

Saunders



Aseptic Diaphragm Valves

CRANE

Saunders

Converting Visions into Reality



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Originator

The aseptic diaphragm valve is the most important control component in today's biopharmaceutical process systems. As the inventor of the diaphragm valve, Saunders has been a key player in the evolution of high purity valve technology.

Innovator

Beginning with the introduction of forged bodies and compact thermoplastic actuators through to today's machined from solid compound and multi-port valve solutions, Saunders has taken the lead in aseptic valve technology.

Leader

Current design and construction standards in the pharmaceutical industry place ever-higher demands on the sterility, cleanability, integrity and performance of piping components. Utilising the latest in computer design and manufacturing tools, Saunders Bio-Block valves can be engineered and machined from solid stainless steel bar or billet converting visions into solutions which can meet your specific process needs.

Technology

Our direct design to tool computer interface minimises manufacturing engineering time. Unique design tools enable us to produce e-mailable 3D representations for evaluation and review before committing to manufacture.

Dynamic

Saunders Design Engineering uses Computational Fluid Dynamic software to analyse flow conditions and design the optimum diaphragm valve solutions.

Total Solution

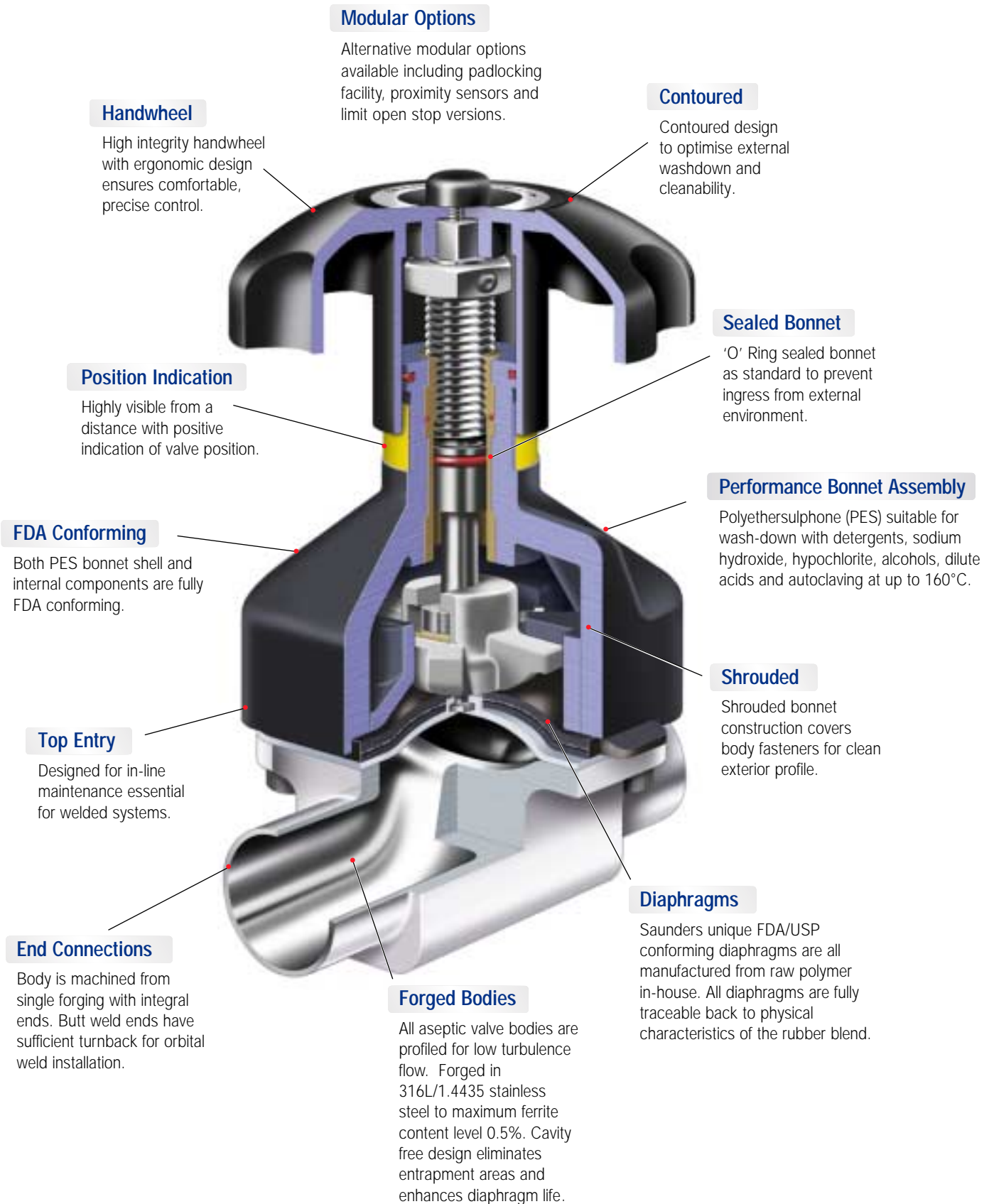
Bio-Block custom machined valves are the perfect compliment to Saunders full range of standard two way valves, machined branch valves and welded cluster configurations from which to produce the optimum system design.

All Saunders customised and standard valve bodies are supplied with full material traceability and are used with Saunders FDA (Food and Drug Administration) conforming, traceable and USP Class VI (United States Pharmacopeia) tested diaphragms and Saunders ergonomic range of manual bonnets and actuators. All these products are engineered specifically for aseptic applications within the biopharm and allied industries.



Saunders Diaphragm Valve Features

For Aseptic Applications



Saunders AFP Type Diaphragm Valves

Standard 2-Way Bodies

Saunders invented the diaphragm valve concept and then pioneered the development of the first true high purity diaphragm valve with the introduction of the AFP forged 316L/1.4435 body range. The entrapment free design and self-draining characteristics of the diaphragm valve body make it the ideal choice for both aseptic processes and systems that must be cleaned in place. Top entry design allows maintenance while the valve is installed and thus permits the valve to be welded in place reducing the required number of mechanical joints and enhancing system security.

Standard 2-Way Valves

Pure performance forged valves	8 – 15 mm
Forged stainless steel valves	15 – 80 mm
Solid block stainless steel valves	100 – 150 mm
Cast stainless steel valves	8 – 100 mm

AFP Forged Stainless Steel Bodies (DN15–DN80)

Saunders standard AFP body is forged from wrought 316L/1.4435 stainless steel bar. The forging process results in a homogeneous surface that is free of defects such as porosity, inclusions or shrinkage cavities. This defect free surface is an ideal substrate for the high levels of mechanical and electropolished surfaces demanded by the biopharm industry to maintain sterility and optimise cleaning processes. Saunders forged bodies are manufactured to achieve low ferrite levels of less than 0.5% maximum. This reduces the potential for migration of oxides through a high purity water system. These bodies are fully FDA compliant, meet all existing ASME BPE (American Society of Mechanical Engineers Bioprocessing Equipment) standards and cGMP (current Good Manufacturing Practice) principles and are ideal for all high purity biopharm applications.

Saunders Valve Body Highlights

- ◆ Cavity free and self draining
- ◆ Isolating diaphragm, top entry design, and positive closure.
- ◆ Low maintenance costs.
- ◆ Readily incorporated into valve cluster and access valve/fitting fabrications.
- ◆ Materials of construction compatible to entire system.
- ◆ Bubble tight closure against both pressure and vacuum.
- ◆ Bi-directional flowpath
- ◆ Diaphragm valves are recognised by the biopharm industry as the only truly aseptic valve.



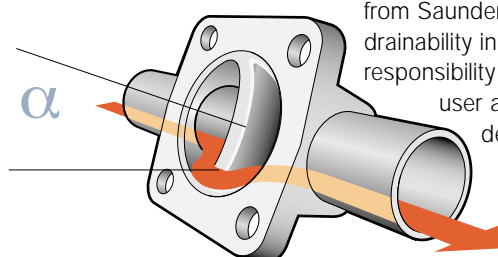
Drainability

The diaphragm valve has outstanding self draining characteristics when compared with other valve types and this feature has contributed in making the valve a standard for hygienic/aseptic application requirements. Factors which affect drainability are:-

- ◆ Valve size and end specification
- ◆ Internal surface finish
- ◆ Drain orientation (as shown)
- ◆ Surface tension and viscosity of media
- ◆ Pipe run angle – generally recommended at 2 to 3 degrees

Valves with body orientation indicators are available on request (the marks must be located in a plane cutting the vertical centreline of the pipe).

Guideline drain orientation angles for individual size and tube specifications are readily available from Saunders on request. Please note that drainability in a process system is ultimately the responsibility of the system designer and/or end user as a result of the variance factors denoted above.



Saunders AFP Type Diaphragm Valves

Standard 2-Way Bodies



Pure Performance (Bio-Seal) Forged Bodies (DN8–DN15)

Saunders Pure Performance fractional valve bodies offer a compact, space saving, high integrity solution for critical applications. Manufactured from a 316L/1.4435 stainless steel forging, the valve is used widely as a sample or drain port in biopharm system design. All major tube designations (O.D., butt weld, Tri-Clamp, DIN/ISO) are machined integrally from the forging and cover sizes, DN8, DN10 and DN15. This flexibility is achieved by utilisation of the same DN8 body design for all options and machining inlet/outlet ports to the desired end specification. This allows the valve to utilise the same size (DN8) diaphragm, bonnet and actuator across all specification requirements regardless of end connection size.



Machined from Block Standard AFP Valve Bodies (DN100–DN150)

Larger size designations are now machined integrally from solid wrought stainless steel barstock. This construction brings the same high level of surface integrity and metallurgical security as available with the AFP forgings.



AFP Investment Cast Stainless Steel Bodies (DN8–DN100)

Saunders' investment cast range uses high quality materials and selective casting processes to provide an economical solution for the food, beverage, dairy, and bioprocess industries. Available in all major international tube designations including, O.D. tubing, Tri-Clamp, DIN and ISO. Stringent quality control is employed to minimise any risk of porosity and ensure a finished product of the highest integrity.

Saunders Type AFP Diaphragm Valves

Body Material Specification (Forgings)

Saunders standard body material for all forged bodies is stainless steel 316L/1.4435. This provides conformity with most major international specification requirements and ensures compatibility with Biopharm pipework.

Full material traceability to EN10204 (DIN 50049 3.1b) is available for all body combinations to compliment the availability of data on physical properties for all elastomer and polymer diaphragms within the range. Consequently all wetted areas in contact with the process are fully traceable and adhere to cGMP guidelines.



Material		
1.4435/316L EN 10222-5		
Forged SS		%
Carbon	max.	0.03
Silicon	max.	1.00
Manganese	max.	2.00
Phosphorus	max.	0.045
Sulphur	max.	0.03
Chromium		17.0/19.0
Nickel		12.5/15.0
Molybdenum		2.5/3.0
Nitrogen		0.11

In certain application areas in biopharmaceutical installations there may be a requirement for special alloys/materials – for instance, the presence of high chloride concentrations may necessitate the use of a special material to avoid the effects of ‘pitting corrosion’. Under these demanding application conditions Saunders are able to offer any of the following material options:

- ◆ Hastelloy™
- ◆ Titanium
- ◆ AL6XN
- ◆ 904L

Body options in special alloy material may be manufactured from forgings or wrought barstock depending on the material, size, volume and body configuration.

Saunders AFP 2-Way Bodies

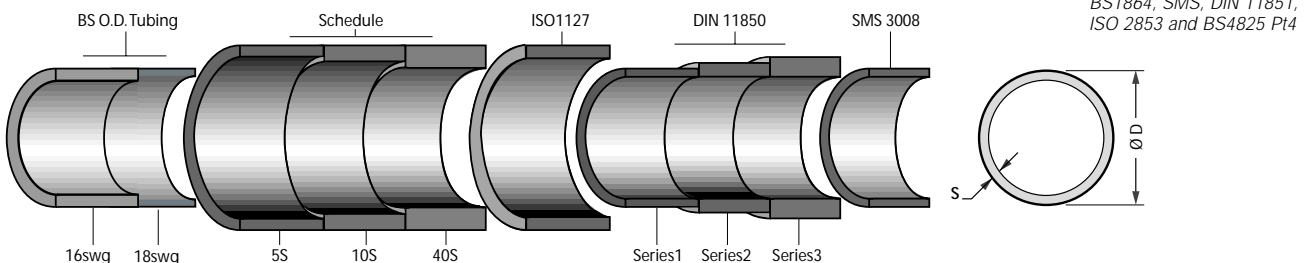
End Connections and Specifications

Saunders provide weld and mechanical end connections to meet the vast majority of international piping standards. Standard bodies feature integral butt weld or hygienic clamp ends for maximum integrity without the requirement of fabrication welds. Saunders butt weld bodies have tangent lengths long enough to permit weld installation with standard orbital welding equipment. This eliminates the need for costly tube end extensions and reduces the number of system welds, associated documentation and manufacturing delays. Saunders bodies can be welded into pipework without dis-assembly* and are also available with hash marks to indicate optimum drain angle for easy field installation.

* Please note that the bonnet flange area should be kept at or below 175°C

Butt Weld Specifications

Saunders range of AFP aseptic bodies is available with a wide variety of standard butt weld connections. The dimensions of the outside diameter and wall thickness differ according to the tube specification as illustrated in the example shown below for valve size DN25.



Screwed Ends
BS1864, SMS, DIN 11851,
ISO 2853 and BS4825 Pt4

DN	BS O.D. Tubing			Schedule			ISO 1127	DIN 11850			SMS3008	
	16swg18swg			5S	10S	40S		Series 1			Series 1	
	D	S	S	D	S	S	D	S	D	S	D	S
8	6.35	1.63	1.22	13.72	—	1.65	2.24	13.5	1.6	—	—	—
10	9.53	1.63	1.22	17.15	—	1.65	2.31	17.2	1.6	12	1.0	13
15	12.70	1.63	1.22	21.34	1.65	2.11	2.77	21.3	1.6	18	1.0	19
20	19.05	1.63	1.22	26.67	1.65	2.11	2.87	26.9	1.6	22	1.0	23
25	25.40	1.63	1.22	33.40	1.65	2.77	3.38	33.7	2.0	28	1.0	29
32	31.75	1.63	1.22	42.16	1.65	2.77	3.56	42.4	2.0	34	1.0	35
40	38.10	1.63	1.22	48.26	1.65	2.77	3.68	48.3	2.0	40	1.0	41
50	50.80	1.63	1.22	60.33	1.65	2.77	3.91	60.3	2.6	52	1.0	53
65	63.50	1.63	1.22	73.03	2.11	3.05	5.16	76.1	2.6	70	2.0	—
80	76.20	1.63	1.22	88.90	2.11	3.05	5.49	88.9	2.6	85	2.0	—
100	101.60	#	#	114.30	2.11	3.05	6.02	114.3	2.6	104	2.0	—

14swg standard on DN100/4" (S = 2.11)
OD. Tubing conforms to ASTM A269/A270

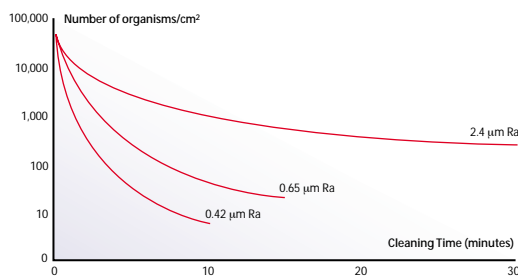
Saunders Type AFP Diaphragm Valves

Standard 2-Way Bodies – Surface Finish

Saunders valve bodies are available in a complete range of mechanically polished and electropolished surface finish options to match system design requirements. All bodies are permanently marked with heat number coding and are available with full material traceability certification against request. Major objectives in specifying the appropriate surface finish are:

- ◆ To minimise product adhesion to the interior surface of the valve and pipework
- ◆ To achieve a surface which is readily cleanable by SIP/CIP (Steam in Place/Clean in Place) in the minimum of time.
- ◆ To result in a defect free and consistent surface to minimise any risk of process contamination

Effect of Surface Finish on Cleaning Time



There is little published information on the relationship between surface finish and residual soil levels. Although research work* has shown that it takes approximately twice as long to clean a surface of 1.0 µm Ra as it does to one of 0.5 Ra µm Ra (see above graph).



Saunders utilise a surtronic measurement device as part of our standard quality control procedures and can, if requested, supply official certification for a particular order. Designated points (internally and externally) are measured to provide consistent methodology.

*Timperley and Lawson

Saunders standard surface finish designations are detailed in the table below. Importantly all values are quantified as maximum Ra figures to avoid the misinterpretation associated with average readings.

MAXIMUM Ra (µm)		
	Internal Surface	External Surface
Vacublast	1.6	As forged/cast
Satin	0.5	0.5
Mirror	0.25*	0.25*

* Mirror finish is available only for forged bodies

The Ra value (roughness average) has become the accepted methodology for quantifying the surface finish of a stainless steel surface, and removes the confusion and misinterpretation associated with grit designations.

It can be identified as the average value of all the absolute distances of the roughness profile R from the centre line within the measuring length l_m . (The prescribed sample length).

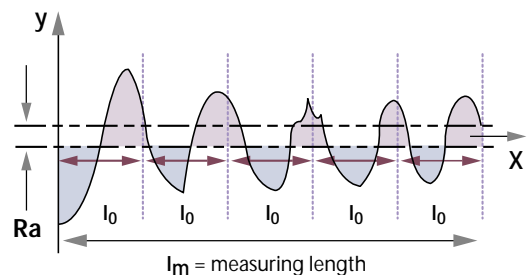
Surface Finish can then be described by using the roughness average (Ra) value.

Conversion – micro metres to micro inches

1 micro metre = 39.3701 micro inches
1 micro inch = 0.0254 micro metres

Arithmetic mean roughness value:

$$Ra = \frac{1}{l_m} \int_0^{l_m} |y| dx$$



Standard 2-Way Bodies

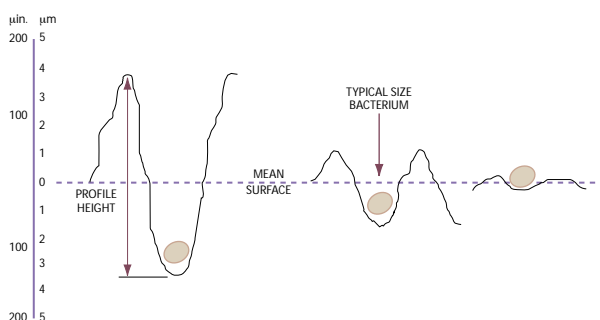
Electropolishing

The most effective method of eliminating burrs, folds, inclusions and other surface abnormalities is through electropolishing. This electrolytic process, the opposite of the plating process, is designed to remove metal without smearing or folding. 'Peaks' are dissolved more quickly than 'valleys' as a result of the greater concentration of current over the protruberances. This action produces a smoothing and rounding of the surface profile.

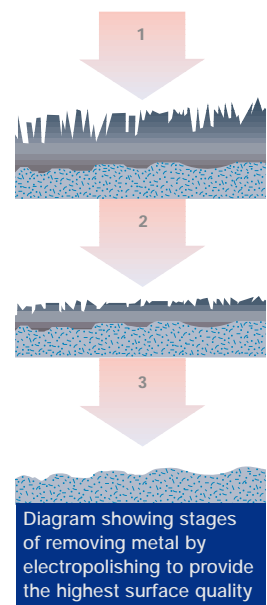
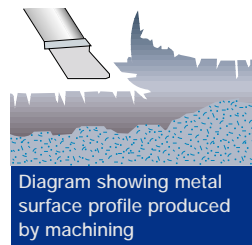
Mechanical polishing or machining may leave numerous microscopic surface imperfections which cause areas of differing electrical potential due to surface stresses. An electropolished surface is essentially balanced. Local corrosive cells cannot be set up, because galvanic differences caused by polishing stresses in the stainless surfaces have been eliminated.

Electropolishing can result in up to 50% improvement in surface finish of machined or mechanically polished surfaces. The inherent benefits of electropolishing subsequent to mechanical polishing can be summarised as follows:

- ◆ Superior surfaces for cleaning and sterilisation
- ◆ Superior passivated surfaces for corrosion resistance by virtue of enhanced chrome oxide surface layer
- ◆ Superior high lustre aesthetic appearance
- ◆ Superior elimination of smeared or torn surfaces caused by abrasive finishing
- ◆ Superior removal of inclusions and entrapped contaminants such as lubricants and grit particles



Surface finish research* (above) has shown that a succession of valleys and peaks of approximately $4\mu\text{m}$ in height would successfully hide contaminating bacteria (normally quantified at $0.28\mu\text{m}$ in diameter). By comparison a highly polished surface finish ($0.25\mu\text{m}$) would facilitate effective cleaning and sterilisation cycles.

