



*It isn't just Industrial Control Valves and Regulators
– It's the Know How!*

Ball Sector Valve – V[^]] ^ KS

Ball Sector Valve Type KS is designed and manufactured in Sweden. The valve was introduced in 1967 and since then many thousands of valves have been installed in:

- Pulp- & Paper industry
- Chemical industry
- Mineral ore processing plants
- Steel mills
- Cement industry
- Pharmaceutical industry
- Water- and Waste water treatment plants
- Power & Heat generation plants

Construction details and manufacturing technique of type KS are based on long and diversified usage in often harsh applications and environments. Type KS has proved to be advantageous for tight shut off and for throttling control of gases, liquids and slurry at moderate pressure and temperature conditions:

- Air and gases such as oxygen, nitrogen, argon, methane, propane, ammonia
- Vapors and condensate
- Oils
- Cellulose & Paper pulp
- Caustic and acid solutions
- Abrasive liquid suspensions like iron ore, coal, lime slurry and fly ash

Construction principle

V[^]] Ball Sector Valve is made from a half ball sector which via two shafts is journal led in the valve body. One part of the ball sector sphere is used for shut-off. The other part of the sphere has a hole with a diameter, which is about 80% of the nominal valve size.

The ball sector is turned through 90° on operation from

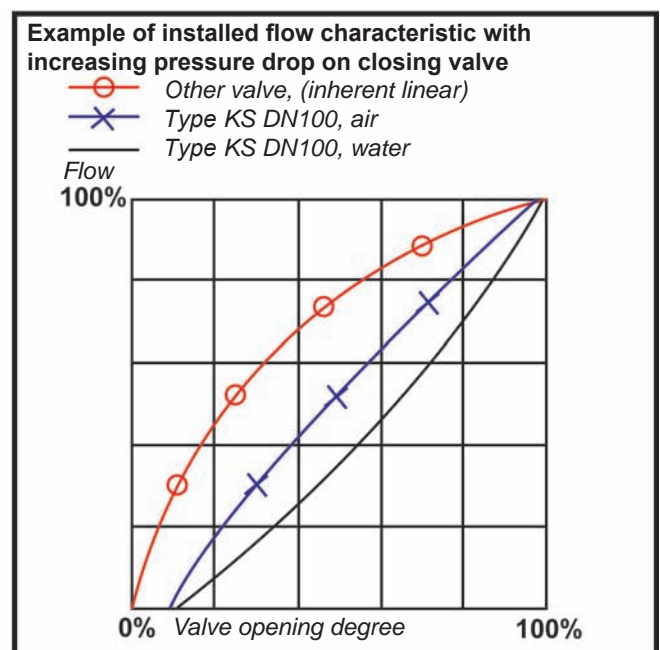
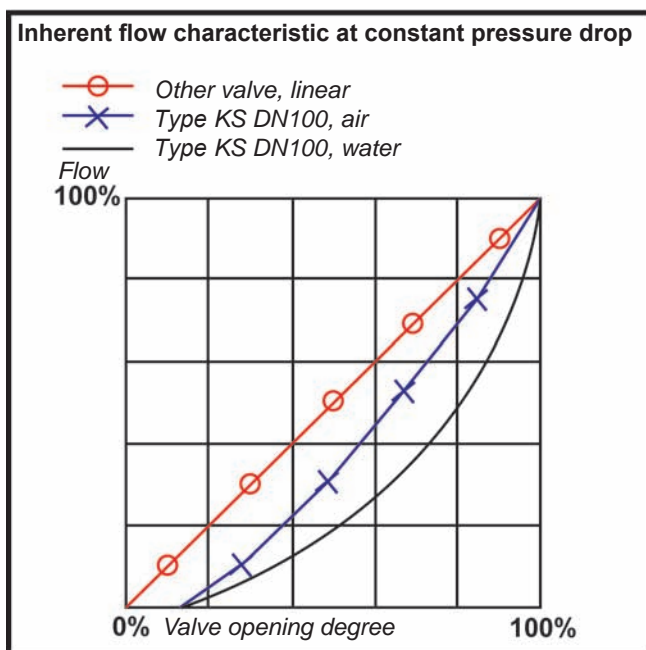
open to fully closed. The shape of the valve opening (flow area) is thereby changing from fully round to narrow elliptic. The near round opening shape reduces the risk of plugging and is less subject to wear in throttling position than the more slot-like flow in certain other types of control valves.

