Over 40 New Products in this Catalogue

Relief Cartridge Valves

Page 9: The **RP*S** is a seated style pilot operated relief valve. This provides reduced leakage, faster response and a reduced pressure overshoot to give improved pressure control.

Page 10: The **RPGT** is a "soft start" relief valve available in series 2 only providing a pressure ramping over 300 milliseconds when it opens to provide excellent pressure protection and reduce shock.

Page 13: The **RBAP** is an electro-proportional, direct acting pilot relief valve that fits into the Sun T-8A cavity. It can be used as a pilot valve on it's own or together with many types of main stage pressure control valves that have the T-8A cavity in the end of the cartridge.

Page 14: The **RP*C-8** is a normally closed spool type modulating valve, with a T-8A cavity in the end. This would enable any of the Sun pilot valves, such as the RBAP proportional valve, to be fitted into the end to make a high capacity proportional relief valve.

Page 15: The **RP*S-8** is a seated style normally closed modulating valve, with a T-8A cavity in the end. This would enable any of the Sun pilot valves, such as the RBAP proportional valve, to be fitted into the end to make a proportional relief valve with low leakage on the main stage.

Page 18: The **RV*S** is a ventable, seated style, pilot operated relief valve. This provides reduced leakage, faster response and a reduced pressure overshoot to give improved pressure control.

Page 20: The **RV*D-8** is a normally closed, balanced piston, modulating element with a T-8A cavity in the end. The cartridge is ventable and also has an external drain connection. This would enable any Sun pilot valve, such as the RBAP proportional valve, to be fitted into the end to make a ventable proportional relief with separate drain port.

Sequence Cartridge Valves

Page 23: The **RSDC-8** is a normally closed, balanced piston, modulating element with a T-8A cavity in the end and external drain. This would enable any Sun pilot valve such as the RBAP proportional valve to be fitted into the end to make a relief valve with separate pilot drain.

Reducing/Relieving Cartridge Valves

Page 37: The **PB*B-8** is a normally open modulating element with a T-8A cavity in the end. This would enable any Sun pilot valve such as the RBAP proportional valve to be fitted to make a proportional pressure reducing valve.

Page 38: The **PP*B-8** is a normally open modulating element with a T-8A cavity in the end. This would enable any Sun pilot such as the RBAP proportional valve to be fitted into the end to make a proportional pressure reducing/ relieving valve.

Page 39: The **PV*A-8** is a normally open modulating element with a T-8A cavity in the end and an external drain. This would enable any Sun pilot valve, such as the RBAP proportional valve, to be fitted into the end to make a proportional pressure reducing/relieving valve with external drain.

Page 40 and 41: The **PRD*** is an electro-proportional, direct acting, pressure reducing/relieving valve available in series 1 only. There are two versions available, one with low leakage and the other with higher leakage and improved response.

Flow Control Cartridge Valves

Page 73: The **FPCC** is an electro-proportional, normally closed throttle valve available in series 1 only. It provides some pressure compensation but needs a separate compensator for more accurate control.

Page 74: The **FPCH** is an electro-proportional, normally open throttle valve available in series 1 only. It provides some pressure compensation but needs a separate compensator for more accurate control.

Priority Flow Control Cartridge Valves

Page 78: The **FV*A-8** is a ventable, fixed orifice, priority flow control valve with a T-8A cavity in the end of the cartridge. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the priority flow condition or bypass all flow to tank.

Logic Elements

Page 89: The **LO**-8** is a poppet type, spring biased closed, pilot-to-close unbalanced logic valve with a T-8A cavity in the end of the cartridge. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 95: The **DO*R**-8 is a poppet type, pilot-to-close, normally open balanced logic valve with a T-8A cavity in the end of the cartridge. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 100: The **DK*R-8** is a poppet type, pilot-to-open, normally closed balanced logic valve with a T-8A cavity in the end of the cartridge. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Over 40 New Products in this Catalogue

Directional Cartridge Valves

Page 105: The **DRBO** is direct acting, externally drained, normally closed, three-way directional valve in series 1 only. It is available with an adjustment on the pressure at which the valve will switch.

Page 105: The **DRBP** is direct acting, externally drained, normally open, three-way directional valve in series 1 only. The valve is available with an adjustment on the pressure at which the valve will switch.

Page 105: The **DRBR** is a direct acting, internally drained, externally piloted, three-way directional valve in series 1 only. The valve is available with an adjustment on the pressure at which the valve will switch.

Page 106: The **DV*A-8** is a direct acting, normally open, two-way directional valve with a T-8A cavity in the end. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 106: The **DV*B-8** is a direct acting, normally closed, two-way directional valve with a T-8A cavity in the end. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 106: The **DV*C-8** is a direct acting, three-way directional valve with Port 1 blocked and a T-8A cavity in the end. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 106: The **DV*D-8** is a direct acting, three-way directional valve with Port 1 open and a T-8A cavity in the end. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 107: The **DV*M-8** is a vent-to-operate two-position two-way, normally open directional valve with a T-8A cavity in the end and external drain. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 107: The **DV*N-8** is a vent-to-operate two-position two-way, normally closed directional valve with a T-8A cavity in the end and external drain. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 107: The **DV*O-8** is a vent-to-operate two-position three-way directional valve with a T-8A cavity in the end and external drain. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 107: The **DV*P-8** is a vent-to-operate two-position three-way directional valve with a T-8A cavity in the end and external drain. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 108: The **DF*A-8** two-position, two-way normally closed port 1 to 2, directional valve with a T-8A cavity in the end of the cartridge. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Page 109: The **DF*B-8** two-position, two-way normally closed port 2 to 1, directional valve with a T-8A cavity in the end of the cartridge. This enables a Sun pilot solenoid, pneumatic or manual valve to be fitted into the cartridge to select the valve in the open or closed condition.

Pilot Control Cartridge Valves

Page 125: The **DAAM** is a manually operated, two-position, two-way pilot valve. This valve could be fitted into any cartridge with a T-8A cavity in the end to provide manual switching. Available with momentary, detented, or dual operator.

Page 129: The **DBAM** is a manually operated, two-position, three-way valve.

Circuit Savers

Page 146: The **COFO** is a 120:1 ratio, pilot to close check valve in series 2 only. This valve is specifically designed for accumulator unloading and dump circuits when the pump is not operating.

Page 152: The **DS*X** is a two-position, three-way, vent-to-shift, normally closed diverter valve. This valve could be used in parallel with flow divider valves to enable the function to be bypassed in traction drive circuits.

Page 153: The **DS*Y** is a two-position, three-way, vent-to-shift diverter valve. This valve works as a simple flow diverter valve.

Page 154: The **LHDT** is a bi-directional, normally open modulating valve in series 1 only. This valve can be used with an external orifice to provide pressure compensated flow control in both directions.

Hybrid Relief Cartridge Valves

Page 156: The **HRDA** is a dual function cartridge providing both a direct acting relief valve and check valve. The relief function is before the check valve.

Page 157: The **HRDB** is a dual function cartridge providing both a direct acting relief valve and check valve. The relief function is after the check valve.

Page 158: The **HVCA** is a dual function cartridge providing both a ventable pilot operated relief and check valve. The ventable relief function is before the check valve.

Page 159: The **HVCA-8** is a dual function cartridge providing both a normally closed modulating function and a check valve and a T-8A cavity in the end of the cartridge. This would enable a Sun pilot valve such as a pilot proportional valve to provide a proportional pressure control and check function in one cartridge.

Contents

Model Codes printed in Red are Preferred Versions of products shown in this catalogue and most readily available.

SUN RECOMMENDED QUANTITY DISCOUNTS FOR STANDARD VALVES

One line item ■ One order ■ One shipment ■ F.O.B. Sarasota, FL. USA

Prices shown for SUN Cavity form tools are net and not subject to discounts.
Prices for Custom Products and Modifications of Standard Valves are by quotation only.

Quantity:	1-2	3-9	10-29	30-99	100-299	300-999
Discount:	List	7%	15%	25%	35%	On Request

Consult your SUN distributor for terms and conditions covering blanket orders or orders for scheduled repetitive shipments.

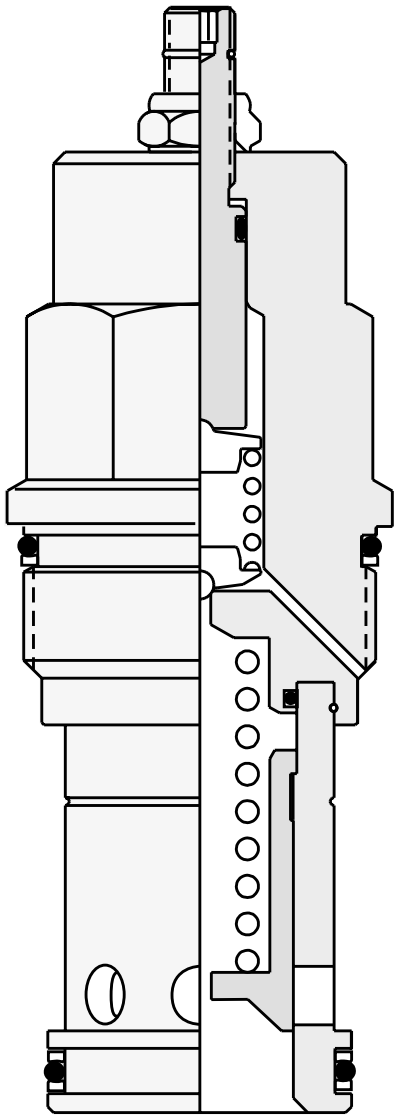
Sun Hydraulics Corporation reserves the right to change existing prices and discounts at any time without notice to its customers.
Selling prices are governed by the price list in effect at the time of acceptance of a purchase order.

Specifications, descriptions and illustrative material contained herein were accurate as known at the time this publication was approved for printing.

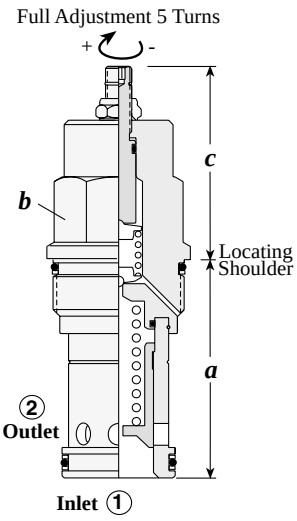
Sun Hydraulics reserves the right to discontinue models at any time, or change prices, specifications or designs without notice or incurring obligation.

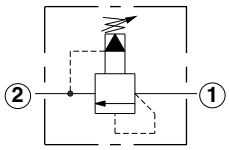
Printed in the United States of America

Relief Cartridge Valves



PILOT OPERATED BALANCED PISTON,



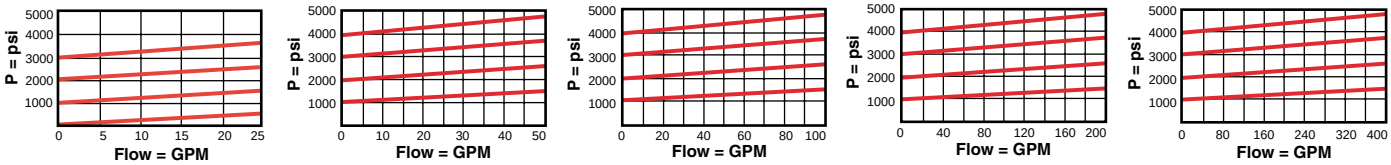


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
12 GPM	**RPCC – LAN**	T - 162A	1.22	3/4”	2.11	2.17	2.31	25/30
25 GPM	**RPEC – LAN**	T - 10A	1.56	7/8”	2.00	2.06	2.25	30/35
50 GPM	**RPGC – LAN**	T - 3A	1.88	1 1/8”	2.12	2.18	2.38	45/50
100 GPM	**RPIC – LAN**	T - 16A	2.44	1 1/4”	2.44	2.47	2.69	150/160
200 GPM	**RPKC – LAN**	T - 18A	3.13	1 5/8”	2.81	2.94	3.06	350/375

Performance Curves

RPCC **RPEC** **RPGC** **RPIC** **RPKC**

Typical Pressure Rise



- Maximum operating pressure = 5000 psi
- Will accept maximum pressure at Port 2.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting.
- Factory pressure settings established at 4 GPM
- Typical response time 10 ms.
- Maximum leakage = RPCC, RPEC: 2 in^3/min./1000 psi, RPGC: 3 in^3/min./1000 psi, RPIC: 4 in^3/min./1000 psi, RPKC: 5 in^3/min./1000 psi.
- RPCC minimum setting for all spring ranges is 75 psi

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

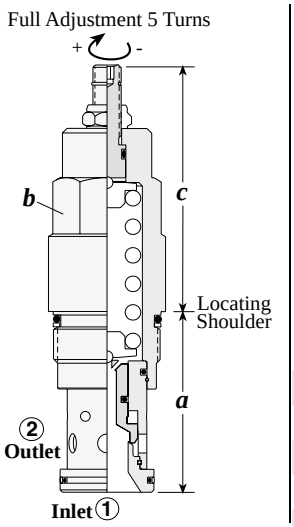
RP ★ C – ★ ★ ★

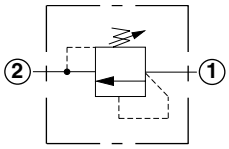
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C 12 GPM*	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
E 25 GPM	**C** Tamper Resistant	**B** 50 - 1500 psi	**V** Viton
G 50 GPM	**K** Handknob	**C** 150 - 6000 psi	
I 100 GPM		**N** 60 - 800 psi	
K 200 GPM		**Q** 60 - 400 psi	
		W 150 - 4500 psi	

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
Q Option is standard set at 200 psi.
** Minimum setting 75 psi on all ranges.*
Customer may specify pressure setting.

*** See page 162 for information on Control Options*

DIRECT ACTING



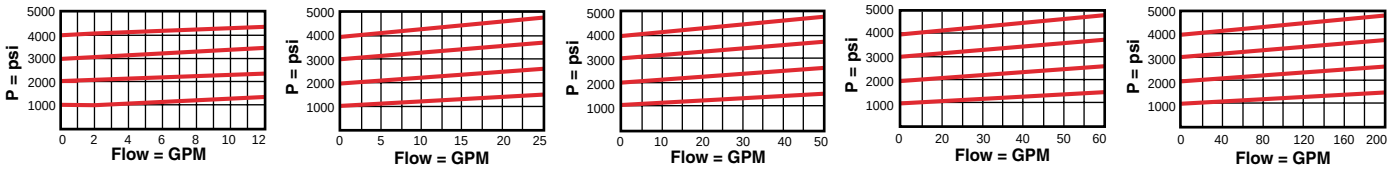


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
12 GPM	**RDBA – LAN**	T - 162A	1.22	3/4"	2.11	2.17	25/30
25 GPM	**RDDA – LAN**	T - 10A	1.56	7/8"	2.38	2.44	30/35
50 GPM	**RDFA – LAN**	T - 3A	1.88	1 1/8"	2.50	2.56	45/50
100 GPM	**RDHA – LAN**	T - 16A	2.44	1 1/4"	3.25	3.31	150/160
200 GPM	**RDJA – LAN**	T - 18A	3.13	1 5/8"	3.94	4.07	350/375

Performance Curves

RDBA **RDDA** **RDFA** **RDHA** **RDJA**

Typical Pressure Rise



- Maximum operating pressure = 5000 psi
- Cannot be adjusted with pressure at Port 1.
- Will accept maximum pressure at Port 2.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting.
- Factory pressure settings established at 4 GPM
- Typical response time 2 ms.
- Maximum leakage = 10 drops/min. at reseat.
- Reseat exceeds 90% of cracking pressure.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

RD ✶ A – ✶ ✶ ✶

Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
B 12 GPM	**L** Standard Screw	**A** 500 - 3000 psi	**N** Buna-N
D 25 GPM	**C** Tamper Resistant	**B** 300 - 1500 psi	**V** Viton
F 50 GPM		**C** 1000 - 6000 psi	
H 100 GPM		**D** 200 - 800 psi	
J 200 GPM		**E** 100 - 400 psi	
		S 50-200 psi	
		W 1000 - 4500 psi	

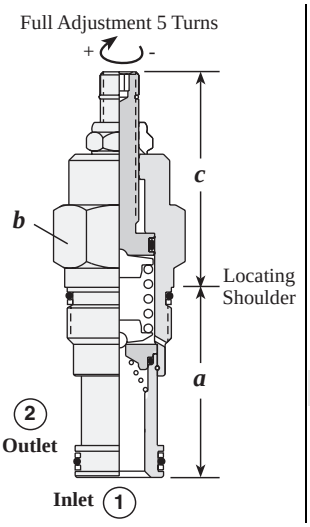
Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
S Option is standard set at 100 psi.
Customer may specify pressure setting.

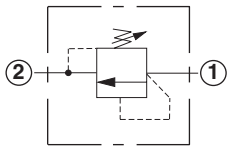
U.S. Patent #4,742,846
European Patent Pending

** *See page 162 for information on Control Options*

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

DIRECT ACTING, PILOT STAGE



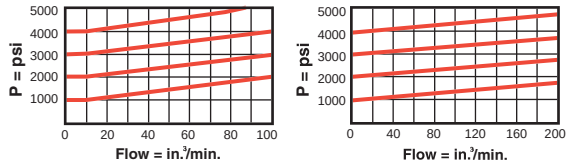


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
60 in.³/min.	**RBAC – LAN**	T - 10A	1.56	7/8"	2.00	2.06	2.25	30/35
120 in.³/min.	**RBAA – LAN**	T - 3A	1.88	1 1/8"	2.12	2.18	2.38	45/50

Performance Curves

RBAC **RBAA**

Typical Pressure Rise



- Maximum operating pressure = 5000 psi
- Typical response time 2 ms.
- Maximum leakage less than 5 drops/min.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

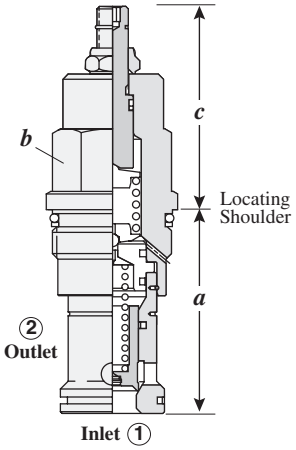
RB A ✶ – ✶ ✶ ✶

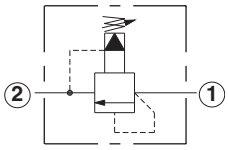
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C 60 in.3/min.	**L** Standard Screw	**A** 25 - 3000 psi	**N** Buna-N
A 120 in.3/min.	**C** Tamper Resistant	**B** 25 - 1500 psi	**V** Viton
	K Handknob	**C** 25 - 6000 psi	
		D 25 - 800 psi	
		E 25 - 400 psi	
		W 25 - 4500 psi	

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
Customer may specify pressure setting.

PILOT OPERATED, BALANCED POPPET



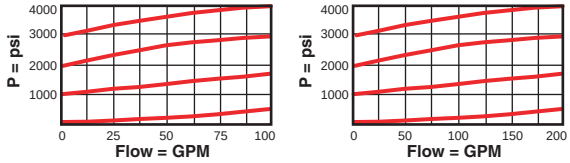


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
50 GPM	**RPGS – LAN**	T - 3A	1.88	1 1/8"	2.12	2.18	45/50
100 GPM	**RPIS – LAN**	T - 16A	2.44	1 1/4"	2.44	2.47	150/160

Performance Curves

RPGS **RPIS**

Typical Pressure Rise



- Maximum operating pressure = 5000 psi
- Maximum leakage 10 drops/min. at reseat
- Reseat exceeds 90% of cracking pressure.
- Factory pressure settings established at 4 GPM
- Typical response time 10 ms.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting

OPTION ORDERING INFORMATION

RP ★ S – ★ ★ ★

Nominal Capacity

G 50 GPM

I 100 GPM

Control**

C Tamper Resistant Factory Set

K Handknob

L Standard Screw Adjustment

** *See page 162 for information on Control Options*

Adjustment Range

A 100 - 3000 psi

B 50 - 1500 psi

C 150 - 6000 psi

N 60 - 800 psi

Q 60 - 400 psi

W 100 - 4500 psi

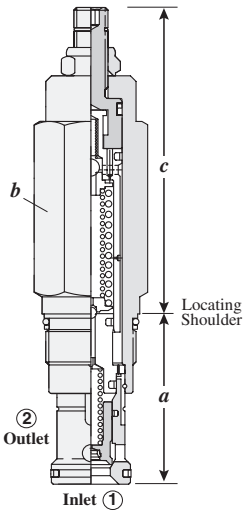
Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
Q Option is standard set at 200 psi.
Customer may specify pressure setting.

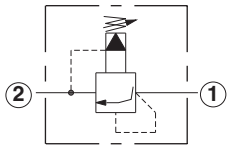
Seal

N Buna-N

V Viton

PILOT OPERATED, BALANCED POPPET, SOFT START



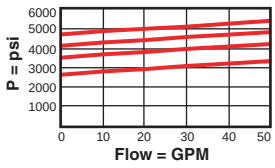


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*Installation Torque (lb. ft.)*
50 GPM	**RPGT - LAN**	T - 3A	1.88	1 1/8"	3.38	3.47	45/50

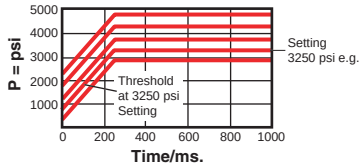
Performance Curves

RPGT

Typical Pressure Rise



Typical Ramp Time



- Maximum operating pressure = 5000 psi
- Will accept maximum pressure at Port 2.
- Factory pressure settings established at 4 GPM
- Shifting time from minimum to maximum setting 250 ms.
- Control pilot flow = 10 to 25 in^3/min.

OPTION ORDERING INFORMATION

RP G T – ★ ★ ★

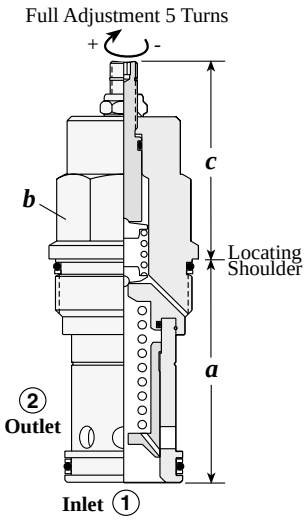
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
G 50 GPM	**C** Tamper Resistant Factory Set	**A** 2000 - 3000 psi	**N** Buna-N
		C 4500 - 6000 psi	**V** Viton
	L Standard Screw Adjustment	**W** 3000 - 4500 psi	

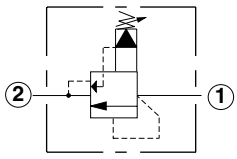
Patents:
U.S. #6,039,070;
Germany EP 1 001 197;
Japan #3,119,230

*** See page 162 for information on Control Options*

Adjustment Range Options:
A is standard set at 2000 psi.
C is standard set at 4500 psi.
W is standard set at 3000 psi.
Customer may specify pressure setting.

PILOT OPERATED, KICK-DOWN



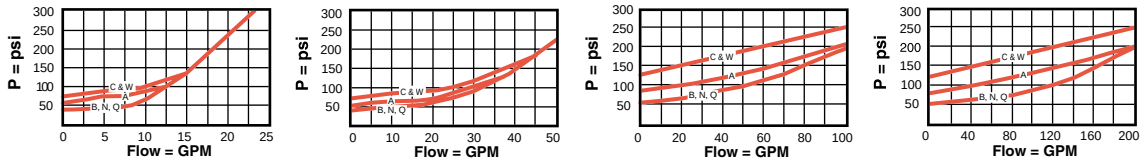


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
25 GPM	**RQEB – LAN**	T - 10A	1.56	7/8”	2.00	2.06	2.25	30/35
50 GPM	**RQGB – LAN**	T - 3A	1.88	1 1/8”	2.12	2.18	2.38	45/50
100 GPM	**RQIB – LAN**	T - 16A	2.44	1 1/4”	2.44	2.47	2.69	150/160
200 GPM	**RQKB – LAN**	T - 18A	3.13	1 5/8”	2.81	2.94	3.06	350/375

Performance Curves

RQEB **RQGB** **RQIB** **RQKB**

Unloaded Pressure Drop



- Maximum operating pressure = 5000 psi
- Will accept maximum pressure at Port 2.
- Flow through cartridge must cease to reset valve.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting
- Factory pressure settings established at kick down point.
- Typical response time 25 ms.
- Maximum leakage = RQEB: 2 in^3/min./1000 psi; RQGB: 3 in^3/min./1000 psi, RQIB: 4 in^3/min./1000 psi, RQKB: 5 in^3/min./1000 psi

OPTION ORDERING INFORMATION

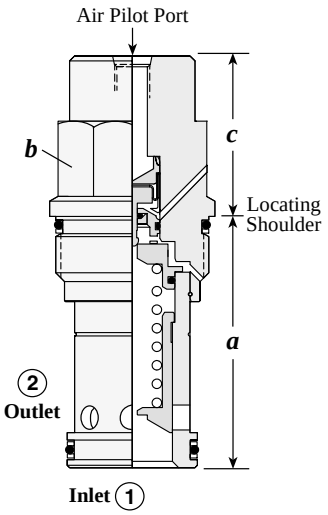
RQ ★ B – ★ ★ ★

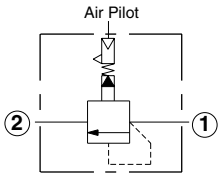
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
E 25 GPM	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
G 50 GPM	**C** Tamper Resistant	**B** 50 - 1500 psi	**V** Viton
I 100 GPM	**K** Handknob	**C** 150 - 6000 psi	
K 200 GPM		**N** 60 - 800 psi	
		Q 60 - 400 psi	
		W 150 - 4500 psi	

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
Q Option is standard set at 200 psi.
Customer may specify pressure setting.

PILOT OPERATED, BALANCED PISTON, AIR CONTROLLED



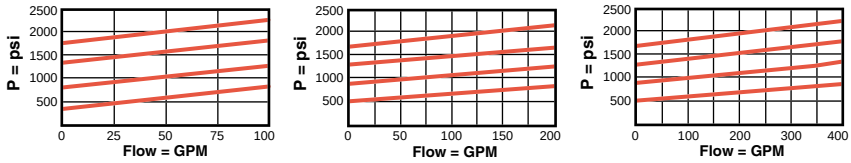


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (lb. ft.)*
			a	*b*	*c*		
					A	B	
50 GPM	**RPGD – ABN**	T - 3A	1.88	1 1/8”	1.31	-	45/50
100 GPM	**RPID – BBN**	T - 16A	2.44	1 1/4”	-	1.62	150/160
200 GPM	**RPKD – BBN**	T - 18A	3.13	1 5/8”	-	2.00	350/375

Performance Curves

RPGD **RPID** **RPKD**

Typical Pressure Rise



- Maximum operating pressure = 2000 psi
- Will accept maximum pressure at Port 2.
- Maximum air pressure should not exceed 150 psi.
- Pilot ratio, air to hydraulic = 1:20
- Typical response time 10 ms.
- Maximum leakage = RPGD: 3 in^3/min./1000, RPID: 4 in^3/min./1000 psi, RPKD: 5 in^3/min./1000 psi.

OPTION ORDERING INFORMATION

RP ★ D – ★ ★ ★

Nominal Capacity

G 50 GPM

I 100 GPM

K 200 GPM

Control

Available for RPGD only

A 1/4" NPTF Pilot Port at end of Cartridge*

Available for RPID, RPKD only

B SAE-4 Pilot Port at end of Cartridge*

* *Maximum air pilot pressure should not exceed 150 psi.*

Adjustment Range

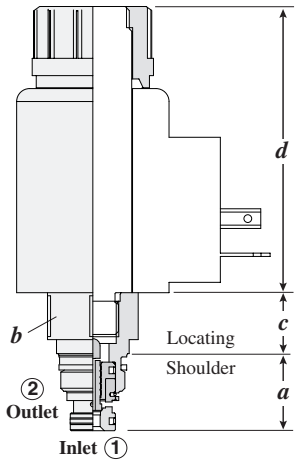
B 50 - 1500 psi

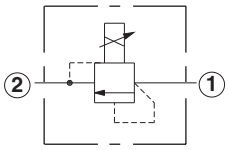
Seal

N Buna-N

V Viton

ELECTRO-PROPORTIONAL PILOT

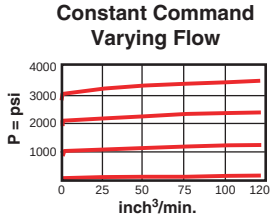


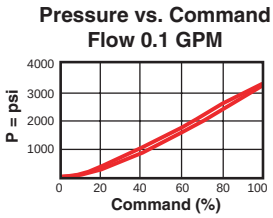


			Cartridge Dimensions				
Capacity	*Typical Cartridge Model Code*	*Cavity*	*a*	*b*	*c*	*d*	*Installation Torque (lb. ft.)*
.25 GPM	**RBAP – MAN**	T - 8A	.75	7/8	.59	2.76	25/30

Performance Curves

RBAP





- Maximum operating pressure = 5000 psi
- Maximum leakage = 1.5 in^3/min at reseat
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to valve setting
- Reseat exceeds 85% of cracking pressure.
- Hysteresis with dither <4%
- Hysteresis with DC input <8%
- Linearity with dither <2%
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.

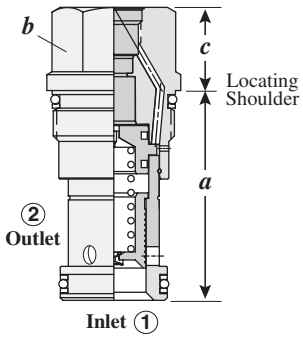
OPTION ORDERING INFORMATION

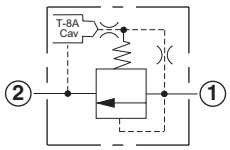
Model Codes printed in Red are Preferred Versions and most readily available

RB A P – ★ ★ ★

Nominal Capacity	*Control*	*Adjustment Range*	*Seal*
A .25 GPM	**M** Manual Override (Standard)	**A** 300 - 3000 psi	**N** Buna-N
		B 150 - 1500 psi	**V** Viton
	NOTE: Coil must be ordered separately. Use 12V DC or 24V DC (Series 770-*) coils only. See page 167.**	**W** 500 - 5000 psi	

BALANCED PISTON, MODULATING ELEMENT WITH INTEGRAL PILOT CONTROL CAVITY





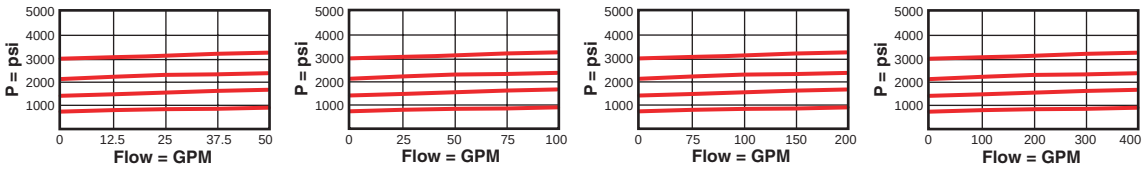
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
25 GPM	**RPEC – 8WN**	T - 10A	1.56	7/8	.75	30/35
50 GPM	**RPGC – 8WN**	T - 3A	1.88	1 1/8”	.69	45/50
100 GPM	**RPIC – 8WN**	T - 16A	2.44	1 1/4”	.97	150/160
200 GPM	**RPKC – 8WN**	T - 18A	3.13	1 5/8”	1.18	350/375

Performance Curves

RPEC-8 **RPGC-8** **RPIC-8** **RPKC-8**

Pressure vs. Flow



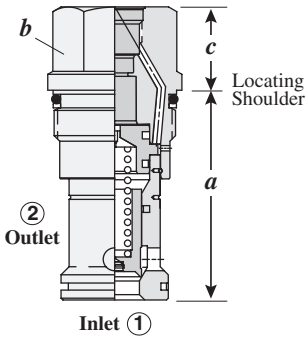
- Maximum operating pressure = 5000 psi
- Will accept maximum pressure at Port 2.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting
- Control pilot flow = RPEC-8: 7 to 10 in^3/min., RPGC-8: 10 to 15 in^3/min., RPIC, RPKC-8: 15 to 20 in^3/min.
- Maximum leakage = RPEC-8: 2 in^3/min./1000 psi: RPGC-8: 3 in^3/min./1000 psi, RPIC-8: 4 in^3/min./1000 psi, RPKC-8: 5 in^3/min./1000 psi.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

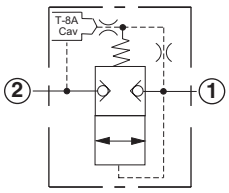
OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

RP ✶ C – 8 ✶ ✶

Nominal Capacity	*Control*	*MinimumControl Pressure*	*Seal*
E 25 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**D** 25 psi	**N** Buna-N
G 50 GPM		**W** 100 psi	**V** Viton
I 100 GPM			
K 200 GPM			

BALANCED POPPET, MODULATING ELEMENT WITH INTEGRAL PILOT CONTROL CAVITY





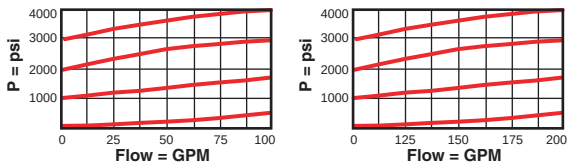
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
50 GPM	**RPGS – 8WN**	T - 3A	1.88	1 1/8”	.69”	45/50
100 GPM	**RPIS – 8WN**	T - 16A	2.44	1 1/4”	.97	150/160

Performance Curves

RPGS-8 **RPIS-8**

Typical Pressure Rise



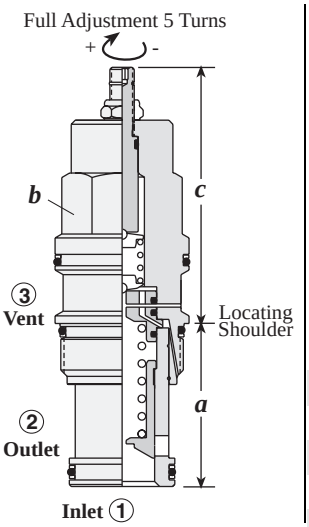
- Maximum operating pressure = 5000 psi
- Will accept maximum pressure at Port 2.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting.
- Typical response time 10 ms
- Control pilot flow = RPGS-8: 10 to 15 in^3/min., RPIS-8: 15 to 20 in^3/min.
- Maximum leakage = 10 drops/min. at reseat
- Reseat exceeds 90% of cracking pressure.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

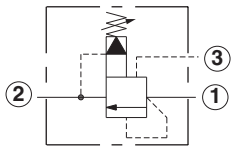
OPTION ORDERING INFORMATION

RP ★ S – 8 ★ ★

Nominal Capacity	*Control***	*MinimumControl Pressure*	*Seal*
G 50 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**B** 50 psi	**N** Buna-N
I 100 GPM		**W** 100 psi	**V** Viton

VENTABLE, PILOT OPERATED, BALANCED PISTON



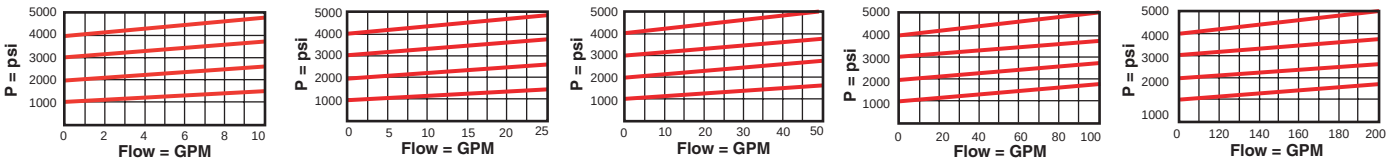


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
7.5 GPM	**RVBA – LAN**	T - 163A	1.22	3/4”	2.55	2.63	2.77	25/30
15 GPM	**RVCA – LAN**	T - 11A	1.38	7/8”	2.50	2.56	2.75	30/35
30 GPM	**RVEA – LAN**	T - 2A	1.38	1 1/8”	2.81	2.88	3.06	45/50
60 GPM	**RVGA – LAN**	T - 17A	1.81	1 1/4”	3.28	3.31	3.53	150/160
120 GPM	**RVIA – LAN**	T - 19A	2.50	1 5/8”	3.94	4.09	4.19	350/375

Performance Curves

RVBA **RVCA** **RVEA** **RVGA** **RVIA**

Typical Pressure Rise



- Maximum operating pressure = 5000 psi
- Pressure at port 3 (vent) controls the valve below its setting.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting.
- Control pilot flow = RVBA, RVCA: 7 to10 in^3/min.; RVEA: 10 to 15 in^3/min.; RVGA, RVIA: 15 to 20 in^3/min.
- Factory pressure setting established at 4 GPM
- Typical response time 10 ms.
- Maximum leakage = RVBA, RVCA: 2 in^3/min./1000 psi, RVEA: 3 in^3/min./ 1000 psi, RVGA: 4 in^3/min./1000 psi, RVIA: 5 in^3/min./1000 psi
- RVBA minimum setting for all spring ranges is 75 psi
- Will accept maximum pressure at port 2.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

RV ✶ A – ✶ ✶ ✶

Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
B 7.5 GPM*	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
C 15 GPM	**C** Tamper Resistant	**B** 50 - 1500 psi	**V** Viton
E 30 GPM	**K** Handknob	**C** 150 - 6000 psi	
G 60 GPM		**N** 60 - 800 psi	
I 120 GPM		**Q** 60 - 400 psi	
		W 150 - 4500 psi	

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
Q Option is standard set at 200 psi.

*** See page 162 for information on Control Options*

* *Minimum setting 75 psi on all ranges.*
Customer may specify pressure setting.

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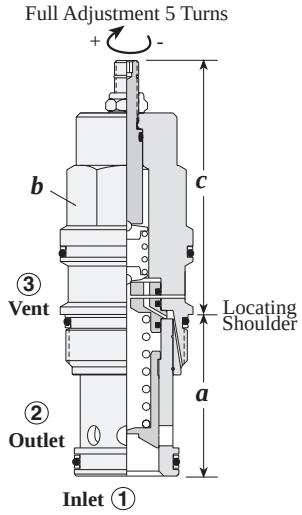
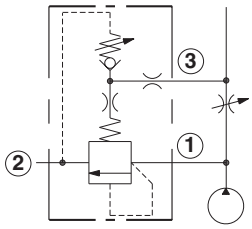
MODULATING ELEMENT WITH RELIEF FUNCTION



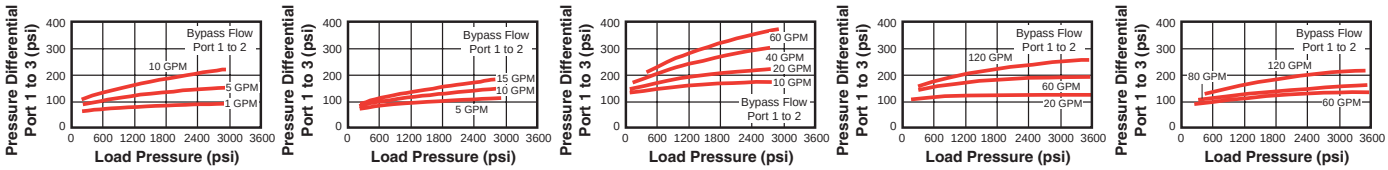


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
2.5 GPM	**RVBB – LAN**	T - 163A	1.22	3/4”	2.55	2.63	2.77	25/30
5 GPM	**RVCB – LAN**	T - 11A	1.38	7/8”	2.50	2.56	2.75	30/35
10 GPM	**RVEB – LAN**	T - 2A	1.38	1 1/8”	2.81	2.88	3.06	45/50
20 GPM	**RVGB – LAN**	T - 17A	1.81	1 1/4”	3.28	3.31	3.53	150/160
40 GPM	**RVIB – LAN**	T - 19A	2.50	1 5/8”	3.94	4.09	4.19	350/375

Performance Curves

RVBB **RVCB** **RVEB** **RVGB** **RVIB**

Typical Compensator Differentials



- Maximum operating pressure = 5000 psi
- Back pressue on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting.
- Factory pressure setting established at 4 GPM
- Typical response time 10 ms.
- Maximum leakage = RVBB, RVCB: 2 in^3/min./1000 psi, RVEB: 3 in^3/min./ 1000 psi, RVGB: 4 in^3/min./1000 psi, RVIB: 5 in^3/min./1000 psi

OPTION ORDERING INFORMATION

RV ★ B – ★ ★ ★

Nominal Capacity		*Control***		*Adjustment Range*		*Seal*	
B	2.5 GPM*	**L**	Standard Screw	**A**	100 - 3000 psi	**N**	Buna-N
C	5 GPM	**C**	Tamper Resistant	**B**	100 - 1500 psi*	**V**	Viton
E	10 GPM	**K**	Handknob	**C**	100 - 6000 psi		
G	20 GPM						
I	40 GPM						

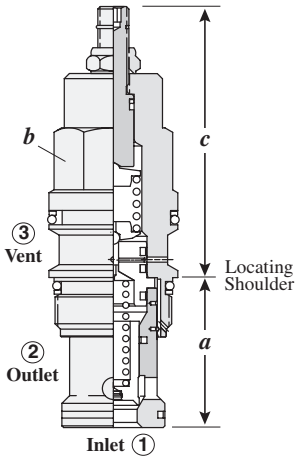
** For RVCB, the bias pressure is 60 psi.*

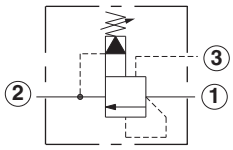
*** See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and C are standard set at 1000 psi.
** Minimum setting 100 psi on all ranges.*
Customer may specify pressure setting.

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

VENTABLE, PILOT OPERATED, BALANCED POPPET



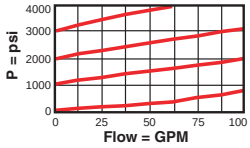


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (lb. ft.)*
30 GPM	**RVES – LAN**	T - 2A	1.38	1 1/8”	2.81	2.88	3.06	45/50
50 GPM	**RVGS – LAN**	T - 17A	1.81	1 1/4”	3.28	3.31	3.53	150/175

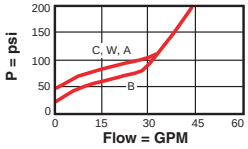
Performance Curves

RVES

Typical Pressure Rise

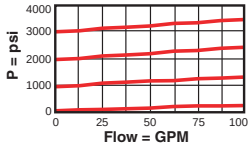


Vented Pressure

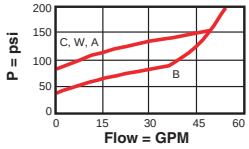


RVGS

Typical Pressure Rise



Vented Pressure



- Maximum operating pressure = 5000 psi.
- Will accept maximum pressure at port 2
- Pressure at port 3 (vent) controls the valve below its setting.
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to the valve setting.
- Factory pressure setting established at 4 GPM
- Maximum leakage at reseat = 10 drops/min.
- Reseat exceeds 90% of cracking pressure.
- Typical response 10 ms
- Control pilot flow = RVES: 10 to 15 in^3/min, RVGS: 15 to 20 in^3/min.

OPTION ORDERING INFORMATION

RV ★ S – ★ ★ ★

Nominal Capacity

E 30 GPM

G 50 GPM

*Control***

C Tamper Resistant Factory Set

K Handknob

L Standard Screw Adjustment

Adjustment Range

A 100 - 3000 psi

B 50 - 1500 psi

C 150 - 6000 psi

N 60 - 800 psi

Q 60 - 400 psi

W 100 - 4500 psi

Adjustment Range Options:
A, B, C and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
Q option is standard set at 200 psi.

Seal

N Buna-N

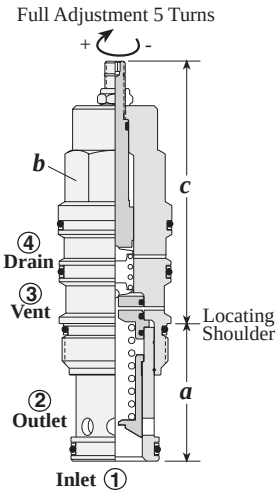
V Viton

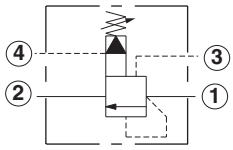
** *See page 162 for information on Control Options*

Customer may specify pressure settings.

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

VENTABLE, PILOT OPERATED, BALANCED PISTON WITH EXTERNAL DRAIN



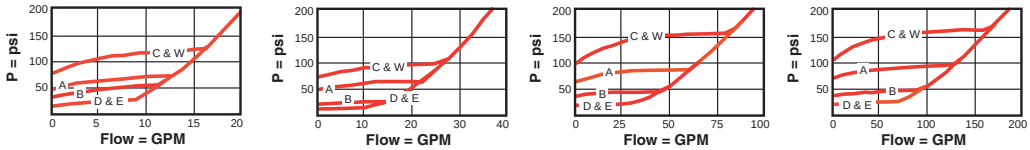


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Cartridge Dimensions c K	Installation Torque (lb. ft.)
15 GPM	**RVCD – LAN**	T - 21A	1.38	7/8”	3.09	3.15	3.34	30/35
30 GPM	**RVED – LAN**	T - 22A	1.38	1 1/8”	3.44	3.50	3.69	45/50
60 GPM	**RVGD – LAN**	T - 23A	1.81	1 1/4”	3.93	3.99	4.19	150/160
120 GPM	**RVID – LAN**	T - 24A	2.50	1 5/8”	4.78	4.90	5.03	350/375

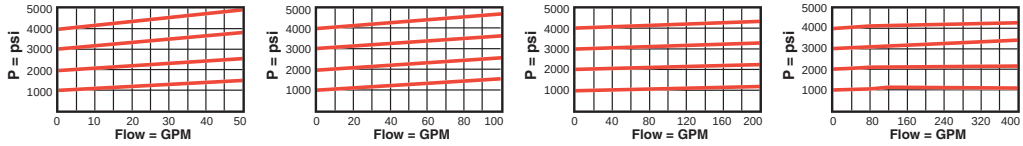
Performance Curves

RVCD **RVED** **RVGD** **RVID**

Vented Pressure



Typical Pressure Rise



- Maximum operating pressure = 5000 psi
- Pressure at port 4 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi
- Pressure at port 3 (vent) controls the valve below its setting.
- Control pilot flow = RVCD: 7 to10 in^3/min.; RVED: 10 to 15 in^3/min.; RVGD, RVID: 15 to 20 in^3/min.
- Factory pressure setting established at 4 GPM
- Typical response time 10 ms.
- Maximum leakage = RVCD: 2 in^3/min./1000 psi, RVED: 3 in^3/min./1000 psi, RVGD: 4 in^3/min./1000 psi, RVID: 5 in^3/min./1000 psi.

OPTION ORDERING INFORMATION

RV ✶ D – ✶ ✶ ✶

Nominal Capacity		*Control***		*Adjustment Range*		*Seal*	
C	15 GPM	**L**	Standard Screw	**A**	100 - 3000 psi	**N**	Buna-N
E	30 GPM	**C**	Tamper Resistant	**B**	50 - 1500 psi	**V**	Viton
G	60 GPM	**K**	Handknob	**C**	150 - 6000 psi		
I	120 GPM			**D**	25 - 800 psi		
				E	25 - 400 psi		
				W	150 - 4500 psi		

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
Customer may specify pressure setting.

***See page 162 for information on Control Options*

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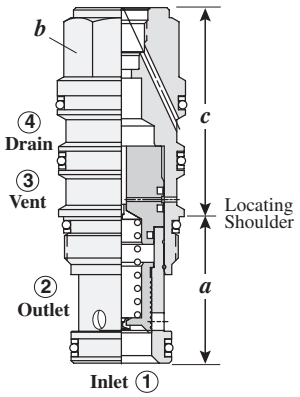
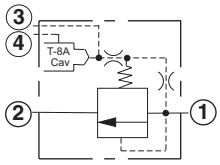
VENTABLE, BALANCED PISTON, MODULATING ELEMENT WITH EXTERNAL DRAIN AND INTEGRAL PILOT CONTROL ELEMENT





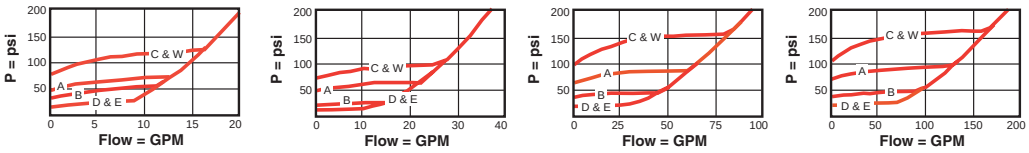
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**RVCD – 8WN**	T - 21A	1.38	7/8	1.78	30/35
30 GPM	**RVED – 8WN**	T - 22A	1.38	1 1/8	2.00	45/50
60 GPM	**RVGD – 8WN**	T - 23A	1.814	1 1/4	2.59	150/160
120 GPM	**RVID – 8WN**	T - 24A	2.50	1 5/8	3.16	350/375

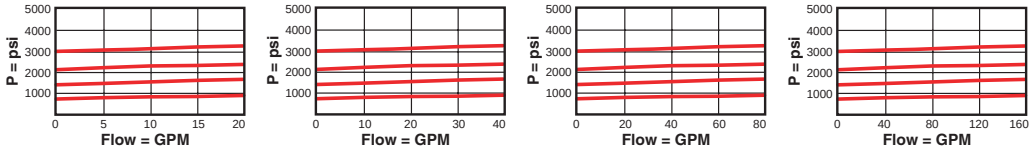
Performance Curves

RVCD-8 **RVED-8** **RVGD-8** **RVID-8**

Vented Pressure



Typical Pressure Rise



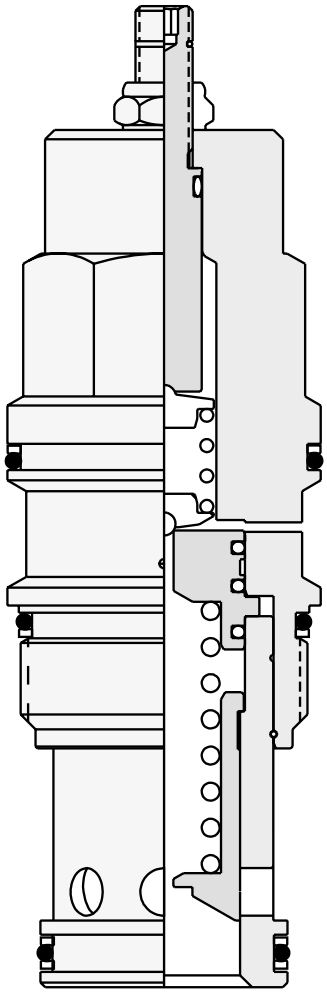
- Maximum operating pressure = 5000 psi
- Pressure at port 4 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi
- Pressure at port 3 (vent) controls the valve below its setting.
- Control pilot flow = RVCD: 7 to10 in^3/min.; RVED: 10 to 15 in^3/min.; RVGD, RVID: 15 to 20 in^3/min.
- Factory pressure setting established at 4 GPM
- Typical response time 10 ms.
- Maximum leakage = RVCD: 2 in^3/min./1000 psi, RVED: 3 in^3/min./1000 psi, RVGD: 4 in^3/min./1000 psi, RVID: 5 in^3/min./1000 psi.