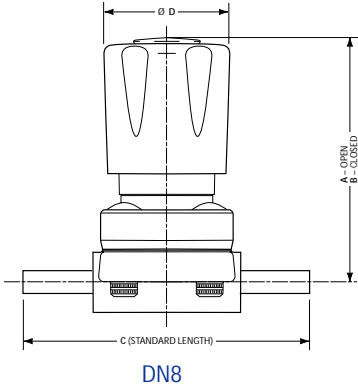


*Timperley and Lawson

Standard 2-Way Bodies

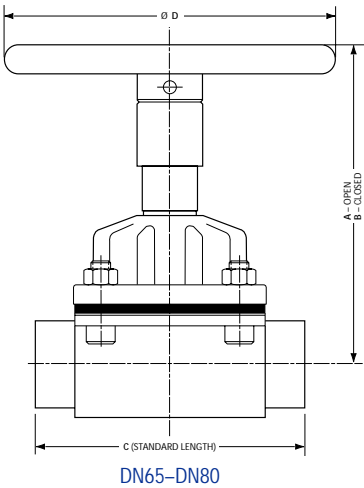
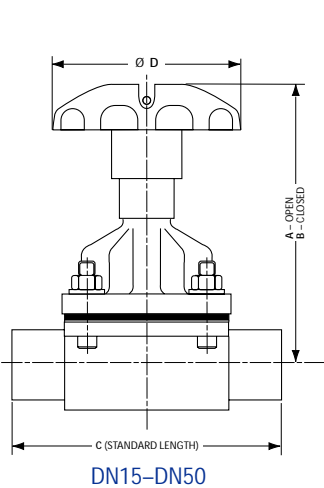
Valve Dimensions

Pure Performance Bonnet Assembly



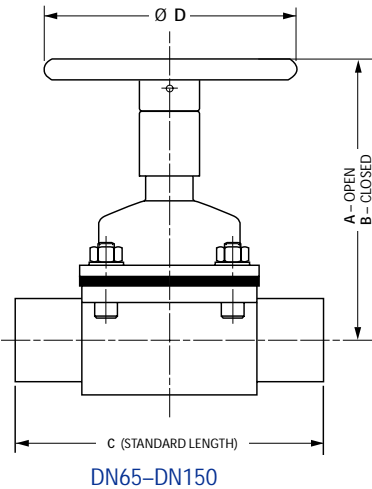
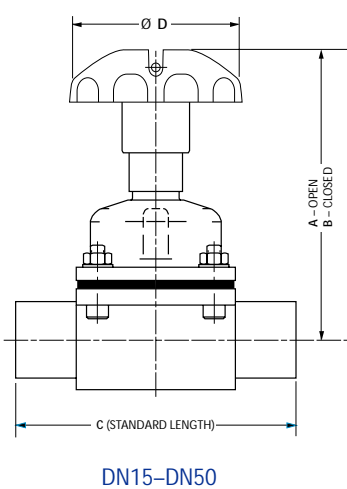
DN	A	B	C	D
8	67	62	78	34

White Epoxy Bonnet Assembly



DN	A	B	C	D
15	88	81	108	62
20	91	85	117	62
25	114	104	127	80
40	164	147	159	120
50	185	161	190	120
65	239	206	217	170
80	260	225	254	230

Stainless Steel Bonnet Assembly



DN	A	B	C	D
15	88	81	108	62
20	91	85	117	62
25	114	104	127	80
40	164	147	159	120
50	185	161	190	120
65	239	207	217	170
80	260	225	254	230
100	323	281	329	280
150	445	375	406	368

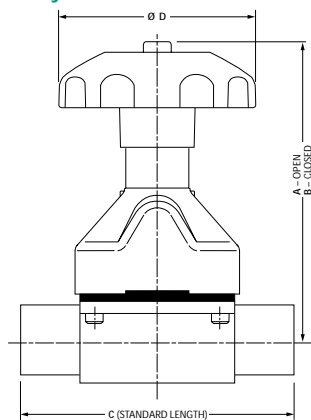
Standard 2-Way Bodies

Valve Dimensions

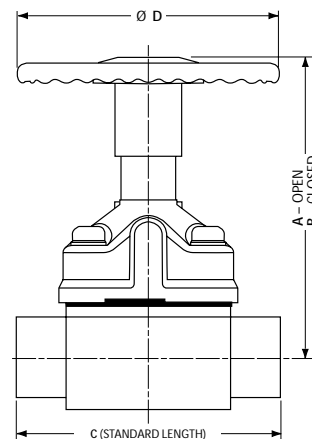


PES – Performance Bonnet Assembly

DN	A	B	C	D
15	110	103	108	62
20	116	106	117	62
25	146	132	127	80
40	203	181	159	140
50	212	183	190	140
65	216	189	217	140
80	288	245	254	250



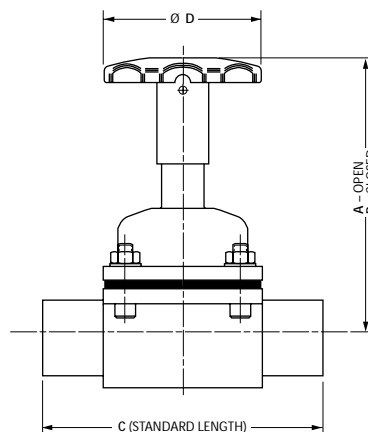
DN15–DN50



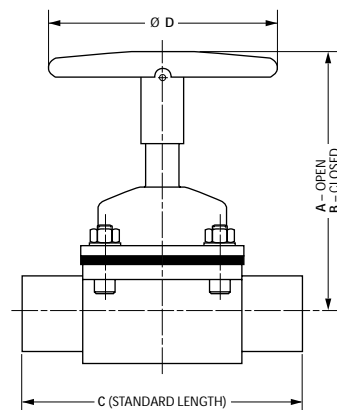
DN65–DN80

Stainless Steel Sealed Bonnet Assembly

DN	A	B	C	D
15	101	94	108	62
20	105	98	117	62
25	122	112	127	80
40	161	146	159	100
50	188	164	190	112
65	227	196	217	170
80	252	215	254	220



DN15–DN50



DN65–DN80

Saunders Customised Fabrication Options

Tandem Valves

Welded Valve Fabrications

The first and still most common customised valve concept is the tandem valve or valve and fitting combination. A main valve is ported and a section of tube is welded to the port to create an access point into the valve. This tube can in turn be welded to a second valve forming a two-valve cluster, or the tube can be turned into a weld end, hygienic clamp or other type of fitting. The fabrication weld is polished to match the required surface finish specification. The resulting assembly is designed to optimise drainability and meet standard process considerations including cGMPs for dead legs.

Applications include diverse requirements such as flow diversion, sampling, steam injection or condensate drain and block and bleed applications.

The following rules help define the possible orientation of tandem valves:

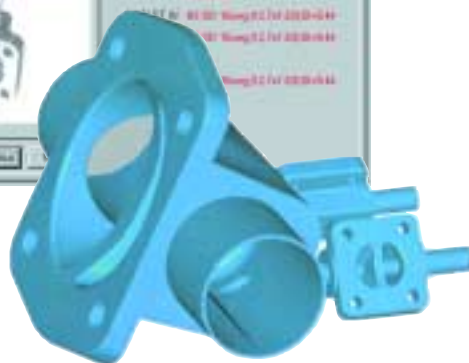
- ◆ The main valve and access valve may be installed to drain in either the horizontal or vertical position. When installed in a horizontal run the valve must be rotated into the self-drain position to drain.
- ◆ Allowance must be made to permit access to bonnet or actuator fasteners and for diaphragm maintenance.
- ◆ The access valve can be any size including the same size as the main valve.
- ◆ The amount of dead leg between main and access valves will vary depending on respective valve sizes and orientation. Virtually all combinations fall within cGMP requirements.
- ◆ 'Handwheel opposite' designs generally have shorter tangents than configurations with the handwheel of the main and access valves in the same quadrant.
- ◆ All Saunders welded valve fabrications are 100% hydro-tested before and after all welding and polishing processes to ensure mechanical integrity. Full material certification of all tube and fittings utilised is standard.
- ◆ Saunders bonnets, actuators and diaphragms fit fabricated valve assemblies without adaptors or distance pieces.

Saunders has created electronic tools to assist our customers in the selection and orientation of these fabrications. Saunders Tandem Valve Selection Programme enables engineers and design detailers to select the optimum orientation to suit system requirements and produce a fully coded 3D graphic for immediate translation to valve manufacture.



Saunders Tandem Valve

- ◆ Full range of horizontal and vertical, drainable options
- ◆ Can be configured to your exact pipe layout with minimum deadlegs
- ◆ Product transfer, purging, steam sterilisation, condensate drains, CIP systems



Saunders Customised Fabrication Body Options

Tandem Valve Orientation Options

Horizontal main at drain angle/vertical tandem



H 04 54



H 04 36



H 04 00



H 04 18

Horizontal main at drain angle/vertical tandem



H 32 36



H 32 18



H 32 54



H 32 00

Horizontal main/vertical tandem



H 18 36



H 18 18



H 18 54



H 18 00

Vertical main/tandem at drain angle



V 18 58



V 18 14



V 18 22



V 18 50

Horizontal main and tandem at drain angle



H 22 68



H 22 40



H 14 04



H 14 32

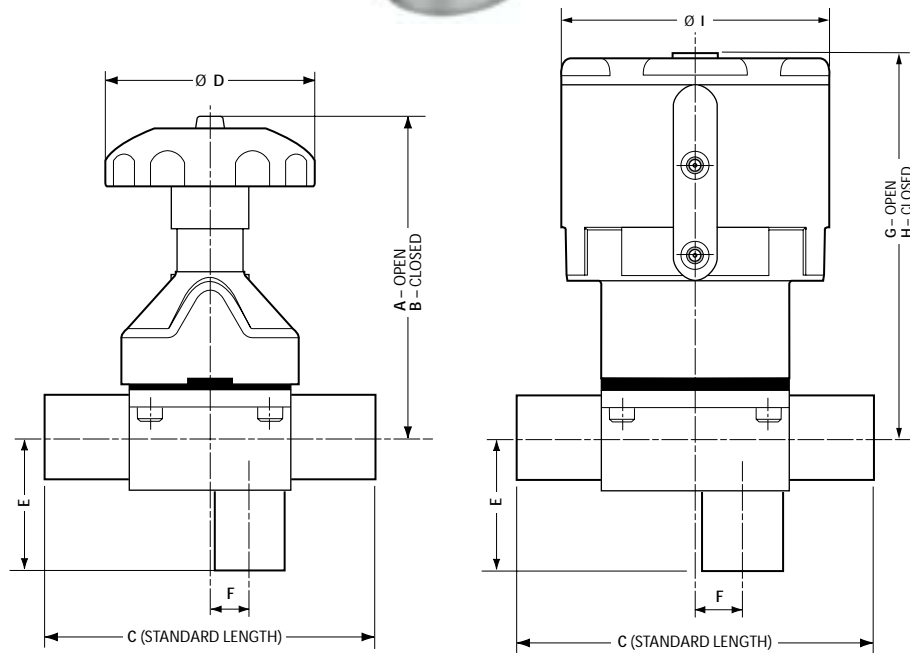
Saunders Customised Fabrication Options

ZDL Zero Deadleg Valve 'L' Pattern

The Saunders ZDL 'L' pattern diaphragm valve is typically installed in a vertical line. The function of a 90 degree fitting and a take-off valve are combined with the valve body. The bore of the third port is situated in line with the point of seal where the diaphragm meets the weir. This ensures low point drainability and elimination of deadlegs.

The ZDL valve is available with tri-clamp or butt-weld end connections in sizes DN8–DN100.

Common applications include WFI (Water for Injection) point of use, CIP manifolds and vertical inlet/outlet piping to process equipment requiring low point drainage.



DN	A	B	C	D	E	F	G	H	I
15	111	104	108	62	44	9	115	110	70
20	117	107	117	62	50	14	160	152	103
25	147	133	127	80	56	16	168	160	103
40	204	181	159	140	58	16	231	217	153
50	212	183	190	140	64	26	249	229	153
65	216	189	217	140	92	35	–	–	–
80	288	245	254	250	100	42	–	–	–

Dimensions based on BS OD 16swg.
Please refer to Saunders for all other specifications.

Saunders Customised Fabrication Options

Valve Manifolds/Clusters

Configuration of optimum process fabrication presents system designers with an ongoing challenge. Minimum space envelope, reduced hold up areas, reduced cost and facilitating ease of installation are all key considerations.

Saunders provides all of its customers with an expert, yet straightforward customisation service designed to create the optimum valve configuration for their process. Our engineers can review either sketch detail or P + ID's (Piping and Instrumentation Drawings) and put forward an innovative solution. Saunders will rapidly respond with a fully detailed CAD (Computer Aided Design) drawing for you to verify and approve. This process ensures that the product we make matches client requirements in every respect.

The benefits of such fabrications include:

- ◆ Manufacture by Saunders under stringent ISO 9001 quality control
- ◆ Tailor-made solutions to customer requirements
- ◆ Fully tested assembled units manufactured under controlled conditions
- ◆ Full traceability of all components

All Saunders process fabrications utilise either forgings or machined barstock components to ensure process integrity.



Customised 5-way diverter fabricated manifold



Specialised valve and actuator cluster



Manual valve cluster

Standard Machined Block Bodies

ZDT Zero Deadleg 'T' Pattern

Essential in the elimination of dead legs and designed to ease installation and validation, Saunders Zero Deadleg T pattern range (ZDT) makes an important contribution in enhancing the integrity of critical systems. Machined integrally from a forging, the ZDT normally features three common ports with the same bore dimensions and incorporates a valve body and tee fitting into a single solution. ZDT valves form the ideal solution for feeding laterals off recirculating loops, sample points or use point applications. The bodies can be supplied with weld or hygienic clamp end connections or included in a U-bend configuration for point-of-use service.

Major benefits of the range include:-

- ◆ Virtual elimination of deadleg to enhance process integrity
- ◆ Highly compact, space saving design providing ideal solution where space is a concern
- ◆ Excellent drainage characteristics to facilitate quick and effective sterilisation
- ◆ Patented design to aid validation for FDA and cGMP compliance
- ◆ Machined integrally from Stainless Steel 316L/1.4435 forging (no welds)
- ◆ Available in size range DN15–DN50 with full range of FDA conforming diaphragm/bonnet/actuation options



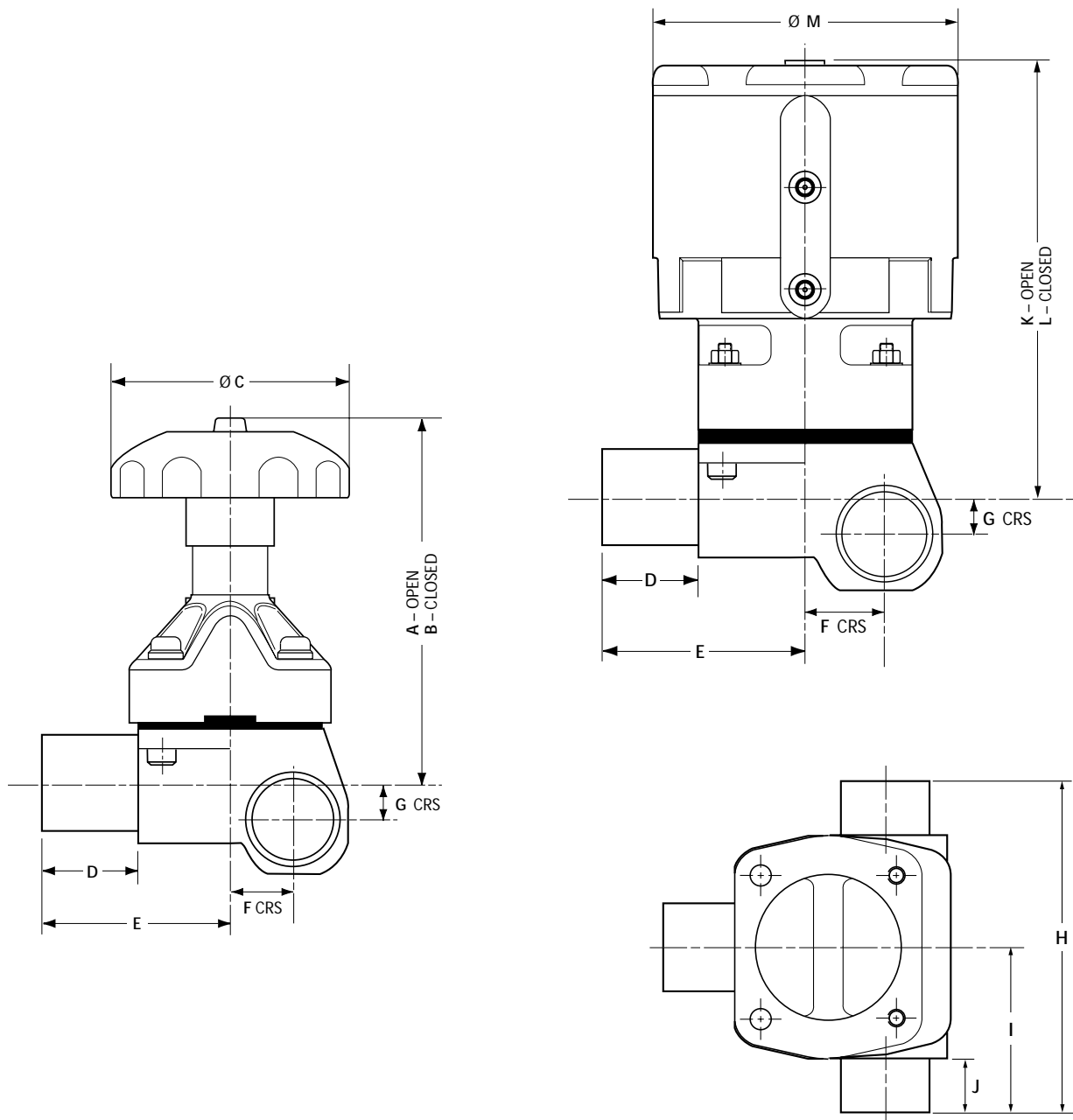
Saunders ZDT*

Zero deadleg 'T' Pattern Valves provide excellent drainability and elimination of deadleg for process sampling.

* (Worldwide Patents Apply)

Standard Machined Block Bodies

ZDT Zero Deadleg 'T' Pattern



Dimensions and Centre Lines

	A	B	C	D	E	F	G	H	I	J	K	L	M
15	111	104	62	30	54	13.1	5	108	54	28	115	110	70
20*	111	104	62	30	54	11.9	6	108	54	28	115	110	70
25	147	133	80	28.5	63.5	15.6	6.2	127	63.5	25	167	161	103
40	204	181	159	34	79.5	24.4	29.1	159	79.5	29	231	217	153
50	212	183	190	41	95	36	11	190	95	31	250	230	153

* Note: DN20 comes from DN15 or DN25 forging depending on end specification.
Dimensions based on BS OD 16swg. Please refer to Saunders for all other specifications.

Standard Machined Block Bodies

CCB Close-Coupled Branch Valves

Saunders Close Coupled Branch Valve (CCBV) directly compliments the patented ZDT design by facilitating larger main line size options and providing the ideal solution when the main process line is at least one size larger than the valve/branch size. The unique tee construction is engineered from a machined billet to enhance structural integrity and ease installation and validation.

The CCB valve provides a straight through unobstructed main line flow path and will eliminate the deadleg normally associated with welding a conventional two-way valve to a T-piece. By virtue of the weir size, the CCB offers a compact, flexible and economic design solution.



Saunders Close-Coupled Branch Valve

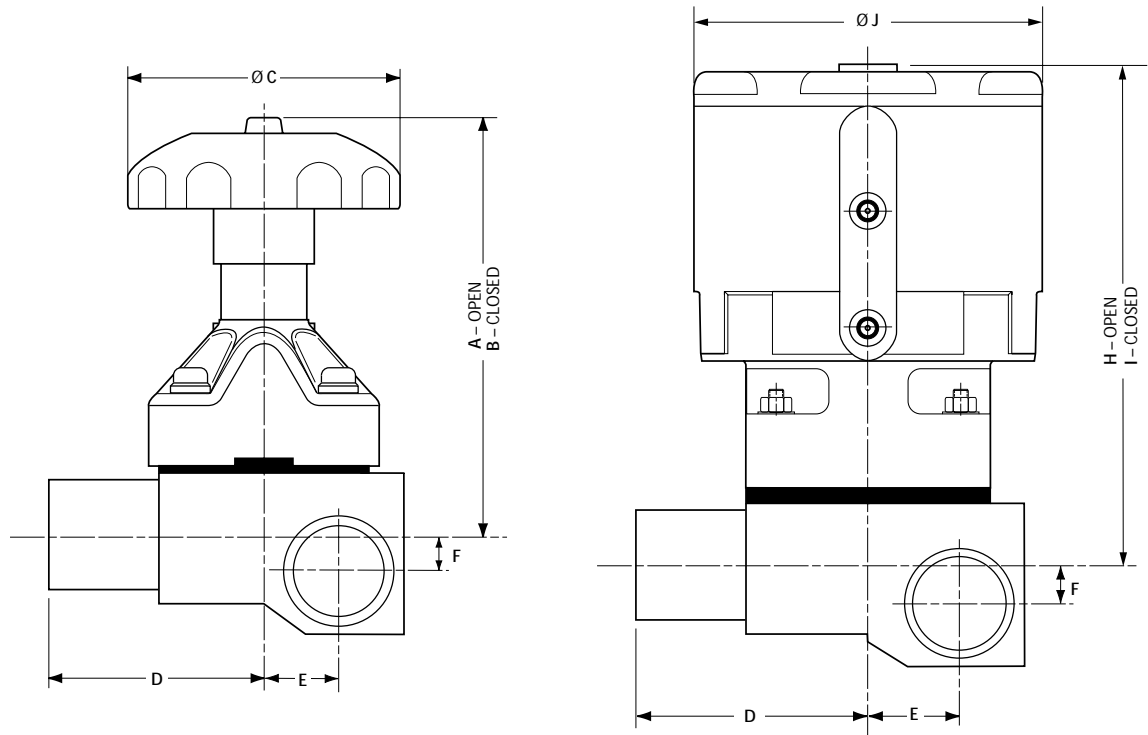
- ◆ Compact flexible design providing excellent drainage characteristics and absence of deadleg
- ◆ Machined block construction provides security of installation, rapid sterilisation and easier regulatory compliance
- ◆ Ideal solution when main process line is larger than valve/branch size (i.e. main line DN50 valve/branch DN25) utilises DN25 diaphragm/bonnet/ actuator
- ◆ Sampling/injection points on high purity water systems



TECHNICAL DATA

Standard Machined Block Bodies

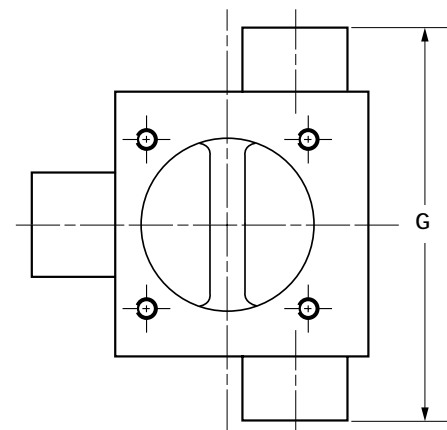
Close-Coupled Branch Valves



Sizes (DN) 16swg/tri-clamp only

BRANCH	MAIN	A	B	C	D	E	F	G	H	I	J
15	20	107	101	62	54	11.2	12.7	127	111	106	70
15	25	107	101	62	54	14.5	16.7	127	111	106	70
15	40	107	101	62	54	20.7	22.7	127	111	106	70
15	50	107	101	62	54	27.2	27.9	139.7	111	106	70
15	65	107	101	62	54	33.6	31.2	139.7	111	106	70
15	80	107	101	62	54	40.5	34.7	139.7	111	106	70
15	100	107	101	62	54	53.2	42.8	152.4	111	106	70
20	25	114	104	62	58.5	14.9	13.5	139.7	156	148	103
20	40	114	104	62	58.5	20.5	19.4	139.7	156	148	103
20	50	114	104	62	58.5	26.9	24.7	152.4	156	148	103
20	65	114	104	62	58.5	33.2	27.9	152.4	156	148	103
20	80	114	104	62	58.5	39.6	31.4	152.4	156	148	103
20	100	114	104	62	58.5	52.3	40.1	165.1	156	148	103
25	40	144	130	80	63.5	21.4	19.3	149.2	164	156	103
25	50	144	130	80	63.5	27.8	24.7	161.9	164	156	103
25	65	144	130	80	63.5	34.1	29.3	161.9	164	156	103
25	80	144	130	80	63.5	40.5	32.3	161.9	164	156	103
25	100	144	130	80	63.5	53.2	40.3	174.6	164	156	103
40	50	198	176	140	79.5	28.7	18.0	184.2	225	211	153
40	65	198	176	140	79.5	35.1	23.0	184.2	225	211	153
40	80	198	176	140	79.5	41.4	30.0	184.2	225	211	153
40	100	198	176	140	79.5	53.8	39.2	196.9	225	211	153
50	65	206	178	140	95.0	36.1	22.2	203.2	244	224	153
50	80	206	178	140	95.0	42.4	26.9	203.2	244	224	153
50	100	206	178	140	95.0	54.8	38.3	215.9	244	224	153

Dimensions based on BS OD 16swg. Please refer to Saunders for all other specifications.



