Saunders®
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INVENTORS OF THE ORIGINAL DIAPHRAGM VALVE - PERFECTED BY POLYMER EXPERTS WITH IN-HOUSE MANUFACTURING

SAUNDERS®
Industrial Diaphragm Valves

CRANE®

www.cranecpe.com

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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

❶ **The Science Inside®:** Proprietary diaphragm technology provides unique sealing solution and complete emissions control.

❷ **Unmatched Expertise & Innovation:** Comprehensive selection of polymers delivers superior corrosion and abrasion resistance for a wide range of demanding applications, since 1928.

❸ **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

"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)

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

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

"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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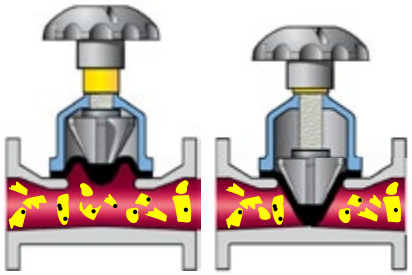
Why Diaphragm Valves?

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.

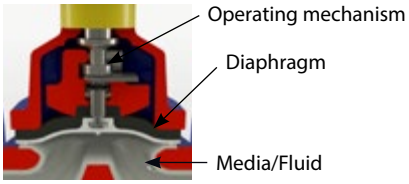


❸ Leak Tight

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

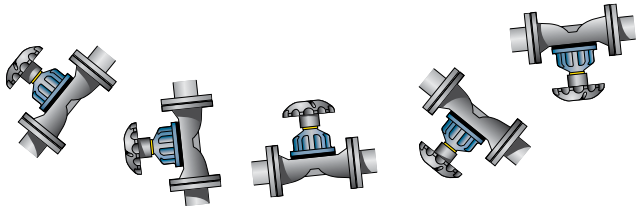
Throttling and control characteristics are enhanced by a streamlined flow path that is cavity free and provides excellent flow control capabilities.

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.

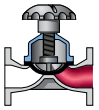
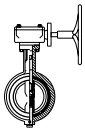
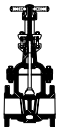
❽ Installation Versatility

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
- Lithium Mining / Refining

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 XE[2]
C / A	Gypsum (FGD)	Butyl	Butyl, Ultimate XE[2]
C / A	Titanium dioxide	Glass, Butyl, Soft rubber	Butyl, Natural rubber
C / A	Fertilizers	Butyl, Polychloroprene	Butyl, Polychloroprene, Ultimate XE[2]
C / A	Pulp & Paper	Glass, Butyl	EPDM, Butyl, Polychloroprene, Ultimate XE[3]
A	China clay	Butyl, Soft rubber	Natural rubber, Polychloroprene
G	Water demineralization, desalination, & sewage treatment	Hard rubber, Soft rubber, Butyl	EPDM, 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 gun-metal	EPDM, 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

PROPRIETY 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.

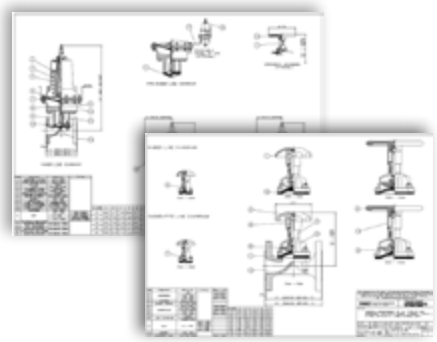
Contact your local sales office or distributor for more details on how to obtain the data sheet package.

Material Compatibility Database

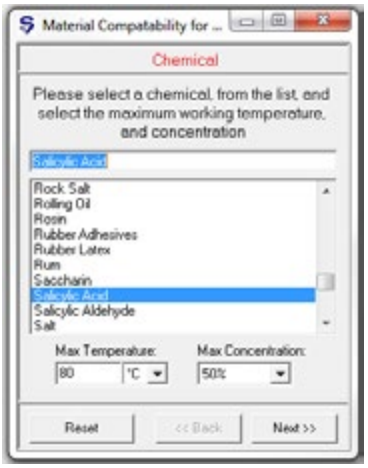
Saunders® has a database of over 800 chemicals, which can be used to aid lining and diaphragm material selection.

