(3/4” - 14”) (DN20-DN350)</td>
<td>-10°C to 110°C</td>
</tr>
<tr>
<td>Hard Rubber (Ebonite)</td>
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<tr>
<td>Soft Rubber</td>
<td>Cast Iron</td>
<td>(3/4” - 14”) (DN20-DN350)</td>
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<td>SG Iron*</td>
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<td>-10°C to 110°C</td>
</tr>
</tbody>
</table>

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### Notes

- **Lower temperature limit is dependant on body substrate material.**
- **Glass is not suitable for applications where thermal cycling occurs.**

Note: For size and standards of the different combinations, please contact Saunders.
How to identify your diaphragm

Manufacturing information

In the range of PTFE diaphragms, Saunders offers both moulded open and closed (214S/425) and moulded open (214/425) for your convenience. Moulded closed 214S has been specifically designed to reduce polymeric creep, increasing the sealing properties and life of the diaphragm.

PTFE Diaphragm

214/300 - Used in strong acids and alkali, salts in water at high temperature. Sulphuric acid is a good example with temperatures up to 110°C and concentrations up to 96%.

214/425 - Typical applications are strong acids. Alkalis and salts in water at high temperature. Constant steam is also another important application.

214/226 - Strong acid, diluted chlorine, bromine solutions at low concentration.

214S/425 - Strong acids, alkalis and salts in water at high temperature. Constant steam applications where the valve is mainly closed (diaphragm is moulded closed).

214K/425 - Three layer diaphragm with PTFE/PVDF/245, the best option for Chlorine, bromine gas and Chlorinated solutions.

214/300 - Used in strong acids and alkali, salts in water at high temperature. Sulphuric acid is a good example with temperatures up to 110°C and concentrations up to 96%.

214/425 - Typical applications are strong acids. Alkalis and salts in water at high temperature. Constant steam is also another important application.

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214K/425 - Three layer diaphragm with PTFE/PVDF/245, the best option for Chlorine, bromine gas and Chlorinated solutions.

Rubber Diaphragm

425 - Salts in water, acids and alkalis, ozone, water, intermittent steam. Great solution for food and beverages applications. FDA and USP approved(1).

300 - Chemicals, diluted acids and alkalis, drinking water. Additional abrasive applications like phosphoric acid with low concentration. FDA, USP and WRAS approved(1).

226 - Great solution for hydrogen at high temperature, concentrated acids, aromatics solvents, low concentrated chlorine solutions, ozone, unleaded petroleum.

C & CV - Lubricating oil, cutting oils, paraffin, animal vegetable oils, aviation’s kerosene at low temperatures. CV is ideal for Vacuum applications, where oils are present, (compressed air, acetylene gas, LPG).

Q - Salts in water, diluted acids and alkalis and abrasive applications.

HT - Suitable for abrasive slurries containing hydrocarbons.

226 - Great solution for hydrogen at high temperature, concentrated acids, aromatics solvents, low concentrated chlorine solutions, ozone, unleaded petroleum.

C & CV - Lubricating oil, cutting oils, paraffin, animal vegetable oils, aviation’s kerosene at low temperatures. CV is ideal for Vacuum applications, where oils are present, (compressed air, acetylene gas, LPG).

Q - Salts in water, diluted acids and alkalis and abrasive applications.

1) FDA - Food & Drug Association

USP - United States Pharmacopeia

WRAS – Water Regulations Advisory Scheme

All rubber diaphragms have threaded brass fixings, except vacuum diaphragm (Cv, 300v), which have steel fixings. PTFE diaphragms have a stainless steel bayonet fixings.
**DIAPHRAGM VALVES TYPE A TOP WORKS**

### Top Works

#### Standard Range

- **Rising Handwheel**
  - Valves: DN8 to DN10 (1/4" to 3/8")
- **Cast iron bonnet with rising plastic handwheel**
  - Valves: DN15 to DN50 (1/2" to 2")
- **Cast iron bonnet with rising metal handwheel**
  - Valves: DN15 to DN150 (1/2" to 6")
- **Rising Handwheel with indicator (simple padlocking)**
  - Valves: DN15 to DN150 (1/2" to 6")
- **Standard Non-Rising Handwheel without indicator**
  - Valves: DN200 to DN150 (8" to 14")
- **Non-Rising Handwheel with indicator**
  - Valves: DN200 to DN150 (8" to 14")

#### High Performance

- **Fluoroelastomer sealed padlocking**
  - Valves: DN15 to DN150 (1/2" to 6")
- **Fluoroelastomer sealed bonnet**
  - Valves: DN15 to DN150 (1/2" to 6")