Throttling control characteristic

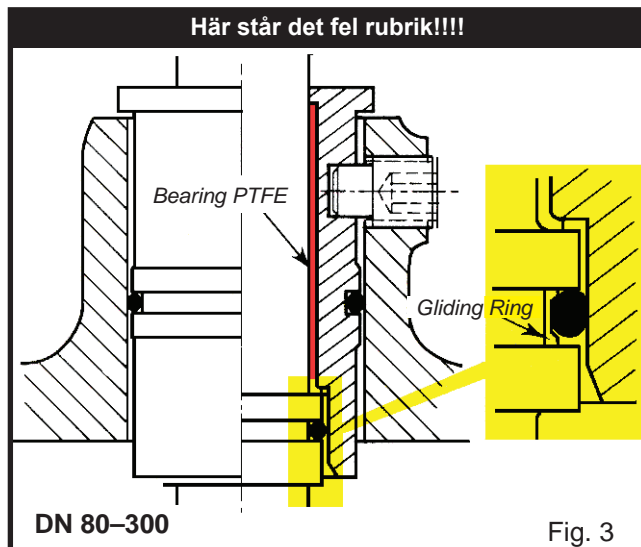
It is necessary to observe the difference between inherent valve flow characteristic at constant pressure drop and installed valve flow characteristic at varying pressure drop. The left hand diagram below (Fig 1) presents the inherent flow characteristic of V[^]] ^ KS for air and water when pressure drop is constant. It is near to equal percentage. Shown also for comparison is the characteristic of a linear valve.

The right hand diagram (Fig 2) presents the installed char-

acteristic for the same valves when installed in a control loop where the valve pressure drops increases when the valve is closing. An equal percentage characteristic becomes more like linear. A linear characteristic becomes more like quick opening. The more the pressure drop is changing for a certain change of flow, the more the installed characteristic is altered. The comparison shows that the installed flow characteristic of V[^]] ^ KS is very suitable for the majority of all control valve installations.



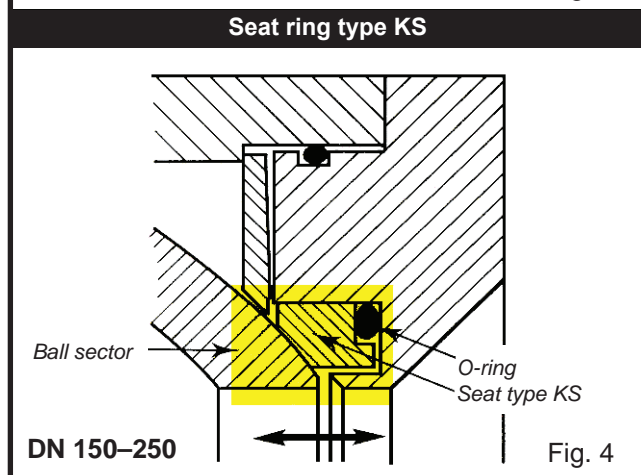
Maintenance free and accurate control valve



Valve shafts are pivoted in maintenance free PTFE-based bearings which make the valve require low operating force without stick-slip effect. The required operating force is little affected by varying pressure drops in the valve. The same size of actuator can always be used for a certain size and type of valve regardless of pressure drop. Operating torques is stated in table 1. Recommended actuator torques is stated in table 5.

Maintenance free shaft seals type KS

HndY KS has O-ring shaft seals of Viton®, EP, Aflas® or Kalrez®. They are maintenance free and assure easy stick-slip free movement. Thanks to a unique gliding ring of PTFE between the shaft and the O-ring there is no wear on the O-ring seal when the shaft is turning, no matter whether the valve is operated often or seldom. The shaft seal is tight also for vacuum. The location of the O-ring seal to the inside of the bearing prevents dirt from penetrating the bearing surfaces.



