Over 35 New Products in this Catalogue

Relief Cartridge Valves

Page 7: The **RDDA-3**** (series 1) and **RDFA-3**** (series 2) are non-adjustable direct-acting relief cartridges. They are normally closed, pressure-limiting valves used to protect hydraulic components from pressure transients. When the pressure at the inlet (port 1) reaches the valve setting, the valve starts to open to tank (port 2), throttling the flow to limit the pressure rise. These valves are smooth and quiet, with essentially zero leakage, dirt tolerant, immune to silting, and are very fast.

Page 8: The **RDDT-Q**** (series 1) and **RDFT-Q**** (series 2) are direct-acting relief cartridges. They are normally closed, pressure-limiting valves used to protect hydraulic components from pressure transients. When the pressure at the inlet (port 1) reaches the valve setting, the valve starts to open to tank (port 2), throttling the flow to limit the pressure rise. These valves are smooth and quiet, with essentially zero leakage, dirt tolerant, immune to silting, and are very fast. These CE marked valves are safety valves that meet the requirements of the European Directive for Pressurized Devices (PED) 97/23/EC.

Page 12: **RP*S** are pilot-operated, balanced-poppet relief cartridges and are normally closed pressure regulating valves. When the pressure at the inlet (port 1) reaches the valve setting, the valve starts to open to tank (port 2), throttling flow to regulate the pressure. These valves are accurate, smooth, quiet, fast, and have low pressure rise vs. flow.

Page 11: The **RPET, RPGT, RPIT,** and **RPKT** are series 1, 2, 3, and 4 pilot operated soft relief valves which control the rate of pressure rise in a system as well as maximum pressure. These valves provide excellent pressure protection and reduced system shock.

Page 12: The **RQCB** is a series 0 kick-down, relief valve which works like a circuit breaker in an electrical system. When the pressure setting is reached, the valve kicks wide open, passing flow at low pressure. It stays open until flow to the valve stops.

Page 15: The **RBAN-X**** is an electro-proportional, direct acting pilot relief valve which fits into the Sun T-8A cavity. This valve has an inverse operation, meaning the valve is at a maximum setting with no signal to the solenoid coil. The setting decreases as the signal increases.

Page 17: The **RP*S-8**** are seated-style, normally closed modulating valves with a T-8A cavity. When used with RBAP proportional relief fitted into this cavity, the RPES becomes a series 1 proportional relief with low main stage leakage.

Page 19: **RV*S-***** are vented, pilot operated, relief valves with a seated style main stage. When compared to a standard spool-type vented relief, this valve provides lower leakage, and faster response resulting in reduced overshoot and improved pressure control.

Page 20: The **RV*T** is a vented, pilot operated, soft relief valve which controls the rate of pressure rise in a system as well as the maximum pressure. By providing a smoother, controlled pressure loading in the non-vented condition, this valve minimizes shock in systems.

Sequence Cartridge Valves

Page 28: The **SQBB** is a series 0 kick-down sequence valve used to sequence a function in a system when pressure on the inlet reaches the valve setting. The valve goes wide open and stays open until flow to the valve stops.

Reducing/Relieving Cartridge Valves

Page 42: The **PS*T-***** is a direct acting, pressure reducing/relieving valve mainstage piloted from port 4. This valve incorporates a damped construction for stable operation allowing the use of high reduced pressure.

Counterbalance Cartridge Valves

Sun has added a number of fixed setting valves to its counterbalance line of products: CBB*-X**, (Semi-restrictive, 40 L/min.), CBA*-X (Restrictive, 10 L/min.), CBB*-X (Restrictive, 20 L/min.) and CBC*-X (Standard, 60 L/min.). Fixed-setting, 3-port, T-11A cavity, counterbalance valves with pilot assist function similar to the adjustable versions except the fixed setting is pre-set to a nominal value. These fixed-setting valves are meant to control an overrunning load. The check valve allows free flow from the directional valve (port 2) to the load (port 1), while a direct-acting, pilot-assisted relief valve controls flow from port 1 to port 2. Pilot assist at port 3 lowers the effective setting of the relief valve at a rate determined by the pilot ratio. **See page 72. Also review these products at www.sunhydraulics.com. *Products: Counterbalance: Click View All Counterbalance Valves.***

Load Control: Load Reactive Cartridge Valves

Page 64: **MB*A-L**** (3:1 pilot ratio), **MB*B-L**** (1.5:1 pilot ratio), **MB*G-L**** (4.5:1 pilot ratio) are load reactive, non-vented load control valves. This valve is functionally a 3 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

Page 65: **MB*A-X**** (3:1 pilot ratio), **MB*B-X**** (1.5:1 pilot ratio), **MB*G-X**** (4.5:1 pilot ratio) are load reactive, non-vented, fixed setting, load control valves. This valve is functionally a 3 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

Page 66: **MW*A-L**** (3:1 pilot ratio), **MW*B-L**** (1.5:1 pilot ratio), **MW*G-L**** (4.5:1 pilot ratio) are load reactive, vented, load control valves. This valve is functionally a 4 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

Over 35 New Products in this Catalogue

Load Control: Load Reactive Cartridge Valves *(Continued)*

Page 67: **MW*A-X**** (3:1 pilot ratio), **MW*B-X**** (1.5:1 pilot ratio), **MW*G-X**** (4.5:1 pilot ratio) are load reactive, vented, load control valves. This valve is functionally a 4 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

Load Control: Balanced Cartridge Valves

Page 70: The **MB*M-X**** is a balanced, non-vented, non-relieving load control valve. This valve displays characteristics of a pressure compensating flow control valve. Performance is best in the meter-out mode with port 1 being the load and port 2 being tank.

Page 71: The **MW*M-X**** is a vented, balanced non-relieving, load control valves that combines a balanced modulating element with a reverse flow check. This valve displays characteristics of a pressure compensating flow control valve. Performance is best in the meter-out mode with port 1 being the load and port 2 being tank.

Check Cartridge Valves

Page 74: **CXAA-XB*** is a free flow, nose-to-side, check valve which fits into T-8A cavity.

Logic Element Cartridge Valves

Page 110: **LO*C-ZD*** is a balanced poppet, pilot-to-close, spring biased closed, logic element with position indicating switch.

Page 111: **LO*O-ZD*** is a balanced poppet, pilot-to-close, spring biased open, logic element with position indicating switch.

Page 116: The **LH*A-X**** is a bypass/restrictive, priority modulating element.

Solenoid Operated Cartridge Valves

Page 132: The **DTDA-S**** is a 2-position, 2-way direct operating poppet-type directional solenoid valve with soft shift armature.

Page 133: The **DAAL-S**** is a 2-position, 2-way, spool-type pilot solenoid valve with soft shift armature.

Page 134: The **DLDA-S**** is a 2-position, 2-way spool-type directional solenoid valve with soft shift armature.

Page 135: The **DWDA-X**** is a 2-position, 3-way poppet-type directional solenoid valve.

Page 136: The **DBAL-S**** is a 2-position, 3-way, spool-type pilot solenoid valve with soft shift armature.

Page 137: The **DMDA-S**** is a 2-position, 3-way spool-type directional solenoid valve with soft shift armature.

Page 138: The **DNDA-S**** is a 2-position, 4-way spool-type directional solenoid valve with soft shift armature.

Page 139: The **DNDC-X**** is a direct acting, solenoid-operated, 4-way, 3-position spool valve that is spring centred to the neutral position.

Pilot Control Cartridge Valves

Page 146: **DAAL-X**** is a 2-way, solenoid operated, directional spool-type, pilot valve.

Page 146: **DAAL-S**** is a 2-position, 2-way, spool-type pilot solenoid valve with soft shift armature.

Page 150: The **DBAL-X**** is a 3-way, 2-position, solenoid operated, directional spool-type, pilot valve.

Page 150: **DBAL-S**** is a 3-way, 2-position, solenoid operated, directional spool-type pilot valve with soft shift armature.

Corrosion Resistant Cartridge Valves

Sun is continually adding to its line of corrosion resistant valves. These valve have stainless steel and titanium external components with heat treated internal components in carbon and alloy steels. These valves are recommended for marine, oil and gas industries and for use in stationary aero-drives. All external components are qualified by a 1,000 hour salt spray test to ASTM B117-03. In all cases, the internal working components remain the same as the standard Sun valve. Where the cartridge product is offered in corrosion resistant materials, you will see a note in the bottom right corner of the page. ***Visit www.sunhydraulics.com for complete information on our Corrosion Resistant Cartridges. Products: Cartridges: Corrosion Resistant: View All Corrosion Resistant Cartridges for complete information about these cartridges.***

Weatherized Coils and Weatherized Coil Kits

Page 190, 191: Sun's new weatherized coils and kits are designed for Sun's full flow solenoid operated and electro-proportional cartridge valves. They are protection against high-pressure wash-downs or marine environments for Sun's electrically-actuated cartridge valves. These coil kits are only available with the Metri-Pack Series 150-2M connector with a choice of four voltages.

A weatherization kit is required in conjunction with a weatherized coil and a modified cavity (consult the Sun website to view cavity modification instructions for the use of each kit). The coil is not included in the kits and must be purchased separately. Weatherization kits are cartridge model code and cavity dependant. **These kits are intended for new installations only and are not suitable for retrofitting existing equipment or for standard Sun bodies.**

Consult www.sunhydraulics.com for complete details on weatherized coils and weatherized coil kits. Go to Products: Cartridges: Coils: View All Coils: Weatherized Coils. View individual Weatherized Coil Seal Kit page for detailed installation instructions.

Contents

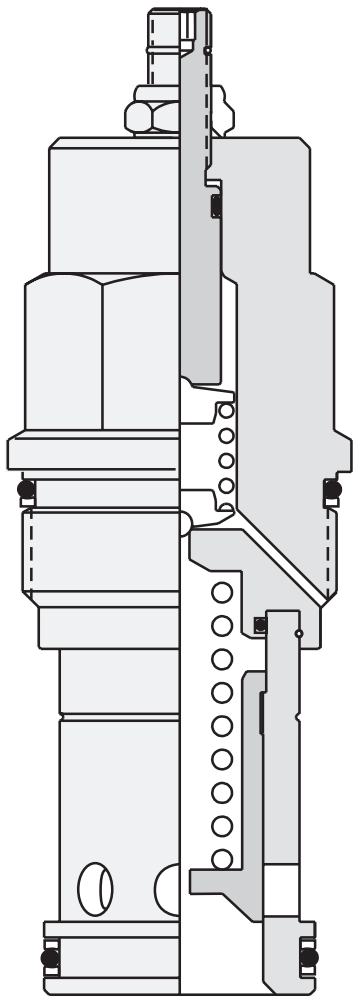
Model Codes printed in Red are Preferred Versions of Products shown in this catalogue and most readily available.

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

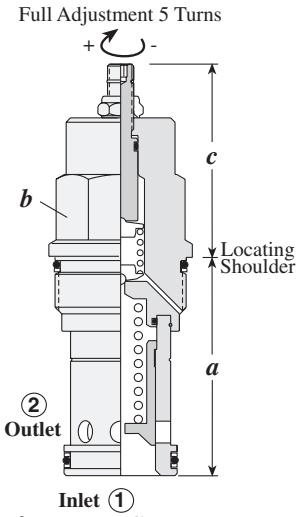
Sun Hydraulics reserves the right to discontinue models at any time, or change prices, specifications or designs without notice or incurring obligation.

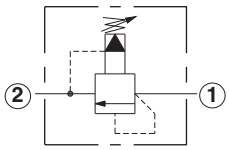
Printed in the United States of America

Relief Cartridge Valves



PILOT OPERATED, BALANCED PISTON



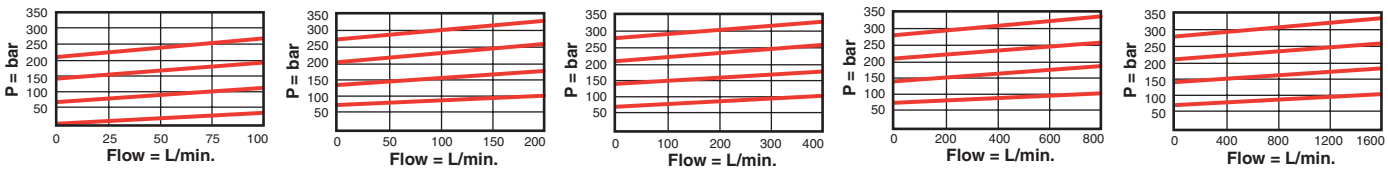


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
45 L/min.	**RPCC – LAN**	T - 162A	31,0	19,1	53,6	55,1	60,7	35 - 40
95 L/min.	**RPEC – LAN**	T - 10A	39,6	22,2	50,8	54,6	57,2	45 - 50
200 L/min.	**RPGC – LAN**	T - 3A	47,8	28,6	53,8	55,4	60,5	60 - 70
380 L/min.	**RPIC – LAN**	T - 16A	62,0	31,8	62,0	62,7	68,3	200 - 215
760 L/min.	**RPKC – LAN**	T - 18A	79,5	41,3	71,4	74,7	77,7	465 - 500

Performance Curves

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

Typical Pressure Rise



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = RPCC, RPEC: 30 cc/min. at 70 bar; RPGC: 50 cc/min. at 70 bar; RPIC: 65,5 cc/min. at 70 bar; RPKC: 80 cc/min. at 70 bar.
- Typical response time 10 ms.
- Factory pressure settings established at 15 L/min.
- 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.

OPTION ORDERING INFORMATION

RP ✱ C – ✱ ✱ ✱

Nominal Capacity

- **C** 45 L/min.
- **E** 95 L/min.
- **G** 200 L/min.
- **I** 380 L/min.
- **K** 760 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

RPEC, RPGC only:

- **O** Handknob with Panel Mount

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

RPCC only:

- **A** 5 - 210 bar Standard set at 70 bar
- **B** 5 - 105 bar Standard set at 70 bar
- **C** 5 - 420 bar Standard set at 70 bar
- **N** 5 - 55 bar Standard set at 30 bar
- **Q** 5 - 25 bar Standard set at 14 bar
- **W** 5 - 315 bar Standard set at 70 bar

RPEC, RPGC, RPIC, RPKC only:

- **A** 7 - 210 bar Standard set at 70 bar
- **B** 3,5 - 105 bar Standard set at 70 bar
- **C** 10,5 - 420 bar Standard set at 70 bar
- **N** 4 - 55 bar Standard set at 28 bar
- **Q** 4 - 25 bar Standard set at 14 bar
- **W** 10,5 - 315 bar Standard set at 70 bar

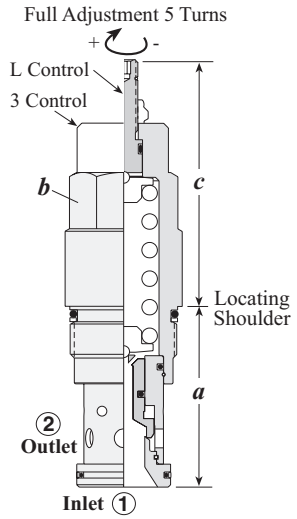
Seal Material

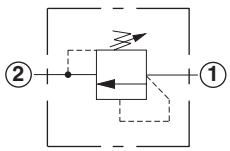
- **N** Buna-N
- **V** Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING AND DIRECT ACTING, NON-ADJUSTABLE





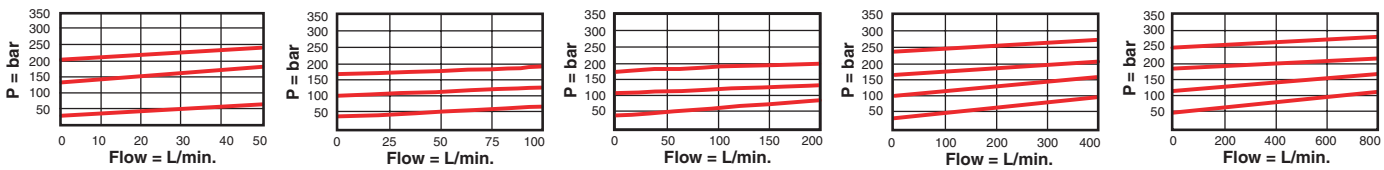
RD*A

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*Installation Torque (Nm)*
45 L/min.	**RDBA – LAN**	T - 162A	31,0	19,1	53,6	56,4	35 - 40
95 L/min.	**RDDA – LAN**	T - 10A	39,6	22,2	59,2	63,2	45 - 50
200 L/min.	**RDFA – LAN**	T - 3A	47,8	28,6	63,5	65,0	60 - 70
380 L/min.	**RDHA – LAN**	T - 16A	62,0	31,8	82,6	84,1	200 - 215
760 L/min.	**RDJA – LAN**	T - 18A	79,5	41,3	100,0	103,4	465 - 500

Performance Curves

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

Typical Pressure Rise



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = 0,7 cc/min.
- Typical response time 2 ms.
- Factory pressure settings established at 15 L/min.
- 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.
- The seals on the adjust screw are exposed to system pressure which means this valve can only be adjusted when the pressure is removed. The setting procedure is; check the setting, remove the pressure, adjust the valve, check the new setting.
- Reseat exceeds 90% of cracking pressure.
- Select a spring range where the desired relief setting is approximately mid-range between the minimum and maximum pressure to ensure maximum valve repeatability.

OPTION ORDERING INFORMATION

RD ✱ A – ✱ ✱ ✱

Nominal Capacity

- **B** 45 L/min.
- **D** 95 L/min.
- **F** 200 L/min.
- **H** 380 L/min.
- **J** 760 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set

RDDA, RDFA only:

- **3*** Non-Adjustable

** **Special setting required. Specify at time of order.***

*** **See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

- **A** 35 - 210 bar Standard set at 70 bar
- **B** 20 - 105 bar Standard set at 70 bar
- **C** 70 - 420 bar Standard set at 70 bar
- **D** 14 - 55 bar Standard set at 28 bar
- **E** 10 - 28 bar Standard set at 14 bar
- **S** 3,5 - 14 bar Standard set at 7 bar
- **W** 55 - 315 bar Standard set at 70 bar

RDDA-3, RDFA-3 only available with A, C, D ranges.

Seal Material

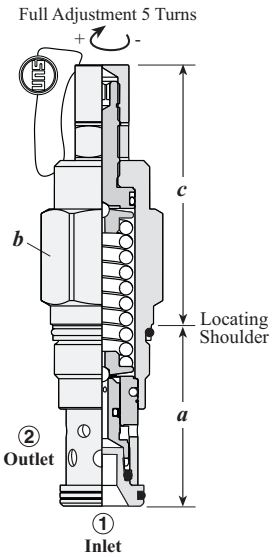
- **N** Buna-N
- **V** Viton

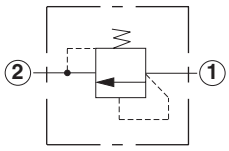
Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING, CE MARKED





The CE marked valve is a safety valve that meets the requirements of the European Directive for Pressurized Devices (PED) 97/23/EC.

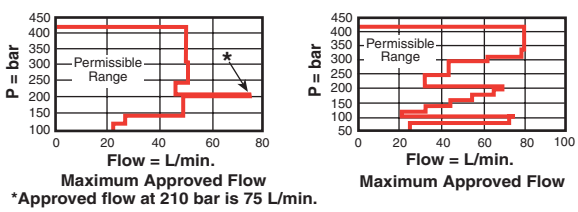
Each delivery contains a TüV approval, which is a certification of the excess operating pressure and the approved flow, an EC declaration of conformity, and an instructional manual. See Sun website for further information.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
75 L/min.	**RDDT – QAN**	T - 10A	40,0 mm	22,2 mm	65,0 mm	45 - 50
79 L/min.	**RDFT – QAN**	T - 3A	47,8 mm	28,6 mm	70,4 mm	60 - 70

Performance Curves

RDDT **RDFT**

Permissible Operating Range



- Maximum valve leakage at reseat = 0,7 cc/min.
- Reseat = > 90% of set pressure.
- Typical response time 2 ms.
- Standard settings for preset valves: 100, 140, 160, 210, 250, and 330 bar.
- Pressure setting from 100 bar up to 422 bar are approved and certified by TüV.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits.
- Back pressure on the tank port (port 2) is additive to the valve setting at a 1:1 ratio.

OPTION ORDERING INFORMATION

RD ✱ T – ✱ ✱ ✱

Nominal Capacity

D 75 L/min.

F 79 L/min.

Control

Q* Capped and Lockwire

* *Special setting required. Specify at time of order.*

Adjustment Range

RDDT:

A 100 - 210 bar

C 315 - 422 bar

W 211 - 314 bar

RDFT:

A 106 - 209 bar

B 60 - 105 bar

C 210 - 420 bar

Seal Material

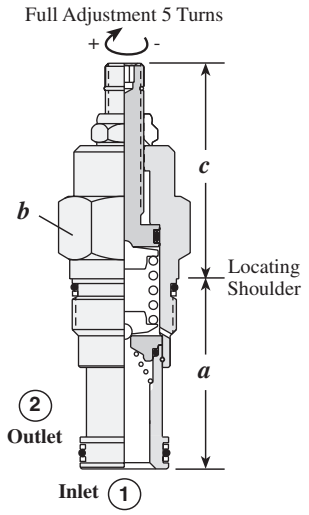
N Buna-N

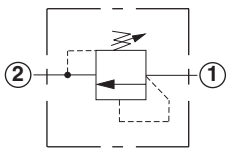
V Viton

U.S. Patent #4,742,846

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING, PILOT CAPACITY



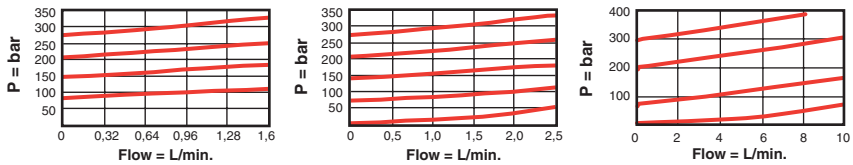


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	c O	Installation Torque (Nm)
1 L/min.	**RBAC – LAN**	T - 10A	39,6	22,2	50,8	54,6	57,2	58,0	45 - 50
2 L/min.	**RBAA – LAN**	T - 3A	47,8	28,6	53,8	55,4	60,5	61,0	60 - 70
10 L/min.	**RBAE – LAN**	T - 8A	19,0	22,2	60,5	62,7	67,6	67,6	35 - 40

Performance Curves

RBAC **RBAA** **RBAE**

Typical Pressure Rise



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat at 24 cSt = RBAC, RBAA: 0,4 cc/min.; RBAE: 1 cc/min.
- Typical response time 2 ms.
- Back pressure on the tank port (port 2) is directly additive to the pressure setting at port 1 (inlet) at a 1:1 ratio to the valve setting.
- RBAE: Utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

OPTION ORDERING INFORMATION

RB A ✱ – ✱ ✱ ✱

Nominal Capacity

AC 1 L/min.

AA 2 L/min.

AE 10 L/min.

*Control***

L Standard Screw Adjustment

C* Tamper Resistant with Lock Knob

K Handknob Factory Set

O Handknob with Panel Mount

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

A 1,7 - 210 bar Standard set at 70 bar

B 1,7 - 105 bar Standard set at 70 bar

C 1,7 - 420 bar Standard set at 70 bar

D 1,7 - 55 bar Standard set at 25 bar

E 1,7 - 25 bar Standard set at 14 bar

W 1,7 - 315 bar Standard set at 70 bar

Seal Material

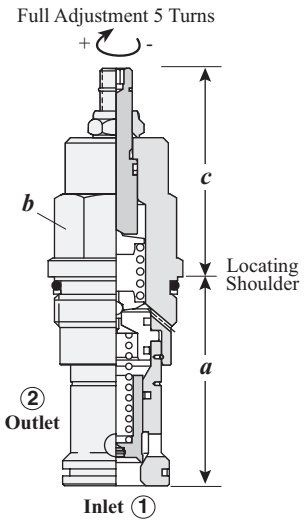
N Buna-N

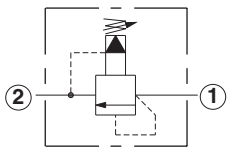
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED POPPET



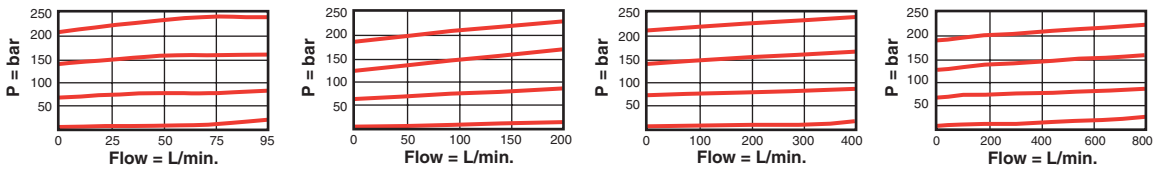


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
95 L/min.	**RPES – LAN**	T - 10A	39,6	22,2	50,8	54,6	57,2	40 - 50
200 L/min.	**RPGS – LAN**	T - 3A	47,8	28,6	53,8	55,4	60,5	60 - 70
380 L/min.	**RPIS – LAN**	T - 16A	62,0	31,8	62,0	62,7	68,3	200 - 215
760 L/min.	**RPKS – LAN**	T - 18A	79,5	41,3	71,4	74,7	77,7	465 - 500

Performance Curves

RPES **RPGS** **RPIS** **RPKS**

Typical Pressure Rise



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = RPES: 0,7 cc/min.; RPGS, RPIS, RPKS: 2,1 cc/min.
- Typical response time 2 ms.
- Factory pressure settings established at 15 L/min.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits.
- 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

E 95 L/min.

G 200 L/min.

I 380 L/min.

K 760 L/ min.

Control**

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

L Standard Screw Adjustment

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

A 7 - 210 bar
Standard set at 70 bar

B 3,5 - 105 bar
Standard set at 70 bar

C 10,5 - 420 bar
Standard set at 70 bar

N 4 - 55 bar
Standard set at 30 bar

Q 4 - 25 bar
Standard set at 14 bar

RPES, RPGS only:
W 7 - 315 bar
Standard set at 70 bar

RPIS, RPKS only:
W 10,5 - 315 bar
Standard set at 70 bar

Seal Material

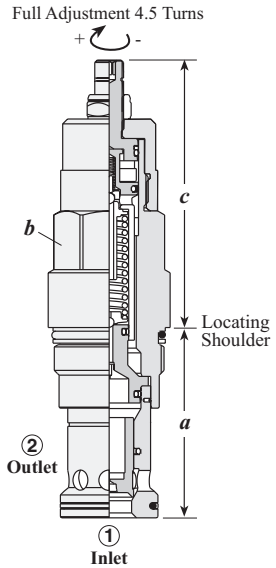
N Buna-N

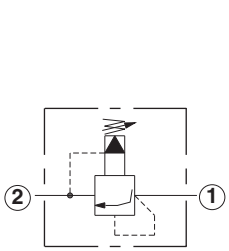
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

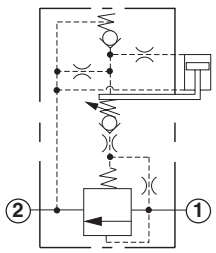
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED POPPET, SOFT





Simplified Symbol



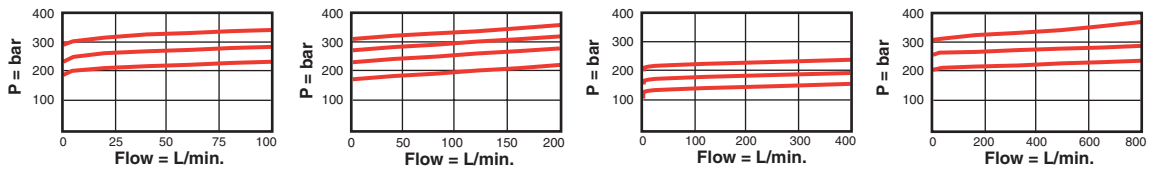
Complex Symbol

Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (Nm)
95 L/min.	**RPET - LAN**	T - 10A	39,6	22,8	79,5	85,1	40 - 50
200 L/min.	**RPGT - LAN**	T - 3A	47,8	28,6	85,9	88,1	60 - 70
380 L/min.	**RPIT - LAN**	T - 16A	61,7	31,8	86,9	89,2	200 - 215
760 L/min.	**RPKT - LAN**	T - 18A	79,2	41,3	88,4	85,3	465 - 500

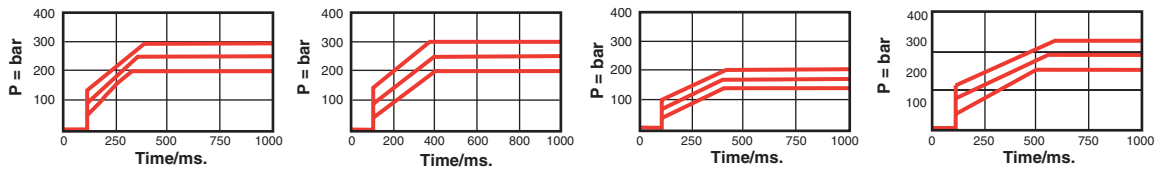
Performance Curves

RPET **RPGT** **RPIT** **RPKT**

Pressure Differential vs. Flow



Time vs. Pressure



- Maximum operating pressure = 350 bar.
- Control pilot flow = 0,16 to 0,41 L/min.
- Pressure Ramp Up Time = RPET: 200 ms., RPGT: 300 ms., RPIT: 400 ms., RPIC: 500 ms.
- Factory pressure settings established at 15 L/min.
- Will accept maximum pressure at Port 2.
- When pressure at the inlet (port 1) exceeds the threshold setting, the valve opens to tank (port 2). The pilot section moves forward at a steady rate, increasing the setting by compressing the pilot spring. Maximum setting is achieved when the pilot section reaches a mechanical stop.

OPTION ORDERING INFORMATION

RP ✱ T – ✱ ✱ ✱

Nominal Capacity

E 95 L/min.
G 200 L/min.
I 380 L/min.
K 760 L/min.

*Control***

C* Tamper Resistant Factory Set
L Standard Screw Adjustment

* *Special setting required. Specify at time of order.*

** *See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

A 140 - 210 bar Standard set at 140 bar
C 315 - 420 bar Standard set at 315 bar
W 210-315 bar Standard set at 210 bar

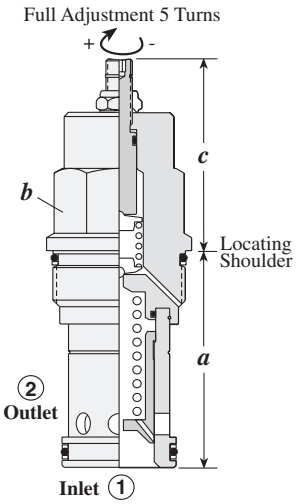
Seal Material

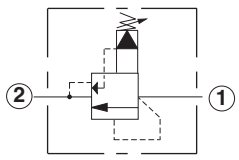
N Buna-N
V Viton

Patent: U.S. #6,039,070.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, KICK-DOWN, BALANCED PISTON



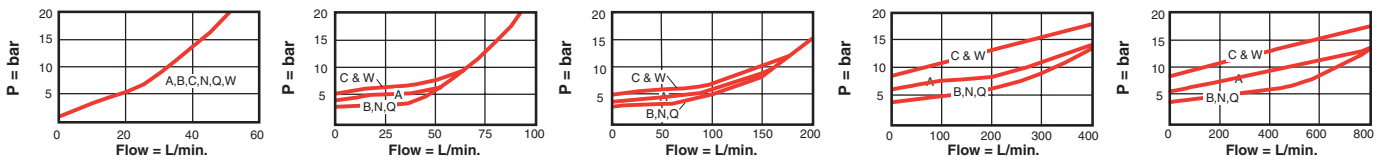


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
45 L/min.	**RQCB – LAN**	T - 162A	31,0	19,1	53,6	55,1	58,7	35 - 40
95 L/min.	**RQEB – LAN**	T - 10A	39,6	22,2	50,8	54,6	57,2	45 - 50
200 L/min.	**RQGB – LAN**	T - 3A	47,8	28,6	53,8	55,4	60,5	60 - 70
380 L/min.	**RQIB – LAN**	T - 16A	62,0	31,8	62,0	62,7	68,3	200 - 215
760 L/min.	**RQKB – LAN**	T - 18A	79,5	41,3	71,4	74,7	77,7	465 - 500

Performance Curves

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

Unloaded Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = RQCB, RQEB: 30 cc/min. at 70 bar; RQGB: 49,2 cc/min. at 70 bar; RQIB: 65,5 cc/min. at 70 bar; RQKB: 81,9 cc/min. at 70 bar.
- Typical response time 25 ms.
- Factory pressure settings established at kick down point.
- Flow through cartridge must cease to reset valve.
- Back pressure on the tank port (port 2) is directly additive to the valve setting at a 1:1 ratio.

OPTION ORDERING INFORMATION

RQ ✱ B – ✱ ✱ ✱

Nominal Capacity

- **C** 45 L/min.
- **E** 95 L/min.
- **G** 200 L/min.
- **I** 380 L/min.
- **K** 760 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

RQCB only:
- **A** 5 - 210 bar Standard set at 70 bar
- **B** 5 - 105 bar Standard set at 70 bar
- **C** 5 - 420 bar Standard set at 70 bar
- **N** 5 - 55 bar Standard set at 25 bar
- **Q** 5 - 25 bar Standard set at 14 bar
- **W** 5 - 315 bar Standard set at 70 bar

RQEB, RQGB, RQIB, RQKB only:
- **A** 7 - 210 bar Standard set at 70 bar
- **B** 3,5 - 105 bar Standard set at 70 bar
- **C** 10,5 - 420 bar Standard set at 70 bar
- **Q** 4 - 25 bar Standard set at 14 bar
- **W** 10,5 - 315 bar Standard set at 70 bar

RQEB, RQGB, only:
- **N** 4 - 55 bar Standard set at 25 bar

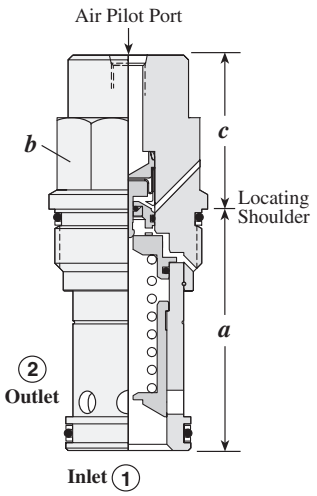
Seal Material

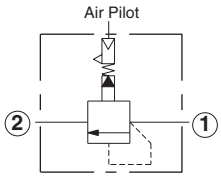
- **N** Buna-N
- **V** Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED PISTON, AIR CONTROLLED



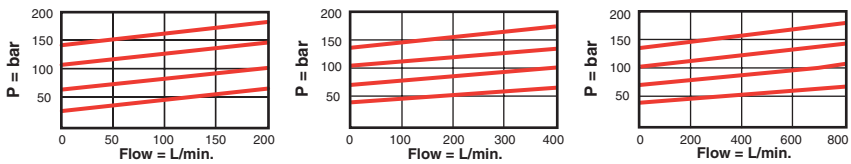


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c* A	*c* B	
200 L/min.	**RPGD – ABN**	T - 3A	47,8	28,6	33,3	—	60 - 70
380 L/min.	**RPID – BBN**	T - 16A	62,0	31,8	—	41,1	200 - 215
760 L/min.	**RPKD – BBN**	T - 18A	79,5	41,3	—	50,8	465 - 500

Performance Curves

RPGD **RPID** **RPKD**

Typical Pressure Rise



- Pilot ratio, air to hydraulic = 20:1.
- Maximum air pressure = 10,5 bar.
- Maximum operating pressure = 140 bar.
- Maximum valve leakage at 24 cSt = RPGD: 50 cc/min. at 70 bar; RPID: 65 cc/min. at 70 bar; RPKD: 80 cc/min. at 70 bar.
- Typical response time 10 ms.
- Will accept maximum pressure at Port 2; suitable for use in cross-port relief circuits.

OPTION ORDERING INFORMATION

RP ✱ D – ✱ ✱ ✱

Nominal Capacity

G 200 L/min.
I 380 L/min.
K 760 L/min.

Control

RPGD only:
A External 1/4" NPTF Pilot Port at end of Cartridge*

RPID, RPKD only:
B External SAE-4 Pilot Port at end of Cartridge*

Adjustment Range

RPGD only:
B 3,5 - 105 bar
I 1 - 70 bar

RPID, RPKD only:
B 3,5 - 105 bar

RPKD only:
J 2 - 105 bar

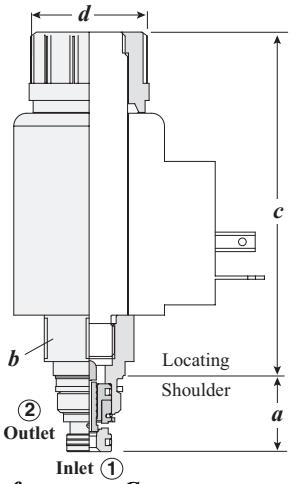
Seal Material

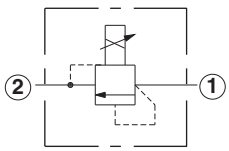
N Buna-N
V Viton

* *Maximum air pilot pressure should not exceed 10 bar.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

ELECTRO-PROPORTIONAL, PILOT CAPACITY



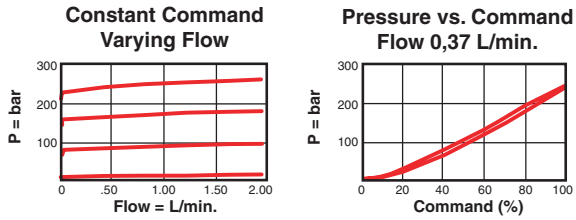


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c*** L/T	c*** X/M	d	Installation Torque (Nm)
1 L/min.	**RBAP – X****	T - 8A	18,8	22,2	130,0	85,1	37,3	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

RBAP



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = 25 cc/min.
- Hysteresis with dither <4% and with DC input <8%.
- Linearity with dither <2% and repeatability with dither <2%.
- Recommended dither frequency = 140 Hz.
- Low leakage at levels in the closed position. Reseat occurs at 85% of cracking pressure.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.
- The L control allows one to manually adjust the valve in case of an electrical failure. The L control also allows one to offset the pressure range. For instance, if an A range valve is mechanically offset to a setting of 105 bar, the new maximum will be 310 bar.
- This electro-proportional cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2 port pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.
- A wide variety of coil termination and voltage options are available. See the Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

R B A P – X ✱ ✱ – ✱ ✱ ✱

Nominal Capacity

A 1 L/min.

Control*

X No Manual Override

M Manual Override

L Manual Override Adjustable

T Tuning Adjustment

* *See page 178 for information on Control Options*

Adjustment Range

A 20 - 210 bar

B 10,5 - 105 bar

D 3,5 - 50 bar

W 35 - 350 bar

Coil Options**

See page 188: Coil option information for Electro-Proportional Cartridges.

Seal Material

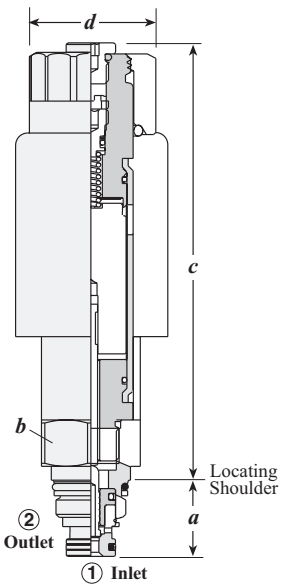
N Buna-N

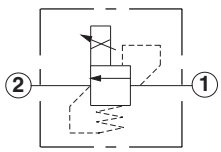
V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

ELECTRO-PROPORTIONAL, PILOT CAPACITY, HIGH PRESSURE SETTING WITH NO COMMAND, INVERSE FUNCTION



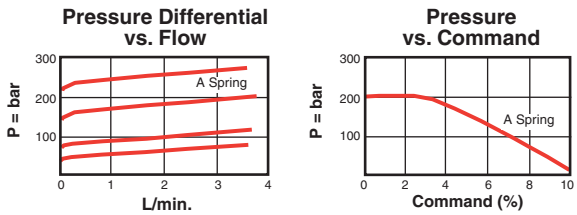


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c***	d	Installation Torque (Nm)
1 L/min.	**RBAN – XAN**	T - 8A	18,8	22,2	108,2	37,3	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

RBAN



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = 25 cc/min.
- Hysteresis with dither <4% and with DC input <8%.
- Linearity with dither <2% and repeatability with dither <2%.
- Recommended dither frequency = 140 Hz.
- Low leakage at levels in the closed position. Reseat occurs at 85% of cracking pressure.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.
- This electro-proportional cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2 port pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.
- Desired de-energized pressure, within the adjustment range must be specified when ordered.
- A wide variety of coil termination and voltage options are available. See the Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

R B A N – X * * – * * *

Nominal Capacity

A 1 L/min.

Control

X* No Manual Override

** Special setting required. Specify at time of order.*

Customer specified special setting stamped on hex.

Adjustment Range*

A 210 - 105 bar

B 105 - 55 bar

D 55 - 20 bar

W 315- 210 bar

*** Customer is required to specify setting within the selected spring range.**

Seal Material

N Buna-N

V Viton

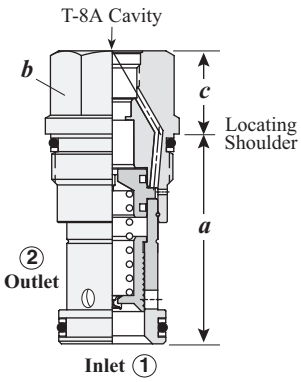
Coil Options**

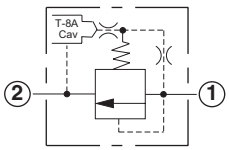
See page 188: Coil option information for Electro-Proportional Cartridges.

*** Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED PISTON, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY





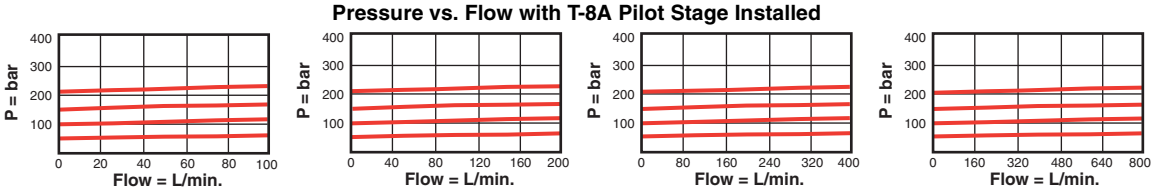
The -8 control option allows a pilot control valve to be incorporated directly into the end of the relief cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
95 L/min.	**RPEC – 8WN**	T - 10A	39,6	22,2	19,0	45 - 50
200 L/min.	**RPGC – 8WN**	T - 3A	47,8	28,6	17,5	60 - 70
380 L/min.	**RPIC – 8WN**	T - 16A	62,0	31,8	24,6	200 - 215
760 L/min.	**RPKC – 8WN**	T - 18A	79,5	41,3	30,2	465 - 500

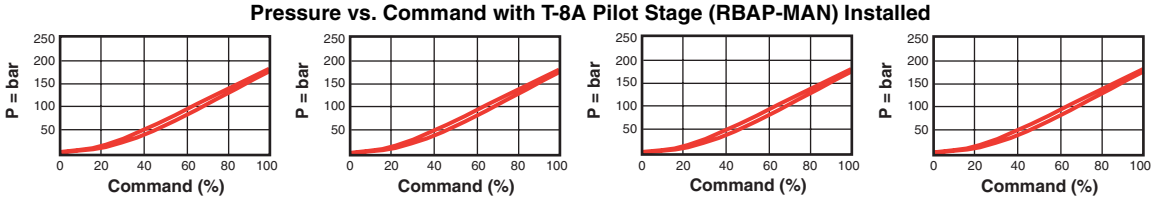
Performance Curves

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

Pressure vs. Flow with T-8A Pilot Stage Installed



Pressure vs. Command with T-8A Pilot Stage (RBAP-MAN) Installed



- Maximum operating pressure = 350 bar.
- Control pilot flow = RPEC-8: 0,11 to 0,16 L/min.; RPGC-8: 0,16 to 0,25 L/min.; RPIC-8, RPKC-8: 0,25 to 0,33 L/min.
- Main stage leakage at 24 cSt = RPEC-8: 50 cc/min. at 70 bar; RPGC-8: 50 cc/min. at 70 bar; RPIC-8: 65 cc/min. at 70 bar; RPKC-8: 80 cc/min. at 70 bar.
- Will accept maximum pressure at Port 2; suitable for use in cross-port relief circuits.
- Back pressure on the tank port (port 2) is directly additive to the valve setting at a 1:1 ratio.
- 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 ✱ C – 8 ✱ ✱

Nominal Capacity

- **E** 95 L/min.
- **G** 200 L/min.
- **I** 380 L/min.
- **K** 760 L/min.

Control

- **8** T-8A Cavity in hex body for pilot operation

Pilot valve to be ordered separately

Minimum Control Pressure

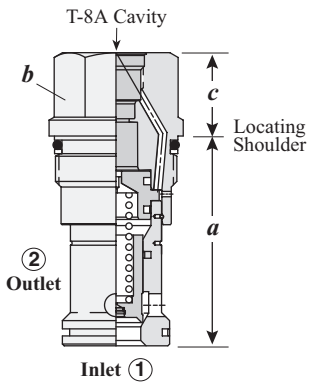
- **D** 1,7 bar
- **W** 7 bar

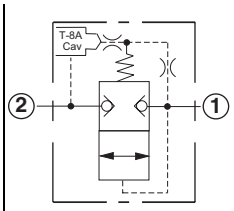
Seal Material

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED POPPET, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY





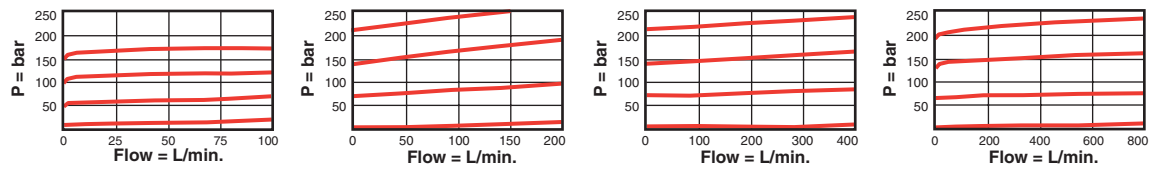
The -8 control option allows a pilot control valve to be incorporated directly into the end of the relief cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
95 L/min.	**RPES – 8WN**	T - 10A	39,6	22,2	19,0	40 - 50
200 L/min.	**RPGS – 8WN**	T - 3A	47,8	28,6	17,5	60 - 70
380 L/min.	**RPIS – 8WN**	T - 16A	62,0	31,8	24,6	200 - 215
760 L/min.	**RPKS – 8WN**	T - 18A	79,2	41,3	30,0	465 - 500

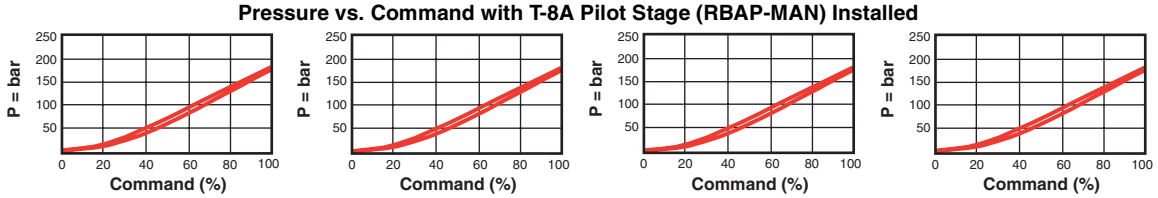
Performance Curves

RPES-8 **RPGS-8** **RPIS-8** **RPKS-8**

Pressure Differential vs. Flow with T-8A Pilot Stage Installed



Pressure vs. Command with T-8A Pilot Stage (RBAP-MAN) Installed



- Maximum operating pressure = 350 bar.
- Control pilot flow = RPES-8: 0,16 to 0,41 L/min.; RPGS-8: 0,16 to 0,25 L/min.; RPIS-8, RPKS-8: 0,25 to 0,33 L/min.
- Main stage leakage at 10% reseat = 0,7 cc/min.
- Typical response time 2 ms.
- Will accept maximum pressure at Port 2; suitable for use in cross-port relief circuits.
- Back pressure on the tank port (port 2) is directly additive to the valve setting at a 1:1 ratio.
- 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*	*Minimum Control Pressure*	*Seal Material*
E 95 L/min.	**8** T-8A Cavity in hex body for pilot operation	**B** 3,5 bar	**N** Buna-N
G 200 L/min.	Pilot valve to be ordered separately	**W** 7 bar	**V** Viton
I 380 L/min.		***RPES-8 only:*** **D** 1,7 bar	
K 760 L/min.			

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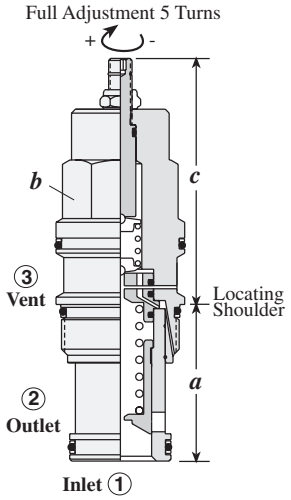
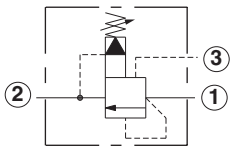
PILOT OPERATED, BALANCED PISTON, VENTABLE



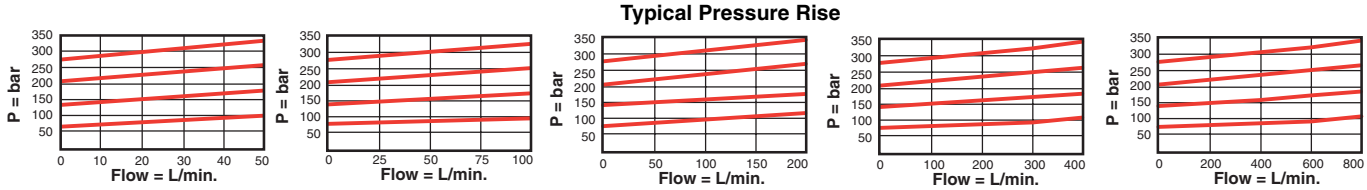


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	c O	Installation Torque (Nm)
30 L/min.	**RVBA – LAN**	T - 163A	31,0	19,1	64,8	66,8	70,4	71,0	35 - 40
60 L/min.	**RVCA – LAN**	T - 11A	35,1	22,2	63,5	67,3	70,0	70,0	45 - 50
120 L/min.	**RVEA – LAN**	T - 2A	34,8	28,6	71,4	73,2	77,7	—	60 - 70
240 L/min.	**RVGA – LAN**	T - 17A	46,0	31,8	83,3	84,1	89,7	—	200 - 215
480 L/min.	**RVIA – LAN**	T - 19A	63,5	41,3	100,0	103,9	106,4	—	465 - 500

Performance Curves

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

Typical Pressure Rise



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = RVBA, RVCA: 30 cc/min. at 70 bar; RVEA: 50 cc/min. at 70 bar; RVGA: 65 cc/min. at 70 bar; RVIA: 80 cc/min. at 70 bar.
- Typical response time 10 ms.
- Control pilot flow = RVBA, RVCA: 0,11 to 0,16 L/min.; RVEA: 0,16 to 0,25 L/min.; RVGA, RVIA: 0,25 to 0,33 L/min.
- Factory pressure setting established at 15 L/min.
- A remote pilot relief on port 3 (vent) will control the valve below its own setting.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits. If used in cross-port relief circuits, consider spool leakage.
- Back pressure on the tank port (port 2) is directly additive to the valve setting at a 1:1 ratio.

OPTION ORDERING INFORMATION

RV ✱ A – ✱ ✱ ✱

Nominal Capacity

- **B** 30 L/min.
- **C** 60 L/min.
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

RVCA, RVEA only:

- **O** Handknob with Panel Mount

****Special setting required. Specify at time of order.***

***** *See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

RVBA only:

- **A** 5 - 210 bar Standard set at 70 bar
- **B** 5 - 105 bar Standard set at 70 bar
- **C** 5 - 420 bar Standard set at 70 bar
- **N** 5 - 55 bar Standard set at 28 bar
- **Q** 5 - 25 bar Standard set at 14 bar
- **W** 5 - 315 bar Standard set at 70 bar

RVCA, RVEA, RVGA, RVIA only:

- **A** 7 - 210 bar Standard set at 70 bar
- **B** 3,5 - 105 bar Standard set at 70 bar
- **C** 10 - 420 bar Standard set at 70 bar
- **D** 1,7 - 55 bar Standard set at 28 bar
- **E** 1,7 - 28 bar Standard set at 14 bar
- **W** 10 - 315 bar Standard set at 70 bar

Seal Material

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

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Adjustment Ranges (Continued)

RVEA, RVIA only:

- **N** 4 - 55 bar Standard set at 28 bar

RVEA only:

- **Q** 4 - 28 bar Standard set at 14 bar

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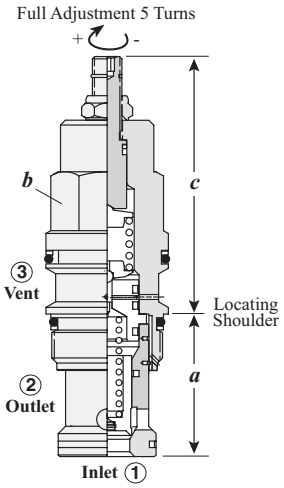
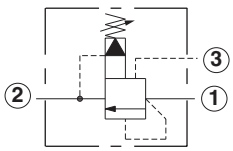
PILOT OPERATED, BALANCED POPPET, VENTABLE



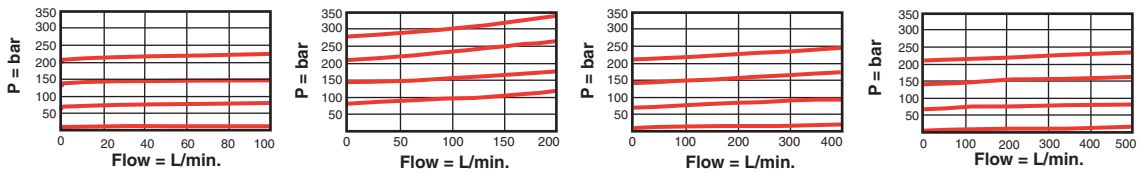


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (Nm)*
60 L/min.	**RVCS – LAN**	T - 11A	34,8	22,2	63,2	67,3	70,0	45 - 50
95 L/min.	**RVES – LAN**	T - 2A	34,8	28,6	71,4	73,2	77,7	60 - 70
200 L/min.	**RVGS – LAN**	T - 17A	46,0	31,8	83,3	84,1	89,7	200 - 215
480 L/min.	**RVIS – LAN**	T - 19A	63,5	41,3	99,8	103,1	106,4	465 - 500

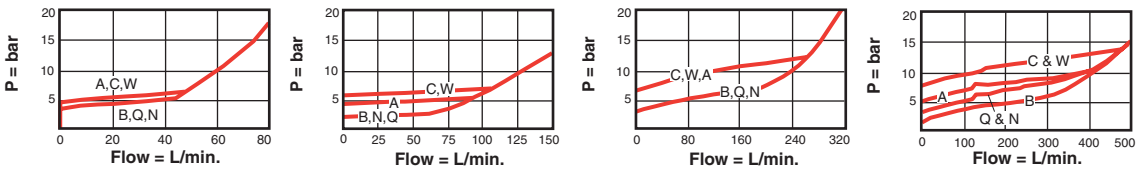
Performance Curves

RVCS **RVES** **RVGS** **RVIS**

Typical Pressure Rise



Vented Pressure



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 90% reseat = RVCS: 2 cc/min at 70 bar.; RVES, RVGS, RVIS: 0,7 cc/min at 70 bar.
- Typical response 2 ms.
- Control pilot flow = RVCS: 0,11 to 0,16 L/min.; RVES, RVIS, RVGS: 0,25 to 0,33 L/min.
- Factory pressure setting established at 15 L/min.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits.
- A remote pilot relief on port 3 (vent) will control the valve below its own setting.
- Back pressure on the tank port (port 2) is directly additive to the valve setting at a 1:1 ratio.

OPTION ORDERING INFORMATION

RV ✱ S – ✱ ✱ ✱

Nominal Capacity

C 60 L/min.

E 95 L/min.

G 200 L/min.

I 480 L/min.

*Control***

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

L Standard Screw Adjustment

* *Special setting required. Specify at time of order.*

** *See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

A 7 - 210 bar Standard set at 70 bar

B 3,5 - 105 bar Standard set at 70 bar

C 10,5 - 420 bar Standard set at 70 bar

N 4 - 55 bar Standard set at 25 bar

Q 4 - 25 bar Standard set at 14 bar

W 10,5 - 315 bar Standard set at 70 bar

Seal Material

N Buna-N

V Viton

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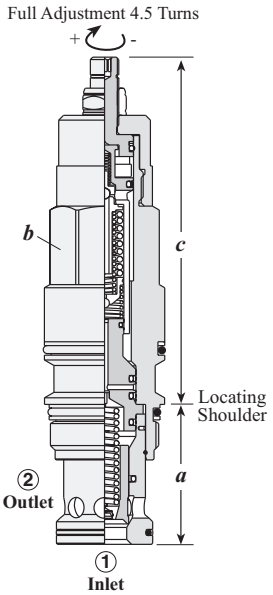
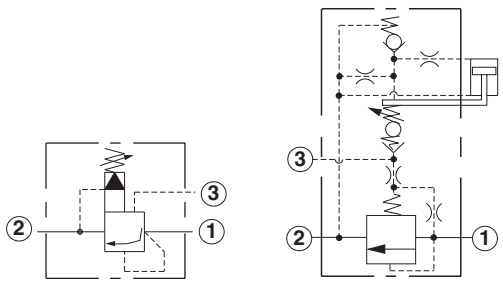
PILOT OPERATED, BALANCED POPPET, VENTABLE, SOFT





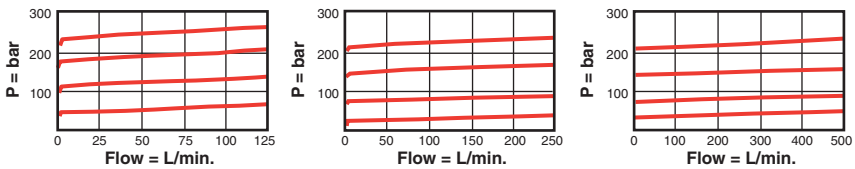
Simplified Symbol **Complex Symbol**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*Installation Torque (Nm)*
120 L/min.	**RVET – LAN**	T - 2A	35,1	28,6	110,2	113,5	60 - 70
240 L/min.	**RVGT – LAN**	T - 17A	46,0	31,8	114,3	116,8	200 - 215
480 L/min.	**RVIT – LAN**	T - 19A	63,5	35,1	115,6	120,1	465 - 500

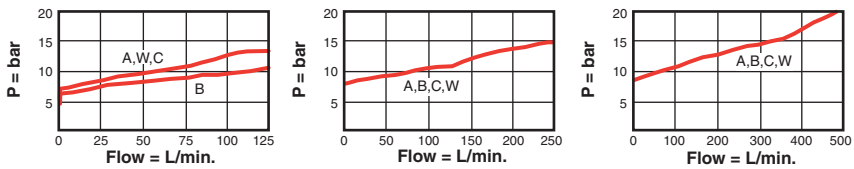
Performance Curves

RVET **RVGT** **RVIT**

Pressure vs. Flow - A Spring Range Shown



Vented Pressure vs. Flow



- Maximum operating pressure = 350 bar.
- Control pilot flow = RVET: 0,16 to 0,41 L/min.; RVGT, RVIT: 0,25 to 0,33 L/min.
- Pressure ramp up time = RVET: 300 ms.; RVGT: 400 ms.; RVIT: 500 ms.
- Typical response time 2 ms.
- Factory pressure setting established at 15 L/min.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits.
- A remote pilot relief on port 3 (vent) will control the valve below its own setting.

OPTION ORDERING INFORMATION

RV ✱ T – ✱ ✱ ✱

Nominal Capacity

E 120 L/min.

G 240 L/min.

I 480 L/min.

*Control***

C* Tamper Resistant Factory Set

L Standard Screw Adjustment

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

A 35 - 210 bar Standard set at 70 bar

B 35 - 105 bar Standard set at 70 bar

C 70 - 420 bar Standard set at 70 bar

W 70 - 315 bar Standard set at 70 bar

Seal Material

N Buna-N

V Viton

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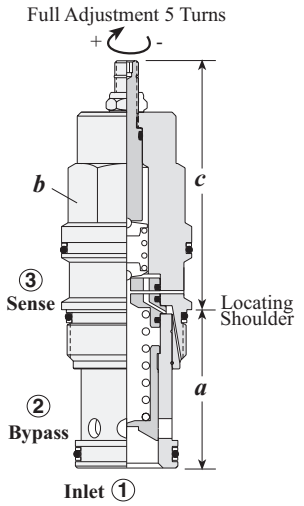
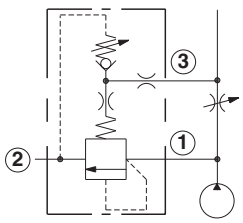
BYPASS COMPENSATOR WITH RELIEF FUNCTION, NORMALLY CLOSED





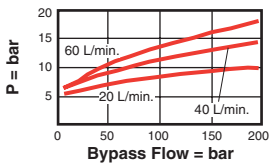
Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
20 L/min.	**RVBB – LAN**	T - 163A	30,7	19,1	64,5	66,8	70,4	35 - 40
40 L/min.	**RVCB – LAN**	T - 11A	35,1	22,2	63,5	65,3	69,3	45 - 50
80 L/min.	**RVEB – LAN**	T - 2A	35,1	28,6	71,4	73,2	77,7	60 - 70
160 L/min.	**RVGB – LAN**	T - 17A	46,0	31,8	83,3	84,1	89,7	200 - 215
320 L/min.	**RVIB – LAN**	T - 19A	63,8	41,3	100,0	103,1	105,9	465 - 500

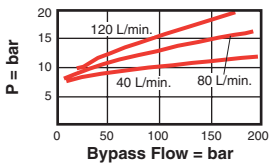
Performance Curves

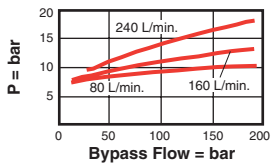
RVBB **RVCB** **RVEB** **RVGB** **RVIB**

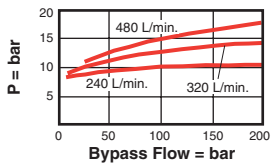
Typical Compensator Differentials

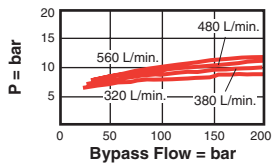
The X axis of the performance curves shown indicates the system pressure. The Y axis of the performance curves indicates the pressure differential that the valve creates across the control orifice. The curves represent various bypass flows (pump flow minus control flow). The capacities listed and performance of these valves are determined by the bypass flow. The control flow is not a factor.











- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = RVBB, RVCB: 30 cc/min. at 70 bar; RVEB: 50 cc/min. at 70 bar; RVGB: 65 cc/min. at 70 bar; RVIB: 80 cc/min. at 70 bar.
- Typical response time 10 ms.
- Factory pressure setting established at 15 L/min.
- Back pressure on the tank port (port 2) is directly additive to the valve setting at a 1:1 ratio.
- Compensating pressure for all ranges is 8 bar.

OPTION ORDERING INFORMATION

RV ✱ B – ✱ ✱ ✱

Nominal Capacity

B 20 L/min.

C 40 L/min.

E 80 L/min.

G 160 L/min.

I 320 L/min.

Control**

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

RVBB only:

A 5 - 210 bar
Standard set at 70 bar

B 5 - 105 bar
Standard set at 70 bar

C 5 - 420 bar
Standard set at 70 bar

N 5 - 55 bar
Standard set at 30 bar

Q 5 - 25 bar
Standard set at 14 bar

W 5 - 315 bar
Standard set at 70 bar

RVCB, RVEB, RVGB, RVIB only:

A 7 - 210 bar
Standard set at 70 bar

C 10,5 - 420 bar
Standard set at 70 bar

D 2 - 55 bar
Standard set at 30 bar

Adjustment Ranges (Continued)

RVCB, RVGB, RVIB only:

B 3,5 - 105 bar
Standard set at 70 bar
RVCB, bias pressure is 4 bar.

RVCB, RVEB only:

W 7 - 315 bar
Standard set at 70 bar

Seal Material

N Buna-N

V Viton

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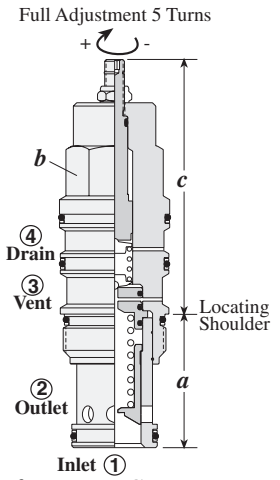
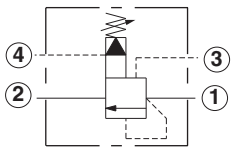
PILOT OPERATED, BALANCED PISTON, VENTABLE WITH EXTERNAL DRAIN



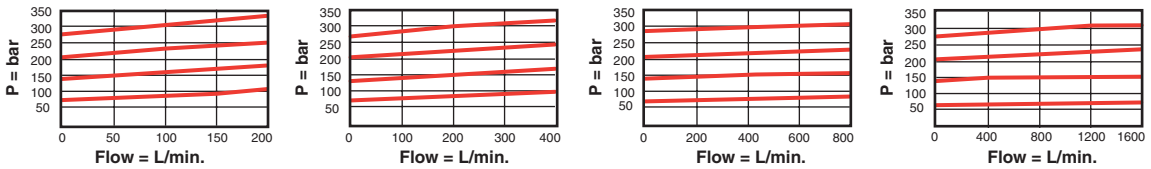


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
60 L/min.	**RVCD – LAN**	T - 21A	35,1	22,2	78,5	82,6	84,8	45 - 50
120 L/min.	**RVED – LAN**	T - 22A	35,1	28,6	87,4	89,0	93,7	60 - 70
240 L/min.	**RVGD – LAN**	T - 23A	46,0	31,8	99,8	101,3	106,4	200 - 215
480 L/min.	**RVID – LAN**	T - 24A	63,5	41,8	121,4	126,7	127,8	465 - 500

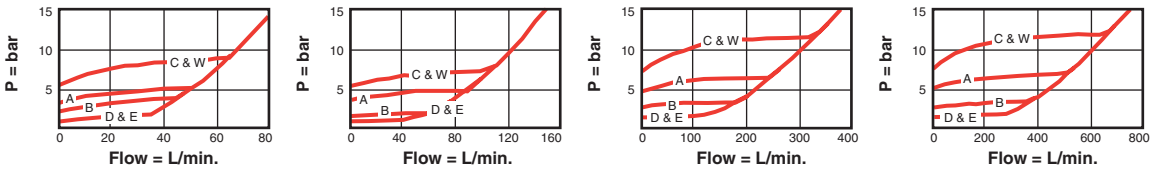
Performance Curves

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

Typical Pressure Rise



Vented Pressure



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = RVCD: 30 cc/min. at 70 bar; RVED: 50 cc/min. at 70 bar; RVGD: 65 cc/min. at 70 bar; RVID: 80 cc/min. at 70 bar.
- Control pilot flow = RVCD: 0,11 to 0,16 L/min.; RVED: 0,16 to 0,25 L/min.; RVGD, RVID: 0,25 to 0,33 L/min.
- Typical response time 10 ms.
- Factory pressure setting established at 15 L/min.
- Pressure at port 4 is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits.

