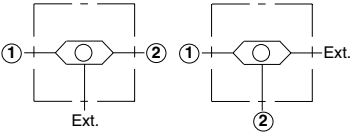
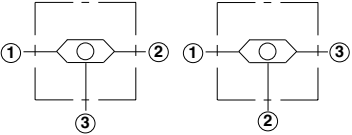
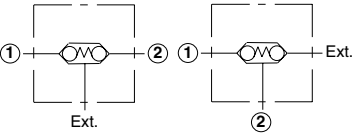
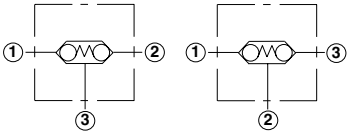
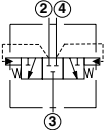
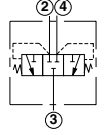
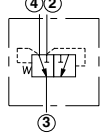
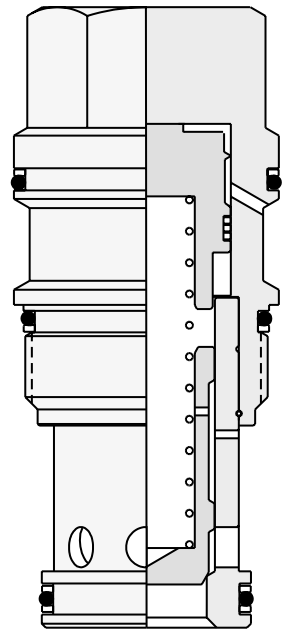
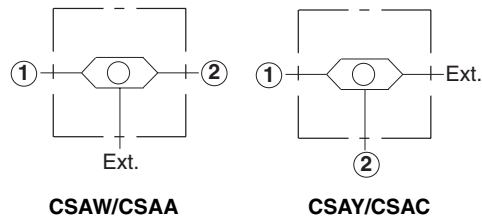
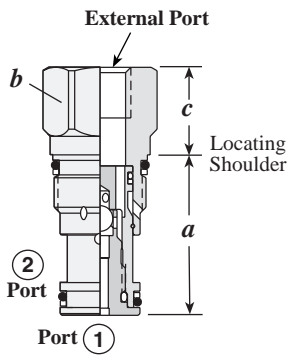


Shuttle Valves

	<i>Cartridge Type</i>	<i>Page</i>
 <p>Two schematic diagrams for a single ball shuttle valve. The first shows port 1 on the left, port 2 on the right, and an external port (Ext.) at the bottom. The second shows port 1 on the left, port 2 at the bottom, and an external port (Ext.) on the right.</p>	Single Ball Shuttle	136
 <p>Two schematic diagrams for a single ball shuttle valve with a signal port. The first shows port 1 on the left, port 2 on the right, and port 3 at the bottom. The second shows port 1 on the left, port 2 at the bottom, and port 3 on the right.</p>	Single Ball Shuttle Valve with Signal at Port 3 or Port 2	137
 <p>Two schematic diagrams for a back-to-back check/shuttle valve. The first shows port 1 on the left, port 2 on the right, and an external port (Ext.) at the bottom. The second shows port 1 on the left, port 2 at the bottom, and an external port (Ext.) on the right.</p>	Back-to-back Check/Shuttle	138
 <p>Two schematic diagrams for a back-to-back check/shuttle valve with a third port. The first shows port 1 on the left, port 2 on the right, and port 3 at the bottom. The second shows port 1 on the left, port 2 at the bottom, and port 3 on the right.</p>	Back-to-back Check/Shuttle	139
 <p>A schematic diagram for a low side, 3-position, hot oil shuttle valve. It shows a central vertical port (3) and two side ports (2 and 4) at the top.</p>	Low Side, 3-position, Hot Oil Shuttle Valve	140
 <p>A schematic diagram for a high side, 3-position shuttle valve. It shows a central vertical port (3) and two side ports (2 and 4) at the top.</p>	High Side, 3-position, Shuttle Valve	141
 <p>A schematic diagram for a spring offset, 2-position, high side shuttle valve. It shows a central vertical port (3) and two side ports (4 and 2) at the top.</p>	Spring Offset, 2-position, High Side Shuttle	142