OPTION ORDERING INFORMATION

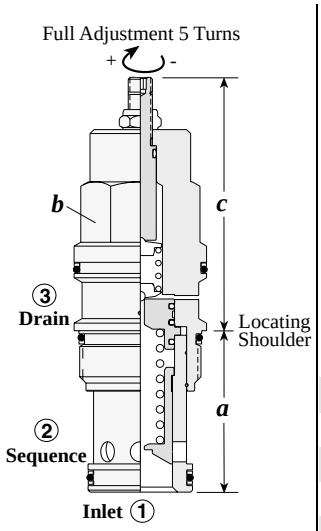
RV ★ D – 8 ★ ★

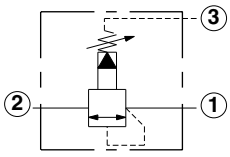
Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal*
C 15 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**D** 27 psi	**N** Buna-N
E 30 GPM		**W** 100 psi	**V** Viton
G 60 GPM			
I 120 GPM			

Sequence Cartridge Valves



PILOT OPERATED, BALANCED PISTON



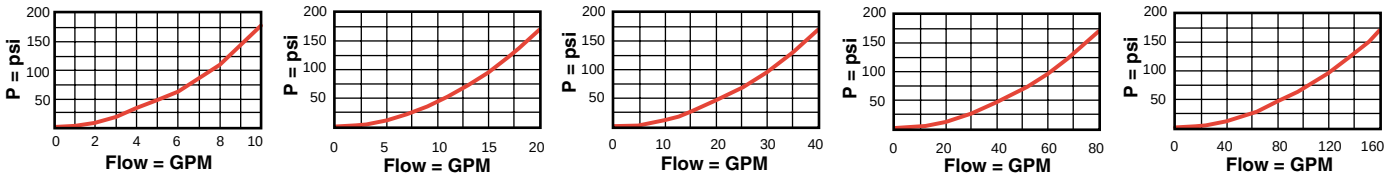


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
7.5 GPM	**RSBC – LAN**	T - 163A	1.22	3/4"	2.55	2.63	2.77	25/30
15 GPM	**RSDC – LAN**	T - 11A	1.38	7/8"	2.50	2.56	2.75	30/35
30 GPM	**RSFC – LAN**	T - 2A	1.38	1 1/8"	2.81	2.88	3.06	45/50
60 GPM	**RSHC – LAN**	T - 17A	1.81	1 1/4"	3.28	3.31	3.53	150/160
120 GPM	**RSJC – LAN**	T - 19A	2.50	1 5/8"	3.94	4.09	4.19	350/375

Performance Curves

RSBC **RSDC** **RSFC** **RSHC** **RSJC**

Pressure Drop Sequenced Open



- Maximum operating pressure = 5000 psi
- Maximum leakage = RSDC: 2 in^3/min./1000 psi, RSFC: 3 in^3/min./1000 psi, RSHC: 4 in^3/min./1000 psi RSJC: 5 in^3/min./1000 psi.
- Typical response time 10 ms
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi.
- Pilot flow continues to increase as the pressure at port 1 (inlet), relative to the pressure at port 3 (drain), rises above the valve setting.
- RSBC minimum setting is 75 psi for all spring ranges.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

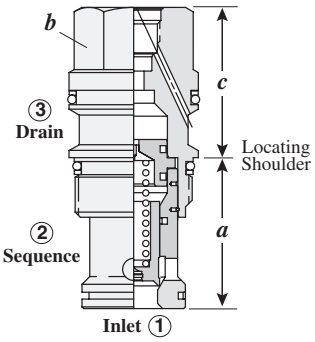
RS ✶ C – ✶ ✶ ✶

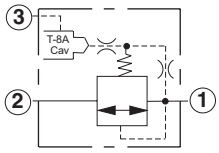
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
B 7.5 GPM*	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
D 15 GPM	**C** Tamper Resistant	**B** 50 - 1500 psi	**V** Viton
F 30 GPM	**K** Handknob	**C** 150 - 6000 psi	
H 60 GPM		**N** 60 - 800 psi	
J 120 GPM		**Q** 60 - 400 psi	
		W 150 - 4500 psi	

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
Q Option is standard set at 200 psi.
** Minimum setting 75 psi on all ranges.*
Customer may specify pressure setting.

*** See page 162 for information on Control Options*

EXTERNALLY DRAINED, BALANCED PISTON, MODULATING ELEMENT





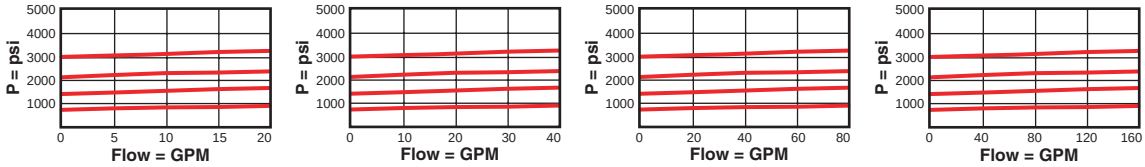
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (lb. ft.)
15 GPM	**RSDC – 8WN**	T - 11A	1.38	7/8	1.19	30/35
30 GPM	**RSFC – 8WN**	T - 2A	1.38	1 1/8	1.38	45/50
60 GPM	**RSHC – 8WN**	T - 17A	1.81	1 1/4	1.81	150/160
120 GPM	**RSJC – 8WN**	T - 19A	2.50	1 5/8	2.31	350/375

Performance Curves

RSDC-8 **RSFC-8** **RSHC-8** **RSJC-8**

Typical Pressure Rise



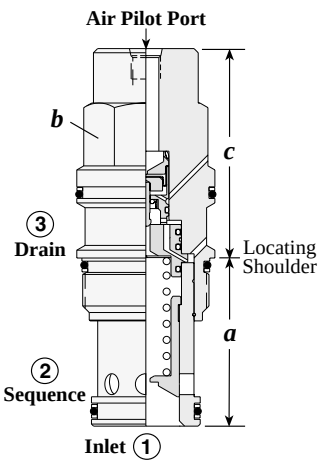
- Maximum operating pressure = 5000 psi
- Will accept maximum pressure at Port 2.
- Pressure at port 3 is directly additive at a 1:1 ratio to the valve setting and should not exceed 5000 psi.
- Control pilot flow = RSDC-8: 7 to 10 in^3/min., RSFC-8: 10 to 15 in^3/min., RSHC, RSJC-8: 15 to 20 in^3/min.
- Maximum leakage = RSDC-8: 2 in^3/min./1000 psi: RSFC-8: 3 in^3/min./1000 psi, RSHC-8: 4 in^3/min./1000 psi, RSJC-8: 5 in^3/min./1000 psi.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

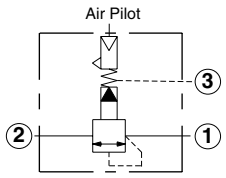
OPTION ORDERING INFORMATION

RS ★ C – 8 ★ ★

Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal*
D 15 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**D** 25 psi	**N** Buna-N
F 30 GPM		**W** 100 psi	**V** Viton
H 60 GPM			
J 120 GPM			

AIR CONTROLLED, PILOT OPERATED, BALANCED PISTON



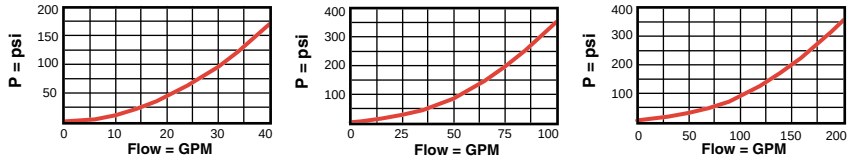


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c A	c B	Installation Torque (lb. ft.)
30 GPM	**RSFE – ABN**	T - 2A	1.38	1 1/8"	2.00	-	45/50
60 GPM	**RSHE – BBN**	T - 17A	1.81	1 1/4"	-	2.47	150/160
120 GPM	**RSJE – BBN**	T - 19A	2.50	1 5/8"	-	3.12	350/375

Performance Curves

RSFE **RSHE** **RSJE**

Pressure Drop Sequenced Open



- Pilot ratio, air to hydraulic 1:20
- Maximum operating pressure = 2000 psi
- Maximum air pressure should not exceed 150 psi.
- Typical response time 10 ms.
- Maximum leakage = RSFE: 3 in^3/min./1000 psi , RSHE: 4 in^3/min./1000 psi, RSJE: 5 in^3/min./1000 psi.

OPTION ORDERING INFORMATION

RS ✶ E – ✶ B ✶

Nominal Capacity

F 30 GPM

H 60 GPM

J 120 GPM

Control

Available for RSFE only

A 1/4" NPTF Pilot Port at end of Cartridge*

Available for RSHE, RSJE only

B SAE-4 Pilot Port at end of Cartridge*

Adjustment Range

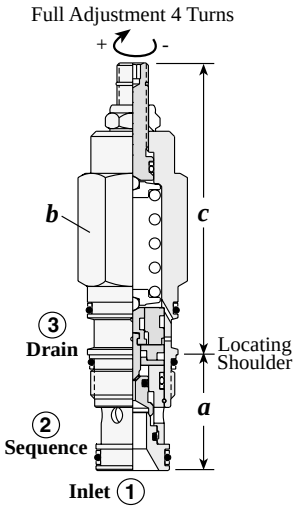
B 50 - 1500 psi

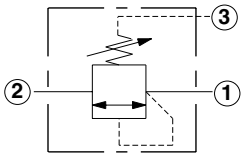
Seal

N Buna-N

V Viton

DIRECT ACTING WITHOUT REVERSE FLOW CHECK



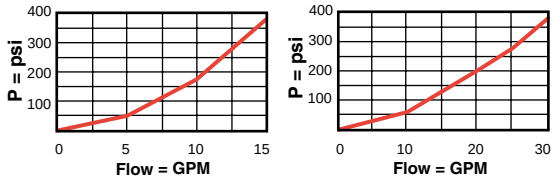


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (lb. ft.)
15 GPM	**SXCA – LAN**	T - 11A	1.38	7/8”	3.09	3.15	30/35
30 GPM	**SXEA – LAN**	T - 2A	1.38	1 1/8”	3.47	3.53	45/50

Performance Curves

SXCA **SXEA**

Pressure Drop Sequenced Open



- Maximum operating pressure = 5000 psi
- Maximum valve leakage at reseat = 10 drops/min.
- Typical response time 2 ms
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi.
- Reseat exceeds 85% of cracking pressure.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

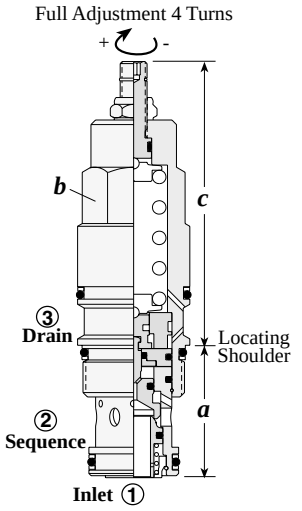
SX ✶ A – ✶ ✶ ✶

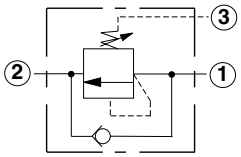
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C 15 GPM	**L** Standard Screw	**A** 500 - 3000 psi	**N** Buna-N
E 30 GPM	**C** Tamper Resistant	**B** 300 - 1500 psi	**V** Viton
		C 2000 - 6000 psi	
		D 200 - 800 psi	
		W 800 - 4500 psi	

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
C Option is standard set at 2000 psi.
D Option is standard set at 400 psi.
Customer may specify pressure setting.

DIRECT ACTING WITH REVERSE FLOW CHECK



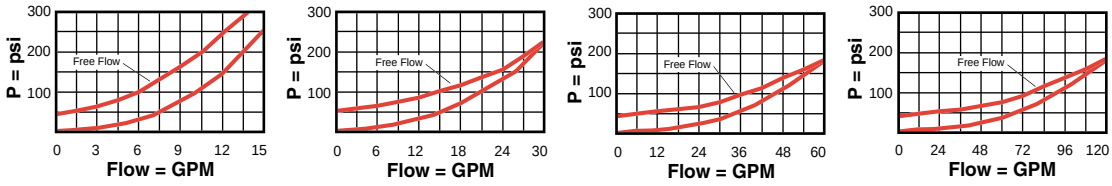


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
15 GPM	**SCCA – LAN**	T - 11A	1.38	7/8”	3.09	3.15	30/35
30 GPM	**SCEA – LAN**	T - 2A	1.38	1 1/8”	3.47	3.53	45/50
60 GPM	**SCGA – LAN**	T - 17A	1.81	1 1/4”	3.94	4.00	150/160
120 GPM	**SCIA – LAN**	T - 19A	2.50	1 5/8”	4.72	4.92	350/375

Performance Curves

SCCA **SCEA** **SCGA** **SCIA**

Free Flow to Pressure Drop Sequenced Open



- Maximum operating pressure = 5000 psi
- Maximum valve leakage at reseat = 10 drops/min.
- Free flow check cracking pressure = 40 psi
- Typical response time 2 ms
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi.
- Reseat exceeds 85% of cracking pressure.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

SC ★ A – ★ ★ ★

Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C 15 GPM	**L** Standard Screw	**A** 500 - 3000 psi	**N** Buna-N
E 30 GPM	**C** Tamper Resistant	**B** 300 - 1500 psi	**V** Viton
G 60 GPM		**C** 2000 - 6000 psi	
I 120 GPM		**D** 200 - 800 psi	
		W 800 - 4500 psi	

*** See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
C Option is standard set at 2000 psi.
D Option is standard set at 400 psi.
Customer may specify pressure setting.

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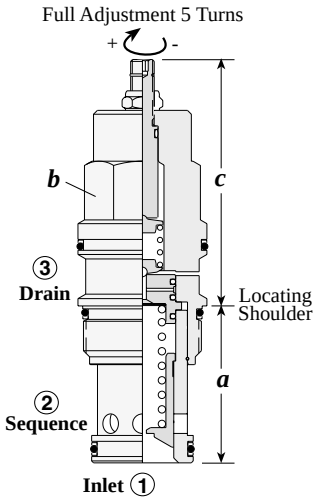
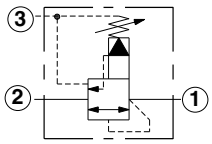
PILOT OPERATED, KICK-DOWN



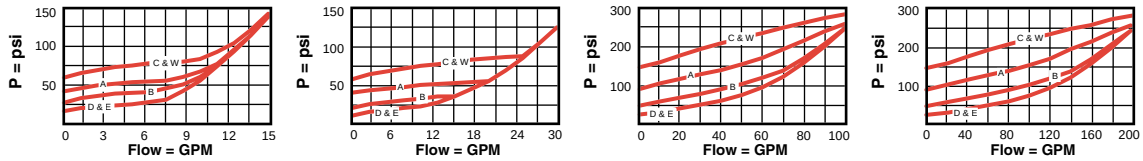


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
15 GPM	**SQDB – LAN**	T - 11A	1.38	7/8”	2.50	2.56	2.75	30/35
30 GPM	**SQFB – LAN**	T - 2A	1.38	1 1/8”	2.81	2.88	3.06	45/50
60 GPM	**SQHB – LAN**	T - 17A	1.81	1 1/4”	3.28	3.31	3.53	150/160
120 GPM	**SQJB – LAN**	T - 19A	2.50	1 5/8”	3.94	4.09	4.19	350/375

Performance Curves

SQDB **SQFB** **SQHB** **SQJB**

Pressure Drop Sequenced Open



- Maximum operating pressure = 5000 psi
- Maximum leakage = SQDB: 2 in^3/min./1000 psi , SQFB: 3 in^3/min./1000 psi , SQHB: 4 in^3/min./1000 psi SQJB: 5 in^3/min./1000 psi
- Typical response time 25 ms
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi.
- To reset valve, flow through the cartridge must cease.

OPTION ORDERING INFORMATION

SQ ★ B – ★ ★ ★

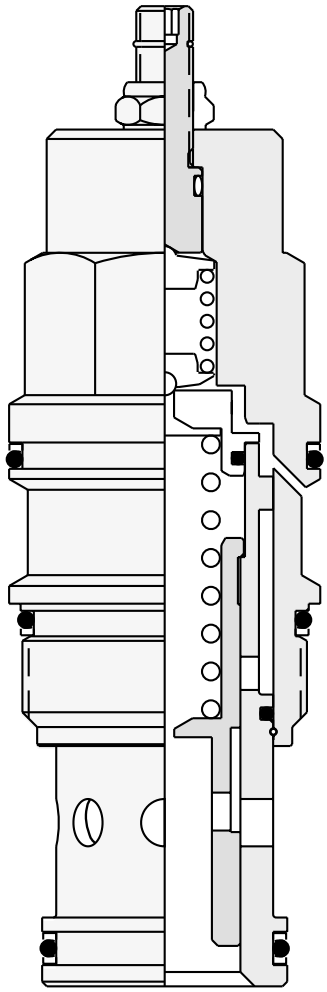
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
D 15 GPM	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
F 30 GPM	**C** Tamper Resistant	**B** 50 - 1500 psi	**V** Viton
H 60 GPM	**K** Handknob	**C** 150 - 6000 psi	
J 120 GPM		**D** 25 - 800 psi	
		E 25 - 400 psi	
		W 150 - 4500 psi	

*** See page 162 for information on Control Options*

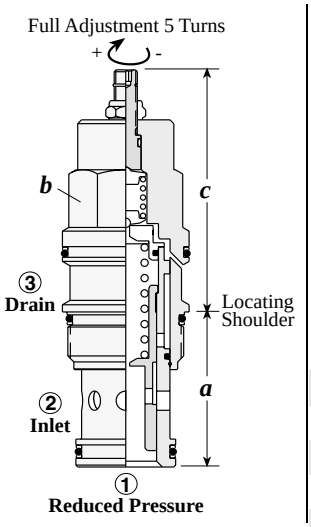
Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
Customer may specify pressure setting.

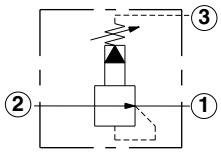
NOTES

Reducing and Reducing/Relieving Cartridge Valves



PILOT OPERATED REDUCING



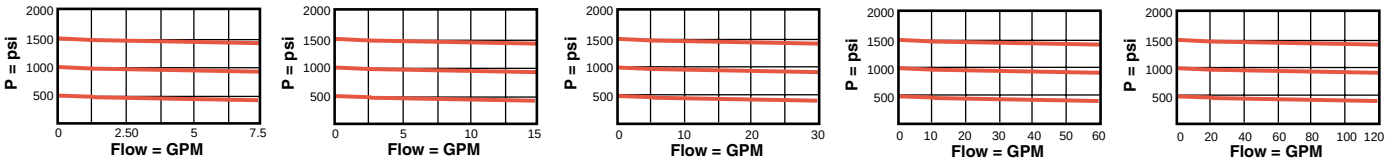


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
5 GPM	**PBBB – LAN**	T - 163A	1.22	3/4"	2.55	2.63	2.77	25/30
10 GPM	**PBDB – LAN**	T - 11A	1.38	7/8"	2.50	2.56	2.75	30/35
20 GPM	**PBFB – LAN**	T - 2A	1.38	1 1/8"	2.81	2.88	3.06	45/50
40 GPM	**PBHB – LAN**	T - 17A	1.81	1 1/4"	3.28	3.31	3.53	150/160
80 GPM	**PBJB – LAN**	T - 19A	2.50	1 5/8"	3.94	4.09	4.19	350/375

Performance Curves

PB*B **PBDB** **PBFB** **PBHB** **PBJB**

Regulated Pressure



- Maximum operating pressure = 5000 psi
- Factory pressure setting established at blocked control port (deadhead)
- Control pilot flow = PBBB, PBDB: 7 to 10 in^3/min., PBFB: 10 to 15 in^3/min., PBHB, PBJB: 15 to 20 in^3/min.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

PB ★ B – ★ ★ ★

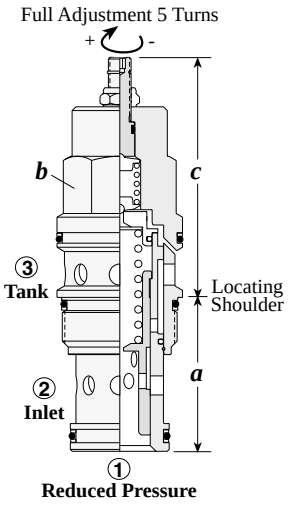
Nominal Capacity		*Control***	*Adjustment Range*		*Seal*	
B	5 GPM*	**L** Standard Screw	**A**	100 - 3000 psi	**N**	Buna-N
D	10 GPM	**C** Tamper Resistant	**B**	50 - 1500 psi	**V**	Viton
F	20 GPM	**K** Handknob	**N**	60 - 800 psi		
H	40 GPM		**Q**	60 - 400 psi		
J	80 GPM		**W**	150 - 4500 psi		

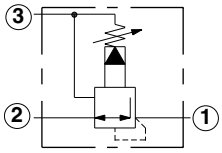
Adjustment Range Options:
All are standard set at 200 psi.
Maximum pressure differentials for spring ranges:
A and B are 3000 psi.
N and Q are 2000 psi.
W is 5000 psi inlet pressure.

** *See page 162 for information on Control Options*

* *Minimum setting 75 psi on all ranges.*
Customer may specify pressure setting.

PILOT OPERATED REDUCING/RELIEVING



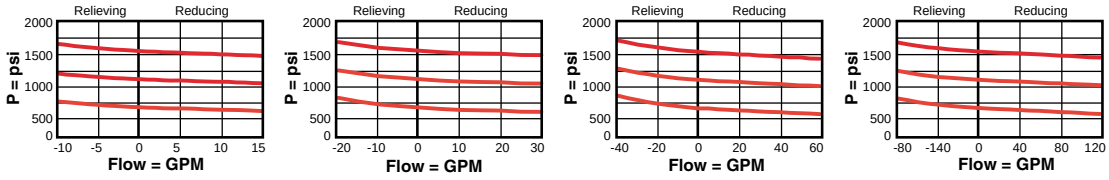


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (lb. ft.)*
10 GPM	**PPDB – LAN**	T - 11A	1.38	7/8”	2.50	2.56	2.75	30/35
20 GPM	**PPFB – LAN**	T - 2A	1.38	1 1/8”	2.81	2.88	3.06	45/50
40 GPM	**PPHB – LAN**	T - 17A	1.81	1 1/4”	3.28	3.31	3.53	150/160
80 GPM	**PPJB – LAN**	T - 19A	2.50	1 5/8”	3.94	4.09	4.19	350/375

Performance Curves

PPDB **PPFB** **PPHB** **PPJB**

Regulated Pressure



- Maximum operating pressure = 5000 psi
- Factory pressure setting established at blocked control port (deadhead)
- Control pilot flow = PPDB: 7 to 10 in^3/min., PPFB: 10 to 15 in^3/min., PPHB, PPJB: 15 to 20 in^3/min.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

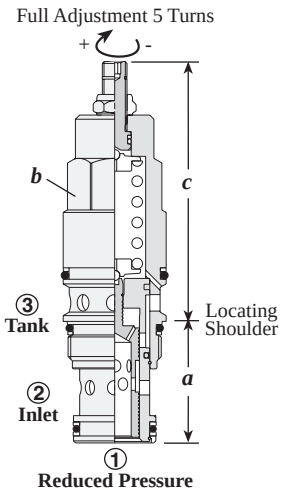
PP ★ B – ★ ★ ★

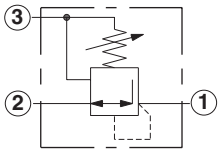
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
D 10 GPM	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
F 20 GPM	**C** Tamper Resistant	**B** 50 -1500 psi	**V** Viton
H 40 GPM	**K** Handknob	**N** 60 - 800 psi	
J 80 GPM		**Q** 60 - 400 psi	
		W 150 - 4500 psi	

Adjustment Range Options:
All are standard set at 200 psi.
Maximum pressure differentials for spring ranges:
A and B are 3000 psi.
N and Q are 2000 psi.
W is 5000 psi inlet pressure.
Customer may specify pressure setting.

** *See page 162 for information on Control Options*

DIRECT ACTING REDUCING/RELIEVING



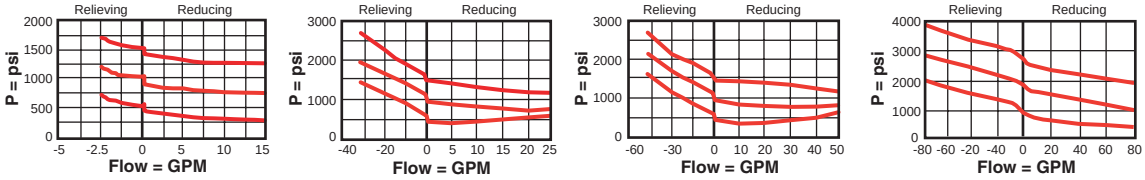


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (lb. ft.)*
10 GPM	**PRDB – LAN**	T - 11A	1.38	7/8”	3.09	3.16	3.34	30/35
20 GPM	**PRFB – LAN**	T - 2A	1.38	1 1/8”	3.47	3.53	3.75	45/50
40 GPM	**PRHB – LAN**	T - 17A	1.81	1 1/4”	3.94	4.00	4.19	150/160
80 GPM	**PRJB – LAN**	T - 19A	2.50	1 5/8”	4.88	5.03	5.12	350/375

Performance Curves

PRDB **PRFB** **PRHB** **PRJB**

Regulated Pressure



- Maximum operating pressure = 5000 psi
- Factory pressure setting established at blocked control port (deadhead)
- Maximum valve leakage = PRDB: 2 in^3/min./1000 psi: PRFB: 3 in^3/min./1000 psi, PRHB: 4 in^3/min./1000 psi, PRJB: 5 in^3/min./1000 psi
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi .
- All spring ranges are capable of operating with 5000 psi inlet pressure.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

PR ★ B – ★ ★ ★

Nominal Capacity

D 10 GPM
F 20 GPM
H 40 GPM
J 80 GPM

Control**

L Standard Screw
C Tamper Resistant
K Handknob

Adjustment Range

A 500 - 3000 psi
B 50 - 1500 psi
D 20 - 800 psi
E 20 - 400 psi
S 20 - 200 psi
W* 750 - 4500 psi

Available for PRFB and PRHB

A 750 - 3000 psi
B 300 - 1500 psi
D 200 - 800 psi
E 100 - 400 psi
S 50 - 200 psi

Seal

N Buna-N
V Viton

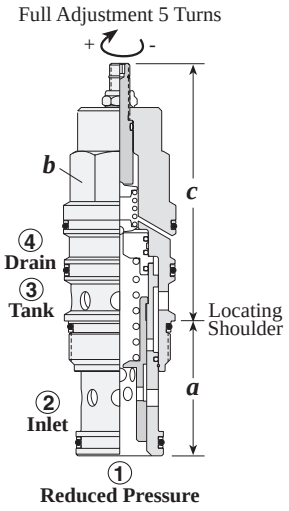
Adjustment Range Options:
PRDB Only:
A is standard set at 1000 psi.
B, D, E, S are standard set at 200 psi.
PRFB, PRHB:
A, W are standard set at 1000 psi.
D is standard set at 400 psi.
E is standard set at 200 psi.
S is standard set at 100 psi.

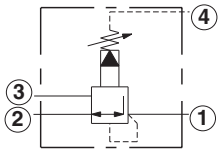
** *See page 162 for information on Control Options*

* *Not available for PRFB, PRHB*
Customer may specify pressure setting.

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

PILOT OPERATED REDUCING/RELIEVING, EXTERNALLY DRAINED



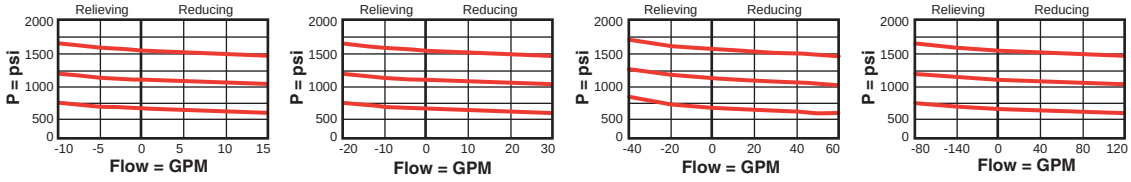


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
10 GPM	**PVDA – LAN**	T - 21A	1.38	7/8”	3.09	3.15	3.34	30/35
20 GPM	**PVFA – LAN**	T - 22A	1.38	1 1/8”	3.44	3.50	3.69	45/50
40 GPM	**PVHA – LAN**	T - 23A	1.81	1 1/4”	3.93	3.99	4.18	150/160
80 GPM	**PVJA – LAN**	T - 24A	2.50	1 5/8”	4.78	4.90	5.03	350/375

Performance Curves

PVDA **PVFA** **PVHA** **PVJA**

Regulated Pressure



- Maximum operating pressure = 5000 psi
- Factory pressure setting established at blocked control port (deadhead)
- Control pilot flow = PVDA: 7 to 10 in^3/min., PVFA: 10 to 15 in^3/min., PVHA, PVJA: 15 to 20 in^3/min.
- Maximum pressure at port 3 should be limited to 3000 psi.
- Pressure on the drain (port 4) is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi.

OPTION ORDERING INFORMATION

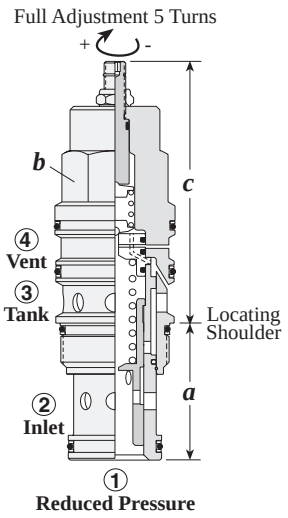
PV ★ A – ★ ★ ★

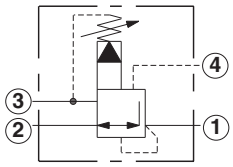
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
D 10 GPM	**L** Standard Screw	**A** 100 - 3000 psi	**N** Buna-N
F 20 GPM	**C** Tamper Resistant	**B** 50 -1500 psi	**V** Viton
H 40 GPM	**K** Handknob	**D** 25 - 800 psi	
J 80 GPM		**E** 25 - 400 psi	
		W 150 - 4500 psi	

***See page 162 for information on Control Options*

Adjustment Range Options:
All are standard set at 200 psi.
Maximum pressure differentials for spring ranges:
A and B are 3000 psi.
D and E are 2000 psi.
W is 5000 psi inlet pressure.
Customer may specify pressure setting.

PILOT OPERATED REDUCING/RELIEVING, VENTABLE



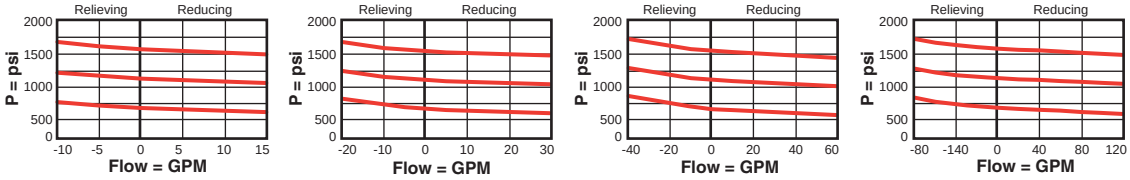


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
10 GPM	**PVDB – LAN**	T - 21A	1.38	7/8”	3.09	3.15	3.34	30/35
20 GPM	**PVFB – LAN**	T - 22A	1.38	1 1/8”	3.44	3.50	3.69	45/50
40 GPM	**PVHB – LAN**	T - 23A	1.81	1 1/4”	3.93	3.99	4.18	150/160
80 GPM	**PVJB – LAN**	T - 24A	2.50	1 5/8”	4.78	4.90	5.03	350/375

Performance Curves

PVDB **PVFB** **PVHB** **PVJB**

Regulated Pressure



- Maximum operating pressure = 5000 psi
- Factory pressure setting established at blocked control port (deadhead)
- Control pilot flow = PVDB: 7 to 10 in^3/min., PVFB: 10 to 15 in^3/min., PVHB, PVJB: 15 to 20 in^3/min.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.
- By controlling the pressure at the vent (port 4), the effective setting of the valve can be controlled below the nominal valve setting.

OPTION ORDERING INFORMATION

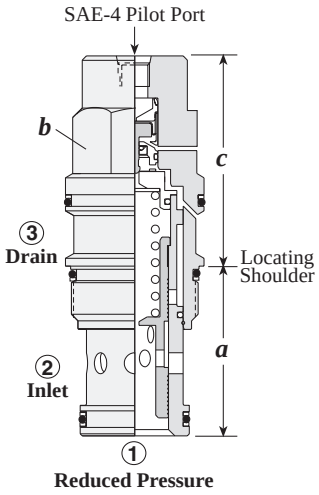
PV ★ B – ★ ★ ★

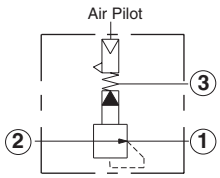
Nominal Capacity		*Control***		*Adjustment Range*		*Seal*	
D	10 GPM	**L**	Standard Screw	**A**	100 - 3000 psi	**N**	Buna-N
F	20 GPM	**C**	Tamper Resistant	**B**	50 -1500 psi	**V**	Viton
H	40 GPM	**K**	Handknob	**D**	25 - 800 psi		
J	80 GPM			**E**	25 - 400 psi		
				W	150 - 4500 psi		

** *See page 162 for information on Control Options*

Adjustment Range Options:
All are standard set at 200 psi.
Maximum pressure differentials for spring ranges:
A and B are 3000 psi.
D and E are 2000 psi.
W is 5000 psi inlet pressure.
Customer may specify pressure setting.

AIR CONTROLLED, PILOT OPERATED REDUCING



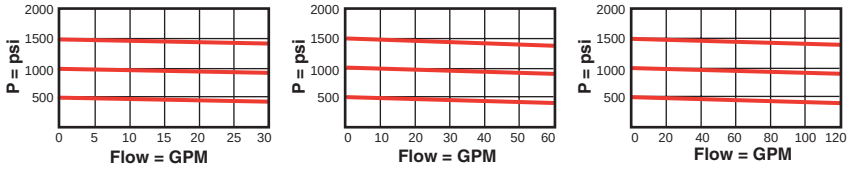


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c A	c B	Installation Torque (lb. ft.)
20 GPM	**PBFC – ABN**	T - 2A	1.38	1 1/8"	2.01	-	45/50
40 GPM	**PBHC – BBN**	T - 17A	1.81	1 1/4"	-	2.48	150/160
80 GPM	**PBJC – BBN**	T - 19A	2.50	1 5/8"	-	3.11	350/375

Performance Curves

PBFC **PBHC** **PBJC**

Regulated Pressure



- Pilot ratio, air to hydraulic 1:20
- Maximum operating pressure = 2000 psi
- Maximum air pressure should not exceed 150 psi.
- Control pilot flow = PBFC: 10 to 15 in^3/min., PBHC, PBJC: 15 to 20 in^3/min.
- Maximum pressure differential, inlet to outlet = 3000 psi.
- The pressure at port 3 determines the minimum valve setting and should not exceed 1000 psi.

OPTION ORDERING INFORMATION

PB ✶ C – ✶ ✶ ✶

Nominal Capacity

F 20 GPM
H 40 GPM
J 80 GPM

Control

Available in PBFC only

A 1/4" NPTF Pilot Port at end of Cartridge

Available for PBHC, PBJC only

B SAE-4 Pilot Port at end of Cartridge

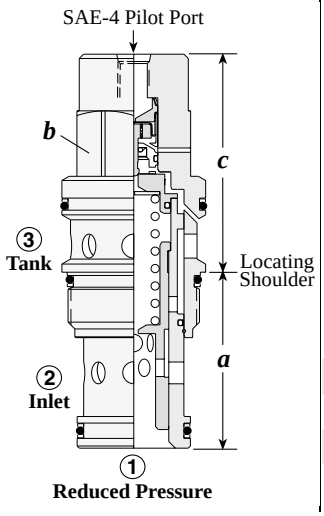
Adjustment Range

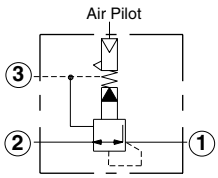
B 50 - 1500 psi

Seal

N Buna-N
V Viton

AIR CONTROLLED, PILOT OPERATED REDUCING/RELIEVING



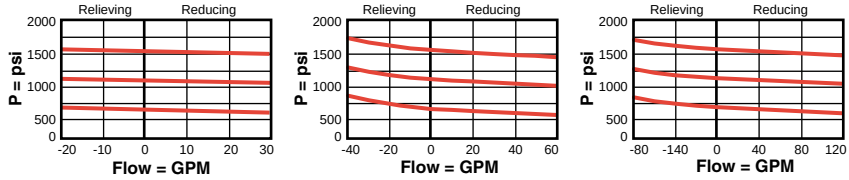


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c A	c B	Installation Torque (lb. ft.)
20 GPM	**PPFC – ABN**	T - 2A	1.38	1 1/8”	2.24	-	45/50
40 GPM	**PPHC – BBN**	T - 17A	1.81	1 1/4”	-	2.48	150/160
80 GPM	**PPJC – BBN**	T - 19A	2.50	1 5/8”	-	3.11	350/375

Performance Curves

PPFC **PPHC** **PPJC**

Regulated Pressure



- Pilot ratio, air to hydraulic 1:20
- Maximum operating pressure = 2000 psi
- Maximum air pressure should not exceed 150 psi.
- Control pilot flow = PPFC: 10 to 15 in^3/min., PPHC, PPJC: 15 to 20 in^3/min.
- Maximum pressure differential, inlet to outlet = 3000 psi.
- The pressure at port 3 determines the minimum valve setting and should not exceed 1000 psi

OPTION ORDERING INFORMATION

PP ★ C – ★ ★ ★

Nominal Capacity

F 20 GPM

H 40 GPM

J 80 GPM

Control

Available in PPFC only

A 1/4" NPTF Pilot Port at end of Cartridge

Available for PPHC, PPJC only

B SAE-4 Pilot Port at end of Cartridge

Adjustment Range

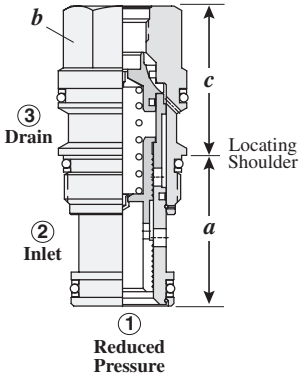
B 50 - 1500 psi

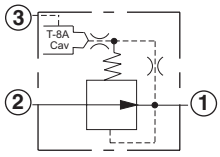
Seal

N Buna-N

V Viton

MODULATING ELEMENT WITH INTEGRAL PILOT CONTROL CAVITY





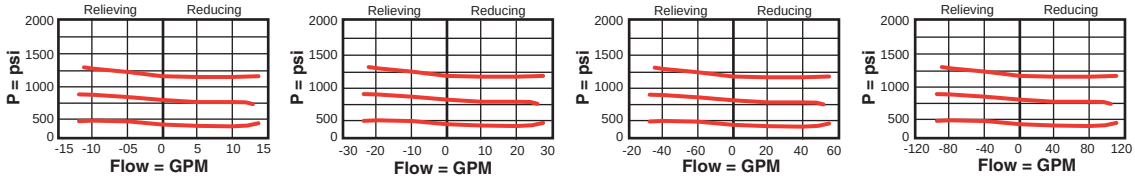
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
10 GPM	**PBDB – 8WN**	T - 11A	1.38	7/8	1.19	30/35
20 GPM	**PBFB – 8WN**	T - 2A	1.38	1 1/8	1.38	45/50
40 GPM	**PBHB – 8WN**	T - 17A	1.81	1 1/4	1.81	150/160
80 GPM	**PBJB – 8WN**	T - 19A	2.50	1 5/8	2.31	350/375

Performance Curves

PBDB-8 **PBFB-8** **PBHB-8** **PBJB-8**

Regulated Pressure with T-8A Pilot Stage Installed



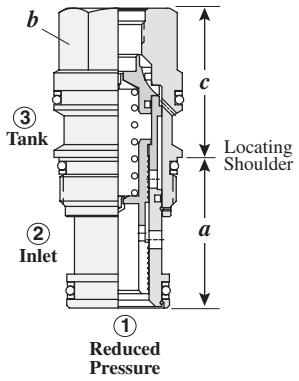
- Maximum operating pressure = 5000 psi
- Control pilot flow = PBDB-8: 7 to 10 in^3/min., PBFB-8: 10 to 15 in^3/min., PBHB-8, PBJB-8: 15 to 20 in^3/min.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.
- Maximum inlet pressure is determined by the bias spring. The D spring is limited to 2000 psi maximum differential pressure and the W spring is limited to 5000 psi maximum inlet pressure.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

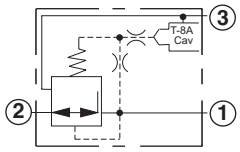
OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

PB ★ B – 8 ★ ★

Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal*
D 10 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**D** 25 psi	**N** Buna-N
F 20 GPM		**W** 100 psi	**V** Viton
H 40 GPM			
J 80 GPM			

3-WAY, MODULATING ELEMENT WITH INTEGRAL PILOT CONTROL CAVITY





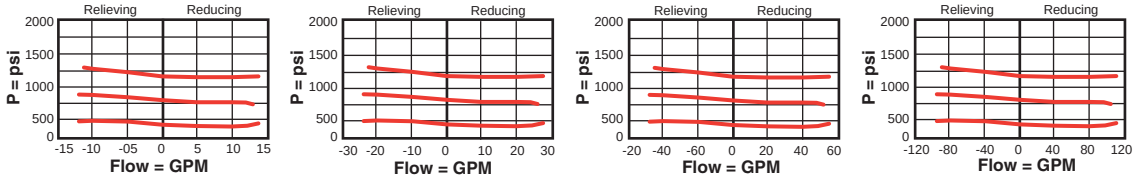
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
10 GPM	**PPDB – 8WN**	T - 11A	1.38	7/8	1.19	30/35
20 GPM	**PPFB – 8WN**	T - 2A	1.38	1 1/8	1.38	45/50
40 GPM	**PPHB – 8WN**	T - 17A	1.81	1 1/4	1.81	150/160
80 GPM	**PPJB – 8WN**	T - 19A	2.50	1 5/8	2.31	350/375

Performance Curves

PPDB-8 **PPFB-8** **PPHB-8** **PPJB-8**

Regulated Pressure with T-8A Pilot Stage Installed



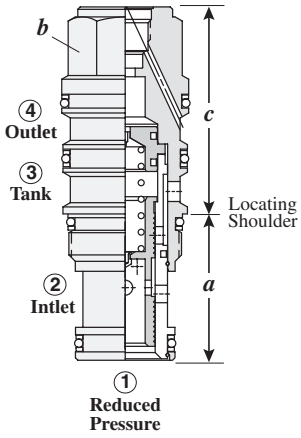
- Maximum operating pressure = 5000 psi.
- Control pilot flow = PPDB-8: 7 to 10 in^3/min., PPFB-8: 10 to 15 in^3/min., PPHB-8, PPJB-8: 15 to 20 in^3/min.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.
- Maximum inlet pressure is determined by the bias spring. The D spring is limited to 2000 psi maximum differential pressure and the W spring is limited to 5000 psi maximum inlet pressure.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

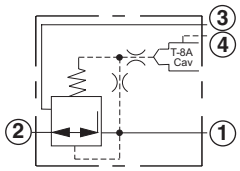
OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

PP ★ B – 8 ★ ★

Nominal Capacity	*Control*	*MinimumControl Pressure*	*Seal*
D 10 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**D** 25 psi	**N** Buna-N
F 20 GPM		**W** 100 psi	**V** Viton
H 40 GPM			
J 80 GPM			

3-WAY, EXTERNALLY DRAINED, MODULATING ELEMENT WITH INTEGRAL PILOT CONTROL CAVITY





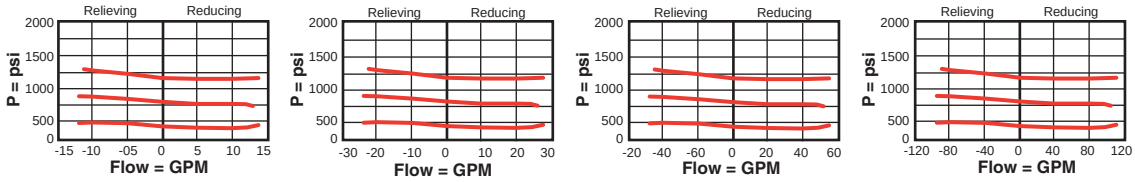
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
10 GPM	**PVDA – 8WN**	T - 21A	1.38	7/8	1.78	30/35
20 GPM	**PVFA – 8WN**	T - 22A	1.38	1 1/8	2.00	45/50
40 GPM	**PVHA – 8WN**	T - 23A	1.81	1 1/4	2.59	150/160
80 GPM	**PVJA – 8WN**	T - 24A	2.50	1 5/8	3.16	350/375

Performance Curves

PVDA-8 **PVFA-8** **PVHA-8** **PVJA-8**

Regulated Pressure with T-8A Pilot Stage Installed



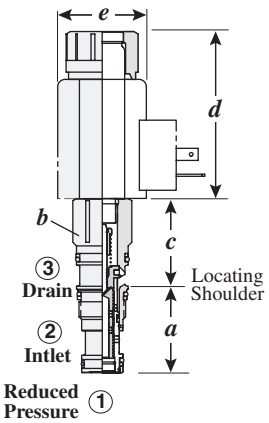
- Maximum operating pressure = 5000 psi
- Control pilot flow = PVDA-8: 7 to 10 in^3/min., PVFA-8: 10 to 15 in^3/min., PVHA-8, PVJA-8: 15 to 20 in^3/min.
- Maximum pressure at port 3 should be limited to 3000 psi.
- Pressure on the drain (port 4) is directly additive to the valve setting at a 1:1 ratio and should not exceed 5000 psi.
- Maximum inlet pressure is determined by the bias spring. The D spring is limited to 2000 psi maximum differential pressure and the W spring is limited to 5000 psi maximum inlet pressure.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

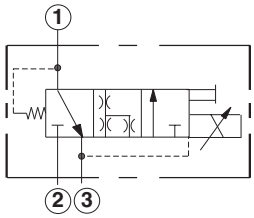
OPTION ORDERING INFORMATION

PV ★ A – 8 ★ ★

Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal*
D 10 GPM	**8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**D** 25 psi	**N** Buna-N
F 20 GPM		**W** 100 psi	**V** Viton
H 40 GPM			
J 80 GPM			

ELECTRO-PROPORTIONAL, DIRECT ACTING REDUCING/RELIEVING

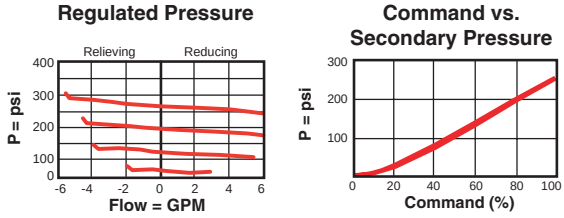




Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (lb. ft.)*
			a	*b*	*c*	*d*	*e (dia.)*	
5 GPM	**PRDL - MDN**	T-11A	1.38	7/8”	1.50	2.76	1.47	30/35

Performance Curves

PRDL



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 20 in³/min. at deadhead.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.

