ENGINEERING
TOMORROW

User Guide

Vickers® by Danfoss
Slip-in Cartridge Valves

to ISO 7368 (DIN 24342)



VICKERS
by Danfoss

BC477776514893en-000301

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Product Availability Summary - Covers

Sizes 16 to 63

Model Type	Description	Size 16	25	32	40	50	63	Insert Most Commonly Used With
A	Stroke adjuster	•	•	•	•	•	•	R15, F15
A3	Stroke adjuster with size 03 pilot interface	•	•	•	•	•	•	R15, F15
B	Blank	•	•	•	•	•	•	DC15
C	Relief	•	•	•	•			D10, C10F, R10, D10Z
C3	Relief with size 03 pilot interface	•	•	•	•			D10, C10F, R10, D10Z
C025	1:0.25 area ratio	•	•	•	•	•	•	C025
D3	Directional with size 03 pilot interface	•	•	•	•	•	•	D15, R15
DC3	Dual check valve with size 03 pilot interface	•	•	•	•	•	•	D15, R15
HFV	Valvistor proportional throttle HFV	•	•	•	•			
N	Basic	•	•	•	•	•	•	D105, D15
OD	Prefill valve		•	•	•	•	•	OD105
PC	Pilot operated check	•	•	•	•	•	•	D15
SC	Main system relief	•	•	•	•			D10
SC3	Main system relief with size 03 pilot interface	•	•	•	•			D10
U	Unloading relief	•	•	•	•			U
U3	Unloading relief with size 03 pilot interface	•	•	•	•			U
W	Shuttle	•	•	•	•	•	•	D15
W13	Shuttle type 1, with size 03 pilot interface	•	•	•	•	•	•	D15
W33	Shuttle type 3, with size 03 pilot interface	•	•	•	•	•	•	D15
X	Pressure reducer	•	•	•	•			X2
X3	Pressure reducer with size 03 pilot interface	•	•	•	•			X2
ZD1/ZD3	Dynamic with size 03 pilot interface	•	•	•	•			ZD105, ZDN105
ZDA1/ZDA3	Dynamic with stroke adjuster and size 03 pilot interface		•	•	•	•		ZD105, ZDN105
OD3	Prefill valve with size 03 pilot interface		•	•	•	•	•	OD105

Product Availability Summary - Inserts

Sizes NG-16 to NG-63

Model Type	Description	Size 16	25	32	40	50	63	Cover Most Commonly Used With
C025	1:0.25 area ratio	•	•	•	•			C025
D10	Relief 1:1 area ratio	•	•	•	•			(S)C, (S)C3
C10F	1:1 area ratio with fixed orifice	•	•	•	•			(S)C, (S)C3
D10V	1:1 area ratio with variable orifice	•	•	•	•			(S)C, (S)C3
D10Z	Relief 1:1 area ratio -zero leak spool		•	•	•			(S)C, (S)C3
C10FZ	1:1 area ratio with fixed orifice -zero leak spool		•	•	•			(S)C, (S)C3
D10VZ	1:1 area ratio with variable orifice -zero leak spool		•	•	•			(S)C, (S)C3
R10	Damping 1:1 area ratio	•	•	•	•			(S)C, (S)C3
D105	1:1.05 area ratio	•	•	•	•	•	•	A, D3, N
D105V	1:1.05 area ratio with variable orifice	•	•	•	•	•	•	A, D3, N
D105Z	1:1.05 area ratio -zero leak spool		•	•	•	•	•	A, D3, N
D105VZ	1:1.05 area ratio with variable orifice -zero leak spool		•	•	•	•	•	A, D3, N
D15	Directional 1: 1.5 area ratio	•	•	•	•	•	•	D3, N, PC, W, W13, W33
DC15	Direct check 1:1.5 area ratio	•	•	•	•	•	•	B
R15	Damping 1:1.5 area ratio	•	•	•	•	•	•	A, A3, D3, N
F15	Flow control 1:1.5 area ratio	•	•	•	•	•	•	A, A3, D3, N
D15Z	1: 1.5 area ratio -zero leak spool		•	•	•	•	•	D3, N, PC, W, W13, W33
U	1:1 Unloading normally closed (sliding spoo)	•	•	•	•			U, U3
X1	Reducing -Normally open	•	•	•	•			X, X3
X2	Reducing -Normally closed	•	•	•	•			X, X3
D20	Directional 1:2 area ratio	•	•	•	•	•	•	A, D3, N, PC, W, W13, W33
R20	Damping 1:2 area ratio	•	•	•	•	•	•	A, A3, D3, N
F20	Flow control 1:2 area ratio	•	•	•	•	•	•	A, A3, D3, N
D20Z	Directional 1:2 area ratio -zero leak spool		•	•	•	•	•	A, D3, N, PC, W, W13, W33
OD105	1:1.05 normally open (prefill)	•	•	•	•	•	•	OD
ZD105	Dynamic 1:1.05. zero pilot leakage	•	•	•	•	•	•	ZD*, ZDA*
ZDN105	Dynamic 1:1.05., fast response, low hysteresis	•	•	•	•	•	•	ZD*, ZDA*

Product Availability Summary - Units

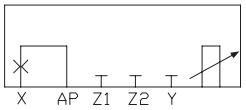
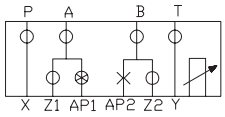
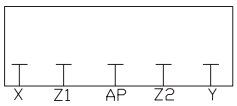
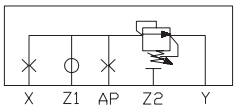
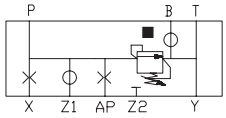
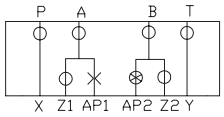
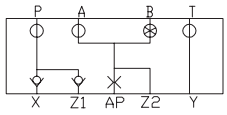
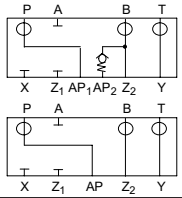
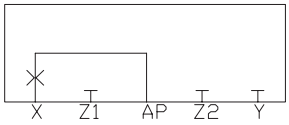
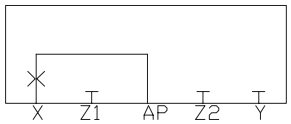
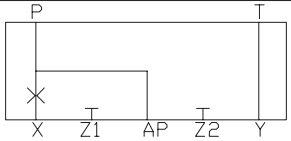
Cartridge Valve Units (CVU-**)

Model Type	Description	Size 16	25	32	40	50	63
EFP1	Proportional throttle (two-stage)	•	•	•	•		
SWD	Position monitor switch	•	•	•	•	•	•
SWD3	Position monitor switch with size 03 pilot interface	•	•	•	•	•	•
ZSWD3	Dynamic position monitor switch with size 03 pilot interface	•	•	•	•		

Pilot Control Modules (CVG***-3)

Model Type	Description
CVGC-3	Relief module: P-T
CVGCA-3	Relief module: A-T
CVGCPA-3	Relief module: P & A-T
CVGMS1-3	Shuttle module
CVGPC1-3	Pilot operated check valve
CVGS1-3	Shuttle valve

Functional Symbols - Covers

Cover Type	Graphical Symbol	Cover Model
Directional with stroke adjuster		CVCS-**-A-*-*-30-* Sizes 16-63
Directional with size 03▲ pilot interface & stroke adjuster		CVCS-**-A3-*-*-30-***** Sizes 16-63
Blank		CVCS-**-B-*-30 Sizes 16-63
Relief (ISO 7368---A)		CVCS-**-C-*-***-*-30-**** Sizes 16-40
Relief with size 03▲ pilot interface (ISO 7368---A)		CVCS-**-C3-*-***-*-30-**** Sizes 16-40 ■ No orifice/plug tapping on this port on size 16
Directional with size 03▲ pilot interface		CVCS-**-D3-*-30-***** Sizes 16-63
Dual check valve with size 03▲ pilot interface		CVCS-**-DC3-*-30-***** Sizes 16-63
Valvistor® proportional throttle		CVCS-**-HFV*-W-*2(9)-10 For models without free reverse flow capability CVCS-**-HFV*-*2(9)-10 For models with free reverse flow capability Sizes 16-63
Directional		CVCS-**-N-*-30-* Sizes 16-63
Prefill		CVCS-**-OD-*-30-* Sizes 25-63
Prefill with size 03▲ pilot interface		CVCS-**-OD3-*-30-**** Sizes 25-63

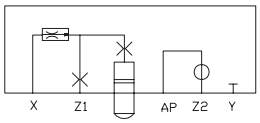
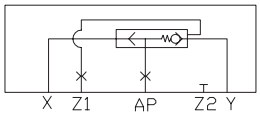
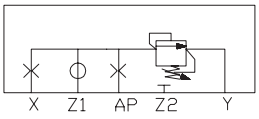
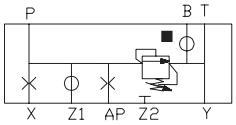
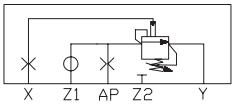
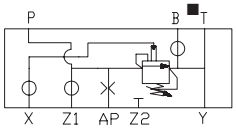
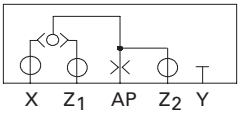
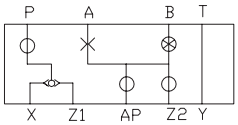
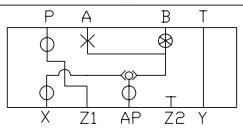
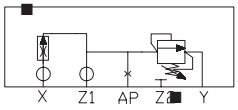
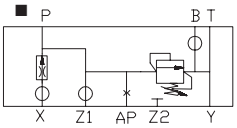
▲ISO 4401, size 03 (ANSI/B93.7M-D03)

>< Standard (factory-fitted) orifice

◯ Tapped port for installation of optional orifice

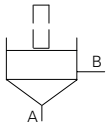
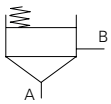
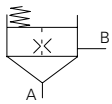
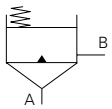
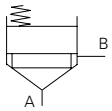
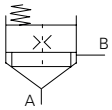
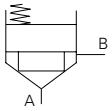
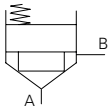
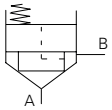
⊗ Plugged port

Functional Symbols - Covers (continued)

Cover Type	Graphical Symbol	Cover Model
1:0.25 area ratio		CVCS-**-C025-*-30-*** Sizes 16-40
Pilot operated check		CVCS-**-PC-*-30-** Sizes 16-63
Main system relief (ISO 7368---B)		CVCS-**-SC-*-***-*-30-**** Sizes 16-40
Main system relief with size 03▲ pilot interface (ISO 7368---B)		CVCS-**-SC3-*-***-*-30-**** Sizes 16-40 ■ No orifice/plug tapping on this port on size 16
Unloading/relief		CVCS-**-U-*-***-*-30-**** Sizes 16-40
Unloading/relief with size 03▲ pilot interface		CVCS-**-U3-*-***-*-30-**** Sizes 16-40 ■ No orifice/plug tapping on this port on size 16
Shuttle		CVCS-**-W-*-30-**** Sizes 16-63
Shuttle type 1 with size 03▲ pilot interface and W11/W13 function		CVCS-**-W13-*-30-***** Sizes 16-63
Shuttle type 3 with size 03▲ pilot interface and W31/W33 function		CVCS-**-W33-*-30-***** Sizes 16-63
Reducer		CVCS-**-X-*-***-*-30-**** Sizes 16-40 ■ No orifice/plug tapping on this port on size 16
Reducer with size 03▲ pilot interface		CVCS-**-X3-*-***-*-30-**** Sizes 16-40 ■ No orifice/plug tapping on this port on size 16
Dynamic with size 03▲ pilot interface	See page 67	CVCS-**-ZD*-*-20-*** Sizes 16-63
Dynamic with stroke limiter with size 03▲ pilot interface	See page 67	CVCS-**-ZDA*-*-*-20-*** Sizes 16-63

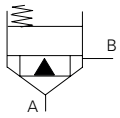
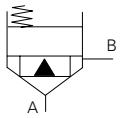
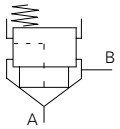
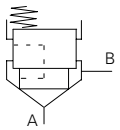
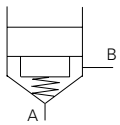
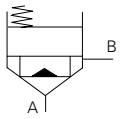
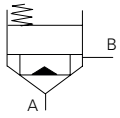
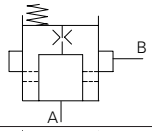
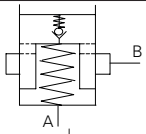
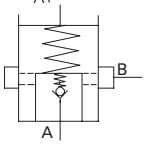
▲ISO 4401, size 03 (ANSI/B93.7M-D03)

Functional Symbols - Inserts

Insert Type	Function	Functional Symbol	Area Ratio $A_A : A_{AP}$	Sizes/ Insert Model	Cracking Pressure bar (psi) A to B	B to A
1:0.25 area ratio	C025		1:0.25	Sizes 16-40: CVI-**-C025-60	N/A – No spring used	
Relief, standard	D10		1:1	Sizes 16-63: CVI-**-D10-L-60 CVI-**-D10-M-60 CVI-**-D10-H-60 ■ Zero leak options 'D10Z' are available except size 16.	0.33 (4.8) ▲ 1.67 (24.2) ▲ 3.34 (48.4) ▲	
Relief with orifice	C10F		1:1	CVI-16-C10F-M-60 CVI-25-C10F-H-60 CVI-32-C10F-H-60 CVI-40-C10F-H-60 ■ Zero leak options 'C10FZ' are available except size 16.	1.67 (24.2) ▲ 3.34 (48.4) ▲ 3.34 (48.4) ▲ 3.34 (48.4) ▲	
Relief, damped	R10		1:1	Sizes 16-40: CVI-**-R10-L-60 CVI-**-R10-M-60 CVI-**-R10-H-60	0.33 (4.8) ▲ 1.67 (24.2) ▲ 3.34 (48.4) ▲	
Directional	D105		1:1.05	Sizes 16-63: CVI-**-D105-L-60 CVI-**-D105-M-60 CVI-**-D105-H-60 ■ Zero leak options 'D105Z' are available except size 16.	0.35 (5.1) ▲ 1.75 (25.4) ▲ 3.5 (50.8) ▲	
Directional with orifice	D105V		1:1.05	Sizes 16-63: CVI-**-D105V-L-60 -* CVI-**-D105V-M-60 -* CVI-**-D105V-H-60 -* ■ Zero leak options 'D105VZ' are available except size 16.	0.35 (5.1) ▲ 1.75 (25.4) ▲ 3.5 (50.8) ▲	
Directional	D15		1:1.5	Sizes 16-63: CVI-**-D15-L-60 CVI-**-D15-M-60 CVI-**-D15-H-60 ■ Zero leak options 'D15Z' are available except size 16.	0.5 (7.3) 2.5 (36.3) 5.0 (73)	0.75 (10.9) 3.75 (54.4) 7.5 (108.8)
Directional	D20		1:2	Sizes 16-63: CVI-**-D20-L-60 CVI-**-D20-M-60 CVI-**-D20-H-60 ■ Zero leak options 'D20Z' are available except size 16.	0.58 (8.4) 3.0 (44.0) 5.8 (84.7)	0.58 (8.4) 3.0 (44.0) 5.8 (84.7)
Direct check	DC15		1:1.5	Sizes 16-63: CVI-**-DC15-L-60 CVI-**-DC15-M-60 CVI-**-DC15-H-60	0.5 (7.3) 2.5 (36.3) 5.0 (73)	0.75 (10.9) 3.75 (54.4) 7.5 (108.8)

▲ D105 and D10 inserts not normally used for flow from "B" to "A".

Functional Symbols - Inserts (continued)

Insert Type	Function	Functional Symbol	Area Ratio $A_A : A_{AP}$	Sizes/ Insert Model	Cracking Pressure bar (psi) A to B	B to A
Flow restricting	F		1:1.5	Sizes 16-63: CVI-**-F15-L-60 CVI-**-F15-M-60 CVI-**-F15-H-60	 0.5 (7.3) 2.5 (36.3) 5.0 (73.0)	 0.75 (10.9) 3.75 (54.4) 7.5 (108.8)
Flow restricting	F		1:2	Sizes 16-63: CVI-**-F20-L-60 CVI-**-F20-M-60 CVI-**-F20-H-60	 0.58 (8.4) 2.5 (36.3) 5.0 (73.0)	 0.58 (8.4) 2.5 (36.3) 5.0 (73.0)
Valvistor® proportional throttle	HFV		1:2	Sizes 16-63: CVI-**-HFV-20-A-***-1*	 –	 –
				Sizes 16-63: CVI-**-HFV-20-B-***-1*	 –	 –
Normally open close: 0.05 P_B	OD105		◆	Sizes 25-63: CVI-**-OD105-60	Normally open	Pilot pressure to 2,5 (36.3) + P_A +
Damping	R20		1:2	Sizes 16-63: CVI-**-R-L-60 CVI-**-R-M-60 CVI-**-R-H-60	 0.58 (8.4) 3.0 (44.0) 5.8 (84.7)	 0.58 (8.4) 3.0 (44.0) 5.8 (84.7)
Damping	R15		1:1.5	Sizes 16-63: CVI-**-R15-L-60 CVI-**-R15-M-60 CVI-**-R15-H-60	 0.5 (7.3) 2.5 (36.3) 5.0 (73.0)	 0.75 (10.9) 3.75 (54.4) 7.5 (108.8)
Unloading	U		1:1	Sizes 16-40: CVI-**-U-60	 3,5 (51.0)	 –
Reducing	X2 & X1		1:1	Sizes 16-40: CVI-**-X2-60	 –	 1.8 (26.1)
			1:1	Sizes 16-40: CVI-**-X1-60		1.8 (26.1)
Dynamic, zero pilot leakage	ZD105	See page 67	◆	Sizes 16-63: CVI-**-ZD105-L-20 CVI-**-ZD105-M-20 CVI-**-ZD105-H-20	 1.0 (14.5) 2.5 (36.3) 4.5 (62.2)	 – – –
Dynamic, fast response, low hysteresis	ZDN105	See page 67	◆	Sizes 16-63: CVI-**-ZDN105-L-20 CVI-**-ZDN105-M-20 CVI-**-ZDN105-H-20	 0.5 (7.3) 2.0 (29.0) 4.0 (58.0)	 – – –

◆ Spool geometry based on 1:1.05 ratio spools.

Introduction to Cartridge Valves

Design Concept

Poppet type valves have been used in hydraulic systems for many years. They are commonly known as two-port check valves. In this form, they serve as a one-way valve, allowing free flow in one direction while blocking flow in the reverse direction. With some refinements, these valves can be controlled to overcome the normal blocking action, thereby allowing control of flow in both directions. This is the basis of the control concept known as cartridge valves.

Refinements in hydraulic system development have led to greater use of manifold block construction. Block systems eliminate a multitude of interconnecting lines between components, thereby virtually eliminating potential leakage points and related oil waste. Inserting the active element of cartridge valves into standardized cavities in the manifold, and retaining this insert by a passive block (cover), completes the cartridge valve concept.

Vickers by Danfoss New Design

Vickers by Danfoss valves are defined as slip-in cartridge valves to differentiate them from another type known as screw-in. Generally, slip-in valves are associated with relatively high flows, i.e. 150 L/min (40 USgpm) or more. Slip-in cartridge valves, which will henceforth be referred to simply as cartridge valves in this catalog, are targeted at more efficient, faster and more compact hydraulic has developed its cartridge valve system technology to meet the changing needs of new generations of hydraulically operated machinery and equipment. Today's machines need controls that are exceptionally cost effective and energy efficient. Vickers by Danfoss cartridge valves fulfill these needs.

Cartridge Valve Advantages

- System design flexibility
- Lower installed cost
- Smaller package size
- Better performance and control
- Improved reliability
- Higher pressure capability
- More efficient operation
- Elimination of external leakage and reduction of internal leakage
- Greater contamination tolerance
- Faster cycle times

System Design Considerations

Cartridge valves offer an alternative rather than a replacement for conventional sliding spool valves. Often, the most economical system incorporates combinations of manifold mounted spool valves and screw-in and slip-in cartridge valves. Engineers faced with a system design problem should consider all possibilities before deciding on a particular solution. Cartridge valve systems will become more cost effective if some of the following design parameters are significant.

- Flow rates exceeding 150 L/min (40 USgpm)
- Working pressure above 210 bar (3000 psi)
- Small envelope size
- Complex circuitry
- Fast response
- Low internal leakage
- Good stability
- Low noise level

Because cartridge valves are two-position valves, a single valve can control flow between only two major flow points in a system. Thus, for example, four cartridge valves are required to replace a typical three position, four-way spool valve (Figure 1). Operating characteristics of cartridge valves can be altered easily to fine tune the motions of a machine. For instance, a cartridge cover can be changed to control poppet time and travel, thus controlling actuator acceleration and speed. Shock is easily avoided by carefully sizing orifices in the valve cover and by timing the opening and closing sequence of individual cartridges. In conventional spool type valves, timing of the opening or closing of all four ports occurs simultaneously with less ability to avoid shock.

Conventional spool valves must be sized for the highest flow at any one port. When differential-area cylinders are used, a spool valve would probably be sized for the return flow rate out of the head end of the cylinder. Cartridge valves, on the other hand, are sized to handle only the flow required through their individual ports. Economies are realized and the system is optimized. Cartridge valves are compatible with computer or programmable controls via electrically modulated pressure and flow control models. Simple on-off solenoid pilot controls, as well as air operated types, are also available. The Vickers by Danfoss soft shift pilot valves DG4V-3-****2** (catalog 614) can also be used to achieve smooth opening and closing.

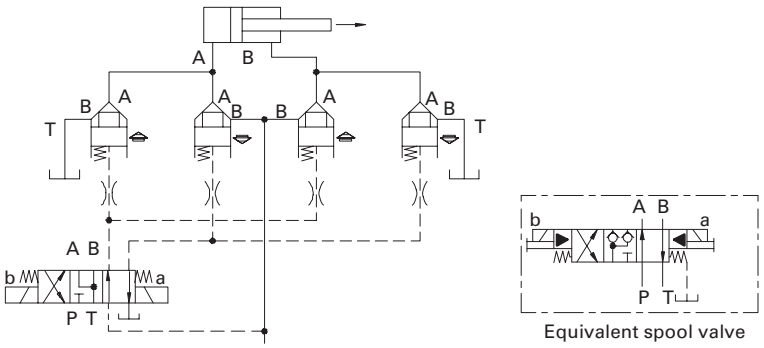


Figure 1

Features and Benefits

Features	Benefits
Positive-seating check type valving mechanism	• Minimum internal valve leakage with little energy waste. • Improved control of load holding enhances machine performance. • Higher flow capacity results in more economical valve sizing. (Check type valve opening area is greater than that of equal port size spool valves.) • Lower pressure drops with less heat generation provide greater machine efficiency. • Faster response – up to four times faster than spool type valves – allows faster machine cycling for greater productivity. Flow begins as soon as the cartridge check type valve poppet lifts off its seat. (Spool valves must clear their overlap before flow begins.)
Individual port control	• Each cartridge can be tuned to reduce system shock, resulting in smoother machine operation. • Each cartridge in a system can be sized for the actual flow encountered, optimizing component size and cost. (Spool valves must be sized for the maximum flow seen at any of their ports.) This is a refinement over spool type valves wherein all ports are affected simultaneously by spool movement, and the demands of one port compromise the others.
Cartridges combine functions of direction, flow and/or pressure	• Multi-function reduces the number of valving components required, resulting in lower machine costs.
Manifold block assemblies that are compact, neat and low in weight	• Machine system installation is easier and faster, thereby reducing assembly costs. • Piping can be eliminated, providing leak free construction. • Cartridges can be easily serviced without disturbing system piping, thereby increasing machine uptime and reducing maintenance time and costs.
Headloss	• Vickers by Danfoss “best in class” cartridge valves offer more power efficiency.
Flexibility	• Components can be individually matched to system requirements.
Serviceability	• System can be easily serviced as all valves are surface mounted.
Reliability	• Cartridge technology proven over several decades of use. • Vickers by Danfoss valves undergo fatigue and endurance tests before release. • 420 bar (6090 psi) rating.
Conformity	• RoHS Directive - 2011/65/EU • REACH Regulation
$MTTF_D$	• 150 years as per ISO 13849

Cartridge Valve Design

Construction

Vickers by Danfoss cartridge valves are similar to poppet check valves and consist of an insert assembly that slips into a cavity machined into a manifold. This cavity is made to ISO 7368 or to DIN 24342. The insert is retained in the cavity by a control cover which is bolted to the manifold. The insert consists of a sleeve, poppet, spring and seals. Typically, inserts and covers are supplied separately, e.g. insert model CVI-**-D10 and cover model CVCS-**-C (relief valve) shown in Figure 2. For some functions, inserts and covers are supplied as a unit (complete assembly); e.g. the CVU-**-EFP1 (proportional throttle) shown on page 87.

Drilled holes in the manifold connect insert main ports A and B to other cartridges or to the operating hydraulic system. Similarly, drilled control lines in the manifold interconnect control ports X, Z1, and Z2 as desired, see page 123 for port locations to ISO 7368. Drain port Y is always connected directly to the reservoir.

Three different spring rates provide a selection of insert poppet cracking pressures. The control cover can also contain a manual adjustment for limiting poppet lift and flow rate. Provision is made for the fitting of various orifices to optimize or tune cartridge valve response in relation to that of the complete hydraulic system. Some covers have an ISO 4401 size 03 (ANSI/B93.7M-D03) interface for integrally mounting a pilot directional, or pressure, control valve, (metric thread mounting bolts). Control functions can be expanded by adding control modules between the pilot valve and the cover.

Typical single cartridge arrangements are symbolized on the following pages. Your Danfoss representative can illustrate various grouped arrangements. Grouping cartridge assemblies for control by one or more common pilot valves can provide directional, check, pressure and/or flow restrictor functions for flow rates up to 5500 L/min (1450 USgpm) per cartridge.

Functions

Cartridge valves for directional and check functions are essentially hydraulically piloted check valves. Cartridge relief valves feature manual pressure setting adjustment. Additionally, venting and remote piloting are possible. Alternative arrangements include electrical selection of pressure or venting, and of dual pressure settings and venting, via a pilot valve mounted to the cartridge cover. Electrohydraulic proportional control of pressure is also available.

Relief valve arrangements described in this catalog can be built into system manifold assemblies in combination with directional flow regulating and pressure reducing functions in cartridge form. The basic pressure reducing cartridge arrangement features manual adjustment of reduced pressure, plus a pilot port for optional remote control. Options include electrical selection of high and low pressures, and electrohydraulic proportional control of reduced pressure.

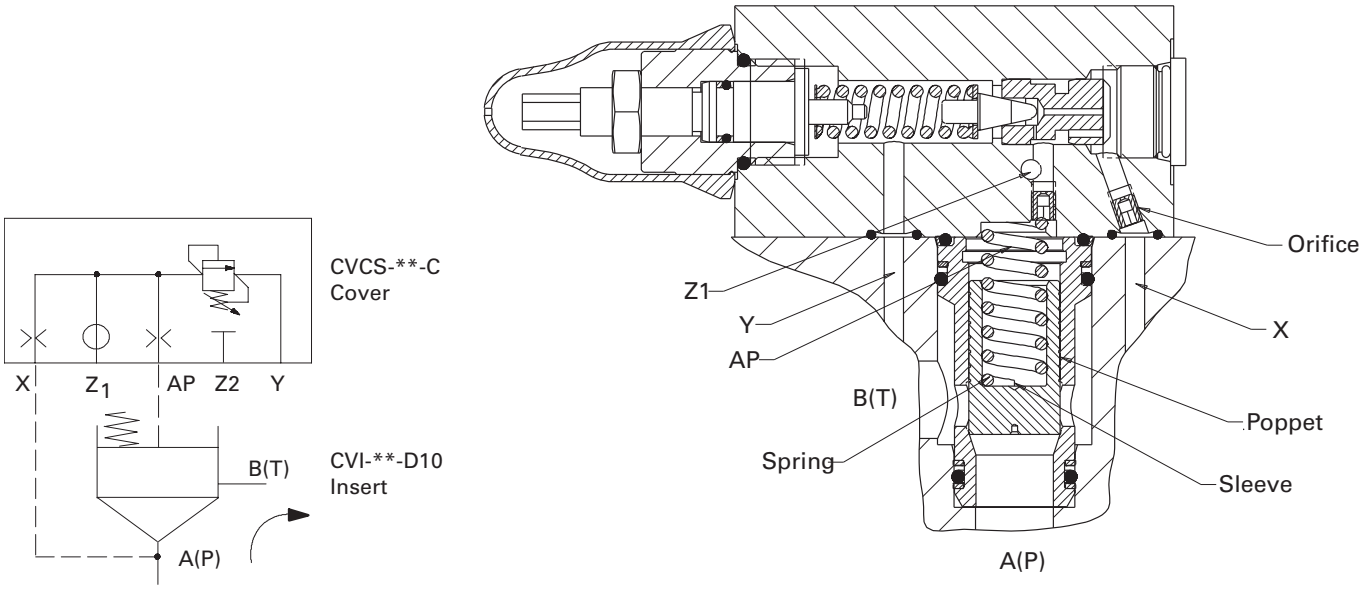


Figure 2

Poppet Area Ratios

A cartridge valve is simply a two-port valve that blocks flow, allows free flow, or modulates flow or pressure. A basic cartridge valve insert, Figure 3, consists of a sleeve, spring, and poppet. The insert has three areas, identified as AA, AB and AAP , that affect the opening or closing of the valve poppet relative to the seat in the sleeve. The A-port area is the circular area defined by the seat diameter. The B-port area is the annular area between the seat and the outside diameter of the poppet. Area AP is the circular area defined by the diameter of the poppet. Pressure on the AP area, plus the spring force, holds the poppet against the seat. Pressure on the AA and AB areas tends to lift the poppet off the seat, allowing flow through the valve.

A = Main port

B = Main port

AP = Spring chamber

$\mathbf{A_A}$ = Effective area of port A

$\mathbf{A_B}$ = Effective area of port B (annular)

$\mathbf{A_{AP}}$ = Area related to poppet diameter

The valve opens and closes in accordance with the force balance formula:

$$\mathbf{(P_{AP}xA_{AP})+F_S-(P_AxA_A)-(P_BxA_B)-F_f}$$

< 0 . . . . . Valve opens

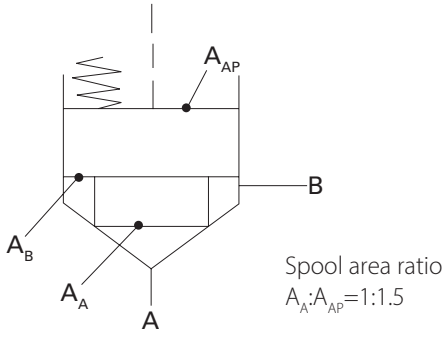
> 0 . . . . . Valve closes

Where:

$\mathbf{F_S}$ = Spring force
$\mathbf{F_f}$ = Flow force

Referring to a 1:1.5 poppet area ratio (AA:AAP), Figure 4, the poppet will remain closed, thereby blocking flow between ports A and B as long as pressure in area AAP, plus the spring force, exceeds pressure on either area AA, annulus AB, or their combined effect. Flow force (Ff) plays a role when the valve is open, but will not be covered in this catalog.

Graphic Symbol



Spool area ratio
A_A:A_{AP}=1:1.5

Figure 4

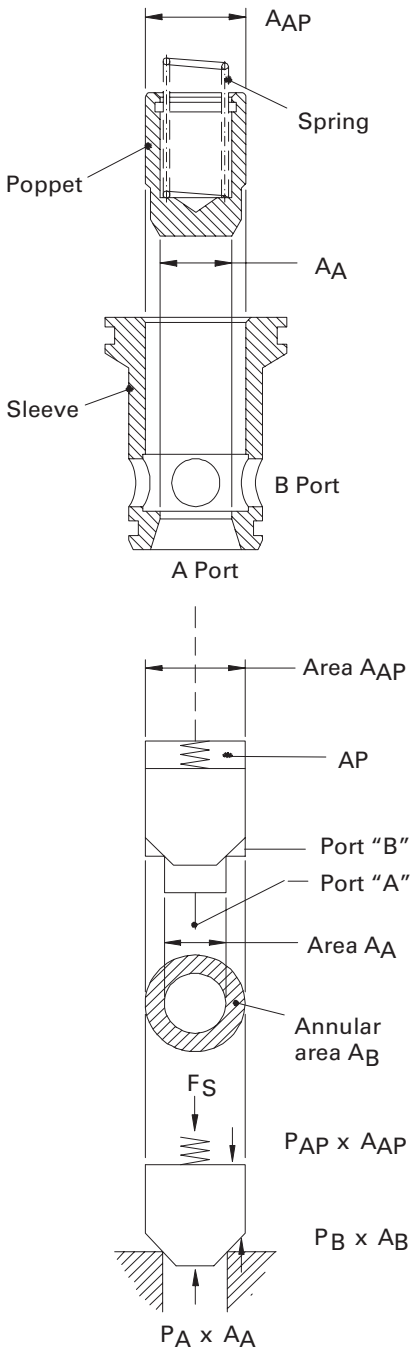


Figure 3

Poppet Area Ratios

Vickers by Danfoss range of cartridge valves includes five operating area ratios:

- 1:2 area ratio, where AAP is 2 x the A-port area, and ports A and B areas are equal. This valve is used primarily for directional control.
- 1:1.5 area ratio, where A_{AP} is 1.5 x the A-port area. This valve is used primarily for directional control.
- 1:1.05 area ratio, where A_{AP} is 1.05 x A-port area. This valve is used for directional control or pressure control.
- 1:1 area ratio, where A_{AP} equals the A-port area and the B-port area is zero. This valve is used for pressure control.

Figure 5 shows area ratio relationships, associated hydraulic symbols, and related model codes.

The reducer insert, Figure 6 and Figure 7, differs from other inserts in that it has a spool type valving mechanism, rather than poppet type, and has an integral check valve to relieve surge pressures in the reduced pressure A (load) port. The reducer insert is available normally open and normally close configurations. The normally closed i.e. the spool tends to widen the hole opening in the sleeve with increased load pressure at port A. Flow is always from port B to port A. The normally open i.e. spool tends to close the hole opening in the sleeve with increased load pressure of port A. Flow is always from port B to port A.

Unlike most reducing valves, pilot pressure is obtained from high-pressure port B rather than from reduced pressure port A, thus providing significantly more flow capacity.

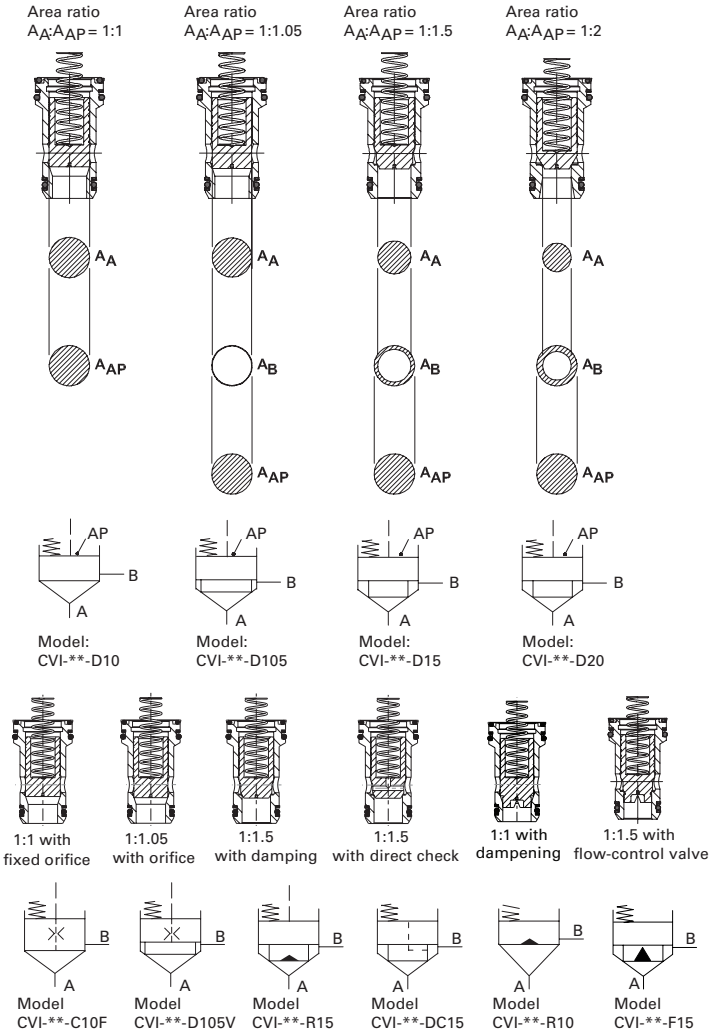


Figure 5

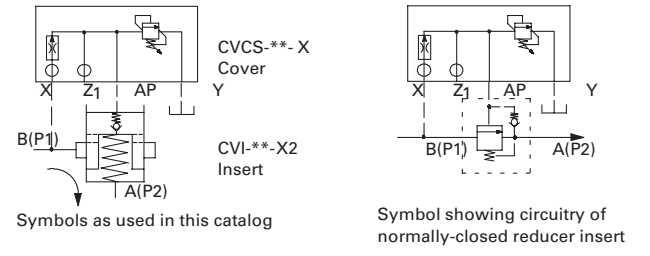


Figure 6

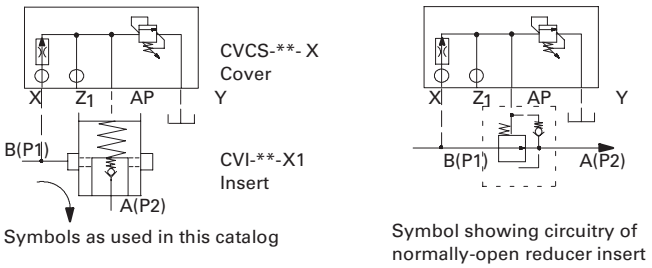
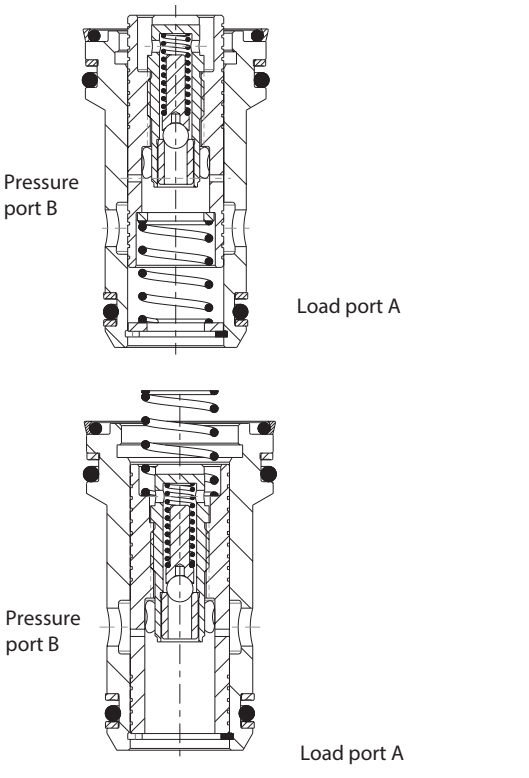


Figure 7



Applications, Ratings and Characteristics

Applications

Cartridge valves are generally used in medium to high pressure hydraulic systems, where flows may be greater than 150 L/min (40 USgpm), to provide power transmission and motion control in a wide variety of applications.

- Presses
- Plastics molding machines
- Die casting machines
- Shears and balers
- Machine tools and metal forming machinery
- Steel mill machinery and other primary metal processing equipment
- Mobile vehicles
- Marine

Response Time

Response time is generally faster than that of large spool type valves which have to clear their overlap before flow starts. With cartridge valves, flow starts as soon as the poppet starts to lift off the seat in the cartridge sleeve. A typical DG4V-3 solenoid operated pilot valve starts to pass pilot flow about 10 ms after it is energized. Full opening time of the cartridge valve depends on the operating pressure and the control orifice size used. Sizing of control orifices is key to tuning the relative response of each cartridge unit. A guide to orifice sizing is on page 117.

Flow Ratings

See chart below. Nominal flow rate at 5 bar (72 psi) pressure drop for insert types:

C10F, D10, D10V for sizes 06-10 (NG16-40)
D10 for sizes 11 and 12 (NG50 & 63)

▲ Nominal size relates to drilled hole (port size) in manifold that connects one cartridge to another.

■ Operational pressures above 350 bar require a pilot valve with the same or higher operating pressure as that of main stage.

Nominal Size ▲ ISO 7368 (DIN 24342)	Flow		Maximum Operating Pressure ■
	L/min	USgpm	
06 (NG16) (approx. 5/8")	333	88	420 bar (6090 psi)
08 (NG25) (approx. 1")	730	193	420 bar (6090 psi)
09 (NG32) (approx. 1 1/4")	1540	407	420 bar (6090 psi)
10 (NG40) (approx. 1 9/16")	2235	590	420 bar (6090 psi)
11 (NG50) (approx. 2")	2350	620	350 bar (5000 psi)
12 (NG63) (approx. 2 1/2")	3650	965	350 bar (5000 psi)

Temperature Limits

Ambient min. . . . –20°C (–4°F)
Ambient max. . . +70°C (+158°F)

Fluid temperatures:

	Petroleum oil	Water-containing
Min.	–20°C (–4°F)	+10°C (+50°F)
Max.	+80°C (+176°F)	+55°C (+131°F)

Viscosity

The extreme viscosity range is from 500 to 5 cSt (2270 to 42 SUS) but the recommended running range is from 54 to 13 cSt (245 to 70 SUS).

Fluids and Seals

Sizes 16 to 63

All standard seals are NBR (Buna-N). Water glycol (HFC), water-in-oil emulsion fluids (HFB) and petroleum oil may be used with these seals.The use of synthetic fire-resistant fluids requires a valve with special FKM selas. Use 'N' for NBR and 'V' for FKM seals in the model code

Cartridges may be used up to 70 bar (1000 psi) with high water base HFA (95/5) fluids. For higher pressures, consult your Danfoss representative. Contact your fluid supplier for seal recommendations.

HYDRAULIC FLUIDS, OPERATING TEMPERATURES AND RECOMMENDED SEAL MATERIAL

Application Fluid	Hydraulic Fluid Classification	Standard	Application Temperature Range	Recommended Sealing Material
Mineral / Petroleum Oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	-20°C to +80°C (-4°F to +176°F)	NBR
	HH, HL, HM, HV, HG	ISO 6374		
Mineral / Petroleum Oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	-20°C to +80°C (-4°F to +176°F)	FKM
	HH, HL, HM, HV, HG	ISO 6374		
Environmentally Friendly Oils	HETG (Vegetable oil based / Natural Ester)	ISO 15380	-20°C to +80°C (-4°F to +176°F)	FKM
	HEES (Synthetic Ester)			FKM
	HEPG (Polyalkylene Glycol) - Water Soluble			FKM
	HEPR (Polyalphaolefin related)			FKM
Fire Resistant Fluids - Anhydrous	HFDU (Glycol base)	ISO 12922	-20°C to +80°C (-4°F to +176°F)	FKM
	HFDU (Ester base)			FKM
	HFDR (Phosphate Ester)			FKM
Fire Resistant Fluids - Water containinig	HFA (High water based fluids)	ISO 12922	+10°C to +55°C (+50°F to +131°F)	NBR
	HFB (Invert Emulsion)			NBR
	HFC (Water Glycol)			NBR

NOTE: Fluid viscocity at operating temperatures shall meet the viscocity recommendation of valves

Orifices

Throughout this catalog, graphical symbols are used to describe the function of the cartridge cover and inserts. By changing orifice sizes or adding or deleting them, a cartridge can be fine tuned to achieve desired machine operation. Figure 8 shows a sample graphical symbol with orifices described. Standard orifice sizes and optional orifice kits are shown on pages 115 and 116.

>< Standard (factory-fitted) orifice

◯ Tapped port for installation of optional orifice

⊗ Plugged port

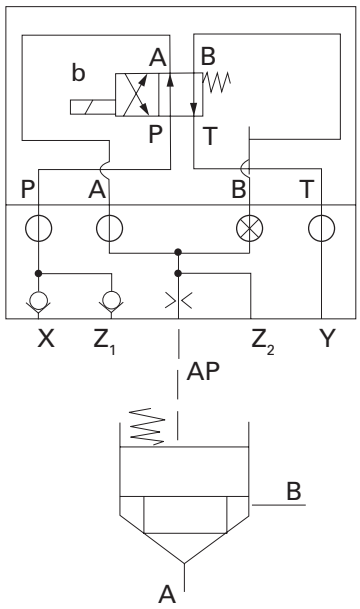


Figure 8

Standard Threads for Covers

Covers in new version are universal design and are with metric pilot interface and orifices. Blanking plugs are with SAE threads.

For versions: HFV, ZD, ZDA
Covers: covers type CVC(S)-**-*1(or *2) have UNC/UNF threads for pilot valve mounting bolts and orifice/closure plugs with SAE gauge ports if applicable.

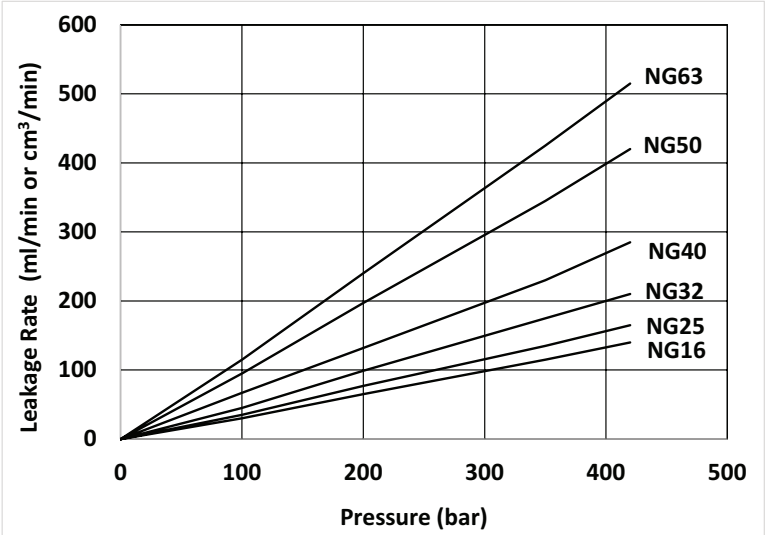
Leakage

Excepting pressure reducing and unloader cartridge inserts, which have spool type construction, inserts are designed with a positive-seating poppet mechanism. Therefore, there is virtually no leakage between ports A and B when the poppet is held in the closed position (Figure 2, page 12). However, leakage can pass through the diametral clearance between area AP and port B.

Leakage should be considered when designing circuits; see graph for maximum leakages. Proper orientation of the cartridge and pilots can yield very low internal leakage in systems.

Maximum Internal Leakages

Fluid viscosity 36 cSt (168 SUS)



Filtration and Viscosity Requirements

Essential information on the correct methods for treating hydraulic fluid is included in the Danfoss publication 03-401-2010 "Danfoss Guide to Systemic Contamination Control", available from your local Danfoss distributor or by contacting Danfoss. Recommendations on filtration and the selection of products to control fluid condition are included in Danfoss publication 03-401-2010.

Recommended cleanliness levels using petroleum oil under common conditions are based on the highest fluid pressure levels in the system. In referencing the table below, the shaded areas highlight the recommended cleanliness level for cartridge valves and proportional throttles. Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes. See Danfoss publication 03-401-2010 for exact details.

