Saunders®
the science inside

brands you trust.






Industrial Diaphragm Valves

CRANE®
Crane ChemPharma & Energy

www.cranecpe.com

OVERVIEW

Pioneers in Diaphragm Valve Technology

Since P.K. Saunders invented the original diaphragm valve in 1928, Saunders® has led the way in providing solutions to industries where flawless operation and resistance to corrosion, abrasion and contamination are imperative. Simplicity of design coupled with more than 85 years of innovation has resulted in the Saunders® diaphragm valve's ability to handle a wider range of fluids than any other valve type. 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 manufacture 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:

- PTFE and modified PTFE diaphragms
- Glass and fluorocarbon linings
- Non-bonded PTFE diaphragm
- Compact pneumatic actuators
- Three layer diaphragm for corrosive-gas applications
- 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

Backed by more than 80 years of experience in polymer technology, Saunders® proudly develops and manufactures its own polymer compounds. It is "The Science Inside™" our valves which sets us apart.

Global Compliance

Saunders® diaphragm valves are fully compliant to all relevant global standards.

Key Diaphragm Valve Features

1. **The Science Inside®:** Proprietary diaphragm technology provides unique sealing solution and complete emissions control.
2. **Unmatched Expertise & Innovation:** Comprehensive selection of polymers delivers superior corrosion and abrasion resistance for a wide range of demanding applications, since 1928.
3. **Efficient Operation:** Top entry design enables in-line maintenance capability to reduce plant down-time.

KEY PRODUCTS

"A Type" Weir Design for Corrosive Media and Utilities

- Versatile and extensively used in industrial applications
- Can handle up to 15% solids (depending on process conditions)
- Perfect valve for on/off or control applications on corrosive processes

KB and K Type Straight Through Designs for Solids Handling

- Smooth, straight-through design
- High flow capacity
- Can handle highly abrasive fluids with up to 100% solids content

"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)

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

"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 Cruises (UK) Ltd

Actuation - Modular or Compact Actuators

- Different actuator types that cover DN008 (¼") to DN250 (10")
- 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

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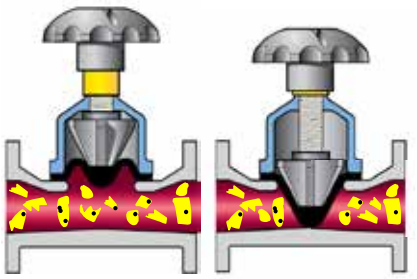
WHY DIAPHRAGM VALVES?

❶ Corrosion Resistance

Saunders® lined valves are the first choice for highly corrosive applications. We offer an extensive range of linings and diaphragms to suit most applications. This wide selection of body lining and diaphragm materials provides an effective and economical solution by eliminating the need for exotic alloys. Our extensive range of valve options include elastomer and fluoropolymer linings, designed especially to combat corrosion.

❷ Abrasion Resistance

Saunders® polymer technology provides superior abrasion resistance. The KB straight through valve will handle up to 100% solids and ensure leak-free shut off with a soft rubber diaphragm.

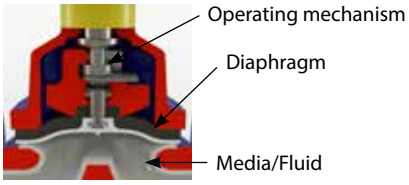


❸ Leak Tight

In pressure and vacuum services, Saunders® diaphragm valves deliver 100% leak-tight shutoff in accordance with standards MSS SP-88 and BS EN 12266-1, even after thousands of operations. This reduces processing and handling costs by eliminating emissions commonly associated with other valve designs.

❹ Operating Mechanism Isolated from 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.



❺ Easy Maintenance

A 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.

❻ Suitable for Control

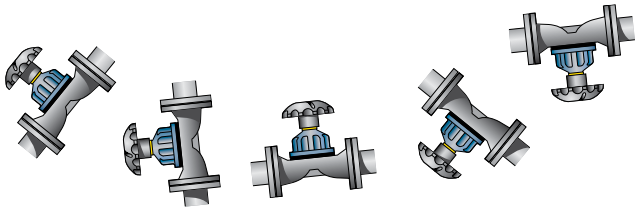
Throttling and control characteristics are enhanced by a streamlined flow path that is cavity free and provides excellent flow control capabilities.

❼ Linear Operation

Linear movement of the valve eliminates the rotational seat wear that is characteristic of quarter-turn valves, resulting in a longer service life and reduced total cost of ownership. This results in a longer service lifetime.

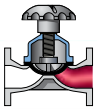
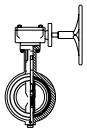
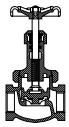
❽ Installation Versatility

The Saunders® valve can be installed in any position without affecting its operation. However, we recommend installation to be at least six times the pipe diameter from a bend or pump (ten times the pipe diameter if the valve is used for control).



Links to animations depicting the concepts discussed here are available on the Saunders® section of the Crane ChemPharma & Energy website.

VALVE COMPARISON

Valve/Service Feature	 Diaphragm	 Ball	 Butterfly	 Globe	 Gate	 Lubricated Plug
Leak tight* shut-off against gases, liquids and solids						
Resistance to abrasion and erosion						
Wide choice of materials to match service conditions						
Non-turbulent flow path						
Low fluid friction loss						
Resistance to corrosion						
Vacuum capability						
In-line maintenance, low cost spares						
Resistance to seat wear						
High purity						
Control applications						
On/off applications						
Temperature range						
Pressure range						
Weight/size ratio						

Suitable **Not Suitable**

Saunders® offers a comprehensive range of diaphragm valves for use in 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.

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

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APPLICATIONS

CORROSIVE

Corrosion is estimated to cost worldwide industry more than 300 billion dollars every year. Saunders® lined diaphragm valves are the best option to handle these media.

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

ABRASIVE

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

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

GENERAL INDUSTRY

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

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

Type	Applications	Body/Lining	Diaphragm
C	Strong Acids	ETFE, PVDF, PFA, Glass[1]	PTFE
C	Fine Chemicals and Chlor-alkali	Glass[1], Wide range of rubbers and plastic linings	Fluoroelastomer, Chlorosulfonated polyethylene, PTFE
C / A	Mineral processing	Butyl, Soft rubber	Butyl, Natural rubber and the Ultimate XA[2]
C / A	Gypsum (FGD)	Butyl	Butyl, Ultimate XA[2]
C / A	Titanium dioxide	Glass, Butyl, Soft rubber	Butyl, Natural rubber
C / A	Fertilizers	Butyl, Polychloroprene	Butyl, Polychloroprene, Ultimate XA[2]
C / A	Pulp & Paper	Glass, Halar, Butyl	EPM, Butyl, Polychloroprene, Ultimate XA[3]
A	China clay	Butyl, Soft rubber	Natural rubber, Polychloroprene
G	Water demineralization, desalination, & sewage treatment	Hard rubber, Soft rubber, Butyl	EPM, Butyl, Polychloroprene, Butadiene Acrylonitrile
G	Marine, fire fighting[3]	SG Iron, Gunmetal	Chlorosulfonated polyethylene (fabric reinforced)
G	HVAC, utilities (air, water and gas lines)[4], drinking water	Screwed/Flanged unlined valves in iron, stainless steel or gunmetal	EPM, Butyl, Polychloroprene

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

[1] Glass is not suitable for applications with thermal cycling. Chemical etching may occur when in contact with hydrofluoric acid or highly concentrated alkali solutions. Please contact Saunders® for precise recommendations.
[2] The Ultimate XA Diaphragm was specially developed for highly corrosive and abrasive applications.
[3] Used primarily as water hydrant valves.
[4] Used in copper or stainless steel piping in water, oxygen and other gases.