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

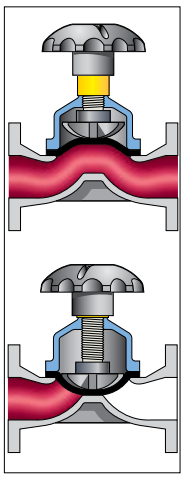
EXAMPLES OF PRODUCT AND SYSTEM APPROVALS

- ISO 9001
- PED 2014/68/EU
- WRAS (Water Regulations Advisory Scheme)
- Lloyd's Register of Shipping
- Lloyd's Register Type Approval System
- ATEX Directive (94/9/EC)
- Food & Drug Administration (FDA)

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

A Type Features

Original Saunders® Design



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-DN250	14°F to 347°F -10°C to 175°C
ETFE	SG Iron	½"-6" DN15-DN250	14°F to 302°F -10°C to 150°C
PP	SG Iron	¾"-6" DN15-DN250	14°F to 185°F -10°C to 85°C
Glass	Cast Iron	½"-8" DN15-DN150	14°F to 347°F -10°C to 175°C
Butyl (Isobutylene Isoprene)	Cast Iron	¾"-20" DN20-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	¾"-20" DN20-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	¾"-20" DN20-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

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

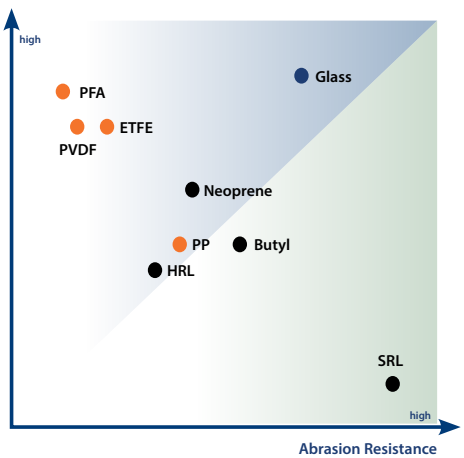
PFA *Perfluoroalkoxy* – Excellent suitability for concentrated strong acids at high temperature, aromatics, aliphatic and chlorinated solvents. (White)

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)

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.

Diaphragm valves Type A Diaphragm

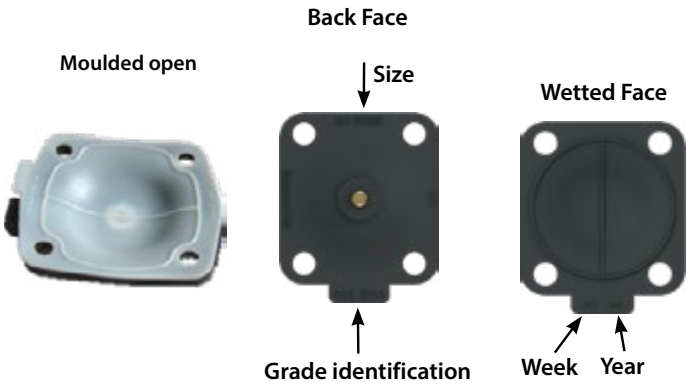
A Type Diaphragm

Catalouge Code	Diaphragm Grade	Composition	Size	Temperature
XB	300	Butyl (Isobutylene Isoprene)	All Sizes	-40°F to 226°F -40°C to 130°C
U1	237	CSM (Chlorosulfonated Polyethylene)	All Sizes	14°F to 212°F -10°C to 100°C
XE	425 or XA	EPDM (Ethylene Propylene Diene)	All Sizes	-40°F to 266°F -40°C to 130°C
HT	HT	Neoprene (Polychloroprene)	All Sizes	-22°F to 212°F -30°C to 100°C
XC	226	FKM (Fluoroelastomer)	All Sizes	23°F to 302°F -5°C to 150°C
C1	C	Nitrile (Butadiene Acrylonitrile)	All Sizes	-4°F to 212°F -20°C to 100°C
Q1	Q	Natural Rubber	All Sizes	-58°F to 212°F -50°C to 100°C

PB	214/300	PTFE/Butyl	¼"-10" DN8-DN250	-4°F to 302°F -20°C to 150°C
PE	214/425	PTFE/EPM	¼"-10" DN8-DN250	-4°F to 320°F -20°C to 160°C
PC	214/226	PTFE/FKM	¼"-10" DN8-DN250	23°F to 347°F -5°C to 175°C
KC	214K/226	PTFE/PVDF/FKM	½"-6" DN15-DN150	5°F to 301°F -15°C to 150°C
KE	214K/425	PTFE/PVDF/EPDM	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.



