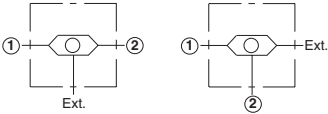
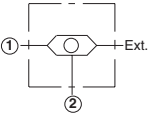
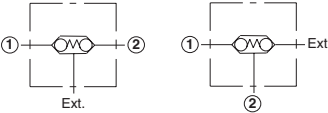
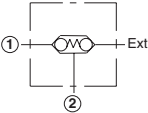
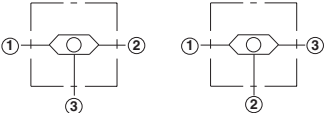
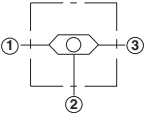
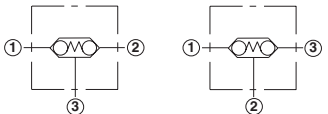
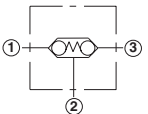
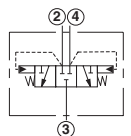
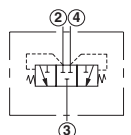
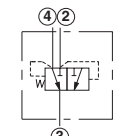
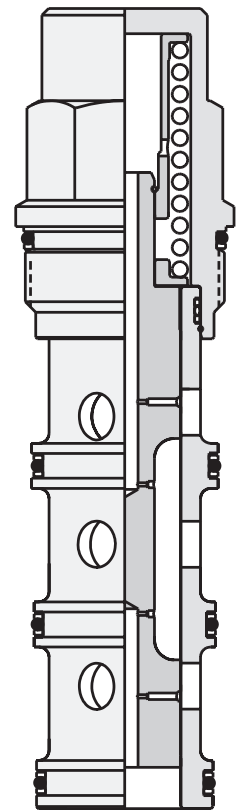
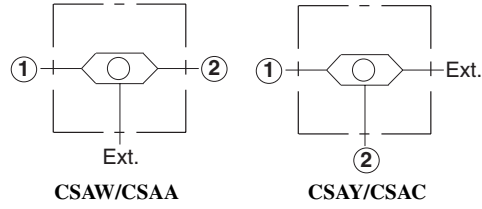
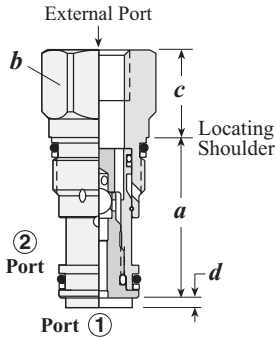


Shuttle Valves

		<i>Cartridge Type</i>	<i>Page</i>
		Single Ball Shuttle, Signal External or Signal at Port 2	156
		Back-to-back Check/Shuttle, Signal External or Signal at Port 2	157
		Single Ball Shuttle Valve with Signal at Port 3 or Port 2	158
		Back-to-back Check/Shuttle, Signal at Port 2 or Port 3	159
		Low Side, 3-position, Hot Oil Shuttle	160
		High Side, 3-position, Shuttle	161
		Spring Offset, 2-position, High Side Shuttle	162



SINGLE BALL SHUTTLE, SIGNAL EXTERNAL OR SIGNAL AT PORT 2



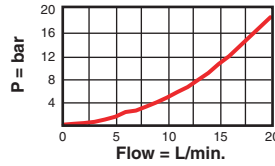
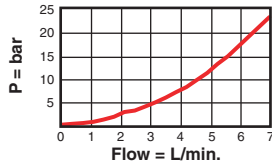
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions				Installation Torque (Nm)
			a	b	c	d	
5 L/min.	CSAW – BXN	T - 162A	31,0	19,1	20,8	1,2	35 - 40
5 L/min.	CSAY – BXN	T - 162A	31,0	19,1	20,8	1,2	35 - 40
10 L/min.	CSAA – BXN	T - 13A	35,1	22,2	19,1	—	45 - 50
10 L/min.	CSAC – BXN	T - 13A	35,1	22,2	19,1	—	45 - 50

