THE DIAMOND DOUBLE SEAT VALVE
USER MANUAL

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Introduction and Contents

The double seat valve is designed on a modular basis sharing common components with all DPL products using the spherical housing. The fully machined housing gives a clean, self-draining and crevice free interior which is gentle on your product.

SECTION 1
FUNCTION

The double seat valve is designed to eliminate the risk of mixing different products or product with CIP. An area between the two seats drains to atmosphere and ensures that a damaged seal can not cause a leak between the two valve bodies. This double seat function replaces two or three single seat or butterfly valves.

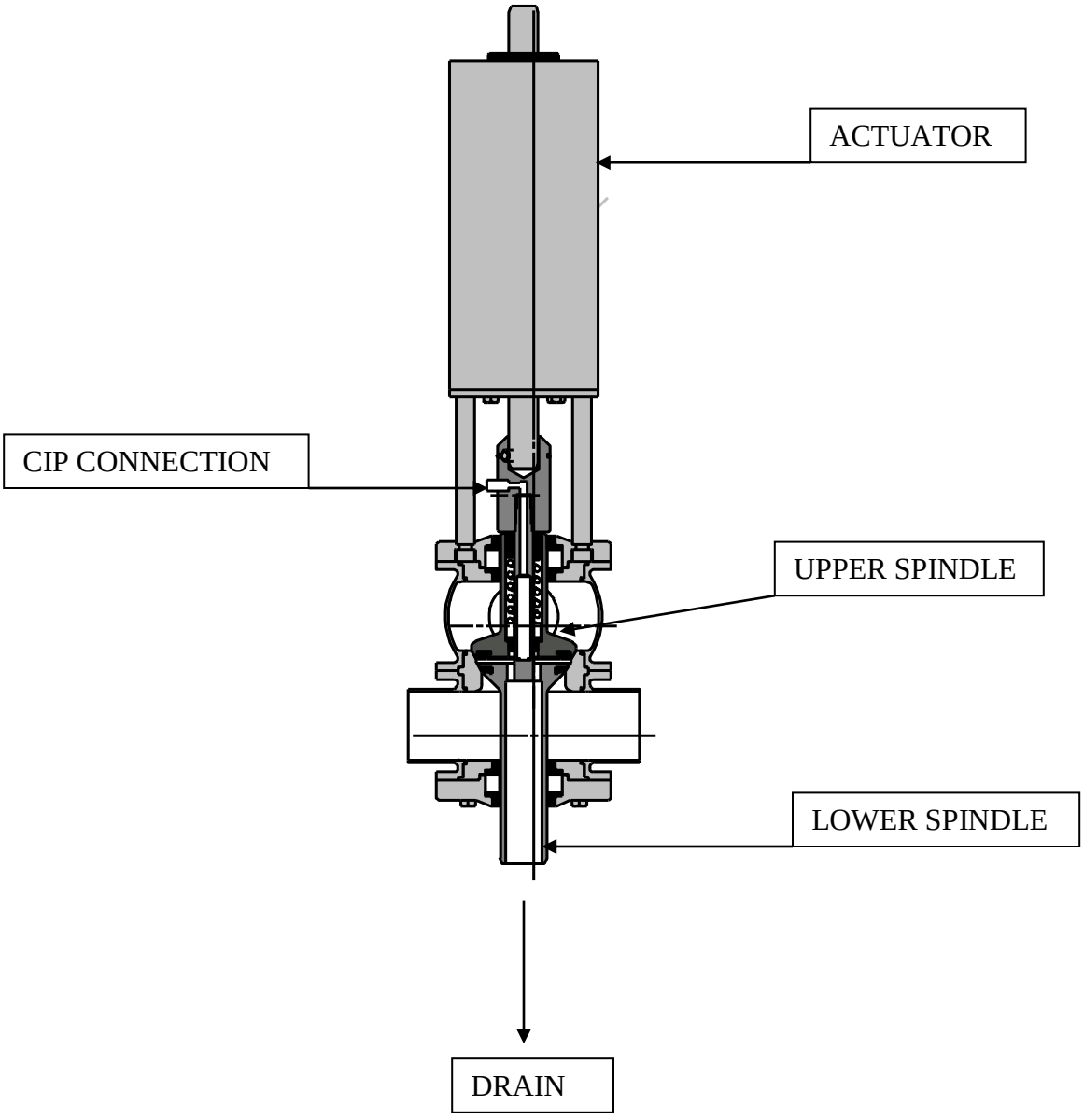
When the actuator spring closes the valve, both the spindles move down towards the seat. When the upper spindle and seal close against the seat they stop and an additional spring allows the lower spindle to continue moving until the lower seal closes against the lower seat. The extended movement by the lower spindle creates a gap between the upper and lower spindles. This gap drains through the lower spindle to atmosphere and so prevents any pressure build up between the two seats.

The two-spring system provides an additional safety feature by releasing any product pressure shocks in the lower valve body. The pressure shock will lift the lower plug without lifting the upper plug so the leakage escapes through the drain.

To open the valve, the actuator lifts the lower spindle until it seals against the upper spindle then lifts the two spindles together to the fully open full flow position. This movement seals the area between the two valve seats, which is open to atmosphere, before opening the valve.

To clean the area between the two valve seats a flexible CIP feed is connected to the internal cleaning system. The CIP connection is located on the valve/actuator coupling and is suitable for a variety of tubing including stainless steel, Teflon, semi-rigid nylon and polyurethane. The standard connection suits 6 mm O/D tube and includes sleeve nut and olive, other sizes are available. When the valve is in the closed position, the pressurised cleaning media feeds down through the centre spindle and is injected into the area between the seats and then drains out through the lower spindle. This cleaning operation can be carried out while the product is in the upper, lower or both of the valve bodies.

GENERAL ASSEMBLY



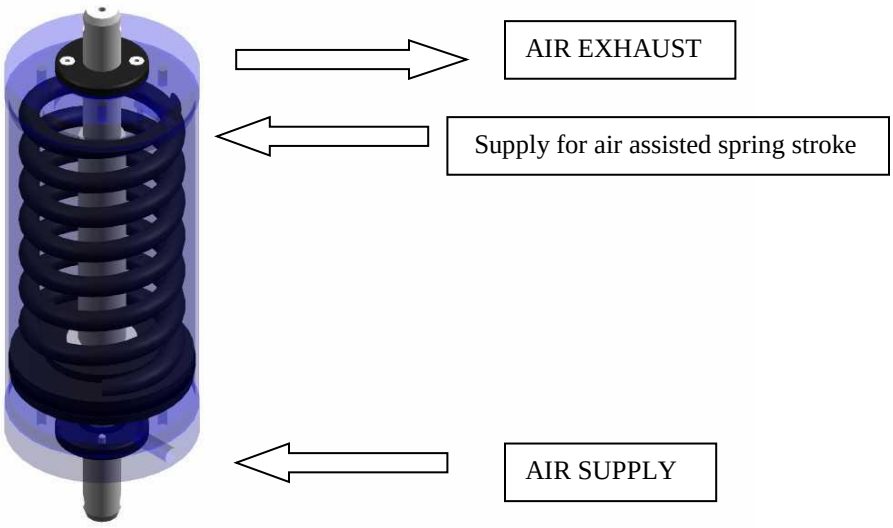
SECTION 2
OPERATION

ACTUATOR DETAILS

The valve is operated by means of a pneumatic actuator. Two actuator sizes are available, one for 1½" and 2" valves and one for 2½" - 4" valves. Both actuators are available as spring return or double acting.