POLYMER SCIENCE

At Saunders®, we apply rigorous quality control measures at every manufacturing step of our polymer materials. For many years, we have increased 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 the highest standards of quality control.

A type, butyl rubber diaphragm

PTFE diaphragm
with butyl rubber backing

KB type, soft natural rubber diaphragm

214K diaphragm for high performance in chlorine applications

Fitments Features

Rubber diaphragms Screw fitment

PTFE diaphragms Bayonet fitment

BEST MATERIALS — STRINGENT QUALITY CONTROLS — RELIABILITY, LONG LIFE AND SIMPLIFIED MAINTENANCE

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.

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SUPPORTING DATA AND CERTIFICATIONS

Saunders® Data Sheets

Digital copies of technical data sheets, which provide detailed information on the Saunders® IDV range, can assist with valve selection and are available upon request.

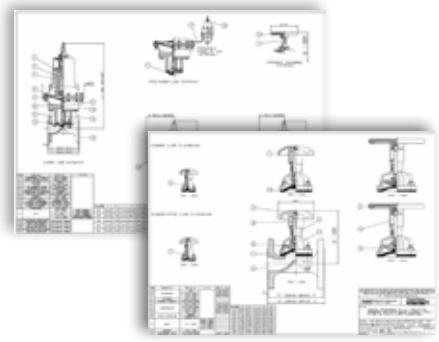
Contact your local sales office or distributor for more details on how to obtain the data sheet package.

Material Compatibility Database

Saunders® has a database of over 800 chemicals, which can be used to aid lining and diaphragm material selection.

By selecting the process fluid, temperature and concentration, the suitable material options are identified.

Data sheet index and typical valve information



Example of 2D Drawings available on Saunders® website.

Screenshot of Saunders® Material Compatibility Database

Saunders® 2D Drawings

A library containing technical drawings of the Saunders Industrial Diaphragm Valve and Actuator range is available online at www.saundersdrawings.com.

Quality Statements And Approvals

CERTIFIED QUALITY FROM SAUNDERS®

- 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
- Certified compliance to the European Pressure Equipment Directive 97/23/EC, authorizing Saunders® to CE mark relevant valve products
- TUV-Merkblatt HPO Qualification for our product manufacturing and certification
- International product approval from authorities such as Bureau Veritas, Lloyds, ABS, RINA and TSG
- Polymer materials certified as meeting the requirements of FDA, USP and WRAS

EXAMPLES OF PRODUCT AND SYSTEM APPROVALS

- 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)

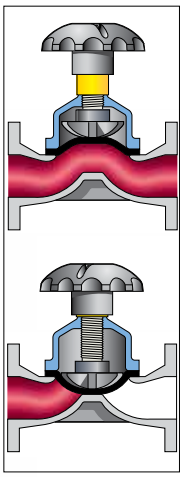
BSI REGISTERED UKAS QUALITY MANAGEMENT 003

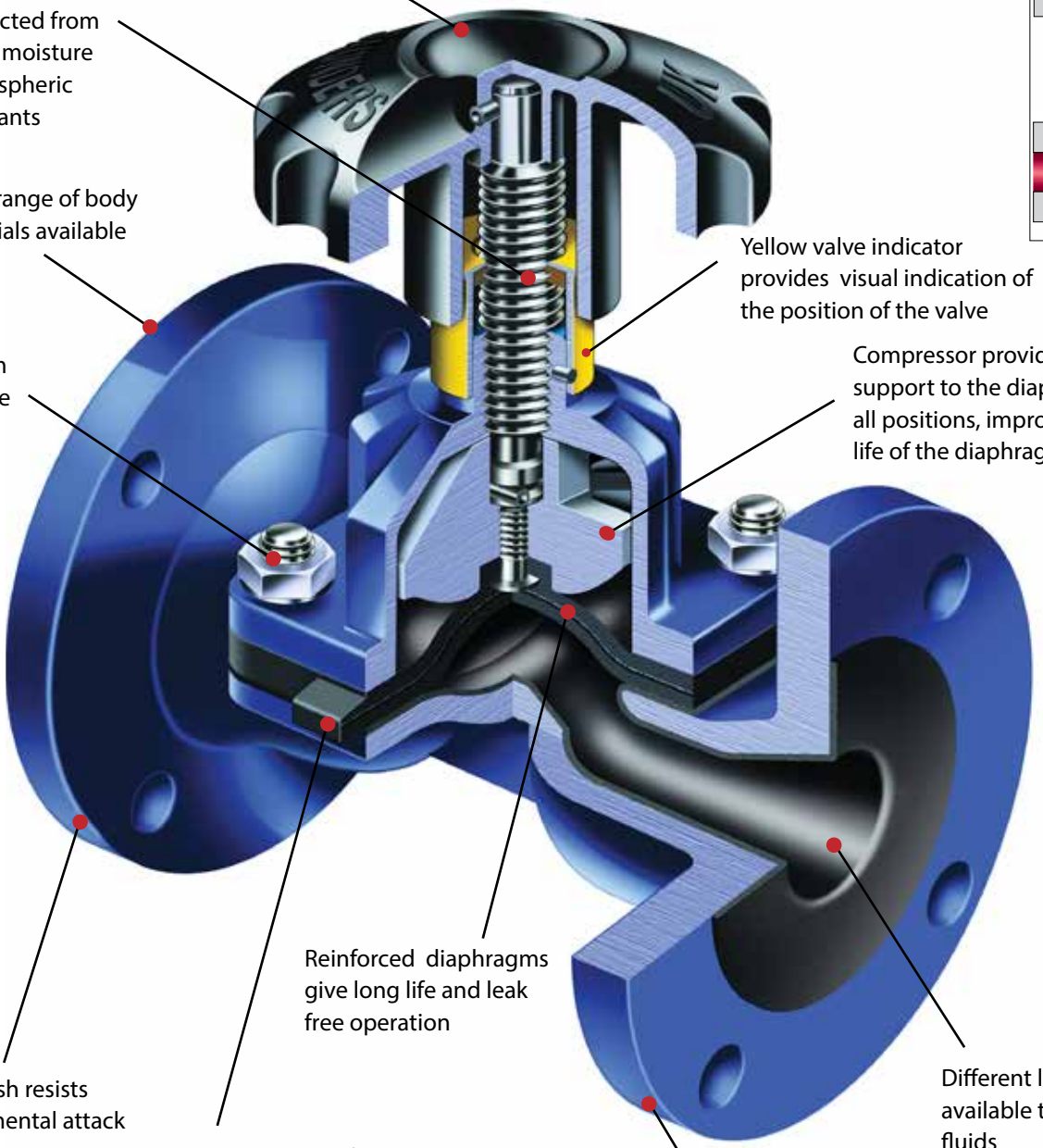
RWTÜV

Compliance WITH
FDA Code 21
TNO CERTIFICATION 3A
cGMP USP 23

A TYPE - FEATURES

Original Saunders® Design





Hand wheel sized for comfortable grip and easy operation

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

Wide range of body materials available

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

Diaphragm replaceable with valve in-line

Compressor provides support to the diaphragm in all positions, improving the life of the diaphragm

Reinforced diaphragms give long life and leak free operation

Paint finish resists environmental attack

Wide choice of diaphragm materials, which isolate all bonnet working parts from the line fluid

Different lining options available to handle all fluids

Screwed, flanged or welded end connections that adhere to various international standards

Saunders® A type Diaphragm Valve:
the valve of choice to handle highly corrosive media

A TYPE - BODY

Lined and Unlined Options

Our metal bodies provide simultaneous mechanical support for the lining and protection against Ultraviolet (UV) attack. The nominal bore thicknesses of Saunders® linings range from 1 to 5.5 mm, depending on lining material and valve size: glass 1 mm, rubber 2-4.5 mm and plastic 4-5.5 mm.