OPTION ORDERING INFORMATION

RV ✱ D – ✱ ✱ ✱

Nominal Capacity

C 60 L/min.

E 120 L/min.

G 240 L/min.

I 480 L/min.

Control**

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

A 7 - 210 bar Standard set at 70 bar

B 3,5 - 105 bar Standard set at 70 bar

C 10,5 - 420 bar Standard set at 70 bar

D 1,7 - 55 bar Standard set at 30 bar

E 1,7 - 28 bar Standard set at 14 bar

W 10,5 - 315 bar Standard set at 70 bar

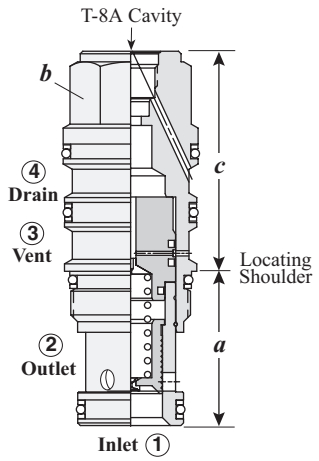
Seal Material

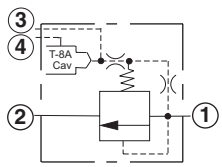
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED PISTON, VENTABLE, DRAIN TO PORT 4, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY





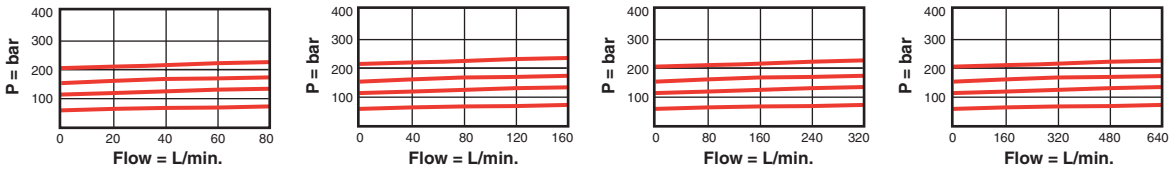
The -8 control option allows a pilot control valve to be incorporated directly into the end of the relief cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
60 L/min.	**RVCD – 8WN**	T - 21A	35,1	22,2	45,2	45 - 50
120 L/min.	**RVED – 8WN**	T - 22A	35,1	28,6	50,8	60 - 70
240 L/min.	**RVGD – 8WN**	T - 23A	46,0	31,8	65,8	200 - 215
480 L/min.	**RVID – 8WN**	T - 24A	63,5	41,3	80,3	465 - 500

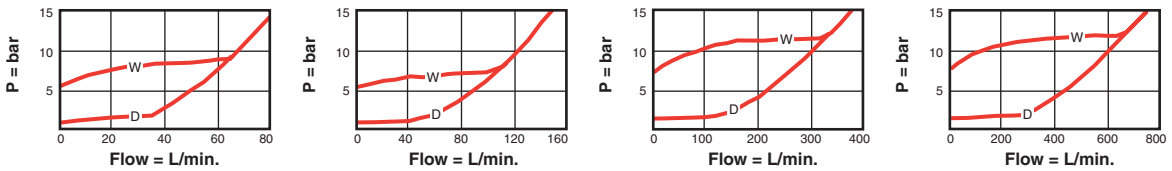
Performance Curves

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

Pressure vs. Flow



Pressure vs. Command with T-8A Pilot Stage (RBAP-MAN) Installed



- Maximum operating pressure = 350 bar.
- Main stage leakage at 24 cSt = RVCD-8: 30 cc/min. at 70 bar; RVED-8: 50 cc/min. at 70 bar; RVGD-8: 65 cc/min. at 70 bar; RVID-8: 80 cc/min. at 70 bar.
- Control pilot flow = RVCD-8: 0,11 to 0,16 L/min.; RVED-8: 0,16 to 0,25 L/min.; RVGD-8, RVID-8: 0,25 to 0,33 L/min.
- Typical response time 10 ms.
- Will accept maximum pressure at port 2; suitable for use in cross-port relief circuits.
- Pressure at port 4 is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.

OPTION ORDERING INFORMATION

RV ✱ D – 8 ✱ ✱

Nominal Capacity		*Control*		*Minimum Control Pressure*		*Seal Material*	
C	60 L/min.	**8**	T-8A Cavity in hex body for pilot operation	**D**	1,7 bar	**N**	Buna-N
E	120 L/min.			**W**	7 bar	**V**	Viton
G	240 L/min.		Pilot valve to be ordered separately				
I	480 L/min.						

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Protection against pressure spikes. . .

NEW SOFT SHIFT OPTION FOR SUN RELIEF CARTRIDGE VALVES

Using these newly designed pressure relief valves, pressures can be ramped up and ramped down. These relief valves work purely mechanically, and protect hydraulic components against pressure spikes that could damage machinery. Soft shift relief valves are available as pure pressure relief valves and as ventable relief valves in different frame sizes. As cartridge valves they can be used in many different types of assemblies such as sandwich, line mount, gasket mount, and custom.

Benefits of Sun's Soft Relief

- ***Controlled rate of pressure rise means less dynamic stress for components.***
  - No pressure transients above setting.
  - Limited rate of force change.
  - Increases the life expectancy of hoses and other critical components in the circuit.
- ***Uses a normally open pilot section to maintain a minimum threshold setting.***
  - A minimum threshold setting allows the valve to begin controlling the rate of pressure rise immediately from the vent pressure setting.
  - Incorporates a return spring to ensure a reliable reset.

*See catalogue pages 11 (RP*T) and 20 (RV*T) for detailed information on relief cartridges with soft shift options.*

Soft Shift option extended to Sun Solenoid Operated Directional Valves. . .

Sun's small pilot solenoid valves are used to unload larger main-stage elements remotely, or by directly integrating the pilot valve into the main-stage element. In this latter approach, unique to Sun, 12 different pilot valves (proportional, solenoid, hydraulic and pneumatic) can be integrated into a variety of main-stage elements.

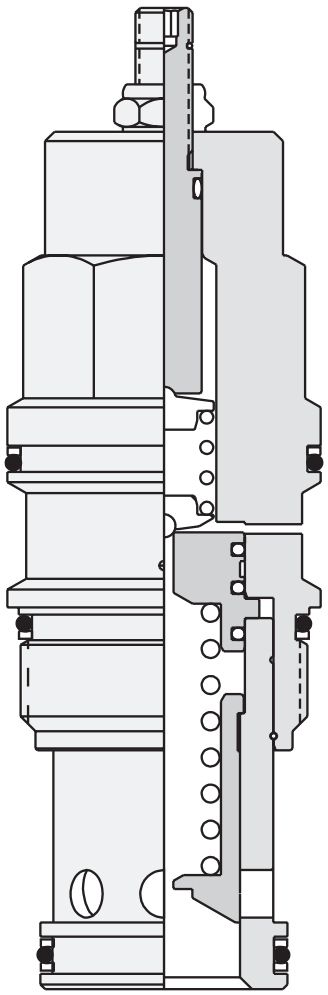
Most 2-position, 2-way screw-in cartridge pilot solenoid valves utilize a poppet style construction to satisfy low leakage requirements. Sun Hydraulics has adopted a different approach that utilizes a precision spool/sleeve design. Available in both 2-position, 2- and 3-way pilot solenoid cartridges, this approach produces leakage characteristics equivalent to poppet style designs.

Since control volumes in pilot circuits are typically small, the lower gain characteristics of spool valves produce a softer unload. To further extend the operating rate, Sun offers a soft shift option that adds an orifice in the valve's armature to gain greater control of fluid displacement. Combining the benefits of a spool valve with the soft shift option extends shift times, which can reduce the hydraulic shock generated when unloading main-stage elements. Sun's Soft Shift option is offered on all of its spool-type solenoid valves.

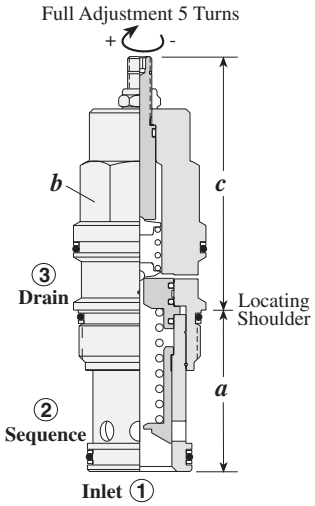
You will find additional information about the DTDA-S, DAAL-S, DLDA-S, DBAL-S, DMDA-S, DNDA-S on pages 132 through 138 in the Solenoid section of this catalogue.

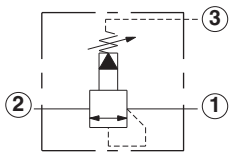
Consult the Sun website
www.sunhydraulics.com
for detailed and complete information on Sun soft shift options.
Products: Cartridges: Relief: View All Relief Cartridges and Products: Cartridges: Solenoids: View all Solenoid Operated Cartridges.
Products: Cartridges: Solenoid Operated: View All Solenoid Operated Cartridges

Sequence Cartridge Valves



PILOT OPERATED, BALANCED PISTON



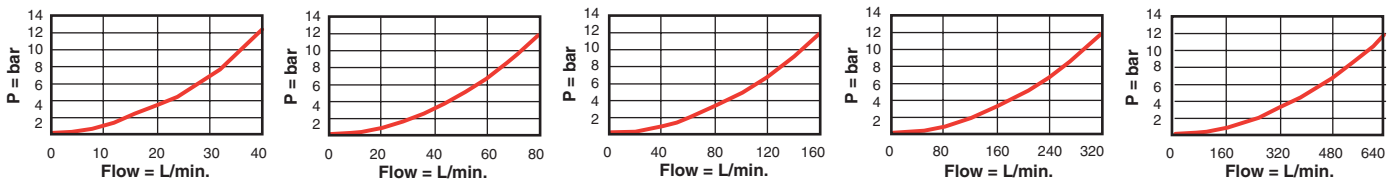


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
30 L/min.	**RSBC – LAN**	T - 163A	31,0	19,1	64,8	66,8	70,4	35 - 40
60 L/min.	**RSDC – LAN**	T - 11A	35,1	22,2	63,5	67,3	70,0	45 - 50
120 L/min.	**RSFC – LAN**	T - 2A	35,1	28,6	71,4	73,2	77,7	60 - 70
240 L/min.	**RSHC – LAN**	T - 17A	46,0	31,8	83,3	84,1	89,7	200 - 215
480 L/min.	**RSJC – LAN**	T - 19A	63,5	41,3	100,0	103,9	106,4	465 - 500

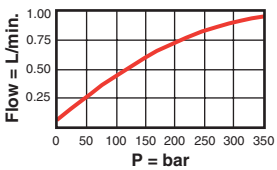
Performance Curves

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

Pressure Drop Fully Sequenced



Pilot Flow after Valve Sequence for RS*C



- Maximum operating pressure = .350 bar.
- Maximum valve leakage at 24 cSt = RSBC, RSDC: 30 cc/min. at 70 bar; RSFC: 50 cc/min. at 70 bar; RSHC: 65 cc/min. at 70 bar; RSJC: 80 cc/min. at 70 bar.
- 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 350 bar.
- 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.

OPTION ORDERING INFORMATION

RS ✱ C – ✱ ✱ ✱

Nominal Capacity

- **B** 30 L/min.
- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

RSBC only:
- **A** 5 - 210 bar Standard set at 70 bar
- **B** 5 - 105 bar Standard set at 70 bar
- **C** 5 - 420 bar Standard set at 70 bar
- **N** 5 - 55 bar Standard set at 28 bar
- **Q** 5 - 28 bar Standard set at 14 bar
- **W** 5 - 315 bar Standard set at 70 bar

RSDC, RSFC, RSHC, RSJC only:
- **A** 7 - 210 bar Standard set at 70 bar
- **B** 3,5 - 105 bar Standard set at 70 bar
- **C** 10 - 420 bar Standard set at 70 bar
- **W** 10 - 315 bar Standard set at 70 bar

Adjustment Ranges (Continued)

RSDC, RSFC, RSHC only:
- **N** 4 - 55 bar Standard set at 28 bar

RSDC, RSFC, RSJC only:
- **Q** 4 - 28 bar Standard set at 14 bar

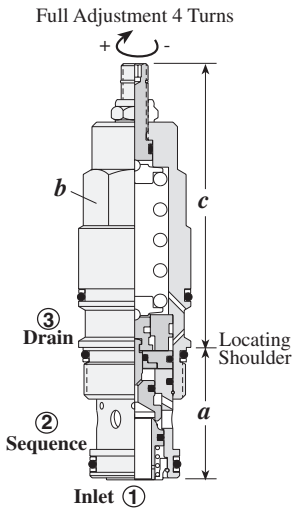
Seal Material

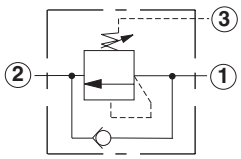
- **N** Buna-N
- **V** Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING WITH REVERSE FLOW CHECK



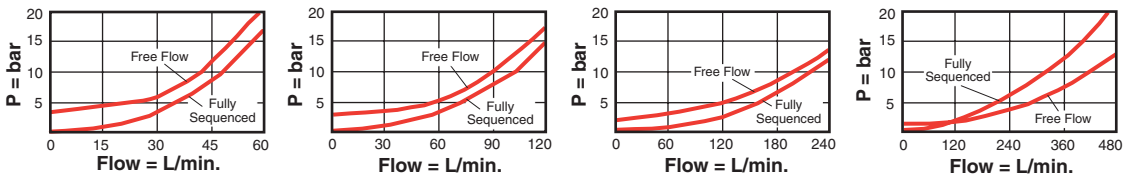


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (Nm)
60 L/min.	**SCCA – LAN**	T - 11A	35,1	22,2	78,5	80,0	45 - 50
120 L/min.	**SCEA – LAN**	T - 2A	35,1	28,6	88,1	89,7	60 - 70
240 L/min.	**SCGA – LAN**	T - 17A	46,0	31,8	100,0	101,6	200 - 215
480 L/min.	**SCIA – LAN**	T - 19A	63,5	41,3	122,9	128,5	465 - 500

Performance Curves

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

Free Flow to Pressure Drop Fully Sequenced



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = 0,7 cc/min.
- Reverse flow check cracking pressure = SCCA: 2,8 bar; SCEA: 1,7 bar; SCGA, SCIA: 1,5 bar.
- 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 350 bar.
- Although this is a zero pilot flow valve, port 3 (drain) must be connected to maintain a pressure reference in the control chamber. If port 3 is blocked, reciprocating seal weepage will cause the valve to malfunction.

OPTION ORDERING INFORMATION

SC ✱ A – ✱ ✱ ✱

Nominal Capacity

C 60 L/min.
E 120 L/min.
G 240 L/min.
I 480 L/min.

Control**

L Standard Screw Adjustment
C* Tamper Resistant Factory Set

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

A 35 - 210 bar Standard set at 70 bar
B 20 - 105 bar Standard set at 70 bar
C 140 - 420 bar Standard set at 140 bar
D 14 - 55 bar Standard set at 28 bar
W 55 - 315 bar Standard set at 70 bar

SCCA only:
E 7 - 28 bar Standard set at 14 bar

Seal Material

N Buna-N
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

U.S. Patent #4,834,135

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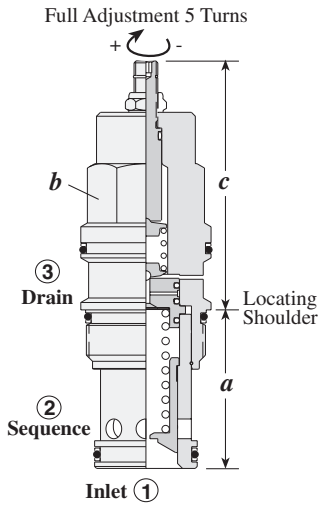
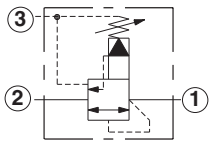
KICK-DOWN, PILOT OPERATED, BALANCED PISTON



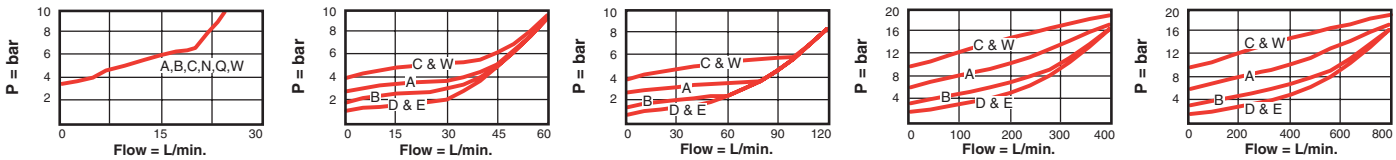


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					L	C	K	
30 L/min.	**SQBB – LAN**	T - 163A	31,0	19,1	64,8	67,8	70,0	35 - 40
60 L/min.	**SQDB – LAN**	T - 11A	35,1	22,2	63,5	65,0	70,0	40 - 50
120 L/min.	**SQFB – LAN**	T - 2A	35,1	28,6	71,4	73,2	77,7	60 - 70
240 L/min.	**SQHB – LAN**	T - 17A	46,0	31,8	83,3	84,1	89,7	200 - 215
480 L/min.	**SQJB – LAN**	T - 19A	63,5	41,3	100,0	103,9	106,4	465 - 500

Performance Curves

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

Pressure Drop After Opening



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = SQBB, SQDB: = 30 cc/min. at 70 bar; SQFB: 50 cc/min. at 70 bar; SQHB: 65 cc/min. at 70 bar; SQJB: 80 cc/min. at 70 bar.
- 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 350 bar.

OPTION ORDERING INFORMATION

SQ ✱ B – ✱ ✱ ✱

Nominal Capacity

- **B** 30 L/min.
- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

SQBB only:

- **A** 5 - 210 bar Standard set at 70 bar
- **B** 5 - 105 bar Standard set at 70 bar
- **C** 5 - 420 bar Standard set at 70 bar
- **N** 5 - 55 bar Standard set at 28 bar
- **Q** 5 - 28 bar Standard set at 14 bar
- **W** 5 - 315 bar Standard set at 70 bar

SQDB, SQFB, SQHB, SQJB only:

- **A** 7 - 210 bar Standard set at 70 bar
- **B** 3,5 - 105 bar Standard set at 70 bar
- **C** 10,5 - 420 bar Standard set at 70 bar
- **D** 1,7 - 55 bar Standard set at 28 bar
- **E** 1,7 - 28 bar Standard set at 14 bar
- **W** 10,5 - 315 bar Standard set at 70 bar

Seal Material

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

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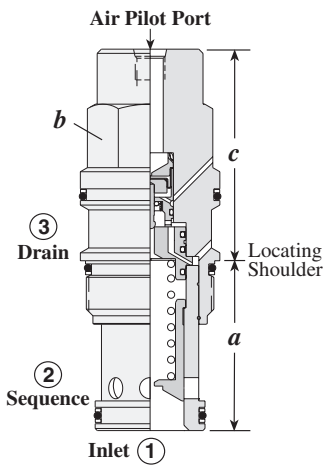
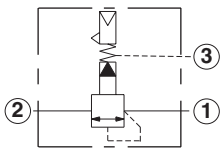
AIR CONTROLLED, PILOT OPERATED, BALANCED PISTON



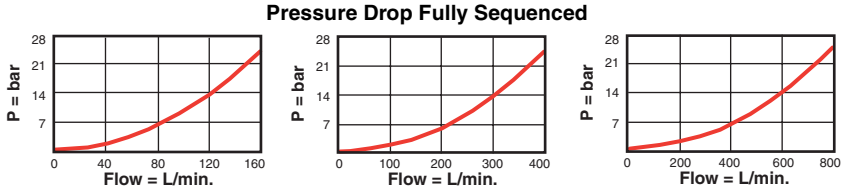


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c A	c B	Installation Torque (Nm)
120 L/min.	**RSFE – ABN**	T - 2A	35,1	28,6	50,8	-	60 - 70
240 L/min.	**RSHE – BBN**	T - 17A	46,0	31,8	-	62,7	200 - 215
480 L/min.	**RSJE – BBN**	T - 19A	63,5	41,3	-	79,2	465 - 500

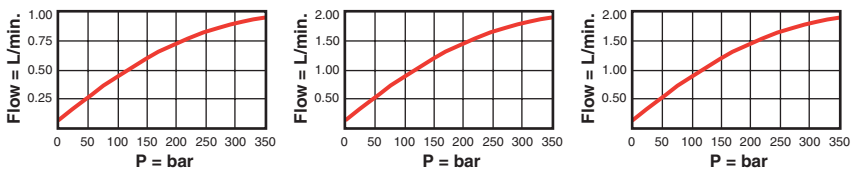
Performance Curves

RSFE **RSHE** **RSJE**

Pressure Drop Fully Sequenced



Pilot Flow after Vavle Sequence



- Pilot ratio, air to hydraulic = 20:1.
- Maximum operating pressure = 140 bar.
- Maximum air pressure = 10 bar.
- Maximum valve leakage at 24 cSt = RSFE: 50 cc/min. at 70 bar; RSHE: 65 cc/min. at 70 bar; RSJE: 80 cc/min. at 70 bar.
- Typical response time 10 ms.

OPTION ORDERING INFORMATION

RS ✱ E – ✱ B ✱

Nominal Capacity

F 120 L/min.

H 240 L/min.

J 480 L/min.

Control

Available for RSFE only

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

RSHE, RSJE only

B External SAE-4 Pilot Port at end of Cartridge

Adjustment Range

B 3,5 - 105 bar

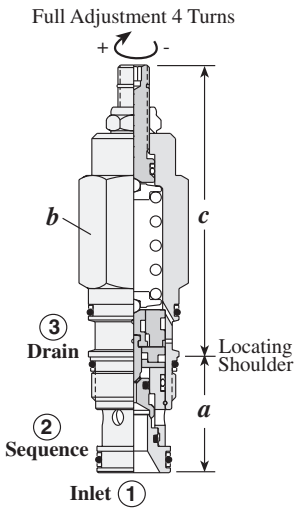
Seal Material

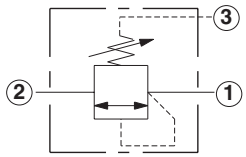
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING WITHOUT REVERSE FLOW CHECK



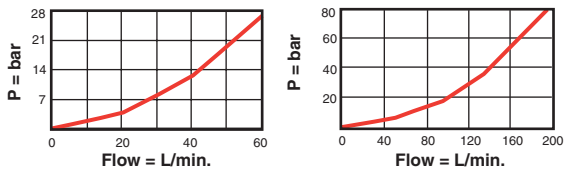


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*Installation Torque (Nm)*
60 L/min.	**SXCA – LAN**	T - 11A	35,1	22,2	78,5	80,3	45 - 50
120 L/min.	**SXEA – LAN**	T - 2A	35,1	28,6	88,1	89,9	60 - 70

Performance Curves

SXCA **SXEA**

Pressure Drop Fully Sequenced



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = 0,7 cc/min. Reseat exceeds 85% of cracking pressure.
- 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 350 bar.
- Although this is a zero pilot flow valve, port 3 (drain) must be connected to maintain a pressure reference in the control chamber. If port 3 is blocked, reciprocating seal weepage will cause the valve to malfunction.

OPTION ORDERING INFORMATION

SX ✱ A – ✱ ✱ ✱

Nominal Capacity

C 60 L/min.

E 120 L/min.

*Control***

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

A 35 - 210 bar Standard set at 70 bar

B 20 - 105 bar Standard set at 70 bar

C 140 - 420 bar Standard set at 140 bar

D 14 - 55 bar Standard set at 28 bar

W 55 - 315 bar Standard set at 70 bar

Seal Material

N Buna-N

V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

U.S. Patent #4,834,135.

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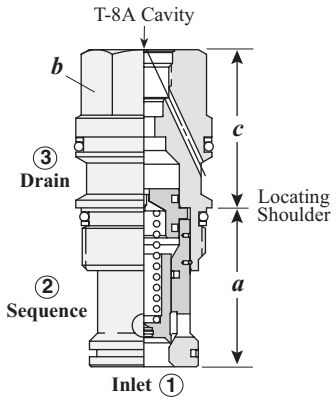
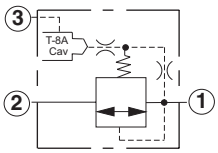
PILOT OPERATED, BALANCED PISTON, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY





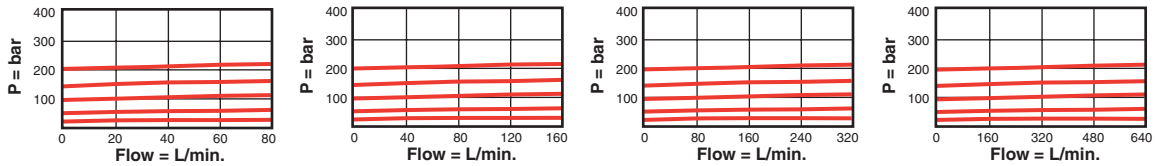
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**RSDC – 8WN**	T - 11A	35,1	22,2	30,2	45 - 50
120 L/min.	**RSFC – 8WN**	T - 2A	35,1	28,6	35,1	60 - 70
240 L/min.	**RSHC – 8WN**	T - 17A	46,0	31,8	46,0	200 - 215
480 L/min.	**RSJC – 8WN**	T - 19A	63,5	41,3	58,7	465 - 500

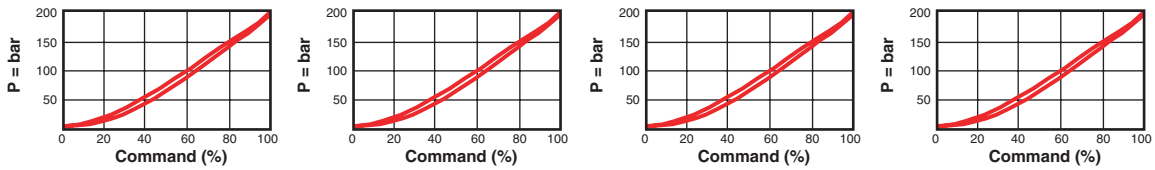
Performance Curves

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

Typical Pressure vs. Flow with T-8A Pilot Stage (RBAP-MAN) Installed



Pressure vs. Command



- Maximum operating pressure = 350 bar.
- Main stage leakage at 24 cSt = RSDC-8: 30 cc/min. at 70 bar; RSFC-8: 50 cc/min. at 70 bar; RSHC-8: 65 cc/min. at 70 bar; RSJC-8: 80 cc/min. at 70 bar.
- Control pilot flow = RSDC-8: 0,11 to 0,16 L/min.; RSFC-8: 0,16 to 0,25 L/min.; RSHC-8, RSJC-8: 0,25 to 0,33 L/min.
- Will accept maximum pressure at Port 2; suitable for use in cross-port relief circuits. If used in cross-port relief circuits, consider spool leakage.
- Pressure at port 3 is directly additive at a 1:1 ratio to the valve setting and should not exceed 350 bar.
- 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 Material*
D 60 L/min.	**8** T-8A Cavity in hex body for pilot operation	**D** 1,7 bar	**N** Buna-N
F 120 L/min.		**W** 7 bar	**V** Viton
H 240 L/min.	Pilot valve to be ordered separately		
J 480 L/min.			

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Differentiation in Sun Manifold Design

CUSTOM VALVE PACKAGES

Sun Hydraulics manufactures custom engineered valve packages or “valvepaks” at all of its locations around the world. Valvepaks are comprised of standard screw-in cartridge valves housed in a custom manifold. Once a customer’s hydraulic circuit has been developed, it is incorporated into a single, custom manifold designed to fit into a defined location.

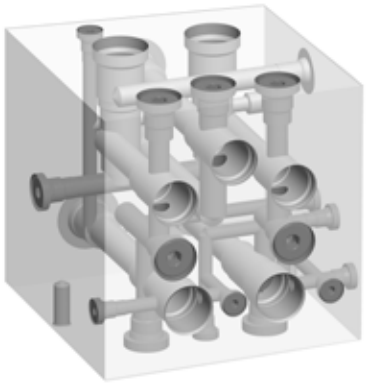
Benefits to customers:

- Creative and innovative manifold design using solid modeling.
- Rapid response for prototypes.
- Utilizing Sun cartridges with our unique floating style cartridge construction.
- Compound angle drill for extremely compact designs.
- Construction plugs are eliminated or dramatically reduced.
- Larger and more efficient flow paths.
- Manifolds available in T-6061 (210 bar) aluminium and 65-45-12 high-strength (350 bar) SG iron.

Let Sun design your manifold.

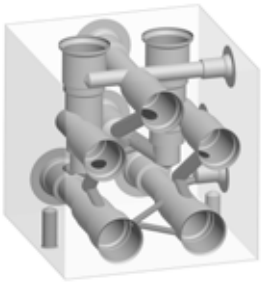
Classic Three-Axis Straight Hole Drilling

125 cubic inches (5 x 5 x 5)
2,048 cubic centimetres (12,7 x 12,7 x 12,7)
17 construction plugs.



Sun’s Five-Axis Compound Angle Drilling

64 cubic inches (4 x 4 x 4)
1,049 cubic centimetres (10,2 x 10,2 x 10,2)
0 construction plugs.



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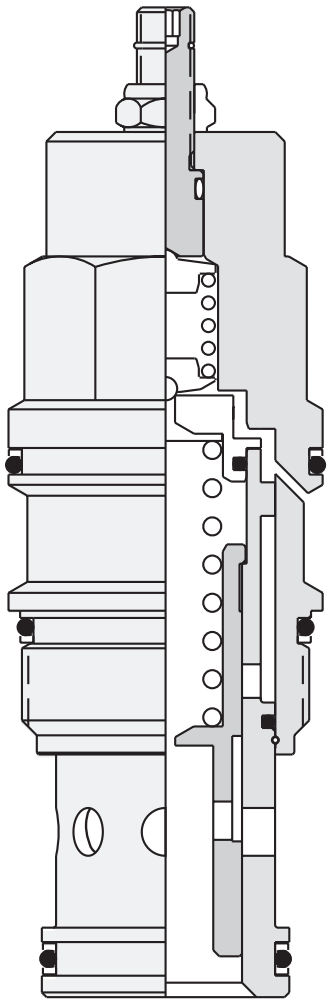
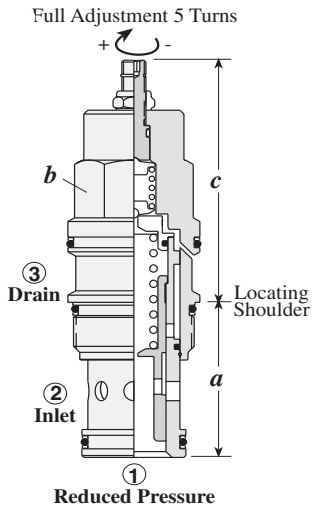
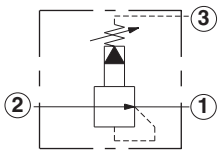
Products: Manifolds: Manifold Selector
Products: Product Selector
Or select your cartridge first, then select a matching manifold from menu at the top of cartridge page

Reducing and Reducing/Relieving Cartridge Valves



PILOT OPERATED

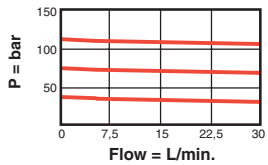




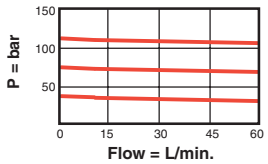
Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
20 L/min.	**PBBB – LAN**	T - 163A	31,0	19,1	65,0	67,0	70,0	35 - 40
40 L/min.	**PBDB – LAN**	T - 11A	35,0	22,2	63,5	67,3	70,0	45 - 50
80 L/min.	**PBFB – LAN**	T - 2A	35,0	28,6	71,4	73,2	77,7	60 - 70
160 L/min.	**PBHB – LAN**	T - 17A	46,0	31,8	83,3	84,1	90,0	200 - 215
320 L/min.	**PBJB – LAN**	T - 19A	63,8	41,3	100,1	103,9	106,4	465 - 500

Performance Curves

PBBB

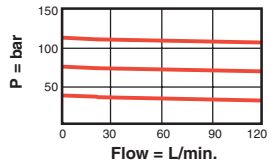


PBDB

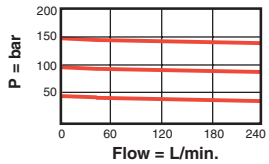


PBFB

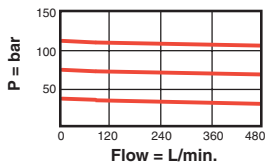
Regulated Pressure



PBHB



PBJB



- Maximum operating pressure = 350 bar.
- Control pilot flow = PBBB, PBDB: 0,11 to 0,16 L/min.; PBFB: 0,16 to 0,25 L/min.; PBHB, PBJB: 0,25 to 0,33 L/min.
- Factory pressure setting established at blocked control port (deadhead).
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.

OPTION ORDERING INFORMATION

PB ✱ B – ✱ ✱ ✱

Nominal Capacity

- **B** 20 L/min.
- **D** 40 L/min.
- **F** 80 L/min.
- **H** 160 L/min.
- **J** 320 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

PBBB only:

- **A** 5 - 210 bar Max. Pressure Differential 210 bar
- **B** 5 - 105 bar Max. Pressure Differential 210 bar
- **N** 5 - 55 bar Max. Pressure Differential 210 bar
- **Q** 5 - 25 bar Max. Pressure Differential 140 bar
- **W** 5 - 315 bar Max. Inlet Pressure 350 bar

PBDB, PBFB, PBHB, PBJB only:

- **A** 7 - 210 bar Max. Pressure Differential 210 bar
- **B** 3,5 - 105 bar Max. Pressure Differential 210 bar
- **N** 4 - 55 bar Max. Pressure Differential 140 bar
- **Q** 4 - 25 bar Max. Pressure Differential 140 bar
- **W** 10,5 - 315 bar Max. Inlet Pressure 350 bar

Adjustment Ranges are all standard set at 14 bar.

Seal Material

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

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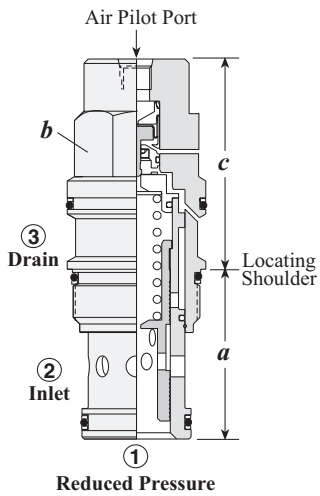
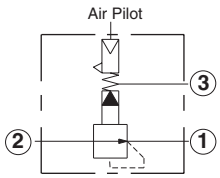
PILOT OPERATED, AIR CONTROLLED



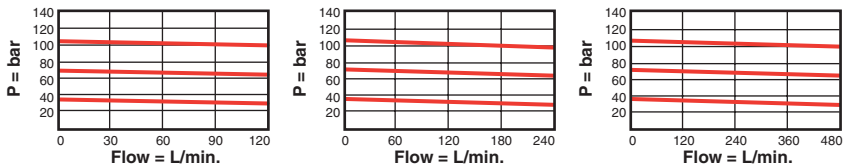


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* A	*c* B	*Installation Torque (Nm)*
80 L/min.	**PBFC – ABN**	T - 2A	35,0	28,6	51,1	-	60 - 70
160 L/min.	**PBHC – BBN**	T - 17A	46,0	31,8	-	63,0	200 - 215
320 L/min.	**PBJC – BBN**	T - 19A	63,8	41,3	-	79,0	465 - 500

Performance Curves

PBFC **PBHC** **PBJC**

Regulated Pressure



- Pilot ratio, air to hydraulic = 20:1.
- Maximum operating pressure 140 bar.
- Maximum air pressure = 10,5 bar.
- Control pilot flow = PBFC: 0,16 to 0,25 L/min.; PBHC, PBJC: 0,25 to 0,33 L/min.
- Maximum pressure differential, inlet to outlet should not exceed 210 bar.
- The pressure at port 3 determines the minimum valve setting and should not exceed 70 bar.

OPTION ORDERING INFORMATION

PB ✱ C – ✱ ✱ ✱

Nominal Capacity

F 80 L/min.

H 160 L/min.

J 320 L/min.

Control

Available in PBFC only:

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

PBHC, PBJC only:

B External SAE-4 Pilot Port at end of Cartridge

Adjustment Range

B 3,5 - 105 bar

Seal Material

N Buna-N

V Viton

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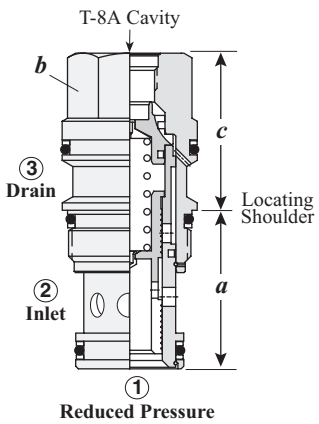
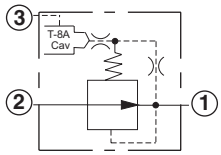
PILOT OPERATED, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY





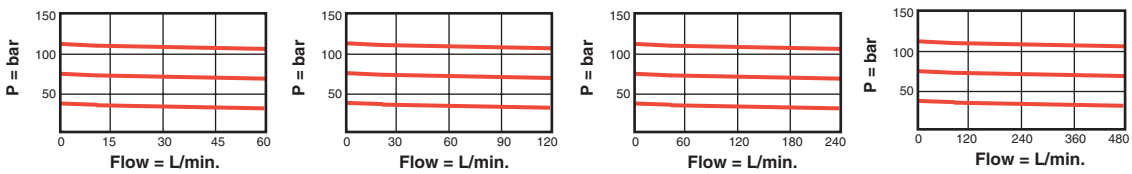
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**PBDB – 8WN**	T - 11A	35,1	22,2	30,2	45 - 50
80 L/min.	**PBFB – 8WN**	T - 2A	35,1	28,6	35,1	60 - 70
160 L/min.	**PBHB – 8WN**	T - 17A	46,0	31,8	46,0	200 - 215
320 L/min.	**PBJB – 8WN**	T - 19A	63,5	41,3	58,7	465 - 500

Performance Curves

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

Regulated Pressure with T-8A Pilot Stage Installed



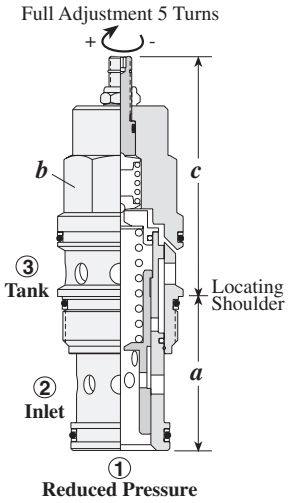
- Maximum operating pressure = 350 bar.
- Control pilot flow = PBDB-8: 0,11 to 0,16 L/min.; PBFB-8: 0,16 to 0,25 L/min.; PBHB-8, PBJB-8: 0,25 to 0,33 L/min.
- Pilot operated valves exhibit very low dead band transition between reducing and relieving modes.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.
- 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.

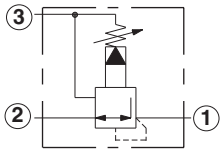
OPTION ORDERING INFORMATION

PB ✱ B – 8 ✱ ✱

Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal Material*
D 40 L/min.	**8** T-8A Cavity in hex body for pilot operation	**D** 1,7 bar Max. Pressure Differential 140 bar	**N** Buna-N
F 80 L/min.			**V** Viton
H 160 L/min.	Pilot valve to be ordered separately	**W** 7 bar Max. Inlet Pressure 350 bar	
J 320 L/min.			

PILOT OPERATED



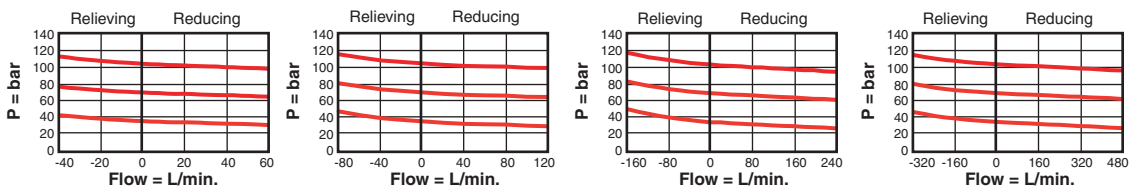


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (Nm)*
40 L/min.	**PPDB – LAN**	T - 11A	35,0	22,2	63,5	67,3	70,0	45 - 50
80 L/min.	**PPFB – LAN**	T - 2A	35,0	28,6	71,4	73,2	77,7	60 - 70
160 L/min.	**PPHB – LAN**	T - 17A	46,0	31,8	83,3	84,1	90,0	200 - 215
320 L/min.	**PPJB – LAN**	T - 19A	63,5	41,3	100,1	103,9	106,4	465 - 500

Performance Curves

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

Regulated Pressure



- Maximum operating pressure = 350 bar.
- Control pilot flow = PPDB: 0,11 to 0,16 L/min.; PPFB: 0,16 to 0,25 L/min.; PPHB, PPJB: 0,25 to 0,33 L/min.
- Factory pressure setting established at blocked control port (deadhead).
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 210 bar.
- Maximum pressure at port 3 should be limited to 210 bar.

OPTION ORDERING INFORMATION

PP ✱ B – ✱ ✱ ✱

Nominal Capacity

- **D** 40 L/min.
- **F** 80 L/min.
- **H** 160 L/min.
- **J** 320 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob
- ***** ***Special setting is required. Specify at time of order.***

***** *See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

- **A** 7 - 210 bar Max. Pressure Differential 210 bar
- **B** 3,5 - 105 bar Max. Pressure Differential 210 bar
- **N** 4 - 55 bar Max. Pressure Differential 140 bar
- **Q** 4 - 25 bar Max. Pressure Differential 140 bar
- **W** 10,5 - 315 bar Max. Inlet Pressure 350 bar

Adjustment Ranges are all standard set at 14 bar.

Seal Material

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

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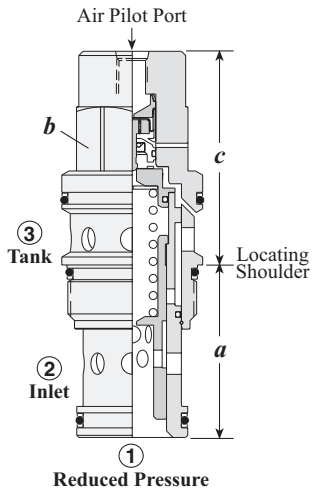
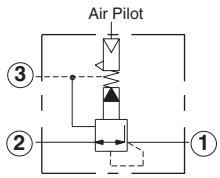
PILOT OPERATED, AIR CONTROLLED



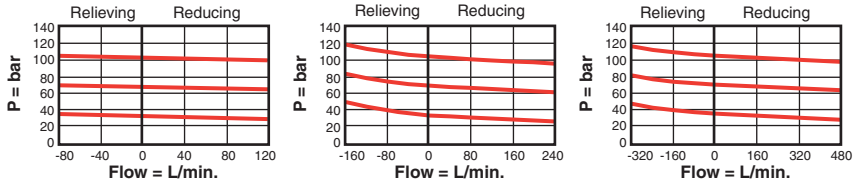


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c* A	*c* B	
80 L/min.	**PPFC – ABN**	T - 2A	35,0	28,6	50,8	-	60 - 70
160 L/min.	**PPHC – BBN**	T - 17A	46,0	31,8	-	63,0	200 - 215
320 L/min.	**PPJC – BBN**	T - 19A	63,8	41,3	-	79,0	465 - 500

Performance Curves

PPFC **PPHC** **PPJC**

Regulated Pressure



- Pilot ratio, air to hydraulic = 20:1.
- Maximum operating pressure = 140 bar.
- Maximum air pressure = 10,5 bar.
- Control pilot flow = PPFC: 0,16 to 0,25 L/min.; PPHC, PPJC: 0,25 to 0,33 L/min.
- Maximum pressure differential, inlet to outlet should not exceed 210 bar.
- The pressure at port 3 determines the minimum valve setting and should not exceed 70 bar.

OPTION ORDERING INFORMATION

PP ✱ C – ✱ ✱ ✱

Nominal Capacity

F 80 L/min.

H 160 L/min.

J 320 L/min.

Control

Available in PPFC only

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

PPHC, PPJC only

B External SAE-4 Pilot Port at end of Cartridge

Adjustment Range

B 3,5 - 105 bar

Seal Material

N Buna-N

V Viton

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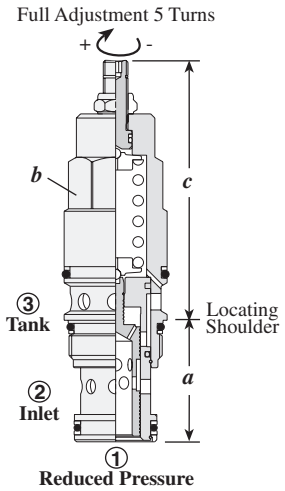
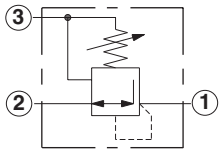
DIRECT ACTING



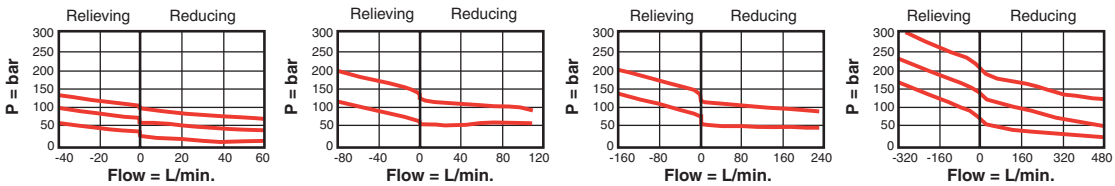


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (Nm)*
40 L/min.	**PRDB – LAN**	T - 11A	35,0	22,2	78,5	80,3	84,8	45 - 50
80 L/min.	**PRFB – LAN**	T - 2A	35,0	28,6	88,1	90,0	94,0	60 - 70
160 L/min.	**PRHB – LAN**	T - 17A	46,0	31,8	100,1	101,6	106,4	200 - 215
320 L/min.	**PRJB – LAN**	T - 19A	63,5	41,3	123,8	127,8	130,2	465 - 500

Performance Curves

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

Regulated Pressure



- Maximum operating pressure = 350 bar.
- Maximum leakage at 24 cSt = PRDB: 30 cc/min.; PRFB: 50 cc/min.; PRHB: 65 cc/min.; PRJB: 80 cc/min. Leakage specified is out of port 3 with a supply pressure of 140 bar and the valve set at mid-range. This leakage is directly proportional to pressure differential and inversely proportional to viscosity expressed in centistokes.
- Factory pressure setting established at blocked control port (deadhead).
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 210 bar.

OPTION ORDERING INFORMATION

PR ✱ B – ✱ ✱ ✱

Nominal Capacity

- **D** 40 L/min.
- **F** 80 L/min.
- **H** 160 L/min.
- **J** 320 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

PRDB only:
- **A** 35 - 210 bar, Standard set at 50 bar
- **B** 3,5 - 105 bar, Standard set at 14 bar
- **D** 1,7 - 55 bar, Standard set at 14 bar
- **E** 1,7 - 28 bar, Standard set at 14 bar
- **S** 1,7 - 14 bar, Standard set at 14 bar
- **W** 50 - 315 bar, Standard set at 70 bar

PRFB, PRHB, PRJB only:
- **A** 50 - 210 bar, Standard set at 70 bar
- **B** 20 - 105 bar, Standard set at 35 bar
- **D** 14 - 55 bar, Standard set at 28 bar
- **E** 7 - 28 bar, Standard set at 14 bar
- **S** 3,5 - 14 bar, Standard set at 7 bar

PRJB only:
- **W** 76 - 315 bar, Standard set at 76 bar

Seal Material

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

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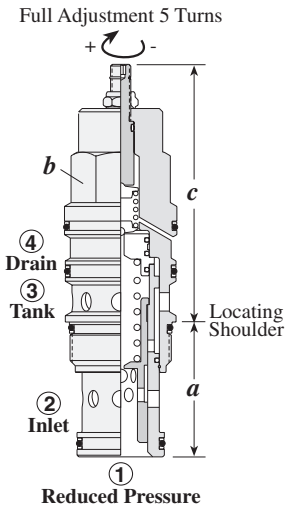
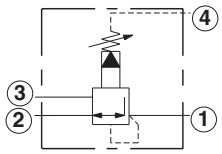
PILOT OPERATED, EXTERNALLY DRAINED TO PORT 4



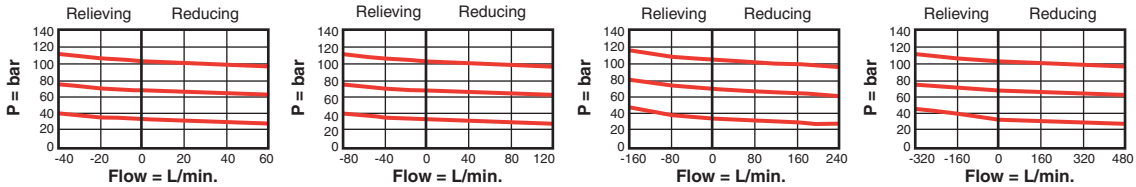


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
40 L/min.	**PVDA – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50
80 L/min.	**PVFA – LAN**	T - 22A	35,0	28,6	87,9	90,0	94,0	60 - 70
160 L/min.	**PVHA – LAN**	T - 23A	46,2	31,8	100,1	101,1	105,9	200 - 215
320 L/min.	**PVJA – LAN**	T - 24A	63,5	41,3	121,5	125,0	128,0	465 - 500

Performance Curves

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

Regulated Pressure



- Maximum operating pressure = 350 bar.
- Control pilot flow = PVDA: 0,11 to 0,16 L/min.; PVFA: 0,16 to 0,25 L/min.; PVHA, PVJA: 0,25 to 0,33 L/min.
- Factory pressure settings established at blocked control port (deadhead).
- Maximum pressure at port 3 should be limited to 210 bar.
- Pilot operated valves exhibit very low dead band transition between reducing and relieving modes.
- Pressure on the drain (port 4) is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.

OPTION ORDERING INFORMATION

PV ✱ A – ✱ ✱ ✱

Nominal Capacity

- **D** 40 L/min.
- **F** 80 L/min.
- **H** 160 L/min.
- **J** 320 L/min.

*Control***

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

* ***Special setting is required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

- **A** 7 - 210 bar Max. Pressure Differential 210 bar
- **B** 3,5 - 105 bar Max. Pressure Differential 210 bar
- **D** 1,7 - 55 bar Max. Pressure Differential 140 bar
- **E** 1,7 - 28 bar Max. Pressure Differential 140 bar
- **W** 10,5 - 315 bar Max. Inlet Pressure 350 bar

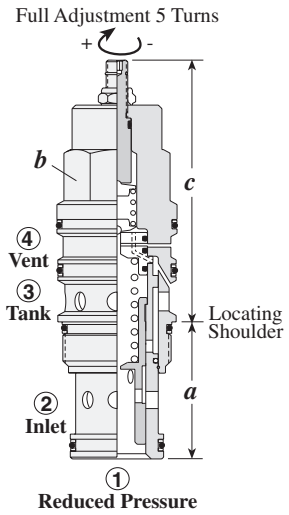
Adjustment Ranges are all standard set at 14 bar.

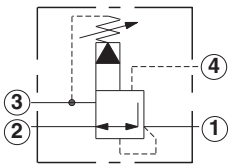
Seal Material

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, VENTABLE



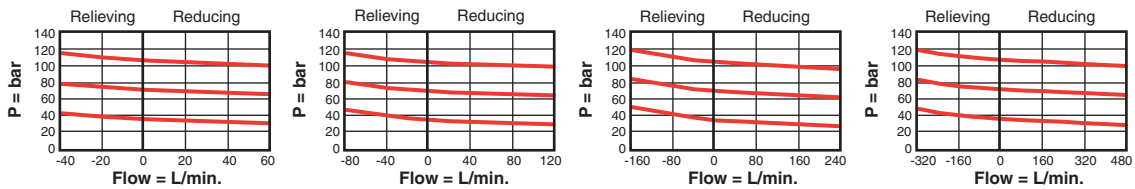


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c L	c C	c K	*Installation Torque (Nm)*
40 L/min.	**PVDB – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50
80 L/min.	**PVFB – LAN**	T - 22A	35,0	28,6	87,9	90,0	94,0	60 - 70
160 L/min.	**PVHB – LAN**	T - 23A	46,2	31,8	100,0	101,1	105,9	200 - 215
320 L/min.	**PVJB – LAN**	T - 24A	63,5	41,3	121,5	125,0	128,0	465 - 500

Performance Curves

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

Regulated Pressure



- Maximum operating pressure = 350 bar.
- Control pilot flow = PVDB: 0,11 to 0,16 L/min.; PVFB: 0,16 to 0,25 L/min.; PVHB, PVJB: 0,25 to 0,33 L/min.
- Factory pressure setting established at blocked control port (deadhead).
- Pilot operated valves exhibit very low dead band transition between reducing and relieving modes.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 210 bar.
- 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

D 40 L/min.
F 80 L/min.
H 160 L/min.
J 320 L/min.

*Control***

L Standard Screw Adjustment
C* Tamper Resistant Factory Set
K Handknob with Lock Knob

* ***Special setting is required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

A 7 - 210 bar Max. Pressure Differential 210 bar
B 3,5 - 105 bar Max. Pressure Differential 210 bar
D 1,7 - 55 bar Max. Pressure Differential 140 bar
E 1,7 - 28 bar Max. Pressure Differential 140 bar
W 10,5 - 315 bar Max. Inlet Pressure 350 bar

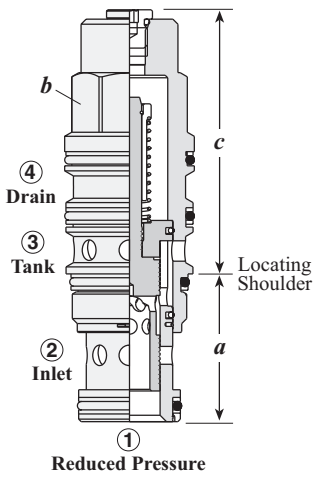
Adjustment Ranges are all standard set at 14 bar.

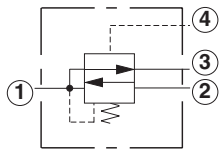
Seal Material

N Buna-N
V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING, MAIN STAGE, PILOTED FROM PORT 4



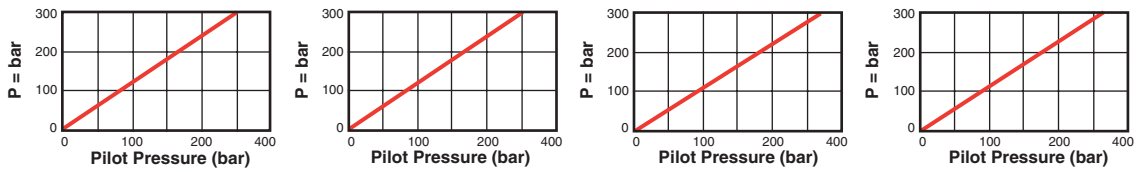


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**PSDT – XFN**	T - 21A	35,1	22,2	60,7	45 - 50
80 L/min.	**PSFT – XFN**	T - 22A	34,8	28,6	70,3	60 - 70
160 L/min.	**PSHT – XFN**	T - 23A	46,0	31,8	82,0	200 - 215
320 L/min.	**PSJT – XFN**	T - 24A	63,5	41,0	104,0	475 - 510

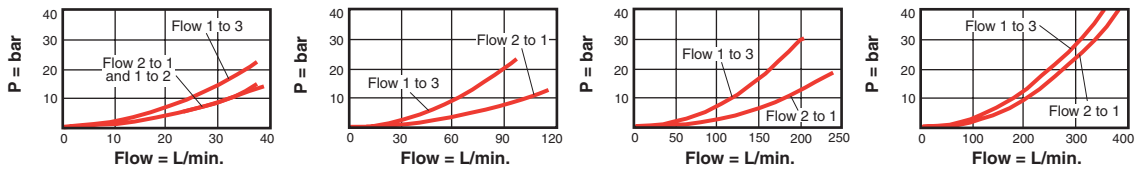
Performance Curves

PSDT **PSFT** **PSHT** **PSJT**

Reduced Pressure vs. Pilot Pressure



Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = PSDT: 41 cc/min. at 70 bar; PSFT: 50 cc/min. at 70 bar; PSHT: 65 cc/min. at 70 bar; PSJT: 80 cc/min. at 70 bar. Leakage specified is out of port 3 with a supply pressure of 140 bar and the valve set at mid-range. This leakage is directly proportional to pressure differential and inversely proportional to viscosity expressed in centistokes.
- The valve is biased to the relieving mode with a 7 bar spring. Pressure at port 4 is directly added to the setting of the valve once this threshold is exceeded. For example, 70 bar at port 4 will result in a setting of 63 bar at port 1.
- Maximum pressure at port 3 should be limited to 210 bar.
- Pressure on the drain (port 4) is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.

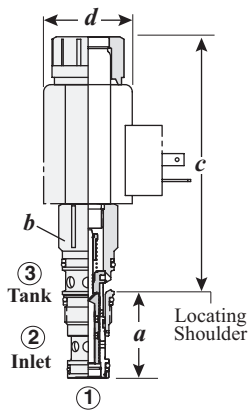
OPTION ORDERING INFORMATION

PS ✱ T – X F ✱

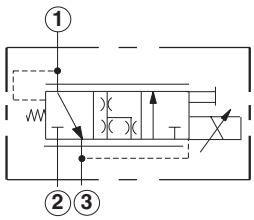
Nominal Capacity	*Control*	*Bias Pressure*	*Seal Material*
D 40 L/min.	**X** Not Adjustable	**F** 7 bar	**N** Buna-N
F 80 L/min.			**V** Viton
H 160 L/min.			
J 320 L/min.			

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING, OPEN TRANSITION, IMPROVED DYNAMIC RESPONSE



Reduced Pressure



Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c***	*d*	
20 L/min.	**PRDL - MDN**	T-11A	35,1	22,2	108,2	37,3	45 - 50

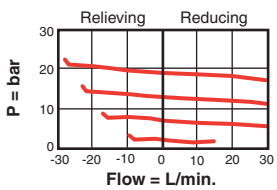
***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

PRDL

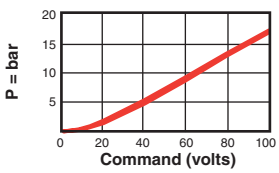
Pressure vs. Flow

E Spring Range Shown



Command vs. Secondary Pressure

E Spring Range Shown



See www.sunhydraulics.com for additional performance curves.

- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,33 cc/min.
- Hysteresis with dither = <4% and with DC input = <8%.
- Linearity with dither = <2% and repeatability with dither = <2%.
- Recommended dither frequency = 140 Hz.
- Maximum pressure at port 3 should be limited to 210 bar.
- Pressure at port 3 is directly additive to the valve setting at 1:1 ratio and should not exceed 210 bar.
- The transition from reducing to relieving is slightly open. The result is very good pressure control with oil consumption of about 0,4 L/min.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100-250 Hz.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

P R D L – M D ✱ – ✱ ✱ ✱

Nominal Capacity

D 20 L/min.

Control*

M Manual Override Standard

X No Manual Override

Operating Range

D 3,5 - 35 bar

E 1,7 - 18 bar

B 7 - 80 bar

S 0,7 - 7 bar

Seal Material

N Buna-N

V Viton

Coil Options*

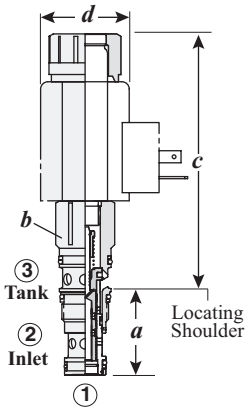
See page 188: Coil option information for Electro-Proportional Cartridges.

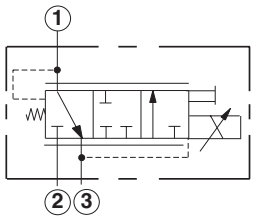
* *See page 178 for information on Control Options*

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING, LOW LEAKAGE





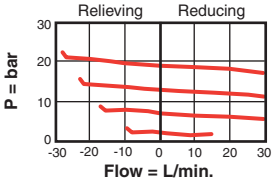
Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c***	d	Installation Torque (Nm)
20 L/min.	**PRDP - MDN**	T-11A	35,1	22,2	108,2	37,3	45 - 50

***An additional 50,8 mm clearance is needed for coil installation and removal.

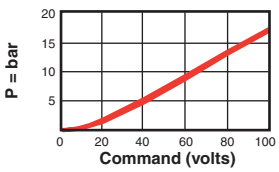
Performance Curves

PRDP

Pressure vs. Flow
E Spring Range Shown



Command vs. Secondary Pressure
E Spring Range Shown



See www.sunhydraulics.com for additional performance curves.

- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 41 cc/min. Leakage specified is out of port 3 with a supply pressure of 140 bar and the valve set at mid-range. This leakage is directly proportional to pressure differential and inversely proportional to viscosity expressed in centistokes.
- The transition from reducing to relieving is closed. The result is very low leakage. However, there is a transitional step increase in pressure between reducing and relieving modes. The step equals about 5% of the high end of the adjustment range, independent of the valve setting.
- Hysteresis with dither = <4% and with DC input = <8%.
- Linearity with dither = <2% and repeatability with dither = <2%.
- Recommended dither frequency = 140 Hz.
- Maximum pressure at port 3 should be limited to 210 bar.
- Pressure at port 3 is directly additive to the valve setting at 1:1 ratio and should not exceed 210 bar.
- There is no upper limit to the pressure setting when using the M control. The more force you exert on the manual override, the higher the resulting pressure.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100-250 Hz.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

P R D P – M D ✱ – ✱ ✱ ✱

Nominal Capacity

D 20 L/min.

Control*

M Manual Override Standard

X No Manual Override

Operating Range

D 3,5 - 35 bar

E 1,7 - 18 bar

B 7 - 80 bar

Seal Material

N Buna-N

V Viton

Coil Options**

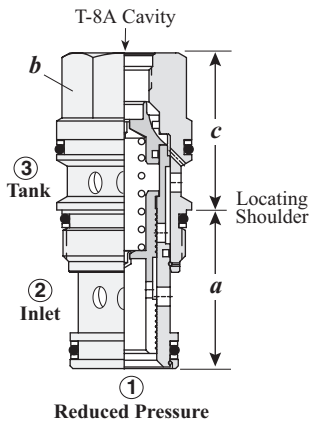
See page 188: Coil option information for Electro-Proportional Cartridges.

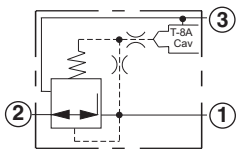
* ***See page 178 for information on Control Options***

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY





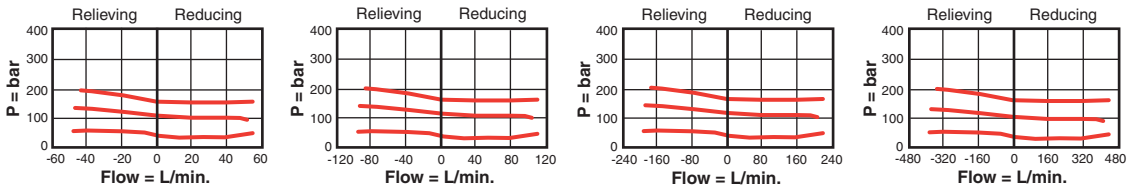
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**PPDB – 8WN**	T - 11A	35,1	22,2	30,2	45 - 50
80 L/min.	**PPFB – 8WN**	T - 2A	35,1	28,6	35,1	60 - 70
160 L/min.	**PPHB – 8WN**	T - 17A	46,0	31,8	46,0	200 - 215
320 L/min.	**PPJB – 8WN**	T - 19A	63,5	41,3	58,7	465 - 500

Performance Curves

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

Regulated Pressure with T-8A Pilot Stage Installed



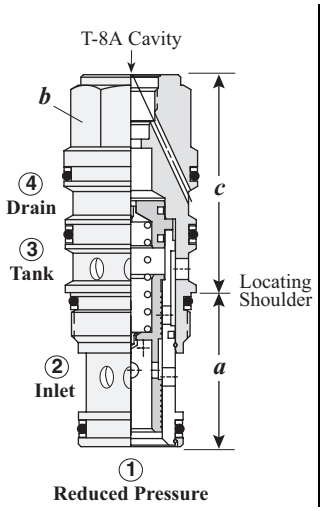
- Maximum operating pressure = 350 bar.
- Control pilot flow = PPDB-8: 0,11 to 0,16 L/min.; PPFB-8: 0,16 to 0,25 L/min.; PPHB-8, PPJB-8: 0,25 to 0,33 L/min.
- Maximum pressure at port 3 should be limited to 210 bar.
- Pressure at port 3 is directly additive to the valve setting at a 1:1 ratio and should not exceed 210 bar.
- 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.

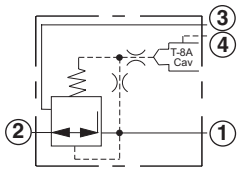
OPTION ORDERING INFORMATION

PP ✱ B – 8 ✱ ✱

Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal Material*
D 40 L/min.	**8** T-8A Cavity in hex body for pilot operation	**D** 1,7 bar Max. Pressure Differential 140 bar	**N** Buna-N
F 80 L/min.	Pilot valve to be ordered separately	**W** 7 bar Max. Inlet Pressure 350 bar	**V** Viton
H 160 L/min.			
J 320 L/min.			

PILOT OPERATED, MAIN STAGE WITH INTEGRAL T-8A CONTROL CAVITY, DRAIN TO PORT 4, EXTERNALLY DRAINED





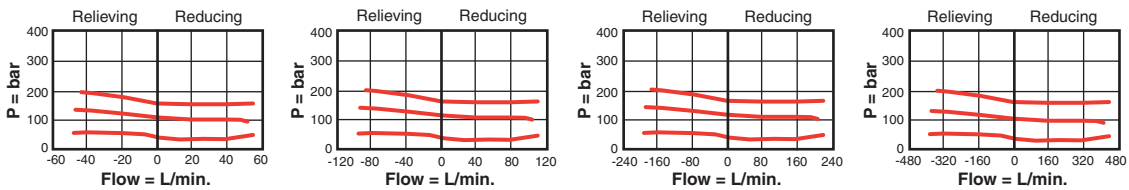
The -8 control option allows a pilot control valve to be incorporated directly into the end of the modulating element via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**PVDA – 8WN**	T - 21A	35,1	22,2	45,2	45 - 50
80 L/min.	**PVFA – 8WN**	T - 22A	35,1	28,6	50,8	60 - 70
160 L/min.	**PVHA – 8WN**	T - 23A	46,0	31,8	65,8	200 - 215
320 L/min.	**PVJA – 8WN**	T - 24A	63,5	41,3	80,3	465 - 500

Performance Curves

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

Regulated Pressure with T-8A Pilot Stage Installed



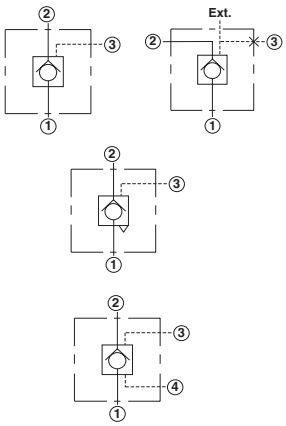
- Maximum operating pressure = 350 bar.
- Control pilot flow = PVDA-8: 0,11 to 0,16 L/min.; PVFA-8: 0,16 to 0,25 L/min.; PVHA-8, PVJA-8: 0,25 to 0,33 L/min.
- Maximum pressure at port 3 should be limited to 210 bar.
- Pilot operated valves exhibit very low dead band transition between reducing and relieving modes.
- Pressure on the drain (port 4) is directly additive to the valve setting at a 1:1 ratio and should not exceed 350 bar.
- 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.