#### Saunders Actuation

- **EC actuators (spring close/spring open/double acting)**
  - Valve sizes: DN8 to DN50 (1/4" to 2")
- **ECX actuators (spring close/spring open/double acting)**
  - Valve sizes: DN65 to DN150 (2 1/2" to 6")
- **ESM/ES actuators (spring close/spring open/double acting)**
  - Valve sizes: DN15 to DN250 (1/2" to 10")

Note: Designs may vary across size range

For more details in actuation see pages 17-20

### Manual Valves Working Pressure & Temperature

Maximum manual working pressures for A Type Saunders Diaphragm valves. For actuated valves, please refer to the appropriate datasheets.

<table>
<thead>
<tr>
<th>Size (DN)</th>
<th>Pressure (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rubber (bar)</td>
</tr>
<tr>
<td></td>
<td>PTFE (bar)</td>
</tr>
<tr>
<td></td>
<td>Rising handwheel</td>
</tr>
<tr>
<td></td>
<td>Non-Rising handwheel</td>
</tr>
<tr>
<td></td>
<td>Rising handwheel</td>
</tr>
<tr>
<td></td>
<td>Non-Rising handwheel</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>20</td>
<td>16</td>
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<tr>
<td>25</td>
<td>16</td>
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<tr>
<td>32</td>
<td>16</td>
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<tr>
<td>40</td>
<td>16</td>
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<tr>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>80</td>
<td>10</td>
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<tr>
<td>100</td>
<td>10</td>
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<tr>
<td>125</td>
<td>10</td>
</tr>
<tr>
<td>150</td>
<td>10</td>
</tr>
<tr>
<td>175</td>
<td>10</td>
</tr>
<tr>
<td>200</td>
<td>6</td>
</tr>
<tr>
<td>215</td>
<td>5</td>
</tr>
<tr>
<td>250</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td></td>
</tr>
<tr>
<td>350</td>
<td></td>
</tr>
</tbody>
</table>

Note: For temperature rating, please refer to adjacent graphs.

All Saunders valves are pressure tested in accordance with BS EN12266-1 standard.

- Shell test: 1.5 times max rating working pressure
- Seat test: 1.1 times max rating working pressure

* When lined body is cast steel, minimum temperature is -22F-30°C.
* ** When Del Grade EN-GJS-400-18-LT is used, minimum temperature is -4F-20°C.
** Depends on body substrate material.
† 2145 Moulded closed version only.
Saunders KB Design

Hand wheel sized for comfortable grip and easy operation

Lubricated for long life, and protected from dust, dirt and atmospheric contaminants

Double Threaded stem reduces handwheel turns

Diaphragm replaceable with valve in line

Paint finish resists environmental attack

Resilient diaphragm handles abrasives and suspended particles in the line, but still provides positive shut-off and isolates all bonnet working parts from the line fluid

Reinforced diaphragms give long life and leak-free operation

Yellow valve indicator provides visual indication on the position of the valve

smooth non-turbulent body design for unrestricted flow and minimum pressure drop

Body lining including glass and a wide range of elastomers

Screwed and flanged options in a wide range of body materials

Saunders type K & KB high flow valves: the choice for corrosive slurry applications
Saunders full bore KB type diaphragm valves, with their smooth non-turbulent body design, have proven to be outstanding in resisting the erosion effect of abrasive media, providing low pressure drop and high flow characteristics. The flexible diaphragms ensure consistent leak tightness even when solids, powders and dry media are present. The wide range of lining materials make the valve suitable for many corrosive/abrasive applications (up to a maximum pressure of 10 bar.)

### Unlined Options

<table>
<thead>
<tr>
<th>Material</th>
<th>Connection</th>
<th>Standard</th>
<th>Size</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast Iron</td>
<td>Screwed</td>
<td>BS EN1561 GJL-250</td>
<td>(1/2’’ - 2’’) (DN15-DN50)</td>
<td>-10°C to 120°C</td>
</tr>
<tr>
<td></td>
<td>Flanged</td>
<td></td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td></td>
</tr>
<tr>
<td>SG Iron</td>
<td>Screwed</td>
<td>BS EN1563 GJL-450-10</td>
<td>(1/4’’ - 2’’) (DN8-DN50)</td>
<td>-10°C to 175°C</td>
</tr>
<tr>
<td></td>
<td>Flanged</td>
<td>BS EN1563 GJL-400-18</td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td></td>
</tr>
<tr>
<td>Gun Metal</td>
<td>Screwed</td>
<td>BS EN1982 CC491K-GS</td>
<td>(1/2’’ - 2’’) (DN15-DN50)</td>
<td>30°C to 120°C</td>
</tr>
<tr>
<td></td>
<td>Flanged</td>
<td>BS EN1982 CC492K-GS</td>
<td>(1/2’’ - 4’’) (DN15-DN100)</td>
<td></td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>Flanged</td>
<td>BS EN10283 1.4408(1)</td>
<td>(1/2’’ - 10’’) (DN15-DN250)</td>
<td>-30°C to 120°C</td>
</tr>
</tbody>
</table>