Unlined Bodies

Material	Connection	Standard	Material Grade*	Size	Temperature
Cast Iron	Flanged	BS EN1561	GJL-250	½"-20" DN15-DN500	14°F to 347°F -10°C to 175°C
SG Iron	Screwed	BS EN1563	GJS-450-10	¼"-2" DN8-DN50	14°F to 347°F -10°C to 175°C
	Flanged		GJS-400-18[1]	½"-14" D15-DN350	
Cast Steel	Flanged	ASTM A216	WCB	½"-10" DN15-DN250	-22°F to 347°F -30°C to 175°C
Gunmetal	Screwed	BS EN1982	CC491K-GS	¼"-3" DN8-DN80	-22°F to 347°F -30°C to 175°C
	Flanged		CC492K-GS	½"-8" DN15-DN200	
Stainless Steel	Screwed	BS EN10283	1.4408[2]	¼"-3" DN8-DN80	-22°F to 347°F -30°C to 175°C
	Flanged			½"-8" DN15-DN200	

[1] For some sizes GJS-400-18-LT grade is available with a low temperature limit of -20°C (-4°F)
[2] Replaces the standard BS3100 316C16
* Please contact Saunders® for information on comparable/equivalent material grades.

Lined Options - Flanged Bodies Only

Lining	Body Material	Size	Temperature
PFA	SG Iron	½"-8" DN15-DN200	14°F to 347°F -10°C to 175°C
ETFE	SG Iron	½"-6" DN15-DN150	14°F to 302°F -10°C to 150°C
PVDF	SG Iron	¾"-6" DN20-DN150	14°F to 257°F -10°C to 125°C
PP	SG Iron	¾"-6" DN20-DN150	14°F to 185°F -10°C to 85°C
Glass	Cast Iron	½"-8" DN15-DN200	14°F to 347°F -10°C to 175°C
Butyl (Isobutylene Isoprene)	Cast Iron	¾"-20" DN20-DN500	14°F to 230°F -10°C to 110°C
	SG Iron		-22°F to 230°F -30°C to 110°C
	Cast Steel		
Neoprene (Polychloroprene)	Cast Iron	¾"-20" DN20-DN500	14°F to 221°F -10°C to 105°C
	SG Iron		-22°F to 221°F -30°C to 105°C
	Cast Steel		
Hard Natural Rubber (Ebonite)	Cast Iron	¾"-20" DN20-DN500	14°F to 185°F -10°C to 85°C
	SG Iron		-22°F to 185°F -30°C to 85°C
	Cast Steel		

Standard material grade fasteners:
Stainless steel fasteners - All stainless steel, plastic lined and glass lined valves
Aluminium Bronze fasteners - Gunmetal flanged valves
Carbon Steel fasteners - All remaining valves.
Special material grade fasteners available upon request

Plastic Lining

PFA *Perfluoroalkoxy* – Excellent suitability for concentrated strong acids at high temperature, aromatics, aliphatic and chlorinated solvents. (White)

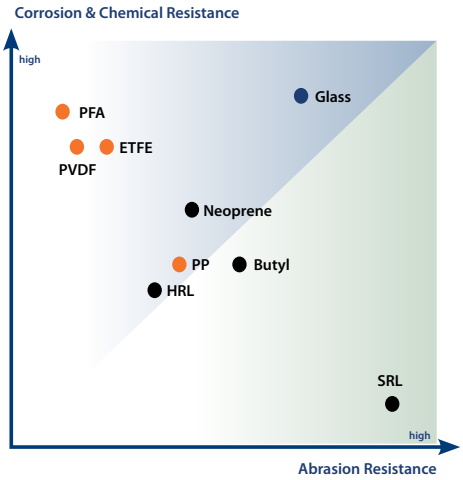
ETFE *Ethylene Tetrafluoroethylene* – Suitable for strong acids, salts in water, solvents at medium temperature. ETFE has the highest abrasion resistance of all the fluorocarbon linings. (Red)

PP *Polypropylene* – Economic solution for mineral acids, salts in water, de-ionised water and effluent treatment chemicals. (Light grey)

PVDF *Polyvinylidene Fluoride* – Suitable for mineral acids, salts in water, water and effluent treatment, additionally it is the best solution for wet chlorine gas or chlorine in water. (Black)

Glass Lining

Used in many different applications, including strong acids. 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)



Rubber Lining

HRL *Hard Natural Rubber (Ebonite)*- – Used for salts in water, diluted acids, de-ionised water, plating solutions and potable water. HRL has better chemical resistance than SRL. (Black)

Butyl *Isobutylene Isoprene* – Great for corrosive & abrasive slurries, and acidic slurries. Additional applications are salts in water, dilute acids and alkalis, and lime. (Black)

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

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.

A TYPE - DIAPHRAGM

A Type Diaphragm

Diaphragm	Composition	Size	Temperature
425	EPM (Ethylene Propylene)	All Sizes	-40°F to 226°F -40°C to 130°C
300	Butyl (Isobutylene Isoprene)	All Sizes	-40°F to 226°F -40°C to 130°C
237	CSM (Chlorosulfonated Polyethylene)	All Sizes	14°F to 212°F -10°C to 100°C
XA	EPDM (Ethylene Propylene Diene)	All Sizes	-40°F to 266°F -40°C to 130°C
HT	Neoprene (Polychloroprene)	All Sizes	-22°F to 212°F -30°C to 100°C
226	FKM (Fluoroelastomer)	All Sizes	23°F to 302°F -5°C to 150°C
C	Nitrile (Butadiene Acrylonitrile)	All Sizes	-4°F to 212°F -20°C to 100°C
Q	Natural Rubber	All Sizes	-58°F to 212°F -50°C to 100°C

214/300	PTFE/Butyl	¼"-10" DN8-DN250	-4°F to 302°F -20°C to 150°C
214/425	PTFE/EPM	¼"-10" DN8-DN250	-4°F to 320°F -20°C to 160°C
214/226	PTFE/FKM	¼"-10" DN8-DN250	23°F to 347°F -5°C to 175°C
214S/425	TFM/EPM	¼"-6" DN8-DN150	-4°F to 320°F -20°C to 160°C
214K/425	PTFE/PVDF/EPM	½"-6" DN15-DN150	-4°F to 212°F -20°C to 100°C

Diaphragm Identification

In the range of PTFE diaphragms, Saunders offers both moulded open and closed options for your convenience. The 214S is available as moulded closed and was designed specifically to reduce polymeric creep, therefore increasing the sealing properties and life of the diaphragm.

Moulded closed

Moulded open

PTFE Diaphragm

214/300 - Used in strong acids and alkalis, and salts in water at high temperature. Sulfuric acid is a good example with temperatures up to 110°C (230°F) 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/425, 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 in low concentrations. FDA, USP and WRAS approved[1].