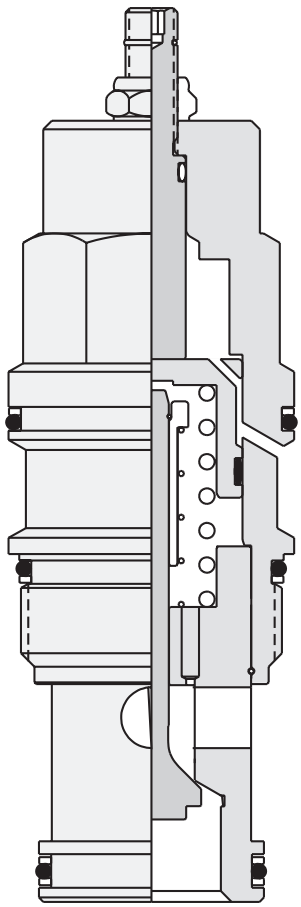
OPTION ORDERING INFORMATION

PV ✱ A – 8 ✱ ✱

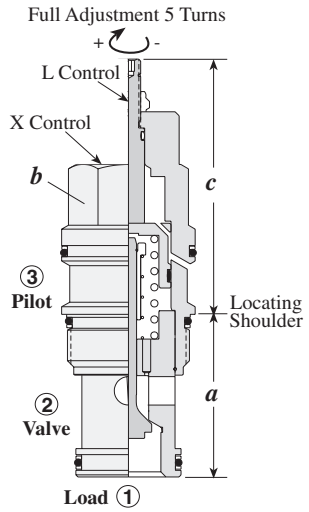
Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal Material*
D 40 L/min.	**8** T-8A Cavity in hex body for pilot operation	**D** 1,7 bar Max. Pressure Differential 140 bar	**N** Buna-N
F 80 L/min.	Pilot valve to be ordered separately	**W** 7 bar Max. Inlet Pressure 350 bar	**V** Viton
H 160 L/min.			
J 320 L/min.			

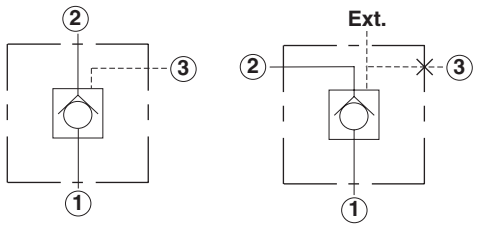
Pilot-to-Open Check Cartridge Valves





NON-VENTED, STANDARD PILOT (CK*B), SEALED PILOT (CK*D), STEEL SEAT





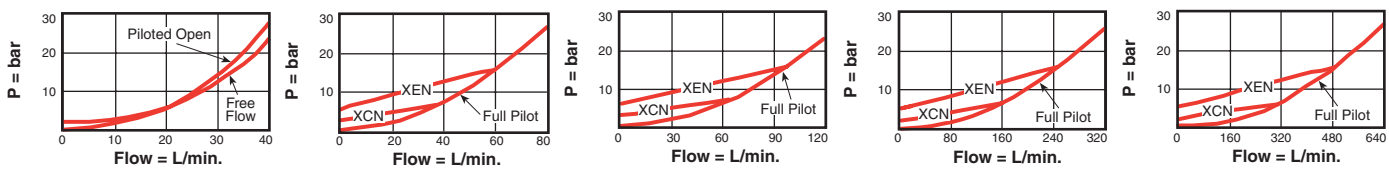
X, L Controls **B, E, P Controls**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c*		
					X,B,E,P	L	
30 L/min.	**CKBB – XCN**	T - 163A	31,0	19,1	31,8	42,5	35 - 40
60 L/min.	**CKCB – XCN**	T - 11A	35,1	22,2	30,2	63,5	45 - 50
120 L/min.	**CKEB – XCN**	T - 2A	35,1	28,6	35,1	71,4	60 - 70
240 L/min.	**CKGB – XCN**	T - 17A	46,0	31,8	46,0	83,3	200 - 215
480 L/min.	**CKIB – XCN**	T - 19A	63,5	41,3	58,7	100,1	465 - 500

Performance Curves

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

Typical Pressure Drop



- Pilot Ratio = 3:1.
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- CKBB, CKBD available only with 2 bar or 5 bar check valve cracking pressures.
- CK*B has standard unsealed pilot to allow air trapped in the pilot line to be purged from the circuit.
- CK*D has sealed pilot for use in circuits where cross-port leakage is undesirable.

OPTION ORDERING INFORMATION

CK ✱ ✱ – ✱ ✱ ✱

Nominal Capacity

- **B** 30 L/min.
- **C** 60 L/min.
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version

- **B** Bleed through Pilot
- **D** Sealed Pilot

Control**

*Available for all CK*B, CK*D*

- **X** Standard Pilot
- **L** Manual Load Release
- **E** External SAE-4 Pilot, Port 3 blocked
- **P** External 1/4" NPTF Pilot, Port 3 blocked

CKCB, CKEB, CKGB, CKCD only:

- **B** External 1/4" BSPP Pilot Port 3 blocked

Cracking Pressure

- **A** 0,3 bar
- **B** 1,0 bar
- **C*** 2,0 bar
- **D** 3,5 bar
- **E*** 5,0 bar
- **F** 7,0 bar

* *CKBB, CKBD available with C and E cracking pressures only.*

Seal Material

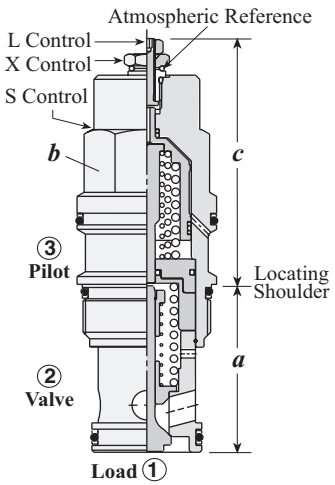
- **N** Buna-N
- **V** Viton

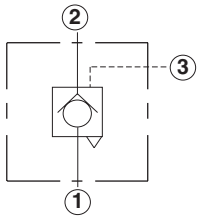
** *See page 178 for information on Control Options*

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

ATMOSPHERICALLY REFERENCED, VENTED, SEALED PILOT, STEEL SEAT



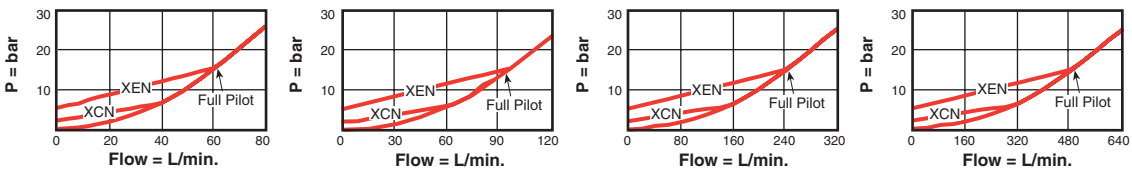


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					X	L	S	
60 L/min.	**CKCV – SCN**	T - 11A	35,1	22,2	51,0	56,9	42,7	40 - 50
120 L/min.	**CKEV – SCN**	T - 2A	35,1	28,6	59,0	65,0	50,8	60 - 70
240 L/min.	**CKGV – SCN**	T - 17A	46,0	31,8	71,0	76,7	62,7	200 - 215
480 L/min.	**CKIV – SCN**	T - 19A	63,5	41,3	84,0	95,8	—	465 - 500

Performance Curves

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

Typical Pressure Drop



- Pilot Ratio = 3:1.
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Approximately 0,07 cc of fluid will pass from the pilot area to the vented spring chamber every 4000 cycles.
- For models with manual load release control option, turn load release clockwise to release load.
- Atmospherically referenced pilot-to-open check valves are considered problem solvers for existing circuits using non-vented valves. However, the atmospherically referenced valve will eventually leak externally or allow moisture into the spring chamber. Four-port vented pilot-to-open check cartridges are recommended for new applications.

OPTION ORDERING INFORMATION

CK ✱ V – ✱ ✱ ✱

Nominal Capacity

C 60 L/min.
E 120 L/min.
G 240 L/min.
I 480 L/min.

*Control***

L Manual Load Release, External Vent
S External SAE-4 Vent Port
X Standard Pilot Atmospheric Vent

Cracking Pressure

A 0,3 bar
B 1,0 bar
C 2,0 bar
D 3,5 bar
E 5,0 bar
F 7,0 bar

Seal Material

N Buna-N
V Viton

** *See page 178 for information on Control Options*

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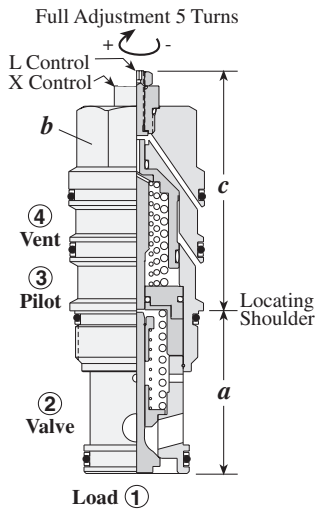
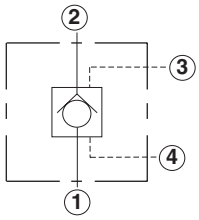
VENTED, SEALED PILOT, STEEL SEAT



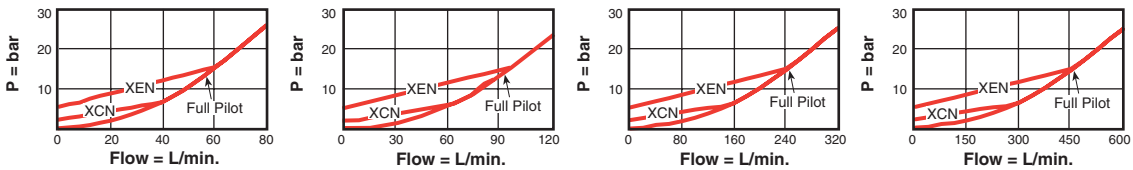


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X	*c* L	*Installation Torque (Nm)*
60 L/min.	**CVCV – XCN**	T - 21A	35,1	22,2	53,3	59,4	45 - 50
120 L/min.	**CVEV – XCN**	T - 22A	35,1	28,6	59,4	65,0	60 - 70
240 L/min.	**CVGV – XCN**	T - 23A	46,0	31,8	71,4	77,0	200 - 215
480 L/min.	**CVIV – XCN**	T - 24A	63,5	41,3	88,9	95,8	465 - 500

Performance Curves

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

Typical Pressure Drop



- Pilot Ratio = 3:1.
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Port 4 (vent) should never be blocked as seal weepage will eventually cause valve to malfunction.
- Will accept pressure at port 4 (vent) up to 350 bar maximum but back pressure will increase by 1 + pilot ratio times back pressure.

OPTION ORDERING INFORMATION

CV ✱ V – ✱ ✱ ✱

Nominal Capacity	*Control***	*Adjustment Range*	*Seal Material*
C 60 L/min.	**X** Standard Pilot	**A** 0,3 bar	**N** Buna-N
E 120 L/min.	**L** Manual Load Release	**B** 1,0 bar	**V** Viton
G 240 L/min.		**C** 2,0 bar	
I 480 L/min.		**D** 3,5 bar	
		E 5,0 bar	
		F 7,0 bar	

** *See page 178 for information on Control Options*

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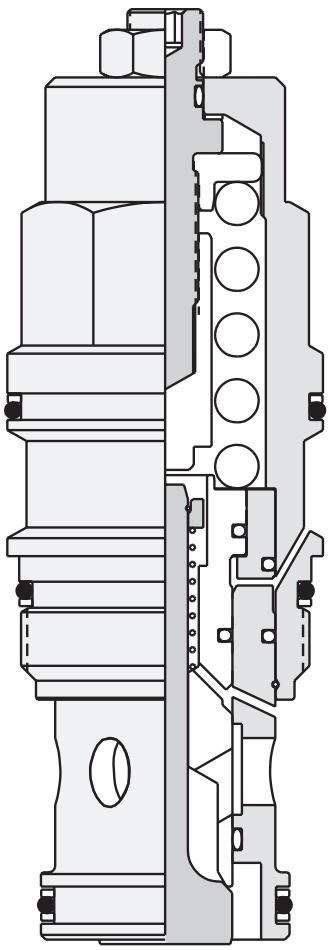
Counterbalance Cartridge Valves



Adjustment Range

A, H:	70-280 bar	–	Standard Setting 210 bar
B, I:	30-105 bar	–	Standard Setting 70 bar
C, J:	140-350 bar	–	Standard Setting 210 bar
D, K:	70-175 bar	–	Standard Setting 140 bar
F:	70-175 bar	–	Standard Setting 140 bar
G:	140-420 bar	–	Standard Setting 280 bar

Cracking Pressure of Reverse Free Flow Check
Valves with pressure range A, B, C, D have a .3 bar cracking pressure for the reverse free flow check. All others are 1.5 to 3 bar cracking pressure. In applications with loads that change quickly, higher cracking pressures are recommended.

Influence of Back Pressure
Pressure downstream of the counterbalance valve (port 2) is additive to the setting with the given factor (influence of back pressure). The setting is the load pressure (on port 1) that opens the valve with no pilot pressure (on port 3).

In applications with proportional valves that throttle the return flow, Sun recommends using vented counterbalance valves (CW** or CA**). CW** counterbalance valves have a spring chamber drained to port 4. CA** valves have an atmospherically vented spring chamber. CA** valves can be used when some external leakage (drops) is acceptable. The spring chamber cannot corrode due to splash water.

Stability
Circuits with counterbalance valves can be unstable. In most cases the circuit will be more stable after replacing the counterbalance valve with a valve that has a lower pilot ratio or is restrictive or smaller. Pilot ratio 3:1 is very common and works in most cases.

Notes (see numbers within table at right)
(1) Fully restrictive valves have a very limited flow capacity as relief valves. Counterbalance restrictive valves can be used to limit the pressure due to thermal expansion.

(2) These counterbalance valves have an internal bleed-off orifice between port 3 and 2 to reduce the effective pilot ratio. The pilot flow between port 3 and 2 is about .6 L/min. at 70 bar pilot pressure.

(3) These valves have no sealed pilot piston. The leakage from port 3 to port 2 is .93 L/min. at 70 bar pilot pressure.

(4) These are valves with no sealed pilot piston. Leakage between port 3 and port 2 is between .03 and .3 L/min. The high leakage occurs when the pilot pressure is half the load pressure or higher.

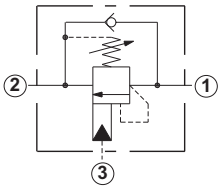
CBCA and CBEA are available with sealed pilot piston (these would be custom numbered valves).

All Model Codes shown in boldface type are in the counterbalance section of this catalogue. Consult www.sunhydraulics.com for our complete line of counterbalance cartridge products.

Cavity Adapters

T-17A to T-2A:	XHOC-BXN
T-17A to T-11A:	XHOC-EXN
T-19A to T-17A:	XJOC-GXN
T-23A to T-22A:	XPOC-NXN
T-24A to T-23A:	XQOC-PXN

COUNTERBALANCE CARTRIDGE VALVES / NON-VENTED



Fully Restricted — ***Series 1***

Cavity	T-11A
Nominal Capacity	10 L/min.

Model Code	*Adjustment Range*
CBAB	H; I; A; B
CBAA	H; I; A; B
CBAG	J; K; C; D

Restrictive **(1)** — ***Series 1***

Cavity	T-11A
Nominal Capacity	20 L/min.

Model Code	*Adjustment Range*
CBBY (2)	**H; I; A; B**
CBBA	**H; I; A; B**
CBBG	**J; K; C; D**
CBBH (3)	J; K; C; D

Semi-restrictive — ***Series 1***

Cavity	T-11A
Nominal Capacity	40 L/min.

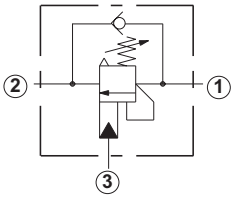
Model Code	*Adjustment Range*
CBBB	**H; I; A; B**
CBBL	**J; K; C; D**
CBBC	**H; I; A; B**
CBBD	**J; K; C; D**

Standard — ***Series 1***

Cavity	T-11A
Nominal Capacity	60 L/min.

Model Code	*Adjustment Range*
CBCB	H; I; A; B
CBCY (2)	**H; I; A; B**
CBCL	**J; K; C; D**
CBCA(3)	**H; I; A; B**
CBCG (3)	**J; K; C; D**
CBCH (4)	**J; K; C; D**

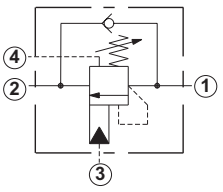
COUNTERBALANCE CARTRIDGE VALVES / VENTED



Standard — ***Series 1***

Cavity	T-11A
Nominal Capacity	60 L/min.

Model Code	*Adjustment Range*
CACK	**H; I**
CACL	**F; G**
CACA	**H; I**
CACG	**F; G**



Standard — ***Series 1***

Cavity	T-21A
Nominal Capacity	60 L/min.

Model Code	*Adjustment Range*
CWCK	**H; I**
CWCL	**F; G**
CWCA	**H; I**
CWCG	**F; G**

Series 2		Series 3		Series 4				
						Pilot Ratio	Max. Setting Depends on Pressure Range	Influence of Back Pressure
						1.5:1	280 bar	2.5
						3:1	280 bar	4
						4.5:1	350 bar	5.5

Series 2		Series 3		Series 4				
T-2A		T-17A		T-19A				
20 L/min.		40 L/min.		80 L/min.				
Model Code	Adjustment Range	Model Code	Adjustment Range	Model Code	Adjustment Range	Pilot Ratio	Max. Setting Depends on Pressure Range	Influence of Back Pressure
						2:1	280 bar	3
CBDA	**H; I; A; B**	**CBFA**	**H; I; A; B**	**CBHA**	**H; I; A; B**	3:1	280 bar	4
CBDG	**J; K; C; D**	**CBFG**	**J; K; C; D**	**CBHG**	**J; K; C; D**	4.5:1	350 bar	5.5
CBDH	J; K; C; D	CBFH	J; K; C; D			10:1	350 bar	11

Series 2		Series 3		Series 4			
T-2A		T-2A					
80 L/min.		160 L/min.					
Model Code	Adjustment Range	Model Code	Adjustment Range			Pilot Ratio	Max. Setting Depends on Pressure Range	Influence of Back Pressure
CBDB	**H; I; A; B**	**CBFB**	**H; I; A; B**			1.5:1	280 bar	2.5
CBDL	**I; J; K; B; C; D**	**CBFL**	**J; K; C; D**			2.3:1	350 bar	3.3
CBDC	**H; I; A; B**	**CBFC**	**H; I; A; B**			3:1	280 bar	4
CBDD	**J; C; K; D**	**CBFD**	**J; K; C; D**			4.5:1	350 bar	5.5

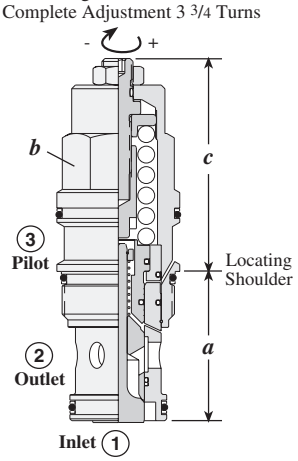
Series 2		Series 3		Series 4				
T-2A		T-17A		T-19A				
120 L/min.		240 L/min.		480 L/min.				
Model Code	Adjustment Range	Model Code	Adjustment Range	Model Code	Adjustment Range	Pilot Ratio	Max. Setting Depends on Pressure Range	Influence of Back Pressure
CBEB	**H; I; A; B**	**CBGB**	**H; I; A; B**	**CBIB**	**H; I; A; B**	1.5:1	280 bar	2.5
CBEY (2)	**H; A; B**	**CBGY (2)**	**H; A; B; I**	**CBIY (2)**	**H; I; A; B**	2:1	280 bar	3
CBEL	**I; J; K; B; C; D**	**CBGL**	**J; K; C; D**	**CBIL**	**J; K; C; D**	2.3:1	350 bar	3.3
CBEA(3)	**H; I; A; B**	**CBGA**	**H; I; A; B**	**CBIA**	**H; I; A; B**	3:1	280 bar	4
CBEG (3)	**I; J; K; B; C; D**	**CBGG**	**J; K; C; D**	**CBIG**	**J; K; C; D**	4.5:1	350 bar	5.5
CBEH (4)	**I; J; K; B; C; D**	**CBGH**	**J; K; C; D**	**CBIH**	**J; K; C; D**	10:1	350 bar	11

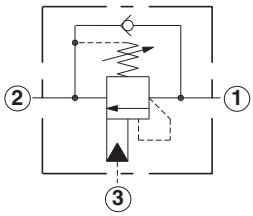
Series 2		Series 3		Series 4				
T-2A		T-17A		T-19A				
120 L/min.		240 L/min.		480 L/min.				
Model Code	Adjustment Range	Model Code	Adjustment Range	Model Code	Adjustment Range	Pilot Ratio	Max. Setting Depends on Pressure Range	Influence of Back Pressure
CAEK	**H; I**	**CAGK**	**H; I**	**CAIK**	**H; I**	1:1	280 bar	0
CAEL	**F; G**	**CAGL**	**F; G**	**CAIL**	**F; G**	2:1	420 bar	0
CAEA	**H; I**	**CAGA**	**H; I**	**CAIA**	**H; I**	3:1	280 bar	0
CAEG	**F; G**	**CAGG**	**F; G**	**CAIG**	**F; G**	5:1	420 bar	0

Series 1		Series 3		Series 4				
T-22A		T-23A		T-24A				
120 L/min.		240 L/min.		480 L/min.				
Model Code	Adjustment Range	Model Code	Adjustment Range	Model Code	Adjustment Range	Pilot Ratio	Max. Setting Depends on Pressure Range	Influence of Back Pressure
CWEK	**H; I**	**CWGK**	**H; I**	**CWIK**	**H; I**	1:1	280 bar	0
CWEL	**F; G**	**CWGL**	**F; G**	**CWIL**	**F; G**	2:1	420 bar	0
CWEA	**H; I**	**CWGA**	**H; I**	**CWIA**	**H; I**	3:1	280 bar	0
CWEG	**F; G**	**CWGG**	**F; G**	**CWIG**	**F; G**	5:1	420 bar	0

NON-VENTED, STANDARD, 280 BAR MAXIMUM SETTING, 3:1, 1.5:1, 2:1 PILOT RATIOS

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



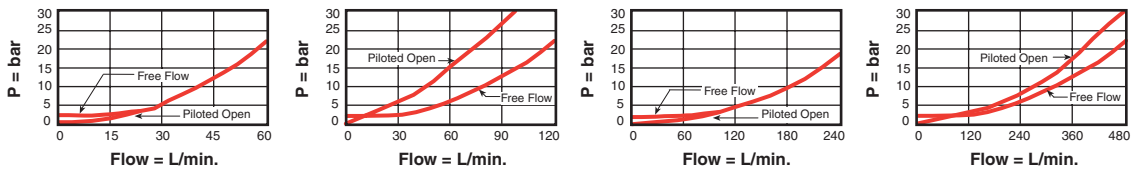


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*Installation Torque (Nm)*
60 L/min.	**CBCA – LHN**	T - 11A	35,1	22,2	49,8	58,2	45 - 50
120 L/min.	**CBEA – LHN**	T - 2A	35,1	28,6	60,5	63,5	60 - 70
240 L/min.	**CBGA – LHN**	T - 17A	46,0	31,8	69,9	84,1	200 - 215
480 L/min.	**CBIA – LHN**	T - 19A	63,5	41,3	89,9	103,9	465 - 500

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 215 bar.
- Maximum setting = 280 bar.
- Maximum valve leakage at reseat = 0,4 cc/mm.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when valve is standard set. Settings lower than the standard pressure may result in lower reseat percentage.
- 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.
- Two check valve cracking pressures are available. Use the 1,7 bar check unless actuator cavitation is a concern.

OPTION ORDERING INFORMATION

CB ** – *

Nominal Capacity

C 60 L/min.
E 120 L/min.
G 240 L/min.
I 480 L/min.

Version

A 3:1 Pilot Ratio
B 1.5:1 Pilot Ratio (Sealed Pilot)
Y 2:1 Pilot Ratio (Bleed through Pilot)

*Control***

L Standard Screw Adjustment
C* Tamper Resistant Factory Set

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Functional Setting Range

H 70 - 280 bar with 1,7 bar check Standard set at 210 bar
I 28 - 105 bar with 1,7 bar check Standard set at 70 bar
A 70 - 280 bar with 0,3 bar check Standard set at 210 bar
B 28 - 105 bar with 0,3 bar check Standard set at 70 bar

Seal Material

N Buna-N
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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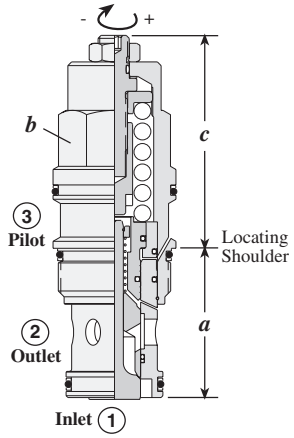
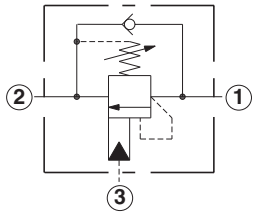
NON-VENTED, STANDARD, 350 BAR MAXIMUM SETTING, 4.5:1, 10:1, 2.3:1 PILOT RATIOS

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



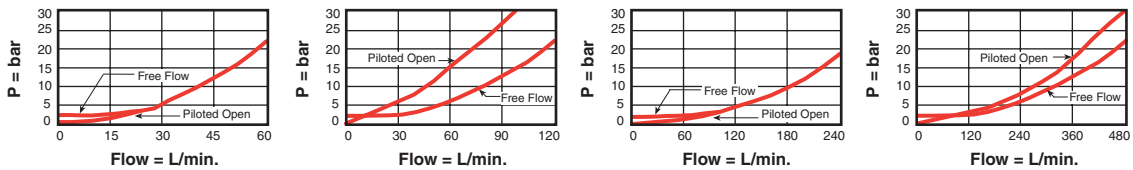


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (Nm)
60 L/min.	**CBCG – LJN**	T - 11A	35,1	22,2	50,0	58,2	45 - 50
120 L/min.	**CBEG – LJN**	T - 2A	35,1	28,6	60,5	63,5	60 - 70
240 L/min.	**CBGG – LJN**	T - 17A	46,0	31,8	69,9	84,1	200 - 215
480 L/min.	**CBIG – LJN**	T - 19A	63,5	41,3	89,9	103,9	465 - 500

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 270 bar.
- Maximum setting = 350 bar.
- Maximum valve leakage at reseat = 0,4 cc/mm.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when valve is standard set. Settings lower than the standard pressure may result in lower reseat percentage.
- 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.
- Two check valve cracking pressures are available. Use the 1,7 bar check unless actuator cavitation is a concern.

OPTION ORDERING INFORMATION

CB ** – *

Nominal Capacity

- **C** 60 L/min.
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version

- **G** 4.5:1 Pilot Ratio
- **H** 10:1 Pilot Ratio
- **L** 2.3:1 Pilot Ratio (Sealed Pilot)

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Functional Setting Range

- **J** 140 - 350 bar with 1,7 bar check Standard set at 210 bar
- **K** 70 - 175 bar with 1,7 bar check Standard set at 140 bar
- **C** 140 - 350 bar with 0,3 bar check Standard set at 210 bar
- **D** 70 - 175 bar with 0,3 bar check Standard set at 140 bar

Seal Material

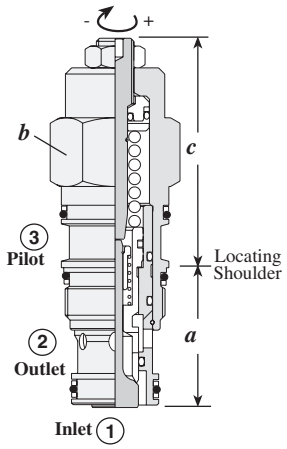
- **N** Buna-N
- **V** Viton

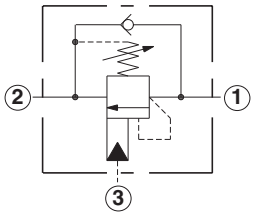
Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

NON-VENTED, SEMI-RESTRICTIVE, 280 BAR MAXIMUM SETTING, 1.5:1, 3:1 PILOT RATIOS

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



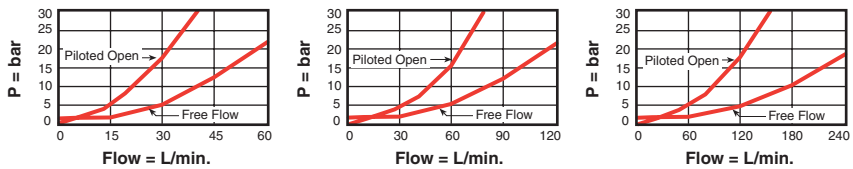


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (Nm)
40 L/min.	**CBBC – LHN**	T - 11A	35,1	22,2	50,0	58,2	45 - 50
80 L/min.	**CBDC – LHN**	T - 2A	35,1	28,6	60,5	63,5	60 - 70
160 L/min.	**CBFC – LHN**	T - 17A	46,0	31,8	69,9	84,1	200 - 215

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 215 bar.
- Maximum setting = 280 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when the valve is standard set. Settings lower than the standard sets pressure may result in lower reseat percentages.
- 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.
- Two check valve cracking pressures are available. Use the 1,7 bar check unless actuator cavitation is a concern.

OPTION ORDERING INFORMATION

CB ✱ ✱ – ✱ ✱ ✱

Nominal Capacity

B 40 L/min.

D 80 L/min.

F 160 L/min.

Version

C 3:1 Pilot Ratio (Sealed Pilot)

B 1.5:1 Pilot Ratio (Sealed Pilot)

Control**

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

** **Special setting required. Specify at time of order.***

*** **See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Functional Setting Range

H 70 - 280 bar with 1,7 bar check Standard set at 210 bar

I 28 - 105 bar with 1,7 bar check Standard set at 70 bar

A 70 - 280 bar with 0,3 bar check Standard set at 210 bar

B 28 - 105 bar with 0,3 bar check Standard set at 70 bar

Seal Material

N Buna-N

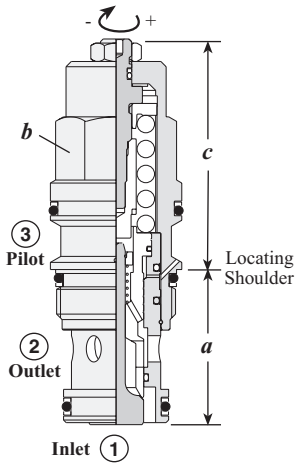
V Viton

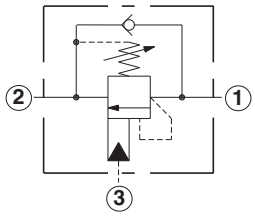
Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

NON-VENTED, SEMI-RESTRICTIVE, 350 BAR MAXIMUM SETTING, 4.5:1, 2.3:1 PILOT RATIOS

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



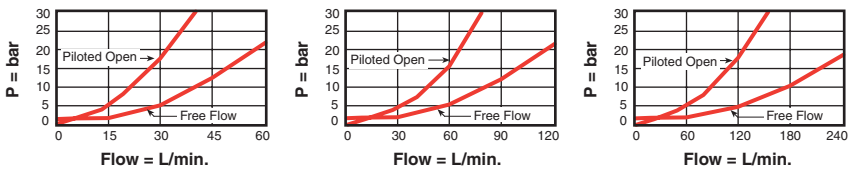


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*Installation Torque (Nm)*
40 L/min.	**CBBD – LJN**	T - 11A	35,1	22,2	49,8	58,2	45 - 50
80 L/min.	**CBDD – LJN**	T - 2A	35,1	28,6	60,5	63,5	60 - 70
160 L/min.	**CBFD – LJN**	T - 17A	46,0	31,8	69,9	84,1	200 - 215

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 270 bar.
- Maximum setting = 350 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when valve is standard set. Settings lower than the standard pressure may result in lower reseat percentage.
- 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.
- Two check valve cracking pressures are available. Use the 1,7 bar check unless actuator cavitation is a concern.

OPTION ORDERING INFORMATION

CB ✱ ✱ – ✱ ✱ ✱

Nominal Capacity
- **B** 40 L/min.
- **D** 80 L/min.
- **F** 160 L/min.

Version
- **D** 4.5:1 Pilot Ratio (Sealed Pilot)
- **L** 2.3:1 Pilot Ratio (Sealed Pilot)

Control**
- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Functional Setting Range
- **J** 140 - 350 bar with 1,7 bar check Standard set at 210 bar
- **K** 70 - 175 bar with 1,7 bar check Standard set at 140 bar
- **C** 140 - 350 bar with 0,3 bar check Standard set at 210 bar
- **D** 70 - 175 bar with 0,3 bar check Standard set at 140 bar

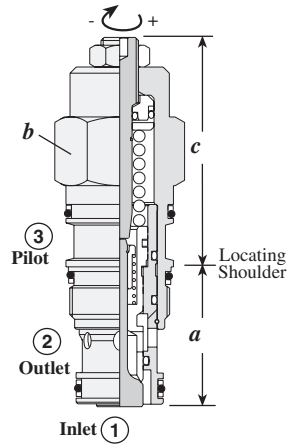
Seal Material
- **N** Buna-N
- **V** Viton

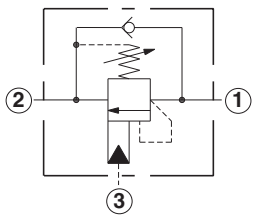
Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

NON-VENTED, RESTRICTIVE, 280 BAR MAXIMUM SETTING, 3:1, 2:1 PILOT RATIOS

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



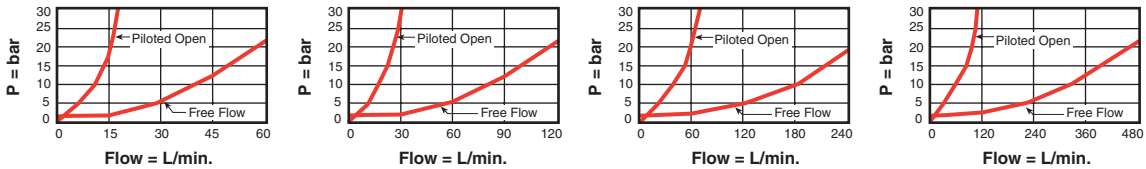


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (Nm)
15 L/min.	**CBBA – LHN**	T - 11A	35,1	22,2	50,0	58,2	45 - 50
30 L/min.	**CBDA – LHN**	T - 2A	35,1	28,6	60,5	63,5	60 - 70
60 L/min.	**CBFA – LHN**	T - 17A	46,0	31,8	69,9	84,1	200 - 215
80 L/min.	**CBHA – LHN**	T - 19A	63,5	41,3	89,9	103,9	465 - 500

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 215 bar.
- Maximum setting = 280 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when valve is standard set. Settings lower than the standard pressure may result in lower reseat percentage.
- 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.
- Restrictive valves have no relief capacity other than as a thermal relief.
- Two check valve cracking pressures are available. Use the 1,7 bar check unless actuator cavitation is a concern.

OPTION ORDERING INFORMATION

CB ✱✱ – ✱✱✱

Nominal Capacity

- **B** 15 L/min.
- **D** 30 L/min.
- **F** 60 L/min.
- **H** 80 L/min.

Version

- **A** 3:1 Pilot Ratio (Sealed Pilot)

CBBY only:

- **Y** 2:1 Pilot Ratio (Bleed through Pilot)

Control**

- **L** Standard Screw Adjustment
- **C***Tamper Resistant Factory Set

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Functional Setting Range

- **H** 70 - 280 bar with 1,7 bar check Standard set at 210 bar
- **I** 28 - 105 bar with 1,7 bar check Standard set at 70 bar
- **A** 70 - 280 bar with 0,3 bar check Standard set at 210 bar
- **B** 28 - 105 bar with 0,3 bar check Standard set at 70 bar

Seal Material

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

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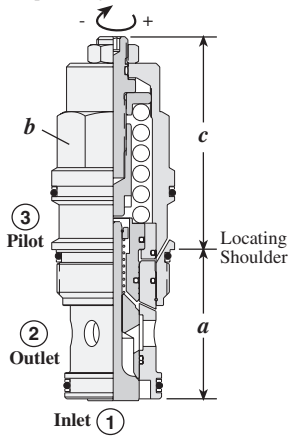
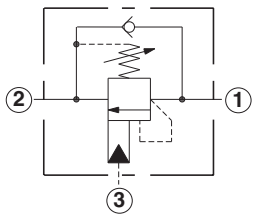
NON-VENTED, RESTRICTIVE, 350 BAR MAXIMUM SETTING, 4.5:1 PILOT RATIO

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



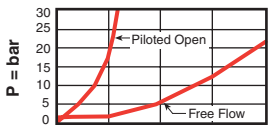


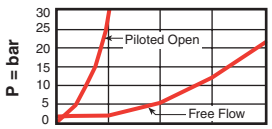
Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	Cartridge Dimensions b	Cartridge Dimensions c L	Cartridge Dimensions c C	Installation Torque (Nm)
15 L/min.	**CBBG – LJN**	T - 11A	35,1	22,2	50,0	58,2	45 - 50
30 L/min.	**CBDG – LJN**	T - 2A	35,1	28,6	60,5	63,5	60 - 70
60 L/min.	**CBFG – LJN**	T - 17A	46,0	31,8	69,9	84,1	200 - 215
80 L/min.	**CBHG – LJN**	T - 19A	63,5	41,3	89,9	103,9	465 - 500

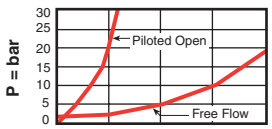
Performance Curves

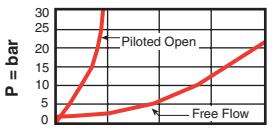
CBBG **CBDG** **CBFG** **CBHG**

Free Flow and Piloted Open Pressure Drop









- Maximum recommended load pressure at maximum setting = 270 bar.
- Maximum setting = 350 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when valve is standard set. Settings lower than the standard pressure may result in lower reseat percentage.
- 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.
- Restrictive valves have no relief capacity other than as a thermal relief.
- Two check valve cracking pressures are available. Use the 1,7 bar check unless actuator cavitation is a concern.

OPTION ORDERING INFORMATION

CB ✱ G – ✱ ✱ ✱

Nominal Capacity

- **B** 15 L/min.
- **D** 30 L/min.
- **F** 60 L/min.
- **H** 80 L/min.

Version

- **G** 4.5:1 Pilot Ratio (Sealed Pilot)

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Functional Setting Range

- **J** 140 - 350 bar with 1,7 bar check Standard set at 210 bar
- **K** 70 - 175 bar with 1,7 bar check Standard set at 140 bar
- **C** 140 - 350 bar with 0,3 bar check Standard set at 210 bar
- **D** 70 - 175 bar with 0,3 bar check Standard set at 140 bar

Seal Material

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

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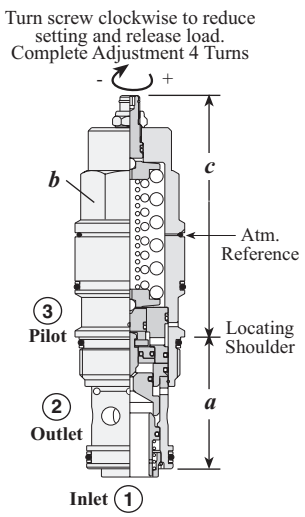
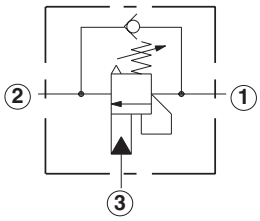
VENTED, ATMOSPHERICALLY REFERENCED, 3:1, 5:1, 1:1, 2:1 PILOT RATIOS



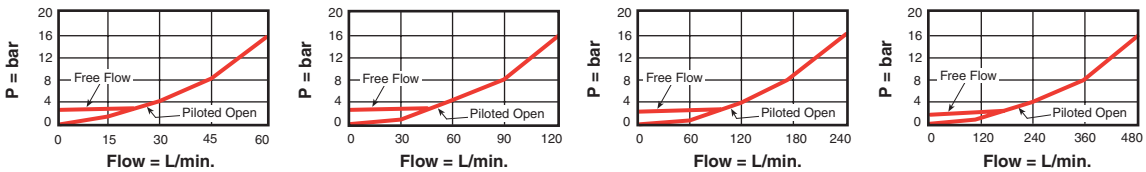


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (Nm)
60 L/min.	**CACA – LHN**	T - 11A	35,1	22,2	73,4	82,6	45 - 50
120 L/min.	**CAEA – LHN**	T - 2A	35,1	28,6	83,6	89,9	60 - 70
240 L/min.	**CAGA – LHN**	T - 17A	46,0	31,8	95,0	100,8	200 - 215
480 L/min.	**CAIA – LHN**	T - 19A	63,5	41,3	116,3	126,0	465 - 500

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = CA*A, CA*K: 215 bar, CA*G, CA*L: 320 bar.
- Maximum setting = CA*A, CA*K: 280 bar, CA*G, CA*L: 420 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Reverse flow check cracking pressure = CAC*: 2,8 bar, CAE*, CAG*: 1,7 bar, CAI*: 1,5 bar.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when the valve is standard set. Settings lower than the standards set pressure may result in lower reseats percentages.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.
- Approximately 1 drop of fluid will pass from the pilot area to the vented spring chamber every 4000 cycles.

OPTION ORDERING INFORMATION

CA ** – *

Nominal Capacity

- **C** 60 L/min.
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

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 Adjustment
- **C*** Tamper Resistant Factory Set

** **Special setting required. Specify at time of order.***

*** **See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Functional Setting Range

CA*A, CA*K, only:

- **H** 70 - 280 bar Standard set at 210 bar
- **I** 28 - 105 bar Standard set at 70 bar

CA*G, CA*L only:

- **F** 70 - 175 bar Standard set at 140 bar
- **G** 140 - 420 bar Standard set at 280 bar

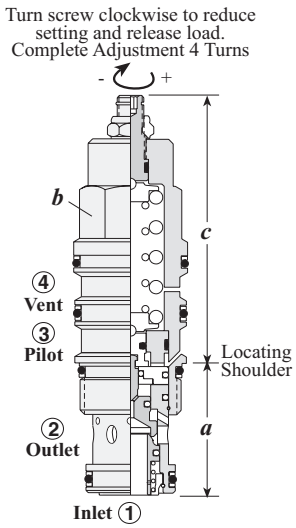
Seal Material

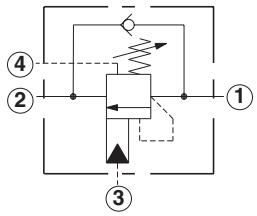
- **N** Buna-N
- **V** Viton

CA*A, CA*K, CA*G, CA*L:
Patent: U.S. #4,834,135

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

VENTED, 280 BAR MAXIMUM SETTING, 3:1, 1:1 PILOT RATIOS



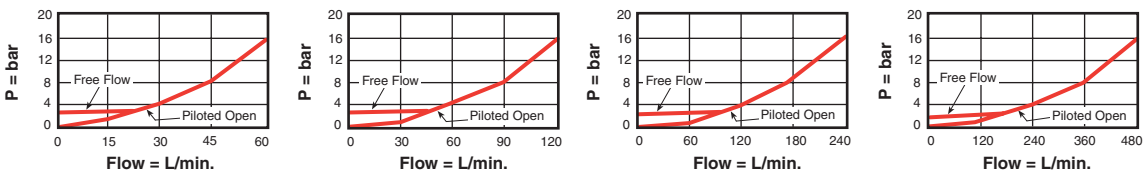


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (Nm)
60 L/min.	**CWCA– LHN**	T - 21A	34,9	22,2	74,0	82,6	40 - 50
120 L/min.	**CWEA– LHN**	T - 22A	34,9	28,6	84,0	90,0	60 - 70
240 L/min.	**CWGA– LHN**	T - 23A	46,0	31,8	95,3	101,0	200 - 215
480 L/min.	**CWIA – LHN**	T - 24A	63,5	41,3	117,0	126,0	465 - 500

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 215 bar.
- Maximum setting = 280 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Reverse flow check cracking pressure = CWC*: 2,8 bar, CWE*, CWG*: 1,7 bar, CWI*: 1,5 bar.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when the valve is standard set. Settings lower than the standards set pressure may result in lower reseats percentages.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.

OPTION ORDERING INFORMATION

CW * * – * * ***

Nominal Capacity

- **C** 60 L/min.
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version

- **A** 3:1 Pilot Ratio
- **K** 1:1 Pilot Ratio

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set

* ***Special setting required. Specify at time of order.***

Functional Setting Range

- **H** 70 - 280 bar Standard set at 210 bar
- **I** 28 - 105 bar Standard set at 70 bar

Seal Material

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

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

CW*A, CW*K:
Patent: U.S. #4,834,135

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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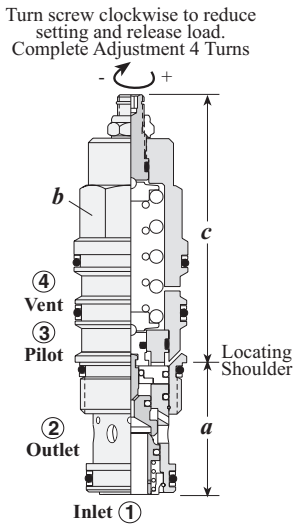
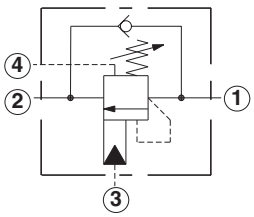
VENTED, 420 BAR MAXIMUM SETTING, 5:1, 2:1 PILOT RATIOS



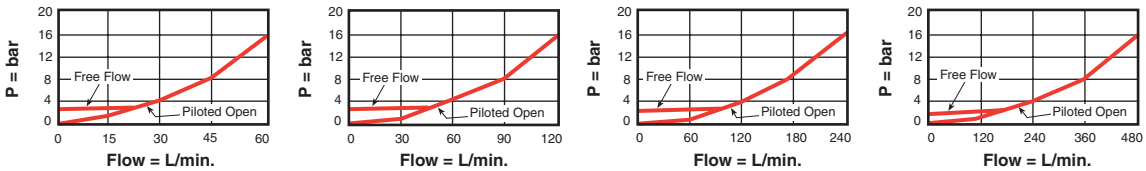


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	Installation Torque (Nm)
60 L/min.	**CWCG– LFN**	T - 21A	35,0	22,2	74,0	82,6	40 - 50
120 L/min.	**CWEG– LFN**	T - 22A	35,0	28,6	83,6	90,0	60 - 70
240 L/min.	**CWGG– LFN**	T - 23A	46,0	31,8	93,3	101,0	200 - 215
480 L/min.	**CWIG – LFN**	T - 24A	63,5	41,3	117,0	126,0	465 - 500

Performance Curves

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

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 320 bar.
- Maximum setting = 420 bar.
- Maximum valve leakage at reseat = 0,4 cc/min.
- Reverse flow check cracking pressure = CWC*: 2,8 bar, CWE*, CWG*: 1,7 bar, CWI*: 1,5 bar.
- Factory pressure setting established at 30 cc/min.
- Reseat exceeds 85% of set pressure when the valve is standard set. Settings lower than the standards set pressure may result in lower reseats percentages.
- Counterbalance valves should be set at least 1.3 times the maximum load induced pressure.

OPTION ORDERING INFORMATION

CW * * – * * *

Nominal Capacity
- **C** 60 L/min.
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version
- **G** 5:1 Pilot Ratio
- **L** 2:1 Pilot Ratio

Control**
- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set

* ***Special setting required. Specify at time of order.***

Functional Setting Range
- **F** 70 - 175 bar Standard set at 140 bar
- **G** 140 - 420 bar Standard set at 280 bar

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

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

CW*G, CW*L:
Patent: U.S. #4,834,135

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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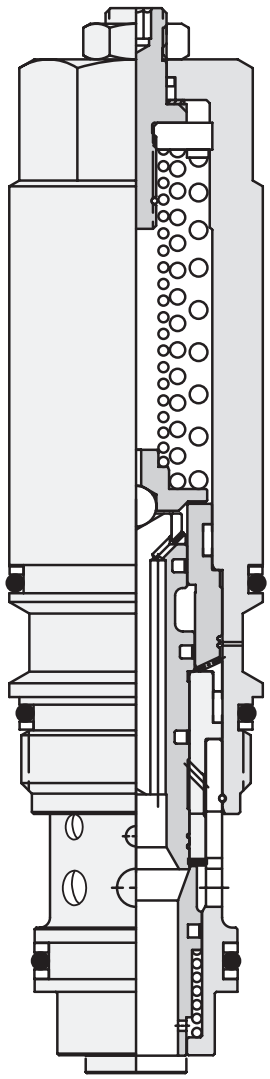
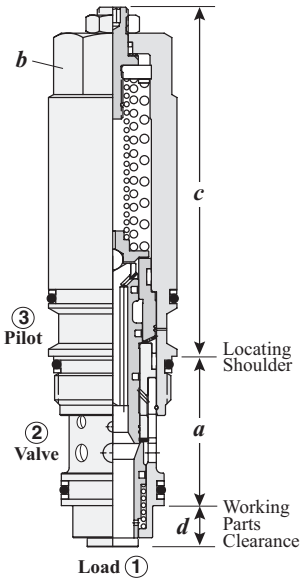
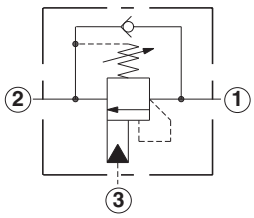
Load Control:
Load Reactive Cartridge Valves



NON-VENTED, 3:1, 1.5:1, 4.5:1 PILOT RATIOS



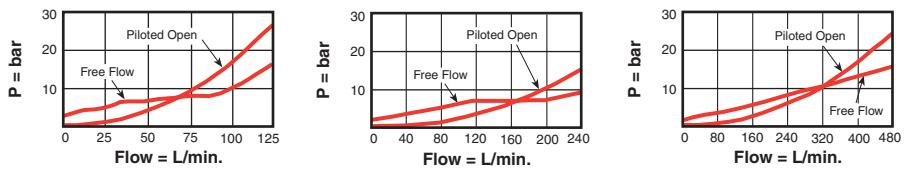


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*d*	*Installation Torque (Nm)*
120 L/min.	**MBEA – LHN**	T-2A	35,1	28,6	92,7	7,1	60 - 70
240 L/min.	**MBGA– LHN**	T-17A	46,2	31,8	107,5	9,4	200 - 215
480 L/min.	**MBIA – LHN**	T-19A	63,5	41,3	124,0	5,8	465 - 500

Performance Curves

MBE*-L **MBG*-L** **MBI*-L**

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 260 bar.
- Maximum setting = 350 bar.
- Factory pressure setting established at 30 cc/min.
- Maximum valve leakage at reseat = 0,3 cc/min.
- Reseat = >85% of set pressure.
- Reverse flow check cracking pressure = 2 bar.
- Load reactive load control valves should be set at least 1.3 times the maximum load induced pressure.
- Full clockwise lowest setting is 70 bar for the H range and 140 bar for the J range.
- Back pressure at port 2 adds to the effective relief setting at a ratio of 1 plus the pilot ratio times the back pressure.
- This valve is functionally a 3 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

OPTION ORDERING INFORMATION

M B ✱ ✱ – L ✱ ✱

Nominal Capacity

E 120 L/min.

G 240 L/min.

I 480 L/min.

Version

A 3:1 Pilot Ratio

B 1.5:1 Pilot Ratio

G 4.5:1 Pilot Ratio

Control

L Standard Screw Adjustment

MBEA, MBEB, MBEG only:

C* Tamper Resistant Factory Set

** Special setting required. Specify at time of order.*

Functional Setting Range

H 70 - 280 bar
Standard set at 210 bar

J 140 - 350 bar
Standard set at 210 bar

Customer specified special setting stamped on hex.

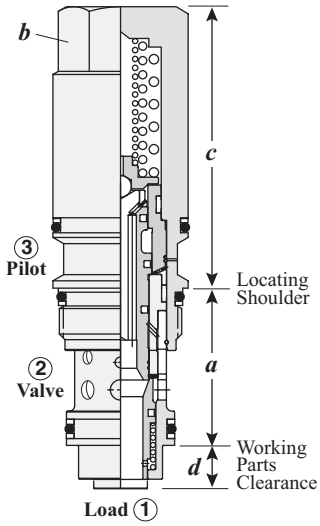
Seal Material

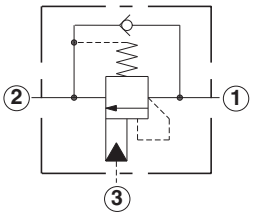
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

NON-VENTED, FIXED SETTING, 3:1, 1.5:1, 4.5:1 PILOT RATIOS



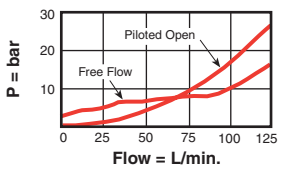


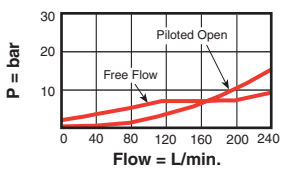
Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (Nm)
120 L/min.	**MBEA– XLN**	T-2A	35,1	28,6	67,6	7,1	60 - 70
240 L/min.	**MBGA– XLN**	T-17A	46,2	31,8	82,6	9,4	200 - 215
480 L/min.	**MBIA – XLN**	T-19A	63,5	41,3	124,0	5,8	465 - 500

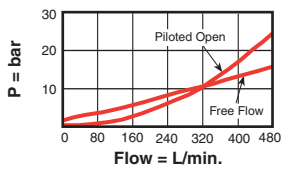
Performance Curves

MBE*-X **MBG*-X** **MBI*-X**

Free Flow and Piloted Open Pressure Drop







- Factory pressure setting established at 30 cc/min.
- Maximum valve leakage at reseat = 0,3 cc/min.
- Reseat = >85% of set pressure.
- Reverse flow check cracking pressure = 2 bar.
- Load reactive load control 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.
- Fixed setting valves have much wider cracking pressure ranges than adjustable setting valves, which can be set to within +/- 3,5 bar. The valve-to-valve cracking pressure for fixed setting valves can be large either side of the mean pressure, as indicated in the range selected.
  - 210 bar fixed setting: +20/-35 bar
  - 280 bar fixed setting: +20/-60 bar
  - 350 bar fixed setting: +20/-70 bar
- This valve is functionally a 3 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

OPTION ORDERING INFORMATION

MB ✱ ✱ – X ✱ ✱

Nominal Capacity

- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version

- **A** 3:1 Pilot Ratio
- **B** 1.5:1 Pilot Ratio
- **G** 4.5:1 Pilot Ratio

Control

- **X** Fixed

Factory Set

- **K** 210 bar Max. Recommended Load Pressure 160 bar Highest Cracking Pressure 210 bar
- **L** 280 bar Max. Recommended Load Pressure 215 bar Highest Cracking Pressure 300 bar
- **M** 350 bar Max. Recommended Load Pressure 270 bar Highest Cracking Pressure 370 bar

Seal Material

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

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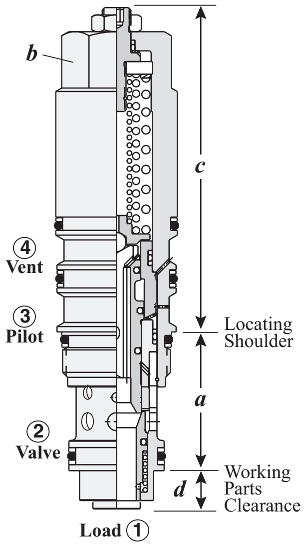
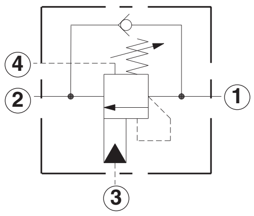
VENTED, 3:1, 1.5:1, 4.5:1 PILOT RATIOS



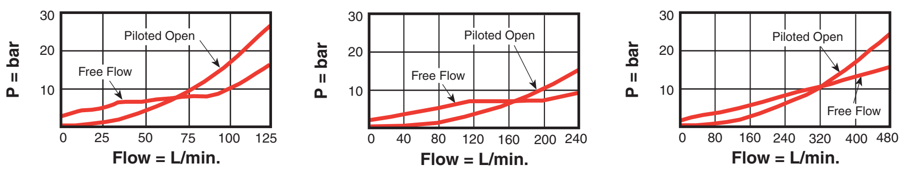


Capacity	Typical Cartridge Model Code	Cavity	*Cartridge Dimensions* a	b	c	d	Installation Torque (Nm)
120 L/min.	**MWEA– LHN**	T-22A	35,1	28,6	92,7	7,1	60 - 70
240 L/min.	**MWGA– LHN**	T-23A	46,2	31,8	107,5	9,4	200 - 215
480 L/min.	**MWIA – LHN**	T-24A	63,5	41,3	124,0	5,8	465 - 500

Performance Curves

MWE*-L **MWG*-L** **MWI*-L**

Free Flow and Piloted Open Pressure Drop



- Maximum recommended load pressure at maximum setting = 260 bar.
- Maximum setting = 350 bar.
- Factory pressure setting established at 30 cc/min.
- Maximum valve leakage at reseat = 0,3 cc/min.
- Reseat = >85% of set pressure.
- Reverse flow check cracking pressure = 2 bar.
- Load reactive load control valves should be set at least 1.3 times the maximum load induced pressure.
- This valve is functionally a 4 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.
- Full clockwise lowest setting is 70 bar for H range and 140 bar for J range.

OPTION ORDERING INFORMATION

MW * * – L * *

Nominal Capacity

E 120 L/min.

G 240 L/min.

I 480 L/min.

Version

A 3:1 Pilot Ratio

B 1.5:1 Pilot Ratio

G 4.5:1 Pilot Ratio

Control

L Standard Screw Adjustment

MWEA only:

C* Tamper Resistant Factory Set

** Special setting required. Specify at time of order.*

Functional Setting Range

H 70 - 280 bar Standard set at 210 bar

J 140 - 350 bar Standard set at 210 bar

Seal Material

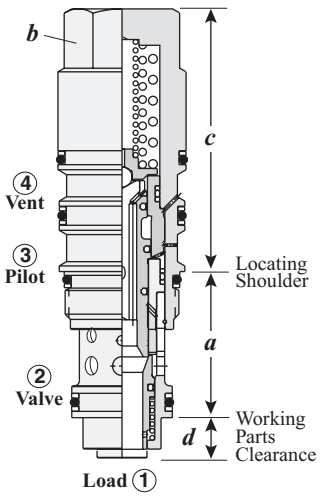
N Buna-N

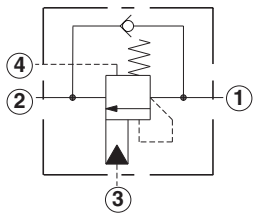
V Viton

Customer specified special setting stamped on hex.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

VENTED, FIXED SETTING, 3:1, 1.5:1, 4.5:1 PILOT RATIOS



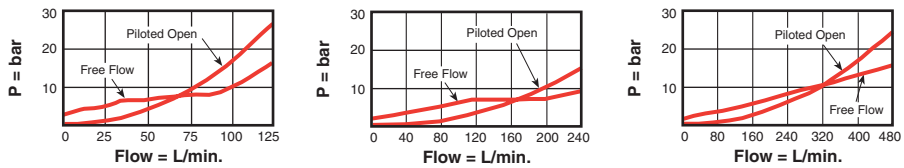


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (Nm)
120 L/min.	**MWEA– XLN**	T-22A	35,1	28,6	67,6	7,1	60 - 70
240 L/min.	**MWGA– XLN**	T-23A	46,2	31,8	82,6	9,4	200 - 215
480 L/min.	**MWIA – XLN**	T-24A	63,5	41,3	114,3	5,8	465 - 500

Performance Curves

MWE*-X **MWG*-X** **MWI*-X**

Free Flow and Piloted Open Pressure Drop



- Factory pressure setting established at 30 cc/min.
- Maximum valve leakage at reseat = 0,3 cc/min.
- Reseat = >85% of set pressure.
- Reverse flow check cracking pressure = 2 bar.
- Load reactive load control 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.
- Fixed setting valves have much wider cracking pressure ranges than adjustable setting valves, which can be set to within +/- 3,5 bar. The valve-to-valve cracking pressure for fixed setting valves can be large either side of the mean pressure, as indicated in the range selected.
  - 210 bar fixed setting: +20/-35 bar
  - 280 bar fixed setting: +20/-60 bar
  - 350 bar fixed setting: +20/-70 bar
- This valve is functionally a 4 port counterbalance valve. It seats as a poppet valve and modulates as a spool valve.

OPTION ORDERING INFORMATION

M W ✱ ✱ – X ✱ ✱

Nominal Capacity

E 120 L/min.

G 240 L/min.

I 480 L/min.

Version

A 3:1 Pilot Ratio

B 1.5:1 Pilot Ratio

G 4.5:1 Pilot Ratio

Control

X Fixed

Factory Set

K 210 bar
Max. Recommended Load Pressure 160 bar
Highest Cracking Pressure 210 bar

L 280 bar
Max. Recommended Load Pressure 215 bar
Highest Cracking Pressure 300 bar

M 350 bar
Max. Recommended Load Pressure 270 bar
Highest Cracking Pressure 370 bar

Seal Material

N Buna-N

V Viton

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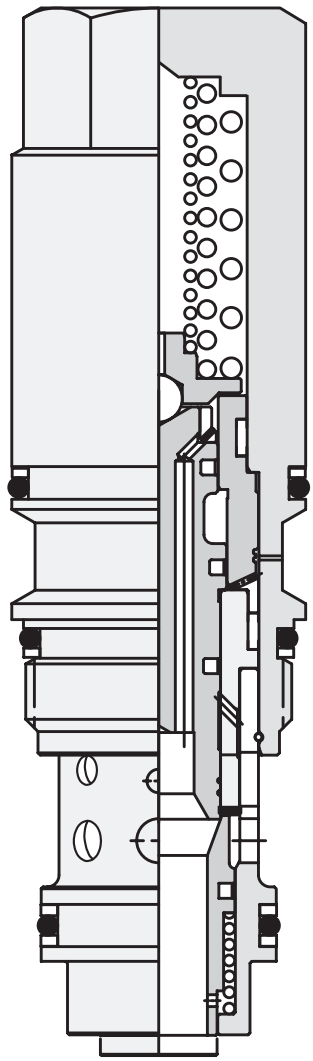
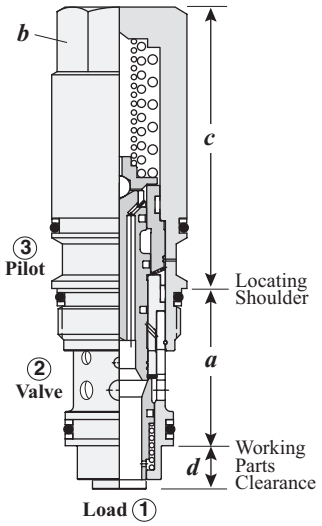
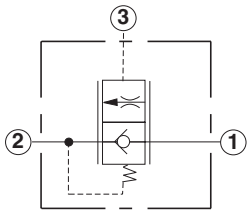
NOTES

Load Control:
Balanced Cartridge Valves



NON-VENTED, NON-RELIEVING



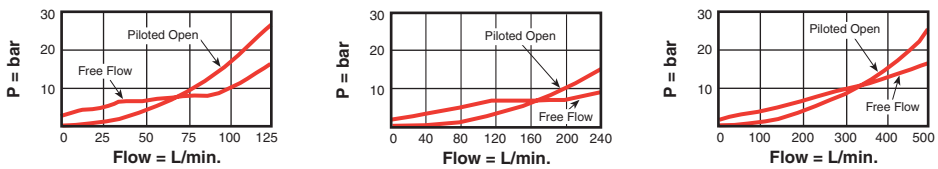


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (Nm)*
120 L/min.	**MBEM– XIN**	T-2A	35,1	28,6	92,7	7,1	60 - 70
240 L/min.	**MBGM– XIN**	T-17A	46,2	31,8	107,5	12,7	200 - 215
480 L/min.	**MBIM – XIN**	T-19A	63,5	41,3	114,3	5,8	465 - 500

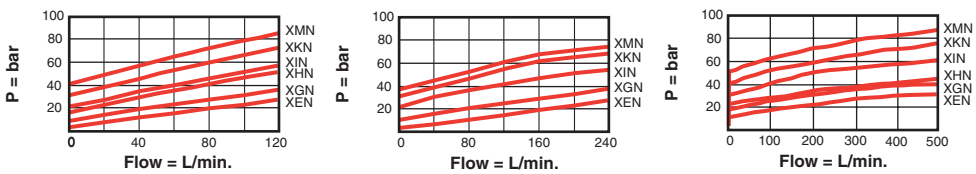
Performance Curves

MBEM-X **MBGM-X** **MBIM-X**

Free Flow and Piloted Open Pressure Drop



Pilot Pressure vs. Flow (70 bar Load Pressure)



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = I, K, M ranges: 0,4 cc/min. at 14 bar below cracking pressure; E, G, H ranges: 50 cc/min. at 3,5 bar below cracking pressure.
- Reverse flow check cracking pressure = 2 bar.
- Back pressure at port 2 directly opposes pilot pressure at port 3.
- This valve has no relief function, not even thermal expansion relief.
- This valve is balanced against load pressures and therefore exhibits self-compensation. Flow is controlled by the pilot pressure. Because of dynamic seals, performance is best in the meter-out mode with port 1 being the load and port 2 being tank.