Standard Machined Block Bodies

Point-of-Use Options (Close-Coupled Branch Valve 'U' Bend)

Use Point Options

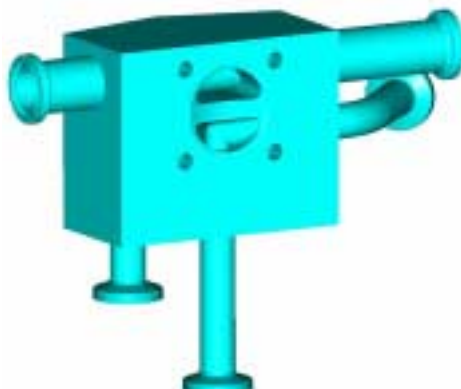
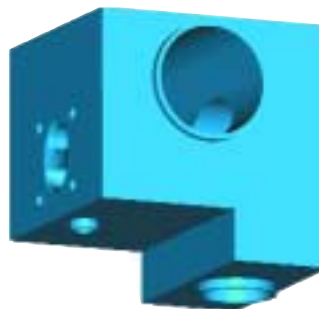
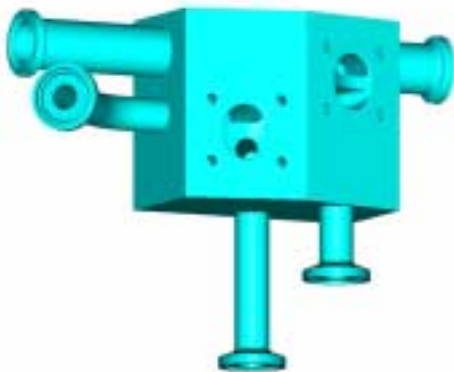
One of the most sensitive applications in a WFI loop is the use point valve. These valves represent the barrier between the safety of the recirculating loop and the potential hazards of the environment and function as the take off point for consumption of WFI. Valves for this application need the highest level of design security, integrity and cleanliness. Saunders point-of-use valves are engineered to minimise dead areas and fully drain all associated tubing.



Saunders Point-of-Use Valve

Horizontal or vertical drain port. Significantly reduces the hold-up volume and necessary site welds associated with conventional 'U' bends and branch tee assemblies. Sampling or injection points on high integrity systems.

Sample quality directly from water loop with integral back sample option.

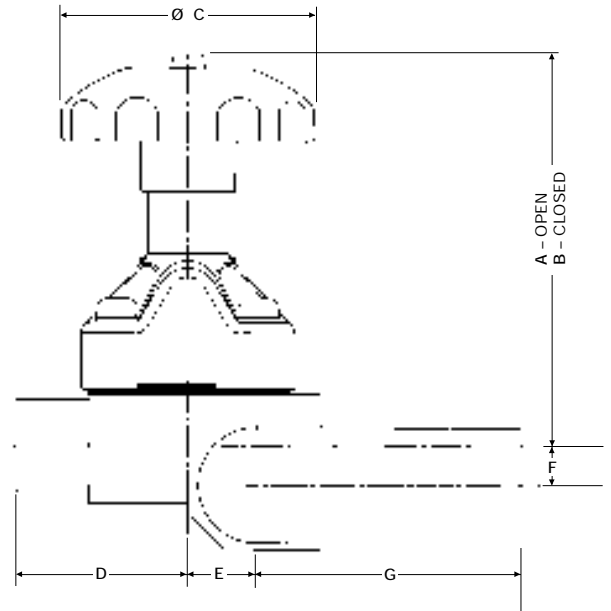
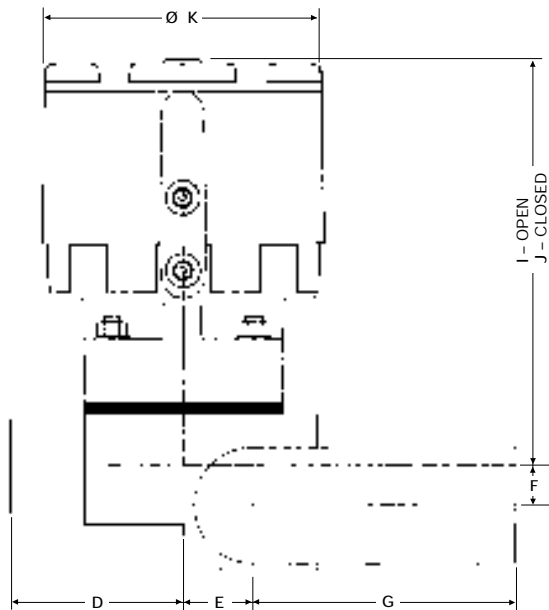


Optional integral sample ports can be included to permit real time sampling of WFI without breaking a sterile use point connection. Valve for point of use service can be fitted with a wide variety of end connections and orientations to meet specific system requirements. Alternate use point designs can be manufactured to accommodate special centre lines, reduced envelope requirements or other design considerations.

TECHNICAL DATA

Standard Machined Block Bodies

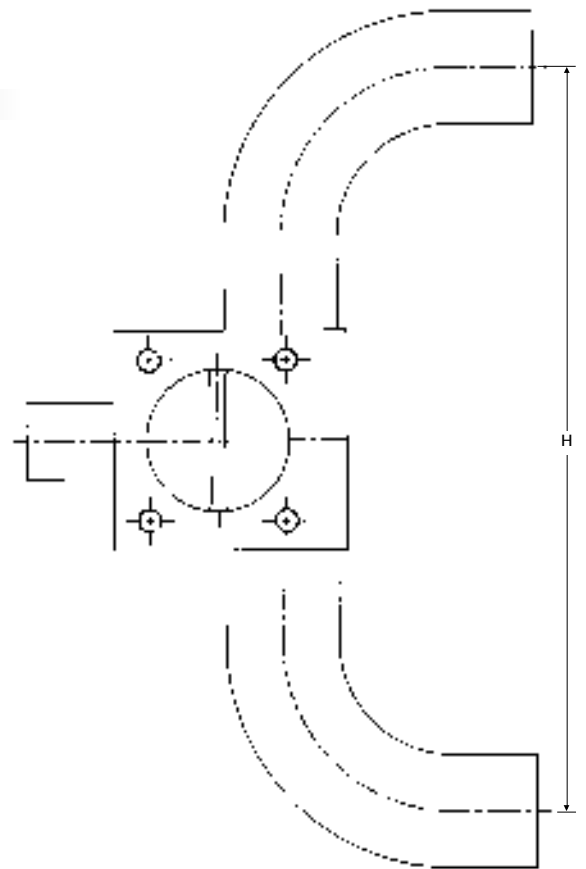
Point-of-Use (Close-Coupled Branch Valve 'U' Bend)



Sizes (DN) 16swg/tri-clamp only

BRANCH	MAIN	A	B	C	D	E	F	G	H	I	J	K
15	20	107	101	62	54	11.2	12.7	76.2	126.7	111	106	70
15	25	107	101	62	54	14.5	16.7	76.2	126.7	111	106	70
15	40	107	101	62	54	20.7	22.7	114.3	164.8	111	106	70
15	50	107	101	62	54	27.2	27.9	145.0	195.5	111	106	70
15	65	107	101	62	54	33.6	31.2	145.0	195.5	111	106	70
15	80	107	101	62	54	40.5	34.7	165.1	215.6	111	106	70
15	100	107	101	62	54	53.2	42.8	215.9	266.4	111	106	70
20	25	114	104	62	58.5	14.9	13.5	76.2	140.7	156	148	103
20	40	114	104	62	58.5	20.5	19.4	114.3	178.8	156	148	103
20	50	114	104	62	58.5	26.9	19.4	114.3	178.8	156	148	103
20	65	114	104	62	58.5	33.2	27.9	145.0	209.5	156	148	103
20	80	114	104	62	58.5	39.6	31.4	165.1	229.6	156	148	103
20	100	114	104	62	58.5	52.3	40.1	215.9	280.4	156	148	103
25	40	144	130	80	63.5	21.4	19.3	114.3	188.3	164	156	103
25	50	144	130	80	63.5	27.8	24.7	145.0	219.0	164	156	103
25	65	144	130	80	63.5	34.1	29.3	145.0	219.0	164	156	103
25	80	144	130	80	63.5	40.5	32.3	165.1	239.1	164	156	103
25	100	144	130	80	63.5	53.2	40.3	215.9	289.9	164	156	103
40	50	198	176	140	79.5	28.7	18.0	145.0	247.0	225	211	153
40	65	198	176	140	79.5	35.1	23.0	145.0	247.0	225	211	153
40	80	198	176	140	79.5	41.4	30.0	165.1	267.1	225	211	153
40	100	198	176	140	79.5	53.8	39.2	215.9	317.9	225	211	153
50	65	206	178	140	95.0	36.1	22.2	145.0	273.0	244	224	153
50	80	206	178	140	95.0	42.4	26.9	165.1	293.1	244	224	153
50	100	206	178	140	95.0	54.8	38.3	215.9	343.9	244	224	153

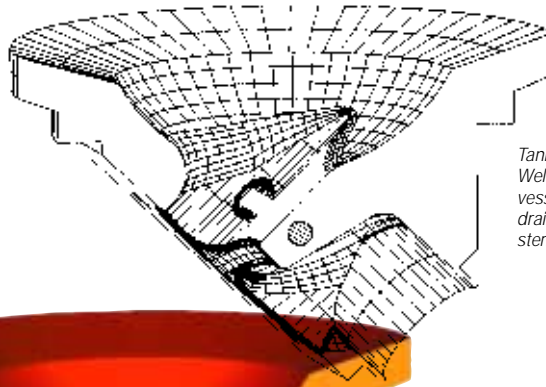
Dimensions based on BS OD 16swg. Please refer to Saunders for all other specifications.



Standard Machined Block Bodies

Tank Bottom Valves

The Saunders tank bottom valve incorporates the performance and features of a diaphragm valve into a one piece fully forged tank outlet design. These valves are free from fabrication welds and dead legs, enhancing structural integrity and reducing the potential for process contamination. The absence of dead legs also improves drainability, and facilitates effective mixing. Sample valves, purge valves and ports are easily incorporated into the tank bottom design to achieve the desired performance.



*Tank bottom valve
Weld installation at low point of
vessel base enabling optimum
drainage, cleaning and
sterilisation.*



*Internal purge options
available either on vessel side
or outlet side depending on
system requirements*

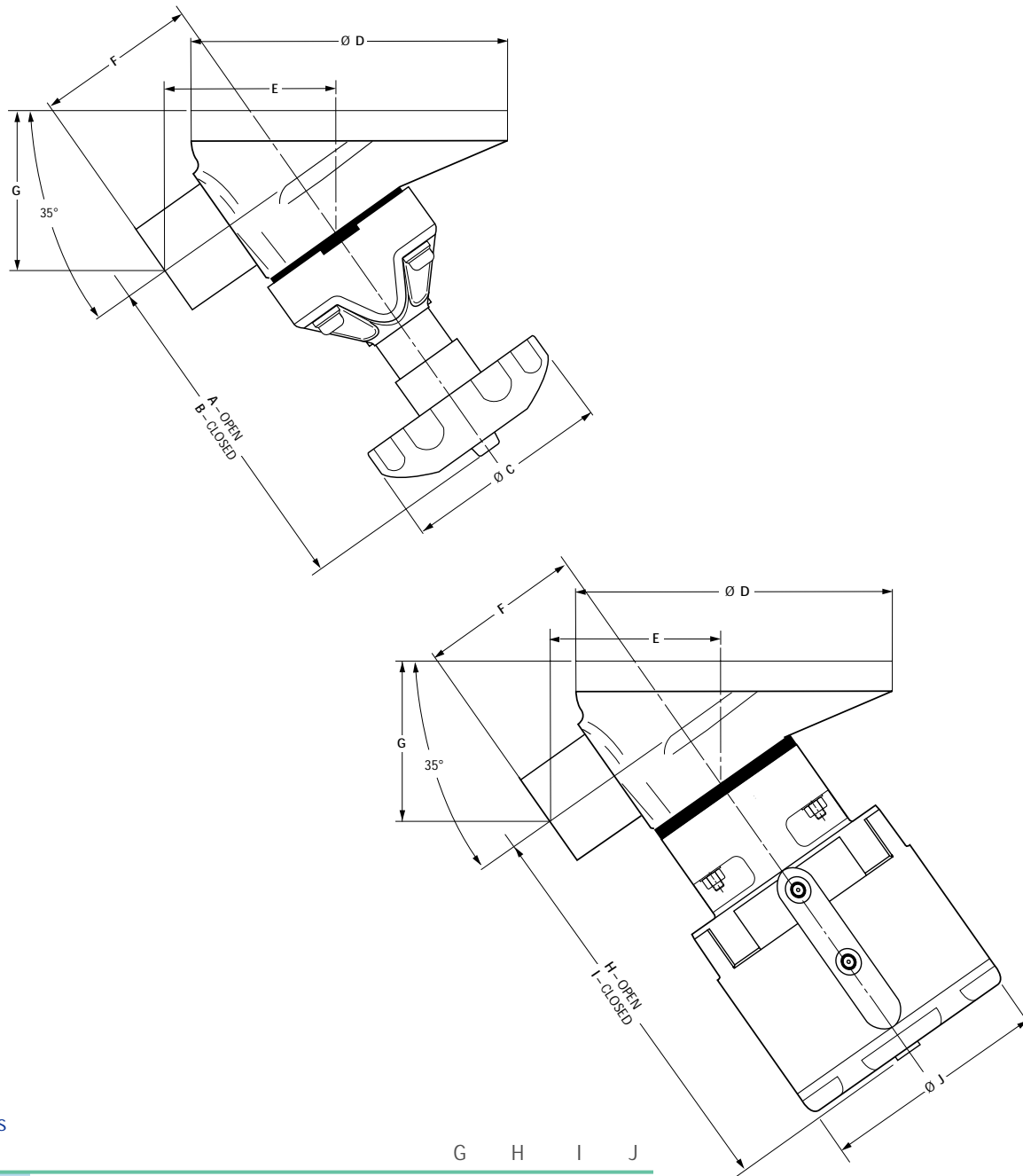


*Conventional
purge
fabrication*

TECHNICAL DATA

Standard Machined Block Bodies

Tank Bottom Valves



Sizes

							G	H	I	J
15	110	103	62	65	49.6	54.0	45.4	115	110	70
20	110	103	62	65	49.6	54.0	45.4	115	110	70
25	147	133	80	107	60.2	63.5	59.5	168	160	103
40	204	181	140	140	82.0	79.5	72.1	231	217	153
50	213	184	140	166	96.5	95.0	82.2	249	229	153
65	288	245	250	237	134.5	127.0	107.0	—	—	—
80	288	245	250	237	134.5	127.0	107.0	—	—	—

* Note: DN20 comes from DN15 or DN25 forging depending on end specification.
 Dimensions based on BS OD 16swg. Please refer to Saunders for all other specifications.

Standard Machined Block Bodies

Multi-port Diverter Valves

Diverter Valves

Modern machining technology is employed in the design and manufacture of Saunders range of Bio-Block diverter valves. This product brings two or more weirs or control points together in a single configuration that is manufactured from a single block of stainless steel. This results in a completed design without internal fabrication welds for maximum strength with reduced holdup volumes and without stagnant areas. On one side of the weirs there is a common chamber and on the other side of the weir the flow is divided and split into multiple control points. Diverter valve designs are ideal solutions whenever a process line needs to be divided into two or more process streams or when multiple lines are combined into one.

Two weir diverter valves drain in horizontal and vertical orientation. Diverter valves with three or more weirs only drain vertically. Diverter valves can be supplied with either autoweld or hygienic clamp ends arranged to meet system design requirements.



Standard Machined Block Bodies



Diverter Multi-port Configurations

Saunders multiport diverter valves have significant advantages over conventional multiple valve assemblies.

- ◆ Machined Block construction, free from fabrication welds to enhance structural integrity
- ◆ Minimal deadleg design to reduce risk of process contamination
- ◆ Inlet machined integrally eliminates a potential source of contamination (many other designs employ bolted inlet)
- ◆ Excellent drainage characteristics for quick and effective sterilisation
- ◆ Reduced space requirement provides greater flexibility in system design and simplified installation
- ◆ Complete aseptic solution including FDA compliant diaphragms, manual bonnets and actuators
- ◆ Fully certified range, with comprehensive validation support documentation on request



The Saunders diverter software selection programme supports the multi-port diverter range. Like the tandem valve programme, this electronic tool enables our customers to select the ideal multi-port valve solution including end selection and valve arrangement and then print the selection in a 3D format.

YOU HAVE FINISHED		5 D 3 025 B Y A E 04 X J T O	
 		SUMMARY FOR: AFP Diverter Valve	
Notes:		# OF OUTLETS: 3 SIZE: 25 mm MATERIAL: 316L / 1.4405 FINISH: Satin/Vec	
<input checked="" type="radio"/> Print with Pictures <input type="radio"/> Print without Pictures		INLET SPEC: Tri-Clamp Ø50.4 / DN25 16way bore OUTLET SPEC: Tri-Clamp Ø50.4 / DN25 16way bore INLET: Clamp, Straight OUTLET 1: Clamp, 90° Angle - @ 0° OUTLET 2: Clamp, Straight OUTLET 3: Clamp, 90° Angle - @ 270°	
<input type="button" value="Print Report"/>			

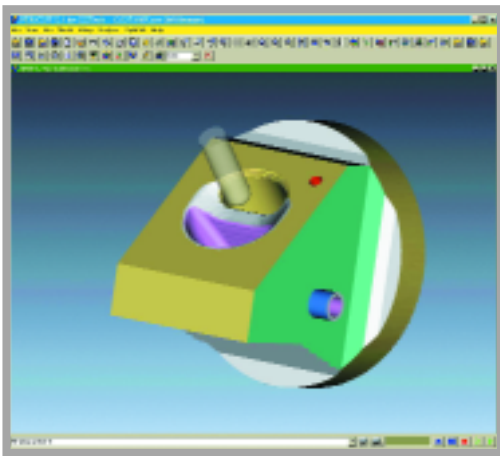
Bio-Block Customised Design Options

Computer Aided Engineering Capability (CAE)

Bio-Block Standard and Compound Valves

There exists in almost every process system a unique piping challenge that does not lend itself to conventional solutions. Saunders design team recognise this and have developed a philosophy of working with customers to create unique machined valve designs that we call Bio-Blocks. The type of requirements that engineers face that command these 'outside of the box' solutions may be driven by process, space constraints, regulatory issues or other specific requirements.

The key elements in producing Bio-Block valve solutions have been the development of advanced CAE (Computer Aided Engineering) design and manufacturing tools that enable our engineers to convert concept into reality. This approach to manufacturing makes possible custom machined valve products without incurring long lead times in design or production. Saunders work closely with customers to co-ordinate solutions to unique application challenges.



Tool path verification

Saunders custom Bio-Block valves replace welded valve clusters, manifolds and valve/fitting combinations. Machined Bio-Blocks have the advantages of reduced wetted area and dead-legs; no internal fabrication welds and reduced documentation for installation and validation. Faster and easier installation of process manifolds can be achieved using advanced "machined from solid" valves.



Engineering team with client

All standard and custom Bio-Block valve bodies accept Saunders standard diaphragms, bonnets and actuators without modification or adaptors. The compact design of the EC actuator range enables Saunders to produce the most compact solutions in the industry.