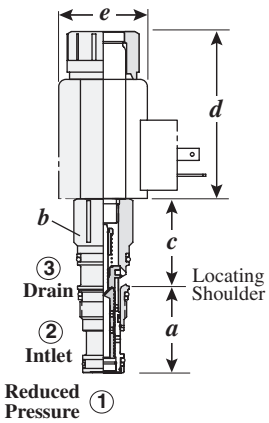
OPTION ORDERING INFORMATION

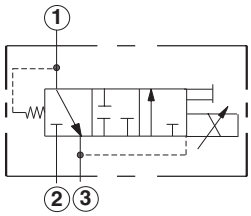
PR D L – M D N

Nominal Capacity	*Control*	*Operating Range*	*Seal*
L 5 GPM	**M** Manual Override (Standard)	**D** 50 - 500 psi	**N** Buna-N
		E 25 - 250 psi	**V** Viton
		S 10 - 100 psi	

NOTE: Coil must be ordered separately. Use 12V DC or 24V DC (Series 770-*) coils only. See page 167.**

ELECTRO-PROPORTIONAL, DIRECT ACTING WITH LOW LEAKAGE

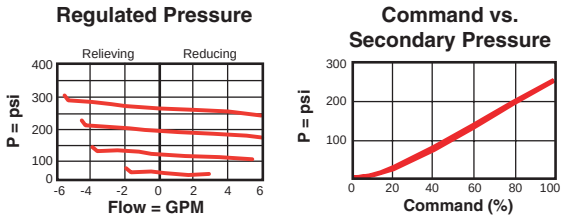




Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	e (dia.)	Installation Torque (lb. ft.)
5 GPM	**PRDP - MDN**	T-11A	1.38	7/8”	1.50	2.76	1.47	30/35

Performance Curves

PRDP



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 2 in³/min. at deadhead.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 3000 psi.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

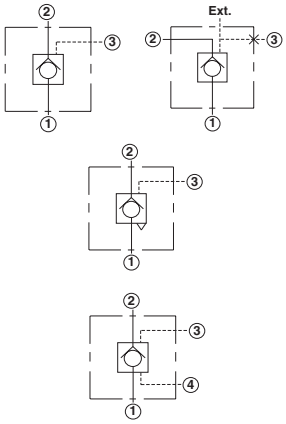
PR D P – M D N

Nominal Capacity	*Control*	*Operating Range*	*Seal*
P 5 GPM	**M** Manual Override (Standard)	**D** 50 - 500 psi	**N** Buna-N
		E 25 - 250 psi	**V** Viton

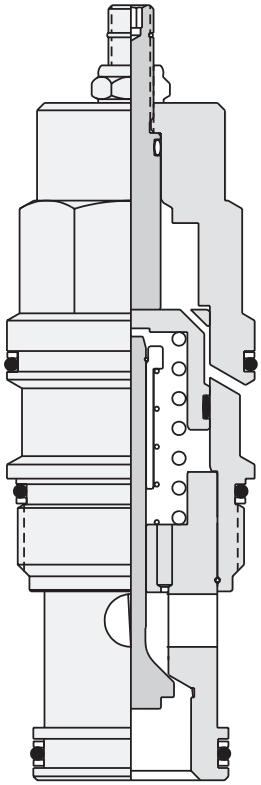
NOTE: Coil must be ordered separately. Use 12V DC or 24V DC (Series 770-*) coils only. See page 167.**

NOTES

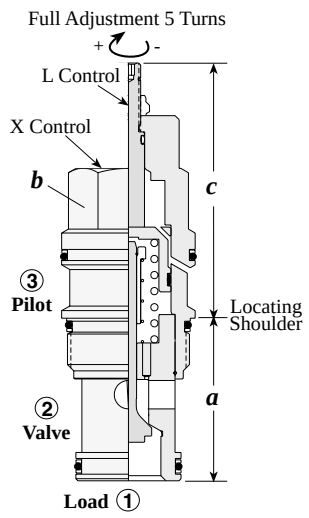
Pilot Operated Check Cartridge Valves

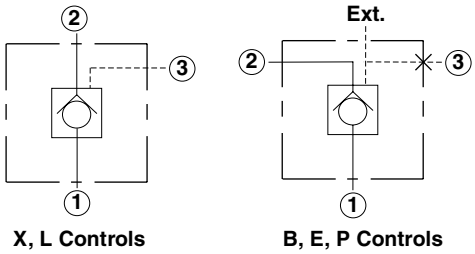


Cartridge Type	*Page*
Pilot Operated	44
Atmospherically Referenced, 3 Port Cavity	45
Vented, 4 Port Cavity	46



PILOT OPERATED



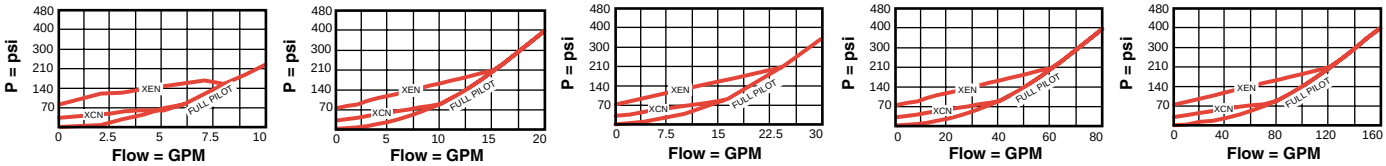


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X,B,E,P	*c* L	*Installation Torque lb. ft.*
7.5 GPM	**CKBB – XCN**	T - 163A	1.22	3/4"	1.25	1.76	25/30
15 GPM	**CKCB – XCN**	T - 11A	1.38	7/8"	1.19	2.50	30/35
30 GPM	**CKEB – XCN**	T - 2A	1.38	1 1/8"	1.38	2.81	45/50
60 GPM	**CKGB – XCN**	T - 17A	1.81	1 1/4"	1.81	3.28	150/160
120 GPM	**CKIB – XCN**	T - 19A	2.50	1 5/8"	2.31	3.94	350/375

Performance Curves

CKB* **CKC*** **CKE*** **CKG*** **CKI***

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 drop/min.
- CKBB, CKBD available only with 30 psi or 75 psi check valve cracking pressures.
- CK*D has sealed pilot for use in circuits where cross port leakage is undesirable.
- CK*B has unsealed pilot to allow air trapped in the pilot line to be purged from the circuit.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

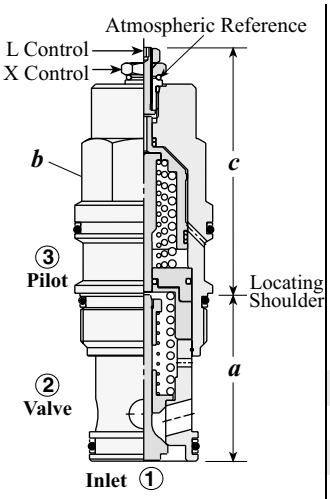
CK ✶ ✶ – ✶ ✶ ✶

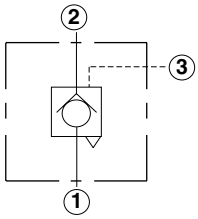
Nominal Capacity	*Version*	*Control***	*Cracking Pressure*	*Seal*
B* 7.5 GPM	**B** Bleed through Pilot	**X** Standard Pilot	**A** 4 psi	**N** Buna-N
C 15 GPM	**D** Sealed Pilot Piston	**L** Manual Load Release	**B** 15 psi	**V** Viton
E 30 GPM		**B** 1/4" BSPP External Pilot Port 3 blocked	**C** 30 psi	
G 60 GPM		**E** SAE-4 External Pilot Port 3 blocked	**D** 50 psi	
I 120 GPM		**P** 1/4" NPTF External Pilot Port 3 blocked	**E** 75 psi	
			F 100 psi	

** *See page 162 for information on Control Options*

* *CKBB, CKBD available with C and E Cracking Pressures Only.*

ATMOSPHERICALLY REFERENCED, 3 PORT CAVITY



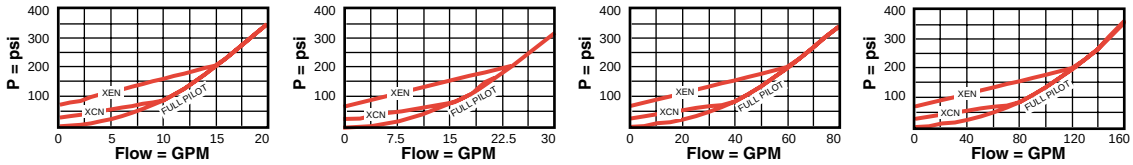


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (lb. ft.)*
			a	*b*	*c*			
					X	L	S	
15 GPM	**CKCV – XCN**	T - 11A	1.38	7/8”	1.99	2.24	1.68	30/35
30 GPM	**CKEV – XCN**	T - 2A	1.38	1 1/8”	2.31	2.56	2.0	45/50
60 GPM	**CKGV – XCN**	T - 17A	1.81	1 1/4”	2.78	3.02	2.47	150/160
120 GPM	**CKIV – XCN**	T - 19A	2.50	1 5/8”	3.30	3.77	-	350/375

Performance Curves

CKCV **CKEV** **CKGV** **CKIV**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 drop/min.
- Approximately 1 drop of fluid will pass from the pilot area to the vented spring chamber every 4000 cycles.

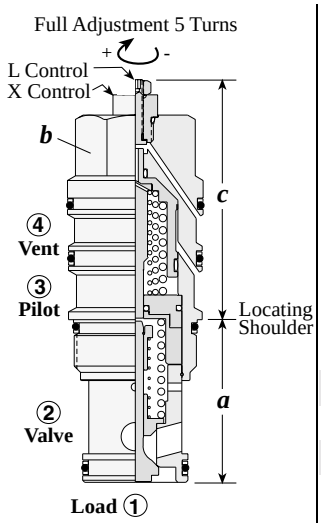
OPTION ORDERING INFORMATION

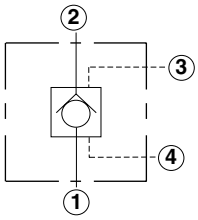
CK ✶ V – ✶ ✶ ✶

Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
C 15 GPM	**X** Standard Pilot	**A** 4 psi	**N** Buna-N
E 30 GPM	**S** External SAE-4 Vent Port	**B** 15 psi	**V** Viton
G 60 GPM	**L** Manual Load Release External Vent	**C** 30 psi	
I 120 GPM		**D** 50 psi	
		E 75 psi	
		F 100 psi	

*** See page 162 for information on Control Options*

VENTED, 4 PORT CAVITY



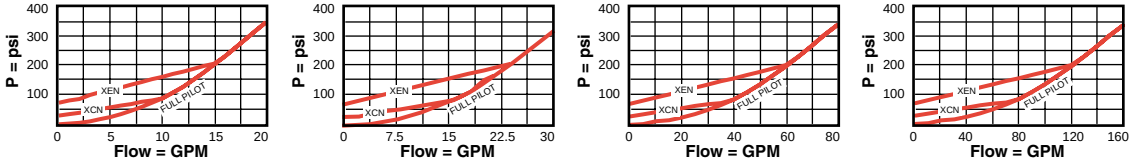


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X	*c* L	*Installation Torque (lb. ft.)*
15 GPM	**CVCV – XCN**	T - 21A	1.38	7/8”	2.11	2.34	30/35
30 GPM	**CVEV – XCN**	T - 22A	1.38	1 1/8”	2.34	2.56	45/50
60 GPM	**CVGV – XCN**	T - 23A	1.81	1 1/4”	2.81	3.03	150/160
120 GPM	**CVIV – XCN**	T - 24A	2.50	1 5/8”	3.50	3.77	350/375

Performance Curves

CVCV **CVEV** **CVGV** **CVIV**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 drop/min.
- Port 4 (vent) should never be blocked as seal weepage will eventually cause valve to malfunction.
- Will accept pressure at port 4 (vent) but cannot exceed 5000 psi.

OPTION ORDERING INFORMATION

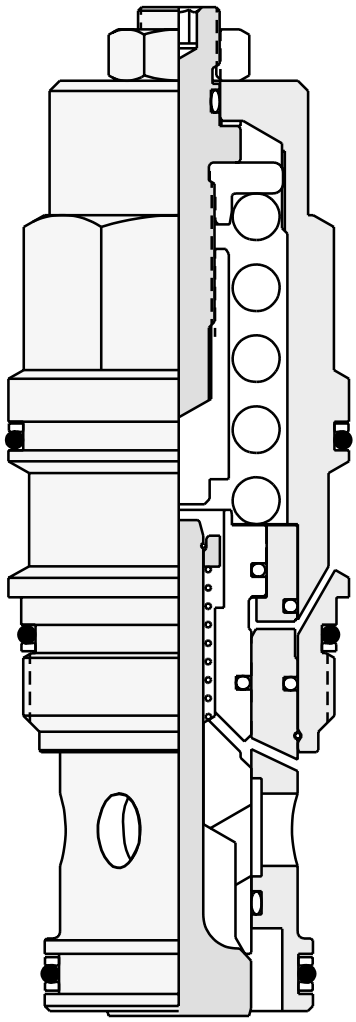
Model Codes printed in Red are Preferred Versions and most readily available

CV ✶ V – ✶ ✶ ✶

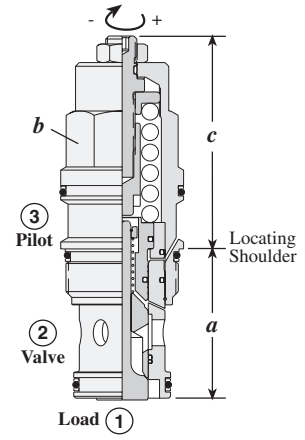
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C 15 GPM	**X** Standard Pilot	**A** 4 psi	**N** Buna-N
E 30 GPM	**L** Manual Load Release	**B** 15 psi	**V** Viton
G 60 GPM		**C** 30 psi	
I 120 GPM		**D** 50 psi	
		E 75 psi	
		F 100 psi	

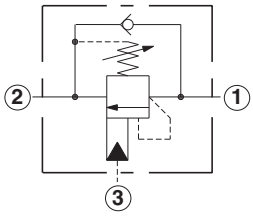
** *See page 162 for information on Control Options*

Counterbalance Cartridge Valves



STANDARD, 4000 PSI MAXIMUM SETTING



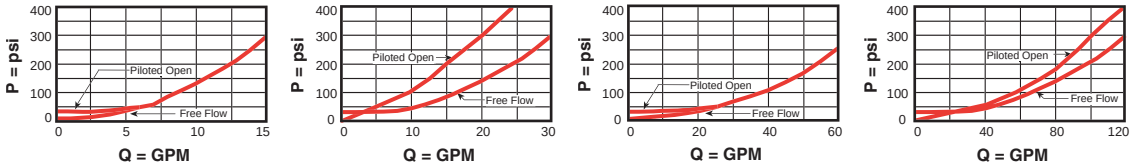


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (lb. ft.)
15 GPM	**CBCA – LHN**	T - 11A	1.38	7/8”	1.97	2.19	30/35
30 GPM	**CBEA – LHN**	T - 2A	1.38	1 1/8”	2.38	2.50	45/50
60 GPM	**CBGA – LHN**	T - 17A	1.81	1 1/4”	2.75	3.31	150/160
120 GPM	**CBIA – LHN**	T - 19A	2.50	1 5/8”	3.50	4.09	350/375

Performance Curves

CBC* **CBE*** **CBG*** **CBI***

Free Flow and Pilot Open Pressure Drop



- Load holding to 3000 psi with 4000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

CB ✶ ✶ – ✶ ✶ ✶

Nominal Capacity

C 15 GPM

E 30 GPM

G 60 GPM

I 120 GPM

Version

A 3:1 Pilot Ratio

B 1.5:1 Pilot Ratio (with sealed pilot)

Y 2:1 Pilot Ratio (with Bleed through Pilot)

Control**

L Standard Screw

C Tamper Resistant

*** See page 162 for information on Control Options*

Cracking Pressure

25 psi Check Spring

H 1000 - 4000 psi

I 400 - 1500 psi

4 psi Check Spring

A 1000 - 4000 psi

B 400 - 1500 psi

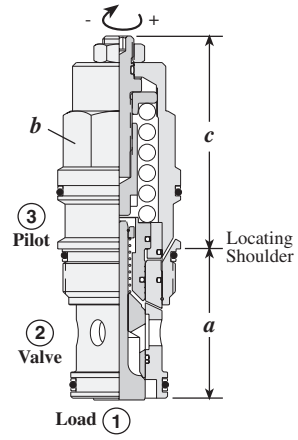
Adjustment Range Options:
A and H are standard set at 3000 psi.
I and B are standard set at 1000 psi.
Customer may specify setting.

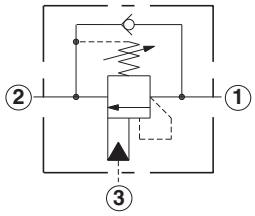
Seal

N Buna-N

V Viton

STANDARD, 5000 PSI MAXIMUM SETTING



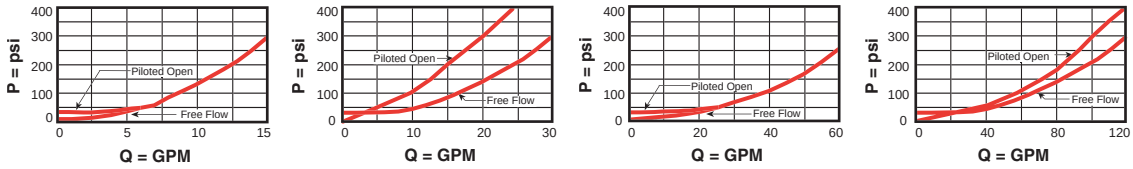


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
15 GPM	**CBCG – LJN**	T - 11A	1.38	7/8"	1.97	2.19	30/35
30 GPM	**CBEG – LJN**	T - 2A	1.38	1 1/8"	2.38	2.50	45/50
60 GPM	**CBGG – LJN**	T - 17A	1.81	1 1/4"	2.75	3.31	150/160
120 GPM	**CBIG – LJN**	T - 19A	2.50	1 5/8"	3.50	4.09	350/375

Performance Curves

CBC* **CBE*** **CBG*** **CBI***

Free Flow and Pilot Open Pressure Drop



- Load holding to 3850 psi with 5000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

CB ★ ★ – ★ ★ ★

Nominal Capacity

- **C** 15 GPM
- **E** 30 GPM
- **G** 60 GPM
- **I** 120 GPM

Version

- **G** 4.5:1 Pilot Ratio
- **H** 10:1 Pilot Ratio
- **L** 2.3:1 Pilot Ratio (with sealed pilot)

Control**

- **L** Standard Screw
- **C** Tamper Resistant

Cracking Pressure

25 psi Check Spring

- **J** 2000 - 5000 psi
- **K** 1000 - 2500 psi

4 psi Check Spring

- **C** 2000 - 5000 psi
- **D** 1000 - 2500 psi

Seal

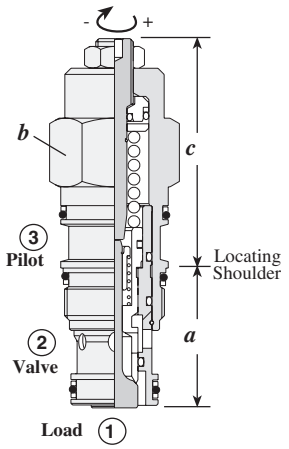
- **N** Buna-N
- **V** Viton

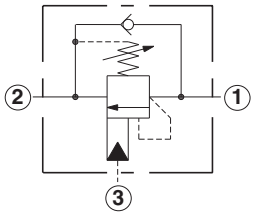
** *See page 162 for information on Control Options*

Adjustment Range Options:
J and C are standard set at 3000 psi.
K and D are standard set at 2000 psi.
Customer may specify setting.

SEMI-RESTRICTIVE, 4000 PSI MAXIMUM SETTING

Turn screw clockwise to reduce setting and release load.
Complete Adjustment 3 3/4 Turns



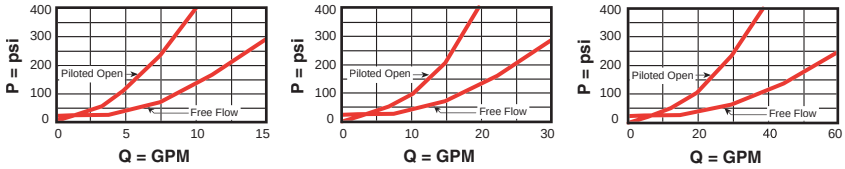


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
10 GPM	**CBBC – LHN**	T - 11A	1.38	7/8”	1.97	2.19	30/35
20 GPM	**CBDC – LHN**	T - 2A	1.38	1 1/8”	2.38	2.50	45/50
40 GPM	**CBFC – LHN**	T - 17A	1.81	1 1/4”	2.75	3.31	150/160

Performance Curves

CBB* **CBD*** **CBF***

Free Flow and Pilot Open Pressure Drop



- Load holding to 3000 psi with 4000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in^3/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

CB ✶ ✶ – ✶ ✶ ✶

Nominal Capacity

B 10 GPM
D 20 GPM
F 40 GPM

Version

B 1.5:1 Pilot Ratio (with sealed pilot)
C 3:1 Pilot Ratio (with sealed pilot)

Control**

L Standard Screw
C Tamper Resistant

Cracking Pressure

25 psi Check Spring

H 1000 - 4000 psi
I 400 - 1500 psi

4 psi Check Spring

A 1000 - 4000 psi
B 400 - 1500 psi

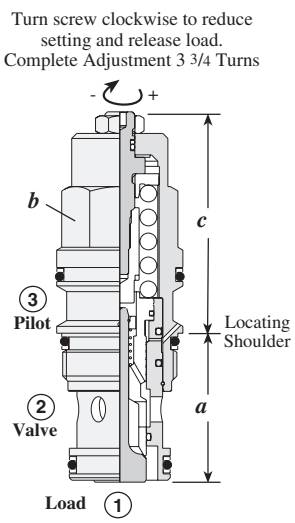
Adjustment Range Options:
A and H are standard set at 3000 psi.
I and B are standard set at 1000 psi.
Customer may specify setting.

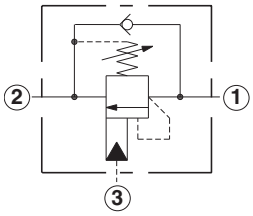
Seal

N Buna-N
V Viton

** *See page 162 for information on Control Options*

SEMI-RESTRICTIVE, 5000 PSI MAXIMUM SETTING



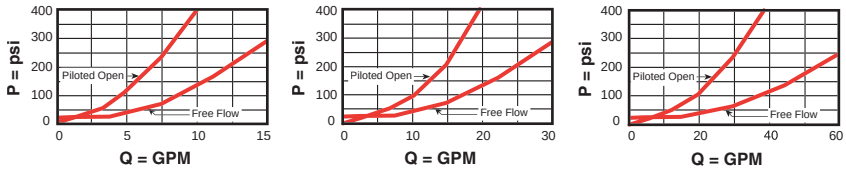


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
10 GPM	**CBBD – LJN**	T - 11A	1.38	7/8”	1.97	2.19	30/35
20 GPM	**CBDD – LJN**	T - 2A	1.38	1 1/8”	2.38	2.50	45/50
40 GPM	**CBFD – LJN**	T - 17A	1.81	1 1/4”	2.75	3.31	150/160

Performance Curves

CBB* **CBD*** **CBF***

Free Flow and Pilot Open Pressure Drop



- Load holding to 3850 psi with 5000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in^3/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

CB ★ ★ – ★ ★ ★

Nominal Capacity

- **B** 10 GPM
- **D** 20 GPM
- **F** 40 GPM

Version

- **D** 4.5:1 Pilot Ratio (with sealed pilot)
- **L** 2.3:1 Pilot Ratio (with sealed pilot)

Control**

- **L** Standard Screw
- **C** Tamper Resistant

Cracking Pressure

25 psi Check Spring

- **J** 2000 - 5000 psi
- **K** 1000 - 2500 psi

4 psi Check Spring

- **C** 2000 - 5000 psi
- **D** 1000 - 2500 psi

Adjustment Range Options:
J and C are standard set at 3000 psi.
K and D are standard set at 2000 psi.
Customer may specify setting.

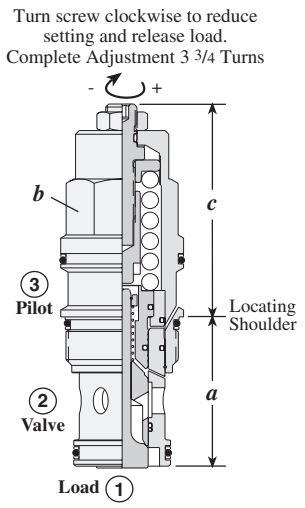
Seal

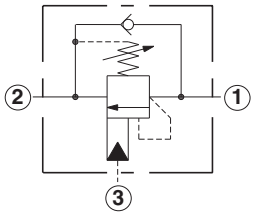
- **N** Buna-N
- **V** Viton

** *See page 162 for information on Control Options*

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

RESTRICTIVE, 4000 PSI MAXIMUM SETTING



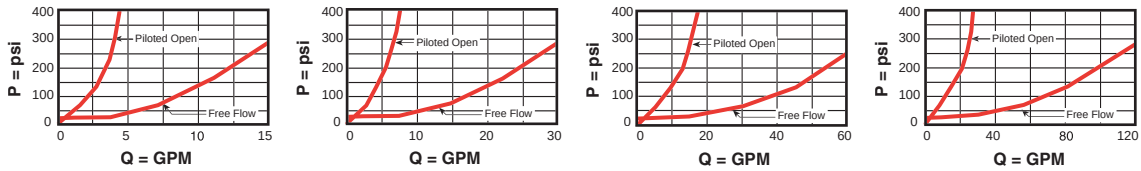


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (lb. ft.)
5 GPM	**CBBA – LHN**	T - 11A	1.38	7/8”	1.97	2.19	30/35
8 GPM	**CBDA – LHN**	T - 2A	1.38	1 1/8”	2.38	2.50	45/50
15 GPM	**CBFA – LHN**	T - 17A	1.81	1 1/4”	2.74	3.31	150/160
20 GPM	**CBHA – LHN**	T - 19A	2.50	1 5/8”	3.50	4.09	350/375

Performance Curves

CBB* **CBD*** **CBF*** **CBH***

Free Flow and Pilot Open Pressure Drop



- Restrictive valves have no relief capacity other than as a thermal relief.
- Load holding to 3075 psi with 4000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.

OPTION ORDERING INFORMATION

CB ★ ★ – ★ ★ ★

Nominal Capacity

B 5 GPM

D 8 GPM

F 15 GPM

H 20 GPM

Version

A 3:1 Pilot Ratio (with sealed pilot)

Available in CBBY only

Y 2:1 Pilot Ratio (with Bleed through Pilot)

Control**

L Standard Screw

C Tamper Resistant

*** See page 162 for information on Control Options*

Cracking Pressure

25 psi Check Spring

H 1000 - 4000 psi

I 400 - 1500 psi

4 psi Check Spring

A 1000 - 4000 psi

B 400 - 1500 psi

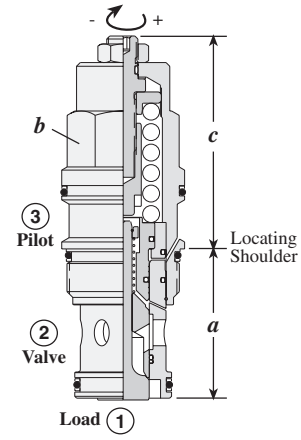
Adjustment Range Options:
A and H are standard set at 3000 psi.
I and B are standard set at 1000 psi.
Customer may specify setting.

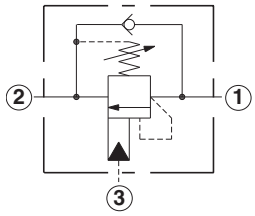
Seal

N Buna-N

V Viton

RESTRICTIVE, 5000 PSI MAXIMUM SETTING



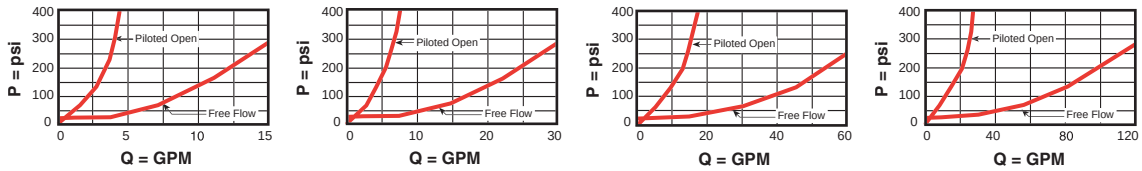


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
5 GPM	**CBBG – LJN**	T - 11A	1.38	7/8"	1.97	2.19	30/35
8 GPM	**CBDG – LJN**	T - 2A	1.38	1 1/8"	2.38	2.50	45/50
15 GPM	**CBFG – LJN**	T - 17A	1.81	1 1/4"	2.75	3.31	150/160
20 GPM	**CBHG – LJN**	T - 19A	2.50	1 5/8"	3.50	4.09	350/375

Performance Curves

CBB* **CBD*** **CBF*** **CBH***

Free Flow and Pilot Open Pressure Drop



- Restrictive valves have no relief capacity other than as a thermal relief.
- Load holding to 3850 psi with 5000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.

OPTION ORDERING INFORMATION

CB ★ ★ – ★ ★ ★

Nominal Capacity

B 5 GPM
D 8 GPM
F 15 GPM
H 20 GPM

Version

G 4.5:1 Pilot Ratio (with sealed pilot)

Control**

L Standard Screw
C Tamper Resistant

Cracking Pressure

25 psi Check Spring

J 2000 - 5000 psi
K 1000 - 2500 psi

4 psi Check Spring

C 2000 - 5000 psi
D 1000 - 2500 psi

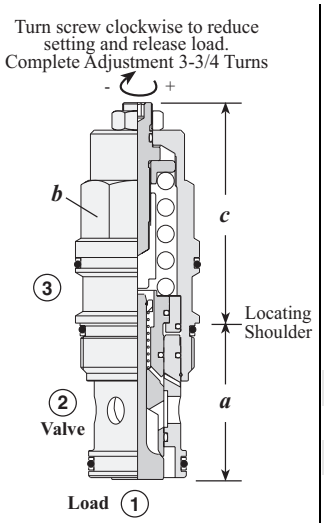
Seal

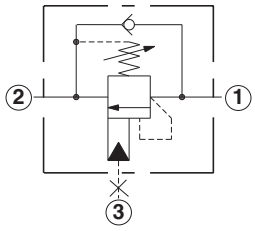
N Buna-N
V Viton

** *See page 162 for information on Control Options*

Adjustment Range Options:
J and C are standard set at 3000 psi.
K and D are standard set at 2000 psi.
Customer may specify setting.

WITHOUT PILOT ASSIST, 3 PORT CAVITY



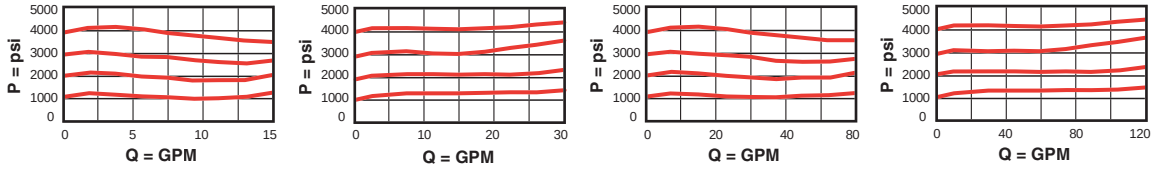


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (lb. ft.)
15 GPM	**CCCA – LAN**	T - 11A	1.38	7/8”	1.97	2.19	30/35
30 GPM	**CCEA – LAN**	T - 2A	1.38	1 1/8”	2.38	2.50	45/50
60 GPM	**CCGA – LAN**	T - 17A	1.81	1 1/4”	2.74	3.31	150/160
120 GPM	**CCIA – LAN**	T - 19A	2.50	1 5/8”	3.52	4.09	350/375

Performance Curves

CCCA **CCEA** **CCGA** **CCIA**

Typical Relief Characteristics



- Maximum operating pressure = 4000 psi
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Back pressure at port 2 is directly additive to the relief setting of the valve.

OPTION ORDERING INFORMATION

CC ✶ A – ✶ ✶ ✶

Nominal Capacity

C 15 GPM
E 30 GPM
G 60 GPM
I 120 GPM

Version

A Standard

Control**

L Standard Screw
C Tamper Resistant

Cracking Pressure

25 psi Check Spring

H 1000 - 4000 psi
I 400 - 1500 psi

4 psi Check Spring

A 1000 - 4000 psi
B 400 - 1500 psi

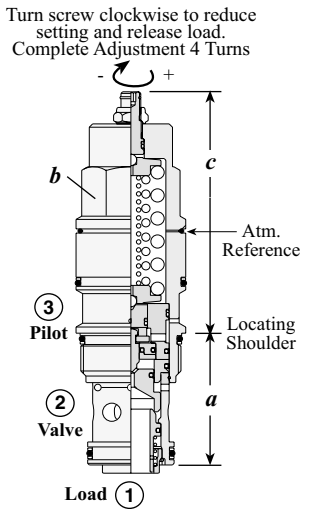
Seal

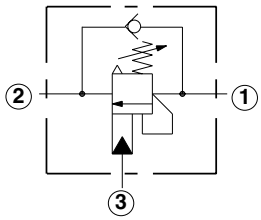
N Buna-N
V Viton

*** See page 162 for information on Control Options*

Adjustment Range Options:
A and H are standard set at 3000 psi.
I and B are standard set at 1000 psi.
Customer may specify setting.

ATMOSPHERICALLY REFERENCED, 3 PORT CAVITY



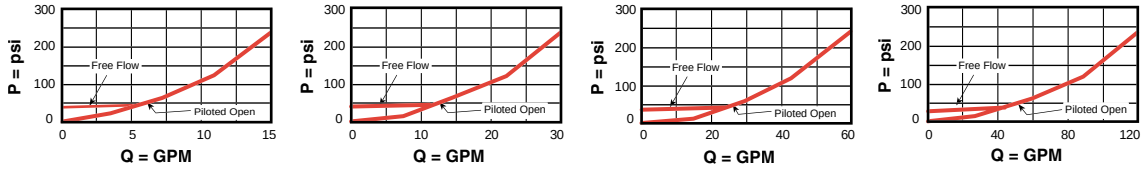


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
15 GPM	**CACA – LHN**	T - 11A	1.38	7/8"	2.91	3.16	30/35
30 GPM	**CAEA – LHN**	T - 2A	1.38	1 1/8"	3.29	3.54	45/50
60 GPM.	**CAGA – LHN**	T - 17A	1.81	1 1/4"	3.75	3.97	150/160
120 GPM	**CAIA – LHN**	T - 19A	2.50	1 5/8"	4.58	4.96	350/375

Performance Curves

CAC* **CAE*** **CAG*** **CAI***

Free Flow and Pilot Open Pressure Drop



- Load holding to 3000 psi with 4000 psi valve setting for CA*A, CA*K; 4600 psi with 6000 psi valve setting for CA*G, CA*L.
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in^3/min.
- Free flow check cracking pressure = 40 psi
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.

OPTION ORDERING INFORMATION

CA ★ ★ – ★ ★ ★

Nominal Capacity
- **C** 15 GPM
- **E** 30 GPM
- **G** 60 GPM
- **I** 120 GPM

Version
- **A** 3:1 Pilot Ratio
- **G** 5:1 Pilot Ratio
- **K** 1:1 Pilot Ratio
- **L** 2:1 Pilot Ratio

Control**
- **L** Standard Screw
- **C** Tamper Resistant

Cracking Pressure

A and K Pilot Ratios
- **H** 1000 - 4000 psi
- **I** 400 - 1500 psi

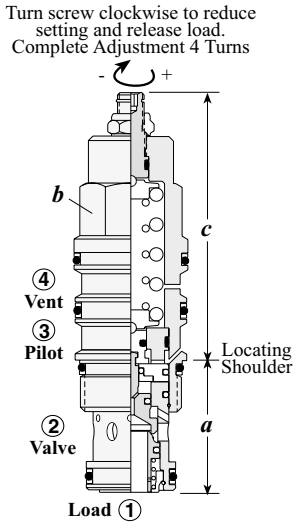
G and L Pilot Ratios
- **F** 1000 - 2500 psi
- **G** 2000 - 6000 psi

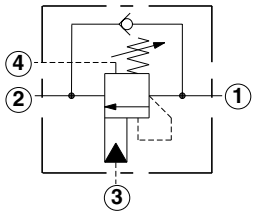
Adjustment Range Options:
H is standard set at 3000 psi.
I is standard set at 1000 psi.
F is standard set at 2000 psi.
G is standard set at 4000 psi.
Customer may specify setting.

Seal
- **N** Buna-N
- **V** Viton

** *See page 162 for information on Control Options*

VENTED, 4000 PSI MAXIMUM SETTING



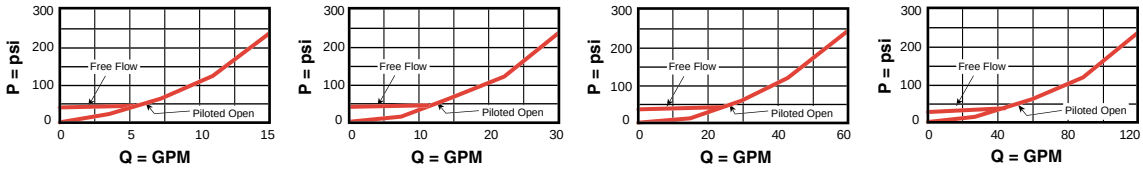


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
15 GPM	**CWCA– LHN**	T - 21A	1.38	7/8”	2.91	3.16	30/35
30 GPM	**CWEA– LHN**	T - 22A	1.38	1 1/8”	3.29	3.54	45/50
60 GPM	**CWGA– LHN**	T - 23A	1.81	1 1/4”	3.75	3.97	150/160
120 GPM	**CWIA – LHN**	T - 24A	2.50	1 5/8”	4.58	4.78	350/375

Performance Curves

CWC* **CWE*** **CWG*** **CWI***

Free Flow and Pilot Open Pressure Drop



- Load holding to 3000 psi with 4000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Free flow check cracking pressure = 40 psi
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

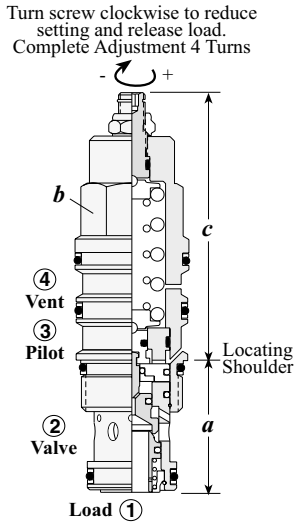
CW ★ ★ – ★ ★ ★

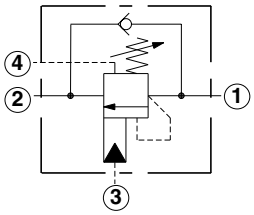
Nominal Capacity	*Version*	*Control***	*Cracking Pressure*	*Seal*
C 15 GPM	**A** 3:1 Pilot Ratio	**L** Standard Screw	***Pilot Ratios***	**N** Buna-N
E 30 GPM	**K** 1:1 Pilot Ratio	**C** Tamper Resistant	**H** 1000 - 4000 psi	**V** Viton
G 60 GPM			**I** 400 - 1500 psi	
I 120 GPM				

** *See page 162 for information on Control Options*

Adjustment Range Options:
H is standard set at 3000 psi.
I is standard set at 1000 psi.
Customer may specify setting.

VENTED, 6000 PSI MAXIMUM SETTING



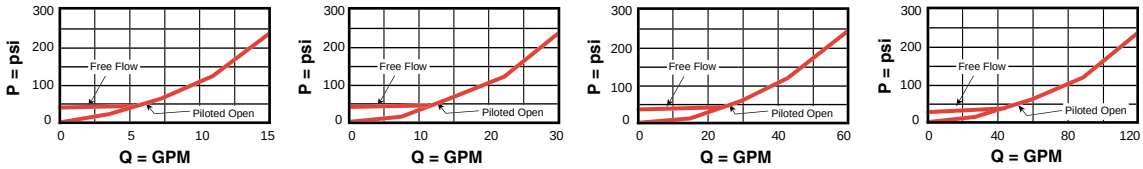


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (lb. ft.)
15 GPM	**CWCG– LFN**	T - 21A	1.38	7/8”	2.91	3.16	30/35
30 GPM	**CWEG– LFN**	T - 22A	1.38	1 1/8”	3.29	3.54	45/50
60 GPM	**CWGG– LFN**	T - 23A	1.81	1 1/4”	3.75	3.97	150/160
120 GPM	**CWIG – LFN**	T - 24A	2.50	1 5/8”	4.58	4.78	350/375

Performance Curves

CWC* **CWE*** **CWG*** **CWI***

Free Flow and Pilot Open Pressure Drop



- Load holding to 4600 psi with 6000 psi valve setting
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of set pressure
- Factory pressure setting established at 2 in³/min.
- Free flow check cracking pressure = 40 psi
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

CW ★ ★ – ★ ★ ★

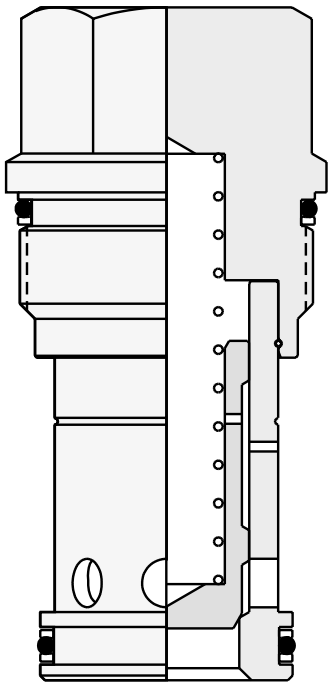
Nominal Capacity	*Version*	*Control***	*Cracking Pressure*	*Seal*
C 15 GPM	**G** 5:1 Pilot Ratio	**L** Standard Screw	*Pilot Ratios*	**N** Buna-N
E 30 GPM	**L** 2:1 Pilot Ratio	**C** Tamper Resistant	**F** 1000 - 2500 psi	**V** Viton
G 60 GPM			**G** 2000 - 6000 psi	
I 120 GPM				

** *See page 162 for information on Control Options*

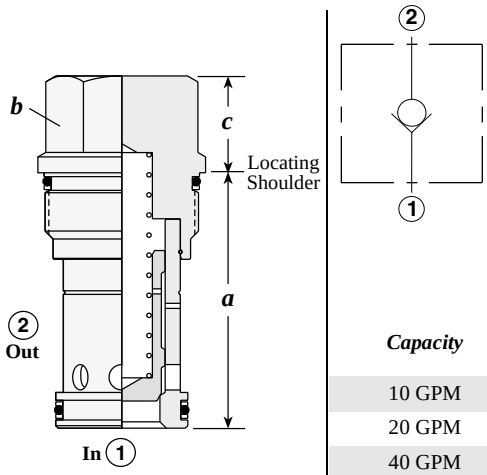
Adjustment Range Options:
F is standard set at 2000 psi.
G is standard set at 4000 psi.
Customer may specify setting.

NOTES

Check Cartridge Valves



FREE FLOW NOSE TO SIDE

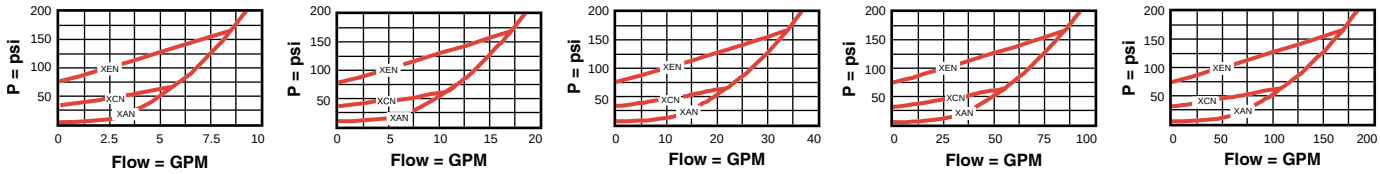


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	Installation Torque lb. ft.
10 GPM	**CXBA – XCN**	T - 162A	1.22	3/4”	.82	25/30
20 GPM	**CXDA – XCN**	T - 13A	1.38	7/8”	.75	30/35
40 GPM	**CXFA – XCN**	T - 5A	1.62	1 1/8”	.69	45/50
80 GPM	**CXHA – XCN**	T - 16A	2.44	1 1/4”	.97	150/160
160 GPM	**CXJA – XCN**	T - 18A	3.13	1 5/8”	1.19	350/375

Performance Curves

CXBA **CXDA** **CXFA** **CXHA** **CXJA**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 drop/min.
- Will accept 5000 psi at ports 1 and 2.

OPTION ORDERING INFORMATION

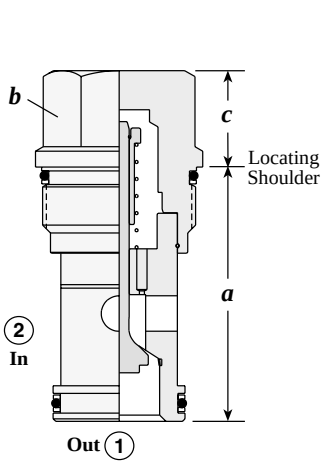
Model Codes printed in Red are Preferred Versions and most readily available

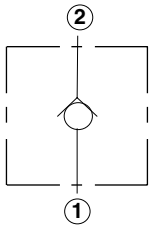
CX ★ A – ★ ★ ★

Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
B 10 GPM	**X** Non-adjustable	**A** 4 psi	**N** Buna-N
D 20 GPM		**B** 15 psi	**V** Viton
F 30 GPM		**C** 30 psi	
H 80 GPM		**D** 50 psi	
J 160 GPM		**E** 75 psi	
		F 100 psi	

** *See page 162 for information on Control Options*

FREE FLOW SIDE TO NOSE



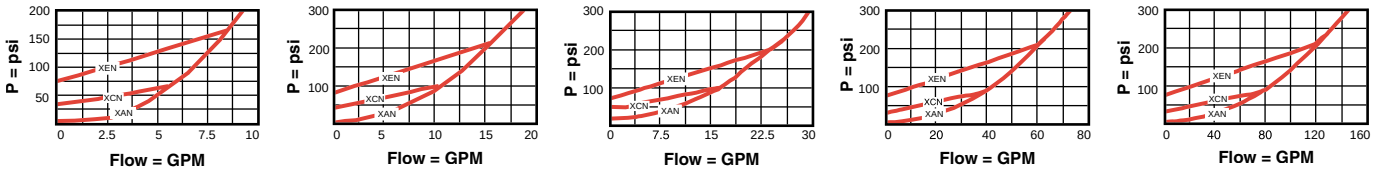


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	Installation Torque lb. ft.
7.5 GPM	**CXAD – XCN**	T - 162A	1.22	3/4”	.82	25/30
15 GPM	**CXCD – XCN**	T - 13A	1.38	7/8”	.75	30/35
30 GPM	**CXED – XCN**	T - 5A	1.62	1 1/8”	.69	45/50
60 GPM	**CXGD – XCN**	T - 16A	2.44	1 1/4”	.97	150/160
120 GPM	**CXID – XCN**	T - 18A	3.13	1 5/8”	1.19	350/375

Performance Curves

CXAD **CXCD** **CXED** **CXGD** **CXID**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 drop/min.
- Will accept 5000 psi at ports 1 and 2.
- CXAD only available with 4, 30 and 75 psi cracking pressures.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

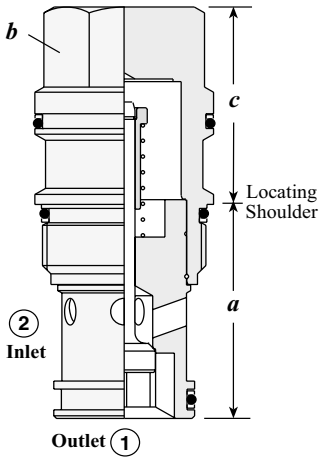
CX ✶ D – ✶ ✶ ✶

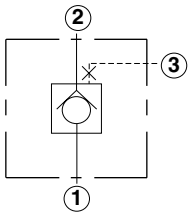
Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
A* 7.5 GPM	**X** Non-adjustable	**A** 4 psi	**N** Buna-N
C 15 GPM		**B** 15 psi	**V** Viton
E 30 GPM		**C** 30 psi	
G 60 GPM		**D** 50 psi	
I 120 GPM		**E** 75 psi	
		F 100 psi	

** *See page 162 for information on Control Options*

* *CXAD available with A, C, E Cracking Pressures Only.*

FREE FLOW SIDE TO NOSE, PORT 3 BLOCKED



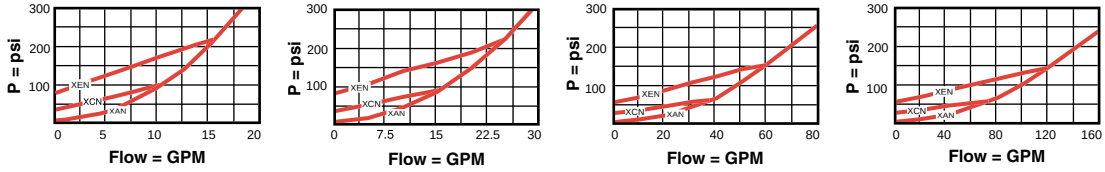


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	Installation Torque lb. ft.
15 GPM	**CXCE – XCN**	T - 11A	1.38	7/8”	1.19	30/35
30 GPM	**CXEE – XCN**	T - 2A	1.38	1 1/8”	1.38	45/50
60 GPM	**CXGE – XCN**	T - 17A	1.81	1 1/4”	1.81	150/160
120 GPM	**CXIE – XCN**	T - 19A	2.50	1 5/8”	2.31	350/375

Performance Curves

CXCE **CXEE** **CXGE** **CXIE**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 drop/min.
- Will accept 5000 psi at ports 1 and 2.