Performance Curves

CSAW/CSAY

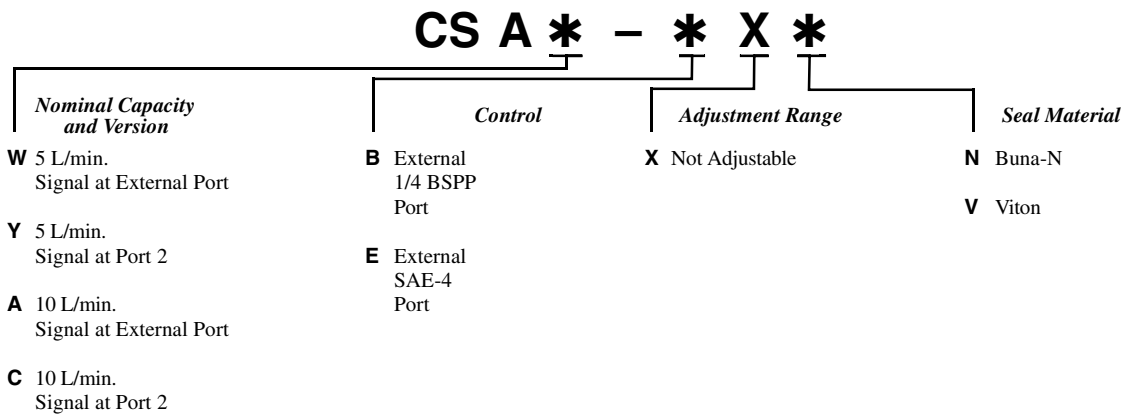
CSAA/CSAC

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Shuttle cartridges feature hardened steel balls and seats for excellent wear characteristics and contamination tolerance.
- The single ball allows for the decay of the pressure signal when both load ports drop to a lower pressure.

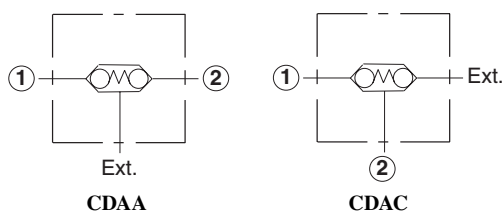
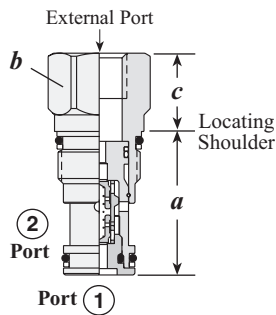
OPTION ORDERING INFORMATION



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BACK-TO-BACK CHECK/SHUTTLE, SIGNAL EXTERNAL OR SIGNAL AT PORT 2

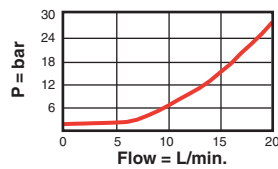


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
10 L/min.	CDAA – BBN	T - 13A	35,1	22,2	19,1	45 - 50
10 L/min.	CDAC – BBN	T - 13A	35,1	22,2	19,1	45 - 50

Performance Curves

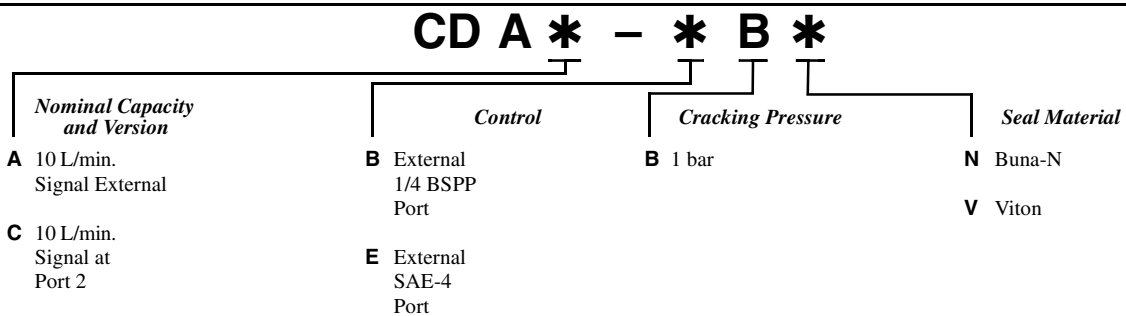
CDAA/CDAC

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Back-to-back check cartridges feature hardened, spherically lapped, guided poppets and a lightly stressed helical spring that result in excellent wear characteristics and extremely low leakage rates.
- The back-to-back checks do not provide a means of lowering a signal. They will trap a high signal if the load pressures drop to a lower pressure. Some means of bleeding off the signal should be provided.