SINGLE BALL SHUTTLE



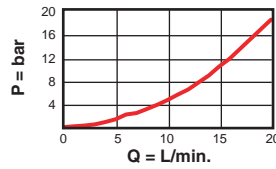
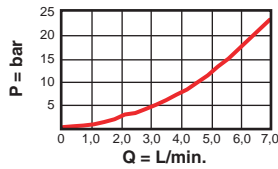
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
5 L/min.	CSAW – BXN	T - 162A	31	19,1	20,8	35/40
5 L/min.	CSAY – BXN	T - 162A	31	19,1	20,6	35/40
10 L/min.	CSAA – BXN	T - 13A	35,1	22,2	30,2	40/50
10 L/min.	CSAC – BXN	T - 13A	35,1	22,2	30,2	40/50

Performance Curves

CSAW/CSAY

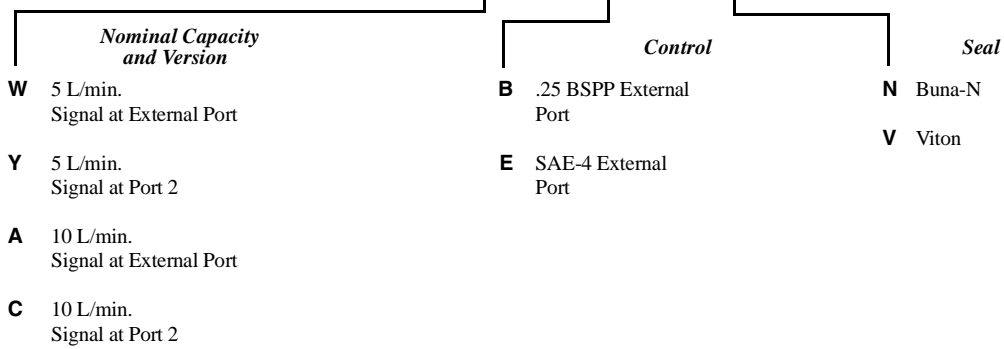
CSAA/CSAC

Typical Pressure Drop



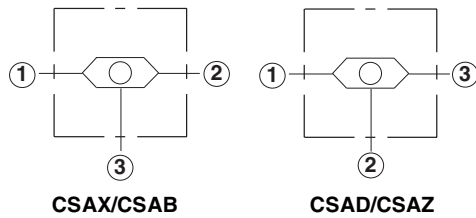
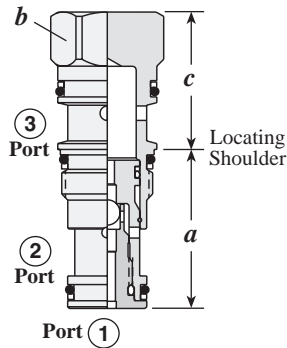
- Maximum operating pressure = 350 bar
- Maximum valve leakage = 0,4 cc/min.

CS A * - * X *



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



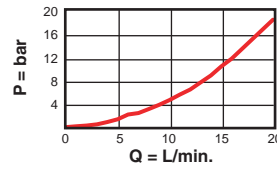
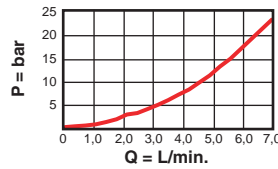
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
5 L/min.	CSAX – XXN	T - 163A	31	19,1	32	35/40
5 L/min.	CSAZ – XXN	T - 163A	31	19,1	31,8	35/40
10 L/min.	CSAB – XXN	T - 11A	34,9	22,2	31	40/50
10 L/min.	CSAD – XXN	T - 11A	35,1	22,2	30,2	40/50