The actuator is a factory lubricated sealed unit, requiring no maintenance. It is therefore recommended to operate with filtered air in order to prevent particles from entering the actuator. Although maintenance is not normally required, two external actuator seals are accessible for service, and can be changed if necessary by following the valve maintenance dismantling procedure.
IMPORTANT: To avoid serious injury the actuator cylinder should not be dismantled any further than to replace the two external seals as described above. The actuator cylinder is a sealed unit that houses a powerful spring under compression.

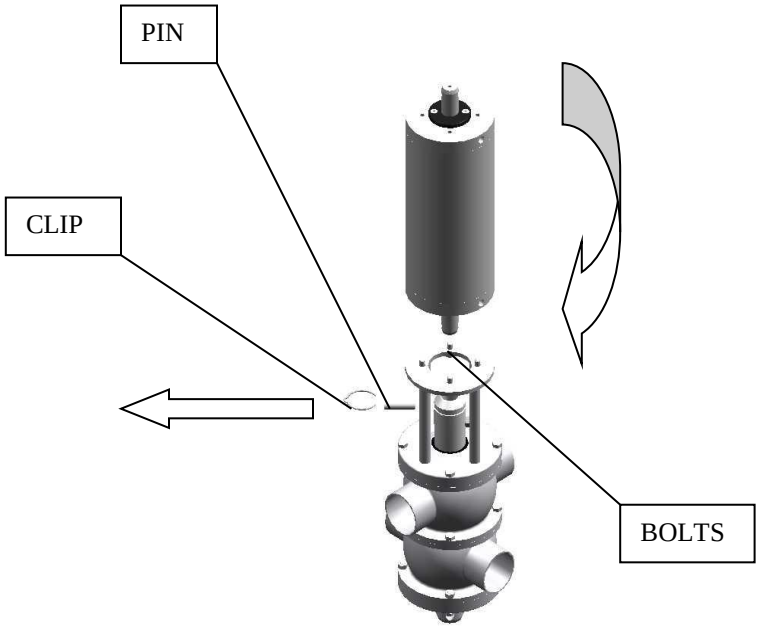
Operating temperature	-15°C to 120°C In sub zero temperature the operating media must be free from moisture.
Recommended operating air pressure	5.5 Bar (80 PSI)
Maximum air pressure	6.0 Bar
Air Connections	1/8" BSP Female



FAILSAFE POSITION

As standard, the valves are fitted with the spring return actuator closing the valve spindle down-wards with the spring; this is termed normally closed (NC). The valves can be fitted with the actuator opening the valve spindle up-wards with the spring; this is termed normally open (NO). Normally open or normally closed, is the position that the valve will be returned by the spring at rest or due to an air supply failure. The actuator is easily field reversible for NC or NO.

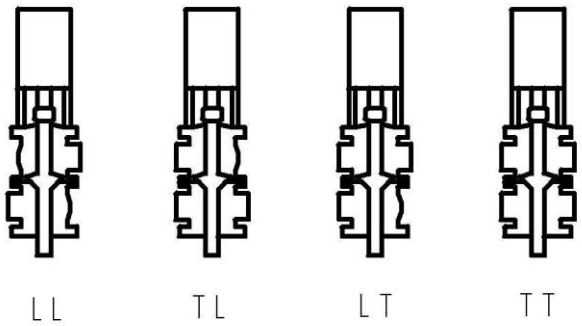
To remove the actuator, simply undo the four bolts and remove the clip and pin from the coupling. See maintenance instructions for full details.



Because the DPL actuator produces equal force at the end of the spring and air stroke at 80 psi, reversing the actuator does not change the pressure rating of the valve.

SECTION 3
CONFIGURATIONS

The most common configurations are shown below.
All common end connections are available including 1”– 4” RJT, IDF, ILC, CLAMP, FLANGED, WELD AND DIN.

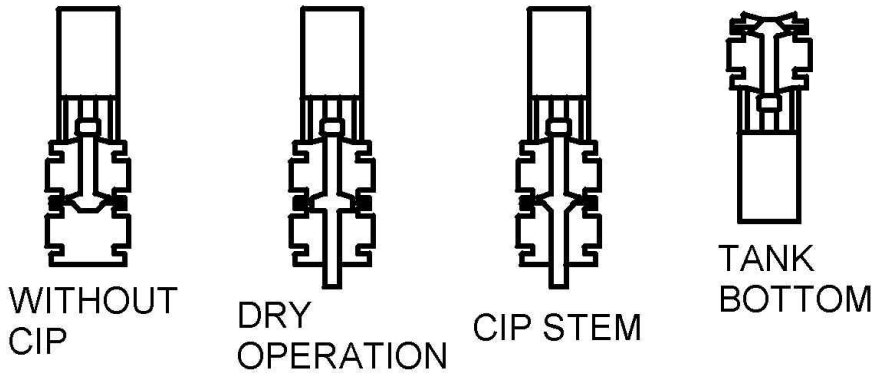


The above schematic diagram shows the number of ports and the ‘L’ or ‘T’ configuration. The actual ports on the upper and lower valve bodies are offset at 90° to avoid the end connections interfering with each other. Bodies with weld ends can be assembled without the 90° offset if the pipes can be moved apart for maintenance.

PORTS OFFSET
AT 90°

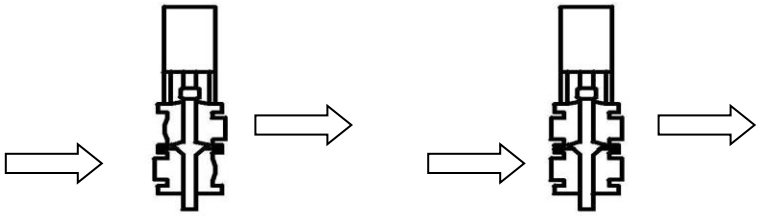
PORTS CAN ROTATE IN
90° INCREMENTS
(check end connection interference)

The valves modular design gives many assembly options, some are shown below.



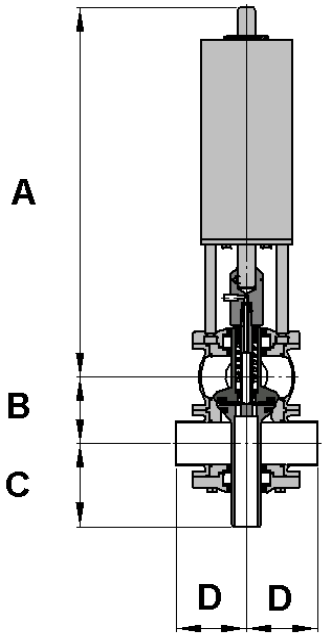
FLOW DIRECTION

Liquid flow direction needs to be considered because pressure shocks are likely to arise if moving product stops suddenly.
An air regulator can be fitted to the actuator inlet to slow down the valve action.