Product Line	Minimum Range	Optimum Range	Maximum Allowed Startup	ISO 4406:2021 Cleanliness Requirements	Comments
Heavy-Duty Piston Pumps and Motors	*45 SUS (6 cSt)	60-180 SUS (10-39 cSt)	10,000 SUS (2158 cSt)	21/18/13	
Medium-Duty Piston Pumps and Motors Charged Systems	*45 SUS (6 cSt)	60-180 SUS (10-39 cSt)	10,000 SUS (2158 cSt)	21/18/13	
Medium-Duty Piston Pumps and Motors Non-Charged Systems	*45 SUS (6 cSt)	60-180 SUS (10-39 cSt)	2,000 SUS (432 cSt)	21/18/13	
Light-Duty Transaxles Transmission, Pumps and Series 1150 Transaxles	* 60 SUS (10 cSt)	82-180 SUS (16-39 cSt)	10,000 SUS (2158 cSt)	21/18/13	
Char-Lynn® J,R,T and S Series Motors, Disc Valve Motors and VIS Motors	*70 SUS (13 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	20/18/13	
Char-Lynn A Series and H Series Motors	*100 SUS (20 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	20/18/13	
Char-Lynn Steering Control Units	*55 SUS (9 cSt)	100-200 SUS (20-43 cSt)	8,000 SUS (1900 cSt)	20/18/13	When emergency manual steering is required, maximum viscosity is 2000 SUS {450 cSt}
Gear Pumps, Motors and Standard Cylinders	*45 SUS (6 cSt)	60-200 SUS (10-43 cSt)	10,000 SUS (2158 cSt)	20/18/13	
Global Gear (A-AI) Products	52 SUS (8 cSt)	82-185 SUS (16-40 cSt)	8800 SUS (2000 cSt)	20/18/13	
Vane Pumps (Industrial)	60 SUS (10 cSt)	82-188 SUS (16-40 cSt)	4000 SUS) (860 cSt	18/16/13	
Vane Pumps (Mobile)	47 SUS (6.5 cSt)	82-188 SUS (16-40 cSt)	8800 SUS (2000 cSt)	18/16/13	
Open-Circuit Piston Pumps PVM, PVH, PVE	60 SUS (10 cSt)	82-188 SUS (16-40 cSt)	4550 SUS (1000 cSt)	21/18/13	
Open-Circuit Piston Pumps pya, PVB	60 SUS (10 cSt)	82-188 SUS (16-40 cSt)	1000 SUS (220 cSt)	21/18/13	
Open-Circuit Piston Pumps 420	60 SUS (10 cSt)	82-188 SUS (16-40 cSt)	9720 SUS (2100 cSt)	21/18/13	
Hydrokraft ™ Pumps PVW, PFW, PYX, PFX,IVX, TVW	60 SUS (10 cSt)	82-349 SUS (16-75 cSt)	4550 SUS (1000 cSt)	18/15/13	
Hydrokraft Motors MVX, MFX, MVW, MFW	60 SUS (10 cSt)	82-349 SUS (16-75 cSt)	4550 SUS (1000 cSt)	18/15/13	

*Minimum viscosity applies at intermittent condition of 10% of every minute.

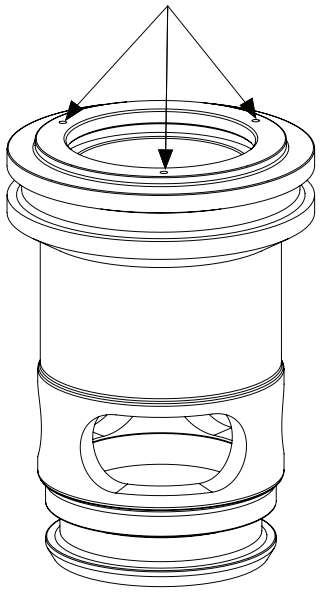
Filtration and Viscosity Requirements (continued)

Product Line	Minimum Range	Optimum Range	Maximum Allowed Startup	ISO 4406:99 Cleanliness Requirements	Comments
Directional Valves (DG)	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	19/17/14	
STAK Valves	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	17/15/12	
Slip in, Screw in and Valvistor Cartridge Valves	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	18/16/13	
K Series Proportional (Directional/Throttle)	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS) (2158 cSt	17/15/12	
DG, eM and Mono Block Directional Control Valves	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	20/18/15	
CMX and CML Proportional Control Valves	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	18/16/14	
KDG Proportional Control Valves	70 SUS (13 cSt)	100-250 SUS (20-54 cSt)	2300 SUS (500 cSt)	17/15/12	
Pressure and Flow Control Valves	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	19/17/14	
Servo Valves	45 SUS (6 cSt)	100-250 SUS (20-54 cSt)	10,000 SUS (2158 cSt)	16/14/11	15/13/10 is is recommended for longer life

Insert Assembly Guidance:

In case of insert sizes 16, 25, 32 and 40, one of the 'Insert Assembly Guide Holes' as highlighted in adjacent picture, should be aligned with Port 'B' to optimize the performance.

Insert Assembly Guide Holes Nos. 3, positioned at 120° from one-another



Check, Directional and Flow Restrictor
Functions Sizes 16 to 63

General Information

Cartridge valves for directional and check functions are essentially hydraulically piloted check valves. Control options include single or multiple pilot arrangements, flow restrictors, and solenoid controlled, pilot operated directional control. Grouping cartridge assemblies (selected individually according to flow requirements) for control by one or more common pilot valves can provide directional, check and/or flow restrictor functions for normal flow rates up to 3650 L/min (965 USgpm) per cartridge. Typical single cartridge arrangements are symbolized on the following pages, and your Danfoss representative can illustrate various grouped arrangements. Basic poppets are illustrated. Others provide flow restrictions between ports A and B and internal pilot orificing between port A and spring chamber AP. Poppets can be combined with different springs to provide three different cracking pressures. Standard combinations are shown in the inserts model code on page 26.

Pressure Ratings

Maximum pressure allowable at ports A and B is 420 bar (6090 psi) for all cartridges. Minimum pressure is 0,3 to 5 bar (4.4 to 72 psi), dependent on the poppet/spring combination. See inserts model code on page 26. The maximum pressure limit at pilot ports X, Z1, Z2 and AP and pilot valve interface ports P, T, A and B is generally 420 bar (6090 psi), dependent on the limit of any associated pilot valve or module.

Pilot port Y maximum pressure limit is also 420 bar (6090 psi).

However, port Y is normally used as the pilot drain port, when it should be connected directly to the reservoir. In many functions any pressure at port Y is additive to the set opening/cracking pressure of the cartridge.

Remote Pilot Operated Functions

Remote piloted arrangements (pilot not integrally mounted on cartridge cover) require the application of pilot flows and pressures appropriate to the application and within the limits of any associated pilot valves and modules, whichever have the lower limits. See pilot operated check valve information, page 20. Pilot Control Modules Details of CVG***-3 pilot control modules are shown on pages 111-114.

Solenoid Operated, Hydraulically Piloted Arrangements

For full technical data of pilot valves see appropriate Danfoss catalog:

Nominal Size ISO 7368 (DIN 24342)	Nominal flow at Δ p = 1 bar L/min	USgpm	Nominal flow at Δ p = 5 bar L/min	USgpm
06 (NG16)	149	39	333	88
08 (NG25)	367	97	820	216
09 (NG32)	689	182	1540	407
10 (NG40)	1000	264	2235	590
11 (NG50)	850	225	2350	620
12 (NG63)	1400	370	3650	965

Index to Functional Descriptions on Following Pages

Page

Basic check valve using type N cover 20
Direct-acting check valve using type B cover 20
Pilot operated check valve 20
2-way, 2-position, bi-directional control 21
2-way, 2-position, uni-directional control 21
Damping function 21
Pilot shuttle control 21
Adjustable stroke limiter; bi-directional control 24
Adjustable stroke limiter; uni-directional control 24

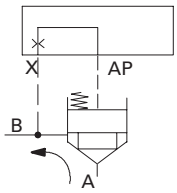
Solenoid controlled, pilot operated models

2-way, 2-position; single- and double-solenoid control; sizes 16 to 40 22
Shuttle type 1 (cover types W13) 23
Shuttle type 3 (cover types W33) 23
Dual check (cover types DC3) 23
Adjustable stroke limiter; bi-directional control 24

Check Valve Functions

Basic Check Valve: Sizes 16 to 63

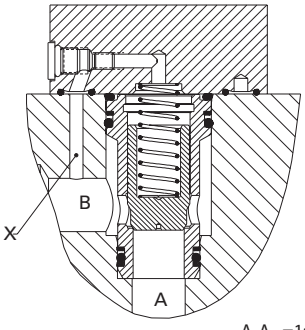
The standard directional cover (model code letter N), contains a pilot pressure passage with an orifice to control the poppet's opening and closing rate. When used with insert model D15 (1:1.5 area ratio poppet), or model D20 (1:2 area ratio poppet), the combined cover and insert, Figure 9, becomes a check valve. Port X in the cover is connected to port B in the insert. This allows free flow from insert port A to port B while blocking flow from B to A.



CVC(S)-**- N Cover

CVI-**-D15 , or CVI-**-D20 Insert

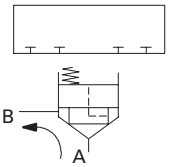
Figure 9



Basic poppet $A_A A_{AP}$=1:1.5 or $A_A A_{AP}$=1:2

Direct Acting Check: Sizes 16 to 63

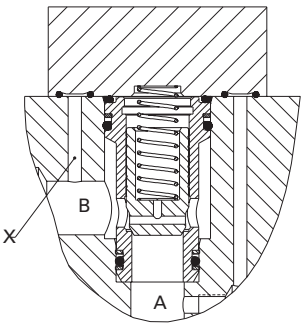
The type DC15 insert is used with the type B cover to provide a direct check function, Figure 10. The free flow direction is A to B. Flow in the opposite direction (B to A) is prevented by connecting port B to the full poppet area A_{AP}, via drilled holes on the poppet, whereby any pressure at port B assists the spring in holding the poppet hard on to its seat.



CVCS-**- B Cover

CVI-**-DC15 Insert

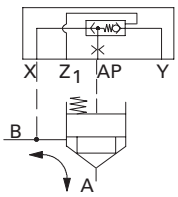
Figure 10



Basic poppet $A_A A_{AP}$=1:1.5

Pilot Operated Check Valve (Pilot Open): Sizes 16 to 63

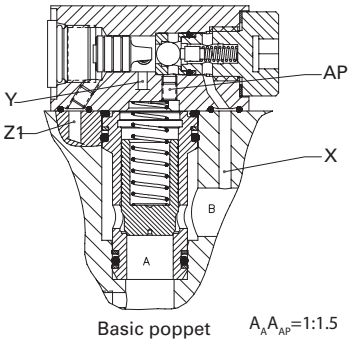
A model PC cover can be combined with a model D15 insert to form a pilot operated check valve (Figure 11). Pilot pressure at Z1 vents spring chamber AP to Y, permitting flow from B to A. Flow from A to B is independent of pilot pressure. With port B connected to the system load, pilot pressure at Z1 must be at least 30% of load pressure, the latter including any intensification that may occur such as when controlling double-acting cylinders. Port Y is normally connected to a drain line.



CVCS-**- PC Cover

CVI-**-D15 Insert

Figure 11

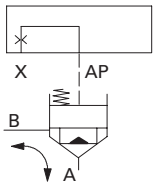


Basic poppet $A_A A_{AP}$=1:1.5

Directional Valve Functions

2-Way, 2-Position Function: Sizes 16 to 63

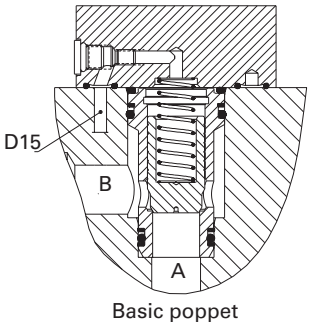
Using a model N cover with a D15 insert, Figure 12, can provide directional control of flow from insert port A to B or from B to A. Pressurizing port X from a remote source will block flow from insert port A and B. With X connected to B, system flow is from A to B. Flow will be from B to A if X is connected to tank or A.



CVCS-**- N Cover

CVI-**-R15/R20 Insert

Figure 12

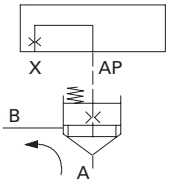


Basic poppet

Area ratio
$A_A:A_{AP}$=1:1.5

2-Way, 2-Position Function (With Internal Pilot): Sizes 16 to 63

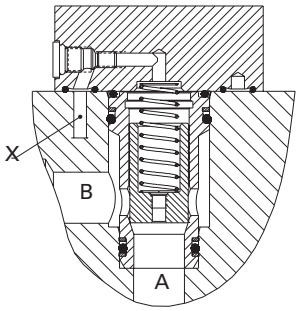
A model N cover is used with a D105 insert (1:1.05 area ratio) which can be supplied with an orifice in the poppet. See Figure 13. This configuration is used to open A to B or block A to B. D105 poppets cannot be used for flow from B to A. The orifice avoids the need to machine a connecting hole in the manifold to port A. To obtain a D105 insert with an orifice in the poppet (i.e. D105V), the orifice size must be specified at the end of the insert model number.



CVCS-**- N Cover

CVI-**-D105V Insert

Figure 13

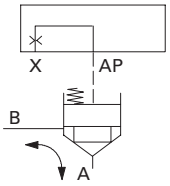


Basic poppet

Area ratio
$A_A:A_{AP}$=1:1.05

Damping Function: Sizes 16 to 63

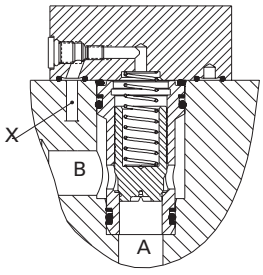
Damping can be achieved with a model R15 insert (area ratio 1:1.5) and R20 (area ratio 1:2), see Figure 14. The poppet has a skirt with a damping notch which helps smooth shifting (reduces gain) of the poppet. R15/R20 inserts may be used with any check or directional function where a D15/D20 insert is ordinarily used.



CVCS-**- N Cover

CVI-**-R15 Insert

Figure 14

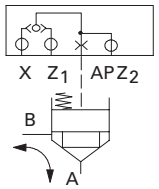


Basic poppet

Sizes 16 to 63: $A_A:A_{AP}$=1:1.5
$A_A:A_{AP}$=1:2

Pilot Shuttle Control: Sizes 16 to 63

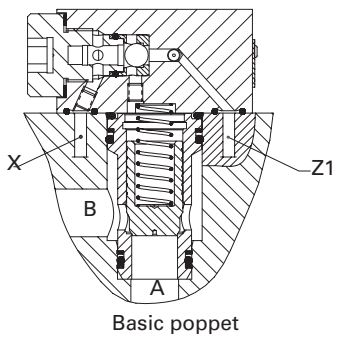
The shuttle function is obtained with a model W cover and D15 insert (Figure 15). The shuttle directs the higher of the pressures at the X and Z1 ports to the spring area (AP) of the insert poppet to close it. The Z2 port can be used as a convenience to operate another cartridge simultaneously.



CVCS-**- W Cover

CVI-**-D15 Insert

Figure 15



Basic poppet

Area ratio
$A_A:A_{AP}$=1:1.5

Sizes 16 to 63

Covers are available with mounting interfaces for pilot valves. These pilots are typically the DG4V-3(S) solenoid operated directional valve that mounts to the ISO 4401, size 03 (ANSI/ B93.7M-D03) interface. Manually operated DG17V-3, pilot operated DG3V-3, or air operated DG18V-3 pilots are also applicable. The Vickers by Danfoss soft shift pilot valves DG4V-3-**-2/3-**-60 can also be used to achieve smooth opening and closing.

Single or dual solenoid pilots are applicable (Figure 16), depending on circuit requirements. The spool center condition of the solenoid pilots also depends on the circuit function desired. Ports Z1 and Z2 are for remote control of additional cartridges. That is, for D3 covers, Z1 is connected to pilot port A. The X port is the pilot pressure port. The Y port should always go directly to the reservoir. The insert used can be either the model D15 (1:1.5 area ratio poppet), or model D20 (1:2 area ratio poppet).

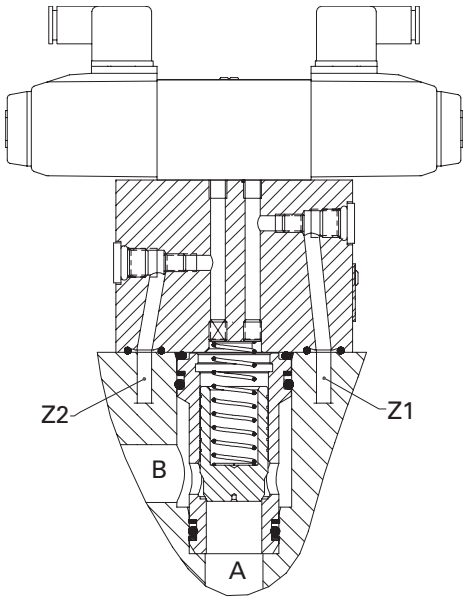
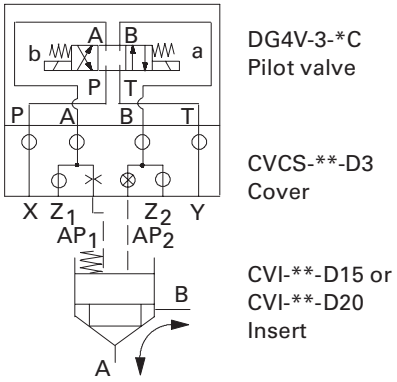
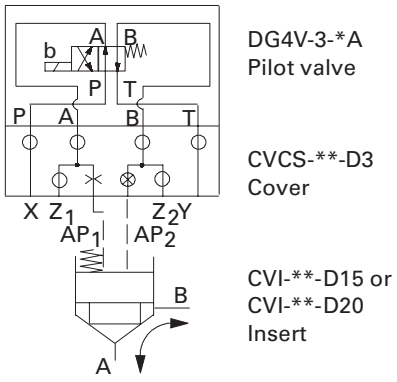


Figure 16

Dual Solenoid Control: Sizes 16 to 63
3-position, spring centered pilot valve



Single Solenoid Control: Sizes 16 to 63
2-position, spring offset pilot valve



Note that the circuitry (i.e. flow path and orifice locations) of these 16 to 40 sizes is different from that of sizes 50 and 63 shown on the next page.

Operational pressures above 350 bar require a pilot valve with the same or higher operating pressure as that of main stage.

Pilot Operated Directional Valves with Shuttle Function

General Information

The shuttle function in combination with a solenoid operated pilot valve is available in cartridge sizes 16 through 63. In each cartridge size, the pilot valve is the DG4V-3 that mounts to the ISO 4401, size 03 (ANSI/B93.7M-D03) interface. There are two functional cover types, W13 and W33, that are applied with a model DG4V-3 pilot valve. The insert used can be either the model D15 (1:1.5 area ratio poppet), or model D20 (1:2 area ratio poppet).

Shuttle Type 1 (W13 Cover): Sizes 16 to 63

With the solenoid de-energized, Figure 17, the cartridge is shut by the higher of the pressures at X or Z_1. Pilot port Z_2 can be used to pilot a second cartridge simultaneously.

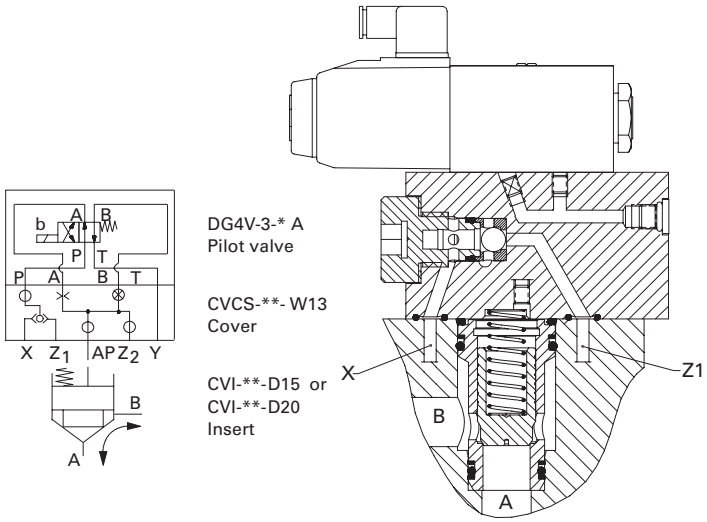


Figure 17

Shuttle Type 3 (W33 Cover): Sizes 16 to 63

The function of the W33 cover, Figure 18, is to provide a non-reverse-flow check, thereby eliminating the need for a separate back flow check. Flow is either blocked or allowed from port B to port A. Flow from port A to port B is always blocked. The application would have pump flow going into port B, port A connected to the actuator and control port X connected to port A.

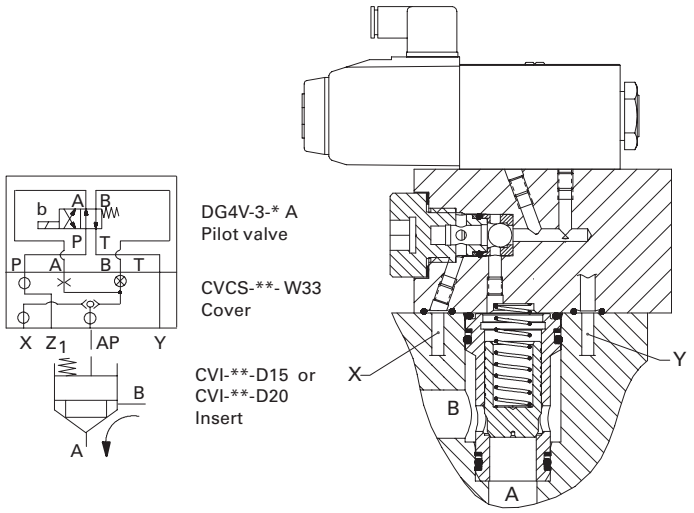


Figure 18

Dual Check (DC3 Cover): Sizes 16 to 63

The DC3 cover, Figure 19, provides parallel check functions in pilot control ports X and Z1. The higher of these two pressures is then available at pilot port P to close the insert via the size 03 solenoid operated valve. A second cartridge can be operated simultaneously from pilot port Z2.

The DC3 cover is similar to the type W13 cover but, whereas there is an open transient condition in the shuttle function (type W13), the DC3 design uses two check valves to ensure that no transient loss of pressure in port P can occur during pilot pressure change-over between ports X and Z1. This feature is of benefit in any application where there must be absolutely no risk of the cartridge even momentarily opening during pilot pressure changeover.

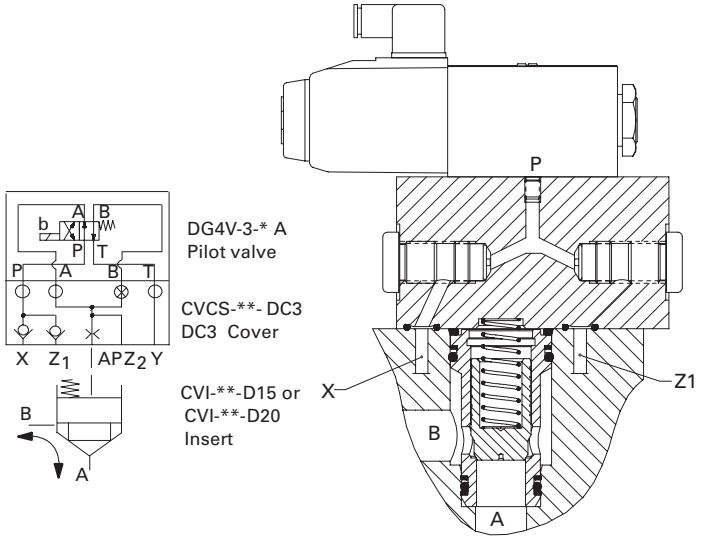


Figure 19

Stroke Limiter Control Functions

General Information

Flow control is by means of a standard cover with a stroke adjuster which limits the stroke of any of the inserts and thereby limits the flow.

Size 16 to 63

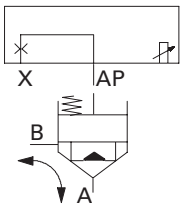
The R10 insert (1:1), R15 insert (1:1.5), R20 insert (1:2) has smaller skirt and used as dampening function as well as for fine flow metering (reduced flow gain) during the notch engangement.

The F15 insert (1:1.5) & F20 insert (1:2) are the flow control functions with longer skirt and longer notch, hence more notch engagement enabling flow metering over larger stroke.

Adjustable Stroke Limiter and Directional Functions:
Sizes 16 to 63

The adjustable limiting of the insert poppet opening restricts flow in both directions (A to B and B to A). Control is from pilot port X. See Figure 20.

Sizes 16 to 63



CVC(S)-**- A
Cover

CVI-**-F or
CVI-**-R
Insert

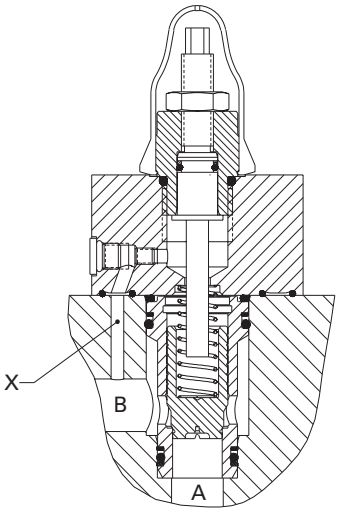
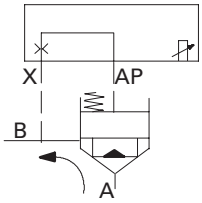


Figure 20

Adjustable Stroke Limiter and Check Functions:
Sizes 16 to 63

The adjustable poppet lift limiter restricts flow from A to B. The check function prevents flow from B to A. The X pilot port of the cover is connected to the B port of the insert. See Figure 21.

Sizes 16 to 63



CVC(S)-**-A
Cover

CVI-**-F or
CVI-**-R
Insert

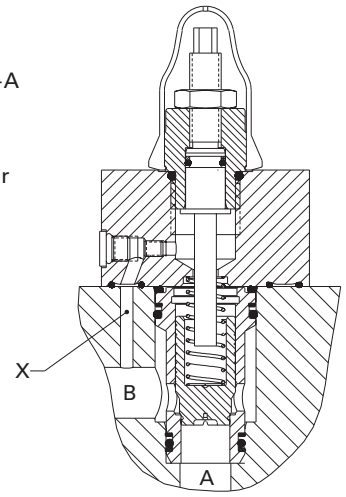


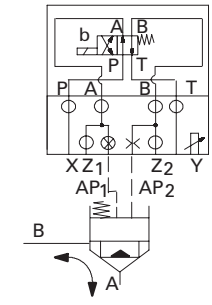
Figure 21

Adjustable Stroke Limiter and Pilot (Directional) Function:
Sizes 16 to 63

Stroke limiters are available with an ISO 4401, size 03 (ANSI/B93.7M-D03) interface for mounting a single-solenoid controlled DG4V-3(S) pilot valve. These type A3 covers are supplied configured for a "normally open" function, i.e. the insert poppet is vented when the solenoid of the pilot valve is de-energized (with pilot pressure applied to port X).

The opposite, "normally closed" (NC) function, can be obtained by interchanging the orifice and plug in ports AP1/AP2. With this arrangement, the insert poppet is "normally closed" (NC) and is open when the solenoid of the pilot valve is energized (with pilot pressure applied to port X).

Normally Open Function

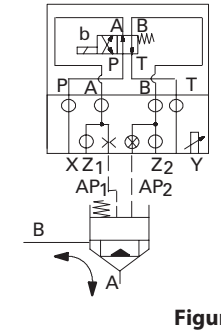


DG4V-3-*A
Pilot valve

CVCS-**-A3
Cover as supplied

CVI-**-R15
Insert

Normally Closed Function



DG4V-3-*A
Pilot valve

CVCS-**-A3
Cover

CVI-**-F*
CVI-**-R*
Inserts

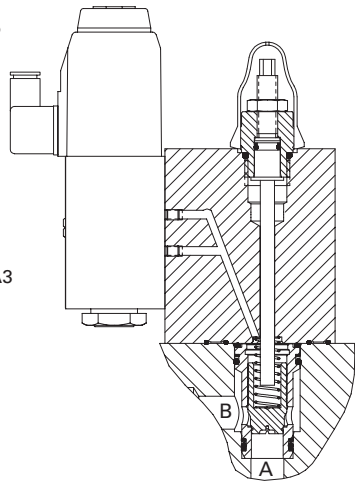


Figure 22

Model Codes - Check, Directional and Flow Restrictor Functions - Sizes 16 to 63

CVCS Covers

Vickers by Danfoss type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and DIN 24342. This includes port usage changes to the D3, PC, W and

Metric Models

Metric bolt tappings and orifice threads; SAE plugs.

W13 functions from prior published information for cover types

"CVC." For availability of covers by size and function see page 4. All features must be specified when ordering; those in

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVCS-**-***-*-*-30-*****

CVCS	**	***	*	*	30	(NC)	*****
1	2	3	4	5	6	7	8

1 Model

CVCS - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

3 Function

A - Stroke adjuster (flow restrictor)

A3 - Stroke adjuster with mounting face for size 03 pilot valve

B - Blanking cover

D3 - Standard directional with mounting face for size 03 pilot valve

DC3 - Two check valves with mounting face for size 03 pilot valve

N - Basic

PC - Pilot operated check

W - Pilot shuttle (ports X and Z_1)

W13 - As type W with mounting face for size 03 pilot valve

W33 - Pilot shuttle (ports X and B) with mounting face for size 03 pilot valve

4 Adjuster mechanism (for A, A3 functions only)

W - wrench adjustment with hex lock nut (for all sizes)

K - micrometer adjuster with key lock (for NG-16 to 40 sizes only)

M - micrometer adjuster without key lock (for NG-16 to NG-40 sizes only)

5 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

6 Design number 30 series

7 Normal function (for A, A3 functions only)

NC - Normally closed
Blank - Normally open

See page 115 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Danfoss representative. Non-standard orifice requirements should be defined as follows:

8 Pilot control orifice location and size

See table below for pilot control orifice locations, as per selected 'Function'. The letter 'S' in brackets indicates default factory-fitted 'standard' orifice associated with that location. The letter 'S' should be included in the model code at locations where standard orifice is required. Letter 'Z' in brackets indicates that no orifice plug is fitted, whereas letter 'A' indicates blocked port. Letter 'Z' can be omitted if these are at the end of the model code. To specify non-standard orifice sizes, refer table on page 116.

Function	Location 1	Location 2	Location 3	Location 4	Location 5
A	A(S)	-	-	-	-
A3 - NC	AP1(S)	P(Z)	A(Z)	B(Z)	-
A3 - NO	AP2(S)	P(Z)	A(Z)	B(Z)	-
B	-	-	-	-	-
D3	AP1(S)	AP2(A)	A(Z)	B(Z)	Z1(Z)
DC3	AP(S)	P(Z)	A(Z)	B (Z)	T(Z)
N	X(S)	-	-	-	-
PC	AP(S)	Z1(Z)	-	-	-
W	AP(S)	X(Z)	Z1(Z)	Z2(Z)	-
W13	AP(Z)	P(Z)	A(S)	B(A)	Z2(Z)
W33	AP(Z)	X(Z)	P(Z)	A(S)	B(A)

Letter in brackets to be mentioned in the model code at appropriate orifice location.

Refer pages 6 and 7 for pictorial representation of orifice locations.

Model Codes - Check, Directional and Flow Restrictor Functions - Sizes 16 to 63

CVI Inserts

For availability of inserts by size and function see page 5. All features must be specified when ordering; those in brackets ( ) are optional.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVI-**-****-*-*-60-***

CVI	**	****	*	*	60	(*)
1	2	3	4	5	6	7

1 Model

CVI - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

3 Function

Sizes 16 to 63

D10 - 1:1 ratio
R10 - 1:1 ratio with damping
D105 - 1:1.05 ratio
D105V - 1:1.05 ratio with variable orifice plug
D15 - 1:1.5 ratio
D20 - 1:2 ratio
DC15 - 1:1.5 ratio direct check
R15 - 1:1.5 ratio with damping
F15 - 1:1.5 ratio with flow restrictor
R20 - 1:2 ratio with damping
F20 - 1:2 ratio with flow restrictor

Zero leak options
D10Z - 1:1 ratio
D105Z - 1:1.05 ratio
D105VZ - 1:1.05 ratio
D15Z - 1:1.5 ratio
D20Z - 1:2 ratio

4 Cracking pressure, bar (psi)

For flow direction A to B
Sizes 16 to 63

Spring Code	Insert Code	
	D10	D105(V)
L	0.37 (5.4)	0.40 (5.8)
M	1.87 (27.2)	1.97 (28.6)
H	3.67 (53.3)	3.86 (56.0)

Spring Code	Insert Code	
	D15, R15, DC15	D20, R20, F20
L	0.5 (7.3)	0.56 (8.1)
M	2.50 (36.3)	2.90 (42.1)
H	5.00 (72.5)	5.58 (80.9)

5 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

6 Design number 60 series Sizes 16 - 63

D10	60 design
R10	60 design
D105	60 design
D105V	60 design
D15	60 design
D20	60 design
DC15	60 design
R15	60 design
R15	60 design
R20	60 design
F20	60 design

7 Orifice size

In case of D105V and D105VZ, use letter 'S' to specify 'standard' factory-fitted orifice. To specify non-standard orifice, see table on page 116. Other orifice sizes and locations can be fitted by special arrangement with your Danfoss representative.

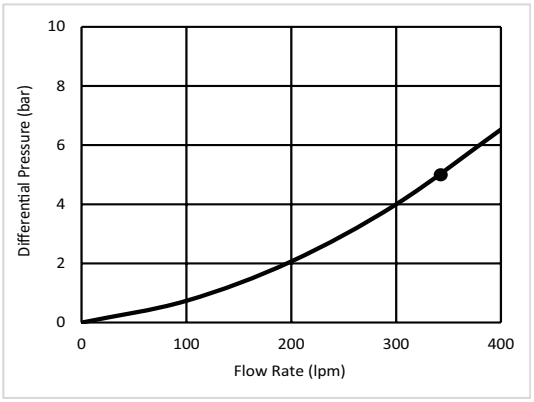
Note: A nameplate is supplied with each insert for fixing to the cover to identify the insert in use.

Unless otherwise stated, performances are based on petroleum oil at 36 cSt (168 SUS) and at 50° C (122° F). For pressure drops at other viscosities, see page 118.

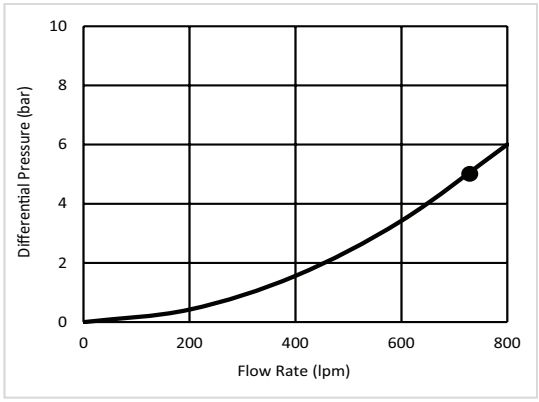
Pressure Drop/Flow Through Insert (Flow from Port A to B)

• = Rated flow point

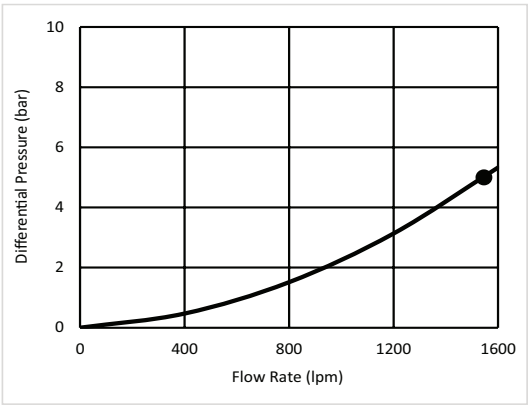
CVI-16-C025; D10; D105; D105V



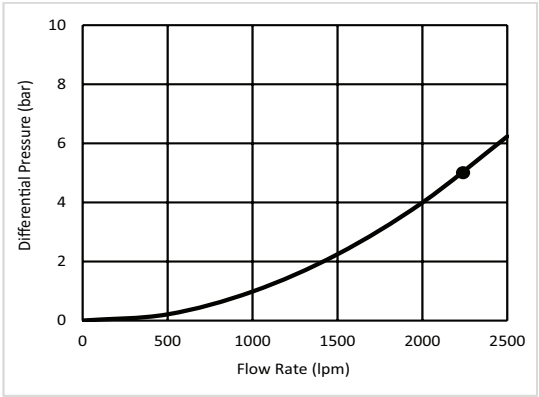
CVI-25-C025; D10; D105; D105V; OD105



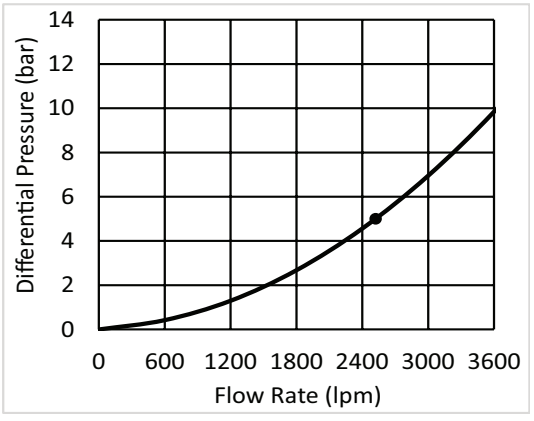
CVI-32-C025; D10; D105; D105V; OD105



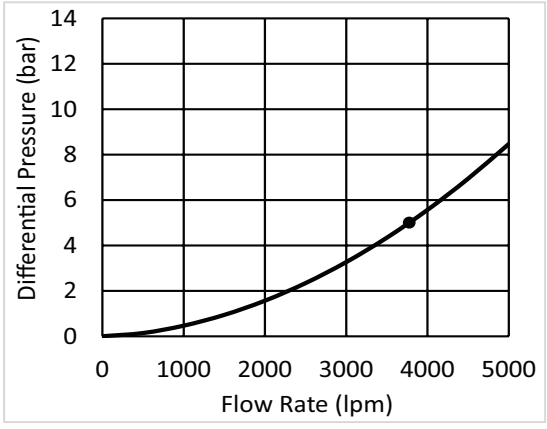
CVI-40-C025; D10; D105; D105V; OD105



CVI-50-D10; D105; D105V; OD105



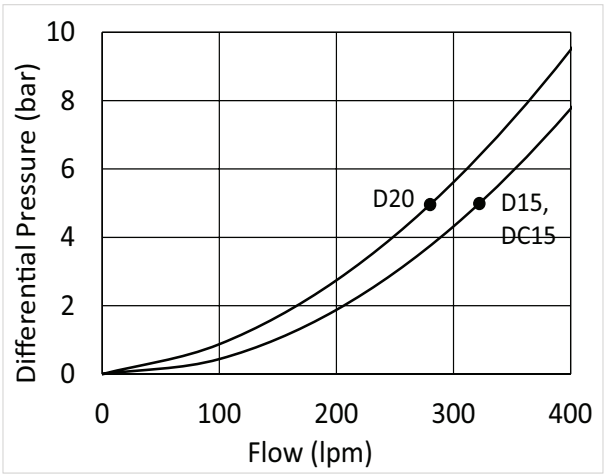
CVI-63-D10; D105; D105V; OD105



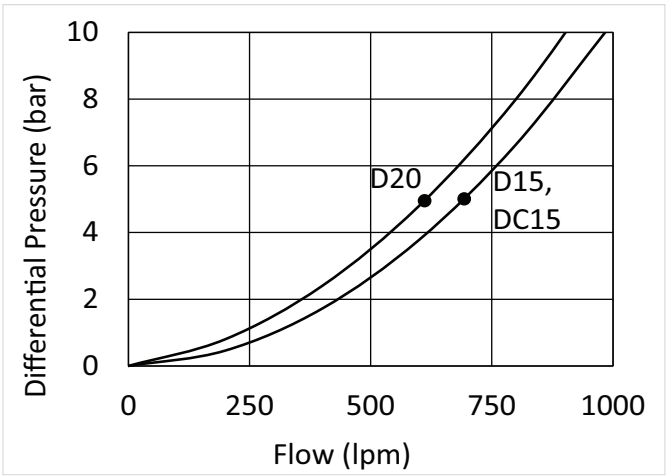
Pressure Drop/Flow Through Insert
(Flow from Port A to B)

• = Rated flow point

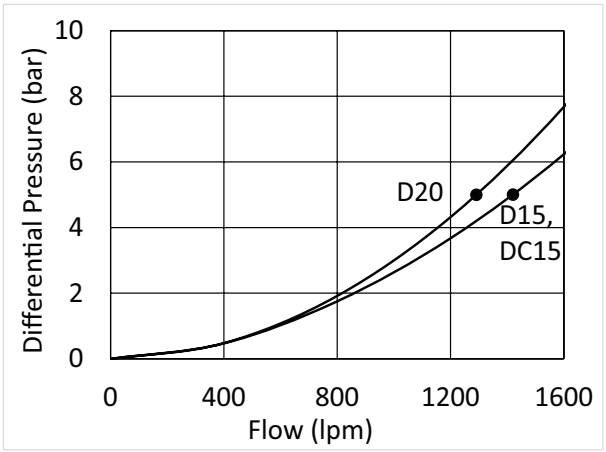
CVI-16-D15; DC15; D20



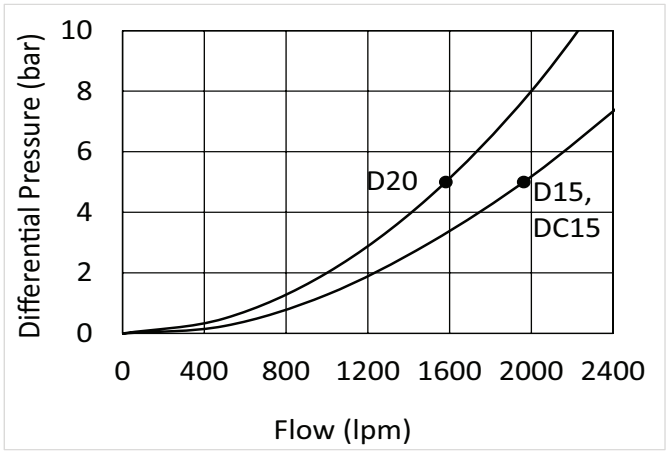
CVI-25-D15; DC15; D20



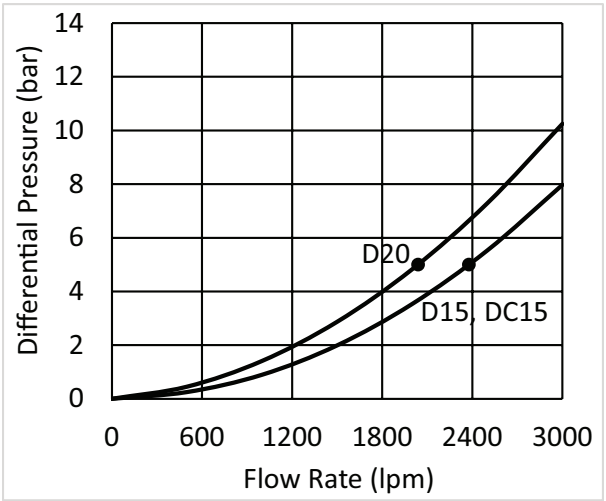
CVI-32-D15; DC15; D20



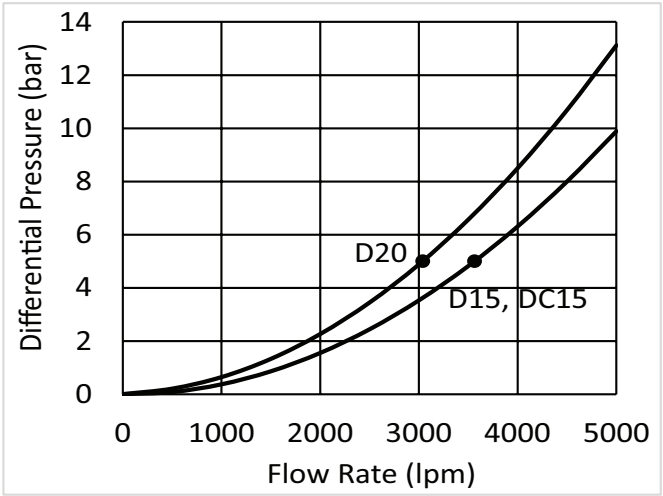
CVI-40-D15; DC15; D20



CVI-50-D15; DC15; D20



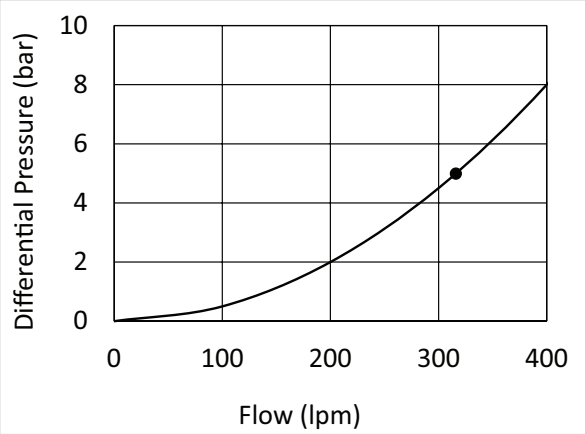
CVI-63-D15; DC15; D20



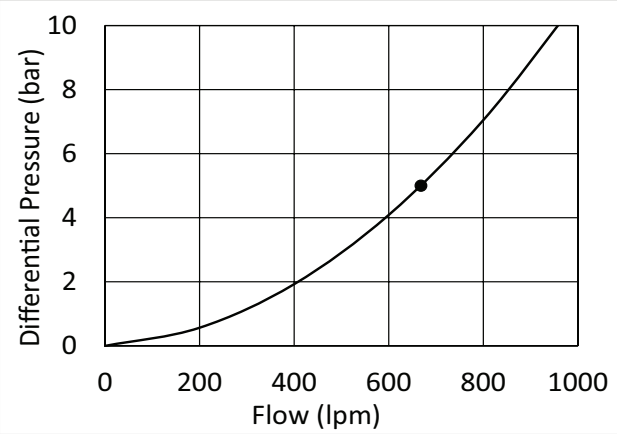
Pressure Drop/Flow Through Insert
(Flow from Port A to B)