OPTION ORDERING INFORMATION

M B ✱ M – X ✱ ✱

Nominal Capacity
- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version
- **M** Non-vented, Sealed Pilot

Control
- **X** Not Adjustable

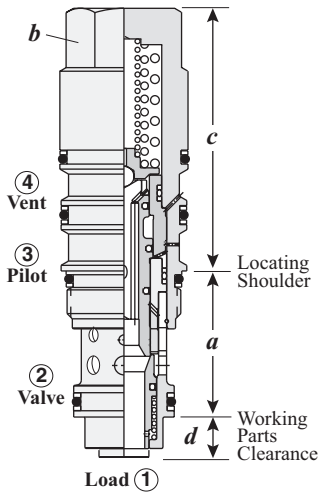
Minimum Control Pressure
- **E** 5 bar
- **G** 10,5 bar
- **I** 20 bar
- **K** 33 bar
- **M** 36,7 bar

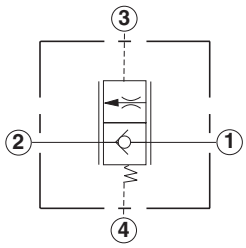
Available with MBEM-X, MBIM-X only:
- **H** 14 bar

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

VENTED, NON-RELIEVING



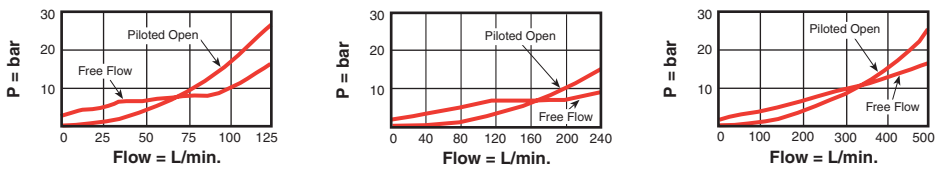


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (Nm)*
120 L/min.	**MWEM– XIN**	T-22A	35,1	28,6	92,7	7,1	60 - 70
240 L/min.	**MWGM–XIN**	T-23A	46,2	31,8	107,5	9,4	200 - 215
480 L/min.	**MWIM – XIN**	T-24A	63,5	41,3	114,3	5,8	465 - 500

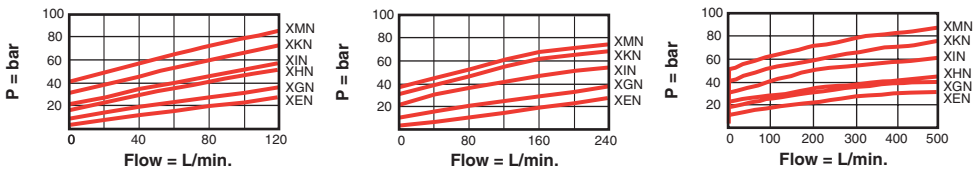
Performance Curves

MWEM-X **MWGM-X** **MWIM-X**

Free Flow and Piloted Open Pressure Drop



Pilot Pressure vs. Flow (70 bar Load Pressure)



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = I, K, M ranges: 0,4 cc/min. at 14 bar below cracking pressure; E, G, H ranges: 50 cc/min. at 3,5 bar below cracking pressure.
- Reverse flow check cracking pressure = 2 bar.
- This valve has no relief function, not even thermal expansion relief.
- This valve is balanced against load pressures and therefore exhibits self-compensation. Flow is controlled by the pilot pressure. Because of dynamic seals, performance is best in the meter-out mode with port 1 being the load and port 2 being tank.

OPTION ORDERING INFORMATION

M W* M – X * *

Nominal Capacity

- **E** 120 L/min.
- **G** 240 L/min.
- **I** 480 L/min.

Version

- **M** Vented, Sealed Pilot

Control

- **X** Not Adjustable

Minimum Control Pressure

- **E** 5 bar
- **G** 10,5 bar
- **I** 20 bar
- **K** 33 bar
- **M** 36,7 bar

Available with MWEM-X, MWIM-X only:

- **H** 14 bar

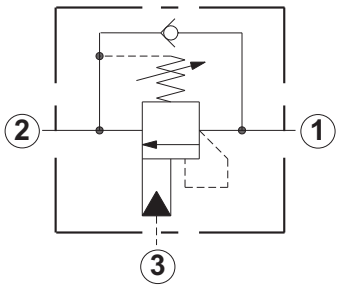
Seal Material

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

SUN FIXED SETTING COUNTERBALANCE VALVES FEATURE LOWER PROFILE

Sun recently introduced four new, standard fixed setting counterbalance valves in the series 1 frame size (T-11A cavity). These valves are pre-set to a nominal value at the factory and are offered with a 1,7 bar integral check. Because there is no adjustment mechanism in these cartridges, they are approximately 40% shorter than adjustable versions (dimension from locating shoulder of cartridge to end of hex body).



COUNTERBALANCE CARTRIDGE VALVES, NON-VENTED, FIXED SETTING

	Model Code	*Pilot Ratio*
	T-11A	
	40 L/min.	
Semi-restrictive	**CBBL-X****	2.3:1
	CBBC-X**	3:1
	CBBD-X**	4.5:1
	10 L/min.	
Restrictive	**CBAB-X****	1.5:1
	CBAA-X**	3:1
	20 L/min.	
Restrictive	**CBBA-X****	3:1
	CBBG-X**	4.5:1
	60 L/min.	
Standard	**CBCL-X****	2.3:1
	CBCA-X**	3:1
	CBCG-X**	4.5:1
	CBCH-X**	10:1

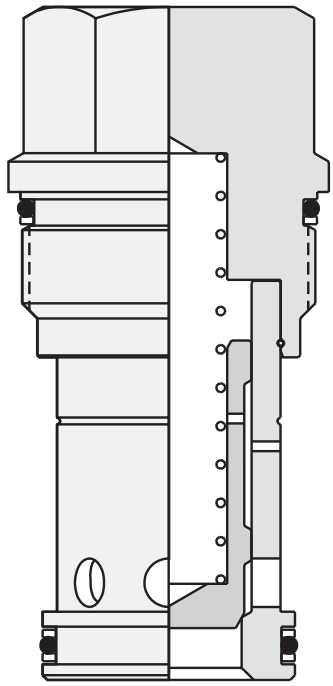
Other alternatives are available as custom part numbers. Contact your Sun Distributor for more information.

For detailed information on these new fixed setting counterbalance cartridges consult

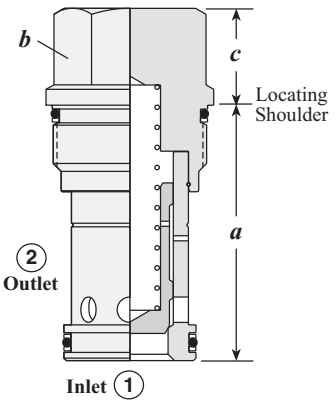
www.sunhydraulics.com

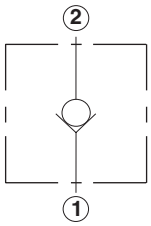
Products: Cartridges: Counterbalance: View All Counterbalance Cartridges

Check Cartridge Valves



FREE FLOW, NOSE-TO-SIDE



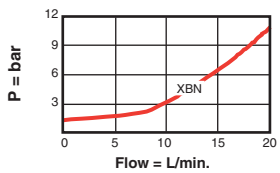


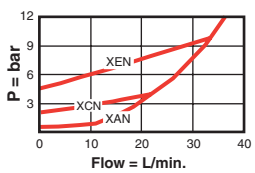
Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (Nm)
20 L/min.	**CXAA – XBN**	T - 8A	19,1	22,2	11,4	35 - 40
40 L/min.	**CXBA – XCN**	T - 162A	31,0	19,1	20,8	35 - 40
80 L/min.	**CXDA – XCN**	T - 13A	35,1	22,2	19,1	45 - 50
160 L/min.	**CXFA – XCN**	T - 5A	41,1	28,6	17,5	60 - 70
320 L/min.	**CXHA – XCN**	T - 16A	62,0	31,8	24,6	200 - 215
640 L/min.	**CXJA – XCN**	T - 18A	79,5	41,3	30,2	465 - 500

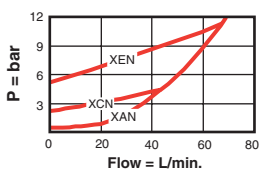
Performance Curves

CXAA **CXBA** **CXDA**

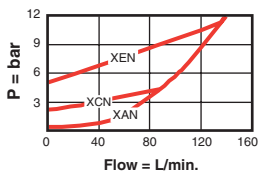
Typical Pressure Drop

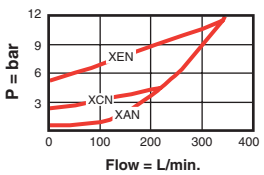


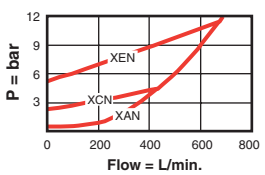




CXFA **CXHA** **CXJA**







- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Will accept 350 bar at ports 1 and 2.
- Caution: CX*A two port nose-to-side check valves and CX*D side-to-nose valves (shown in this catalogue section) share the same cavities and are mechanically interchangeable, but have opposite flow paths.

OPTION ORDERING INFORMATION

CX ✱ A – ✱ ✱ ✱

Nominal Capacity	*Control*	*Cracking Pressure*	*Seal Material*
A 20 L/min.	**X** Not Adjustable	**A** 0,3 bar	**N** Buna-N
B 40 L/min.		**B** 1 bar	**V** Viton
D 80 L/min.		**C** 2 bar	
F 160 L/min.		**D** 3,5 bar	
H 320 L/min.		**E** 5 bar	
J 640 L/min.		**F** 7 bar	
		Only Available Cracking Pressure for CXAA: **B** 1 bar	

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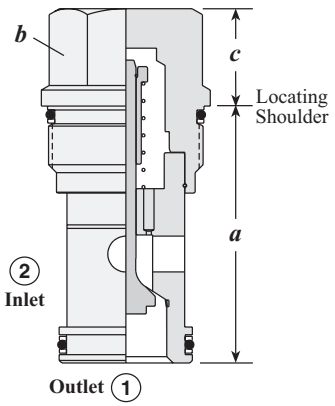
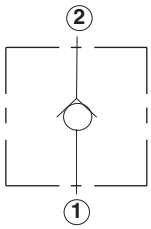
FREE FLOW, SIDE-TO-NOSE



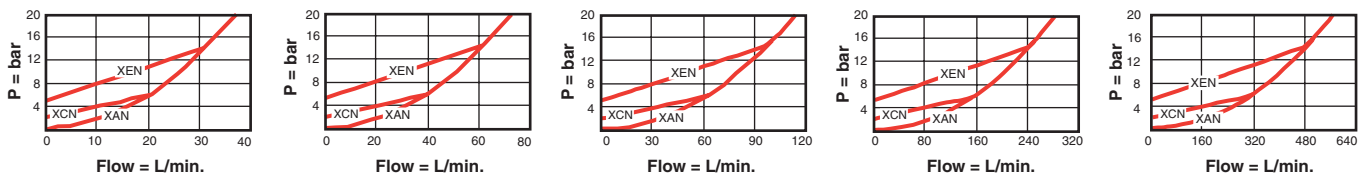


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (Nm)
30 L/min.	**CXAD – XCN**	T - 162A	31,0	19,1	20,8	35 - 40
60 L/min.	**CXCD – XCN**	T - 13A	35,1	22,2	19,1	45 - 50
120 L/min.	**CXED – XCN**	T - 5A	41,1	28,6	17,5	60 - 70
240 L/min.	**CXGD – XCN**	T - 16A	62,0	31,8	24,6	200 - 215
480 L/min.	**CXID – XCN**	T - 18A	79,5	41,3	30,2	465 - 500

Performance Curves

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

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Will accept 350 bar at ports 1 and 2.
- Caution: CX*A two port nose-to-side check valves and CX*D side-to-nose valves (shown in this catalogue section) share the same cavities and are mechanically interchangeable, but have opposite flow paths.

OPTION ORDERING INFORMATION

CX ✱ D – ✱ ✱ ✱

Nominal Capacity	*Control***	*Cracking Pressure*	*Seal Material*
A 30 L/min.	**X** Not Adjustable	**A*** 0,3 bar	**N** Buna-N
C 60 L/min.		**B** 1 bar	**V** Viton
E 120 L/min.		**C*** 2 bar	
G 240 L/min.		**D*** 3,5 bar	
I 480 L/min.		**E*** 5 bar	
		F 7 bar	

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

*** See page 178 for information on Control Options*

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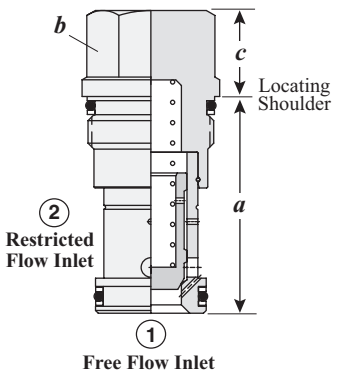
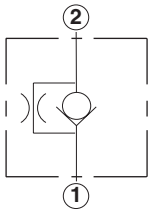
FREE FLOW, NOSE-TO-SIDE WITH BYPASS ORIFICE



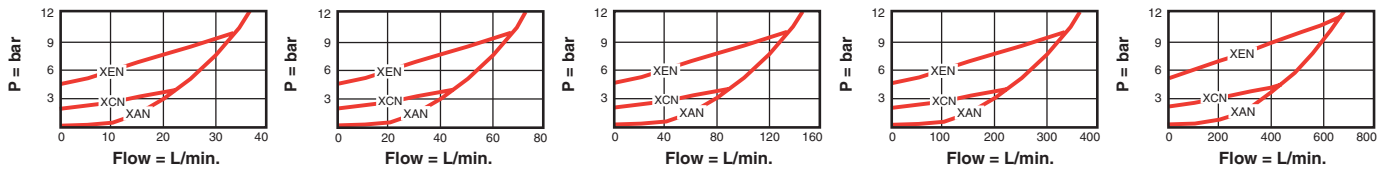


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
30 L/min.	**CNBC – XCN**	T - 162A	31,0	19,1	20,8	35 - 40
60 L/min.	**CNDC – XCN**	T - 13A	35,1	22,2	19,1	45 - 50
120 L/min.	**CNFC – XCN**	T - 5A	41,4	28,6	17,5	60 - 70
240 L/min.	**CNHC – XCN**	T - 16A	61,7	31,8	24,6	200 - 215
480 L/min.	**CNJC – XCN**	T - 18A	79,5	41,3	30,2	465 - 500

Performance Curves

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

Typical Pressure Drop
Performance Data Shown Reflects Blocked Orifice



- Maximum operating pressure = 350 bar.
- Will accept 350 bar at ports 1 and 2.
- Two port check valves share the same cavity for a given frame size; however, pay close attention as flow paths maybe in opposite directions.

OPTION ORDERING INFORMATION

CN ✱ C – ✱ ✱ ✱

Nominal Capacity	*Control***	*Cracking Pressure**	*Seal Material*
B 30 L/min.	**X** Not Adjustable	**A** 0,3 bar	**N** Buna-N
D 60 L/min.		**B** 1 bar	**V** Viton
F 120 L/min.		**C** 2 bar	
H 240 L/min.		**D** 3,5 bar	
J 480 L/min.		**E** 5 bar	
		F 7 bar	

*** Customer specified orifice setting stamped on hex:***

Orifice Setting:
CNBC: 0,4 - 1,6 mm.
CNDC: 0.4 - 2,7 mm.
CNFC: 0,4 - 3,2 mm.
CNHC: 0,4 - 6,4 mm.
CNJC: 0,4 - 9,0 mm.

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*** See page 178 for information on Control Options*

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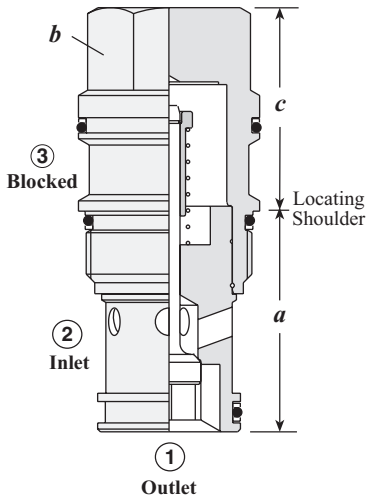
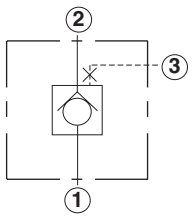
FREE FLOW, SIDE-TO-NOSE, PORT 3 BLOCKED



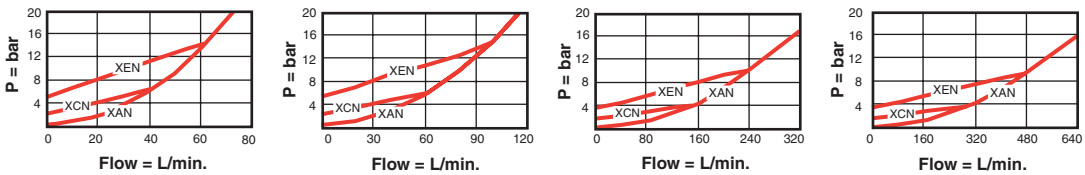


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (Nm)
60 L/min.	**CXCE – XCN**	T - 11A	35,1	22,2	30,2	45 - 50
120 L/min.	**CXEE – XCN**	T - 2A	35,1	28,6	35,1	60 - 70
240 L/min.	**CXGE – XCN**	T - 17A	46,0	31,8	46,0	200 - 215
480 L/min.	**CXIE – XCN**	T - 19A	63,5	41,3	58,7	465 - 500

Performance Curves

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

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Will accept 350 bar at ports 1 and 2.
- Caution: CX*A two port nose-to-side check valves and CX*D side-to-nose valves (shown in this catalogue section) share the same cavities and are mechanically interchangeable, but have opposite flow paths.

OPTION ORDERING INFORMATION

CX ✱ E – ✱ ✱ ✱

Nominal Capacity	*Control***	*Cracking Pressure*	*Seal Material*
C 60 L/min.	**X** Not Adjustable	**A** 0,3 bar	**N** Buna-N
E 120 L/min.		**B** 1 bar	**V** Viton
G 240 L/min.		**C** 2 bar	
I 480 L/min.		**D** 3,5 bar	
		E 5 bar	
		F 7 bar	

*** See page 178 for information on Control Options*

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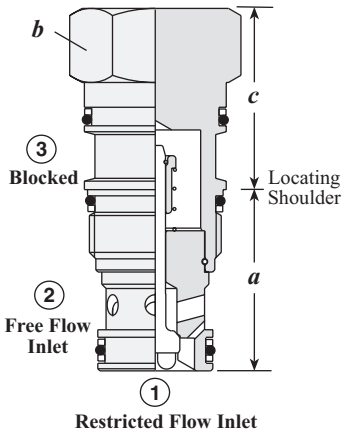
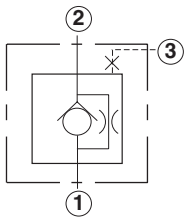
FREE FLOW, SIDE-TO-NOSE, WITH BYPASS ORIFICE, PORT 3 BLOCKED



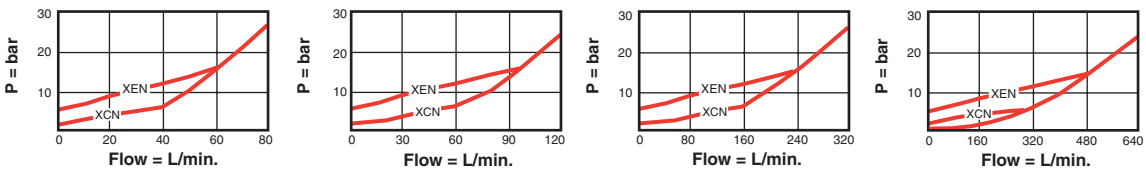


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
60 L/min.	**CNCD – XCN**	T - 11A	35,1	22,2	30,2	45 - 50
120 L/min.	**CNED – XCN**	T - 2A	35,1	28,6	35,1	60 - 70
240 L/min.	**CNGD – XCN**	T - 17A	46,0	31,8	46,0	200 - 215
480 L/min.	**CNID – XCN**	T - 19A	63,5	41,3	58,7	465 - 500

Performance Curves

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

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Will accept 350 bar at ports 1 and 2.
- When used in a full time regeneration circuit, these valves allow full force to be developed by the cylinder when it comes to a stop. The bypass orifice drops the rod end pressure to zero when flow out of the rod stops.

OPTION ORDERING INFORMATION

CN ✱ D – ✱ ✱ ✱

Nominal Capacity	*Control***	*Cracking Pressure**	*Seal Material*
C 60 L/min.	**X** Not Adjustable	**A** 0,3 bar	**N** Buna-N
E 120 L/min.		**B** 1 bar	**V** Viton
G 240 L/min.		**C** 2 bar	
I 480 L/min.		**D** 3,5 bar	
		E 5 bar	
		F 7 bar	

*** Customer specified orifice effective diameter stamped on hex:*

Orifice Diameter Range:
CNCD: 0.4 - 3,9 mm
CNED: 0,4 - 3,4 mm
CNGD: 0,4 - 5,5 mm
CNID: 0,4 - 5,5 mm

*** See page 178 for information on Control Options*

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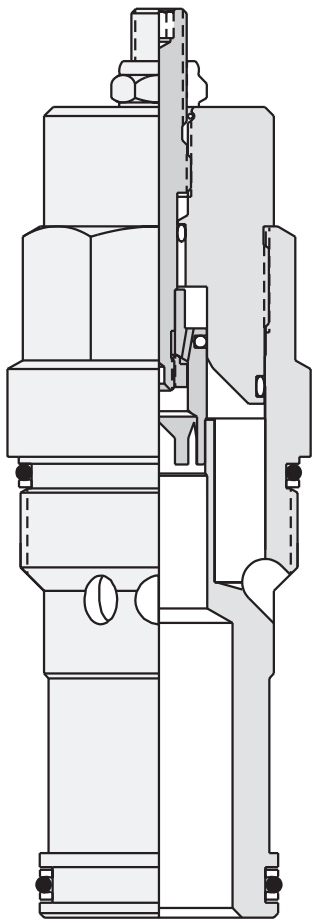
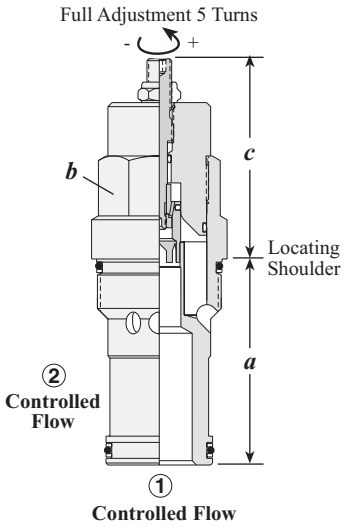
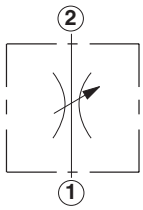
Flow Control Valves



FULLY ADJUSTABLE NEEDLE



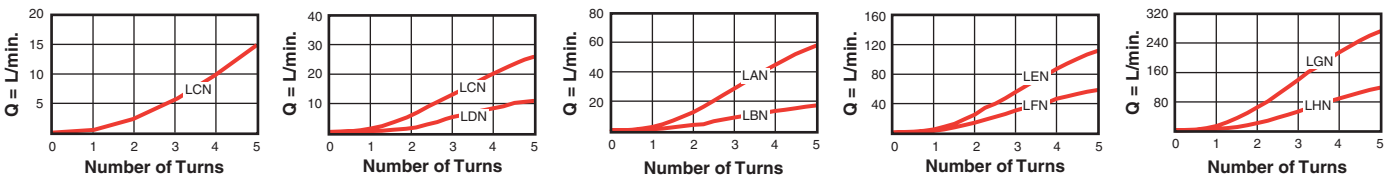


Maximum Nominal Orifice	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					L	H	K	
4,0 mm dia.	**NFBC – LCN**	T - 162A	31,0	19,1	40,4	-	43,9	35 - 40
4,8 mm dia.	**NFCC – LCN**	T - 13A	35,0	22,2	57,7	63,2	63,5	45 - 50
6,4 mm dia.	**NFDC – LAN**	T - 5A	41,4	28,6	59,7	71,6	69,3	60 - 70
9,7 mm dia.	**NFEC – LEN**	T - 16A	62,0	31,8	67,6	77,7	74,7	200 - 215
14,2 mm dia.	**NFFC – LGN**	T - 18A	79,5	41,3	84,1	88,9	88,1	465 - 500

Performance Curves

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

Adjustment Sensitivity at 7 bar Differential



- Maximum operating pressure = 350 bar.
- Because needle valves are non-compensating devices, the fixed orifice size will regulate flow through the valve in proportion to the square root of the pressure differential across ports 1 and 2.
- The sharp edged orifice design minimizes flow variations due to viscosity changes.
- There is no leakage when the adjustment mechanism is turned to the shut-off position.

OPTION ORDERING INFORMATION

NF ✱ C – ✱ ✱ ✱

Maximum Nominal Orifice

- **B** 4,0 mm dia.
- **C** 4,8 mm dia.
- **D** 6,3 mm dia.
- **E** 9,6 mm dia.
- **F** 14,2 mm dia.

Control**

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

* *Not Available on NFBC*

Maximum Orifice Diameter

NFBC
- **C** 4 mm

NFCC
- **C** 4,8 mm
- **D** 2,3 mm

NFDC
- **A** 6,4 mm
- **B** 3,0 mm

NFEC
- **E** 9,7 mm
- **F** 7,1 mm

NFFC
- **G** 14,2 mm
- **H** 9,6 mm

Seal Material

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

** *See page 178 for information on Control Options*

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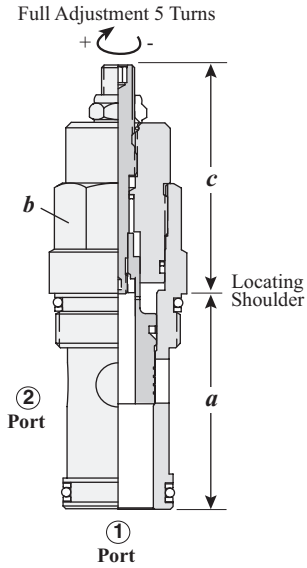
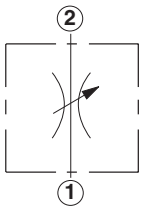
FULLY ADJUSTABLE NEEDLE, HIGH CAPACITY





Nominal Orifice	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					L	H	K	
8,4 mm dia.	**NFCD – LFN**	T - 13A	35,0	22,2	57,4	62,5	63,2	45 - 50
12,7 mm dia.	**NFDD – LGN**	T - 5A	41,4	28,6	59,7	71,4	69,1	60 - 70
17,5 mm dia.	**NFED – LHN**	T - 16A	62,0	31,8	67,6	77,7	74,7	200 - 215
21,6 mm dia.	**NFFD – LIN**	T - 18A	79,5	41,3	84,1	88,9	88,1	465 - 500

- Maximum operating pressure = 350 bar.
- Because needle valves are non-compensating devices, the fixed orifice size will regulate flow through the valve in proportion to the square root of the pressure differential across ports 1 and 2.
- A balanced adjustment mechanism allows for easy adjustment even at high pressures.
- The sharp edged orifice design minimizes flow variations due to viscosity changes.
- The flow path through this valve is bi-directional. The preferred path is port 1 to 2, to allow interchangeability with other flow controls.
- There is no leakage when the adjustment mechanism is turned to the shut-off position.

OPTION ORDERING INFORMATION

NF ✱ D – ✱ ✱ ✱

Nominal Orifice

C 8,4 mm dia.
D 12,7 mm dia.
E 17,5 mm dia.
F 21,6 mm dia.

Control**

L Standard Screw Adjustment
H Calibrated Detent Lock Handknob with
K Handknob with Lock Knob

Maximum Orifice Diameter

NFCD
F 8,4 mm

NFDD
G 12,7 mm

NFED
H 17,5 mm

NFFD
I 21,6 mm

Seal Material

N Buna-N
V Viton

*** See page 178 for information on Control Options*

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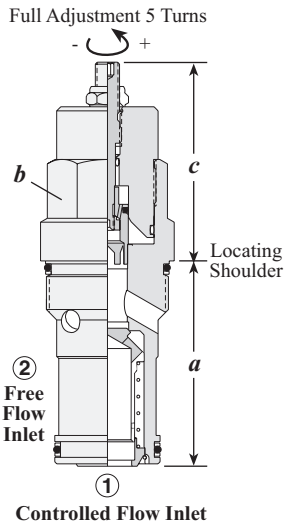
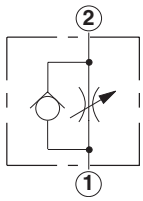
FULLY ADJUSTABLE NEEDLE WITH REVERSE FLOW CHECK, HIGH CAPACITY



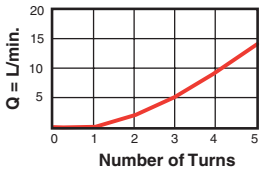


Maximum Nominal Orifice	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* H	*c* K	*Installation Torque (Nm)*
4,0 mm dia.	**NCBB – LCN**	T - 162A	31,0	19,1	40,4	-	43,9	35 - 40
1,5 mm dia.	**NCCD – LCN**	T - 13A	35,0	22,2	57,7	63,2	63,5	45 - 50
4,8 mm dia.	**NCCB – LCN**	T - 13A	35,0	22,2	57,7	63,2	63,5	45 - 50
6,3 mm dia.	**NCEB – LCN**	T - 5A	41,4	28,6	59,7	71,6	69,3	60 - 70
9,7 mm dia.	**NCFB – LCN**	T - 16A	62,0	31,8	67,6	77,7	74,7	200 - 215
14,2 mm dia.	**NCGB – LCN**	T - 18A	79,5	41,3	84,1	88,9	88,1	465 - 500

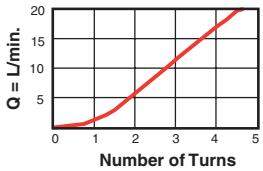
Performance Curves

Adjustment Sensitivity at 7 bar Differential

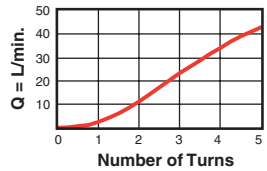
NCBB



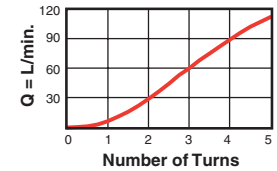
NCC*



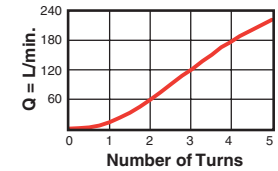
NCE*



NCF*



NCG*



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,4 cc/min.
- Because needle valves are non-compensating devices, the fixed orifice size will regulate flow through the valve in proportion to the square root of the pressure differential across ports 1 and 2.
- The sharp edged orifice design minimizes flow variations due to viscosity changes.

OPTION ORDERING INFORMATION

NC ✱ ✱ – ✱ C ✱

Maximum Nominal Orifice

NCBB* 4,0 mm dia.

NCCB 4,8 mm dia.
NCCC 2,3 mm dia.
NCCD 1,5 mm dia.

NCEB 6,3 mm dia.
NCEC 3,2 mm dia.

NCFB 9,7 mm dia.
NCFC 7,1 mm dia.

NCGB 14,2 mm dia.
NCGC 9,6 mm dia.

Version

B High Capacity

C Low Capacity

D Low Capacity

*Control***

L Standard Screw Adjustment

H Calibrated Handknob with Detent Lock

K Handknob with Lock Knob

Cracking Pressure Reverse Flow Check

A* 0,3 bar

B* 1,0 bar

C 2,0 bar

D* 3,5 bar

E* 5,0 bar

* *Cracking Pressure Ranges A, B, D, and E are not available for NCBB, T-162A cavity.*

Seal Material

N Buna-N

V Viton

** *See page 178 for information on Control Options*

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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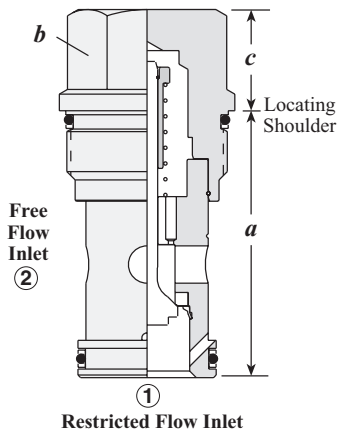
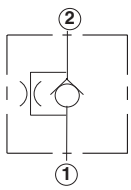
FIXED ORIFICE, NON-PRESSURE COMPENSATED, WITH REVERSE FLOW CHECK



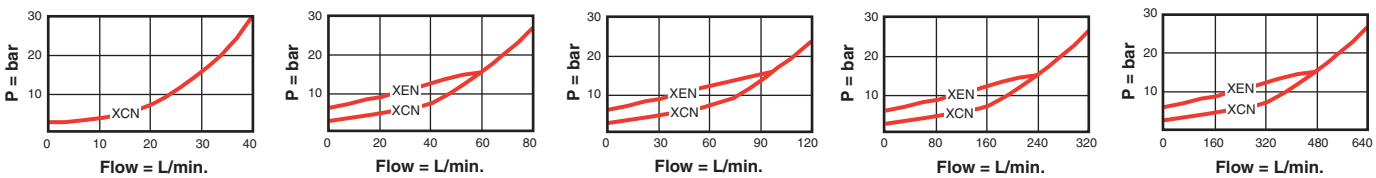


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
30 L/min.	**CNAC – XCN**	T - 162A	31,0	19,1	20,8	35 - 40
60 L/min.	**CNCC – XCN**	T - 13A	35,1	22,2	19,1	45 - 50
120 L/min.	**CNEC – XCN**	T - 5A	41,1	28,6	17,5	60 - 70
240 L/min.	**CNGC – XCN**	T - 16A	62,0	31,8	24,6	200 - 215
480 L/min.	**CNIC – XCN**	T - 18A	79,5	41,3	30,2	465 - 500

Performance Curves

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

Maximum Reverse Free Flow Pressure Drop



- Maximum operating pressure = 350 bar.
- There are essentially check valves with bypass orifices. The flow path matches Sun's flow controls and can be used in any flow control manifolds. Valves with the opposite direction of flow can be found under check valves with bypass orifice.
- Because needle valves are non-compensating devices, the fixed orifice size will regulate flow through the valve in proportion to the square root of the pressure differential across ports 1 and 2.

OPTION ORDERING INFORMATION

CN ✱ C – X ✱ ✱

Nominal Capacity

A 30 L/min.
C 60 L/min.
E 120 L/min.
G 240 L/min.
I 480 L/min.

Control

X Not Adjustable

Cracking Pressure

A* 0,3 bar
B* 1,0 bar
C* 2,0 bar
D* 3,5 bar
E* 5,0 bar
F* 7,0 bar
Z* 0,7 bar
CNAC available in A, C, E Cracking Pressures Only

** Customer specified effective orifice diameter stamped on hex.*

Orifice Ranges:
CNAC: 0,4 - 1,6 mm.
CNCC: 0,4 - 3,89 mm.
CNEC: 0,4 - 3,42 mm.
CNGC: 0,4 - 5,54 mm.
CNIC: 0,4 - 5,54 mm.

Seal Material

N Buna-N
V Viton

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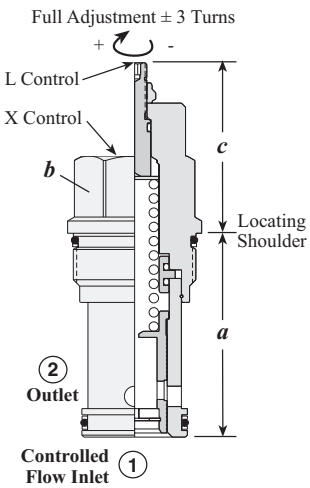
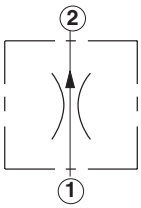
FIXED ORIFICE, PRESSURE COMPENSATED



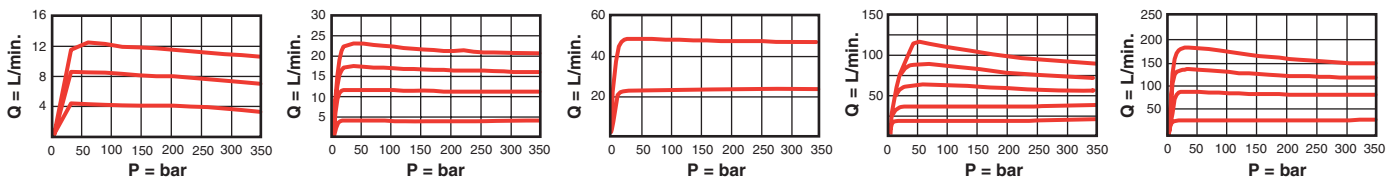


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					X	L	K	
11 L/min.	**FXBA – XAN**	T - 162A	31,0	19,1	20,8	53,6	64,8	35 - 40
23 L/min.	**FXCA – XAN**	T - 13A	35,1	22,2	19,1	50,8	57,2	45 - 50
45 L/min.	**FXDA – XAN**	T - 5A	41,1	28,6	17,5	53,8	60,5	60 - 70
95 L/min.	**FXEA – XAN**	T - 16A	62,0	31,8	24,6	62,0	68,3	200 - 215
200 L/min.	**FXFA – XAN**	T - 18A	79,5	41,3	30,2	71,4	77,7	465 - 500

Performance Curves

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

Flow vs. Pressure Differential



- Maximum operating pressure = 350 bar.
- Customer must specify a flow setting. The factory set flow ratings for FXCA, FXDA, FXEA, FXFA, are within +/- 10% of the required setting. The factory set flow rating for FXBA is within +/-15% of the required setting.
- Accurate pressure compensated control requires that a 14 bar minimum pressure differential be maintained across the valve.
- The tuneable control option provides +/- 25% variation from the nominal factory pre-set flow. Turn the adjustment clockwise to increase.
- The sharp edged orifice design minimizes flow variations due to viscosity changes.

OPTION ORDERING INFORMATION

FX ✱ A – X A ✱

Nominal Capacity

- **B** 11 L/min.
- **C** 23 L/min.
- **D** 45 L/min.
- **E** 95 L/min.
- **F** 200 L/min.

*Control***

- **X** Not Adjustable
- **L+** Tuning Adjustment ±25% of customer specified flow
- **K** Handknob with Lock Knob

+ Special setting is required. Specify at time of order.

Setting Range

FXBA:
- **A*** Orifice Not Replaceable

FXCA, FXDA, FXEA, FXFA:
- **A*** Replaceable Orifice

Seal Material

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

** Customer specified flow setting stamped on hex.*

Flow Settings:
FXBA: 0,4 - 11 L/min.
FXCA: 0,4 - 23 Lmin.
FXDA: 0,4 - 45 L/min.
FXEA: 0,8 - 95 L/min.
FXFA: 0,8 - 200 L/min.

*** See page 178 for information on Control Options*

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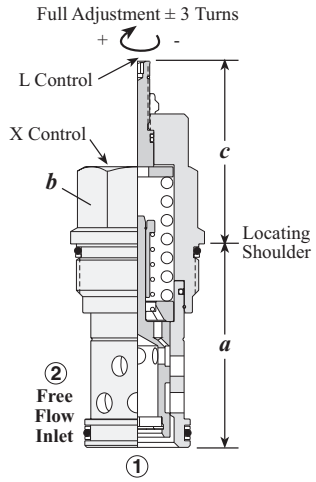
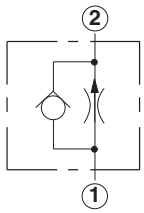
FIXED ORIFICE, PRESSURE COMPENSATED, WITH REVERSE FLOW CHECK



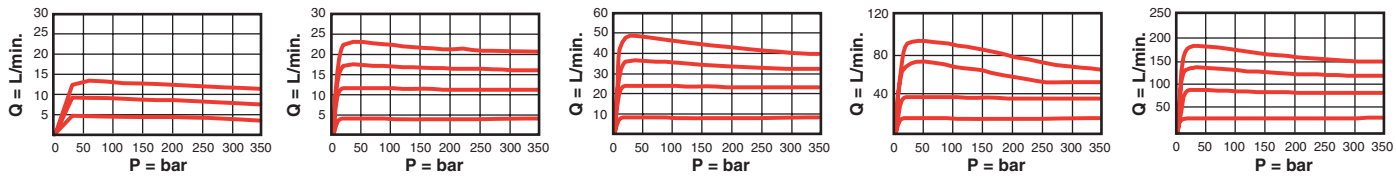


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	c L	c K	Installation Torque (Nm)
11 L/min.	FCBB – XAN	T - 162A	31,0	19,1	20,8	53,6	58,0	35 - 40
23 L/min.	FCCB – XAN	T - 13A	35,1	22,2	19,1	50,8	57,2	45 - 50
45 L/min.	FCDB – XAN	T - 5A	41,1	28,6	17,5	53,8	60,5	60 - 70
95 L/min.	FCEB – XAN	T - 16A	62,0	31,8	24,6	62,0	68,3	200 - 215
200 L/min.	FCFB – XAN	T - 18A	79,5	41,3	30,2	71,4	77,7	465 - 500

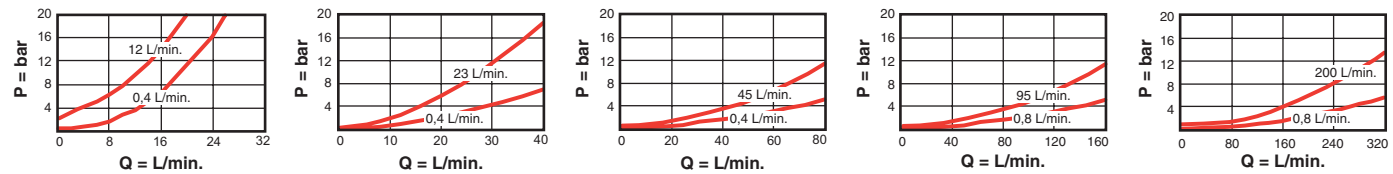
Performance Curves

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

Flow vs. Pressure Differential



Reverse Free Flow Pressure Drop Based on Specified Flow Extremes



- Maximum operating pressure = 350 bar.
- Customer must specify a flow setting. The factory set flow ratings for FCCB, FCDB, FCEB, FCFB, are within +/- 10% of the required setting. The factory set flow rating for FCBB is within +/-15% of the required setting.
- Accurate pressure compensated control requires that a 14 bar minimum pressure differential be maintained across the valve.
- The tuneable control option provides +/- 25% variation from the nominal factory pre-set flow. Turn the adjustment clockwise to increase.
- The sharp edged orifice design minimizes flow variations due to viscosity changes.

OPTION ORDERING INFORMATION

FC ✱ B – ✱ A ✱

Nominal Capacity

- **B** 11 L/min.
- **C** 23 L/min.
- **D** 45 L/min.
- **E** 95 L/min.
- **F** 200 L/min.

Control**

- **X** Not Adjustable
- **L+** Tuning Adjustment ±25% of customer specified flow
- **K** Handknob with Lock Knob

+ Special setting is required. Specify at time of order.

Setting Range

FCBB:
- **A*** Orifice Not Replaceable

FCCB, FCDB, FCEB, FCFB:
- **A*** Replaceable Orifice

** Customer specified flow setting stamped on hex.*

Flow Settings:
FCBB: 0,4 - 11 L/min.
FCCB: 0,4 - 23 Lmin.
FCDB: 0,4 - 45 L/min.
FCEB: 0,8 - 95 L/min.
FCFB: 0,8 - 200 L/min.

Seal Material

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

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*** See page 178 for information on Control Options*

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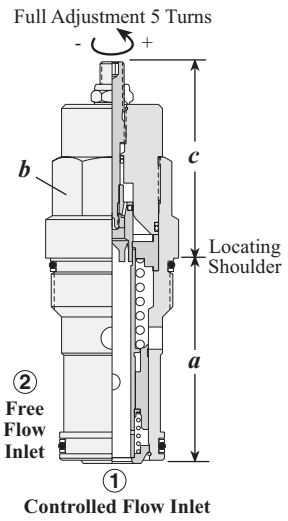
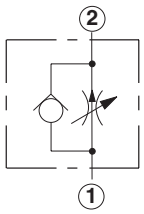
FULLY ADJUSTABLE, PRESSURE COMPENSATED, WITH REVERSE FLOW CHECK



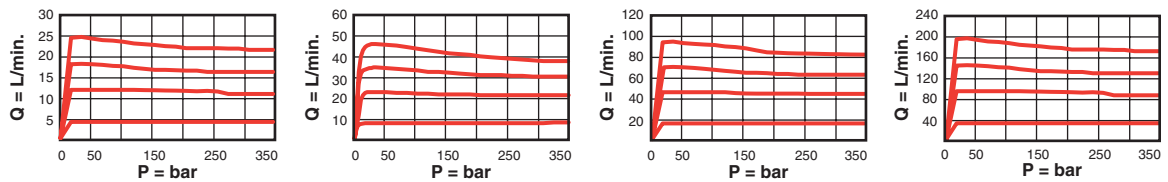


Nominal Flow Range	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c* L	*c* H	*c* K	
23 L/min.	**FDBA – LAN**	T - 13A	35,1	22,2	57,7	62,0	58,7	45 - 50
45 L/min.	**FDCB – LAN**	T - 5A	41,1	28,6	59,7	71,6	69,3	60 - 70
95 L/min.	**FDEA – LAN**	T - 16A	62,0	31,8	67,6	77,7	73,9	200 - 215
200 L/min.	**FDFA – LAN**	T - 18A	79,5	41,3	84,1	88,9	88,1	465 - 500

Performance Curves

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

Flow vs. Pressure Differential



- Maximum operating pressure = 350 bar.
- Accurate pressure compensated control requires that a 14 bar minimum pressure differential be maintained across the valve.
- A balanced adjustment mechanism allows for easy adjustment even at high pressures.
- The sharp edged orifice design minimizes flow variations due to viscosity changes.

OPTION ORDERING INFORMATION

FD ** – * A *

Nominal Flow Range

BA 23 L/min.

CB 45 L/min.

EA 95 L/min.

FA 200 L/min.

*Control***

L Standard Screw Adjustment

H Calibrated Handknob with Detent Lock

K Handknob with Lock Knob

*Adjustment Range**

FDBA
A 0,4 - 23 L/min.
B 0,4 - 8 L/min.

FDCB
A 0,4 - 45 L/min.
B 0,4 - 11 L/min.

FDEA
A 0,8 - 95 L/min.
B 0,8 - 60 L/min.

FDFA
A 0,8 - 200 L/min.

Seal Material

N Buna-N

V Viton

U.S. Patent #4,630,640

*** See page 178 for information on Control Options*

** Customer specified special setting stamped on hex.*

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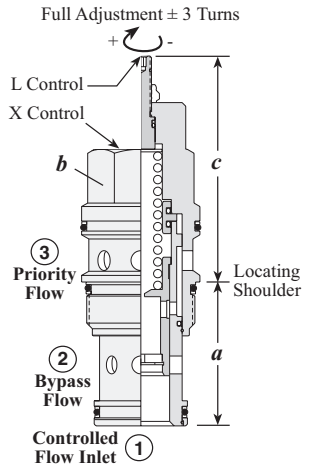
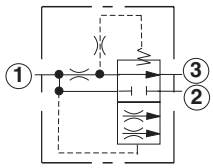
FIXED ORIFICE, BYPASS / RESTRICTIVE, PRIORITY FLOW



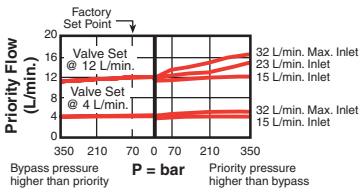


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	c L	c K	Installation Torque (Nm)
11 L/min.	**FRBA – XAN**	T - 163A	31,0	19,1	32,0	64,8	70,4	35 - 40
23 L/min.	**FRCA – XAN**	T - 11A	35,1	22,2	30,2	63,5	69,9	45 - 50
45 L/min.	**FRDA – XAN**	T - 2A	35,1	28,6	35,1	71,4	77,7	60 - 70
95 L/min.	**FREA – XAN**	T - 17A	46,0	31,8	46,0	83,3	89,7	200 - 215
200 L/min.	**FRFA – XAN**	T - 19A	63,5	41,3	69,9	100,1	106,4	465 - 500

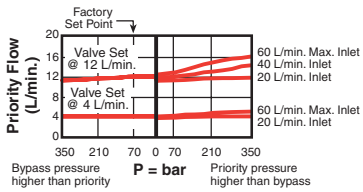
Performance Curves

Typical Performance

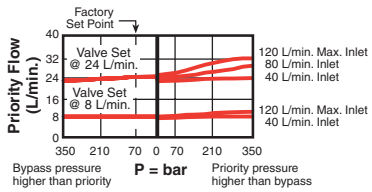
FRBA



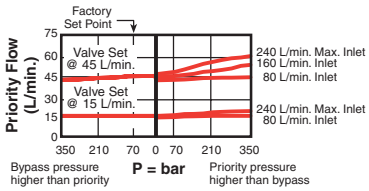
FRCA



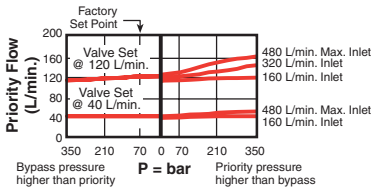
FRDA



FREA



FRFA



- Maximum operating pressure = 350 bar.
- Maximum input flow: FRBA: 30 L/min., FRCA: 60 L/min., FRDA: 120 L/min., FREA: 240 L/min., FRFA: 480 L/min.
- Customer must specify a flow rating. The factory set flow ratings for FRCA, FRDA, FREA, FRFA, are within +/- 10% of the requested setting. The factory set flow rating for FRBA is within +/-15% of the requested setting.
- Priority remains relatively constant regardless of variation in input flow.
- Both priority and bypass flow are usable up to the system operating pressure.
- Bypass flow is not available until priority flow requirements are satisfied.
- Pressure at the bypass port (port 2) may exceed pressure at the priority port (port 3).

OPTION ORDERING INFORMATION

FR ✱ A – ✱ A ✱

Nominal Capacity

- **B** 11 L/min.
- **C** 23 L/min.
- **D** 45 L/min.
- **E** 95 L/min.
- **F** 200 L/min.

Control**

- **X** Not adjustable
- **L+** Tuning Adjustment ±25% of customer specified flow
- **K** Handknob with Lock Knob

+ ***Special setting is required. Specify at time of order.***

***** See page 178 for information on Control Options***

Adjustment Range

FRBA:
- **A*** Orifice Not Replaceable

FRCA, FRDA, FREA, FRFA:
- **A*** Replaceable Orifice

***** ***Customer specified flow setting stamped on hex.***

Flow Settings:
FRBA: 0,4 - 11 L/min.
FRCA: 0,4 - 23 Lmin.
FRDA: 0,4 - 45 L/min.
FREA: 1 - 95 L/min.
FRFA: 1 - 200 L/min.

Seal Material

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

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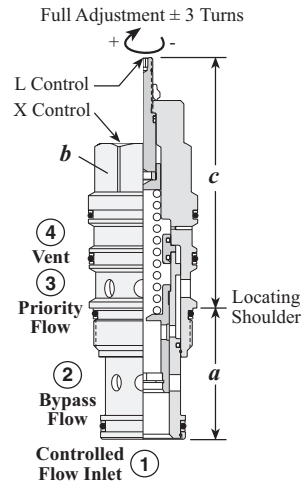
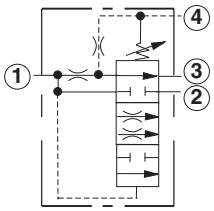
VENTABLE, FIXED ORIFICE, BYPASS / RESTRICTIVE, PRIORITY FLOW



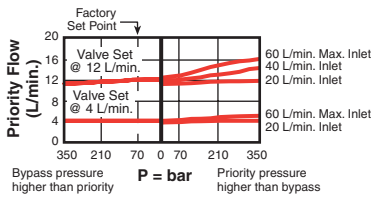


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c X	c L	c K	Installation Torque (Nm)
23 L/min.	**FVCA – XAN**	T - 21A	35,1	22,2	45,2	78,5	84,8	45 - 50
45 L/min.	**FVDA – XAN**	T - 22A	35,1	28,6	50,8	87,4	93,7	60 - 70
95 L/min.	**FVEA – XAN**	T - 23A	46,0	31,8	63,5	100,1	106,4	200 - 215
200 L/min.	**FVFA – XAN**	T - 24A	63,5	41,3	81,0	120,9	127,3	465 - 500

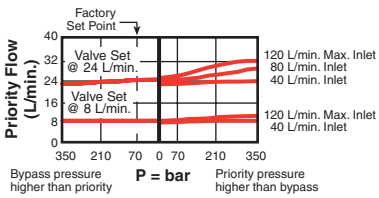
Performance Curves

Typical Performance

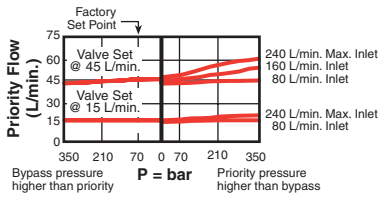
FVCA



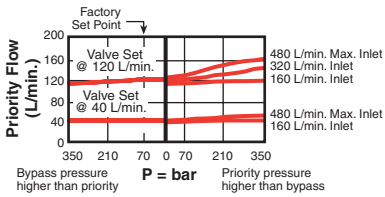
FVDA



FVEA



FVFA



- Maximum operating pressure = 350 bar.
- Maximum input flow: FVCA: 60 L/min., FVDA: 120 L/min., FVEA: 240 L/min., FVFA: 480 L/min.
- Nominal vent flow = 0,75 L/min.
- 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).
- Priority remains relatively constant regardless of variation in input flow.
- A tuneable adjustment control option provides +/- 25% variation from the nominal factory pre-set flow. Adjustment is done with +/- 3 turns of the adjustment screw.

OPTION ORDERING INFORMATION

FV ✱ A – X A ✱

Nominal Capacity

- **C** 23 L/min.
- **D** 45 L/min.
- **E** 95 L/min.
- **F** 200 L/min.

*Control***

- **X** Not Adjustable
- **L+** Tuning Adjustment ±25% of customer specified flow
- **K** Handknob with Lock Knob
- **+** ***Special setting is required. Specify at time of order.***
- ** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

- **A*** Replaceable Orifice

** Customer specified flow setting stamped on hex.*

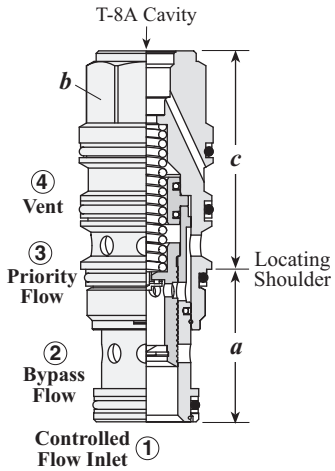
Flow Settings:
FVCA: 0,4 - 23 Lmin.
FVDA: 0,4 - 45 L/min.
FVEA: 0,8 - 95 L/min.
FVFA: 0,8 - 200 L/min.

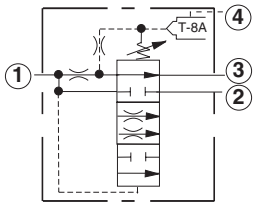
Seal Material

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

VENTABLE, FIXED ORIFICE, BYPASS / RESTRICTIVE, PRIORITY FLOW, WITH INTEGRAL T-8A CONTROL CAVITY





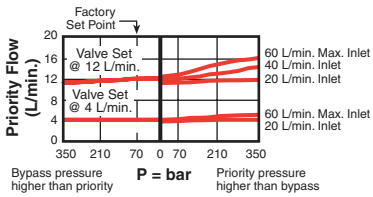
The -8 control option allows the pilot control valve to be incorporated directly into the end of the priority flow control cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
23 L/min.	**FVCA – 8AN**	T - 21A	34,8	22,2	45,2	45 - 50
45 L/min.	**FVDA – 8AN**	T - 22A	34,8	28,6	50,8	60 - 70
95 L/min.	**FVEA – 8AN**	T - 23A	45,9	31,8	65,7	200 - 215
200 L/min.	**FVFA – 8AN**	T - 24A	63.5	41,3	80,0	465 - 500

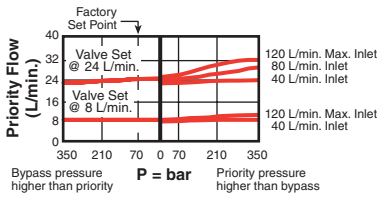
Performance Curves

Typical Performance

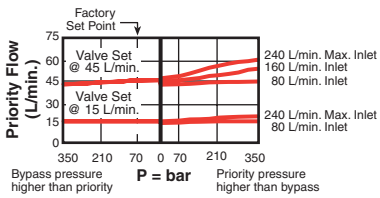
FVCA-8



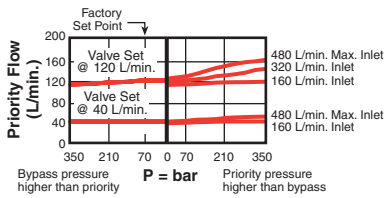
FVDA-8



FVEA-8



FVFA-8



- Maximum operating pressure = 350 bar.
- Maximum input flow: FVCA: 60 L/min., FVDA: 120 L/min., FVEA: 240 L/min., FVFA: 480 L/min.
- Nominal vent flow = 0,75 L/min.
- Customer must specify a flow rating. Factory set flow ratings are within +/-10% of the requested setting.
- Both priority and bypass flow are usable up to the system operating pressure.
- Priority remains relatively constant regardless of variation in input flow.
- Pressure at the bypass port (port 2) may exceed pressure at the priority port (port 3).

OPTION ORDERING INFORMATION

FV ✱ A – 8 A ✱

Nominal Capacity

- **C** 23 L/min.
- **D** 45 L/min.
- **E** 95 L/min.
- **F** 200 L/min.

Control

- **8** T-8A cavity in hex body for pilot operation. Pilot valve to be ordered separately

Setting Range

- **A*** Replaceable Orifice

Seal Material

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

* *Customer specified flow setting stamped on hex.*

Flow Settings:
FVCA-8: 0,4 - 23 Lmin.
FVDA-8: 0,4 - 45 L/min.
FVEA-8: 0,8 - 95 L/min.
FVFA-8: 1 - 200 L/min.

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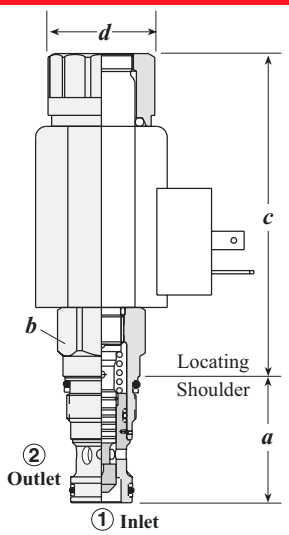
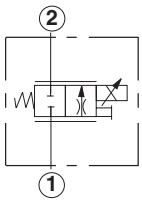
NORMALLY CLOSED THROTTLE





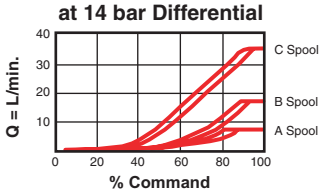
Maximum Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*** X,M	*c*** D,L,T	*d*	*Installation Torque (Nm)*
40 L/min.	**FPCC – XCN**	T - 13A	35,1	22,2	89,2	114,0	38,1	45 - 50

***An additional 50,8 mm clearance is needed for coil installation and removal.

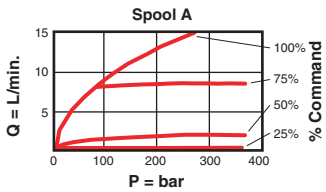
Performance Curves

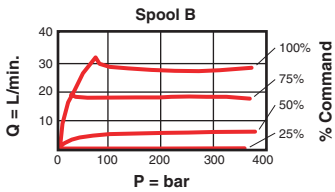
FPCC

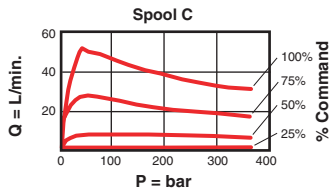
Flow vs. Command at 14 bar Differential



Flow vs. Pressure Differential







- Capable of operating with pressures up to 350 bar.
- Maximum valve leakage at 24 cSt = 100 cc/min. at 210 bar.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke =2,5 mm.
- Hysteresis with dither = <4% and with DC input = <8%.
- Linearity with dither = <2% and repeatability with dither = <2%.
- Recommended dither frequency = 140 Hz.
- Deadband nominal (as percentage of input) = 25%.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100-250 Hz.
- Available in either a normally open or normally closed configuration with three different capacity ranges.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

F P C C – X ✱ ✱ – ✱ ✱ ✱

Maximum Nominal Capacity

C 40 L/min.

Control*

X No Manual Override

D Twist/Lock Dual, Manual Override

L Twist/Lock, Detent, Manual Override

M Manual Override

T Twist/Lock, Momentary, Manual Override

** ***See page 178 for information on Control Options***

Flow Rate

A 0,4 - 6 L/min.

B 0,6 - 14 L/min.

C 0,8 - 28 L/min.

D 1 - 40 L/min.

Seal Material

N Buna-N

V Viton

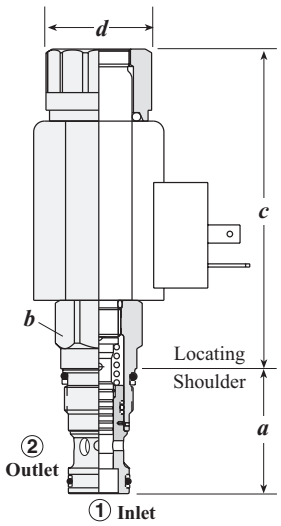
Coil Options**

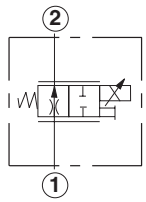
See page 188: Coil option information for Electro-Proportional Cartridges.

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

NORMALLY OPEN THROTTLE





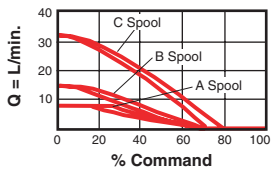
Maximum Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c***		*d*	
					X,M	D,L,T		
28 L/min.	**FPCH – XCN**	T - 13A	35,1	22,2	89,2	114,0	38,1	45 - 50

***An additional 50,8 mm clearance is needed for coil installation and removal.

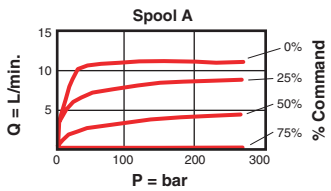
Performance Curves

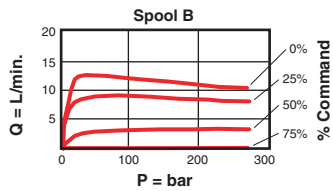
FPCH

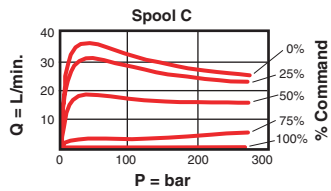
Flow vs. Command at 14 bar Differential



Flow vs. Pressure Differential







- Capable of operating with pressures up to 350 bar.
- Maximum valve leakage at 24 cSt = 100 cc/min. at 210 bar.
- Hysteresis with dither = <4% and with DC input = <8%.
- Linearity with dither = <2% and repeatability with dither = <2%.
- Recommended dither frequency = 140 Hz.
- Deadband nominal (as percentage of input) = 25%.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke =2,5 mm.
- Available in either a normally open or normally closed configuration with three different capacity ranges.
- Low leakage levels in the closed position.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100-250 Hz.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

F P C H – X ✱ ✱ – ✱ ✱ ✱

Nominal Capacity

C 28 L/min.

Control*

X No Manual Override

D Twist/Lock Dual, Manual Override

L Twist/Lock, Detent, Manual Override

M Manual Override

T Twist/Lock, Momentary, Manual Override

** *See page 178 for information on Control Options*

Flow Rate

C 0,8 - 28 L/min.

A 0,4 - 6 L/min.

B 0,6 - 14 L/min.

Seal Material

N Buna-N

V Viton

Coil Options**

See page 188: Coil option information for Electro-Proportional Cartridges.

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

A Sun Amplifier, Controlling a Sun Coil, Powering a Sun Valve:

Sun Hydraulics' Optimized Solution

Electro-Hydraulic Proportional Valves WITH ON-BOARD ELECTRONICS

Sun's proportional hydraulic cartridge valves:

- Available in a wide array of pilot, single-stage and two-stage versions.
- Affordable for mobile and industrial applications.
- Systems become more efficient and versatile.
- Circuits become less complicated hydraulically.
- System plumbing and wiring are simplified.

Proportional pilot valves incorporated as the pilot control option can mount directly into any of Sun's ventable and pilot operated cartridges which are configured to accept the pilot. This versatility allows proportional control of high pressures and high flows with the power consumption of a much smaller valve.

And Sun's electro-proportional valves with embedded electronics can be mounted close to actuators for improved performance, while minimizing system wiring and plumbing.

All Sun Proportional, Ramping and Power Saver Amplifiers offer improved efficiency, precise control, and enhanced reliability. Performance is optimized with Sun proportional valves — valve, coil, and amplifier are matched (serialized) for easy "plug and play". And, assemblies are ultrasonically welded and polyurethane potted for excellent environmental protection.

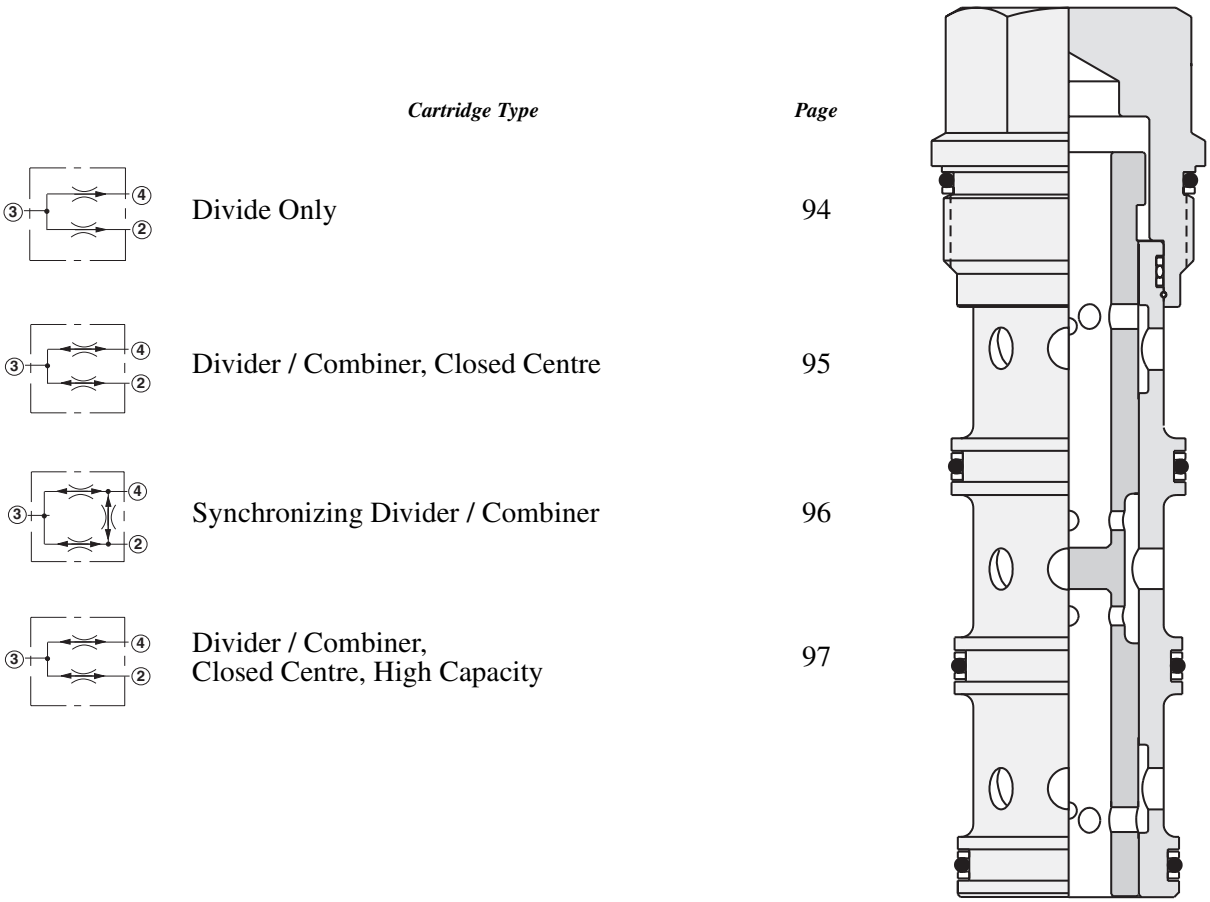
*See catalogue pages: 14 (RBAP), 15 (RBAN), 16 (RP*C-8), 17 (RP*S-8), 23 (RV*D-8), 31 (RS*C-8), 36 (PB*B-8), 43 (PRDL), 44 (PRDP), 45 (PP*B-8), 46 (PV*A-8), 90 (FPCC), and 91 (FPCH).*

View our full range of Electronic Products, Cartridges and Manifolds, call your Sun Distributor or consult the Sun web site:

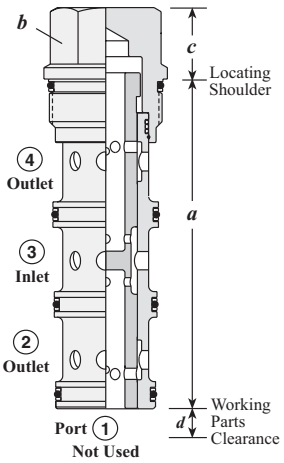
www.sunhydraulics.com

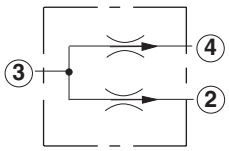
Products: Cartridges: Electro-Proportional: View All Electro-Proportional Cartridges.
Products: Cartridges: Coils or Coil Search.
Standard and Embedded Coil Options are listed at the bottom of each cartridge web page.