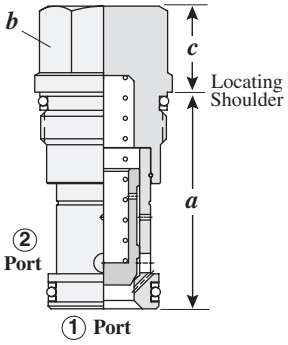
OPTION ORDERING INFORMATION

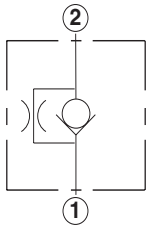
CX ★ E – ★ ★ ★

Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
C 15 GPM	**X** Non-adjustable	**A** 4 psi	**N** Buna-N
E 30 GPM		**B** 15 psi	**V** Viton
G 60 GPM		**C** 30 psi	
I 120 GPM		**D** 50 psi	
		E 75 psi	
		F 100 psi	

** *See page 162 for information on Control Options*

FREE FLOW NOSE TO SIDE WITH BYPASS ORIFICE



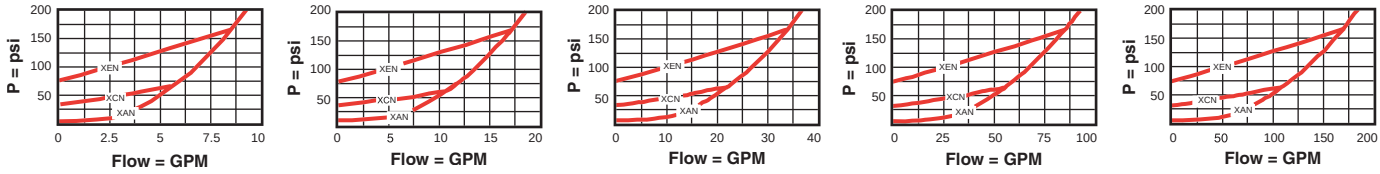


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c X	*Installation Torque lb. ft.*
7.5 GPM	**CNBC – XCN**	T - 162A	1.22	3/4”	.82	25/30
15 GPM	**CNDC – XCN**	T - 13A	1.38	7/8”	.75	30/35
30 GPM	**CNFC – XCN**	T - 5A	1.63	1 1/8”	.69	45/50
60 GPM	**CNHC – XCN**	T - 16A	2.43	1 1/4”	.97	150/160
120 GPM	**CNJC – XCN**	T - 18A	3.13	1 5/8”	1.19	350/375

Performance Curves

CNBC **CNDC** **CNFC** **CNHC** **CNJC**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Will accept 5000 psi at ports 1 and 2.
- Orifice range = CNBC, CNDC: .015 - .062 in., CNFC: .015 - .078 in., CNHC: .015 - .094 in., CNJC: .015 - .125 in.

OPTION ORDERING INFORMATION

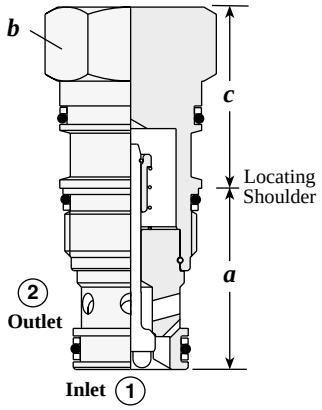
CN ★ C – ★ ★ ★

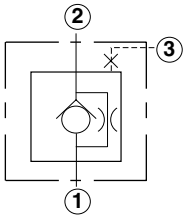
Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
B 7.5 GPM	**X** Non-adjustable	**A** 4 psi	**N** Buna-N
D 15 GPM		**B** 15 psi	**V** Viton
F 30 GPM		**C** 30 psi	
H 60 GPM		**D** 50 psi	
J 120 GPM		**E** 75 psi	
		F 100 psi	

***See page 162 for information on Control Options*

Customer specified orifice setting range:
CNBC: .015 - .062 in.
CNDC: .015 - .062 in.
CNFC: .015 - .078 in.
CNHC: .015 - .094 in.
CNJC: .015 - .125 in.

2 TO 1 FREE FLOW, WITH CUSTOMER SPECIFIED ORIFICE, PORT 3 BLOCKED, 3 PORT CAVITY



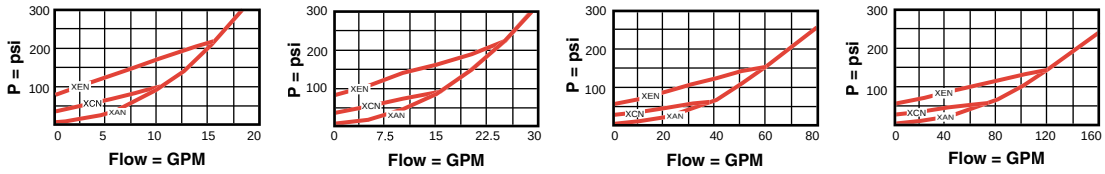


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c X	Installation Torque lb. ft.
15 GPM	**CNCD – XCN**	T - 11A	1.38	7/8”	1.19	30/35
30 GPM	**CNED – XCN**	T - 2A	1.38	1 1/8”	1.38	45/50
60 GPM	**CNGD – XCN**	T - 17A	1.81	1 1/4”	1.81	150/160
120 GPM	**CNID – XCN**	T - 19A	2.50	1 5/8”	2.31	350/375

Performance Curves

CNCD **CNED** **CNGD** **CNID**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Will accept 5000 psi at ports 1 and 2
- Orifice range = CNCD: .015 - .062 in., CNED: .015 - .078 in., CNGD: .015 - .094 in., CNID: .015 - .125 in.

OPTION ORDERING INFORMATION

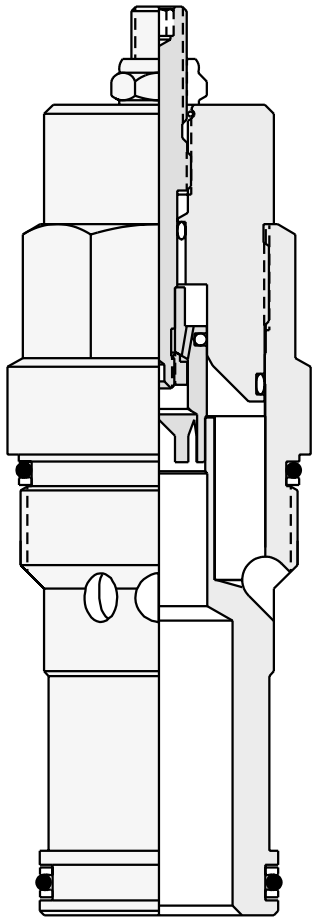
CN ★ D – ★ ★ ★

Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
C 15 GPM	**X** Non-adjustable	**A** 4 psi	**N** Buna-N
E 30 GPM		**B** 15 psi	**V** Viton
G 60 GPM		**C** 30 psi	
I 120 GPM		**D** 50 psi	
		E 75 psi	
		F 100 psi	

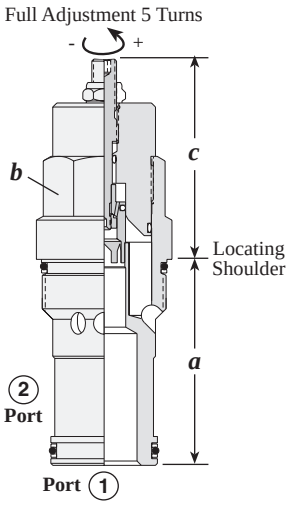
** *See page 162 for information on Control Options*

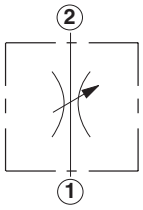
Customer specified orifice setting range:
CNCD: .015 - .062 in.
CNED: .015 - .078 in.
CNGD: .015 - .094 in.
CNID: .015 - .125 in.

Flow Control Valves



FULLY ADJUSTABLE NEEDLE



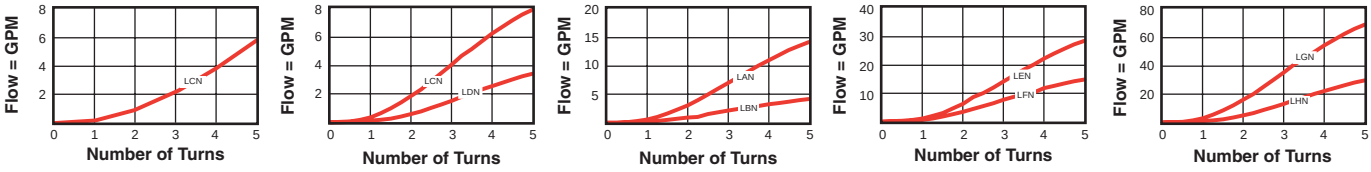


Maximum Nominal Orifice	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque lb. ft.*
			a	*b*	*c*			
					L	H	K	
.16" dia.	**NFBC – LCN**	T - 162A	1.22	3/4"	1.59	-	1.73	25/30
.19" dia.	**NFCC – LCN**	T - 13A	1.38	7/8"	2.27	2.49	2.50	30/35
.25" dia.	**NFDC – LAN**	T - 5A	1.62	1 1/8"	2.35	2.82	2.73	45/50
.38" dia.	**NFEC – LEN**	T - 16A	2.44	1 1/4"	2.66	3.06	2.91	150/160
.56" dia.	**NFFC – LGN**	T - 18A	3.13	1 5/8"	3.31	3.50	3.47	350/375

Performance Curves

NFBC **NFCC** **NFDC** **NFEC** **NFFC**

Adjustment Sensitivity at 100 psi Differential



- Maximum operating pressure = 5000 psi
- Maximum valve leakage at shutoff = less than 5 drops/min.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

NF ★ C – ★ ★ ★

Maximum Nominal Orifice

- **B** .16" dia.
- **C** .19" dia.
- **D** .25" dia.
- **E** .38" dia.
- **F** .56" dia.

*Control***

- **L** Standard Screw
- **H** Calibrated Handknob with Detent Lock
- **K** Handknob

Orifice Options

NFBC
- **C** .16"

NFCC
- **C** .19"
- **D** .09"

NFDC
- **A** .25"
- **B** .13"

NFEC
- **E** .38"
- **F** .28"

NFFC
- **G** .56"
- **H** .38"

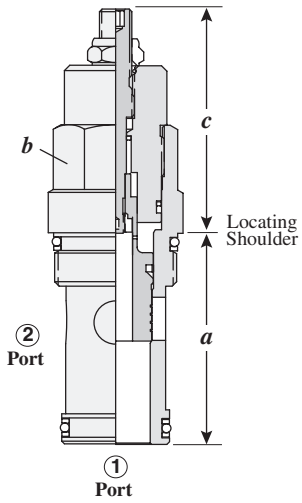
Seal

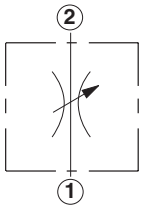
- **N** Buna-N
- **V** Viton

** *See page 162 for information on Control Options*

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

FULLY ADJUSTABLE NEEDLE, HIGH CAPACITY



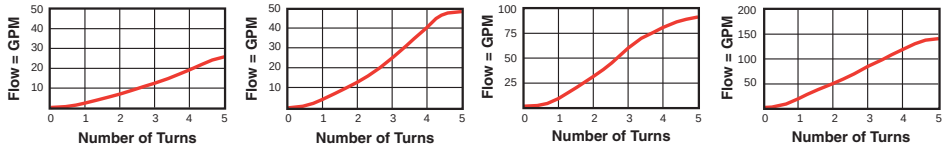


Nominal Orifice	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c H	c K	Installation Torque (lb. ft.)
.33" dia.	**NFCD – LFN**	T - 13A	1.38	7/8"	2.27	2.49	2.50	30/35
.50" dia.	**NFDD – LGN**	T - 5A	1.62	1 1/8"	2.35	2.82	2.73	45/50
.69" dia.	**NFED – LHN**	T - 16A	2.44	1 1/4"	2.66	3.06	2.91	150/160
.85" dia.	**NFFD – LIN**	T - 18A	3.13	1 5/8"	3.31	3.50	3.47	350/375

Performance Curves

NFCD **NFDD** **NFED** **NFFD**

Adjustment Sensitivity at 100 psi Differential



- Maximum operating pressure = 5000 psi
- Maximum valve leakage at shutoff = less than 5 drops/min.

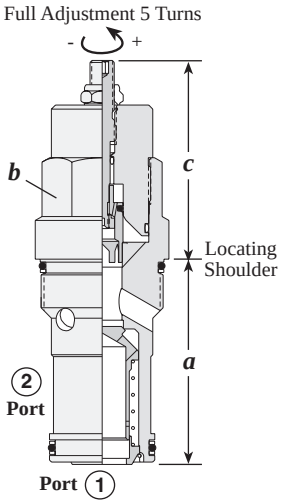
OPTION ORDERING INFORMATION

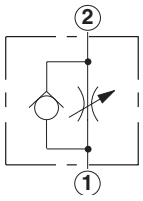
NF ★ D – ★ ★ ★

Nominal Orifice	Control**	Orifice Options	Seal
C .33" dia.	**L** Standard Screw	*NFCD* **F** .33"	**N** Buna-N
D .50" dia.	**H** Calibrated Handknob with Detent Lock	*NFDD* **G** .50"	**V** Viton
E .69" dia.		*NFED* **H** .69"	
F .85" dia.	**K** Handknob	*NFFD* **I** .85"	

** *See page 162 for information on Control Options*

FULLY ADJUSTABLE NEEDLE WITH REVERSE FLOW CHECK



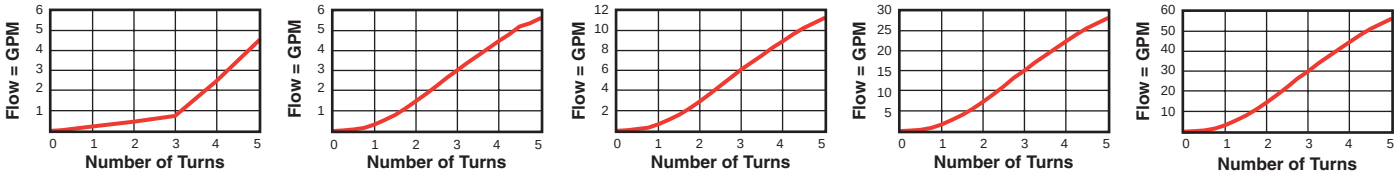


Maximum Nominmal Orifice	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c H	c K	Installation Torque (lb. ft.)
.16" dia.	**NCBB – LCN**	T - 162A	1.22	3/4"	1.59	-	1.73	25/30
.19" dia.	**NCCB – LCN**	T - 13A	1.38	7/8"	2.27	2.49	2.50	30/35
.25" dia.	**NCEB – LCN**	T - 5A	1.62	1 1/8"	2.35	2.82	2.73	45/50
.38" dia.	**NCFB – LCN**	T - 16A	2.44	1 1/4"	2.66	3.06	2.91	150/160
.56" dia.	**NCGB – LCN**	T - 18A	3.13	1 5/8"	3.31	3.50	3.47	350/375

Performance Curves

NCBB **NCCB** **NCEB** **NCFB** **NCGB**

Adjustment Sensitivity at 100 psi Differential



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 5 drops/min.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

NC ★ ★ – ★ C ★

Maximum Nominal Orifice

NCBB* .16" dia.

NCCB .19" dia.
NCCC .09" dia.

NCEB .25" dia.
NCEC .13" dia.

NCFB .38" dia.
NCFC .28" dia.

NCGB .56" dia.
NCGC .38" dia.

Version

B High Capacity

C Low Capacity

*Control***

L Standard Screw

H Calibrated Handknob with Detent Lock

K Handknob

*Cracking Pressure**

A 4 psi

C 30 psi

E 75 psi

Seal

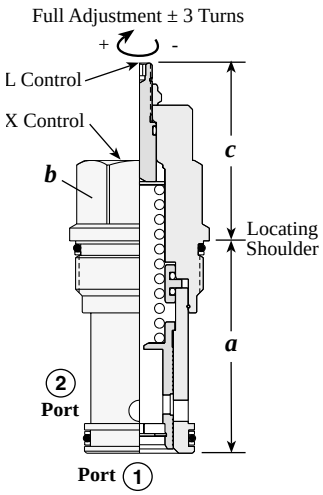
N Buna-N

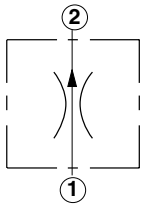
V Viton

** *See page 162 for information on Control Options*

**Cracking Pressure Ranges:*
A and E ranges are not available in T-162A cavity.

FIXED ORIFICE, PRESSURE COMPENSATED



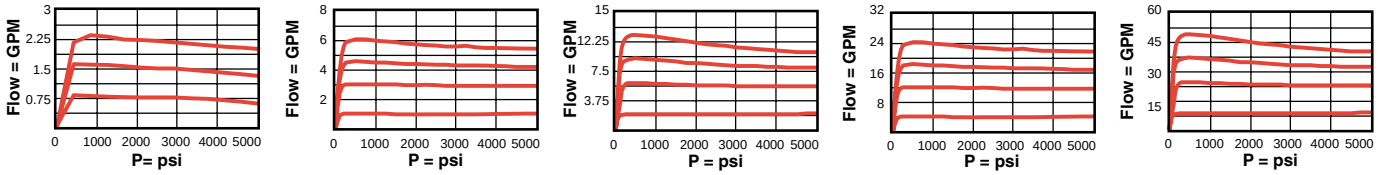


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X	*c* L	*c* K	*Installation Torque (lb. ft.)*
.1-3 GPM	**FXBA – XAN**	T - 162A	1.22	3/4”	.82	2.11	2.55	25/30
.1-6.0 GPM	**FXCA – XAN**	T - 13A	1.38	7/8”	.75	2.00	2.25	30/35
.1-12.0 GPM	**FXDA – XAN**	T - 5A	1.62	1 1/8”	.69	2.12	2.38	45/50
.2-25 GPM	**FXEA – XAN**	T - 16A	2.44	1 1/4”	.97	2.44	2.69	150/160
.2-50 GPM	**FXFA – XAN**	T - 18A	3.13	1 5/8”	1.19	2.81	3.06	350/375

Performance Curves

FXBA **FXCA** **FXDA** **FXEA** **FXFA**

Typical Performance



- Maximum operating pressure = 5000 psi
- Customer must specify flow setting
- Accurate pressure compensated control requires that a 200 psi minimum pressure differential be maintained across the valve.
- The tuneable control option provides +/- 25% variation from the nominal factory pre-set flow.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

FX ✶ A – ✶ A ✶

Nominal Capacity

- **B** .1-3 GPM
- **C** .1-6.0 GPM
- **D** .1-12.0 GPM
- **E** .2-25 GPM
- **F** .2-50 GPM

Control**

- **X** Non-adjustable Factory set at customer specified flow
- **L** Tuning Adjustment ±25% of customer specified flow
- **K** Handknob with **L** control

Adjustment Range

- **A** Fixed Orifice

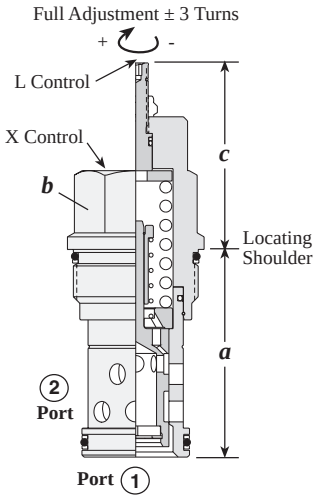
Customer must specify flow

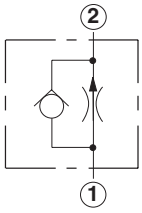
Seal

- **N** Buna-N
- **V** Viton

** *See page 162 for information on Control Options*

FIXED ORIFICE, PRESSURE COMPENSATED WITH REVERSE FLOW CHECK



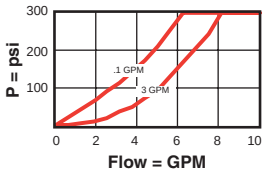


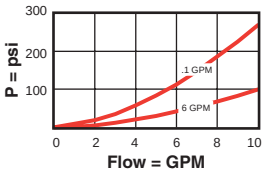
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	c L	c K	Installation Torque (lb. ft.)
.1-3 GPM	**FCBB – XAN**	T - 162A	1.22	3/4”	.82	2.11	2.55	25/30
.1-6.0 GPM	**FCCB – XAN**	T - 13A	1.38	7/8”	.75	2.00	2.25	30/35
.1-12.0 GPM	**FCDB – XAN**	T - 5A	1.62	1 1/8”	.69	2.12	2.38	45/50
.2-25 GPM	**FCEB – XAN**	T - 16A	2.44	1 1/4”	.97	2.44	2.69	150/160
.2-50 GPM	**FCFB – XAN**	T - 18A	3.13	1 5/8”	1.19	2.81	3.06	350/375

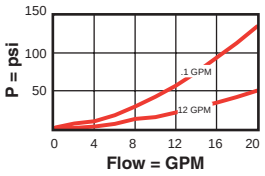
Performance Curves

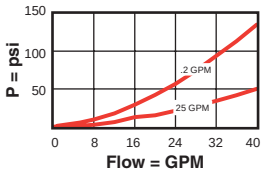
FCBB **FCCB** **FCDB** **FCEB** **FCFB**

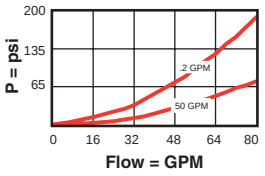
Reverse Free Flow Pressure Drop Based on Specified Flow Extremes











- Maximum operating pressure = 5000 psi
- Customer must specify flow setting
- Accurate pressure compensated control requires that a 200 psi minimum pressure differential be maintained across the valve.
- The tuneable control option provides +/- 25% variation from the nominal factory pre-set flow.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

FC ✶ B – ✶ A ✶

Nominal Capacity

- **B** .1-3 GPM
- **C** .1-6.0 GPM
- **D** .1-12.0 GPM
- **E** .2-25 GPM
- **F** .2-50 GPM

Control**

- **X** Non-adjustable Factory set at customer specified flow
- **L** Tuning Adjustment ±25% of customer specified flow
- **K** Handknob with **L** control

Adjustment Range

- **A** Fixed Orifice

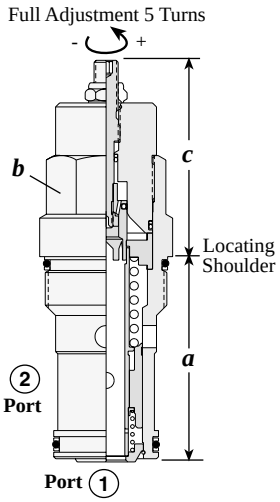
Customer must specify flow

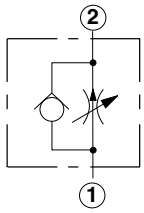
Seal

- **N** Buna-N
- **V** Viton

*** *See page 162 for information on Control Options*

FULLY ADJUSTABLE, PRESSURE COMPENSATED WITH REVERSE FLOW CHECK



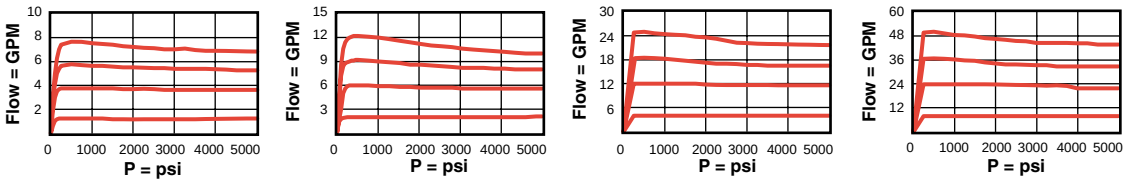


Nominal Flow Range	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c H	c K	Installation Torque (lb. ft.)
.1-6 GPM	**FDBA – LAN**	T - 13A	1.38	7/8”	2.27	2.44	2.31	30/35
.1-12 GPM	**FDCB – LAN**	T - 5A	1.62	1 1/8”	2.35	2.82	2.73	45/50
.2-25 GPM	**FDEA – LAN**	T - 16A	2.44	1 1/4”	2.66	3.06	2.91	150/160
.2-50 GPM	**FDFA – LAN**	T - 18A	3.13	1 5/8”	3.31	3.50	3.47	350/375

Performance Curves

FDBA **FDCB** **FDEA** **FDFA**

Typical Performance



- Maximum operating pressure = 5000 psi
- Accurate pressure compensated control requires that a 200 psi minimum pressure differential be maintained across the valve.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

FD ✶✶ – ✶ A ✶

Nominal Flow Range

BA .1-6 GPM

CB .1-12 GPM

EA .2-25 GPM

FA .2-50 GPM

Control**

L Standard Screw

H Calibrated Handknob with Detent Lock

K Handknob

Adjustment Range

FDBA
A .1 - 6 GPM

FDCB
A .1 - 12 GPM

FDEA
A .1 - 25 GPM

FDFA
A .1 - 50 GPM

Seal

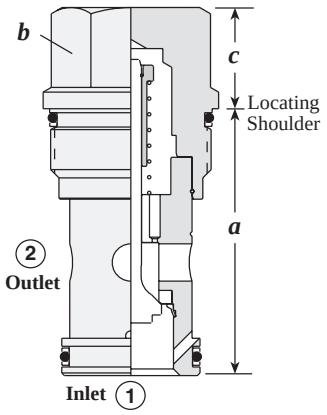
N Buna-N

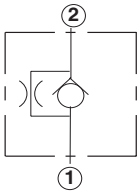
V Viton

*** See page 162 for information on Control Options*

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

FREE FLOW SIDE-TO-NOSE WITH BYPASS ORIFICE



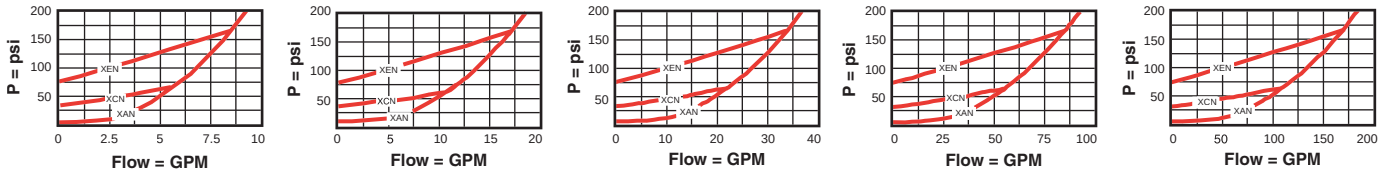


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c X	*Installation Torque lb. ft.*
7.5 GPM	**CNAC – XCN**	T - 162A	1.22	3/4”	.82	25/30
15 GPM	**CNCC – XCN**	T - 13A	1.38	7/8”	.75	30/35
120 GPM	**CNEC – XCN**	T - 5A	1.62	1 1/8”	.69	45/50
60 GPM	**CNGC – XCN**	T - 16A	2.44	1 1/4”	.97	150/160
120 GPM	**CNIC – XCN**	T - 18A	3.13	1 5/8”	1.19	350/375

Performance Curves

CNAC **CNCC** **CNEC** **CNGC** **CNIC**

Typical Pressure Drop for Nominal Cracking Pressures



- Maximum operating pressure = 5000 psi
- Will accept 5000 psi at ports 1 and 2.
- * Orifice range = CNAC, CNCC: .015 - .062 in., CNEC: .015 - .078 in., CNGC: .015 - .094 in., CNIC: .015 - .125 in.

OPTION ORDERING INFORMATION

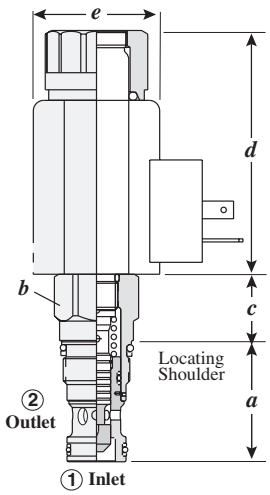
CN ★ C – ★ ★ ★

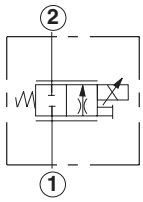
Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
A 7.5 GPM	**X** Non-adjustable	**A** 4 psi	**N** Buna-N
C 15 GPM		**B** 15 psi	**V** Viton
E 30 GPM		**C** 30 psi	
G 60 GPM		**D** 50 psi	
I 120 GPM		**E** 75 psi	
		F 100 psi	

** *See page 162 for information on Control Options*

* **Customer specified orifice setting range:**
CNAC: .015 - .062 in.
CNCC: .015 - .062 in.
CNEC: .015 - .078 in.
CNGC: .015 - .094 in.
CNIC: .015 - .125 in.

ELECTRO-PROPORTIONAL, NORMALLY CLOSED THROTTLE

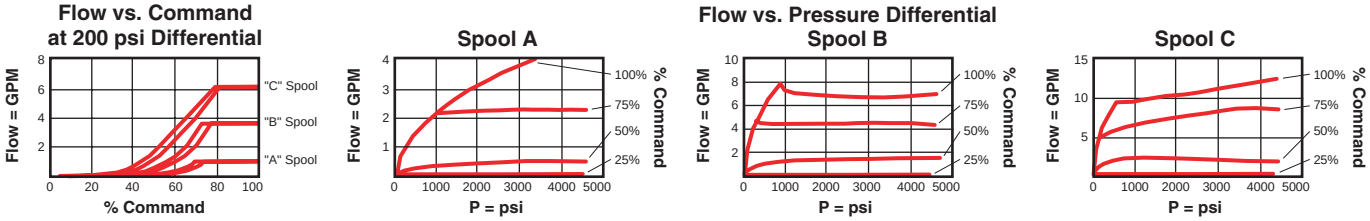




Maximum Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	e	Installation Torque lb. ft.
7 GPM	**FPCC – MCN**	T - 13A	1.38	7/8”	.75	2.76	1.47	30/35

Performance Curves

FPCC



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 6 in³/min. at 3000 psi
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

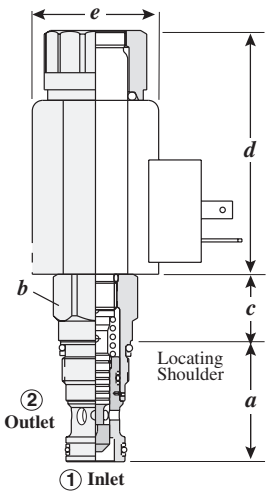
FP C C – ★ ★ ★

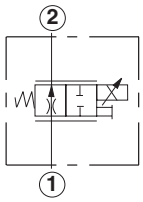
Maximum Nominal Capacity	*Control***	*Nominal Capacity*	*Seal*
C 7 GPM	**M** Manual Override (Standard)	**A** 1.5 GPM	**N** Buna-N
		B 3.5 GPM	**V** Viton
		C 7 GPM	

NOTE: Coil must be ordered separately. Use 12V DC or 24V DC (Series 770-*) coils only. See page 167.**

** *See page 162 for information on Control Options*

ELECTRO-PROPORTIONAL, NORMALLY OPEN THROTTLE

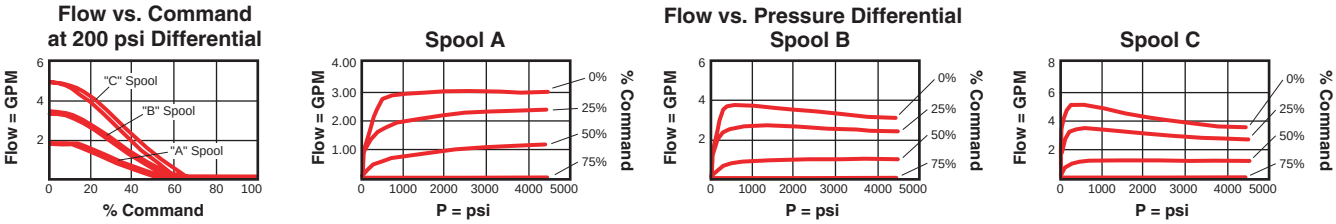




Maximum Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	e	*Installation Torque lb. ft.*
7 GPM	**FPCH – MCN**	T - 13A	1.38	7/8”	.75	2.76	1.47	30/35

Performance Curves

FPCH



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 6 in³/min. at 3000 psi
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

FP C H – ★ ★ ★

Maximum Nominal Capacity

C 7 GPM

Control**

D Manual Override (Standard)

NOTE: Coil must be ordered separately. Use 12V DC or 24V DC (Series 770-*) coils only. See page 167.**

Nominal Capacity

A 1.5 GPM

B 3.5 GPM

C 5 GPM

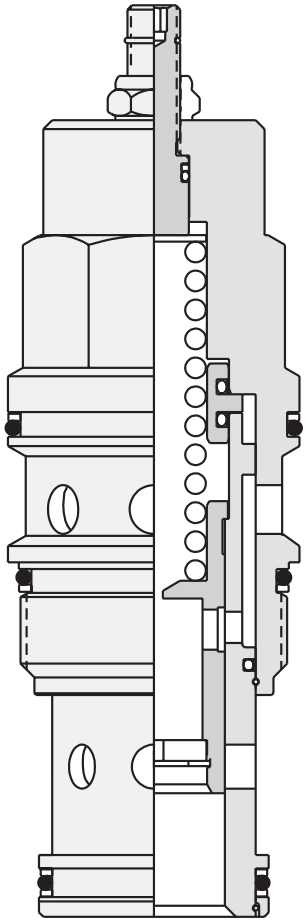
Seal

N Buna-N

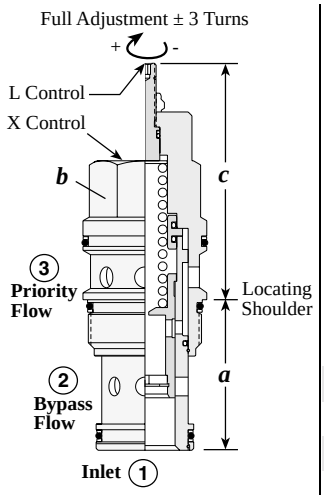
V Viton

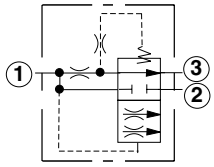
** *See page 162 for information on Control Options*

Priority Flow Control Cartridge Valves



BYPASS / RESTRICTIVE, FIXED ORIFICE



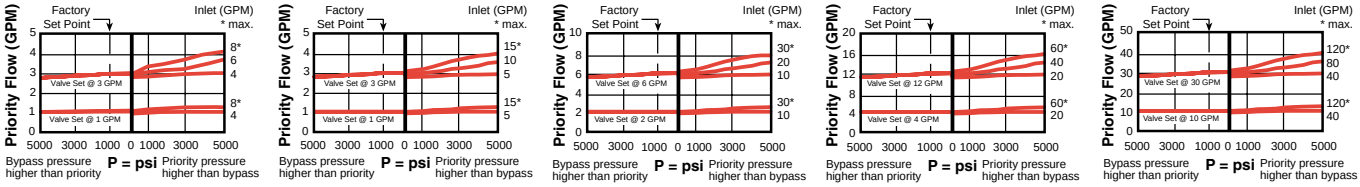


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	c L	c K	Installation Torque (lb. ft.)
.1-3 GPM	**FRBA – XAN**	T - 163A	1.22	3/4”	1.25	2.55	2.77	25/30
.1-6.0 GPM	**FRCA – XAN**	T - 11A	1.38	7/8”	1.19	2.50	2.75	30/35
.1-12.0 GPM	**FRDA – XAN**	T - 2A	1.38	1 1/8”	1.38	2.81	3.06	45/50
.2-25 GPM	**FREA – XAN**	T - 17A	1.81	1 1/4”	1.81	3.28	3.53	150/160
.2-50 GPM	**FRFA – XAN**	T - 19A	2.50	1 5/8”	2.75	3.94	4.19	350/375

Performance Curves

FRBA **FRCA** **FRDA** **FREA** **FRFA**

Typical Performance



- Maximum operating pressure = 5000 psi
- Customer must specify a flow rating. Factory set flow ratings are within +/- 10% of the requested setting.
- Pressure at the bypass port (port 2) may exceed pressure at the priority port (port 3).
- Maximum pressure at port 3 should be limited to 3000 psi.
- Both priority and bypass flow are usable up to the system operating pressure.
- Bypass flow is not available until priority flow requirements are satisfied.
- Blocking priority flow will also block bypass flow.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

FR ✶ A – ✶ A ✶

Nominal Capacity

B .1-3 GPM

C .1-6.0 GPM

D .1-12.0 GPM

E .2-25 GPM

F .2-50 GPM

Control**

X Non-adjustable Factory set at customer specified flow

L Tuning Adjustment ±25% of customer specified flow

K Handknob for **L** control

Adjustment Range

A Fixed Orifice

Customer must specify flow

Seal

N Buna-N

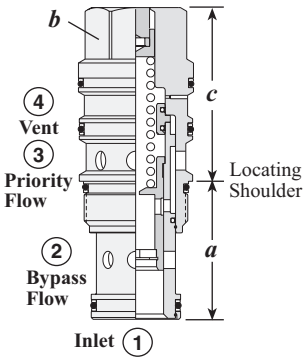
V Viton

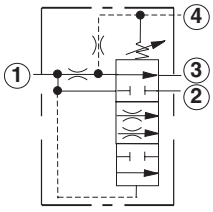
Maximum Inlet Flow:
FRBA: 7.5 GPM
FRCA: 15 GPM
FRDA: 30 GPM
FREA: 60 GPM
FRFA: 120 GPM

*** See page 162 for information on Control Options*

Priority Flow ranges:
FRBA: .1 - 3 GPM
FRCA:.1 - 6.0 GPM
FRDA:.1 - 12.0 GPM
FREA: .2 - 25 GPM
FRFA: .2 - 50 GPM

VENTABLE, BYPASS / RESTRICTIVE, FIXED ORIFICE



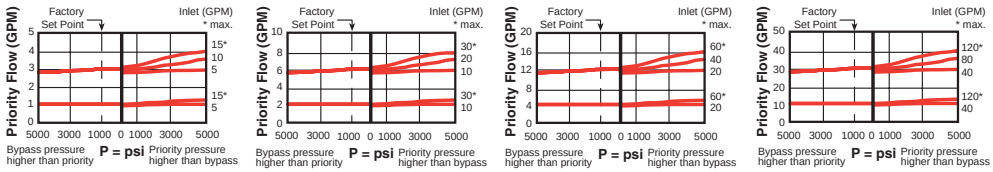


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X	*c* L	*c* K	*Installation Torque (lb. ft.)*
.1-6.0 GPM	**FVCA – XAN**	T - 21A	1.38	7/8”	1.78	3.09	3.34	30/35
.1-12.0 GPM	**FVDA – XAN**	T - 22A	1.38	1 1/8”	2.00	3.44	3.69	45/50
.2-25 GPM	**FVEA – XAN**	T - 23A	1.81	1 1/4”	2.50	3.94	4.19	150/160
.2-50 GPM	**FVFA – XAN**	T - 24A	2.50	1 5/8”	3.16	4.76	5.01	350/375

Performance Curves

FVCA **FVDA** **FVEA** **FVFA**

Typical Performance



- Maximum operating pressure = 5000 psi
- Nominal vent flow = 46 in³/min.
- Pressure at the bypass port (port 2) may exceed pressure at the priority port (port 3).
- Maximum pressure at port 3 should be limited to 3000 psi.
- Both priority and bypass flow are usable up to the system operating pressure.
- Bypass flow is not available until priority flow requirements are satisfied, except when the valve is vented. When port 4 (vent) is open, all flow diverts to port 2 if pressure at port 1 (inlet) is 150 psi or higher.
- Using a pressure control on port 4 will limit the pressure at the priority port (port 3). If pressure on the bypass port (port 2) exceeds the setting of the pressure control, priority flow will be shut off and all the flow will go out the bypass port.
- Blocking priority flow will also block bypass flow.

OPTION ORDERING INFORMATION

FV ✶ A – ✶ A ✶

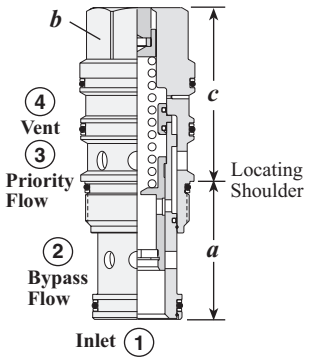
Nominal Capacity		*Control***		*Adjustment Range*		*Seal*	
C	.1-6.0 GPM	**X**	Non-adjustable factory set at customer specified flow	**A**	Fixed Orifice	**N**	Buna-N
D	.1-12.0 GPM	**L**	Tuning Adjustment ±25% of customer specified flow		**Customer must specify flow**	**V**	Viton
E	.2-25 GPM						
F	.2-50 GPM	**K**	Handknob (includes L controls)				

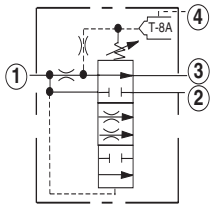
Maximum Inlet Flow:
FVCA: 15 GPM
FVDA: 30 GPM
FVEA: 60 GPM
FVFA: 120 GPM

***See page 162 for information on Control Options*

Priority Flow ranges:
FVCA: .1 - 6.0 GPM
FVDA: .1 - 12.0 GPM
FVEA: .2 - 25 GPM
FVFA: .2 - 50 GPM

VENTABLE, BYPASS / RESTRICTIVE, FIXED ORIFICE WITH INTEGRAL PILOT CONTROL CAVITY





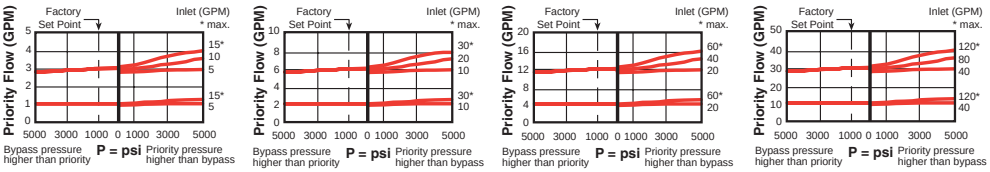
The -8 control option allows the pilot control valve to be incorporated directly into the end of the priority flow control cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c* **8**	
.1-6.0 GPM	**FVCA – 8AN**	T - 21A	1.38	7/8”	1.78	30/35
.1-12.0 GPM	**FVDA – 8AN**	T - 22A	1.38	1 1/8”	1.78	45/50
.2-25.0 GPM	**FVEA – 8AN**	T - 23A	1.81	1 1/4”	1.78	150/160
2-50.0 GPM	**FVFA – 8AN**	T - 24A	2.50	1 5/8”	1.78	350/375

Performance Curves

FVCA-8 **FVDA-8** **FVEA-8** **FVFA-8**

Typical Performance



- Maximum operating pressure = 5000 psi
- Nominal vent flow = 46 in³/min.
- Pressure at the bypass port (port 2) may exceed pressure at the priority port (port 3).
- Maximum pressure at port 3 should be limited to 3000 psi.
- Both priority and bypass flow are usable up to the system operating pressure.
- Bypass flow is not available until priority flow requirements are satisfied, except when the valve is vented. When port 4 (vent) is open, all flow diverts to port 2 if pressure at port 1 (inlet) is 150 psi or higher.
- Using a pressure control on port 4 will limit the pressure at the priority port (port 3). If pressure on the bypass port (port 2) exceeds the setting of the pressure control, priority flow will be shut off and all the flow will go out the bypass port.
- Blocking priority flow will also block bypass flow.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

FV ★ A – 8 A ★

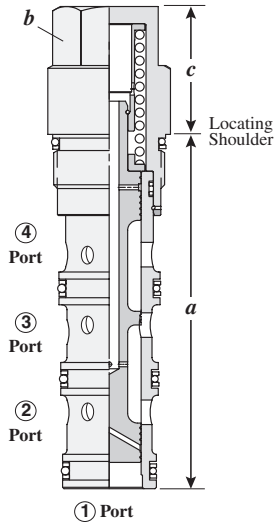
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C .1-6.0 GPM	**8** T-8A cavity in hex body for pilot operation (Pilot valve to be ordered separately)	**A** Fixed Orifice	**N** Buna-N
D .1-12.0 GPM		**Customer must specify flow**	**V** Viton
E .2-25 GPM			
F .2-50 GPM			

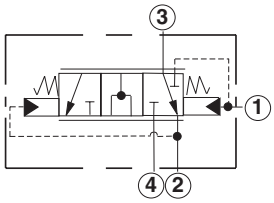
Maximum Inlet Flow:
FVCA: 15 GPM
FVDA: 30 GPM
FVEA: 60 GPM
FVFA: 120 GPM

***See page 162 for information on Control Options*

Priority Flow ranges:
FVCA: .1 - 6.0 GPM
FVDA: .1 - 12.0 GPM
FVEA: .2 - 25 GPM
FVFA: .2 - 50 GPM

BYPASS / RESTRICTIVE MODULATING ELEMENT





Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	Installation Torque (lb. ft.)
15 GPM	**LHDA – XFN**	T - 31A	3.34	7/8”	1.18	30/35
30 GPM	**LHFA – XFN**	T - 32A	3.63	1 1/8”	1.31	45/50
60 GPM	**LHHA – XFN**	T - 33A	4.50	1 1/4”	1.63	150/160
120 GPM	**LHJA – XFN**	T - 34A	5.50	1 5/8”	2.00	350/375

- Maximum operating pressure = 5000 psi
- Bypass flow is not available until priority flow requirements are satisfied.
- Bypass pressure at port 4 can be higher than pressure at control port 2.
- Priority flow can be turned on or off with a pilot sized solenoid valve on port 1.

OPTION ORDERING INFORMATION

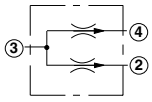
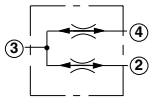
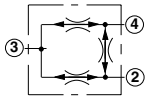
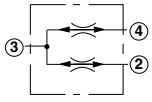
LH ★ A – X ★ ★

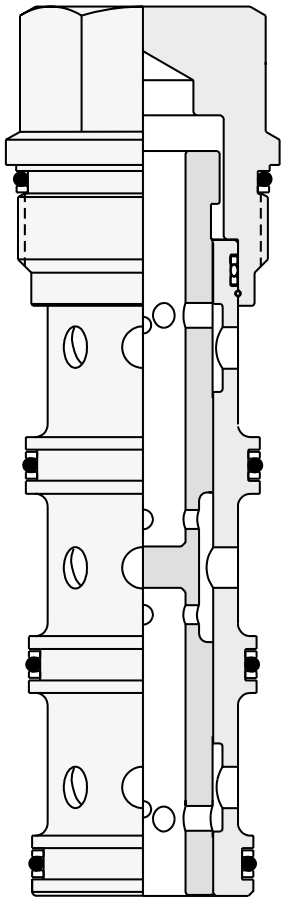
Maximum Inlet Flow	*Control***	*Adjustment Range*	*Seal*
D 15 GPM	**X** Non-adjustable	**E** 75 - 100 psi	**N** Buna-N
F 30 GPM		**F** 100 - 140 psi	**V** Viton
H 60 GPM			
J 120 GPM			

*** See page 162 for information on Control Options*

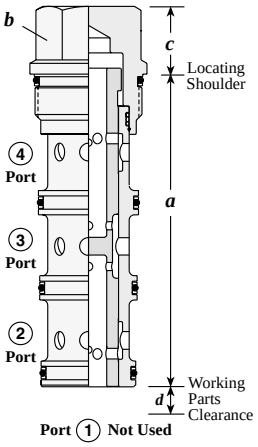
NOTES

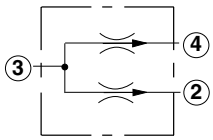
Flow Divider / Combiner Cartridge Valves

	Cartridge Type	*Page*
	Divider	82
	Divider / Combiner, Closed Center	83
	Synchronizing Divider / Combiner	84
	High Capacity Divider / Combiner, Closed Center	85



DIVIDER



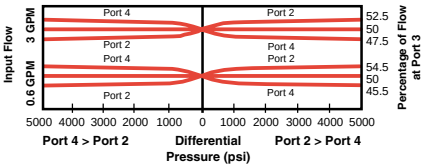


Capacity Min/Max	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (lb. ft.)
.6-3 GPM	**FSBD – XAN**	T - 31A	3.35	7/8”	.75	.14	30/35
1.5-8 GPM	**FSCD – XAN**	T - 31A	3.35	7/8”	.75	.14	30/35
3-15 GPM	**FSDD – XAN**	T - 32A	3.63	1 1/8”	.69	.15	45/50
6-30 GPM	**FSED – XAN**	T - 33A	4.50	1 1/4”	.97	.21	150/160
12-60 GPM	**FSFD – XAN**	T - 34A	5.50	1 5/8”	1.19	.27	350/375

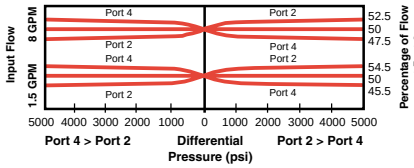
Performance Curves

Operating Characteristics

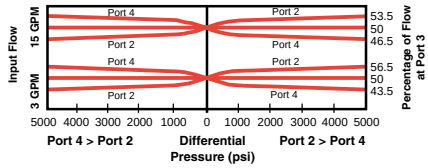
FSBD-XAN



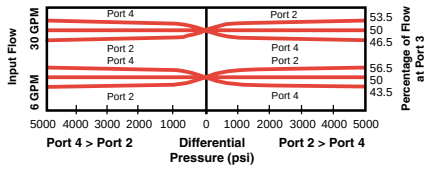
FSCD-XAN



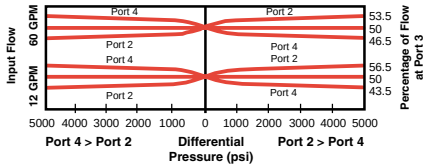
FSDD-XAN



FSED-XAN



FSFD-XAN



- Maximum operating pressure = 5000 psi
- This valve is a divider only; any attempt to flow backwards through the valve is not advised.
- Divisional accuracy at maximum rated input flow = FSBD: ±2.5%, FSCD, FSDD, FSED, FSFD: ±3.5%
- Divisional accuracy at minimum rated input flow = FSBD: ±4.5%, FSCD, FSDD, FSED, FSFD: ±6.5%
- Pressure drop at maximum input flow = 250 psi
- Pressure drop at minimum input flow = 10 psi
- Below the minimum flow rating there is not enough flow for the valve to modulate. It is effectively a tee. If flow starts at zero and rises, there will be no dividing control until the flow reaches the minimum rating.