Where possible, the flow should be from the lower valve housing into the upper valve housing, so that the valve closes into the flow.

SECTION 4
DIMENSIONS

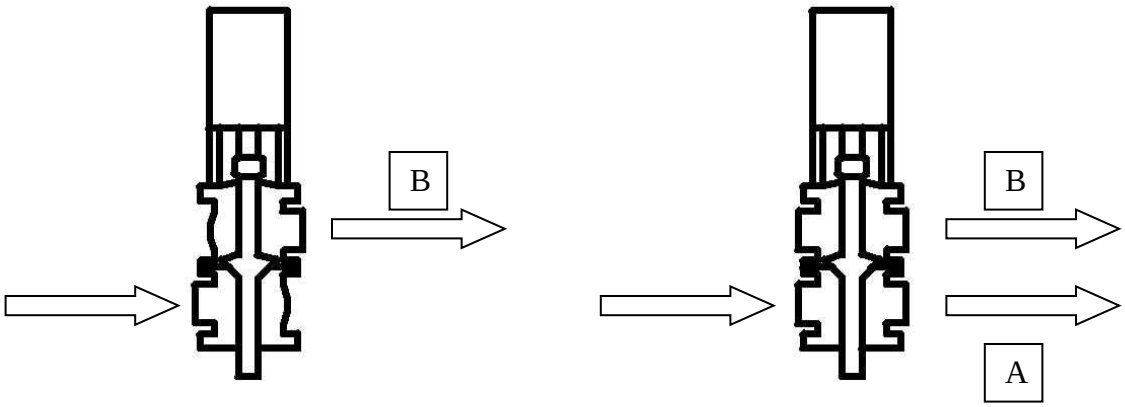


DOUBLE SEAT VALVES (Dimensions)					
SIZE	1.5"	2"	2.5"	3"	4"
A (mm)	455	450	535	530	550
B (mm)	63.3	76	92.8	105.5	142
C (mm)	105	100	130	125	170
D (mm)	75	79	95	99	127
PRESSURE (BAR)	5.5	5.5	6.0	6.0	5.5

Higher pressures ratings are available using air assist or balance pistons.

Weld end dimensions	Outside diameter (mm)	Wall thickness (mm)
1.5”	38.1	1.6
2”	50.8	1.6
2.5”	63.5	1.6
3”	76.2	1.6
4”	101.6	2.0

PRESSURE DROPS



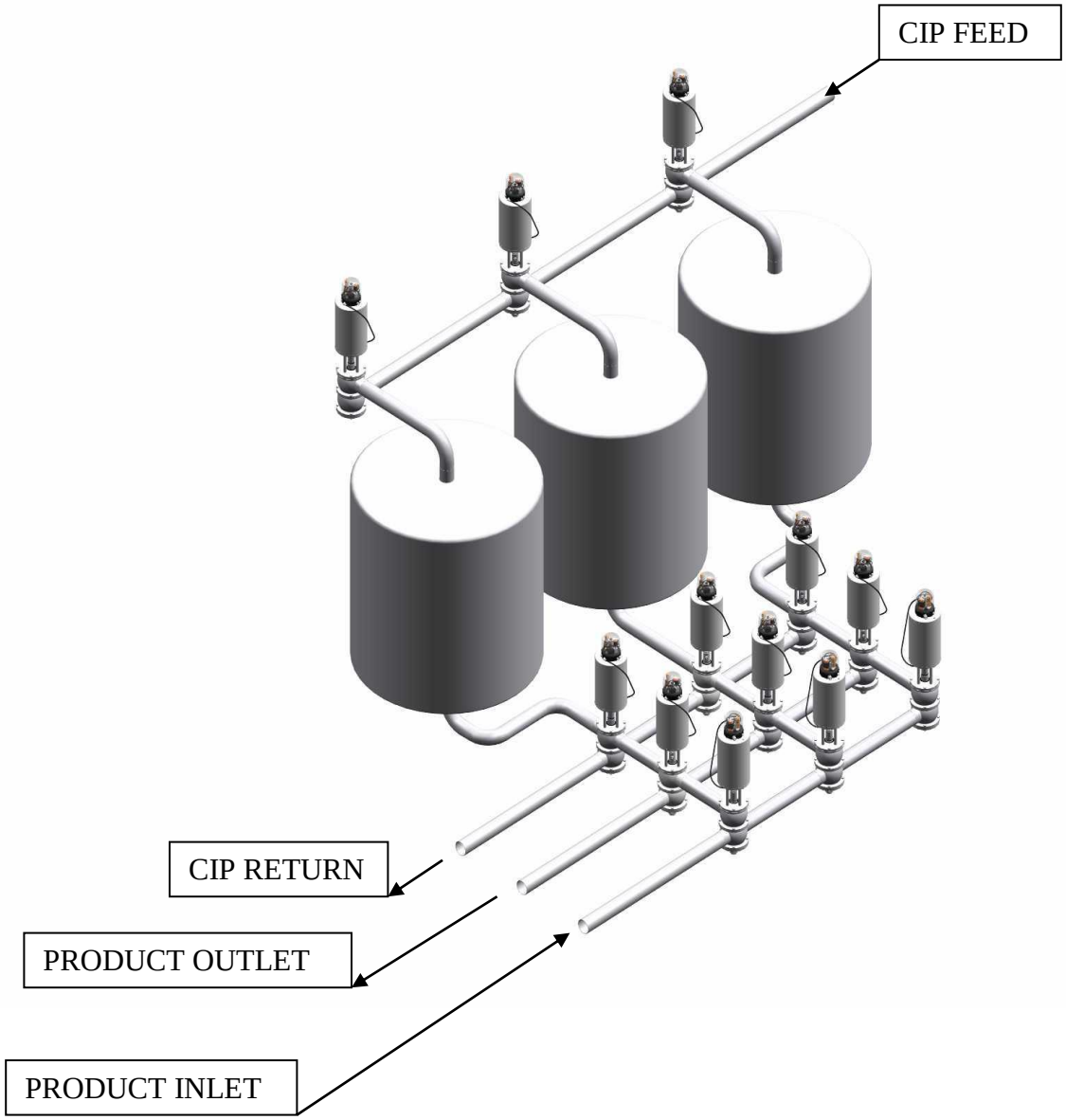
Pressure drop values of valves in equivalent pipe lengths (meters)