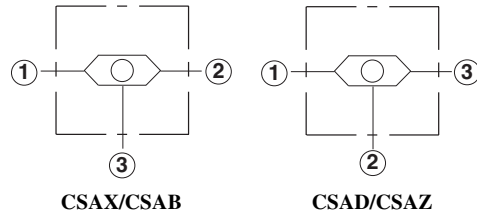
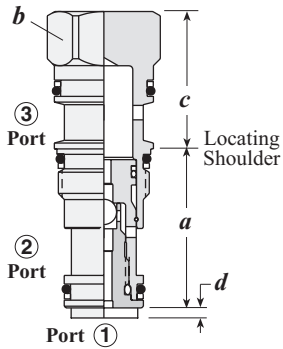
OPTION ORDERING INFORMATION



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SINGLE BALL SHUTTLE VALVE WITH SIGNAL AT PORT 3 OR PORT 2



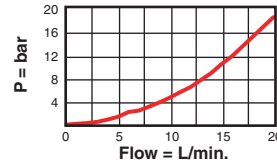
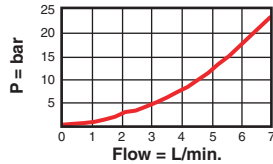
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions				Installation Torque (Nm)
			a	b	c	d	
5 L/min.	CSAX – XXN	T - 163A	31,0	19,1	31,8	1,2	35 - 40
5 L/min.	CSAZ – XXN	T - 163A	31,0	19,1	31,8	1,2	35 - 40
10 L/min.	CSAB – XXN	T - 11A	35,1	22,2	30,2	—	45 - 50
10 L/min.	CSAD – XXN	T - 11A	35,1	22,2	30,2	—	45 - 50

Performance Curves

CSAX/CSAZ

CSAB/CSAD

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Shuttle cartridges feature hardened steel balls and seats for excellent wear characteristics and contamination tolerance.
- The single ball allows for the decay of the pressure signal when both load ports drop to a lower pressure.

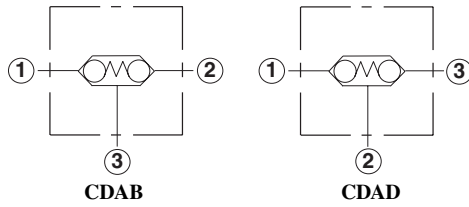
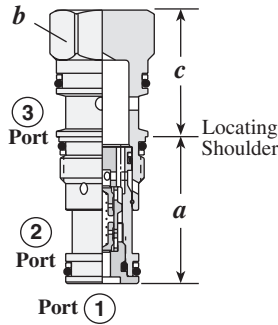
OPTION ORDERING INFORMATION

CS A * - X X *			
Nominal Capacity and Version	Control	Adjustment Range	Seal Material
X 5 L/min. Signal at Port 3	X Not Adjustable	X Not Adjustable	N Buna-N
Z 5 L/min. Signal at Port 2	A Auxiliary External SAE-4 Port		V Viton
B 10 L/min. Signal at Port 3	B Auxiliary External 1/4 BSPP Port		
D 10 L/min. Signal at Port 2	E External SAE-4 Port, Port 3 Blocked		

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BACK-TO-BACK CHECK/SHUTTLE, SIGNAL AT PORT 2 OR PORT 3

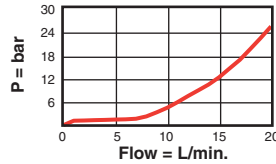


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			<i>a</i>	<i>b</i>	<i>c</i>	
10 L/min.	CDAB – XBN	T - 11A	35,1	22,2	30,2	45 - 50
10 L/min.	CDAD – XBN	T - 11A	35,1	22,2	30,2	45 - 50