Typical CAD three dimensional image



Five axis machining centre

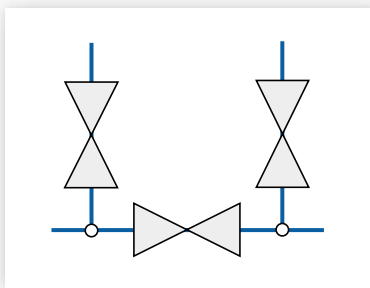
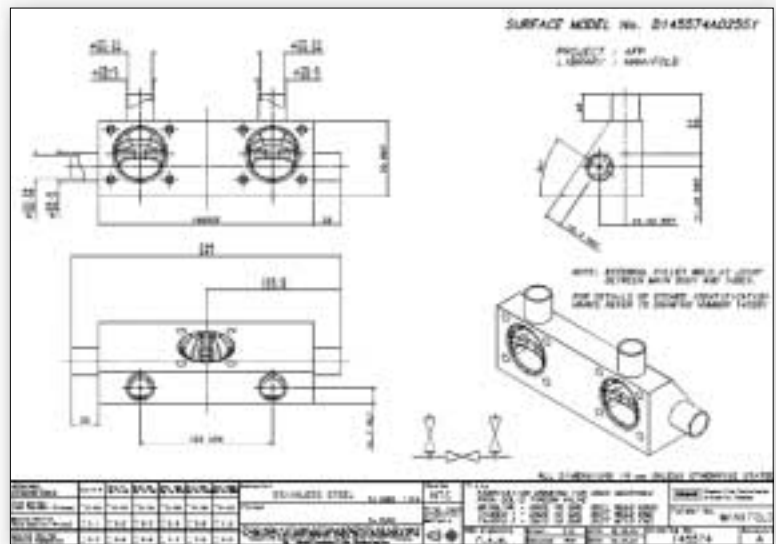
Bio-Block Customised Design Options

Conceptual Approach

Bio-Block Compound Valve Solutions

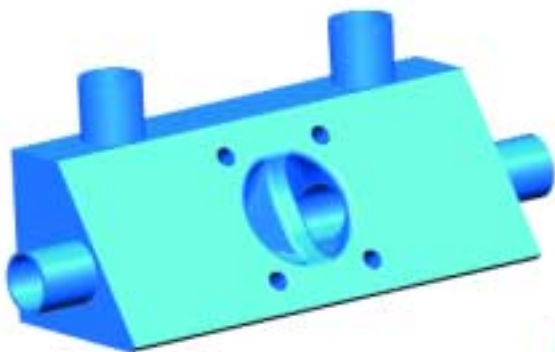
Many of today's most challenging applications cannot be addressed by one valve configuration. Instead, a combination of two or more valve concepts must be machined from a single block of stainless to meet system requirements.

The resulting valve types are a hybrid or compound solution that entails the use of more than one valve concept. For example combining a tank bottom valve with an access valve, a multi-port valve with access valves to perform as steam and condensate port or a point-of-use valve together with a sample valve. Saunders highly trained and experienced engineering staff and modern CAD design tools combined with our manufacturing expertise result in custom valve configurations that combine utility and performance.

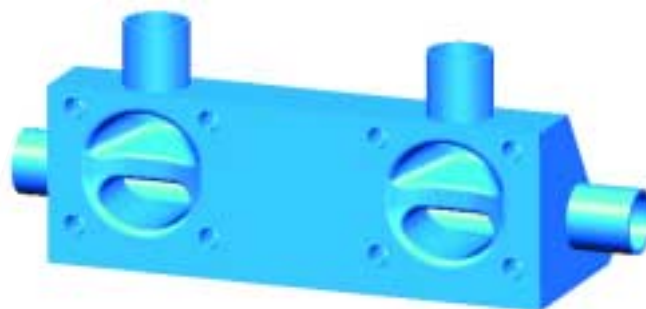


There are some key considerations when configuring custom "machined from solid" valves.

- ◆ Valve centrelines
- ◆ Drain point of body bore and any associated tubing
- ◆ Drain point of weirs
- ◆ Centre to face dimensions
- ◆ Allowance for bonnet or actuator assembly and diaphragm maintenance
- ◆ Internal flow patterns and drain paths
- ◆ Minimise deadleg area
- ◆ Meet cGMP requirements



Double tandem valve machined from solid barstock. Main weir inclined at optimum drain angle.



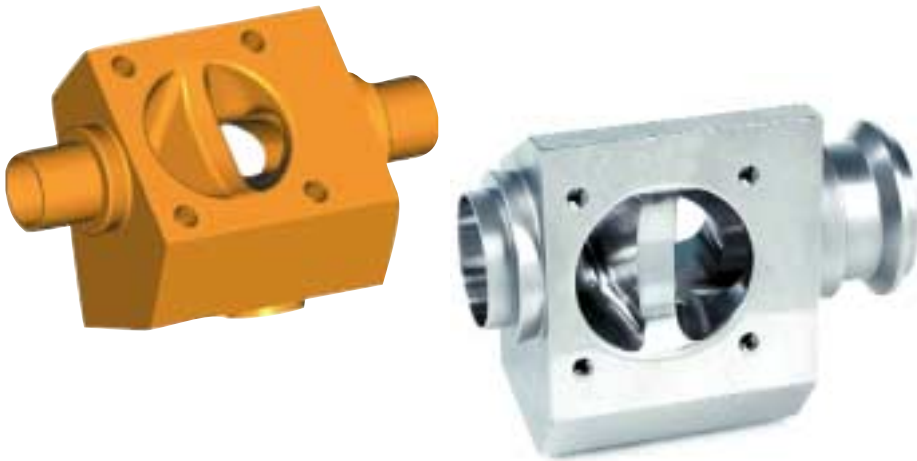
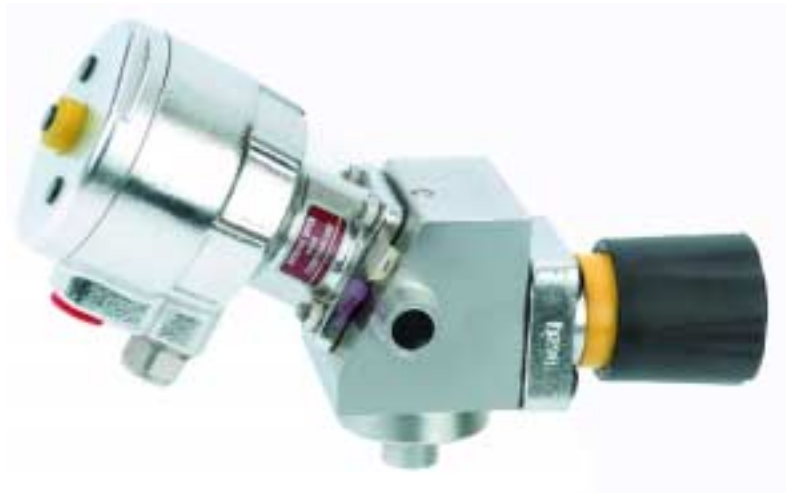
Bio-Block Customised Design Options

Bio-Block Machined Tandem Valves

This design is a machined from solid version of the welded valve-to-valve or tandem valve assembly. Machined from a single block of wrought stainless steel it provides several benefits.

- ◆ Absence of internal fabrication welds enhances product integrity
- ◆ Hold up volumes can be reduced
- ◆ Dead legs minimised
- ◆ Reduced number of material certificates required

These advantages are especially realised in the smaller sizes where valve geometry makes it difficult to achieve cGMP requirements for minimum dead legs.



Bio-Block Integral Steam, Purge and Condensate Porting

Rather than control steam supply and condensate drain by means of 'stand off' welded access valves that may entail large design envelopes or dead legs, Saunders Bio-Block valves can be machined with integral weirs and/or ports.



Bio-Block tank manifold arrangement. Combining conventional tank bottom and ZDT technology into a high integrity machined block configuration for bio-pharm vessel applications. Cleanability, facilitated by purging into offset weirs (sterile barrier).

Bio-Block Customised Design Options

Conceptual Approach

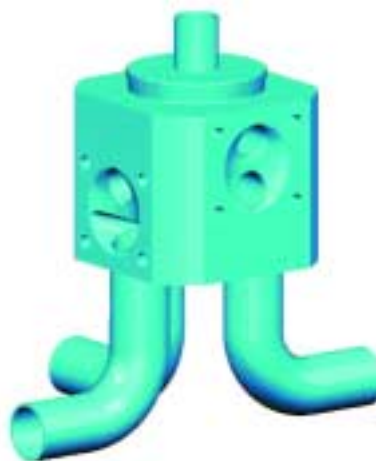
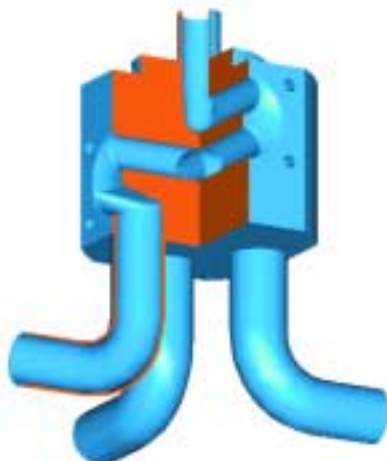
Bio-Block Serial Weir Option

This concept puts two weirs in line but 180° apart and sharing a common chamber. This allows the common chamber to be sterilised and form a barrier between two process flow streams. Our customers have incorporated this concept in requirements as diverse as Point-of-Use, Tank Outlet and in 'Mix-Proof' applications.



Bio-Block Controlled Inlet Option

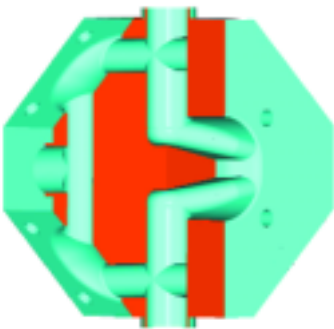
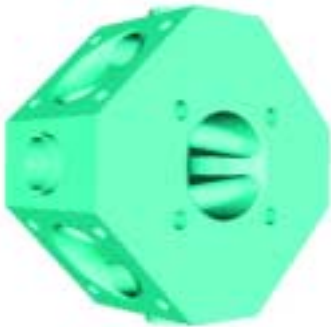
Generally associated with multi-port designs, this option involves machining a weir at the inlet to the common chamber of a Bio-Block valve. This design permits control of flow entering into the multi-port valve. The controlled inlet option can be included in any number of compound Bio-Block solutions to comply with specific system requirements.



Bio-Block Customised Design Options

Bio-Block Chromatography Valves

This Bio-Block option incorporates a central control weir to permit the division of flow into distinct process streams or to allow flow to pass through the valve as required during resin regeneration or cleaning cycles.



*Typical chromatography
Bio-Block arrangement*



Design and Installation Advantages

Bio-Block machined valve solutions are the ideal complement to modular component design and construction. One Bio-Block valve can replace a welded piping manifold comprised of several valves and fittings resulting in both reduced design envelope, installation times and thus overall cost savings. All this accomplished while requiring fewer welds and less documentation.



*Steam-cross arrangement
machined from solid barstock*



*Typical steam-cross
fabrication arrangement*

Bio-Block Customised Design Options

Advanced Aseptic Valve Design Tools

It is important that all aspects of the application be properly communicated between customer and designer ensuring that the resulting design meets expected performance criteria. Saunders has adopted tools to better communicate and understand the configuration of unique and often complex concepts such as compound Bio-Block designs.

Foremost of these is the use of 3D software utility. This computer program produces a 3D model of a proposed valve complete with a viewer in an e-mailable format that can be shared easily between Saunders design and applications engineering and our customers. The 3D representation of the valve design is derived from the same programme file that is used in the design and in the manufacturing of the final product.

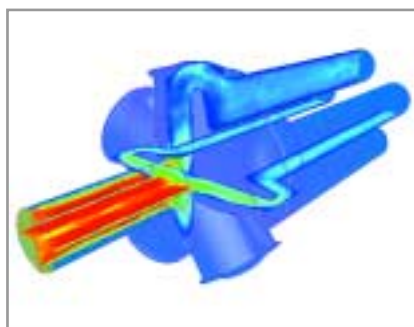
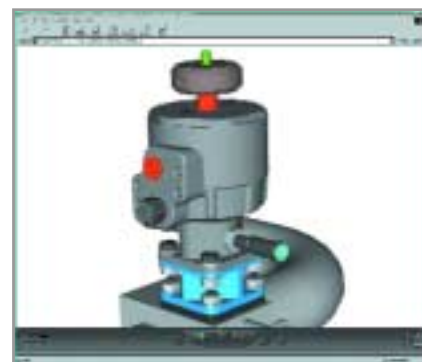
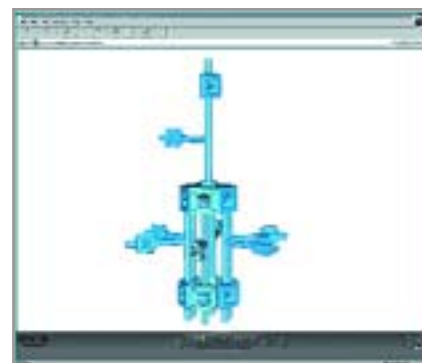
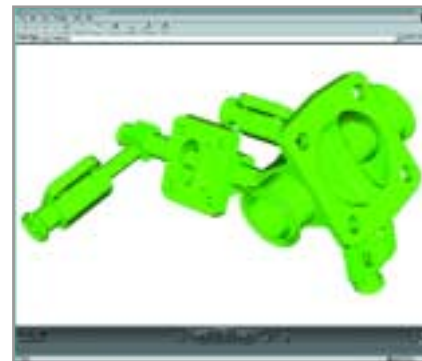
Using this software utility our customers can select from five isometric 3D views or freely rotate the valve to confirm flow paths or drainability.

Additional features include both zoom and the facility to 'wire frame' the view and access the internal configuration.

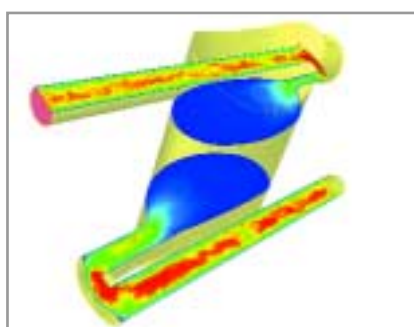
Computational Fluid Dynamics (CFD)

Saunders employs the use of Computational Fluid Dynamics software to ensure that flow characteristics including Cv (Kv), pressure drop and flow paths meet client requirements. Actual flow paths can be viewed to eliminate low flow areas or potential cavitation.

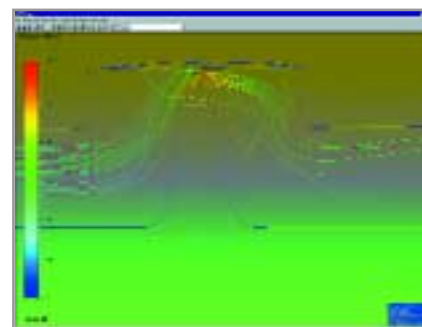
Trained and experienced Saunders sales and engineering staff are ready to work with you to develop unique Bio-Block valve solutions. Saunders is committed to excellence in the application, design and manufacture of custom machined valve solutions as reflected in its innovative and evolving range of Bio-Block valves.



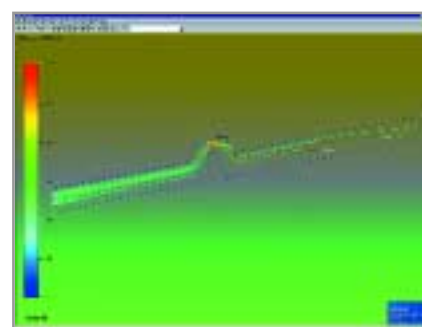
CFD analysis of
Bio-Block five-way
diverter



CFD analysis
of sterile barrier
manifold



CFD analysis
of standard
AFP forging



Manual Biopharm Bonnet Assemblies

Polymer and Stainless Steel

Biopharm Bonnet Assemblies

The best all-round choice for your application

The unique needs of the Biopharm Industry have been considered in every aspect of design. Saunders manual bonnet range incorporates:

- ◆ Hi-tech polymer materials that are lightweight and corrosion resistant
- ◆ Truly autoclavable models
- ◆ Modular options to suit all application needs
- ◆ Stainless steel and polymer options that are contoured for ease of cleaning



Stainless Steel Bonnet Assembly

Constructed from materials which fulfil all FDA requirements, this bonnet offers the best possible levels of security, durability and corrosion resistance.

- ◆ Represents a high integrity solution for situations where coated or plastic bonnets would be unacceptable
- ◆ Features smooth contours and an electropolished surface to eliminate bug traps
- ◆ Fully autoclavable up to 140°C to ensure maximum levels of sterility
- ◆ Supplied with PES (polyether sulphone) handwheel to offer high temperature performance and excellent chemical resistance
- ◆ Available in size range DN15–DN150
- ◆ Suitable for Steam-in-Place (SIP)



White Epoxy Coated Bonnet

This consistently popular bonnet is the economic solution for applications which do not require high temperature steam autoclaving.

- ◆ Suitable for washing externally with semi-corrosive fluids
- ◆ Engineered in sizes DN15–DN100 with a white epoxy coating
- ◆ Features an easily cleaned surface, which is free from pits or crevices
- ◆ Suitable for Steam-in-Place (SIP)



Stainless Steel Sealed Bonnet Assembly

Meeting all FDA requirements, this is the optimum solution in bonnet assemblies for the Biopharm market.

- ◆ Thrust pad and 'O' rings apart, completely constructed from stainless steel ensuring long life and providing the ultimate in security, reliability and corrosion resistance
- ◆ Fully sealed, with a primary seal that provides absolute containment for critical applications
- ◆ Electropolished to meet both aesthetic and aseptic requirements
- ◆ Operational at temperatures up to 160°C
- ◆ Suitable for Steam-in-Place (SIP)
- ◆ Available in size range DN15–DN80



Pure Performance Bonnet

Available only in size DN8 (4 bolt), this bonnet is produced in PPS (Poly-phenylenesulphide). Features include:

- ◆ Built in overclosure stop for greater process control
- ◆ 'O' Ring seal preventing ingress of foreign material and providing containment of process media
- ◆ 4-Bolt design providing optimum sealing capability
- ◆ Fully autoclavable up to 140°C

Manual Bonnets

Black PES Performance Bonnet

Black PES (Polyethersulphone)

Designed for the most demanding Biopharm applications and featuring PES, a high performance thermoplastic material with excellent chemical resistance, to ensure long life and high reliability.

Fully autoclavable, the PES bonnet is available across the size range DN15–DN80.

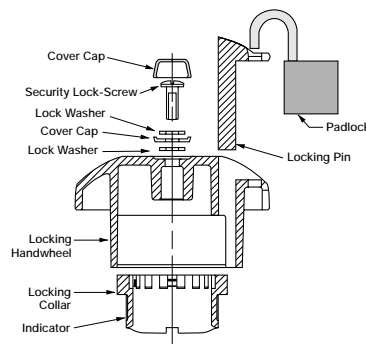


The PES Performance Bonnet offers several key features:

- ◆ High integrity, ergonomic handwheel. Design ensures comfortable operation and precise control
- ◆ Fully autoclavable to 140°C
- ◆ 'O' Ring seal prevents both the escape of product and the potential ingress of contaminants
- ◆ Shrouded bonnet construction provides maximum containment and diaphragm support for critical applications
- ◆ Modular options available including padlocking facility, proximity sensors, 'V' notch vent plugs and limit open stop version
- ◆ Fully FDA conforming materials of construction
- ◆ Limit closing stop to provide process/flow control option

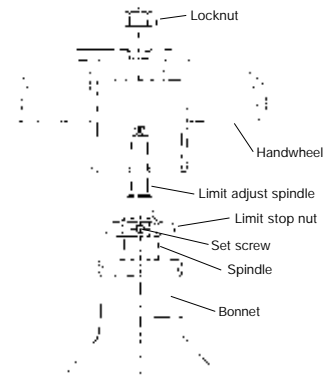
Padlock Option

The padlocking facility can be supplied to order or is available in kit form for retro-fitting to the bonnet sub-assembly or whole valve.



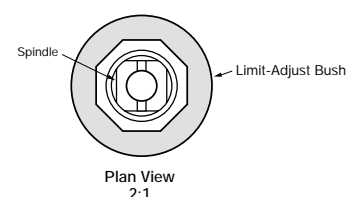
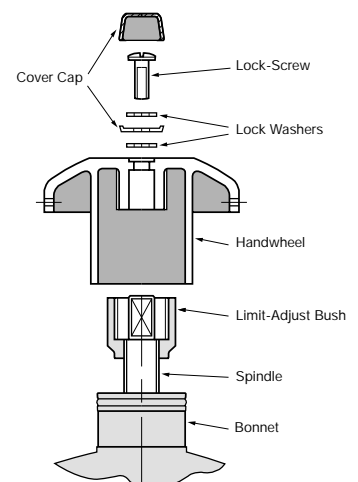
Limit open stop option

Limit open stop bonnet to facilitate effective running of system under normal capacity



Limit closing stop option

A fully adjustable limit closing stop is fitted as standard to all 'Performance' bonnets. The limit closure stop is located under the handwheel and is adjusted by first removing the handwheel fixing screw and the handwheel assembly.



Saunders Pneumatic Valve Actuation

Compact Actuators that Provide Reliable Remote Control

Saunders EC and SSC Pneumatic Actuators facilitate remote operation of the valve, either as a simple alternative to manual bonnet assemblies or as an integral part of the control system. Both are compact piston style actuators with excellent chemical and temperature resistance.

The versatile and robust design derived from the use of high technology materials of construction, results in an actuator suitable for a wide range of process industry applications.



*EC Actuator mounted on a ZDT valve
Size range: DN8 – DN50*



*SSC Actuator
Size range: DN8 – DN50*

EC

The EC is manufactured by injection moulding in PES (polyethersulphone), which has a temperature range of -10° to +100°C ambient (autoclave maximum 150°C). Actuators can be supplied as spring close, spring open or double acting with various spring pack options for a variety of pressure requirements.