Seat ring gives bidirectional shut off

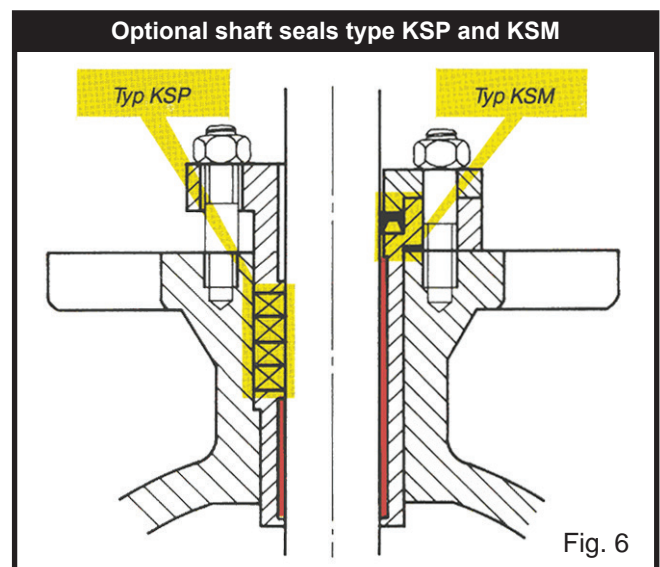
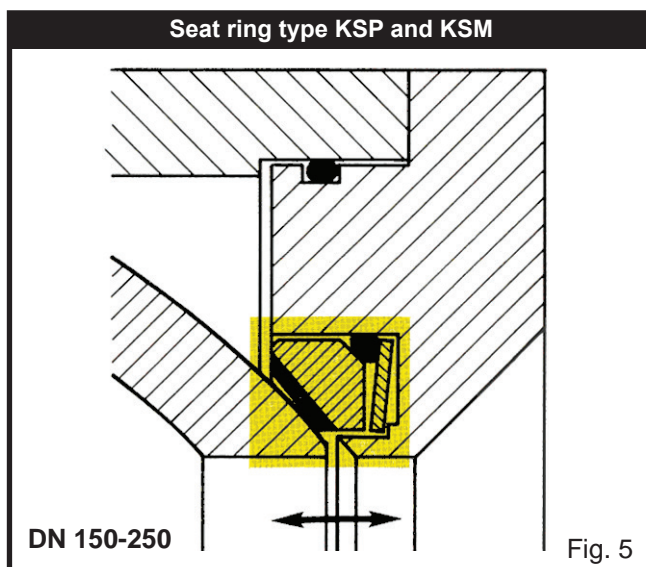
V] ^ KS has a seat ring of carbon/graphite filled PTFE or of stainless steel with sealing surface of Stellite®. An elastic O-ring of Viton®, EP Kalrez®, Aflas® or FEP sheathed Viton®, is sealing off and pressing the seat against the ball sector so that tight shut off is guaranteed for both flow directions. The unilateral seat ring makes the valve self-cleaning and easily operated regardless of pressure conditions. The seat is fully protected in full open position by the ball sector throttling edge.

Viton® and Kalrez® is a registered trademark of DuPont Dow Elastomer.

Hype KSM and KSP. Optional seals for elevated temperatures

In cases where elastic O-ring seals can not be used due to elevated temperatures or corrosive conditions it is possible to have the valve with shaft seals of conventional packing box or lip seal type. The seat ring may then be made of 316SST with PTFE insert or stellite

seat surface. A spring washer of 329SST and seal ring of PTFE are pressing the seat against the ball sector. Valve designation is c] ^ KSM (lip seal) and KSP (packing box).



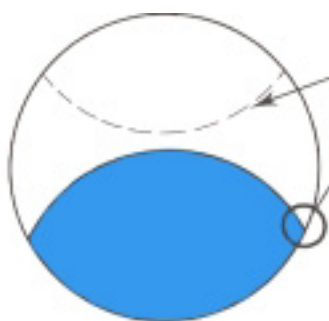
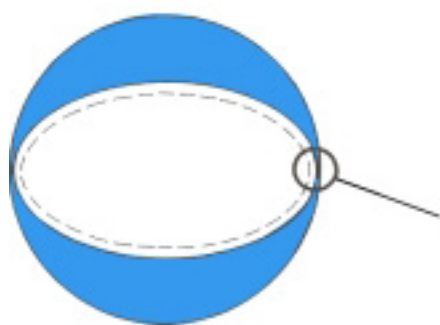
Ball Sector Valve – V[]] ^ KS

V[]] ^ KS and its variations KSM and KSP offer accurate and economical throttling of many abrasive media. The shape of the throttling area is changing from fully round to narrow elliptic. This shape is more favorable than the openings in certain other valve types. The round shape reduces the risk of plugging and reduces the wear in the throttling area where velocity is highest.

V[]] ^ KS is normally installed with the throttling ball sector edge on the inlet side of the valve. When controlling abrasive media it is however more appropriate to mount the valve body in the opposite direction. With the throttling orifice placed on the outlet side of the valve, the velocity and thereby abrasion in the valve body is reduced to a minimum or most often to zero.