• = Rated flow point

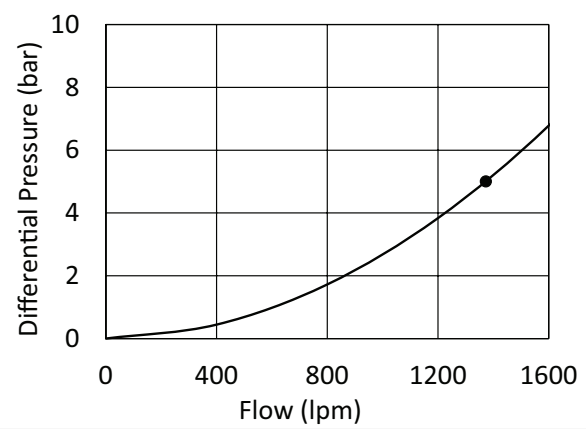
CVI-16-R15



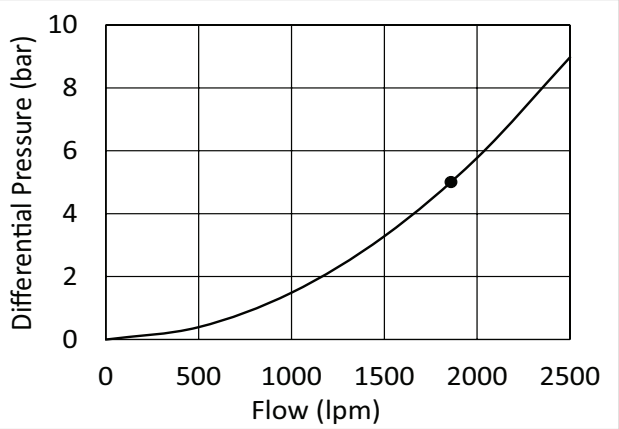
CVI-25-R15



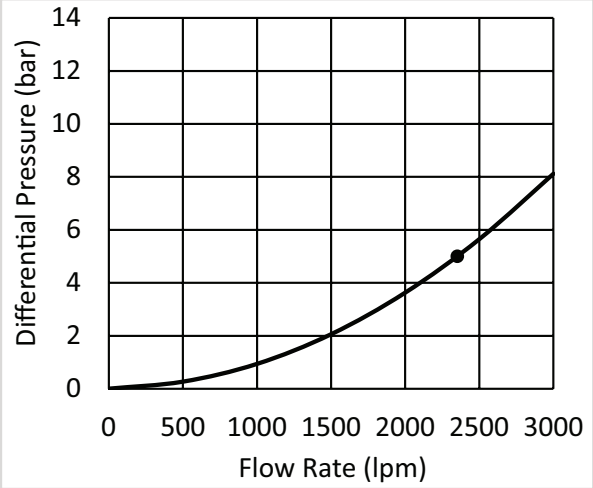
CVI-32-R15



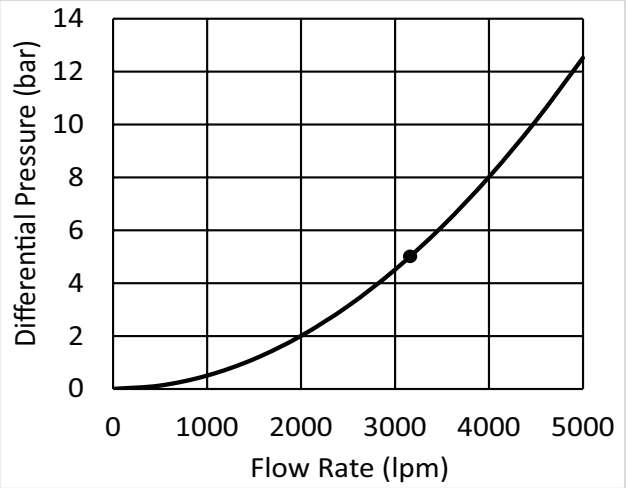
CVI-40-R15



CVI-50-R15



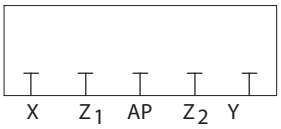
CVI-63-R15



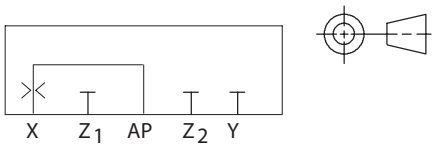
Covers for Blanking "B" and Basic "N" Functions

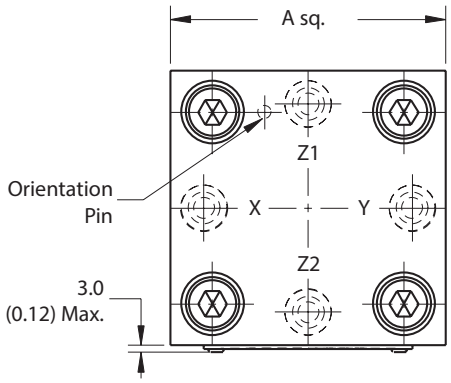
CVCS-**-B
Sizes 16 to 63

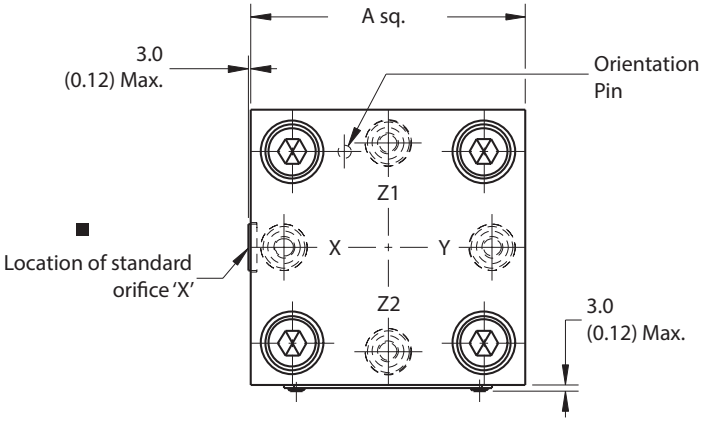
Dimensions
mm (inches)

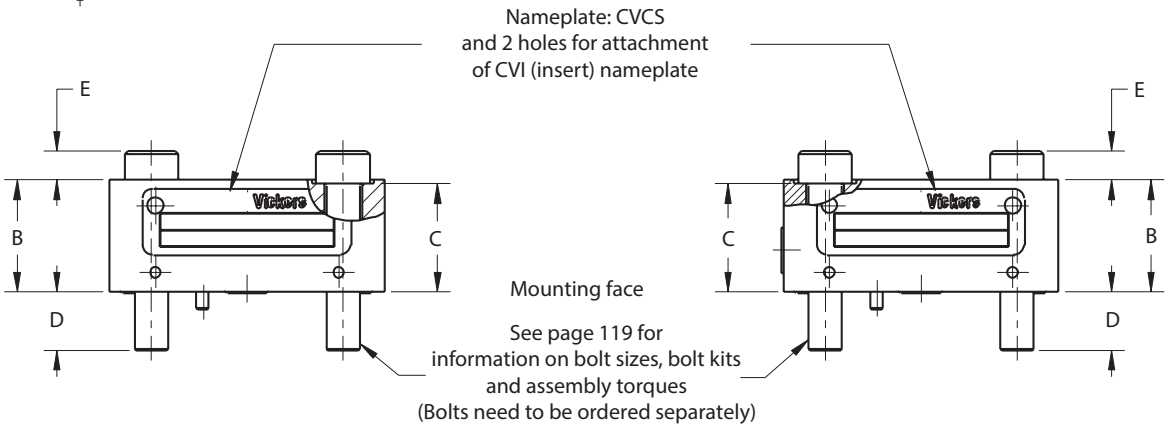


CVCS-**-N
Sizes 16 to 63





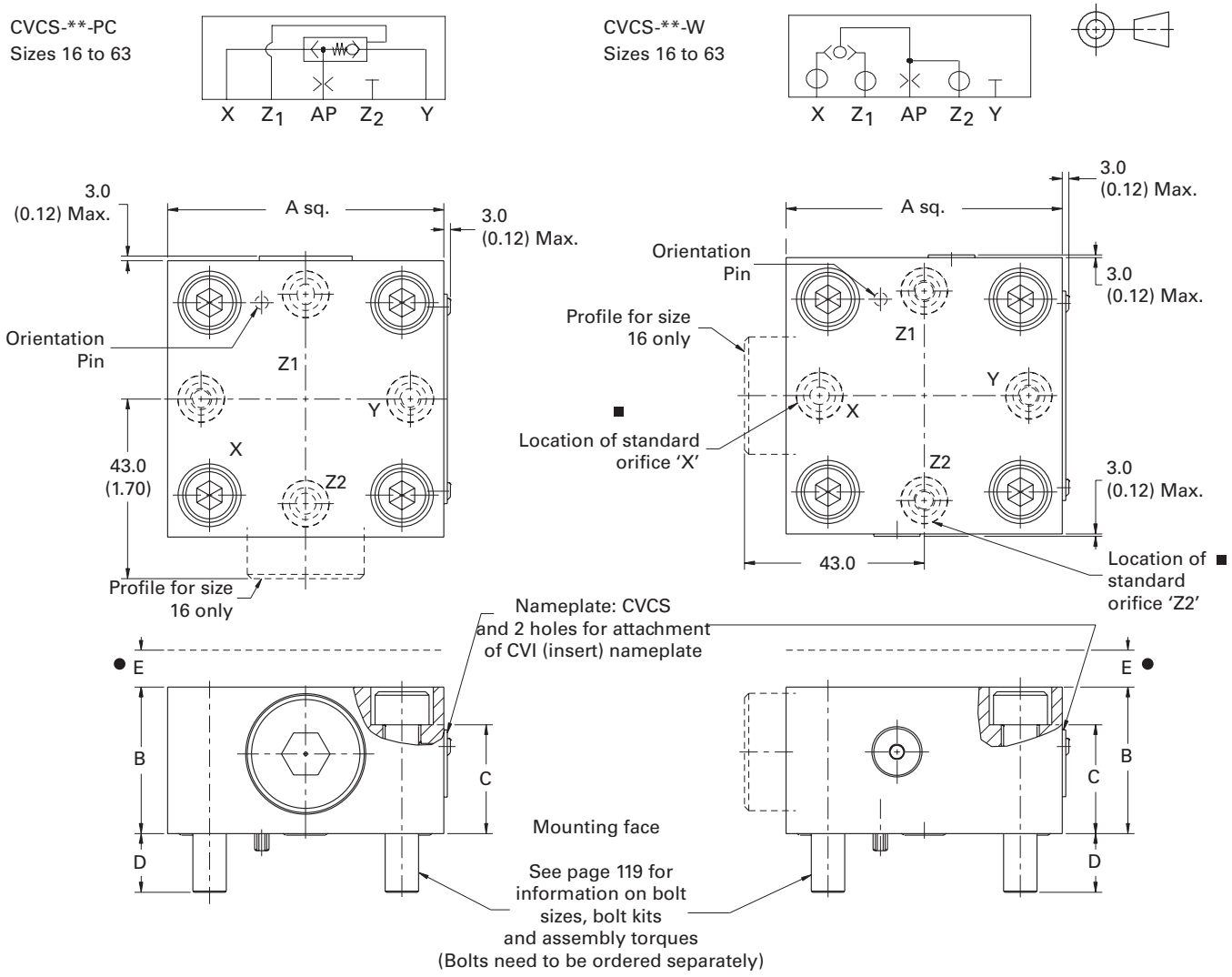




■ For thread sizes and orifice kits see page 115.

Size	A	B	C	D	E	Location of Nameplates Type B	Type N
16	66.0 (2.6)	27.0 (1.06)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	Side Z2	Side Z2
25	86.0 (3.39)	26.0 (1.02)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	Side Z2	Side Z2
32	101.6 (4.00)	31.0 (1.22)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	Side Z2	Side Z2
40	126.0 (4.96)	36.0 (1.42)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	Side Z2	Side Z2
50	140.0 (5.51)	45.0 (1.77)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	Side Z2	Side Z2
63	180.0 (7.09)	49.0 (1.93)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	Side Z2	Side Z2

Covers for Pilot Operated Check "PC" and Shuttle "W" Functions

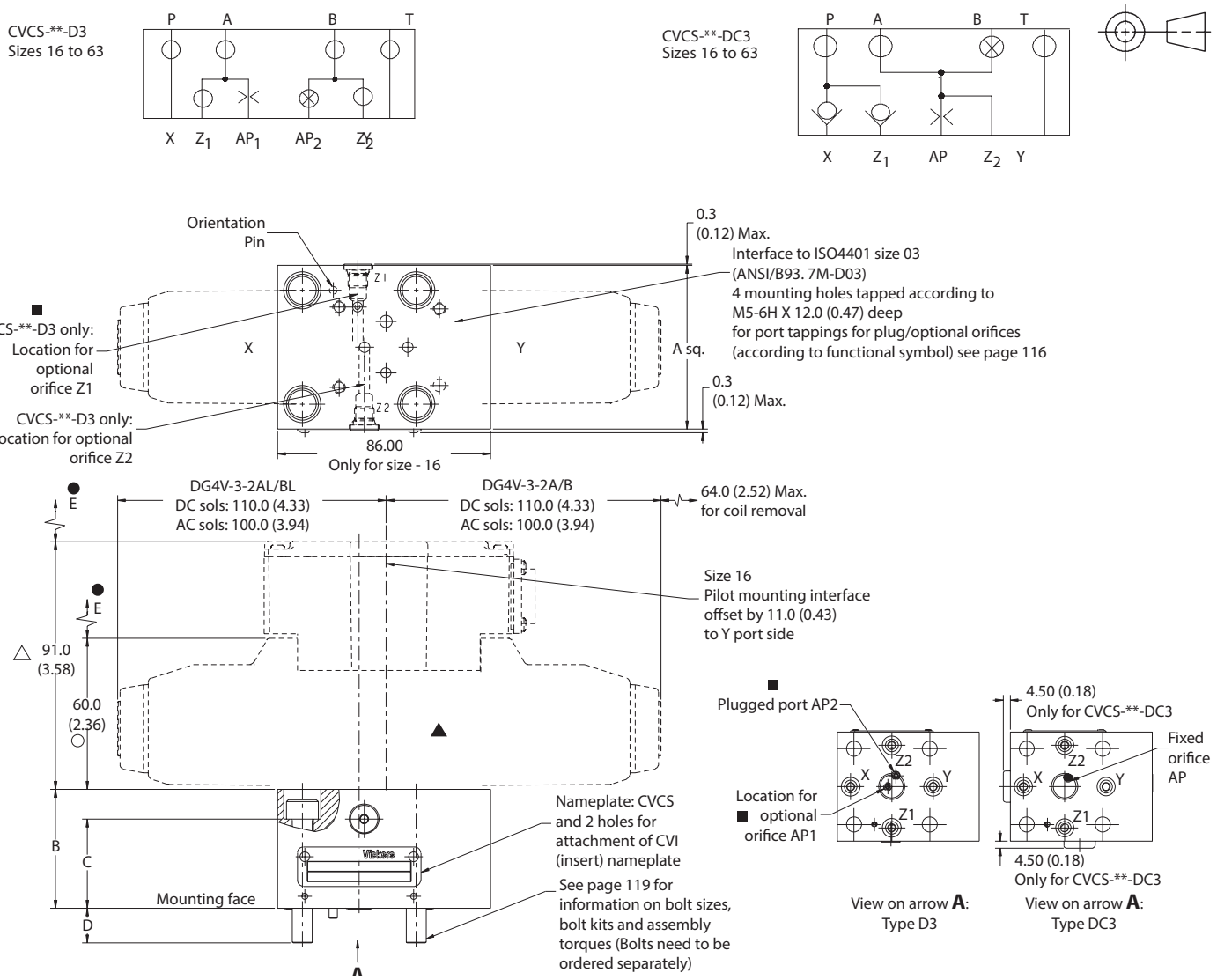


■ For thread sizes and orifice kits see page 115.

● Minimum clearance for removal of cover from manifold.

Size	A	B	C	D	E	Location of Nameplates Type PC	Type W
16	66.0 (2.6)	35.0 (1.38)	26.0 (1.02)	14.0 (0.55)	10.0 (0.39)	Side Y	Side Y
25	86.0 (3.39)	40.0 (1.57)	25.0 (0.98)	15.0 (0.59)	10.0 (0.39)	Side Y	Side Y
32	101.6 (4.00)	50.0 (1.97)	30.0 (1.18)	25.0 (0.98)	10.0 (0.39)	Side Y	Side Z2
40	126.0 (4.96)	48.0 (1.89)	35.0 (1.38)	25.0 (0.98)	10.0 (0.39)	Side Y	Side Y
50	140.0 (5.51)	53.0 (2.09)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	Side Y	Side Y
63	180.0 (7.09)	53.0 (2.09)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	Side Y	Side Y

Covers for Directional/Flow Control Functions "D(C)3"



■ For thread sizes and orifice kits see page 115.

● Minimum clearance for removal of cover from manifold.

▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.

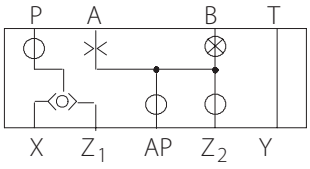
○ DG4V-3 with coil type U.

△ DG4V-3-70

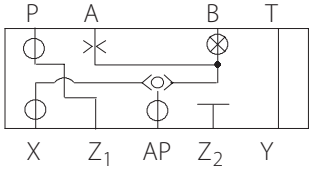
		B					Location of Nameplates	
Size	**A**	**D3**	**DC3**	**C**	**D**	**E**	**Type D3**	**Type DC3**
16	66.0 (2.6)	48.0 (1.89)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	Side Z2	Side Z2
25	86.0 (3.39)	40.0 (1.57)	50.0 (1.97)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	Side Y	Side Z2
32	101.6 (4.00)	49.0 (1.93)	49.0 (1.93)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	Side Y	Side Z2
40	126.0 (4.96)	36.0 (1.42)	48.0 (1.89)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	Side Y	Side Z2
50	140.0 (5.51)	45.0 (1.77)	45.0 (1.77)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	Side Y	Side Z2
63	180.0 (7.09)	49.0 (1.93)	49.0 (1.93)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	Side Y	Side Z2

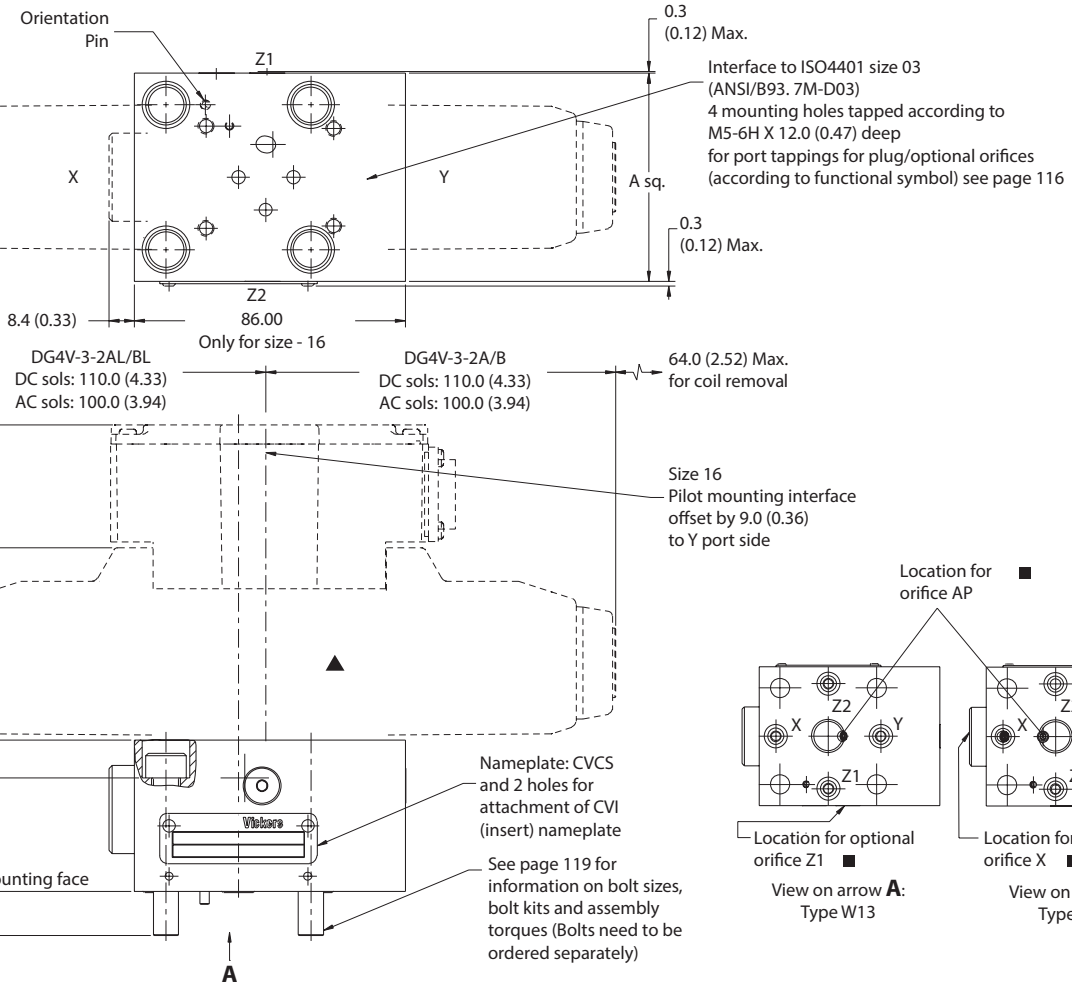
"W13" and "W33" Covers with Size 03 Pilot Valve Interface

CVCS--W13**
Sizes 16 to 63



CVCS--W33**
Sizes 16 to 63



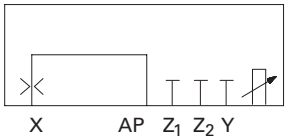


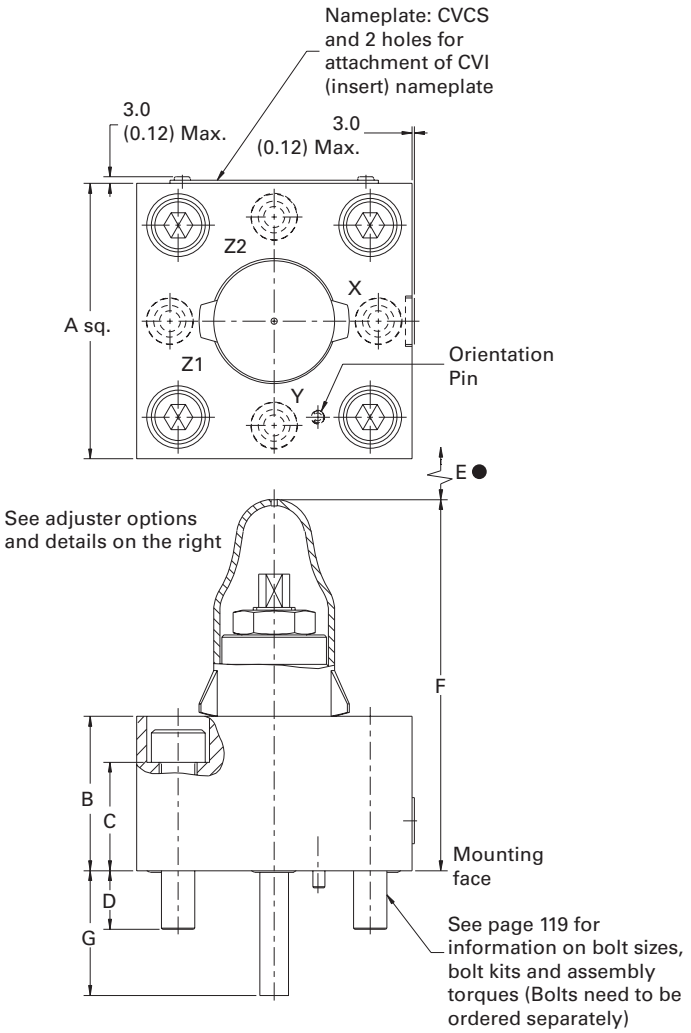
■ For thread sizes and orifice kits see page 115.
● Minimum clearance for removal of cover from manifold.
▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.
○ DG4V-3 with coil type U.
△ DG4V-3-70

		B					Location of Nameplates	
Size	**A**	**W13**	**DC3**	**C**	**D**	**E**	**Type W13**	**Type W33**
16	66.0 (2.6)	48.0 (1.89)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	Side Z2	Side Z2
25	86.0 (3.39)	50.0 (1.97)	50.0 (1.97)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	Side Z2	Side Z2
32	101.6 (4.00)	60.0 (2.36)	50.0 (1.97)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	Side Z2	Side Z2
40	126.0 (4.96)	60.0 (2.36)	50.0 (1.97)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	Side Z2	Side Z2
50	140.0 (5.51)	60.0 (2.36)	50.0 (1.97)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	Side Z2	Side Z2
63	180.0 (7.09)	60.0 (2.36)	50.0 (1.97)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	Side Z2	Side Z2

Covers with Stroke Limiters "A" for Flow Control Functions

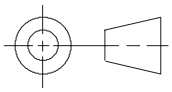
CVCS-**-A
Sizes 16 to 63





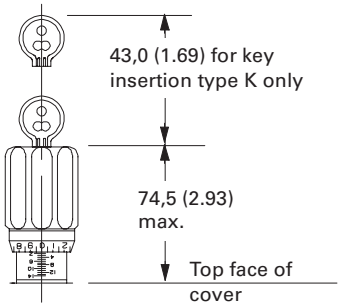
● Minimum clearance for removal of cover from manifold. For adjuster type K allow 43,0 (1.69) for key removal.

Details of Stroke Adjusters
For cover types CVC(S)-**-A, A3

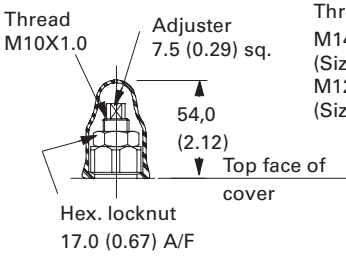


Types K and M
Sizes 16, 25 and 32 only

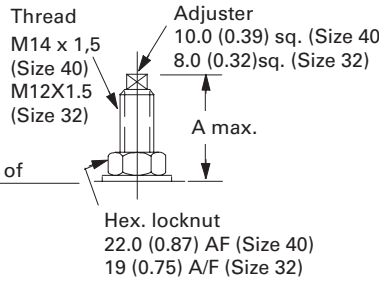
Type K:
Adjustment of valve setting is only possible while key is inserted and turned to engage driving pin. When key is removed, adjuster knob can be freely spun and does not engage with mechanism.



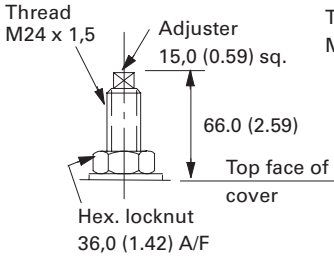
Type W
Sizes 16 and 25
Size 32 (CVCS-**-A3 only)



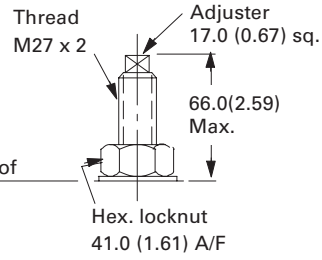
Type W
Size 32 (CVCS-**-A only)
Size 40
Size 32: A = 36,0 (1.42)
Size 40: A = 49.0 (1.93)



Type W
Size 50



Type W
Size 63

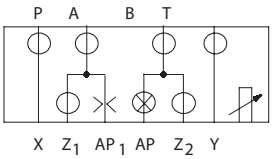


Size	A	B	C	D	E	F W	F K&M	G max.	G min.	Location for Nameplates
16	66.0 (2.60)	37.0 (1.46)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	91.0 (3.58)	111.5 (4.39)	28.0 (1.10)	19.0 (0.75)	Side Z2
25	86.0 (3.39)	37.0 (1.46)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	91.0 (3.58)	111.5 (4.39)	41.0 (1.61)	30.0 (1.18)	Side Z2
32	101.6 (4.00)	50.0 (1.97)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	86.0 (3.39)	124.5 (4.90)	50.0 (1.97)	36.0 (1.42)	Side Z2
40 W	126.0 (4.96)	48.0 (1.89)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	97.0 (3.82)	-	70.0 (2.76)	51.0 (2.01)	Side Z2
40 K&M	126.0 (4.96)	60.0 (2.36)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	-	134.5 (5.3)	70.0 (2.76)	51.0 (2.01)	Side Z2
50	140.0 (5.51)	76.0 (2.99)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	142.0 (5.59)	-	82.0 (3.23)	52.0 (2.05)	Side Z2
63	180.0 (7.09)	91.0 (3.58)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	156.0 (6.14)	-	111.0 (4.37)	82.0 (3.23)	Side Z2

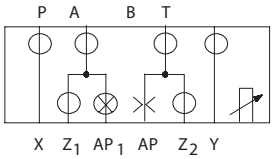
Covers for Directional and Flow Control Functions "A3"

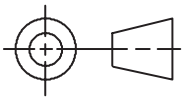
CVCS--A3**
Sizes 16 to 32
(For size 40 to 63 see next page)

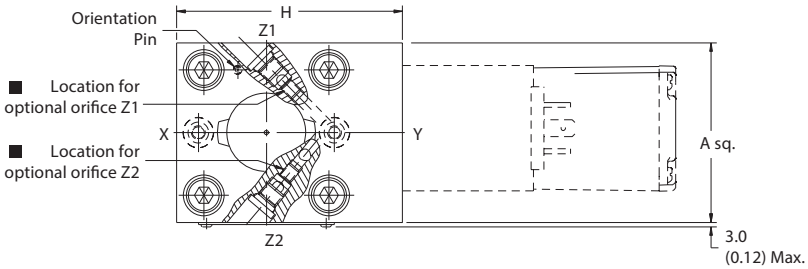
As supplied for
Normally Closed function

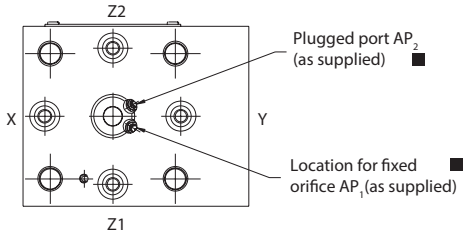


As can be modified for Normally Open function: interchange plug/orifice in AP_1/AP_2



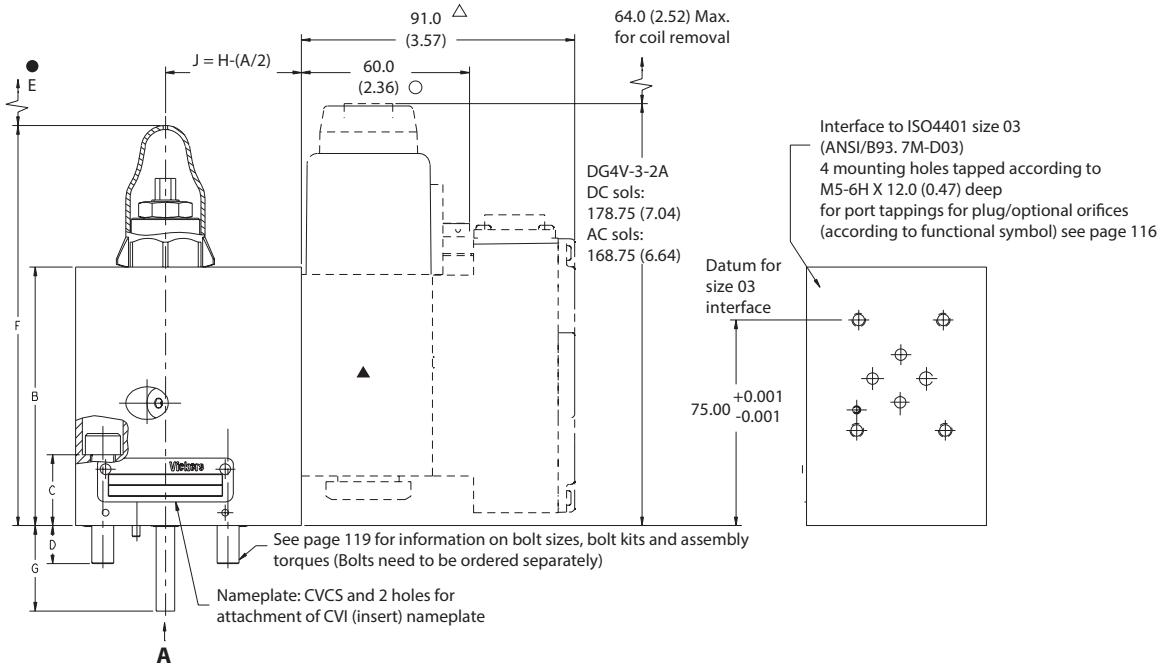






View on arrow **A**

Type W adjuster as fitted to sizes 16, 15, 32 see page 34 for:
- Type W adjuster as fitted to larger models
- Type K & M adjusters (sizes 16, 25 & 32 only)
- Adjuster wrench sizes



■ For thread sizes and orifice kits see page 115.

● Minimum clearance for removal of cover from manifold. For adjuster type K allow 43,0 (1.69) for key removal, see page 34.

▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss- DG4V-3.

○ DG4V-3- with coil type U.

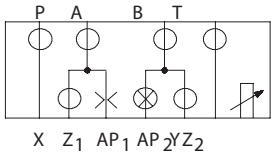
△ DG4V-3-70

Size	A	B	C	D	E	F W	F K&M	G max.	G min.	H	Location for Nameplates
16	66.0 (2.60)	95.0 (3.74)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	149.0 (5.87)	169.5 (6.67)	29.0 (1.14)	18.0 (0.71)	83.0 (3.27)	Side Z2
25	86.0 (3.39)	95.0 (3.74)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	149.0 (5.87)	169.5 (6.67)	44.0 (1.73)	33.0 (1.30)	100.0 (3.94)	Side Z2
32	101.6 (4.00)	95.0 (3.74)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	148.0 (5.83)	168.5 (6.63)	52.0 (2.05)	38.0 (1.50)	105.0 (4.13)	Side Z2

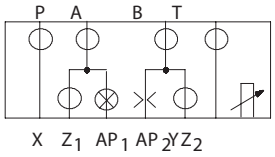
Covers for Directional and Flow Control Functions "A3"

CVCS--A3**
Size 50 - 63

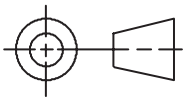
As supplied for
Normally Closed function

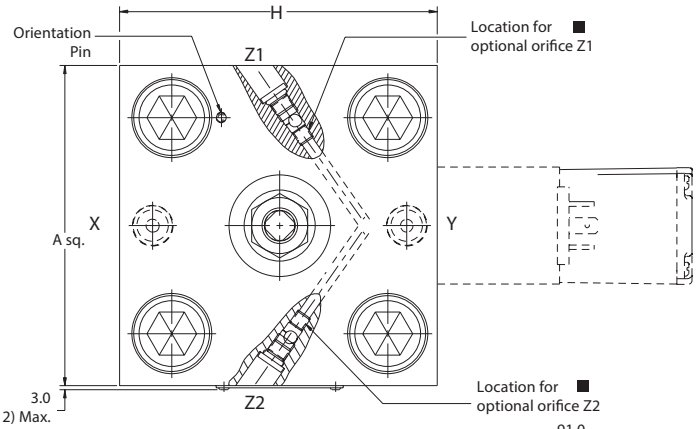


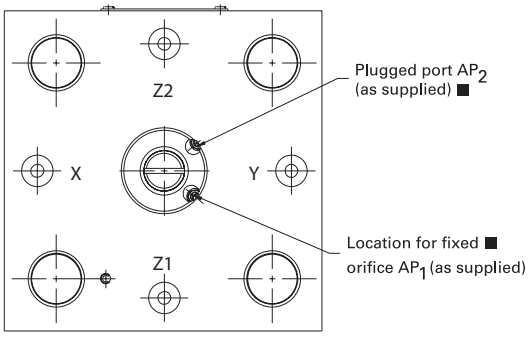
As can be modified for Normally Open function: interchange plug/orifice in AP



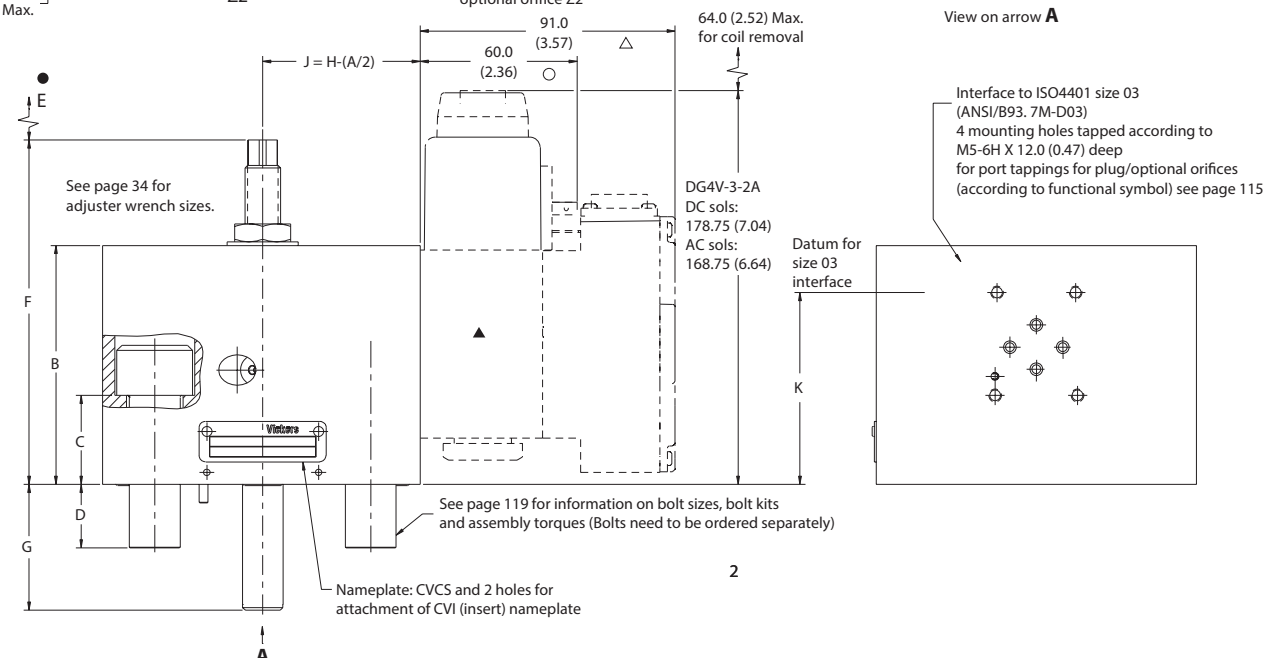
1/AP2







View on arrow **A**



■ For thread sizes and orifice kits see page 115.

● Minimum clearance for removal of cover from manifold. For adjuster type K allow 43,0 (1.69) for key removal, see page 34.

▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss- DG4V-3.

○ DG4V-3- with coil type U.

△ DG4V-3-70

Size	A	B	C	D	E	F W	F K&M	G max.	G min.	H	K	Location for Nameplates
40	126.0 (4.96)	94.0 (3.70)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	136.0 (5.35)	-	72.0 (2.83)	53.0 (2.09)	125.0 (4.92)	75.5 (2.97)	Side Z2
50	140.0 (5.51)	94.0 (3.70)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	141.0 (5.55)	-	82.0 (3.23)	52.0 (2.05)	139.0 (5.47)	82.5 (3.25)	Side Z2
63	180.0 (7.09)	109.0 (4.29)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	170.0 (6.69)	-	111.0 (4.37)	82.0 (3.23)	179.0 (7.05)	82.5 (3.25)	Side Z2

Pressure Relief and Venting Functions

General Information

Cartridge relief valve covers feature manual pressure setting adjustment with a choice of adjusters, i.e. micrometer (M), micrometer with key lock (K), or standard square end screw with hex. locknut (W). Additionally, venting, unloading, and remote piloting are possible. Alternative arrangements include integral electrical selection of pressure or venting and of dual pressure settings and venting. Electrically proportional control is also available.

The cartridge insert consists of a sleeve, a seating poppet (area ratio 1:1), and a closing spring (Figure 2, page 12). It is retained in the manifold cavity by a control cover which contains the manually adjustable pilot valve and all piloting connections. An ISO 4401, size 03 (ANSI/B93.7M-D03) mounting interface for pilot control valves or modules is optional. Cartridge valve characteristics can be matched to application requirements by adding suitable orifices in the pilot circuit. Relief valve arrangements described in this catalog can be built into system manifold assemblies with directional flow regulating and pressure reducing functions in cartridge form.

System Relief Valve

ISO 7368, B*-**-2-B specifies an interface strictly for use with main system relief valves. This interface differs from ISO 7368, B*-**-2-A, only in the position of the orientation pin see page 123) which prevents any other valve function from being inadvertently installed where a system relief valve should be used. Vickers by Danfoss introduces system relief valve covers, type CVCS-**-SC(*) in compliance with ISO 7368, B*-**-2-B. This is in addition to existing relief covers type CVCS-**-C(*) which conform to ISO 7368, B*-**-2-A.

Maximum Operating Pressure

Up to 420 bar (6090 psi), dependent on the maximum pressure of any pilot valve or module used.

Pressure Adjustment Range

3 to 125 bar (43 to 1800 psi)
5 to 250 bar (72 to 3600 psi)
8 to 350 bar (116 to 5000 psi)
10 to 420 bar (145 to 6090 psi)

Maximum Recommended Flow Rates

Nominal sizes ISO 7368 (DIN 24342):

06 (NG16).....333 lpm (88 US gpm)

08 (NG25).....820 lpm (216 US gpm)

09 (NG32).....1540 lpm (407 US gpm)

10 (NG40).....2235 lpm (590 US gpm)

Control Data

Manual pressure adjustment is located in the control cover. Adjustment options are shown starting on page 45. A vent connection is provided for optional remote control by suitable pilot pressure or pilot directional control valve(s). These can simulate remotely the integral pilot options shown starting on page 45. For typical pilot flows, see chart below.

Pilot Control Modules

Details of CVG***-3 pilot control modules are shown on pages 111-114.

Pilot Control Flows for Maximum Pressure

Nominal valve size ISO 7368 (DIN 24342)	Flow rate through main valve lpm (USgpm)	Pilot flow in lpm (USgpm) for pressure at the A(P) port of 350 bar (5000 psi)
06 (NG16)	50 (13.2)	1,60 (0.42)
	230 (60.1)	2,00 (0.53)
08 (NG25)	20 (5.3) 1,15 (0.30)	
	200 (52.8)	1,50 (0.4)
	550 (145)	1,70 (0.45)
09 (NG32)	25 (6.6) 1,14 (0.30)	
	200 (52.8)	1,60 (0.42)
	680 (180)	1,75 (0.46)
10 (NG40)	25 (6.6) 1,28 (0.34)	
	400 (105.7)	1,60 (0.42)
	700 (184.9)	2,00 (0.53)

General Information

The pressure relief function is obtained by using a model D10 or C10F (1:1 area ratio) insert poppet and either a model C or C3 cover. Zero leak function to have no leakages from pilot to B line is also available using D10Z & C10FZ (ratio 1:1) spool. The C3 cover includes a mounting pad for a pilot valve with an ISO 4401, size 03 (ANSI/ B93.7M-D03) interface. Single or double solenoid pilot valves are applicable. A model CVGC-3 module is available for use with dual solenoid pilot valves to obtain two pressure settings and a vent (both solenoids de-energized) condition.

For main system relief functions use model type SC, SC3. Electrically controlled proportional pilots provide infinitely variable pressure settings over a wide pressure range, achieved by using either a D3 cover or a remote pilot. In each configuration the Z1 port is used as a vent port or for remote hydraulic control. A suitable remote control is the CGR-02 valve. Port Z1 should be blocked when not required. Port Y is a drain port.

When the insert's B port goes directly to tank the Y port can be connected to it. However, any back pressure in the B port is additive to the pressure setting. If there are pressure surges in the B port, the Y port should be directly drained to the tank through a separate line. All functions are available in sizes 16, 25, 32 and 40.

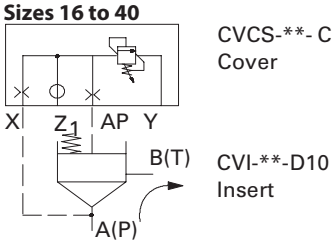
Two insert types are available for pressure relief functions:
Type D10 has no internal orifice and requires pilot connection A to X to be made in the manifold block.

Type D10 insert has good response combined with low shock characteristics and is recommended for general use.

Type C10F has a fixed orifice connecting port A to the pilot relief stage, allowing through-spool piloting for faster response. The higher response characteristics of type C10F can be further enhanced by the addition of the connection A to X within the manifold block. System shock generation is dependent on the usual factors of trapped volume, system pressure and flow rate.

For stable valve operation follow Vickers by Danfoss recommendations for selection of spring for each size of insert. See model code 5, page 41. Factory-fitted orifices in the covers are sized such that a given relief cover can be used with either insert type. Further fine tuning to suit particular system requirements can be achieved by changing orifice sizes. Operation of both types D10 and C10F is similar: System pressure at A(P), Figures 23 and 24, is determined by manual pilot adjustment. Orifices in AP and X ports dampen poppet reaction time, preventing instability. Connecting port Z1 to tank (via an appropriate remote control valve) vents the system pressure at port A(P) to a level equivalent to insert poppet spring load plus override pressure. See curves starting on page 43 for override pressure versus flow rate.

Pressure Relief Function:
Sizes 16 to 40



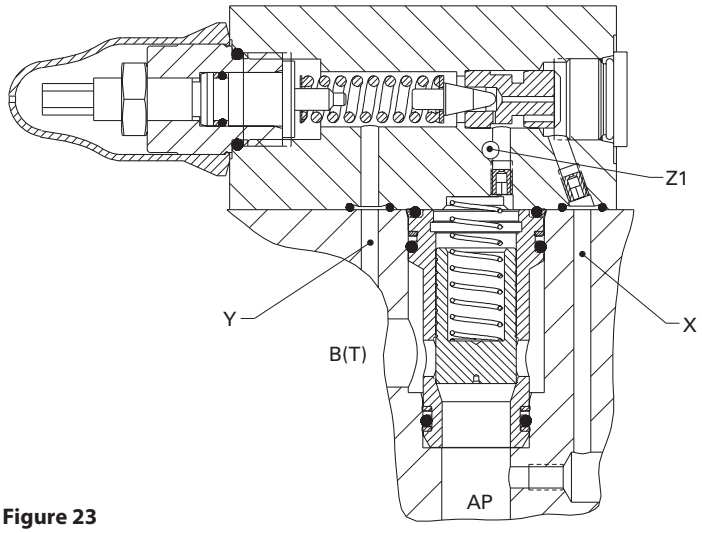
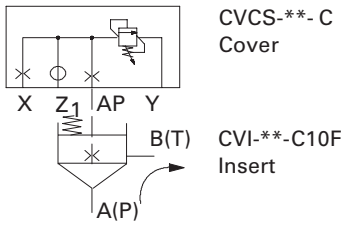


Figure 23



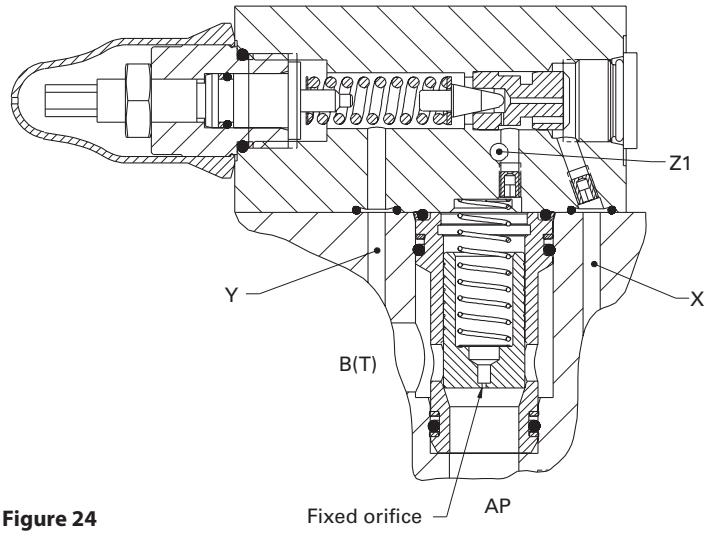
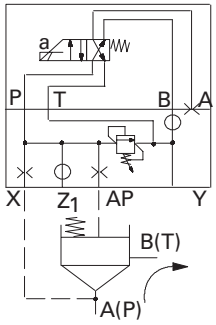


Figure 24

Pressure Relief and Single Solenoid
Pilot Valve: Sizes 16 to 40

When the solenoid is de-energized, Figure 25, the cartridge is vented. When the solenoid is energized, pressure at port A(P) is limited by the setting of the adjuster in the cover. A left hand pilot valve arrangement is shown. A right hand model would allow venting when the solenoid is energized.