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

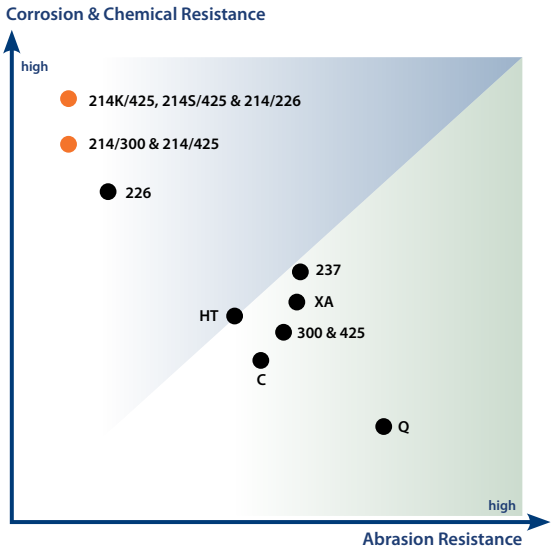
XA - Specifically designed for both abrasive and corrosive applications such as phosphoric acid, metal treatment, mining applications.

HT - Suitable for abrasive slurries containing hydrocarbons.

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

C - Lubricating oil, cutting oils, paraffin, animal and vegetable oils, aviation kerosene at low temperatures. Cv is ideal for vacuum applications, where oils are present, e.g. (compressed air, acetylene gas, LPG).

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

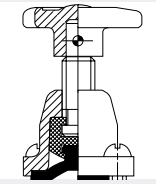


[1] ***FDA*** *- Food and Drug Administration*
USP *- United States Pharmacopeia*
WRAS *– Water Regulations Advisory Scheme*

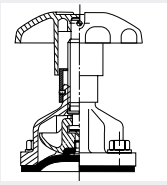
All rubber diaphragms have threaded brass fitments, except vacuum diaphragm (Cv, 300v, 425v), which have steel fitments. PTFE diaphragms have a stainless steel bayonet fitment.

A TYPE - TOP WORKS

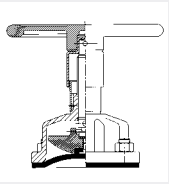
Standard Range



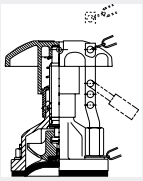
Rising handwheel (2 bolt)
DN8 - DN10
¼" - ⅜"



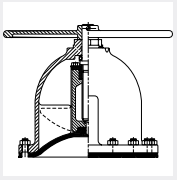
Cast iron bonnet with rising plastic handwheel
DN15 - DN50
½" - 2"



Cast iron bonnet with rising metal handwheel
DN15 - DN150
½" - 6"



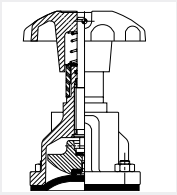
Rising handwheel with indicator (simple padlocking)
DN15 - DN150
½" - 6"



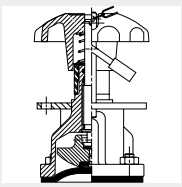
Standard non-rising handwheel without indicator
DN200 - DN350
8" - 14"

Non-rising handwheel with indicator
DN200 - DN350
8" - 14"

High Performance

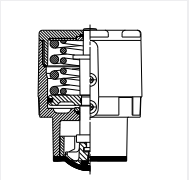


Fluoroelastomer sealed bonnet
DN15 - DN150
½" - 6"

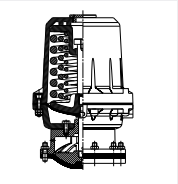


Fluoroelastomer sealed with padlocking
DN15 - DN150
½" - 6"

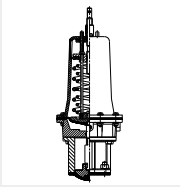
Saunders® Actuation



EC actuators (spring close/spring open/ double acting)
DN8 - DN50
¼" - 2"



ECX actuators (spring close/spring open/double acting)
DN65 - DN150
2½" - 6"



ESM/ES actuators (spring close/spring open/double acting)
DN15 - DN250
½" - 10"

Note: Designs may vary across size range

For more details of actuation see pages 17-20

Manual Valves Working Pressure & Temperature

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

Bonnet pressure limits

		Pressure (bar/psi)							
Diaphragm		Rubber				PTFE			
Handwheel		Rising		Non-Rising		Rising		Non-Rising	
Size (DN/in)									
8	¼"	16	232			10	145		
10	⅜"	16	232			10	145		
15	½"	16	232			10	145		
20	¾"	16	232			10	145		
25	1"	16	232			10	145		
32	1¼"	16	232			10	145		
40	1½"	16	232			10	145		
50	2"	16	232			10	145		
65	2½"	10	145			10	145		
80	3"	10	145			10	145		
100	4"	10	145			10	145		
125	5"	10	145			10	145		
150	6"	10	145			7	102		
200	8"			6	87			6	87
250	10"			5	73			5	71
300	12"			4	58				
350	14"			3.5	51				

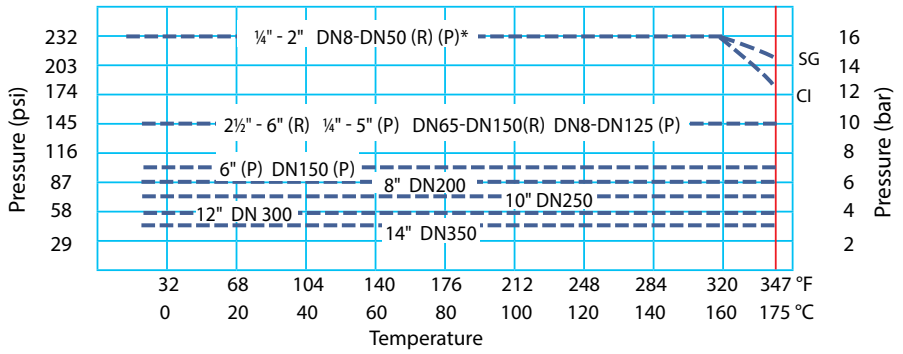
Note: For temperature rating, please refer to adjacent graphs.

All Saunders® valves are pressure tested in accordance with standard BS EN 12266-1.

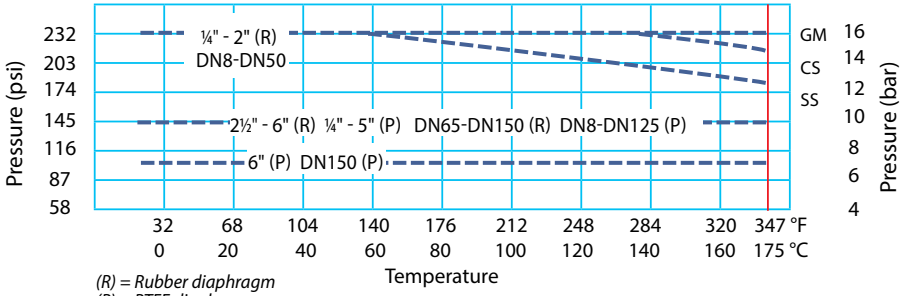
- *Shell test: 1.5 times maximum rated working pressure*
- *Seat test: 1.1 times maximum rated working pressure*