Flow Divider / Combiner Cartridge Valves



DIVIDE ONLY





Capacity Min/Max	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	d	*Installation Torque (Nm)*
6-30 L/min.	**FSCD – XAN**	T - 31A	85,1	22,2	19,1	3,6	45 - 50
12-60 L/min.	**FSDD – XAN**	T - 32A	92,2	28,6	17,1	3,8	60 - 70
23-115 L/min.	**FSED – XAN**	T - 33A	114,3	31,8	24,6	5,3	200 - 215
45-230 L/min.	**FSFD – XAN**	T - 34A	139,7	41,3	30,2	6,9	465 - 500

Operating Characteristics

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation* High Flow Leg L/min.	Low Flow Leg L/min.
FSCD					
50:50	Max. Rated	30	+/-3.5%	14,0-16,0	—
	Min. Rated	6	+/-6.5%	2,6-3,4	—
40:60	Max. Rated	26,5	+/-3.5%	15,0-16,8	9,7-11,6
	Min. Rated	5,3	+/-6.5%	2,8-3,5	1,8-2,5
33:67	Max. Rated	22,7	+/-3.5%	14,4-16	6,7-8,3
	Min. Rated	4,5	+/-6.5%	2,7-3,3	1,2-1,8
FSDD					
50:50	Max. Rated	60	+/-3.5%	28-32	—
	Min. Rated	12	+/-6.5%	5,2-6,7	—
40:60	Max. Rated	47	+/-3.5%	26,6-29,8	17,2-20-4
	Min. Rated	9,4	+/-6.5%	5,0-6,2	3,2-4,4
33:67	Max. Rated	42	+/-3.5%	26,5-29,5	12,5-15,5
	Min. Rated	8,4	+/-6.5%	5,1-6,2	2,2-3,3

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation* High Flow Leg L/min.	Low Flow Leg L/min.
FSED					
50:50	Max. Rated	115	+/-3.5%	53,5-61,5	—
	Min. Rated	23	+/-6.5%	10-13	—
40:60	Max. Rated	95	+/-3.5%	54-60	35-41
	Min. Rated	19	+/-6.5%	10,2-12,6	6,4-8,8
33:67	Max. Rated	85	+/-3.5%	54-60	25-31
	Min. Rated	17	+/-6.5%	10,3-12,5	4,5-6,7
FSFD					
50:50	Max. Rated	230	+/-3.5%	10-123	—
	Min. Rated	45	+/-6.5%	19,6-25,4	—
40:60	Max. Rated	200	+/-3.5%	113-127	73-87
	Min. Rated	38	+/-6.5%	20,3-25,3	12,7-17,7
33:67	Max. Rated	180	+/-3.5%	114-126	54-66
	Min. Rated	36	+/-6.5%	22-26	10-14

The maximum variation is at 350 bar differential between legs with the high pressure leg being the higher flow.

- Maximum operating pressure = 350 bar.
- Pressure drop at maximum input flow = 18 bar; at minimum input flow = 0,7 bar.
- This valve is a divider; any attempt to flow backwards through the valve is not advised.

OPTION ORDERING INFORMATION

FS ✱ D – X ✱ ✱

Nominal Capacity
- **C** 6-30 L/min.
- **D** 12-60 L/min.
- **E** 23-115 L/min.
- **F** 45-230 L/min.

Control
- **X** Not Adjustable

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

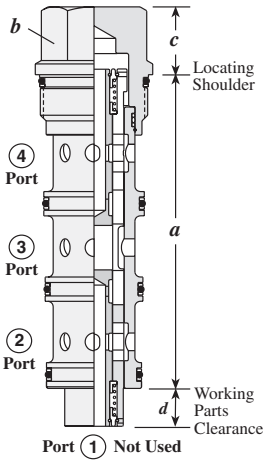
* *Port 4 is always high percentage flow.*

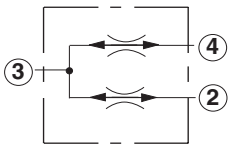
Seal Material
- **N** Buna-N
- **V** Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIVIDER / COMBINER, CLOSED CENTRE





Note: Closed centre valves have spring centred internal spools that provide blocked flow paths when centred. Centring 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*	*Cartridge Dimensions* *Cavity*	*a*	*b*	*c*	*d*	*Installation Torque (Nm)*
6-30 L/min.	**FSCA – XAN**	T - 31A	85,1	22,2	19,1	16,5	45 - 50
12-60 L/min.	**FSDA – XAN**	T - 32A	92,2	28,6	17,5	19,6	60 - 70
23-115 L/min.	**FSEA – XAN**	T - 33A	114,3	31,8	24,6	25,1	200 - 215
45-230 L/min.	**FSFA – XAN**	T - 34A	139,7	41,3	30,2	23,1	465 - 500

Operating Characteristics

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation L/min.*
FSCA				
50:50	Max. Rated	30	+/-2.5%	14,3-15,8
	Min. Rated	6	+/-4.5%	2,73-3,27
FSDA				
50:50	Max. Rated	60	+/-2.5%	28,5-31,5
	Min. Rated	12	+/-4.5%	5,5-6,5

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation L/min.*
FSEA				
50:50	Max. Rated	115	+/-2.5%	54,6-60,4
	Min. Rated	23	+/-4.5%	10,5-12,5
FSFA				
50:50	Max. Rated	230	+/-2.5%	109-120
	Min. Rated	45	+/-4.5%	21-25

The maximum variation is at 350 bar differential between legs with the high pressure leg being the higher flow in dividing mode and the lower flow in combining mode.

- Maximum operating pressure = 350 bar.
- Pressure drop at maximum input flow = 24 bar; at minimum input flow = 1 bar.
- Operating characteristics cause the leg of the circuit with the greatest load to receive the higher percentage of the flow in dividing mode. If a rigid mechanism is used to tie actuators together, the lead actuator may pull the lagging actuator and cause it to cavitate.
- In combining mode, compensating characteristics will cause the leg of the circuit with the lowest load to receive the higher percentage of flow. If a synchronization feature is not included, an additive accuracy error will be experienced with each full stroke of the actuator.

OPTION ORDERING INFORMATION

FS ✱ A – X A ✱

Nominal Capacity

C 6-30 L/min.

D 12-60 L/min.

E 23-115 L/min.

F 45-230 L/min.

Control

X Not Adjustable

Flow Split

A 50/50

Seal Material

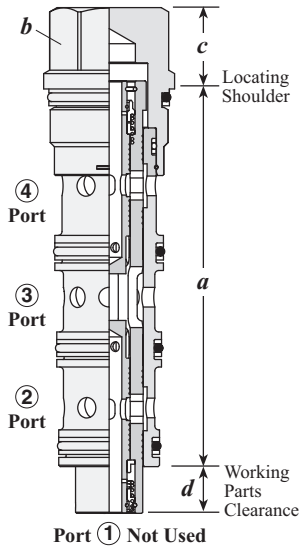
N Buna-N

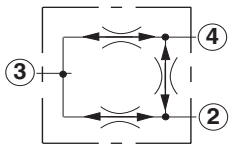
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

SYNCHRONIZING DIVIDER / COMBINER





Capacity Min/Max	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c*	*d*	
6-30 L/min.	**FSCS – XAN**	T - 31A	85,1	22,2	19,0	16,5	45 - 50
12-60 L/min.	**FSDS – XAN**	T - 32A	92,2	28,6	17,5	19,6	60 - 70
23-115 L/min.	**FSES – XAN**	T - 33A	114,3	31,8	24,6	25,1	200 - 215
45-230 L/min.	**FSFS – XAN**	T - 34A	139,7	41,3	30,2	23,1	465 - 500

Operating Characteristics

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation L/min.*
FSCS				
50:50	Max. Rated	30	+/-2.5%	14,3-15,8
	Min. Rated	6	+/-4.5%	2,73-3,27
	Synchronizing Flow:			0,94-2,46
FSDS				
50:50	Max. Rated	60	+/-2.5%	28,5-31,5
	Min. Rated	12	+/-4.5%	5,5-6,5
	Synchronizing Flow:			1,1-2,8

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation L/min.*
FSES				
50:50	Max. Rated	115	+/-2.5%	54,6-60,4
	Min. Rated	23	+/-4.5%	10,5-12,5
	Synchronizing Flow:			3,4-6,6
FSFS				
50:50	Max. Rated	230	+/-2.5%	109-120
	Min. Rated	45	+/-4.5%	21-25
	Synchronizing Flow:			6,6-13,2

The maximum possible variation is at 350 bar differential between legs with the high pressure leg being the higher flow in dividing mode and the lower flow in combining mode.

- Maximum operating pressure = 350 bar.
- Pressure drop at maximum input flow = 24 bar; at minimum input flow = 1 bar.
- Operating characteristics cause the leg of the circuit with the greatest load to receive the higher percentage of the flow in dividing mode. If a rigid mechanism is used to tie actuators together, the lead actuator may pull the lagging actuator and cause it to cavitate.
- In combining mode, compensating characteristics will cause the leg of the circuit with the lowest load to receive the higher percentage of flow. If a synchronization feature is not included, an additive accuracy error will be experienced with each full stroke of the actuator.

OPTION ORDERING INFORMATION

FS ✱ S – X A ✱

Nominal Capacity

- **C** 6-30 L/min.
- **D** 12-60 L/min.
- **E** 23-115 L/min.
- **F** 45-230 L/min.

Control

- **X** Not Adjustable

Flow Split

- **A** 50/50

Seal Material

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

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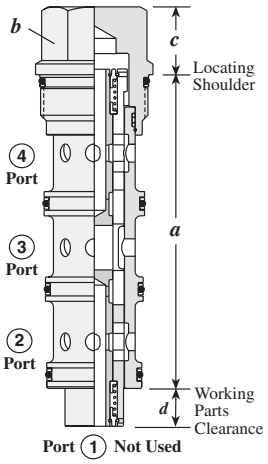
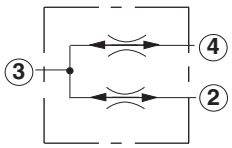
DIVIDER / COMBINER, CLOSED CENTRE, HIGH CAPACITY





Note: Closed centre valves have spring centred internal spools that provide blocked flow paths when centered. Centring occurs when the Port 3 flow is also blocked. This internal blocking isolates Port 2 and 4 from cross flow. These high capacity valves have approximate 30% greater capacity than standard closed-centre divider/combiners and are designed for use in tractive drive systems. Note: Accuracy on these cartridges is not equivalent to the accuracy of standard closed-centre divider/combiners.

Capacity Min/Max	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c*	*d*	
8-38 L/min.	**FSCH – XAN**	T - 31A	85,1	22,2	19,1	16,5	45 - 50
15-75 L/min.	**FSDH – XAN**	T - 32A	92,2	28,6	17,5	19,6	60 - 70
30-150 L/min.	**FSEH – XAN**	T - 33A	114,4	31,8	24,6	25,1	200 - 215
60-300 L/min.	**FSFH – XAN**	T - 34A	139,7	41,3	30,2	23,1	465 - 500

Operating Characteristics

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation L/min.*
FSCH				
50:50	Max. Rated	38	+/-3.5%	17,7-20,3
	Min. Rated	8	+/-6.5%	3,5-4,5
FSDH				
50:50	Max. Rated	75	+/-3.5%	35-40
	Min. Rated	15	+/-6.5%	6,5-8,5

Split	*Divisional Accuracy* Input Flow L/min.		Rated Accuracy	*Maximum Possible Flow Variation L/min.*
FSEH				
50:50	Max. Rated	150	+/-3.5%	70-80
	Min. Rated	30	+/-6.5%	13-17
FSFH				
50:50	Max. Rated	300	+/-3.5%	139-160
	Min. Rated	60	+/-6.5%	26-34

The maximum possible variation is at 350 bar differential between legs with the high pressure leg being the higher flow in dividing mode and the lower flow in combining mode.

- Maximum operating pressure = 350 bar.
- Pressure drop at maximum input flow = 24 bar; at minimum input flow = 1 bar.
- Operating characteristics cause the leg of the circuit with the greatest load to receive the higher percentage of the flow in dividing mode. If a rigid mechanism is used to tie actuators together, the lead actuator may pull the lagging actuator and cause it to cavitate.
- In combining mode, compensating characteristics will cause the leg of the circuit with the lowest load to receive the higher percentage of flow. If a synchronization feature is not included, an additive accuracy error will be experienced with each full stroke of the actuator.

OPTION ORDERING INFORMATION

FS ✱ H – X A ✱

Nominal Capacity

C 8-38 L/min.

D 15-75 L/min.

E 30-150 L/min.

F 60-300 L/min.

Control

X Not Adjustable

Flow Split

A 50/50

Seal Material

N Buna-N

V Viton

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CARTRIDGE FILTERS

Sun Filter Cartridges are pressure rated the same as all other Sun Cartridges

Surface Type (Last Chance) Elements

Surface type (Last Chance) elements are 40 µm nominal range with single layer stainless steel mesh supported by a perforated sheet tube. Crush pressure is greater than 350 bar. The flow path is port 2 to port 1 only. Do not use in reverse flow mode even with a reverse free flow check valve installed. The stainless steel mesh is not externally supported and will fail through fatigue. The four sizes are rated for 38, 76, 151, and 303 L/min. with a maximum differential pressure of 2.4 bar in the clean state.

Surface type elements are designed to capture errant particles that may not be trapped in the main system filter or particles resulting from a component failure. The 40 µm surface type element will not provide system filtration but is a "last chance" element. With a correctly assembled system, these elements will be unnoticed during regular operation but will provide protection from sudden component failure. Installation directly above the subplate will protect the entire valve stack from particles.

Depth Style Elements

Depth type elements are available in 3µm, 10µm, and 25µm nominal ranges. The crush pressure is 350 bar and the flow path is port 2 to port 1 only. Do not use in reverse flow mode. Due to their physical size and the requirement for a pleated filtration material, the elements are only available in Series 3 and Series 4 sizes. The flow capacities for cartridges limit their use to flows of 30 and 90 L/min. respectively at 7 bar. They are offered as a means to install a system filter in small manifold packages using your available Sun cavity tooling. These elements provide contamination holding capability that the "last chance" 40µm elements do not. For small manifold packages with expensive proportional or servo valves installed, very fine filtration in an extremely small space is available. Filter life will depend on initial system cleanliness and the amount of dirt ingression to the system when operating.

FILTER CARTRIDGES

Sun filter cartridges are pressure rated the same as all other Sun cartridges.

Model Code	*Series*	*Micron Rating*	*Nominal Flow Rating (L/min.)*	*Cavity*	*Filter Type*
FLDA-XD*	1	40	10/40	T-13A	Surface
FLFA-XD*	2	40	20/80	T-5A	Surface
FLHA-XA*	3	3	8/32	T-16A	Depth
FLHA-XB*	3	10	8/32	T-16A	Depth
FLHA-XC*	3	25	8/32	T-16A	Depth
FLHA-XD*	3	40	40/160	T-16A	Surface
FLJA-XA*	4	3	24/95	T-18A	Depth
FLJA-XB*	4	10	24/95	T-18A	Depth
FLJA-XC*	4	25	24/95	T-18A	Depth
FLJA-XD*	4	40	80/320	T-18A	Surface

View our full range of filter cartridges and manifold products on the Sun website:

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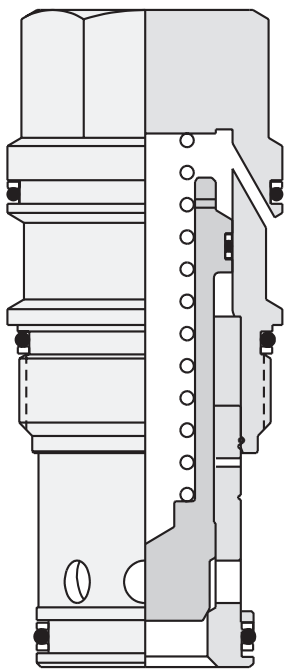
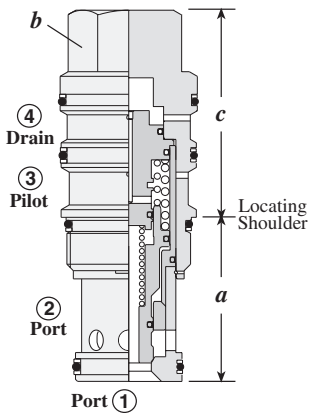
Products: Cartridges: Circuit Savers
or click Search on home page and key in filter model code shown above.
or Products: Literature: Litertature Download: View Cartridge Filters Booklet

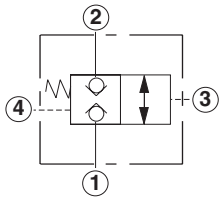
Logic Elements

Cartridge Type



BALANCED POPPET, NORMALLY CLOSED, DIRECT OPERATED, PILOT-TO-OPEN



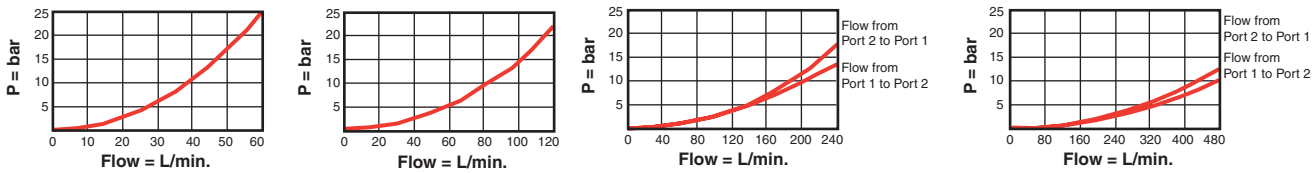


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**DKDS – XHN**	T - 21A	35,0	22,2	45,2	45 - 50
120 L/min.	**DKFS – XHN**	T - 22A	35,0	28,6	50,8	60 - 70
240 L/min.	**DKHS – XHN**	T - 23A	46,2	31,8	62,7	200 - 215
480 L/min.	**DKJS – XHN**	T - 24A	63,5	41,3	80,3	465 - 500

Performance Curves

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

Piloted Open Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DKDS, DKFS: 28 bar; DKHS, DKJS: 20 bar.
- Pilot passage into valve = DKDS, DKFS: 0,8 mm; DKHS, DKJS: 1,19 mm.
- Pilot volume displacement = DKDS: 0,16 cc; DKFS: 0,33 cc; DKHS: 0,82 cc; DKJS: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at both ports 1 and 2, with the external drain open and minimum pilot pressure at port 3.
- These valves are hydraulically balanced between port 1 and port 2.
- Port 1 and port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Valve will reseat when the pilot pressure falls below 10 bar.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- Any back pressure at the drain port is directly additive to the required pilot pressure for reliable operation.

OPTION ORDERING INFORMATION

DK ✱ S – X H ✱

Nominal Capacity
- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Control
- **X** Standard Pilot

Minimum Pilot Pressure
- **H** 28 bar

DKDS, DKFS only:

DKHS, DKJS:
20 bar

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

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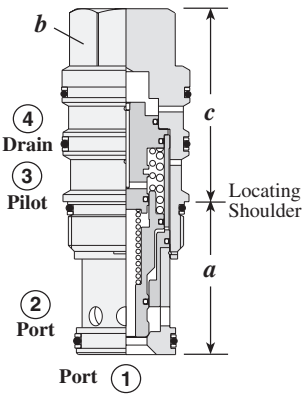
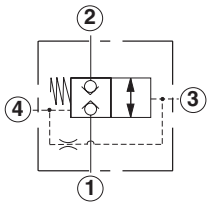
BALANCED POPPET, NORMALLY CLOSED, VENT-TO-OPERATE



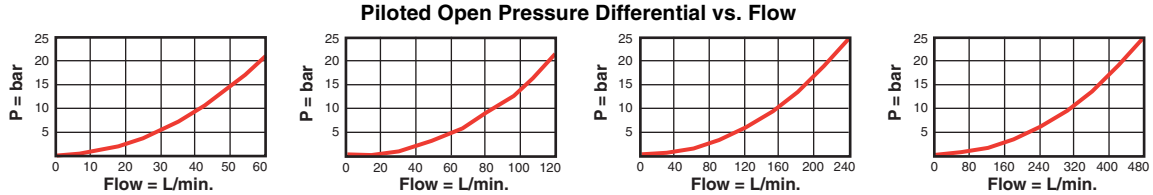


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**DKDR – XHN**	T - 21A	35,0	22,2	45,2	45 - 50
120 L/min.	**DKFR – XHN**	T - 22A	35,0	28,6	50,8	60 - 70
240 L/min.	**DKHR – XHN**	T - 23A	46,2	31,8	62,7	200 - 215
480 L/min.	**DKJR – XHN**	T - 24A	63,5	41,3	80,3	465 - 500

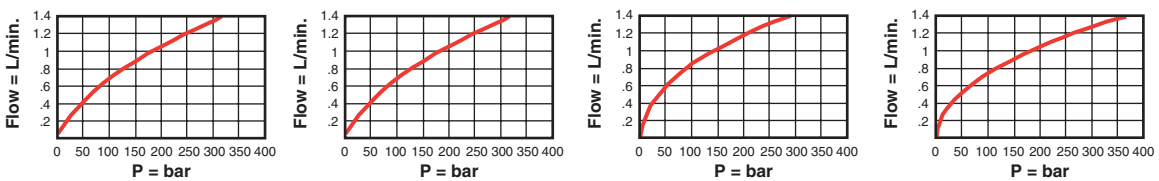
Performance Curves

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

Piloted Open Pressure Differential vs. Flow



Pilot Pressure vs. Pilot Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DKDR, DKFR: 28 bar; DKHR, DKJR: 20 bar.
- Pilot passage into valve = DKDR, DKFR: 0,8 mm; DKHR, DKJR: 1,19 mm.
- Pilot volume displacement = DKDR: 0,16 cc; DKFR: 0,33 cc; DKHR: 0,82 cc; DKJR: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at both ports 1 and 2, with the vent (port 4) open and minimum pilot pressure at port 3.
- These valves are hydraulically balanced between port 1 and port 2.
- Valve will reseat when the pilot pressure falls below 10 bar.
- Port 1 and Port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- 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 DA*-*** solenoid pilot valve is ideal for this application.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.

OPTION ORDERING INFORMATION

DK ✱ R – X ✱ ✱

Nominal Capacity

D 60 L/min.
F 120 L/min.
H 240 L/min.
J 480 L/min.

Control

X Vent-to-operate

Minimum Pilot Pressure

DKDR, DKFR only:
H 28 bar

DKHR, DKJR:
20 bar

Seal Material

N Buna-N
V Viton

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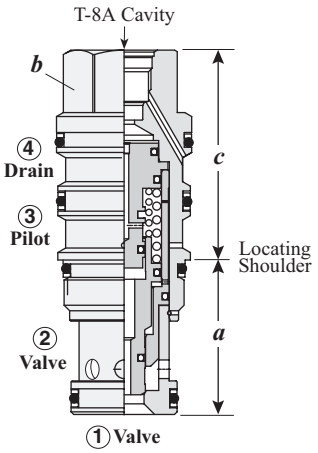
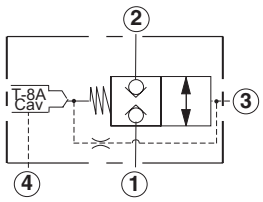
BALANCED POPPET, NORMALLY CLOSED, VENT-TO-OPERATE, WITH INTEGRAL T-8A CONTROL CAVITY





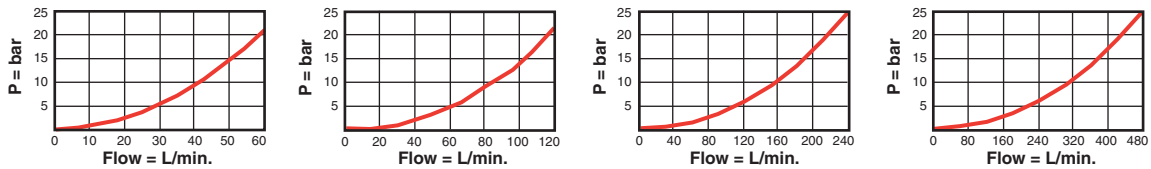
The -8 control option allows a pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**DKDR – 8HN**	T - 21A	35,0	22,2	45,2	45 - 50
120 L/min.	**DKFR – 8HN**	T - 22A	35,0	28,6	50,8	60 - 70
240 L/min.	**DKHR – 8HN**	T - 23A	46,2	31,8	62,7	200 - 215
480 L/min.	**DKJR – 8HN**	T - 24A	63,5	41,3	80,3	465 - 500

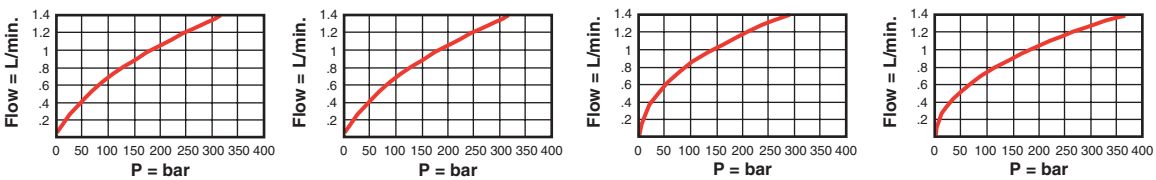
Performance Curves

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

Piloted Open Pressure Differential vs. Flow with T-8A Pilot Stage Installed



Pilot Pressure vs. Pilot Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DKDR-8, DKFR-8: 28 bar; DKHR-8, DKJR-8: 20 bar.
- Pilot passage into valve = DKDR-8, DKFR-8: 0,8 mm; DKHR-8, DKJR-8: 1,19 mm.
- Pilot volume displacement = DKDR-8: 0,16 cc; DKFR-8: 0,33 cc; DKHR-8: 0,82 cc; DKJR-8: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at port 1 and port 2. Switching will only occur when both minimum pilot pressure at port 3 is present and pilot control is open.
- The valves are hydraulically balanced between port 1 and port 2.
- Port 1 and port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- Valve will reseat when the pilot pressure falls below 10 bar.
- 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 of 35-40 Nm.

OPTION ORDERING INFORMATION

DK ✱ R – 8 H ✱

Nominal Capacity		*Control*	*Minimum Pilot Pressure*	*Seal Material*
D	60 L/min.	**8** with T-8A cavity in hex body for pilot operation	***DKDR-8, DKFR-8: only:***	**N** Buna-N
F	120 L/min.		**H** 28 bar	**V** Viton
H	240 L/min.	See pilot control section for alternate options	***DKHR-8, DKJR-8:*** 20 bar	
J	480 L/min.			

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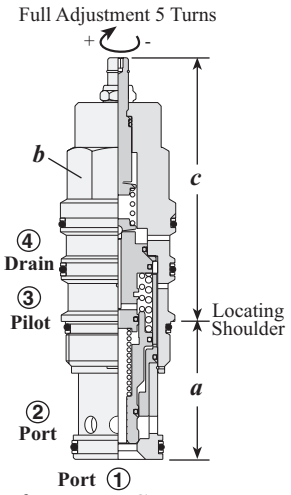
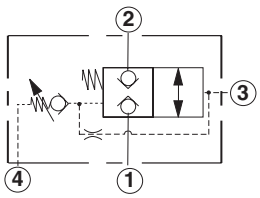
BALANCED POPPET, NORMALLY CLOSED, PRESSURE ADJUSTABLE



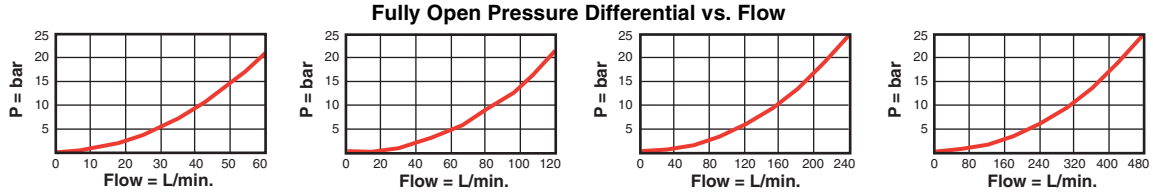


Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
60 L/min.	**DKDP – LAN**	T - 21A	35,0	22,2	79,0	82,6	84,8	45 - 50
120 L/min.	**DKFP – LAN**	T - 22A	35,0	28,6	87,4	89,0	94,0	60 - 70
240 L/min.	**DKHP – LAN**	T - 23A	46,2	31,8	100,1	101,1	105,9	200 - 215
480 L/min.	**DKJP – LAN**	T - 24A	63,5	41,3	121,5	125,0	128,0	465 - 500

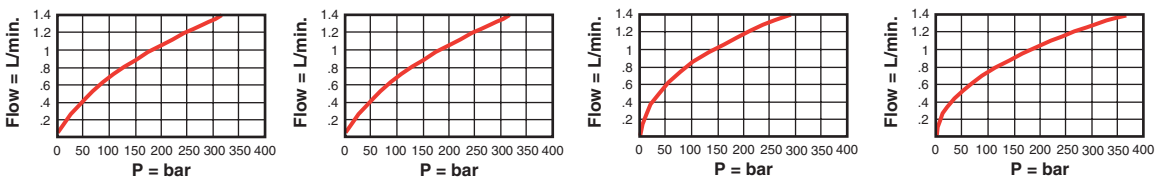
Performance Curves

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

Fully Open Pressure Differential vs. Flow



Pilot Pressure vs. Pilot Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DKDP, DKFP: 28 bar; DKHP, DKJP: 20 bar.
- Pilot passage into valve = DKDP, DKFP: 0,8 mm; DKHP, DKJP: 1,19 mm.
- Pilot volume displacement = DKDP: 0,16 cc; DKFP: 0,33 cc; DKHP: 0,82 cc; DKJP: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at both port 1 and port 2. When the remote pressure signal at port 3 exceeds the internal valve setting, the valve shifts to the open position.
- Port 1 and port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- Any back pressure at the drain port is directly additive to the valve setting.
- Valve will reseat when the pilot pressure falls to 85% of the cracking value.

OPTION ORDERING INFORMATION

DK ✱ P – ✱ ✱ ✱

Nominal Capacity

- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Control**

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

DKDP, DKFP only:
- **A** 28 - 210 bar Standard set at 70 bar
- **B** 28 - 105 bar Standard set at 70 bar
- **W** 28 - 315 bar Standard set at 70 bar

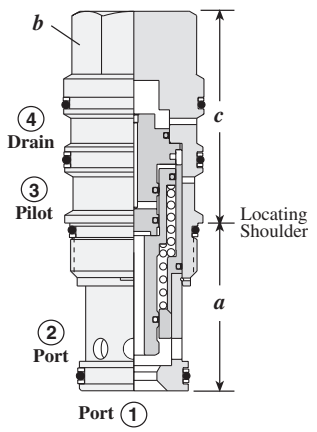
DKHP, DKJP:
- **A** 20 - 210 bar Standard set at 70 bar
- **B** 20 - 105 bar Standard set at 70 bar
- **W** 20 - 315 bar Standard set at 70 bar

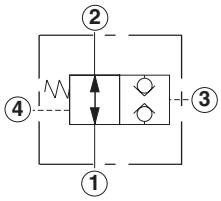
Seal Material

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

BALANCED POPPET, NORMALLY OPEN, PILOT-TO-CLOSE



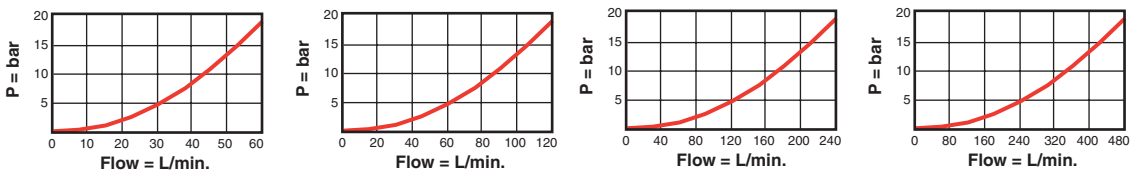


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**DODS – XHN**	T - 21A	35,0	22,2	45,2	45 - 50
120 L/min.	**DOFS – XHN**	T - 22A	35,0	28,6	50,8	60 - 70
240 L/min.	**DOHS – XHN**	T - 23A	46,2	31,8	62,7	200 - 215
480 L/min.	**DOJS – XHN**	T - 24A	63,5	41,3	80,3	465 - 500

Performance Curves

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

Fully Open Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DODS, DOFS: 28 bar; DOHS, DOJS: 20 bar.
- Pilot passage into valve = DODS, DOFS: 0,8 mm; DOHS, DOJS: 1,19 mm.
- Pilot volume displacement = DODS: 0,16 cc; DOFS: 0,33 cc; DOHS: 0,82 cc; DOJS: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at both ports 1 and 2, with the external drain open and minimum pilot pressure at port 3.
- These valves are hydraulically balanced between port 1 and port 2.
- Port 1 and Port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Valve will open when the pilot pressure falls below 10 bar.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- Any back pressure at the drain port is directly additive to the required pilot pressure for reliable operation.

OPTION ORDERING INFORMATION

DO ✱ S – X H ✱

Nominal Capacity

D 60 L/min.
F 120 L/min.
H 240 L/min.
J 480 L/min.

Control

X Standard Pilot

Minimum Pilot Pressure

DODS, DOFS only:
H 28 bar

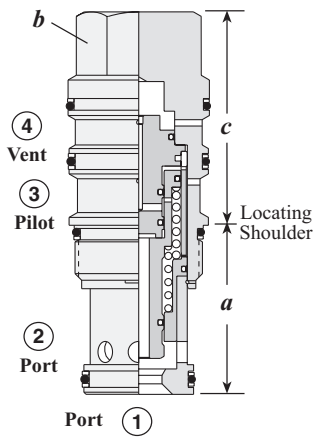
DOHS, DOJS only:
H 20 bar

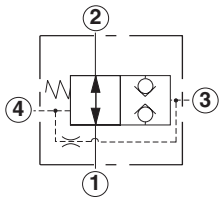
Seal Material

N Buna-N
V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

BALANCED POPPET, NORMALLY OPEN, VENT-TO-OPERATE



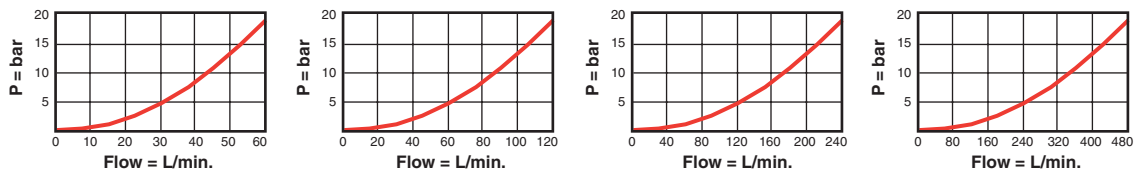


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
60 L/min.	**DODR – XHN**	T - 21A	35,0	22,2	45,2	45 - 50
120 L/min.	**DOFR – XHN**	T - 22A	35,0	28,6	50,8	60 - 70
240 L/min.	**DOHR – XHN**	T - 23A	46,2	31,8	62,7	200 - 215
480 L/min.	**DOJR – XHN**	T - 24A	63,5	41,3	80,3	465 - 500

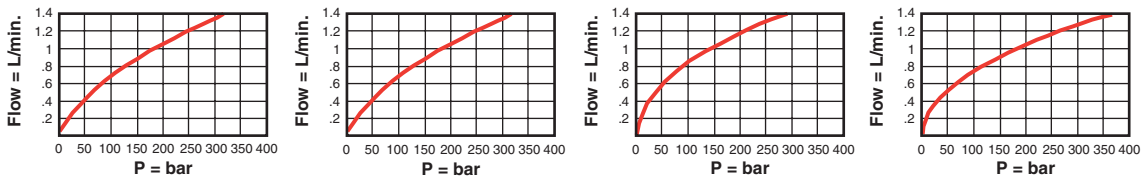
Performance Curves

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

Fully Open Pressure Differential vs. Flow



Pilot Pressure vs. Pilot Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DODR, DOFR: 28 bar; DOHR, DOJR: 20 bar.
- Pilot passage into valve = DODR, DOFR: 0,8 mm; DOHR, DOJR: 1,19 mm.
- Pilot volume displacement = DODR: 0,16 cc; DOFR: 0,33 cc; DOHR: 0,82 cc; DOJR: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at both ports 1 and 2, with the vent (port 4) open and minimum pilot pressure at port 3.
- These valves are hydraulically balanced between port 1 and port 2.
- Port 1 and Port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Valve will open when the pilot pressure falls below 10 bar or with port 4 blocked.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- Port 4 may be externally connected to a pilot switching valve. the pilot valve should have a leakage rate of less than 0,6 cc/min. and be able to satisfy the pilot flow requirements. Sun model DAA*-*** solenoid pilot valve is ideal for this application.

OPTION ORDERING INFORMATION

DO ✱ R – X H ✱

Nominal Capacity
- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Control
- **X** Vent-to-operate

Minimum Pilot Pressure
- **H** 28 bar

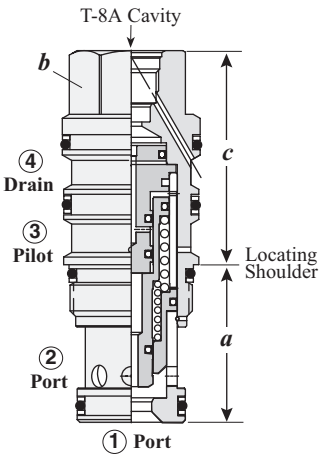
DODR, DOFR only:

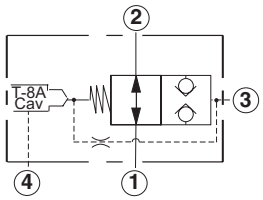
DOHR, DOJR:
20 bar

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

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

BALANCED POPPET, NORMALLY OPEN, VENT-TO-OPERATE WITH INTEGRAL T-8A CONTROL CAVITY





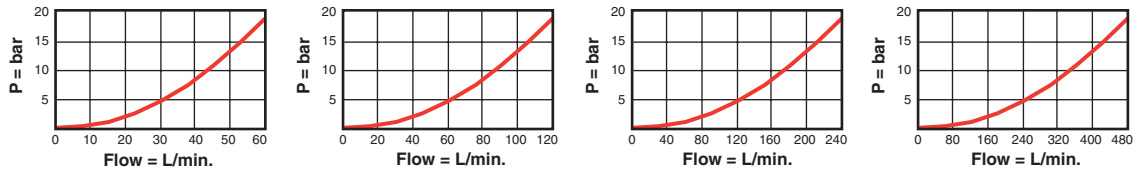
The -8 control option allows a pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
60 L/min.	**DODR – 8HN**	T - 21A	35,0	22,2	45,2	45 - 50
120 L/min.	**DOFR – 8HN**	T - 22A	35,0	28,6	50,8	60 - 70
240 L/min.	**DOHR – 8HN**	T - 23A	46,2	31,8	62,7	200 - 215
480 L/min.	**DOJR – 8HN**	T - 24A	63,5	41,3	80,3	465 - 500

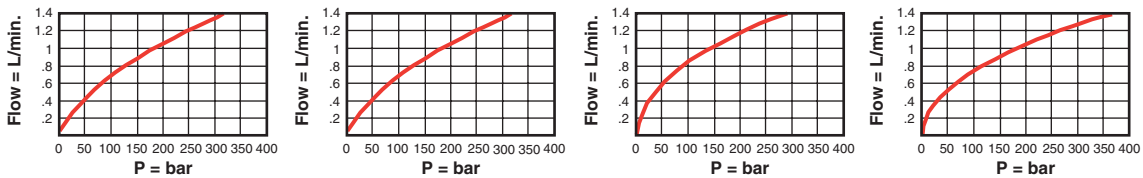
Performance Curves

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

Fully Open Pressure Differential vs. Flow with T-8A Pilot Stage Installed



Pilot Pressure vs. Pilot Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DODR-8, DOFR-8: 28 bar; DOHR-8, DOJR-8: 20 bar.
- Pilot passage into valve = DODR-8, DOFR-8: 0,8 mm; DOHR-8, DOJR-8: 1,19 mm.
- Pilot volume displacement = DODR-8: 0,16 cc; DOFR-8: 0,33 cc; DOHR-8: 0,82 cc; DOJR-8: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at port 1 and 2. Switching will only occur when both minimum pilot pressure at port 3 is present and pilot control valve is open.
- These valves are hydraulically balanced between port 1 and port 2.
- Port 1 and Port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Valve will open when the pilot pressure falls below 10 bar.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- 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 of 35-40 Nm.

OPTION ORDERING INFORMATION

DO ✱ R – 8 H ✱

Nominal Capacity

D 60 L/min.
F 120 L/min.
H 240 L/min.
J 480 L/min.

Control

8 with T-8A cavity in hex body for pilot operation

See pilot control section for alternate options

Minimum Pilot Pressure

DODR-8, DOFR-8 only:
H 28 bar

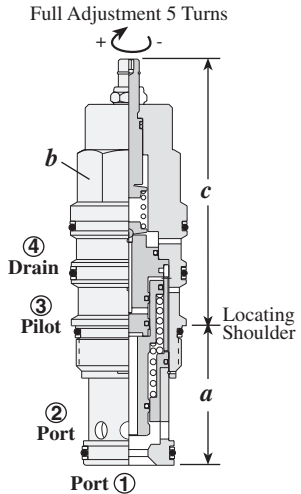
DOHR-8, DOJR-8:
20 bar

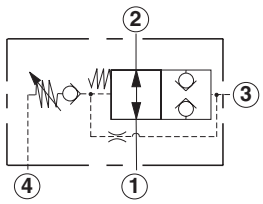
Seal Material

N Buna-N
V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

BALANCED POPPET, NORMALLY OPEN, PRESSURE ADJUSTABLE



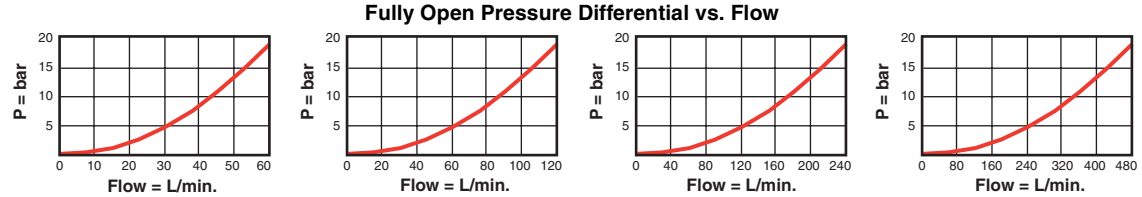


Nominal Capacity	Typical Cartridge Model Code	Cavity	a	b	Cartridge Dimensions c L	c C	c K	Installation Torque (Nm)
60 L/min.	**DODP – LAN**	T - 21A	35,0	22,2	79,0	82,6	84,8	45 - 50
120 L/min.	**DOFP – LAN**	T - 22A	35,0	28,6	87,9	89,0	94,0	60 - 70
240 L/min.	**DOHP – LAN**	T - 23A	46,2	31,8	100,1	101,1	105,9	200 - 215
480 L/min.	**DOJP – LAN**	T - 24A	63,5	41,3	121,4	125,0	128,0	465 - 500

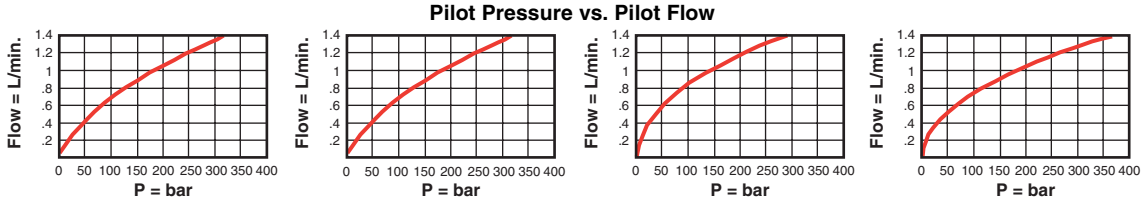
Performance Curves

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

Fully Open Pressure Differential vs. Flow



Pilot Pressure vs. Pilot Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Minimum pilot pressure required to shift valve = DODP, DOFP: 28 bar; DOHP, DOJP: 20 bar.
- Pilot passage into valve = DODP, DOFP: 0,8 mm; DOHP, DOJP: 1,19 mm.
- Pilot volume displacement = DODP: 0,16 cc; DOFP: 0,33 cc; DOHP: 0,82 cc; DOJP: 2,8 cc.
- Unique balanced construction provides predictable switching with 350 bar at both port 1 and port 2. When the remote pressure signal at port 3 exceeds the internal valve setting, the valve shifts to the closed position.
- These valves are hydraulically balanced between port 1 and port 2.
- Port 1 and port 2 are fully sealed from port 3 and port 4. Ports 3 and 4 are positively sealed.
- Valve will open when the pilot pressure falls below 10 bar.
- Leakage rate between port 1 and port 2 is less than 0,3 cc/min. at 350 bar.
- Any back pressure at the drain port is directly additive to the valve setting.

OPTION ORDERING INFORMATION

DO ✱ P – ✱ ✱ ✱

Nominal Capacity

- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Control

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Customer specified special setting stamped on hex.

Adjustment Range

DODP, DOFP only:
- **A** 28 - 210 bar Standard set at 70 bar
- **B** 28 - 105 bar Standard set at 70 bar
- **W** 28 - 315 bar Standard set at 70 bar

DOHP, DOJP:
- **A** 20 - 210 bar Standard set at 70 bar
- **B** 20 - 105 bar Standard set at 70 bar
- **W** 20 - 315 bar Standard set at 70 bar

Seal Material

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

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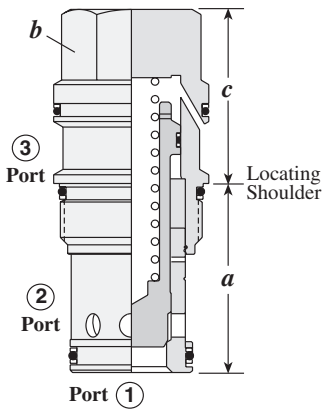
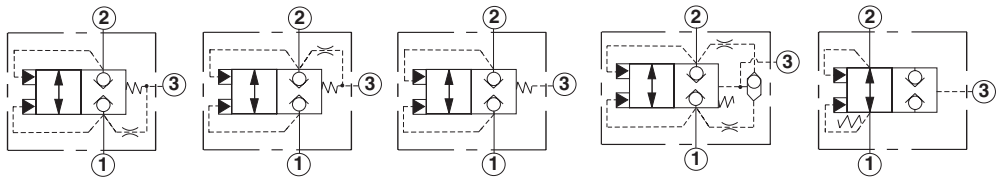
UNBALANCED POPPET, PILOT-TO-CLOSE AND VENT-TO-OPEN





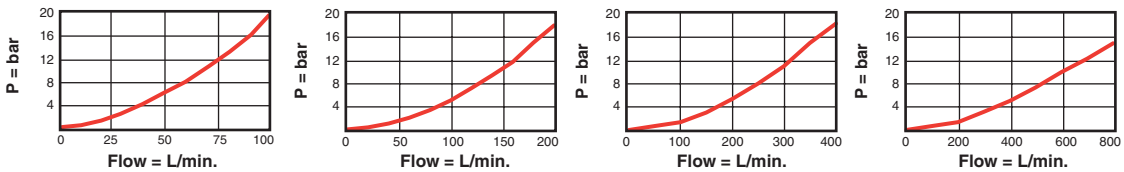
LO*A **LO*B** **LO*C** **LO*D** **LO*O**

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c X	c E	*Installation Torque (Nm)*
95 L/min.	**LODC – XDN**	T - 11A	35,0	22,2	30,2	30,2	45 - 50
200 L/min.	**LOFC – XDN**	T - 2A	35,0	28,6	35,1	35,1	60 - 70
380 L/min.	**LOHC – XDN**	T - 17A	46,0	31,8	46,0	46,0	200 - 215
760 L/min.	**LOJC – XDN**	T - 19A	63,8	41,3	58,7	58,7	465 - 500

Performance Curves

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

Full Open Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min.
- Area ratio: A3 to A1 = 1.8:1; A3 to A2 = 2.25:1.
- Control orifice diameter = LOFA, LODB, LOFB, LODD, LOFD: 0,53 mm; LOHA, LOHB, LOHD: 0,8 mm; LOJA, LOJB, LOJD: 0,9 mm.
- Pilot passage into valve = LOD*: 0,8 mm; LOF*: 0,9 mm; LOH*: 1,50 mm; LOJ*: 2,3 mm.
- Pilot volume displacement = LOD*: 0,66 cc; LOF*: 1,1 cc; LOH*: 4,1 cc; LOJ*: 6,9 cc.
- 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

LO ✱ ✱ – X D ✱

Nominal Capacity

- **D** 95 L/min.
- **F** 200 L/min.
- **H** 380 L/min.
- **J** 760 L/min.

Version

- **A** Spring biased closed, Pilot source from Port 1, Vent-to-open
- **B** Spring biased closed, Pilot source from Port 2, Vent-to-open
- **C** Spring biased closed, Port 3 pilot source, Pilot-to-close
- **D** Spring biased closed, higher of Ports 1 or 2 pilot source, Vent-to-open
- **O** Spring biased open, Port 3 pilot source, Pilot-to-close

*Control***

- **X** Not Adjustable

LODA, LOHA, LO*C, LOHD, LODO, LOHO, LOFO only:

- **E** External SAE-4 Pilot, Port 3 blocked

LODA, LOFA, LODB, LOFB, LODC, LOFC, LODD, LOFD, LOFO only:

- **L** Stroke Adjustment

Minimum Pilot Pressure

- **D** 3,5 bar

Seal Material

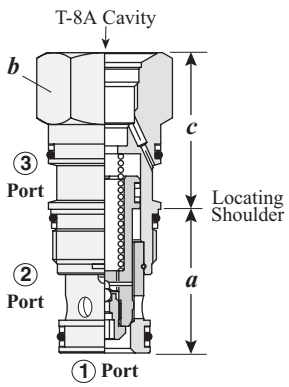
- **N** Buna-N
- **V** Viton

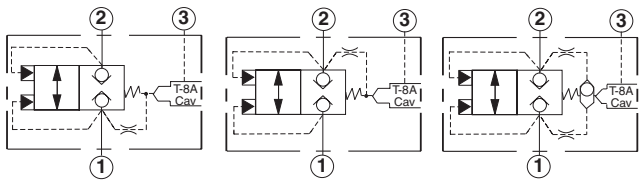
*** See page 178 for information on Control Options*

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

UNBALANCED POPPET, VENT-TO-OPEN, WITH INTEGRAL T-8A CONTROL CAVITY





LO*A-8 **LO*B-8** **LO*D-8**

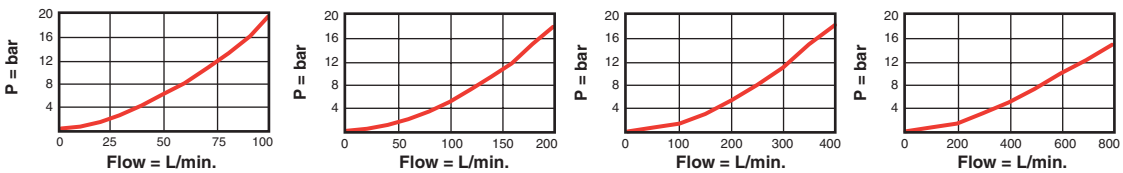
The -8 control option allows a pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid and air pilot operation. See Pilot Control Cartridges on page 141.

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
95 L/min.	**LODA – 8DN**	T - 11A	35,0	22,2	30,2	45 - 50
200 L/min.	**LOFA – 8DN**	T - 2A	35,0	28,6	35,1	60 - 70
380 L/min.	**LOHA – 8DN**	T - 17A	46,0	31,8	46,0	200 - 215
760 L/min.	**LOJA – 8DN**	T - 19A	63,5	41,3	58,7	465 - 500

Performance Curves

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

Full Open Pressure Drop with T-8A Pilot Stage Installed



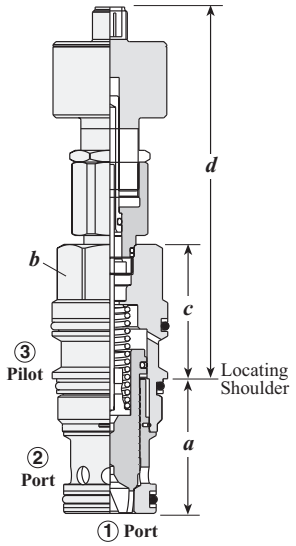
- Maximum operating pressure = 350 bar.
- Area ratio: A3 to A1 = 1.8:1; A3 to A2 = 2.25:1.
- Control orifice diameter = LOD*-8, LOF*-8: 0,53 mm, LOH*-8: 0,8 mm, LOJ*-8: 0,9 mm.
- Pilot volume displacement= LOD*-8: 0,66 cc; LOF*-8: 1,1 cc; LOH*-8: 4,1 cc.; LOJ*-8: 6,9 cc.
- These valves are pressure responsive 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.

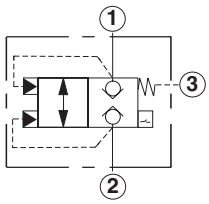
OPTION ORDERING INFORMATION

LO ✱ ✱ – 8 D ✱

Nominal Capacity	*Version*	*Control*	*Cracking Pressure*	*Seal Material*
D 95 L/min.	**A** Spring biased closed, Pilot source from Port 1	**8** T-8A Cavity in hex body for pilot operation	**D** 3,5 bar	**N** Buna-N
F 200 L/min.	**B** Spring biased closed, Pilot source from Port 2	Pilot valve to be ordered separately		**V** Viton
H 380 L/min.	**D** Spring biased closed, with pilot source from Ports 1 or 2			
J 760 L/min.				

UNBALANCED POPPET, PILOT-TO-CLOSE, SPRING BIASED OPEN WITH POSITION INDICATING SWITCH



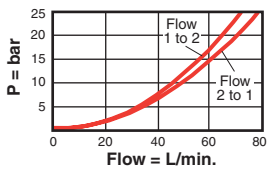


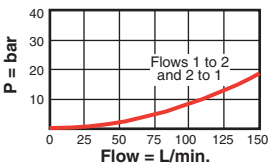
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c*	*d*	
45 L/min.	**LOEC – ZDN**	T - 2A	35,1	28,6	35,1	116,8	60 - 70
200 L/min.	**LOFC – ZDN**	T - 2A	35,1	28,6	35,1	116,8	60 - 70
160 L/min.	**LOGC – ZDN**	T - 17A	45,8	31,8	45,8	127,3	200 - 215
380 L/min.	**LOHC – ZDN**	T - 17A	45,8	31,8	45,8	127,3	200 - 215

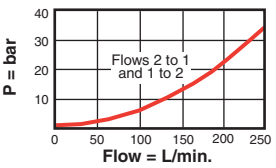
Performance Curves

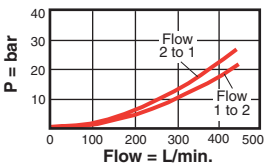
LOEC-Z **LOFC-Z** **LOGC-Z** **LOHC-Z**

Pressure Differential vs. Flow Sequenced Open









- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Area Ratio: A3 to A1 = 1.8:1; A3 to A2 = 2.25:1.
- Pilot passage into valve = LOEC-Z, LOFC-Z: 0,9 mm; LOGC-Z, LOHC-Z: 1,50 mm.
- Pilot volume displacement = LOEC-Z, LOFC-Z: 1,1 cc; LOGC-Z, LOHC-Z: 4,1 cc.
- The position switch confirms that poppet is in the spring biased closed position.
- Switch specifications: supply voltage: 20-32 V DC; Maximum output load: ≤ 400 mA, duty ratio 100%. Turn on time: ≤ 25 ms.; Operating temperature range: -25 to 80° C. See the Sun website for complete switch specifications.

OPTION ORDERING INFORMATION

LO ✱ C – Z D ✱

Nominal Capacity

- **E** 45 L/min.
- **F** 200 L/min.
- **G** 160 L/min.
- **H** 380 L/min.

Version

- **C** Spring biased closed, Port 3 pilot source

Control

- **Z** Position switch*

Cracking Pressure

- **D** 3,5 bar

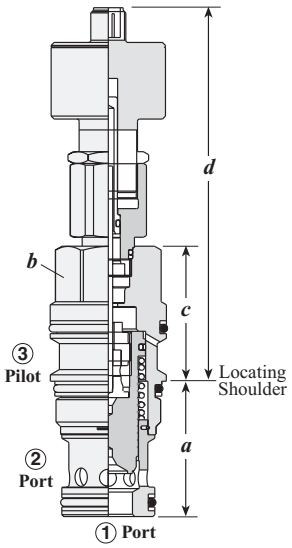
Seal Material

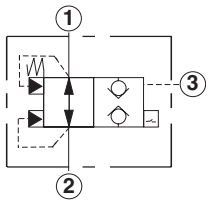
- **N** Buna-N
- **V** Viton

** See Sun website for complete Switch Specifications.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

UNBALANCED POPPET, PILOT-TO-CLOSE, SPRING BIASED CLOSED WITH POSITION INDICATING SWITCH



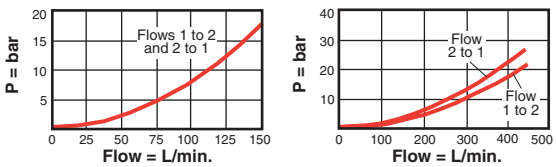


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c*	*d*	
200 L/min.	**LOFO – ZDN**	T - 2A	35,0	28,6	35,1	116,8	60 - 70
380 L/min.	**LOHO – ZDN**	T - 17A	46,0	31,8	46,0	127,3	200 - 215

Performance Curves

LOFO-Z **LOHO-Z**

Pressure Differential vs. Flow Sequenced Open



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Area Ratio: A3 to A1 = 1.8:1; A3 to A2 = 2.25:1.
- Pilot passage into valve = LOFO-Z: 0,9 mm LOHO-Z: 1,50 mm.
- Pilot volume displacement = LOFO-Z: 1,1 cc; LOHO-Z: 4,1 cc.
- The position switch confirms that the valve is in the open position.
- Switch specifications: supply voltage: 20-32 V DC; Maximum output load: ≤ 400 mA, duty ratio 100%. Turn on time: ≤ 25 ms.; operating temperature range: -25 to 80° C. See the Sun website for complete switch specifications.

OPTION ORDERING INFORMATION

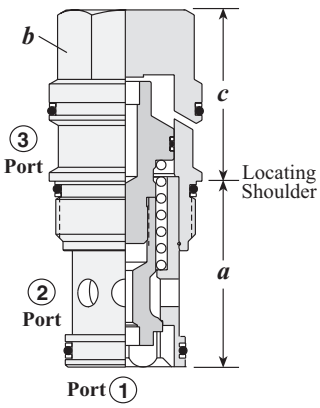
LO ✱ O – Z D ✱

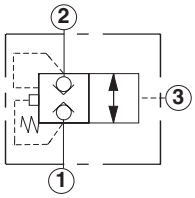
Nominal Capacity	*Version*	*Control*	*Cracking Pressure*	*Seal Material*
F 200 L/min.	**O** Spring biased open, Port 3 pilot source	**Z** Position switch*	**D** 3,5 bar	**N** Buna-N
H 380 L/min.				**V** Viton

** See Sun website for complete Switch Specifications.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

UNBALANCED POPPET, PILOT-TO-OPEN, SPRING BIASED CLOSED



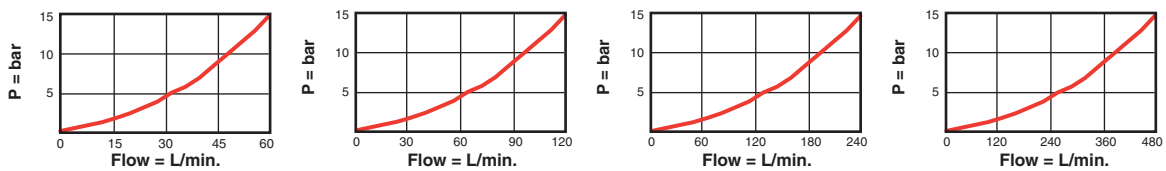


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* X	*c* L	*Installation Torque (Nm)*
60 L/min.	**LKDC – XDN**	T - 11A	35,0	22,2	29,0	63,0	45 - 50
120 L/min.	**LKFC – XDN**	T - 2A	35,0	28,6	35,0	71,6	60 - 70
240 L/min.	**LKHC – XDN**	T - 17A	46,0	31,8	46,0	—	200 - 215
480 L/min.	**LKJC – XDN**	T - 19A	63,8	41,3	58,7	—	465 - 500

Performance Curves

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

Full Open Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 70 bar.
- Area ratio: A3 to A1 = 1.8:1; A3 to A2 = 2.25:1.
- Pilot passage into valve = LKDC: 0,8 mm; LKFC: 0,9 mm; LKHC: 1,50 mm; LKJC: 2,3 mm.
- Pilot volume displacement = LKDC: 0,33 cc; LKFC: 0,98 cc; LKHC: 2,5 cc; LKJC: 4,9 cc.
- 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 ✱ ✱ – X D ✱

Nominal Capacity

D 60 L/min.
F 120 L/min.
H 240 L/min.
J 480 L/min.

Version

C Spring biased closed, Pilot source from port 3

Control**

LK*C
X Not Adjustable

LKDC, LKFC only:
L Manual Release

Minimum Pilot Pressure

D 3,5 bar

Seal Material

N Buna-N
V Viton

U.S. Patent # 4,795,129

*** See page 178 for information on Control Options*

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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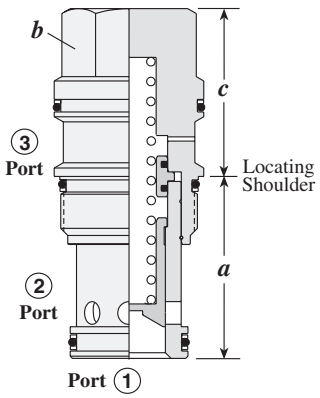
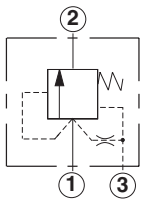
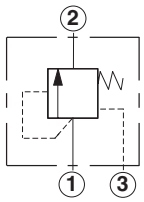
NORMALLY CLOSED, MODULATING ELEMENT





LR*A



LR*C

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c X	c L	*Installation Torque (Nm)*
30 L/min.	**LRBC – XHN**	T - 163A	31,8	19,1	31,8	64,8	35 - 40
60 L/min.	**LRDC – XHN**	T - 11A	35,0	22,2	30,2	63,5	45 - 50
120 L/min.	**LRFC – XHN**	T - 2A	35,0	28,6	35,0	83,1	60 - 70
240 L/min.	**LRHC – XHN**	T - 17A	46,0	31,8	46,0	84,0	200 - 215
480 L/min.	**LRJC – XHN**	T - 19A	63,8	41,3	58,7	100,1	465 - 500

- Maximum operating pressure = 350 bar.
- Control orifice diameter = LRBA, LRDA, LRFA: 0,4 mm; LRHA, LRJA: 0,53 mm.
- Control Pilot Flow = LRBA, LRDA, LRFA: 0,16 - 0,25 L/min.; LRHA, LRJA: 0,25 - 0,50 L/min.
- An optional tuning adjustment (L control) is offered to vary the pressure drop across the compensator to increase or decrease the flow. **This option is only available with the D differential pressure range.**

OPTION ORDERING INFORMATION

LR ** – X ** *

Nominal Capacity

- **B** 30 L/min.
- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Version

- **A** Internal pilot, Pilot source from port 1 (mainstage relief element)
- **C** External pilot (bypass compensator)

Control**

- **X** Not Adjustable

Available in D Differential Pressure only:

- **L** Tuning Adjustment

Differential Pressure

- **D** 3,5 bar
- **F** 7,0 bar
- **G***10,0 bar
- **H** 14,0 bar

* *Differential Pressure not available in LRBA, LRDA, LRHA, LRJA, and LRBC*

Seal Material

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

*** See page 178 for information on Control Options*

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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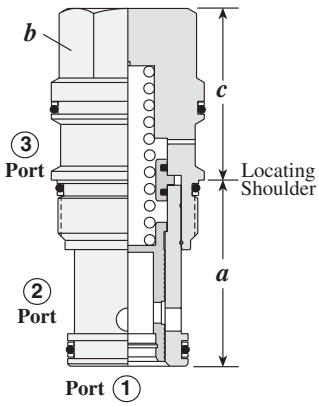
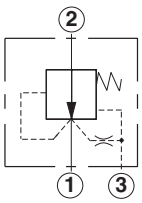
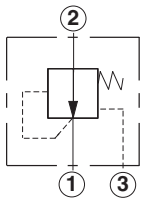
NORMALLY OPEN, MODULATING ELEMENT





LP*A



LP*C

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*				*Installation Torque (Nm)*
			a	*b*	*c*		
					X	**L**	
30 L/min.	**LPBC – XHN**	T - 163A	31,0	19,1	31,8	64,8	35 - 40
60 L/min.	**LPDC – XHN**	T - 11A	35,0	22,2	30,2	63,5	45 - 50
120 L/min.	**LPFC – XHN**	T - 2A	35,0	28,6	35,0	71,6	60 - 70
240 L/min.	**LPHC – XHN**	T - 17A	46,0	31,8	46,0	83,1	200 - 215
480 L/min.	**LPJC – XHN**	T - 19A	63,5	41,3	58,7	100,0	465 - 500

- Maximum operating pressure = 350 bar.
- Control Pilot Flow = LPBA, LPDA, LPFA: 0,16 - 0,25 L/min.; LPHA, LPJA: 0,25 - 0,50 L/min.
- Control Orifice Diameter = LPBA, LPDA, LPFA: 0,4 mm; LPHA, LPJA: 0,53 mm.
- An optional tuning adjustment (L control) is offered to vary the pressure drop across the compensator to increase or decrease the flow. **This option is only available with the D differential pressure range.**

OPTION ORDERING INFORMATION

LP ✱✱ – X✱✱

Nominal Capacity

- **B** 30 L/min.
- **D** 60 L/min.
- **F** 120 L/min.
- **H** 240 L/min.
- **J** 480 L/min.