(1) Replaces the standard BS3100 316C16
(2) For some SG Iron grade (eg.GJS-400-18-LT), the lower temperature limit of -20°C. For more information on different materials, please contact Saunders.

### Lining Options – Flanged only

<table>
<thead>
<tr>
<th>Lining</th>
<th>Body Material</th>
<th>Size</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass**</td>
<td>Cast Iron</td>
<td>(1/2’’ - 8’’) (DN15-DN200)</td>
<td>-10°C to 120°C</td>
</tr>
<tr>
<td>Isobutylene Isoprene (Butyl)</td>
<td>Cast Iron</td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td>-10°C to 110°C</td>
</tr>
<tr>
<td>Isoprene (Butyl)</td>
<td>SG Iron*</td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td>-10°C to 105°C</td>
</tr>
<tr>
<td>Polychloroprene</td>
<td>Cast Iron</td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td>-10°C to 105°C</td>
</tr>
<tr>
<td>Hard Rubber (Ebonite)</td>
<td>Cast Iron</td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td>-10°C to 85°C</td>
</tr>
<tr>
<td>Soft Rubber (Natural Rubber)</td>
<td>Cast Iron</td>
<td>(1/2’’ - 14’’) (DN15-DN350)</td>
<td>-10°C to 85°C</td>
</tr>
<tr>
<td></td>
<td>SG Iron*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Lower temperature limit is dependant on body substrate material.**
** Glass is not suitable for applications where thermal cycling occurs.

---

**Glass Lining**

Used in many different applications, including strong acids, salts and halogenated gases. Superior corrosion and abrasion resistance within a wide range of temperatures and concentrations. (Blue colour)

**Rubber Lining**

**Butyl Isobutylene Isoprene** — Great for corrosive & abrasive slurries, and acidic slurries. Additional applications are salts in water, diluted acids and alkali and lime; (Black colour). WRAS Approved.

**Polychloroprene** — Perfect solution for a combination of abrasive slurries containing hydrocarbons, sludge oils and also sea water. (Black colour)

**Soft Rubber Polyisoprene** — High abrasion resistance on powders, abrasive slurries, clays, coal dust, dry fertilizers, gypsum, as well as titanium dioxide and sewage. (Brown colour)

The temperature ranges above are given for general reference purposes only. Service conditions, such as media being handled and concentration of solids will determine the highest possible working temperature. Additionally, the performance of the valve will also depend on the diaphragm material. Lining thickness depends on lining and size. Please contact us for full availability details.
Diaphragm

Many factors can accelerate the ageing effects of polymer compounds. Temperature and abrasion have a significant impact on the effect of chemicals on rubber compounds. At Saunders we are proud of our core competence, the in-house manufacture of Saunders diaphragms. Our know-how in polymer science assures the best range of diaphragms to suit the most challenging duties with total security. This explains why Saunders diaphragms are a synonym of longer life, reduced maintenance and higher plant operating efficiencies.

How to identify your diaphragm

Manufacturing information

Fluoroelastomer

226 - Great solution for hydrogen at high temperature, concentrated acids, aromatics solvents, low concentrated chlorine solutions, ozone, unleaded petroleum.

300 - Chemicals, diluted acids and alkalis, drinking water. Additional abrasive applications like phosphoric acid with low concentration. FDA, USP and WRAS approved(1).

HT - Suitable for abrasive slurries containing hydrocarbons.

425 - Salts in water, acids and alkalis, ozone, water, intermittent steam. Great solution for on food and beverages applications. FDA and USP approved(1).

Rubber Diaphragm

237 - The best solution for sodium hypochlorite. Great with strong acids and low concentration chlorine gas. It is also oil resistant.

XA - Specifically design for both abrasive and corrosive application such as phosphoric acid, metal treatment and mining applications.