All three operation modes, double acting, spring to close and spring to open feature the same physical dimensions for a given valve size. This provides uniform compact envelope dimensions and outstanding economic benefits particularly for spring return failsafe actuation.

Field conversion of manual valves to power actuation is readily achieved 'in-line' without special tools or modification.

SSC

With the same flexibility as the EC Actuator, the SSC has been manufactured with a 316L stainless steel investment cast housing. Suitable for both aseptic and industrial applications the SSC provides excellent resistance to both chemical and steam duties.



ECX

Saunders ECX type actuators are designed to offer an extension to the EC size range whilst still maintaining the compact envelope size. The housing is manufactured in coated silicon aluminium for optimum chemical resistance and long life. With the extensive range of spring packs we can offer an actuator to suit a wide range of pressure and flow variations.

Available in spring close, spring open and double acting modes of operation to suit process needs. A wide range of options including switches, positioners, limit stop and visual open/close indication are also available.



*ECX Actuator with visual indicator
Size range: DN65 – DN150*



*ECX Actuator with Module Switchbox
Size range: DN65 – DN150*

Pneumatic Actuators for Larger Valves

EV and ES

The EV/ES actuator range directly replaces manual bonnet assemblies and may be ordered as part of a whole valve or separately to convert a manual valve to automatic operation. Installation may be carried out with the valve body in the pipeline.

Saunders EV/ES actuators are designed with close coupled bonnet assemblies and have complete flexibility of performance. Several different actuator models may be provided for each valve size to suit different application requirements. The range allows valve closure against the maximum valve working pressures and can be successfully used for modulating control duties in addition to more normal isolation functions.



EV Actuator
Size range: DN15 – DN200



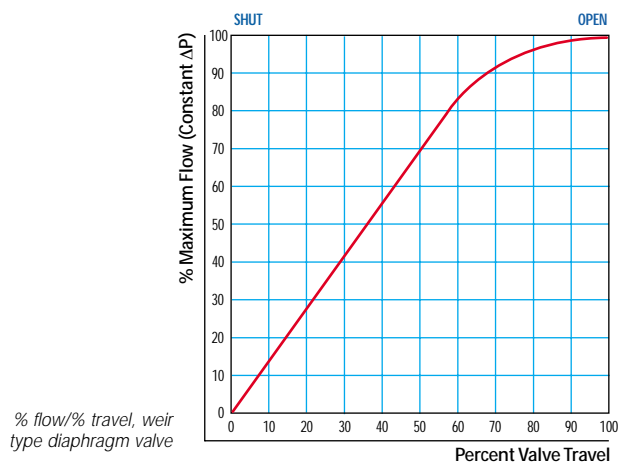
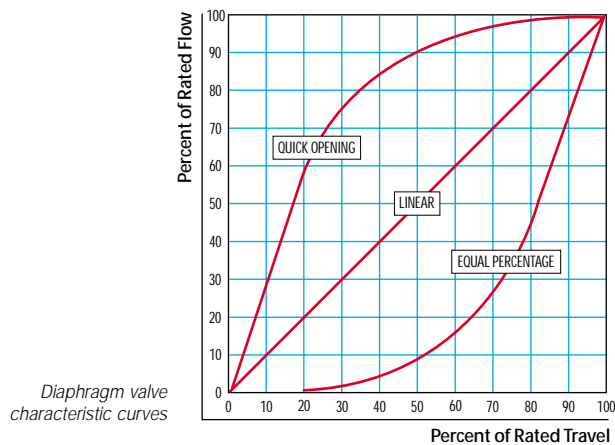
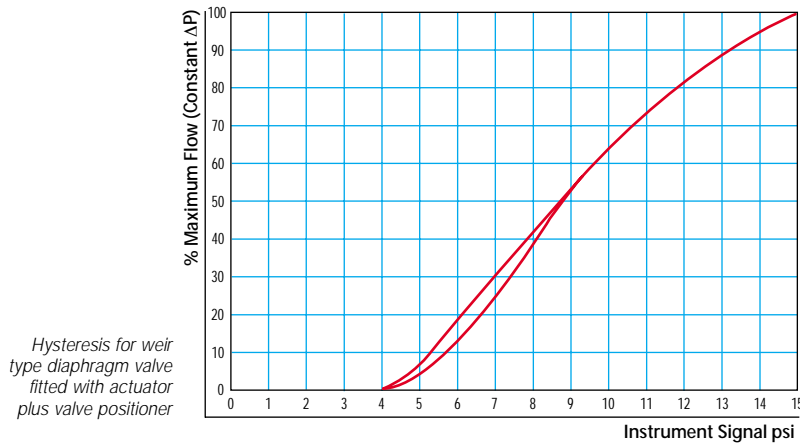
ES Actuator
Size range: DN15 – DN200

Failsafe closing actuators are fully adjustable, i.e. spring compression can be externally adjusted to provide optimum diaphragm forces and hence provide extremely long diaphragm life in service.

Many accessory options are available which include solenoid valves, remote indication devices (switches or sensors) to suit environmental conditions such as hazardous services. Limit stops and positioners and many other devices may be offered to allow usage within particular control systems. EV/ES actuators are provided with a tough epoxy coating which gives maximum durability, even in exposed locations.

Pneumatic Valve Actuation

Valve Throttling and Flow Control



Saunders diaphragm valves offer excellent control capabilities within a broad range of pressure, flow or level control applications.

Rangeability (ratio of maximum flow vs. minimum control flow) of Saunders weir type valves is 35:1 extending beyond the range of most process and service control systems.

The positive shut-off characteristics of the valve can, in many instances, eliminate the need for independent block valves, a major component in the piping system cost.

The inherent flow characteristics illustrated shows linearity up to 60% of travel (80% of flow).

The chart illustrates installed characteristics affected by the dynamic friction loss for the remainder of the piping system. Equal % characteristics can be obtained through the use of characterised positioners.

Pressure recovery factor = 0.7.

TECHNICAL DATA

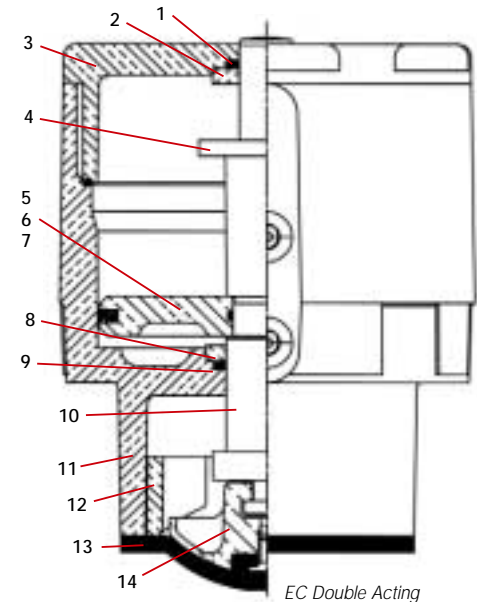
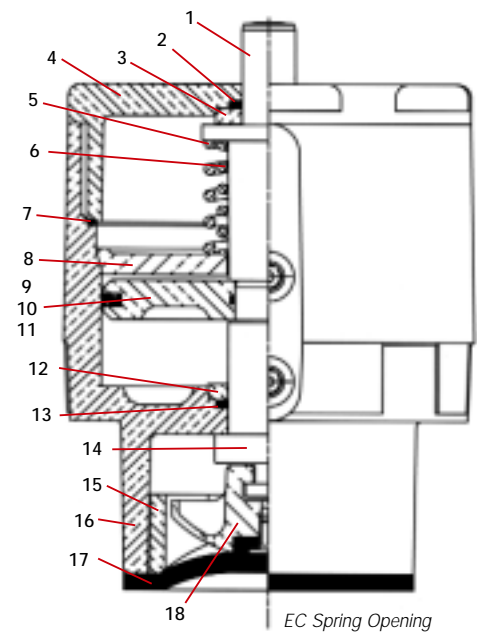
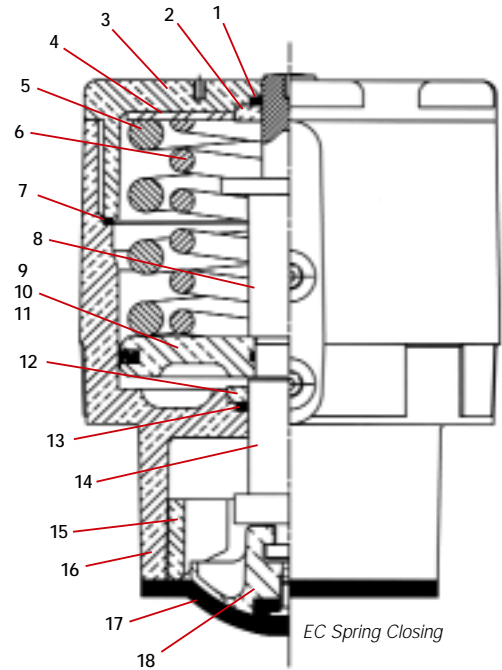
EC Pneumatic Actuators DN8 – DN50

Materials of Construction

MATERIALS OF CONSTRUCTION EC/SC		
Item	Component	Material
1	Indicator seal	Fluoroelastomer
2	Cap washer	PES (DN8-DN25) IXEF (DN40-DN50)
3	Cap	PES (DN8-DN25) IXEF (DN40-DN50)
4	Loading plate	Mild steel
5	Outer spring	Steel
6	Inner spring	Steel
7	Bonnet cap 'O' ring	Nitrile
8	Indicator	IXEF
9	Outer piston seal	Fluoroelastomer
10	Piston	PES (DN8-DN25) IXEF (DN40-DN50)
11	Inner piston seal	Nitrile
12	Bonnet washer	PES
13	Spindle seal	Fluoroelastomer
14	Spindle	PES
15	Bonnet insert	PES (DN40-DN50)
16	Bonnet	PES
17	Line diaphragm	Rubber, Rubber/PTFE
18	Compressor	Mazak (DN8), Mild Steel (DN15-25), Silicon Aluminium (DN15-DN50)

MATERIALS OF CONSTRUCTION EC/SO		
Item	Component	Material
1	Indicator	IXEF
2	Indicator seal	Fluoroelastomer
3	Cap washer	PES (DN8-DN25) IXEF (DN40-DN50)
4	Cap	PES (DN8-DN25) IXEF (DN40-DN50)
5	Outer spring	Steel
6	Inner spring	Steel
7	Bonnet cap 'O' ring	Nitrile
8	Spring support plate	PES
9	Outer piston seal	Fluoroelastomer
10	Piston	PES (DN8-DN25) IXEF (DN40-DN50)
11	Inner piston seal	Fluoroelastomer
12	Bonnet washer	PES
13	Spindle seal	Nitrile
14	Spindle	PES
15	Bonnet insert	PES (DN40-DN50)
16	Bonnet	PES
17	Line diaphragm	Rubber, Rubber/PTFE
18	Compressor	Mazak (DN8), Mild Steel (DN15-25), Silicon Aluminium (DN15-DN50)

MATERIALS OF CONSTRUCTION EC/DA		
Item	Component	Material
1	Indicator seal	Fluoroelastomer
2	Cap washer	PES (DN8-DN25) IXEF (DN40-DN50)
3	Cap	PES (DN8-DN25) IXEF (DN40-DN50)
4	Indicator	IXEF
5	Outer piston seal	Fluoroelastomer
6	Piston	PES (DN8-DN25) IXEF (DN40-DN50)
7	Inner piston seal	Fluoroelastomer
8	Bonnet washer	PES
9	Spindle seal	Nitrile
10	Spindle	PES
11	Bonnet	PES
12	Bonnet insert	PES (DN40-DN50)
13	Line diaphragm	Rubber, Rubber/PTFE
14	Compressor	Mazak (DN8), Mild Steel (DN15-25), Silicon Aluminium (DN15-DN50)



TECHNICAL DATA

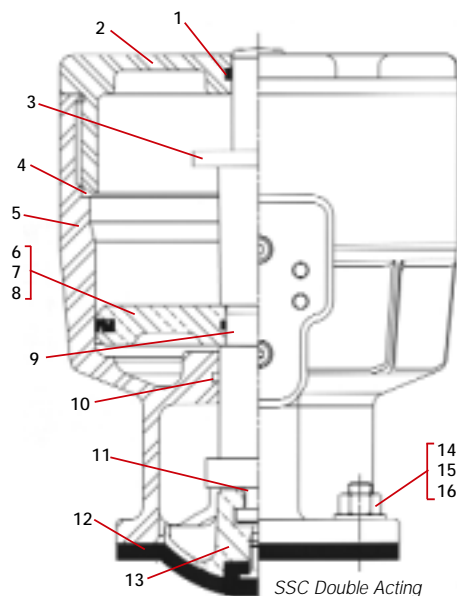
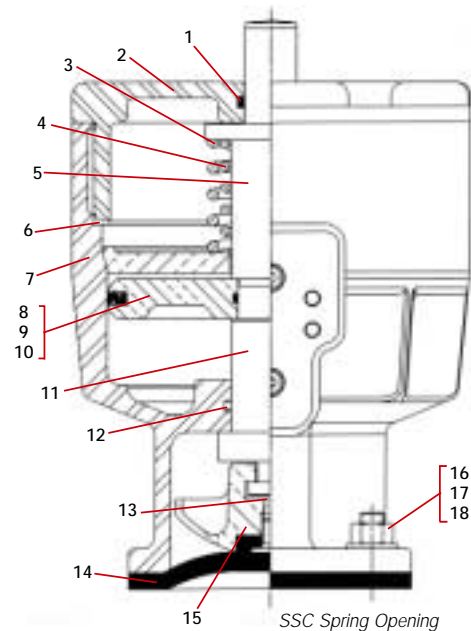
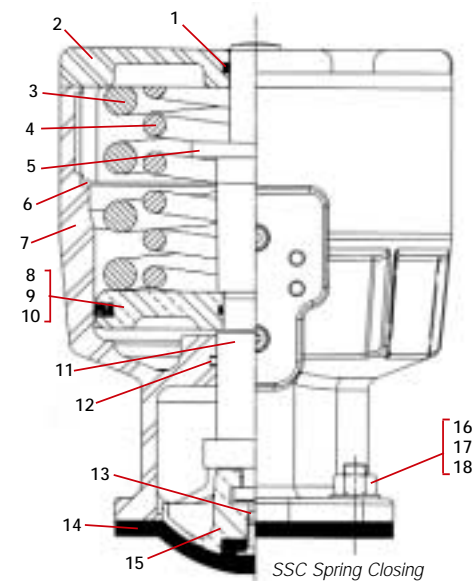
SSC (Stainless Steel) Compact Pneumatic Actuators DN8 – DN50

Materials of Construction

MATERIALS OF CONSTRUCTION SSC/SC		
Item	Component	Material
1	Indicator seal	Viton
2	Cap	Stainless Steel
3	Outer spring	Steel
4	Inner spring	Steel
5	Indicator	IXEF
6	Bonnet cap 'O' ring	Nitrile
7	Bonnet	Stainless Steel
8	Outer piston seal	Fluoroelastomer
9	Piston inner 'O' ring	Nitrile
10	Piston	PES (DN8-DN25) IXEF (DN40-DN50)
11	Spindle	PES
12	Spindle 'O' ring	Fluoroelastomer
13	Thrust pad	Nylatron (DN8-DN20)
14	Line diaphragm	Rubber, Rubber/PTFE
15	Compressor	Stainless Steel
16	Body/bonnet nut	Stainless Steel
17	Body/bonnet washer	Stainless Steel
18	Body/bonnet bolt/stud	Stainless Steel

MATERIALS OF CONSTRUCTION SSC/SO		
Item	Component	Material
1	Indicator seal	Viton
2	Cap	Stainless Steel
3	Outer spring	Steel
4	Inner spring	Steel
5	Indicator	IXEF
6	Bonnet cap 'O' ring	Nitrile
7	Bonnet	Stainless Steel
8	Outer piston seal	Fluoroelastomer
9	Piston inner 'O' ring	Nitrile
10	Piston	PES (DN8-DN25) IXEF (DN40-DN50)
11	Spindle	PES
12	Spindle 'O' ring	Fluoroelastomer
13	Thrust pad	Nylatron (DN8-DN20)
14	Line diaphragm	Rubber, Rubber/PTFE
15	Compressor	Stainless Steel
16	Body/bonnet nut	Stainless Steel
17	Body/bonnet washer	Stainless Steel
18	Body/bonnet bolt/stud	Stainless Steel

MATERIALS OF CONSTRUCTION SSC/DA		
Item	Component	Material
1	Indicator seal	Viton
2	Cap	Stainless Steel
3	Indicator	IXEF
4	Bonnet cap 'O' ring	Nitrile
5	Bonnet	Stainless Steel
6	Outer piston seal	Fluoroelastomer
7	Piston inner 'O' ring	Nitrile
8	Piston	PES (DN8-DN25) IXEF (DN40-DN50)
9	Spindle	PES
10	Spindle 'O' ring	Fluoroelastomer
11	Thrust pad	Nylatron (DN8-DN20)
12	Line diaphragm	Rubber, Rubber/PTFE
13	Compressor	Stainless Steel
14	Body/bonnet nut	Stainless Steel
15	Body/bonnet washer	Stainless Steel
16	Body/bonnet bolt/stud	Stainless Steel



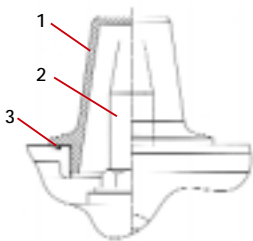
TECHNICAL DATA

ECX Pneumatic Actuators DN65 – DN150

Materials of Construction

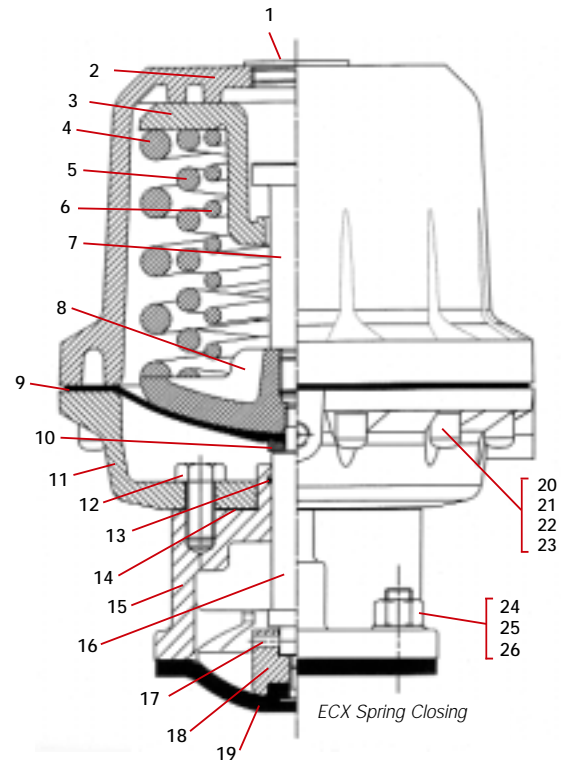
MATERIALS OF CONSTRUCTION ECX/SC		
Item	Component	Material
1	Plug	Polyethylene
2	Cover	Silicon aluminium
3	Upper spring plate	SG iron
4	Outer spring	Steel
5	Middle spring	Steel
6	Inner spring	Steel
7	Spring retaining bolt	Mild steel
8	Diaphragm plate	Forged steel
9	Operating diaphragm	Rubber
10	Clamp washer	Mild steel
11	Lower cylinder	Silicon aluminium
12	Cylinder/bonnet bolt	Steel
13	Bonnet 'O' ring	Nitrile
14	Bonnet/cylinder joint	Klingsil
15	Bonnet	Cast iron
16	Spindle	Stainless Steel
17	Compressor pin	Steel
18	Compressor	Cast iron
19	Line diaphragm	Rubber, Rubber/PTFE
20	Screw cover	PE
21	Cylinder cover screw	Steel
22	Cylinder cover nut	Steel
23	Cylinder cover washer	Steel
24	Body/bonnet nut	Stainless steel
25	Body/bonnet stud	Stainless steel
26	Body/bonnet washer	Stainless steel

MATERIALS OF CONSTRUCTION INDICATOR		
Item	Component	Material
1	Indicator cover	Polycarbonate
2	Indicator	Polycarbonate
3	Indicator 'O' ring	Rubber

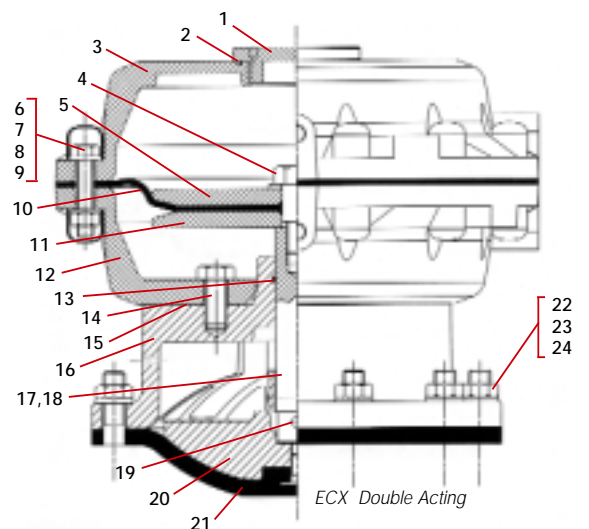
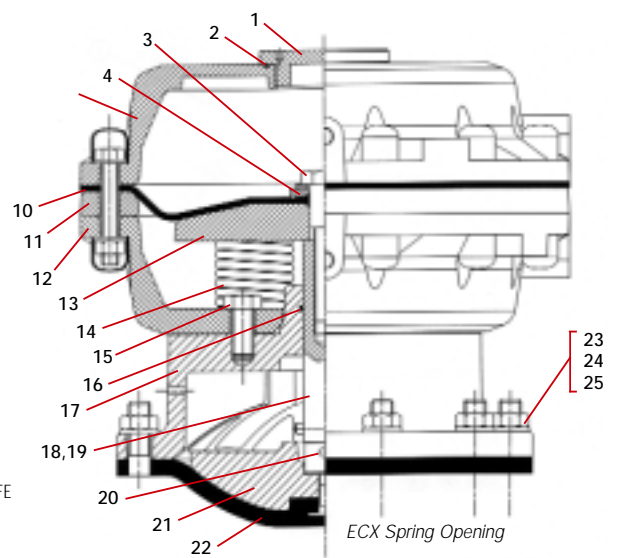


Note: Visual indicator is an optional extra on the ECX.