Version

- **A** Internal pilot, Pilot source from port 1. (mainstage reducing element)
- **C** External pilot (restrictive compensator)

Control**

- **X** Not Adjustable

Available in D Differential Pressure only:

- **L** Tuning Adjustment

Differential Pressure

- **D** 3,5 bar
- **F** 7,0 bar
- **G***10,0 bar
- **H** 14,0 bar

* *Differential Pressure Range not available in LPBC, LPBA, LPDA, LPFA, and LPJA.*

Seal Material

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

***** See page 178 for information on Control Options***

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

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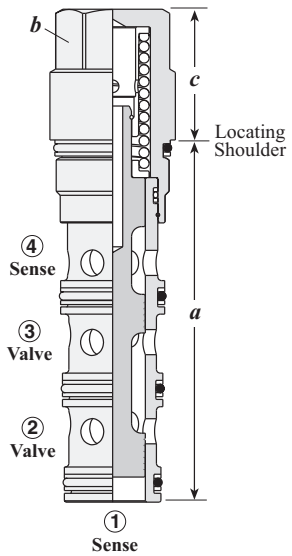
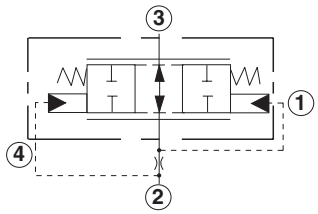
BI-DIRECTIONAL, MODULATING ELEMENT, NORMALLY OPEN

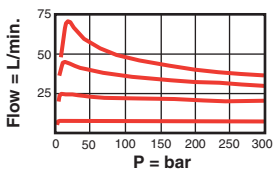




Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
60 L/min.	**LHDT – XFN**	T - 31A	84,8	22,2	30,2	45 - 50
120 L/min.	**LHFT – XFN**	T - 32A	92,2	28,6	33,3	60 - 70
240 L/min.	**LHHT – XFN**	T - 33A	114,3	31,8	41,3	200 - 215

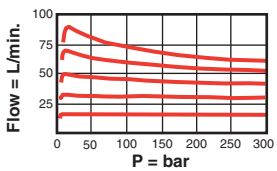
Performance Curves

LHDT

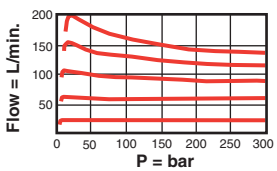


LHFT

Pressure Differential vs. Flow



LHHT



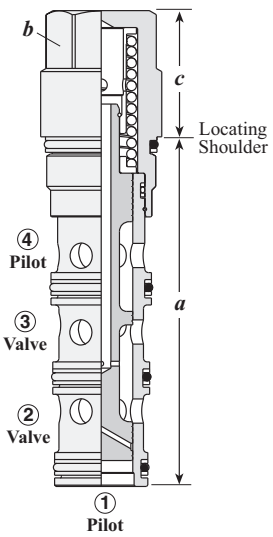
- Maximum operating pressure = 350 bar.
- All ports will accept 350 bar.
- These bi-directional, normally open, modulating elements, used with an external orifice, create a bi-directional, pressure compensated flow control.

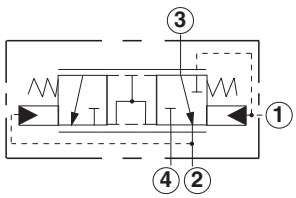
OPTION ORDERING INFORMATION

LH ✱ T – X ✱ ✱

Nominal Capacity		*Control*		*Nominal Control Pressure*		*Seal Material*	
D	60 L/min.	**X**	Not Adjustable	**D**	3,5 bar	**N**	Buna-N
F	120 L/min.			**E**	5 bar	**V**	Viton
H	240 L/min.			**F**	7 bar		

BYPASS/RESTRICTIVE, PRIORITY MODULATING ELEMENT





Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**LHDA – XFN**	T - 31A	84,8	22,2	30,1	45 - 50
120 L/min.	**LHFA – XFN**	T - 32A	92,2	28,6	33,3	60 - 70
240 L/min.	**LHHA – XFN**	T - 33A	114,3	31,8	41,3	200 - 215
480 L/min.	**LHJA – XFN**	T - 34A	139,7	41,3	54,0	465 - 500

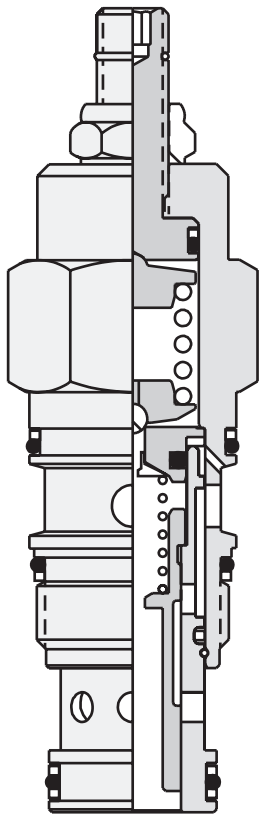
- Maximum operating pressure = 350 bar.
- Bypass flow is not available until priority flow requirements are satisfied.
- Bypass pressure at port 4 can be higher than pressure at control port 2.
- Priority flow can be turned off with a pilot sized solenoid valve on port 1.

OPTION ORDERING INFORMATION

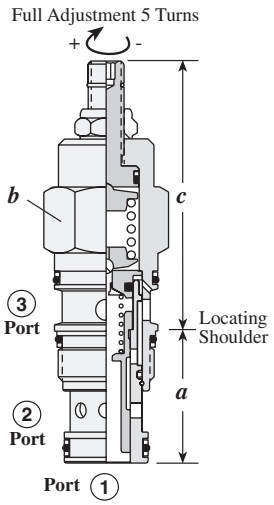
LH ✱ A – X ✱ ✱

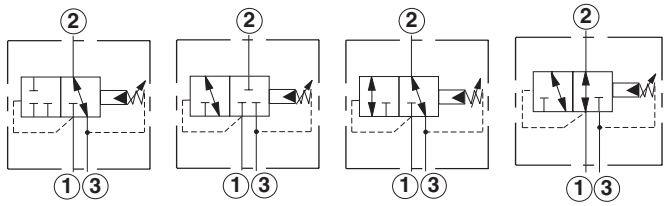
Nominal Capacity	*Control*	*Differential Pressure*	*Seal Material*
D 60 L/min.	**X** Not Adjustable	**E** 5 bar	**N** Buna-N
F 120 L/min.		**F** 7 bar	**V** Viton
H 240 L/min.			
J 480 L/min.			

Directional Cartridge Valves



2-WAY AND 3-WAY, WITH INTERNAL DRAIN TO PORT 3





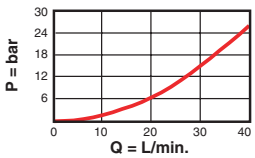
DPBA, DPCA **DPBB, DPCB** **DPBC, DPCC** **DPBD, DPCD**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (Nm)*
28 L/min.	**DPBA – LAN**	T - 11A	35,1	22,2	63,5	67,6	69,9	45 - 50
60 L/min.	**DPCA – LAN**	T - 2A	35,1	28,6	71,4	73,2	77,7	60 - 70

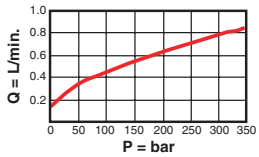
Performance Curves

DPB*

Typical Pressure Drop

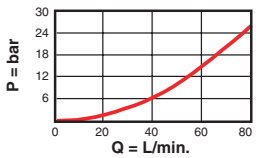


Pilot Oil Flow vs. Load Pressure above Valve Setting

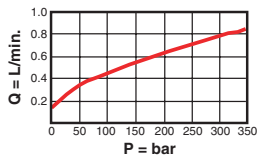


DPC*

Typical Pressure Drop



Pilot Oil Flow vs. Load Pressure above Valve Setting



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 15 cc/min. at 70 bar.
- Control pilot flow = DPBA, DPBB, DPBC, DPBD: 0,11 - 0,16 L/min.; DPCA, DPCB, DPCC, DPCD: 0,16 - 0,25 L/min.
- Maximum pressure at port 3 should be limited to 210 bar. This is due to fatigue strength limits not hydraulic operating limits.
- 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.
- Direct acting and pilot operated versions of these valves are interchangeable. They fit the same cavities and have the same flow paths.
- These valves are not bistable; it is capable of modulating between the two positions shown.

OPTION ORDERING INFORMATION

DP ** – *

Nominal Capacity

B 28 L/min.

C 60 L/min.

Version

A 2-Way, Pilot Operated, with Internal Drain to Port 3, Normally Open

B 2-Way, Pilot Operated, with Internal Drain to Port 3, Normally Closed

C 3-Way, 2-Position, Pilot Operated, with Internal Drain to to Port 3, Port 1 Blocked, 2 to 3 Open

D 3-Way, 2-Position, Pilot Operated, with Internal Drain to Port 3, Port 3 Blocked, 1 to 2 Open

Control**

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Adjustment Range

A 7 - 210 bar Standard set at 70 bar

B 3,5 - 105 bar Standard set at 70 bar

D 1,7 - 55 bar Standard set at 28 bar

E 1,7 - 28 bar Standard set at 14 bar

W 10,5 - 315 bar Standard set at 70 bar

C 10,5 - 420 bar Standard set at 70 bar

Seal Material

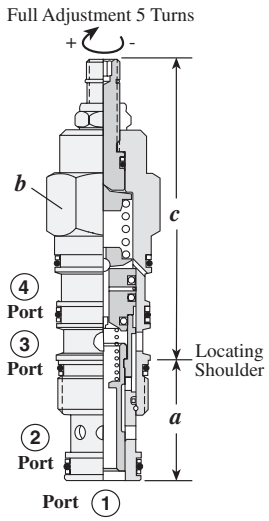
N Buna-N

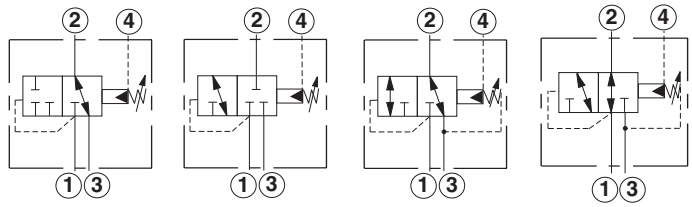
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY AND 3-WAY, WITH DRAIN TO PORT 4



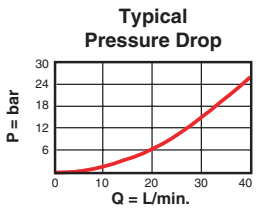


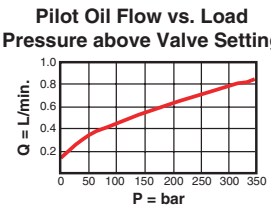
DPBM, DPCM **DPBN, DPCN** **DPBO, DPCO** **DPBP, DPCP**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c L	c C	c K	*Installation Torque (Nm)*
28 L/min.	**DPBM– LAN**	T - 21A	35,1	22,2	78,5	82,6	84,8	45 - 50
60 L/min.	**DPCM– LAN**	T - 22A	35,1	28,6	87,4	88,9	93,7	60 - 70

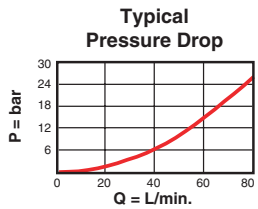
Performance Curves

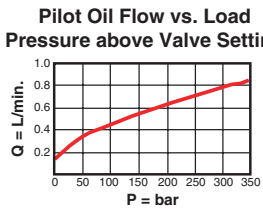
DPB*





DPC*





- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 15 cc/min. at 70 bar.
- Control pilot flow = DPBM, DPBN, DPBO, DPBP: 0,11 - 0,16 L/min.; DPCM, DPCN, DPCO, DPCP: 0,16 - 0,25 L/min.
- Maximum pressure at port 3 should be limited to 210 bar. This is due to fatigue strength limits not hydraulic operating limits.
- 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.
- Direct acting and pilot operated versions of these valves are interchangeable. They fit the same cavities and have the same flow paths.
- These valves are not bistable; it is capable of modulating between the two positions shown.

OPTION ORDERING INFORMATION

DP ** – *

Nominal Capacity

B 28 L/min.

C 60 L/min.

Version

M 2-Way, Pilot Operated, with Drain to Port 4, Normally Open

N 2-Way, Pilot Operated, with Drain to Port 4, Normally Closed

O 3-Way, 2-Position, Pilot Operated, with Drain to Port 4, 2 to 3 Open, Port 1 Blocked

P 3-Way, 2-Position, Pilot Operated, with Drain to Port 4, 1 to 2 Open, Port 3 Blocked

*Control***

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Adjustment Range

A 7 - 210 bar Standard set at 70 bar

B 3,5 - 105 bar Standard set at 70 bar

D 1,7 - 55 bar Standard set at 28 bar

E 1,7 - 28 bar Standard set at 14 bar

W 10,5 - 315 bar Standard set at 70 bar

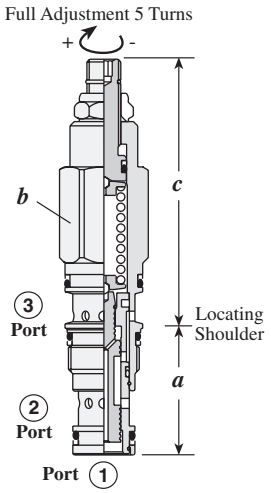
Seal Material

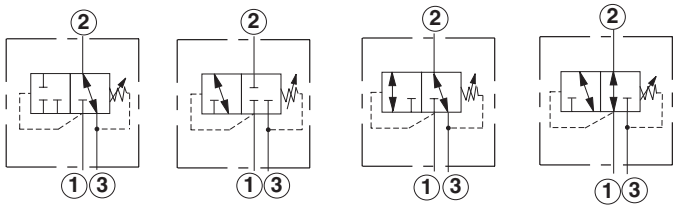
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY AND 3-WAY DIRECT ACTING, INTERNAL DRAIN TO PORT 3





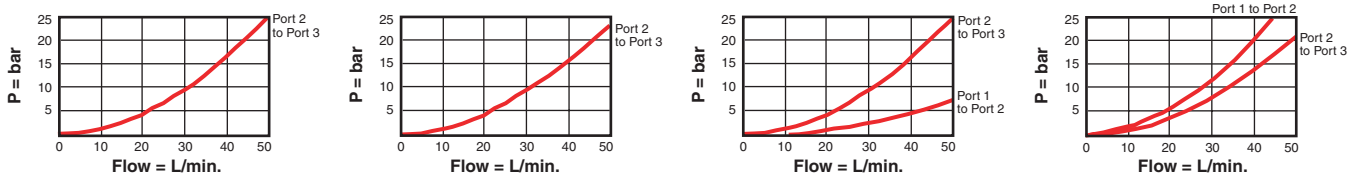
DRBA **DRBB** **DRBC** **DRBD**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (Nm)*
28 L/min.	**DRBA – LAN**	T - 11A	35,0	22,2	78,5	82,6	85,0	45 - 50
28 L/min.	**DRBB – LAN**	T - 11A	35,0	22,2	78,5	82,6	85,0	45 - 50
28 L/min.	**DRBC – LAN**	T - 11A	35,0	22,2	78,5	82,6	85,0	45 - 50
28 L/min.	**DRBD – LAN**	T - 11A	35,0	22,2	78,5	82,6	85,0	45 - 50

Performance Curves

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

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum combined valve leakage (ports 2 and 3) = 30 cc/min. at 70 bar.
- 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.
- Pilot pressure at port 3 is limited to 210 bar.
- Direct acting and pilot operated versions of these valves are interchangeable. They fit the same cavities and have the same flow paths.
- Because of their direct acting design, these cartridges feature low internal leakage and low pilot flow consumption.
- These valves are not bistable; it is capable of modulating between the two positions shown.

OPTION ORDERING INFORMATION

DR ** ** – *

Nominal Capacity

B 28 L/min.

Version

A 2-Way, Direct Acting, with Internal Drain to Port 3, Normally Open

B 2-Way, Direct Acting, with Internal Drain to Port 3, Normally Closed

C 3-Way, 2-Position, Direct Acting, with Internal Drain to to Port 3, Port 1 Blocked, 2 to 3 Open

D 3-Way, 2-Position, Direct Acting, with Internal Drain to Port 3, Port 3 Blocked, 1 to 2 Open

Control**

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

** Special setting required. Specify at time of order.*

*** See page 178 for information on Control Options*

Adjustment Range

A 35 - 210 bar Standard set at 70 bar

B 3,5 - 105 bar Standard set at 14 bar

D 1,7 - 55 bar Standard set at 14 bar

E 1,7 - 28 bar Standard set at 14 bar

S 1,7 - 14 bar Standard set at 14 bar

W 50 - 315 bar Standard set at 70 bar

Seal Material

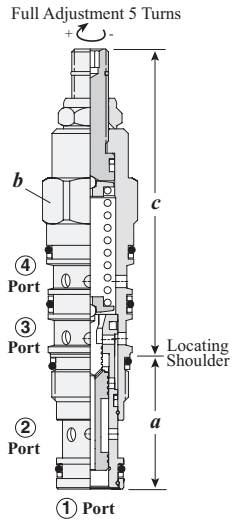
N Buna-N

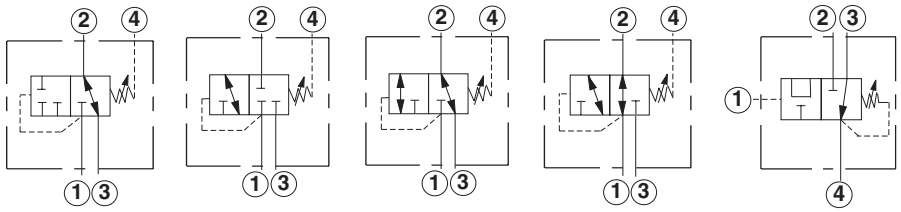
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY AND 3-WAY DIRECT ACTING, DRAIN TO PORT 4



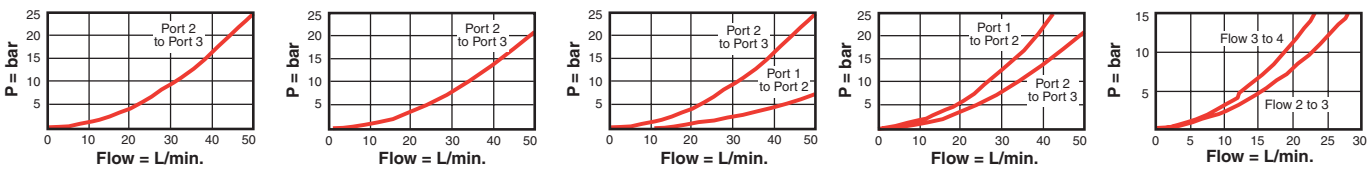


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
28 L/min.	**DRBM – LAN**	T - 21A	35,1	22,2	78,7	80,3	84,8	45 - 50
28 L/min.	**DRBN – LAN**	T - 21A	35,1	22,2	78,7	80,3	84,8	45 - 50
28 L/min.	**DRBO – LAN**	T - 21A	35,1	22,2	78,7	80,3	84,8	45 - 50
28 L/min.	**DRBP – LAN**	T - 21A	35,1	22,2	78,7	80,3	84,8	45 - 50
28 L/min.	**DRBR – LAN**	T - 21A	35,1	22,2	78,7	80,3	84,8	45 - 50

Performance Curves

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

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum combined valve leakage (ports 2, 3, and 4) = 30 cc/min. at 70 bar.
- Maximum pressure at port 3 should be limited to 210 bar. This is due to fatigue strength limits not hydraulic operating limits.
- Port 3 can be used as a work port.
- Pressure at port 4 is directly additive to the setting of the valve.
- Because of their direct acting design, these cartridges feature low internal leakage and low pilot flow consumption.
- Direct acting and pilot operated versions of these valves are interchangeable. They fit the same cavities and have the same flow paths.
- This valve is not bistable; it is capable of modulating between the two positions shown.
- DRBR: 55 bar is the highest setting possible for this valve. The flow path between ports 2 and 3 is bidirectional.

OPTION ORDERING INFORMATION

DR ✱✱ – ✱✱✱

Nominal Capacity

B 28 L/min.

DRCO only:
C 60 L/min.

Version

M 2-Way, Direct Acting, with Drain to Port 4, Normally Open
N 2-Way, Direct Acting, with Drain to Port 4, Normally Closed
O 3-Way, 2-Position, Direct Acting, with Drain to Port 4, Port 2 to 3 Open, Port 1 Blocked
P 3-Way, 2-Position, with Drain to Port 4, Port 1 to 2 Open, Port 3 Blocked
R 3-Way, 2-Position, Direct Acting, with Drain to Port 4, Port 3 to Port 4 Open, Port 2 Blocked

Control**

L Standard Screw Adjustment
C* Tamper Resistant Factory Set
K Handknob with Lock Knob

* ***Special setting required. Specify at time of order.***

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

Adjustment Range

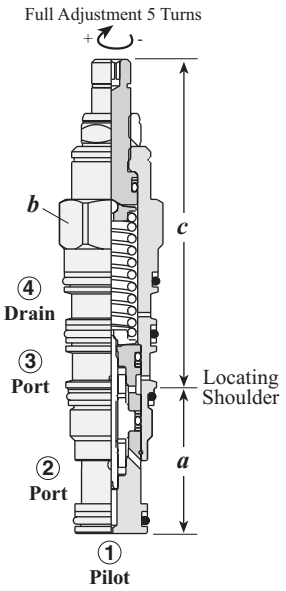
A 35 - 210 bar
Standard set at 70 bar
B 3,5 - 105 bar
Standard set at 14 bar
D 1,7 - 55 bar
Standard set at 14 bar
E 1,7 - 28 bar
Standard set at 14 bar
S 1,7 - 14 bar
Standard set at 14 bar
W 50 - 315 bar
Standard set at 70 bar
DRBR only:
N 4 - 55 bar
Standard set at 14 bar
E 1,7 - 28 bar
Standard set at 14 bar
S 1,7 - 14 bar
Standard set at 14 bar

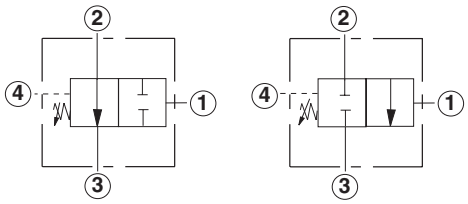
Seal Material

N Buna-N
V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY, DIRECT ACTING, SEALED PILOT, PILOT-TO-SHIFT





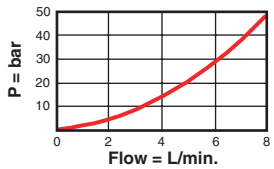
DRAY **DRAX**

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
2 L/min.	**DRAY – LAN**	T - 21A	35,1	22,2	78,5	45 - 50
2 L/min.	**DRAX – LAN**	T - 21A	35,1	22,2	78,5	45 - 50

Performance Curves

DRAY, DRAX

Typical Pressure Drop vs. Flow
Port 2 to Port 3



- Maximum operating pressure = 350 bar.
- Reseat = > 85% of set pressure.
- The pilot area (port 1) and the spring chamber drain (port 4) are positively sealed.
- The valve is designed not to modulate and is the equivalent of a hydraulic pressure switch.
- There is spool leakage at 0,6 cc/min. at 70 bar between work ports 2 and 3.

OPTION ORDERING INFORMATION

DR A ✱ – L ✱ ✱

Nominal Capacity

A 2 L/min.

Version

Y 2-Way, Pilot-to-shift with Drain to Port 4, Normally Open

X 2-Way, Pilot-to-shift with Drain to Port 4, Normally Closed

Control

L Standard Screw Adjustment

Adjustment Range*

A 70 - 210 bar
Standard set at 70 bar

C 140 - 420 bar
Standard set at 140 bar

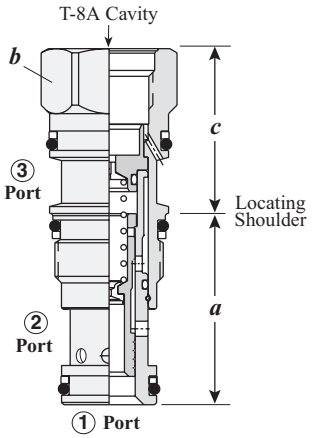
Seal Material

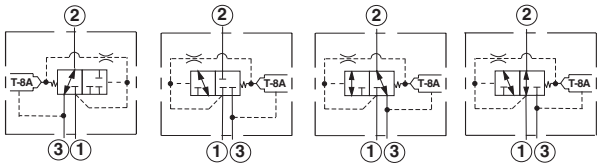
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY AND 3-WAY, VENT-TO-OPERATE WITH INTEGRAL T-8A CONTROL CAVITY





DV*A-8 **DV*B-8** **DV*C-8** **DV*D-8**

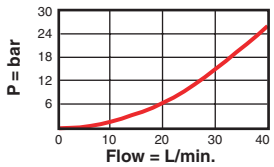
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
28 L/min.	**DVB* – 8FN**	T-11A	35,1	22,2	35,1	45 - 50
60 L/min.	**DVC* – 8FN**	T-2A	35,1	28,6	35,1	60 - 70

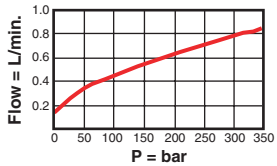
Performance Curves

DVB∗-8

Typical Pressure Drop with T-8A Pilot Stage Installed

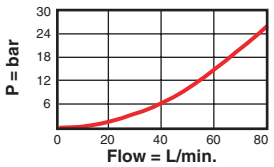


Pilot Oil Flow vs. Load Pressure above Valve Setting

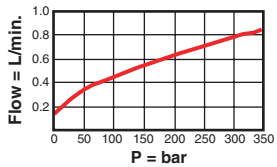


DVC∗-8

Typical Pressure Drop with T-8A Pilot Stage Installed



Pilot Oil Flow vs. Load Pressure above Valve Setting



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 30 cc/min. at 70 bar.
- Control pilot flow = DVBA-8, DVBB-8, DVBC-8, DVBD-8: 0,11 - 0,16 L/min.; DVCA-8, DVCB-8, DVCC-8, DVCD-8: 0,16 - 0,25 L/min.
- 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.
- Pressure at port 3 is limited to 210 bar.
- These valves are not bistable; they are capable of modulating between the two positions shown.
- 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 F ∗

Nominal Capacity

- **B** 28 L/min.
- **C** 60 L/min.

Version

- **A** 2-Way, Vent-to-operate, with Internal Drain to Port 3, Normally Open
- **B** 2-Way, Vent-to-operate, with Internal Drain to Port 3, Normally Closed
- **C** 3-Way, 2-Position, Vent-to-operate, with Internal Drain to Port 3, Port 2 to 3 Open, Port 1 Blocked
- **D** 3-Way, 2-Position, Vent-to-operate, with Internal Drain to Port 3, Port 1 to 2 Open, Port 3 Blocked

Control

- **8** T-8A Cavity in hex body for pilot operation

  Pilot valve to be ordered separately

Minimum Control Pressure

- **F** 7 bar

Seal Material

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

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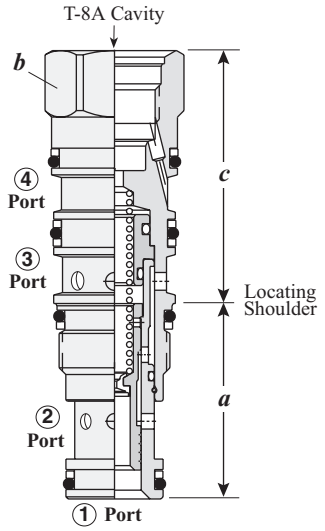
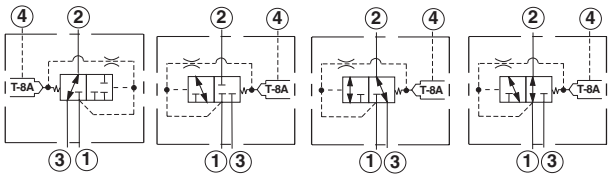
2-WAY AND 3-WAY, VENT-TO-OPERATE, WITH INTEGRAL T-8A CONTROL CAVITY





DV*M-8 **DV*N-8** **DV*O-8** **DV*P-8**

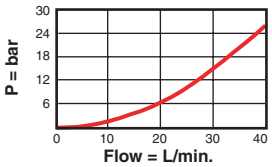
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
28 L/min.	**DVB* – 8FN**	T-21A	35,1	22,2	42,9	45 - 50
60 L/min.	**DVC* – 8FN**	T-22A	35,1	28,6	50,8	60 - 70

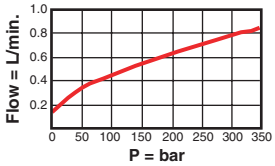
Performance Curves

DVB*-8

Typical Pressure Drop with T-8A Pilot Stage Installed

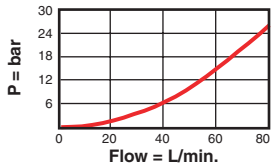


Pilot Oil Flow vs. Load Pressure above Valve Setting

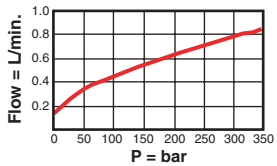


DVC*-8

Typical Pressure Drop with T-8A Pilot Stage Installed



Pilot Oil Flow vs. Load Pressure above Valve Setting



- Maximum operating pressure = 350 bar.
- Maximum leakage at 24 cSt = 30,0 cc/min. at 70 bar.
- Control pilot flow at opening = DVB*-8, DVC*-8: 0,11 - 0,16 L/min.
- Port 3 can be used as a work port.
- The flow path between port 2 and port 3 is bidirectional.
- Pressure at port 3 is limited to 210 bar.
- These valves are not bistable; it is capable of modulating between the two positions shown.
- 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 F ✱

Nominal Capacity

B 28 L/min.

C 60 L/min.

Version

M 2-Way, Vent-to-operate, with Drain to Port 4, Normally Open

N 2-Way, Vent-to-operate, with Drain to Port 4, Normally Closed

O 3-Way, 2-Position, Vent-to-operate, with Drain to Port 4, Port 2 to 3 Open, Port 1 Blocked

P 3-Way, 2-Position, Vent-to-operate, with Drain to Port 4, Port 1 to 2 Open, Port 3 Blocked

Control

8 T-8A Cavity in hex body for pilot operation

Pilot valve to be ordered separately

Minimum Control Pressure

F 7 bar

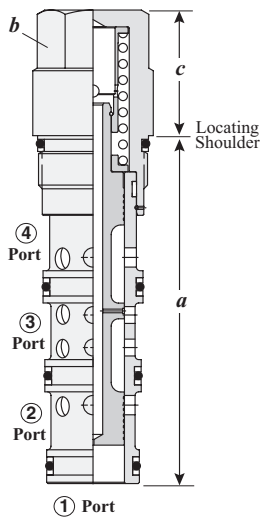
Seal Material

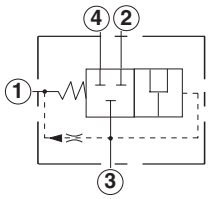
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

3-WAY, 2-POSITION VENT-TO-SHIFT, DIVERTER, NORMALLY CLOSED



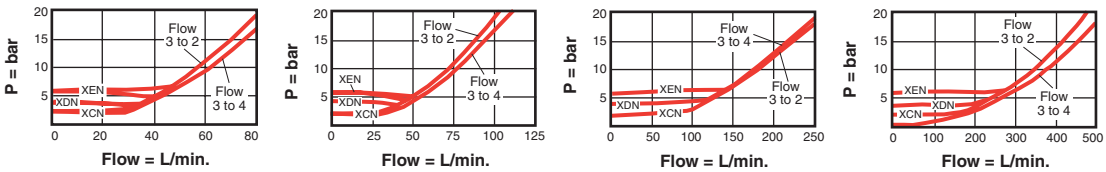


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (Nm)
60 L/min.	**DSCX – XEN**	T - 31A	84,8	22,2	30,2	45 - 50
120 L/min.	**DSEX – XEN**	T - 32A	92,2	28,6	33,3	60 - 70
240 L/min.	**DSGX – XEN**	T - 33A	114,6	31,8	41,4	200 - 215
480 L/min.	**DSIX – XEN**	T - 34A	139,7	41,3	53,8	465 - 500

Performance Curves

DSCX **DSEX** **DSGX** **DSIX**

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Pressure compensated vent flow = DSCX, DSEX: 0,38 L/min.; DSGX, DSIX: 0,60 L/min.
- There must be a pressure source at port 3, relative to port 1, to shift the valve.
- The pressure at port 3 must be greater than port 1 and is dependant on the minimum control pressure selected.
- One application of this valve is to bypass divider/combiner valves in a limited-slip tractive circuit. Closed, the oil must go through the divider/combiner valves. Open, there is a large path around the divider/combiner valves for efficient high speed operation.
- One pilot valve may be used; to vent multiple diverter valves if blocking checks are used at port 1of each diverter. If blocking checks are not used, there will be interaction between high and low pressure legs of the circuits.
- Hardened spool and sleeve provide consistent and low spool leakage rates and excellent wear characteristics.
- The valve is not bistable; it is capable of modulation between the two positions shown.

OPTION ORDERING INFORMATION

DS ✱ X – X E ✱

Nominal Capacity		*Control*		*Minimum Control Pressure*		*Seal Material*	
C	60 L/min.	**X**	Not Adjustable	**C**	2 bar	**N**	Buna-N
E	120 L/min.			**D**	3,5 bar	**V**	Viton
G	240 L/min.			**E**	5 bar		
I	480 L/min.						

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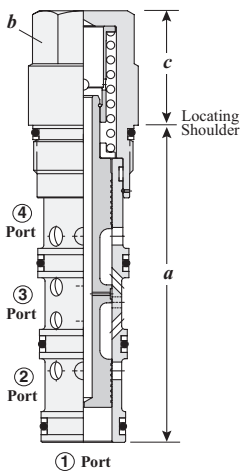
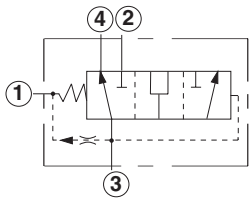
3-WAY, 2-POSITION, VENT-TO-SHIFT, DIVERTER, NORMALLY OPEN



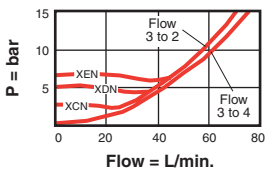


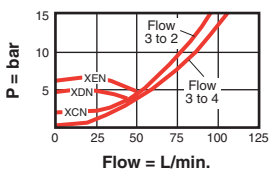
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**DSCY – XEN**	T - 31A	84,8	22,2	30,2	45 - 50
120 L/min.	**DSEY – XEN**	T - 32A	92,2	28,6	33,3	60 - 70
240 L/min.	**DSGY – XEN**	T - 33A	114,6	31,8	41,4	200 - 215
480 L/min.	**DSIY – XEN**	T - 34A	139,7	41,3	53,8	465 - 500

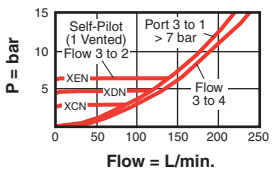
Performance Curves

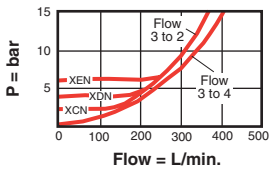
DSCY **DSEY** **DSGY** **DSIY**

Typical Pressure Drop









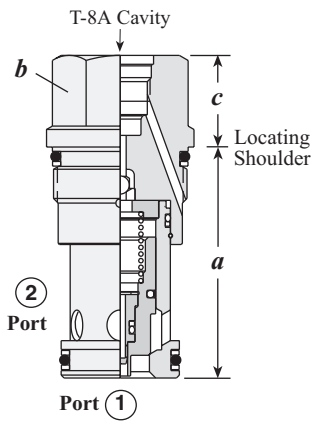
- Maximum operating pressure = 350 bar.
- Pressure compensated vent flow = DSCY, DSEY: 0,38 L/min.; DSGY, DSIY: 0,60 L/min.
- The pressure at port 3 must be greater than port 1 and is dependant on the minimum control pressure selected.
- There must be a pressure source at port 3, relative to port 1, to shift the valve.
- One application of this valve is to be used in pairs to select between 2 motors or pumps.
- Hardened spool and sleeve provide consistent and low spool leakage rates and excellent wear characteristics.
- The valve is not bistable; it is capable of modulation between the two positions shown.

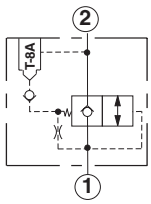
OPTION ORDERING INFORMATION

DS ✱ Y – X E ✱

Nominal Capacity		*Control*		*Minimum Control Pressure*		*Seal Material*	
C	60 L/min.	**X**	Not Adjustable	**C**	2 bar	**N**	Buna-N
E	120 L/min.			**D**	3,5 bar	**V**	Viton
G	240 L/min.			**E**	5 bar		
I	480 L/min.						

2-WAY POPPET, WITH INTEGRAL T-8A CONTROL CAVITY, CONTROL PORT 1 TO PORT 2





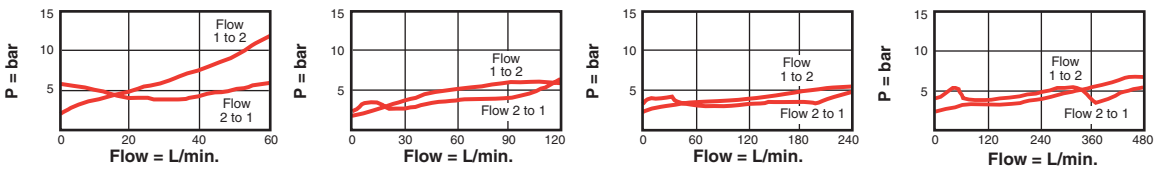
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
60 L/min.	**DFCA – 8DN**	T - 13A	35,1	22,2	19,1	45 - 50
120 L/min.	**DFDA – 8DN**	T - 5A	41,1	28,6	17,5	60 - 70
240 L/min.	**DFEA – 8DN**	T - 16A	62,0	31,8	24,6	200 - 215
480 L/min.	**DFFA – 8DN**	T - 18A	79,5	41,3	30,2	465 - 500

Performance Curves

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

Pressure Differential vs. Flow



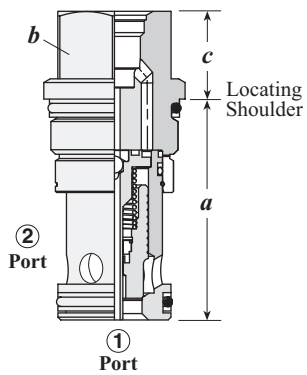
- Maximum operating pressure = 350 bar.
- Maximum main stage valve leakage at 24 cSt = 0,6 cc/min. at 350 bar (for complete assembly, port valve leakage must be considered).
- The main stage valve should first be installed to the correct torque value followed by the T-8A pilot control section into the main stage valve to its required torque value.

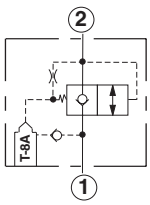
OPTION ORDERING INFORMATION

DF ✱ A – 8 D ✱

Nominal Capacity	*Control*	*Cracking Pressure*	*Seal Material*
C 60 L/min.	**8** T-8A cavity in hex body for pilot operation	**D** 3,5 bar	**N** Buna-N
D 120 L/min.	Pilot valve to be ordered separately Options are:		**V** Viton
E 240 L/min.	• Solenoid Pilot		
F 480 L/min.	• Air Pilot		
	• Hydraulic Pilot		
	• Manual Control		

2-WAY POPPET, WITH INTEGRAL T-8A CONTROL CAVITY, CONTROL PORT 2 TO PORT 1





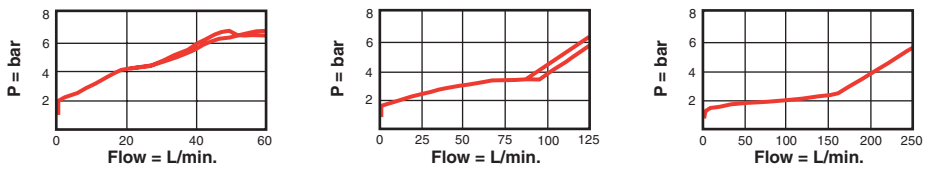
The -8 control option allows the pilot control valve to be incorporated directly into the end of the cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
60 L/min.	**DFCB – 8DN**	T - 13A	35,1	22,2	19,1	45 - 50
120 L/min.	**DFDB – 8DN**	T - 5A	41,1	28,6	17,5	60 - 70
240 L/min.	**DFEB – 8DN**	T - 16A	62,0	31,8	24,6	200 - 215

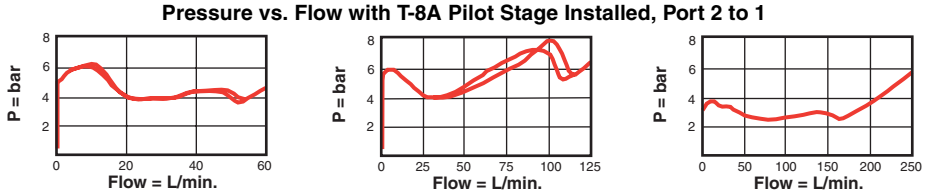
Performance Curves

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

Pressure vs. Flow with T-8A Pilot Stage Installed, Port 1 to 2



Pressure vs. Flow with T-8A Pilot Stage Installed, Port 2 to 1



- Maximum operating pressure = 350 bar.
- Maximum main stage valve leakage at 24 cSt = 0,6 cc/min. at 350 bar (for complete assembly, port valve leakage must be considered).
- 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

DF ✱ B – 8 D ✱

Nominal Capacity

- **C** 60 L/min.
- **D** 120 L/min.
- **E** 240 L/min.

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

Cracking Pressure

- **D** 3,5 bar

Seal Material

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

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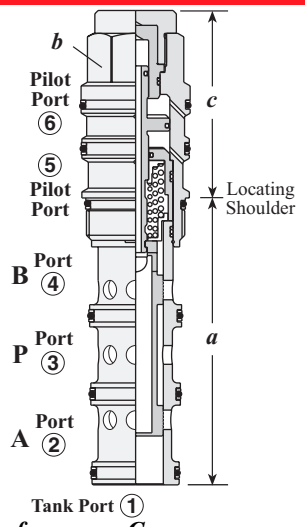
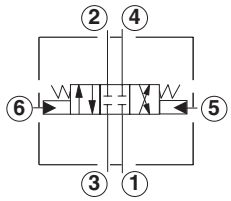
3-POSITION, 4-WAY, PILOT-TO-SHIFT



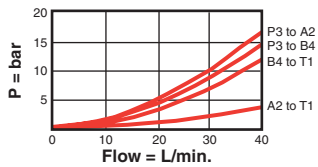


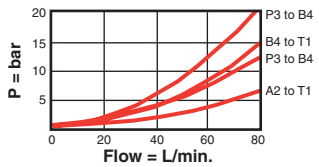
Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	Installation Torque (Nm)
40 L/min.	**DCCC – XCN**	T - 61A	85,1	22,2	50,0	45 - 50
80 L/min.	**DCDC – XCN**	T - 62A	92,2	28,6	58,7	60 - 70
160 L/min.	**DCEC – XCN**	T - 63A	114,6	31,8	72,1	200 - 215
320 L/min.	**DCFC – XCN**	T - 64A	140,0	41,3	91,2	465 - 500

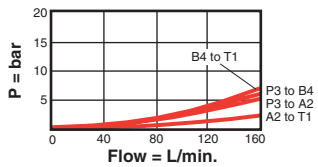
Performance Curves

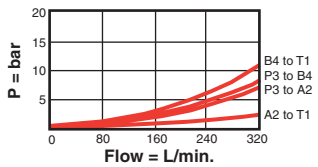
DCCC **DCDC** **DCEC** **DCFC**

Typical Pressure Drop

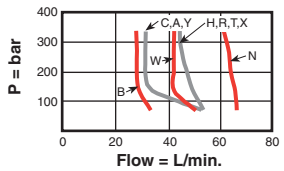


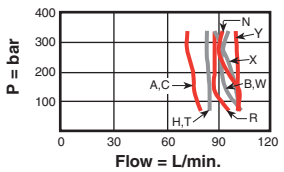


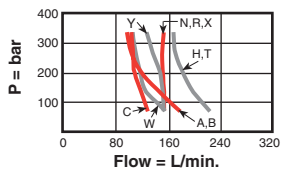


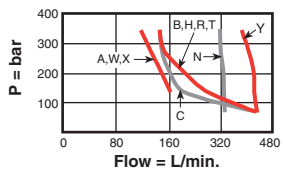


Flow Capacity vs. System Pressure with 12 bar Pilot Signal









- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 30 cc/min. at 70 bar.
- Minimum pilot pressure required to shift valve = DCCC: 12 bar, DCDC: 10,5 bar, DCEC, DCFC: 9 bar.
- Pilot volume displacement = DCCC: 0,33 cc,; DCDC: 0,98 cc,; DCEC: 2,8 cc,; DCFC: 6,9 cc.
- All ports will accept 350 bar, including the x and y pilot ports (port 5 and port 6).
- The pilot ports, 5 and 6 are positively sealed from the work ports.
- The reason for the different capacities, or performance limits, for the different spool configurations are flow forces. Flow forces are proportional to flow and pressure drop. Typically, they resist the opening of a passage. Spool configurations that open passages as they spring centre are the most susceptible. If the flow forces due to the flow and pressure conditions exceed the centring spring force the valve may not shift completely. Higher flows may be used at lower pressures.

OPTION ORDERING INFORMATION

DC ✱ C – X ✱ ✱

Nominal Capacity

- **C** 40 L/min.
- **D** 80 L/min.
- **E** 160 L/min.
- **F** 320 L/min.

Control

- **X** Standard Pilot

Spool Configuration

- **A** A to T Centre
- **B** B to T Centre
- **C** Blocked Centre
- **H** Open Centre
- **N** P to A and B to T Centre

Spool Configuration

- **R** Regen Centre
- **T** Tandem Centre
- **W** A and B Bleed to T Centre
- **X** P to B and A to T Centre
- **Y** A and B to T Centre

Seal Material

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

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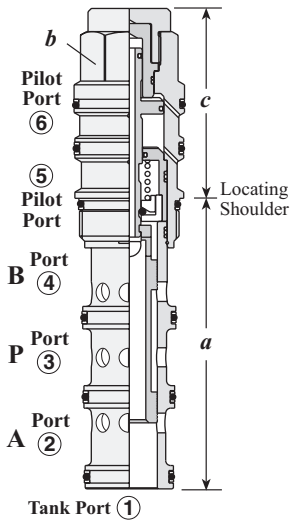
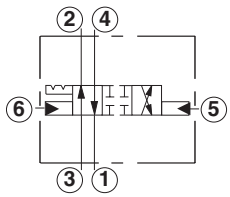
2-POSITION, 4-WAY, PILOT-TO-SHIFT, DETENTED



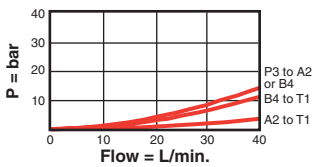


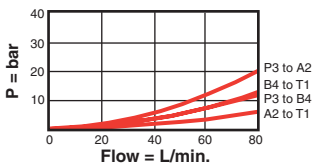
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
40 L/min.	**DCCD – XCN**	T - 61A	85,1	22,2	50,0	45 - 50
80 L/min.	**DCDD – XCN**	T - 62A	92,2	28,6	58,7	60 - 70
160 L/min.	**DCED – XCN**	T - 63A	114,6	31,8	72,1	200 - 215
320 L/min.	**DCFD – XCN**	T - 64A	140,0	41,3	91,2	465 - 500

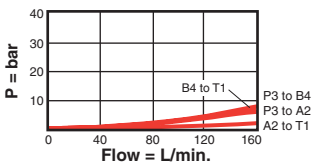
Performance Curves

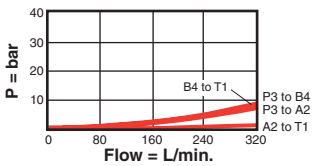
DCCD **DCDD** **DCED** **DCFD**

Typical Pressure Drop









See www.sunhydraulics.com for additional performance curves.

- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 30 cc/min. at 70 bar.
- Minimum pilot pressure required to shift valve = DCCD: 12 bar, DCDD: 10,5 bar, DCED, DCFD: 9 bar.
- Pilot volume displacement = DCCD: 0,82 cc,; DCDD: 2,0 cc,; DCED: 5,6 cc,; DCFD: 14,0 cc.
- All ports will accept 350 bar, including the x and y pilot ports (port 5 and port 6).
- The pilot ports, 5 and 6, are positively sealed from the work ports.

OPTION ORDERING INFORMATION

DC ✱ D – X ✱ ✱

Nominal Capacity

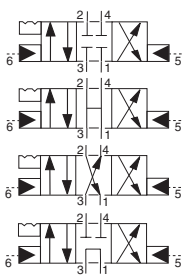
C 40 L/min.
D 80 L/min.
E 160 L/min.
F 320 L/min.

Control

X Standard Pilot

Spool Configuration

C Blocked Crossover
H Open Crossover
X P to B and A to T Crossover
Available for DCCD only:
T Tandem Crossover



Seal Material

N Buna-N
V Viton

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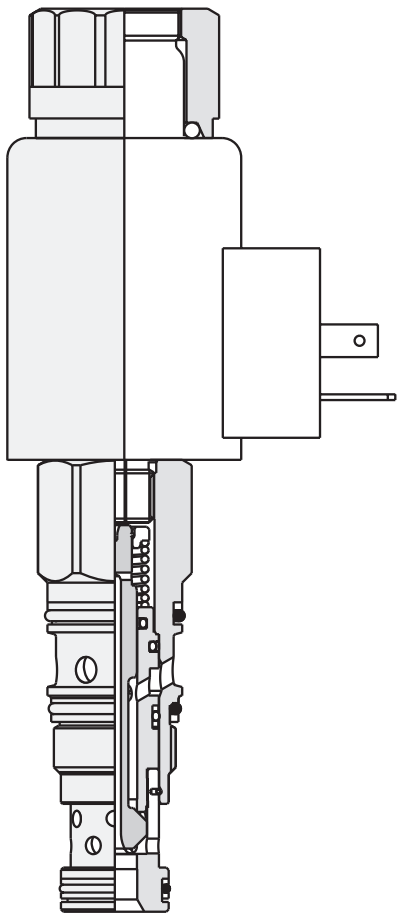
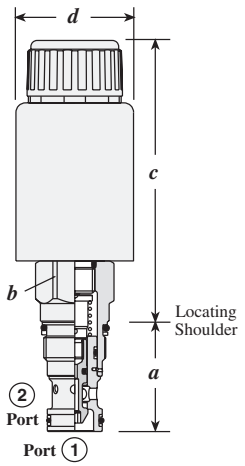
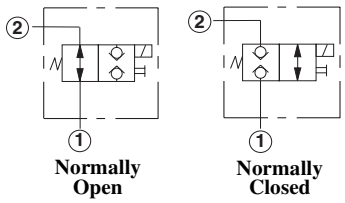
Solenoid Operated Cartridge Valves



2-WAY, DIRECT ACTING, POPPET DIRECTIONAL VALVE





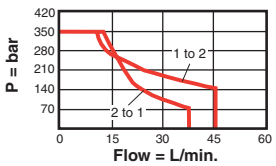
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c*** M,X,S	c*** D,L,T	d	*Installation Torque (Nm)*
40 L/min.	**DTDA –*** **	T - 13A	35,0	22,2	89,2	114,3	37,3	45 - 50

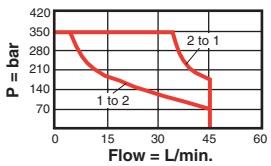
***An additional 50,8 mm clearance is needed for coil installation and removal.

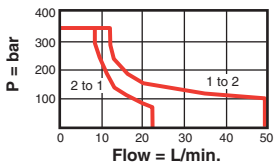
Performance Curves

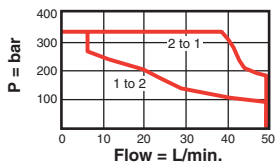
DTDA-MC* **DTDA-MH*** **DTDA-SC*** **DTDA-SH*** **DTDA-***

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature

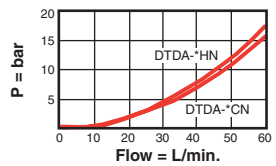








Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D T D A – M * * – * * *

Nominal Capacity

D 40 L/min.

*Control**

M Manual Override

X No Manual Override

S Soft Shift

D Twist/Lock, Dual, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

* *See page 178 for information on Control Options*

*Spool Configuration***

H Normally Open

C Normally Closed

*Coil Options***

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

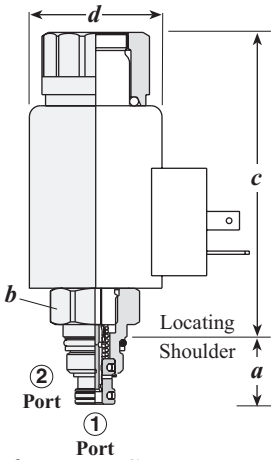
N Buna-N

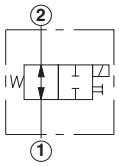
V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

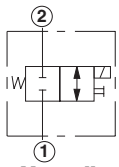
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY, DIRECTIONAL SPOOL VALVE, PILOT CAPACITY





Normally Open



Normally Closed

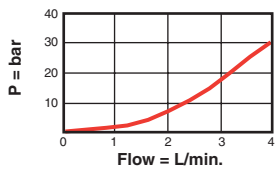
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c*** M,X,S	c*** D,L,T	d	*Installation Torque (Nm)*
1 L/min.	**DAAL – *****	T - 8A	18,5	22,2	83,6	108,7	37,3	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

DAAL-X**, DAAL-S**

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 6,6 kg at 100 bar at port 1.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D A A L – X * * – * * *

Nominal Capacity
- **A** 1 L/min.

Control*
- **X** No Manual Override
- **M** Manual Override
- **S** Soft Shift
- **D** Twist/Lock, Dual, Manual Override
- **L** Twist/Lock, Detent, Manual Override
- **T** Twist/Lock, Momentary, Manual Override

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

Coil Options**

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

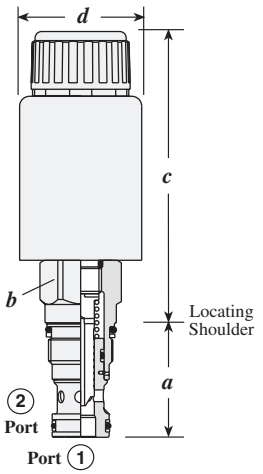
Seal Material
- **N** Buna-N
- **V** Viton

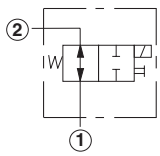
* ***See page 178 for information on Control Options***

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

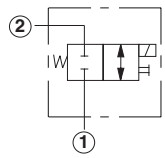
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

2-WAY, SOFT SHIFT, DIRECTIONAL SPOOL VALVE





Normally Open



Normally Closed

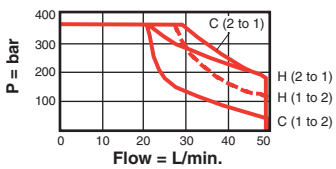
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c***		*d*	
					M,X,S	D,L,T		
45 L/min.	**DLDA – *****	T - 13A	35,0	22,2	89,4	114,3	37,3	45 - 50

***An additional 50,8 mm clearance is needed for coil installation and removal.

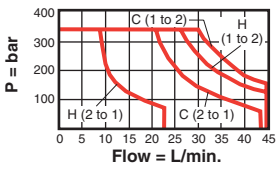
Performance Curves

DLDA-M**

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature

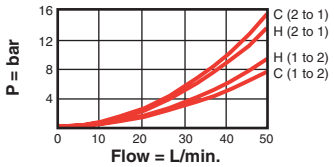


DLDA-S**



DLDA-***

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 80 cc/min. at 210 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D L D A – M * * – * * *

Nominal Capacity

D 45 L/min.

Control*

M Manual Override

X No Manual Override

S Soft Shift

D Twist/Lock, Dual, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

* ***See page 178 for information on Control Options***

Spool Configuration*

H Normally Open

C Normally Closed

Coil Options*

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

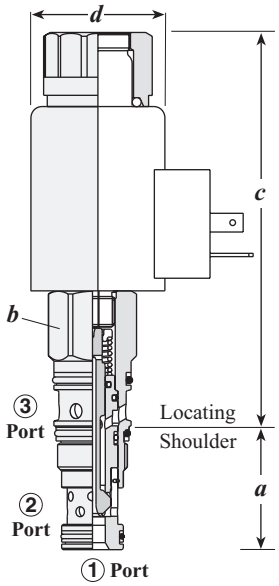
N Buna-N

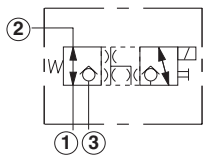
V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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





Normally Open

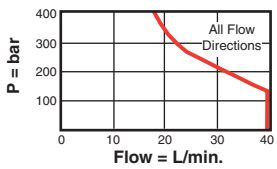
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c*** M,X	c*** D,L,T	d	*Installation Torque (Nm)*
30 L/min.	**DWDA– XAN**	T - 11A	34,8	22,2	108,2	133,1	37,3	45 - 50

***An additional 50,8 mm clearance is needed for coil installation and removal.

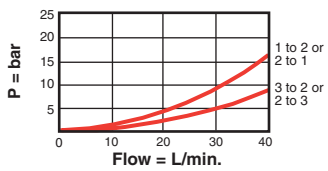
Performance Curves

DWDA-XAN

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature



Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D WD A – X A * – * * *

Nominal Capacity

D 30 L/min.

Control*

X No Manual Override

M Manual Override

D Twist/Lock, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

* *See page 178 for information on Control Options*

Spool Configuration**

A Normally Open Port 1 to 2, Closed 2 to 3

Coil Options**

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

N Buna-N

V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

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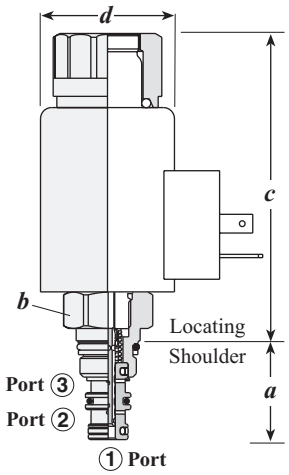
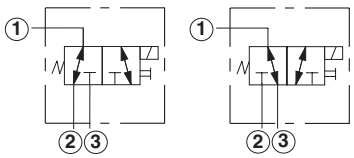
3-WAY, 2-POSITION, DIRECTIONAL SPOOL VALVE, PILOT CAPACITY





Normally Open Port 1 to 2 | **Normally Open Port 1 to 3**

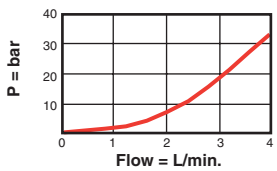
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c*** M,X,S	c*** D,L,T	d	*Installation Torque (Nm)*
1 L/min.	**DBAL – *****	T - 9A	27,4	22,2	83,6	108,7	37,8	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

DBAL-M**, DBAL-S

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 6,6 kg at 100 bar at port 1.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D B A L – X * * – * * *

Nominal Capacity

A 1 L/min.

Control*

X No Manual Override

M Manual Override

S Soft Shift

D Twist/Lock, Dual, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

Spool Configuration*

H Normally Open Port 1 to 2, Closed 1 to 3

C Normally Open Port 1 to 3, Closed 1 to 2

Coil Options*

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

N Buna-N

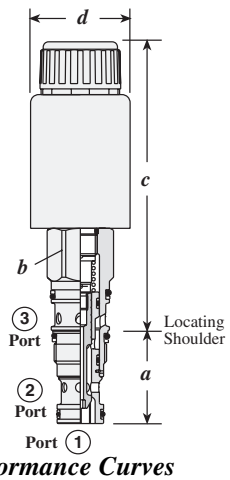
V Viton

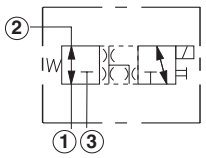
* ***See page 178 for information on Control Options***

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

3-WAY, 2-POSITION, SOFT SHIFT, DIRECTIONAL SPOOL VALVE





DMDA-***

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c*** M,X,S	c*** D,L,T	d	*Installation Torque (Nm)*
45 L/min.+	**DMDA – *****	T - 11A	35,0	22,2	108,2	132,8	37,3	45 - 50

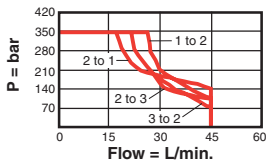
***An additional 50,8 mm clearance is needed for coil installation and removal.

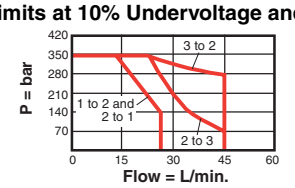
\+ Only for A and N spools. View performance curves for other spool configurations.

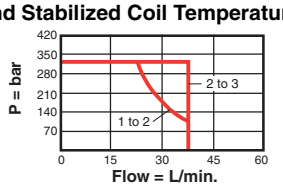
Performance Curves

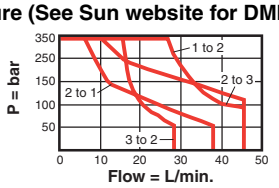
DMDA-MA* **DMDA-MN*** **DMDA-MB*** **DMDA-SA*** **DMDA-SN***

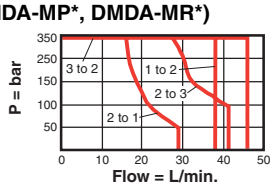
Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature (See Sun website for DMDA-MP*, DMDA-MR*)



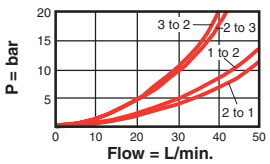


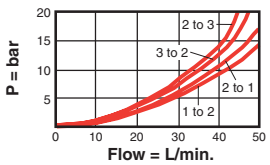


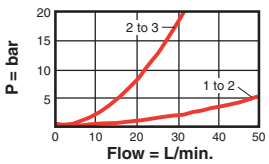


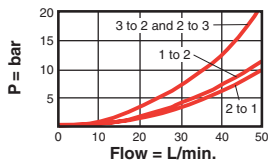


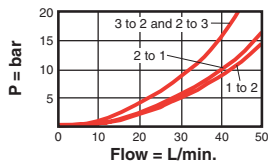
Pressure Differential vs. Flow (See Sun website for DMDA-MP*, DMDA-MR*)











- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 80 cc/min. at 210 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- Spools B and R are closed in the transition between their two positions. This results in a higher performance limit at the expense of lower capacity. When used as pilot controls, where capacity is not a factor, the closed transition will provide faster and more consistent response times.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D M D A – M * * – * * *

Nominal Capacity

D 45 L/min.

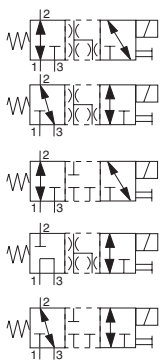
Control*

M Manual Override
X No Manual Override
S Soft Shift
D Twist/Lock, Dual, Manual Override
L Twist/Lock, Detent, Manual Override
T Twist/Lock, Momentary, Manual Override

* *See page 178 for information on Control Options*

Spool Configuration*

A Normally Open Port 1 to 2, Closed 2 to 3
N Normally Open Port 2 to 3, Closed 1 to 2
B Normally Open Ports 1 to 2, Closed 2 to 3, Closed Transition
P Normally Open Ports 1 to 3, Closed 1 to 2
R Normally Open Ports 2 to 3, Closed 1 to 2, Closed Transition



Coil Options*

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

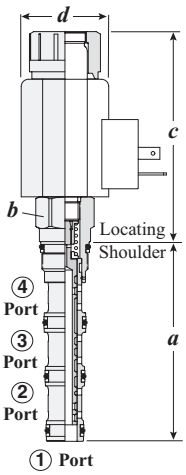
Seal Material

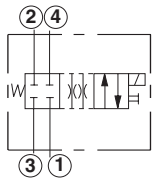
N Buna-N
V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

4-WAY, 2-POSITION, DIRECTIONAL SPOOL VALVE





DNDA-***

Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c*** X,M,S	c*** D,L,T	d	*Installation Torque (Nm)*
40 L/min.	**DNDA – *****	T - 31A	84,8	22,2	89,4	114,3	37,3	45 - 50

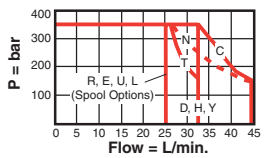
***An additional 50,8 mm clearance is needed for coil installation and removal.

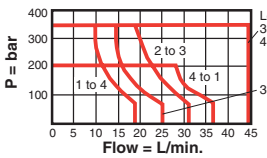
Performance Curves

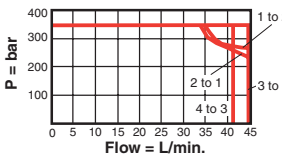
DNDA-X** **DNDA-SC*** **DNDA-SN*** **DNDA-*****

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature

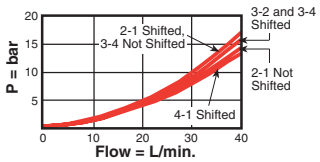
Note: Performance limits are derived with 4-way operation and symmetrical flow. For valve applications where either asymmetrical flow or 3-way operation are present, these performance limits may be reduced.







Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 160 cc/min. at 210 bar.
- Manual override force requirement = 10 kg at 350 bar.
- Manual override stroke = 2,5 mm.
- Response time - typical = 50 ms.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D N D A – X * * – * * *

Nominal Capacity

D 40 L/min.