SIZE	1.5”	2”	2.5”	3”	4”
A (flow)	2	2	3	3	4
B (flow)	5	5	10	10	15

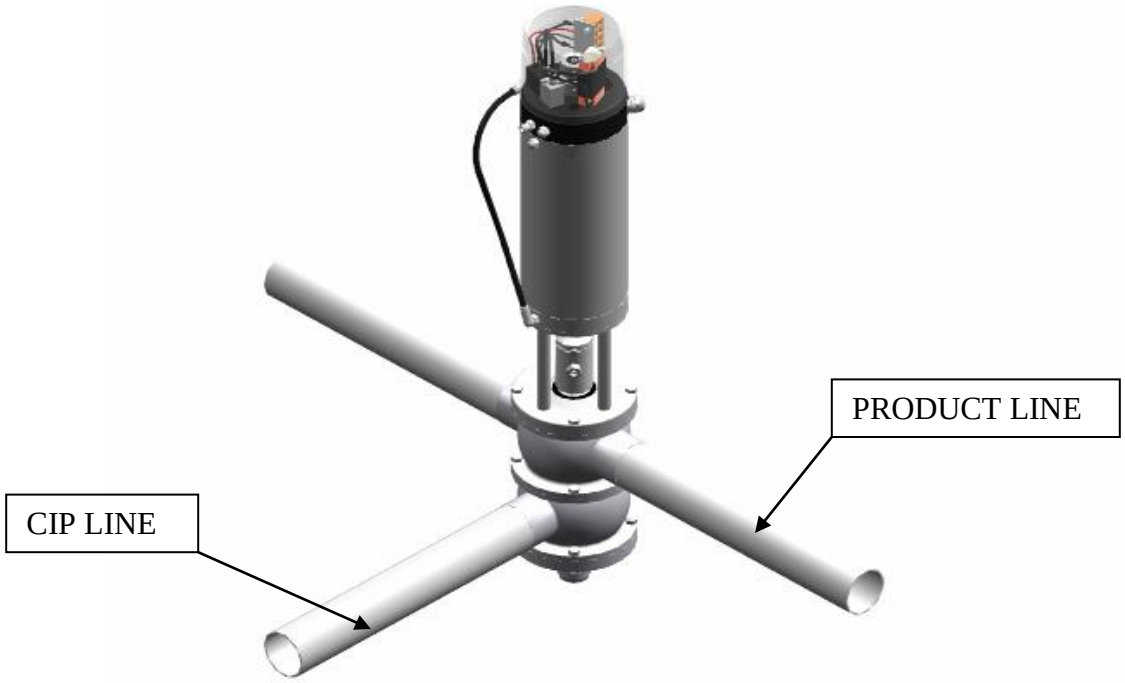
Figures are approximate for flow velocities of 1 – 3 m/s water.

SECTION 5
APPLICATIONS

VALVE MANIFOLD OR MATRIX
TRANSFERS PRODUCT TO AND FROM TANKS/PROCESSES
BODIES CAN BE LEFT IN PLACE DURING MAINTENANCE



Any number of tanks can be filled, emptied or cleaned without risk of mixing CIP with product.



An Ideal application for a double seat valve is in a critical position in a process system such as on the CIP inlet to a product line where the valve will prevent accidental mixing of CIP with product.
All other valves on the CIP set and the product line can be single seat. The double seat valve is used as an on/off valve, but offers the safety benefit of protection against pressure shock in the lower valve body or leakage from a damaged seal. Any leakage will be detected at the drain outlet from the leakage chamber.

The modular construction allows for several variants of valve to be built to suit exact applications. If the internal CIP function is not required, the drain is not necessary and the CIP feed can be used as a leak detection indicator. A dry operation valve is available which has a low switching over leakage compared to the standard valve, but does not offer pressure shock protection. Another variant is the tank bottom valve that again uses the CIP feed as a leak detection indicator. The tank bottom valve allows the outlet pipe from the tank to be cleaned all the way to the tank without leaving a dead area.

SECTION 6
INSTALLATION

A process system can generally be associated with many varying conditions such as water hammer, pressure shock, vibration and thermal expansion due to temperature change. Stress and strain within the pipeline will result and unless such conditions are allowed for at the system design and installation stages, the valve and pipe assembly may be damaged.

When installing the valve into a pipe assembly system, careful consideration must be made to ensure adequate support by means of framework and pipe clip fasteners, for both the valve and the surrounding pipe assembly.

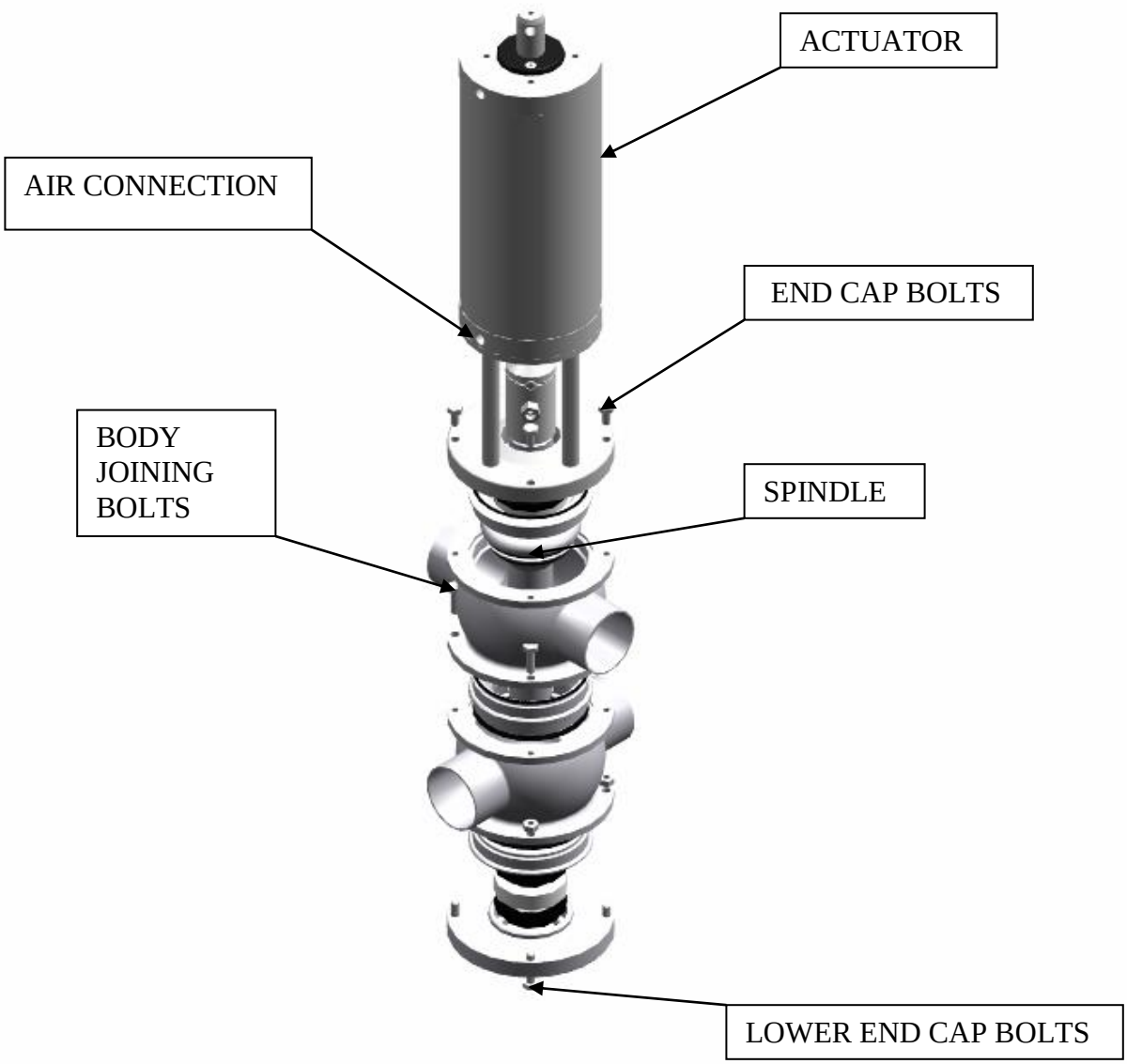
If welding the valve body directly into the pipeline, the valve should be partly disassembled and all seal components removed from the valve body. This will prevent heat damage to the valve seals and other internal components. Gas backed TIG welding is recommended, a minimum weld bead should be produced to minimise the risk of heat distortion within the valve body.