A Type Valve Temperature/Pressure Relationship

Cast Iron and SG Iron



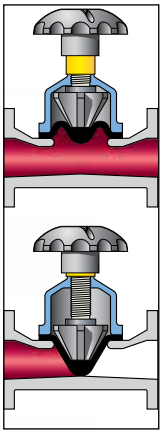
Carbon Steel, Stainless Steel & Gunmetal

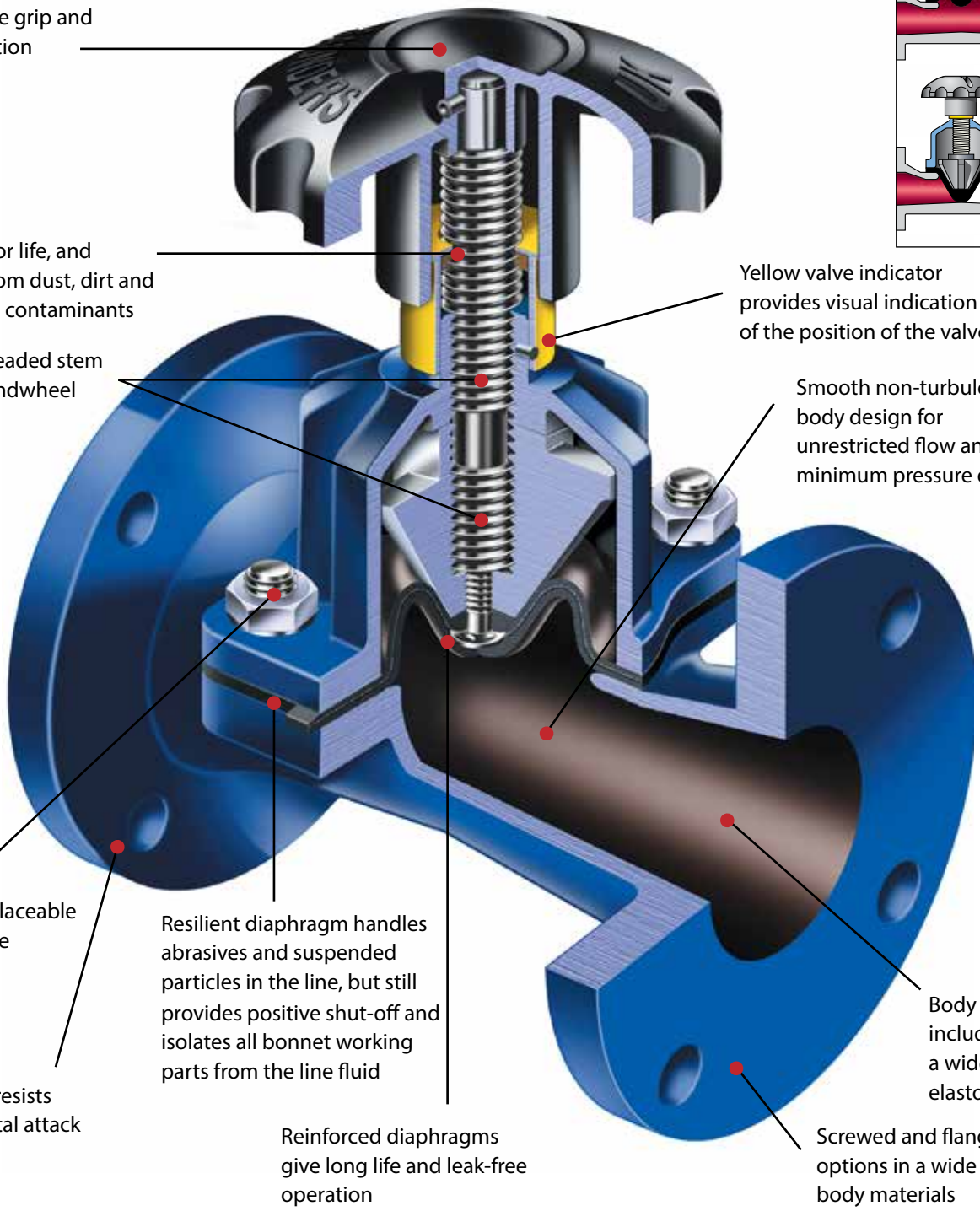


(R) = Rubber diaphragm
(P) = PTFE diaphragm
** 214S Moulded closed version only.*

KB/K TYPE – FEATURES

Saunders® KB and K Design





Saunders® KB and K type (higher flow) valves: the choice for corrosive slurry applications

KB/K TYPE - BODY

Lined and Unlined Options

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.

Unlined Bodies

Material	Connection	Standard	Material Grade*	Size	Temperature
Cast Iron	Screwed	BS EN1561	GJL-250	½"-2" DN15-DN50	14˚F to 347˚F -10˚C to 175˚C
	Flanged			½"-14" DN15-DN350	
SG Iron	Screwed	BS EN1563	GJS-450-10	¼"-2" DN8-DN50	14˚F to 347˚F -10˚C to 175˚C
	Flanged		GJS-400-18[1]	½"-14" DN15-DN350	
Gun Metal	Screwed	BS EN1982	CC491K-GS	½"-2" DN15-DN50	-22˚F to 347˚F -30˚C to 175˚C
	Flanged		CC492K-GS	½"-4" DN15-DN100	
Stainless Steel	Flanged	BS EN10283	1.4408[2]	½"-10" DN15-DN250	-22˚F to 347˚F -30˚C to 175˚C

[1] For some sizes GJS-400-18-LT grade is available with a low temperature limit of 20˚C (-4˚F)
[2] Replaces the standard BS3100 316C16
* Please contact Saunders® for information on comparable/equivalent material grades.
Standard material grade fasteners:
Stainless steel fasteners - All stainless steel, plastic lined and glass lined valves
Aluminium Bronze fasteners - Gunmetal flanged valves
Carbon Steel fasteners - All remaining valves.
Special material grade fasteners available upon request

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 (145 psi).

Lined Options - Flanged Bodies Only

Lining	Body Material	Size	Temperature
Butyl (Isobutylene Isoprene)	Cast Iron	1"-14" DN25-DN350	14˚F to 230˚F -10˚C to 110˚C
	SG Iron		
	Cast Steel		-22˚F to 230˚F -30˚C to 110˚C
Neoprene (Polychloroprene)	Cast Iron	1"-14" DN25-DN350	14˚F to 221˚F -10˚C to 105˚C
	SG Iron		
	Cast Steel		-22˚F to 221˚F -30˚C to 105˚C
Hard Natural Rubber (Ebonite)	Cast Iron	1"-14" DN25-DN350	14˚F to 185˚F -10˚C to 85˚C
	SG Iron		
	Cast Steel		-22˚F to 185˚F -30˚C to 85˚C
SRL (Soft Natural Rubber)	Cast Iron	1"-14" DN25-DN350	14˚F to 185˚F -10˚C to 85˚C
	SG Iron		
	Cast Steel		-22˚F to 185˚F -30˚C to 85˚C
Glass	Cast Iron	½" - 6" DN15-DN150	14˚F to 347˚F -10˚C to 175˚C

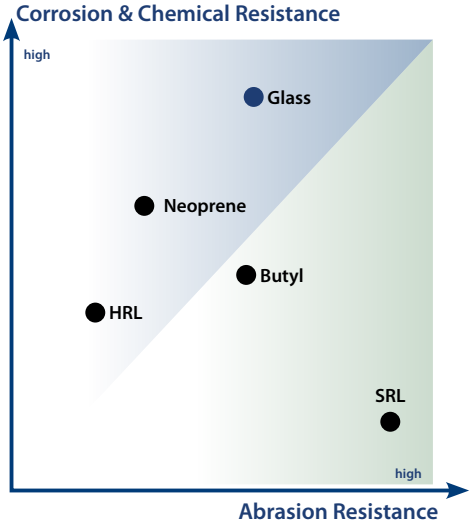
Glass Lining

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. *Note that glass is not suitable for applications where thermal cycling occurs.* (Blue)

Rubber Lining

Butyl *Isobutylene Isoprene* — Great for corrosive and abrasive slurries, and acidic slurries. Additional applications are salts in water, dilute acids and alkalis, and lime. WRAS approved. (Black)

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



Rubber Lining

HRL *Hard Natural Rubber (Ebonite)* — Used for salts in water, diluted acids, de-ionised water, plating solutions and potable water. HRL has better chemical resistance than SRL. (Black)

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

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.