DG4V-3-* AL
Pilot valve

CVCS-**-C3
Cover

CVI-**-D10
Insert ■

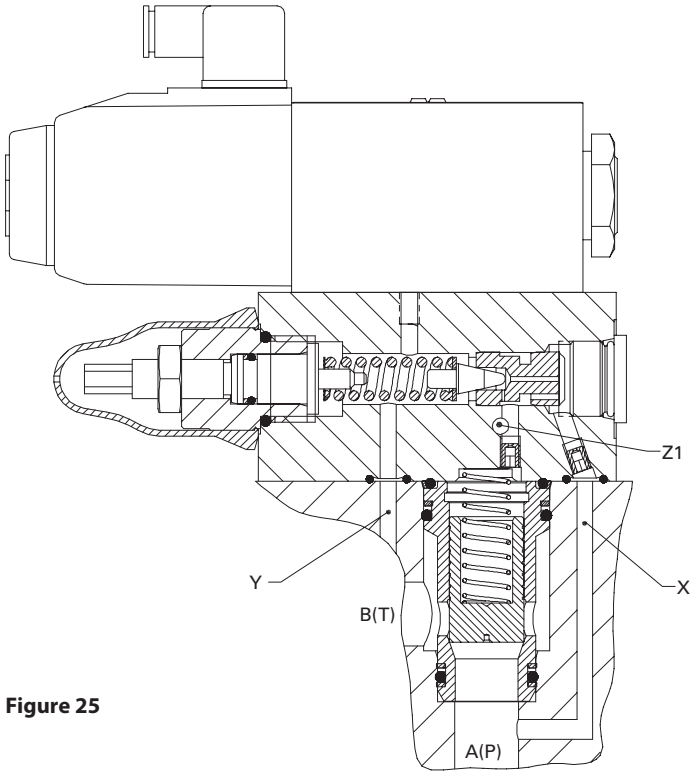
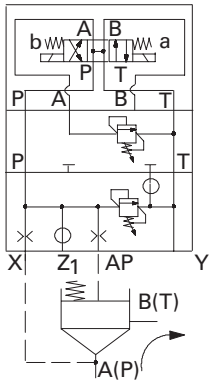


Figure 25

Pressure Relief and Dual Solenoid
Pilot Valve: Sizes 16 to 40

The CVGC-3 module, Figure 26, controls low pressure which occurs when solenoid "a" is energized. Solenoid "b" is energized to obtain the high pressure set by the adjuster on the C3 cover. When both solenoids are de-energized, system pressure is vented to the reservoir. For selection of pilot control module CVGC-3, see pages 111-114.



DG4V-3-* C Pilot valve

CVGC-3
Module
Low pressure control

CVCS-**- C3
Cover

CVI-**-D10
Insert ■

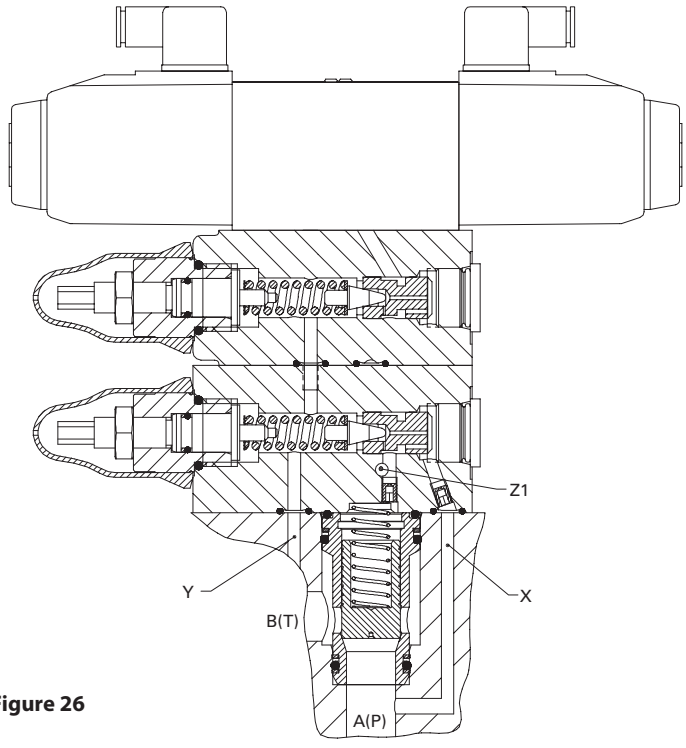


Figure 26

■ *Inserts used for the relief function or combination relief and unloading functions are D10 models. The D15 insert is not to be used as a pressure control such as relief or counterbalancing.*

Pressure Relief (Proportional) and Unloading/Relief Functions

Pressure Relief (Proportional) and Unloading/Relief Functions Remote Relief By Electrohydraulic Proportional Control: Sizes 16 to 40

Maximum pressure is set by the adjuster on the C3 cover. See Figure 27. Pressures below this pressure are remotely electrically adjusted by the proportional pilot valve. Increasing current to the pilot increases the pressure setting.

The pilot valve can be any of those shown in the following table, depending on the working pressure involved. Electronic controllers for the pilots are also shown. For precise KCG-3 configuration according to pressure range and size of cover being used, please refer to page 48.

Pilot Valve	Maximum Adjustable Pressure	Pilot Valve Catalog	Electronic Controller
KCG-3	350 bar (5000 psi)	2162	EEA-PAM-513-A-**
KBCG-3	350 bar (5000 psi)	V-VLPO-MCOO2-E	Internal

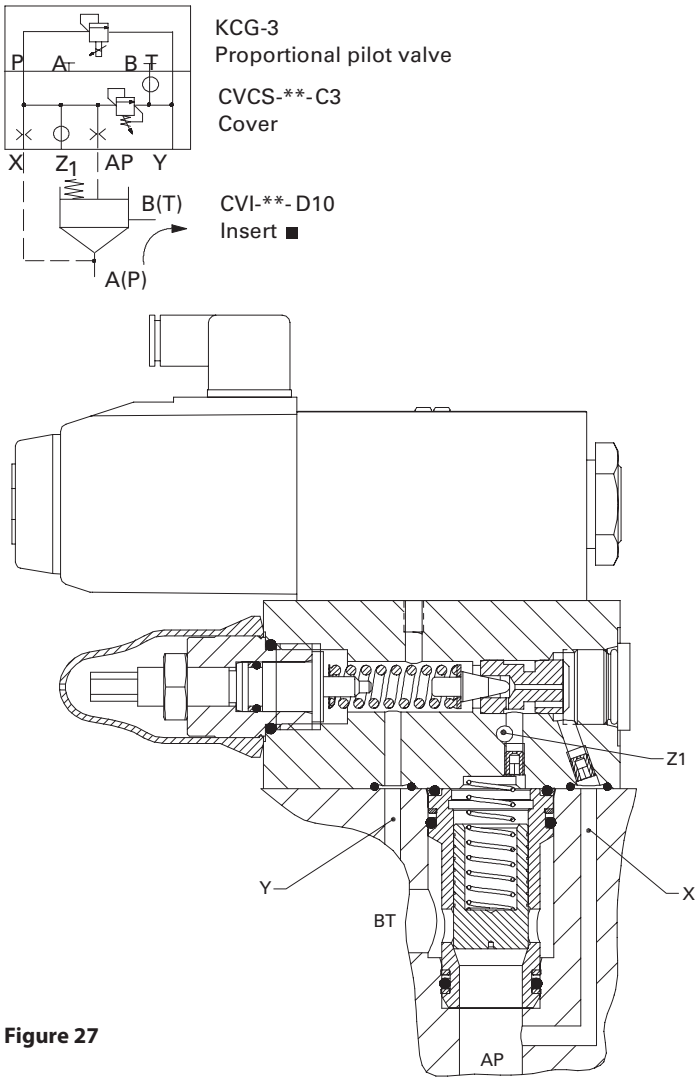


Figure 27

Unloading functions are D10 models. The D16 insert is not to be used as a pressure control such as relief or counterbalancing.

Model Codes - Pressure Relief and Venting Functions

CVCS Covers

Vickers by Danfoss type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and DIN 24342. This includes function types SC, SC3. All features must be specified when ordering; those in brackets () are optional or apply only to specific models.

Metric Models

Metric bolt tappings and orifice threads; SAE plugs.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVCS-**-*C*-*-***-*-30-******

CVCS	**	(S)C(3)	*	***	*	30	****
1	2	3	4	5	6	7	8

1 Model

CVCS - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

3 Function

C - Pressure relief (ISO 7368, B*-**-2-A)
C3 - Pressure relief (ISO 7368, B*-**-2-A) with mounting face for size 03 pilot valve
SC - Pressure relief (ISO 7368, B*-**-2-B)
SC3 - Pressure relief (ISO 7368, B*-**-2-B) with mounting face for size 03 pilot valve

4 Adjuster mechanism

K - micrometer adjuster with key lock (for NG-16 to 40 sizes only)
M - micrometer adjuster without key lock (for NG-16 to NG-40 sizes only)
W - wrench adjustment with hex lock nut (for all sizes)

5 Adjustable pressure range

125 - 3-125 bar (44-1800 psi)
250 - 5-250 bar (73-3600 psi)
350 - 8-350 bar (116-5000 psi)
420 - 10-420 bar (145-6090 psi)
For proportional control ranges, see page 48.

6 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

7 Design number 30 series

See page 115 for sizes of factory fitted standard orices. Other orice sizes and locations can be fitted by special arrangement with your Danfoss representative. Non-standard orice requirements should be dened as follows:

8 Pilot control orifice location and size

See table below for pilot control orifice locations, as per selected 'Function'. The letter 'S' in brackets indicates default factory-fitted 'standard' orifice associated with that location. The letter 'S' should be included in the model code at locations where standard orifice is required. Letter 'Z' in brackets indicates that no orifice plug is fitted, whereas letter 'A' indicates blocked port. Letter 'Z' can be omitted if these are at the end of the model code. To specify non-standard orifice sizes, refer table on page 116.

Function	Location 1	Location 2	Location 3	Location 4
(S)C(3)	AP(S)	X(S)	B(Z)	Z1(Z)

Letter in brackets to be mentioned in the model code at appropriate orifice location.

Refer pages 6 and 7 for pictorial representation of orifice locations.

Model Codes - Pressure Relief and Venting Functions

CVI Inserts

All features must be specified when ordering; those in brackets ( ) are optional.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVI-**-*10**-*-*-60**

CVI	**	*10(F)(Z)	*	*	60
1	2	3	4	5	6

1 Model

CVI - Cartridge valve insert

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

3 Function

C10F - 1:1 ratio with fixed orifice
D10 - 1:1 ratio
D10Z - 1:1 ratio with zero leak
C10FZ - 1:1 ratio with fixed orifice and zero leak

4 Cracking pressure, bar (psi)

For correct relief function specify spring code according to model size.

Cracking Pressure (bar)			
Size\ Spring	L	M	H
NG16	0.34	1.67	3.33
NG25	0.41	2.07	3.87
NG32	0.38	1.93	3.85
NG40	0.36	1.82	3.64

5 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

6 Design number, 60 series

Note: A nameplate is supplied witheach insert for fixing to the cover to identify the insert in use.

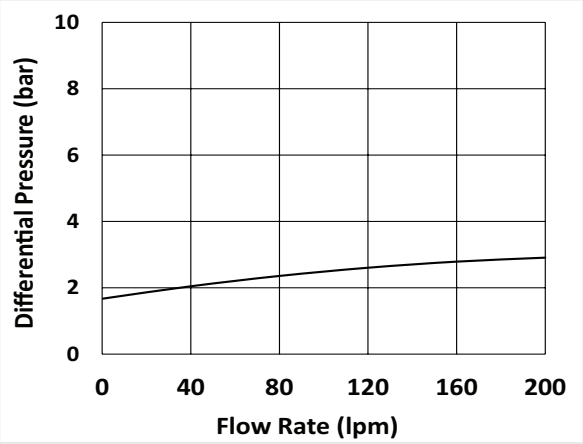
Performance Data - Pressure Relief and Venting Functions

CVCS Covers

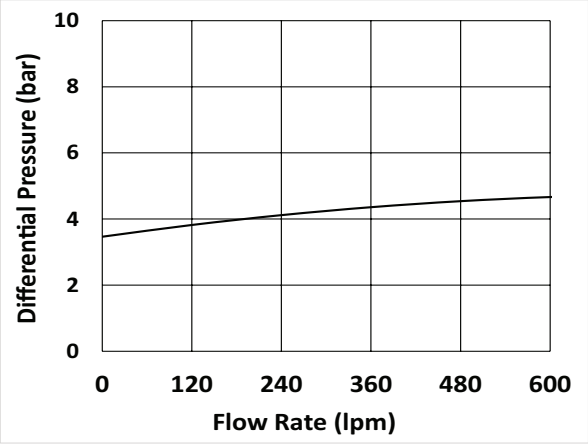
Unless otherwise stated, performances are based on petroleum oil at 36 cSt (168 SUS) and at 50º C (122º F). For pressure drops at other viscosities, see page 118. Thermal stability of proportional cartridge systems primarily depends on the proportional pilot valve.

Pressure Drop/Flow
(Flow from Port A to B)

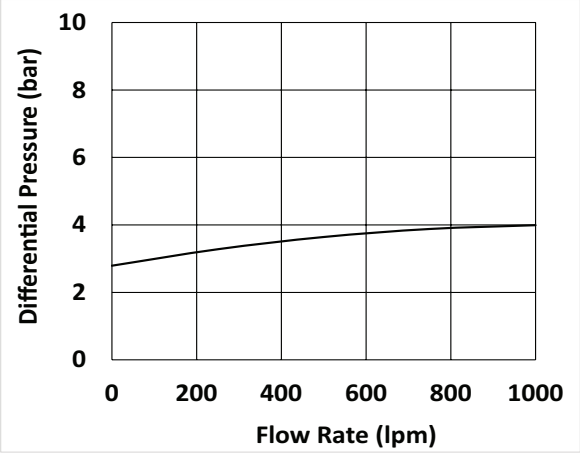
Cover CVCS-16-C-*-***-30
Inserts CVI-16-D10-M-*-60 and CVI-16-C10F-M-*-60



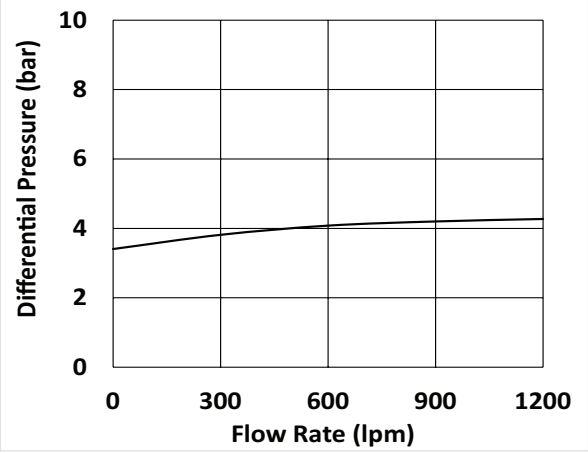
Cover CVCS-25-C-*-***-30
Inserts CVI-25-D10-H-*-60 and CVI-25-C10F-H-*-60



Cover CVCS-32-C-*-***-30
Inserts CVI-32-D10-H-*-60 and CVI-32-C10F-H-*-60



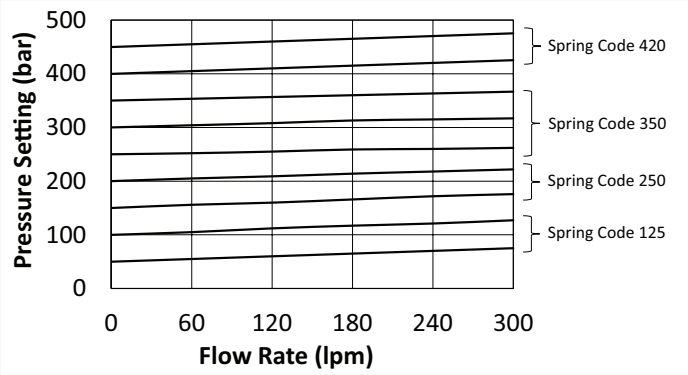
Cover CVCS-40-C-*-***-30
Inserts CVI-40-D10-H-*-60 and CVI-40-C10F-H-*-60



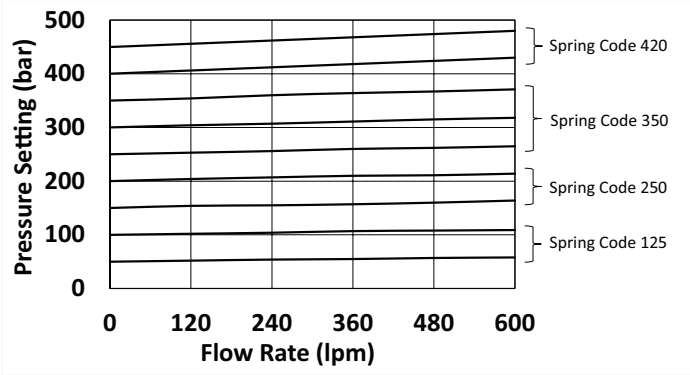
Performance Data - Pressure Relief and Venting Functions

Pressure Override

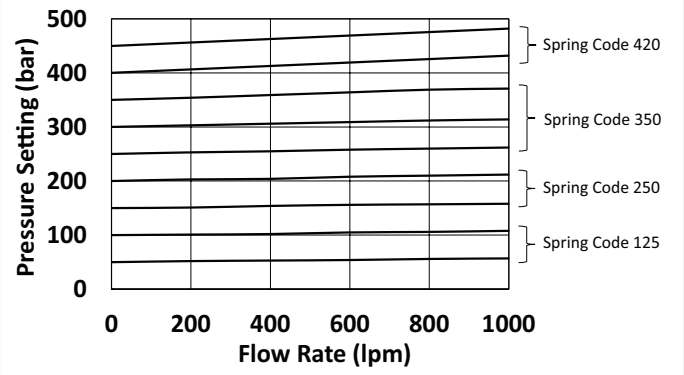
Cover CVCS-16-C-*-***-30
Inserts CVI-16-D10-M-*-60 and CVI-16-C10F-M-*-60



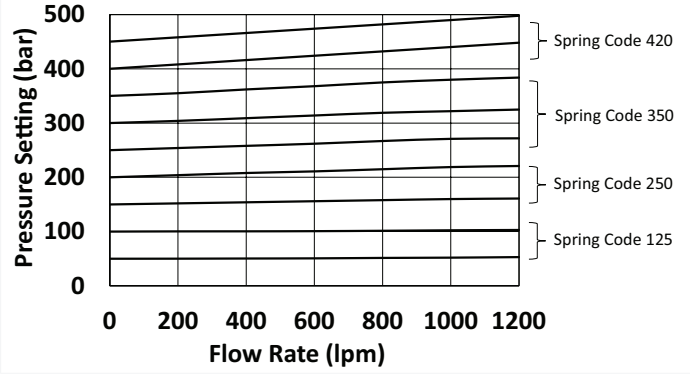
Cover CVCS-25-C-*-***-30
Inserts CVI-25-D10-H-*-60 and CVI-25-C10F-H-*-60



Cover CVCS-32-C-*-***-30
Inserts CVI-32-D10-H-*-60 and CVI-32-C10F-H-*-60

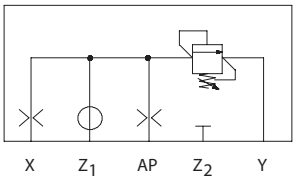


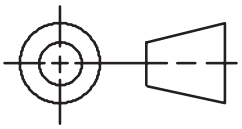
Cover CVCS-40-C-*-***-30
Inserts CVI-40-D10-H-*-60 and CVI-40-C10F-H-*-60

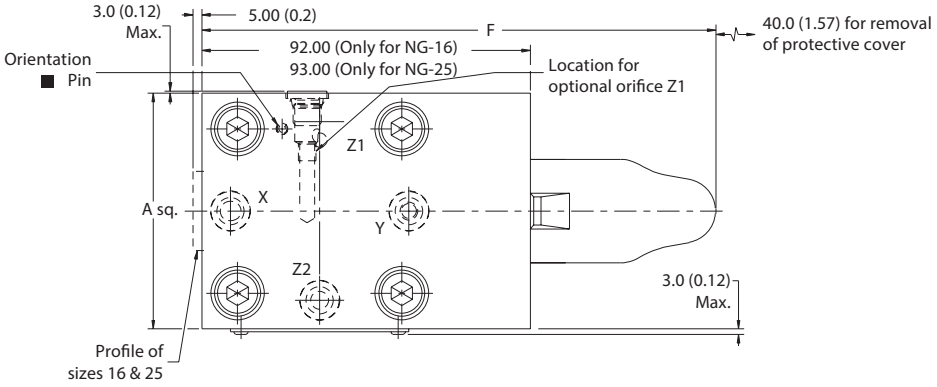


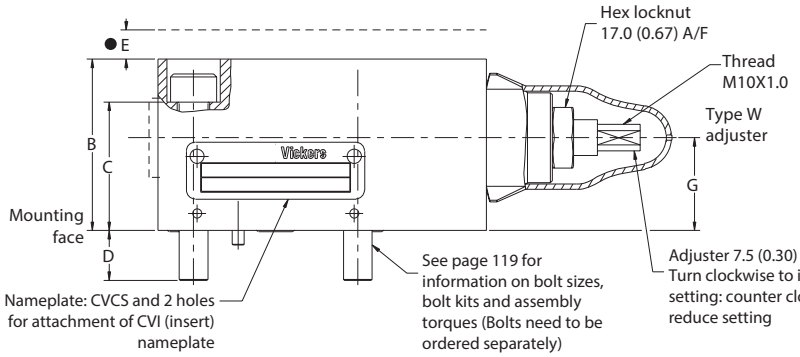
Pressure Relief and Venting Functions

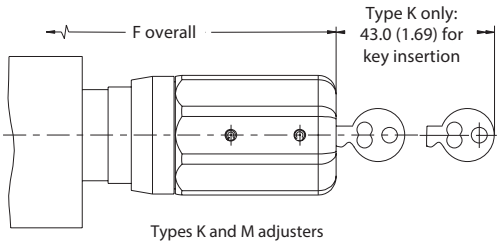
CVCS--C**
Sizes 16 to 40



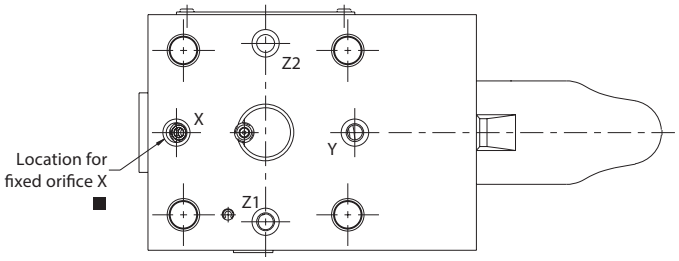








Types K and M adjusters
Type K:
Adjustment of valve setting is only possible while key is inserted and turned to engage driving pin. When key is removed, adjuster knob can be freely spun and does not engage with mechanism.



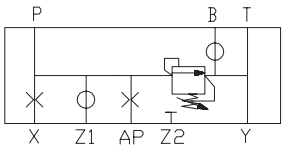
■ For thread sizes and orifice kits see page 115.

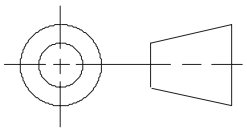
● Minimum clearance for removal of cover from manifold.

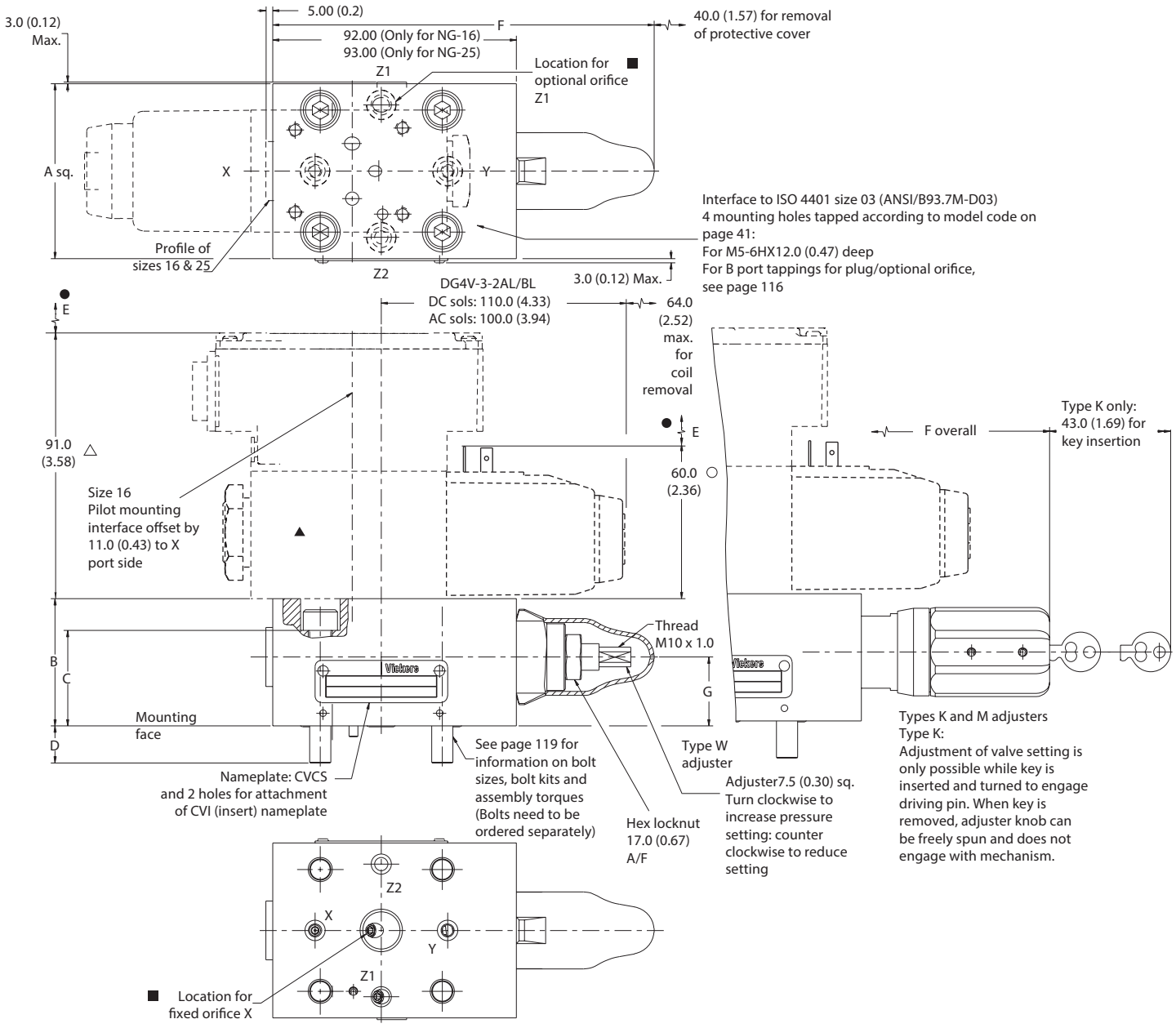
Size	A	B	C	D	E	F W	F K&M	G	Location for Nameplates
16	66.0 (2.6)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	10.0 (0.39)	146.0 (5.75)	166.5 (6.56)	26.0 (1.02)	Side Z2
25	86.0 (3.39)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	10.0 (0.39)	147.0 (5.79)	167.5 (6.59)	28.0 (1.10)	Side Z2
32	101.6 (4.00)	52.0 (2.05)	30.0 (1.18)	25.0 (0.98)	10.0 (0.39)	155.6 (6.13)	176.1 (6.93)	35.0 (1.38)	Side Z2
40	126.0 (4.96)	57.0 (2.24)	35.0 (1.38)	25.0 (0.98)	10.0 (0.39)	180.0 (7.09)	200.5 (7.89)	39.0 (1.54)	Side Z2

Pressure Relief & Venting Functions with Electrical Selection

CVCS--C3**
Sizes 16 to 40







■ *For thread sizes and orifice kits see page 115.*

● *Minimum clearance for removal of cover from manifold.*

▲ *Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.*

○ *DG4V-3 with coil type U.*

△ *DG4V-3-70*

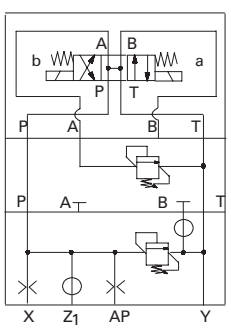
Size	A	B	C	D	E	F W	F K&M	G	Location for Nameplates
16	66.0 (2.6)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	146.0 (5.75)	166.5 (6.56)	26.0 (1.02)	Side Z2
25	86.0 (3.39)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	147.0 (5.79)	167.5 (6.59)	28.0 (1.10)	Side Z2
32	101.6 (4.00)	60.0 (2.36)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	155.6 (6.13)	176.1 (6.93)	35.0 (1.38)	Side Z2
40	126.0 (4.96)	57.0 (2.24)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	180.0 (7.09)	200.5 (7.89)	39.0 (1.54)	Side Z2

Pressure Relief Function with High and Low Adjustable Settings, Vented by Electrical Selection

Dual Pressure Control

For dimensions of CVCS-**-C3 covers, and adjustment types, see page 46.

For dimensions of CVGC-3 module see page 114.

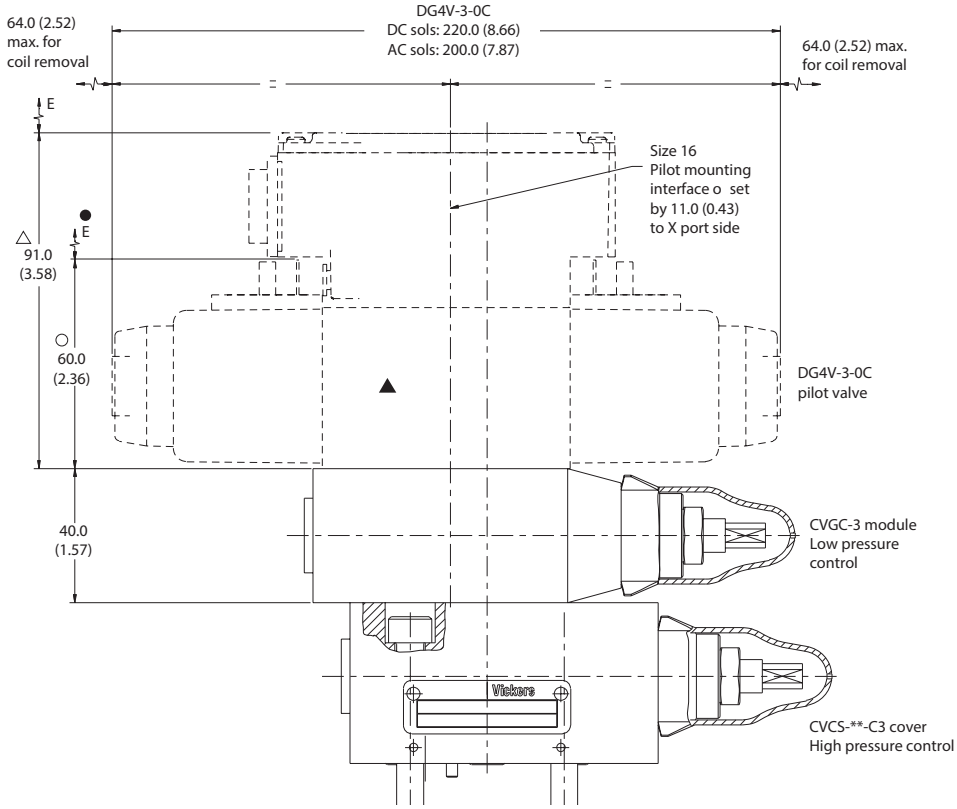


DG4V-3-0C pilot valve
Energize sol. a for low pressure
Energize sol. b for high pressure
De-energize solenoids for venting

CVGC-3 module Low pressure control

CVCS-**-C3 cover
High pressure control

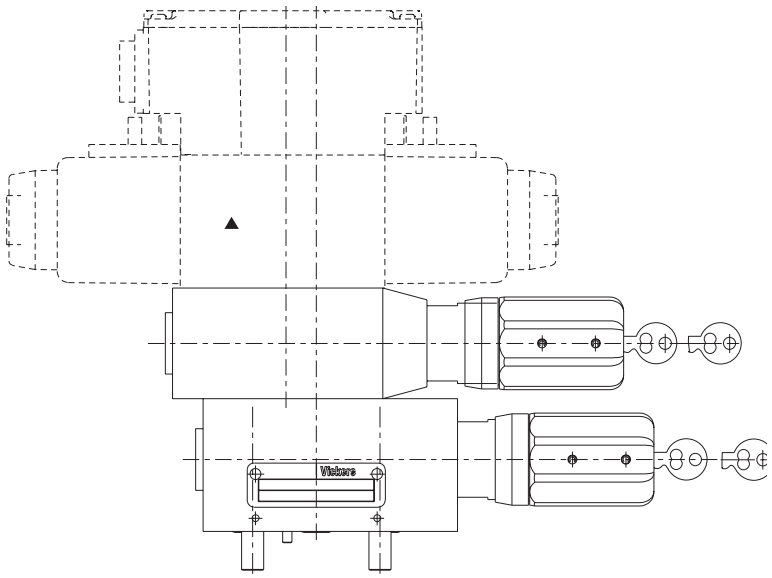
Arrangement With Type W Adjusters



Arrangement With Types K and M Adjusters

Type K:

Adjustment of valve setting is only possible while key is inserted and turned to engage driving pin. When key is removed, adjuster knob can be freely spun and does not engage with mechanism.



■ *For thread sizes and orifice kits see page 115.*

● *Minimum clearance for removal of cover from manifold. See previous page*

▲ *Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.*

○ *DG4V-3 with coil type U.*

△ *DG4V-3-70*

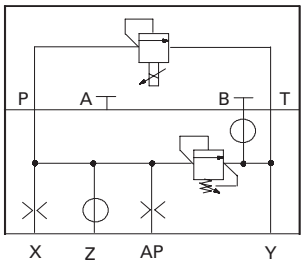
Pressure Relief Function with Electrohydraulic Proportional Control/ KCG-3 Pilot

For dimensions of CVCS-**-C3 covers, and adjustment types, see page 46.

CVCS-**-C3 Cover with KCG-3 Pilot Valve

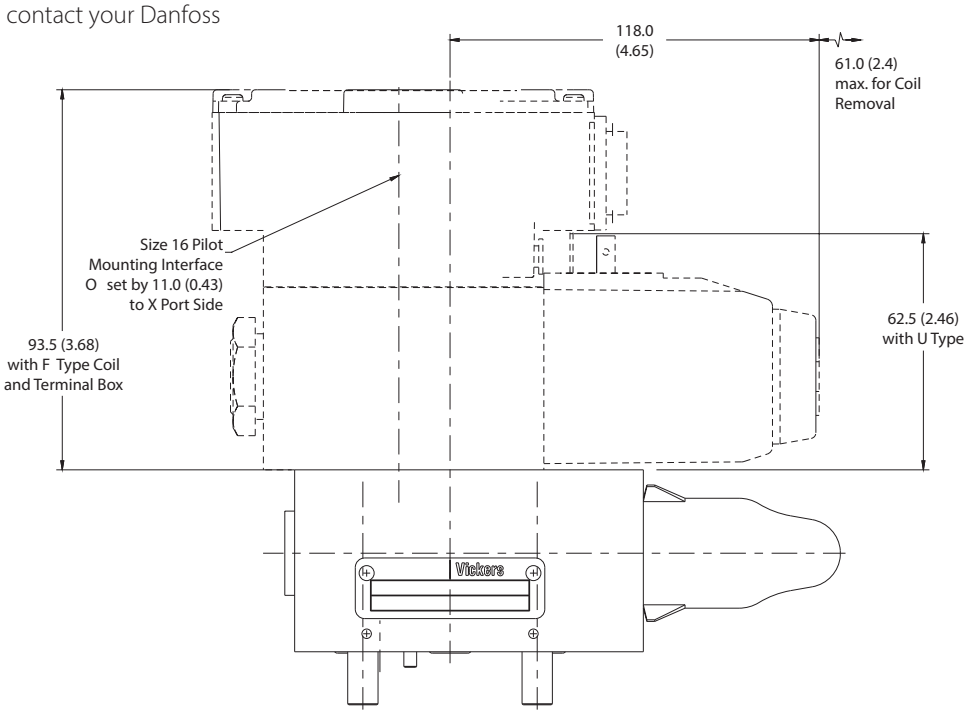
For proportional relief valves using standard CVCS-**-C3 covers, the correct KCG-3 proportional pilot valve should be selected from the following table according to the size and pressure range being used. The sizing and combination of orifices fitted into these pilot valves have been determined by testing to give good response and stable operation across a wide range of average system parameters using standard covers (i.e. with standard sizes of factory fitted orifices – see page 115).

Other orifice combinations can be provided to meet individual requirements of customer installations. Please contact your Danfoss representative.



KCG-3
Proportional pilot valve

CVCS-**-C3
Cover



Size	Pressure control range bar (psi)	Cover max. pressure code, see CVCS model code 6, page 41	Pilot valve model code For KCG models add required coil connection and rating (See catalog GB-C-2162B for full model code details of KCG-3)
16	5-40 (72-580)	125	KCG-3-40-D-Z-M---10 (standard)
	6-100 (87-1450)	125	KCG-3-100-D-Z-M---10-P18-T15
	7-160 (102-2320)	250	KCG-3-160-D-Z-M---10-P15-T12
	7,5-250 (109-3625)	250	KCG-3-250-D-Z-M---10-P15-T10
	7,5-350 (109-5075)	350	KCG-3-350-D-Z-M---10-P15-T10
25	5-40 (72-580)	125	KCG-3-40-D-Z-M---10 (standard)
	6-100 (87-1450)	125	KCG-3-100-D-Z-M---10-P18-T15
	7-160 (102-2320)	250	KCG-3-160-D-Z-M---10-P15-T12
	7,5-250 (109-3625)	250	KCG-3-250-D-Z-M---10-P15-T10
	7,5-350 (109-5075)	350	KCG-3-350-D-Z-M---10-P15-T10
32	7-40 (102-580)	1215	KCG-3-40-D-Z-M---10 (standard)
	8,5-100 (124-1450)	125	KCG-3-100-D-Z-M---10-P18-T15
	9,5-160 (138-2320)	250	KCG-3-160-D-Z-M---10-P15-T12
	10,5-250 (153-3625)	250	KCG-3-250-D-Z-M---10-P15-T12
	10,5-350 (153-5075)	350	KCG-3-350-D-Z-M---10-P15-T12
40	7-40 (102-580)	125	KCG-3-40-D-Z-M---10-T15
	8,5-100 (124-1450)	125	KCG-3-100-D-Z-M---10-T15
	9,5-160 (138-2320)	250	KCG-3-160-D-Z-M---10-T15
	10,5-250 (153-3625)	250	KCG-3-250-D-Z-M---10-T15
	10,5-350 (153-5075)	350	KCG-3-350-D-Z-M---10-T15

Pressure Unloading/Relief Functions

General Information

In addition to providing the basic relief function (as described in the preceding section, "Valves for Pressure Relief Functions") the unloading relief function provides the means of automatically loading/unloading a fixed delivery pump according to system demands. The high pressure side of the hydraulic system is connected, via port X, to a small piston fitted in front of the poppet of the pilot relief stage in the unloader cover. When system pressure on port A reaches the pressure setting of the pilot stage, the valve, acting as a relief valve, starts to open. The pressure drop created by the pilot flow through the orifices (in the main poppet and the cover) is seen across the ends of the pilot piston, causing the piston to quickly move up and hold the pilot relief poppet off its seat. Full pilot flow at low pressure then creates sufficient pressure to fully lift the main poppet to open the mainstream flow path from A to B.

The valve remains in this condition until the reference pressure at port X drops to approximately 80% of the maximum, when the force of the pilot relief spring pushes the pilot piston back, allowing the pilot poppet to re-seat, bringing the system on-load again. Venting is controlled through port Z1. Design features providing smooth load/unload characteristics, with metering capability for partial unloading, together with stable operation are:

- Poppet is sliding spool type, with metering holes to give progressive opening.
- High gain pilot relief stage poppet.
- 20% differential pilot stage unloader piston.

Maximum Operating Pressure

420 bar (6090 psi)

Pressure Adjustment Range

3 to 125 bar (43 to 1800 psi)
5 to 250 bar (72 to 3600 psi)
8 to 350 bar (116 to 5000 psi)
10 to 420 bar (145 to 6090 psi)

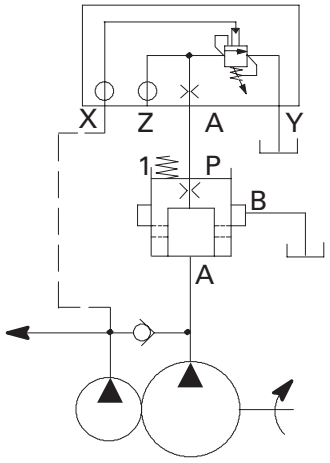
Nominal Flow Rates

At 5 bar (72 psi) pressure drop with valve unloaded.

Nominal sizes ISO 7368 (DIN 24342)

06 (NG16).....190 lpm (50 USgpm)
08 (NG25).....300 lpm (79 USgpm)
09 (NG32).....615 lpm (162 USgpm)
10 (NG40).....915 lpm (242 USgpm)

Typical applications for unloader functions are:



Note: Relief valve for high pressure pump omitted for clarity
Figure 28

2. Accumulator systems, see Figure 29, where one pump section (usually the smaller) is maintained on load against its own high pressure relief valve, and the other section off/onloaded according to system demands.

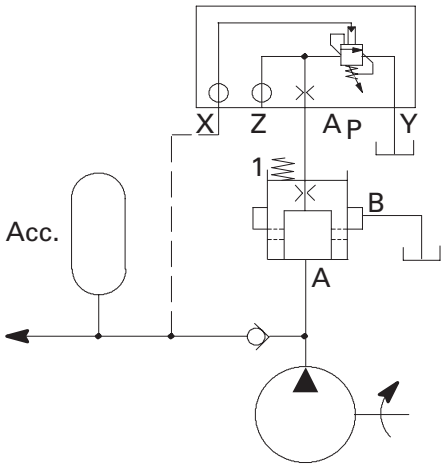


Figure 29

Pressure Relief and Unloading:
Sizes 16 to 40

Pilot connection A to Z1 is needed to ensure the pressure relief function A to B. Pump flow at port A can be unloaded by application of pilot pressure to port X. This pressure must be equal to the pressure setting of the unloader pilot stage to initiate unloading; the system pressurizes again when this pressure drops by approx. 20% or more.

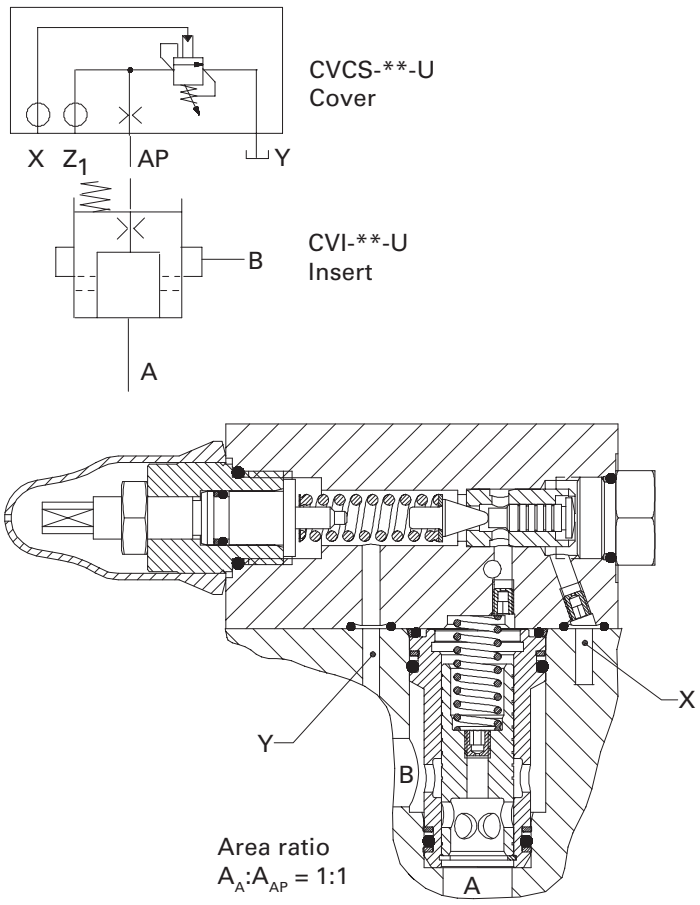


Figure 30

Pressure Relief and Unloading with Electrical Selection of Venting:
Sizes 16 to 40

When it is required to unload the system independently of the system demands, this can be achieved by using the cover types U3 and selecting a suitable size 03 solenoid operated pilot valve. By using Vickers by Danfoss model type DG4V-3-2AL for example, the system is unloaded when the solenoid is de-energized. When the solenoid is energized the unloader function operates (via pilot port X) as described above.

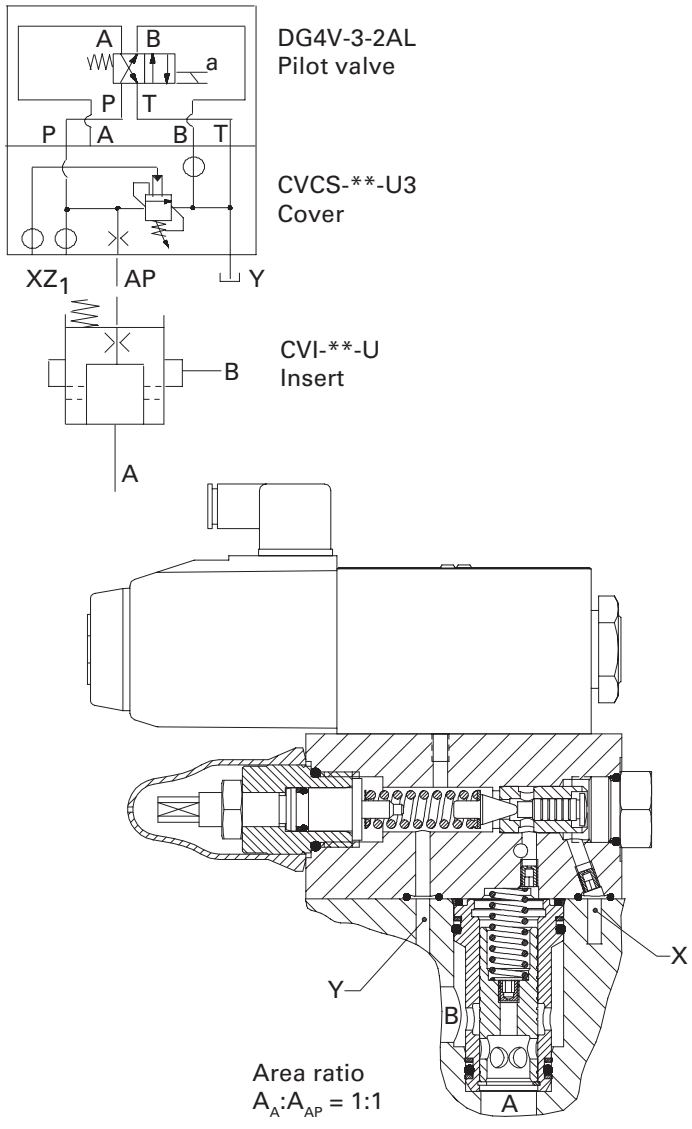


Figure 31

Model Codes - Unloading/Relief Functions

CVCS Covers

Vickers by Danfoss type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and DIN 24342. All features must be specified when ordering; those in brackets () are optional or apply only to specific models.