Performance Curves

CSAX/CSAZ

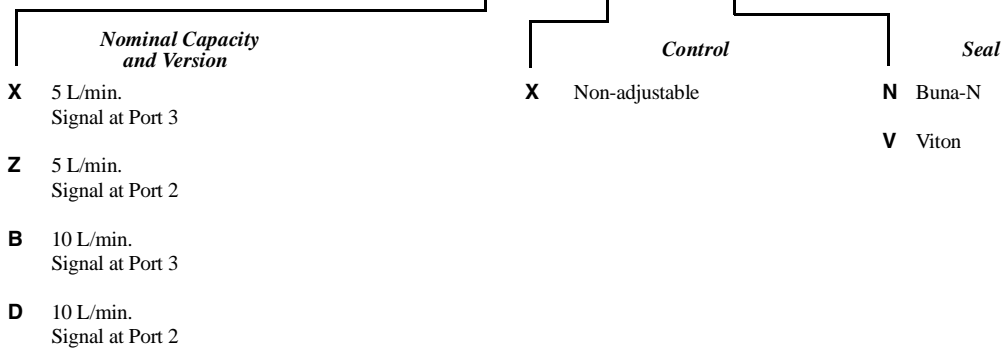
CSAB/CSAD

Typical Pressure Drop



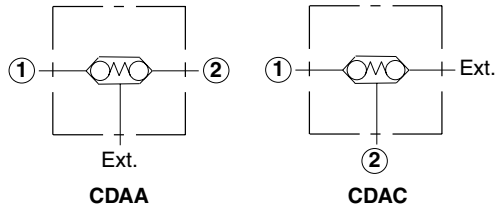
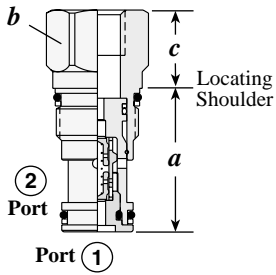
- Maximum operating pressure = 350 bar
- Maximum valve leakage = 0,4 cc/min.

CS A ★ - X X ★



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BACK-TO-BACK CHECK/SHUTTLE

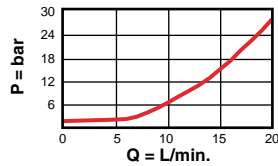


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
10 L/min.	CDAA – BBN	T - 13A	35,1	22,2	30,2	40/50
10 L/min.	CDAC – BBN	T - 13A	35,1	22,2	19	40/50

Performance Curves

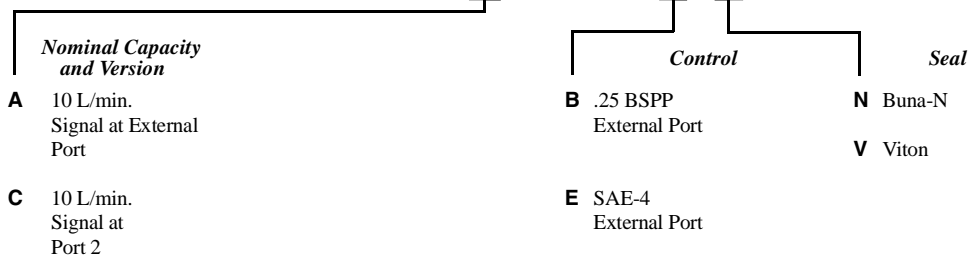
CDAA/CDAC

Typical Pressure Drop



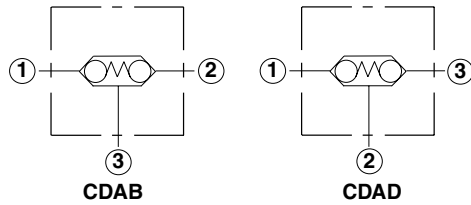
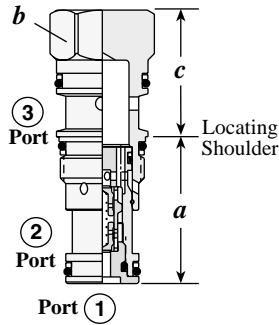
- Maximum operating pressure = 350 bar
- Maximum valve leakage = 0,4 cc/min.
- The back-to-back checks do not provide a means of lowering a signal. They will trap a high signal if the load pressures drop to a lower pressure. Some means of bleeding off the signal should be provided.
- 1,0 bar check.

CD A ★ - ★ B ★



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BACK-TO-BACK CHECK/SHUTTLE

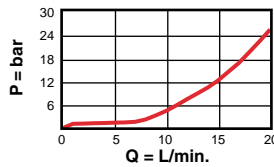


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
10 L/min.	CDAB – XBN	T - 11A	35,1	22,2	30,2	40/50
10 L/min.	CDAD – XBN	T - 11A	35,1	22,2	30,2	40/50