OPTION ORDERING INFORMATION

FS ✶ D – X ✶ ✶

Nominal Capacity

- **B** .6-3 GPM
- **C** 1.5-8 GPM
- **D** 3-15 GPM
- **E** 6-30 GPM
- **F** 12-60 GPM

Control

- **X** Non-adjustable

Flow Proportion

- **A** 50/50 Flow Split
- **B***40/60 Flow Split
- **C***33/67 Flow Split

Seal

- **N** Buna-N
- **V** Viton

* *Port 4 is always high percentage flow.*

Reverse Flow Path is unpredictable
Divisional Accuracy =
FSCD, FSDD, FSED and FSFD:
± 6.5 % at minimum input flow
± 3.5 % at maximum input flow
FSBD:
± 4.5 % at minimum input flow
± 2.5 % at maximum input flow

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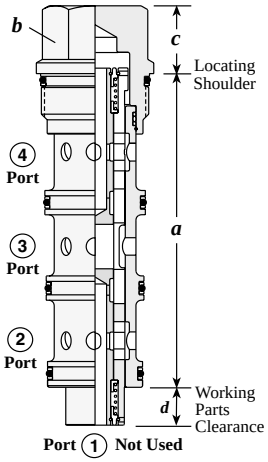
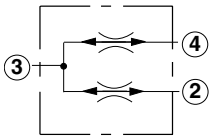
DIVIDER / COMBINER, CLOSED CENTER





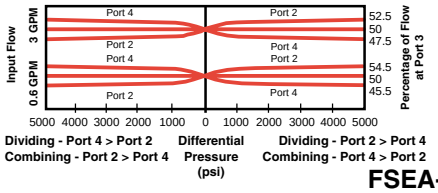
Note: Closed center valves have spring centered internal spools that provide blocked flow paths when centered. Centering occurs when the Port 3 flow is also blocked. This internal blocking isolates Port 2 and 4 from cross flow.

Capacity Min/Max	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (lb. ft.)*
.6-3 GPM	**FSBA – XAN**	T - 31A	3.35	7/8”	.75	.65	30/35
1.5-8 GPM	**FSCA – XAN**	T - 31A	3.35	7/8”	.75	.65	30/35
3-15 GPM	**FSDA – XAN**	T - 32A	3.63	1 1/8”	.69	.77	45/50
6-30 GPM	**FSEA – XAN**	T - 33A	4.50	1 1/4”	.97	.99	150/160
12-60 GPM	**FSFA – XAN**	T - 34A	5.50	1 5/8”	1.19	.91	350/375

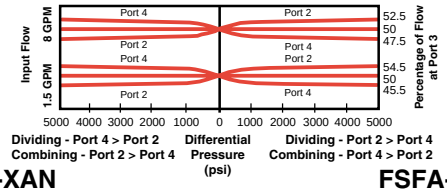
Performance Curves

Operating Characteristics

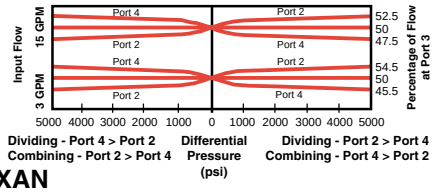
FSBA-XAN



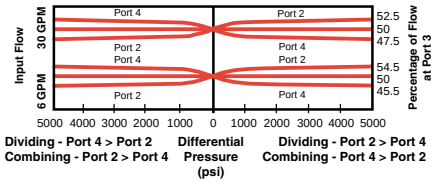
FSCA-XAN



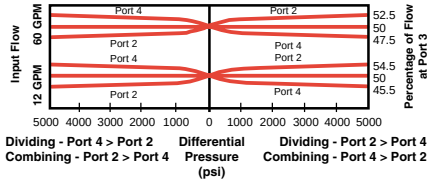
FSDA-XAN



FSEA-XAN



FSFA-XAN



- Maximum operating pressure = 5000 psi
- Divisional accuracy at rated maximum input flow = 50% ±2.5%
- Divisional accuracy at rated minimum input flow = 50% ±4.5%
- Pressure drop at maximum input flow = 350 psi
- Pressure drop at minimum input flow = 25 psi
- Below the minimum flow rating there is not enough flow for the valve to modulate. It is effectively a tee. If flow starts at zero and rises, there will be no dividing or combining control until the flow reaches the minimum rating.
- Divisional and combining accuracy are equal.

OPTION ORDERING INFORMATION

FS ★ A – X A ★

Nominal Capacity	*Control*	*Flow Proportion*	*Seal*
B .6-3 GPM	**X** Non-adjustable	**A** 50/50 Flow Split	**N** Buna-N
C 1.5-8 GPM			**V** Viton
D 3-15 GPM			
E 6-30 GPM			
F 12-60 GPM			

Divisional Accuracy (Combining and Dividing) =
± 4.5 % at minimum input flow
± 2.5 % at maximum input flow

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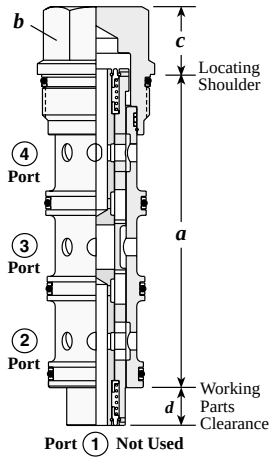
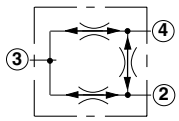
SYNCHRONIZING DIVIDER / COMBINER



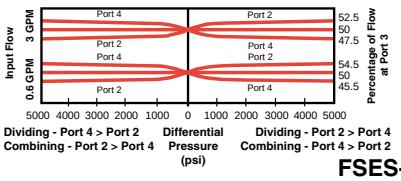


Capacity Min/Max	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (lb. ft.)*
.6-3 GPM	**FSBS – XAN**	T - 31A	3.35	7/8”	.75	.65	30/35
1.5-8 GPM	**FSCS – XAN**	T - 31A	3.35	7/8”	.75	.65	30/35
3-15 GPM	**FSDS – XAN**	T - 32A	3.63	1 1/8”	.69	.77	45/50
6-30 GPM	**FSES – XAN**	T - 33A	4.50	1 1/4”	.97	.99	150/160
12-60 GPM	**FSFS – XAN**	T - 34A	5.50	1 5/8”	1.19	.91	350/375

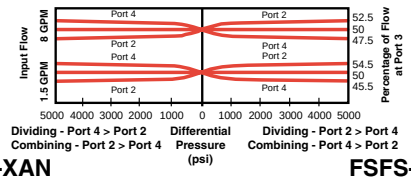
Performance Curves

Operating Characteristics

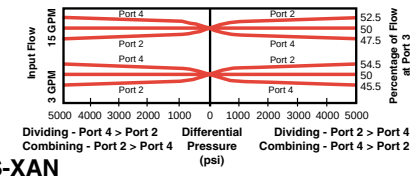
FSBS-XAN



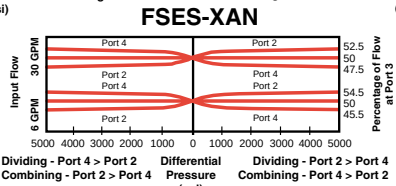
FSCS-XAN



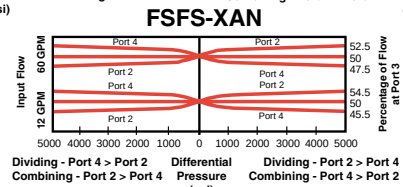
FSDS-XAN



FSES-XAN



FSFS-XAN



- Maximum operating pressure = 5000 psi
- Divisional accuracy at rated maximum input flow = 50% ±2.5%
- Divisional accuracy at rated minimum input flow = 50% ±4.5%
- Pressure drop at maximum input flow = 350 psi
- Pressure drop at minimum input flow = 25 psi
- Below the minimum flow rating there is not enough flow for the valve to modulate. It is effectively a tee. If flow starts at zero and rises, there will be no dividing or combining control until the flow reaches the minimum rating.
- The synchronization feature provides bi-directional static error correction.
- Divisional and combining accuracy are equal.

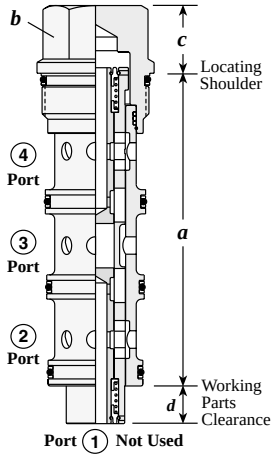
OPTION ORDERING INFORMATION

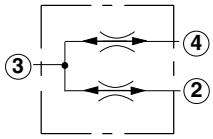
FS ✶ S – X A ✶

Nominal Capacity	*Control*	*Flow Proportion*	*Seal*
B .6-3 GPM	**X** Non-adjustable	**A** 50/50 Flow Split	**N** Buna-N
C 1.5-8 GPM			**V** Viton
D 3-15 GPM			
E 6-30 GPM			
F 12-60 GPM			

Divisional Accuracy (Combining and Dividing) =
± 4.5 % at minimum input flow
± 2.5 % at maximum input flow
Synchronizing Flow per Leg:
FSBS: .16 - .25 GPM
FSCS: .2 - .5 GPM
FSDS: .3 - .6 GPM
FSES: .8 - 1.5 GPM
FSFS: 2.4 - 3.5 GPM

HIGH CAPACITY DIVIDER / COMBINER, CLOSED CENTER





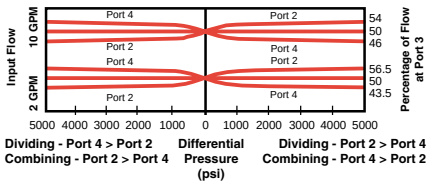
Note: Closed center valves have spring centered internal spools that provide blocked flow paths when centered. Centering occurs when the Port 3 flow is also blocked. This internal blocking isolates Port 2 and 4 from cross flow.

Capacity Min/Max	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (lb. ft.)*
2-10 GPM	**FSCH – XAN**	T - 31A	3.35	7/8”	.75	.65	30/35
4-20 GPM	**FSDH – XAN**	T - 32A	3.63	1 1/8”	.69	.77	45/50
8-40 GPM	**FSEH – XAN**	T - 33A	4.50	1 1/4”	.97	.99	150/160
15-80 GPM	**FSFH – XAN**	T - 34A	5.50	1 5/8”	1.19	.91	350/375

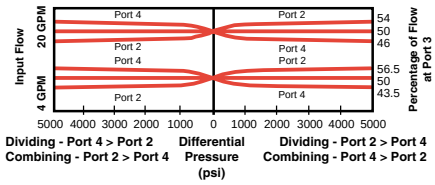
Performance Curves

Constant Command - Varying Flow

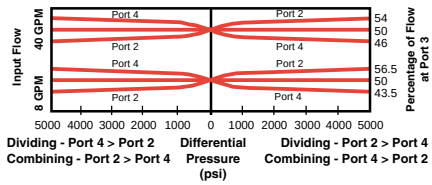
FSCH-XAN



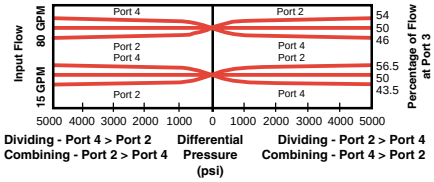
FSDH-XAN



FSEH-XAN



FSFH-XAN



- Maximum operating pressure = 5000 psi
- Divisional accuracy at rated maximum input flow = 50% ±4%
- Divisional accuracy at rated minimum input flow = 50% ±6.5%
- Pressure drop at maximum input flow = 350 psi
- Pressure drop at minimum input flow = 25 psi
- Below the minimum flow rating there is not enough flow for the valve to modulate. It is effectively a tee. If flow starts at zero and rises, there will be no dividing or combining control until the flow reaches the minimum rating.
- Divisional and combining accuracy are equal.

OPTION ORDERING INFORMATION

FS ✶ H – X A ✶

Nominal Capacity	*Control*	*Flow Proportion*	*Seal*
C 2-10 GPM	**X** Non-adjustable	**A** 50/50 Flow Split	**N** Buna-N
D 4-20 GPM			**V** Viton
E 8-40 GPM			
F 15-80 GPM			

Divisional Accuracy (Combining and Dividing) =
± 6.5 % at minimum input flow
± 4.0 % at maximum input flow

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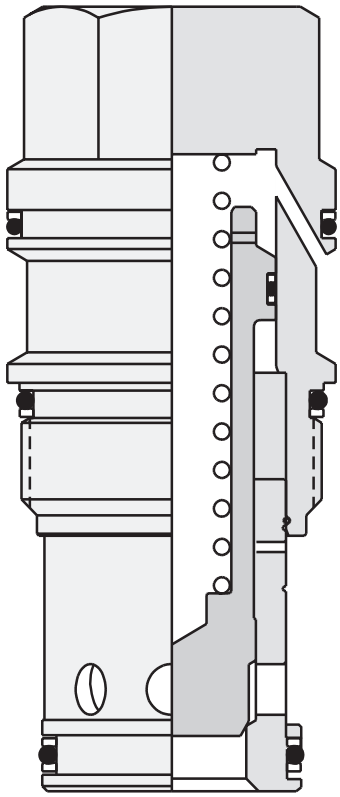
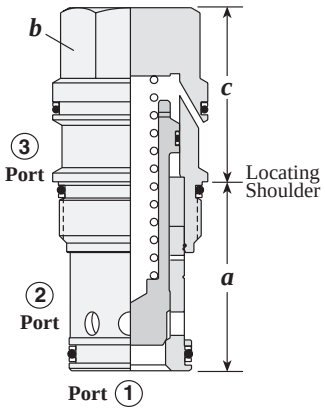
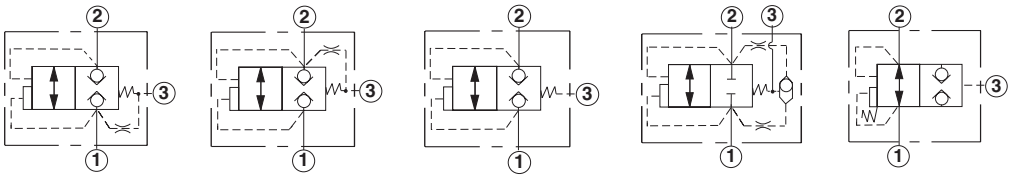
NOTES

Logic Elements



UNBALANCED POPPET, PILOT-TO-CLOSE SWITCHING ELEMENT



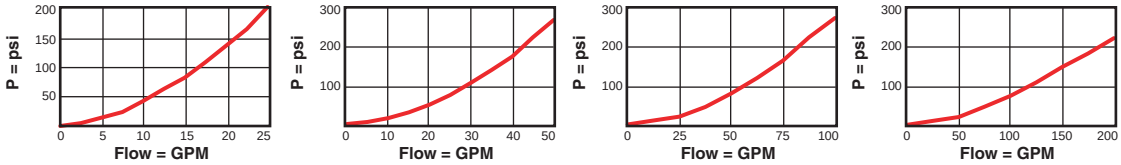


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	c E	Installation Torque (lb. ft.)
25 GPM	**LODC – XDN**	T - 11A	1.38	7/8”	1.19	1.19	30/35
50 GPM	**LOFC – XDN**	T - 2A	1.38	1 1/8”	1.38	1.38	45/50
100 GPM	**LOHC – XDN**	T - 17A	1.81	1 1/4”	1.81	1.81	150/160
200 GPM	**LOJC – XDN**	T - 19A	2.50	1 5/8”	2.31	2.31	350/375

Performance Curves

LOD* **LOF*** **LOH*** **LOJ***

Full Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Area ratio: A3 to A1 = 1.8:1
- Area ratio: A3 to A2 = 2.25:1
- Control orifice diameter = LODA, LODB, LODD, LOFA, LOFB, LOFD:.021 in., LOHA, LOHB, LOHD: .031 in., LOJA, LOJB, LOJD: .035 in.
- Pilot volume for complete shift = LOD*: .04 in³/min., LOF*: .07 in³/min., LOH*: .25 in³/min., LOJ*: .42 in³/min.
- These valves are pressure responsive at all three ports, therefore it is essential to consider all aspects of system operation through a complete cycle. Pressure changes at any one port may cause a valve to switch from a closeld to an open position, or vice versa. All possible pressure changes in the complete circuit must be considered to assure a safe, functional system design.

OPTION ORDERING INFORMATION

LO ★ ★ – ★ ★ ★

Nominal Capacity
- **D** 25 GPM
- **F** 50 GPM
- **H** 100 GPM
- **J** 200 GPM

Version
- **A** Spring biased closed Port 1 pilot source
- **B** Spring biased closed Port 2 pilot source
- **C** Spring biased closed Port 3 pilot source
- **D** Spring biased closed higher of Ports 1or 2 pilot source
- **O** Spring biased open Port 3 pilot source

Control**
- **X** Non-adjustable

Available in B and C Versions Only
- **E** SAE-4 Port in Hex Body, Port 3 blocked

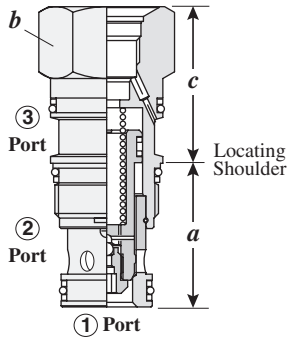
Available in D and F Capacities Only
- **L** Stroke Adjustment

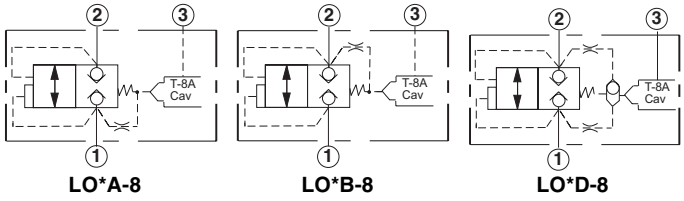
Cracking Pressure A, B, C, D Versions
- **D** 50 psi at Port 1 (30 psi to close at Port 3 for **O** Version)

Seal
- **N** Buna-N
- **V** Viton

** *See page 162 for information on Control Options*

UNBALANCED POPPET, PILOT-TO-CLOSE SWITCHING ELEMENT WITH INTEGRAL PILOT CONTROL CAVITY





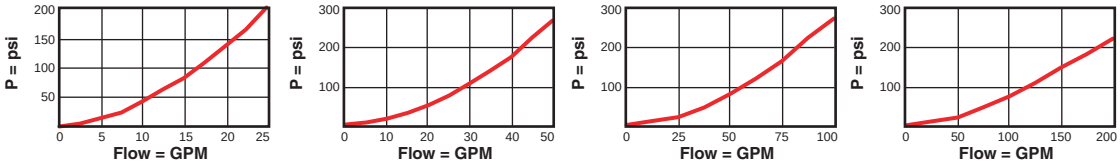
The -8 control option allows a pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid and air pilot operation. See Pilot Control Cartridges on page 121.

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
25 GPM	**LODA – 8DN**	T - 11A	1.38	7/8”	1.19	30/35
50 GPM	**LOFA – 8DN**	T - 2A	1.38	1 1/8”	1.38	45/50
100 GPM	**LOHA – 8DN**	T - 17A	1.81	1 1/4”	1.81	150/160
200 GPM	**LOJA – 8DN**	T - 19A	2.50	1 5/8”	2.31	350/375

Performance Curves

LOD*-8 **LOF*-8** **LOH*-8** **LOJ*-8**

Full Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Area ratio: A3 to A1 = 1.8:1
- Area ratio: A3 to A2 = 2.25:1
- Control orifice diameter = LOD*-8, LOD*-8, LOF*-8, LOF*-8: .021 in., LOH*, LOH*-8: .031 in., LOJ*, LOJ*-8: .035 in.
- These valves are pressure responsive at all three ports, therefore it is essential to consider all aspects of system operation through a complete cycle. Pressure changes at any one port may cause a valve to switch from a closed to an open position, or vice versa. All possible pressure changes in the complete circuit must be considered to assure a safe, functional system design.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

LO ✶ ✶ – 8 ✶ ✶

Nominal Capacity
- **D** 25 GPM
- **F** 50 GPM
- **H** 100 GPM
- **J** 200 GPM

Version
- **A** Spring biased closed Port 1 pilot source
- **B** Spring biased closed Port 2 pilot source
- **D** Spring biased closed higher of Ports 1or 2 pilot source

Control**
- **8** T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)

Cracking Pressure A, B, D Versions
- **D** 50 psi at Port 1

Seal
- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

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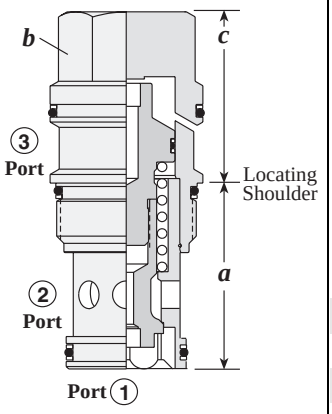
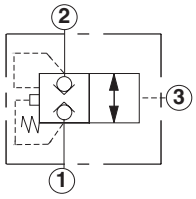
UNBALANCED POPPET, PILOT-TO-OPEN SWITCHING ELEMENT



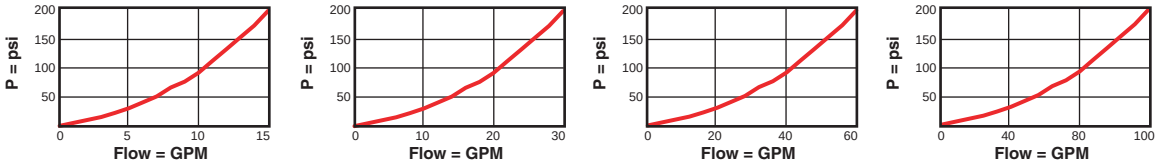


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (lb. ft.)
15 GPM	**LKDC – XDN**	T - 11A	1.38	7/8”	1.19	30/35
30 GPM	**LKFC – XDN**	T - 2A	1.38	1 1/8”	1.38	45/50
60 GPM	**LKHC – XDN**	T - 17A	1.81	1 1/4”	1.81	150/160
120 GPM	**LKJC – XDN**	T - 19A	2.50	1 5/8”	2.31	350/375

Performance Curves

LKDC **LKFC** **LKHC** **LKJC**

Full Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Area ratio: A3 to A1 = 1.8:1
- Area ratio: A3 to A2 = 2.25:1
- Control orifice diameter = LKDC: .031 in., LKFC: .035 in., LKHC: .062 in., LKJC: .094 in.
- Pilot volume for complete shift = LKDC: .02 in³/min., LKFC: .06 in³/min., LKHC: .15 in³/min., LKJC: .30 in³/min.
- These valves are pressure responsive at all three ports, therefore it is essential to consider all aspects of system operation through a complete cycle. Pressure changes at any one port may cause a valve to switch from a closed to an open position, or vice versa. All possible pressure changes in the complete circuit must be considered to assure a safe, functional system design.

OPTION ORDERING INFORMATION

LK ★ ★ – ★ ★ ★

Nominal Capacity
- **D** 15 GPM
- **F** 30 GPM
- **H** 60 GPM
- **J** 120 GPM

Version
- **C** Port 3 pilot source

Control**
- **X** Non-adjustable

Available in D and F Capacities Only
- **L** Manual Release

Cracking Pressure
- **D** 30 psi at Port 3

Seal
- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

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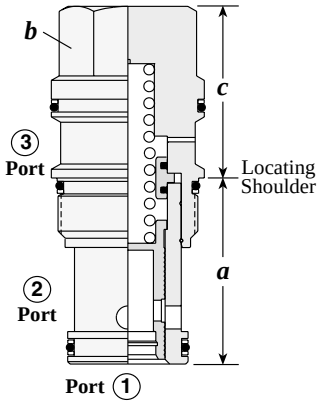
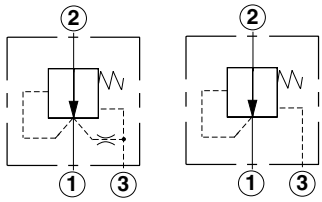
NORMALLY OPEN MODULATING ELEMENT





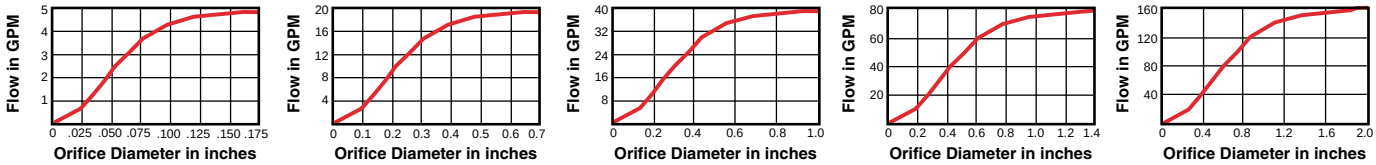
LP*A **LP*C**

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X	*c* L	*Installation Torque (lb. ft.)*
7.5 GPM	**LPBC – XHN**	T - 163A	1.22	3/4”	1.25	2.55	25/30
15 GPM	**LPDC – XHN**	T - 11A	1.38	7/8”	1.19	2.50	30/35
30 GPM	**LPFC – XHN**	T - 2A	1.38	1 1/8”	1.38	2.82	45/50
60 GPM	**LPHC – XHN**	T - 17A	1.81	1 1/4”	1.81	3.27	150/160
120 GPM	**LPJC – XHN**	T - 19A	2.50	1 5/8”	2.31	3.94	350/375

Performance Curves

LPBC **LPDC** **LPFC** **LPHC** **LPJC**

Capacity as a Restrictive Compensator



- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS, port 3 = 1 in³/min.
- Control orifice diameter = LPB*, LPD*, LPF*: .016 in., LPH*, LPJ*: .021 in.

OPTION ORDERING INFORMATION

LP ★ ★ – ★ ★ ★

Nominal Capacity

- **B** 7.5 GPM
- **D** 15 GPM
- **F** 30 GPM
- **H** 60 GPM
- **J** 120 GPM

Version

- **A** Internal pilot Port 1 to Port 3 (mainstage reducing element)
- **C** External pilot (restrictive compensator)

Control**

- **X** Non-adjustable

Available in D Adjustment Range only

- **L** Tuning Adjustment ± 25% of customer specified flow

Control Pressure

- **D** 50 psi
- **F** 100 psi
- **G***150 psi
- **H** 200 psi

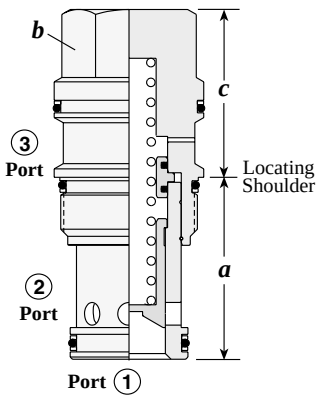
Seal

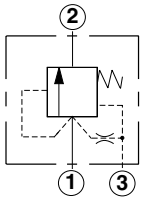
- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

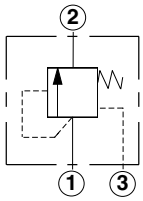
* *G Adjustment Range not available in LPBA, LPBC.*

NORMALLY CLOSED MODULATING ELEMENT





LR*A



LR*C

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c X	c L	*Installation Torque (lb. ft.)*
7.5 GPM	**LRBC – XHN**	T - 163A	1.22	3/4”	1.25	2.55	25/30
15 GPM	**LRDC – XHN**	T - 11A	1.38	7/8”	1.19	2.50	30/35
30 GPM	**LRFC – XHN**	T - 2A	1.38	1 1/8”	1.38	2.82	45/50
60 GPM	**LRHC – XHN**	T - 17A	1.81	1 1/4”	1.81	3.27	150/160
120 GPM	**LRJC – XHN**	T - 19A	2.50	1 5/8”	2.31	3.94	350/375

- Maximum operating pressure = 5000 psi
- Control orifice diameter = LRB*, LRD*, LRF*: .016 in., LRH*, LRJ*: .021 in.

OPTION ORDERING INFORMATION

LR ★ ★ – ★ ★ ★

Nominal Capacity

- **B** 7.5 GPM
- **D** 15 GPM
- **F** 30 GPM
- **H** 60 GPM
- **J** 120 GPM

Version

- **A** Internal pilot Port 1 to Port 3 (mainstage relief element)
- **C** External pilot (bypass compensator)

Control**

- **X** Non-adjustable

Available in D Adjustment Range only

- **L** Tuning Adjustment ± 25% of customer specified flow

Control Pressure

- **D** 50 psi
- **F** 100 psi
- **G***150 psi
- **H** 200 psi

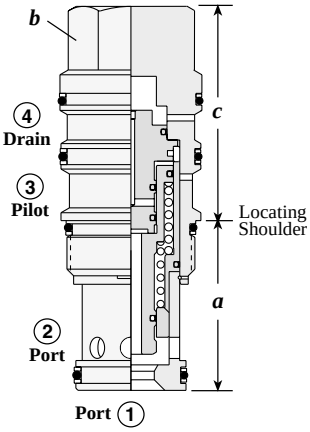
Seal

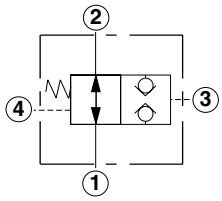
- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

** G Adjustment Range not available in LRBA, LRBC.*

NORMALLY OPEN, DIRECT OPERATED



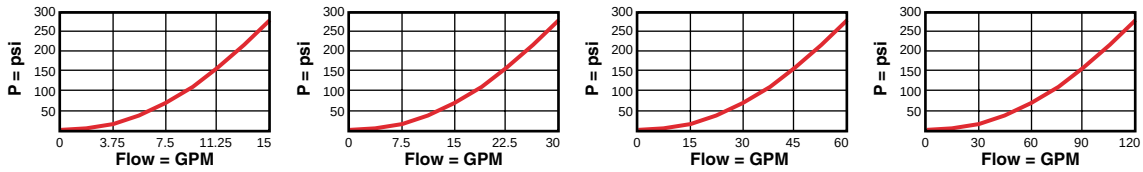


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**DODS – XHN**	T - 21A	1.38	7/8”	1.78	30/35
30 GPM	**DOFS – XHN**	T - 22A	1.38	1 1/8”	2.00	45/50
60 GPM	**DOHS – XHN**	T - 23A	1.81	1 1/4”	2.47	150/160
120 GPM	**DOJS – XHN**	T - 24A	2.50	1 5/8”	3.16	350/375

Performance Curves

DODS **DOFS** **DOHS** **DOJS**

Fully Open Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi (Port 1 and Port 2)
- Minimum pilot pressure to shift valve = DODS: 400 psi, DOFS, DOHS, DOJS: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Pilot volume for complete shift = DODS: .01 in³/min., DOFS: .02 in³/min., DOHS: .05 in³/min., DOJS: .17 in³/min.
- Valve will open when the pilot pressure falls below 145 psi.
- Any back pressure at the drain port is directly additive to the required pilot pressure for reliable operation.

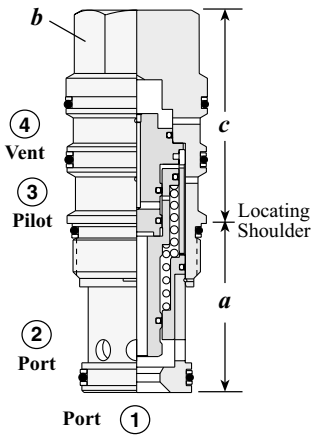
OPTION ORDERING INFORMATION

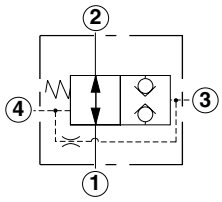
DO ✶ S – ✶ H ✶

Nominal Capacity		*Control***		*Control Pressure*		*Seal*	
D	15 GPM	**X**	Non-adjustable	**H**	200 psi	**N**	Buna-N
F	30 GPM					**V**	Viton
H	60 GPM						
J	120 GPM						

** *See page 162 for information on Control Options*

NORMALLY OPEN, VENT-TO-OPERATE



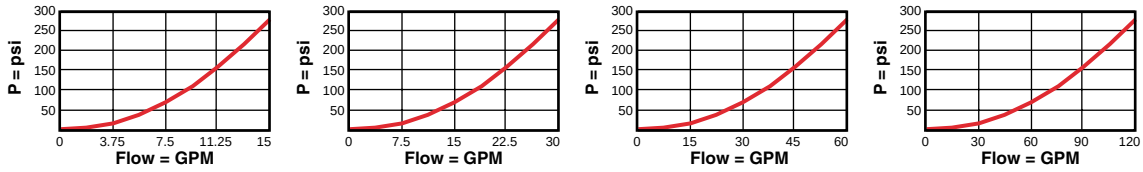


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (lb. ft.)
15 GPM	**DODR – XHN**	T - 21A	1.38	7/8”	1.78	30/35
30 GPM	**DOFR – XHN**	T - 22A	1.38	1 1/8”	2.00	45/50
60 GPM	**DOHR – XHN**	T - 23A	1.81	1 1/4”	2.47	150/160
120 GPM	**DOJR – XHN**	T - 24A	2.50	1 5/8”	3.16	350/375

Performance Curves

DODR **DOFR** **DOHR** **DOJR**

Fully Open Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve with Port 4 vented to tank = DODR: 400 psi, DOFR, DOHR, DOJR: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Control pilot flow = DODR: 25 in³/min., DOFR: 22 in³/min., DOHR, DOJR: 35 in³/min.
- Valve will open when the pilot pressure falls below 145 psi or with Port 4 blocked.
- Port 4 may be externally connected to a pilot switching valve. The pilot valve should have a leakage rate of less than 10 drops/min. and be able to satisfy the pilot flow requirements. Sun model DAAA-*** solenoid pilot valve is ideal for this application.

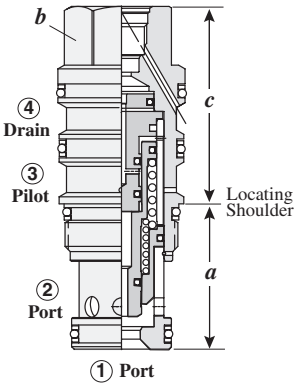
OPTION ORDERING INFORMATION

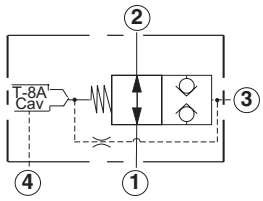
DO ★ R – ★ ★ ★

Nominal Capacity	*Control***	*Control Pressure*	*Seal*
D 15 GPM	**X** Non-adjustable	**H** 200 psi	**N** Buna-N
F 30 GPM			**V** Viton
H 60 GPM			
J 120 GPM			

*** See page 162 for information on Control Options*

NORMALLY OPEN, VENT-TO-OPERATE WITH INTEGRAL PILOT CONTROL CAVITY





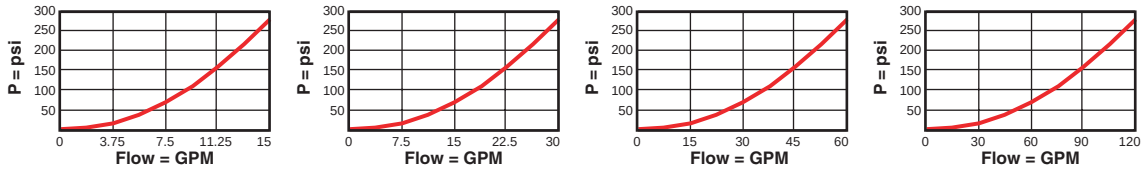
The -8 control option allows a pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**DODR – 8HN**	T - 21A	1.38	7/8”	1.78	30/35
30 GPM	**DOFR – 8HN**	T - 22A	1.38	1 1/8”	2.00	45/50
60 GPM	**DOHR – 8HN**	T - 23A	1.81	1 1/4”	2.47	150/160
120 GPM	**DOJR – 8HN**	T - 24A	2.50	1 5/8”	3.16	350/375

Performance Curves

DODR-8 **DOFR-8** **DOHR-8** **DOJR-8**

Fully Open Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve = DODR: 400 psi, DOFR, DOHR, DOJR: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Control pilot flow = DODR: 25 in³/min., DOFR: 22 in³/min., DOHR, DOJR: 35 in³/min.
- Valve will open when the pilot pressure falls below 145 psi.
- Any back pressure at the drain port is directly additive to the required pilot pressure.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

DO ✶ R – 8 ✶ ✶

Nominal Capacity

- **D** 15 GPM
- **F** 30 GPM
- **H** 60 GPM
- **J** 120 GPM

Control**

- **8** with T-8A cavity in hex body for pilot operation (see pilot control section for alternate options)

Control Pressure

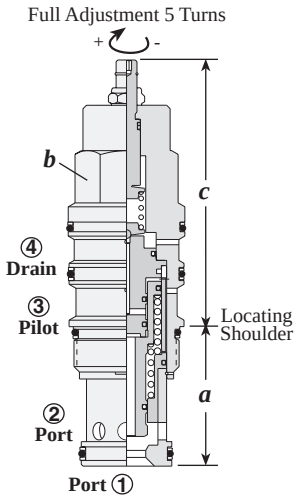
- **H** 200 psi

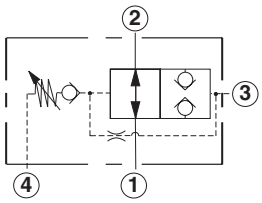
Seal

- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

NORMALLY OPEN, PRESSURE ADJUSTABLE



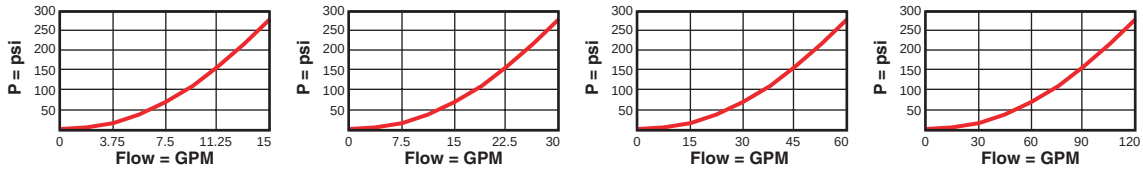


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*a*	*b*	*Cartridge Dimensions* *c* L	*c* C	*c* K	*Installation Torque (lb. ft.)*
15 GPM	**DODP – LAN**	T - 21A	1.38	7/8”	3.11	3.15	3.35	30/35
30 GPM	**DOFP – LAN**	T - 22A	1.38	1 1/8”	3.43	3.50	3.70	45/50
60 GPM	**DOHP – LAN**	T - 23A	1.81	1 1/4”	3.94	3.98	4.17	150/160
120 GPM	**DOJP – LAN**	T - 24A	2.50	1 5/8”	4.76	4.92	5.04	350/375

Performance Curves

DODP **DOFP** **DOHP** **DOJP**

Fully Open Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve = DODP: 400 psi, DOFP, DOH, DOJP: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Control pilot flow at shift = DODP, DOFP: 24 in^3/min., DOHP, DOJP: 36 in^3/min.
- Valve will open when the pilot pressure drops 85% below setting.
- Any back pressure at the drain port is directly additive to the required pilot pressure.

OPTION ORDERING INFORMATION

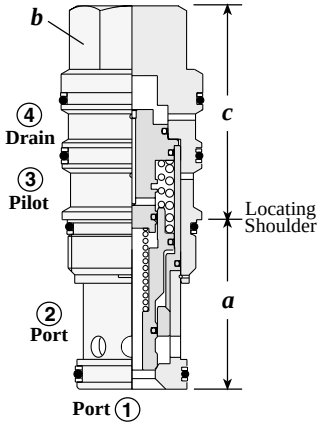
DO ★ P – ★ ★ ★

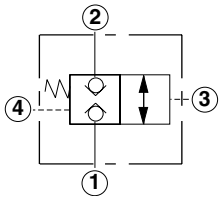
Nominal Capacity		*Control***		*Nominal Adjustable Shift Pressure Range*		*Seal*	
D	15 GPM	**L**	Standard Screw	**A**	300 - 3000 psi	**N**	Buna-N
F	30 GPM	**C**	Tamper Resistant	**B**	300 - 1500 psi	**V**	Viton
H	60 GPM	**K**	Handknob	**W**	300 - 4500 psi		
J	120 GPM						

** *See page 162 for information on Control Options*

Customer may specify pressure setting.

NORMALLY CLOSED, DIRECT OPERATED



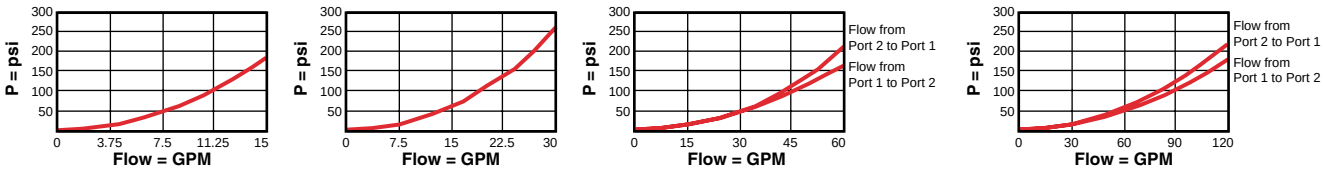


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**DKDS – XHN**	T - 21A	1.38	7/8”	1.78	30/35
30 GPM	**DKFS – XHN**	T - 22A	1.38	1 1/8”	2.00	45/50
60 GPM	**DKHS – XHN**	T - 23A	1.81	1 1/4”	2.47	150/160
120 GPM	**DKJS – XHN**	T - 24A	2.50	1 5/8”	3.16	350/375

Performance Curves

DKDS **DKFS** **DKHS** **DKJS**

Pilot Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve = DKDS: 400 psi, DKFS, DKHS, DKJS: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Pilot volume for complete shift = DKDS: .01 in³/min., DKFS: .02 in³/min., DKHS: .05 in³/min., DKJS: .17 in³/min.
- Valve will reseat when the pilot pressure drops 85% below setting.
- Any back pressure at the drain port is directly additive to the required pilot pressure.

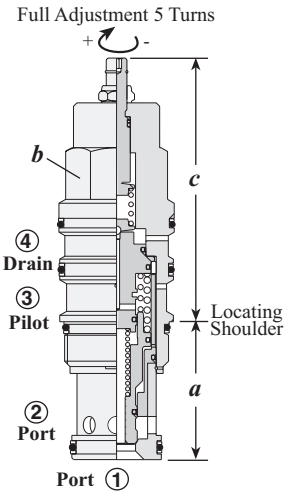
OPTION ORDERING INFORMATION

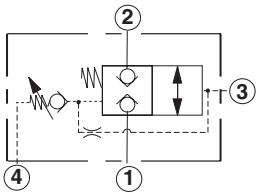
DK ✶ S – ✶ ✶ ✶

Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
D 15 GPM	**X** Non-adjustable	**H** 200 psi	**N** Buna-N
F 30 GPM			**V** Viton
H 60 GPM			
J 120 GPM			

** *See page 162 for information on Control Options*

NORMALLY CLOSED, PRESSURE ADJUSTABLE



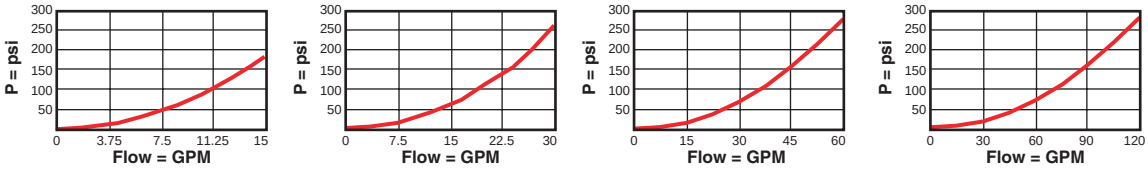


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*a*	*b*	*Cartridge Dimensions* *c* L	*c* C	*c* K	*Installation Torque (lb. ft.)*
15 GPM	**DKDP – LAN**	T - 21A	1.38	7/8”	3.11	3.16	3.34	30/35
30 GPM	**DKFP – LAN**	T - 22A	1.38	1 1/8”	3.44	3.50	3.70	45/50
60 GPM	**DKHP – LAN**	T - 23A	1.81	1 1/4”	3.94	3.98	4.17	150/160
120 GPM	**DKJP – LAN**	T - 24A	2.50	1 5/8”	4.78	4.92	5.04	350/375

Performance Curves

DKDP **DKFP** **DKHP** **DKJP**

Piloted Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve = DKDP: 400 psi, DKFP, DKHP, DKJP: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Control pilot flow at shift = DKDP, DKFP: 24 in³/min., DKHP, DKJP: 36 in³/min.
- Any back pressure at the drain port is directly additive to the required pilot pressure.
- Valve will reseat when the pilot pressure falls to 85% of the cracking value.

OPTION ORDERING INFORMATION

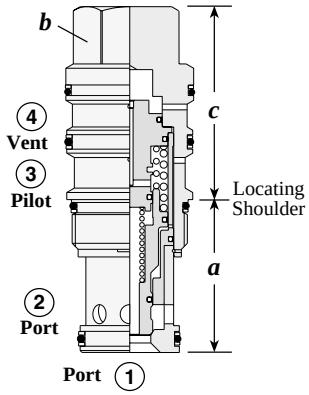
DK ★ P – ★ ★ ★

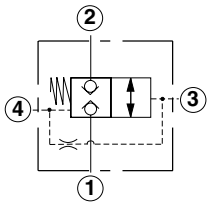
Nominal Capacity	*Control***	*Nominal Adjustable Shift Pressure Range*	*Seal*
D 15 GPM	**L** Standard Screw	**A** 300 - 3000 psi	**N** Buna-N
F 30 GPM	**C** Tamper Resistant	**B** 300 - 1500 psi	**V** Viton
H 60 GPM	**K** Handknob	**W** 300 - 4500 psi	
J 120 GPM			

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
Customer may specify pressure setting.

NORMALLY CLOSED, VENT-TO-OPERATE



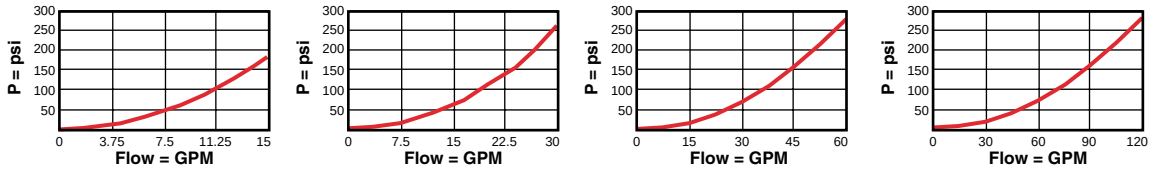


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**DKDR – XHN**	T - 21A	1.38	7/8”	1.78	30/35
30 GPM	**DKFR – XHN**	T - 22A	1.38	1 1/8”	2.00	45/50
60 GPM	**DKHR – XHN**	T - 23A	1.81	1 1/4”	2.47	150/160
120 GPM	**DKJR – XHN**	T - 24A	2.50	1 5/8”	3.16	350/375

Performance Curves

DKDR **DKFR** **DKHR** **DKJR**

Piloted Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve with Port 4 vented to tank = DKDR: 400 psi, DKFR, DKHR, DKJR: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Control pilot flow = DKDR: 25 in³/min., DKFR: 22 in³/min., DKHR, DKJR: 35 in³/min.
- Valve will reseat when the pilot pressure falls below 145 psi.
- Port 4 may be externally connected to a pilot switching valve. The pilot valve should have a leakage rate of less than 10 drops/min. and be able to satisfy the pilot flow requirements. Sun model DAAA-*** solenoid pilot valve is ideal for this application.