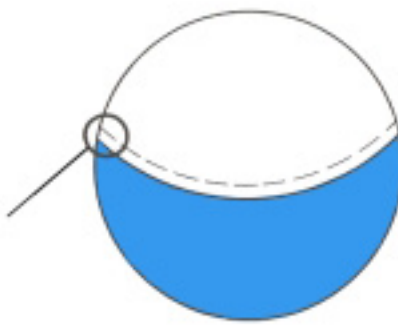
Fig. 7 – mdyKS, throttling position

Butterfly valve, throttling position



Seat sealing surface, when ball sector turned to closed position, is protected against wear
Eventual wear starts here far away from ball sector sealing surface

Ball segment valve, throttling position



Wear starts here in this narrow area where shut-off sealing surfaces are located.

Material executions for abrasive media

V[]] ^ KS is for throttling control of abrasive media supplied with seat ring of hard faced stainless steel.

The ball sector and eventually the conical shaped outlet are in such cases hard chromed. For more severe abrasive media c[]] ^ KS is supplied with a modified deep seat ring of stellited 316SST, see table 6, and code 1E.

For the control of abrasive slurry and liquids at moderate pressure drops within the mineral ore processing plants, a rubber lined Ball Sector Valve, c[]] ^ KSG, has often proved to be superior to all other valve types. The rubber-lined valve is manufactured in sizes DN80–200 for max working pressure 5 bars and is described in a separate data sheet.

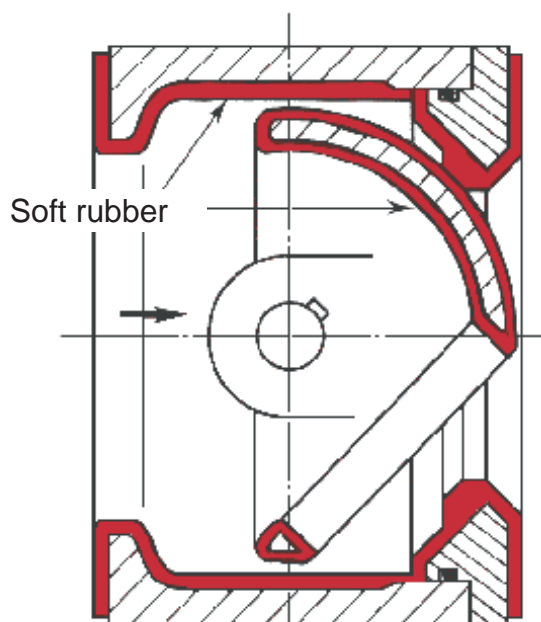


Fig. 8 – type KSG

Specifications

Table 1 – Valve sizes, Cv/Kvs-values, operating torques

Valve size DN			Bore (mm)	Cv/Kvs	Nominal actuating torque in Nm (1)	
Type KS	Type KSP	Type KSM			Type KS	Type KSP/KSM
25/0,03(K)	-----	-----	Not (2)	0,03/0,025	5	-----
25/0,3(F)	-----	-----	Not (2)	0,3/0,25	5	-----
25/0,7(D)	-----	-----	Not (2)	0,7/0,6	5	-----
25/1,3(C)	-----	-----	Not (2)	1,3/1,1	5	-----
25/2,5(A)	-----	-----	Not (2)	2,5/2,1	5	-----
25/5	-----	-----	Not (3)	5,8/5	5	-----
25/10	-----	-----	Not (3)	9/7,5	5	-----
25/15	-----	-----	15	15/12,5	5	-----
25/20	-----	-----	19	25/21	5	-----
40/25	50/25	-----	25	40/34	10	20
40/32	50/32	-----	32	75/64	10	20
50	50/40	-----	40	110/94	10	20
80	80	-----	64	300/255	20	40
100	100	-----	80	460/390	30	60
150	150	150	120	950/810	50	100
200	200	200	155	1600/1365	70	150
250	250	250	195	2600/2220	120	250
300	-----	300	250	4500/3840	300	300

(1) Torque figures are approximate and apply for valves with seat ring of PTFE controlling clean water in half open position at 100 kPa (1 bar) pressure drop.

(2) Ball sector with triangle shaped groove on the sphere, 0-72°, percentage characteristic.

(3) Ball sector with triangle shaped bore, modified percentage characteristic.