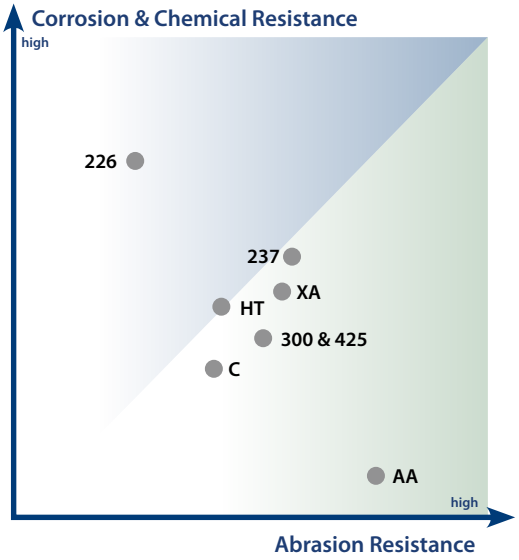
The nominal bore thicknesses of Saunders® linings range from 1 to 5.5 mm, depending on lining material and valve size: glass 1 mm, rubber 2-4.5 mm and plastic 4-5.5 mm.

KB/K TYPE – DIAPHRAGM

Many factors can accelerate the aging 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 expertise 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.

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

Diaphragm Identification



Rubber Diaphragm

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

300 - Chemicals, diluted acids and alkalis, drinking water. Additional abrasive applications like phosphoric acid in 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 food and beverages applications. FDA and USP approved[1].

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

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

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

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

[1] ***FDA*** *- Food and Drug Administration* ***USP*** *- United States Pharmacopeia*
WRAS *– Water Regulations Advisory Scheme*

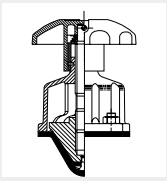
KB/K Type Diaphragm

Diaphragm	Composition	Size	Temperature
226	FKM (Fluoroelastomer)	½" to 12" DN15-DN300	23˚F to 302˚F -5˚C to 150˚C
425	EPM (Ethylene Propylene)	All Sizes	-40˚F to 226˚F -40˚C to 130˚C
AA	Natural Rubber	All Sizes	-40˚F to 194˚F -40˚C to 90˚C
HT	Neoprene (Polychloroprene)	All Sizes	-22˚F to 212˚F -30˚C to 100˚C
237	CSM (Chlorosulfonated Polyethylene)	All Sizes	14˚F to 212˚F -10˚C to 100˚C
300	Butyl (Isobutylene Isoprene)	All Sizes	-40˚F to 266˚F -40˚C to 130˚C
C	Nitrile (Butadiene Acrylonitrile)	All Sizes	-4˚F to 212˚F -20˚C to 100˚C
XA	EPDM (Ethylene Propylene Diene)	All Sizes	-40˚F to 266˚F -40˚C to 130˚C

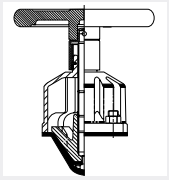
KB/K TYPE – TOP WORKS

Top Works

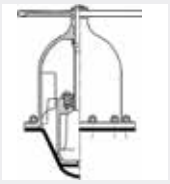
Standard Range



Standard plastic rising handwheel with indicator
DN15 - DN50
½" - 2"



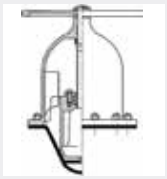
Metal rising handwheel with indicator
DN15 - DN150
2½" - 6"



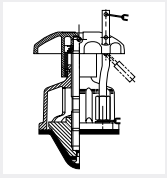
Standard non-rising handwheel without indicator
DN200 - DN350
8" - 14"

Non-rising handwheel with indicator
DN200 - DN300
8" - 12"

High Performance

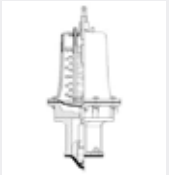


Non-rising handwheel (fluoroelastomer sealed)
DN15 - DN300
½" - 12"



Rising handwheel with indicator (simple padlocking)
DN15 - DN150
½" - 6"

Saunders® Actuation



ESM/ES actuators (spring close/ spring open/double acting)
DN15 to DN250
½" to 10"

For more details of actuation see pages 17-20

Manual Valves Working Pressure & Temperature

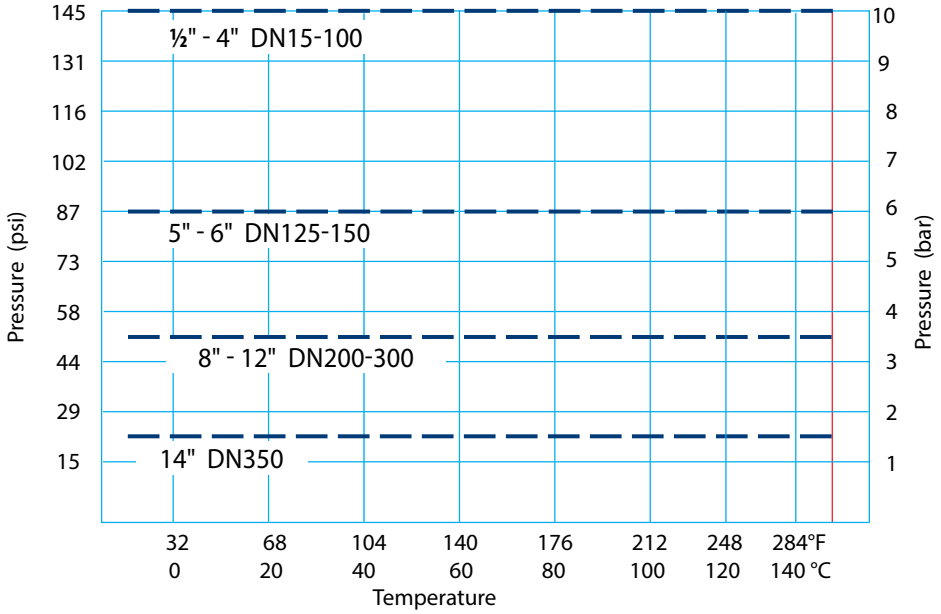
Maximum manual working pressures for Saunders® KB Type Diaphragm valve. For actuated valves, please refer to the appropriate datasheets.