PTFE Diaphragm

PB - 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 %.

PE - Typical applications are strong acids, alkalis and salts in water at high temperature. Constant steam is also another important application.

PC - Strong acid, diluted chlorine, bromine solutions at low concentration.

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

KE - Three layer diaphragm with PTFE/PVDF/425, the best option for chlorine, bromine gas and chlorinated solutions.

Rubber Diaphragm

XB - Chemicals, diluted acids and alkalis, drinking water. Additional abrasive applications like phosphoric acid in low concentrations. FDA, USP and WRAS approved[1].

H1 - The best solution for sodium hypochlorite. Great with strong acids and low concentration chlorine gas. It is also oil resistant.

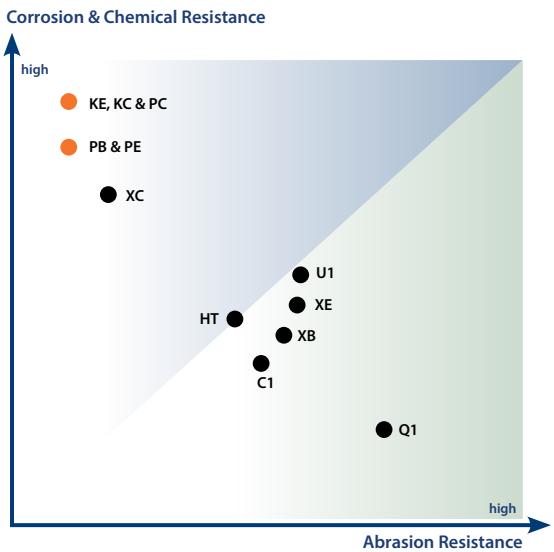
XE - Specifically designed for both abrasive and corrosive applications such as phosphoric acid, metal treatment, mining applications.

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

N1 - Suitable for abrasive slurries containing hydrocarbons.

C1 - 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).

Q1 - Salts in water, diluted acids and alkalis, and abrasive applications.

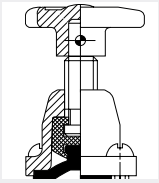


WRAS *– Water Regulations Advisory Scheme*

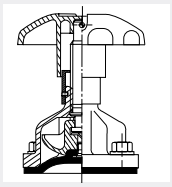
All rubber diaphragms have threaded brass fitments, except vacuum diaphragm (C1V, XBv), which have steel fitments. PTFE diaphragms have a stainless steel bayonet fitment.

A Type - Top Works

Standard Range

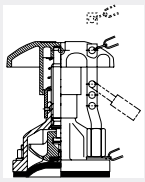


Rising handwheel (2 bolt)
DN8 - DN10
¼" - 3/8"

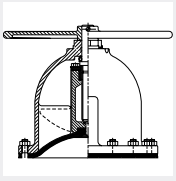


Cast iron bonnet with rising plastic handwheel
DN15 - DN50
½" - 2"

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



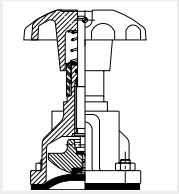
Rising handwheel with indicator (simple padlocking)
DN15 - DN150
½" - 6"



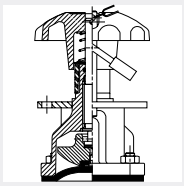
Standard non-rising handwheel without indicator
DN200 - DN350
8" - 14"

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

High Performance

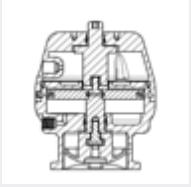


Fluoroelastomer sealed bonnet
DN15 - DN150
½" - 6"

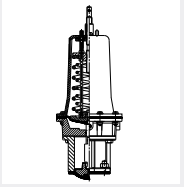


Fluoroelastomer sealed with padlocking
DN15 - DN150
½" - 6"

Saunders® Actuation



S360 actuators (spring close/spring open/double acting)
DN8 - DN50
¼" - 2"



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	3/8"	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			