Table 2 – Pressure recovery factor $F_L(C_i)$

Factor $F_L(C_i)$	Opening in percent of travel						
	5%	10%	20%	40%	60%	80%	100%
	0,9	0,88	0,85	0,77	0,67	0,62	0,60

Valve leakage rates

V[∗]] ^ KS generally gives tight shut off on liquids and gases and are tested before delivery as per following standards:

Seat of PTFE:

Tested with air at 600 kPa and 20°C acc to DIN 3230-BO. Leak rate 2 or on request rate 1.

Seat of 316SST+PTFE:

Tested with water at 20°C - better than 0,005 l/h per inch valve size .

Seat of 316SST with stellited sealing surface:

Tested with water at 20°C - better than 0,005% or max 0,01% of max Kv/Cv-value. May be reduced to a fraction on special order.

Table 3 – Max differential pressure vs temperature

Valve-size	max recommended differential pressure				
	Seat of PTFE			Seat of 316SST+Stellite	
DN	0-80°C kPa	120°C kPa	150°C kPa	0-80°C kPa	170°(200°)C kPa
25-50	2500	600	100	2500	2500
80-100	1600	600	100	1600	1600
150-250	1600	600	100	1600	1200
300	1000	600	100	1000	800

Above values are guidelines only for normal throttling control and shut off with clean media. For applications involving rapidly cycling pressure and temperature conditions there is sometimes necessary to apply an extra safety factor.

Range ability

Better than 100:1

Note that higher rangeability is normally beyond the precision limits of normal actuators.

Actuators

Valves of all sizes are supplied with a drive shaft with keyway and with a rugged flange for easy and stable mounting of an actuator. Y[^] manufacture highly dependable pneumatic actuators which are especially built for the purpose of accurate throttling control. Actuators of other type and manufacture are easily mounted.

Separate dimensional drawings with weight information are available for valves with:

Hand lever, lockable

Pneumatic double acting and single acting actuators for on-off control or with positional for throttling control

Electric actuators with synchronous motor for on-off or throttling control or stepping motors for extremely accurate throttling control.

Mounting and flange standards

DN 25 – 50	flangeless design for connection between pipe flanges acc. to SMS/DIN, PN 10/40, ANSI 300/600 lb (1"-2")
DN 80 – 100	Ditto acc. to SMS/DIN, PN10/25, ANSI 300 lb (3"-4")
DN 150 – 250	Ditto acc. to SMS/DIN, PN10/16, ANSI 150 lb (6"-8")
DN 300	Flanged body for connection to flanges acc. to SMS/DIN, PN16

Effective turning angel

All valve sizes may be turned 90° on operation but due to extra reduced ball sector bore in some of the smaller sizes, the effective angle for throttling control from fully open to closed is somewhat reduced.

See table 4.

Table 4

Valve DN	Shut	Flow control
25/A-K	0°-18°	18°-90°
25/5	0°-30°	30°-90°
25/10	0°	0°-90°
25/15	0°-25°	25°-90°
25/20	0°	0°-90°
40/25, 50/25	0°-30°	30°-90°
40/32, 50/32	0°-20°	20°-90°
50-300	0°	0°-90°

Table 5 – Recommended torque for choice of actuators
Torque (Nm)

Valve type KS	Recommended torque(1)	Max torque
DN25	20-50	100
40-50	30-90	100
80-100	80-200	200
150-200	160-400	400
250	250-600	700
300	700-1200	2000

(1) The lower part of the torque range can be used for on-off applications for clean media at normal temperatures.
The higher part of the torque range shall be used for pneumatic actuators with positioner when high control accuracy is needed or for dirty/sticky media.



Fig. 9 – Valve type KS, DN25-200 and KSG (with handlever) DN125

Table 6 – Material combinations for valve type KS/KSP

The valve body has a material code stamped in per following table.

Material code: 1=316/329SST(DN25-300), 5=Titanium(DN25-100)