Size DN	Size IN	Pressure (bar) Rising handwheel		Non-Rising handwheel	
15	½"	10	145	-	
20	¾"	10	145	-	
25	1"	10	145	-	
32	1¼"	10	145	-	
40	1½"	10	145	-	
50	2"	10	145	-	
65	2½"	10	145	-	
80	3"	10	145	-	
100	4"	10	145	-	
125	5"	6	87	-	
150	6"	6	87	-	
200	8"	-		3.5	51
250	10"	-		3.5	51
300	12"	-		3.5	51
350	14"	-		1.5	22

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

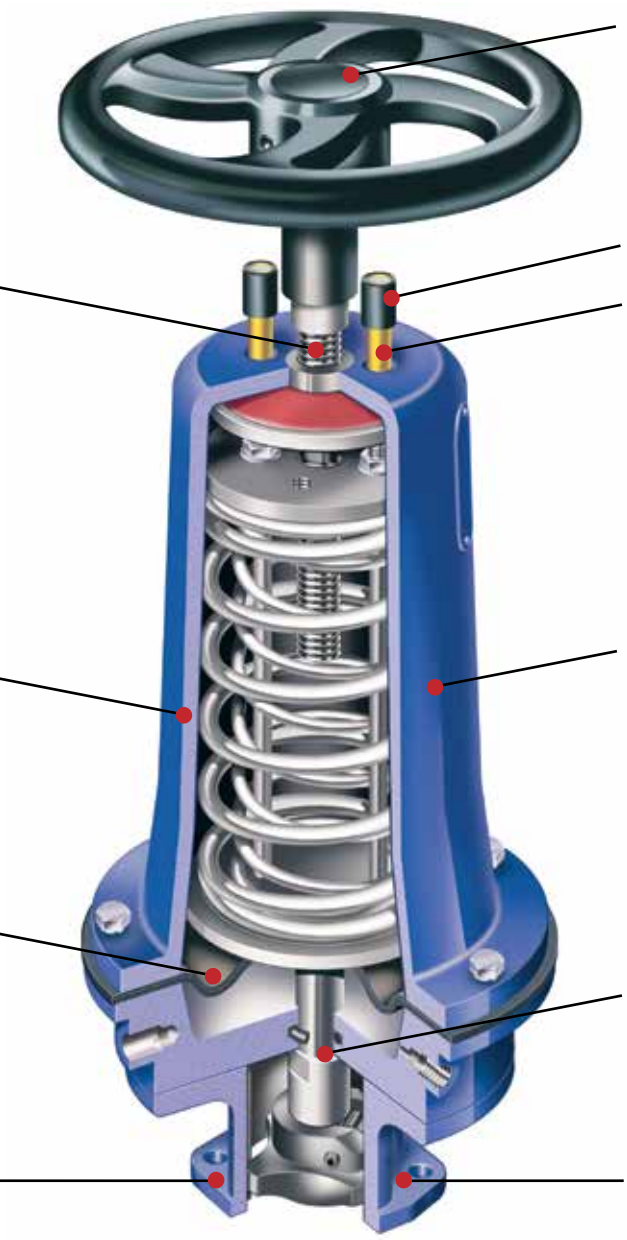
- *Shell test: 1.5 times maximum rated working pressure*
- *Seat test: 1.1 times maximum rated working pressure*

KB Type Valve Temperature/Pressure Relationship*



* For K Type valves, refer to one size larger KB valve.

ACTUATION - ES MODULAR DESIGN



Optional hand wheel for Spring Close (SC) and Spring Open (SO) models

Emergency override is standard on SC and SO

Easy installation of accessories (using position indicator)

Clear visual indication of actuator position

The cylinder is lightweight cast aluminium for more economical installation and exceptional corrosion resistance

Paint finish for high corrosion resistance to external environment

Saunders® offers natural rubber and nitrile operating diaphragms. For optimum performance, diaphragms are manufactured in-house by Saunders®

The master spindle and spindle attachment are protected from the outside environment throughout its travel

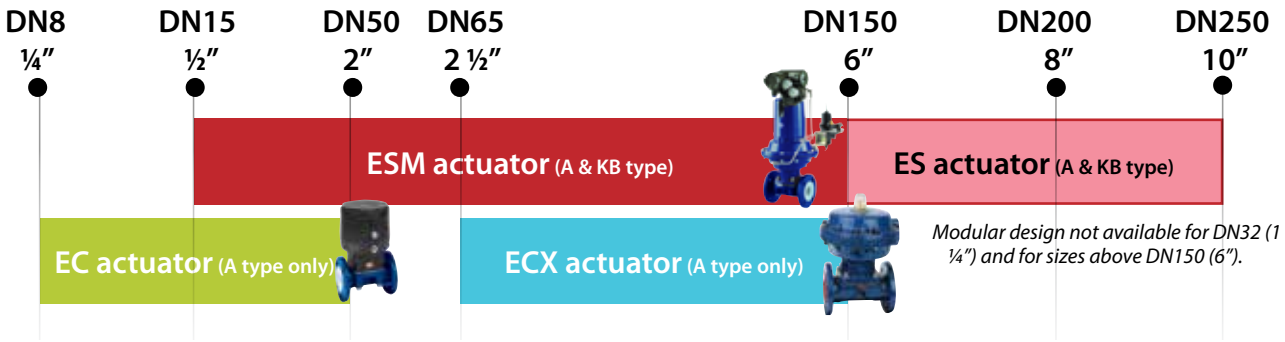
Easy to fit or retrofit on both weir and straight through valves

Inter-changeable modular bonnets for flexibility (offered as a kit including compressor and spindle)

Wide range of actuators that provide reliable remote control

ACTUATION - MODEL RANGE AND MODES OF OPERATION

When manual operation is inadequate or inconvenient, Saunders® offer a variety of actuators covering valve sizes up to DN250 (10"), for different line and operating pressure options. We offer three different actuators, designed for various characteristic performances.



EC

1. Compact piston style actuator
2. Spring packs to suit pressure requirements
3. Polyethersulfone (PES) bonnet
4. Versatile and robust design
5. Temperature range of -10 to 100°C (14 to 212°F) ambient (autoclave maximum 150°C/302°F)

ECX

1. Diaphragm operated actuator, a compact extension to the EC size range
2. Comprehensive spring packs for a wide range of pressures
3. Full range of accessories
4. Light weight silicon aluminium housings
5. Durable paint coating for environmental protection

ES Modular

1. Diaphragm operated actuator, modular design for flexibility
2. Adjustable spring tension to optimize closure force and maximize diaphragm life
3. Full range of accessories
4. Light weight silicon aluminium housings
5. Durable paint coating for environmental protection

	Spring Close (SC)	Spring Open (SO)	Double Acting (DA)
Mode of operation	Closes the valve against line pressure in the event of failure (or intended shutoff) of operating pressure to the actuator.	Opens the valve to allow line fluid to flow in the event of failure (or intended shutoff) of operating pressure to the actuator.	Operating pressure opens and closes the valve. Requires a lock up valve to retain the position preceding the failure.
Normal use	When valve is usually in the closed position (to avoid using a constant supply of operating pressure).	When valve is usually in the open position (to avoid using a constant supply of operating pressure).	When a failsafe mode is not required.