C - Lubricating oil, cutting oils, paraffin, animal vegetable oils and aviation kerosene at low temperatures.

AA - Excellent choice on abrasive applications such as slurries or dry powders. The diaphragm has a light brown colour, and is sulphur cured.

Energising ribs allow efficient shut-off in wide-bore applications

Type KB/K Diaphragm

<table>
<thead>
<tr>
<th>Diaphragm</th>
<th>Composition</th>
<th>Size</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>226</td>
<td>Fluoroelastomer</td>
<td>1/2&quot; to 12&quot;</td>
<td>-5°C to 120°C</td>
</tr>
<tr>
<td>425</td>
<td>Ethylene Propylene (EPM)</td>
<td>All Sizes</td>
<td>-40°C to 100°C</td>
</tr>
<tr>
<td>AA</td>
<td>Natural Rubber (Polyisoprene)</td>
<td>All Sizes</td>
<td>-40°C to 90°C</td>
</tr>
<tr>
<td>HT</td>
<td>Polychloroprene</td>
<td>All Sizes</td>
<td>-20°C to 90°C</td>
</tr>
<tr>
<td>237</td>
<td>Chlorosulphonated Polyethylene</td>
<td>All Sizes</td>
<td>-10°C to 100°C</td>
</tr>
<tr>
<td>300</td>
<td>Isobutylene Isoprene</td>
<td>All Sizes</td>
<td>-20°C to 100°C</td>
</tr>
<tr>
<td>C</td>
<td>Butadiene Acrylonitrile</td>
<td>All Sizes</td>
<td>-10°C to 90°C</td>
</tr>
<tr>
<td>XA</td>
<td>Ethylene Propylene Diene (EPDM)</td>
<td>All Sizes</td>
<td>-40°C to 100°C</td>
</tr>
</tbody>
</table>

1) FDA - Food & Drug Association  USP - United States Pharmacopeia

WRAS – Water Regulations Advisory Scheme
DIAPHRAGM VALVES TYPE KB/K TOP WORKS

Top Works

Standard Range

Standard Plastic Rising Handwheel with indicator
Valves sizes: DN15 to DN50
(1/2" to 2")

Metal Rising Handwheel with indicator
Valves sizes: DN15 to DN150
(1/2" to 2")

Standard Non-Rising Handwheel without indicator
Valves sizes: DN200 to DN350
(8" to 14")

Non-Rising Handwheel with indicator
Valves sizes: DN200 to DN350
(8" to 14")

High Performance

Non-Rising Handwheel (fluoroelastomer sealed)
Valves sizes: DN15 to DN300
(1/2" to 12")

Rising Handwheel with indicator (simple padlocking)
Valves sizes: DN15 to DN150
(1/2" to 2")

Saunders Actuation

ESM/ES actuators (spring close/spring open/double acting)
Valves sizes DN15 to DN250
(1/2" to 10")

Manual Valves Working Pressure & Temperature

Maximum manual working pressures for KB Type Saunders Diaphragm valve. For ES actuators, please refer to appropriate actuator performance selection technical data sheets.

<table>
<thead>
<tr>
<th>Size (DN)</th>
<th>Pressure (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rising handwheel</td>
</tr>
<tr>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
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<tr>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>125</td>
<td>6</td>
</tr>
<tr>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>200</td>
<td>-</td>
</tr>
<tr>
<td>250</td>
<td>-</td>
</tr>
<tr>
<td>300</td>
<td>-</td>
</tr>
<tr>
<td>350</td>
<td>-</td>
</tr>
</tbody>
</table>

All Saunders valves are pressure tested in accordance with BS EN12266-1 standard.
- Shell test: 1.5 times max rating working pressure
- Seat test: 1.1 times max rating working pressure

KB Valve Body Temperature/Pressure Relationship*

For K-Type valves, refer to one size larger KB valve.
DIAPHRAGM VALVES ACTUATION

Original Saunders ES Modular Design

Wide range of actuators that provide reliable remote control.
Saunders Actuators - Model Range and Options

When manual operation is inadequate or inconvenient, Saunders offer a variety of actuators covering valve sizes up to DN250, for different line and operating pressure options. We offer three different actuators, designed for various characteristic performances.