The valve manifolds are normally designed to allow 3 or 4 upper valve bodies to be removed together for maintenance. For this reason it may be necessary to have a few fittings (IDF, RJT etc) in key positions on large manifolds to assist disassembly for maintenance.

If the upper and lower valve bodies are welded in place, a minimum of 50 mm movement must be allowed between the upper and lower pipe work. This movement allows the centre seat and body ‘O’ rings to be refitted. All seals must be removed before welding tube or fittings to the valve bodies.

It is recommended that the upper and lower bodies are bolted back together with the centre seat, but without the ‘O’ rings before welding to ensure correct alignment of the body bolts.

DOUBLE SEAT VALVE DISASSEMBLY



TO DISASSEMBLE THE VALVE FOR WELDING THE BODIES IN LINE

1. NORMALLY CLOSED VALVES ONLY (spring pushing down)

The following procedure to remove the actuator from the valve involves actuating the valve (using compressed air) to the open position. Great care must be taken when introducing air pressure to the actuator. As the valve is actuated the central valve/ actuator shaft will move. Hands/fingers and loose clothing should be kept away from the moving parts of the valve wherever possible, as the valve is actuated.

Start by locating a suitable airline feed with a 5.5 bar supply pressure. Ensure that the airline pressure is zero, then connect to the lower air connection of the valve actuator. The 5.5 bar supply pressure should now be switched on and maintained during the following procedure.

Using an appropriate size spanner, undo and remove the valve body end cap bolts. Lift off the actuator taking with it the spindle, guide and lantern assembly as one unit.

Using an appropriate size spanner, undo and remove the 4 bolts that join the valve bodies together and the 4 bolts that join the lower end cap to the body. All seals can now be removed and the valve bodies welded in place.

On completion, clean the welds and reassemble the assembly in the reverse procedure. Ensure the 'O' ring body seals are in place on the guide discs for ease of assembly and correct location. **Tip**; process compatible grease can help hold the seal in position.

Ensure that hands/fingers and other body parts are clear of the valve then disconnect the airline supply. The valve spindle will move returning the valve seat position to closed.

2. NORMALLY OPEN VALVES ONLY (spring pulling up)

Use the same procedure as per above (section 1) but no air connection is required, the valve does not need to be air actuated.

3. The user should establish a maintenance programme for valves depending on the type of product and frequency of valve use. For valves in constant use DPL recommends replacement of seals and wear related parts at least every two years.

SECTION 7
MATERIALS

PRODUCT CONTACT PARTS

Body: 316L, fully machined from a forging
Spindle: 316L, ground/machined from bar
Guide: 316L, fully machined from bar

NON CONTACT PARTS

304 Machined

SEALS

All DPL polymers are food quality, approved by USDA and comply with FDA's Code of Federal Register – Title 21, part 177.

Temperature range

EPDM	-50°C to +140°C
VITON	-20°C to +200°C
SILICONE	-50°C to +200°C
PTFE	-10°C to +230°C
NITRILE	-30°C to + 90°C

Maximum application temperature in dry atmospheric air.

	Caustic Soda Up to 5%	Nitric Acid Up to 2%	Milk fat<15%	Milk >15%	Beer Cold	Wort 100°C	Hot water Steam
EPDM	A	A	A	C	A	A	A
VITON	B	A	A	A			C
SILICONE	B	B	A	A	A	B	A
PTFE	A	A	A	A	A	A	C

A	Resistant
B	Some resistance
C	Not suitable

Nitrile has been replaced in most applications by EPDM, which offers a wider temperature range, and a lower compression set, Nitrile has superior resistance to fats and some oils/greases.

The above values refer to typical examples, it is recommended that materials be tested on actual processes.

SECTION 8
SWITCHBOXES

The DPL range of single and double seat valve switchboxes can be populated with many combinations of switches and solenoid valves to suit exact specifications including a wide range of voltages, ASI, Intrinsically safe, etc.

Some of the more common switchboxes are listed below:

S/Box No	Valve	Micro switch	Proximity switch	Solenoid
STV102/02	1.5-4”	-	2 x 24V DC	24VDC
STV102/05	1.5-2”	2 x AC/DC	-	24V DC
STV102/06	2.5-4”	2 x AC/DC	-	24V DC
STV102/10	1.5-4”	-	2 x 24V DC	-
STV102/13	1.5-2”	2 x AC/DC	-	-
STV102/14	2.5-4”	2 x AC/DC	-	-

CONSTRUCTION

BASE	ACETAL	Machined from bar
CLEAR TOP	ACRYLIC	Moulded
FASTENERS	STAINLESS STEEL	
BRACKETS	STAINLESS STEEL	

CONNECTIONS

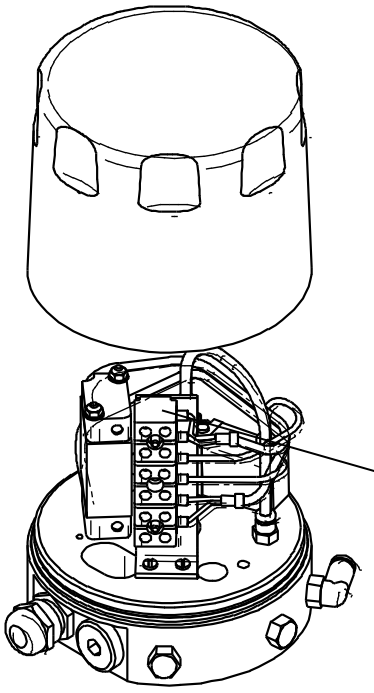
Two PG9 electrical connections, one with a cable gland, the other with a removable plug

Air connections are 1/8” BSP female fitted with connectors to suit 6 mm OD airline.