Control*

X No Manual Override

M Manual Override

S Soft Shift

D Twist/Lock Dual, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

* ***See page 178 for information on Control Options***

Spool Configuration**

C Closed, Shift to Through

D Closed, Shift to Cross

E Cross, Shift to Closed

H Open, Shift to Cross

L Cross, Shift P to A, B and T Blocked

Spool Configuration**

N Through, Shift to Cross

R Regen, Shift to Cross

T Tandem, Shift to Through

U Through, Shift to Through

Y Motor, Shift to Cross

Coil Options**

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

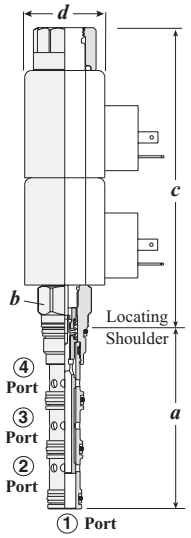
N Buna-N

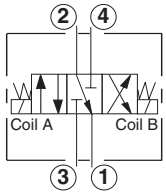
V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

4-WAY, 3-POSITION, SPRING CENTRED, DIRECTIONAL SPOOL VALVE





DNDC-XAN

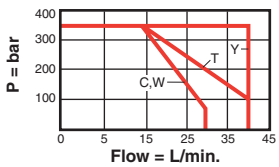
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c***	d	*Installation Torque (Nm)*
20 L/min.	**DNDC – X****	T - 31A	84,8	22,2	139,4	37,3	45 - 50

***An additional 50,8 mm clearance is needed for coil installation and removal.

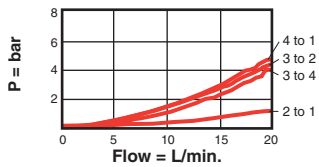
Performance Curves

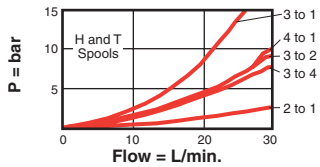
DNDC-X**

Valve Performance Limits at 10% Undervoltage and Stabilized Coil Temperature



Pressure Differential vs. Flow





- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 160 cc/min. at 210 bar.
- Response time - typical = 50 ms.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D N D C – X ✱ ✱ – ✱ ✱ ✱

Nominal Capacity

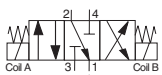
D 20 L/min.

Control*

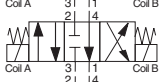
X No Manual Override

Spool Configuration**

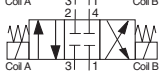
A A to T Centre



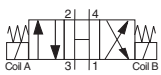
B B to T Centre



C Blocked Centre

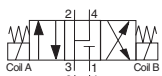


H Open Centre

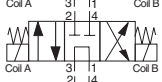


Spool Configuration**

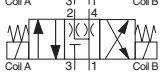
R Regen Centre



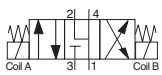
T Tandem Centre



W A and B, Bleed to T Centre



Y A and B to T Centre



Coil Options**

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Sea Material

N Buna-N

V Viton

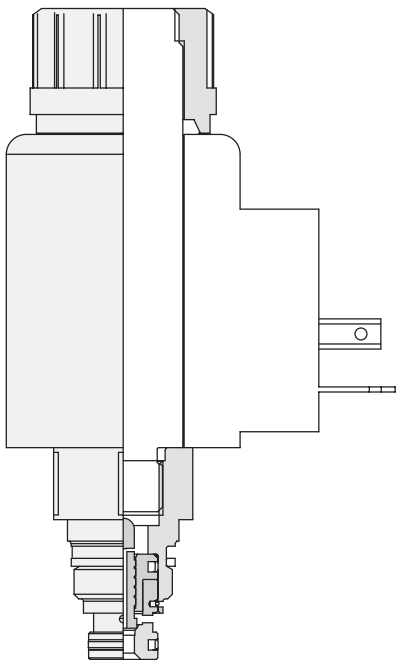
* *See page 178 for information on Control Options*

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

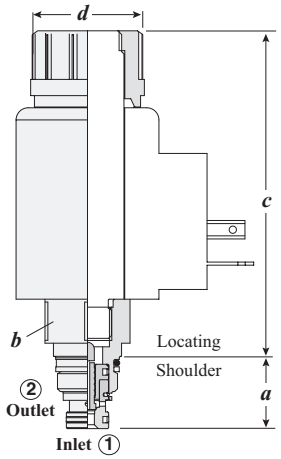
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

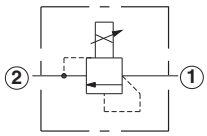
NOTES

Pilot Control Valves



ELECTRO-PROPORTIONAL, RELIEF VALVE, PILOT CAPACITY





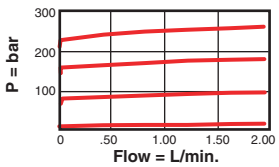
			Cartridge Dimensions					
					c***			
Capacity	*Typical Cartridge Model Code*	*Cavity*	*a*	*b*	**L**	**X/M**	*d*	*Installation Torque (Nm)*
1 L/min.	**RBAP – XAN**	T - 8A	18,8	22,2	130,0	85,1	37,3	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

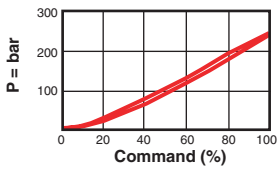
Performance Curves

RBAP

Constant Command Varying Flow



Pressure vs. Command Flow 0,37 L/min.



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at reseat = 25 cc/min.
- Low leakage levels in the closed position. Reseat > 85% of set pressure.
- Hysteresis with dither <4% and with DC input <8%.
- Linearity with dither <2% and repeatability with dither <2%.
- Recommended dither frequency = 140 Hz.
- For optimum performance, an amplifier with current sensing and adjustable dither should be used. Dither should be adjustable between 100 - 250 Hz.
- The L control allows one to manually adjust the valve in case of an electrical failure. The L control also allows offsetting the pressure range. For instance, if an A range valve is offset to a setting of 100 bar with no analog input signal, the new maximum will be 300 bar.
- This electro-proportional cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2 port pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

OPTION ORDERING INFORMATION

R B A P – X ✱ ✱ – ✱ ✱ ✱

Nominal Capacity

A 1 L/min.

Control*

X No Manual Override

M Manual Override

L Manual Override, Adjustable

T Tuning Adjustment

Adjustment Range

A 20 - 210 bar

B 10,5 - 105 bar

D 3,5 - 50 bar

W 35 - 350 bar

Coil Options**

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

N Buna-N

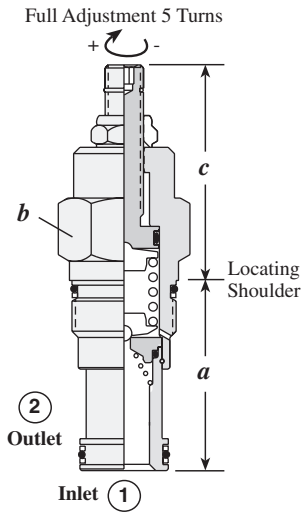
V Viton

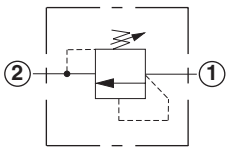
* *See page 178 for information on Control Options*

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING, RELIEF VALVE, PILOT CAPACITY



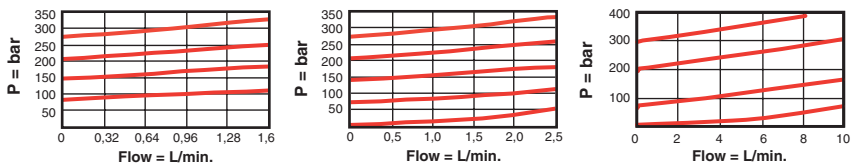


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	c O	Installation Torque (Nm)
1 L/min.	**RBAC – LAN**	T - 10A	39,7	22,2	51,0	55,0	58,0	58,0	45 - 50
2 L/min.	**RBAA – LAN**	T - 3A	47,8	28,6	54,0	56,0	61,0	61,0	60 - 70
10 L/min.	**RBAE – LAN**	T - 8A	19,1	22,2	60,5	62,7	67,6	67,6	35 - 40

Performance Curves

RBAC **RBAA** **RBAE**

Typical Pressure Rise



- Maximum operating pressure = 350 bar.
- Typical response time 2 ms.
- Maximum valve leakage at reseat at 24 cSt = RBAC, RBAA, 0,3 cc/min.; RBAE: 1 cc/min.
- Back pressure on the tank port (port 2) is directly additive to the pressure setting at port 1 (inlet) at a 1:1 ratio to the valve setting.
- RBAE: This cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way, pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

OPTION ORDERING INFORMATION

R B A ✱ – ✱ ✱ ✱

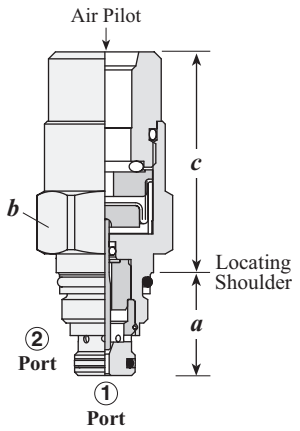
Nominal Capacity	*Control***	*Adjustment Range*	*Seal Material*
C 1 L/min.	**L** Standard Screw Adjustment	**A** 1,7 - 210 bar Standard set at 70 bar	**N** Buna-N
A 2 L/min.	**C*** Tamper Resistant Factory Set	**B** 1,7 - 105 bar Standard set at 70 bar	**V** Viton
E 10 L/min.	**K** Handknob with Lock Knob	**C** 1,7 - 420 bar Standard set at 70 bar	
	O Handknob with Panel Mount	**D** 1,7 - 55 bar Standard set at 28 bar	
	* ***Special setting required. Specify at time of order.***	**E** 1,7 - 28 bar Standard set at 14 bar	
		W 1,7 - 315 bar Standard set at 70 bar	

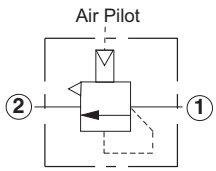
** ***See page 178 for information on Control Options***

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

AIR CONTROLLED, DIRECT ACTING, RELIEF VALVE, PILOT CAPACITY

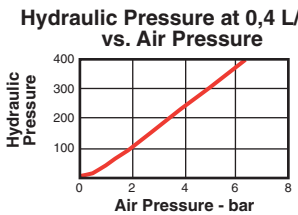


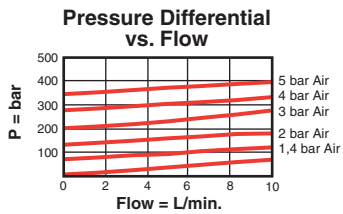


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
10 L/min.	**RBAR – DWN**	T - 8A	19,1	22,2	40,9	35 - 40
10 L/min.	**RBAR – DYN**	T - 8A	19,1	28,6	40,9	35 - 40

Performance Curves

RBAR





- Amplifies air pilot pressure to hydraulic by a nominal 50:1 or 75:1 ratio.
- Maximum air pilot pressure = 10,5 bar.
- Minimum operational air pressure = 1,4 bar.
- Reseat = > 90% of amplified set pressure.
- Maximum amplified operating pressure = 350 bar.
- Maximum valve leakage at reseat at 24 cSt = 1 cc/min.
- Ports 1 and 2 may be pressured to 350 bar.
- Back pressure at port 2 increases the relief setting by .43 multiplier.
- This cartridge utilizes the Sun T-8A 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way, pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

OPTION ORDERING INFORMATION

R B A R – * * *

Nominal Capacity

A 10 L/min.

Pilot Control Port

A External 1/8 NPTF Port

B External SAE-4 Port

D External 1/8 BSPP Port

Air Pilot Ratio

W 50:1

Y 75:1

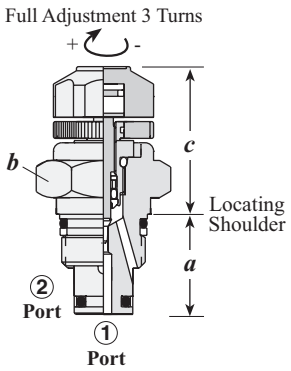
Seal Material

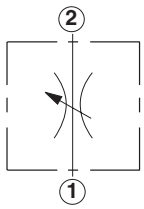
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

FLOW CONTROL, FULLY ADJUSTABLE NEEDLE VALVE, PILOT CAPACITY





Maximum Orifice Diameter	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
0,9 mm	**NFAB – KXN**	T - 8A	19,1	22,2	27,9	35 - 40

- Maximum operating pressure = 350 bar.
- Leakage rate at shutoff is less than .07 cc/min.
- Effective orifice size = 0,9 mm.
- Ports 1 and 2 may be pressured to 350 bar.
- Needle adjusts from fully closed to fully open in three complete turns resulting in extremely fine resolution.
- Adjustment mechanism equipped with locking device to maintain consistent orifice diameter/flow rate.
- This cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way, pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

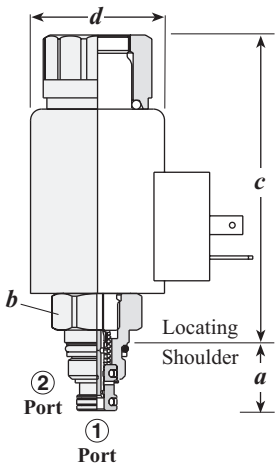
OPTION ORDERING INFORMATION

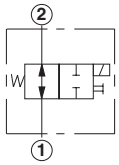
N F A B – K X ✱

Model Code	*Control**	*Maximum Orifice Diameter*	*Seal Material*
NFAB	**K** Handknob with Lock Knob	**X** 0,9 mm	**N** Buna-N
			V Viton

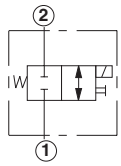
** See page 178 for information on Control Options*

2-WAY, SOLENOID OPERATED, DIRECTIONAL SPOOL VALVE, PILOT CAPACITY





Normally Open



Normally Closed

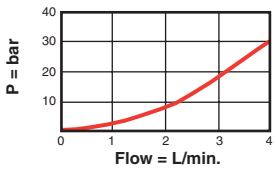
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c***		*d*	
					M,X,S	D,L,T		
1 L/min.	**DAAL–*** **	T - 8A	18,5	22,2	83,6	108,7	38,0	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

DAAL-X, DAAL-S****

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = < 0,6 cc/min. at 350 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 6,6 kg at 100 bar at port 1.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D A A L – X * * – * * *

Nominal Capacity
- **A** 1 L/min.

*Control**
- **X** No Manual Override
- **M** Manual Override
- **S** Soft Shift
- **D** Twist/Lock, Dual, Manual Override
- **L** Twist/Lock, Detent, Manual Override
- **T** Twist/Lock, Momentary, Manual Override

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

*Coil Options***

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

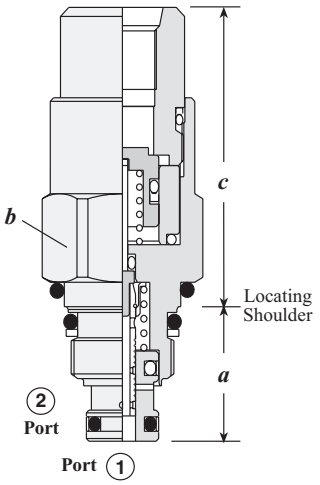
Seal Material
- **N** Buna-N
- **V** Viton

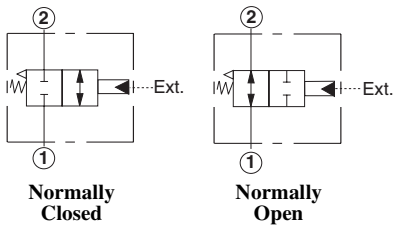
* *See page 178 for information on Control Options*

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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



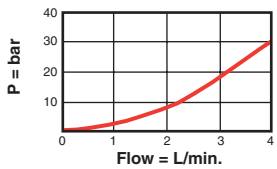


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
1 L/min.	**DAAH – DCN**	T - 8A	19,1	22,2	52,5	35 - 40

Performance Curves

DAAH

Pressure Differential vs. Flow



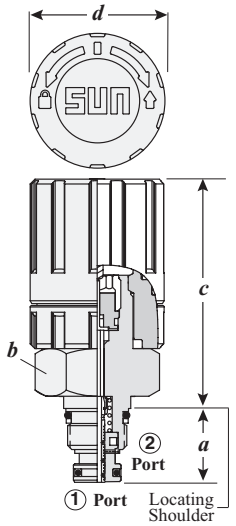
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- The minimum pilot pressure required to operate the valve is determined by the following formula: pilot pressure = 6 bar + pressure at port 1 times 0,023. This results in a pilot pressure range of 6 to 14 bar.
- All ports will accept 350 bar including the pilot control port.
- The preferred flow path through the valve is port 2 to port 1.
- This cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way, pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

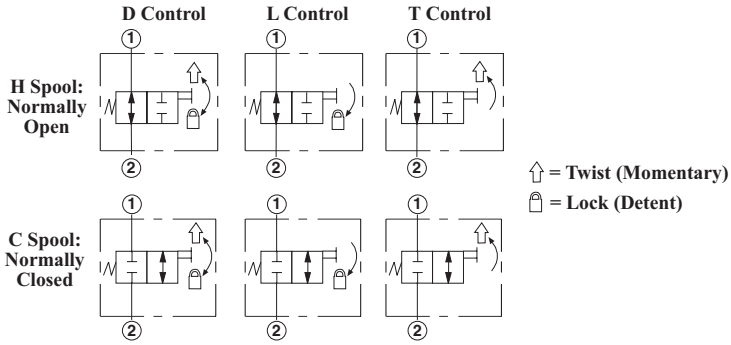
OPTION ORDERING INFORMATION

D A A H – * * *

Nominal Capacity	*Pilot Control Port*	*Spool Configuration*	*Seal Material*
A 1 L/min.	**A** External 1/8 NPTF Port	**H** Normally Open	**N** Buna-N
	B External SAE-4 Port	**C** Normally Closed	**V** Viton
	D External 1/8 BSPP Port		

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



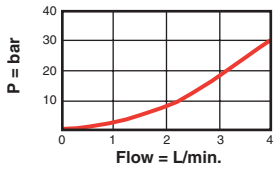


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*d*	*Installation Torque (Nm)*
1 L/min.	**DAAM - LCN**	T-8A	18,5	28,6	61,0	48,3	35 - 40

Performance Curves

DAAM

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- This valve is designed for intermittent use such as a manual override. The manual control assembly has a mechanical life expectancy of about 10,000 cycles.
- The preferred flow path through the valve is port 2 to port 1.
- The dual-operation control option D allows the operator to either shift the valve momentarily by twisting the knob clockwise or shift it into a mechanically detented position by twisting counter-clockwise.
- The detent/lock control option L allows the operator to shift the valve into a mechanically detented position by twisting the knob counter-clockwise. This detented position will be maintained until the operator twists the knob clockwise and allows the valve to return to its normal position.
- The momentary/twist control option T allows the operator to momentarily shift the valve by twisting the knob clock wise and releasing. Once released, the valve returns to its normal position.
- This cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way, pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

OPTION ORDERING INFORMATION

D A A M – L C ✱

Nominal Capacity

A 1 L/min.

*Control**

D Twist/Lock, Dual, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

Spool Configuration

C Normally Closed

H Normally Open

Seal Material

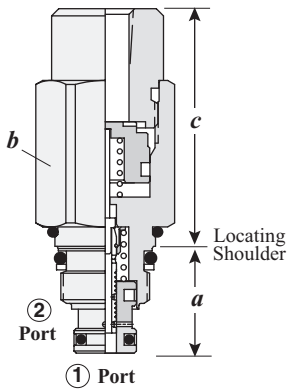
N Buna-N

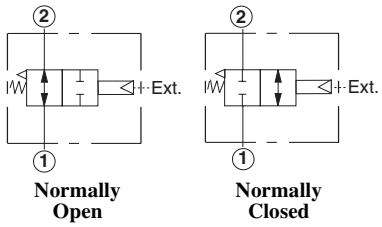
V Viton

** See page 178 for information on Control Options*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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



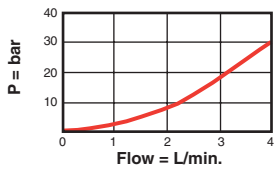


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
1 L/min.	**DAAP–PCN**	T - 8A	19,1	22,2	42,2	35 - 40

Performance Curves

DAAP

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- The minimum pilot pressure required to operate the valve is determined by the following formula: pilot pressure = 6 bar + pressure at port 1 divided by 100. This results in a pilot pressure range of 1,4 to 5 bar.
- All ports will accept 350 bar with the exception of the pilot port which accepts 35 bar maximum.
- The preferred flow path through the valve is port 2 to port 1.
- This cartridge utilizes the Sun T-8A, 2 port cavity making it the ideal choice to use in conjunction with Sun's main stage pilot or vent-to-operate cartridges. Separate pilot lines are eliminated and only one cavity needs to be machined to accommodate both the control and primary function. Note: All 2-position, 2-way, pilot stage control cartridges utilize the same cavity and are physically interchangeable. Functionality is the only consideration.

OPTION ORDERING INFORMATION

D A A P – * * *

Nominal Capacity

A 1 L/min.

Pilot Control Port

E External SAE-4 Port

F External 1/8 NPTF Port

P External 1/8 BSPP Port

Spool Configuration

H Normally Open

C Normally Closed

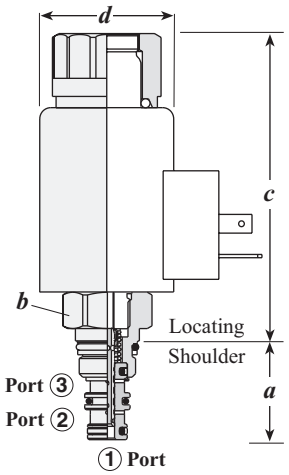
Seal Material

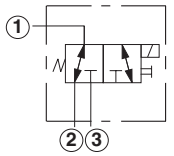
N Buna-N

V Viton

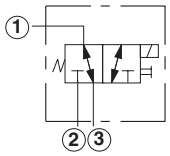
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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





Normally Open Port 1 to 2



Normally Open Port 1 to 3

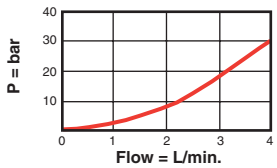
Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c***		*d*	
					M,X,S	D,L,T		
1 L/min.	**DBAL – *****	T - 9A	27,4	22,2	83,5	94,7	37,8	35 - 40

***An additional 50,8 mm clearance is needed for coil installation and removal.

Performance Curves

DBAL-X**, DBAL-S**

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24cSt = 0,6 cc/min. at 350 bar.
- Response time - typical = 50 ms.
- Manual override force requirement = 6,6 kg at 100 bar at port 1.
- Manual override stroke = 2,5 mm.
- Maximum switching frequency = 15000 cycles/hr.
- Viscosity range = 10 - 600 cSt.
- This valve is direct actuated and requires no minimum hydraulic pressure for operation.
- The solenoid tube assembly is fatigue rated for 350 bar service.
- The soft shift feature results in significantly longer response time over Sun's standard solenoid. Response time is dependant on flow, pressure, coil voltage, oil viscosity and ambient temperature. Typical response time ranges from 150 ms to 300 ms.
- A wide variety of coil termination and voltage options are available. See Sun website: Products: Accessories: Coils.

OPTION ORDERING INFORMATION

D B A L – X * * – * * *

Nominal Capacity

A 1 L/min.

Control*

X No Manual Override

M Manual Override

S Soft Shift

D Twist/Lock, Dual, Manual Override

L Twist/Lock, Detent, Manual Override

T Twist/Lock, Momentary, Manual Override

* *See page 178 for information on Control Options*

Spool Configuration**

H Normally Open Port 1 to 2, Closed 1 to 3

C Normally Open Port 1 to 3, Closed 1 to 2

Coil Options**

See page 187: Coil option information for Metal Housing (Round) Solenoid Cartridges.

Seal Material

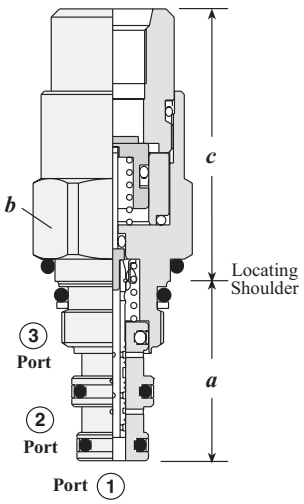
N Buna-N

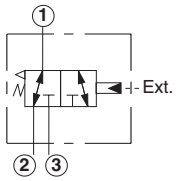
V Viton

** *Consult the Sun website for complete information on Spool Configurations, the full line of Coil Options and Embedded Amplifier Coils/Controllers.*

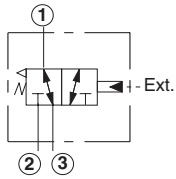
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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





Normally Open 1 to 2



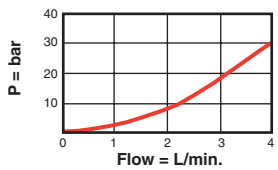
Normally Open 1 to 3

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c*	*Installation Torque (Nm)*
1 L/min.	**DBAH – DCN**	T - 9A	27,7	22,2	42,1	35 - 40

Performance Curves

DBAH

Pressure Differential vs. Flow



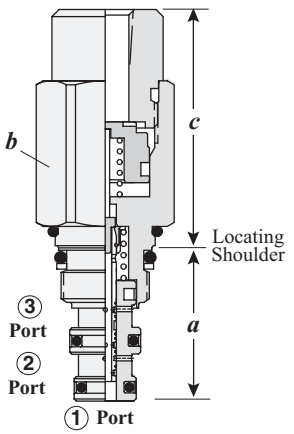
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24cSt = 0,6 cc/min. at 350 bar.
- The minimum pilot pressure required to operate the valve is determined by the following formula: pilot pressure = 6 bar + pressure at port 1 times 0,023. This results in a pilot pressure range of 6 to 14 bar.
- All ports will accept 350 bar including the pilot control port.

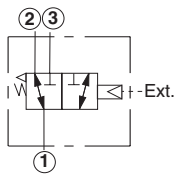
OPTION ORDERING INFORMATION

D B A H – * * *

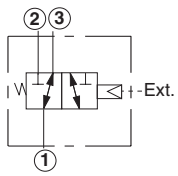
Nominal Capacity	*Pilot Control Port*	*Spool Configuration*	*Seal Material*
A 1 L/min.	**A** External 1/8 NPTF Port	**H** Normally Open Port 1 to 2, 1 to 3 Closed	**N** Buna-N
	B External SAE-4 Port	**C** Normally Open Port 1 to 3, 1 to 2 Closed	**V** Viton
	D External 1/8 BSPP Port		

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





Normally Open Ports 1 to 2



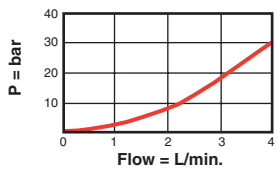
Normally Open Ports 1 to 3

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
1 L/min.	**DBAP–PCN**	T - 9A	27,7	22,2	42,1	35 - 40

Performance Curves

DBAP

Pressure Differential vs. Flow



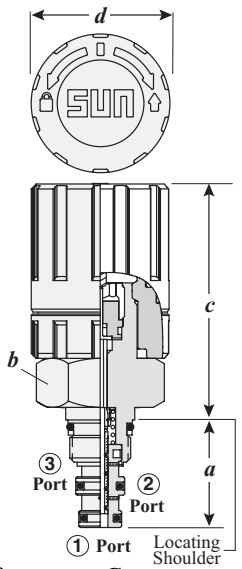
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- The minimum pilot pressure required to operate the valve is determined by the following formula: pilot pressure = 6 bar + pressure at port 1 divided by 100. This results in a pilot pressure range of 1,4 to 5 bar.
- All ports will accept 350 bar with the exception of the pilot port which accepts 35 bar maximum.

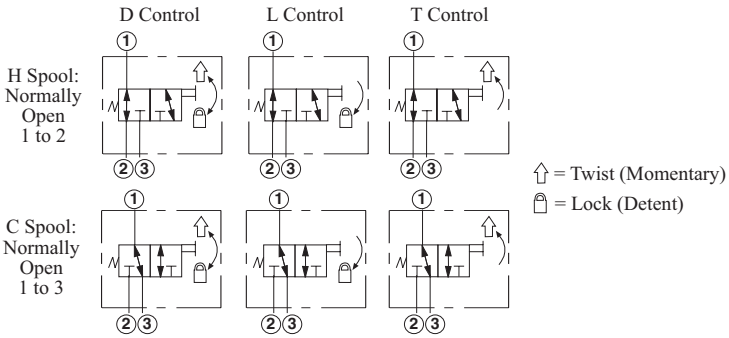
OPTION ORDERING INFORMATION

D B A P – * * *

Nominal Capacity	*Pilot Control Port*	*Spool Configuration*	*Seal Material*
A 1 L/min.	**E** External SAE-4 Port	**H** Normally Open Port 1 to 2, 1 to 3 Closed	**N** Buna-N
	F External 1/8 NPTF Port	**C** Normally Open Port 1 to 3, 1 to 2 Closed	**V** Viton
	P External 1/8 BSPP Port		

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



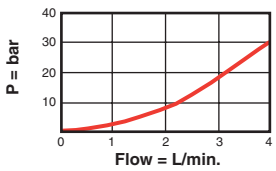


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c	d	Installation Torque (Nm)
1 L/min.	**DBAM– LCN**	T - 9A	27,4	22,2	61,0	35,6	35 - 40

Performance Curves

DBAM

Pressure Differential vs. Flow



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,6 cc/min. at 350 bar.
- This valve is designed for intermittent use such as a manual override. The manual control assembly has a mechanical life expectancy of about 10,000 cycles.
- The dual-operation control option D allows the operator to either shift the valve momentarily by twisting the knob clockwise or shift it into a mechanically detented position by twisting counter-clockwise.
- The detent/lock control option L allows the operator to shift the valve into a mechanically detented position by twisting the knob counter-clockwise. This detented position will be maintained until the operator twists the knob clockwise and allows the valve to return to its normal position.
- The momentary/twist control option T allows the operator to momentarily shift the valve by twisting the knob clockwise and releasing. Once released, the valve returns to its normal position.

OPTION ORDERING INFORMATION

D B A M – L * *

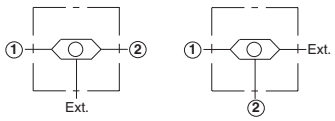
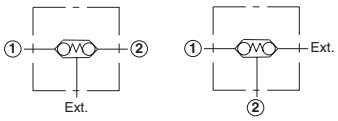
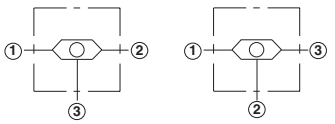
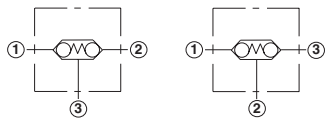
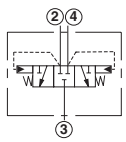
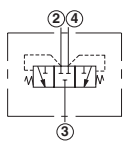
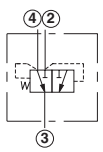
Nominal Capacity	*Control**	*Spool Configuration*	*Seal Material*
A 1 L/min.	**D** Twist/Lock, Dual, Manual Override	**H** Normally Open Port 1 to 2, 1 to 3 Closed	**N** Buna-N
	L Twist/Lock, Detent, Manual Override	**C** Normally Open Port 1 to 3, 1 to 2 Closed	**V** Viton
	T Twist/Lock, Momentary, Manual Override		

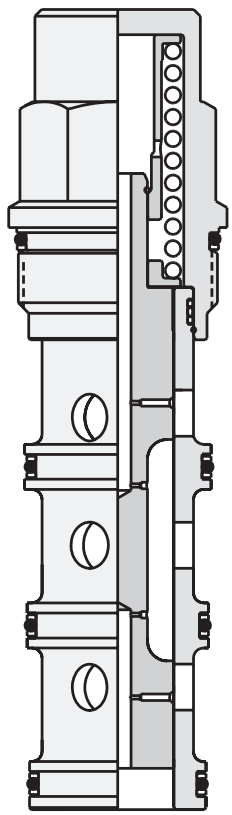
* *See page 178 for information on Control Options*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

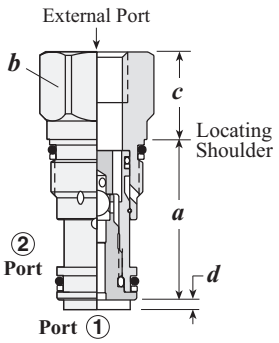
NOTES

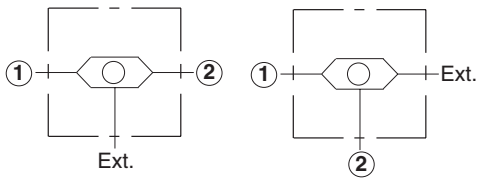
Shuttle Valves

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



SINGLE BALL SHUTTLE, SIGNAL EXTERNAL OR SIGNAL AT PORT 2





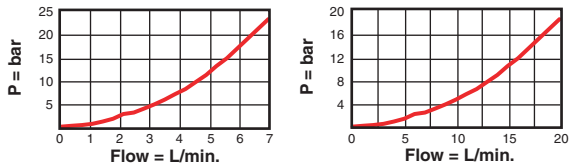
CSAW/CSAA **CSAY/CSAC**

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

Performance Curves

CSAW/CSAY **CSAA/CSAC**

Typical Pressure Drop



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

OPTION ORDERING INFORMATION

CS A ✱ – ✱ X ✱

Nominal Capacity and Version

W 5 L/min.
Signal at External Port

Y 5 L/min.
Signal at Port 2

A 10 L/min.
Signal at External Port

C 10 L/min.
Signal at Port 2

Control

B External
1/4 BSPP
Port

E External
SAE-4
Port

Adjustment Range

X Not Adjustable

Seal Material

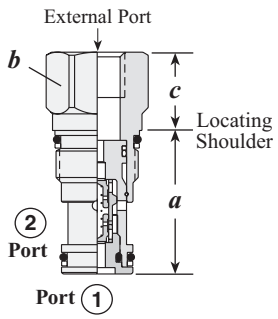
N Buna-N

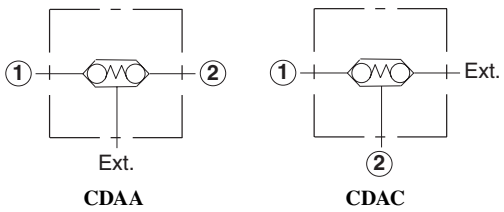
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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



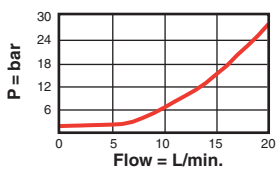


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
10 L/min.	**CDAA – BBN**	T - 13A	35,1	22,2	19,1	45 - 50
10 L/min.	**CDAC – BBN**	T - 13A	35,1	22,2	19,1	45 - 50

Performance Curves

CDAA/CDAC

Typical Pressure Drop



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

OPTION ORDERING INFORMATION

CD A ✱ – ✱ B ✱

Nominal Capacity and Version

A 10 L/min. Signal External

C 10 L/min. Signal at Port 2

Control

B External 1/4 BSPP Port

E External SAE-4 Port

Cracking Pressure

B 1 bar

Seal Material

N Buna-N

V Viton

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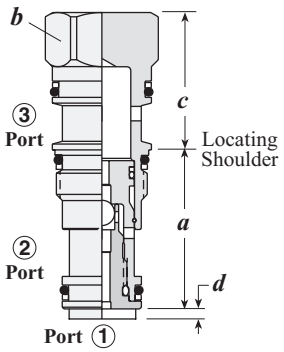
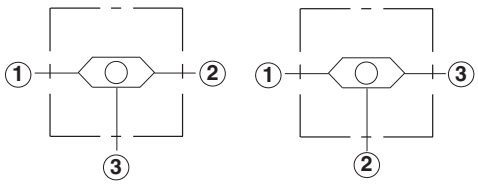
SINGLE BALL SHUTTLE VALVE WITH SIGNAL AT PORT 3 OR PORT 2





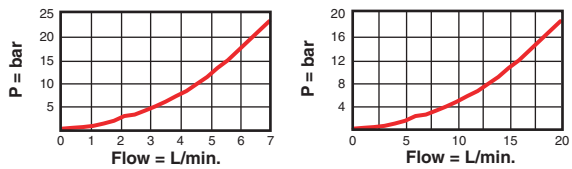
CSAX/CSAB **CSAD/CSAZ**

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

Performance Curves

CSAX/CSAZ **CSAB/CSAD**

Typical Pressure Drop



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

OPTION ORDERING INFORMATION

CS A ✱ – X X ✱

Nominal Capacity and Version

X 5 L/min.
Signal at Port 3

Z 5 L/min.
Signal at Port 2

B 10 L/min.
Signal at Port 3

D 10 L/min.
Signal at Port 2

Control

X Not Adjustable

A Auxiliary External SAE-4 Port

B Auxiliary External 1/4 BSPP Port

E External SAE-4 Port, Port 3 Blocked

Adjustment Range

X Not Adjustable

Seal Material

N Buna-N

V Viton

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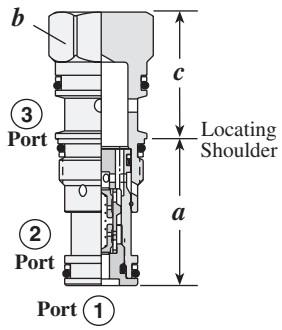
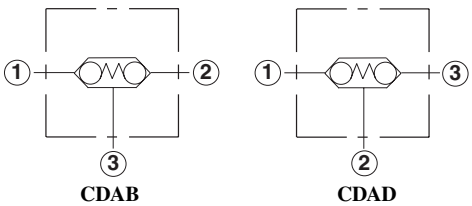
BACK-TO-BACK CHECK/SHUTTLE, SIGNAL AT PORT 2 OR PORT 3



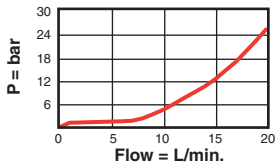


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
10 L/min.	**CDAB – XBN**	T - 11A	35,1	22,2	30,2	45 - 50
10 L/min.	**CDAD – XBN**	T - 11A	35,1	22,2	30,2	45 - 50

Performance Curves

CDAB/CDAD

Typical Pressure Drop



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

OPTION ORDERING INFORMATION

CD A ✱ – X B ✱

Nominal Capacity and Version

B 10 L/min. Signal at Port 3

D 10 L/min. Signal at Port 2

Control

X Not Adjustable

CDAB only:

A Auxiliary External SAE-4 Port

B Auxiliary External 1/4 BSPP Port

E External SAE-4 Port, Port 3 Blocked

Cracking Pressure

B 1 bar

Seal Material

N Buna-N

V Viton

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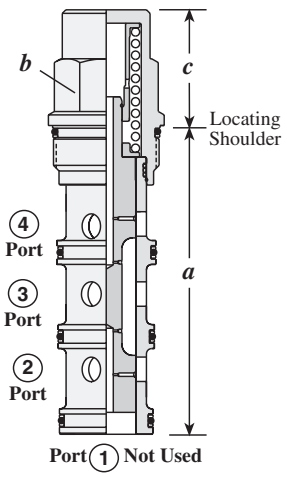
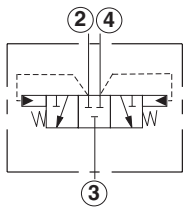
LOW SIDE, 3-POSITION, HOT OIL SHUTTLE



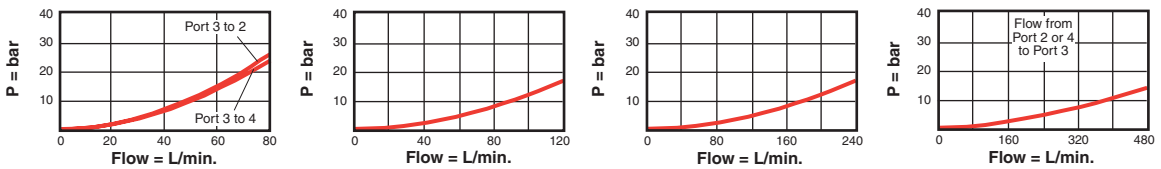


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**DSCH – XHN**	T - 31A	84,8	22,2	30,0	45 - 50
80 L/min.	**DSEH – XHN**	T - 32A	92,2	28,6	34,0	60 - 70
160 L/min.	**DSGH – XHN**	T - 33A	114,4	31,8	42,0	200 - 215
320 L/min.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

Performance Curves

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

Performance Details with Valve Shifted



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

OPTION ORDERING INFORMATION

DS ✱ H – X ✱ ✱

Nominal Capacity

C 40 L/min.

E 80 L/min.

G 160 L/min.

I 320 L/min.

Control

X Not Adjustable

Shifting Pressure

G 10 bar

H 14 bar

E 5 bar

DSEH, DSGH only:

D 3,5 bar

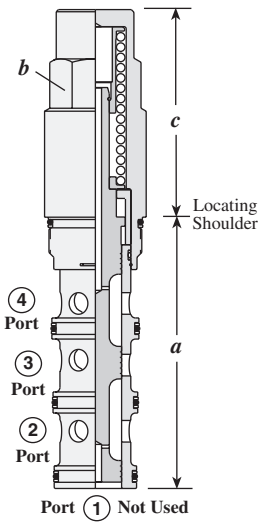
Seal Material

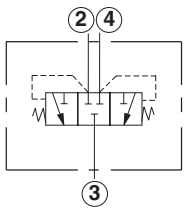
N Buna-N

V Viton

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

HIGH SIDE, 3-POSITION, SHUTTLE



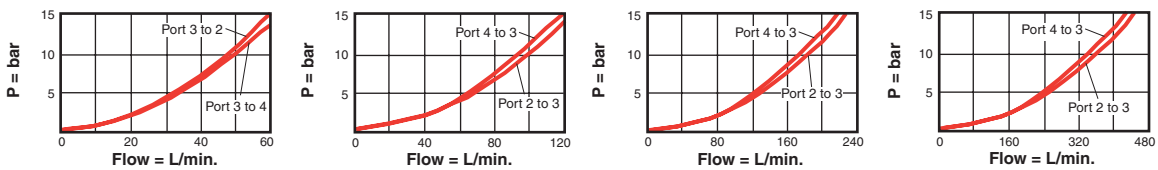


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
60 L/min.	**DSCS – XCN**	T - 31A	84,8	22,2	36,5	45 - 50
120 L/min.	**DSES – XCN**	T - 32A	92,2	28,6	41,4	60 - 70
240 L/min.	**DSGS – XCN**	T - 33A	114,3	31,8	72,0	200 - 215
480 L/min.	**DSIS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

Performance Curves

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

Pressure Differential vs. Flow



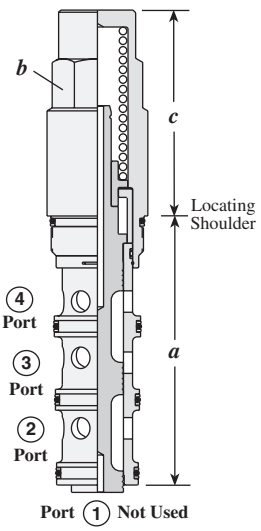
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = DSCS: 30 cc/min. at 70 bar, DSES: 50 cc/min. at 70 bar, DSGS: 65 cc/min. at 70 bar, DSIS: 80 cc/min. at 70 bar.
- Pilot flow = DSCS, DSES: 0,38 L/min., DSGS, DSIS: 0,75 L/min.
- This valve provides overrunning load control in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

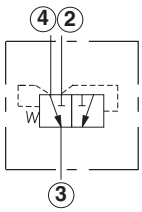
OPTION ORDERING INFORMATION

DS ✱ S – X ✱ ✱

Nominal Capacity	*Control*	*Shifting Pressure*	*Seal Material*
C 60 L/min.	**X** Not Adjustable	**C** 2 bar	**N** Buna-N
E 120 L/min.		**E** 5 bar	**V** Viton
G 240 L/min.		**F** 7 bar	
I 480 L/min.		**G** 10,5 bar	

SPRING OFFSET, 2-POSITION, HIGH SIDE SHUTTLE



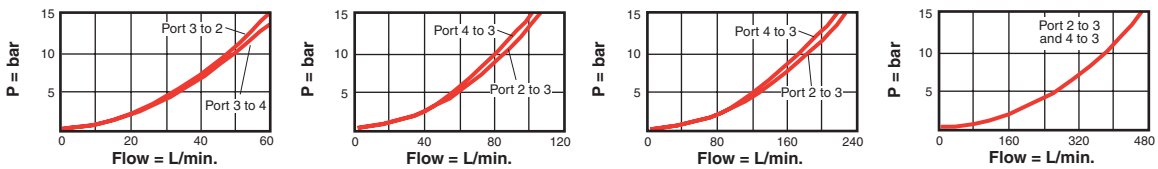


Nominal Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
60 L/min.	**DSCO – XCN**	T - 31A	84,8	22,2	36,5	45 - 50
120 L/min.	**DSEO – XCN**	T - 32A	92,2	28,6	41,4	60 - 70
240 L/min.	**DSGO – XCN**	T - 33A	114,3	31,8	72,0	200 - 215
480 L/min.	**DSIO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

Performance Curves

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

Pressure Differential vs. Flow



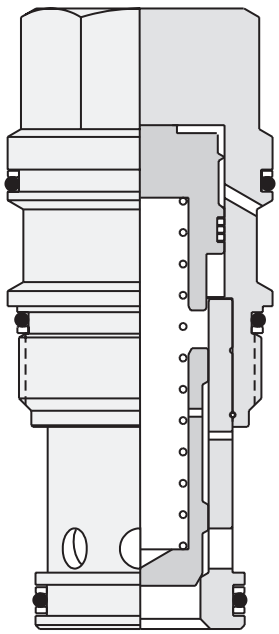
- Maximum operating pressure = 350 bar.
- Although this valve goes into a 4 port cavity, the nose (port 1) is not used.

OPTION ORDERING INFORMATION

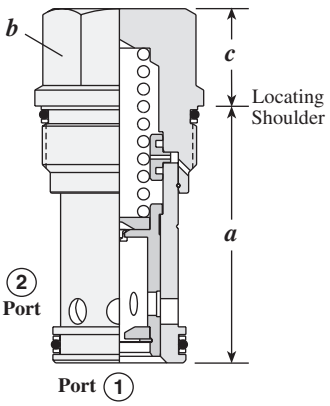
DS ✱ O – X ✱ ✱

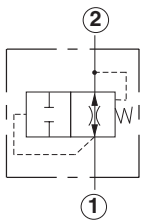
Nominal Capacity	*Control*	*Minimum Control Pressure*	*Seal Material*
C 60 L/min.	**X** Not Adjustable	**C** 2 bar	**N** Buna-N
E 120 L/min.		**E** 5 bar	**V** Viton
G 240 L/min.			
I 480 L/min.			

Circuit Savers



FIXED ORIFICE, FLOW FUSE



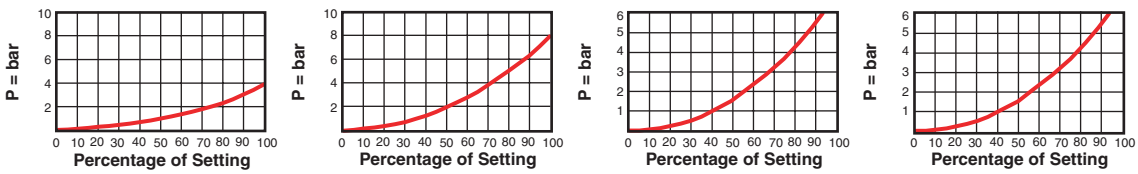


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* a	b	c	*Installation Torque (Nm)*
23 L/min.	**FQCA – XAN**	T - 13A	35,1	22,2	19,1	45 - 50
60 L/min.	**FQEA – XAN**	T - 5A	41,1	28,6	17,5	60 - 70
95 L/min.	**FQGA – XAN**	T - 16A	62,0	31,8	24,6	200 - 215
200 L/min.	**FQIA – XAN**	T - 18A	79,5	41,3	30,2	465 - 500

Performance Curves

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

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = FQCA: 30 cc/min. at 70 bar, FQEA: 50 cc/min. at 70 bar, FQGA: 65 cc/min. at 70 bar, FQIA: 80 cc/min. at 70 bar.
- 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.
- Customer must specify a flow rating. Factory set flow ratings are within +/- 10% of the requested flow ratings.

OPTION ORDERING INFORMATION

FQ ✱ A – X A ✱

Nominal Capacity

C 23 L/min.

E 60 L/min.

G 95 L/min.

I 200 L/min.

Control

X Not Adjustable

Setting Range

A* Replaceable Orifice
FQCA: 2 - 23 L/min.
FQEA: 4 - 60 L/min.
FQGA: 4 - 95 L/min.
FQIA: 4 - 200 L/min.

B* Permanent Orifice
FQCA: 2 - 23 L/min.
FQEA: 4 - 60 L/min.
FQGA: 4 - 95 L/min.
FQIA: 4 - 200 L/min.

* ***Special setting is required. Specify at time of order.***

Seal Material

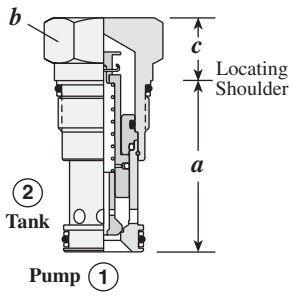
N Buna-N

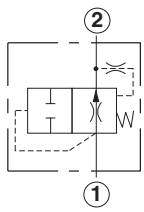
V Viton

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

AIR BLEED AND START-UP

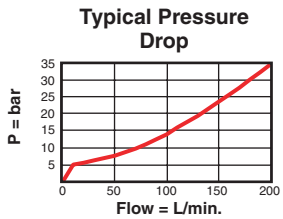


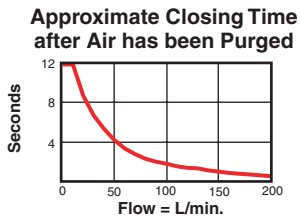


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
15 - 200 L/min.	**NQEB – XAN**	T - 3A	47,8	28,6	17,5	60 - 70

Performance Curves

NQEB





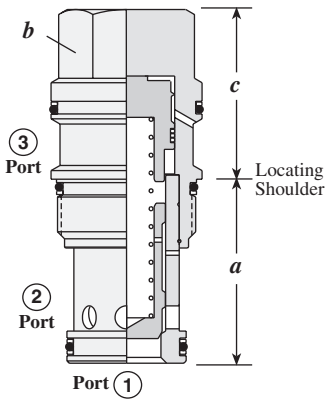
- Maximum operating pressure = 350 bar.
- Air-bleed and start-up valves require a minimum of 15 L/min. flow rate and 5,5 bar system pressure.
- The valve will re-open when system pressure falls below 1,7 bar.
- After air has been purged, closing times vary from approximately 12 seconds at 15 L/min. to 0.5 seconds at 200 L/min.

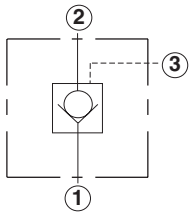
OPTION ORDERING INFORMATION

N Q E B – X A ✱

Nominal Capacity	*Control*	*Adjustment Range*	*Seal Material*
E 15-200 L/min.	**X** Not Adjustable	**A** Not Adjustable	**N** Buna-N
			V Viton

CHECK, PILOT-TO-CLOSE, 1.8:1 PILOT RATIO



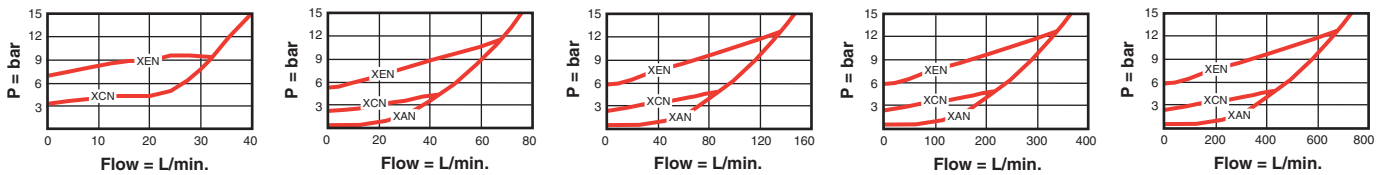


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**COBA – XCN**	T - 163A	31,0	19,1	31,0	35 - 40
80 L/min.	**CODA – XCN**	T - 11A	35,1	22,2	30,2	45 - 50
160 L/min.	**COFA – XCN**	T - 2A	35,1	28,6	35,1	60 - 70
320 L/min.	**COHA – XCN**	T - 17A	46,0	31,8	46,0	200 - 245
640 L/min.	**COJA – XCN**	T - 19A	63,5	41,3	58,7	465 - 500

Performance Curves

COBA **CODA** **COFA** **COHA** **COJA**

Typical Pressure Drop



- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,07 cc/min.
- Nominal Pilot Ratio = 1.8:1. This means that a pressure of 70 bar at the pilot port will close a valve against a pressure of 125 bar at port 1. Any decay or loss of pilot pressure could allow the valve to open, even if it is a momentary decay or loss.
- Reverse flow through the valve from port 2 to port 1 is not possible under any condition.
- Pressure at the port 2 area directly opposes pilot pressure.
- With equal pressures at all ports the valve is closed.

OPTION ORDERING INFORMATION

CO ✱ A – X ✱ ✱

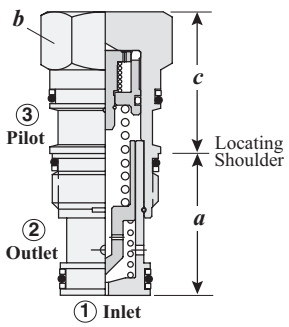
Nominal Capacity		*Control**	*Cracking Pressure*	*Seal Material*
B	40 L/min.	**X** Standard Pilot	**A***0,3 bar	**N** Buna-N
D	80 L/min.	* *See page 178 for information on Control Options*	**B***1,0 bar	**V** Viton
F	160 L/min.		**C** 2,0 bar	
H	320 L/min.		**D** 3,5 bar	
J	640 L/min.		**E** 5,0 bar	
			F 7,0 bar	

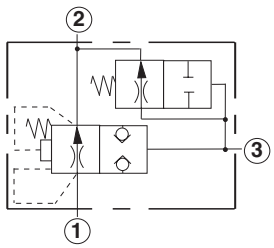
* *COBA is not available in A and B Cracking Pressures.*

Consult the Sun website for our most recent and complete information on the full Corrosion Resistant line of products.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

CHECK, PILOT-TO-CLOSE, 120:1 PILOT RATIO



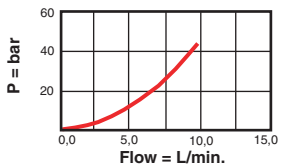


Orifice Diameter	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
1,27 mm	**COFO – XDN**	T - 2A	35,1	28,6	35,1	60 - 70

Performance Curves

COFO

Pressure Differential vs. Flow



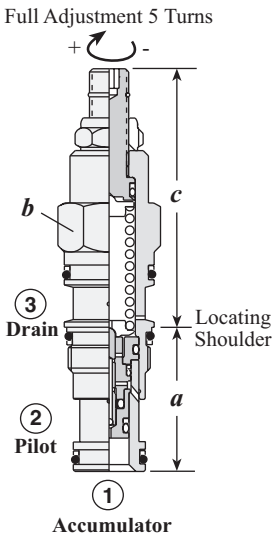
- Maximum operating pressure = 350 bar.
- Maximum valve leakage at 24 cSt = 0,3 cc/min.
- Pilot ratio = 120:1.
- Features hardened steel seats for excellent wear characteristics and contamination tolerance.
- The valve is a poppet design that results in very low leakage of stored fluid from the accumulator.
- When pump pressure is below 20 bar there is a leak path from port 3 to tank (port 2).
- The discharge of the accumulator is across a 1,27 mm diameter orifice. The discharge time for large accumulators with low pre-charge pressures may be too long.

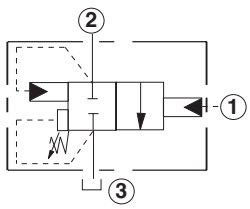
OPTION ORDERING INFORMATION

C O F O – X D N

Orifice Diameter	*Control*	*Minimum Pilot Pressure*	*Seal Material*
F 1,27 mm	**X** Standard Pilot	**D** 3,5 bar	**N** Buna-N
			V Viton

ACCUMULATOR SENSE, PUMP UNLOAD, PILOT CAPACITY





Pilot Flow Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions* *a*	*b*	*c* L	*c* C	*c* K	*Installation Torque (Nm)*
0,75 L/min.	**QPAA – LAN**	T - 11A	35,0	22,2	63,5	67,8	69,3	45 - 50

- Maximum operating pressure = 350 bar.
- The pressure differential between unload and reset will be within +/- 1% of the stated ratio of the valve with up to an additional 1,7 bar due to dynamic seal friction.
- The accumulator sensing area is positively sealed.
- The spool design of this valve allows it to maintain a fixed differential ratio because the areas are created by diameters on the spool that will not wear or change with use.
- Minimum clearance between the spool and sleeve, and seal on the pilot piston diameter significantly reduce the potential for silting.
- When applying this cartridge, a separate drain line is required to prevent erratic operation caused by tank line pressure fluctuations.
- Careful consideration should be given when selecting an adjustment range. System pressure drops and flows tend to affect the operation of unloading valves. Low operating pressures combined with low differential pressures result in a very narrow band between unload and reset, requiring precise system design. High flow rates typically mean high pressure drops, which subtract from the differential with which the valve has to work.

OPTION ORDERING INFORMATION

QPA* – *

Pilot Flow Capacity

A 0,75 L/min.

Version

A 15% Nominal Differential

B 20% Nominal Differential

C 30% Nominal Differential

D 50% Nominal Differential

Control*

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

* ***Special setting is required. Specify at time of order.***

Adjustment Range

A 70 - 210 bar Standard Set at 70 bar

B 35 - 105 bar Standard Set at 35 bar

C 140 - 350 bar Standard Set at 140 bar

D 18 - 55 bar Standard Set at 18 bar

Seal Material

N Buna-N

V Viton

** ***See page 178 for information on Control Options***

Customer specified special setting stamped on hex.

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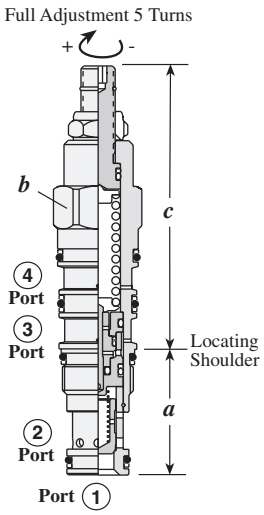
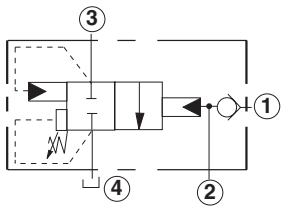
ACCUMULATOR SENSE, PUMP UNLOAD WITH CHECK, PILOT CAPACITY





Nominal Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
45 L/min.	**QCDA – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50
60 L/min.	**QCDB – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50
60 L/min.	**QCDC – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50
60 L/min.	**QCDD – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50

- Maximum operating pressure = 350 bar.
- Pilot flow capacity = 0,75 L/min.
- Pressure drop, port 1 to port 2 = 7 bar at 60 L/min.
- Free flow check cracking pressure = 0,3 bar.
- The pressure differential between unload and reset will be within +/- 1% of the stated ratio of the valve with up to an additional 1,7 bar due to dynamic seal friction.
- The accumulator sensing area is positively sealed.
- The spool design of this valve allows it to maintain a fixed differential ratio because the areas are created by diameters on the spool that will not wear or change with use.
- Minimum clearance between the spool and sleeve, and seal on the pilot piston diameter significantly reduce the potential for silting.
- When applying this cartridge, a separate drain line is required to prevent erratic operation caused by tank line pressure fluctuations.
- Careful consideration should be given when selecting an adjustment range. System pressure drops and flows tend to affect the operation of unloading valves. Low operating pressures combined with low differential pressures result in a very narrow band between unload and reset, requiring precise system design. High flow rates typically mean high pressure drops, which subtract from the differential with which the valve has to work.

OPTION ORDERING INFORMATION

QCD✱ – ✱✱✱

Nominal Capacity

- **DA** 45 L/min.
- **DB** 60 L/min.
- **DC** 60 L/min.
- **DD** 60 L/min.

Version

- **A** 15% Nominal Differential
- **B** 20% Nominal Differential
- **C** 30% Nominal Differential
- **D** 50% Nominal Differential

*Control***

- **L** Standard Screw Adjustment
- **C*** Tamper Resistant Factory Set
- **K** Handknob with Lock Knob
- * ***Special setting is required. Specify at time of order.***

Adjustment Range

- **A** 70 - 210 bar Standard Set at 70 bar
- **B** 35 - 105 bar Standard Set at 35 bar
- **C** 140 - 350 bar Standard Set at 140 bar
- **D** 18 - 55 bar Standard Set at 18 bar

Seal Material

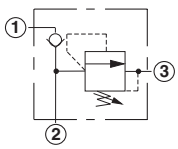
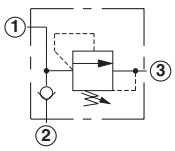
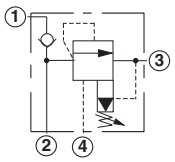
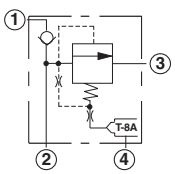
- **N** Buna-N
- **V** Viton

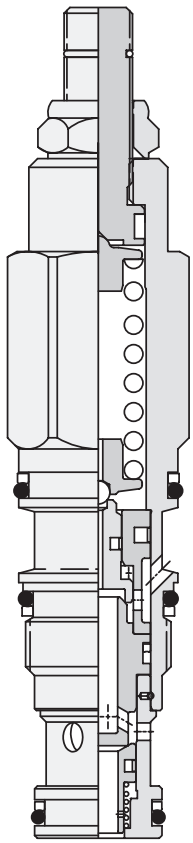
** *See page 178 for information on Control Options*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

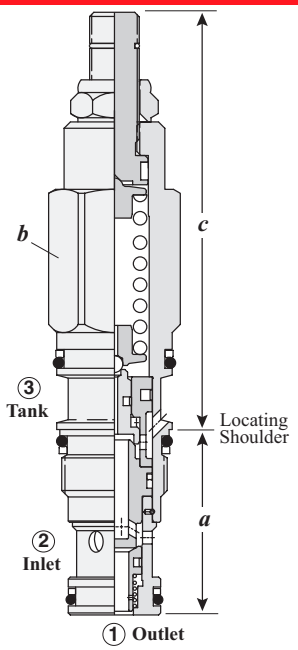
NOTES

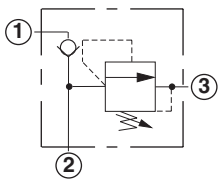
Hybrid Relief Valves

	Cartridge Type	*Page*
	Direct Acting Relief, Before Check	172
	Direct Acting Relief, After Check	173
	Pilot Operated, Balanced Piston, Ventable, Relief, Before Check	174
	Pilot Operated, Balanced Piston, Ventable, Relief, Before Check, with Integral Pilot Control Cavity	175



DIRECT ACTING RELIEF, BEFORE CHECK



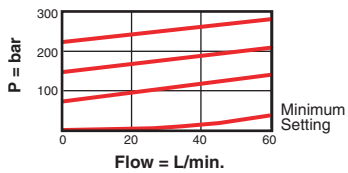


Capacity	Typical Cartridge Model Code	Cavity	Cartridge Dimensions a	b	c L	c C	c K	Installation Torque (Nm)
40 L/min.	**HRDA – LAN**	T - 11A	35,0	22,2	78,5	82,6	84,8	45 - 50

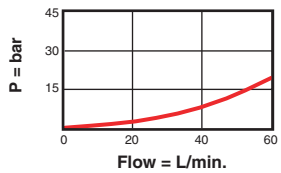
Performance Curves

HRDA

Flow from Port 2 to Port 3 with Port 1 Blocked



Flow from Port 2 to Port 1



- Maximum operating pressure = 350 bar.
- Maximum relief valve leakage at reseat = 0,3 cc/min.
- Maximum check valve leakage = less than 0,07 cc/min.
- Check cracking pressure = 1,7 bar.
- Typical response time = 10 ms.
- The seals on the adjust screw are exposed to system pressure which means this valve can only be adjusted when the pressure is removed. The setting procedure is: check the setting, remove the pressure, adjust the valve, check the new setting.
- Select a spring range where the desired relief setting is approximately mid-range between the minimum and maximum pressure to ensure maximum valve repeatability.
- One purpose of this dual function cartridge is to offer pump isolation and relief protection in single and/or multiple pump circuits.
- The direct acting relief exhibits rapid response characteristics that minimize pressure overshoot and also provides low reseat leakage (less than 0,3 cc/min. at 85% of cracking pressure).
- This valve deviates from Sun's normal flow path for relief valves. It is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

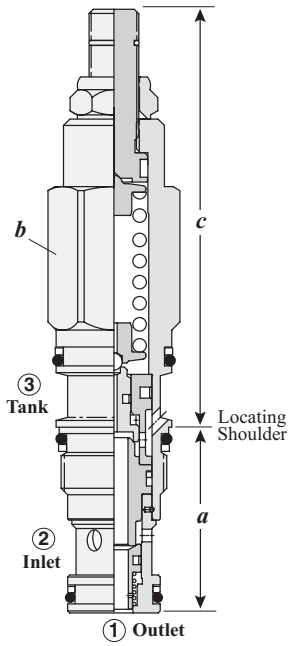
H R D A – * * *

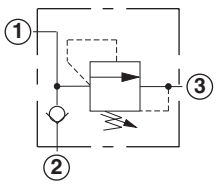
Nominal Capacity	*Control*	*Adjustment Range*	*Seal Material*
D 40 L/min.	**L** Standard Screw Adjustment	**A** 35 - 210 bar Standard Set at 70 bar	**N** Buna-N
	C* Tamper Resistant Factory Set	**W** 55 - 315 bar Standard Set at 70 bar	**V** Viton
	K Handknob with Lock Knob	**D** 14 - 50 bar Standard Set at 28 bar	

** Special setting is required. Specify at time of order.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

DIRECT ACTING RELIEF, AFTER CHECK



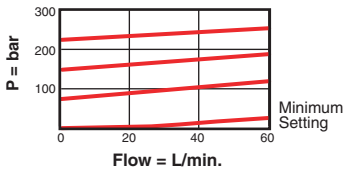


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					L	C	K	
40 L/min.	**HRDB – LA***	T - 11A	35,0	22,2	78,5	82,6	84,8	45 - 50

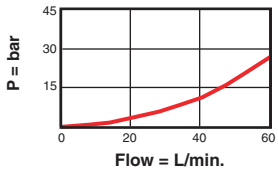
Performance Curves

HRDB

Flow from Port 2 to Port 3 with Port 1 Blocked



Flow from Port 2 to Port 1



- Maximum operating pressure = 350 bar.
- Maximum relief valve leakage at reseat = 0,3 cc/min.
- Maximum check valve leakage = less than 0,07 cc/min.
- Check cracking pressure = 1,7 bar.
- Typical response time = 10 ms.
- This cartridge can be used to provide relief protection on the system side of the circuit.
- The seals on the adjust screw are exposed to system pressure which means this valve can only be adjusted when the pressure is removed. The setting procedure is: check the setting, remove the pressure, adjust the valve, check the new setting.
- Select a spring range where the desired relief setting is approximately mid-range between the minimum and maximum pressure to ensure maximum valve repeatability.
- The direct acting relief exhibits rapid response characteristics that minimize pressure overshoot and also provides low reseat leakage (less than 0,3 cc/min. at 85% of cracking pressure).
- This valve deviates from Sun's normal flow path for relief valves. It is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

H R D B – L A *

Nominal Capacity

D 40 L/min.