ACTUATION ACCESSORIES

Accessories								
Model	**Size Range**	**Valve type**	**Material**	**Solenoid**	**Switchbox**	**Positioner**	**Air Filter**	**Handwheel**
ES	DN15-DN250 ½" - 10"	A, KB	SiAl[1]	✓	✓	✓	✓	✓
EC	DN8-DN50 ¼" - 2"	A	PES[2]	✓	✓	✓	✗	✗
ECX	DN65-DN150 2 ½" - 6"	A	SiAl[1]	✓	✓	✗	✓	✗

[1] SiAl – Silicon-Aluminium [2] PES –Polyethersulfone ✓ 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

Economical, compact and lightweight switchbox suitable for the EC actuator Self setting, which minimizes validation/set-uptime, it is available with mechanical or proximity switches including an intrinsically safe option.

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 and 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.

Shown mounted to ESM Actuator

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 using an EC actuated valve, Saunders® offers 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 and ECX actuator ranges. The switchbox offers a wide range of mechanical and proximity sensors with space for up to 4 switches, integral solenoid valve and ASi interface (which 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 position and various hazardous area classifications. The solenoid range is designed to cover all requirements.

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

Saunders®
the science inside

CATALOGUE CODES

A Weir Type Valves

Example: **050** — **33** — **06** — **A**

Size	Body Type/Spare Type	Body Material & Lining	Length & Flange

Size	
¼	008
3/8	010
½	015
¾	020
1	025
1¼	032
1½	040
2	050
2½	065
3	080
4	100
5	125
6	150
8	200
10	250
12	300
14	350

Valves	
Screwed Ends	22
Socket Weld	23
Butt Weld	24
Flanged - Unlined	33
Flanged - Lined	34
Spares	
Spare Diaphragm	S1
Spare Bonnet	H1
Spare Actuator	T1
Spare Body	B1

Body Material & Lining	
Bronze Gunmetal	03
Cast Iron	04
SG - Ductile Iron	05
Stainless Steel	06
Cast Steel	07
Soft Rubber Lined	21
Hard Natural Lined (Ebonite)	22
Neoprene Lined	23
Butyl Lined	24
Glass Lined	32
Polypropylene Lined	48
ETFE Lined	49
PVDF Lined	50
PFA Lined	52
PFA Lined (SS Body)	56
ETFE Lined, Fluoropolymer coated	63
PFA Lined, Fluoropolymer coated	67

Length & Flange	
US Length ANSI 125/150	A
EN 558 Series 7 ANSI 125/150	B
Socket Weld	C
DIN - ND10	D
DIN - ND10 4 bolt	E
DIN Length ANSI 125/150	F
BS4504 PN10/16	W
BS4504 ANSI 125/150	X
API / NPT	S
BS21 Rp	T

K & KB Straight Through Type Valves

Example: **080** — **55** — **04** — **A**

Size	Body Type/Spare Type	Body Material & Lining	Length & Flange

Size	
½	015
¾	020
1	025
1½	040
2	050
2 ½	065
3	080
4	100
5	125
6	150
8	200
10	250
12	300
14	350

KB Valves	
Screwed API	44
Flanged - Unlined	55
Flanged - Lined	56
KB Spares	
Spare Diaphragm	S2
Spare Bonnet	H2
Spare Actuator	T2
Spare Body	B2
K Valves	
Flanged - Unlined	58
Flanged - Lined	59
K Spares	
Spare Diaphragm	S3
Spare Bonnet	H3
Spare Actuator	T3
Spare Body	B3

Body Material & Lining	
Bronze Gunmetal	03
Cast Iron	04
SG - Ductile Iron	05
Stainless Steel	06
Cast Steel	07
Soft Rubber Lined	21
Hard Natural Lined (Ebonite)	22
Neoprene Lined	23
Butyl Lined	24
Glass Lined	32

Length & Flange	
US Length ANSI 125/150	A
EN 558 Series 7 ANSI 125/150	B
DIN - ND10	D
DIN - ND10 4 bolt	E
DIN Length ANSI 125/150	F
BS4504 PN10/16	W
BS4504 ANSI 125/150	X
API / NPT	S
BS21 Rp	T

CATALOGUE CODES

Topworks — **11R** — Diaphragm — **HT** — Accessories — **-**

Manual Bonnets		Actuated	
Rubber Diaphragms		**ES Modular**	
Handwheel Non-Indicating	10R	DA for Rubber Diaphragm	402-406
Rising Handwheel Indicating	11R	SC for Rubber Diaphragm	502-506
Sealed Bonnet Indicating	13R	SO for Rubber Diaphragm	602-606
Bronze Gunmetal	14R	DA for PTFE Diaphragm	422-426
Locking Bonnet	27R	SC for PTFE Diaphragm	522-526
Sliding Spindle Bonnet	31R	SO for PTFE Diaphragm	622-626
Stainless Steel	36R	**EC**	
Fluoropolymer Coated	48R	DA for Rubber Diaphragm	EC1
PTFE Diaphragms		SC for Rubber Diaphragm	EC2
Handwheel Non-Indicating	10T	SO for Rubber Diaphragm	EC3
Rising Handwheel Indicating	11T	DA for PTFE Diaphragm	EC4
Sealed Bonnet Indicating	13T	SC for PTFE Diaphragm	EC5
Bronze Gunmetal	14T	SO for PTFE Diaphragm	EC6
Locking Bonnet	27T	SC for Rubber Diaphragm 4 bar	EC7
Sliding Spindle Bonnet	31T	SC for PTFE Diaphragm 4 bar	EC8
Stainless Steel	36T		
Fluoropolymer Coated	48T		

Note:
DA = Double Acting
SC = Spring Close
SO = Spring Open

PTFE	
PTFE/Butyl (214/300)	P1
PTFE/EPM (214/425)	P2
PTFE/Fluoroelastomer (214/226)	P3
PTFE/PVDF/EPM (214K/425)	P7
TFM/EPM (214S/425)	S5
Fluoroelastomer	
V1	226
Natural Rubber	
Q1	Q
Butyl	
D1	300
DV	300 vac
Nitrile	
C1	C
CV	C vac
EPM	
E2	425
EV	425 vac
CSM (formerly Hypalon)	
U1	237
Neoprene	
HT	HT

If accessories are required indicate: XX
Accesory detail to be coded separately.

Topworks — **11R** — Diaphragm — **AA** — Accessories — **-**

Manual Bonnets		Actuated	
Handwheel Non-Indicating	10R	**ES Modular**	
Rising Handwheel Indicating	11R	402-406	DA
Sealed Bonnet Indicating	13R	502-506	SC
Locking Bonnet	27R	602-606	SO
Sliding Spindle Bonnet	31R		

Note:
DA = Double Acting
SC = Spring Close
SO = Spring Open

Fluoroelastomer	
V1	226
Natural Rubber	
AA	AA
Butyl	
D1	300
Nitrile	
C1	C
EPM	
E2	425
CSM (formerly Hapalon)	
U1	237
Neoprene	
HT	HT

If accessories are required indicate: XX
Accesory detail to be coded separately.

CATALOGUE CODES

WFB Type Valves

Example: **065** — **17** — **04** — **11R** — **U2**

Size	
1½	040
2½	065

Valves	
Model 1	11
Model 2	12
Model 4	13
Model 6	14
Model 7	15
Model 9	16
Model 11	17
Spares	
Spare Diaphragm	S4
Spare Bonnet	H4
Spare Body	B4

Body Material	
Bronze Gunmetal	03
Cast Iron	04

Manual Bonnets	
Rubber Diaphragms	
Rising Handwheel Indicating	11R
Bronze Gunmetal	14R

Fluoroelastomer	
V1	226
CSM (formerly Hypalon)	
U2	286 Fire

NOTES

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