Switchboxes are fitted with a pressure relief vent to avoid pressurisation inside the box.

ADJUSTMENT

The switchbox is factory set on the valve it is mounted on. If the switchbox is transferred onto another valve the switch point can be adjusted by loosening a screw and moving the switch-activating collar. This allows the switches to remain in the same position.



TERMINAL BLOCK	
TOP SWITCH	BLACK WHITE
SOLENOID	TWO WIRE
LOWER SWITCH	WHITE BLACK

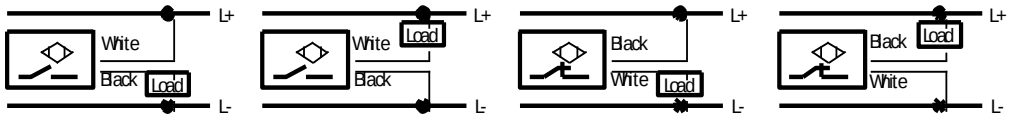
The DPL switchbox is fitted with Quadronorm proximity switches as standard

PROGRAMMING

Quadronorm 2 wire proximity sensors can be programmed to either normally open, normally closed, PNP or NPN by the choice of the wire connection as shown below.

Switch status/connection active face uncovered

PNP switching Normally open	NPN switching normally open	PNP switching normally closed	NPN switching normally closed



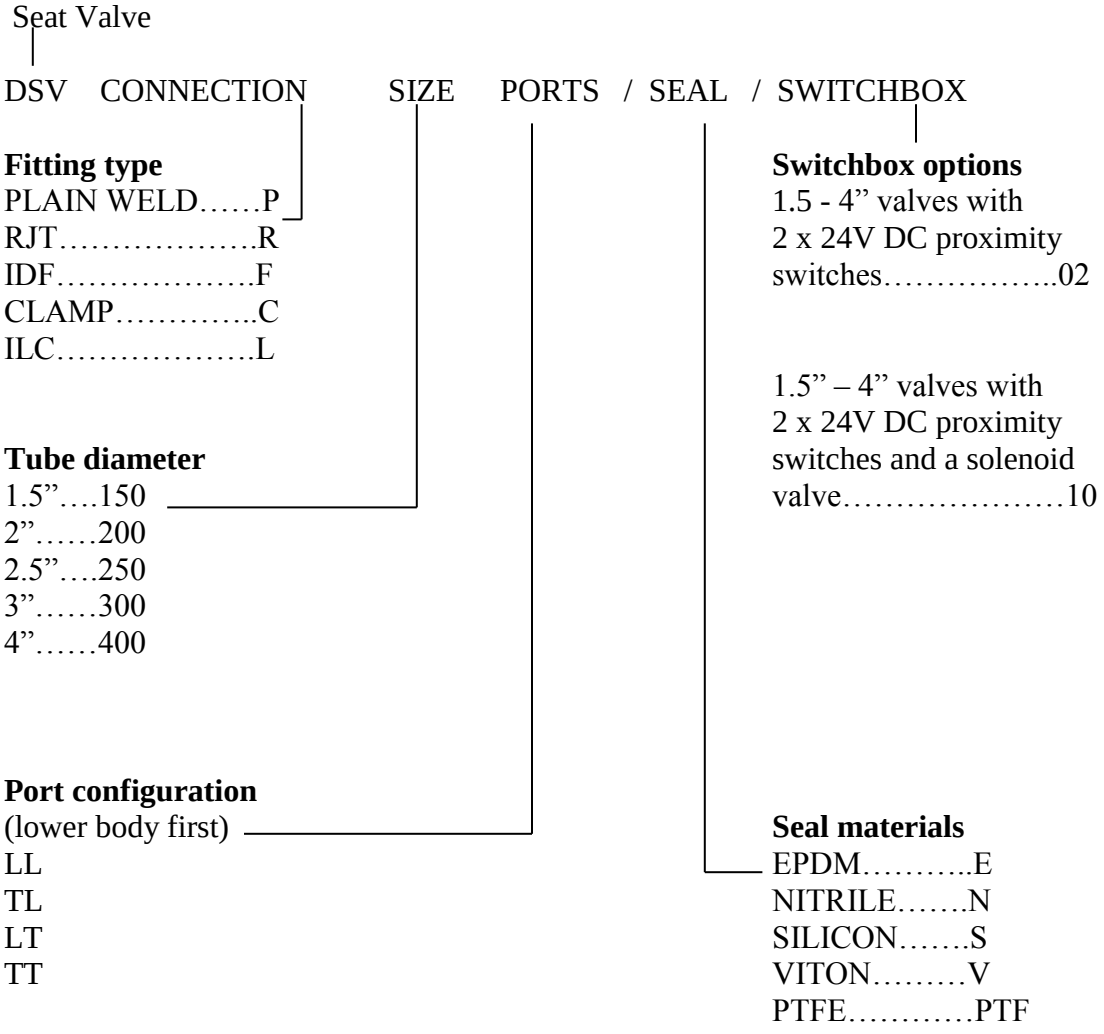
NOTE

2 Wire quadronorm sensors require a minimum load current of 4 mA.

Other switches and wiring diagrams are available on request.