OPTION ORDERING INFORMATION

DK ✶ R – ✶ ✶ ✶

Nominal Capacity
- **D** 15 GPM
- **F** 30 GPM
- **H** 60 GPM
- **J** 120 GPM

*Control***
- **X** Non-adjustable

Nominal Shift Pressure
- **H** 200 psi

Seal
- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

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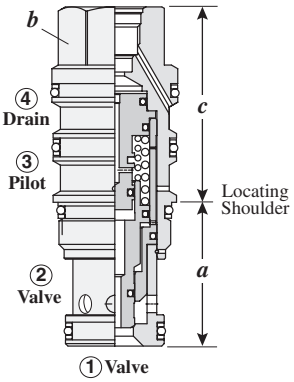
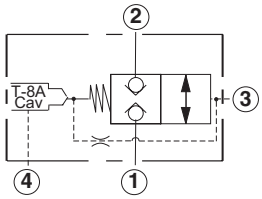
NORMALLY CLOSED, VENT-TO-OPERATE WITH INTEGRAL PILOT CONTROL CAVITY





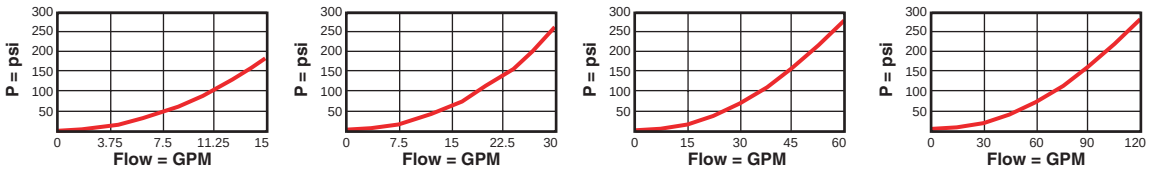
The -8 control option allows a pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**DKDR – 8H***	T - 21A	1.38	7/8”	1.78	30/35
30 GPM	**DKFR – 8H***	T - 22A	1.38	1 1/8”	2.00	45/50
60 GPM	**DKHR – 8H***	T - 23A	1.81	1 1/4”	2.47	150/160
120 GPM	**DKJR – 8H***	T - 24A	2.50	1 5/8”	3.16	350/375

Performance Curves

DKDR-8 **DKFR-8** **DKHR-8** **DKJR-8**

Piloted Open Pressure Drop



- Maximum operating pressure = 5000 psi
- Minimum pilot pressure to shift valve with Port 4 vented to tank = DKDR: 400 psi, DKFR, DKHR, DKJR: 300 psi
- Maximum valve leakage, Port 1 to Port 2 or Port 2 to Port 1 = 5 drops/min.
- Control pilot flow = DKDR: 25 in^3/min., DKFR: 22 in^3/min., DKHR, DKJR: 35 in^3/min.
- Valve will open when the pilot pressure falls below 145 psi.
- Any back pressure at the drain port is directly additive to the required pilot pressure for reliable operation.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

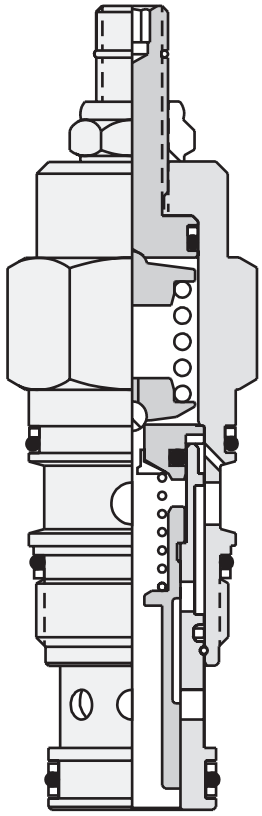
OPTION ORDERING INFORMATION

DK ✶ R – 8 ✶ ✶

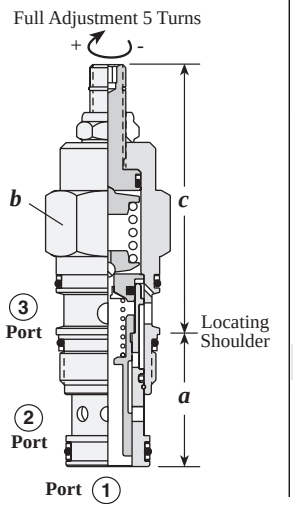
Nominal Capacity	*Control***	*Nominal Shift Pressure*	*Seal*
D 15 GPM	**8** with T-8A cavity in hex body for pilot operation (see pilot control section for alternate options)	**H** 200 psi	**N** Buna-N
F 30 GPM			**V** Viton
H 60 GPM			
J 120 GPM			

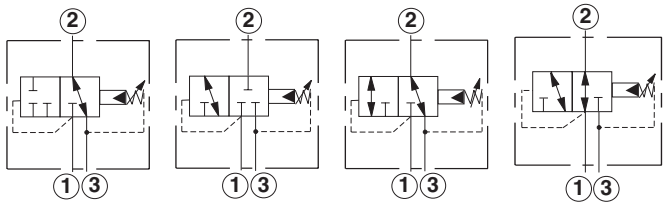
** *See page 162 for information on Control Options*

Directional Cartridge Valves



2 POSITION, 2-WAY AND 3-WAY, WITH INTERNAL DRAIN





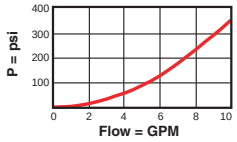
DP*A **DP*B** **DP*C** **DP*D**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c L	c C	c K	*Installation Torque (lb. ft.)*
7.0 GPM	**DPBA – LAN**	T - 11A	1.38	7/8”	2.50	2.56	2.75	30/35
15 GPM	**DPCA – LAN**	T - 2A	1.38	1 1/8”	2.81	2.88	3.06	45/50

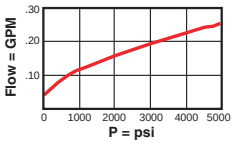
Performance Curves

DPB*

Typical Pressure Drop

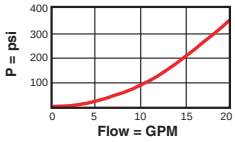


Pilot Oil Flow vs. Load Pressure above Valve Setting

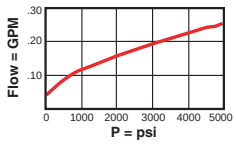


DPC*

Typical Pressure Drop



Pilot Oil Flow vs. Load Pressure above Valve Setting



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 in³/min. at 1000 psi
- Control pilot flow at opening = DPBA, DPBB, DPBC, DPBD = 7 - 10 in³/min., DPCA, DPCB, DPCC, DPCD = 10 - 15 in³/min.
- Maximum pressure at port 3 should be limited to 3000 psi.
- Pressure at port 3 is directly additive to the setting of the valve. Because of this, port 3 may not be useable as a work port in your circuit. If this is a consideration, the 4 port version of this valve may be a solution.
- For DP*C and DP*D port 3 can be blocked to prevent the cartridge from shifting.

OPTION ORDERING INFORMATION

DP ★ ★ – ★ ★ ★

Nominal Capacity

B 7.0 GPM

C 15 GPM

Version

A 2 Position 2-Way Normally Open

B 2 Position 2-Way Normally Closed

C 2 Position 3-Way Port 1 Blocked

D 2 Position 3-Way Port 1 Open

Control**

L Standard Screw

C Tamper Resistant

K Handknob

*** See page 162 for information on Control Options*

Adjustment Range

A 100 - 3000 psi

B 50 - 1500 psi

D 25 - 800 psi

E 25 - 400 psi

W 150 - 4500 psi

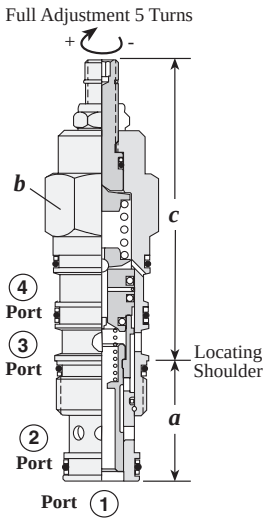
Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
Customer may specify pressure setting.

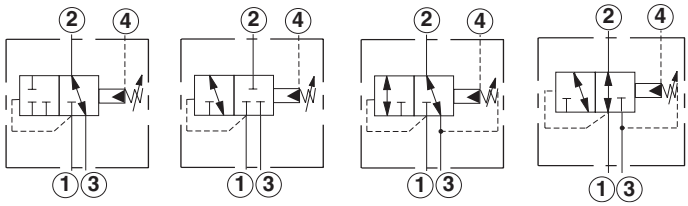
Seal

N Buna-N

V Viton

2 POSITION, 2-WAY AND 3-WAY, WITH EXTERNAL DRAIN



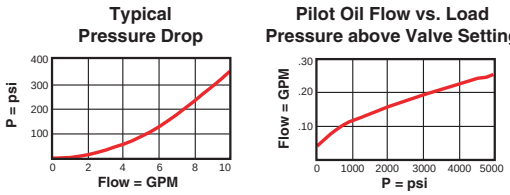


DP*M **DP*N** **DP*O** **DP*P**

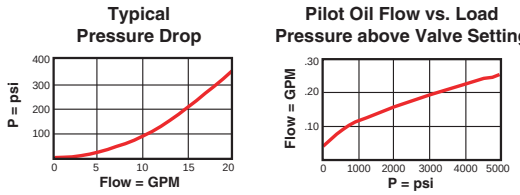
Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c L	c C	c K	*Installation Torque (lb. ft.)*
7.0 GPM	**DPBM– LAN**	T - 21A	1.38	7/8”	3.09	3.15	3.34	30/35
15 GPM	**DPCM– LAN**	T - 22A	1.38	1 1/8”	3.44	3.50	3.69	45/50

Performance Curves

DPB*



DPC*



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 1 in³/min. at 1000 psi
- Control pilot flow at opening = DPBM, DPBN, DPBO, DPBP = 7 - 10 in³/min., DPCM, DPCN, DPCO, DPCP = 10 - 15 in³/min.
- Maximum pressure at port 3 should be limited to 3000 psi.
- Pressure at port 4 is directly additive to the setting of the valve.
- Port 3 can be used as a work port.
- Port 4 can be blocked to prevent the cartridge from shifting.

OPTION ORDERING INFORMATION

DP ★ ★ – ★ ★ ★

Nominal Capacity
- **B** 7.0 GPM
- **C** 15 GPM

Version
- **M** 2 Position 2-Way Normally Open
- **N** 2 Position 2-Way Normally Closed
- **O** 2 Position 3-Way Port 1 Blocked
- **P** 2 Position 3-Way Port 1 Open

Control**
- **L** Standard Screw
- **C** Tamper Resistant
- **K** Handknob

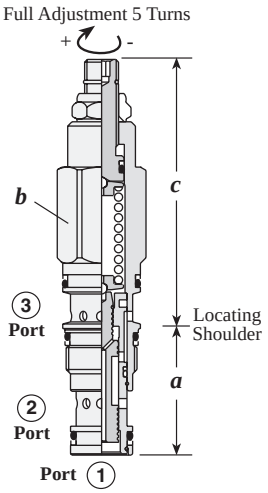
Adjustment Range
- **A** 100 - 3000 psi
- **B** 50 - 1500 psi
- **D** 25 - 800 psi
- **E** 25 - 400 psi
- **W** 150 - 4500 psi

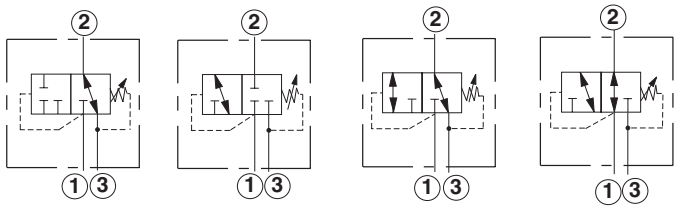
Seal
- **N** Buna-N
- **V** Viton

*** See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
Customer may specify pressure setting.

2 POSITION, 2-WAY AND 3-WAY DIRECT ACTING, INTERNAL DRAIN





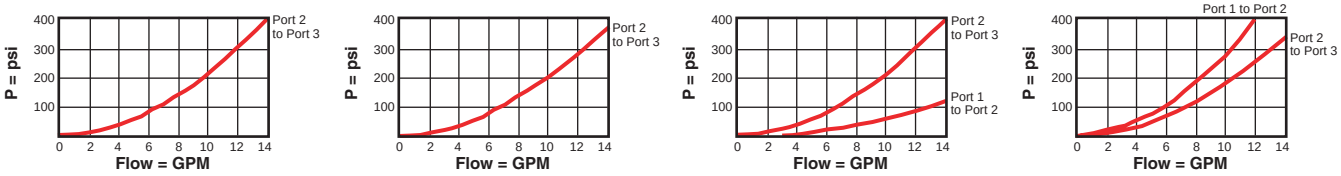
DRBA **DRBB** **DRBC** **DRBD**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	C	K	*Installation Torque (lb. ft.)*
7.0 GPM	**DRBA – LAN**	T - 11A	1.38	7/8”	3.10	3.16	3.34	30/35

Performance Curves

DRBA **DRBB** **DRBC** **DRBD**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 2 in³/min. at 1000 psi
- Maximum pressure at port 3 should be limited to 3000 psi.
- Pressure at port 3 is directly additive to the setting of the valve. Because of this, port 3 may not be useable as a work port in your circuit. If this is a consideration, the 4 port version of this valve may be a solution.

OPTION ORDERING INFORMATION

DR ★ ★ – ★ ★ ★

Nominal Capacity

B 7.0 GPM

Version

A 2 Position 2-Way Normally Open

B 2 Position 2-Way Normally Closed

C 2 Position 3-Way Port 1 Blocked

D 2 Position 3-Way Port 1 Open

Control**

L Standard Screw

C Tamper Resistant

K Handknob

Adjustment Range

A 500 - 3000 psi

B 200 - 1500 psi

D 30 - 800 psi

E 30 - 400 psi

S 30 - 200 psi

W 750 - 4500 psi

Seal

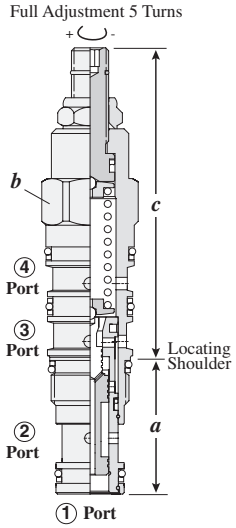
N Buna-N

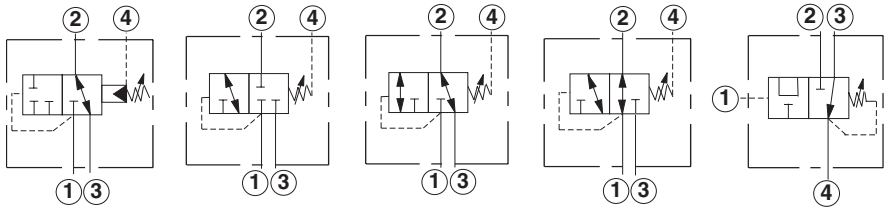
V Viton

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E and S are standard set at 200 psi.
Customer may specify pressure setting.

2-POSITION, 2-WAY AND 3 WAY, DIRECT ACTING



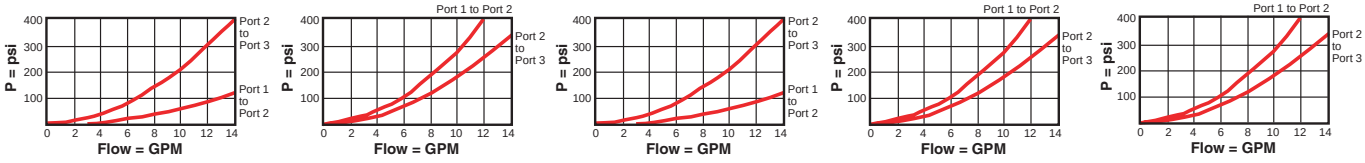


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
7.0 GPM	**DRBM– LAN**	T - 21A	1.38	7/8”	3.10	3.16	3.34	30/35
7.0 GPM	**DRBN – LAN**	T - 21A	1.38	7/8”	3.10	3.16	3.34	30/35
7.0 GPM	**DRBO – LAN**	T - 21A	1.38	7/8”	3.10	3.16	3.34	30/35
7.0 GPM	**DRBP – LAN**	T - 21A	1.38	7/8”	3.10	3.16	3.34	30/35
7.0 GPM	**DRBR – LAN**	T - 21A	1.38	7/8”	3.10	3.16	3.34	30/35

Performance Curves

DRBM **DRBN** **DRBO** **DRBP** **DRBR**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 2 in³/min. at 1000 psi
- Maximum pressure at port 3 should be limited to 3000 psi.
- DRBM, DRBN, DRBO, DRBP: Port 3 can be used as a work port
- DRBM, DRBN, DRBO, DRBP: Pressure at port 4 is directly additive to the setting of the valve.

OPTION ORDERING INFORMATION

DR ★ ★ – ★ ★ ★

Nominal Capacity	Base Price
B 7.0 GPM	**$ 84.50**

Version	
M 2-Position, 2-Way, Normally Open, External Drain	**-$ 7.20**
N 2-Position, 2-Way, Normally Closed, External Drain	**-$ 7.20**
O 2-Position, 3-Way, Port 1 Blocked, External Drain	**-$ .20**
P 2-Position, 3-Way, Port 1 Open, External Drain	**+$ 2.00**
R 2-Position, 3-Way, External Pilot*	**+$ 3.80**

Control**	
L Standard Screw	**+$ 0.00**
C Tamper Resistant	**+$ 4.10**
K Handknob	**+$ 6.00**

Adjustment Range	
A 500 - 3000 psi	**+$ 0.00**
B 200 - 1500 psi	**+$ 0.00**
N* 30 - 800 psi	**+$ 1.00**
E* 30 - 400 psi	**+$ 1.00**
S* 30 - 200 psi	**+$ 2.00**
W 750 - 4500 psi	**+$ 0.00**

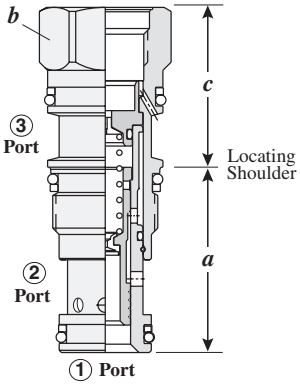
* *DRBR only available with these spring ranges.*

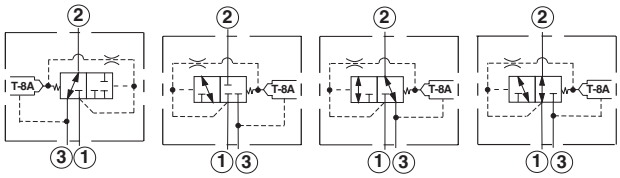
Seal	
N Buna-N	**+$ 0.00**
V Viton	**+$ 3.00**

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, and W are standard set at 1000 psi.
N Option is standard set at 400 psi.
E and S are standard set at 200 psi.
Customer may specify pressure setting. **+$ 1.10**

2-WAY AND 3-WAY WITH INTEGRAL PILOT CONTROL CAVITY





DVBA-8 **DVBB-8** **DVBC-8** **DVBD-8**

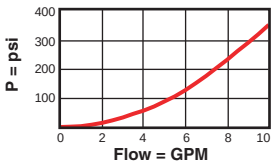
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (lb. ft.)*
7 GPM	**DVBA-8FN**	T-11A	1.38	7/8	1.38	30/35
7 GPM	**DVBB-8FN**	T-11A	1.38	7/8	1.38	30/35
7 GPM	**DVBC-8FN**	T-11A	1.38	7/8	1.38	30/35
7 GPM	**DVBD-8FN**	T-11A	1.38	7/8	1.38	30/35

Performance Curves

DV✶✶-8

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Control pilot flow at opening = DVBA-8, DVBB-8, DVBC-8, DVBD-8 = 7 - 10 in³/min., DVCA-8, DVCB-8, DVCC-8, DVCD-8 = 10 - 15 in³/min.
- Maximum leakage per path = 2 in³/min. at 1000 psi
- Maximum pressure at port 3 should be limited to 3000 psi.
- There must be a pressure source at port 1, relative to port 3, to shift the valve.
- Pressure at port 3 may oppose the opening of the valve. Because of this, port 3 may not be useable as a work port in your circuit. If this is a consideration, the 4 port version of this valve may be a solution.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

DV ✶ ✶ – 8 ✶ ✶

Nominal Capacity

B 7GPM

Version

A 2 Position, 2-Way Normally Open

B 2 Position, 2-Way Normally Closed

C 2 Position, 3-Way, Port 1 Blocked

D 2 Position, 3-Way, Port 1 Open

Control**

8 T-8A Cavity in in hex body for pilot operation (Pilot valve to be ordered separately)

Adjustment Range

F 100 psi

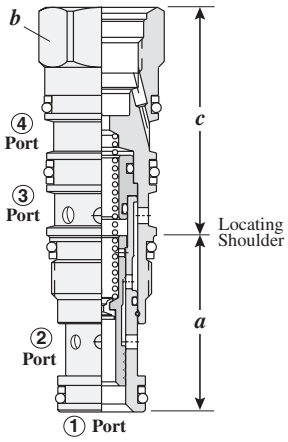
Seal

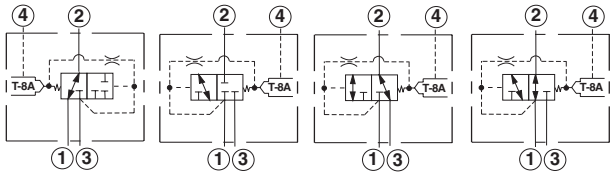
N Buna-N

V Viton

*** See page 162 for information on Control Options*

4-PORT, 2-WAY AND 3-WAY WITH INTEGRAL PILOT CONTROL CAVITY





DVBM-8 **DVBN-8** **DVBO-8** **DVBP-8**

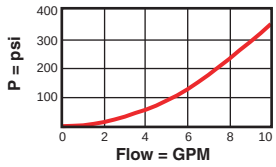
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (lb. ft.)*
7 GPM	**DVBM – 8FN**	T-21A	1.38	7/8	1.69	30/35
7 GPM	**DVBN – 8FN**	T-21A	1.38	7/8	1.69	30/35
7 GPM	**DVBO – 8FN**	T-21A	1.38	7/8	1.69	30/35
7 GPM	**DVBP – 8FN**	T-21A	1.38	7/8	1.69	30/35

Performance Curves

DV✶✶-8

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Control pilot flow at opening = DVBM-8, DVBN-8, DVBO-8, DVBP-8 = 7 - 10 in³/min., DVCM-8, DVCN-8, DVCO-8, DVCP-8 = 10 - 15 in³/min.
- Maximum leakage per path = 2 in³/min. at 1000 psi
- Maximum pressure at port 3 should be limited to 3000 psi.
- There must be a pressure source at port 1, relative to port 4, to shift the valve.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

DV ✶ ✶ – 8 ✶ ✶

Nominal Capacity
B 7 GPM

Version
M 2 Position, 2-Way Normally Open
N 2 Position, 2-Way Normally Closed
O 2 Position, 3-Way, Port 1 Blocked
P 2 Position, 3-Way, Port 1 Open

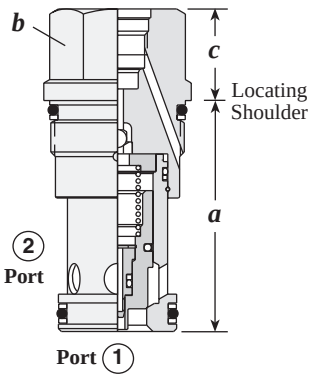
Control**
8 T-8A Cavity in hex body for pilot operation (Pilot valve to be ordered separately)

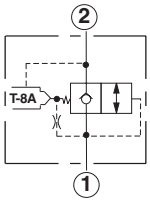
Adjustment Range
F 100 psi

Seal
N Buna-N
V Viton

*** See page 162 for information on Control Options*

2-POSITION, 2-WAY POPPET, CONTROL 1 TO 2 WITH INTEGRAL PILOT CONTROL CAVITY





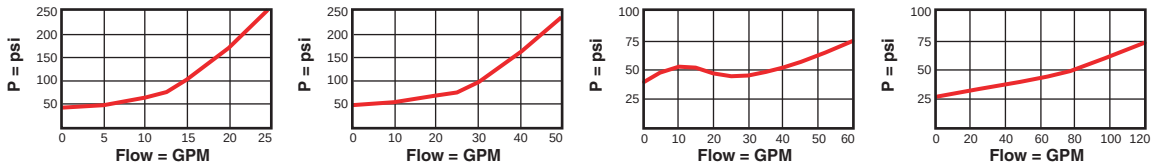
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (lb. ft.)*
15 GPM	**DFCA – 8DN**	T - 13A	1.38	7/8	.75	30/35
30 GPM	**DFDA – 8DN**	T - 5A	1.62	1 1/8	.69	45/50
60 GPM	**DFEA – 8DN**	T - 16A	2.44	1 1/4	.97	150/160
120 GPM	**DFFA – 8DN**	T - 18A	3.13	1 5/8	1.19	350/375

Performance Curves

DFCA-8 **DFDA-8** **DFEA-8** **DFFA-8**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.
- Main stage leakage less than 5 drops/min.

OPTION ORDERING INFORMATION

DF ✶ A – 8 D ✶

Nominal Capacity

- **C** 15 GPM
- **D** 30 GPM
- **E** 60 GPM
- **F** 120 GPM

*Control***

- **8** T-8A cavity in hex body for pilot operation (Pilot valve to be ordered separately) Options are:
  - Solenoid Pilot
  - Air Pilot
  - Hydraulic Pilot
  - Manual Control

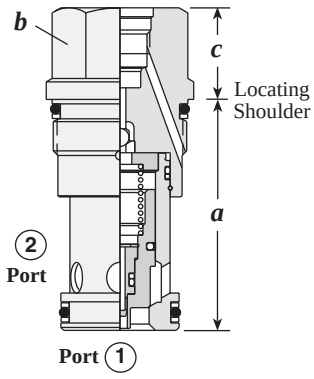
Adjustment Range

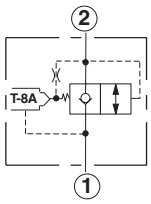
- **D** 50 psi

Seal

- **N** Buna-N
- **V** Viton

2-POSITION, 2-WAY POPPET, CONTROL 2 TO 1 WITH INTEGRAL PILOT CONTROL CAVITY





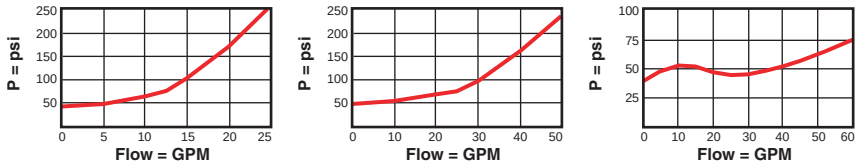
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
15 GPM	**DFCB – 8DN**	T - 13A	1.38	7/8”	.75	30/35
30 GPM	**DFDB – 8DN**	T - 5A	1.62	1 1/8”	.69	45/50
60 GPM	**DFEB – 8DN**	T - 16A	2.44	1 1/4”	.97	150/160

Performance Curves

DFCB-8 **DFDB-8** **DFEB-8**

Typical Pressure Drop



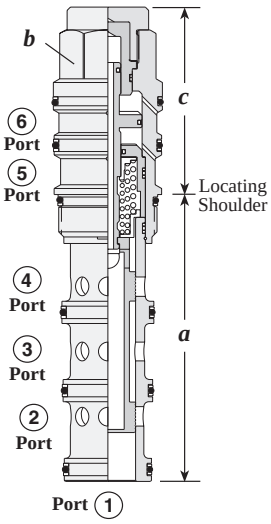
- Maximum operating pressure = 5000 psi
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.
- Main stage leakage less than 5 drops/min.

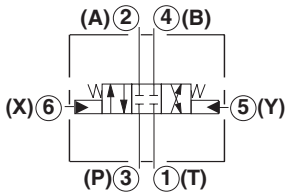
OPTION ORDERING INFORMATION

DF ★ B – 8 D ★

Nominal Capacity	*Control*	*Adjustment Range*	*Seal*
C 15 GPM	T-8A Pilot Cavity Pilot Stage Control to be ordered separately. Options are: • Solenoid Pilot • Air Pilot • Hydraulic Pilot • Manual Control	**D** Bias Spring 50 psi	**N** Buna-N
D 30 GPM			**V** Viton
E 60 GPM			

3-POSITION, 4-WAY SPRING CENTERED



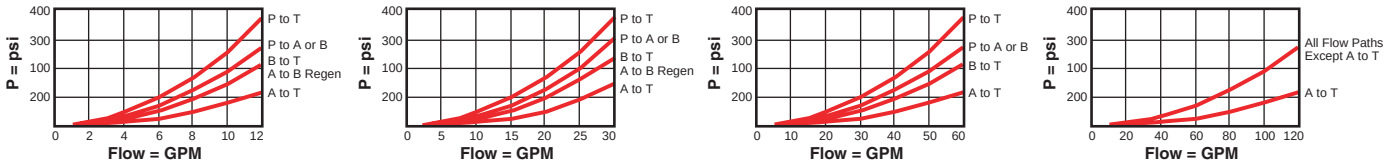


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (lb. ft.)
10 GPM	**DCCC – XCN**	T - 61A	3.35	7/8”	1.97	30/35
20 GPM	**DCDC – XCN**	T - 62A	3.63	1 1/8”	2.31	45/50
40 GPM	**DCEC – XCN**	T - 63A	4.51	1 1/4”	2.84	150/160
80 GPM	**DCFC – XCN**	T - 64A	5.51	1 5/8”	3.59	350/375

Performance Curves

DCCC **DCDC** **DCEC** **DCFC**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum leakage per path = 2 in³/min. at 1000 psi
- Pilot volume for complete shift = DCCC: .02 in³/min., DCDC: .06 in³/min., DCEC: .17 in³/min., DCFC: .42 in³/min.
- Minimum pilot pressure required to shift valve = DCCC: 175 psi, DCDC: 150 psi, DCEC, DCFC: 125 psi
- All ports will accept 5000 psi, including the x and y pilot ports (port 5 and port 6).

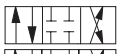
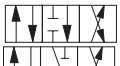
OPTION ORDERING INFORMATION

DC ✶ C – X ✶ ✶

Nominal Capacity

- **C** 10 GPM
- **D** 20 GPM
- **E** 40 GPM
- **F** 80 GPM

Spool Configuration

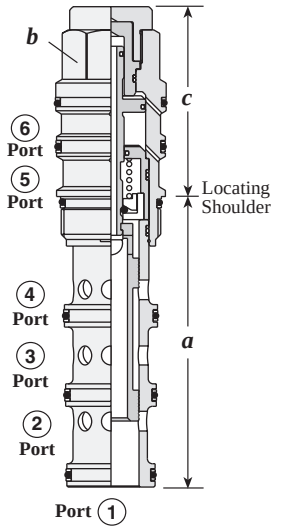
		Capacity (GPM) C	D	E	F
C		10⁺	30⁺	100⁺	200⁺
T		10	24	40	100
H		10	25	40	100
Y		10	30⁺	100⁺	200⁺
W		10⁺	30⁺	100	200
R		7.0	11	25	50
N		7.0	12	25	50
X		7.0	15	30	60
B		10	30⁺	75	150
A		10	30⁺	75	150

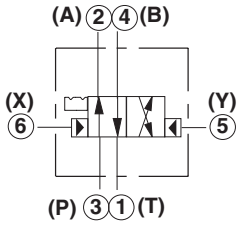
Seal

- **N** Buna-N
- **V** Viton

Typical switching pilot pressure differential between pilot ports 5 and 6 is 200 psi.

2-POSITION, 4-WAY DETENTED



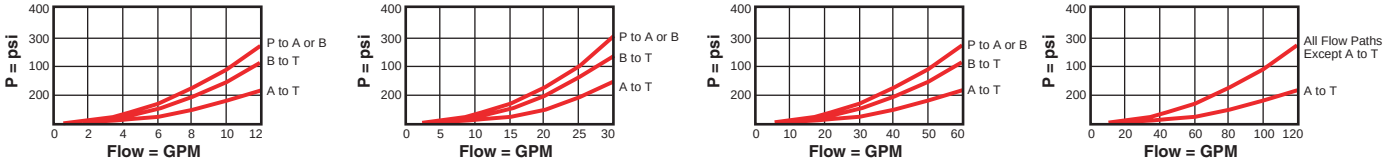


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (lb. ft.)
10 GPM	**DCCD – XCN**	T - 61A	3.35	7/8”	1.97	30/35
20 GPM	**DCDD – XCN**	T - 62A	3.63	1 1/8”	2.31	45/50
40 GPM	**DCED – XCN**	T - 63A	4.51	1 1/4”	2.84	150/160
80 GPM	**DCFD – XCN**	T - 64A	5.51	1 5/8”	3.59	350/375

Performance Curves

DCCD **DCDD** **DCED** **DCFD**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum leakage per path = 2 in³/min. at 1000 psi
- Pilot volume for complete shift = DCCD: .05 in³/min., DCDD: .12 in³/min., DCED: .34 in³/min., DCFD: .84 in³/min.
- Minimum pilot pressure required to shift valve = 40 psi
- All ports will accept 5000 psi, including the x and y pilot ports (port 5 and port 6).

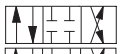
OPTION ORDERING INFORMATION

DC ✶ D – X ✶ ✶

Nominal Capacity

C	10 GPM
D	20 GPM
E	40 GPM
F	80 GPM

Spool Configuration

		Capacity (GPM) C	D	E	F
C		11	22	45	90
H		10	20	40	80
X		13	30⁺	60⁺	120⁺

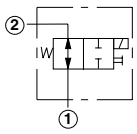
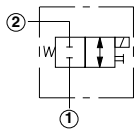
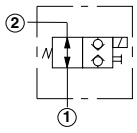
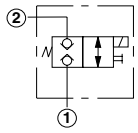
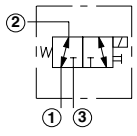
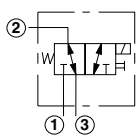
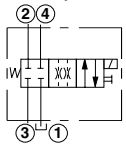
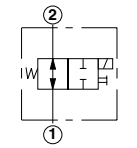
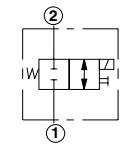
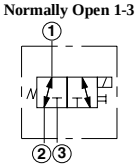
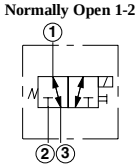
Seal

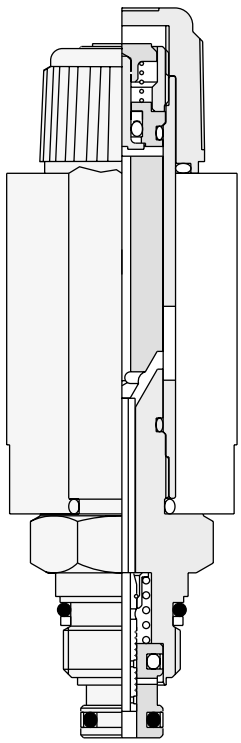
N	Buna-N
V	Viton

Typical switching pilot pressure differential between pilot ports 5 and 6 is 200 psi.

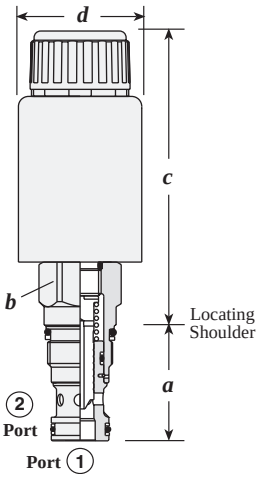
NOTES

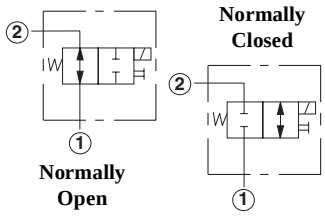
Solenoid Operated Cartridge Valves

	Cartridge Type	*Page*
Normally Open  Normally Closed 	2-position, 2-way Spool Directional Valve	114
Normally Open  Normally Closed 	Direct Acting, 2-position, 2-way Poppet Directional Valve	115
Normally Open  Normally Closed 	2-position, 3-way Spool Directional Valve	116
Normally Closed 	2-position, 4-way Spool Directional Valve	117
Normally Open  Normally Closed 	2-position, 2-way Spool Directional Valve – Pilot Capacity	118
Normally Open 1-3  Normally Open 1-2 	2-position, 3-way Spool Directional Valve – Pilot Capacity	119



2-POSITION, 2-WAY SPOOL DIRECTIONAL VALVE



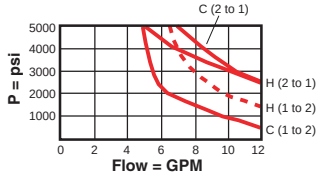


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (lb. ft.)
10 GPM	**DLDA – MHN**	T - 13A	1.38	7/8”	3.51	1.47	30/35

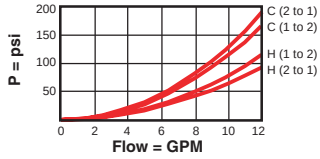
Performance Curves

DLDA-M**

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temp.



Typical Performance Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi**
- Maximum Leakage at 150 SUS = 5 in³/min. at 3000 psi
- Switching frequency = 15000 cycles/hr
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

**For valves produced before January 1, 2004 (date code A041), the maximum operating pressure is 5000 psi at port 2 and 3600 psi at port 1.
NOTE: While the valve will operate reliably with pressures up to 5000 psi at Port 1, solenoid tube fatigue life is reduced.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

D L D A – ★ ★ ★ – ★ ★ ★

Nominal Capacity
D 10 GPM

Control
M Manual Override
X No Manual Override

Spool Configuration
H Normally Open
C Normally Closed

Seal
N Buna-N
V Viton

Coil Configuration*

ISO/DIN
212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

AMP® Junior Timer
612 12 VDC
624 24 VDC

Twin Lead
712 12 VDC
724 24 VDC

Deutsch
912 12 VDC
924 24 VDC
948 48 VDC

Metri-Pack
812 12 VDC
824 24 VDC

Twin Spade
524 24 VDC

Maximum Leakage (in.³/min. at 3000 psi with 150 SUS oil) = 5
Power (Watts) = 22
Operating Voltage Tolerance = ± 10%
Typical response Time (ms) = 50

* *See page 167 for Solenoid Connector Options*

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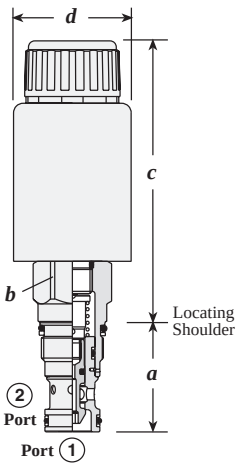
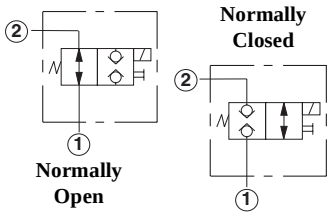
DIRECT ACTING, 2-POSITION, 2-WAY POPPET DIRECTIONAL VALVE



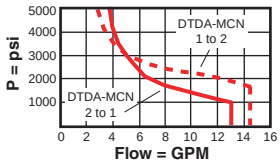


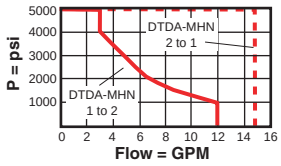
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (lb. ft.)
10 GPM	**DTDA – MHN**	T - 13A	1.38	7/8”	3.51	1.47	30/35

Performance Curves

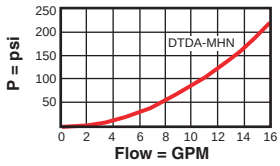
DTDA-M*N

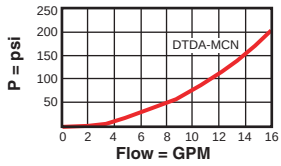
Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature





Typical Performance Pressure Differential vs. Flow





- Maximum operating pressure = 5000 psi**
- Maximum Leakage at 150 SUS = 10 drops/min.
- Switching frequency = 15000 cycles/hr.
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

**For valves produced before January 1, 2004 (date code A041), the maximum operating pressure is 5000 psi at port 2 and 3600 psi at port 1. NOTE: While the valve will operate reliably with pressures up to 5000 psi at Port 1, solenoid tube fatigue life is reduced.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

D T D A – ★ ★ ★ – ★ ★ ★

Nominal Capacity
- **D** 10 GPM

Control
- **M** Manual Override
- **X** No Manual Override

Spool Configuration
- **H** Normally Open
- **C** Normally Closed

Seal
- **N** Buna-N
- **V** Viton

Coil Configuration*

ISO/DIN
- **212** 12 VDC
- **224** 24 VDC
- **211** 115 VAC
- **223** 230 VAC

AMP® Junior Timer
- **612** 12 VDC
- **624** 24 VDC

Twin Lead
- **712** 12 VDC
- **724** 24 VDC

Deutsch
- **912** 12 VDC
- **924** 24 VDC
- **948** 48 VDC

Metri-Pack
- **812** 12 VDC
- **824** 24 VDC

Twin Spade
- **524** 24 VDC

Power (Watts) = 22
Operating Voltage Tolerance = ± 10%
Typical response Time (ms) = 50

* *See page 167 for Solenoid Connector Options*

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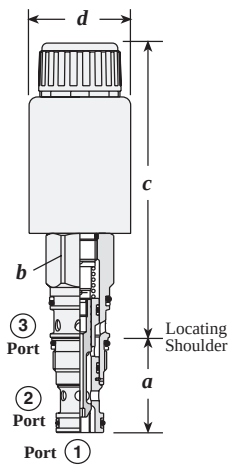
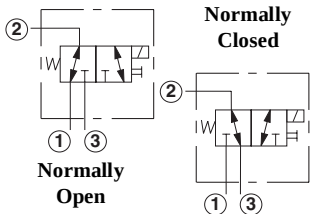
2-POSITION, 3-WAY SPOOL DIRECTIONAL VALVE



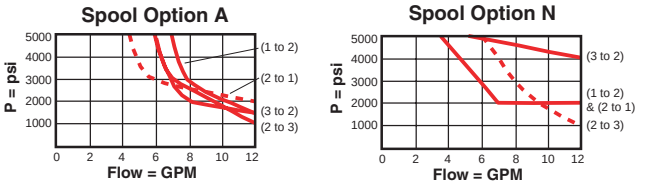


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (lb. ft.)
10 GPM	**DMDA – MNN**	T - 11A	1.38	7/8”	4.26	1.47	30/35

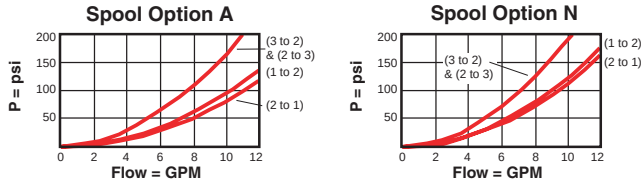
Performance Curves

DMDA-MNN

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature



Typical Performance Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi**
- Maximum Leakage at 150 SUS = 5 in³/min. at 3000 psi
- Switching frequency = 15000 cycles/hr.
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

** For valves produced before January 1, 2004 (date code A041), the maximum operating pressure is 5000 psi at ports 2 and 3 and 3600 psi at port 1.
NOTE: While the valve will operate reliably with pressures up to 5000 psi at Port 1, solenoid tube fatigue life is reduced.

OPTION ORDERING INFORMATION **Model Codes printed in Red are Preferred Versions and most readily available**

D MD A – ✶ ✶ ✶ – ✶ ✶ ✶

Nominal Capacity
D 10 GPM

Control
M Manual Override
X No manual Override

Spool Configuration
A Normally Open Ports 2 to 1
N Normally Open Ports 2 to 3

Seal
N Buna-N
V Viton

Coil Configuration*

ISO/DIN
212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

AMP® Junior Timer
612 12 VDC
624 24 VDC

Twin Lead
712 12 VDC
724 24 VDC

Deutsch
912 12 VDC
924 24 VDC
948 48 VDC

Metri-Pack
812 12 VDC
824 24 VDC

Twin Spade
524 24 VDC

Maximum Leakage (in.³/min. at 3000 psi with 150 SUS oil) = 5
Power (Watts) = 22
Operating Voltage Tolerance = ± 10%
Typical response Time (ms) = 30-50

* *See page 167 for Solenoid Connector Options*

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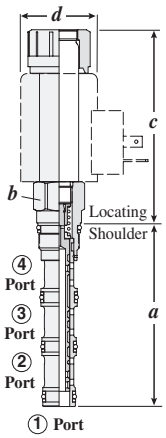
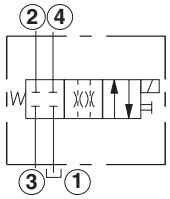
2-POSITION, 4-WAY SPOOL DIRECTIONAL VALVE





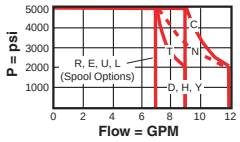
Normally Closed

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (lb. ft.)*
7-12 GPM	**DNDA – MCN**	T - 31A	3.34	7/8”	3.52	1.47	30/35

Performance Curves

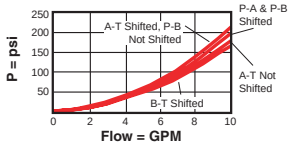
DNDA-MCN

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature



Note: Performance limits are derived with 4-way operation and symmetrical flow. For valve applications where either asymmetrical flow or 3-way operation are present, these performance limits may be reduced.

Typical Performance Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi**
- Maximum Leakage at 150 SUS = 10 in³/min. at 3000 psi
- Switching frequency = 15000 cycles/hr
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

** For valves produced before January 1, 2004 (date code A041), the maximum operating pressure is 5000 psi at ports 2, 3 and 4 and 3600 psi at port 1. NOTE: While the valve will operate reliably with pressures up to 5000 psi at Port 1, solenoid tube fatigue life is reduced.

OPTION ORDERING INFORMATION

Model Codes printed in Red are Preferred Versions and most readily available

D N D A – ★ ★ ★ – ★ ★ ★

Nominal Capacity

D 7-12 GPM

Control

M Manual Override

X No manual Override

Spool Configuration

C 

D 

E 

H 

L 

N 

R 

T 

U 

Y 

Seal

N Buna-N

V Viton

Coil Configuration*

ISO/DIN

212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

AMP® Junior Timer

612 12 VDC
624 24 VDC

Twin Lead

712 12 VDC
724 24 VDC

Deutsch

912 12 VDC
924 24 VDC
948 48 VDC

Metri-Pack

812 12 VDC
824 24 VDC

Twin Spade

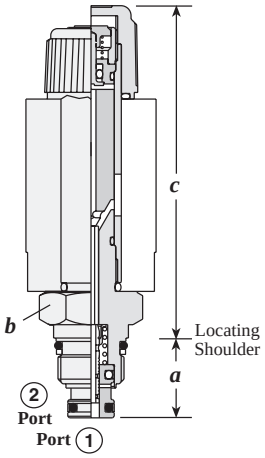
524 24 VDC

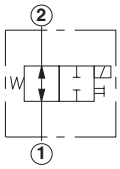
** See page 167 for Solenoid Connector Options*

Maximum Leakage (in.³/min. at 3000 psi with 150 SUS oil) = 10
Power (Watts) = 22
Operating Voltage Tolerance = ± 10%
Typical response Time (ms) = 30-50

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

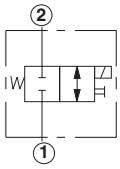
2-POSITION, 2-WAY SPOOL DIRECTIONAL VALVE – PILOT CAPACITY





Normally Open DAAA-MHN

Normally Closed DAAA-MCN

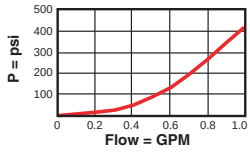


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* M	*c* C	*d*	*Installation Torque (lb. ft.)*
.25 GPM	**DAAA – MCN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DAAA – MHN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DAAC – MCN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DAAC – MHN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30

Performance Curves

DAA*-M*N

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum Leakage at 150 SUS = 10 drops/min.
- Switching frequency = 15000 cycles/hr.
- Cartridge can be installed directly into a cavity in some Sun pilot operated and ventable cartridges to provide electrically operated pilot control functions.
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

OPTION ORDERING INFORMATION

D A A ✶ – ✶ ✶ ✶ – ✶ ✶ ✶

Nominal Capacity

A .25 GPM

Control

M Manual Override

C Concealed Override

Version

A Standard

C Canadian Standards Association Certified 3500 psi max.

Spool Configuration

H Normally Open

C Normally Closed

Seal

N Buna-N

V Viton

Coil Configuration*

ISO/DIN

206 6 VDC
212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

SAE J858

506 6 VDC
512 12 VDC
524 24 VDC

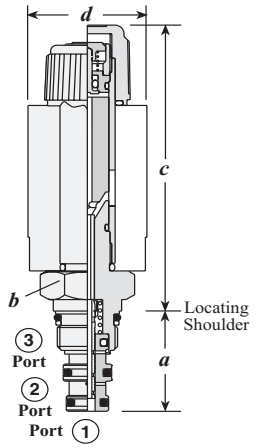
Twin Lead

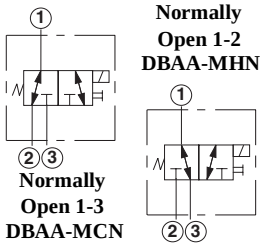
706 6 VDC
712 12 VDC
724 24 VDC

Diameter Effective Orifice (inches) = .045
Operating Voltage Tolerance = ± 10%
Power (Watts) = 12
Typical response Time (ms) = 30

* *See page 167 for Solenoid Connector Options*

2-POSITION, 3-WAY SPOOL DIRECTIONAL VALVE – PILOT CAPACITY



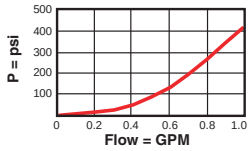


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c M	c C	d	Installation Torque (lb. ft.)
.25 GPM	**DBAA – MCN**	T - 9A	1.09	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DBAA – MHN**	T - 9A	1.09	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DBAC – MCN**	T - 9A	1.09	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DBAC – MHN**	T - 9A	1.09	7/8”	2.94	3.13	1.22	25/30

Performance Curves

DBA*-M*N

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum Leakage at 150 SUS = 10 drops/min.
- Switching frequency = 15000 cycles/hr.
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

OPTION ORDERING INFORMATION

D B A ✶ – ✶ ✶ ✶ – ✶ ✶ ✶

Nominal Capacity

A .25 GPM

Control

M Manual Override

C Concealed Override

Version

A Standard

C Canadian Standards Association Certified 3500 psi max.

Spool Configuration

H Normally Open Ports 1 to 2

C Normally Open Ports 1 to 3

Seal

N Buna-N

V Viton

Coil Configuration*

ISO/DIN

206 6 VDC
212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

SAE J858

506 6 VDC
512 12 VDC
524 24 VDC

Twin Lead

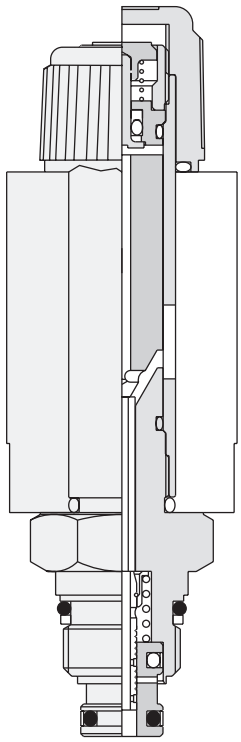
706 6 VDC
712 12 VDC
724 24 VDC

* *See page 167 for Solenoid Connector Options*

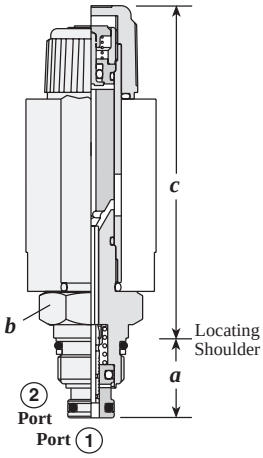
Diameter Effective Orifice (inches) = .045
Operating Voltage Tolerance = ± 10%
Power (Watts) = 12
Typical response Time (ms) = 30

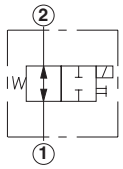
NOTES

Pilot Control Valves

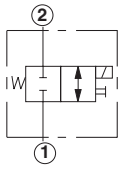


2-POSITION, 2-WAY SPOOL DIRECTIONAL VALVE – PILOT CAPACITY





Normally Open DAAA-MHN



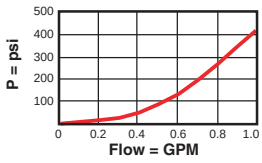
Normally Closed DAAA-MCN

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* M	*c* C	*d*	*Installation Torque (lb. ft.)*
.25 GPM	**DAAA – MCN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DAAA – MHN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DAAC – MCN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30
.25 GPM	**DAAC – MHN**	T - 8A	.75	7/8”	2.94	3.13	1.22	25/30

Performance Curves

DAA*-M*N

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- Switching frequency = 15000 cycles/hour
- Cartridge can be installed directly into a cavity in some Sun pilot operated and ventable cartridges to provide electrically operated pilot control functions.
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

OPTION ORDERING INFORMATION

D A A A – M ✶ ✶ – ✶ ✶ ✶

Nominal Capacity

A .25 GPM

Control

M Manual Override

C Concealed Override

Version

A Standard

C Canadian Standards Association Certified 3500 psi max.