Metric Models

Metric bolt tappings and orifice threads; SAE plugs.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVCS-**-U*-*-***-*-30-******

CVCS	**	U(3)	*	***	*	30	****
1	2	3	4	5	6	7	8

1 Model

CVCS - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

3 Function

U - Unloading relief
U3 - Unloading relief with mounting face for size 03 pilot valve

4 Adjuster mechanism

K - micrometer adjuster with key lock
M - micrometer adjuster without key lock
W - wrench adjustment with hex lock nut

5 Adjustable pressure range

125 - 3-125 bar (44-1800 psi)
250 - 5-250 bar (73-3600 psi)
350 - 8-350 bar (116-5000 psi)
420 - 10-420 bar (145-6090 psi)

6 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

7 Design number 30 series

See page 115 for sizes of factory fitted standard orices. Other orice sizes and locations can be tted by special arrangement with your Danfoss representative. Non-standard orice requirements should be dened as follows:

8 Pilot control orifice location and size

See table below for pilot control orifice locations, as per selected 'Function'. The letter 'S' in brackets indicates default factory-fitted 'standard' orifice associated with that location. The letter 'S' should be included in the model code at locations where standard orifice is required. Letter 'Z' in brackets indicates that no orifice plug is fitted, whereas letter 'A' indicates blocked port. Letter 'Z' can be omitted if these are at the end of the model code. To specify non-standard orifice sizes, refer table on page 116.

Function	Location 1	Location 2	Location 3	Location 4
U(3)	AP(S)	X (Z)	B (Z)	Z1 (S)

Letter in brackets to be mentioned in the model code at appropriate orifice location.

Refer pages 6 and 7 for pictorial representation of orifice locations.

Model Codes - Unloading/Relief Functions

CVI Inserts

All features must be specified when ordering; those in brackets ( ) are optional.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVI-**-U-*-60**

CVI	**	U	*	60
1	2	3	4	5

1 Model

CVI - Cartridge valve insert

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

3 Function

U - 1:1 ratio unloading function, normally closed, sliding spool

4 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

5 Design number 60 series

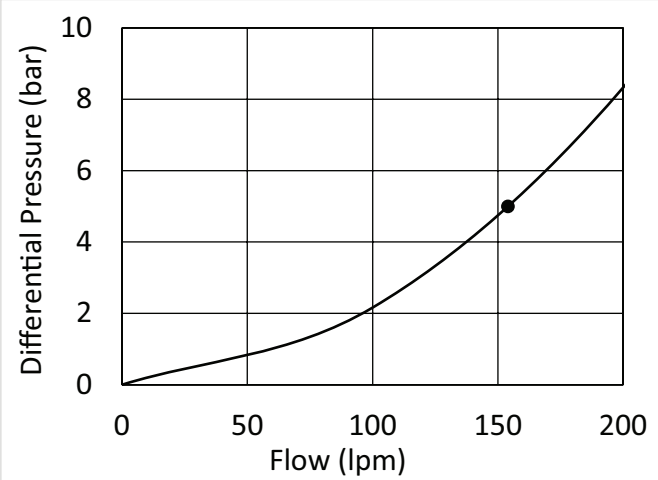
Note: A nameplate is supplied with each insert for fixing to the cover to identify the insert in use.

Performance Data - Unloading/Relief Functions

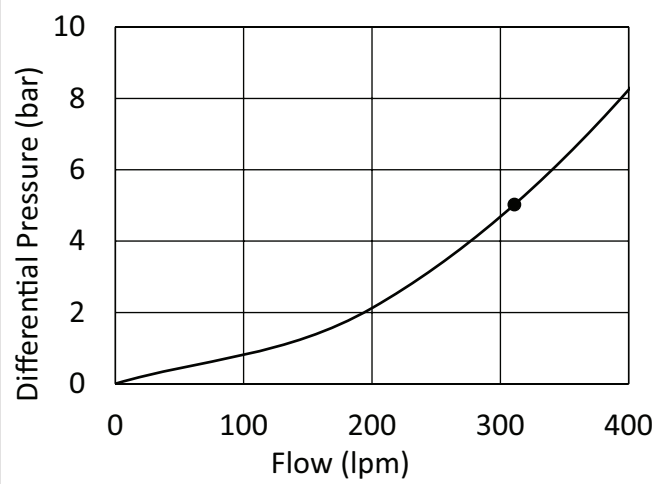
Pressure Drop/Flow Through Insert (Flow from Port A to B)

• = Rated flow point

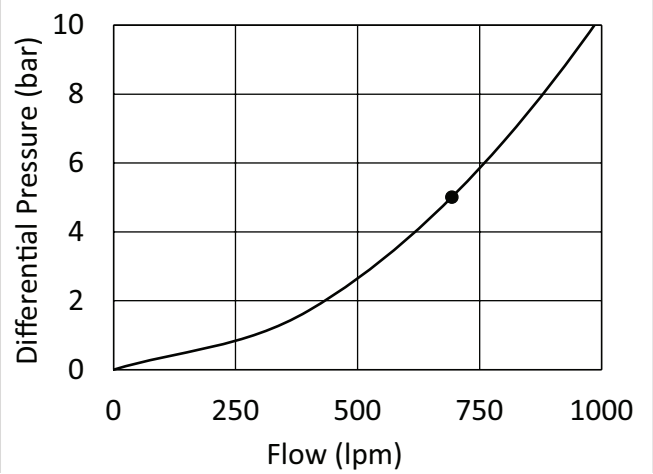
CVI-16-U-*-60



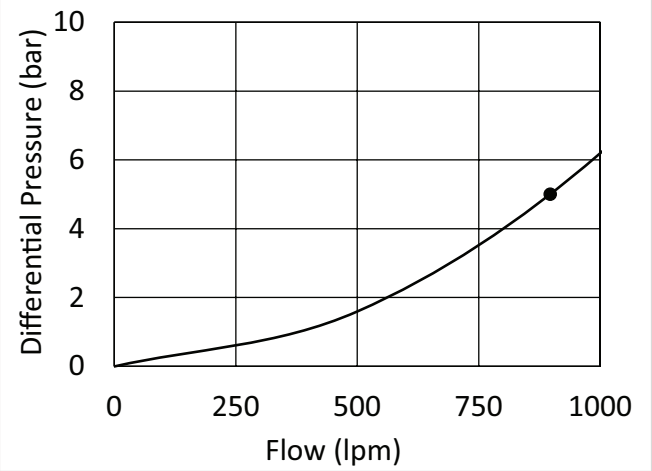
CVI-25-U-*-60



CVI-32-U-*-60



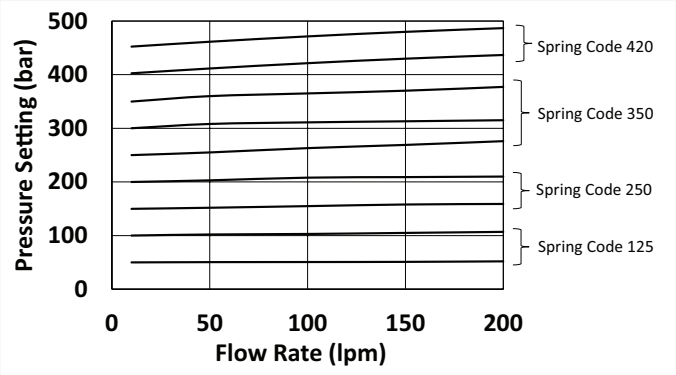
CVI-40-U-*-60



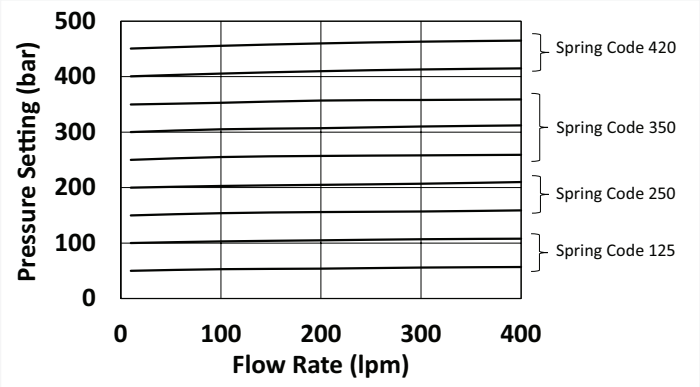
Performance Data - Unloading/Relief Functions

Pressure Override

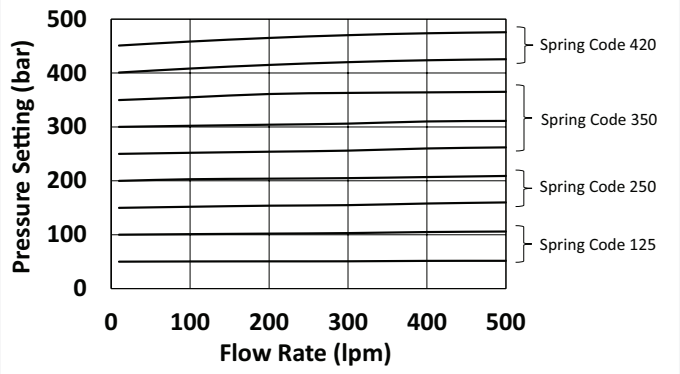
Cover CVCS-16-U-*-***-30
Insert CVI-16-U-*-60



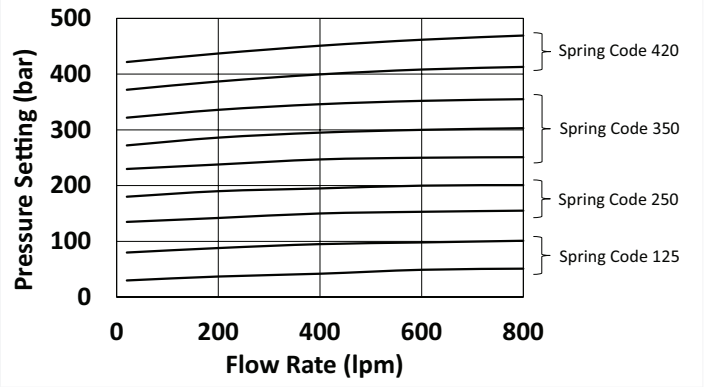
Cover CVCS-25-U--*-***-30
Insert CVI-25-U-*-60



Cover CVCS-32-U--*-***-30
Insert CVI-32-U-*-60



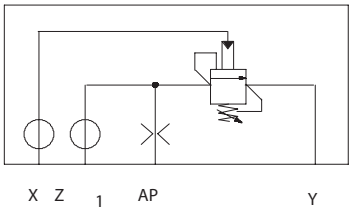
Cover CVCS-40-U--*-***-30
Insert CVI-40-U-*-60

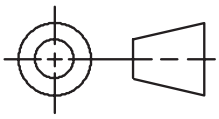


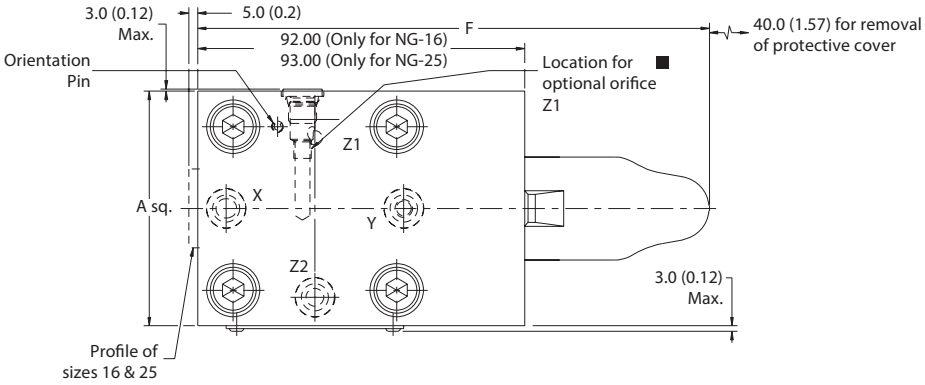
Unloading/Relief Functions

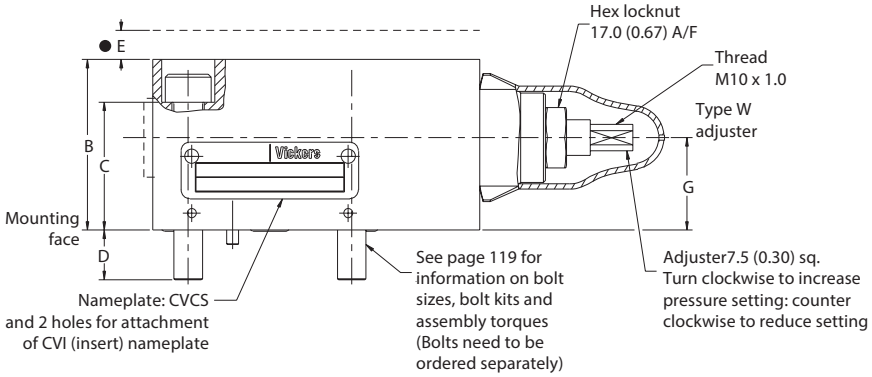
CVCS--U**
Sizes 16 to 40

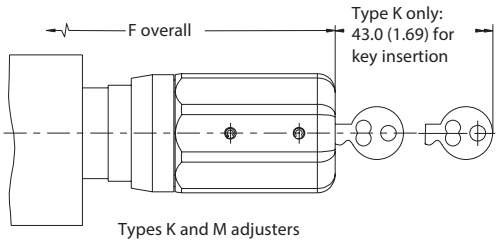
Dimensions
mm (inch)



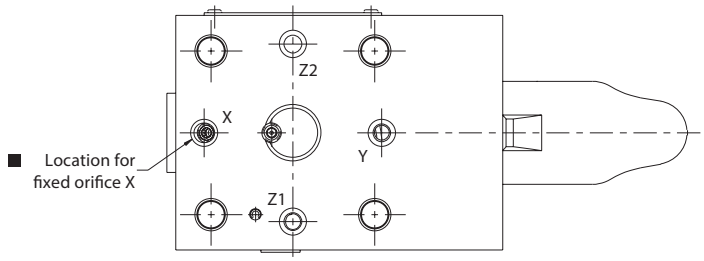








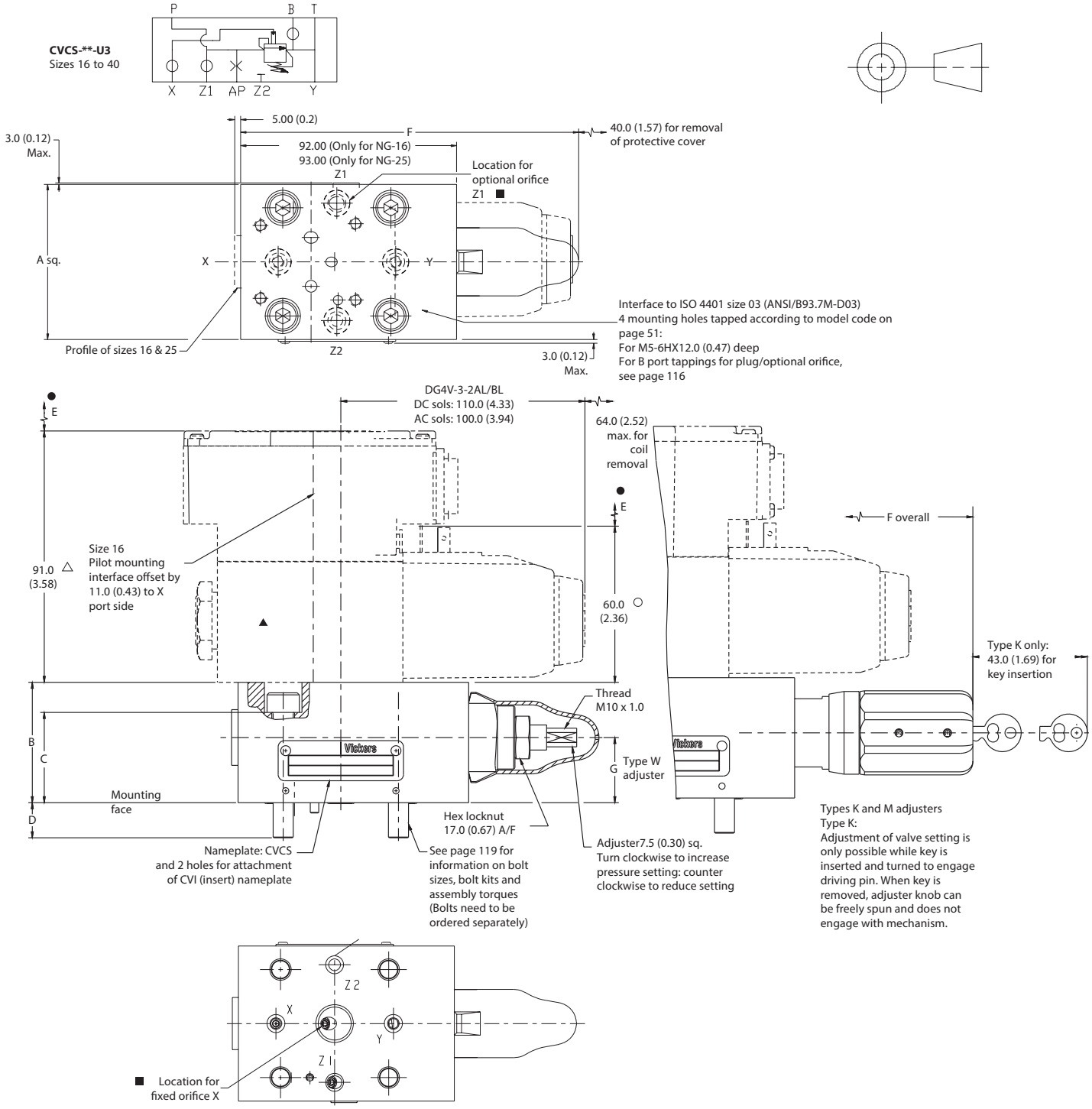
Types K and M adjusters
Type K:
Adjustment of valve setting is only possible while key is inserted and turned to engage driving pin. When key is removed, adjuster knob can be freely spun and does not engage with mechanism.



■ For thread sizes and orifice kits see page 115.
● Maximum clearance for removal of cover from manifold.

Size	A	B	C	D	E	F W	F K&M	G	Location for Nameplates
16	66.0 (2.6)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	10.0 (0.39)	146.0 (5.75)	166.5 (6.56)	26.0 (1.02)	Side Z2
25	86.0 (3.39)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	10.0 (0.39)	147.0 (5.79)	167.5 (6.59)	28.0 (1.10)	Side Z2
32	101.6 (4.00)	52.0 (2.05)	30.0 (1.18)	25.0 (0.98)	10.0 (0.39)	155.6 (6.13)	176.1 (6.93)	35.0 (1.38)	Side Z2
40	126.0 (4.96)	57.0 (2.24)	35.0 (1.38)	25.0 (0.98)	10.0 (0.39)	180.0 (7.09)	200.5 (7.89)	39.0 (1.54)	Side Z2

Unloading/Relief Functions with Electrical Section



■ For thread sizes and orifice kits see page 115.

● Maximum clearance for removal of cover from manifold.

▲ Size 03 pilot control valve to be ordered separately. Recommended mode Vickers by Danfoss DG4V-3.

○ DG4V-3 *with coil type U.*

△ DG4V-3-70

Size	A	B	C	D	E	F W	F K&M	G	Location for Nameplates
16	66.0 (2.6)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	12.0 (0.47)	146.0 (5.75)	166.5 (6.56)	26.0 (1.02)	Side Z2
25	86.0 (3.39)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	147.0 (5.79)	167.5 (6.59)	28.0 (1.10)	Side Z2
32	101.6 (4.00)	60.0 (2.36)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	155.6 (6.13)	176.1 (6.93)	35.0 (1.38)	Side Z2
40	126.0 (4.96)	57.0 (2.24)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	180.0 (7.09)	200.5 (7.89)	39.0 (1.54)	Side Z2

Pressure Reducing Functions

General Information

The basic pressure reducing cartridge features manual adjustment of reduced pressure plus a pilot port for optional remote control. Additional options include electrical selection of high and low pressure, and electrohydraulic proportional control of reduced pressure. Reducing valve arrangements described in this catalog can be built into system manifold assemblies with directional, manually adjustable flow restrictor and pressure relief functions in cartridge form. The reducing function is available in sizes 16, 25, 32 and 40.

Ratings

Maximum operating

Pressure .....420 bar (6090 psi)

Rated flow .....(p = 12 bar / 175 psi)

Size 16.....246 lpm (65 USgpm)

Size 25.....486 lpm (128 USgpm)

Size 32.....730 lpm (193 USgpm)

Size 40.....1150 lpm (304 USgpm)

Pressure adjustment ranges:

1,5 to 125 bar (22 to 1800 psi)

3,0 to 250 bar (44 to 3600 psi)

5,0 to 350 bar (72 to 5000 psi)

10 to 420 bar (145 to 6090 psi),

All ports are rated up to 420 bar (6090 psi), depending on limits for relevant ports in any associated pilot valves or modules. Note that any pressure in port Y is additive to the setting(s) of the integral pilot pressure control(s).

Pressure Reducing Functions

Unlike other cartridge valve inserts, the reducer insert contains a spool rather than a poppet. Therefore, no reference is made to an area ratio in relation to reducing valves. The reducing valve is normally closed. It varies flow to provide a constant outlet pressure below that of the inlet pressure. The pressure differential between inlet and outlet must be at least 5 bar (72 psi) for optimum reduced pressure control for low flows.

System pressure at B is communicated through a compensated flow control in the X or X3 cover into area AP. This flow control maintains a constant flow across the cover poppet, independent of the main flow from B(P1) to A(P2), thereby providing pressure stability at all system flow rates. Load pressure transients are relieved through the check valve located in the insert spool and are limited by the pilot pressure control in the cover.

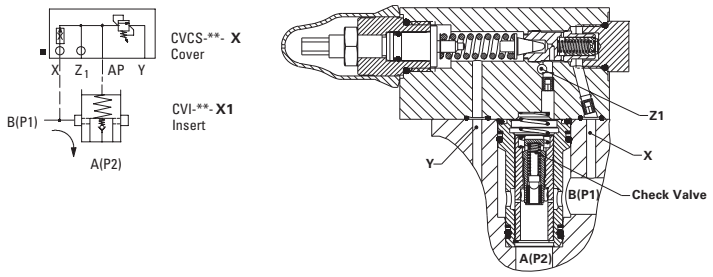
The Z1 port is used for remote control of the reduced pressure. Suitable remote controls are the C-175 and CGR-02. Venting of the Z1 port will cause outlet pressure A(P2) to drop to a minimum pressure related to the spring load in the insert spool. The Z1 port should be blocked when not required. The Y port is used to drain the pilot oil.

Dual reduced pressure functions are available using the model X3 cover and CVGC-3 module. The X3 cover has a mounting pad with an ISO 4401, size 03 (ANSI/B93.7MD03) interface that accepts pilot valve DG4V-3-2AL (two position, spring offset type) or DG4V-3-2N (two-position mechanical detent type). For information on the DG4V-3 valve. Air operated DG18V-3 or DG17V-3 manually operated pilots are also applicable. An electrically modulated proportional pilot is available that can provide infinitely variable reduced pressure settings and a vent condition.

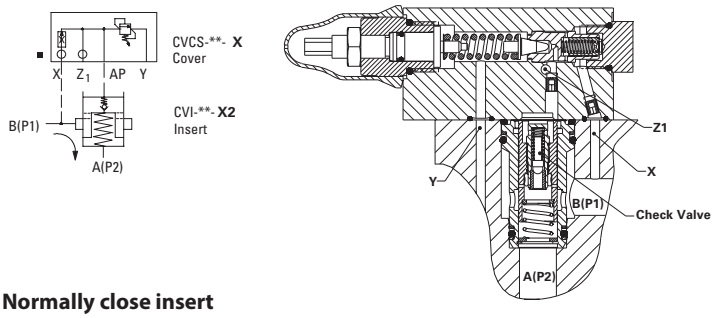
Pressure Reducing with Manual Adjustment and Remote Control: Sizes 16 to 40

Reduced pressure at A(P2) is controlled by the manual adjuster in the cover. Pilot port Z1 is used for remote control. See Figure 32.

■ *This X port orifice/plug tapping not on size 16.*



Normally open insert



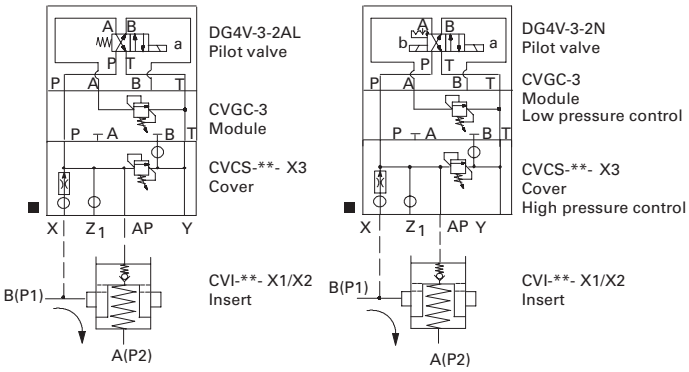
Normally close insert

Figure 32

Dual Level Reduced Pressure by Remote Electrical Selection: Sizes 16 to 40

Alternative arrangements using either the DG4V-3-2AL (two-position, single solenoid, spring-offset) or DG4V-3-2N (double solenoid, two-position detented) pilot valve are shown in Figure 33. Control is at the X3 cover when the DG4V-3-2AL is de-energized or the DG4V-3-2N "b" solenoid is momentarily energized. Control is at the CVGC-3 module, sandwiched between the cover and pilot valve, when the DG4V-3-2AL solenoid "a" is energized or solenoid "a" of the DG4V-3-2N is energized. In each case, the pressure set at the X3 cover should be the higher of the two levels.

■ This X port orifice/plug tapping not on size 16.



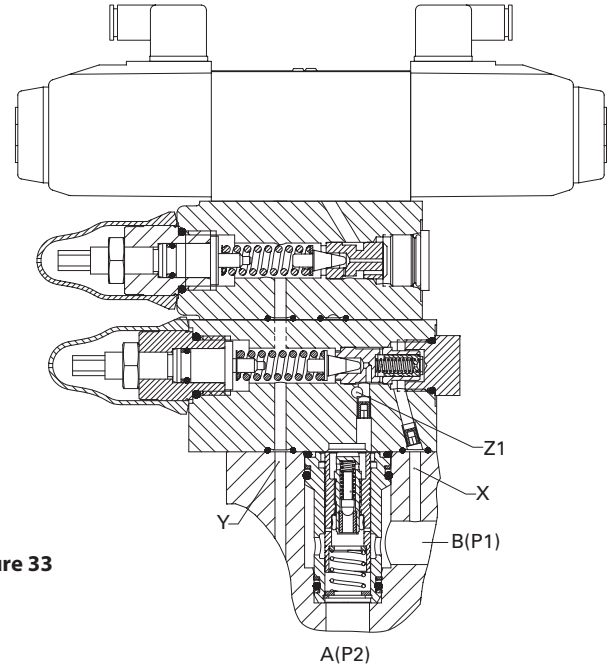
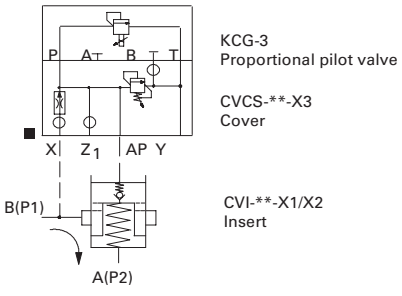


Figure 33

Pressure Reducing Function by Electrohydraulic Proportional Control: Sizes 16 to 40

The electrically modulated pilot controls pressure below the maximum manually set level at the X3 cover. Reduced pressure is proportional to the applied current. Increasing current to the pilot increases the reduced pressure at port A(P2). See Figure 34. The pilot valve can be any of those charted below, depending on the working pressure involved. Electronic controllers to be used with the pilots are also shown. For precise KCG-3 configuration according to pressure range and size of cover being used, please refer to page 66.

Pilot Valve	Maximum Reduced Pressure	Pilot Valve Catalog	Electronic Controller
KCG-3	350 bar (5000 psi)	2162	EEA-PAM-513-A-**
KBCG-3	350 bar (5000 psi)	V-VLPO-MCOO2-E	Internal



■ This X port orifice/plug tapping not on size 16.

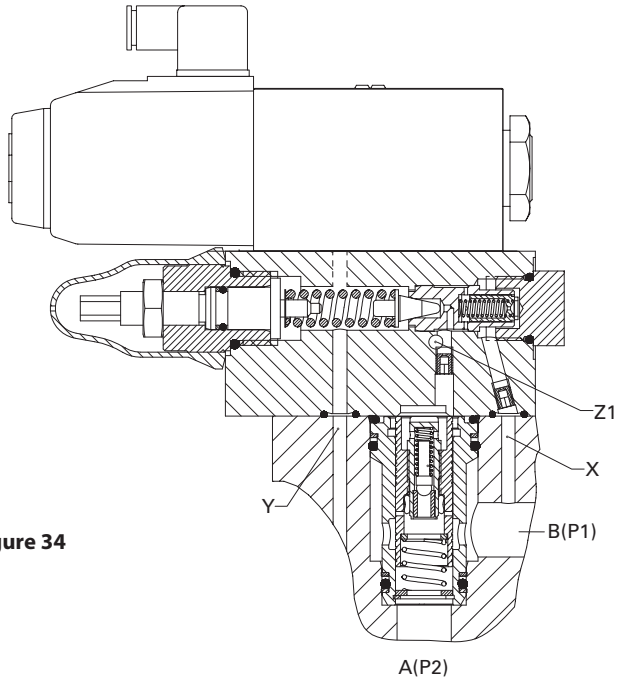


Figure 34

Model Codes - Pressure Reducing Functions

CVCS Covers

Vickers by Danfoss type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and DIN 24342. All features must be specified when ordering; those in brackets () are optional or apply only to specific models.

Metric Models

Metric bolt tappings and orifice threads; SAE plugs.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVCS-**-X*-*-***-*-30-****

CVCS	**	X(3)	*	***	*	30	****
1	2	3	4	5	6	7	8

1 Model

CVCS - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

3 Function

X - Pressure reducing
X3 - Pressure reducing with mounting face for size 03 pilot valve mounting face for size 03 pilot valve

4 Adjuster mechanism

K - micrometer adjuster with key lock
M - micrometer adjuster without key lock
W - wrench adjustment with hex lock nut

5 Adjustable pressure range

125 - 3-125 bar (44-1800 psi)
250 - 5-250 bar (73-3600 psi)
350 - 8-350 bar (116-5000 psi)
420 - 10-420 bar (145-6090 psi)
For proportional control ranges please see page 66

6 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

7 Design number 30 series

See page 115 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Danfoss representative. Non-standard orifice requirements should be defined as follows:

8 Pilot control orifice location and size

See table below for pilot control orifice locations, as per selected 'Function'. The letter 'S' in brackets indicates default factory-fitted 'standard' orifice associated with that location. The letter 'S' should be included in the model code at locations where standard orifice is required. Letter 'Z' in brackets indicates that no orifice plug is fitted, whereas letter 'A' indicates blocked port. Letter 'Z' can be omitted if these are at the end of the model code. To specify non-standard orifice sizes, refer table on page 116.

Function	Location 1	Location 2	Location 3	Location 4
X(3)	AP(S)	X(Z)	B(Z)	Z1(Z)

Letter in brackets to be mentioned in the model code at appropriate orifice location.
Refer pages 6 and 7 for pictorial representation of orifice locations.

Model Codes - Pressure Reducing Functions

CVI Inserts

All features must be specified when ordering; those in brackets ( ) are optional.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVI-**-X-*-60**

CVI	**	X	*	60
1	2	3	4	5

1 Model

CVI - Cartridge valve insert

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

3 Function

X1 - Pressure reducer, normally open, sliding spool

X2 - Pressure reducer, normally closed, sliding spool

4 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

5 Design number 60 series

Note: A nameplate is supplied with each insert for fixing to the cover to identify the insert in use.

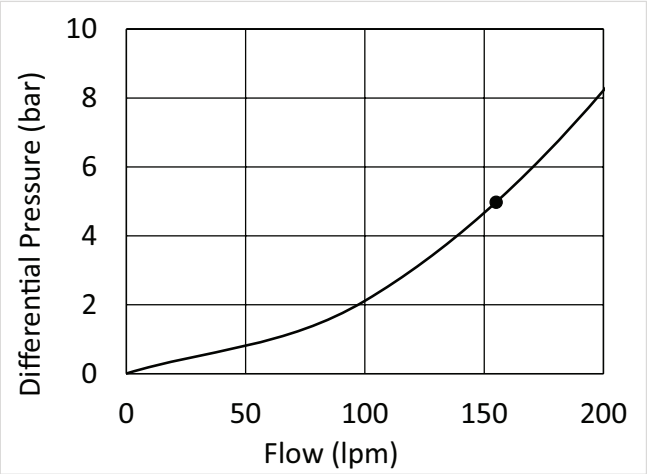
Performance Data - Pressure Reducing Functions

Unless otherwise stated, performances are based on petroleum oil at 36 cSt (168 SUS) and at 50° C (122° F). For pressure drops at other viscosities, see page 118.

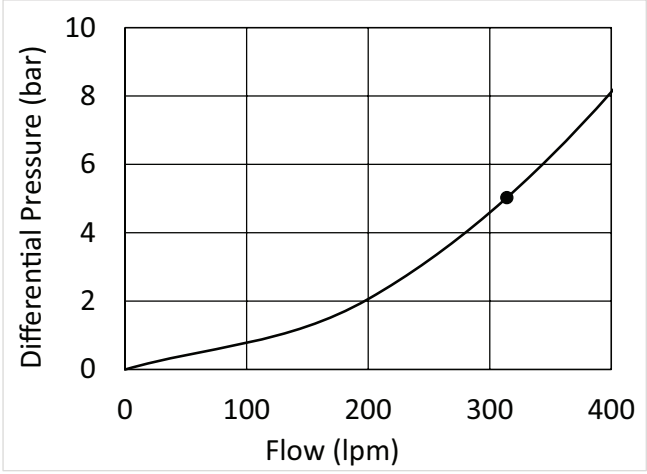
Pressure Drop/Flow (Flow from Port B to A)
Inlet pressure B(P1) = 350 bar (5000 psi)

• = Rated flow point

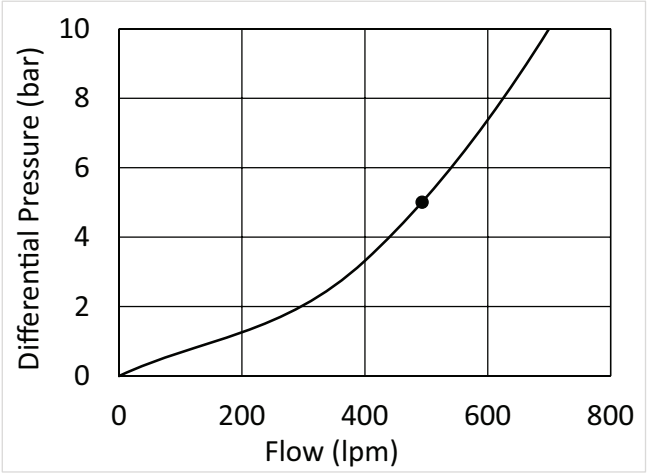
Cover CVCS-16-X*-*-***-30
Insert CVI-16-X1/X2-*-60



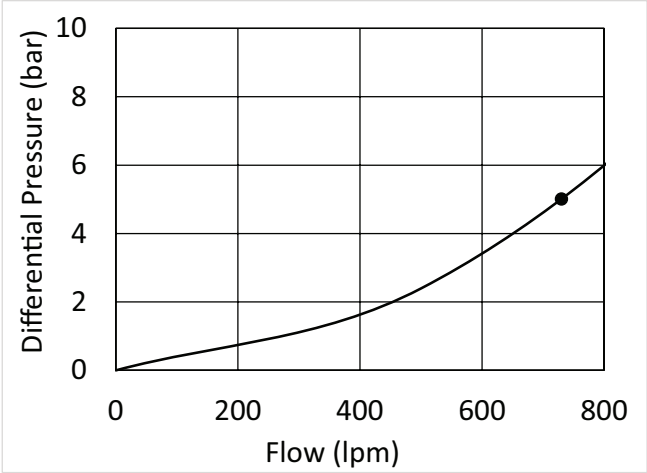
Cover CVCS-25-X*-*-***-30
Insert CVI-25-X1/X2-*-60



Cover CVCS-32-X*-*-***-30
Insert CVI-32-X1/X2-*-60



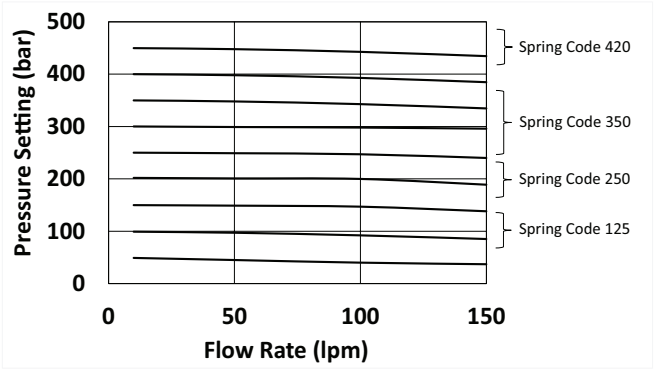
Cover CVCS-40-X*-*-***-30
Insert CVI-40-X1/X2-*-60



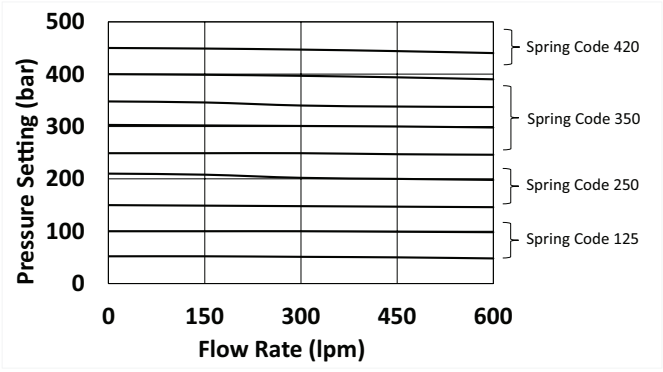
Performance Data - Pressure Reducing Functions

Pressure Underride

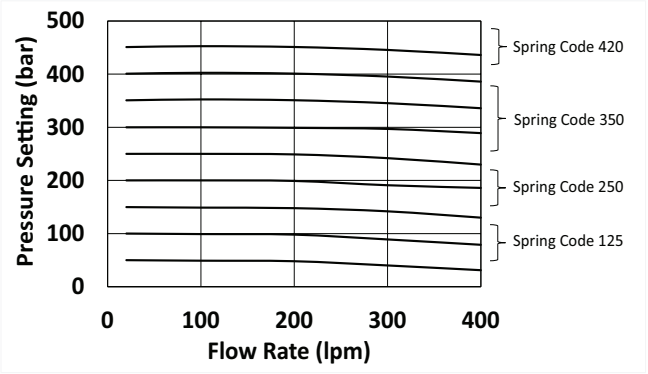
Cover CVCS-16-X-*-***-30
Insert CVI-16-X2-*-60



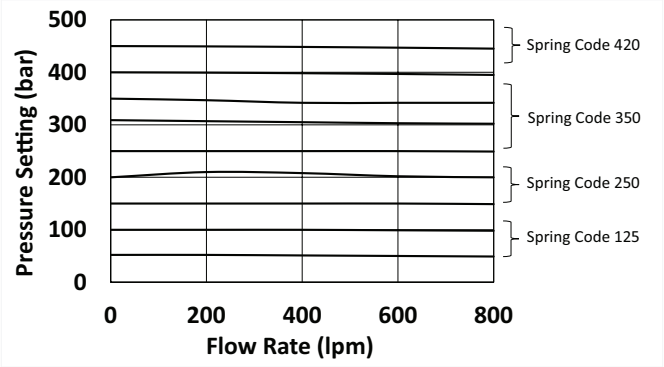
Cover CVCS-25-U-X*-*-***-30
Insert CVI-25-X2-*-60



Cover CVCS-32-X*-*-***-30
Insert CVI-32-X2-*-60



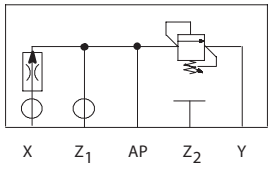
Cover CVCS-40-X-*-***-30
Insert CVI-40-X2-*-60



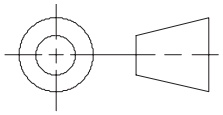
Pressure Reducing Functions

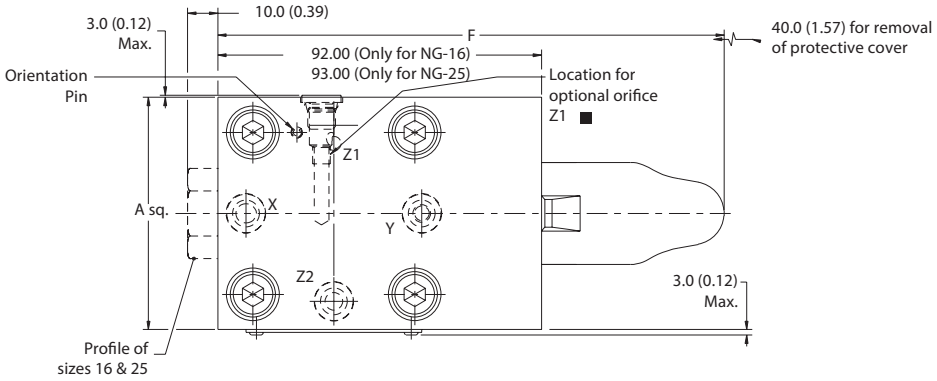
CVCS--X**
Sizes 16 to 40

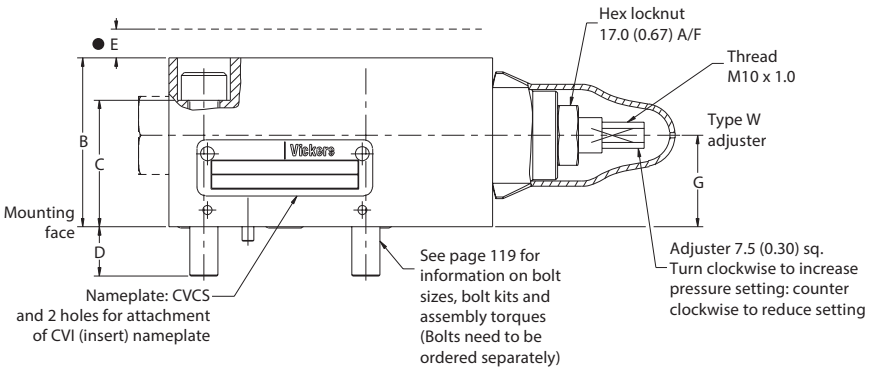
Dimensions
mm (inch)

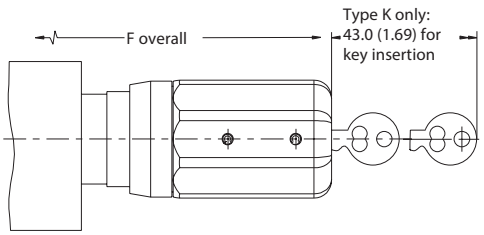


Note: Size 16 does not have X port orifice/plug tapping.

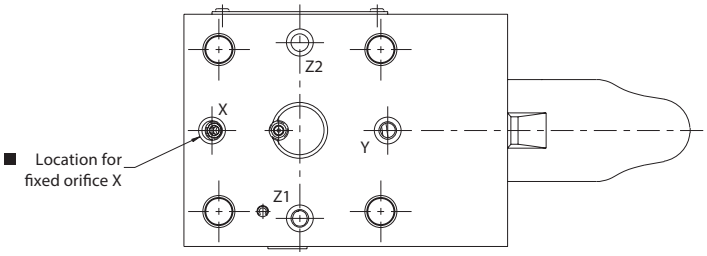








Types K and M adjusters
Type K:
Adjustment of valve setting is only possible while key is inserted and turned to engage driving pin. When key is removed, adjuster knob can be freely spun and does not engage with mechanism.

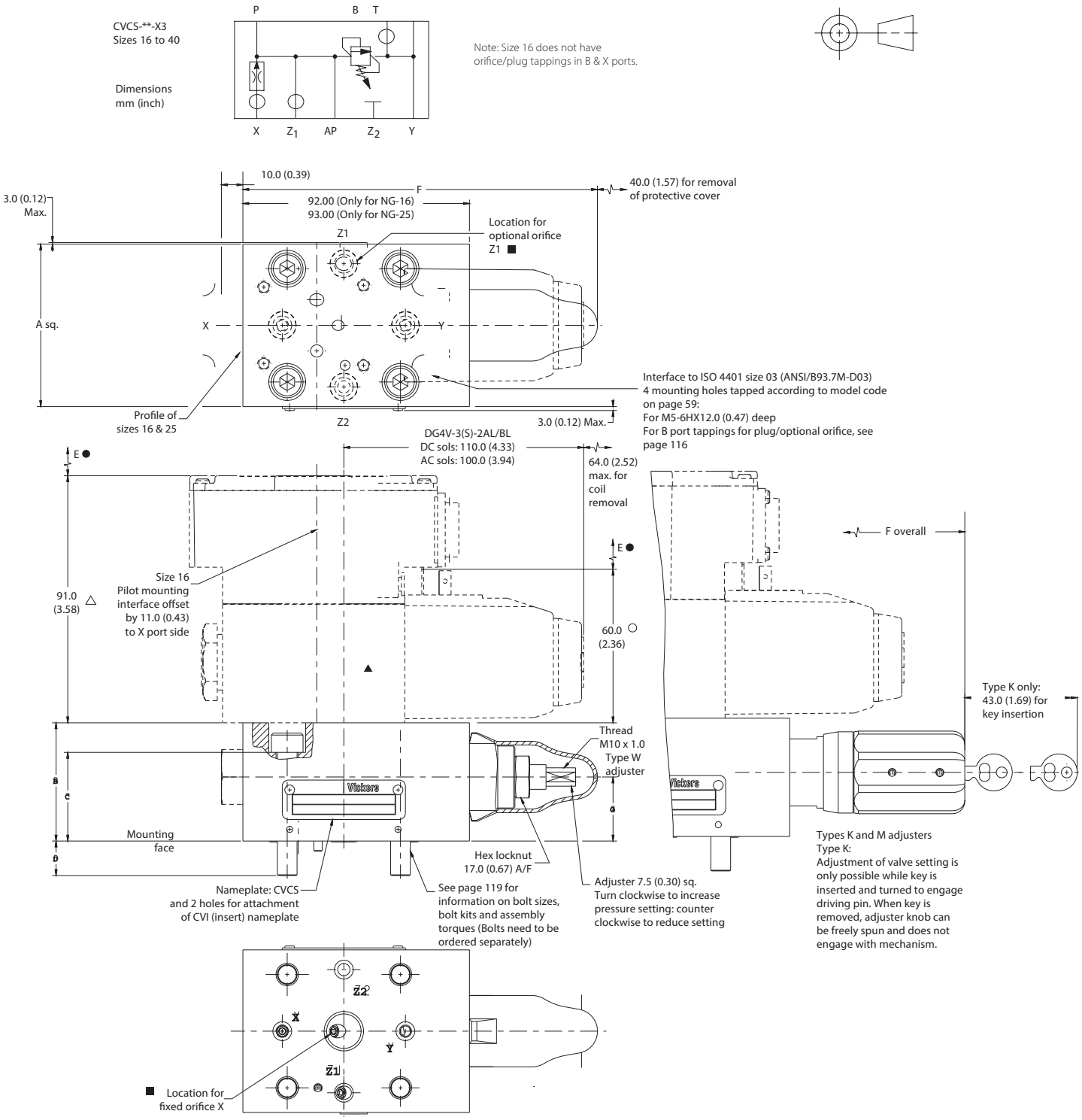


■ *For thread sizes and orifice kits see page 115.*

● *Maximum clearance for removal of cover from manifold.*

Size	A	B	C	D	E	F W	F K&M	G	Location for Nameplates
16	66.0 (2.6)	48.0 (1.89)	26.0 (1.02)	14.0 (0.55)	10.0 (0.39)	146.0 (5.75)	166.5 (6.56)	32.0 (1.26)	Side Z2
25	86.0 (3.39)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	10.0 (0.39)	147.0 (5.79)	167.5 (6.59)	28.0 (1.10)	Side Z2
32	101.6 (4.00)	48.0 (1.89)	35.0 (1.38)	25.0 (0.98)	10.0 (0.39)	155.6 (6.13)	176.1 (6.93)	35.0 (1.38)	Side Z2
40	126.0 (4.96)	48.0 (1.89)	35.0 (1.38)	25.0 (0.98)	10.0 (0.39)	180.0 (7.09)	200.5 (7.89)	30.0 (1.18)	Side Z2

Dual Level Reduced Pressure Functions w/ Electrical Selection



■ *For thread sizes and orifice kits see page 115.*

● *Maximum clearance for removal of cover from manifold.*

▲ *Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.*

○ *DG4V-3 with coil type U.*

△ *DG4V-3-70*

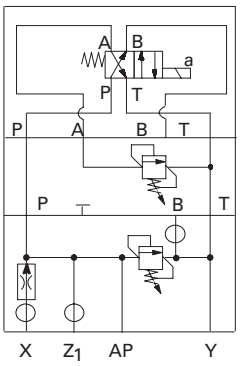
Size	A	B	C	D	E	F W	F K&M	G	Location for Nameplates
16	66.0 (2.6)	48.0 (1.89)	36.0 (1.42)	14.0 (0.55)	12.0 (0.47)	146.0 (5.75)	166.5 (6.56)	30.0 (1.12)	Side Z2
25	86.0 (3.39)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	147.0 (5.79)	167.5 (6.59)	28.0 (1.10)	Side Z2
32	101.6 (4.00)	60.0 (2.36)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	155.6 (6.13)	176.1 (6.93)	35.0 (1.38)	Side Z2
40	126.0 (4.96)	48.0 (1.89)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	180.0 (7.09)	200.5 (7.89)	30.0 (1.18)	Side Z2

Dual Pressure Reducing with Electrical Selection

For dimensions of CVCS-**-X3 covers, and adjustment types, see previous page.