SECTION 9
ASSEMBLY CODES

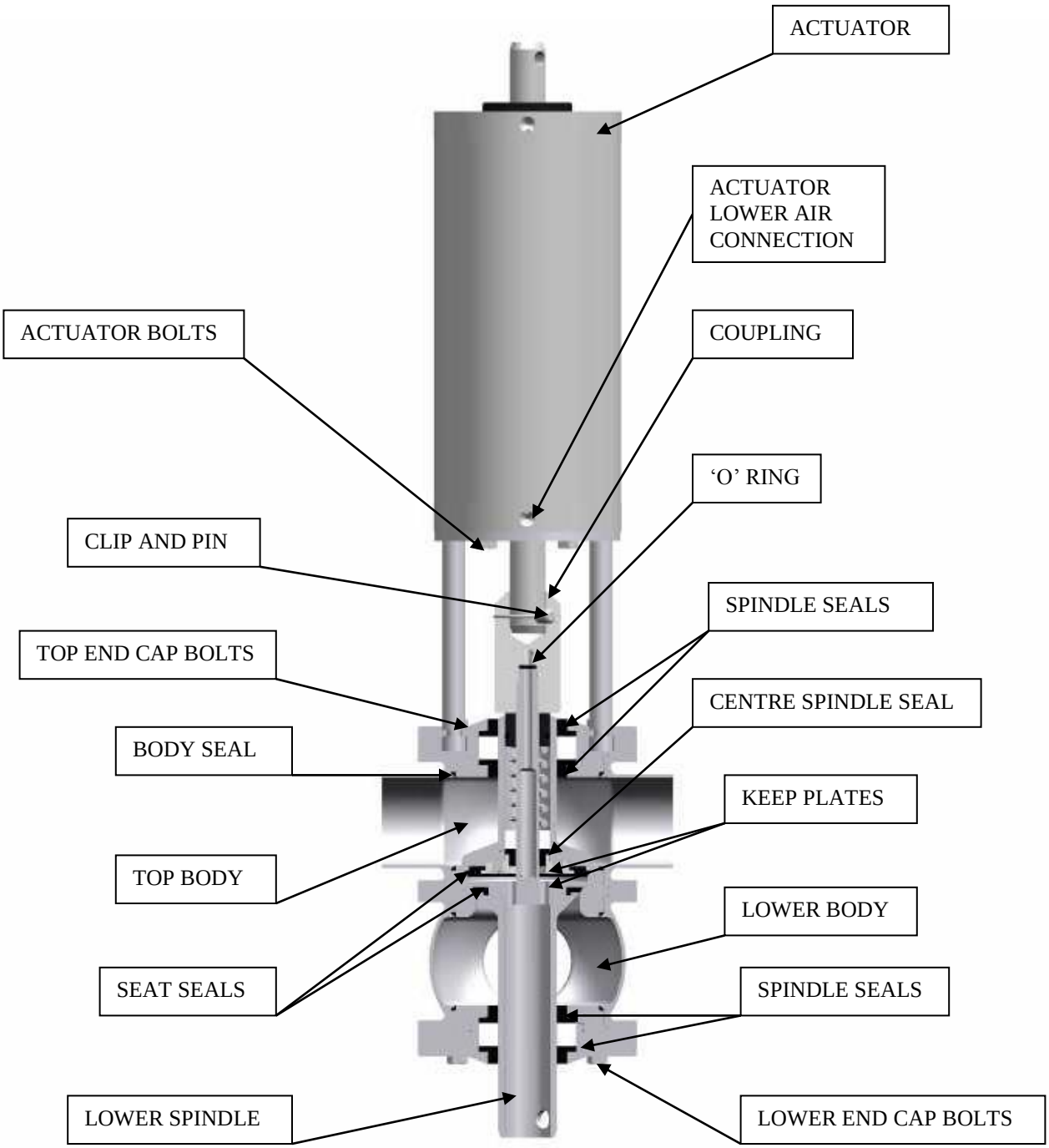
Part numbering of single seat valves.



EXAMPLE
Double seat valve, plain ends, 2", LL ports, EPDM seals fitted with two proximity switches and a solenoid valve in a switchbox…….DSVP200LL/E/02

The RJT, IDF and ILC fittings are male as standard.
Many other options are available not covered by the part numbering system including switchboxes populated to customer's exact requirements.
Valves should be ordered by description not by number and stating the failsafe position, Normally open or Normally closed.

SECTION 10
MAINTENANCE INSTRUCTIONS



TO DISASSEMBLE A DOUBLE SEAT VALVE

1. NORMALLY CLOSED VALVES ONLY (spring pushing down)

Before commencing work the valve should be isolated from all electrical input to the valve switchbox (where fitted). The pneumatic airline pressure should be reduced to zero and disconnected to prevent any automatic operation of the valve. The pipework line pressure should be reduced to zero and all remaining product within the system should be emptied to drain where possible.

If the valve is fitted with a switchbox, this must be removed from the valve. Note the position of any airlines that are fitted to the switchbox and actuator so that the correct orientation is achieved when re-fitting. Unscrew and remove the clear plastic switchbox cap. Using a 3 mm Allen key, undo and remove the central black plastic shaft that passes through the middle of the switchbox by unscrewing the socket head screw in the centre shaft. Lift off the shaft together with the steel collars attached. Using a 5 mm Allen key, undo and remove the two cap head bolts that secure the switchbox base to the actuator. Lift the switchbox assembly up and off the actuator.

The following procedure to remove the actuator from the valve involves actuating the valve (using compressed air) to the open position. Great care must be taken when introducing air pressure to the actuator. As the valve is actuated the central valve/ actuator shaft will move. Hands/fingers and loose clothing should be kept away from the moving parts of the valve wherever possible, as the valve is actuated.

Switch off CIP supply to the coupling to prevent accidental seat clean during maintenance.

Start by locating a suitable airline feed with a 5.5 bar supply pressure. Ensure that the airline pressure is zero, then connect to the lower air connection of the valve actuator. The 5.5 bar supply pressure should be now be switched on and maintained during the following procedure.
Using an appropriate size spanner, undo and remove the 4 top valve body end cap bolts. Turn off then remove the air supply to the actuator.
Lift off the actuator taking with it the spindle, guide and seat assembly.

Check that the body seals came out with the assembly removed.

Unscrew the lower spindle using an appropriate size pin through the cross-hole at the bottom of the spindle and the top of the actuator. Using an appropriate size Allen key remove the four screws from the keep plate on the upper and lower spindles. Now all of the replaceable seals will be accessible, these can now be replaced.

Continued…

Using an appropriate size spanner, undo and remove the 4 lower valve body end cap bolts. Lift away the lower end cap, guide and seal assembly.

Check that the body seal came out with the assembly removed.

The spindle seals and bearing can now be replaced.

Clean and reassemble in the reverse procedure. Place the 'O' ring body seal on the spindle guide discs for ease of assembly and correct location. **Tip**: process compatible grease can help hold the seals in position.

Before replacing the actuator, spindle, guide and seat assembly into the valve body, ensure that hands/fingers and other body parts are clear of the valve then reconnect the airline supply and activate the actuator to lift the spindle. Replace the actuator, spindle, guide and seat assembly into the valve body and tighten the 4 top valve body end cap bolts. Switch off the 5.5 bar air supply, the valve spindle will move returning the valve seat position to closed.