Spool Configuration

H Normally Open

C Normally Closed

Seal

N Buna-N

V Viton

Coil Configuration*

ISO/DIN

206 6 VDC
212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

SAE J858

506 6 VDC
512 12 VDC
524 24 VDC

Twin Lead

706 6 VDC
712 12 VDC
724 24 VDC

* *See page 167 for Solenoid Connector Options*

Maximum Leakage (drops/min. at 5000 psi with 150 SUS oil) = 10
Diameter Effective Orifice (inches) = .045
Operating Voltage Tolerance = ± 20%

Power (Watts) = 12
Typical response Time (ms) = 30

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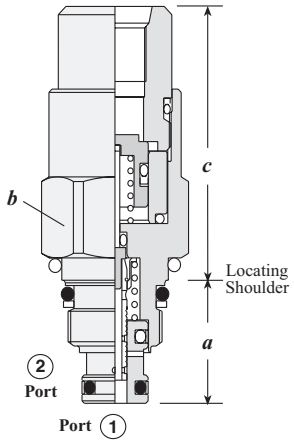
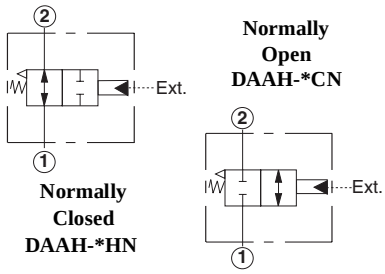
HYDRAULICALLY OPERATED, 2-POSITION 2-WAY, SPOOL DIRECTIONAL VALVE - PILOT CAPACITY



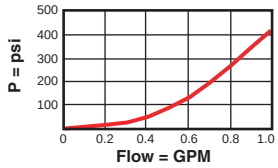


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque lb. ft.*
.25 GPM	**DAAH – BCN**	T - 8A	.75	7/8”	1.66	25/30

Performance Curves

DAAH

Pressure vs. Flow



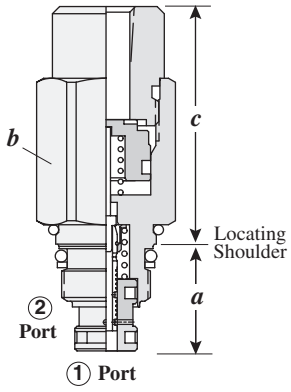
- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- Minimum pilot pressure to operate = 200 psi
- All ports will accept 5000 psi including the pilot control port.
- The preferred flow path through the valve is port 2 to port 1.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

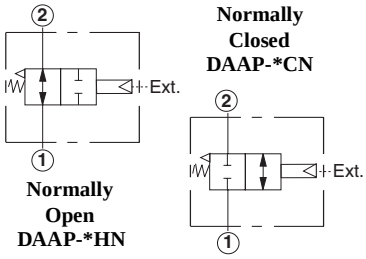
OPTION ORDERING INFORMATION

DA A H – ★ ★ ★

Nominal Capacity	*Pilot Port*	*Spool Configuration*	*Seal*
A .25 GPM	**A** 1/8-27 NPTF	**H** Normally Open	**N** Buna-N
	B SAE-4	**C** Normally Closed	**V** Viton
	D 1/8-28 BSPP		

AIR-OPERATED, 2-POSITION 2-WAY, SPOOL DIRECTIONAL VALVE - PILOT CAPACITY



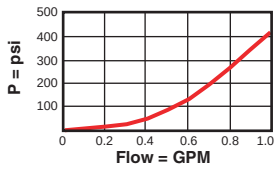


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
.25 GPM	**DAAP – FCN**	T - 8A	.75	7/8”	1.66	25/30

Performance Curves

DAAP

Pressure vs. Flow



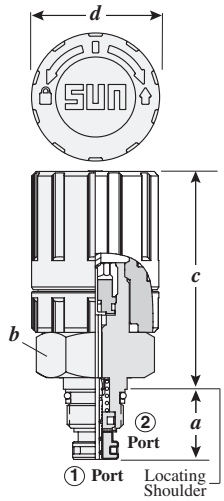
- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- Maximum pilot pressure = 70 psi
- Minimum pilot pressure to operate = 20 psi + port 1 pressure/100 psi
- All ports will accept 5000 psi with the exception of the pilot port which accepts 500 psi maximum.
- The preferred flow path through the valve is port 2 to port 1.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

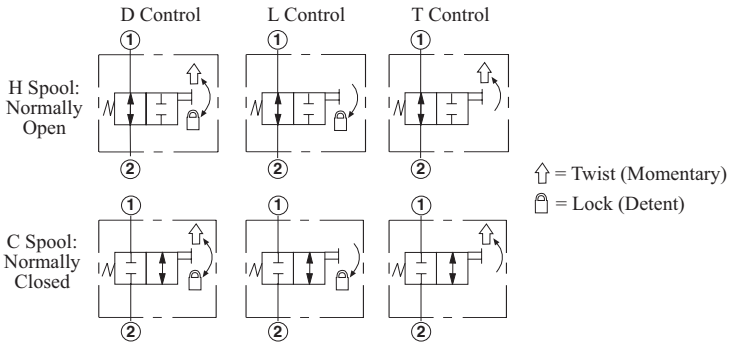
OPTION ORDERING INFORMATION

DA A P – ✶ ✶ ✶

Nominal Capacity	*Pilot Port*	*Spool Configuration*	*Seal*
A .25 GPM	**E** SAE-4	**H** Normally Open	**N** Buna-N
	F 1/8-27 NPTF	**C** Normally Closed	**V** Viton
	P 1/8-28 BSPP		

MANUALLY OPERATED, 2-POSITION 2-WAY, SPOOL DIRECTIONAL VALVE - PILOT CAPACITY



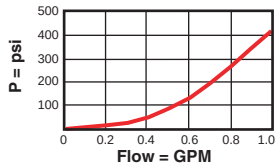


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*d*	*Installation Torque lb. ft.*
.25 GPM	**DAAM - TCN**	T-8A	.75	1 1/8”	2.90	1.90	25/30

Performance Curves

DAAM

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- The preferred flow path through the valve is port 2 to port 1.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

DA A M – ★ ★ ★

Nominal Capacity

A .25 GPM

Pilot Port

D Dual (Twist/Lock)

L Lock (Detent)

T Twist (Momentary)

Spool Configuration

C Normally Closed

H Normally Open

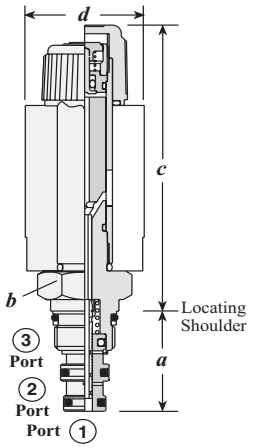
Seal

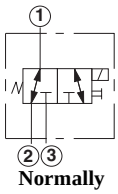
N Buna-N

V Viton

NOTE: Designed for 10,000 cycles of operation maximum under normal conditions.

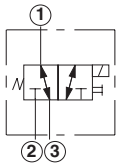
2-POSITION, 3-WAY SPOOL DIRECTIONAL VALVE – PILOT CAPACITY





Normally Open 1-3 DBAA-MCN

Normally Open 1-2 DBAA-MHN

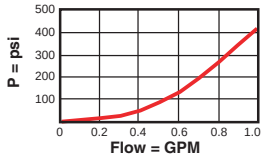


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* M	*c* C	*d*	*Installation Torque (lb. ft.)*
.25 GPM	**DBAA – MCN**	T - 9A	1.09	7/8”	2.94	3.13	1.19	25/30
.25 GPM	**DBAA – MHN**	T - 9A	1.09	7/8”	2.94	3.13	1.19	25/30
.25 GPM	**DBAC – MCN**	T - 9A	1.09	7/8”	2.94	3.13	1.19	25/30
.25 GPM	**DBAC – MHN**	T - 9A	1.09	7/8”	2.94	3.13	1.19	25/30

Performance Curves

DBA*-M*N

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- Switching frequency = 15000 cycles/hour
- Proper installation of solenoid valves requires an extra deep socket to clear the solenoid tube. Sockets are available from Snap On tools (P/N SIML280) or Sun Hydraulics (P/N 998-100-006). See www.sunhydraulics.com for details.

OPTION ORDERING INFORMATION

D B A A – M ✶ ✶ – ✶ ✶ ✶

Nominal Capacity

A .25 GPM

Control

M Manual Override

C Concealed Override

Version

A Standard

C Canadian Standards Association Certified 3500 psi max.

Spool Configuration

H Normally Open Ports 1 to 2

C Normally Open Ports 1 to 3

Seal

N Buna-N

V Viton

Coil Configuration*

ISO/DIN

206 6 VDC
212 12 VDC
224 24 VDC
211 115 VAC
223 230 VAC

SAE J858

506 6 VDC
512 12 VDC
524 24 VDC

Twin Lead

706 6 VDC
712 12 VDC
724 24 VDC

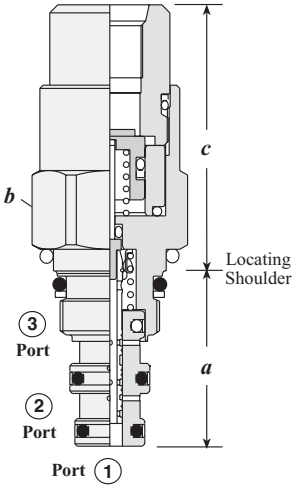
* *See page 167 for Solenoid Connector Options*

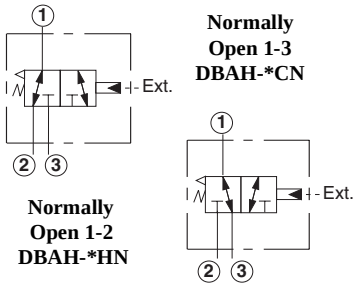
Maximum Leakage (drops/min. at 5000 psi with 150 SUS oil) = 10
Diameter Effective Orifice (inches) = .045
Operating Voltage Tolerance = ± 10%

Power (Watts) = 12
Typical response Time (ms) = 30

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

HYDRAULICALLY OPERATED, 2-POSITION 3-WAY, SPOOL DIRECTIONAL VALVE - PILOT CAPACITY



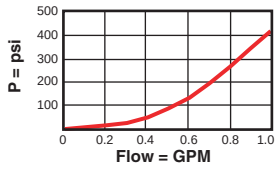


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque lb. ft.*
.25 GPM	**DBAH – BCN**	T - 9A	1.09	7/8”	1.66	25/30

Performance Curves

DBAH

Pressure vs. Flow



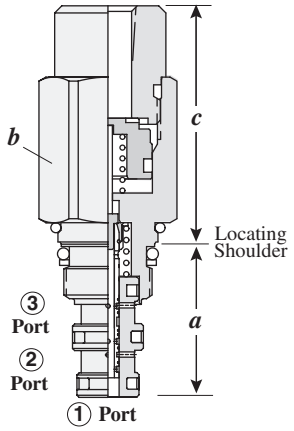
- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- Minimum pilot pressure to operate = 200 psi
- All ports will accept 5000 psi including the pilot control port.

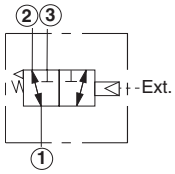
OPTION ORDERING INFORMATION

DB A H – ★ ★ ★

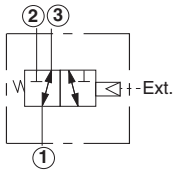
Nominal Capacity	*Pilot Port*	*Spool Configuration*	*Seal*
A .25 GPM	**A** 1/8-27 NPTF	**H** Normally Open Ports 1 to 2	**N** Buna-N
	B SAE-4	**C** Normally Open Ports 1 to 3	**V** Viton
	D 1/8-28 BSPP		

AIR-OPERATED, 2-POSITION 3-WAY, SPOOL DIRECTIONAL VALVE - PILOT CAPACITY





Normally Open 1-2 DBAP-*HN



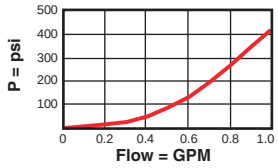
Normally Open 1-3 DBAP-*CN

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (lb. ft.)*
.25 GPM	**DBAP – FCN**	T - 9A	1.09	7/8”	1.66	25/30

Performance Curves

DBAP

Pressure vs. Flow



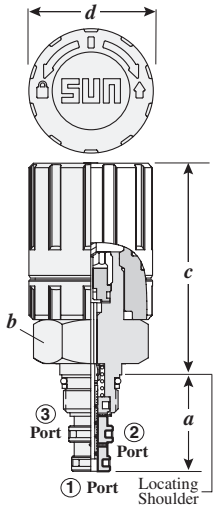
- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi.
- Maximum pilot pressure = 70 psi
- Minimum pilot pressure to operate = 20 psi + port 1 pressure/100 psi
- All ports will accept 5000 psi with the exception of the pilot port which accepts 500 psi maximum.

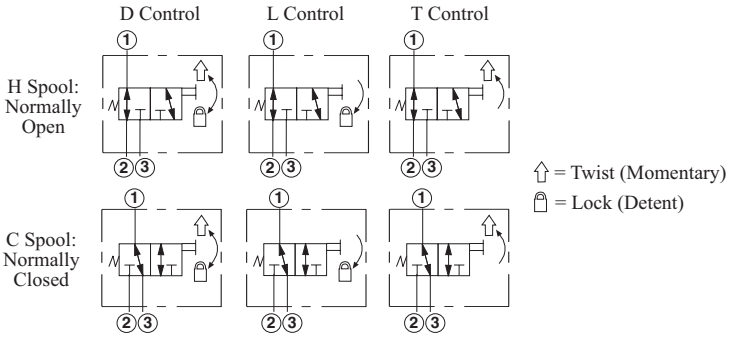
OPTION ORDERING INFORMATION

D B A P – ✶✶✶

Nominal Capacity	*Pilot Port*	*Spool Configuration*	*Seal*
A .25 GPM	**E** SAE-4	**H** Normally Open Ports 1 to 2	**N** Buna-N
	F 1/8-27 NPTF	**C** Normally Open Ports 1 to 3	**V** Viton
	P 1/8-28 BSPP		

MANUALLY OPERATED, 2-POSITION 3-WAY, SPOOL DIRECTIONAL VALVE - PILOT CAPACITY



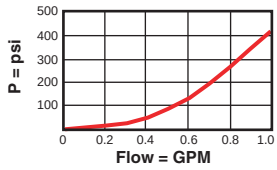


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (lb. ft.)
.25 GPM	**DBAM– TCN**	T - 9A	1.09	1 1/8"	2.40	1.40	25/30

Performance Curves

DBAM

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum leakage at 150 SUS = 10 drops/min. at 5000 psi
- All ports will accept 5000 psi.

OPTION ORDERING INFORMATION

D B A M – ★★★

Nominal Capacity

A .25 GPM

Pilot Port

D Dual (Twist/Lock)

L Lock (Detent)

T Twist (Momentary)

Spool Configuration

C Normally Open 1-3

H Normally Open 1-2

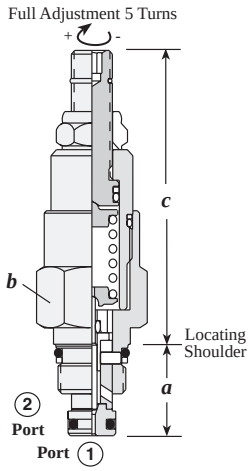
Seal

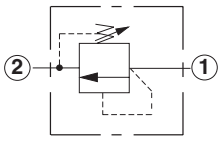
N Buna-N

V Viton

NOTE: Designed for 10,000 cycles of operation maximum under normal conditions.

DIRECT ACTING, ADJUSTABLE PILOT RELIEF



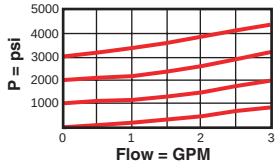


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (lb. ft.)*
			a	*b*	*c*			
					L	**C**	**K**	
2.5 GPM	**RBAE – LAN**	T - 8A	.75	7/8”	2.38	2.47	2.66	25/30

Performance Curves

RBAE

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Maximum leakage = 5 drops/min. at reseat (reseat = 85% of cracking pressure).
- Ports 1 and 2 may be pressured to 5000 psi.
- Back pressure at port 2 (outlet) is directly additive to the pressure setting at port 1 (inlet).
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

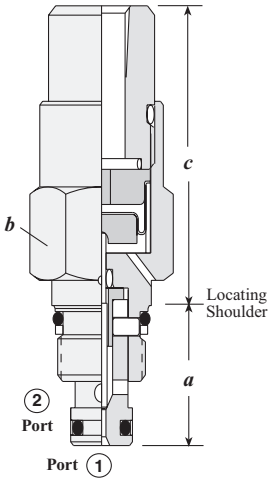
R B A E – ✶✶✶

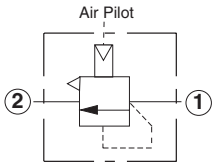
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
A 2.5 GPM	**L** Standard Screw	**A** 25 - 3000 psi	**N** Buna-N
	C Concealed	**B** 25 -1500 psi	**V** Viton
	K Handknob	**C** 25 - 6000 psi	
		D 25 - 800 psi	
		E 25 - 400 psi	
		W 25 - 4500 psi	

** *See page 162 for information on Control Options*

Adjustment Range Options:
A, B, C, and W are standard set at 1000 psi.
D Option is standard set at 400 psi.
E Option is standard set at 200 psi.
Customer may specify pressure setting.

AIR-CONTROLLED, DIRECTING ACTING PILOT RELIEF

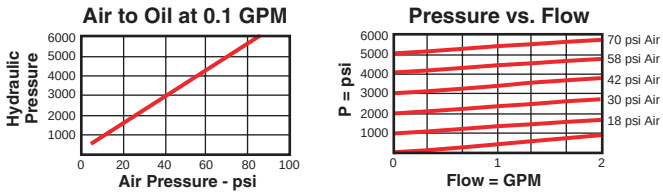




Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (lb. ft.)
2.5 GPM	**RBAR – AWN**	T - 8A	.75	7/8”	1.60	25/30
2.5 GPM	**RBAR – AYN**	T - 8A	.75	1 1/8”	1.60	25/30

Performance Curves

RBAR



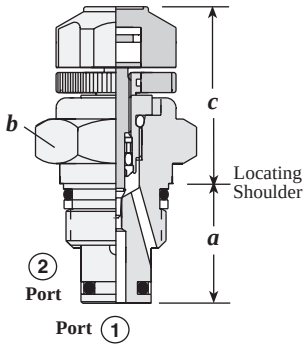
- Maximum operating pressure = 5000 psi
- Maximum leakage = 5 drops/min. at 5000 psi
- Maximum pilot pressure = 150 psi
- Ports 1 and 2 may be pressured to 5000 psi.
- Back pressure at port 2 has no effect on the valve setting.
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

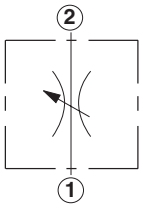
OPTION ORDERING INFORMATION

R B A R – ✶✶✶

Nominal Capacity	*Port*	*Air Pilot Ratio*	*Seal*
A 2.5 GPM	**A** 1/8-27 NPTF Pilot Port	**W** 50:1	**N** Buna-N
	B SAE-4 Pilot Port	**Y** 75:1	**V** Viton
	D 1/8-28 BSPP Port		

FULLY ADJUSTABLE NEEDLE VALVE - PILOT CAPACITY





Maximum Orifice	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
.035 in.	**NFAB – KXN**	T - 8A	.75	7/8”	1.10	25/30

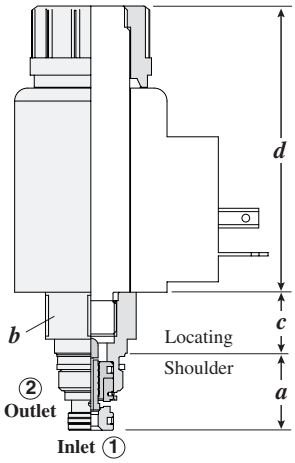
- Maximum operating pressure = 5000 psi
- Maximum leakage at shutoff = less than 5 drops/min. at 5000 psi
- Effective orifice size = .035 in.
- Number of counterclockwise turns fully closed to fully open = 3
- Ports 1 and 2 may be pressured to 5000 psi.

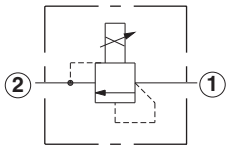
OPTION ORDERING INFORMATION

N F A B – K X ★

Model Code	*Control*	*Maximum Orifice*	*Seal*
NFAB-KXN	**K** Handknob	**X** .035 in.	**N** Buna-N
			V Viton

ELECTRO-PROPORTIONAL PILOT RELIEF

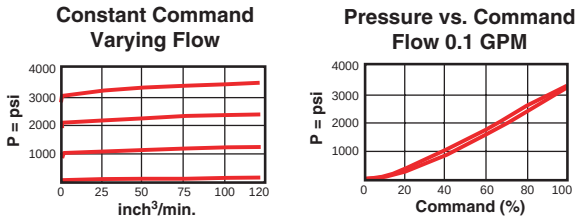




Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (lb. ft.)*
			a	*b*	*c*	*d*	
.25 GPM	**RBAP – MAN**	T - 8A	.75	7/8	.59	2.76	25/30

Performance Curves

RBAP



- Maximum operating pressure = 5000 psi
- Maximum leakage = 1.5 in^3/min at reseat
- Back pressure on the tank port (port 2) is directly additive at a 1:1 ratio to valve setting
- Reseat exceeds 85% of cracking pressure.
- Hysteresis with dither <4%
- Hysteresis with DC input <8%
- Linearity with dither <2%
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.

OPTION ORDERING INFORMATION

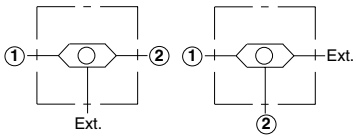
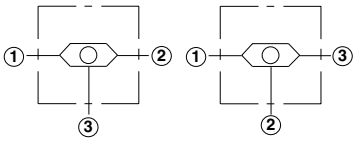
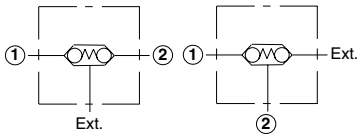
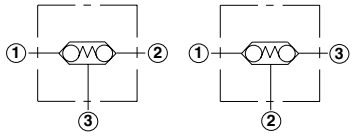
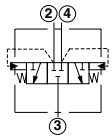
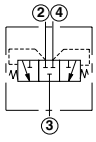
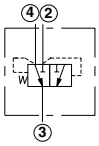
Model Codes printed in Red are Preferred Versions and most readily available

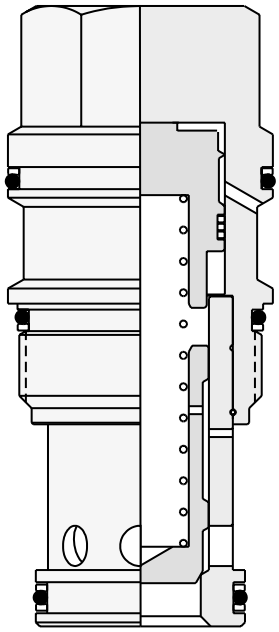
RB A P – ★ ★ ★

Nominal Capacity	*Control*	*Adjustment Range*	*Seal*
A .25 GPM	**M** Manual Override (Standard)	**A** 300 - 3000 psi	**N** Buna-N
		B 150 - 1500 psi	**V** Viton
	NOTE: Coil must be ordered separately. Use 12V DC or 24V DC (Series 770-*) coils only. See page 167.**	**W** 500 - 5000 psi	

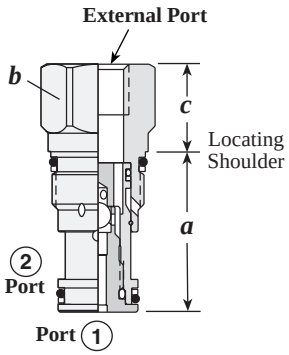
NOTES

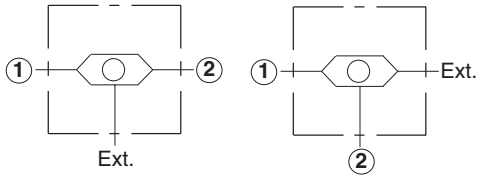
Shuttle Valves

	Cartridge Type	*Page*
	Single Ball Shuttle	136
	Single Ball Shuttle Valve with Signal at Port 3 or Port 2	137
	Back-to-back Check/Shuttle	138
	Back-to-back Check/Shuttle	139
	Low Side, 3-position, Hot Oil Shuttle Valve	140
	High Side, 3-position, Shuttle Valve	141
	Spring Offset, 2-position, High Side Shuttle	142



SINGLE BALL SHUTTLE





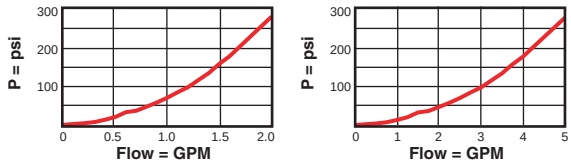
CSAW/CSAA **CSAY/CSAC**

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque lb. ft.*
			a	*b*	*c*	
1.25 GPM	**CSAW– BXN**	T - 162A	1.22	3/4”	.81	25/30
1.25 GPM	**CSAY – BXN**	T - 162A	1.22	3/4”	.81	25/30
2.5 GPM	**CSAA – BXN**	T - 13A	1.38	7/8”	1.19	30/35
2.5 GPM	**CSAC – BXN**	T - 13A	1.38	7/8”	1.19	30/35

Performance Curves

CSAW/CSAY **CSAA/CSAC**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 5 drops/min.

OPTION ORDERING INFORMATION

CS A ✶ – ✶ X ✶

Nominal Capacity and Version

W 1.25 GPM Signal at External Port

Y 1.25 GPM Signal at Port 2

A 2.5 GPM Signal at External Port

C 2.5 GPM Signal at Port 2

Control

B .25 BSPP External Port

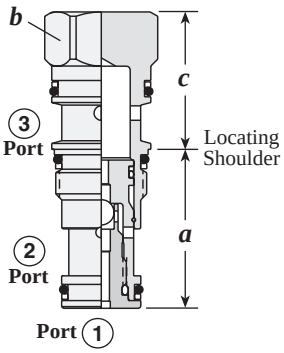
E SAE-4 External Port

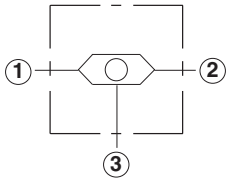
Seal

N Buna-N

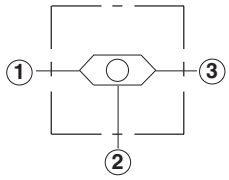
V Viton

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





CSAX/CSAB



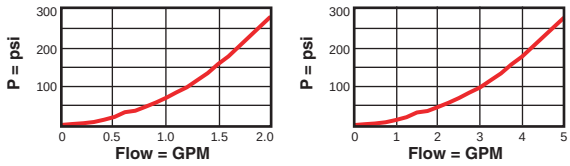
CSAD/CSAZ

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque lb. ft.*
			a	*b*	*c*	
1.25 GPM	**CSAX – XXN**	T - 163A	1.22	3/4”	1.25	25/30
1.25 GPM	**CSAZ – XXN**	T - 163A	1.22	3/4”	1.25	25/30
2.5 GPM	**CSAB – XXN**	T - 11A	1.38	7/8”	1.17	30/35
2.5 GPM	**CSAD – XXN**	T - 11A	1.38	7/8”	1.19	30/35

Performance Curves

CSAX/CSAZ **CSAB/CSAD**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 5 drops/min.

OPTION ORDERING INFORMATION

CS A ★ – X X ★

Nominal Capacity and Version

X 1.25 GPM Signal at Port 3

Z 1.25 GPM Signal at Port 2

B 2.5 GPM Signal at Port 3

D 2.5 GPM Signal at Port 2

Control

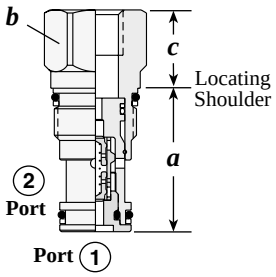
X Non-adjustable

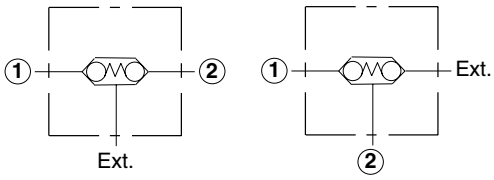
Seal

N Buna-N

V Viton

BACK-TO-BACK CHECK/SHUTTLE





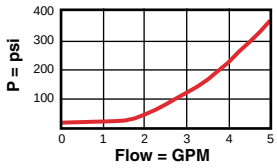
CDAA **CDAC**

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque lb. ft.*
			a	*b*	*c*	
2.5 GPM	**CDAA – BBN**	T - 13A	1.38	7/8”	1.19	30/35
2.5 GPM	**CDAC – BBN**	T - 13A	1.38	7/8”	.75	30/35

Performance Curves

CDAA/CDAC

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 5 drops/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.
- 15 psi check.

OPTION ORDERING INFORMATION

CD A ✶ – ✶ B ✶

Nominal Capacity and Version

A 2.5 GPM Signal at External Port

C 2.5 GPM Signal at Port 2

Control

B .25 BSPP External Port

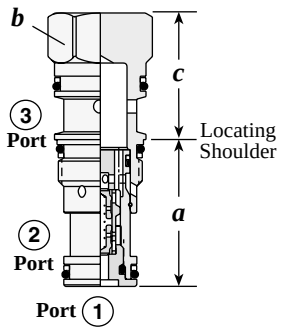
E SAE-4 External Port

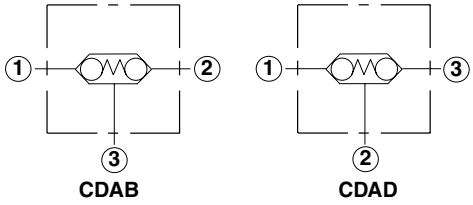
Seal

N Buna-N

V Viton

BACK-TO-BACK CHECK/SHUTTLE



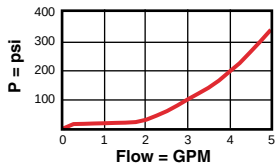


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque lb. ft.*
2.5 GPM	**CDAB – XBN**	T - 11A	1.38	7/8”	1.19	30/35
2.5 GPM	**CDAD – XBN**	T - 11A	1.38	7/8”	1.19	30/35

Performance Curves

CDAB/CDAD

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Maximum valve leakage = 5 drops/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.
- 15 psi check

OPTION ORDERING INFORMATION

CD A ✶ – X B ✶

Nominal Capacity and Version

B 2.5 GPM
Signal at Port 3

D 2.5 GPM
Signal at Port 2

Control

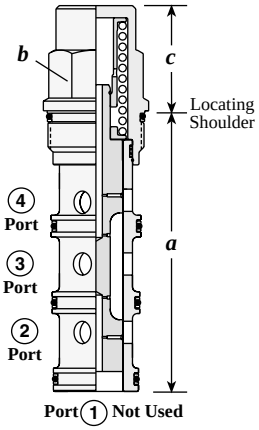
X Non-adjustable

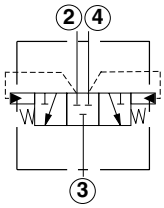
Seal

N Buna-N

V Viton

LOW SIDE, 3-POSITION, HOT OIL SHUTTLE VALVE



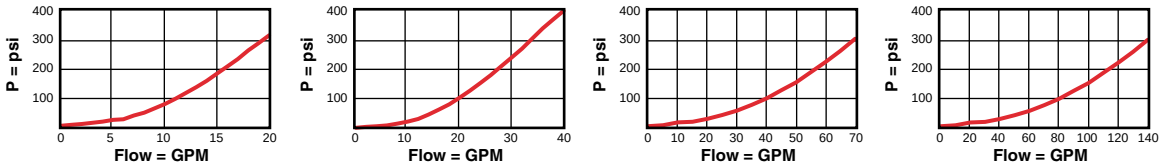


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque lb. ft.*
			a	*b*	*c*	
15 GPM	**DSCH – XHN**	T - 31A	3.35	7/8”	1.19	30/35
30 GPM	**DSEH – XHN**	T - 32A	3.63	1 1/8”	1.31	45/50
60 GPM	**DSGH – XHN**	T - 33A	4.50	1 1/4”	1.63	150/160
120 GPM	**DSIH – XHN**	T - 34A	5.50	1 5/8”	2.00	350/375

Performance Curves

DSCH **DSEH** **DSGH** **DSIH**

Typical Pressure Drop



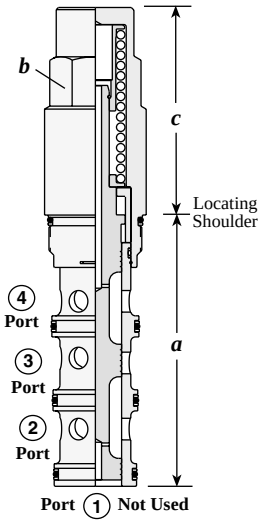
- Maximum operating pressure = 5000 psi
- Pilot flow = DSCH, DSEH: 23 in³/min., DSGH, DSIH: 46 in³/min. (Port 2 and 4 to Port 3).
- Note: Low shift values can potentially result in charge pump pressure alone inadvertently shifting the valve. Use care when selecting shift pressure.
- Pressures on Ports 2 and 4 must equalize before reversed shift can take place.

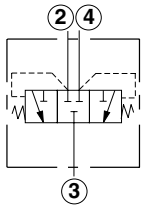
OPTION ORDERING INFORMATION

DS ✶ H – X ✶ ✶

Nominal Capacity	*Control*	*Shifting Pressure*	*Seal*
C 15 GPM	**X** Non-adjustable	**G** 150 psi	**N** Buna-N
E 30 GPM		**H** 200 psi	**V** Viton
G 60 GPM			
I 120 GPM			

HIGH SIDE, 3-POSITION, SHUTTLE VALVE



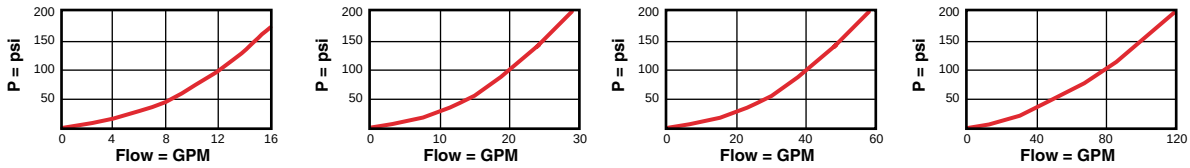


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque lb. ft.*
			a	*b*	*c*	
15 GPM	**DSCS – XCN**	T - 31A	3.35	7/8”	1.44	30/35
30 GPM	**DSES – XCN**	T - 32A	3.63	1 1/8”	1.63	45/50
60 GPM	**DSGS – XCN**	T - 33A	4.50	1 1/4”	2.83	150/160
120 GPM	**DSIS – XCN**	T - 34A	5.50	1 5/8”	4.21	350/375

Performance Curves

DSCS **DSES** **DSGS** **DSIS**

Pressure Drop, Port 2 or 4 to Port 3



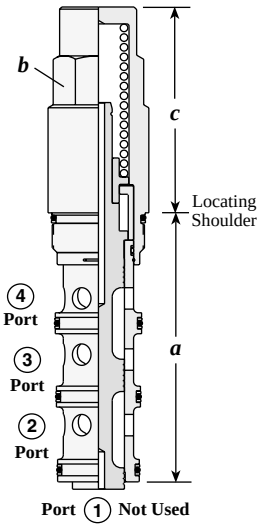
- Maximum operating pressure = 5000 psi
- Maximum valve leakage = DSCS: 2 in³/min. at 1000 psi, DSES: 3 in³/min. at 1000 psi, DSGS: 4 in³/min. at 1000 psi, DSIS: 5 in³/min. at 1000 psi

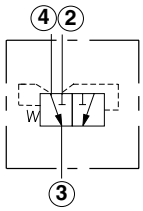
OPTION ORDERING INFORMATION

DS ✶ S – X ✶ ✶

Nominal Capacity		*Control*		*Shifting Pressure*		*Seal*	
C	15 GPM	**X**	Non-adjustable	**C**	30 psi	**N**	Buna-N
E	30 GPM			**E**	75 psi	**V**	Viton
G	60 GPM			**F**	100 psi		
I	120 GPM			**G**	150 psi		

SPRING OFFSET, 2-POSITION, HIGH SIDE SHUTTLE



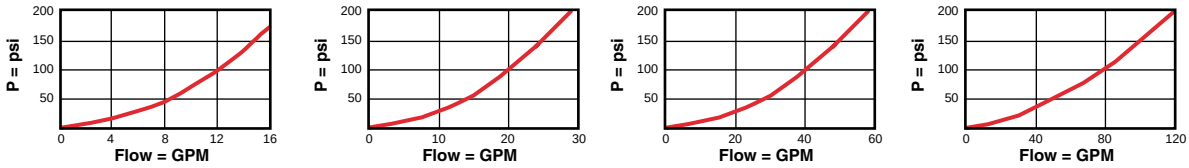


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
15 GPM	**DSCO – XCN**	T - 31A	3.35	7/8”	1.44	30/35
30 GPM	**DSEO – XCN**	T - 32A	3.63	1 1/8”	1.63	45/50
60 GPM	**DSGO – XCN**	T - 33A	4.50	1 1/4”	2.83	150/160
120 GPM	**DSIO – XCN**	T - 34A	5.50	1 5/8”	4.21	350/375

Performance Curves

DSCO **DSEO** **DSGO** **DSIO**

Pressure Drop, Port 4 or 2 to Port 3



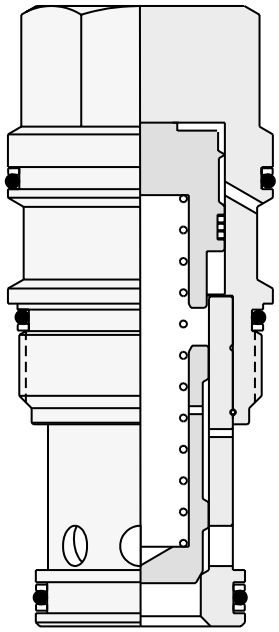
- Maximum operating pressure = 5000 psi
- Minimum pilot pressure required to shift valve = C Range: 30 psi, E Range: 75 psi

OPTION ORDERING INFORMATION

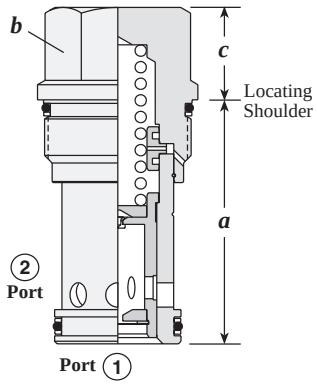
DS ★ O – X ★ ★

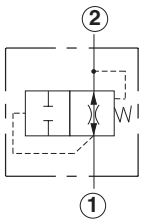
Nominal Capacity	*Control*	*Shifting Pressure*	*Seal*
C 15 GPM	**X** Non-adjustable	**C** 30 psi	**N** Buna-N
E 30 GPM		**E** 75 psi	**V** Viton
G 60 GPM			
I 120 GPM			

Circuit Savers



FIXED ORIFICE, FLOW FUSE VALVE



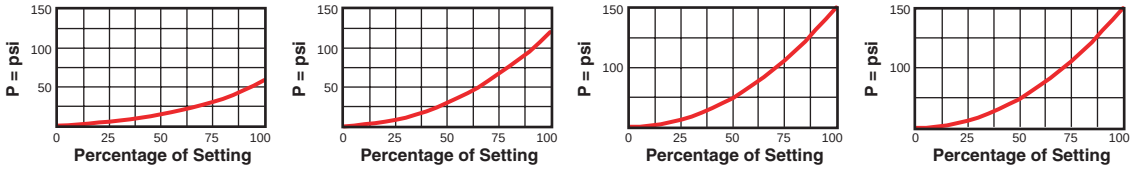


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque lb. ft.*
.5-6 GPM	**FQCA – XAN**	T - 13A	1.38	7/8”	.75	30/35
1-15 GPM	**FQEA – XAN**	T - 5A	1.62	1 1/8”	.69	45/50
1-25 GPM	**FQGA – XAN**	T - 16A	2.44	1 1/4”	.97	150/160
1-50 GPM	**FQIA – XAN**	T - 18A	3.13	1 5/8”	1.19	350/375

Performance Curves

FQCA **FQEA** **FQGA** **FQIA**

Typical Pressure Drop



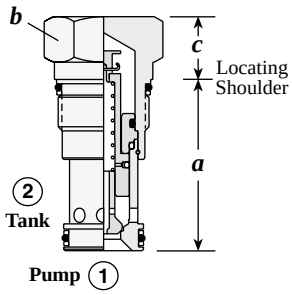
- Maximum operating pressure = 5000 psi
- Maximum valve leakage = FQCA: 2 in³/min. at 1000 psi, FQEA: 3 in³/min. at 1000 psi, FQGA: 4 in³/min. at 1000 psi, FQIA: 5 in³/min. at 1000 psi.
- Valve closes when flow from port 1 to port 2 exceeds the setting of the valve. Valve resets when pressures at port 1 and port 2 are equal.
- Flow setting should be at least 25% above maximum normal system flow.

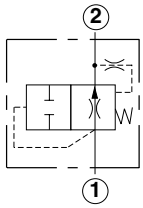
OPTION ORDERING INFORMATION

FQ ★ A – X A ★

Nominal Capacity	*Control***	*Flow Rate*	*Seal*
C .5-6 GPM	**X** Non-adjustable	**A**	**N** Buna-N
E 1-15 GPM			**V** Viton
G 1-25 GPM			
I 1-50 GPM		**Customer must specify flow.**	

AIR BLEED AND START-UP VALVE



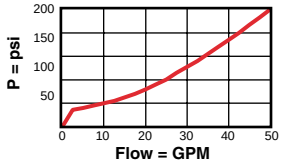


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
4-50 GPM	**NQEB – XAN**	T - 3A	1.88	1 1/8”	.69	45/50

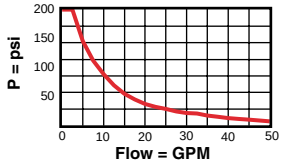
Performance Curves

NQEB

Typical Pressure Drop



Approximate Closing Time after Air has been Purged



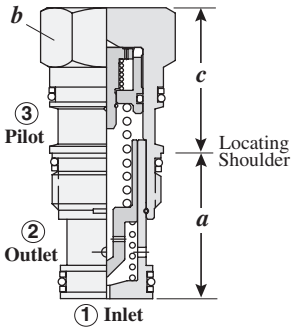
- Maximum operating pressure = 5000 psi
- Air-bleed and start-up valves require a minimum of 4 GPM flow rate and 80 psi system pressure.
- The valve will re-open when system pressure falls below 25 psi.
- After air has been purged, closing times vary from approximately 12 seconds at 4 GPM to 0.5 seconds at 50 GPM.

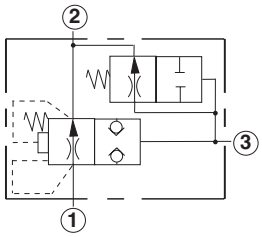
OPTION ORDERING INFORMATION

NQ E B – X A ★

Nominal Capacity	*Control***	*Flow Rate*	*Seal*
E 4-50 GPM	**X** Non-adjustable	**A**	**N** Buna-N
			V Viton

CHECK, PILOT-TO-CLOSE



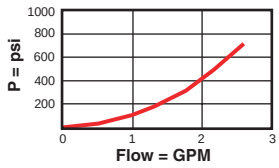


Orifice Diameter	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
.05 in.	**COFO – XDN**	T - 2A	1.38	1 1/8	1.38	45/50

Performance Curves

COFO

Pressure vs. Flow



- Maximum operating pressure = 5000 psi
- Pilot ratio = 120:1
- Leakage rate when closed = 5 drops/min.

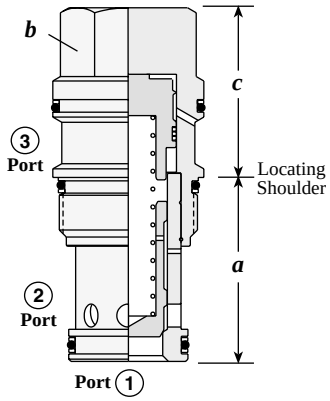
OPTION ORDERING INFORMATION

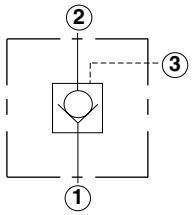
CO F O – X D N

Orifice Diameter	*Control***	*Minimum Pressure*	*Seal*
F .05 in.	**X** Standard Pilot	**D** 50 psi	**N** Buna-N
			V Viton

** *See page 162 for information on Control Options.*

CHECK, PILOT-TO-CLOSE



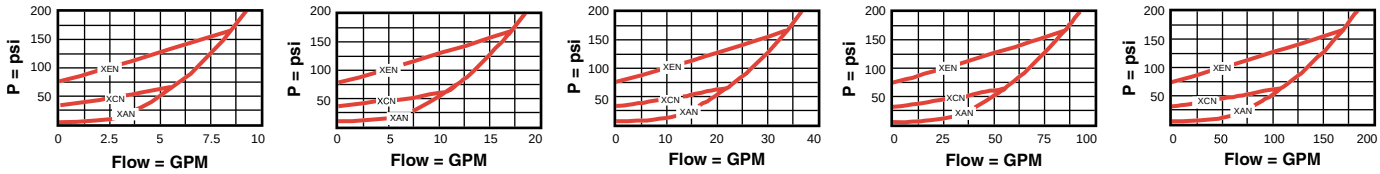


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
10 GPM	**COBA – XCN**	T - 163A	1.22	3/4”	1.22	25/30
20 GPM	**CODA – XCN**	T - 11A	1.38	7/8”	1.19	30/35
40 GPM	**COFA – XCN**	T - 2A	1.38	1 1/8”	1.38	45/50
80 GPM	**COHA – XCN**	T - 17A	1.81	1 1/4”	1.81	150/160
160 GPM	**COJA – XCN**	T - 19A	2.50	1 5/8”	2.31	350/375

Performance Curves

COBA **CODA** **COFA** **COHA** **COJA**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Pilot ratio = 1.8:1
- Leakage rate when closed = 1 drop/min.

OPTION ORDERING INFORMATION

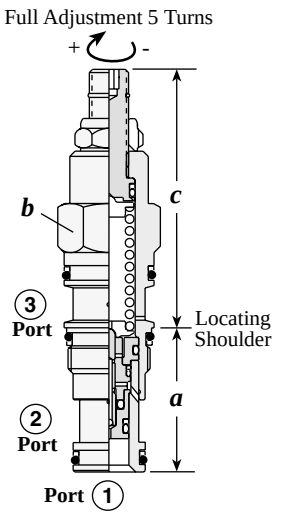
CO ✶ A – ✶ ✶ ✶

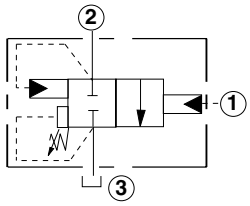
Nominal Capacity	*Control***	*Cracking Pressure*	*Seal*
B 10 GPM	**X** Standard Pilot	**A** *4 psi	**N** Buna-N
D 20 GPM		**B** *15 psi	**V** Viton
F 40 GPM		**C** 30 psi	
H 80 GPM		**D** 50 psi	
J 160 GPM		**E** 75 psi	
		F 100 psi	

** *See page 162 for information on Control Options*

* *COBA and COFA are not available in A and B Cracking Pressures.*

ACCUMULATOR SENSE, PUMP UNLOAD VALVE - PILOT CAPACITY





Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque lb. ft.
.2 GPM	**QPAA – LAN**	T - 11A	1.38	7/8”	2.50	2.56	30/35

- Maximum operating pressure = 5000 psi
- When applying this cartridge, a separate drain line is required to prevent erratic operation caused by tank line pressure fluctuations.
- Note: Careful consideration should be given when selecting an adjustment range. System pressure drops and flows tend to affect the operation of unloading valves.

OPTION ORDERING INFORMATION

QP A ★ – ★ ★ ★

Nominal Capacity

A .2 GPM

Version

A 15% Nominal Differential

B 20% Nominal Differential

C 30% Nominal Differential

D 50% Nominal Differential

Control**

L Standard Screw

C Tamper Resistant

Adjustment Range

A 1000 - 3000 psi

B 400 - 1500 psi

C 2000 - 5000 psi

D 200 - 800 psi

Seal

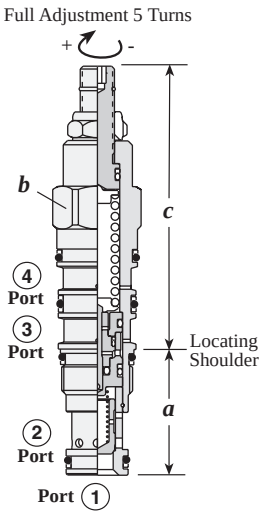
N Buna-N

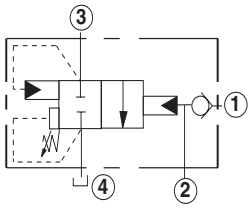
V Viton

*** See page 162 for information on Control Options*

Adjustment Range Options:
A and B Options are standard set at 1000 psi.
D Option is standard set at 400 psi.
C Option is standard set at 2000 psi.
Customer may specify pressure setting.