For dimensions of CVGC-3 module see page 114 and for adjustment types see page 34.

Solenoid must be maintained energized for low pressure selection

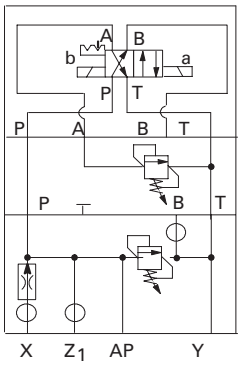


DG4V-3-2AL pilot valve
Energize sol. for low pressure De-energize sol. for high pressure

CVGC-3 module
Low pressure control

CVCS-**-X3 cover
High pressure control

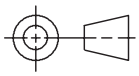
Solenoids can be de-energized after selection



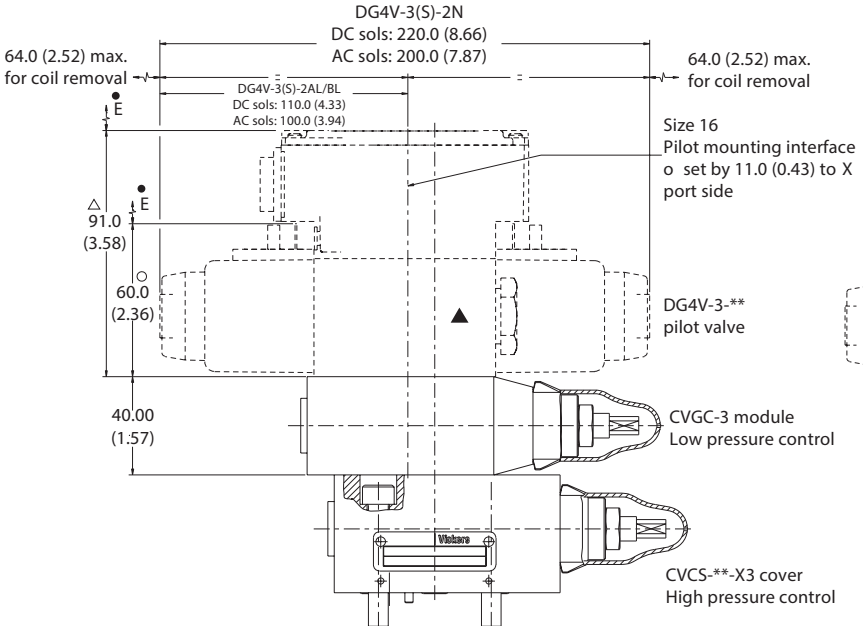
DG4V-3- 2N pilot valve
Energize sol. a for low pressure Energize sol. b for high pressure

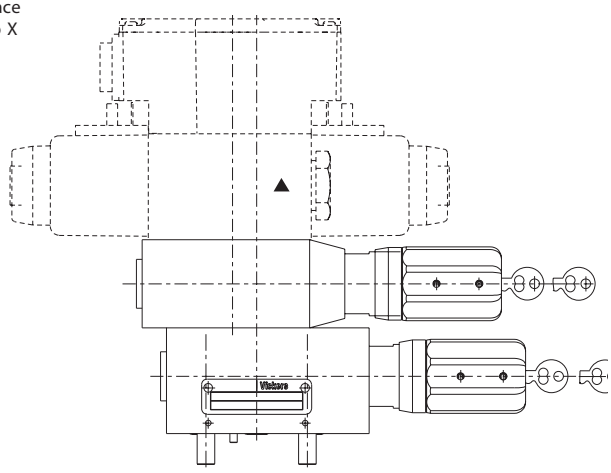
CVGC-3 module
Low pressure control

CVCS-**- X3 cover High pressure control



Arrangement With Type W Adjusters





Arrangement With Types K and M Adjusters

Type K:
Adjustment of valve setting is only possible while key is inserted and turned to engage driving pin. When key is removed, adjuster knob can be freely spun and does not engage with mechanism.

▲*Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.*

● *Minimum clearance for removal of cover from manifold. See table on previous page.*

○ *DG4V-3 with coil type U.*

△ *DG4V-3-70*

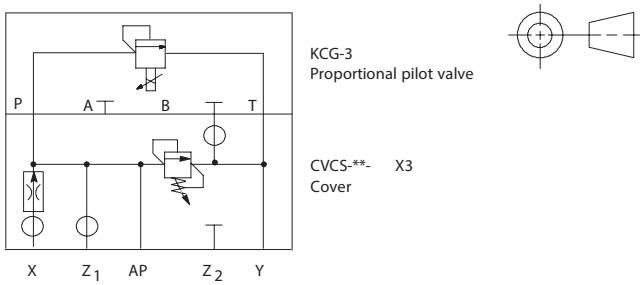
Pressure Reducing Function with Electrohydraulic Proportional Control/KCG-3 Pilot

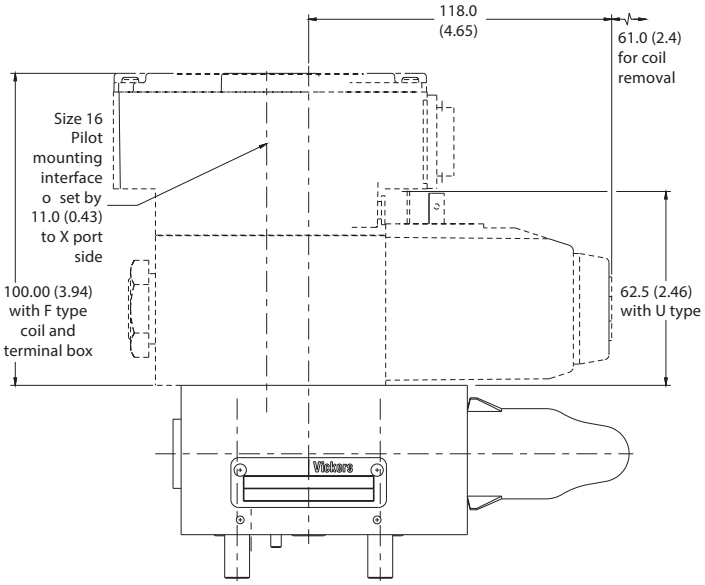
For dimensions of CVCS-**-X3 covers, and adjustment types, see page 64.

CVCS-**-X3 Cover with KCG-3 Pilot Valve

For proportional pressure reducing valves using standard CVCS-**-X3 covers, the correct KCG-3 proportional pilot valve should be selected from the following table according to the size and pressure range being used. The sizing and combination of orifices fitted into these pilot valves have been determined by testing to give good response and stable operation across a wide range of average system parameters using standard covers (i.e. with standard sizes of factory fitted orifices -- see page 115).

Other orifice combinations can be provided to meet individual requirements of customer installations. Please contact your Danfoss representative.





Size	Pressure control range bar (psi)	Cover max. pressure code, see CVCS model code 6 page 59	Pilot valve model code For KCG models add required coil connection and rating (See GB-C-2162 for full model code details of KCG-3)
16	5-40 (72-580)	125	KCG-3-40-D-Z-M---10 (standard)
	6-100 (87-1450)	125	KCG-3-100-D-Z-M---10 (standard)
	8-160 (116-2320)	250	KCG-3-160-D-Z-M---10-P15-T12
	10-250 (145-3625)	250	KCG-3-250-D-Z-M---10-T09
	12-350 (174-5075)	350	KCG-3-350-D-Z-M---10-T09
25	5-40 (72-580)	125	KCG-3-40-D-Z-M---10 (standard)
	6-100 (87-1450)	125	KCG-3-100-D-Z-M---10 (standard)
	8-160 (116-2320)	250	KCG-3-160-D-Z-M---10-T11
	10-250 (145-3625)	250	KCG-3-250-D-Z-M---10-P10L-T12
	12-350 (174-5075)	350	KCG-3-350-D-Z-M---10-P10L-T12
32	5-40 (72-580)	125	KCG-3-40-D-Z-M---10 (standard)
	6-100 (87-1450)	125	KCG-3-100-D-Z-M---10-P18-T18
	8-160 (116-2320)	250	KCG-3-160-D-Z-M---10-P18-T18
	10-250 (145-3625)	250	KCG-3-250-D-Z-M---10-P15-T12
	12-350 (174-5075)	350	KCG-3-350-D-Z-M---10-P15-T12
40	5-40 (72-580)	125	KCG-3-40-D-Z-M---10 (standard)
	6-100 (87-1450)	125	KCG-3-100-D-Z-M---10 (standard)
	8-160 (116-2320)	250	KCG-3-160-D-Z-M---10 (standard)
	10-250 (145-3625)	250	KCG-3-250-D-Z-M---10 (standard)
	12-350 (174-5075)	350	KCG-3-350-D-Z-M---10 (standard)

Dynamic Functions

General Information

Dynamic cartridge valves have been developed for applications which require fast opening and closing times as well as a means of ensuring that the insert/poppet has seated positively.

Inserts are available:

- With seals on the poppet which eliminate internal leakage, ensuring pressure is maintained in pilot port A.
- Without spool seals for fast response with low hysteresis.

Dynamic valves can be built into any system manifold assemblies which require the features offered by this new range, whether for directional or check control function. The inserts are offered with the three springs L, M and H, and the cover comes with or without a stroke limiter. Dynamic range is available in sizes 16 to 63. The inserts have an area ratio of 1:1.05 as seen by the model code CVI-**-ZD105, where Z means dynamic.

Dynamic Functions

Unlike other cartridge valve inserts, the dynamic insert extends above the manifold to allow access to the pilot port. It is this pilot port which pilots the poppet open or closed giving the dynamic feature. The pilot pressure is applied via the Z2 port on the manifold if there is no pilot valve or via the B port on the size 03 interface.

Piloting can be achieved by directly mounting a size 03 directional valve on the mounting pad with an ISO 4401, size 03 (ANSI/B93.7M-D03) interface which accepts any of the DG4V-3 valves. The Z2 port is used for remote control of the dynamic insert.

The dynamic insert can only be used with the special dynamic cover. The cover can also be offered with a stroke limiter for those applications where it is required to limit the stroke and hence the flow of the relevant insert. Dynamic function is suited for directional or check control functions requiring fast response.

Basic Characteristics

Maximum operating pressure.....420 bar (6090 psi)

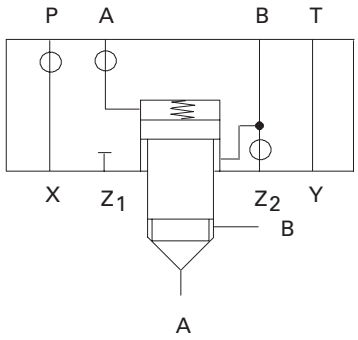
Maximum flow rate (Δp = 5 bar/72 psi):

ISO 7368 (DIN 24342)	A to B	B to A
06 (NG16)	316 lpm (83 US gpm)	298 lpm (79 US gpm)
08 (NG25)	679 lpm (179 US gpm)	634 lpm (167 US gpm)
09 (NG32)	1435 lpm (379 US gpm)	1335 lpm (353 US gpm)
10 (NG40)	2043 lpm (540 US gpm)	1905 lpm (503 US gpm)
11 (NG50)	1800 L/min (476 USgpm)	1560 L/min (412 USgpm)
12 (NG63)	3000 L/min (793 USgpm)	2600 L/min (687 USgpm)

All ports are rated up to 420 bar (6090 psi) depending on limits for relevant ports in any associated pilot valves or modules.

Functional Symbols

Cover CVCS-**-ZD3-*-20
Insert CVI-**-ZD(N)105-*-*-20



Cover CVCS-**-ZDA*-W-*-20
Insert CVI-**-ZD(N)105-*-*-20

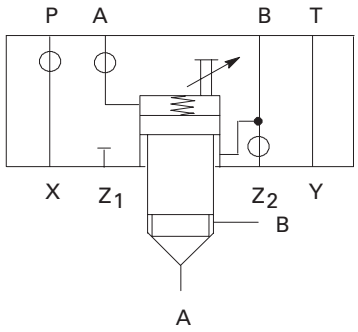


Figure 35

Features and Benefits

- Opening and closing independent of A and B port pressure.
- Positive closing using pilot pressure.
- High degree of control and repeatability.
- Smooth and accurate operation can be achieved (not affected by main flow).
- Fully interchangeable with conventional cartridges.
- Varied circuit application uses: pilot operated check, prefill valve, decompression valve, flow control valve, etc.
- Zero internal pilot leakage option: ZD105.
- Low hysteresis, fast response option: ZDN105.

Cover CVCS-**-ZD3-*-20
Insert CVI-**-ZD(N)105-*-*-20

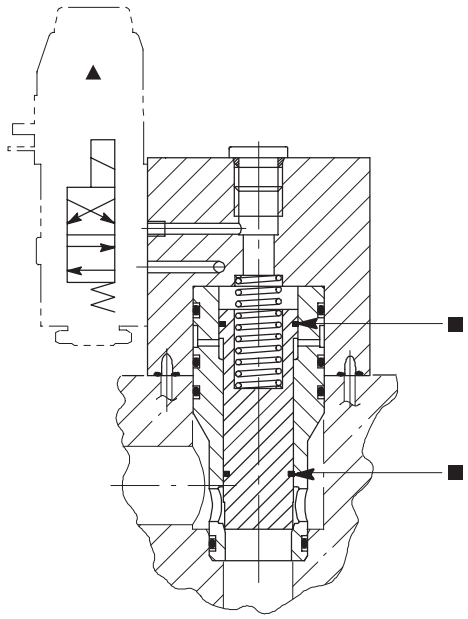


Figure 36

Cover CVCS-**-ZDA3-W-*-20
Insert CVI-**-ZD(N)105-*-*-20

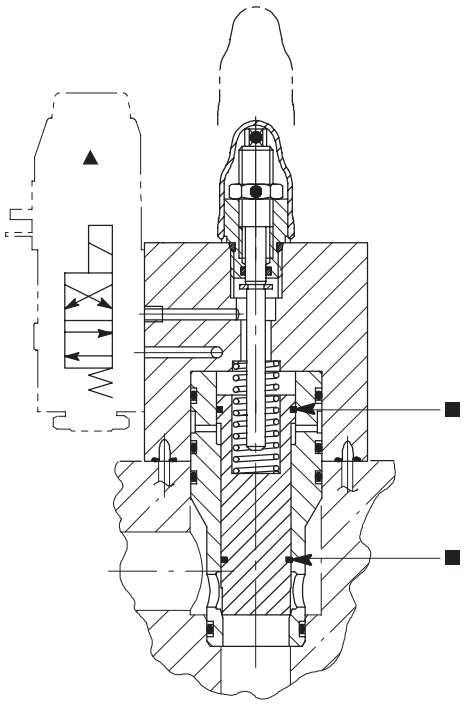


Figure 37

■ *For fast response model CVI-**-ZDN105--- these seals are omitted.*

▲ *Size 03 pilot control valve to be ordered separately. Recommended model Vickers DG4V-3.*

Maximum Leakage

Seat leakage A to B port when spool is held closed.

Size	Max. leakage at 100 bar (1450 psi) cm^3/min (in^3/min)
16	0.15 (0.009)
25	0.20 (0.012)
32	0.28 (0.017)
40	0.35 (0.021)
50	0,40 (0.024)
63	0,55 (0.033)

With spool seals omitted (ZDN105) leakage between spring, pilot chambers and B port is as follows.

Size	Max. leakage at 350 bar (5000 psi) cm^3/min (in^3/min): AP to BP or BP to AP	BP to B or B to BP
16	650 (40)	30 (1.83)
25	700 (43)	40 (2.44)
32	800 (49)	50 (3.05)
40	1400 (86)	60 (3.64)
50	1700 (104)	80 (4.86)
63	2000 (122)	90 (5.46)

With spool seals fitted (ZD105) there is no leakage between AP and BP, or between BP and B.

Area ratio	A_A	:	A_B	:	A_{BP}	:	A_{AP}
Size 16	1	:	0.05	:	0.40	:	1.45
Sizes 25-63	1	:	0.05	:	0.30	:	1.35

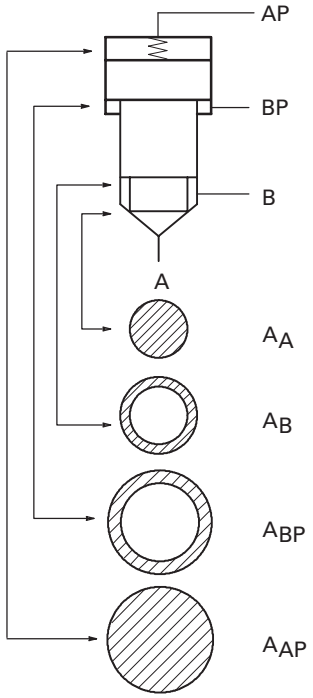


Figure 38

Areas and Strokes

Valve size	Area mm2 (in^2) A_A	A_B	A_{BP}	A_{AP}	Stroke mm (in)
16 (06)	203,58 (0.3155)	9,92 (0.154)	78,17 (0.1212)	291,67 (0.4521)	8,00 (0.315)
25 (08)	467,59 (0.7248)	22,79 (0.0353)	141,80 (0.2198)	632,18 (0.9799)	9,00 (0.354)
32 (09)	764,54 (1.1850)	39,06 (0.0605)	229,66 (0.3560)	1033,26 (1.6016)	11,00 (0.433)
40 (10)	1256,64 (1.9478)	62,78 (0.0973)	376,25 (0.5832)	1695,67 (2.6283)	14,50 (0.571)
50 (11)	2022,84 (3.1354)	99,57 (0.1543)	608,32 (0.9429)	2730,73 (4.2326)	19,00 (0.748)
63 (12)	3257,33 (5.0489)	162,21 (0.2514)	970,68 (1.5046)	4390,22 (6.8049)	25,00 (0.984)

Calculation of Pilot Flow Rate for Given Response Time, t secs:

1. Metric Units

$$\text{Flow rate AP} = \frac{\text{Area } A_{AP}, \text{ mm}^2}{100} \times \frac{\text{Stroke, mm}}{10} \times \frac{60}{t} = \text{cm}^3\text{/min}$$

$$\text{Flow rate BP} = \frac{\text{Area } A_{BP}, \text{ mm}^2}{100} \times \frac{\text{Stroke, mm}}{10} \times \frac{60}{t} = \text{cm}^3\text{/min}$$

2. Inch Units

$$\text{Flow rate AP} = \text{Area } A_{AP}, \text{ in}^2 \times \text{Stroke, in} \times \frac{60}{t} = \text{in}^3\text{/min}$$

$$\text{Flow rate BP} = \text{Area } A_{BP}, \text{ in}^2 \times \text{Stroke, in} \times \frac{60}{t} = \text{in}^3\text{/min}$$

Note:
The required piloting pressures and the actual response time will be influenced by:

1. Spring force (closing force)
2. Pressures acting on main ports A and B (opening forces)
3. Flow forces

Model Codes - Dynamic Functions

CVCS Covers

Vickers by Danfoss type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and DIN 24342. All features must be specified when ordering; those in brackets () are optional or apply only to specific models.

Metric Models

Metric bolt tappings and orifice threads; UNF plugs.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVCS-**-ZD*3-*-*-20-*****

CVCS	**	ZD(A)3	(W)	*	20	***
1	2	3	4	5	6	7

1 Model

CVCS - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

3 Function

ZD3 - Dynamic with mounting face for size 03 pilot valve

ZDA3 - Dynamic with stroke limiter and mounting face for size 03 pilot valve

4 Adjuster mechanism

For model type ZDA(3) only

W - Wrench adjustment with hex locknut

5 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

6 Design number 20 series

See page 115 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Danfoss representative. Non-standard orifice requirements should be defined as follows:

7 Pilot control orifice location and size

See table below for pilot control orifice locations, as per selected 'Function'. The letter 'S' in brackets indicates default factory-fitted 'standard' orifice associated with that location. The letter 'S' should be included in the model code at locations where standard orifice is required. Letter 'Z' in brackets indicates that no orifice plug is fitted, whereas letter 'A' indicates blocked port. Letter 'Z' can be omitted if these are at the end of the model code. To specify non-standard orifice sizes, refer table on page 116.

Function	Location 1	Location 2	Location 3
ZDA(3)	P(Z)	A(Z)	Z2(Z)

Letter in brackets to be mentioned in the model code at appropriate orifice location.

Refer pages 6 and 7 for pictorial representation of orifice locations.

Model Codes - Dynamic Functions

CVI Inserts

All features must be specified when ordering; those in brackets ( ) are optional.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVI-**-ZD*105-*-*-20**

CVI	**	ZD(N)105	*	*	20
1	2	3	4	5	6

1 Model

CVI - Cartridge valve insert

2 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

3 Function

ZD105 - 1:1.05 ratio dynamic (with piston seals to ensure zero control port leakage)

ZDN105 - 1:1.05 ratio dynamic (without piston seals for fast response and low hysteresis)

4 Cracking pressure, bar (psi)

For models ZD105

L - 1.0 (14.5)
M - 2.5 (36.3)
H - 4.5 (62.2)

For models ZDN105

L - 0.5 (7.3)
M - 2.0 (29)
H - 4.0 (58)

5 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

6 Design number 20 series

Note: A nameplate is supplied with each insert for fixing to the cover to identify the insert in use.

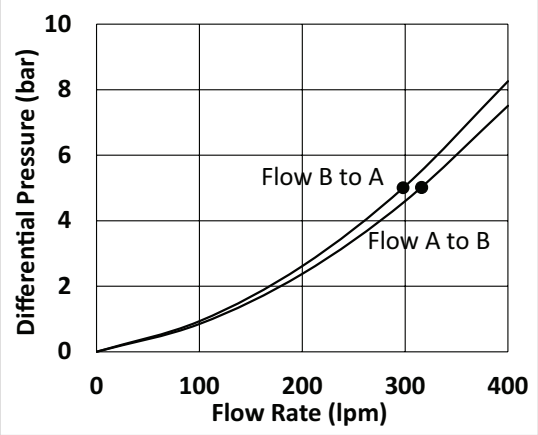
Performance Data - Dynamic Functions

Unless otherwise stated, performances are based on petroleum oil at 36 cSt (168 SUS) and at 50° C (122° F). For pressure drops at other viscosities, see page 118.

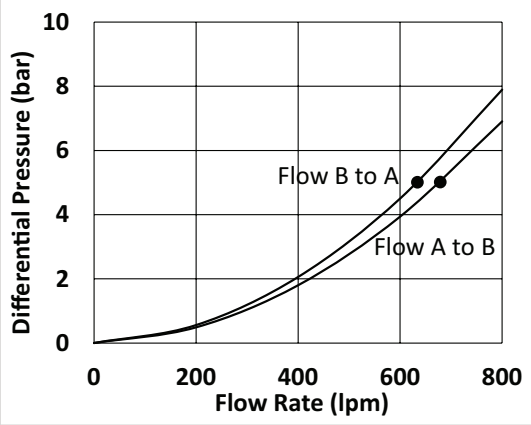
Pressure Drop Through Insert

• = Rated flow point

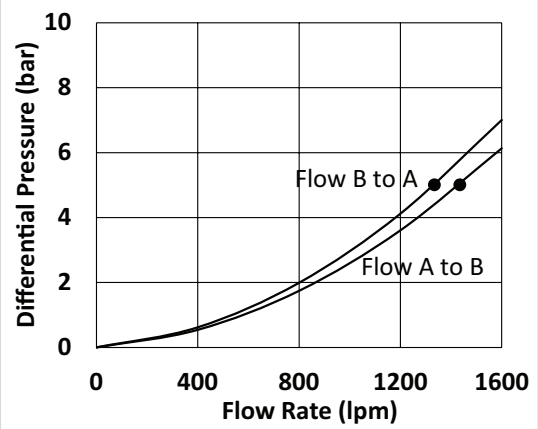
CVI-16-ZD(N)105-*-*-20



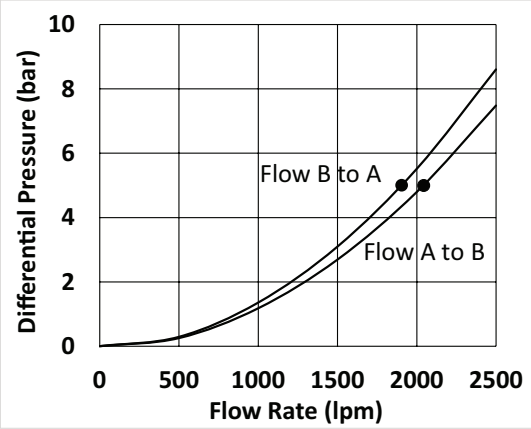
CVI-25-ZD(N)105-*-*-20



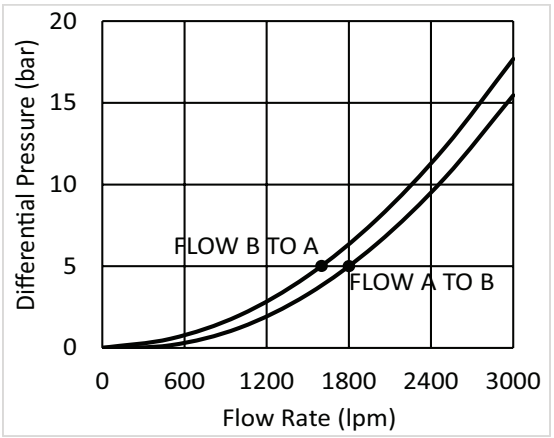
CVI-32-ZD(N)105-*-*-20



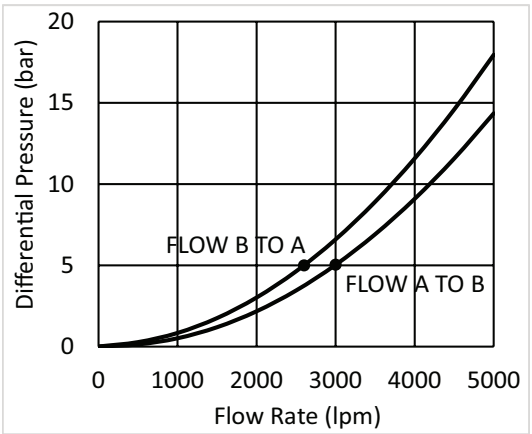
CVI-40-ZD(N)105-*-*-20



CVI-50-ZD(N)105-*-1*

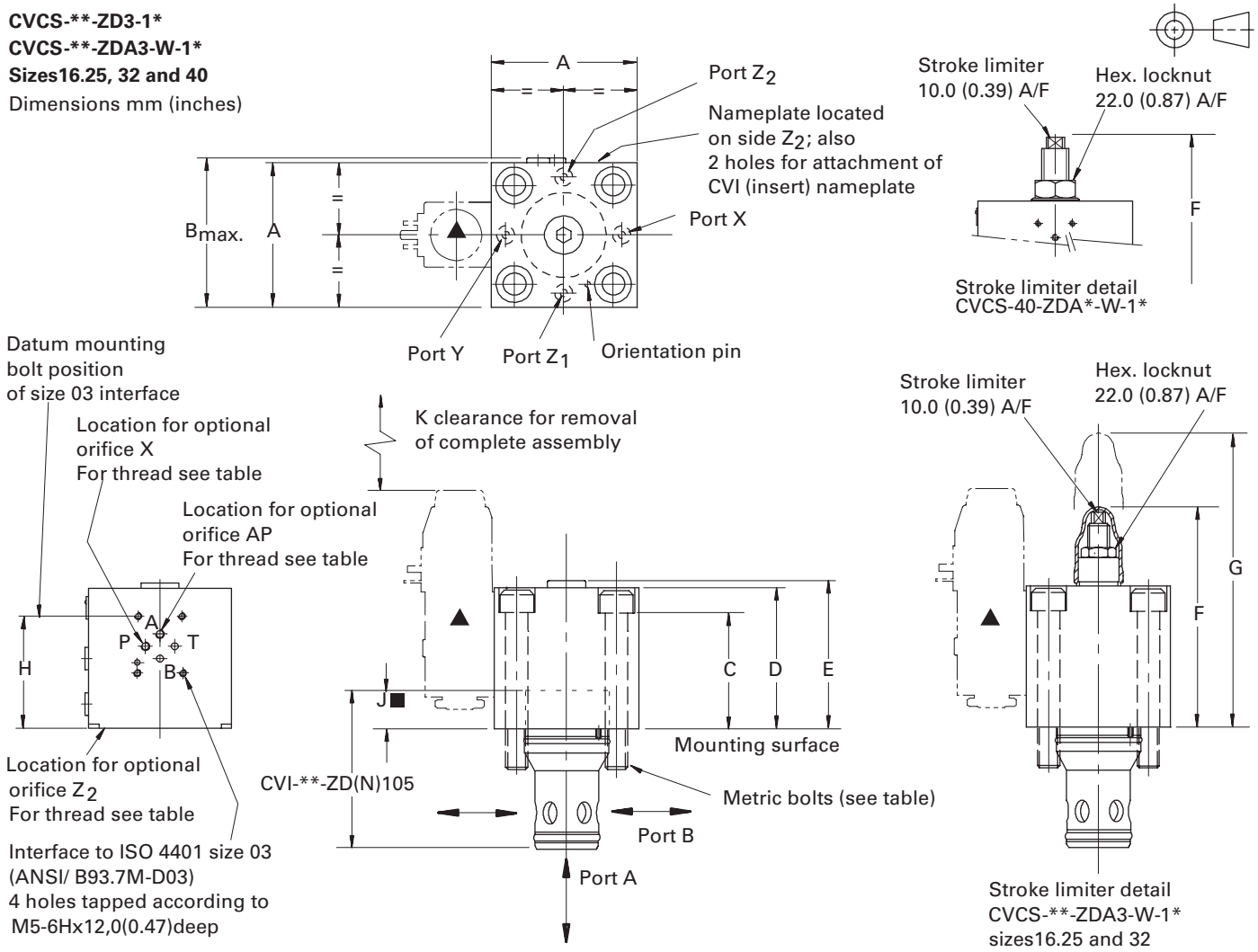


CVI-63-ZD(N)105-*-1*



Dynamic Functions

CVCS--ZD3-1***
CVCS--ZDA3-W-1***
Sizes16.25, 32 and 40
Dimensions mm (inches)

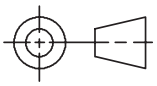


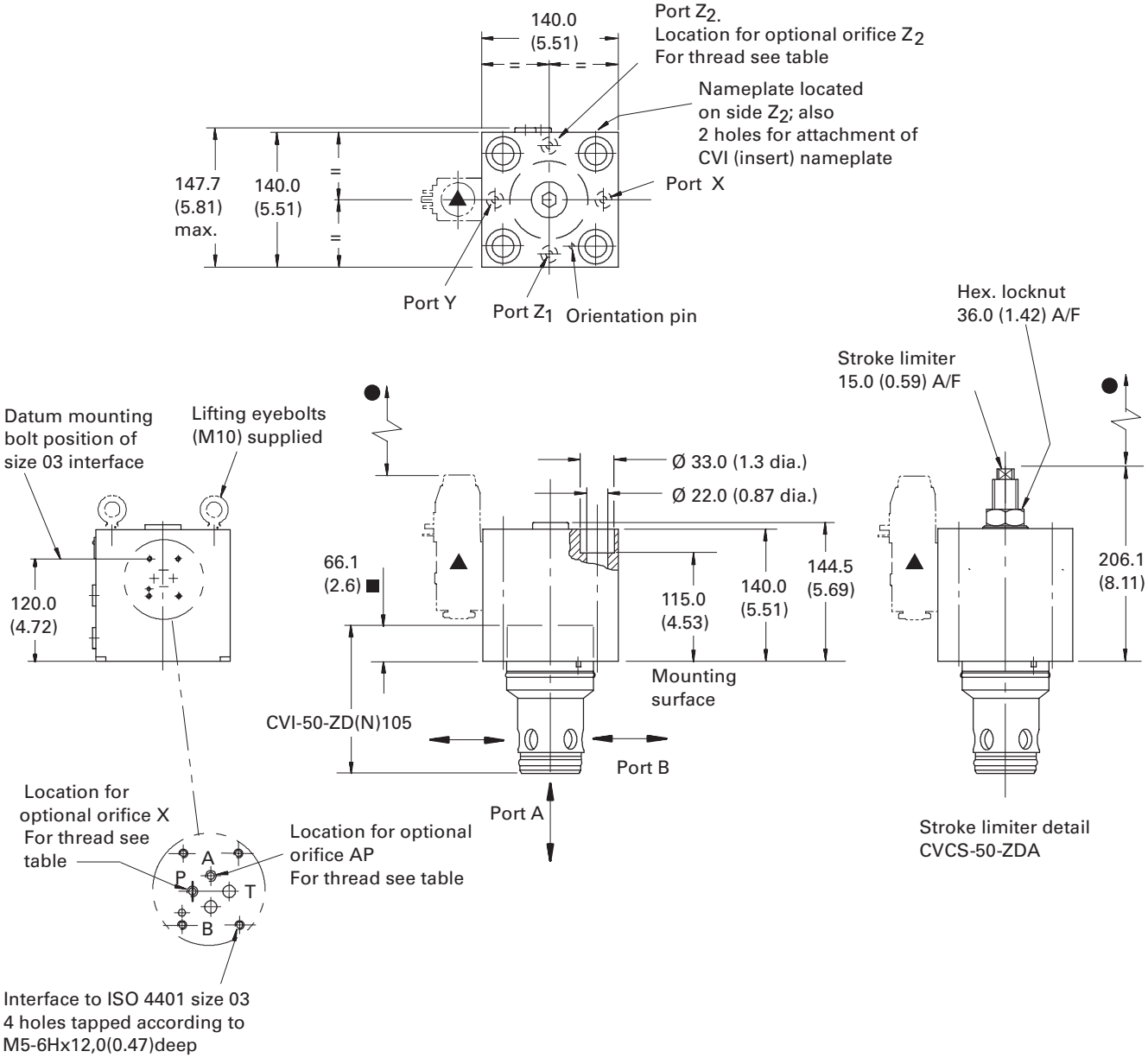
▲*Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.*

■*Recess in cover for insert engagement.*

Dim.	Valve Size 16	25	32	40
A	65,0 (2.56)	85,0 (3.35)	02,0 (4.02)	125,0 (4.92)
B	68,8 (2.71)	89,0 (3.50)	106,0 (4.17)	129,0 5.08)
C	85,0 (3.35)	81,0 (3.19)	82,0 (3.23)	95,0 (3.74)
D	95,0 (3.74)	100,0 (3.94)	100,0 (3.94)	120,0 4.72)
E	99,0 (3.90)	103,5 (4.07)	103,5 (4.07)	124,3 4.89)
F	119,0 (4.68)	139,0 (5.47)	156,0 (6.14)	186,6 7.35)
G	175,1 (6.89)	211,1 (8.31)	241,1 (9.49)	–
H	75,5 (2.97)	80,0 (3.15)	80,0 (3.15)	95,0 (3.74)
J	34,0 (1.34)	38,1 (1.5)	41,1 (1.62)	55,15 2.17)
K	56,1 (2.21)	72,1 (2.84)	85,1 (3.35)	105,1 4.14)
Bolts	4 x M8 x 100	4 x M12 x 100	4 x M16 x 110	4 x M20 x 130
Bolt torque	35 Nm (26 lbf ft)	110 Nm (81 lbf ft)	285 Nm (210 lbf ft)	500 Nm (370 lbf ft)

CVCS-50-ZD3-B2-1*
CVCS-50-ZDA3-B2-W-1*
Dimensions mm (inches)



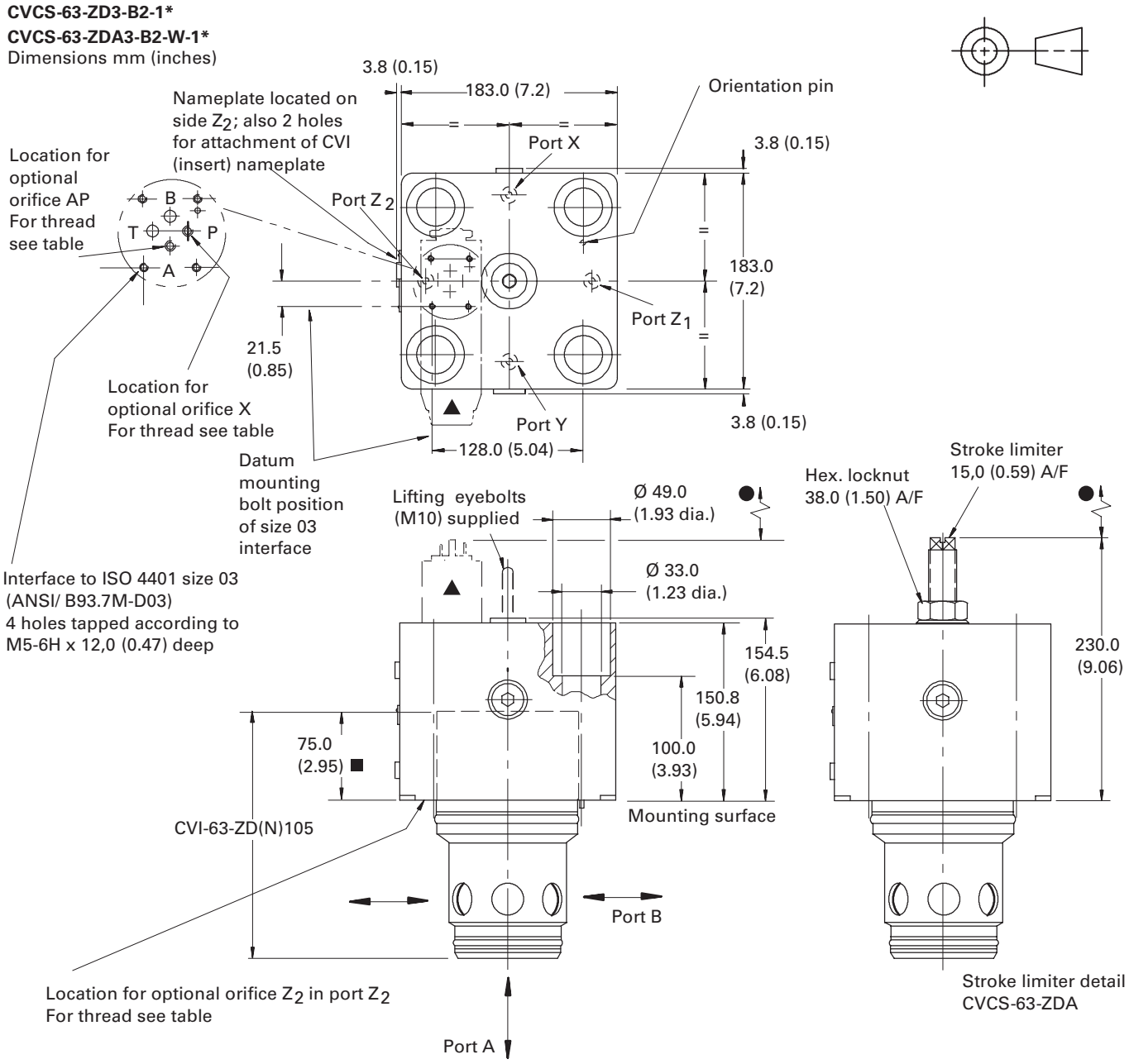


● *122,1 (4.81) clearance for removal of complete assembly.*

▲ *Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.*

■ *Recess in cover for insert engagement.*

CVCS-63-ZD3-B2-1*
CVCS-63-ZDA3-B2-W-1*
Dimensions mm (inches)



● *155,1 (6.11) clearance for removal of complete assembly.*

▲ *Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3(S), see GB-C-2015.*

■ *Recess in cover for insert engagement.*

General Description

Eaton's Vickers® HFV (Hydraulic Feedback Valvistor®) range of slip-in cartridge valves uses a self-regulating hydraulic design for the control of flow rate by a current-controlled PWM signal. The design achieves servo-type control of the main poppet without using an electrical feedback transducer.

The construction and features of these valves open up a wide range of applications with hydraulic cylinders and motors. Such applications include ie casting, deep drawn presses, injection molding, container handling, shovel loaders, forestry and dump trucks. With the addition of HFV valves to the established ISO 7368 (DIN 24342) cartridge valves, Eaton has further enhanced an already comprehensive range.

Valvistor Technology

In "Valvistor" designs a main poppet amplifies a small flow through the pilot circuit, comparable to a transistor. Thus the name "Valvistor", derived from "valve" and "transistor". Figures 39 and 40 show the construction of proportional throttles to ISO 7368. In both cases a Vickers type KTG4V-3S proportional valve is used as the pilot control valve. KBTG4V-3S-EN427 (refer catalog V-VLDI-MS-04-E) & KBFTG4V-3S-EN427 (refer catalog V-VLPO-MC007-E1) can also be used as pilot valves. Hydraulic position feedback is obtained by providing the main poppet with a longitudinal slot (5) in its cylindrical surface. This slot, together with a metering edge inside the sleeve, forms a variable orifice between the inlet of the valve and the volume above the main poppet (3). When the valve is closed and the main poppet is seated, the variable orifice area is almost closed.

Figure 39
Construction for flow direction A to B; poppet in the closed (no flow) condition. (Note: For flow A-B, poppet drilled from A.)

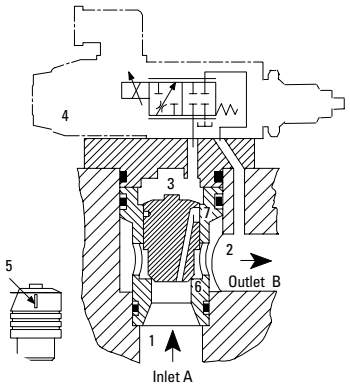
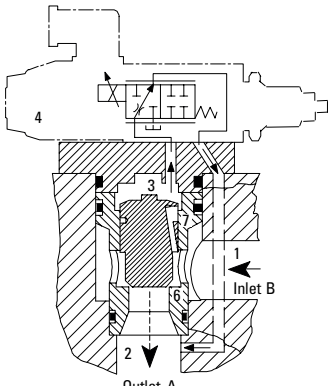


Figure 40
Construction for flow direction B to A; poppet partially open. (Note: For flow B-A, poppet drilled from B.)



Basic Characteristics

Nominal Sizes:

ISO 7368	DIN 24342
06	NG16
08	NG25
09	NG32
10	NG40
11	NG50
12	NG63

Maximum operating pressure .....350 bar (5000 psi)
Flow ratings..... up to 2160 L/min (571 USgpm)

Catalog data based on pilot valve KTG4V-3S-EN427.

As the main poppet opens, the variable orifice area increases. The slot is a part of one leg of a hydraulic bridge circuit and provides an internal position feedback. With the pilot throttle valve closed (figure 39), there is no pilot flow through the closed-off slot in the seated poppet. The pressure above the main poppet (3) is equal to the pressure at the valve inlet (1), due to the controlled small opening at the variable orifice. As the upper area of the poppet is greater than the area facing the inlet (1), the poppet is held against its seat (6) by a force proportional to the difference between valve inlet and outlet pressures.

Opening the pilot throttle valve (figure 40) lowers the pressure in volume (3) allowing the main poppet to move off its seat. As this occurs the slot passes the metering edge (7), opening the variable orifice and allowing flow through the pilot circuit. Initially the flow through the pilot valve equals the flow through the slot plus the volume displaced by the opening movement of the main poppet. The main poppet moves upwards until the pressure drops across the slot and the pilot effects a force balance on the poppet. The poppet is then held in a steady-state condition with equal flow across the slot and the pilot.

If the flow through the pilot valve is reduced (by reducing the command current to the solenoid), the force balance of the main poppet is again disturbed and the main poppet moves downwards reducing the slot area and decreasing flow to the upper chamber until the force balance is restored. Thus by controlling flow through the pilot valve, the main poppet can be controlled in any position from fully closed to fully open. In this manner a very simple, effective servo-control of the main poppet is obtained. If the outlet pressure exceeds inlet pressure when the pilot valve is closed, the main poppet allows reverse flow (see CVCS model code). The main valve function is determined by the type of pilot fitted.

If pressure compensation is added to the pilot stage, the complete valve is pressure compensated. If a pilot relief valve is fitted, the main stage operates as a relief valve. As the pilot flow is returned to the valve outlet (i.e. no "drain" connection) the valve is energy efficient. Therefore the position of the main poppet is controlled by a closed-loop system with a variable orifice in the poppet acting as the internal position feedback element. The command signal in this feedback system is pilot flow, as set at the proportional pilot throttle valve (4).

Features and Benefits

The HFV range with its simplicity, cost effectiveness and performance level can be applied in almost all applications from high performance industrial areas such as injection molding to those applications just requiring proportional functionality.

The data in this catalog is based on the specially developed proportional pilot KTG4V-3S-60-EN427. The functional flexibility of the Valvistor may be extended by the use of different pilots like KBTG4V-3S-60-EN427, KBFTG4V3-3S-60-EN427. Contact Eaton for application assistance.