1. NORMALLY OPEN VALVES ONLY (spring pulling up)

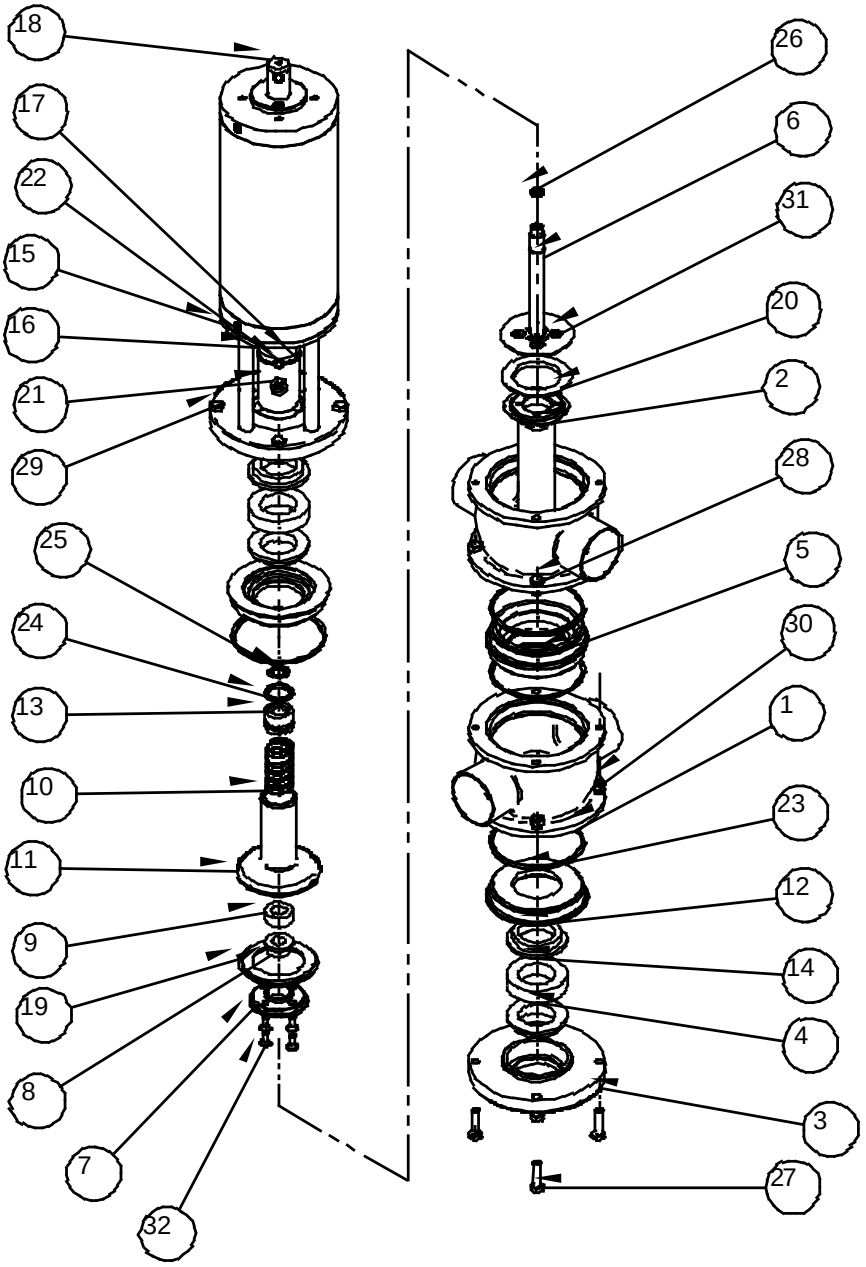
Use the same procedure as per previous page (section 1) but no air connection is required, the valve does not need to be air actuated.

SEAT VALVE SPARES KIT

VALVE SIZE	KIT NUMBER
1.5"	KDSV 15
2"	KDSV 20
2.5"	KDSV 25
3"	KDSV 30
4"	KDSV 40

Spares Kit number is etched on valves manufactured after April 2000
The seal material should be stated when ordering.

DOUBLE SEAT VALVE PARTS LIST



ITEM No	1.5”	2”	2.5”	3”	4”	QTY
1	STV15102	STV20102	STV25102	STV30102	STV40102	2
2	DSV20101	DSV20101	DSV30101	DSV30101	DSV40101	1
3	DSV20102	DSV20102	DSV30102	DSV30102	DSV40102	1
4	DSV20103	DSV20103	DSV30103	DSV30103	DSV40103	2
5	DSV20104	DSV20104	DSV30104	DSV30104	DSV40104	1
6	DSV20105	DSV20105	DSV30105	DSV30105	DSV40105	1
7	DSV20106	DSV20106	DSV30106	DSV30106	DSV40106	1
8	DSV20126	DSV20126	STV40119	STV40119	STV40119	1
9	DSV20127	DSV20127	STV30110	STV30110	DSV40107	1
10	SPRDP88	SPRDP88	SPRDP89	SPRDP89	SPRDP90	1
11	DSV20108	DSV20108	DSV30108	DSV30108	DSV40108	1
12	DSV20109	DSV20109	DSV30109	DSV30109	DSV40109	2
13	DSV20110	DSV20110	DSV30110	DSV30110	DSV40110	1
14	DSV20111	DSV20111	DSV30111	DSV30111	DSV40111	4
15	DSV15112	DSV20112	DSV25112	DSV30112	DSV40112	1
16	DSV40113	DSV40113	DSV40113	DSV40113	DSV40113	1
17	STV40116	STV40116	STV40116	STV40116	STV40116	1
18	STVA201	STVA201	STVA301	STVA301	STVA301	1
19	DSV20114	DSV20114	DSV30114	DSV30114	DSV40114	1
20	DSV20115	DSV20115	DSV30115	DSV30115	DSV40115	1
21	DSV40116	DSV40116	DSV40116	DSV40116	DSV40116	1
22	STV40115	STV40115	STV40115	STV40115	STV40115	1
23	WBS151	WBS151	WBS155	WBS155	WBS161	4
24	WBS117	WBS117	WBS122	WBS122	WBS230	1
25	WBS112	WBS112	WBS116	WBS116	WBS116	1
26	WBS106	WBS106	WBS106	WBS106	WBS106	1
27	WCHHSSM625 1.5” & 2”, WCHHSSM830 2.5” & 3”, WCHHSSM1035 4”					4
28	WCHHSSM612 1.5” & 2” 8 OFF, WCHHSSM816 2.5” & 3” 4 OFF, WCHHSSM1020 4” 4 OFF WCHHSSM816 4” ACTUATOR 4 OFF					
29	WCHHSSM620 1.5” & 2”, WCHHSSM825 2.5” & 3”, WCHHSSM1025 4”					4
30	WNHM6	WNHM6	WNHM8	WNHM8	WNHM10	4
31	WM510CS	WM510CS	WM615CS	WM615CS	WM615CS	4
32	WM512CS	WM512CS	WM615CS	WM615CS	WM620CS	4

The seal part numbers are shown without a material suffix. The material should be stated when ordering a spares kit.

PART DESCRIPTION

ITEM NUMBER	DESCRIPTION	ITEM NUMBER	DESCRIPTION
1	CENTRE BODY	18	ACTUATOR
2	LOWER SPINDLE	19	UPPER SEAT SEAL
3	LOWER END CAP	20	LOWER SEAT SEAL
4	SPINDLE BUSH	21	CIP CONNECTION
5	CENTRE SEAT	22	COUPLING PIN
6	CENTRE SPINDLE	23	‘O’ RING
7	UPPER SPINDLE CAP	24	‘O’ RING
8	STV SPINDLE SEAL	25	‘O’ RING
9	CENTRE BUSH	26	‘O’ RING
10	SPRING	27	HEXAGON HEAD BOLT
11	UPPER SPINDLE	28	HEXAGON HEAD BOLT
12	GUIDE	29	HEXAGON HEAD BOLT
13	SPRING RETAINER	30	HEXAGON HEAD BOLT
14	SPINDLE SEAL	31	HEXAGON NUT
15	LANTERN	32	C/SUNK SCREW
16	COUPLING	33	C/SUNK SCREW
17	RETAINING RING		

If you require further information on this or any other product within our range, please contact us and we will be please to assist. Tel. 01799 522885. Web www.dpluk.co.uk