ACCUMULATOR SENSE, PUMP UNLOAD VALVE WITH CHECK - PILOT CAPACITY





Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque lb. ft.
.2 GPM	**QCDA – LAN**	T - 21A	1.38	7/8”	3.09	3.15	30/35

- Maximum operating pressure = 5000 psi
- Check valve capacity = 12 GPM
- Free flow check cracking pressure = 4 psi
- Pressure drop, port 1 to port 2 = 70 psi at 12 GPM
- When applying this cartridge, a separate drain line is required to prevent erratic operation caused by tank line pressure fluctuations.
- Note: Careful consideration should be given when selecting an adjustment range. System pressure drops and flows tend to affect the operation of unloading valves.

OPTION ORDERING INFORMATION

QC D ★ – ★ ★ ★

Nominal Capacity
- **D** .2 GPM

Version
- **A** 15% Nominal Differential
- **B** 20% Nominal Differential
- **C** 30% Nominal Differential
- **D** 50% Nominal Differential

*Control***
- **L** Standard Screw
- **C** Tamper Resistant

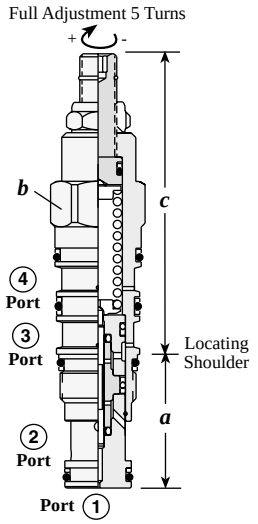
Adjustment Range
- **A** 1000 - 3000 psi
- **B** 400 - 1500 psi
- **C** 2000 - 5000 psi
- **D** 200 - 800 psi

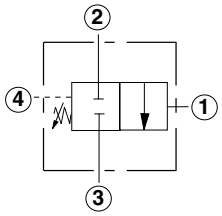
Seal
- **N** Buna-N
- **V** Viton

** *See page 162 for information on Control Options*

Adjustment Range Options:
A and B Options are standard set at 1000 psi.
D Option is standard set at 400 psi.
C Option is standard set at 2000 psi.
Customer may specify pressure setting.

DIRECT ACTING, 2-WAY DIRECTIONAL VALVE WITH DRAIN TO PORT 4 - NORMALLY CLOSED



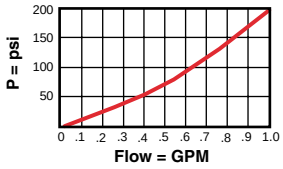


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
.5 GPM	**DRAX – LAN**	T - 21A	1.38	7/8"	3.09	30/35

Performance Curves

DRAX

Pressure Drop vs. Flow
Port 2 to Port 3



- Maximum operating pressure = 5000 psi
- The pilot area (port 1) and the spring chamber drain (port 4) are positively sealed.
- There is spool leakage between the work ports (ports 2 and 3), .03 in³/min. at 1000 psi.

OPTION ORDERING INFORMATION

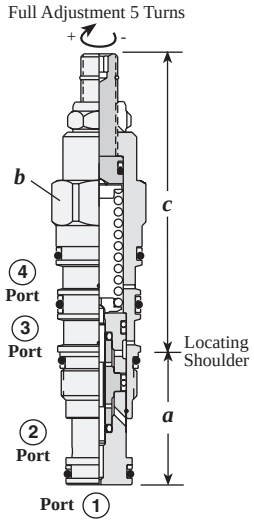
DR A X – L ✶ N

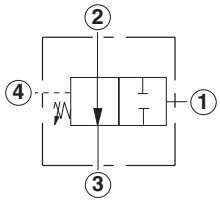
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
A .5 GPM	**L** Standard Screw	**A** 1000 - 3000 psi	**N** Buna-N
		C 2000 - 6000 psi	**V** Viton

** *See page 162 for information on Control Options*

Adjustment Range Options:
A Option is standard set at 1000 psi.
C Option is standard set at 2000 psi.
Customer may specify pressure setting.

DIRECT ACTING, 2-WAY DIRECTIONAL VALVE WITH DRAIN TO PORT 4 - NORMALLY OPEN



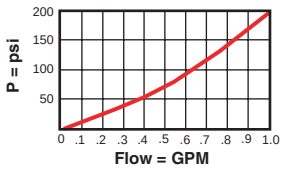


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
.5 GPM	**DRAY – LAN**	T - 21A	1.38	7/8”	3.09	30/35

Performance Curves

DRAY

Pressure Drop vs. Flow
Port 2 to Port 3



- Maximum operating pressure = 5000 psi
- The pilot area (port 1) and the spring chamber drain (port 4) are positively sealed.
- There is spool leakage between the work ports (ports 2 and 3), .03 in³/min. at 1000 psi.

OPTION ORDERING INFORMATION

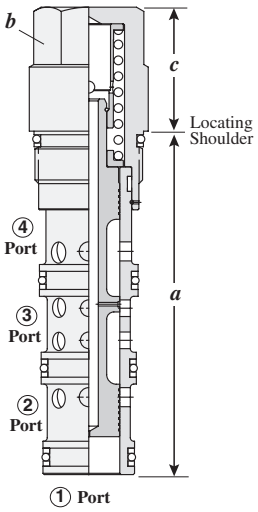
DR A Y – L ✶ N

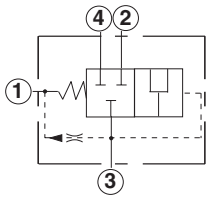
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
A .5 GPM	**L** Standard Screw	**A** 1000 - 3000 psi	**N** Buna-N
		C 2000 - 6000 psi	**V** Viton

** *See page 162 for information on Control Options*

Adjustment Range Options:
A Option is standard set at 1000 psi.
C Option is standard set at 2000 psi.
Customer may specify pressure setting.

VENT-TO-SHIFT 2-POSITION DIVERTER VALVE - NORMALLY CLOSED



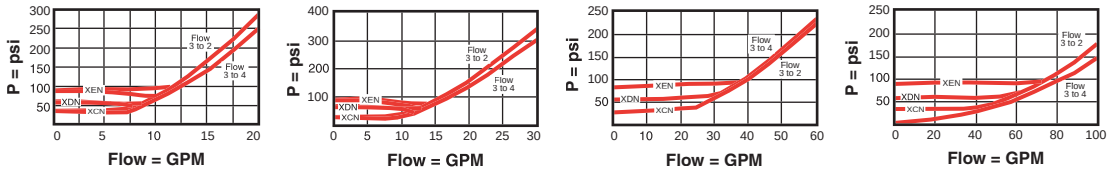


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
15 GPM	**DSCX – XEN**	T - 31A	3.34	7/8	1.19	30/35
30 GPM	**DSEX – XEN**	T - 32A	3.63	1 1/8	1.31	45/50
60 GPM	**DSGX – XEN**	T - 33A	4.51	1 1/4	1.63	150/160
120 GPM	**DSIX – XEN**	T - 34A	5.50	1 5/8	2.12	350/375

Performance Curves

DSCX **DSEX** **DSGX** **DSIX**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Nominal vent flow = DSCX. DSEX: 23 in³/min., DSGX, DSIX: 35 in³/min.
- There must be a pressure source at port 3, relative to port 1, to shift the valve.

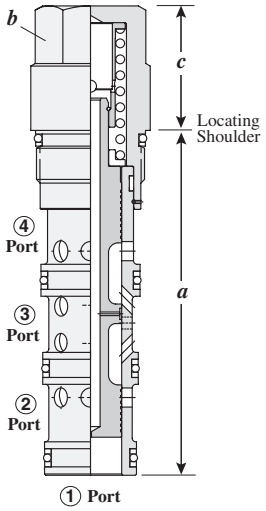
OPTION ORDERING INFORMATION

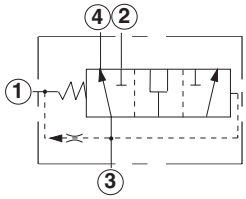
DS ✶ X – X E ✶

Nominal Capacity		*Control*	*Minimum Control Pressure*		*Seal*	
C	15 GPM	**X**	Non-adjustable	**C**	30 psi	**N** Buna-N
E	30 GPM			**D**	50 psi	**V** Viton
G	60 GPM			**E**	75 psi	
I	120 GPM					

Customer may specify pressure setting.

VENT-TO-SHIFT, 2-POSITION, 3-WAY DIVERTER VALVE



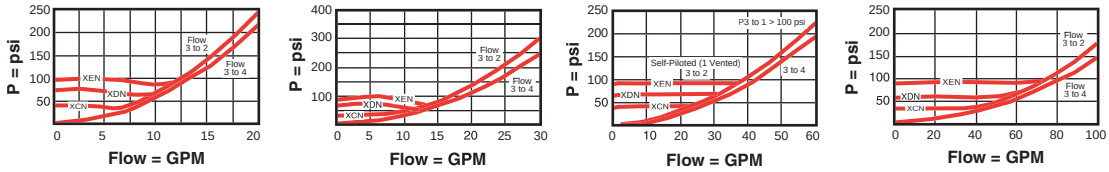


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
15 GPM	**DSCY – XEN**	T - 31A	3.34	7/8	1.19	30/35
30 GPM	**DSEY – XEN**	T - 32A	3.63	1 1/8	1.31	45/50
60 GPM	**DSGY – XEN**	T - 33A	4.51	1 1/4	1.63	150/160
120 GPM	**DSIY – XEN**	T - 34A	5.50	1 5/8	2.12	350/375

Performance Curves

DSCY **DSEY** **DSGY** **DSIY**

Typical Pressure Drop



- Maximum operating pressure = 5000 psi
- Nominal vent flow = DSCY. DSEY: 23 in³/min., DSGY, DSIY: 35 in³/min.
- There must be a pressure source at port 3, relative to port 1, to shift the valve.

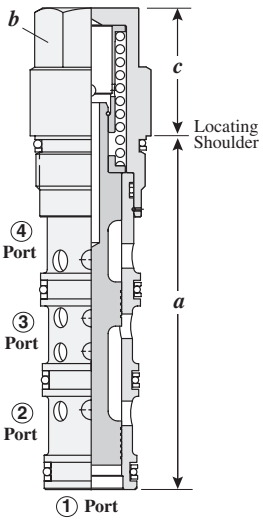
OPTION ORDERING INFORMATION

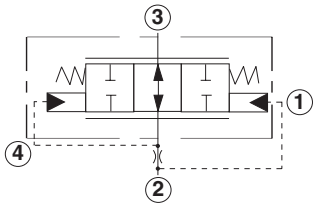
DS ✶ Y – X E ✶

Nominal Capacity		*Control*		*Minimum Control Pressure*		*Seal*	
C	15 GPM	**X**	Non-adjustable	**C**	30 psi	**N**	Buna-N
E	30 GPM			**D**	50 psi	**V**	Viton
G	60 GPM			**E**	75 psi		
I	120 GPM						

Customer may specify pressure setting.

NORMALLY OPEN, BI-DIRECTIONAL, MODULATING LOGIC ELEMENT



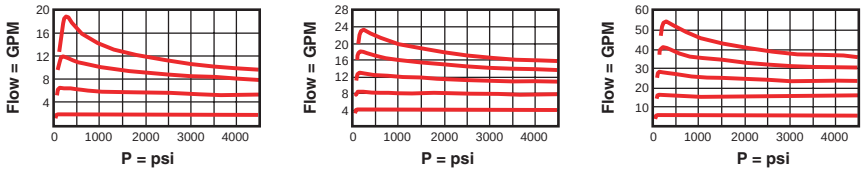


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque lb. ft.
15 GPM	**LHDT – XFN**	T - 31A	3.34	7/8	1.19	30/35
30 GPM	**LHFT – XFN**	T - 32A	3.63	1 1/8	1.31	45/50
60 GPM	**LHHT – XFN**	T - 33A	4.50	1 1/4	1.63	150/160

Performance Curves

LHDT **LHFT** **LHHT**

Typical Performance Pressure Differential vs. Flow



- Maximum operating pressure = 5000 psi

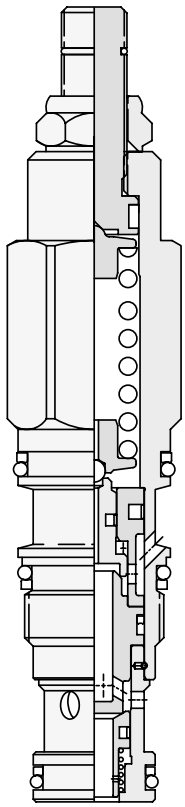
OPTION ORDERING INFORMATION

LH ★ T – X F ★

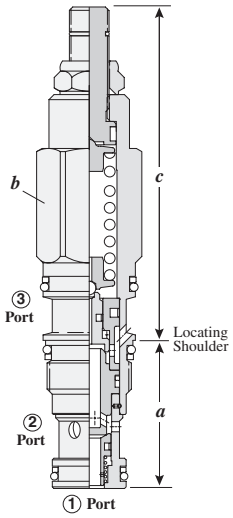
Nominal Capacity	*Control*	*Nominal Control Pressure*	*Seal*
D 15 GPM	**X** Non-adjustable	**D** 50 psi	**N** Buna-N
F 30 GPM		**E** 75 psi	**V** Viton
H 60 GPM		**F** 100 psi	

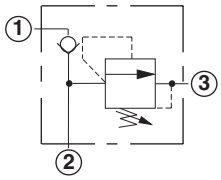
Customer may specify pressure setting.

Hybrid Relief Valves



DIRECT ACTING RELIEF VALVE - BEFORE CHECK

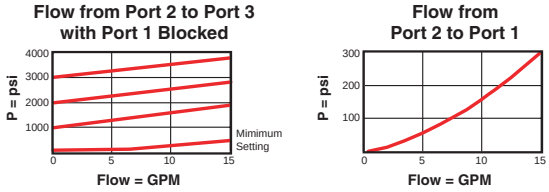




Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
10 GPM	**HRDA – LAN**	T - 11A	1.38	7/8	3.09	3.15	3.34	30/35

Performance Curves

HRDA



- Maximum operating pressure = 5000 psi
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of crack pressure
- Factory pressure setting established at 4 GPM
- Free flow check cracking pressure = 25 psi
- Typical response = 2 ms
- The check portion of the valve has a maximum leakage rate of less than 1 drop/minute.
- Note: This valve deviates from Sun's normal flow path for three port relief valves; port 2 is the inlet, port 1 is the system and port 3 is tank. Therefore, it is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

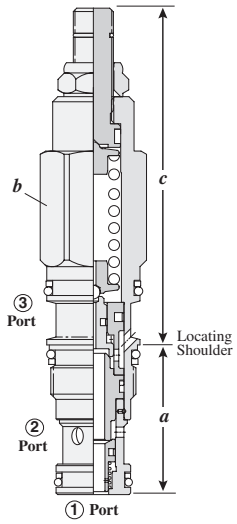
HR D A – L A N

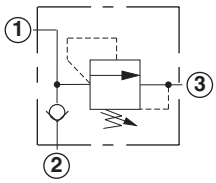
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
D 10 GPM	**L** Standard Screw Adjustment	**A** 500 - 3000 psi	**N** Buna-N
	C Tamper Resistant Factory Set	**W** 800 - 4500 psi	**V** Viton
	K Handknob		

** *See page 162 for information on Control Options*

Customer may specify pressure setting.

DIRECT ACTING RELIEF VALVE - AFTER CHECK

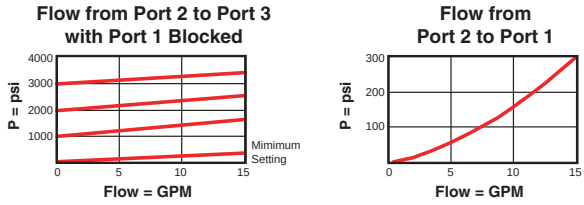




Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (lb. ft.)*
10 GPM	**HRDB – LAN**	T - 11A	1.38	7/8	3.09	3.15	3.34	30/35

Performance Curves

HRDB



- Maximum operating pressure = 5000 psi
- Maximum valve leakage at reseat = 5 drops/min.
- Reseat exceeds 85% of crack pressure
- Factory pressure setting established at 4 GPM
- Free flow check cracking pressure = 25 psi
- Typical response = 2 ms
- The check portion of the valve has a maximum leakage rate of less than 1 drop/minute.
- Note: This valve deviates from Sun's normal flow path for three port relief valves; port 2 is the inlet, port 1 is the system and port 3 is tank. Therefore, it is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

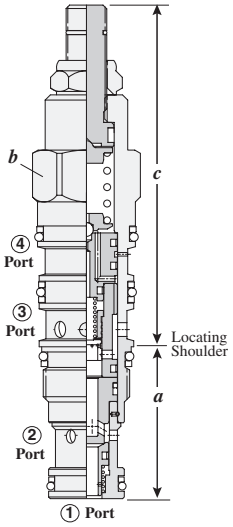
HR D B – L A N

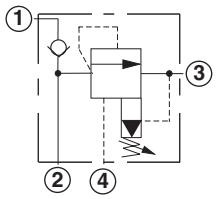
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
D 10 GPM	**L** Standard Screw Adjustment	**A** 500 - 3000 psi	**N** Buna-N
	C Tamper Resistant Factory Set	**W** 800 - 4500 psi	**V** Viton
	K Handknob		

** *See page 162 for information on Control Options*

Customer may specify pressure setting.

VENTABLE, PILOT OPERATED, BALANCED PISTON, RELIEF VALVE - BEFORE CHECK

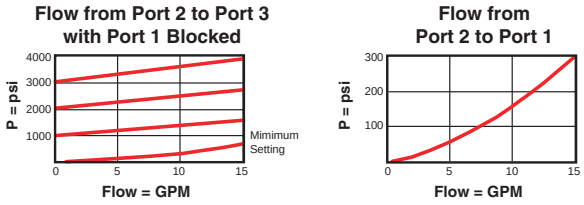




Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (lb. ft.)
10 GPM	**HVCA – LAN**	T - 21A	1.38	7/8	3.09	3.15	3.34	30/35

Performance Curves

HVCA



- Maximum operating pressure = 5000 psi
- Maximum valve leakage (port 2 to port 3) = 2 in³/min. at 1000 psi
- Factory pressure setting established at 4 GPM
- Free flow check cracking pressure = 25 psi
- Typical response = 10 ms
- Minimum setting is 75 psi for all spring ranges.
- Back pressure at port 3 (tank) is directly additive to the valve setting at a 1:1 ratio.
- Pressure at port 4 (vent) controls the valve below its setting.
- The check portion of the valve has a maximum leakage rate of less than 1 drop/minute.
- Note: This valve deviates from Sun's normal flow path for four port relief valves; port 2 is the inlet, port 1 is the system, port 3 is tank and port 4 is vent. Therefore, it is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

HV C A – L A N

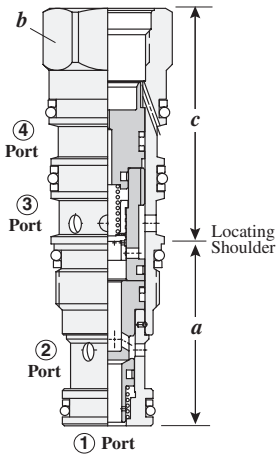
Nominal Capacity	*Control***	*Adjustment Range*	*Seal*
C 10 GPM	**L** Standard Screw Adjustment	**A** 75 - 3000 psi	**N** Buna-N
		B 75 - 1500 psi	**V** Viton
	C Tamper Resistant Factory Set	**D** 75 - 800 psi	
	K Handknob	**W** 75 - 4500 psi	

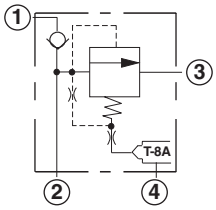
** *See page 162 for information on Control Options*

Customer may specify pressure setting.

Visit www.sunhydraulics.com for detailed and complete technical information on our full line of products.

VENTABLE, PILOT OPERATED, BALANCED PISTON, RELIEF VALVE - BEFORE CHECK WITH INTEGRAL PILOT CONTROL CAVITY



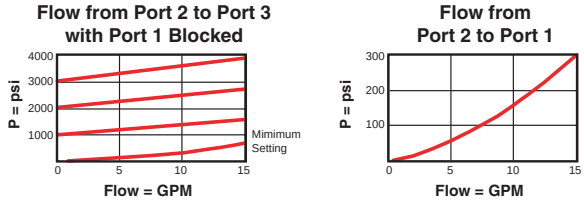


The -8 control option allows the pilot control valve to be incorporated directly into the end of the relief cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 121.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (lb. ft.)*
			a	*b*	*c*	
10 GPM	**HVCA – 8DN**	T - 21A	1.38	7/8	1.78	30/35

Performance Curves

HVCA-8



- Maximum operating pressure = 5000 psi
- Maximum valve leakage (port 2 to port 3) = 2 in³/min. at 1000 psi
- Free flow check cracking pressure = 25 psi
- Minimum setting is 75 psi for all spring ranges.
- Back pressure at port 4 (tank) is directly additive to the valve setting at a 1:1 ratio.
- The check portion of the valve has a maximum leakage rate of less than 1 drop/minute.
- Note: This valve deviates from Sun's normal flow path for four port relief valves; port 2 is the inlet, port 1 is the system, port 3 is tank and port 4 is vent. Therefore, it is probably not useable in existing standard Sun relief manifolds.
- With the -8 control option, the main stage valve should first be installed to the correct torque value. The T-8A pilot control valve should then be installed into the main stage valve to its required torque value.

OPTION ORDERING INFORMATION

HV C A – 8 D N

Nominal Capacity	*Control*	*Adjustment Range*	*Seal*
C 10 GPM	**8** with T-8A cavity in hex body for pilot operation (see pilot control section for alternate options)	**D** 75 psi	**N** Buna-N **V** Viton

NOTES

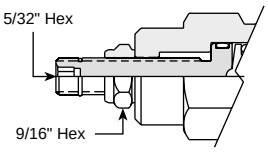
General Information

Cartridge Control Options

General Purpose Controls (for use in systems where adjustment may be changed after installation.)

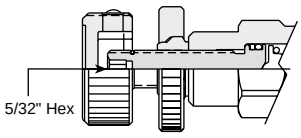
L Standard Screw Adjustment

O-ring seal on adjust screw. Adjust screw positively retained. Overset protection-pilot spring cannot go solid.



K Handknob with Lock Knob

Handknob and lock knob added to **L** control. Sun handknob kits for field conversion are available.



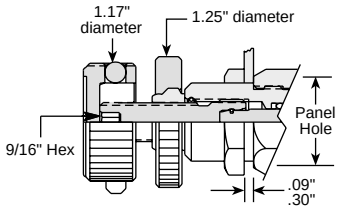
O Handknob with Panel Mount

Special threaded cartridge hex body with panel nut for mounting cartridge through access hole in control panel. Handknob and lock knob included.

Panel Hole:

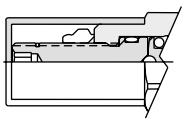
Series 1 cartridges .75" dia.
Series 2 cartridges 1.00" dia.

Panel nut hex size identical to cartridge hex size.



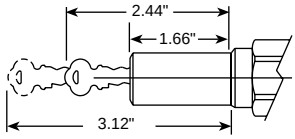
C Tamper Resistant Factory Set

Cover press-fit onto **L** control cartridge shoulder. Valves may be ordered in this configuration from Sun. ***Specify pressure setting on order.*** Setting stamped on cartridge hex. Sun kits for field conversion are available.



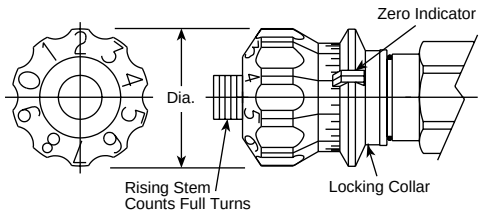
Key Lock Kit

Optional adjustment Key Lock Cover Kit for **L** controls allows adjustment to be locked with a key to prevent unauthorized changes in valve setting. Adjustment is easily accessible when lock assembly is removed. Requires replacement of standard locknut with special locknut which accepts lock assembly, and a new wire stop ring for overset protection.



H Calibrated Handknob with Detent Lock

Fully calibrated handknob for flow control cartridges. 40 radial calibrations per turn. Moveable zero indicator. (Minor disassembly required.) Rising detented locking collar positively locks adjustment knob against vibration or accidental tampering. Any desired setting may be recorded and repeated. U.S. Patent #4,577,831.

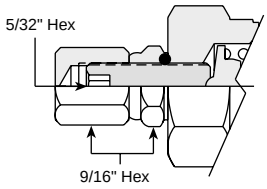


Diameter	*1.13" Dia.*	*1.38" Dia.*	*1.62" Dia.*	*1.62" Dia.*
Series	1	2	3	4
	NCCB	NCEB	NCFB	NCGB
	NCCC	NCEC	NCFC	NCGC
	NFCC	NFDC	NFEC	NFFC
	NFCD	NFDD	NFED	NFFD
	FDBA	FDCB	FDEA	FDFA

Special Purpose Controls (for use in systems where adjustment is seldom changed after installation)

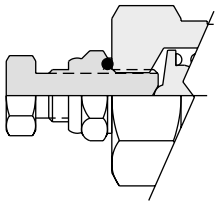
J Socket Head Set Screw with Cap

Stem seal - Seal under locknut. Adjustment screw not retained. No overset protection.



F Wrench Adjustment

Stem seal - Seal under locknut. Adjusting screw is not retained. Overset protection-pilot spring cannot go solid.



Counterbalance Cartridge Controls

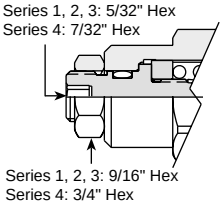
All Sun counterbalance cartridges are built with a leakproof adjustment - O-ring seals are on the adjusting screw-but are not designed for frequent adjustment in the field. Cartridges that are factory pre-set by Sun to a customer specified pressure setting are available and can be installed directly on a machine without the need for further adjustment.

C Tamper Resistant Factory Set

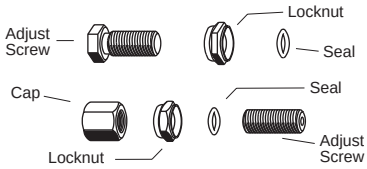
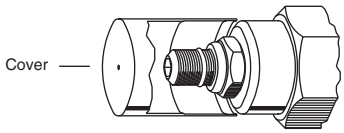
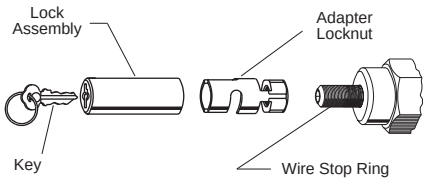
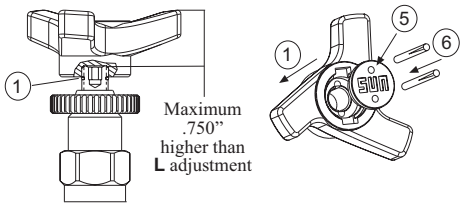
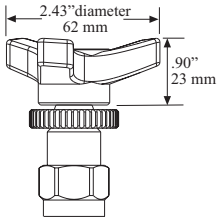
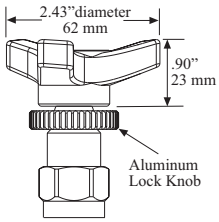
See **"C"** Control description above.

L Standard Leakproof Screw Adjustment.

O-ring seal on adjust screw.

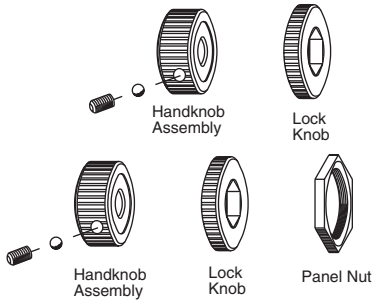
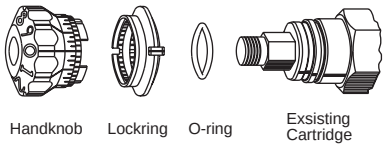
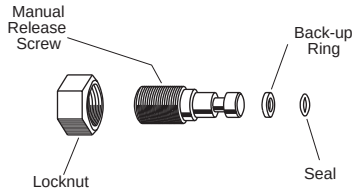


Cartridge Control Kits

Service Kit Number Description	*Use specifically with Control/Cartridge*	*Description*	*Notes*
Adjustment Screw Kit **991-006** Adjustment Screw Kit **991-010**	All **F** controls All **J** controls		To assure a complete seal on the stem - release all pressure on the cartridge after setting. **Then...** tighten locknut (and cap, on **J**).
Tamper Resistant Cover **991-000** **991-004** **991-001** **991-002** **991-003** **991-032** **991-033**	For all Sun cartridges with **L** adjustment Series 0 - 3/4" hex Series 1 - 7/8" hex Series 2 - 1 1/8" hex Series 3 - 1 1/4" hex Series 4 - 1 5/8" hex Series 1 - 7/8" hex (CB**, CC**) Series 2 - 1 1/8" hex (CB**, CC**)		1. Adjust valve to desired setting and tighten locknut. 2. Using an arbor press or a soft hammer, install cover until it seats on cartridge hex. 3. Cover is a press fit on cartridge shoulder.
Key Lock Kit **993-008**	For all Sun cartridges with **L** adjustment (except Series 0 and counterbalance cartridges).		1. Remove original wire stop ring and locknut. 2. Thread on the adapter locknut and install new wire stop ring through slot provided. 3. Adjust valve to desired setting and tighten adapter locknut. 4. Slide lock assembly over adapter, lock and remove key.
Three-winged Handknob Kit **991-034**	For all Series 1, 2, 3, 4 valves with **L** or **O** adjustment except counterbalance cartridges.	Install while cartridge is screwed in cavity to prevent damage. 	1. Do not remove stop ring. 2. Install lock knob by snapping onto the locknut. 3. Install star knob until contact is made with the stop ring. 4. Caution during installation on flow control valves (that have no stop ring). Make sure valve can be shut with hand knob installed. 5. Insert pins in cover so that they project on backside. 6. Put cover on with inserted pins and drive pins in until flush with cover.
	The handknob can be used as a Maximum Setting Limiter.		When knob is used as a maximum Setting Limiter: 1. Set valve at desired maximum setting. 2. Tighten lock nut (110 lbs. inch). 3. Remove stop ring. 4. Install lock knob. 5. Install handknob until flush with the lock knob.
Three-winged Handknob Kit with 1 3/8" dia. aluminum lock knob. **991-039**	This kit should be used in applications where there is high vibration and a plastic lock knob may loosen.		Follow installation instructions described above.

Cartridge Control Kits continue on next page

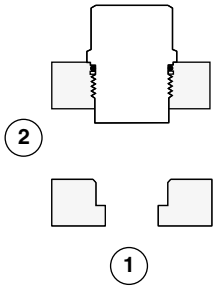
Cartridge Control Kits

Service Kit Number Description	*Use specifically with Control/Cartridge*	*Description*	*Notes*
K Handknob Kit **991-211**	Use this kit to adapt all **L** controls to **K** controls (except Series 0 and counterbalance cartridges).		Only cartridges date stamped "41" or later and originally supplied with plastic knobs. Lock knob snaps onto locknut furnished on cartridge.
991-222	**K** control for Series 0		
Panel Handknob Kit **991-215**	**O** controls All Series 1 cartridges 7/8" hex M20 thread		
Panel Handknob Kit **991-216**	**O** controls All Series 2 cartridges 1 1/8" hex 1"-14 thread		
H Calibrated Handknob Kit	**H** controls All series of flow controls		Only for cartridges originally supplied with an **H** handknob. Valves can not be modified in the field. **Note:** The **H** control is **Only** available for the cartridges shown to the left.
991-219	**FDCB**, **NCEB**, **NCEC**, **NFDC, NFDD** only		
991-220	**FDEA**, **FDFA**, **NCFB**, **NCFC**, **NCGB**, **NCGC**, **NFEC**, **NFED, NFFC, NFFD** only		
991-221	**FDBA**, **NCCB**, **NCCC**, **NFCC, NFDC** only		
Lockwire Kit **991-012**	All **M**, **Q** and **R** controls (except solenoid operated cartridges).		
Adjustment Screw Kit **991-112-003 Viton** **991-112-007 Buna-N**	**CKCA L**CKCD L**** **CKCB L**CPCA L**** **CKCC L****		**Only** cartridges date stamped "62" or earlier.
Adjustment Screw Kit **991-212-003 Viton** **991-212-007 Buna-N**	**CKEA L**CKED L**** **CKEB L**CPEA L**** **CKEC L****		

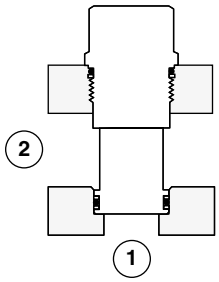
Cavity Plugs

It is sometimes desirable to remove a Sun cartridge valve and still maintain the integrity of the hydraulic system. This may be necessitated by the need to flush a system after repairs or a piping change, or to change an operating function in the circuit. For these requirements, Sun offers two styles of cavity plugs - all ports blocked and main ports open to flow.

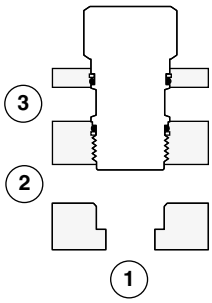
Plugs for Two Port Cavities:



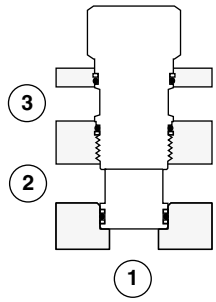
		All Ports Open			All Ports Blocked		
Series	*Cavity*	*Cavity Plug Model Code**	*Buna-N*	*Viton*	*Cavity Plug Model Code*	*Buna-N*	*Viton*
P	T-8A	XAOA-XX*			XACA-XX*		
0	T-162A	XZOA-XX*			XZCB-XX*		
1	T-10A	XFOA-XX*			XFCA-XX*		
	T-13A				XGCA-XX*		
2	T-3A	XCOA-XX*			XCCA-XX*		
	T-5A				XDCA-XX*		
3	T-16A	XIOA-XX*			XICA-XX*		
4	T-18A	XKOA-XX*			XKCA-XX*		



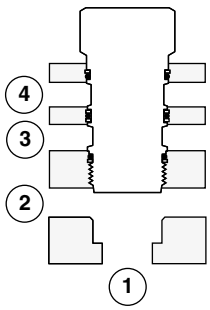
Plugs for Three Port Cavities



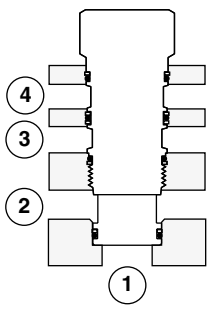
		Ports 1 to 2 Open Port 3 Blocked			All Ports Blocked		
Series	*Cavity*	*Cavity Plug Model Code**	*Buna-N*	*Viton*	*Cavity Plug Model Code*	*Buna-N*	*Viton*
P	T-9A	XAOB-XX*			XACBXX*		
0	T-163A	XZOB-XX*			XZCB-XX*		
1	T-11A	XEOA-XX*			XECA-XX*		
2	T-2A	XBOA-XX*			XBCA-XX*		
3	T-17A	XHOA-XX*			XHCA-XX*		
4	T-19A	XJOA-XX*			XJCA-XX*		



Plugs for Four Port Cavities (Internal Locating Shoulder)

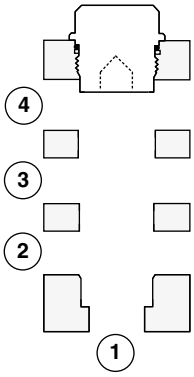


		Ports 1 to 2 Open Port 3 and 4 Blocked			All Ports Blocked		
Series	*Cavity*	*Cavity Plug Model Code**	*Buna-N*	*Viton*	*Cavity Plug Model Code*	*Buna-N*	*Viton*
1	T-21A	XMOA-XX*			XMCA-XX*		
2	T-22A	XNOA-XX*			XNCA-XX*		
3	T-23A	XPOA-XX*			XPCA-XX*		
4	T-24A	XQOA-XX*			XQCA-XX*		

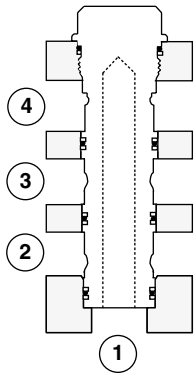


*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

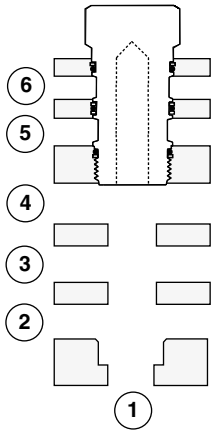
Plugs for Four Port Cavities (External Locating Shoulder)



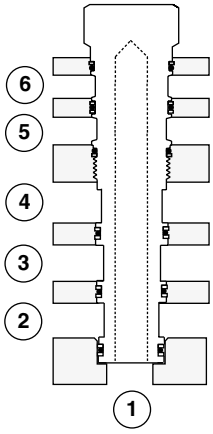
		All Ports Open			All Ports Blocked		
Series	*Cavity*	*Cavity Plug Model Code**	*Buna-N*	*Viton*	*Cavity Plug Model Code**	*Buna-N*	*Viton*
1	T-31A	**XFOA-XX***			**XRCA-XX***		
2	T-32A	**XCOA-XX***			**XSCA-XX***		
3	T-33A	**XIOA-XX***			**XTCA-XX***		
4	T-34A	**XKOA-XX***			**XVCA-XX***		



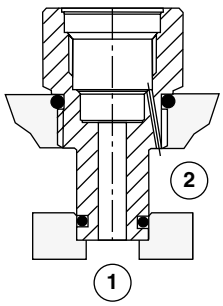
Plugs for Six Port Cavities



		Ports 1, 2, 3 and 4 Open Ports 5 and 6 Blocked			All Ports Blocked		
Series	*Cavity*	*Cavity Plug Model Code**	*Buna-N*	*Viton*	*Cavity Plug Model Code**	*Buna-N*	*Viton*
1	T-61A	**XMOA-XX***			**XRCC-XX***		
2	T-62A	**XNOA-XX***			**XSCC-XX***		
3	T-63A	**XPOA-XX***			**XTCC-XX***		
4	T-64A	**XQOA-XX***			**XVCC-XX***		



Cavity Adaptor (Converts Waterman 12-2 Cavity to the Sun T-8A Cavity)



	All Ports Open		
Cavity	*Cavity Plug Model Code**	*Buna-N*	*Viton*
12-2	**XAAA-8X***		

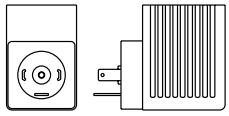
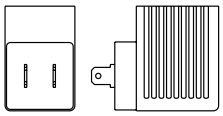
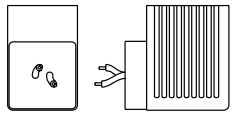
*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

Sun Solenoid Electrical Connector Options

Sun Hydraulics has a range of pilot flow and full flow solenoid products with operating pressures up to 5000 psi. These products are available with the coil configuration options shown below. If you only require pilot flow and want to operate these packages in a 5000 psi system, Sun offers a screw-in adapter that converts the Waterman 12-2 cavity to a Sun T-8A cavity.

Connector Options for Sun Pilot Flow Solenoid Valves (DAAA, DBAA)

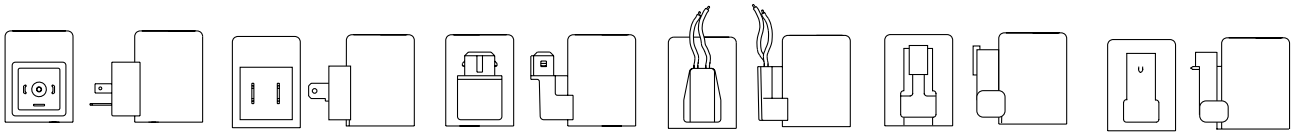
ISO / DIN 43650 | **SAE J858-A** | **Twin Lead**

Description	*Coil only part number*	*Coil only part number*	*Coil only part number*
115 V AC 50/60 Hz	760-211	N/A	N/A
230 V AC 50/60 Hz	760-223	N/A	N/A
6 V DC	760-206	760-506	760-706
12 V DC	760-212	760-512	760-712
24 V DC	760-224	760-524	760-724
28 V DC	760-228	760-528	760-728
36 V DC	760-236	760-536	760-736
48 V DC	760-248	760-548	760-748

Connector Options for Sun Full Flow Solenoid Valves (DLDA, DTDA, DMDA, DNDA) and Proportional Valves (RBAP, PRDP, PRDL)

ISO/DIN 43650 | **Twin Spade (SAE J858A)** | **AMP® Junior Timer** | **Twin Lead** | **Metri-Pack** | **Deutsch**

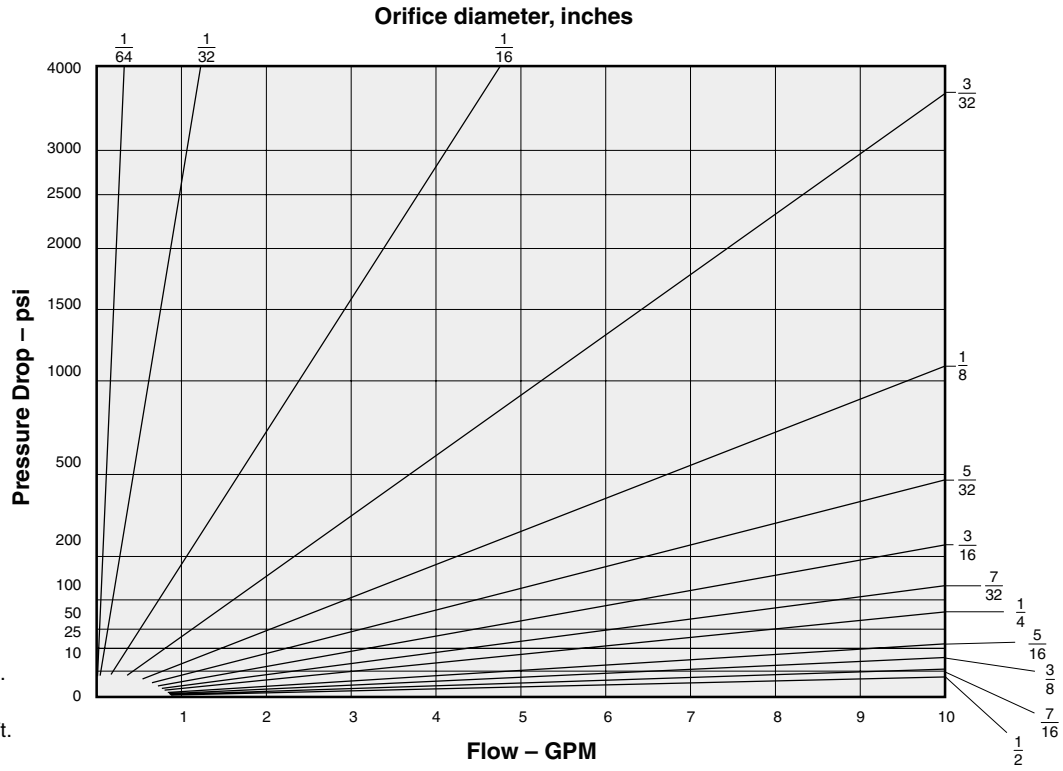


Description	*Coil only part number*	*Coil only part number*	*Coil only part number*	*Coil only part number*	*Coil only part number*	*Coil only part number*
115 V AC 50/60 Hz	770-211	N/A	N/A	N/A	N/A	N/A
230 V AC 50/60 Hz	770-223	N/A	N/A	N/A	N/A	N/A
12 V DC	770-212	770-512	770-612	770-712	770-812	770-912
24 V DC	770-224	770-524	770-624	770-724	770-824	770-924
48VDC*	770-248*	770-548*	770-648*	770-748*	770-848*	770-948*

*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

ORIFICE PRESSURE DROP DATA

No allowance has been made for viscosity effects, or regain of pressure downstream.



These charts are based on the formula:

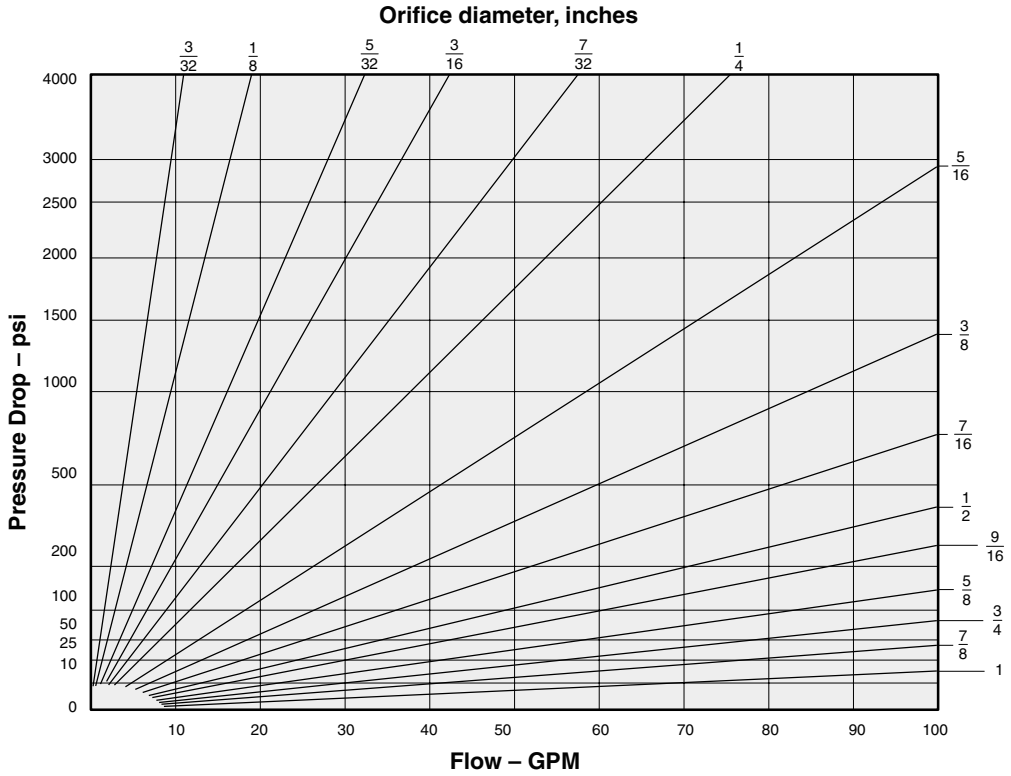
$Q = C \times A \times \sqrt{2_g H}$

Where:

- Q = Flow in Cu. Ft. per Sec.
- C = Orifice Coefficient
- A = Area of Orifice in Sq. Ft.
- H = Pressure Head in Ft.

Specify Gravity of Fluid = .895

This equation becomes
Q(GPM) = 24.12 x A(sq.in.) x $\sqrt{\text{Pressure Drop}}$ (psi) when C = 0.6



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CARTRIDGES

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WARRANTY INFORMATION, PERFORMANCE ASSURANCE, AND APPLICATION LIMITATIONS

Caution

Sun Hydraulics manufactures a variety of cartridge valves that will fit into the same Sun cavity. Each cartridge is marked with a seven-digit part identification code and a four-digit date code, stamped on the hex surfaces. Designers and users of Sun components are advised that **physical interchangeability of cartridges does not necessarily mean functional interchangeability.** When replacing any Sun cartridges, users should first check with the manufacturer's service literature, their local Sun distributor, or the Sun factory before making any part substitutions.

NOTE: To avoid serious injury, the manufacturer's service literature must be consulted before working on any hydraulic system.

Limited Warranty

Sun Hydraulics warrants its products free from defects in material, workmanship, and design for a period of three years after their installation, provided the installation date is less than one year after manufacture. **"O-rings" and seals are specifically exempted from this warranty.** In no instance is there any warranty of fitness for a particular use and Sun Hydraulics cannot and does not accept responsibility of any type for any of its products that have been subjected to improper installation, improper application, negligence, tampering, or abuse, or which have been repaired or altered outside of the Sun Hydraulics factory. Sun's liability under this warranty shall extend only to repair or replacement, f.o.b. Sun's factory, of any defective part or product determined by inspection as not conforming to this warranty. Sun makes no other warranties, expressed or implied, and is not responsible for any consequential damages resulting from use by any buyer or user, Sun Hydraulics' liability being limited to the value of product sold or obligation to replace a defective part.

Performance Assurance

All Sun cartridges valves are individually tested at the factory and preset to specific pressure or flow settings where indicated in this product listing. However, as the actual performance of buyers' equipment cannot be reproduced in Sun's testing laboratory, assurance of suitability of Sun products in the buyer's application is the responsibility of the buyer. This is typically accomplished by the manufacture of a prototype followed by a test or qualification program on the part of the buyer.

Application Limitations

Sun product designs and manufacturing facilities have been specifically developed to provide products for commercial, industrial and mobile hydraulic applications and Sun products are only warranted for these types of uses. **Sun's distributors are not authorized to approve the use of Sun products in any of the following applications:**

- Any product that comes under the U.S. Federal Highway Safety Act, including, but not limited to, steering or braking systems for passenger-carrying vehicles or on-highway trucks.
- Aircraft or space vehicles.
- Ordnance equipment.
- Life support equipment.
- Any end product that comes under the U.S. Nuclear Regulatory Commission rules and regulations, including, but not limited to, products used in nuclear power plant operations.

Specific written approval for any application of Sun products in any of the above named applications should be obtained from Sun Hydraulics. Consultation with Sun distributors or factory engineers is advisable in any situations where applicability is questionable.