In addition, the HFV range offers:

Unequalled simplicity	No inner electrical feedback loop and associated electronics
Two models: for flow direction A to B or B to A	Provides system design options and flexibility
Free flow in reverse direction	Provides system design options and flexibility
Poppet valve construction	Provides tight shut-off and load holding
Internal pilot flow	Simple installation and energy efficient
Very fast response	Provides the system designer with high dynamic acceleration/velocity/deceleration profiles for demanding performance requirements such as: • Cylinder position control including lift/lower • Rotary actuator dynamic control • Velocity profile control
Smooth closing and opening	Shock-free start-up and shut-off allow high velocities to be maintained for longer periods, thus reducing cycle times
Low hysteresis	8% to 1% depending on pilot valve used
Integral feedback	Internal hydraulic feedback provides effective, low-cost position control of main poppet
Repeatability	Provides repeatable and accurate actuator velocity to a given operator command input
Electrical operation	Current-controlled PWM signal
Pressure compensation	Can be achieved by pressure compensating pilot stage only
Cost-effective design	Provides multiple functions such as pressure compensation, flow control and reverse free flow check valve
Optional manual override	Pin design
Compatible with antiwear hydraulic oils and phosphate esters (non alkyl)	Flexible application for broad range of installations
Electrical connections DIN or conduit box	Provides design flexibility to meet OEM or user preference

Inherent benefits of Eaton cartridge valve technology are applicable to the Valvistor range.

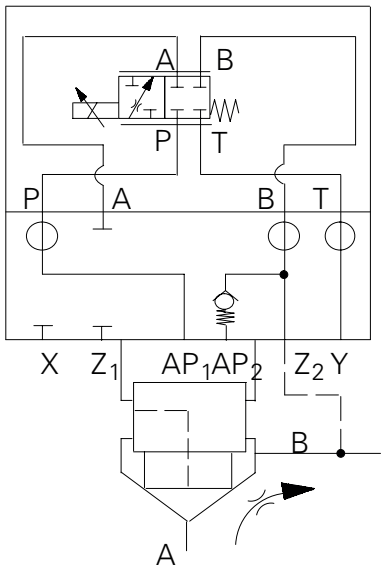
Functional Symbols Valvistor® Proportional Throttle Valves

Complete valve assembly comprises insert, cover and proportional solenoid operated pilot valve (pilot valve to be specified and ordered separately).

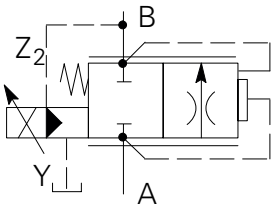
Models without free reverse flow capability
Use cover type CVCS-**-HFV*-**W**-*2(9)-1*

Direction of controlled flow

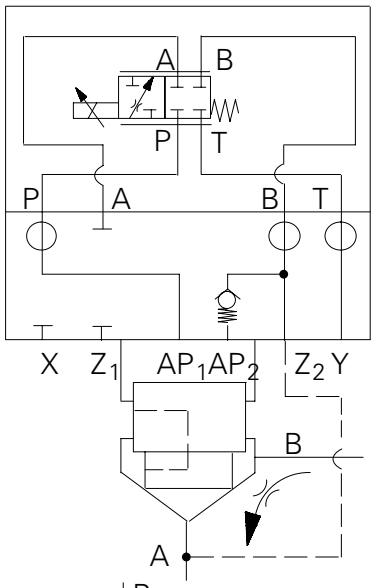
A to B
Use insert type CVI-**-HFV-20-**A**-***-1*

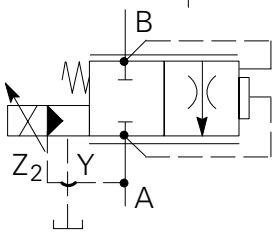


Simplified symbol

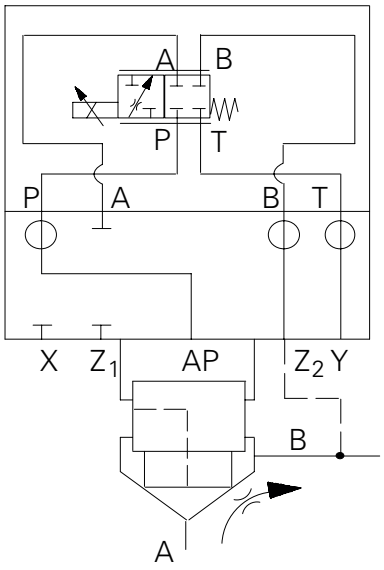


B to A
Use insert type CVI-**-HFV-20-**B**-***-1*

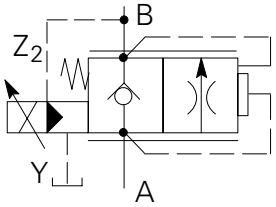


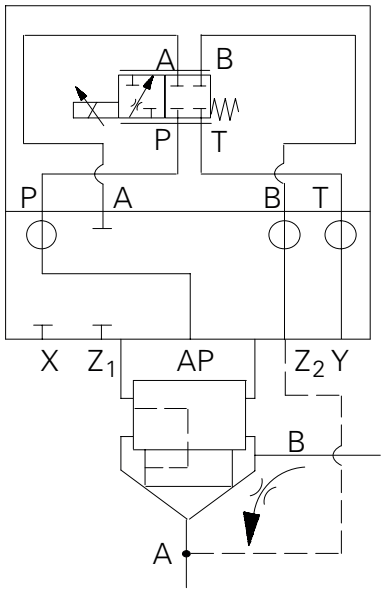


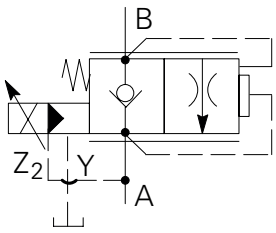
Models with free reverse flow capability
Use cover type CVCS-**-HFV*-*2(9)-1*
Note: Omit W from model code position 6



Simplified symbol







Model Codes Valvistor® Proportional Throttle Valves

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: ****-CVCS-**-HFV-*-*--B29-1* and **-CVI-**-HFV-20-*-***-1***

(F3-)	CVI	**	HFV	20	*	***	1*
1	2	3	4	5	6	7	8

1 Seal Material

F3 - Seals for phosphate esters or chlorinated hydrocarbons. Omit for all other fluid types.

2 Model

CVI - Cartridge valve insert

3 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

4 Flow direction

HFV - Hydraulic feedback, Valvistor

5 Area ratio

20 - 1:2 area ratio

6 Flow direction

A - For flow A to B
B - For flow B to A

7 Flow capacity at Δp = 10 bar (145 psi)

Size/Flow Direction	Code	L/min	USgpm
16A	21	210	55
16B	21	210	55
25A	40	405	107
25B	32	320	107
32A	63	630	166
32B	63	630	166
40A	90	900	238
40B	81	900	238
50A	130	1305	345
50B	130	1305	345
63A	216	2160	571
63B	216	2160	571

Valvistor Throttle Covers (Suitable for flows A to B and B to A)

(F3-)	CVCS	**	HFV	*	*	B	2	9	1*
1	2	3	4	5	6	7	8	9	10

1 Fluid compatibility

F3 - Seals for phosphate esters or chlorinated hydrocarbons. Omit for all other fluid types.

2 Model

CVCS - Cartridge valve cover to ISO 7368

3 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

4 Type

HFV - Hydraulic feedback, Valvistor

5 Size 3 pilot valve mounting bolts

1 - Imperial threads
3 - Metric threads

6 Control option

W - Mainstage Valvistor without free reverse flow. Omit for standard mainstage Valvistor with free reverse flow capability

7 Thread/seal combination

B - G (BSPF) threads for gage ports; metric threads for orifices (only available when "3" specified at position 5)

8 Seals

2 - Inch O-ring seals to ISO 3601

9 Mounting bolts

Sizes 16-40 only

9 - Metric mounting bolts supplied as standard when "B" (BSPF threads) specified at position 7 Omit for sizes 50 and 63

10 Design number, 1* series

Subject to change. Installation dimensions unaltered for design numbers 10 to 19.

Pilot Valve

For operation with 12V control system:
K(B)(F)TG4V-3S2B 08N-(V)M-*** ***
*(1)G5-60-EN427

For operation with 24V control system:
K(B)(F)TG4V-3S2B 08N-(V)M-*** ***
*(1)H5-60-EN427

For full technical details of this valve including types of electrical connections, see Danfoss's Vickers Slip-in Cartridge Valve Catalog.

Operating Data

Data is typical with fluid at 36 cSt (168 SUS) and 50C (122F).

Maximum pressure	350 bar (5000 psi)					
Flow ratings	See model code (CVI)					
Controlled flow characteristics	See graphs on pages 81 and 82					
Pressure drop, free return flow	See graphs on page 83					
Dynamic performance:	06	08	09	10	11	12
Step input ▲ response at p = 10 bar (145 psi)	(NG16)	(NG25)	(NG32)	(NG40)	(NG50)	(NG63)
Opening time (ms)	50	85	130	240	280	340
Closing time (ms)	40	60	85	130	200	300
Hysteresis ▲	<8%	<8%	<8%	<8%	<8%	<8%
Repeatability ▲	<3%	<3%	<3%	<3%	<3%	<3%
Area ratio (all sizes)	2:1					
Hydraulic fluids	See page 15					
Temperature limits	See page 15					
Filtration and viscosity requirements	See page 17					
Mounting bolts and assembly torques	See page 119					
Seal kits	See page 121					
Mass	See page 126					

▲ *Data quoted with KTG4V-3S-–60-EN427 as pilot valve, driven by EEA-PAM-523-A-32 (Economic Performance)*

▲ ***For standard & high performance and On-Board-Electronics (OBE) options, see "Valvistor line extension" on page 85.***

Pilot Valve Electrical Data

Full performance data and model code breakdown can be found in Eaton's Vickers Slip-in Cartridge Valve Catalog.

Type	KTG4V-3S---60-EN427 (denotes special spool)	
Max. current at 50°C (122F)	Coil type	
	G	H
	3.2A	1.6A
Coil resistance at 20°C (68F)	1.8 ohms	7.3 ohms
Coil inductance at 1000 Hz	7.5 mH	29 mH
Relative duty factor	Continuous rating (ED = 100%)	
Electrical protection with plugs fitted correctly	IEC 947 class IP65	
Recommended amplifier	EEA-PAM-523-A-32	

▲ ***For standard & high performance and On-Board-Electronics (OBE) options, see "Valvistor line extension" on page 85.***

Performance Characteristics

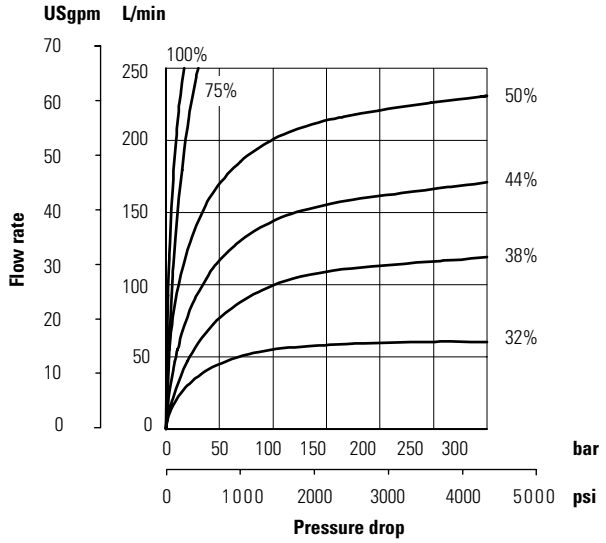
The graphs on the following two pages show typical flow characteristics for different values of input current to pilot valve plot ted against flow rate and valve pressure drop. They are based on a standard HFV insert and cover with a KTG4V-3S---EN427 pilot valve. A minimum pressure drop of 5 bar (72 psi) is recommended. Higher pressure drops result in improved control.

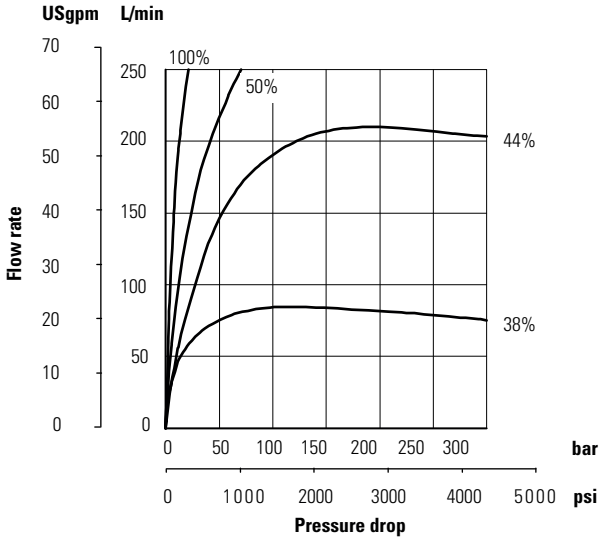
Flow/Pressure Drop vs Solenoid Current (% of max.)

Flow A → B

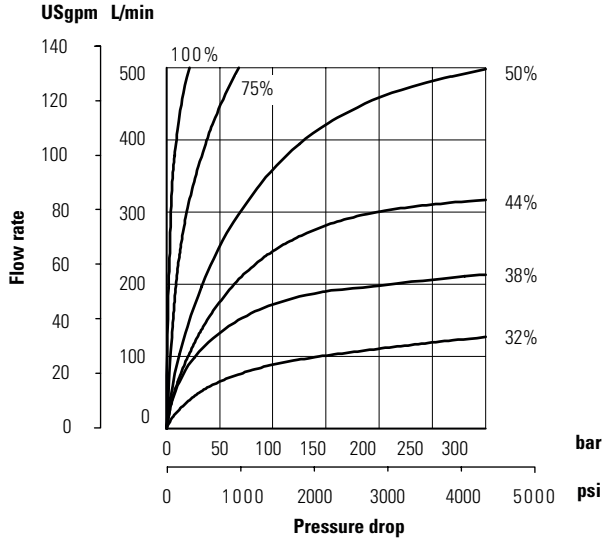
Flow B → A

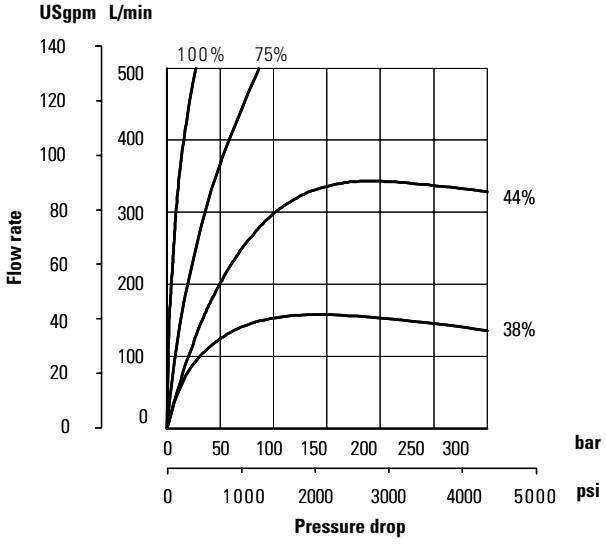
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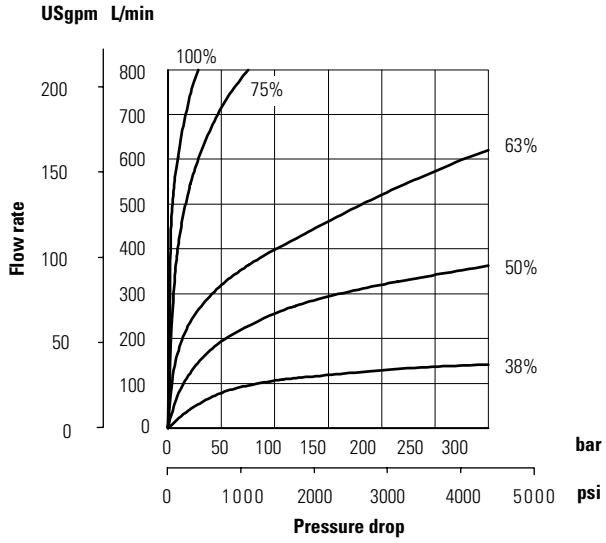


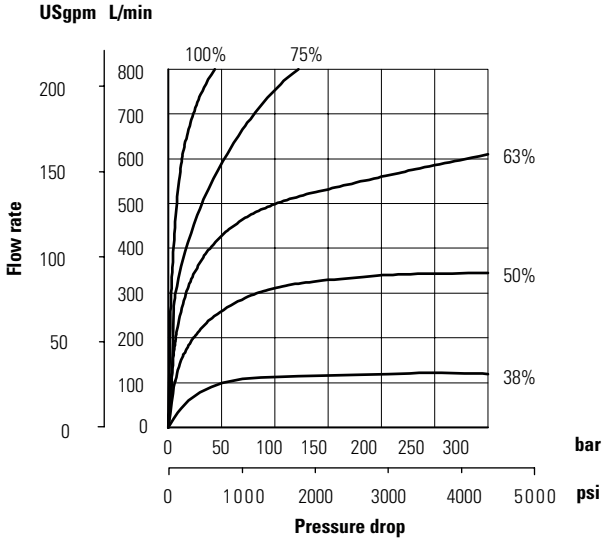
Size 25





Size 32

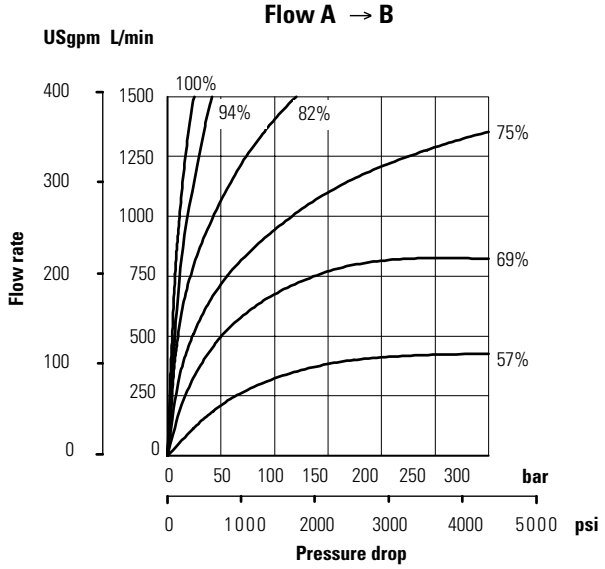




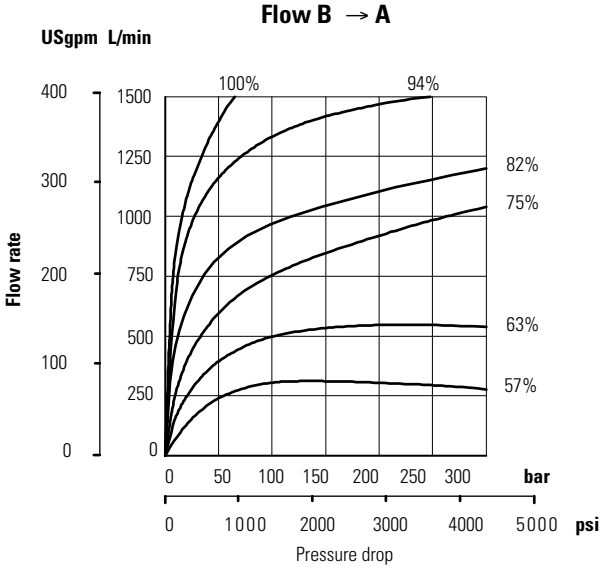
Flow/Pressure Drop vs Solenoid Current (% of max.)

Size 40

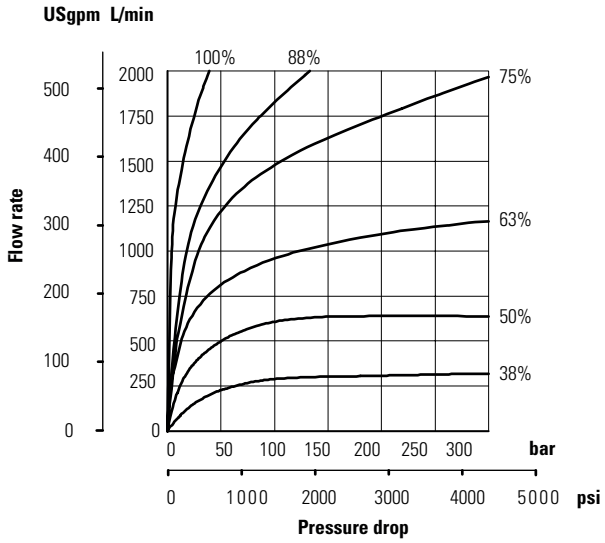
Flow A → B

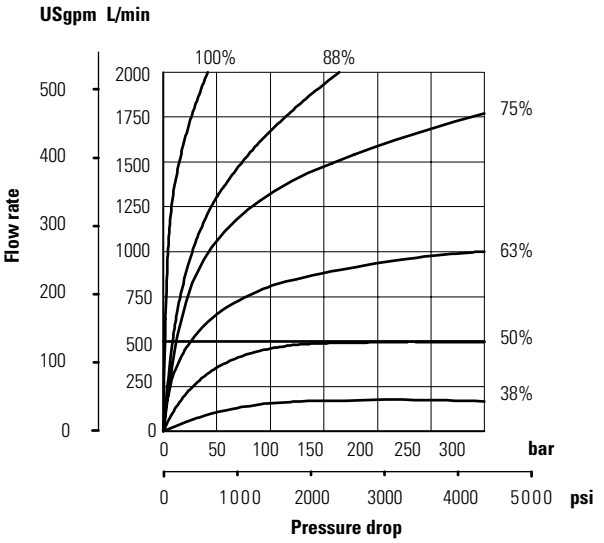


Flow B → A

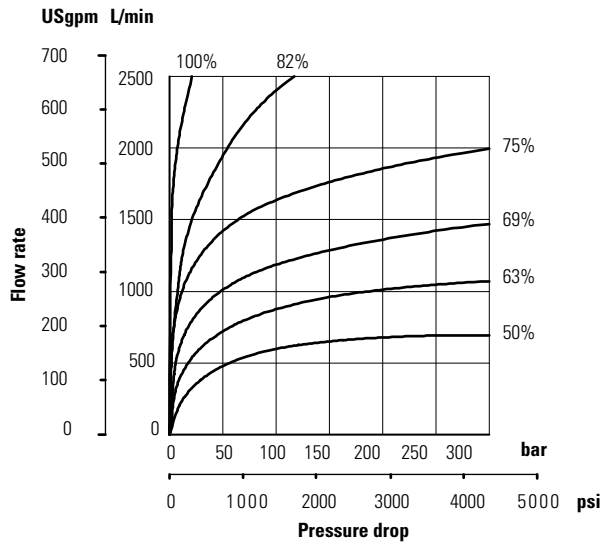


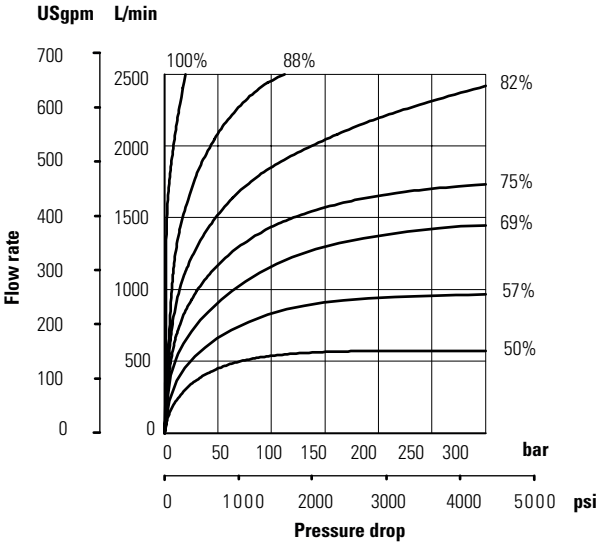
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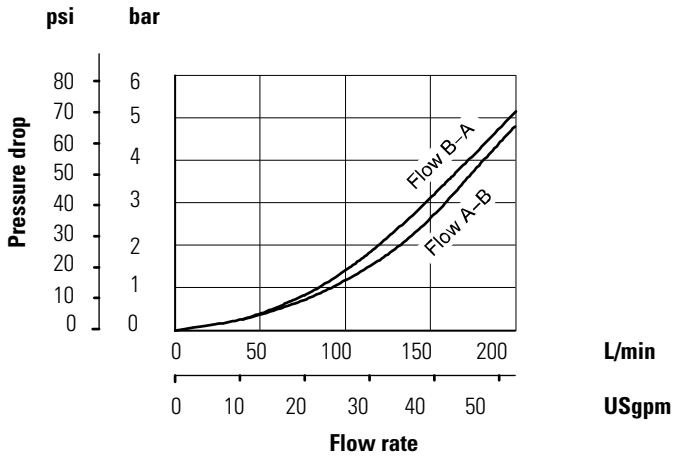
Size 63



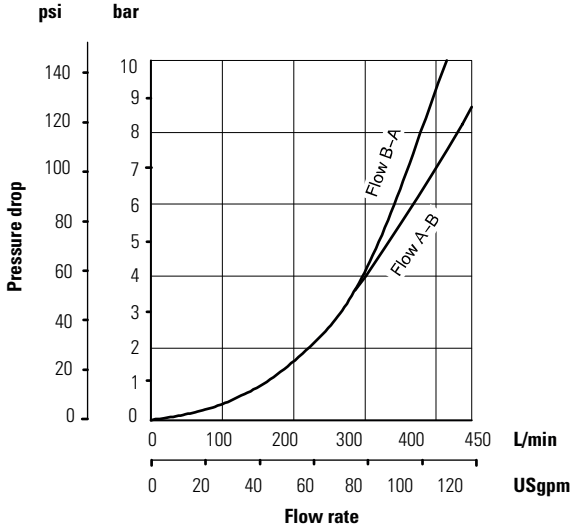


Pressure Drops - Free Return Flow

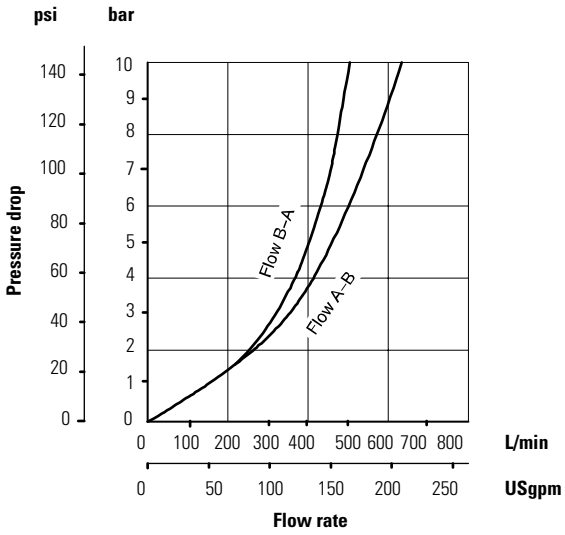
Size 16



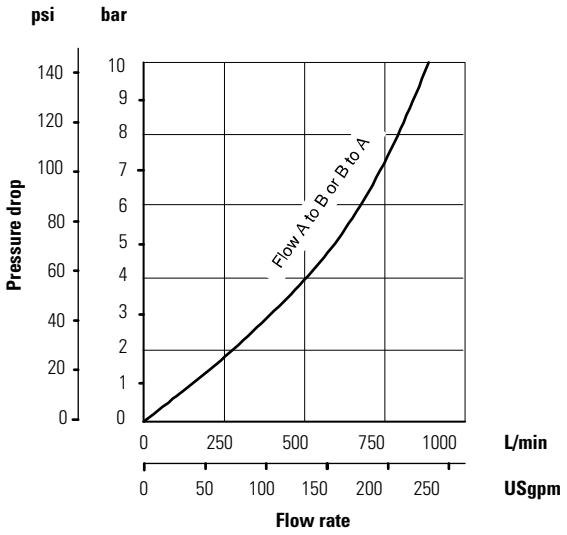
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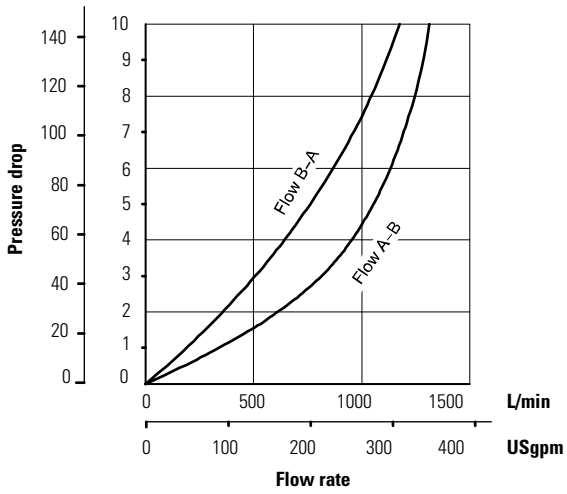
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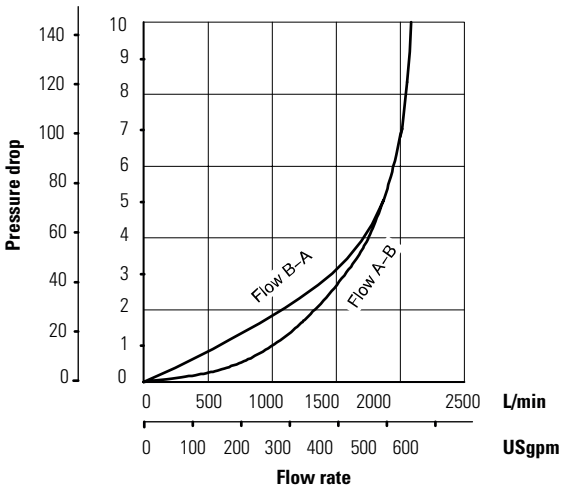
Size 40



Size 50

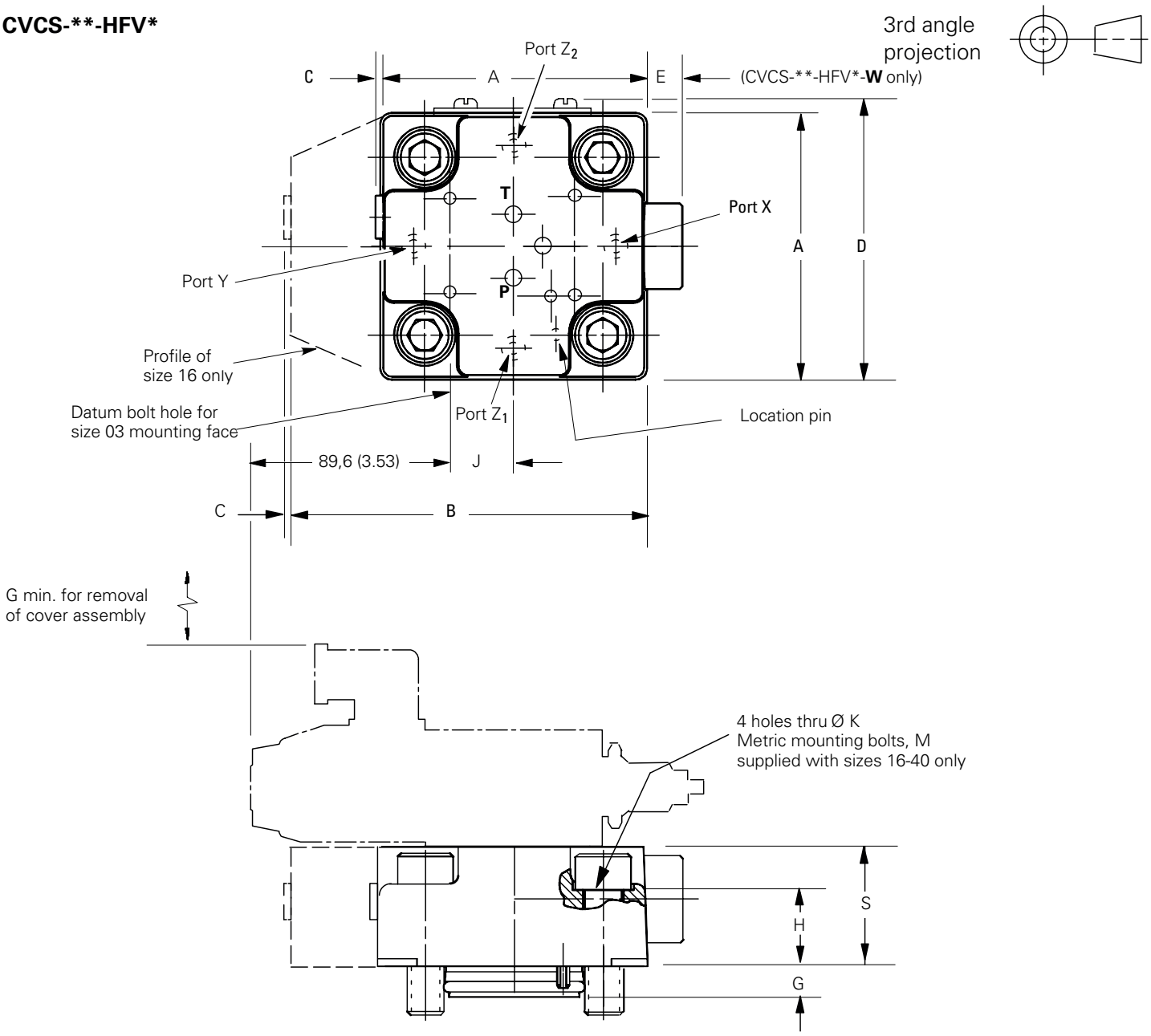


Size 63



Installation Dimensions in mm (inches)

CVCS-**-HFV*



Valve Size	A sq.	B	C max.	D	E max.	G	H	J	Ø K (K dia.)	M Mounting Bolts (supplied)	S
16	66,0 (2.6)	85,5 (3.36)	4,5 (0.18)	68,5 (2.7)	14,5 (0.57)	8,0 (0.32)	36,0 (1.42)	32,50 (1.28)	8,75/9,25 (0.344/0.364)	M8 x 50 cap hd. screw	48,0 (1.89)
25	86,0 (3.38)	– (0.14)	3,5 (3.5)	88,5 (0.53)	13,5 (0.42)	10,5 (0.98)	25,0 (0.82)	20,75	13,75/14,25 (0.541/0.561)	M12 x 40 cap hd. screw	39,0 (1.54)
32	102,5 (4.0)	–	3,5 (0.14)	104,5 (4.2)	13,5 (0.53)	13,0 (0.52)	30,0 (1.18)	21,50 (0.85)	17,75/18,25 (0.699/0.718)	M16 x 55 cap hd. screw	48,0 (1.89)
40	126,0 (5.0)	–	2,0 (0.08)	128,5 (5.1)	11,0 (0.43)	15,0 (0.59)	35,0 (1.38)	21,50 (0.85)	21,75/22,25 (0.856/0.875)	M20 x 60 cap hd. screw	58,0 (2.28)
50	142,5 (5.6)	–	4,5 (0.18)	145,0 (5.7)	0 (0)	18,0 (0.71)	42,0 (1.66)	21,50 (0.85)	21,75/22,25 (0.856/0.875)	–	68,0 (2.68)
63	183,0 (7.2)	–	4,5 (0.18)	185,5 (7.3)	0 (0)	20,0 (0.79)	48,0 (1.89)	21,50 (0.85)	32,75/33,25 (1.289/1.309)	–	83,0 (3.27)

Valvistor® Line Extension

Proportional Slip-in Cartridge Valve, Flow Control

K(B)TG4V-3 Pilot Stage K(B)FTG4V-3 Pilot Stage



Eaton's Vickers® line is now extended with the addition of K(B) TG4V-3 and K(B)FTG4V-3 pilot stage proportional valves. The new features and benefits of the higher performance and on-board electronics (OBE) open up new applications and markets. The valves piloted with K(B)FTG4V-3 offer performance that is close to conventional feedback valves. As its name implies, the Valvistor design has a main poppet valve that amplifies a low flow rate through the pilot circuit, similar to a transistor. This innovative design achieves servo-type control of the main poppet, without using an electrical main poppet position feedback transducer on the Slip-in cartridge valve.

Features and benefits of the new valves include:

- Integral hydraulic feedback on main stage — Closed loop, main-stage performance is achieved without using a main-stage LVDT.
- Pilot stage selected to meet specific requirements — Cost-effective design results in design flexibility.
- Pilot flow is directed to the load — Higher flow efficiency is achieved since the flow is not wasted to the tank.
- IP65 and IP67 environmental protection rated best in class — More reliable performance in harsh environments.
- On board ramp adjustment on KBTG pilot.

Applications include injection and blow molding, rubber molding, press, die-casting, offshore, civil engineering, marine, primary metal, and mobile applications. The tables below show existing Valvistor configurations and the new extended configurations with K(B) TG4V-3 and K(B)FTG4V-3 as pilot valves.

High Performance

	Extended Configuration		Extended Configurations	
Pilot Valve	**Non-OBE Valve**		**OBE Valve**	
Model Code & Part Number	**KFTG4V-3-2B13N-Z-M-U-H7-10, 506834**		**KBFTG4V-3-2B13N-Z-M1-PE7-H7-11, 5996165-001** **KBFTG4V-3-2B13N-Z-M2-PE7-H7-11, 5996350-001**	
Step Response (ms)	**Open**	**Close**	**Open**	**Close**
Delta P Tested	**10 bar**	**10bar**	**10bar**	**10bar**
NG16	51	33	35	25
NG25	88	50	50	30
NG32	135	71	70	45
NG40	249	108	130	65
NG50	290	167	170	100
NG63	352	250	200	150
Hysteresis	1%	1%	1%	1%

Notes Valvistor full flow reached at around 70% command input of K(B)F with 13N spool. For M2 version, the command input range is 4-12ma, valve is fully open at 4ma, and fully closed at 12ma.

Standard Performance

	Extended Configuration		Extended Configurations	
Pilot Valve	**Non-OBE Valve**		**OBE Valve**	
Model Code & Part Number	**KTG4V-3-2B08N-M-U-H7-60-EN427, 02-398752** **Other configurations available.** **Contact Eaton**		**KBTG4V-3-2B08N-M1-PE7-H7-10-EN427, 02-398750** **KBTG4V-3-2B08N-M2-PE7-H7-10-EN427, 02-398751**	
Step Response (ms)	**Open**	**Close**	**Open**	**Close**
Delta P Tested	**10 bar**	**10 bar**	**10 bar**	**10 bar**
NG16	50	40	38	24
NG25	85	60	66	36
NG32	130	85	101	51
NG40	240	130	186	78
NG50	280	200	217	120
NG63	340	300	264	180
Hysteresis	<5	<5	<5	<5

Notes: For M2 version, the command input range is 4-12ma, valve is fully open at 4ma, and fully closed at 12ma.

Economical Solution

	Extended Configuration		Extended Configurations	
Pilot Valve	**Non-OBE Valve**		**OBE Valve**	
Model Code & Part Number	**KTG4V-3S-2B08N-M-U-H5-60-EN427, 02-154581** **Other configurations available.** **Contact Eaton**		**KBTG4V-3S-2B08N-M1-PE7-H5-10-EN427, 02-397168** **KBTG4V-3S-2B08N-M2-PE7-H5-10-EN427, 02-398753**	
Step Response (ms)	**Open**	**Close**	**Open**	**Close**
Delta P Tested	**10 bar**	**10 bar**	**10 bar**	**10 bar**
NG16	50	40	38	24
NG25	85	60	66	36
NG32	130	85	101	51
NG40	240	130	186	78
NG50	280	200	217	120
NG63	340	300	264	180
Hysteresis	<8%	<8%	<8%	<8%

Notes: For M2 version, the command input range is 4-12ma, valve is fully open at 4ma, and fully closed at 12ma.

Released Part Numbers

Model Code	Assembly Number
CVCS-16-HFV3-B29-10	02-310565
CVCS-16-HFV3-W-B29-10	02-312336
CVCS-25-HFV3-B29-10	02-157809
CVCS-25-HFV3-W-B29-10	02-157811
CVCS-32-HFV3-B29-10	02-310641
CVCS-32-HFV3-W-B29-10	02-312335
CVCS-40-HFV3-B29-10	02-157212
CVCS-40-HFV3-W-B29-10	02-312121
CVCS-50-HFV3-B2-10	02-311957
CVCS-50-HFV3-W-B2-10	02-311959
CVCS-63-HFV3-B2-10	02-311958
CVCS-63-HFV3-W-B2-10	02-311960
F3-CVCS-16-HFV3-W-B29-10	02-358045
F3-CVCS-25-HFV3-W-B29-10	02-319363

Model Code	Assembly Number
CVI-16-HFV-20-A-21-10	02-310564
CVI-16-HFV-20-B-21-10	02-310563
CVI-25-HFV-20-A-43-10	02-157670
CVI-25-HFV-20-B-32-10	02-157741
CVI-32-HFV-20-A-63-10	02-310643
CVI-32-HFV-20-B-63-10	02-310642
CVI-40-HFV-20-A-90-10	02-157234
CVI-40-HFV-20-B-81-10	02-157233
CVI-50-HFV-20-A-130-10	02-312101
CVI-50-HFV-20-B-130-10	02-312102
CVI-63-HFV-20-A-216-10	02-311063
CVI-63-HFV-20-B-216-10	02-311062

Electrohydraulic Proportional Throttles
CVU-**-EFP1-3* Series

Basic Characteristics
Valves

Nominal sizes:	ISO 7368	DIN 24342
	06	NG16
	08	NG25
	09	NG32
	10	NG40

Max. operating pressure..... 315 bar (4500 psi)

Flow ratings.....up to 900 L/min (238 USgpm)

Amplifier

Vickers by Danfoss model EEA-PAM-571-A, to be ordered separately. Power input 20-34V DC, 24V DC nominal.

General Description

Proportional throttle (restrictor) valves for use where one or more of the following requirements exist.

- Remote control of machine actuator speed, linear or rotary.
- Speed control in accordance with machine operating cycles or programs.
- Meter-in, meter-out or bleed-off application of the throttle valve itself.
- Pressure compensated flow control with the aid of a pressure hydrostat module, in any of the same three application modes.
- Smooth control of machine acceleration and/or deceleration.
- For industrial and mobile applications.

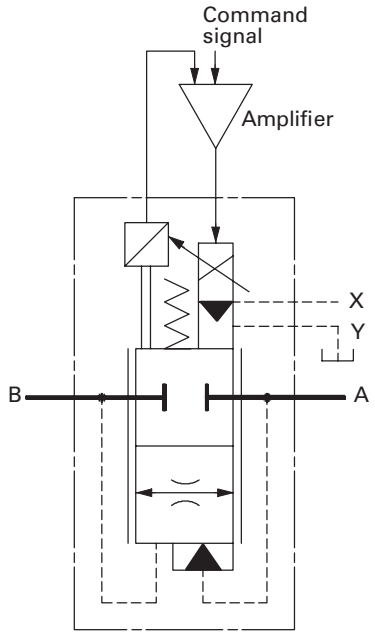
Note: Correct performance of valves can only be obtained using Vickers by Danfoss amplifier EEA-PAM-571-A.

Features and Benefits

- New 09 (NG32) size.
- Valves suitable for unidirectional and bidirectional control of flow.
- 4 valve sizes offer choice of flow capacities
  06 (NG16): 190 L/min (50 USgpm)
  08 (NG25): 450 L/min (119 USgpm)
  09 (NG32): 700 L/min (185 USgpm)
  10 (NG40): 900 L/min (238 USgpm)
  at 10 bar (145 psi) Δp.
- Designed for zero leakage when closed.
- Common amplifier for any valve size minimizes inventory.
- 24V DC nominal supply to amplifier to suit state-of-art control systems.
- Choice of command signals.
- Acceleration and deceleration requirements can be adjusted on-site by "ramp" potentiometer.
- Facility for on-site adjustment of "deadband" compensation and "gain".
- Setting-up and fault diagnosis eased by panel display and signal monitoring points.

Functional Symbol

CVU-**-EFP1



Model Codes Electrohydraulic Proportional Throttles

(F3-)	CVU	**	EFP1	B	2	9	**	3*
1	2	3	4	5	6	7	8	9

1 Special seals for phosphate ester fluids

Omit for standard seals; see "Hydraulic fluids" section.

2 Model

CVU - Cartridge valve unit

3 Nominal size to ISO (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)

4 Type

EFP1 - Electronic feedback, proportional 2–stage

5 Threads on fitted plugs

B - G (BSPF) threads to ISO 228/1

6 Seals

2 - Seals to ISO 3601

7 Mounting Bolts

9 - Metric mounting bolts supplied

8 Rated flow at 10 bar (145 psi) Δ p

19 - 190 L/min (50 USgpm) size 06 (NG16) only

45 - 450 L/min (119 USgpm) size 08 (NG25) only

70 - 700 L/min (185 USgpm) size 09 (NG32) only

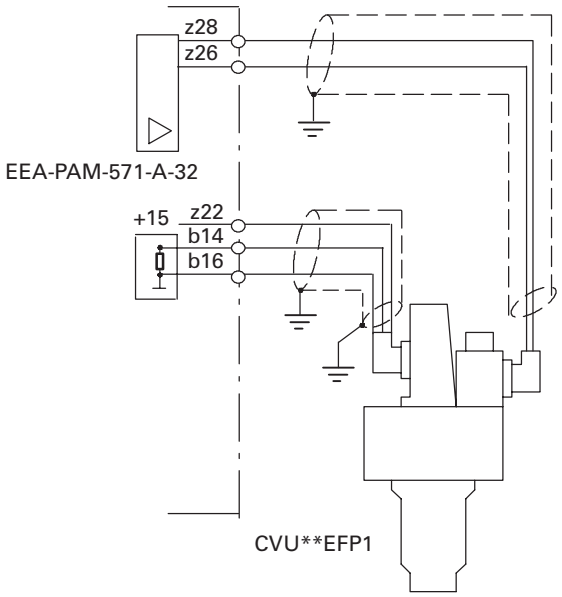
90 - 900 L/min (238 USgpm) size 10 (NG40) only

9 Design number, 3* series

Subject to change. Installation dimensions unaltered for design numbers 31 to 39 inclusive.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: ****-CVU-**-EFP1-B29-**-3***

Wiring Connections



Customer's protective ground connection.

WARNING

Electromagnetic Compatibility (EMC)
It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown. For effective protection the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

WARNING

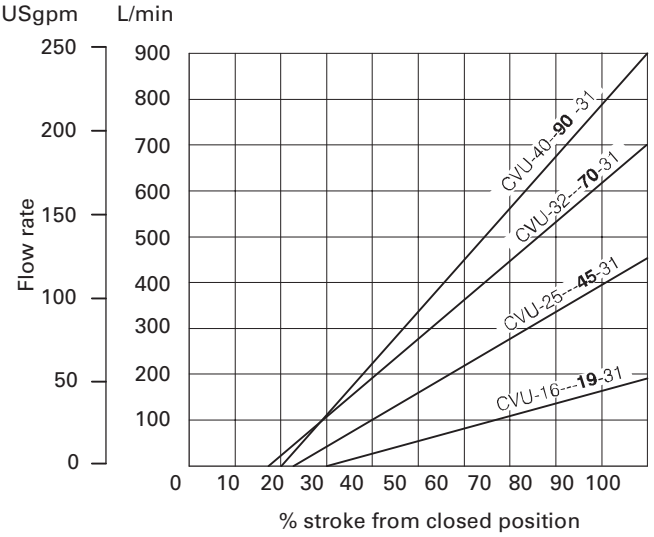
All power must be switched off before connecting or disconnecting any plugs.