Performance Curves

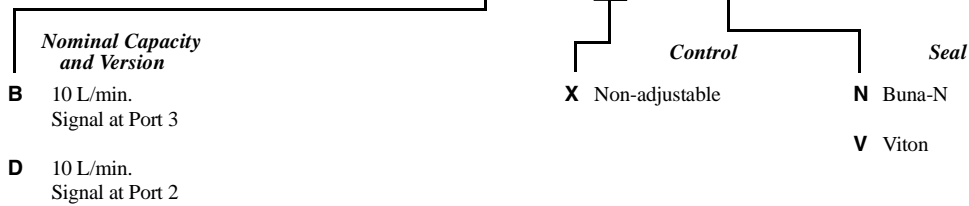
CDAB/CDAD

Typical Pressure Drop



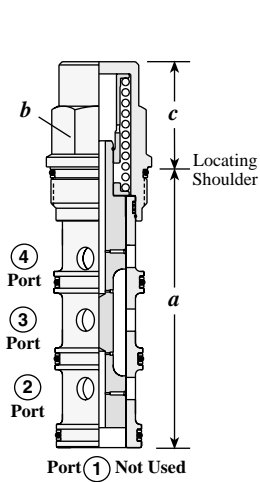
- Maximum operating pressure = 350 bar
- Maximum valve leakage = 0,4 cc/min.
- The back-to-back checks do not provide a means of lowering a signal. They will trap a high signal if the load pressures drop to a lower pressure. Some means of bleeding off the signal should be provided.
- 1,0 bar check

CD A ★ – X B ★



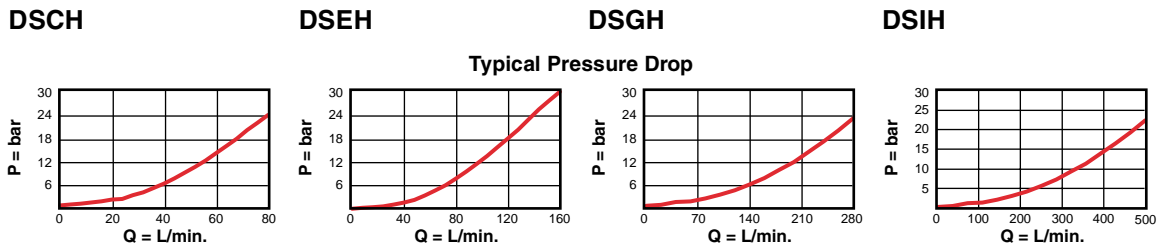
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LOW SIDE, 3-POSITION, HOT OIL SHUTTLE VALVE

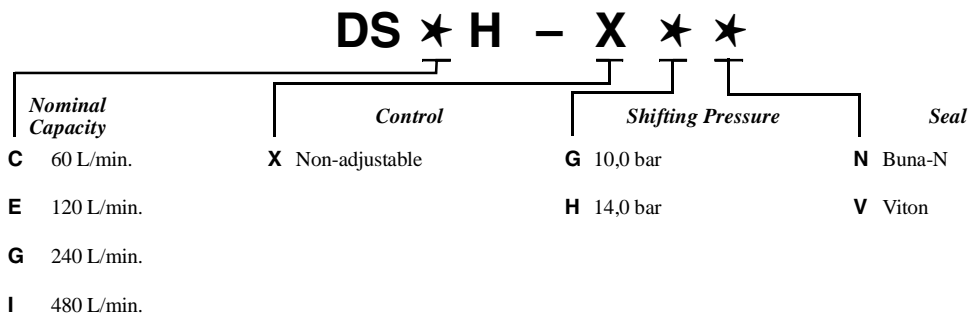


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
60 L/min.	DSCH – XHN	T - 31A	84,8	22,2	30	40/50
120 L/min.	DSEH – XHN	T - 32A	92,2	28,6	34	60/70
240 L/min.	DSGH – XHN	T - 33A	114,4	31,8	42	200/215
480 L/min.	DSIH – XHN	T - 34A	139,7	41,3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

Performance Curves

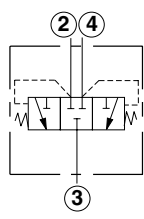
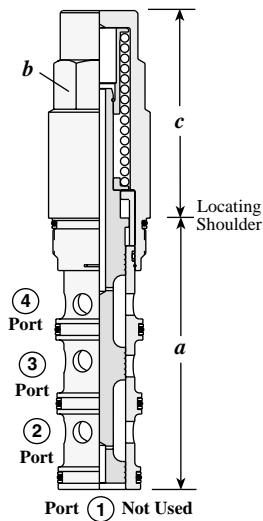


- Maximum operating pressure = 350 bar
- Pilot flow = DSCH, DSEH: 0,38 L/min., DSGH, DSIH: 0,75 L/min. (Port 2 and 4 to Port 3).
- Note: Low shift values can potentially result in charge pump pressure alone inadvertently shifting the valve. Use care when selecting shift pressure.
- Pressures on Ports 2 and 4 must equalize before reversed shift can take place.