Control

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

Adjustment Range

A 35 - 210 bar Standard Set at 70 bar

W 55 - 315 bar Standard Set at 70 bar

Seal Material

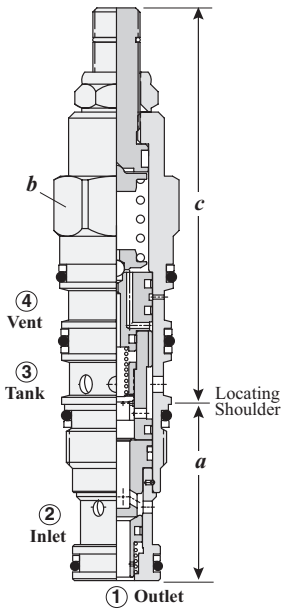
N Buna-N

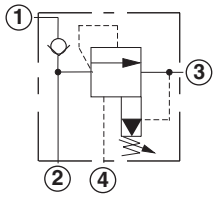
V Viton

** Special setting is required. Specify at time of order.*

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

PILOT OPERATED, BALANCED PISTON, VENTABLE, RELIEF, BEFORE CHECK



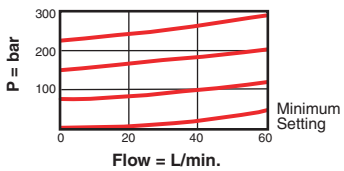


Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*					*Installation Torque (Nm)*
			a	*b*	*c*			
					L	**C**	**K**	
40 L/min.	**HVCA – LAN**	T - 21A	35,0	22,2	78,5	82,6	84,8	45 - 50

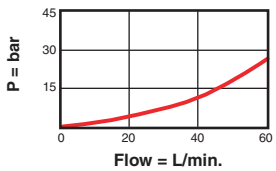
Performance Curves

HVCA

Flow from Port 2 to Port 3 with Port 1 Blocked



Flow from Port 2 to Port 1



- Maximum operating pressure = 350 bar.
- Maximum relief valve leakage at reseat = 0,3 cc/min.
- Maximum check valve leakage = less than 0,07 cc/min.
- Check cracking pressure = 1,7 bar.
- Typical response time = 10 ms.
- Minimum setting is 5 bar for all spring ranges.
- Back pressure at port 3 (tank) is directly additive to the valve setting at a 1:1 ratio.
- A remote pilot relief on port 4 (vent) will control the valve below its setting.
- One purpose of this dual function cartridge is to offer pump isolation and relief protection in single and/or multiple pump circuits. Another purpose is to act as a main stage in an accumulator sense, pump unload circuit.
- This valve deviates from Sun's normal flow path for relief valves. It is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

H V C A – L A N

Nominal Capacity

C 40 L/min.

Control

L Standard Screw Adjustment

C* Tamper Resistant Factory Set

K Handknob with Lock Knob

* ***Special setting is required. Specify at time of order.***

Adjustment Range

A 5 - 210 bar Standard Set at 70 bar

B 5 - 105 bar Standard Set at 70 bar

D 5 - 55 bar Standard Set at 28 bar

W 5 - 315 bar Standard Set at 70 bar

Seal Material

N Buna-N

V Viton

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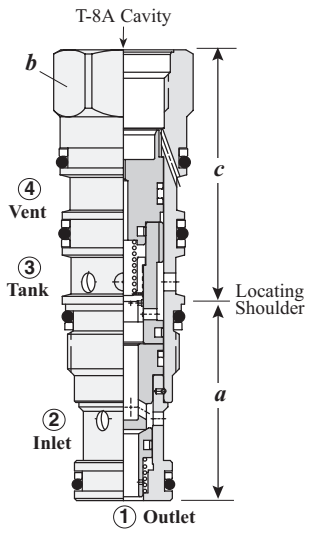
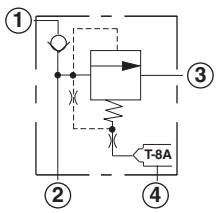
PILOT OPERATED, BALANCED PISTON, VENTABLE, RELIEF, BEFORE CHECK, WITH INTEGRAL PILOT CONTROL CAVITY



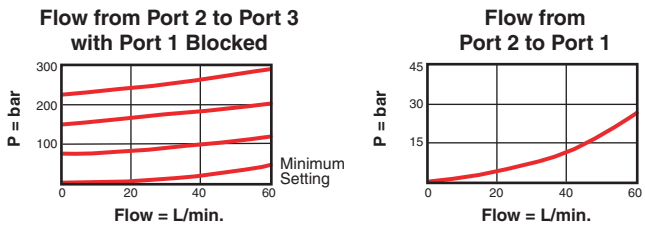


The -8 control option allows the pilot control valve to be incorporated directly into the end of the relief cartridge via the T-8A cavity. These pilot control cartridges are sold separately and include electro-proportional, solenoid, air pilot, and hydraulic pilot operation. See Pilot Control Cartridges on page 141.

Capacity	*Typical Cartridge Model Code*	*Cavity*	*Cartridge Dimensions*			*Installation Torque (Nm)*
			a	*b*	*c*	
40 L/min.	**HVCA – 8D***	T - 21A	35,0	22,2	45,2	45 - 50

Performance Curves

HVCA-8



- Maximum operating pressure = 350 bar.
- Maximum relief valve leakage at reseat = 0,3 cc/min.
- Maximum check valve leakage = less than 0,07 cc/min.
- Typical response time = 10 ms.
- Check cracking pressure = 1,7 bar.
- The main stage orifice is protected against contamination.
- One purpose of this dual function cartridge is to offer pump isolation and relief protection in single and/or multiple pump circuits. Another purpose is to act as a main stage in an accumulator sense, pump unload circuit.
- 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.
- This valve deviates from Sun's normal flow path for relief valves. It is probably not useable in existing standard Sun relief manifolds.

OPTION ORDERING INFORMATION

H V C A – 8 D *

Nominal Capacity	*Control*	*Adjustment Range*	*Seal Material*
C 40 L/min.	**8** with T-8A cavity in hex body for pilot operation. See pilot control section for alternate options.	**D** 5 bar	**N** Buna-N **V** Viton

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New Models are continually added to a Growing Product Line. . .

CORROSION RESISTANT CARTRIDGE VALVES

with ASTM S32101 Duplex Stainless Steel (EN 1.4162) and ASTM grade 5 Titanium (Ti-6Al-4V) External Components

- Heat treated Internal Components in Carbon and Alloy Steels.
- Tested under 1,000 hours of salt spray to ASTM B117-03.
- Superior Cavity Design and Unique Floating Style Screw-in Cartridge Construction.
- 350 bar / 5000 psi Working Pressure at All Ports.
- Standard Valve Performance.
- Recommended for Marine, Oil and Gas Industries, and for use in Aero-drives.

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Products: Cartridges: Corrosion Resistant: View All Corrosion Resistant Cartridges

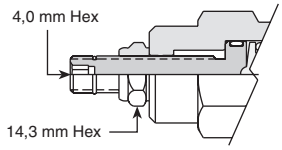
General Information

Cartridge Control Options

General Purpose Controls (for use in systems where adjustment may be changed after installation.)

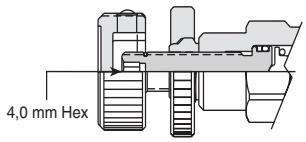
L Standard Screw Adjustment

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. (Except for counterbalance.)



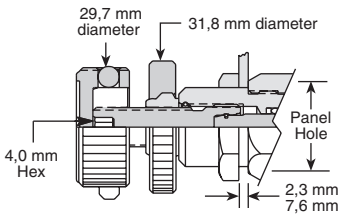
O Handknob with Panel Mount

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 19,0 mm dia.
Series 2 cartridges 25,4 mm dia.

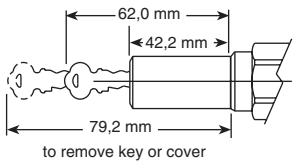
Panel nut hex size identical to cartridge hex size.



Key Lock Kit

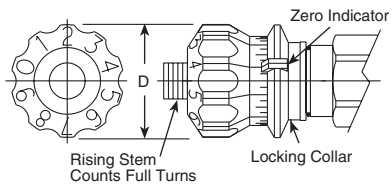
Optional adjustment Key Lock Cover Kit for **L** controls allows adjustment to be locked with a key to prevent unauthorized changes in valve setting. Adjustment is easily accessible when lock assembly is removed.

Requires replacement of standard locknut with special locknut which accepts lock assembly, and a new wire stop ring for overset protection. (Except for Series 0 and counterbalance.)



H Calibrated Handknob with Detent Lock

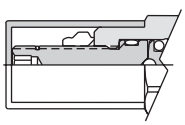
Fully calibrated handknob for flow control cartridges. 40 radial calibrations per turn. Moveable zero indicator. (Minor disassembly required.) Rising detented locking collar positively locks adjustment knob against vibration or accidental tampering. Any desired setting may be recorded and repeated. U.S. Patent #4,577,831.



Diameter	*28,7 mm*	*35,1 mm*	*41,1 mm*	*41,1 mm*
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

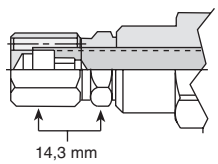
C Tamper Resistant Factory Set

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.



Maximum Setting Limiter

For limiting the maximum setting of cartridges with **L** adjust within their specified range (except Series 0 and counterbalance). These controls come in two varieties: basic Maximum Setting Limiter and Maximum Setting Limiter with Handknob. Once kit is installed, the setting of cartridges can be adjusted within their specified range not to exceed the new permanent maximum setting.

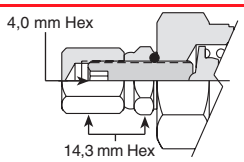


The maximum setting limiters can only be ordered as a kit at this time.Will be available as cartridge control options in future. **Contact your Sun Distributor when ordering as cartridge control option.**

Special Purpose Controls (for use in systems where adjustment is seldom changed after installation)

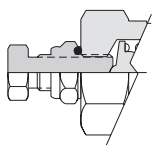
J Socket Head Set Screw with Cap

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

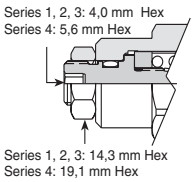
All Sun counterbalance cartridges are built with a leakproof adjustment - O-ring seals are on the adjusting screw-but are not designed for frequent adjustment in the field. Cartridges that are factory pre-set by Sun to a customer specified pressure setting are available and can be installed directly 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.



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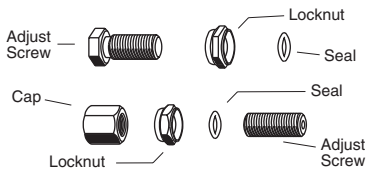
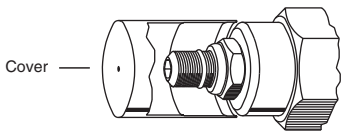
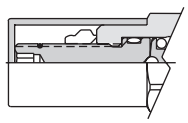
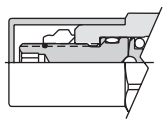
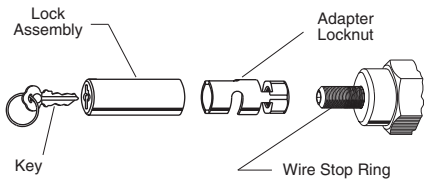
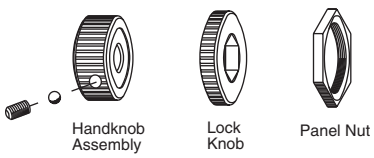
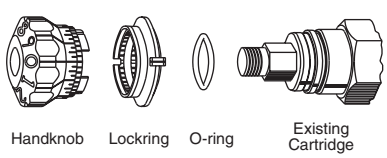
Cartridge Control Kits

Service Kit No. Description	*Use specifically with Control/Cartridge*	*Description*	*Notes*
Adjustment Screw Kit **991-006**	All **F** controls (Zinc plated steel)		To assure a complete seal on the stem - release all pressure on the cartridge after setting. **Then...** tighten locknut (and cap, on **J**).
Adjustment Screw Kit **991-010**	All **J** controls (Zinc plated steel)		
Tamper Resistant Cover (Zinc plated steel)	All Sun Models with **L** adjustment (Except Counterbalance, Series 1 and 2)		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.
991-000	Series 0 - 19,0 mm hex		
991-001	Series 2 - 28,6 mm hex		
991-002	Series 3 - 31,8 mm hex		
991-003	Series 4 - 41,0 mm hex		
991-004	Series 1 - 22,2 mm hex		
991-001-A00	Series 2 - 28,6 mm hex (Stainless steel)		
991-002-A00	Series 3 - 31,8 mm hex (Stainless steel)		
991-003-A00	Series 4 - 41,0 mm hex (Stainless steel)		
991-004-A00	Series 1 - 22,2 mm hex (Stainless steel)		
	For Series 1 and 2, Counterbalance		
991-032	Series 1 - 22,2 mm hex (Zinc plated steel)		
991-033	Series 2 - 28,6 mm hex (Zinc plated steel)		
991-032-A00	Series 1 - 22,2 mm hex (Stainless steel)		
991-033-A00	Series 2 - 28,6 mm hex (Stainless steel)		
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.
K Handknob Kit (Plastic) **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 (Plastic)	**K** control for Series 0		
Panel Handknob Kit (Plastic) **991-215**	**O** controls All Series 1 cartridges 22,2 mm hex, M20 thread		
Panel Handknob Kit (Plastic) **991-216**	**O** controls All Series 2 cartridges 28,6 mm hex, 1"-14 thread		
H Calibrated Handknob Kit (Plastic)	**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, NFCD** only		

Cartridge Control Kits continued on next page.

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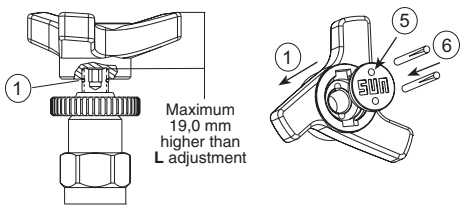
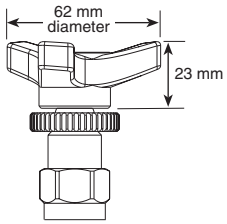
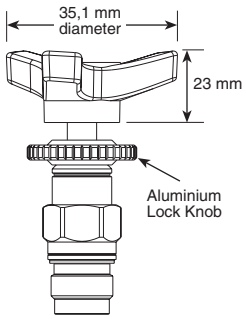
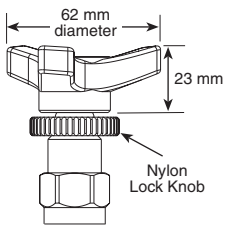
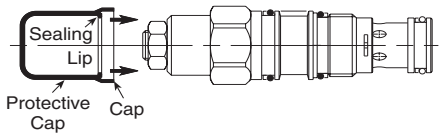
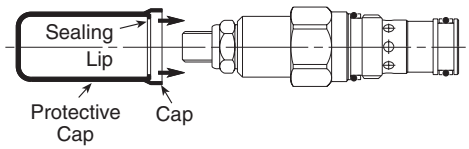
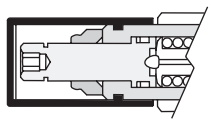
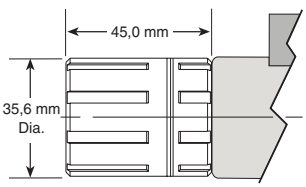
Cartridge Control Kits

Service Kit Number Description	*Use specifically with Control/Cartridge*	*Description*	*Notes*
Tri-grip Handknob Kit (Plastic) **991-034**	For all Series 1, 2, 3, 4 valves with **L** or **O** adjustment except Series 0 and 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. **(Caution: During installation on flow control valves that have no stop ring, make sure valve can be shut with hand knob installed.)** 4. Insert pins in cover so that they project on backside. 5. Put cover on with inserted pins and drive pins in until flush with cover.
	The handknob can be used as a Maximum Setting Limiter. For all Series 1, 2, 3, 4 valves with **L** or **O** adjustment except Series 0 and counterbalance cartridges.		When knob is used as a maximum Setting Limiter: 1. Set valve at desired maximum setting. 2. Tighten lock nut (12,5 Nm.). 3. Remove stop ring. 4. Install lock knob. 5. Install handknob until flush with the lock knob. 6. Insert pins in cover so that they project on backside. 7. Put cover on with inserted pins and drive pins in until flush with cover.
Tri-grip Handknob Kit with Optional Maximum Setting Limiter 35,1 diameter (Plastic with aluminium lock knob) **991-039**	For all Series 1, 2, 3, 4 valves with **L** or **O** adjustment except Series 0 and counterbalance cartridges. This kit should be used in applications where there is high vibration and a plastic lock knob may loosen.		Follow installation instructions described above.
Tri-grip Handknob Kit (Plastic with stainless steel insert) **991-040**	For use with corrosion resistant cartridge line. For all Series 1, 2, 3, 4 valves with **L** or **O** adjustment except Series 0 and 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 handknob until contact is made with the stop ring. **(Caution: On flow control valves that have no stop ring, ensure that valve can be shut with handknob installed.)** 4. Insert pins in holes in cover until they project through. 5. Install cover by driving the pins into the holes in the handknob until the pins are flush with the top of cover. 6. Follow instructions listed above to install Handknob when used as a Maximum Setting Limiter.

Cartridge Control Kits continued on next page.

Cartridge Control Kits

Service Kit Number Description	*Use specifically with Control/Cartridge*	*Description*	*Notes*
Protective Cap (Series 1 Counterbalance) **991-026**	For all Series 1 Counterbalance with **L** control. (Constructed of flexible polyethylene plastic).		**Installation Instructions** (with cartridge already installed in body/manifold): 1. Insure that screw adjustment mechanism (**L** control) is set to proper setting. 2. Press protective cap over end of cartridge assembly as shown in illustration at left. 3. Press **firmly** against end of protective cap until cap lip stretches over beginning of cartridge hex, expelling air within chamber. 4. To remove protective cap, gently pull away from cartridge hex until cap comes loose. 5. Replace protective cap with new one if any abrasions, nicks, or tears are evident along cap lip including interior edge and sealing lip.
Protective Cap (Series 1 cartridges) **991-027**	For all Series 1 with **L** control. (Constructed of flexible polyethylene plastic).		
Tamper Resistant Cap (Series 1 cartridges) **991-035**	For all Series 1 with **L** control. (Black Delrin injection molded cap).		**Installation Instructions:** 1. Adjust valve to desired setting and tighten locknut. 2. To install, press the cap onto the cartridge's hex body until a snapping sound is heard. Do not force the cap to bottom out against the top of the hex. A small gap should remain. Pull back on the cap to verify a successful installation. 3. This tamper resistant cap is designed to be non-removable. Once removed, it can not be re-assembled to the cartridge.
T Twist and Lock Manual Override (momentary/twist operation) (Black plastic) **991-225**	Only for use with DAAL, DAAM, DBAL, DBAM, DTDA, DMDA, DNDA, DLDA, DWDA, Sun Solenoid products.	**Typical Installation:** 1. Ensure that O-ring is installed in seat located at the bottom of the assembly. 2. Remove existing coil nut assembled to end of solenoid tube and discard. 3. Thread twist/lock manual override assembly on to end of solenoid tube. **Position coil connector to point in desired direction and hand-tighten manual override assembly until it bottoms out on solenoid coil and creates snug fit.** **Note:** Depending on operating conditions of valve, thread lock may be applied to override assembly to prevent loosening due to excessive vibration.	**Operating instructions for Momentary Manual Override Assembly 991-225** To manually actuate valve momentarily, hand turn Manual Override Assembly in clockwise direction until it reaches its internal stop. Hold in position to maintain actuated operation. Once released, valve will return to its normal (de-energized) position. *The top face of override assembly depicts an arrow pointing in a clockwise direction with smaller arrow pointing to return position indicating momentary operation.*
L Twist and Lock Manual Override (detent/lock operation) (Black plastic) **991-226**	Only for use with DAAL, DAAM, DBAL, DBAM, DTDA, DMDA, DNDA, DLDA, DWDA, Sun Solenoid products.		**Operating instructions for Locking Manual Override Assembly 991-226** To manually actuate valve and lock, hand turn Override Assembly in counter-clockwise direction until it reaches its internal detent and locks into place. *The top face of override assembly depicts an arrow pointing in a counter-clockwise direction towards a "lock" symbol indicating locking operation.*
D Twist Momentary/ Twist Lock Manual Override (momentary/twist operation) (Black plastic) **991-227**	Only for use with DAAL, DAAM, DBAL, DBAM, DTDA, DMDA, DNDA, DLDA, DWDA, Sun Solenoid products.		**Operating instructions for Dual (Momentary/Twist) Manual Override Assembly 991-227** To manually actuate valve momentarily, follow the instructions shown above for Momentary Operation. To manually actuate valve and lock, follow the instructions shown above for Locking Operation.

Cartridge Control Kits continued on next page.

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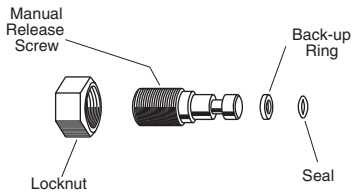
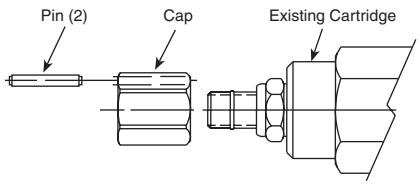
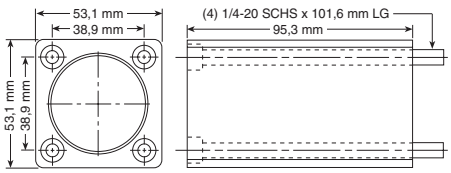
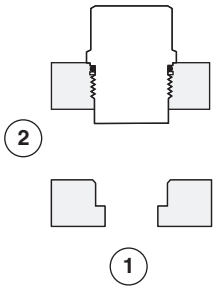
Cartridge Control Kits

Service Kit Number Description	*Use specifically with Control/Cartridge*	*Description*	
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****		
Maximum Setting Limiter (Zinc plated steel) **991-022**	All models with an **L** adjustment control (Except Series 0 and counterbalance.) The maximum setting limiters can only be ordered as a kit at this time. Will be available as cartridge control options in the future with customer specified settings. **Contact your Sun Distributor when ordering as cartridge control option.**		**Installation Instructions:** Kit consists of 2 Driv-Lok pins (811-001-011), Hex Cap (375-020). **To prevent any damage to nose end and/or any moving parts, only install this kit while cartridge is screwed into a cavity.** 1. Set adjustment to desired level within recommended range of valve and tighten jam nut to 12Nm. 2. Remove maximum setting stop ring from the adjust screw. 3. Thread hex cap onto the adjust screw until it bottoms out against jam nut and tighten to 12 Nm. 4. Insert one of the Driv-Lok pins into the hex cap holes and tap into place using a hammer until flush. Repeat procedure with second Driv-Lok pin. 5. Install is now completed.
Lockwire Kit **991-012**	All **M**, **Q** and **R** controls (except solenoid operated cartridges).		
Position Switch Protective Cover (6061-T6 Aluminium) **991-043**	**LOHC-Z****		**Installation:** Threaded holes will need to be machined in the manifold to install cover. Number of Holes: 4 Mounting Hole Thread: .250-20 UNC -2B Mounting Hole Depth: 13,5 mm

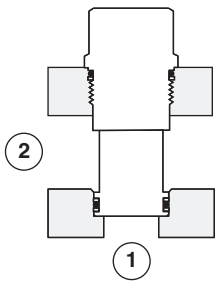
Cavity Plugs

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.

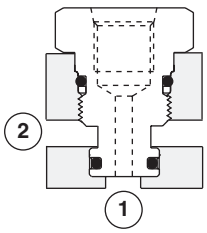
Plugs for Two Port Cavities



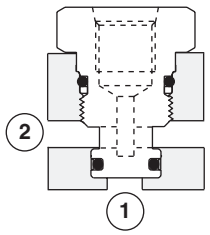
		All Ports Open	All Ports Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code*
P	T-8A	XAOA-XX*	XACA-XX*
0	T-162A	XZOA-XX* +XZOC-XX*	XZCA-XX* XZCC-XX*
1	T-10A T-13A	XFOA-XX*	XFCA-XX* XGCA-XX*
2	T-3A T-5A	XCOA-XX*	XCCA-XX* XDCA-XX*
3	T-16A	XIOA-XX*	XICA-XX*
4	T-18A	XKOA-XX*	XKCA-XX*



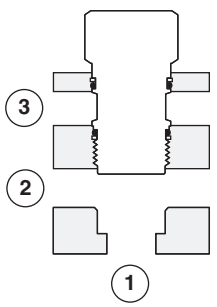
+ Flush Style Plug: Tighten via 5/16" Allen Wrench



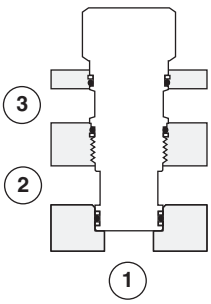
		Port 1 Open to External SAE-4 Port, Port 2 Blocked	Port 2 Open to External SAE-4 Port, Port 1 Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code*
P	T-8A	XACA-EX*	XACC-EX*
0	T-162A	XZCA-EX*	
1	T-10A T-13A	XFCA-EX* XGCA-EX*	

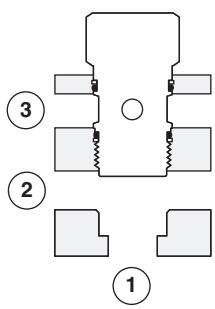


Plugs for Three Port Cavities

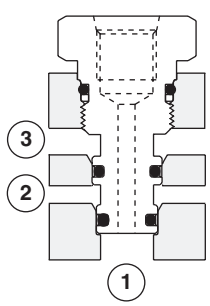


		Port 1 to 2 Open, Port 3 Blocked	All Ports Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code*
P	T-9A	XAOB-XX*	XACB-XX*
0	T-163A	XZOB-XX*	XZCB-XX*
1	T-11A	XEOA-XX*	XECA-XX*
2	T-2A	XBOA-XX*	XBCA-XX*
3	T-17A	XHOA-XX*	XHCA-XX*
4	T-19A	XJOA-XX*	XJCA-XX*





		All Ports Open	Port 1 Open to External SAE-4 Port, Ports 2 and 3 Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code*
P	T-9A		XACB-EX*
0	T-162A	XZOD-XX*	
1	T-11A	XEOB-XX*	
2	T-2A	XBOB-XX*	
3	T-17A	XHOB-XX*	
4	T-19A	XJOB-XX*	

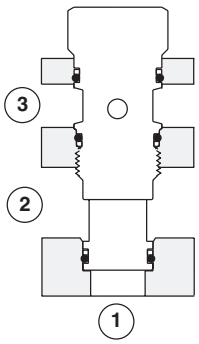


Cavity Plugs continued on next page.

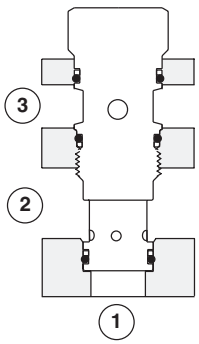
*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

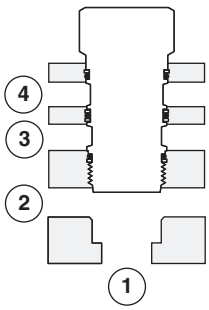
Plugs for Three Port Cavities (*continued*)



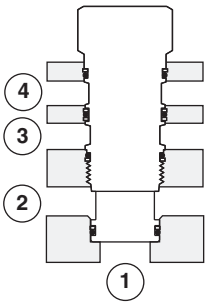
		Ports 1 to 3 Open, Port 2 Blocked	Ports 2 to 3 Open, Port 1 Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code*
P	T-9A	**XAOC-XX***	
0	T-163A		**XZAA-XX***
1	T-11A	**XEBA-XX***	**XEAA-XX***
2	T-2A	**XBBA-XX***	**XBAA-XX***
3	T-17A	**XHBA-XX***	
4	T-19A	**XJBA-XX***	

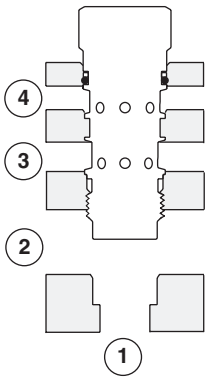


Plugs for Four Port Cavities (Internal Locating Shoulder)



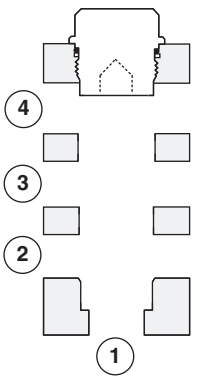
		Ports 1 to 2 Open Ports 3 and 4 Blocked	All Ports Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code*
1	T-21A	**XMOA-XX***	**XMCA-XX***
2	T-22A	**XNOA-XX***	**XNCA-XX***
3	T-23A	**XPOA-XX***	**XPCA-XX***
4	T-24A	**XQOA-XX***	**XQCA-XX***



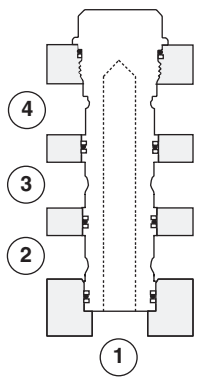


		All Ports Open
Series	*Cavity*	*Cavity Plug Model Code**
1	T-21A	**XMOB-XX***

Plugs for Four Port Cavities (External Locating Shoulder)



		All Ports Open	All Ports Blocked
Series	*Cavity*	*Cavity Plug Model Code**	*Cavity Plug Model Code**
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***

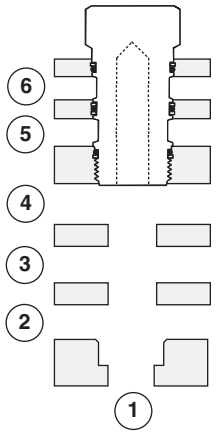


Cavity Plugs continued on next page.

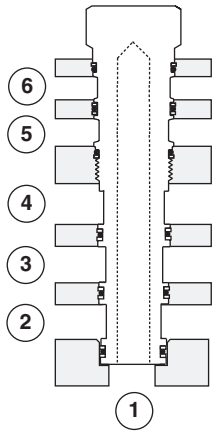
*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

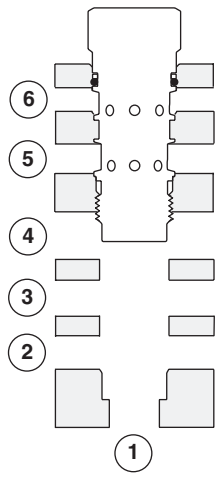
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Plugs for Six Port Cavities



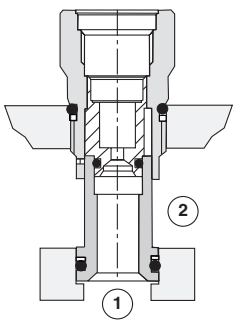
Series	Cavity	Ports 1, 2, 3 and 4 Open Ports 5 and 6 Blocked — Cavity Plug Model Code*	All Ports Blocked — Cavity Plug Model Code*
1	T-61A	**XMOA-XX***	**XRCC-XX***
2	T-62A	**XNOA-XX***	**XSCC-XX***
3	T-63A	**XPOA-XX***	**XTCC-XX***
4	T-64A	**XQOA-XX***	**XVCC-XX***





Series	Cavity	All Ports Open — Cavity Plug Model Code*
1	T-61A	**XMOB-XX***

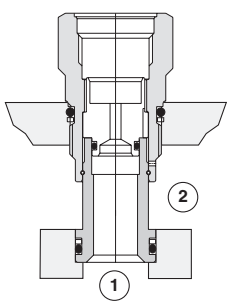
Cavity Adaptor (Converts Sun T-10A Cavity to Sun T-8A Cavity)



Cavity	All Ports Open — Cavity Plug Model Code*
T-10A	**XFAA-8X***
T-10A	**+XFAB-8X***

\+ with filter screen

Cavity Adaptor (Converts Sun T-13A Cavity to Sun T-8A Cavity)



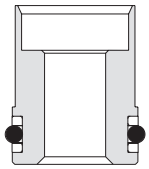
Cavity	All Ports Open — Cavity Plug Model Code*
T-13A	**XGAA-8X***

Cavity Plugs continued on next page.

*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

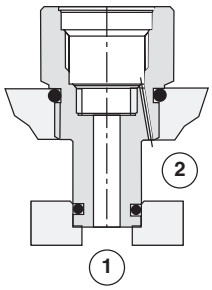
Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Cavity Adaptor (Converts Sun T-162A Cavity to Sun T-8A Cavity)



	All Ports Open
Cavity	*Cavity Plug Model Code**
T-162A	**XZCA-8X***

Cavity Adaptor (Converts Waterman 12-2 Cavity to the Sun T-8A Cavity)



	All Ports Open
Cavity	*Cavity Plug Model Code**
12-2	**XAAA-8X***

For detailed and complete information on
Sun's full list of cavity plugs visit www.sunhydraulics.com.
Products: Accessories: Cavity Plugs

*Insert in the seventh position model code digit N to order Buna-N seals or V to order Viton seals.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Sun Coil Options for Solenoids *(Metal Housing, Round)*

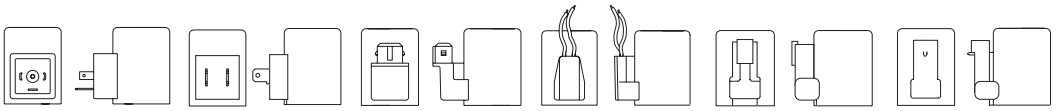
A wide variety of coil options are available for Sun's extensive line of solenoid operated cartridge valves. These metal housing, round coil options are listed in the table below.

Consult the Sun website to view detailed information on our coil options. Every solenoid operated cartridge product page has a Coil Technical Information link and shows a list of cartridge models that use the specific coil that you are viewing.

- Go to Products: Cartridges: Coils: View All Coils
- Or use the Coil Search. Go to Products: Cartridges: Coil Search or Products: Accessories: Coil Search.

19 MILLIMETER TUBED COILS FOR SOLENOID CARTRIDGE VALVES

Standard Coils: Metal Housing, Round



Voltage	*Operating Voltage Range*	*ISO/DIN 43650 Form A* *Coil Part Number Only*	*SAE J858A* *Coil Part Number Only*	*AMP Junior Timer [1]* *Coil Part Number Only*	*Twin Lead* *Coil Part Number Only*	*Metri-Pack 150-2M [2]* *Coil Part Number Only*	*Deutsch DT04-2P [3]* *Coil Part Number Only*
115 V AC 50/60 Hz	+/- 10% nominal	770-211	----	----	----	----	----
230 V AC 50/60 Hz	+/- 10% nominal	770-223	----	----	----	----	----
12 V DC	+/- 10% nominal	770-212	770-512	770-612	770-712	770-812	770-912
14 V DC	+/- 10% nominal	770-214	770-514	770-614	770-714	770-814	770-914
24 V DC	+/- 10% nominal	770-224	770-524	770-624	770-724	770-824	770-924
24 V AC	+/- 10% nominal	770-297	----	----	----	----	----
28 V DC	+/- 10% nominal	770-228	770-528	770-628	770-728	770-828	770-928
36 V DC	+/- 10% nominal	770-236	770-536	770-636	770-736	770-836	770-936
48 V DC	+/- 10% nominal	770-248	770-548	770-648	770-748	770-848	770-948
127 V DC	+/- 10% nominal	770-299	----	----	----	----	----
220 V DC	+/- 10% nominal	770-298	----	----	----	----	----

[1] AMP Junior Timer mating connections are a product of AMP/Tyco Electronics.
[2] Metri-Pack mating connections are a product of Delphi.
[3] Deutsch mating connections are a product of the Deutsch Company.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Sun Coil Options with Embedded Electronic Proportional Amplifiers

A variety of coils are available for Sun's wide line of electro-proportional solenoid operated cartridge valves. These metal housing, round coil options are listed in the table below. Consult the Sun website for our full line of coil options. See page 190 for explanation of part numbering system.

19 MILLIMETER TUBED COILS FOR ELECTRO-PROPORTIONAL SOLENOID CARTRIDGE VALVES

Coils with Embedded Electronic Proportional Amplifiers: Deutsch DT04-6P

Coil Part Number Only	Analog Input Range	Output Current	Voltage		Card Function
790-4A12A	0-20 mA	1200 mA	12 V DC	Proportional Amplifier	includes Separate Command Common, +5V Reference, Enable Switch
790-4A12V	0-10 V	1200 mA	12 V DC	Proportional Amplifier	includes Separate Command Common, +5V Reference, Enable Switch
790-4E12V	-----	(6 sec) 2000 mA Maximum (holding) 1600 mA Maximum	12 V DC	Power Saver	----------
790-4F12V	9-28 V	1200 mA	12 V DC	Ramping Amplifier	
790-4A24A	0-20 mA	600 mA	24 V DC	Proportional Amplifier	includes Separate Command Common, +5V Reference, Enable Switch
790-4A24V	0-10 V	600 mA	24 V DC	Proportional Amplifier	includes Separate Command Common, +5V Reference, Enable Switch
790-4E24V	-----	(6 sec) 2000 mA Maximum (holding) 2000 mA Maximum	24 V DC	Power Saver	----------
790-4F24V	9-28 V	600 mA	24 V DC	Ramping Amplifier	----------

Coils with Embedded Electronic Proportional Amplifiers: ISO/DIN 43560, Form A

790-2B12A	0-20 mA	1200 mA	12 V DC	Proportional Amplifier	(B) Separate Command Common
790-2B12V	0-10 V	1200 mA	12 V DC	Proportional Amplifier	(B) Separate Command Common
790-2C12A	0-20 mA	1200 mA	12 V DC	Proportional Amplifier	(C) +5V Reference
790-2C12V	0-10 V	1200 mA	12 V DC	Proportional Amplifier	(C) +5V Reference
790-2D12A	0-20 mA	1200 mA	12 V DC	Proportional Amplifier	(D) Enable Switch
790-2D12V	0-10 V	1200 mA	12 V DC	Proportional Amplifier	(D) Enable Switch

Coils Table for ISO/DIN 43560, Form A, continued on next page.

19 MILLIMETER TUBED COILS FOR ELECTRO-PROPORTIONAL SOLENOID CARTRIDGE VALVES

Coils with Embedded Electronic Proportional Amplifiers: ISO/DIN 43560, Form A

Coil Part Number Only	Analog Input Range	Output Current	Voltage	Card Function	
790-2E12V	-----	(6 sec) 2000 mA Maximum (holding) 1600 mA Maximum	12 V DC	Power Saver	----------
790-2F12V	9-28 V	1200 mA	12 V DC	Ramping Amplifier	----------
790-2B24A	0-20 mA	600 mA	24 V DC	Proportional Amplifier	(B) Separate Command Common
790-2B24V	0-10 V	600 mA	24 V DC	Proportional Amplifier	(B) Separate Command Common
790-2C24A	0-20 mA	600 mA	24 V DC	Proportional Amplifier	(C) +5V Reference
790-2C24V	0-10 V	600 mA	24 V DC	Proportional Amplifier	(C) +5V Reference
790-2D24A	0-20 mA	600 mA	24 V DC	Proportional Amplifier	(D) Enable Switch
790-2D24V	0-10 V	600 mA	24 V DC	Proportional Amplifier	(D) Enable Switch
790-4E24V	-----	(6 sec) 2000 mA Maximum (holding) 2000 mA Maximum	24 V DC	Power Saver	----------
790-4F24V	9-28 V	600 mA	24 V DC	Ramping Amplifier	----------

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

Sun Weatherized Coils and Coil Kits

Sun weatherized coils and kits are designed for Sun's full flow solenoid operated and electro-proportional cartridge valves. They are protection against high-pressure wash-downs or marine environments for Sun's electrically-actuated cartridge valves.

These coil kits are only available with the Metri-Pack Series 150-2M connector with a choice of four voltages. Weatherized Coil Details:

- Available in four voltages: 12 V DC, 14 V DC, 24 V DC, and 28 V DC.
- Rated for the IP69K which is the Ingress Protection rating for high-pressure, high-temperature wash-down applications. The enclosures are not only dust tight, but must withstand high-pressure and steam cleaning. Additional information about IP ratings can be found on the Sun website.
- Includes a built-in TVS surge suppression diode.
- RoHS compliant.
- Passed a 1000 hour salt fog test, ensuring corrosion resistance for marine applications.

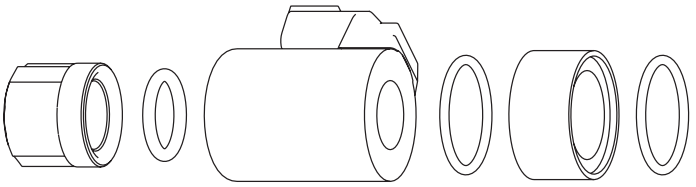
19 MILLIMETER TUBED (ROUND) COILS (Metri-Pack Series 150-2M Connector) FOR FULL FLOW SOLENOID AND ELECTRO-PROPORTIONAL CARTRIDGE VALVES

Voltage	Operating Voltage Range	Metri-Pack 150-2M Coil Part Number Only	Used for Cartridge Models
14 V DC	+/- 10% nominal	773-814	DAAL, DBAL, DLDA, DMDA, DNDA, DNDC, DTCA, DWDA
12 V DC	+/- 10% nominal	773-812	DAAL, DBAL, DLDA, DMDA, DNDA, DNDC, DTCA, DTDA, DWDA, FMDA, FMDB, PRDL, PRDM, PRDN, PRDP, RBAN
24 V DC	+/- 10% nominal	773-824	DAAL, DBAL, DLDA, DMDA, DNDA, DNDC, DTCA, DTDA, DWDA, FMDA, FMDB, PRDL, PRDM, PRDN, PRDP, RBAN, RBAP
28 V DC	+/- 10% nominal	773-828	DAAL, DBAL, DLDA, DMDA, DNDA, DNDC, DTCA

A weatherization kit is required in conjunction with a weatherized coil and a modified cavity (consult the Sun website to view cavity modification instructions for the use of each kit). The coil is not included in the kits and must be purchased separately. Weatherization kits are cartridge model code and cavity dependant. **These kits are intended for new installations only and are not suitable for retrofitting existing equipment or for standard Sun bodies.**

- Consult *www.sunhydraulics.com* for complete details on weatherized coils and weatherized coil kits. Go to Products: Cartridges: Coils: View All Coils: Weatherized Coils. View individual Weatherized Coil Seal Kit page for detailed installation instructions.

WEATHERIZED (ROUND) COIL KITS FOR METRI-PACK SERIES 150-2M CONNECTOR



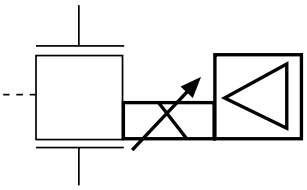
Metri-Pack 150-2M Kit Number Only	Weatherized Kits for Specific Cavities	Used for Cartridge Models
991-055	T-11A Cavity	DMDA, DWDA, PRDL, PRDP, FMDA, FMDB
991-056	T-13A and T-31A Cavities	DLDA, DTCA, DTDA (T-13A), DNDA (T-31A)
991-057	T-31A Cavity (3-position, 4-way)	DNDC
991-058	T-8A and T-9A Cavities	RBAP, DAAL, DBAL
991-059	T-8A Cavity	RBAN
991-060	T-11A Cavity	PRDM, PRDN

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

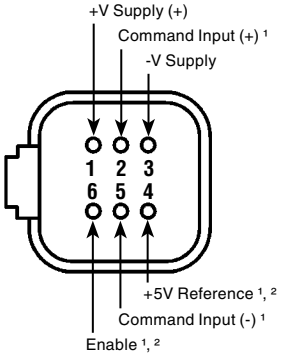
Sun Coil 790-***** Part Numbering System

Sun coils (790-*****) have an embedded amplifier for proportional control. Different versions (see table on pages 188 and 189 of this catalogue) include maximum current of 625 mA or 1200 mA. The command Signal is a voltage (0-10 V) or a current (0-20 mA).
Proportional amplifiers:

- 790-4**** (for the Deutsch DT04-6P) use 6 pins and can be used for different wirings.
- 790-2**** (for ISO/DIN 43560, Form A) use 4 pins and is available in version B through F. See illustration below.
- 790-*E*** (Power Saver) works automatically when power is applied.
- 790-*F*** (Ramping Amplifier) can be controlled with on/off signals.



Deutsch DT04-6P Embedded Electronic Amplifier



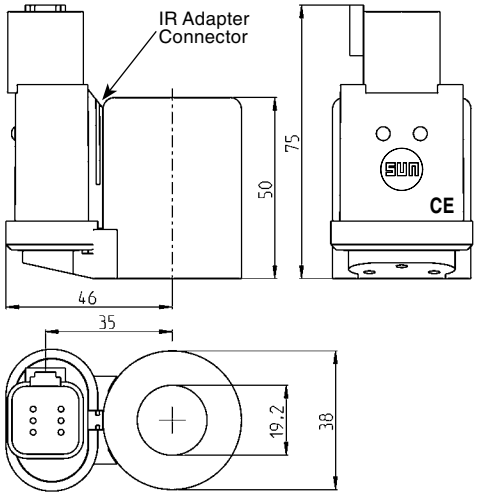
1 Not used on Power Saver
2 Not used on Ramping Amplifier

790-4 * ** *

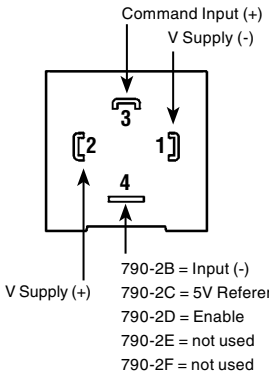
V 0-10V voltage command
A 0-20 mA current command

12 12 V DC nominal voltage for 1200 mA output
24 24 V DC nominal voltage for 600 mA output

A Proportional Amplifier with all functions enabled
E Power Saver to minimize power consumption
F Ramping Amplifier with on/off Signal



ISO/DIN 4360, Form A Embedded Electronic Amplifier

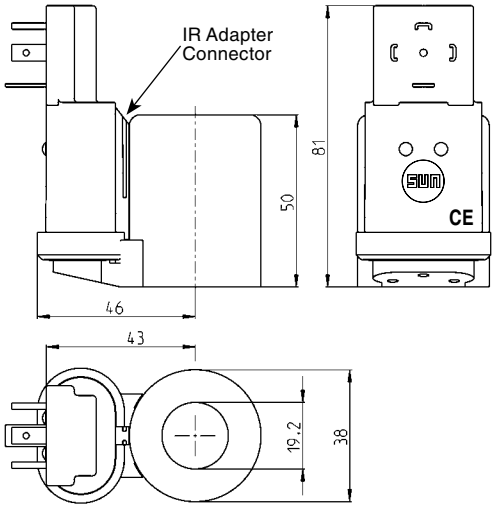


790-2 * ** *

V 0-10V voltage command
A 0-20 mA current command

12 12 V DC nominal voltage for 1200 mA output
24 24 V DC nominal voltage for 600 mA output

B Proportional Amplifier with Separate Command common on pin 4
C Proportional Amplifier with +5V Reference output signal on pin 4
D Proportional Amplifier with Separate Enable input signal on pin 4
E Power Saver to minimize power consumption
F Ramping Amplifier with on/off Signal



Additional Sun Tools for Embedded Electronics:	
991-700	Hand Held Programmer (HHP): Access configuration setting in digital proportional valve amplifier, models C1V, C2A, and 790 series.
991-702	Infrared Cable Adapter: Provides Serial interface between 790 series embedded digital proportional amplifier and HHP
991-703	Infrared Cable Adapter: Provides Serial interface between C1V and C2A digital proportional amplifier and HHP
991-704	Infrared Cable Adapter: USB interface for 790-***** (includes Sun Amplifier Set-up Software on CD or download from website*)
991-705	Infrared Cable Adapter: USB interface for C1V***, C2A*** (includes Sun Amplifier Set-up Software on CD or download from website*)
991-706	Deutsch Cable Assembly: Use with 790 series embedded amplifier equipped with a Deutsch DT04-6P connector

* Go to *www.sunhydraulics.com*. Products: Amplifiers and Amplifier Accessories.

ORIFICE PRESSURE DROP DATA

No allowance has been made for viscosity effects, or regain of pressure downstream.

These charts are based on the formula:

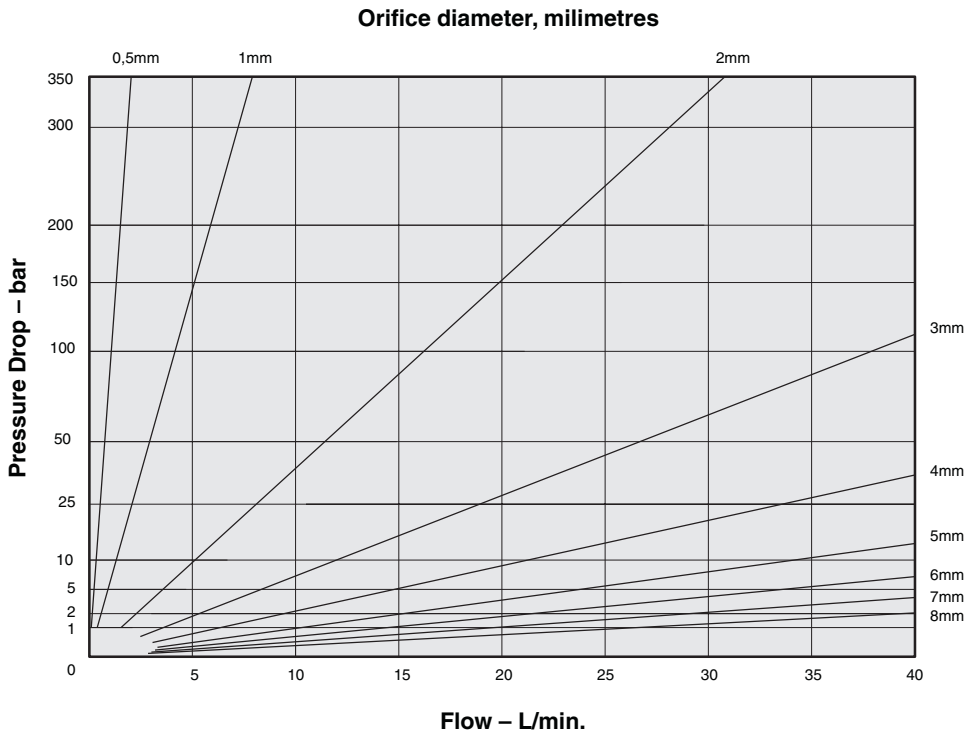
$$Q = \alpha A \sqrt{\frac{2AP}{\rho}}$$

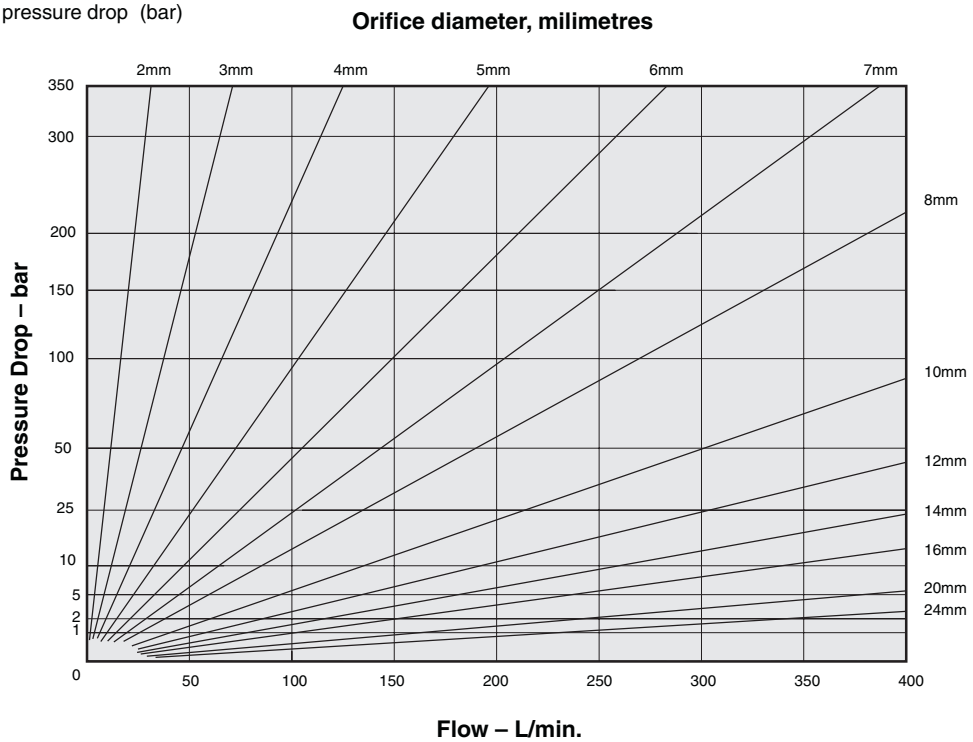
Where:

Q = Flow m^3/sec.
α = orifice coefficient
A = orifice dia. cm^2
ΔP = pressure drop N/m^2
ρ = density Ns^2/m^4

This equation becomes:

Q (l,min) = 0.4212 x d^2 (mm) $\sqrt{\text{pressure drop}}$ (bar)
when c = 0.6
ρ = 0.9 g/cm^3





Sun Model Code System

Sun cartridges have a seven digit model code. Each of the digits in the seven digit sequence has a significance as shown in the typical model code. If a stainless steel cartridge is required, a slash and two letters must be added. See table on right and example below.

The three letter Body Model Code reference applies to most standard line mount bodies and sandwich bodies.

The first two digits of the Body Model Code indicate the body type and the third letter advises the main port size/type.

If the body is required in ductile iron, a slash and a fourth letter is added as shown in the top example. If other requirements are needed refer to the proper modifiers shown in the table.

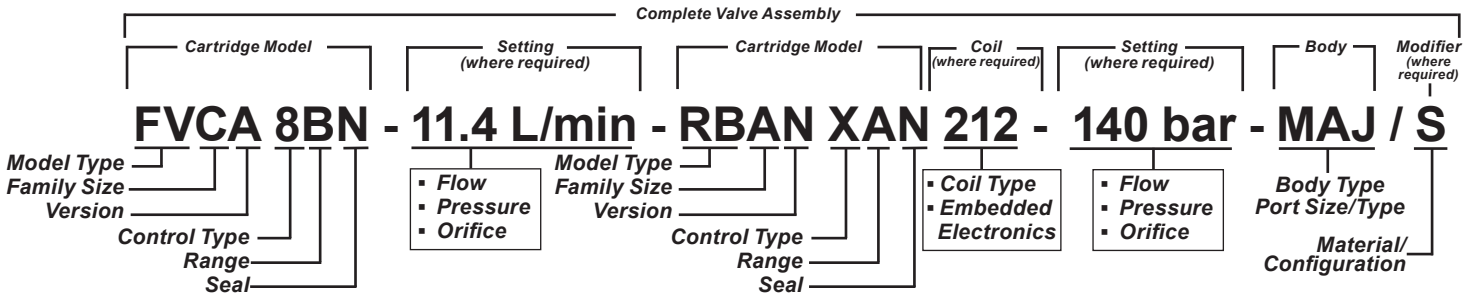
CARTRIDGE MODIFIERS

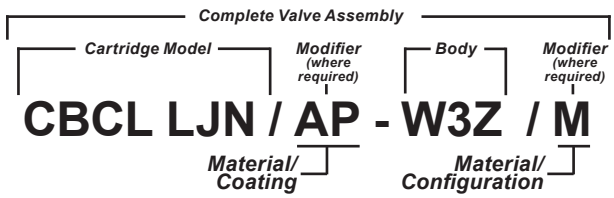
Cartridge Configuration	Modifier	Example
Stainless Steel, Passivated	/AP	See below

MANIFOLD MODIFIERS

Body Configuration	Modifier	To Convert to Viton Change Modifier to:	Examples
Aluminum	None	/V	ZMQ becomes ZMQ/V
Ductile Iron	/S	/Y	ZMQ/S becomes ZMQ/Y
Aluminium-metric	/M	/Z	ZMQ/M becomes ZMQ/Z
Ductile Iron-metric	/T	/W	ZMQ/T becomes ZMQ/W

EXAMPLES OF TYPICAL SUN MODEL CODE STRUCTURE:





EXAMPLES:

CWIA LIV - WGZ/Z*

Vented Counterbalance Valve, 480 L/min., 3:1 Pilot Ratio, 70-280 bar, Viton Seals;
Direct Mount 1.25” SAE Code 62 Aluminium Body, 1/4” BSPP Ports, Viton Seals.

*The Viton Seal Modifier is only applicable if the 3 letter body contains another cartridge or a seal. See table above.

RPEC LAN - 105 bar - FEW

Pilot Operated Relief Valve, 95 L/min., Buna-N Seals, set at 105 bar;
Through Port, Aluminum Body, Ports 1 and 2: 3/4” BSPP Ports, 1/4” BSPP Gage Port.

DLDA XCN 612 - GAU/S

Solenoid Operated, 2-position, 2-way, Spool Valve, No Manual Override, Buna-N Seals;
90 Degree, Ductile Iron Body, 3/8” BSPP Ports, 12 V DC Coil, AMP Junior Timer.

FXEA LAN - 60.0 L/min. - ICX

Fixed Orifice, Pressure Compensated Flow Control Valve, Tuning Adjustment, Buna-N Seals, set at 60.0 L/min.;
Inline Ports, Aluminum Body, 1.00” BSPP Ports.

Model Code Index

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

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NOTES

WARRANTY INFORMATION, PERFORMANCE ASSURANCE, AND APPLICATION LIMITATIONS

Caution

Sun Hydraulics Limited 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 Limited 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 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 Hydraulics Limited 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 catalogue. 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 authorised to approve the use of Sun products in any of the following applications:**

- Any steering or braking systems for passenger-carrying vehicles or on-highway trucks.
- Aircraft or space vehicles.
- Ordnance equipment.
- Life support equipment.
- Any end product which is used in a nuclear power plant application.

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.

Visit www.sunhydraulics.com for current list pricing and complete technical information on all Sun products.

International Distribution

Sun Hydraulics' authorized distributors are qualified to assist customers in the selection, application and purchase of our products. Distributors stock a wide range of product and provide many services, including but not limited to, system design and fabrication, technical service, repair, education and training. Sun believes that its distributors add value to the products it manufactures and through their work contribute to the efficiency, effectiveness and growth of the economy.

COUNTRY	DISTRIBUTOR	TELEPHONE (Dial Intl. Access Code before Country Code number listed below)			FACSIMILE (Dial Intl. Access Code before Country Code number listed below)			EMAIL ADDRESS
		If direct dialing is not available to the country you are calling, dial 00 * and give the operator: name of country, city and local number.						
		Country Code	City Code	Local Number	Country Code	City Code	Local Number	
Argentina	**Verion I.C.S.A.**	54	11	4754-0044	54	11	4755-7167	vendas@verion.com.ar
Australia	**Custom Fluidpower**	61	1300	781-178	61	7	3267-3777	enquiry@ custom. com.au
Austria	**Dorninger Hytronics GmbH**	43	7236	20820-0	43	7236	20820-555	sales@hytronics.at
Azerbaijan	**Hydrolink Caspian Ltd.**	994	12	497-4791	994	12	497-4628	baku@hydrolinkaz.com
Bahrain	**Hydrolink Bahrain W.L.L**	937	17	467-553	937	17	467-554	info@hydrolinkbah.com
Belgium	**Doedijns Hydraulics B.V.**	32	23	61-74-01	32	23	61-74-05	info@doedijns.com
Bosnia	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Brazil	**Verion Oleohidraulica LTDA**	55	11	6100-7400	55	11	6100-7409	vendas@verion.com.br
Canada	**Berendsen Fluid Power Ltd. -MB**	1	204	786-7436	1	204	772-5082	winnipeg@bfpna.com
	Indumo Inc. - PQ	1	514	331-5550	1	514	331-5209	apequette@indumo.com
	Kinecor Inc. - AB	1	780	955-2155	1	780	955-2589	lamyotte@kincor.com
	Lynch Fluid Controls, Inc. - ON	1	905	363-2400	1	905	363-1191	sales@lynch.ca
	Peerless Eng. Sales, Ltd. - BC	1	604	659-4100	1	604	659-4121	info@peerlesse.com
	TRC Hydraulics Inc. - NF	1	506	853-1986	1	506	859-6152	bruce.thompson@trc hydraulics.com
Chile	**Eximtec LTDA.**	56	2	207-6590	56	2	207-6591	eximtec@eximitec.cl
China	**Sun Hydraulics Systems (Shanghai) Co., Ltd.**	86	21	5778-0778	86	21	5778-0768	sunchina@online.sh.cn
Croatia	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Czech Republic	**Sun Hydraulics GmbH**	49	2431	8091-0	49	2431	8091-19	sales@sunhydraulik.de
Denmark	**PMC Hydropower A/S**	45	751	44-444	45	751	44-545	info@pmchydropower.dk
Egypt	**Delta Hydraulic Engineering Company**	20	2	02-2296-0790	20	2	02-2297-4360	deltahydeng@yahoo.com
Finland	**PMC Polarteknik Oy Ab**	358	20	770-9700	358	20	770-9701	info@pmcpolarteknik.com
France	**Sun Hydraulics SARL**	33	557	291-529	33	557	291-857	info@sunfr.com
Germany	**Sun Hydraulik GmbH**	49	2431	8091-0	49	2431	8091-19	sales@sunhydraulik.de
Greece	**Fluid Power Engineering Ltd.**	30	210	558-0402	30	210	558-0403	info@fpe.gr
Hong Kong	**Sun Hydraulics Systems (Shanghai) Co., Ltd.**	86	21	5778-0778	86	21	5778-0768	sunchina@online.sh.cn
Hungary	**Innotechnik Kft.**	36	1	453-9050	36	1	453-9055	inno@innotechnik.hu
Iceland	**Landvelar EHF**	354	---	580-5800	354	---	580-5801	landvelar@landvelar.is
India	**Sun Hydraulics (India**	91	80	252-36325	91	80	252-31855	reddy@sunhydraulics.com
Israel	**Nahum Goldenberg NG, Ltd.**	972	3	534-7976	972	3	534-3049	info@hydrocad.com
Italy	**Oleobi S.r.l.**	39	051	606-5111	39	051	606-5190	info@oleobi.it
Japan	**Kawasaki Heavy Industries, Ltd.**	81	78	991-1808	81	78	991-1809	webseiki@khi.co.jp
Kazakhstan	**Hydrolink Kazakhstan**	7	727	334-0445	7	727	334-0446	alamty@hydrolinkkz.com
Korea	**Sun Hydraulics Korea Corporation**	82	32	813-1350	82	32	813-1147	sales@sunhydraulics. co.kr
Kosovo	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Macedonia	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Malaysia	**Fluid Power (Pte.) Ltd.**	65	6	254-7777	65	6	253-0319	enquiry@fluidpower.com. sg

International Distribution continued on following page.

International Distribution

COUNTRY	DISTRIBUTOR	TELEPHONE (Dial Intl. Access Code before Country Code number listed below)			FACSIMILE (Dial Intl. Access Code before Country Code number listed below)			EMAIL ADDRESS
		If direct dialing is not available to the country you are calling, dial 00 * and give the operator: name of country, city and local number.						
		Country Code	City Code	Local Number	Country Code	City Code	Local Number	
Mexico	**Componentes y Equipos CABA, S.S. de C.V.**	52	81	8367-9940	52	81	8337-6010	adan_hernandez@caba.com.mx
	Joymatic S.A. de C.V.	52	55	5396-0732	52	55	5341-2873	carolina@rahymex.com.mx
Montenegro	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Netherlands	**Doedijns Hydraulics B.V.**	31	182	30-28-88	31	182	30-27-77	info@doedijns.com
New Zealand	**Hydraulic Cartridge Valves, Ltd.**	64	9	573-1051	64	9	573-1052	hcv@hcv.co.nz
Norway	**Hydranor A/S**	47	48	06-56-56	47	32	86-56-55	hydranor@hydranor.no
	PMC Servi A/S	47	64	97-97-97	47	64	97-98-99	post@pmcservi.no
Peru	**Powermatics S. A.**	51	1	615-8800	51	1	348-4121	powermatic@powermatic.com.pe
Philippines	**German Hydraulic & Plant Services, Inc.**	63	2	813-5349	63	2	813-6158	sae_germ@germanhydraulics.com.ph
Poland	**Bibus Menos Sp. z.o.o.**	48	58	660-9598	48	58	661-7132	ple@bibusmenos.pl
	Rockfin Sp. z.o.o.	48	58	684-9804	48	58	684-9807	poczta@rockfin.com.pl
Portugal	**Hidromac LDA**	351	1	299-437-140	351	1	229-437-149	info@hidromac.pt
Qatar	**Hydrolink Qatar**	974	4	620-483	974	4	620-484	pksharma@hydrolinkgroup.com
Russia	**AdamKo**	7	812	313-2207	7	812	313-2207	konkinas@mail.ru
	Bibus Russia	7	812	251-62-71	7	812	251-90-14	info@bibus.ru
Romania	**Bibus Eurofluid SRL**	40	269	206-276	40	269	206-275	office@bibuseurofluid.ro
	SC ST Technik SRL	40	265	318-611	40	265	318-971	sttechnik@yahoo.com
Saudi Arabia	**Hydrolink Company Limited**	966	3	814-1313	966	3	814-0088	crajan@hydrolinkksa.com
Serbia	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Singapore	**Fluid Power (Pte.) Ltd.**	65	6	254-7777	65	6	253-0319	enquiry@fluidpower.com.sg
Slovenia	**Kladivar Ziri**	386	451	59-209	386	451	59-110	ales.bizjak@kladivar.com
Spain	**Ingenieria y Distribucion de Equipaminentos Hidraulicos S.L.**	34	94	369-6095	34	94	369-6507	info@ingenieriaydistribucion.com
South Africa	**Axiom Hydraulics (Pty.) Ltd.**	27	11	334-3068	27	11	334-4543	axiomjhb@mweb.co.za
Sweden	**HYDNET ab**	46	31	499-490	46	31	499-499	info@hydnet.se
	Specma JMS Systemhydraulik AB	46	31	727-6820	46	31	727-6837	sales.g@jms.nu
Switzerland	**ATP Hydraulik AG**	41	41	799-49-49	41	41	799-49-48	info@atphydraulik.ch
Taiwan	**Taiphil Pioneer Corporation**	886	22	505-6992	886	22	500-7051	tailinks@ms24.hinet.net
Thailand	**Tavasin Limited Partnership**	66	2	691-5900	66	2	691-5820	taec@thai-a.com.th
Turkey	**NGR Hidrolik San. ve Tic Ltd. Sti**	90	312	395-7032	90	312	395-7033	info@ngrhidrolik.com
Ukraine	**Hydrotek Ukraine Ltd.**	38	044	583-1456	38	044	583-1456	hydrocontrol@gmail.com
United Arab Emirates	**Hydrolink FZE (Corporate Offices)**	971	4	886-1414	971	4	886-1413	info@hydrolinkgroup.com
	Hydrolink Abu Dhabi	971	2	554-3720	971	2	554-3721	hydroauh@eim.ae
	Hydrolink Co. Ltd.	971	6	528-0801	971	6	528-0830	info@hydrolinkgroup.com
United Kingdom	**Sun Hydraulics Limited**	44	2476	217-400	44	2476	217-488	sales@sunuk.com
United States	**See www.sunhydraulics.com for 22 Distributors with offices in over 200 locations.**							
Yemen	**Hydrolink Yemen**	967	1	244-442	967	1	268-709	----------

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www.sunhydraulics.com