<table>
<thead>
<tr>
<th>DN8</th>
<th>DN15</th>
<th>DN50</th>
<th>DN65</th>
<th>DN150</th>
<th>DN200</th>
<th>DN250</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼&quot;</td>
<td>½&quot;</td>
<td>2&quot;</td>
<td>2½&quot;</td>
<td>6&quot;</td>
<td>8&quot;</td>
<td>10&quot;</td>
</tr>
</tbody>
</table>

**ESM actuator** (A & KB type)  
SC – SO – DA

**ES actuator** (A & KB type)  
SC - SO - DA

**ECX actuator** (A type only)  
SC – SO – DA

**EC actuator** (A type only)  
SC – SO – DA

(1) Modular design not available for DN32 (1 1/4") actuators.
(2) Modular design not available for sizes above DN150 (6”)

---

### Modes of Operation

<table>
<thead>
<tr>
<th></th>
<th>Failsafe Closing</th>
<th>Failsafe Opening</th>
<th>Double Acting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failsafe closing</td>
<td>Failsafe opening</td>
<td>Operating pressure opens and closes the valve.</td>
<td></td>
</tr>
<tr>
<td>Failsafe opening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal Use:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When valve is usually in the closed position (to avoid using a constant supply of operating pressure).</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

### Key Features ES Modular Actuator

1. Modular design for flexibility
2. Adjustable spring tension to optimize closure force and maximizes diaphragm life
3. Full range of accessories
4. Light weight Silicon Aluminium housings
5. Polyester coating for environmental protection

### Key Features EC Actuator

1. Compact piston style actuators
2. Versatile and robust design
3. Composite material
4. Temperature range of -10° to 100°C ambient (autoclave maximum 150°C)
5. Spring packs to suit pressure requirements.

### Key Features ECX Actuator

1. Compact extension to the EC size range
2. Comprehensive spring packs for a wide range of pressure
3. Full range of accessories
4. Light weight Silicon Aluminium housings
5. Polyester coating for environmental protection
# Diaphragm Valves Accessories & Fittings

## Saunders Actuators - Materials & Accessories

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>Model</th>
<th>Size Range</th>
<th>Valve type</th>
<th>Material</th>
<th>Solenoid</th>
<th>Switchbox</th>
<th>Positioner</th>
<th>Air Filter</th>
<th>Handwheel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ES</td>
<td>DN15-DN250</td>
<td>A, KB</td>
<td>SiAl&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/2” - 10”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EC</td>
<td>DN8-DN50</td>
<td>A</td>
<td>PES&lt;sup&gt;(2)&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/4” - 2”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECX</td>
<td>DN65-DN150</td>
<td>A</td>
<td>SiAl&lt;sup&gt;(1)&lt;/sup&gt;</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 1/2” - 6”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>(1)</sup>SiAl – Silicon-Aluminium  
<sup>(2)</sup>PES – polyethersulphone  
✓ Available  
✗ Unavailable

## 007 Switchbox
Modular switch-boxes are available for the ES Modular actuator range. Offering a wide range of both mechanical and proximity switches as well as other options, i.e. ASi-interface.

## Opti-SET
- Self setting. Minimize validation/set-up time.  
- Remote, open/closed indication.  
- Economical, compact, lightweight design.  
- Allows for compression/set of the diaphragm.  
- Easy access, even at difficult angles.  
- Available with mechanical or proximity switches, including safety options.

## Saunders® I-VUE
The Saunders® I-VUE is a compact intelligent valve sensor that provides accurate and reliable valve position feedback. It is suitable for EC or ECX actuated valves. Key **Features and Benefits:**
- Available as Point-to-Point or with network capabilities (ASI & DeviceNet)  
- Highly accurate electronic sensing technology to continuously monitor valve position.  
- Self Setting (without entry) feature that facilitates setting and programming of switch without opening the enclosure.

## ES Positioner
Provides precise control of the flow through the valve. This long life corrosion resistant range suits a wide variety of applications with reliability and accuracy. Available as pneumatic electro-pneumatic intrinsically safe and explosion proof, together with a variety of feedback options. A digital option is also available.

## Mini Positioner
For control application on the EC actuated valve, Saunders offers both pneumatic, electropneumatic and digital inputs with sensor feedback option and linear mounting design providing a compact control solution.

## MODULE Switchbox
This module switchbox option is available for EC & ECX actuator ranges. The switchbox offers a wide range of mechanical and proximity sensors with space for up to 4 switches, integral solenoid valve & ASi interface*.  
*ASi Interface can be retrofitted.

## Solenoid valves
A wide range of locally mounted banjo solenoid valves can be fitted to the Saunders actuator range with a manual override option and various hazardous area classifications. The solenoid range is designed to cover all requirements.

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Other control options available upon request.  
Please, contact Saunders for more information