MATERIALS OF CONSTRUCTION ECX/DA		
Item	Component	Material
1	Cover plug	Mild steel
2	Cover plug 'O' ring	Rubber
3	Upper cylinder	Silicon aluminium
4	Spindle screw	Steel
5	Upper diaphragm plate	Mild steel
6	Screw cover	PE
7	Cylinder screw	Steel
8	Cylinder nut	Steel
9	Cylinder washer	Steel
10	Operating diaphragm	Rubber
11	Lower diaphragm plate	Mild steel
12	Lower cylinder	Silicon aluminium
13	Bonnet 'O' ring	Rubber
14	Cylinder/bonnet bolt	Steel
15	Cylinder/bonnet joint	Klingsil
16	Bonnet	Cast iron
17	Spindle	Stainless steel
18	Spindle limit pin	Steel (150mm)
19	Compressor pin	Steel
20	Compressor	Cast iron
21	Line diaphragm	Rubber, Rubber/PTFE
22	Body/bonnet nut	Stainless steel
23	Body/bonnet stud	Stainless steel
24	Body/bonnet washer	Stainless steel



MATERIALS OF CONSTRUCTION ECX/SO		
Item	Component	Material
1	Cover plug	Mild steel
2	Cover plug 'O' ring	Rubber
3	Spindle screw	Steel
4	Clamp washer	Mild steel
5	Upper cylinder	Silicon aluminium
6	Screw cover	PE
7	Cylinder screw	Steel
8	Cylinder nut	Steel
9	Cylinder washer	Steel
10	Operating diaphragm	Rubber
11	Spacer ring	Silicon aluminium
12	Lower cylinder	Silicon aluminium
13	Diaphragm plate	SG iron
14	Spring	Steel
15	Cylinder/bonnet bolt	Steel
16	Bonnet 'O' ring	Nitrile
17	Bonnet	Cast iron
18	Spindle	Stainless steel
19	Spindle limit pin	Steel
20	Compressor pin	Steel
21	Compressor	Cast iron
22	Line diaphragm	Rubber, Rubber/PTFE
23	Body/bonnet nut	Stainless steel
24	Body/bonnet stud	Stainless steel
25	Body/bonnet washer	Stainless steel



TECHNICAL DATA

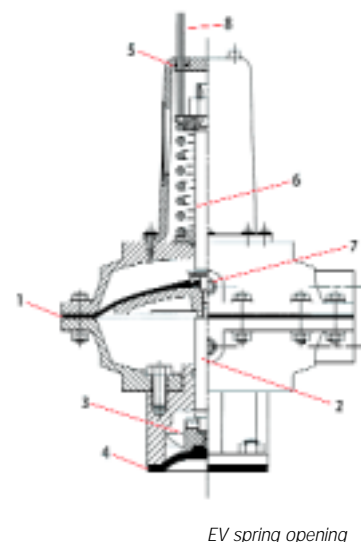
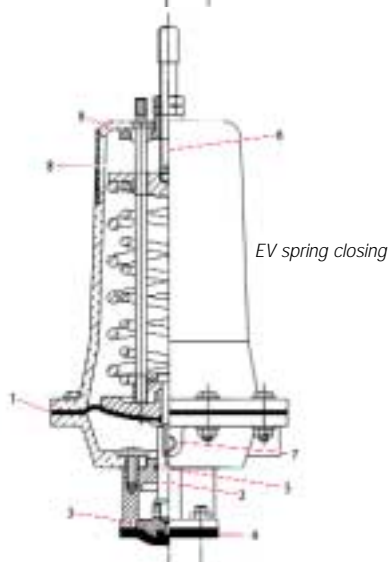
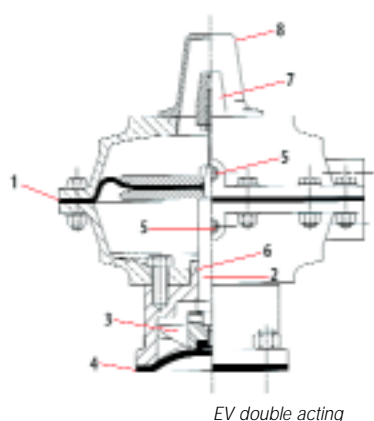
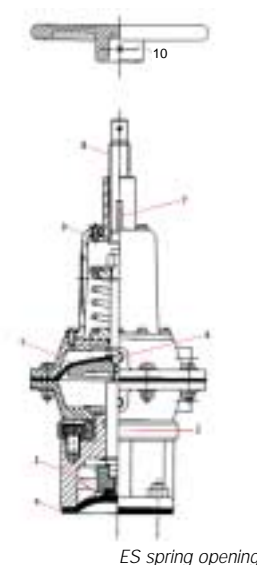
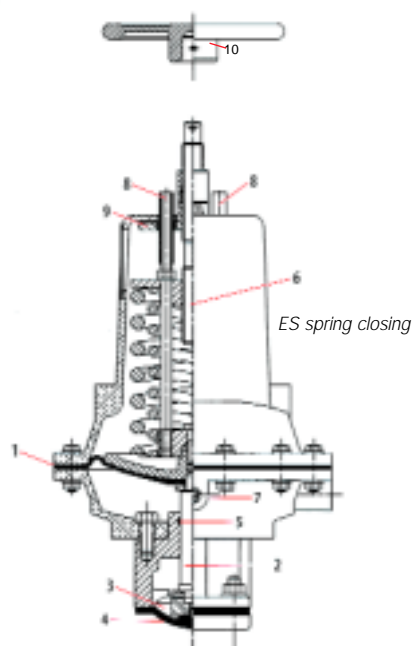
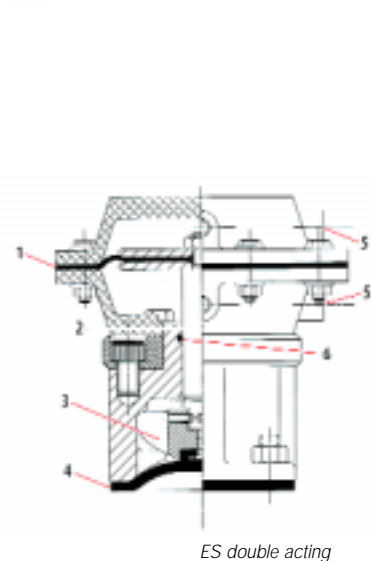
ES/EV Pneumatic Actuation DN15 – DN200

Materials of Construction

MATERIALS OF CONSTRUCTION ES DA		
Item	Component	Material
1	Operating Diaphragm	Rubber
2	Spindle	Stainless Steel
3	Compressor	Cast Iron
4	Line Diaphragm	Rubber, Rubber/PTFE
5	Cylinder Plug	Malleable Iron
6	Bonnet 'O' ring	Rubber

MATERIALS OF CONSTRUCTION ES SC		
Item	Component	Material
1	Operating Diaphragm	Rubber
2	Spindle	Stainless Steel
3	Compressor	Cast Iron
4	Line Diaphragm	Rubber, Rubber/PTFE
5	Spring Adjusting Spindle	Steel
6	Bonnet 'O' ring	Rubber
7	Cylinder Plug	Malleable Iron
8	Indicator Rod	Steel
9	Weatherproof Seal	PVC
10	Handwheel	Cast Iron

MATERIALS OF CONSTRUCTION ES SO		
Item	Component	Material
1	Operating Diaphragm	Rubber
2	Spindle	Stainless Steel
3	Compressor	Cast Iron
4	Line Diaphragm	Rubber, Rubber/PTFE
5	–	–
6	Cylinder Plug	Malleable Iron
7	Bonnet 'O' ring	Rubber
8	Indicator Rod	Steel
9	Weatherproof Seal	PVC
10	Handwheel	Cast Iron



MATERIALS OF CONSTRUCTION EV DA		
Item	Component	Material
1	Operating Diaphragm	Rubber
2	Spindle	Stainless Steel
3	Compressor	Cast Iron
4	Line Diaphragm	Rubber, Rubber/PTFE
5	Cylinder Plug	Malleable Iron
6	Bonnet 'O' ring	Rubber
7	Indicator	Solid Nylon 66 (natural dyed yellow)
8	Indicator cover	Polyamide 6-3-T

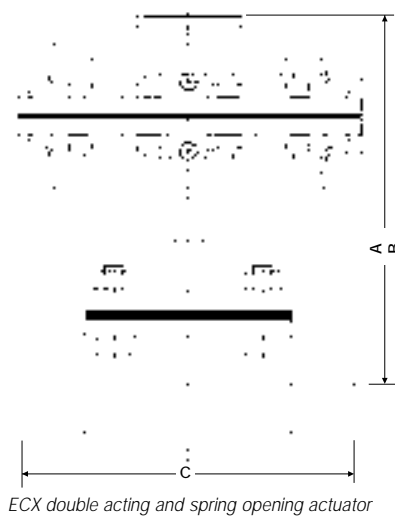
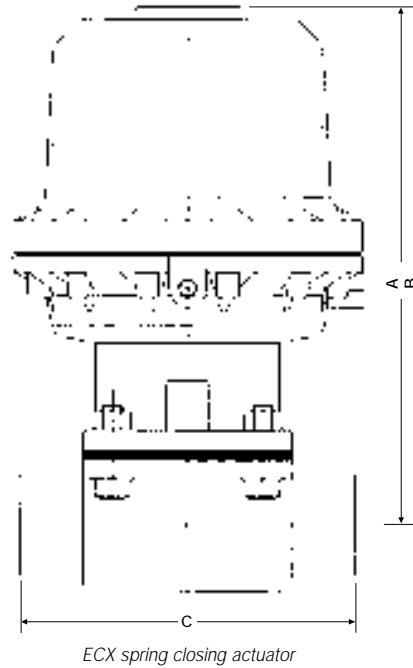
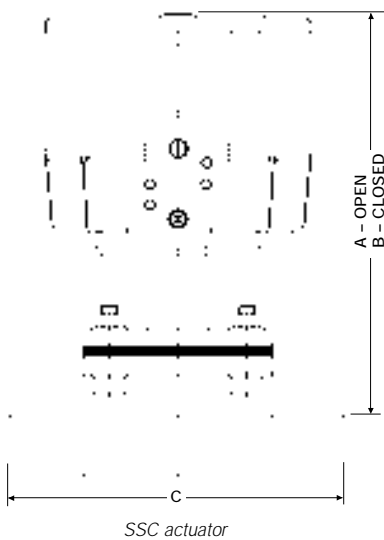
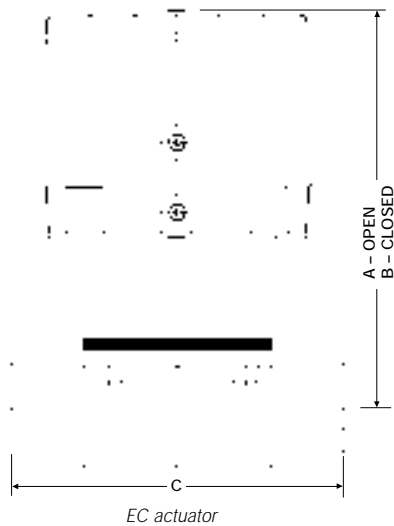
MATERIALS OF CONSTRUCTION EV SC		
Item	Component	Material
1	Operating Diaphragm	Rubber
2	Spindle	Stainless Steel
3	Compressor	Cast Iron
4	Line Diaphragm	Rubber, Rubber/PTFE
5	Bonnet 'O' ring	Rubber
6	Spring Adjusting Spindle	Steel
7	Cylinder Plug	Malleable Iron
8	Indicator Rod	Steel
9	Weatherproof Seal	PVC

MATERIALS OF CONSTRUCTION EV SO		
Item	Component	Material
1	Operating Diaphragm	Rubber
2	Spindle	Stainless Steel
3	Compressor	Cast Iron
4	Line Diaphragm	Rubber, Rubber/PTFE
5	Weatherproof Seal	PVC
6	Spring Adjusting Spindle	Steel
7	Cylinder Plug	Malleable Iron
8	Indicator Rod	Steel

TECHNICAL DATA

EC/SSC/ECX Actuator Dimensions

Size DN	A	B	C
15	115	110	108
20	160	152	117
25	168	161	127
40	231	217	159
50	249	229	190



ECX/SO

Size DN	A	B	C	D
65	258	55	217	266
80	300	55	254	266
100	317	55	329	266

ECX/SC

Size DN	A	B	C	D
Heads S1, SL2 & S3				
65	372	55	217	266
80	386	55	254	266
100	428	55	329	266

ECX/SC

Size DN	A	B	C	D
Heads L1, L2 & L3				
65	411	55	217	266
80	426	55	254	266
100	468	55	329	266

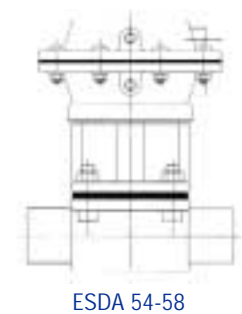
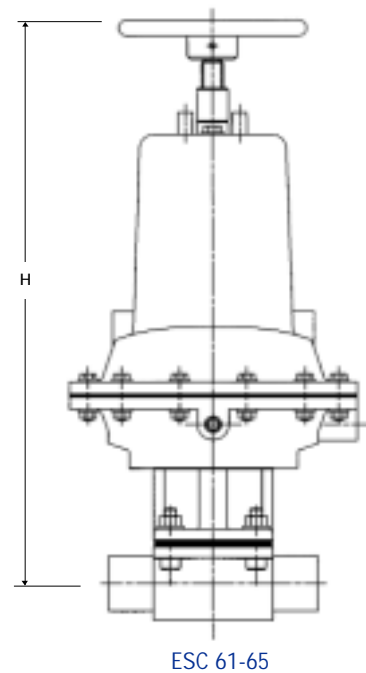
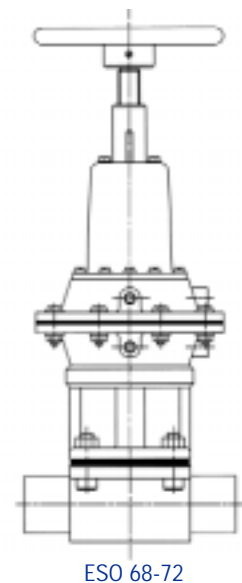
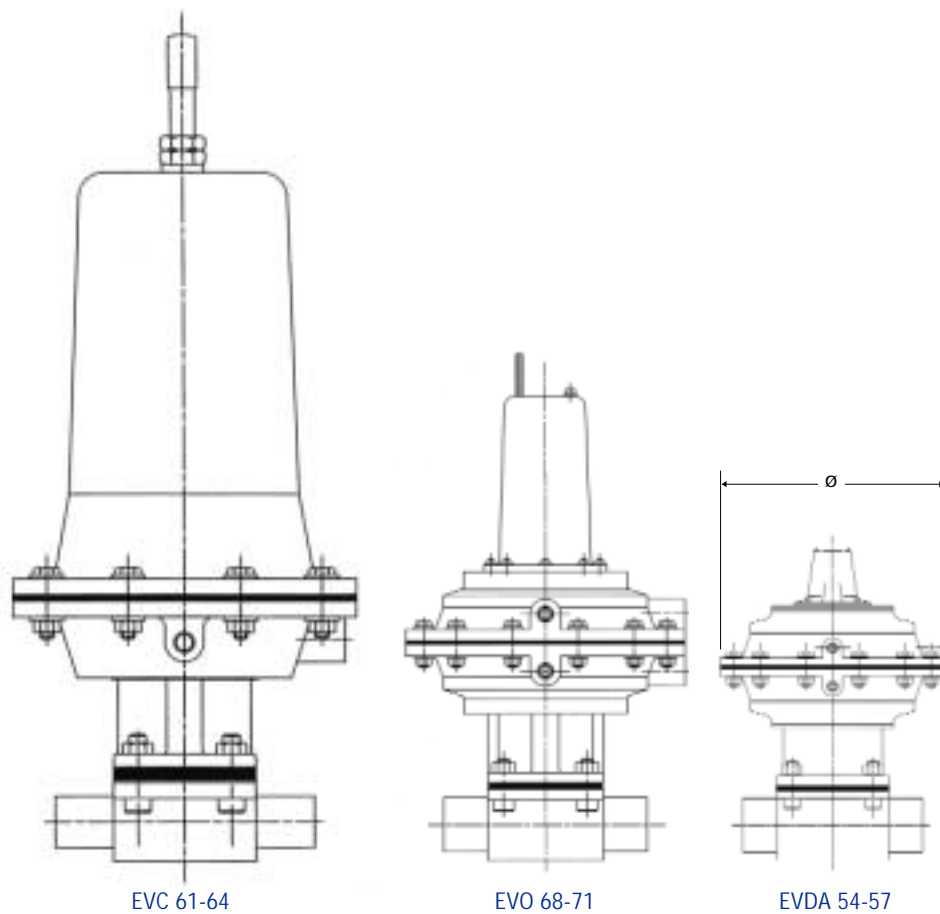
ECX/DA

Size DN	A	B	C	D
65	268	55	217	266
80	284	55	254	266
100	327	55	329	266

Note: Dimension 'B' is for Indicator

TECHNICAL DATA

ES/EV Actuator Dimensions



Model Ø		H (TYPE AFP VALVE) – SIZE IN MM											
		15	20	25	32	40	50	65	80	100	125	150	200
Fail Safe Spring CLOSING	EV 61 168	368	376	386	–	415							
	ES 61 168	384	397	408	–	427							
	EV 62 260	–	–	464	486	491	504	516					
	ES 62 260	–	–	487	505	513	524	534					
	EV 63 318	–	–	–	–	617	637	653					
	ES 63 318	–	–	–	–	667	683	692					
	EV 64 425	–	–	–	–	–	–	779	820	836			
	ES 64 425	–	–	–	–	–	–	826	863	879			
Fail Safe Spring OPENING	ES 65 549	–	–	–	–	–	–	–	1051	–	1131		
	EV 68 168	214	221	278	–	299	331						
	ES 68 168	255	262	371	–	407	435						
	EV 69 260	–	–	–	374	384	444	480	483				
	ES 69 260	–	–	–	450	456	555	570	582				
	EV 70 318	–	–	–	–	–	–	514	555				
	ES 70 318	–	–	–	–	–	–	619	660				
	EV 71 425	–	–	–	–	–	–	–	671	690	753		
DOUBLE ACTING	ES 71 425	–	–	–	–	–	–	–	831	846	912		
	ES 72 549	–	–	–	–	–	–	–	–	–	974	1040	
	EV 54 168	184	196	200	–	224	233						
	ES 54 168	129	136	142	–	165	196						
	EV 55 260	–	–	–	287	303	312	327	340	377			
	ES 55 260	–	–	–	215	221	232	245	257	290			
	EV 56 318	–	–	–	–	–	–	360	397	412			
	ES 56 318	–	–	–	–	–	–	298	337	350			
	EV 57 425	–	–	–	–	–	–	–	437	452	519		
	ES 57 425	–	–	–	–	–	–	–	355	370	436		
	ES 58 549	–	–	–	–	–	–	–	–	–	462	530	

Ø = Actuator Diameter/Width H = Actuator Height

Dimension table shows in mm diameter/width of actuators and the maximum height of the actuator from the centre of the valve flange or pipeline, the dimensions shown are to aid planning.

Actuation Accessories

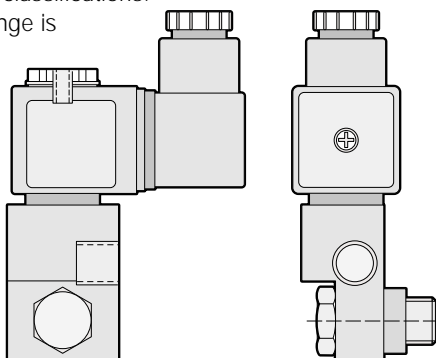
Overview

MODEL	SIZE RANGE	STYLE	MATERIAL	SOLENOID	SWITCH BOX	POSITIONER	AIR FILTER	HANDWHEEL
EC	DN8-50	A, AFP	PES	✓	✓	✓	✗	✗
SSC	DN8-50	A, AFP	316 C12	✓	✓	✓	✗	✓
ECX	DN65-150	A, AFP	SiAl Coated	✓	✓	✗	✓	✗
EV	DN15-150	A, AFP, KB	SiAl Coated	✓	✓	✓	✓	✗
ES	DN15-200	A, AFP, KB	SiAl Coated	✓	✓	✓	✓	✓

✓ = Available and ✗ = Not available

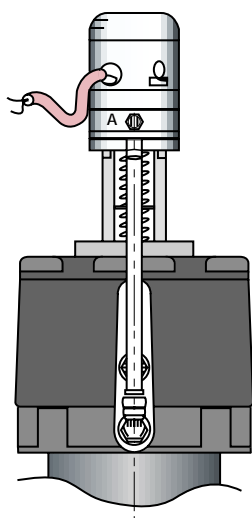
Solenoid Valves

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



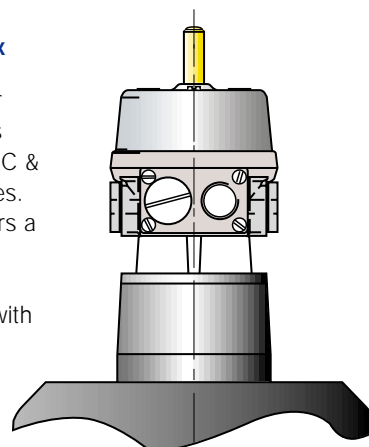
Mini Positioner

For control application on the EC and SSC the VIAPOS mini offers both pneumatic, electro-pneumatic and digital inputs with sensor feedback option and linear mounting design providing a compact control solution.