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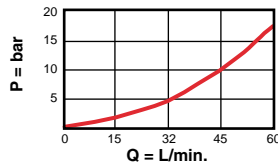
HIGH SIDE, 3-POSITION, SHUTTLE VALVE



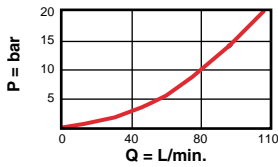
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
60 L/min.	DSCS – XCN	T - 31A	84,8	22,2	37	40/50
120 L/min.	DSES – XCN	T - 32A	92,2	28,6	42	60/70
240 L/min.	DSGS – XCN	T - 33A	114,4	31,8	72	200/215
480 L/min.	DSIS – XCN	T - 34A	139,7	41,3	107	465/500

Performance Curves

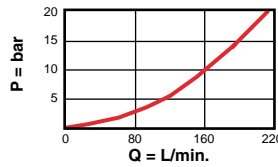
DSCS



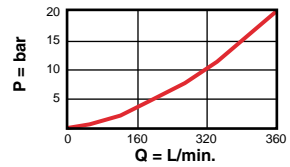
DSES



DSGS



DSIS



Pressure Drop, Port 2 or 4 to Port 3

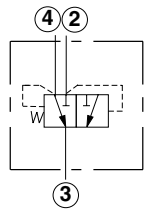
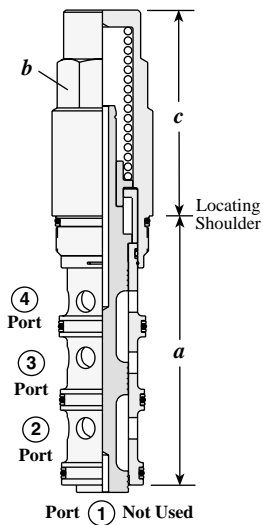
- Maximum operating pressure = 350 bar
- Maximum valve leakage = DSCS: 32,8 cc/min. at 70 bar, DSES: 49,2 cc/min. at 70 bar, DSGS: 65,5 cc/min. at 70 bar, DSIS: 81,9 cc/min. at 70 bar

DS * S - X * *

Nominal Capacity	Control	Shifting Pressure	Seal
C 60 L/min.	X Non-adjustable	C 2,0 bar	N Buna-N
E 120 L/min.		E 5,0 bar	V Viton
G 240 L/min.		F 7,0 bar	
I 480 L/min.		G 10,0 bar	

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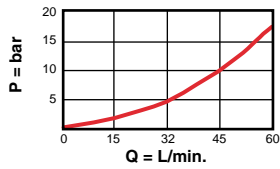
SPRING OFFSET, 2-POSITION, HIGH SIDE SHUTTLE



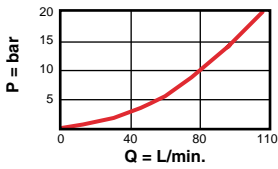
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions			Installation Torque (Nm)
			a	b	c	
60 L/min.	DSCO – XCN	T - 31A	84,8	22,2	37	40/50
120 L/min.	DSEO – XCN	T - 32A	92,2	28,6	42	60/70
240 L/min.	DSGO – XCN	T - 33A	114,4	31,8	72	200/215
480 L/min.	DSIO – XCN	T - 34A	139,7	41,3	107	465/500

Performance Curves

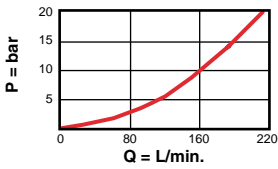
DSCO



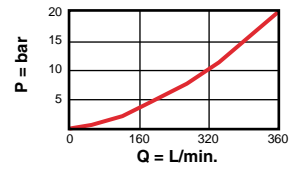
DSEO



DSGO



DSIO



Pressure Drop, Port 4 or 2 to Port 3

- Maximum operating pressure = 350 bar
- Minimum pilot pressure required to shift valve = C Range: 2 bar, E Range: 5 bar

DS * O - X * *

Nominal Capacity	Control	Shifting Pressure	Seal
C 60 L/min.	X Non-adjustable	C 2,0 bar	N Buna-N
E 120 L/min.		E 5,0 bar	V Viton
G 240 L/min.			
I 480 L/min.			

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