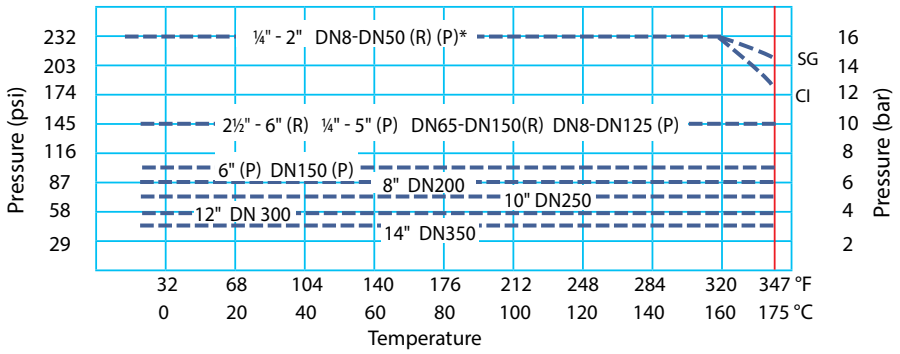
Note: For temperature rating, please refer to adjacent graphs.

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

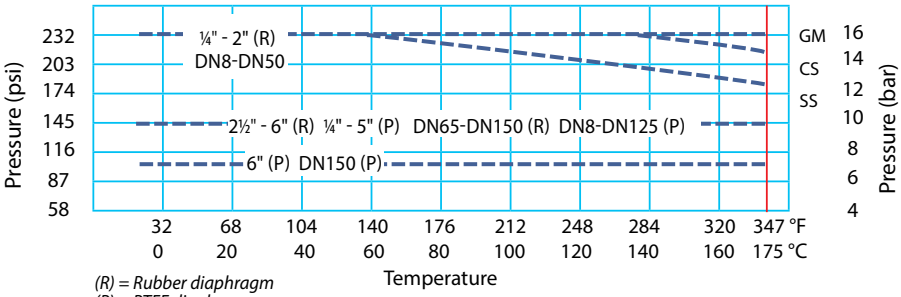
- *Shell test: 1.5 times maximum rated working pressure*
- *Seat test: 1.1 times maximum rated working pressure*

A Type Valve Temperature/Pressure Relationship

Cast Iron and SG Iron



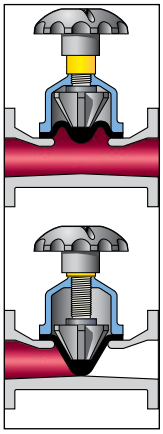
Carbon Steel, Stainless Steel & Gunmetal



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

KB / K Type - Features

Saunders® KB and K Design



Hand wheel sized for comfortable grip and easy operation

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

Double threaded stem reduces handwheel turns

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

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

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

Body lining including glass and a wide range of elastomers

Screwed and flanged options in a wide range of body materials

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

Saunders®
the science inside

KB 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.

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).

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

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

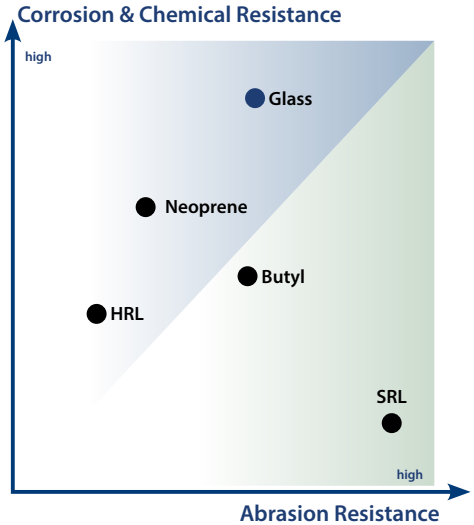
Glass Lining

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.

K Type - Body

Lined and Unlined Options

Saunders® K Type diaphragm valves feature a true 100% full bore design, providing a completely unobstructed flow path when in the open position. This straight-through geometry allows for maximum flow efficiency with minimal pressure loss, making the K Type ideally suited to handling viscous fluids, slurries and process media prone to fouling or build-up.