Module Switchbox

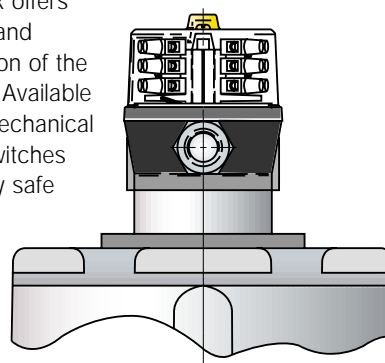
This highly modular switchbox option is available for EC/SSC & ECX actuator ranges. The switchbox offers a wide range of V3 mechanical and proximity sensors with space for up to 4 switch, integral solenoid valve & ASI* interface.



*ASI Interface can be retrofitted.

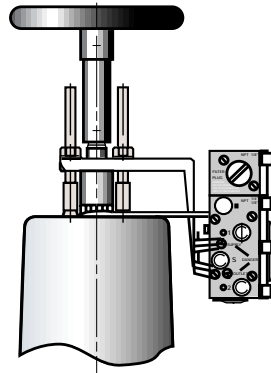
Mini Switchbox

Suitable for both the EC and SSC. This low cost switchbox offers remote, open and closed indication of the valve position. Available with two V4 mechanical or proximity switches and intrinsically safe options.



ES Positioner

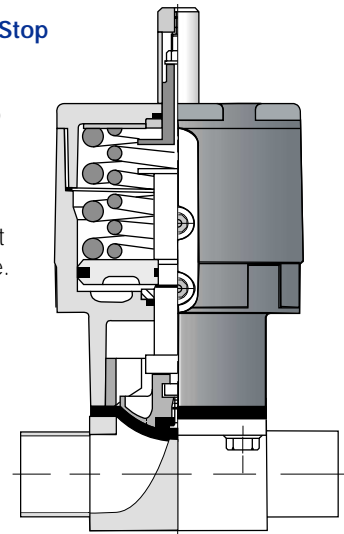
Providing precise control of the flow through the valve. This long life corrosion resistant range suits a wide variety of applications with reliability and accuracy. Available as pneumatic, electro pneumatic, intrinsically safe and explosion proof, together with a variety of feedback options.



Shown mounted to ES Actuator

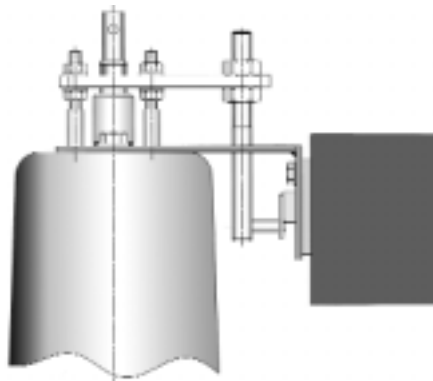
EC & SSC Limit Open Stop

The EC/SSC limit open stop can be supplied to order and offers a fully adjustable travel stop. With the removal of the plastic indicator the limit stop is easily accessible.



007 Switchbox

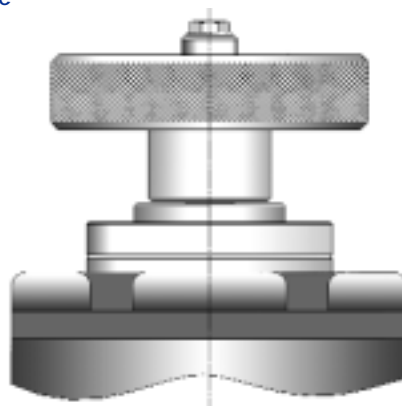
Manufactured from polyester coated aluminium. This switchbox is used for the ES and EV linear actuators. It has the capability for up to 4 switches and can incorporate internal solenoid valve and ASI system.



Shown mounted to ES Actuator

SSC Manual Over-Ride

For extra security the SSC can be supplied with an emergency manual over-ride manufactured from stainless steel. Please contact Crane for further information.



Saunders Type AFP Diaphragm Valves

Diaphragms for Aseptic Applications

The Diaphragm – Key to Successful Valve Performance

Saunders continues to lead the diaphragm valve industry in the development and manufacture of elastomer components based on our in-house core competence in rubber and plastic technologies.

The diaphragm is the key performance component within a diaphragm valve. The diaphragm forms both the differential and atmospheric seal and isolates the topworks from the process media. As the innovator and leader in diaphragm valves, we continuously develop our diaphragm technology and remain the only manufacturer to have front to back ownership of all aspects of polymer research and development, diaphragm design and production.

Saunders offers a full range of diaphragm selections engineered to meet the exacting demands of the pharmaceutical industry. PTFE, modified PTFE and elastomer types are available to suit individual system requirements.

All Saunders aseptic diaphragms are formulated in-house and manufactured from FDA conforming materials to meet the requirements of CFR (Code of Federal Regulations) Chapter 1 Title 21 and are tested and certified to USP Classes V and VI. Certificates of Conformity to FDA and USP are available upon request.

To assist in the validation process and to provide the highest level of reliability, security and regulatory compliance, Saunders provides full batch traceability for all grades of aseptic diaphragms.

Key elements in diaphragm design and selection include media compatibility, levels of extractables, flex and closure performance, resistance to compression set, longevity and regulatory conformance. Saunders elastomer technology and application engineering specialists are available to consult on specifics of material selection.

The Saunders range of FDA conforming diaphragms has been designed to meet the highest standards of performance and reliability based on current elastomer and plastics technology. Equally important is the associated documentation support to assist regulatory compliance and aid plant and system validation. Only Saunders matches the quality and performance of its diaphragms with the highest standard of documentation and validation support available in the industry.

The main categories of aseptic diaphragms are:

Synthetic elastomer – black internally reinforced grades

- ◆ Grade 300 – Butyl
- ◆ Grade 325 – EPDM, peroxide cured
- ◆ Grade 425 – EPM, peroxide cured
- ◆ Grade E5 – EPDM, peroxide cured, post cured
- ◆ Grade E3 – EPM, peroxide cured, post cured.

Synthetic elastomer – white internally reinforced grades

- ◆ Grade 500 – Silicone
- ◆ Grade E4 – EPDM, peroxide cured

PTFE

- ◆ PTFE virgin grade white, grade 214 with either 300, 325 or 425 backing support
- ◆ PTFE modified grade white, grade 214S with 325 or 425 backing

ALL
DIAPHRAGMS
CONFORM
TO FDA
REGULATIONS



Saunders Diaphragms

Diaphragm Design/Performance

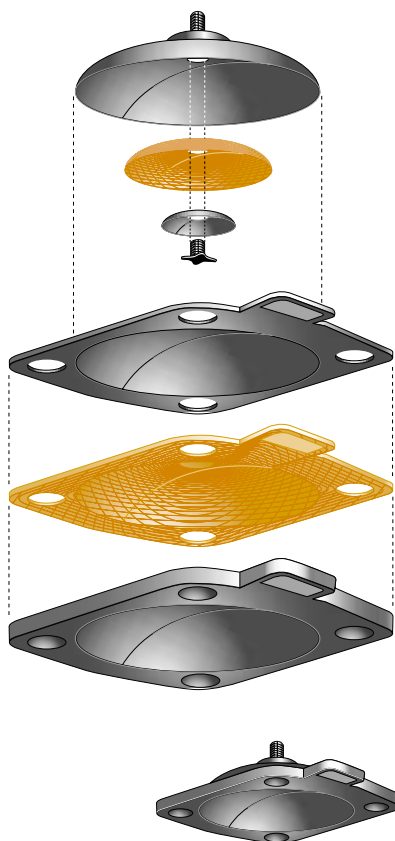
Diaphragm Construction



Rubber diaphragm screw fixing

Rubber Diaphragms

The polymer material is bonded with a high strength woven reinforcement to ensure maximum strength and durability.



PTFE diaphragm bayonet fixing

PTFE Diaphragms

PTFE diaphragms are two piece construction backed with a rubber diaphragm to increase their pressure rating and durability. PTFE faced diaphragms are fitted with a bayonet fitting to ensure reliable installation and maximum life rating.

Grade	Material	Colour	Size Range Lower–Upper	Continuous Temperature Range °C	Hardness IRHD	Tensile Strength Mpa	Approvals		
							FDA	3A Class IV	USP Class V & VI
300	Resin cured butyl rubber (isobutylene/isoprene)	Black	DN8–DN200	-30 to 130	62–68°	12.9	✓	✓	✓
425	Ethylene Propylene, co-polymer peroxide cured	Black	DN8–DN100	-40 to 140	61–67°	12	✓	✓	✓
325	Ethylene propylene (EPDM) diene-modified, peroxide cured	Black	DN8–DN200	-40 to 140	60–65°	12.5	✓	✓	✓
E5	Ethylene propylene (EPDM) diene-modified, peroxide cured, post cured	Black	DN8–DN100	-40 to 140	60–65°	12.5	✓	✓	✓
E3	Ethylene Propylene, co-polymer peroxide cured, post cured	Black	DN8–DN100	-40 to 140	61–67°	12	✓	✓	✓
E4	Ethylene propylene (EPDM) diene-modified, peroxide cured	White	DN8–DN100	-40 to 110	60–66°	11	✓	–	–
214/300	PTFE/Butyl backed	White facing, black backing	DN8–DN200	-20 to 150	–	32	✓	✓	✓
214/425	PTFE/EPM backed	White facing, black backing	DN8–DN200	-20 to 160	–	–	✓	✓	✓
214S/425	PTFE/EPM backed for steam	White facing, black backing	DN8–DN200	-20 to 160	–	–	✓	✓	✓
214/325	PTFE/EPDM backed	White facing, black backing	DN8–DN200	-20 to 160	–	32	✓	✓	✓
500	Silicone DBPH cured	White	DN8–DN200	-40 to 150	67–73°	7.1	✓	✓	–
214S/300	PTFE/Butyl backed for steam	White facing, black backing	DN8–DN200	-20 to 150	–	30	✓	✓	✓
214S/325	PTFE/EPDM backed for steam	White facing, black backing	DN8–DN200	-20 to 160	–	30	✓	✓	✓

Saunders Type AFP Diaphragm Valves

Diaphragm Traceability and Validation

Validation support – from raw materials to your system

- ◆ All ingredients – base polymer, filler, accelerators, etc – are manufactured from FDA conforming materials
- ◆ All diaphragms are fully batch traceable and carry a unique moulded batch identification number
- ◆ All diaphragms can be issued with a certificate of FDA conformity to assist in FDA validation and internal quality controls
- ◆ Physical property data is also available upon request

Saunders diaphragms offer enhanced performance with more confidence

- ◆ The integrity of the product and the quality of your process is assured. All extractables are fully identified and guaranteed to meet FDA limits. Access to all physical data is available upon written request.

Expert and independent verification

- ◆ Saunders has worked with the Rubber and Plastics Research Association (RAPRA) to provide complete and detailed identification of extractables and leachables – leading the way and reaffirming our commitment to our customers and the industry.

Full traceability and product validation

The Saunders valve range is acknowledged right across industry as being a leader in quality assurance techniques and design criteria for biopharm processes. This has led the Saunders product to be taken still one step further, and through its range of fully traceable diaphragms provides its valve users with uniquely valuable support in the validation process.

- ◆ A unique moulded reference number gives precise batch traceability
- ◆ Access is available to all relevant physical data
- ◆ Diaphragms that meet the most stringent validation requirements
- ◆ A certificate of the physical properties of each batch is issued to ensure consistency and support validation on request
- ◆ A profile of the complete physical data of each batch is available to help trouble shooting
- ◆ Complete documentation package is available for all valve components in contact with the process fluids (EN 10204 3.1b certification).



Validation support

Diaphragms conform to section 177,1550 (Perfluorocarbon resins) or 177.2600 (Rubber Articles) in Chapter 1 Title 21 of the FDA Regulations (revised 1st April 2001) USP Class V and VI.
Traceable to EN10204 3.1b (was DIN 50049 3.1b)

VALIDATION PACK INCLUDES:

Certificate of Analysis
Certificate of origin
USP Certificate

Saunders Type AFP Diaphragm Valves

Diaphragm Traceability and Validation

Moulded and coined to provide optimum flex life

Less deformation for longer diaphragm life.

Stud anchorage is fully encapsulated to ensure maximum strength and life rating of the diaphragm.

Reinforcing material to ensure maximum strength in either positive or vacuum pressure duties.

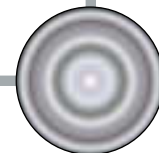


Proven manufacturing process

Blend make-up of raw material, usually 30kg each, weighed out

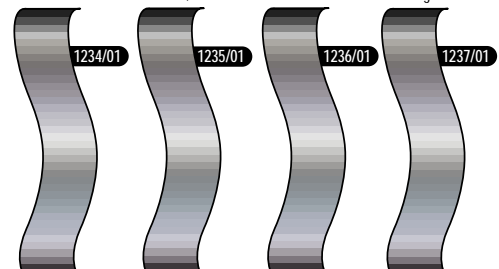


Full physical testing to confirm within specification



RUBBER BLEND
Individual make-ups are mixed together to form a blend of up to 180kg and identified by a numeric system 01 and upwards

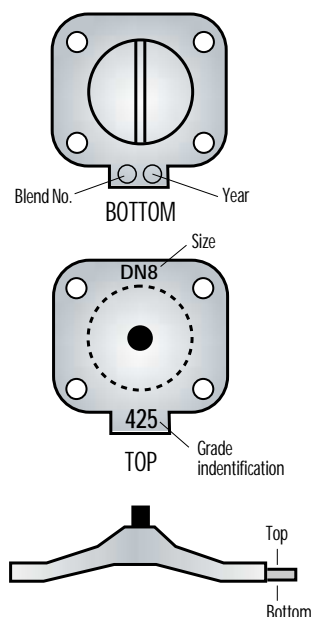
Blend is callendered into liners, continuous rubber sheet in rolls of 100m lengths



Liner is cut to length for construction of diaphragm



TRACEABLE DIAPHRAGM



Saunders Type AFP Diaphragm Valves

Diaphragms – USP Approval, EPDM and EPM Grades

USP Approval

Saunders aseptic range now incorporates a full range of Elastomer and PTFE FDA conforming diaphragms that fulfil the rigorous requirements of USP* Class V and VI accreditation which indicates that products are fit for medical use (implant or injectable).

The stringent systemic and implant toxicity testing regimes associated with USP Class VI means that customers can be fully confident in the quality of their processing. For added confidence, however, and to give further assurance that the polymer element of the valve as well as the valve body itself meet the highest standards of integrity, toxicity testing was undertaken by an independent authority.

USP Class VI approval applies to Saunders' Elastomer and PTFE diaphragms already in service as well as those that may be installed in the future, and adds one more benefit to the established advantages of using Saunders products from Crane Process Flow Technologies. We are proud to declare that we are almost unique in having polymer scientists engaged in research, development and manufacture of our diaphragm range. This enables us to manufacture all elements of the diaphragm in-house and gives us total control of every aspect of material content, design and production. It also assures customers that they are using products of unrivalled reliability that extend service life and minimise downtime.

Grade 425 EPM Diaphragms

Designed specifically for the most demanding biopharmaceutical applications, the 425 EPM elastomer diaphragm provides optimum process security. Manufactured from EPM (a copolymer of ethylene-propylene monomers), this compound uses the latest vulcanisation technology coupled with the inherent stability of the copolymer to eliminate 'weak points' associated with traditional solutions. Used widely in biopharm on aqueous media, CIP fluids, dilute acids and steam duties.

* United States Pharmacopeia

Purity for Demanding Biopharm Processes

Saunders EPDM diaphragms

Ethylene propylene diene monomer (Grade 325) has good mechanical properties and is resistant to ageing, ozone, oxygen and ultra-violet radiation. The diaphragm is cured with an organic peroxide rather than the more commonly used sulphur to optimise product purity.

Used in biotech and pharmaceutical industries on aqueous media with good resistance to steam and CIP fluids, chlorinated caustic and dilute acids.

Approved to USP Class V and VI. Fully traceable to EN 10204 3.1b

The range also includes the E5 EPDM elastomer diaphragm which gives complete confidence that process product is free from leachables and extractables. Manufactured from EPDM (Ethylene Propylene Diene Monomer), the diaphragm is subjected to a post curing process to enhance polymer cross-linking and reduce the level of extractables. The result is improved product purity with minimal or zero contamination. Lasting longer than conventionally produced elastomer diaphragms, the E5 EPDM also provides better reliability and therefore less disruption to your processes.

The E5 EPDM has more quality approvals than any other grade of diaphragm available today.

It actually exceeds current FDA inspection criteria, which means it can replace existing EPDM type diaphragms without any need for FDA revalidation.

The E5 EPDM has been specifically designed in conjunction with leading pharmaceutical manufacturers to:

- ◆ Overcome the problem of sulphur leachables which can be introduced through conventional vulcanisation process
- ◆ Improve product purity
- ◆ Provide a longer life alternative to traditional diaphragms
- ◆ Fully support and simplify the validation process.



Diaphragms

PTFE Grades

Type 214 PTFE (polytetrafluoroethylene) diaphragms

- ◆ Fully fluorinated carbon backbone
- ◆ Widest temperature range of any polymer
- ◆ Inert to corrosive chemicals, only attacked by molten alkali metals, fluorides of chlorine or oxygen and free fluorine
- ◆ Low co-efficient of friction – good anti-stick properties



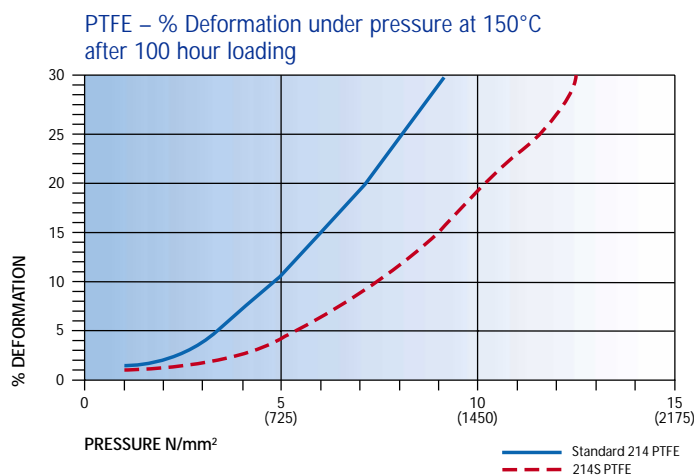
Less Deformation for Longer Diaphragm Life

The PTFE 214S diaphragm has been designed specifically to improve performance in applications where steam is present. It displays improved elastic modulus at high temperature, resulting in less movement due to the effects of cold and hot flow. Indeed, the increased resistance to creep and cold flow of the 214S grade at elevated temperatures make the 214S diaphragm the optimum choice for environments, which call for intermittent steam.

The Saunders range of FDA, USP Class V and VI diaphragms, which includes the PTFE 214S, has been designed to meet the highest standards of reliability and quality today. Equally importantly, however, they are supplied with supporting material that will help you meet your regulatory requirements in full. Only Saunders aseptic diaphragms match the quality of its products with this high standard of documentation to provide all round support in smoothing the demands of FDA validation of plant and process.

Improved life rating

Users of diaphragm valves within the biopharm industry can achieve major processing advantages using the PTFE 214S diaphragm. An innovative formulation means that it can stay in service up to four times longer than conventional PTFE diaphragms without deformation. The net result is less time spent routinely replacing diaphragms and, consequently, fewer interruptions in process run time.



By virtue of its material properties, standard PTFE tends to creep or flow into the body of the valve following steam sterilisation. This occurs when a vacuum is created in the system as the steam condenses. The resulting deformation, over time, reduces the valve's flow capacity, necessitating regular changes of the diaphragm.

Diaphragms

Diaphragm Design/Performance

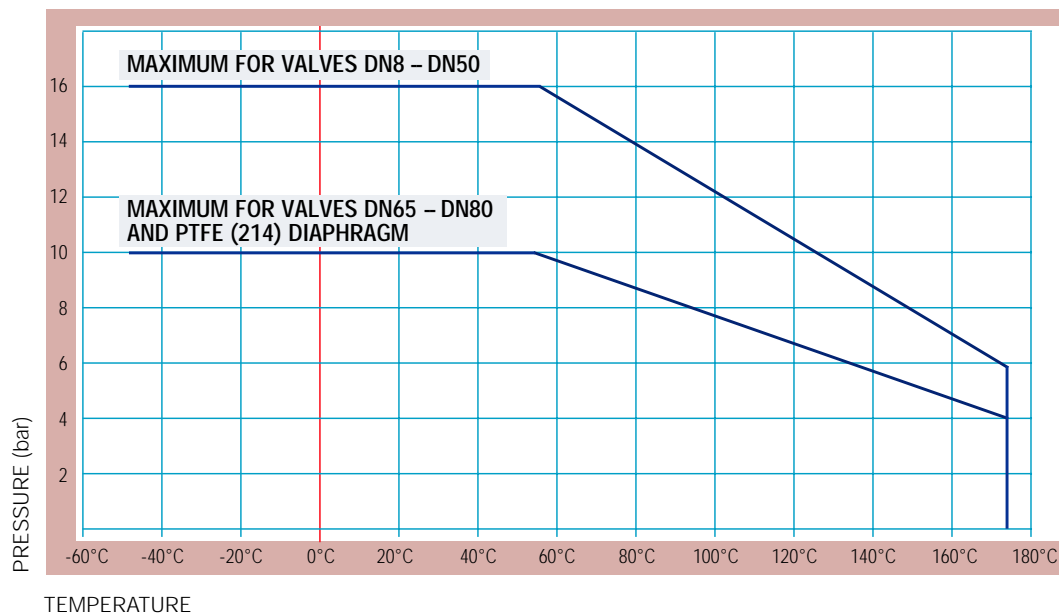
Temperature and pressure are the major limitations of valve operating capability although there can be many other aspects of a process specification that could affect both valve and diaphragm life. It is therefore essential with any valve selection to provide the fullest process and operating details such as operating cycles, speed of temperature fluctuations, sterilising fluids, steam sterilisation temperatures or any other parameter that may be present.