Material code	1	1A	1B	1C	1E	5
Body (item 1)	316SST	316SST	316SST	316SST	316SST	Titanium
Shafts (item 5+6)	329SST	329SST	329SST	329SST	329SST	Titanium
Ball sector (item 3)	316SST	316SST+ Hard chrome	316SST+ Hard chrome	316SST+ Hard chrome	316SST+ Hard chrome	Titanium
Seat holding ring (item 2)	316SST	316SST	316SST	316SST+ Hard chrome	316SST+ Hard chrome	Titanium
Seat ring (pos 10)	Carbon/graphite filled PTFE	Carbon/graphite filled PTFE	316SST+ Stellite	316SST+ Stellite	316SST+ Stellite, deep execution	Carbon/graphite filled PTFE
Shaft bearing (item 9)	Standard = modified TFE (LR) Special = SST/PTFE (MP)					
Shaft sealing type KS O-ring (item 13+14)	Viton®	Viton®	Viton®	Viton®	Viton®	Viton®
Shaft sealing type KSP packing box (item 13)	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE
Seat back-up O-ring type KS (item 15)	Viton®	Viton®	Viton®	Viton®	Viton®	Viton®
Seat back-up spring & seal ring type KSP (item 15A+15B)	329SST/PTFE	329SST/PTFE	329SST/PTFE	329SST/PTFE	329SST/PTFE	----
Sealing between inlet cover ring and body (Item 16)	Viton®	Viton®	Viton®	Viton®	Viton®	Viton®
Valves supplied with other o-ring material than Viton has material code suffix:	(P) = EPDM Peroxid, (E) = EPDM (KKT/KTT) = Kalrez®/Viton® (L) = Viton®GLT (N) = Nitril (C) = Nitril Polar (X) = Other quality					

Table 7 – Pressure and temperature limits

Temperature related max working pressure in bar for material 316SST

PN	-40°C	+20°C	+50°C	+75°C	+100°C	+150°C	+200°C	+250°C
PN10	10	10	9	8,5	8	7,5	7	7
PN16	16	16	14,5	13,5	13	12	11,5	11
PN25	25	25	23	21,5	20,5	19	18	17,5
PN40	40	40	37	35	33	31	29	28

CE- marking – Ć] ^ KS valves can be supplied with CE-label according to PED 97/23/EC, Category 1.

Test pressure – Ć] ^ KS valves are as standard tested and marked for PN16. Other pressures on request.

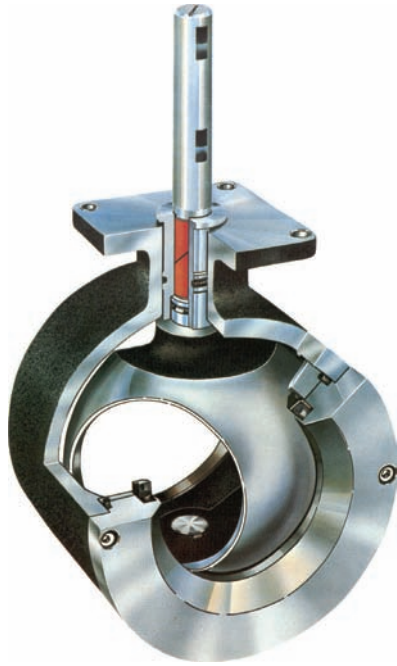
Table 8 – Temperature limits for seat- and sealing material

	O-ring (type KS)					Seat ring (type KS / KSP)		Packing box (type KSP)
Material	Viton®	Viton® GLT	EPDM	Nitril Nitril Polar	Kalrez®	carbon/graphithe filled PTFE	Stellited SST	PTFE-braid
Min temperature	-10°C	-40°C	-20°C	-40°C	-10°C	-40°C	-40°C	-40°C
Max temperature	+170°C	+170°C	+120°C (+140°C) ⁽²⁾	+120°C	+200°C (+250°C) ⁽²⁾	+170°C	+200°C (+250°C) ⁽¹⁾	+250°C

1) with shaft bearing material MP (option)

2) EPDM Peroxid

Information and specification here in are subject to change without notice. Should any question arise, contact W. Käp.



Ball Sector Valve

– V[^]] ^ KS

- DN25-300, PN16 (40)
- Kvs 0,025 to 3840
- Self-draining
- Excellent throttling characteristic
- Good resistance to abrasive flow
- Easy maintenance with quick exchange of seat ring
- Easy to install and automate
- Mounting kits for ISO-actuators
- Economic

Valuable data to be supplied with inquiries and orders

1. Inlet and outlet pressure
2. Pressure drop at closed valve and at minimum and maximum flow
3. Media with density, viscosity, concentration and presence of abrasive particles
4. Temperature at valves inlet
5. Normal, minimum and maximum flow
6. Pipe dimensions
7. Preference to valve material in media wetted parts
8. Type of actuator, signal action and range, fail safe feature, air supply pressure or line voltage, running time open or closed
9. Extra equipments such as spring return solenoid valve, limit switches, potentiometers, air filter regulator etc