Performance Curves

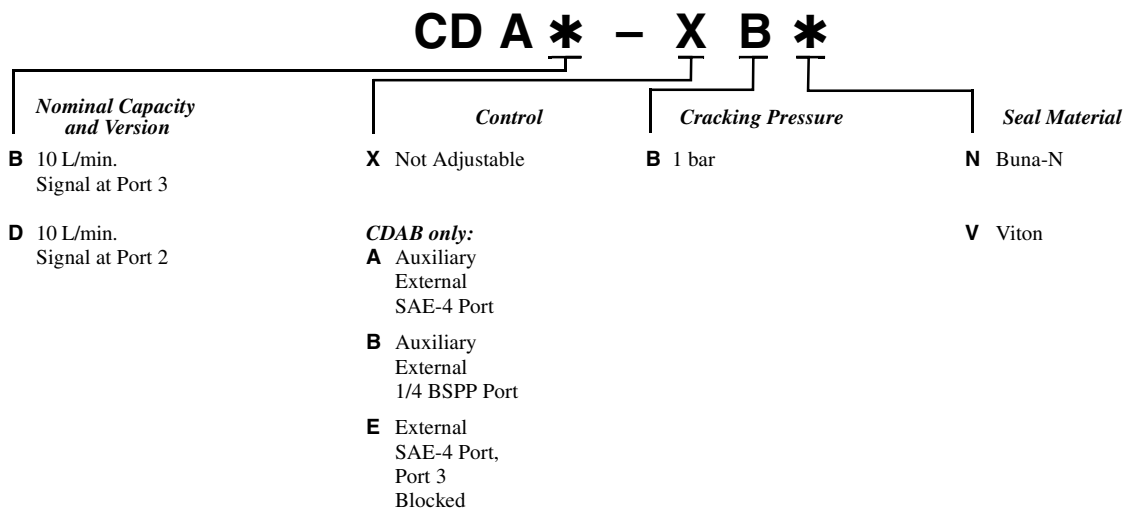
CDAB/CDAD

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Back-to-back check cartridges feature hardened, spherically lapped, guided poppets and a lightly stressed helical spring that result in excellent wear characteristics and extremely low leakage rates.
- The back-to-back checks do not provide a means of lowering a signal. They will trap a high signal if the load pressures drop to a lower pressure. Some means of bleeding off the signal should be provided.

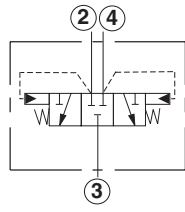
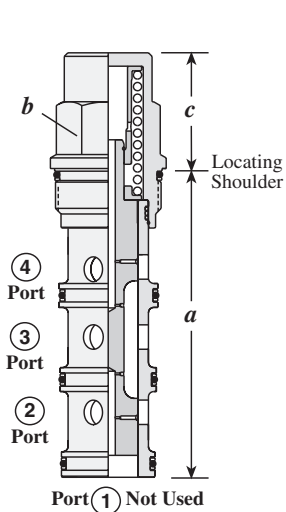
OPTION ORDERING INFORMATION



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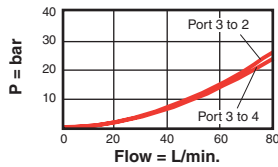
LOW SIDE, 3-POSITION, HOT OIL SHUTTLE



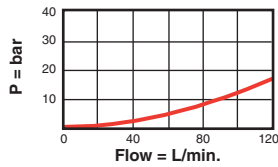
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
40 L/min.	DSCH – XHN	T - 31A	84,8	22,2	30,0	45 - 50
80 L/min.	DSEH – XHN	T - 32A	92,2	28,6	34,0	60 - 70
160 L/min.	DSGH – XHN	T - 33A	114,4	31,8	42,0	200 - 215
320 L/min.	DSIH – XHN	T - 34A	139,7	41,3	51,0	465 - 500