The Saunders aseptic diaphragm range has the following temperature and pressure characteristics: –

- ◆ Moulded and coined to provide optimum flex performance.
- ◆ Reinforcing material to ensure maximum strength in either positive or vacuum pressure duties.
- ◆ Optimum stud anchorage, to provide maximum bond strength and increased life rating of the diaphragm.

Diaphragm Temperature Type AFP (°C)		
-20°	214S/325 & 214/325	160°
-20°	214/425 & 214S/425	160°
-20°	214/300 & 214S/300	150°
-40°	425	140°
-40°	E5	140°
-40°	E3	140°
-40°	E4	110°
-30°	300	130°
-40°	325	140°
-40°	(500) GRADE	150°

Valve Body Temperature/Pressure Relationship



Type AFP – Maximum rated Working Pressure (bar)

	10	10	10	10	25	40	50	65	80
PTFE – (214)	10	10	10	10	10	10	10	10	10
All rubber types	16	16	16	16	16	16	16	10	10

Engineering Data

Flow Co-efficients for Type 'AFP' Forged 2-Way Bodies

BS OD Tubing																		
	DN8 (6.35x1.63)		DN8 (12.7x1.63)		DN15		DN20		DN25		DN40		DN50		DN65		DN80	
% open	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv
100	0.3	0.26	2.24	1.93	2.6	2.2	5.1	4.3	12.5	9.8	27.7	24.0	61.8	52.3	82.6	71.5	165.0	142.7
90	0.3	0.26	2.24	1.93	2.5	2.1	5.1	4.3	12.4	9.8	26.9	23.3	59.8	50.6	80.8	69.9	163.0	141.0
80	0.3	0.26	2.23	1.92	2.4	2.1	5.0	4.2	12.3	9.5	25.6	22.1	57.0	48.2	79.6	68.9	140.9	121.9
70	0.29	0.25	2.15	1.85	2.4	2.0	5.0	4.2	12.3	9.5	24.1	20.8	51.5	43.6	76.8	66.4	132.5	114.6
60	0.29	0.25	1.87	1.61	2.3	1.9	4.8	4.0	10.9	9.3	23.7	20.5	48.2	41.6	74.0	64.0	126.4	109.3
50	0.29	0.25	1.54	1.33	2.3	1.9	4.3	3.6	8.8	8.8	23.0	19.9	45.6	39.45	72.1	62.4	122.6	106.1
40	0.29	0.25	1.27	1.09	2.0	1.7	3.7	3.1	6.9	7.8	18.9	16.3	43.4	36.7	70.7	61.2	113.6	98.3
30	0.29	0.25	0.89	0.77	1.7	1.4	2.9	2.5	4.3	6.3	14.2	12.3	31.8	26.9	53.2	46.0	83.1	71.9
20	0.27	0.23	0.53	0.46	1.2	1.0	2.0	1.7	2.1	4.6	9.3	8.0	20.2	17.1	32.9	28.5	45.7	39.5
10	0.21	0.18	0.21	0.18	0.5	0.5	1.1	0.9	0.4	3.0	4.0	3.5	7.6	6.4	12.3	10.6	20.5	17.7

ISO 1127 Tubing														
	DN15		DN20		DN25		DN40		DN50		DN65		DN80	
% open	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv	Cv	Kv
100	5.8	5.0	6.2	5.4	17.5	15.1	34.1	29.5	65.8	56.9	93.0	80.4	168.7	145.9
90	5.7	4.9	6.2	5.4	17.3	15.0	32.9	28.5	61.0	52.8	91.6	79.2	158.3	136.9
80	5.7	4.9	6.1	5.3	17.2	14.9	30.9	26.7	59.2	51.2	90.2	78.0	140.9	121.9
70	5.5	4.8	6.1	5.3	17.2	14.9	28.9	25.0	56.3	48.7	87.0	75.3	132.5	114.6
60	5.3	4.6	6.0	5.2	14.9	12.9	27.5	23.8	56.0	48.4	81.4	70.4	122.6	106.1
50	4.7	4.1	5.0	4.3	12.0	10.4	25.5	22.1	55.2	47.8	79.0	68.3	127.4	110.2
40	3.7	3.2	3.9	3.4	9.2	8.0	19.8	17.1	44.0	38.1	74.1	64.1	111.6	96.5
30	2.6	2.2	2.6	2.2	6.0	5.2	14.2	12.3	30.4	26.3	57.1	49.4	80.6	69.7
20	1.5	1.3	1.3	1.1	3.1	2.7	8.4	7.3	17.6	15.2	36.2	31.3	48.6	42.0
10	0.5	0.4	0.4	0.3	1.1	1.0	2.8	2.4	5.8	5.0	15.8	13.7	21.4	18.5

Tolerance +/- 10% Cv units – US gallons/minute Kv units – Cubic metres/hour



Every Saunders product supplied to our customers is uniquely laser etched with order reference, item number and quantity. This provides a validation reference against the full product specification supplied and provides the end customer with complete assurance/confidence in the solution provided. Furthermore, any retrospective need for certification can be met given the laser etch reference information.

Weld installation

All Saunders body configurations are manufactured with sufficient turnback length to allow for direct orbital weld installation and do not require tube extensions.

Providing standard TIG orbital weld equipment is used, there is no requirement to disassemble valves prior to installation. This is due to localisation of the heat source.



Size (DN)	Turnback Length (X) *
8	19mm
15	30mm
20	29mm
25	28.5mm
40	34mm
50	41mm
65	42mm
80	48mm

Standard Length to BS 5156

Applications

- ◆ Saunders is a key player in the evolution of high purity valve technology
- ◆ The top ten pharmaceutical companies in the world head our international customer base
- ◆ Apart from diaphragm valves for the aseptic sector, Saunders have an extensive range of valves designed for industrial applications. Dedicated literature and further details are available from your local supplier.



Quality Statements and Approvals



Certified Quality from Crane Process Flow Technologies The Complete Approach to Quality

Quality Management system registered to ISO 9001 standard in which our R & D and manufacturing process are optimised to maintain our product quality and service.

TUV-Merkblatt HPO Qualification for our product manufacturing and certification.

Certified compliance to the European Pressure Equipment Directive 97/23/EC authorising Saunders to CE mark relevant valve products.

International product approval from authorities such as Bureau Veritas, American Bureau of Shipping.

Polymer/Rubber materials certified as meeting the requirements of FDA, 3A, WRAS and USP.

Validation Documentation

Saunders can supply the following validation documentation on request:

- ◆ Certification of chemical composition to EN 10204 for body material
- ◆ Traceability certification for diaphragm grade
- ◆ Full validation manual (polymers)
- ◆ Surface trace certification
- ◆ USP Class V and VI diaphragm certification
- ◆ FDA conformance certification for all biopharm diaphragm grades
- ◆ Certificate of conformity to order specification
- ◆ ISO 9001 certification
- ◆ Certification of testing to BS 6755-1

QUALITY ASSURANCE APPROVALS

BS EN ISO 9001



TÜV AD-MERKBLATT



COMPLIANCE WITH
FDA

TNO CERTIFICATION
3A
cGMP
USP

QA

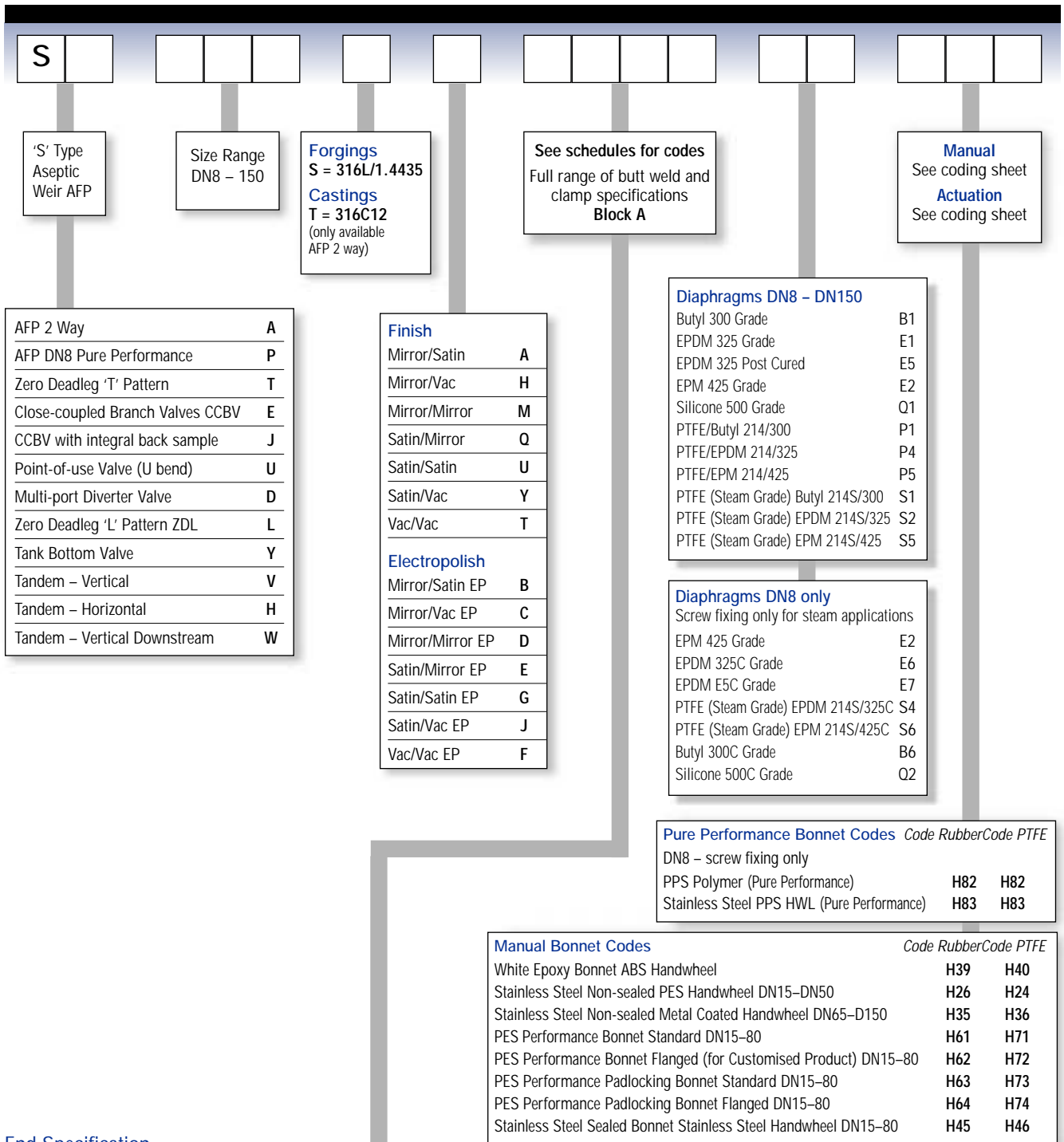
Aseptic Product and
Quality Approvals

FDA

USP

ISO 9001

Saunders Model Numbering System



End Specification

Body Size	ISO 1127	BS 1640 SCH 5	BS 1640 SCH 10	BS 1640 SCH 40	16 SWG	18SWG	20SWG	DIN 11850			SMS 3008	Tri-clamp
	S1	S2	S3	Butt Weld								
08	2Z = (6.0 x 1.0)		43 = (13.72 x 1.65)		00 = (6.35 x 1.63)		22 = (6.35 x 0.91)	3D = (10 x 1)				AC
	3B = (8.0 x 1.0)				01 = (9.53 x 1.63)		23 = (9.53 x 0.91)	63 = (12 x 1)				
	93 = (13.5 x 1.6)				02 = (12.7 x 1.63)		24 = (12.7 x 0.91)	73 = (13 x 1.5)				
15	OD/98	33	45	55	02	13		64	74	81	6Q	AC
20	OK	34	46	56	03	14		65	75	82	6R	AD
25	OU	35	47	57	04	15		66	76	83	6S	AE
40	IG	37	49	59	06	17		68	78	85	6V	AG
50	IQ	38	50	60	07	18		69	79	86	6W	AH
65	IZ	39	51	61	08	19		70			6X	AJ
80	2J	40	52	62	09	20		71			6Y	AK
100	2T (114.4 x 2.6)				10 (14 SWG)			72			7B	AL
150	8R (168.2 x 2.6)				8Q (12 SWG)							BT

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'A'FP ZERO DEADLEG 'T' (ZDT) FORGED VALVES

Type		Size		Material	Finish	End Specification					
S	T				S						
AFP Type Diaphragm		mm		316L 1.4435	See finish codes	End A		End B		End C	
ST = ZDT						Standard options have the same end code for End A and End B				End C can be the same size or less than Ends A and B	



'A'FP CLOSE-COUPLED BRANCH VALVES (CCBV)

Type	Size			Material	Finish	End Specification					
<div>SE</div>	<div></div>	<div></div>	<div></div>	<div>S</div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
AFP Type Diaphragm	mm			316L 1.4435	See finish codes	End A		End B		End C	
SE = CCBV						Standard options have the same end code for End A and End B MAIN LINE TUBE SIZE					
						End C is the VALVE SIZE					



'A'FP CLOSE-COUPLED BRANCH 'POINT-OF-USE' VALVES (CCBV-U BEND)

Type	Size			Material	Finish	End Specification						
<div>S U</div>				<div>S</div>								
AFP Type Diaphragm	mm			316L 1.4435	See finish codes	Outlet A		Outlet B		Outlet C		
SU = 'Point-of-use' CCBV						Standard options have the same end code for Outlet A and End B MAIN LINE TUBE SIZE						Outlet C is the VALVE SIZE



'A'FP TANK BOTTOM (TBV) FORGED VALVES

Type	Size	Material	Finish	OUTLET Specification	
S Y		S			
AFP Type Diaphragm	mm	316L 1.4435	See finish codes	See tube specifications	
SY = Tank Bottom Valve TBV					



'A'FP ZERO DEADLEG 'L' PATTERN (ZDL) FORGED VALVES

Type	Size			Material	Finish	OUTLET Specification							
S L				S									
AFP Type Diaphragm	mm			316L 1.4435	See finish codes	Outlet A		Outlet B		Outlet C		Tube Orientation	
SL = ZDL						Standard options have the same end code for Outlet A and End B				Outlet C size is always less than the VALVE size		04 = 20 degrees 09 = 45 degrees 14 = 70 degrees 18 = 90 degrees 22 = 110 degrees 27 = 135 degrees 32 = 160 degrees	



'A'FP TANDEM VALVES

Type	Size	Material	Finish	OUTLET Specification												
S	H			S												
AFP type	mm	316L	See	Outlet A	Outlet B		Tandem Valve size		Outlet C		Tandem Orientation					
Diaphragm		1.4435	finish codes	Standard options have the same end code for Outlet A and B				mm		Outlet C size is always less than the MAIN VALVE size		See previous sheets for the appropriate CODE				
SH = Tandem Horizontal												H 2268 V 1858 H 1836 H 0454 H 3236				
SV = Tandem Vertical (upstream)												H 2240 V 1814 H 1818 H 0436 H 3218				
SW = Tandem Vertical (downstream)												H 1404 V 1822 H 1854 H 0400 H 3254				
												H 1432 V 1850 H 1800 H 0418 H 3200				



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Aseptic Diaphragm Valves – Actuation Options

TYPE 'EC' COMPACT PNEUMATIC ACTUATORS

Style	Size	Type	Mode of operation	Dia	Air Connection	Slotted	Limit stops
A -	<input type="text"/> <input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Diaphragm Type A	mm	C = EC	4 = 4 bar Spring Closed 6 = 6 bar Spring Closed O = Spring Open D = Double Acting	R = Rubber P = PTFE	B = BSP N = NPT	Y = Yes N = No	N = None O = Limit Open
AA = AP =	Sizes 15mm to 50mm Size 8mm						



TYPE 'SSC' STAINLESS STEEL DIAPHRAGM VALVE ACTUATORS

Style	Size	Type	Mode of operation	Dia	Air Connection	Finish	Limit stops
A A	<input type="text"/> <input type="text"/> <input type="text"/>	T	<input type="text"/>	<input type="text"/>	<input type="text"/>	G	<input type="text"/>
Diaphragm Type A	mm	T = SSC Stainless Steel	4 = 4 bar Spring Closed 6 = 6 bar Spring Closed O = Spring Open D = Double Acting	R = Rubber P = PTFE	B = BSP N = NPT	G = Glass Bead Blast	N = None O = Limit Open



TYPE 'ECX' DIAPHRAGM VALVE ACTUATORS

Style	Size	Type	Mode of operation	Dia	Visual indicator	Limit stops
A A	<input type="text"/> <input type="text"/> <input type="text"/>	X	<input type="text"/> <input type="text"/>	<input type="text"/>	<input type="text"/>	N
Diaphragm 'A' Type	mm	ECX	F2, F4, G2, G3, G4, G5, H2, H4, H5 = Spring Closed OS, OH = Spring Open DS, DH = Double Acting	R = Rubber P = PTFE	Y = Yes N = Only when accessories are used	N = None



EC ACTUATOR MINI SWITCHBOX OPTIONS

Switchbox type	Conduit entry	Switch type	Switch quantity
I	<input type="text"/>	<input type="text"/> <input type="text"/>	<input type="text"/>
Switchbox Mini	G = 6-8mm Cable Gland C = 1/2" NPT Thread	MA = V4 Mechanical Switch PA = Proximity Switch Namur DIN19234 PB = Proximity Switch 3 Wire NO NPN PC = Proximity Switch 3 Wire NO PNP	1 = One 2 = Two



EC ACTUATOR MODULE SWITCHBOX OPTIONS

Type	Size	Switchbox	Module
V C	<input type="text"/> <input type="text"/> <input type="text"/>	B	M <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
V = Accessory C = EC	mm	CONDUIT ENTRY O = Metric P = PG N = NPT	SWITCH TYPE M1 = V3 Mech M2 = V3 Mech. Gold Plated M3 = V24 T7 Mech. DPST M5 = Bartec Ex. Proof EExd P2 = ProxSwitch Intrinsically Safe P6 = ProxSwitch 3 Wire NPN P7 = ProxSwitch 3 wire PNP P9 = ProxSwitch 2 Wire NPN/PNP SWITCH QUANTITY 1 = One 2 = Two PNEUMATIC CONTROL 0 = None 1 = Single/Double Acting 1/8" BSP 2 = Single/Double Acting 1/8" NPT 3 = Single Acting Manifold 1/8" BSP 4 = Single Acting Manifold 1/8" NPT SOLENOID VOLTAGE 0 = None 1 = 220/240v AC 50/60Hz 2 = 110/120v AC 50/60Hz 3 = 24v DC 5 = Intrinsically safe 24v DC



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ASEPTIC AFP TYPE SPARE DIAPHRAGMS									
Type		Size			Diaphragm				
D									
Diaphragm		mm			Refer to Diaphragm Code Listing				
A = 'A' Type Standard P = Pure Performance (4-bolt) 008 Size Only					DN8 Only Button Fixing – B1, E1, E2, E5, Q1, P1, P4, P5, S1, S2, S5 Screw Fixing – E2, E6, E7, S4, S6, B6, Q2				



ASEPTIC MANUAL BONNETS – SPARE BONNET ASSEMBLIES AND KITS									
Type		Size			Bonnet/Kit Code				
H	A								
Diaphragm 'A' Type		mm			Handwheel Kits S11, S12, S13, S15 Compressor Kits S17, S18, S19, S20 Spindle Kits S21, S22, S23 Padlocking Handwheel Kits S09				
					Spare Bonnet Assembly See bonnet codes DN8 Only Button fixing available as spare PPS Polymer Pure Performance – H53 Stainless Steel PPS HWL Pure Performance – H54				

SPARES CODES	
S09	PES Padlocking Handwheel Kit
S11	White Epoxy Handwheel Kit
S12	Stainless Steel Sealed Bonnet Handwheel Kit
S13	Stainless Steel Non-Sealed Bonnet Handwheel Kit
S15	PES Bonnet Handwheel Kit
S17	Stainless Steel Sealed Bonnet Compressor Kit – Rubber Diaphragm
S18	Stainless Steel Non-Sealed Bonnet Compressor Kit – Rubber Diaphragm
S19	Stainless Steel Sealed Bonnet Compressor Kit – PTFE Diaphragm
S20	Stainless Steel Non-Sealed Bonnet Compressor Kit – PTFE Diaphragm
S21	Stainless Steel Sealed Bonnet Spindle Kit
S22	Stainless Steel Non-Sealed Bonnet Spindle Kit
S23	PES Bonnet Spindle Kit
S24	DN8 Screw Fixing Bonnet Compressor Kit

Spare Kits cover the Bonnet Catalogue Codes shown below

S09	Padlock Handwheel Kit	H61	H62	H71	H72						
S11	Handwheel Kit	H39	H40								
S12	Handwheel Kit	H45	H46								
S13	Handwheel Kit	H24	H26								
S15	Handwheel Kit	H61	H62	H71	H72						
S17	Compressor Kit	H45									
S18	Compressor Kit	H26	H29								
S19	Compressor Kit	H46									
S20	Compressor Kit	H24	H30	H71	H72	H73	H74	H75	H76	H77	H78
S21	Spindle Kits	H45	H46								
S22	Spindle Kits	H24	H26								
S23	Spindle Kits	H61	H62	H63	H64	H65	H66	H67	H68		
S23	Spindle Kits	H71	H72	H73	H74	H75	H76	H77	H78		
S24	Compressor Kit	H82	H83								



B/AFP/001/01/04.02

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