K Type

KB Type

Unlined Bodies

Material	Connection	Standard	Material Grade*	Size	Temperature
Cast Iron	Flanged	BS EN1561	GJL-250	½" - 14" DN15-DN350	14˚F to 347˚F -10˚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

Lined Options

Lining	Body Material	Size	Temperature
Butyl (Isobutylene Isoprene)	Cast Iron	1"-14" DN25-DN350	14˚F to 230˚F -10˚C to 110˚C
Neoprene (Polychloroprene)			14˚F to 221˚F -10˚C to 105˚C
Hard Natural Rubber (Ebonite)			14˚F to 185˚F -10˚C to 85˚C
SRL (Soft Natural Rubber)			14˚F to 185˚F -10˚C to 85˚C

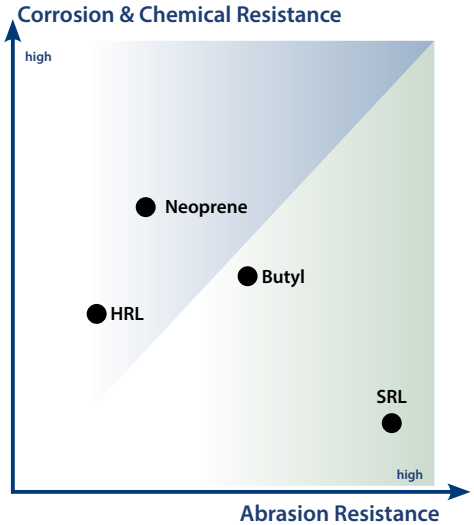
While both KB and K Type valves are designed for straight-through flow, their internal geometry offers different performance characteristics. The KB Type provides an optimised flow path with approximately 80% bore through-flow, delivering a balance between flow performance and diaphragm support. In contrast, the K Type offers a true full bore with no internal restriction, enabling maximum flow efficiency, reduced risk of blockage and the lowest possible pressure drop. This makes the K Type the preferred choice for more demanding applications where maintaining unrestricted flow is critical.

* Note replacement diaphragms and top works are sized up KB products e.g. DN125 KB Diaphragm fits a DN100 K Type valve body .

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)



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)

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.

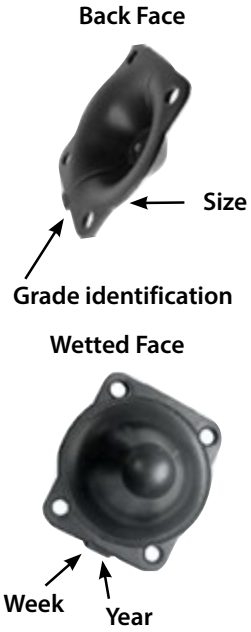
Saunders®
the science inside

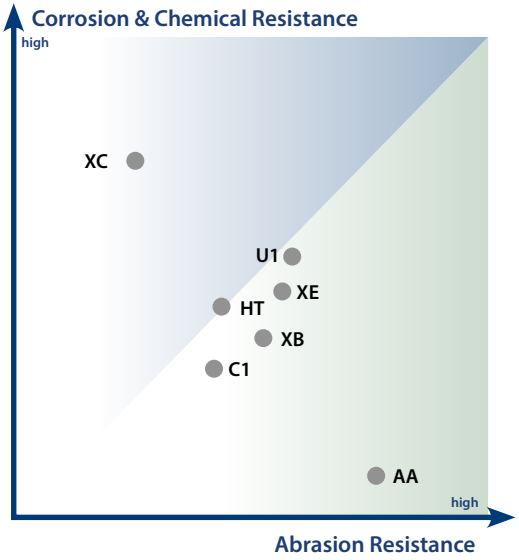
KB / K Type - Diaphragm

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

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

XB - 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.

U1 - The best solution for sodium hypochlorite. Great with strong acids and low concentration chlorine gas. It is also oil resistant.

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

C1 - Lubricating oil, cutting oils, paraffin, animal and vegetable oils and aviation kerosene at low temperatures.

A1 - Excellent choice on abrasive applications such as slurries. The diaphragm has a light brown colour, and is sulfur cured.

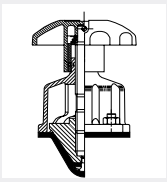
KB/K Type Diaphragm

Catalogue Code	Diaphragm Grade	Composition	Size	Temperature
XC	226	FKM (Fluoroelastomer)	½" to 12" DN15-DN300	23°F to 302°F -5°C to 150°C
AA	AA	Natural Rubber	½" to 14" DN15-DN350	-40°F to 194°F -40°C to 90°C
HT	HT	Neoprene (Polychloroprene)	½" to 14" DN15-DN350	-22°F to 212°F -30°C to 100°C
U1	237	CSM (Chlorosulfonated Polyethylene)	½" to 14" DN15-DN350	14°F to 212°F -10°C to 100°C
XB	300	Butyl (Isobutylene Isoprene)	½" to 14" DN15-DN350	-40°F to 266°F -40°C to 130°C
C1	C	Nitrile (Butadiene Acrylonitrile)	½" to 14" DN15-DN350	-4°F to 212°F -20°C to 100°C
XE	XA or 425	EPDM (Ethylene Propylene Diene)	½" to 14" DN15-DN350	-40°F to 266°F -40°C to 130°C