Performance Curves

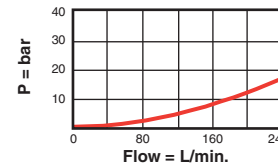
DSCH



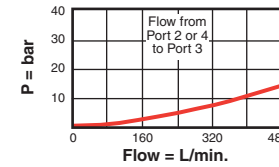
DSEH



DSGH



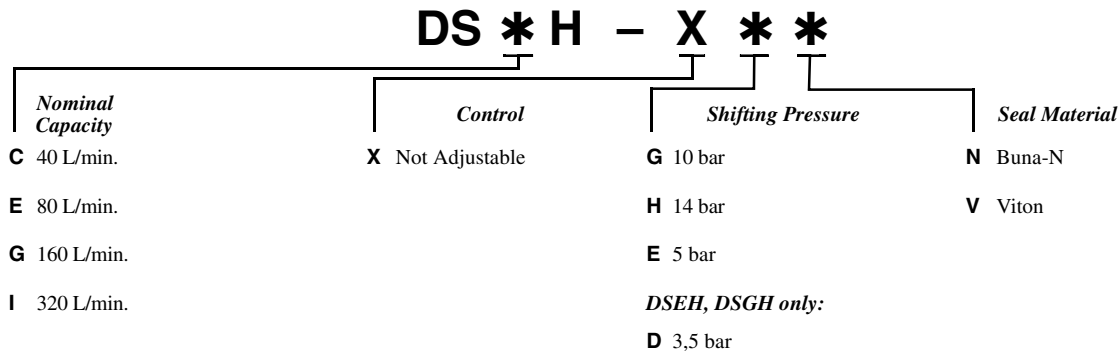
DSIH



Performance Details with Valve Shifted

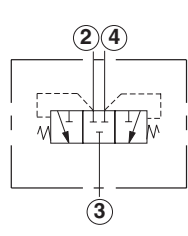
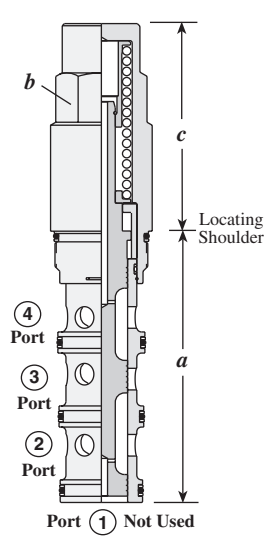
- Maximum operating pressure = 350 bar.
- Pilot flow = DSCH, DSEH: 0,38 L/min., DSGH, DSIH: 0,75 L/min.
- The spool incorporates a hydraulic stop that eliminates mechanical impact and therefore the potential for internal damage.
- The hydraulic stop results in a small pilot flow from the high side work port (port 2 or 4) to the common port (port 3).
- A unique feature due to the hydraulic stop is that the hot oil relief setting can be confirmed with the transmission in neutral.
- Although this valve goes into a 4 port cavity, the nose (port 1) is not used.
- Low shift values can potentially result in charge pump pressure alone inadvertently shifting the valve. Use care when selecting shift pressure.

OPTION ORDERING INFORMATION



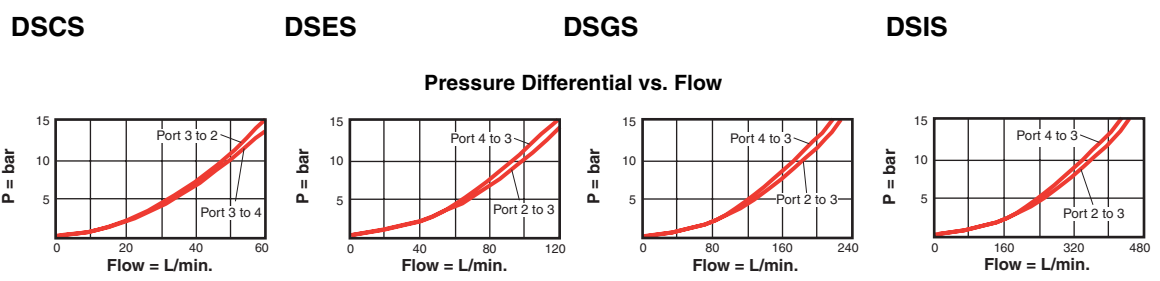
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HIGH SIDE, 3-POSITION, SHUTTLE



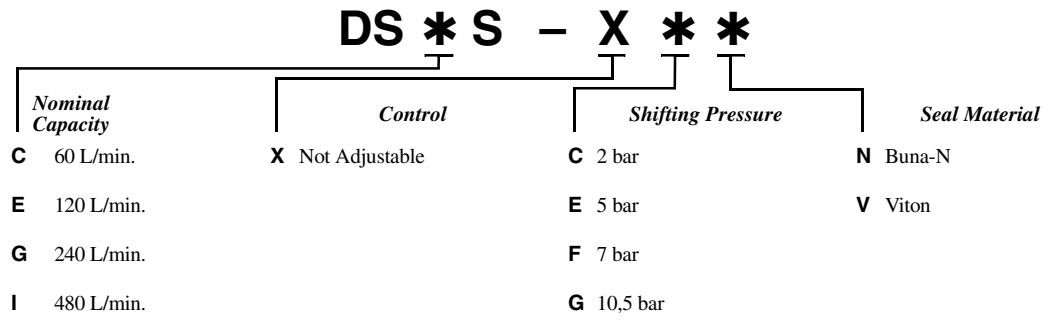
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
60 L/min.	DSCS - XCN	T - 31A	84,8	22,2	36,5	45 - 50
120 L/min.	DSES - XCN	T - 32A	92,2	28,6	41,4	60 - 70
240 L/min.	DSGS - XCN	T - 33A	114,3	31,8	72,0	200 - 215
480 L/min.	DSIS - XCN	T - 34A	139,7	41,3	107,0	465 - 500

Performance Curves



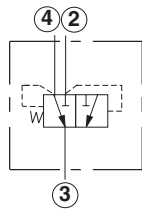
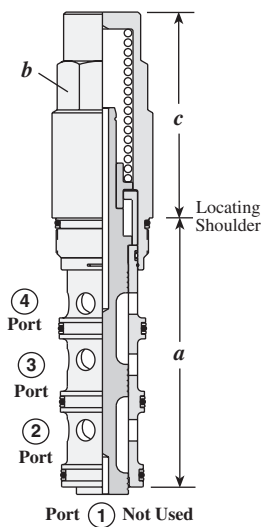
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = DSCS: 30 cc/min. at 70 bar, DSES: 50 cc/min. at 70 bar, DSGS: 65 cc/min. at 70 bar, DSIS: 80 cc/min. at 70 bar.
- Pilot flow = DSCS, DSES: 0,38 L/min., DSGS, DSIS: 0,75 L/min.
- This valve provides overrunning load control in regeneration applications where the load tends to extend the cylinder. Because there is spool leakage, it does not prevent drift.
- Hardened spool/sleeve construction provides excellent wear characteristics and minimizes cross leakage.
- Although this valve goes into a 4 port cavity, the nose (port 1) is not used.

OPTION ORDERING INFORMATION



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SPRING OFFSET, 2-POSITION, HIGH SIDE SHUTTLE



Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
60 L/min.	DSCO – XCN	T - 31A	84,8	22,2	36,5	45 - 50
120 L/min.	DSEO – XCN	T - 32A	92,2	28,6	41,4	60 - 70
240 L/min.	DSGO – XCN	T - 33A	114,3	31,8	72,0	200 - 215
480 L/min.	DSIO – XCN	T - 34A	139,7	41,3	107,0	465 - 500

Performance Curves

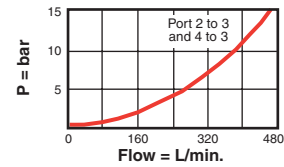
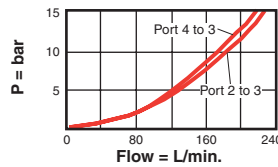
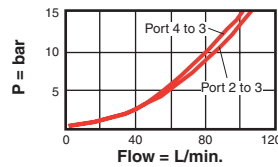
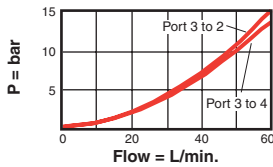
DSCO

DSEO

DSGO

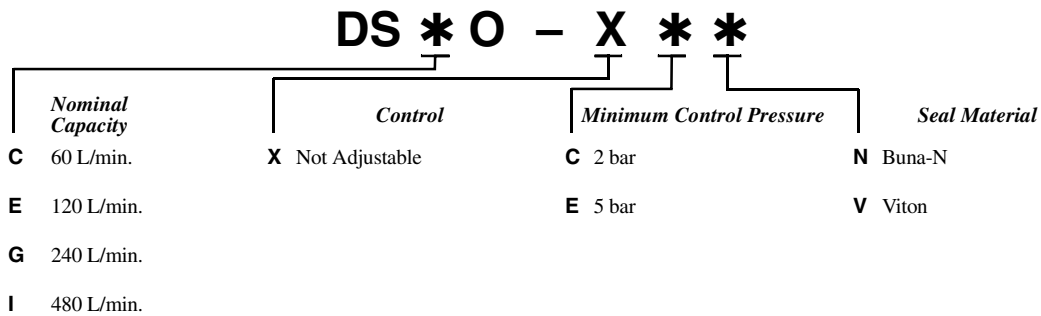
DSIO

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Although this valve goes into a 4 port cavity, the nose (port 1) is not used.

OPTION ORDERING INFORMATION



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