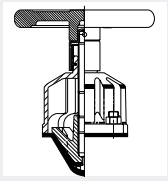
WRAS *– Water Regulations Advisory Scheme (Only applies to Butyl)*

Top Works

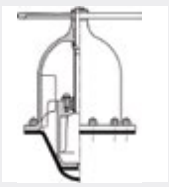
Standard Range



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



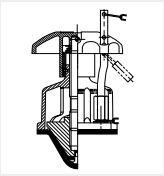
Metal rising handwheel with indicator
DN15 - DN150
2½" - 6"



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

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

High Performance



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

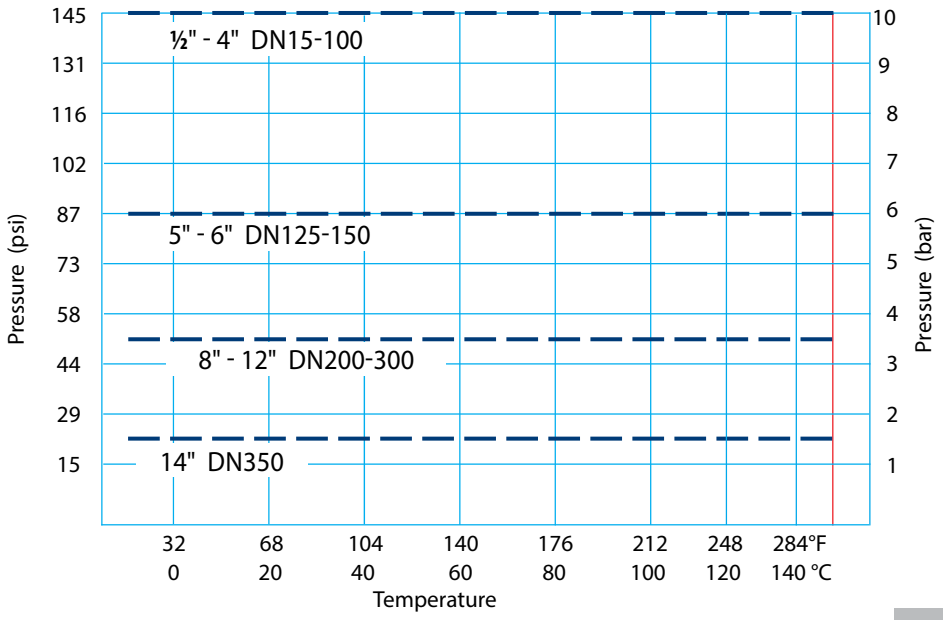
Maximum manual working pressures for Saunders® KB Type Diaphragm valve. For actuated valves, please refer to the appropriate datasheets.

Size DN	Size IN	Pressure (bar) Rising handwheel		Pressure (bar) 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

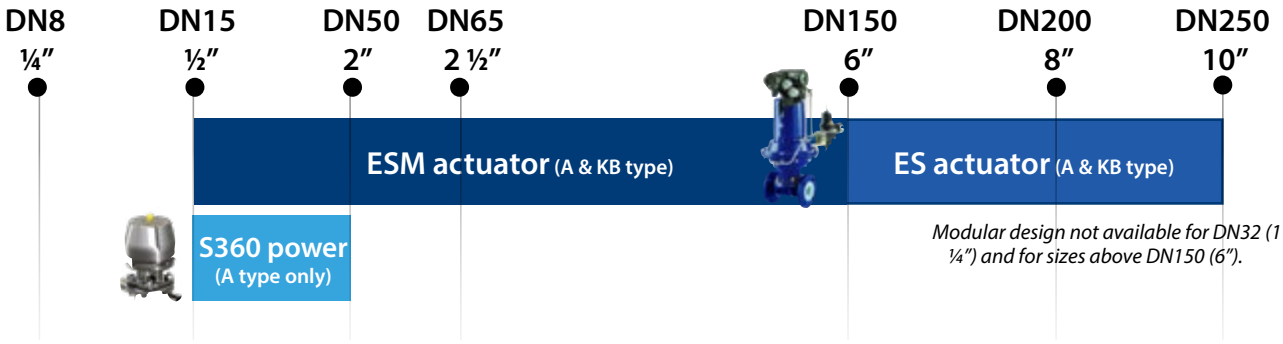
Easy to fit or retrofit on both weir and straight through valves

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 Models 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.



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

S360 Power

1. Modular range delivers compact dimensional envelope to reduce dead-leg between associated valves and optimises system design.
2. Maintenance free piston technology provides powerful closure performance.
3. Smooth corrosion resistant profile optimises cleanability.

	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.

Saunders®
the science inside

Actuation Accessories

Accessories								
Model	**Size Range**	**Valve type**	**Material**	**Solenoid**	**Switchbox**	**Positioner**	**Air Filter**	**Handwheel**
ES/ESM	DN15-DN250 1/2" - 10"	A & KB	Silicon – Aluminium	✓	✓	✓	✓	✓
S360	DN8-DN50 1/2"- 2"	A	Stainless Steel	✓	✓	✓	✓	✗

✓ Available ✗ Unavailable

Limit Switchboxes

Westlock Controls' AccuTrak series offers integrated sensing options, wiring terminals, enclosures, and local visual indication in a compact unit for valve monitoring.

Control Monitors

Westlock Controls' Quantum series combines position sensors and low-power solenoid valves for faster commisioning and control of pneumatic actuators.

Position Transmitters

Westlock Controls' Digital EPIC transmitters provide continous valve travel feedback with 4-20mA and HART protocol.

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.

Saunders® I-VUE

The Saunders® I-VUE is a compact intelligent valve sensor that provides accurate and reliable valve position feedback.

- 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.

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.

Positioners

With advanced features, intuitive inte faces and enhanced diagnostics, Westlock Controls' K20 and ICoT smart positioners ensure faster installation, seamless opertion and long-term reliability.

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.

Saunders® M-VUE

Acurate Operation

- Saunders® M-VUE uses Continous sensing technology via solid state hall effect sensors, providing accuracy of 0.3 millimeters. Continous sensing technology eliminates false alarms by detecting the exact status of the valve.

Self Calibration

- Saunders® M-VUE uses Continuous sensing technology via solid state hall eff ect sensors, providing accuracy of 0.3 millimeters. Continuous sensing technology eliminates false alarms by detecting the exact status of the valve.

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

Catalogue Codes

A Weir Type Valves

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

Size	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
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	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

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Catalogue Codes

A Weir Type Valves

Topworks — Diaphragm — Accessories

11R — **HT** — **-**

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	**S360**	
Fluoropolymer Coated	48R	DA for Rubber	SPR4
PTFE Diaphragms		SC for Rubber	SPR5
Handwheel Non-Indicating	10T	SO for Rubber	SPR6
Rising Handwheel Indicating	11T	DA for PTFE	SPT4
Sealed Bonnet Indicating	13T	SC for PTFE	SPT5
Bronze Gunmetal	14T	SO for PTFE	SPT6
Locking Bonnet	27T		
Sliding Spindle Bonnet	31T		
Stainless Steel	36T		
Fluoropolymer Coated	48T		

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

PTFE	
PTFE/Butyl (214/300)	PB
PTFE/EPDM (214/425)	PE
PTFE/FKM (214/226)	PC
PTFE/PVDF/EPDM (214K/425)	KE
PTFE/PDVF/FKM (214K/226)	KC
Fluoroelastomer (FKM)	
226	XC
Natural Rubber	
Q	Q1
Butyl	
300	XB
300 vac	XBV
Nitrile	
C	C1
C vac	CV
EPDM	
XA	XE
CSM (formerly Hypalon)	
237	U1
Neoprene	
HT	HT

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

K & KB Straight Through Type Valves

Topworks — Diaphragm — Accessories

11R — **AA** — **-**

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	
226	XC
Natural Rubber	
AA	AA
Butyl	
300	XB
Nitrile	
C	C1
EPDM	
XA	XE
CSM (formerly Hapalon)	
237	U1
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	Body Type/Spare Type	Body Material	Topworks	Diaphragm
065	17	04	11R	U2

Size	
1½	040
2½	065

Valves	
Model 9	16
Model 4	13
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

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