Operating and Performance Data
Electrohydraulic Proportional Throttles

Performance data is typical with fluid at 36 cSt (168 SUS) and 500C (1220F)				
Pressure ratings:				
Ports A, B, X	315 bar (4500 psi) max.			
Port Y	≤2 bar (29 psi)			
Cracking pressure: (see diagram on next page for valve area ratios)				
For flow A to B	2,5 bar (36 psi)			
For flow B to A	6,5 bar (94 psi)			
Flow ratings A to B/B to A	See Model Code 8 on previous page			
Spool overlap, deadband typical				
CVU-16	30% of full stroke			
CVU-25	23% of full stroke			
CVU-32	18.5% of full stroke			
CVU-40	20% of full stroke			
Peak solenoid current at 50°C (122°F) ambient				
Nominal	2.2A (13.6W)			
Max.	2.9A (18W)			
Solenoid coil resistance at 20°C (68°F)	2.8Ω			
Relative duty factor	Continuous rating (ED = 100%)			
Electrical protection with plugs fitted	IEC 144 class IP 65			
Dynamic performance (using amplifier EEA-PAM-571-A-32)	CVU-16	CVU-25	CVU-32	CVU-40
• Step input response: valve stroke between zero overlap and fully open 100 bar (1450 psi) at ports A, B and X				
Opening time	40 ms	60 ms	80 ms	125 ms
Closing time	50 ms	60 ms	80 ms	125 ms
• Frequency response	See next page			
• Hysteresis	<1%	<1%	<1%	<1%
• Repeatability	±0.5%	±0.5%	±0.5%	±0.5%
Mass	3,3 kg (7.3 lb)	4,1 kg (9.0 lb)	6,5 kg (14.3 lb)	8,0 kg (17.7 lb)

Flow/Stroke Characteristics

At Δp = 10 bar (145 psi)



For a given input signal value the characteristics of the valve approximate to the theoretical square-law relationship for sharp-edged orifices:

$$\Delta p_x = \Delta pr \bullet \left(\frac{Q_x}{Q_r} \right) 2$$

Where Δp_x = Pressure drop for required flow rate Q_x

Δp_r = Pressure drop at rated current

Q_x = Flow rate for which Δp_x is to be calculated

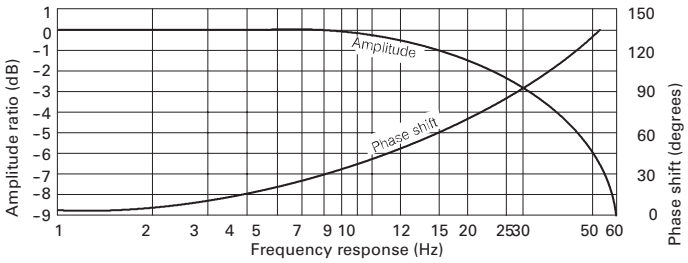
Q_r = Flow rate at rated current

Electrohydraulic Proportional Throttles
CVU-**-EFP1-3* Series

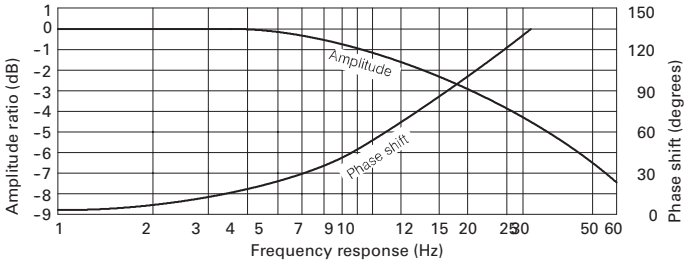
Frequency Response

Typical at PA = PB = 100 bar (1450 psi) and at zero flow. Based on operating valve about the 50% stroke position with a sinusoidal input signal of ±10%

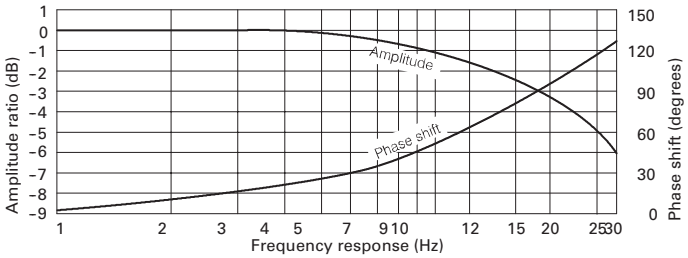
CVU-16-EFP1---3*



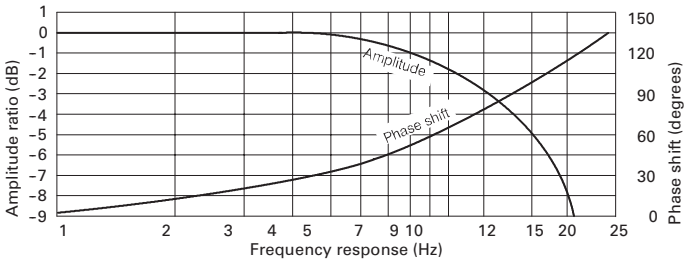
CVU-25-EFP1---3*



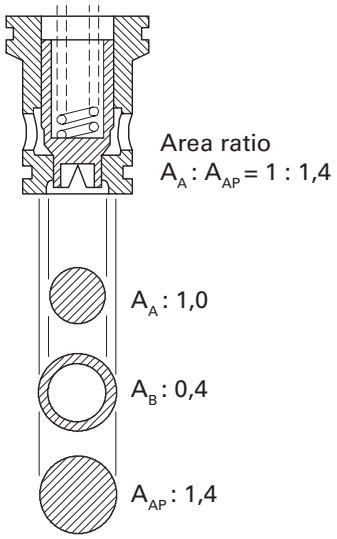
CVU-32-EFP1---3*



CVU-40-EFP1---3*



Valve Area Ratios



Hydraulic Fluids

All cartridge valves can be used with antiwear hydraulic oils, and certain low viscosity fluids. Add prefix "V" to model designations when phosphate ester (not alkyl-based) or chlorinated hydrocarbons are to be used. The extreme viscosity range is from 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is from 54 to 13 cSt (245 to 70 SUS). For further information about fluids, see "Technical information" leaflet B-920.

Temperature Limits

Ambient min ..... 20°C (-4°F)

Ambient max ..... +70°C (+158°F)

Fluid temperatures

	Petroleum Oil	Water Containing
Min.	–20°C (–4°F)	+10°C (+50°F)
Max.	+80°C (+176°F)	+54°C (+129°F)

Filtration Requirements

See page 17.

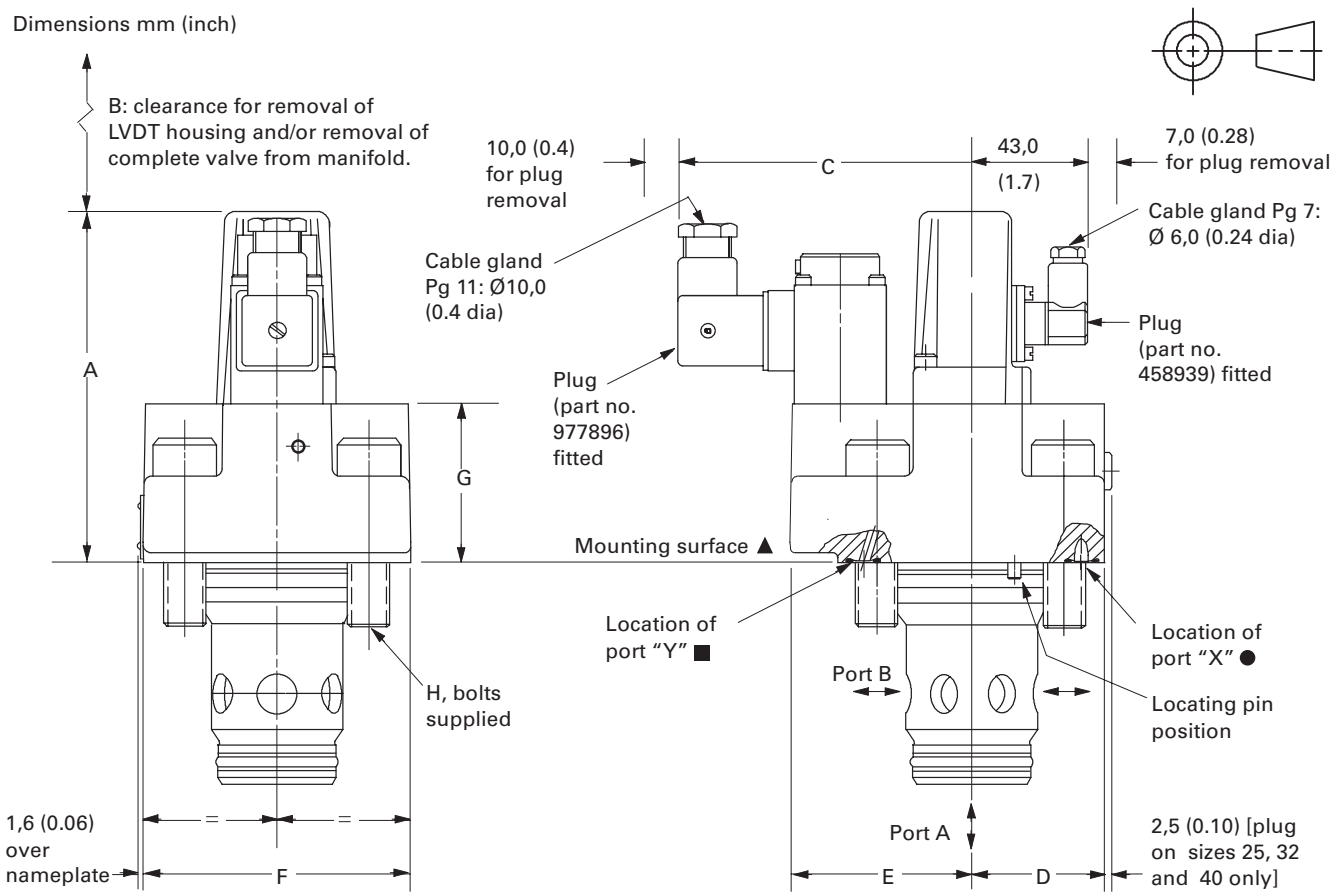
Drive Amplifier

EEA-PAM-571-A. See GB-C-2464.

Other Supporting Products

See electronic accessories GB-C-2460.

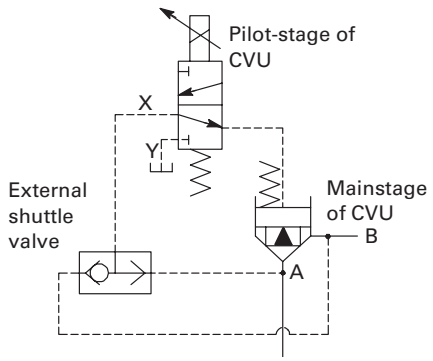
Dimensions mm (inch)



Dimension	CVU-16	CVU-25	CVU-32	CVU-40
A	135,5 (5.33)	133,5 (5.25)	138,5 (5.45)	138,5 (5.45)
B	74,0 (2.91)	77,0 (3.03)	90,5 (3.56)	109,5 (4.31)
C	109,5 (4.31)	105,5 (4.15)	113,5 (4.47)	105,5 (4.15)
D	32,5 (1.28)	42,5 (1.67)	51,0 (2.01)	63,0 (2.48)
E	70,0 (2.76)	65,5 (2.58)	69,0 (2.72)	63,0 (2.48)
F	66,6 (2.62)	85,0 (3.35)	102,0 (4.02)	126,0 (4.96)
G	57,0 (2.24)	55,0 (2.16)	60,0 (2.36)	60,0 (2.36)
H bolts	4 x M8 x 35	4 x M12 x 45	4 x M16 x 55	4 x M20 x 70
Bolt torque	35 Nm	110 Nm	285 Nm	500 Nm
Alternative UNC bolts (not supplied with CVU-**-EFP1)				
Size	$^{5}/_{16}$"-18 x 11/2"	$^{1}/_{2}$"-13 x 11/2"	$^{5}/_{8}$"-11 x 2"	$^{3}/_{4}$"-10 x 2$^{3}/_{4}$"
Bolt kit	BKDNG16700	BKPNG25704	BKNG32713	BKCG825613
Bolt torque	26 lbf ft	81 lbf ft	210 lbf ft	370 lbf ft

Connections to Port X

For unidirectional control of flow (ie A to B or B to A) port X must be connected to upstream port pressure. For bidirectional control of flow (ie flow A to B and B to A at different times during an operating cycle) port X must be connected to both A and B via a shuttle valve (see diagram).



▲ Installation dimensions below mounting surface, including location of ports "X" and "Y" and size/length of bolts "H", conform to requirements of ISO 7368---A (see page 123).

■ Connect to drain: pressure must not exceed 2 bar (29 psi).

• See "Connections to Port X", this page.

Directional Valves with Electrical Indication

CVU-**-SWD, CVU-**-SWD3, CVU-**-ZSWD3

Basic Characteristics

Valves

Nominal sizes:	ISO 7368	DIN 24342
	06	NG16
	08	NG25
	09	NG32
	10	NG40
	11	NG50
	12	NG63

Max. operating pressure

CVU-**-SWD(3) NG16 to NG40 .....420 bar (6090 psi)

CVU-**-SWD(3) NG50 to NG63 .....315 bar (4500 psi)

CVU-**-ZSWD(3) NG16 to NG40 .....315 bar (4500 psi)

Nominal flow ratings for CVU-**-SWD(3)-*-20, Port A to Port B, Δp = 10 bar (145 psi):

CVU-16 .....325 lpm (85.5 USgpm)

CVU-25 .....615 lpm (162 USgpm)

CVU-32 .....1250 lpm (330 USgpm)

CVU-40 .....1925 lpm (510 USgpm)

CVU-50 .....3440 lpm (910 USgpm)

CVU-63 .....5625 lpm (1485 USgpm)

Nominal flow ratings for CVU-**-ZSWD3, Δp = 10 bar (145 psi)

CVU-16 .....210 lpm (55 USgpm)

CVU-25 .....400 lpm (105 USgpm)

CVU-32 .....600 lpm (158 USgpm)

CVU-40 .....900 lpm (236 USgpm)

General Description

These cartridge valves are integral assemblies of cover and insert with a main spool that is fully seated in its closed position. A coaxially mounted switch on the top cover provides a signal when the main spool is in position to close the mainstream flow.

On all models a spring holds the main spool in the closed position, requiring a small pressure to create flow through the valve. Pilot pressure from either a remote source (SWD models), or from a valve mounted directly onto the cover (SWD3 models) can be used to hold the spool fully closed. The "Dynamic" models, ZSWD3, with pilot operation of both opening and closing, cater for applications requiring fast response.

Flow can be in either direction (i.e. A to B, and B to A). The SWD(3) range is specifically designed for application in circuits and systems where electrical signalling of a known (closed) condition of the valve is required. The design of the main spool ensures that both switch indications, i.e. "valve closed" and "valve open", occur when the valve is closed to mainstream flow.

Features and Benefits

- Accurate and repeatable switching points.
- Integrated and pre-set switch assembly, with pressure-tight core tube, requires no setting adjustments to be made at installation.
- Bidirectional flow capability, simplifies manifold block design.
- "Dynamic" version ensures positive opening and closing.
- "Dynamic" version offers fast response times.
- Absence of spool seals improves reliability.
- Robustly protected switch assembly.
- Normally open and normally closed switch contacts.
- Overload and polarity protected.
- Conforms to ISO 7368.

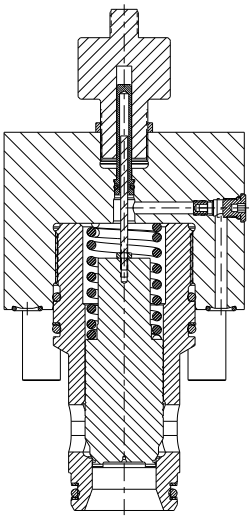
CE

This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compatibility Directive (EMC). For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring Practices for Vickers by Danfoss Electronic Products leaflet 2468. Wiring practices relevant to this Directive are indicated by Electromagnetic Compatibility (EMC).

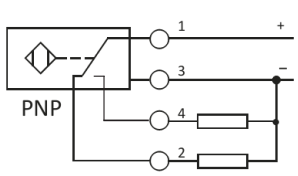
Typical Sectional Arrangements

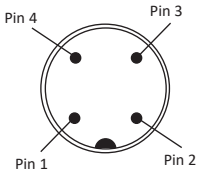
Tapped port for installation of additional orifices.

CVU-32-SWD(3)



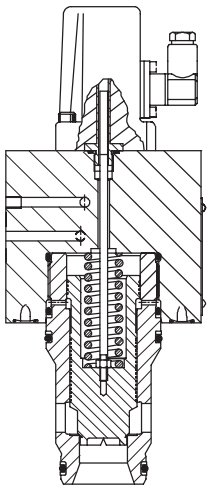
Wiring connections



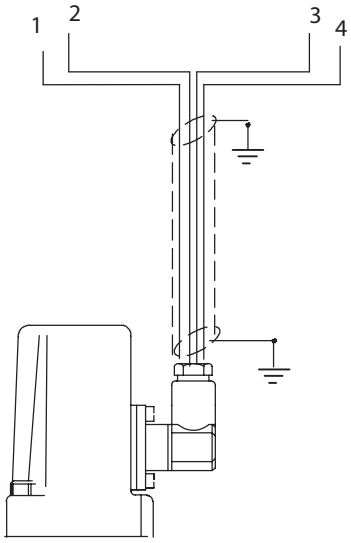


Pin 1 . . . +24V
Pin 2 . . . NC
Pin 3 . . . 0V
Pin 4 . . . NO

CVU-32-ZSWD3



Wiring connections



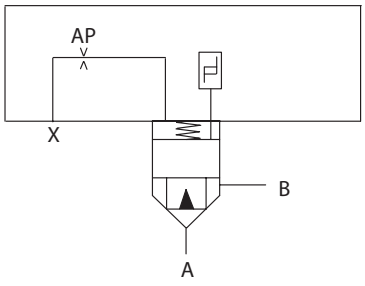
Customer's protective ground connection.

WARNING: *Electromagnetic Compatibility (EMC)*
It is necessary to ensure that the unit is wired up in accordance with the connection arrangements shown in this leaflet. For effective protection the user's electrical cabinet, the valve subplate or manifold and the cable screens should be connected to efficient ground points. In all cases both valve and cable should be kept as far away as possible from any sources of electromagnetic radiation such as cables carrying heavy current, relays and certain kinds of portable radio transmitters, etc. Difficult environments could mean that extra screening may be necessary to avoid the interference.

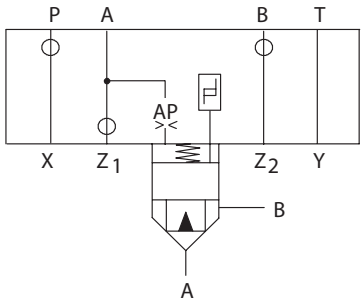
CAUTION
All power must be switched off before connecting or disconnecting any plugs.

Functional Symbols

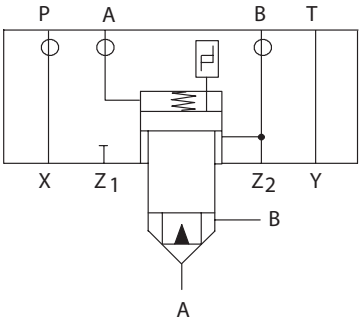
CVU-**-SWD



CVU-**-SWD3



CVU-**-ZSWD3



Standard factory-fitted orifice.

Tapped port for installation of additional orifices.

Model Codes

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: ****-CVU-**-*SWD*-B29-*-****

(F3-)	CVU	**	(Z)	SWD	(3)	*	*	*	*	**
1	2	3	4	5	6	7	8	9	10	11

1 Special Seals for phosphate ester fluids

Omit if not required

2 Model

CVU - Cartridge valve unit

3 Nominal size to ISO 7368 (DIN 24342)

16 - 06 (NG16)
25 - 08 (NG25)
32 - 09 (NG32)
40 - 10 (NG40)
50 - 11 (NG50)
63 - 12 (NG63)

4 Dynamic model

Sizes 16 to 40 only
Z - Pilot operation of main spool opening and closing, via size 3 pilot valve interface.
Note: "3" must also be specified at position 6. Omit if not required

5 Type

SWD - Spool position sensor, series D

6 Function

Model SWD and SWD3, Sizes 16 to 63

Blank - Spring return of main spool to closed position plus facility to hold spool closed by hydraulic pressure from a remote source.

3 - As above but with machined mounting pad, with M5 mounting bolt tappings, for size 3 pilot valve to provide for local hydraulic operation (e.g. solenoid operated directional valve, shuttle valve, pilot operated check valve, etc. according to circuit requirements)
Dynamic Model (Z), Sizes 16 to 40: Only '3' is applicable

Note: The pilot valve and its mounting bolts must be separately specified and ordered.

7 Threads on fitted plugs

B - G (BSPF) thread to ISO 228/1
Applicable only for -10 design

8 Seals

2 - Seals to ISO 3601
Applicable only for -10 design

9 Mounting bolts

9 - Metric bolts supplied with valve
Applicable only for -10 design

10 Main spool opening/ cracking nominal pressure

(Ports A and B)
L - 0,5 bar (7 psi)
M - 2,5 bar (36 psi)
H - 5,0 bar (72 psi)

11 Design number, ** series

SWD(3) Size 16 to 40 available in -20 design

SWD(3) Size 50 to 63 available in -10 design

ZSWD(3) Size 16 to 40 available in -10 design

Installation dimensions unaltered for design numbers 10 and 20.

Typical Model Selection

For applications requiring a valve for a flow rate of 615 lpm (162 US gpm) with remote pilot, main spool cracking pressure of 2,5 bar (36.3 psi) and metric bolts, select: CVU-25-SWD-B29-M-20 For applications requiring electrical indication of spool position for a flow rate of 3000 lpm (792.5 US gpm) with integral pilot operation, main spool cracking pressure of 5,0 bar (72.5 psi) and UNC bolts, select: CVU-50-SWD3-B29-H-20 bolt kit BKDNG50708 For applications requiring electrical indication of spool position with hydraulic pilot operation for opening and closing, a flow rate of 600 lpm (158 US gpm), main spool cracking pressure of 0,5 bar (7.3 psi) and metric bolts, select: CVU-32-ZSWD3-B29-L-10

Operating Data

Maximum Pressures All ports: 420 bar (6090 psi) in case of -20 design, 315 bar (4500 psi) in case of -10 design (-10 design available for models ZSWD3). Actual allowable pressure for some or all ports may be limited by the pressure rating of the selected pilot valve to be used on SWD3 models.

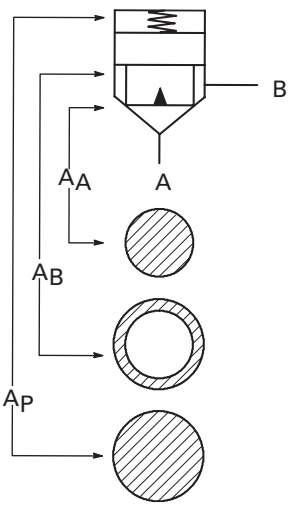
Flow Rates CVU-**-SWD(3)-20

Flow direction A to B, or B to A, with main spool piloted open and at 10 bar (145 psi) pressure drop between A and B.

Flow Rates	A to B	B to A
CVU-16	325 lpm (85.5 US gpm)	295 lpm (78 US gpm)
CVU-25	615 lpm (162 US gpm)	570 lpm (150 US gpm)
CVU-32	1250 lpm (330 US gpm)	895 lpm (235 US gpm)
CVU-40	1925 lpm (510 US gpm)	1200 lpm (315 US gpm)
CVU-50	3440 lpm (910 US gpm)	3060 lpm (810 US gpm)
CVU-63	5625 lpm (1485 US gpm)	5010 lpm (1325 US gpm)

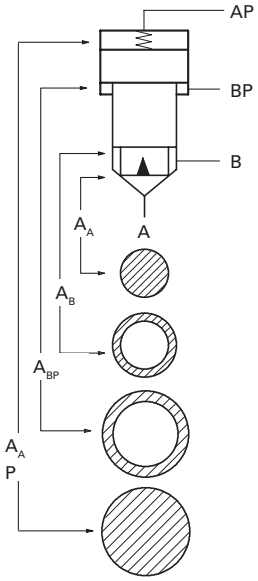
See pressure drop graphs for further data.

Area Ratio CVU-SWD(3)



$A_A : A_B : A_P :: 1 : 0.5 : 1.5$

Area Ratio CVU-ZSWD3



$A_A : A_B : A_P :: 1 : 1 : 2$

Characteristics of Electrical Switch

Input:

Supply voltage	+20 to +32V DC
Current, switch open	5 mA
Current, switch closed	255 mA

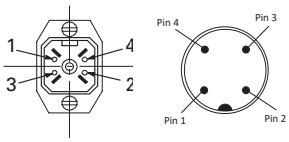
Output:

Number of outputs 2 with alternating function, PNP

Max. Output Load:	≤400mA, duty ratio 100%
Max. Switching Frequency:	10Hz

Plug connections:

M12x1 / 4 Pole Connector

Pin 1:		+ve Supply
Pin 2:		Normal Closed
Pin 3:		0 V
Pin 4:		Normal Open

Protection:

Reverse Polarity Protection:	Yes
Short-circuit Protection:	Yes, load short unlimited
Protection Class:	IP65, DIN40050
EMC:	DIN EN 61000-6-1/2/3/4

Mechanical:

Hysteresis:	≤0.05 mm
Thermal Shift (0°C to 80°C):	≤±0.10 mm
Delay:	≤15 ms
Turn on Time:	≤25 ms
Vibration (0-500Hz):	Max. 20G
Lock Nut Tightening Torque:	20Nm

Switching Positions Relative to Main Spool Position

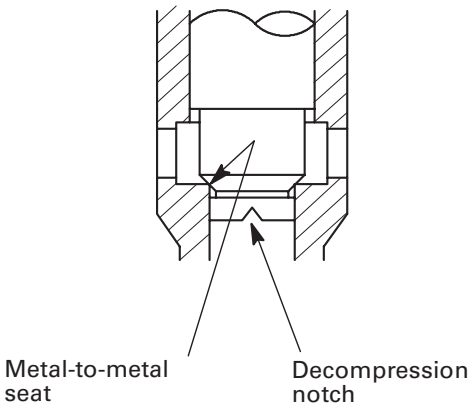


Figure 41

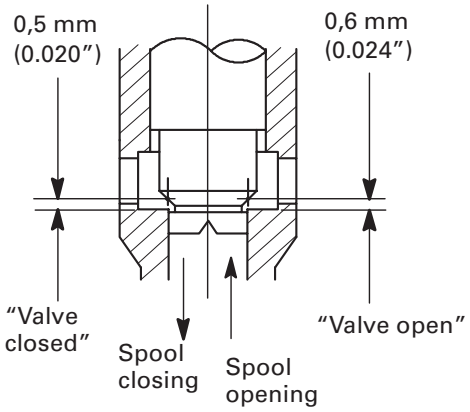


Figure 42

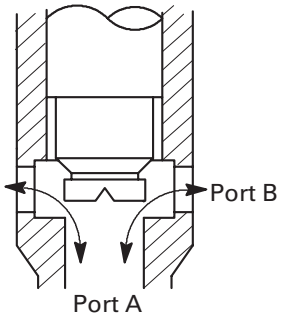


Figure 43

Figure 41: Valve fully closed by hydraulic pilot pressure and/or spring. Spool is fully seated in the sleeve.

Figure 42: When the spool is closing the "valve closed" switch indication occurs 0,5 mm (0.020) before the spool reaches the valve seat.

When the spool moves off its seated position the "valve open" indication occurs when the spool has travelled approx. 0,6 mm (0.024).

At both of these positions the main flow path A–B is closed. There is a small amount of spool travel between these switching points and the decompression notch opening/closing.

The clearance between the spool end and the "A" port diameter is closely controlled to minimize leakage flow at the "valve open" switch point, see "Quiescent Flow" on next page.

Figure 43: The fully open spool allows full flow path A to B, or B to A.

Performance Data Directional Valves with Electrical Indication

Typical with oil at 21 cSt (102 SUS) and at 50 C 122 F) unless otherwise indicated. For pressure drops at other viscosities, see page 118.

Quiescent Flow

These valves are fully seated in the closed position. Maximum flow A to B, or B to A (at the "valve open" switch indication position, see Figure 42 on previous page), at 100 bar (1450 psi) pressure differential A to B (or from B to A):

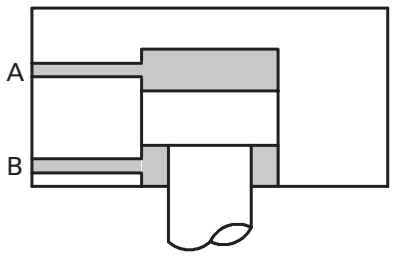
Valve Size Max.	Leakage Flow Rate:	L/min.	(USgpm)
16		2,0	(0.53)
25		3,0	(0.8)
32		4,0	(1.06)
40		6,0	(1.6)
50		12,0	(3.2)
63		18,0	(4.8)

Displacement volumes, ZSWD3 models

Total trapped volumes (up to size 3 mounting face) and displaced volumes for spool opening and closing stroke.

Volumes in cm^3 (in^3)

Nominal Size	At port A: Total Vol. Spool Closed	Stroke Vol.	At port B: Total Vol. Spool Open	Stroke Vol.
16	6,44 (0.39)	2,05 (0.13)	2,45 (0.15)	0,43 (0.03)
25	13,59 (0.83)	4,73 (0.29)	4,40 (0.27)	0,95 (0.06)
32	27,49 (1.68)	11,79 (0.72)	6,69 (0.41)	2,29 (0.14)
40	44,34 (2.70)	21,38 (1.30)	9,92 (0.61)	4,23 (0.26)



Hydraulic Fluids

These valves are suitable for use with hydraulic oils, water-inoil emulsions and water glycols. The extreme operating range is from 500 to 13 cSt (2270 to 70 SUS) but the recommended running range is 54 to 13 cSt (245 to 70 SUS).

Temperature Limits

Ambient:
Minimum – 20°C (– 4°F)
Maximum +80°C (+176°F)

Fluid temperature

Petroleum Oil	Water-Containing
Min. –10°C	+10°C
(+14°F)	(+50°F)
Max.* +80°C	+54°C
(+176°F)	(+129°F)

Filtration Requirements

See page 17.

Mounting Attitude

Unrestricted.

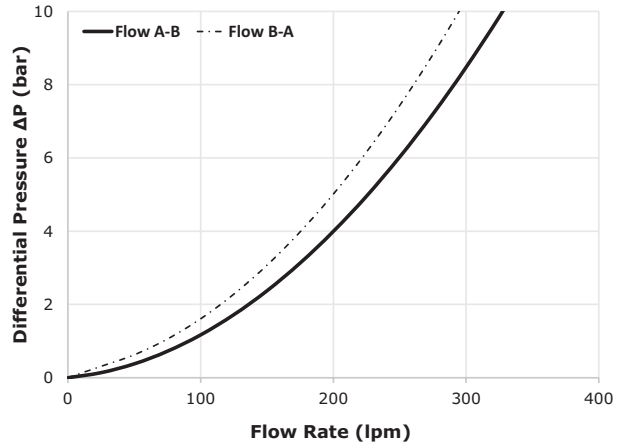
* To obtain optimum service life from both fluid and hydraulic system, 650 C (1500 F) is the recommended maximum fluid temperature, except for water-containing fluids.

For synthetic fluids consult fluid manufacturer or Danfoss where limits are outside those for petroleum oil.

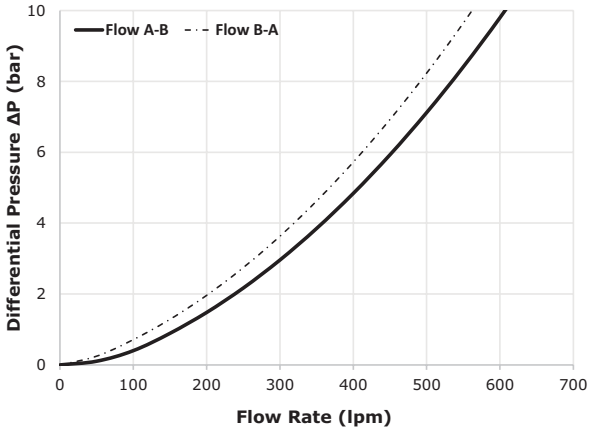
Pressure Drops

Flow in either direction: A to B, or B to A

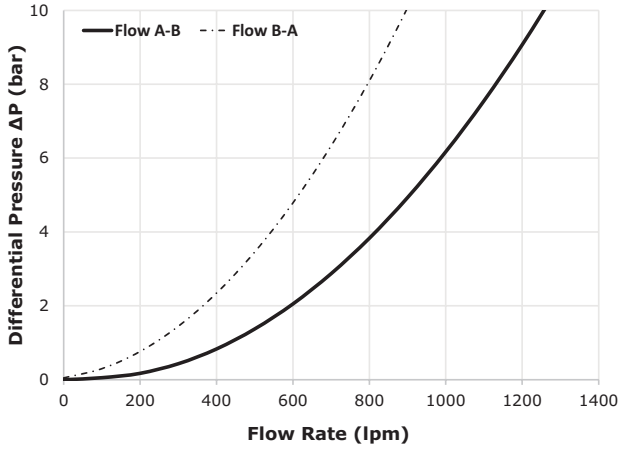
CVU-16-SWD(3)



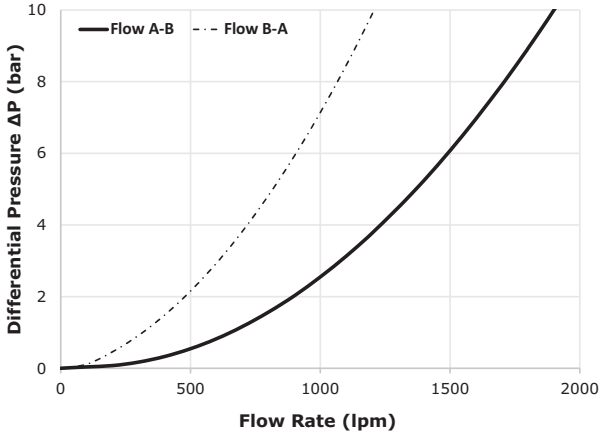
CVU-25-SWD(3)



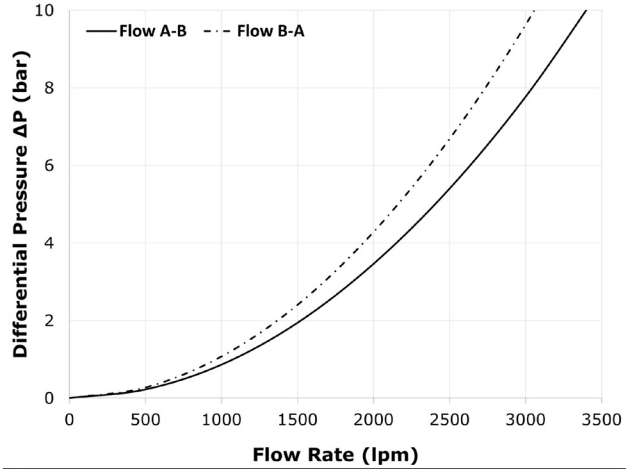
CVU-32-SWD(3) *



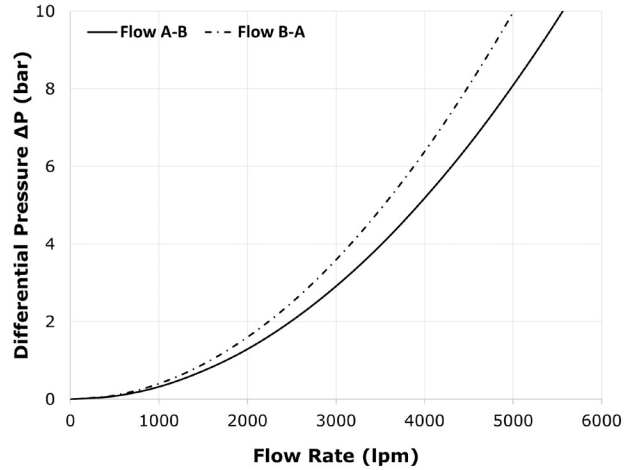
CVU-40-SWD(3) *



CVU-50-SWD(3) *



CVU-63-SWD(3) *

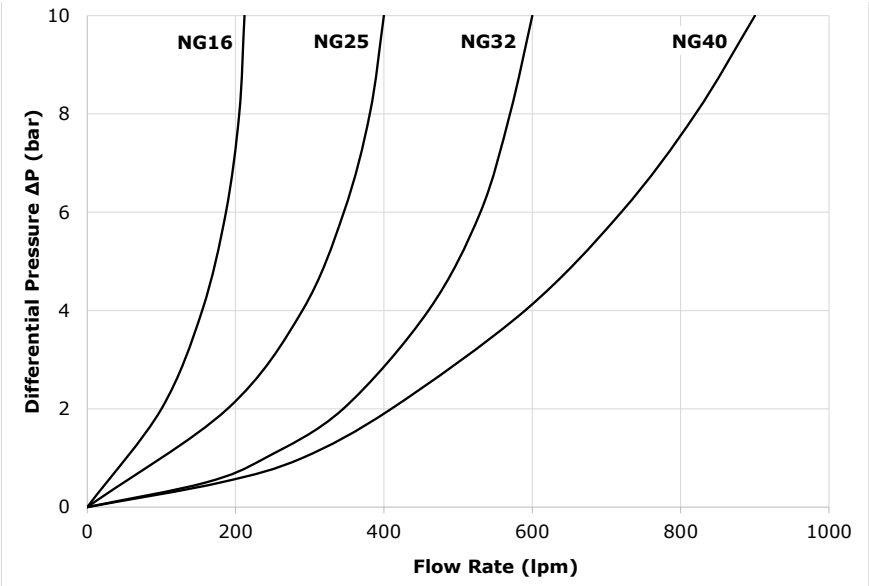


***** - Performance curve at higher flows are based on simulations.

Pressure Drops

Flow in either direction: A to B, or B to A

CVU--ZSWD3**



Standard, Factory Fitted Orifices

Standard orifices fitted in model types SWD and SWD3 are sized to optimize valve dynamics with low shock characteristics over a wide range of system parameters. In model types CVU-**-SWD3 provision for orifice Z1 caters for additional tuning. If it is necessary to change the size of orifice AP then consult your Danfoss representative for information on correct dismantling and re-assembly procedures.

CVU-**-SWD Models

Nominal Size	Orifice AP, Port X in Side of Cover Diameter, mm (inches)	Thread
16	1,0 (0.039)	M6
25	1,2 (0.047)	M6
32	1,4 (0.055)	M6
40	1,4 (0.055)	M6
50	2.0 (0.079)	M6
63	2.2 (0.087)	M6

CVU-**-SWD3 Models

Nominal Size	Orifice AP: Diameter, mm (inches)	Thread	Orifice Z1: Diameter, mm (inches)	Thread
06 (NG16)	1,4 (0.055)	M5	1,0 (0.039)	M5
08 (NG 25)	1,6 (0.063)	M6	1,2 (0.047)	M6
09 (NG 32)	2,0 (0.079)	M6	1,4 (0.055)	M6
10 (NG 40)	2,0 (0.079)	M6	1,4 (0.055)	M6
11 (NG 50)	2,2 (0.087)	M6	1,6 (0.063)	M6
12 (NG 63)	2,5 (0.098)	M6	1,8 (0.071)	M10

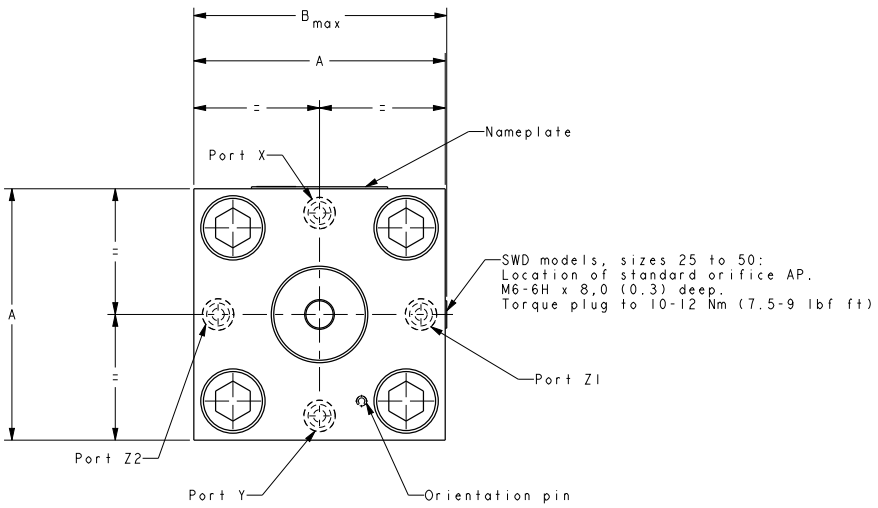
CVU-**-ZSWD3 Models

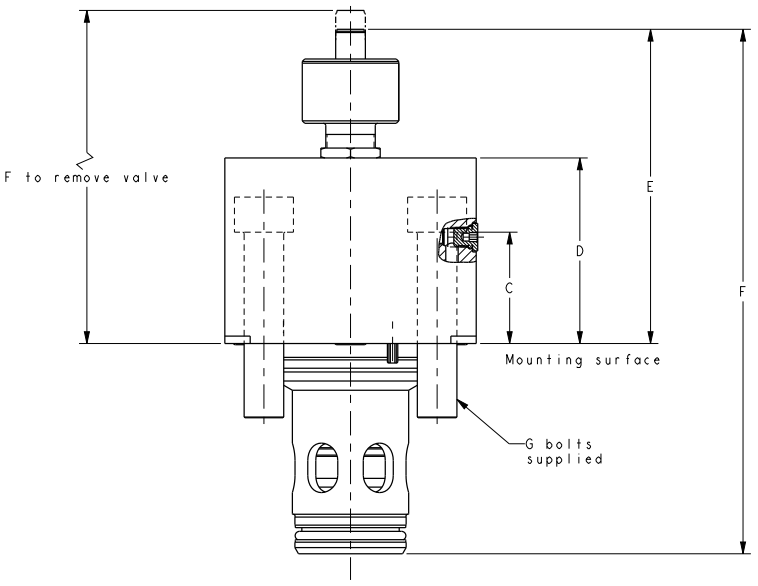
Nominal Size	Orifice locations AP, X, Z_2 Diameter, mm (inches)	Thread
06 (NG16)	No standard	M6
08 (NG 25)	orifices fitted	
09 (NG 32)		
10 (NG 40)		

Directional Valves with Electrical Indication

CVU--SWD-*-** Models**

Sizes 16 to 63



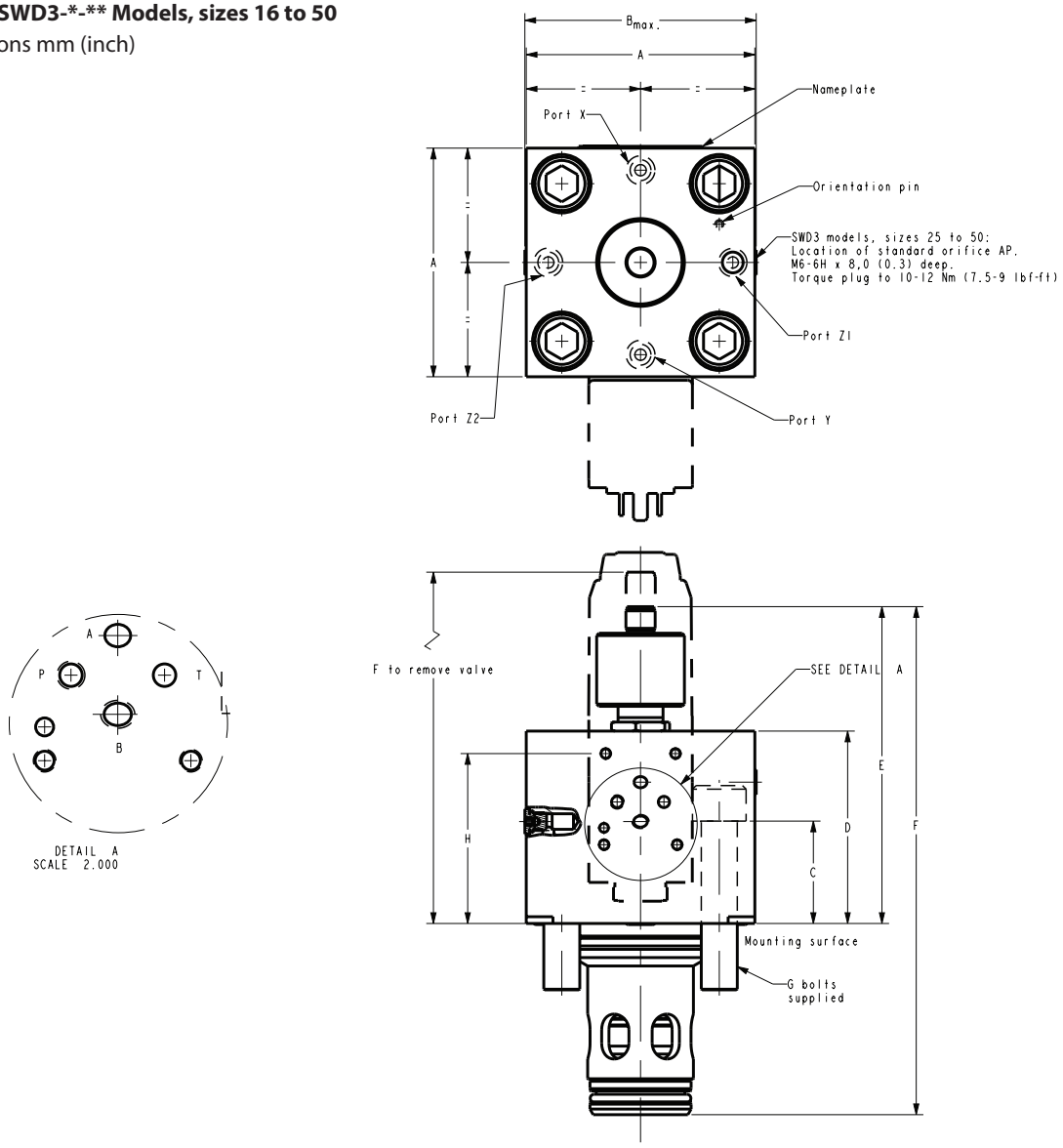


Dimension	CVU-16-SWD	CVU-25-SWD	CVU-32-SWD	CVU-40-SWD	CVU-50-SWD	CVU-63-SWD
A	66,0 (2.60)	86,0 (3.39)	101,6 (4.00)	126,0 (4.96)	142,5 (5.61)	183,0 (7.20)
B	66,6 (2.62)	86,6 (3.41)	102,2 (4.02)	126,6 (4.98)	143,1 (5.63)	183,5 (7.23)
C	40,0 (1.57)	55,0 (2.17)	45,0 (1.77)	42,0 (1.65)	44,0 (1.73)	63,5 (2.50)
D	58,0 (2.28)	70,0 (2.76)	75,0 (2.95)	72,0 (2.83)	78,5 (2.09)	98,5 (2.88)
E	116,5 (4.59)	128,5 (5.06)	133.5 (5.26)	130.5 (5.14)	151.8 (5.98)	171.8 (6.76))
F	171.95 (6.77)	200.25 (7.88)	218.48 (8.60)	234.95 (9.25)	273.20 (10.76)	326.15 (12.84)
G bolts▲	4 x M8 x 55	4 x M12 x 75	4 x M16 x 75	4 x M20 x 75	4 x M20 x 85	4 x M30 x 110
Bolt torque Nm (lbf ft)	35 (26)	110 (81)	285 (210)	500 (370)	500 (370)	1200 (885)

▲ For details of equivalent inch/UNC bolts see page 119.

● Installation dimensions below mounting surface, including location of port "X" and size/length of bolts "G",conform to requirements of ISO 7368---A (see page 123).

CVU--SWD3-*-** Models, sizes 16 to 50**
Dimensions mm (inch)



Dimension	CVU-16-SWD3	CVU-25-SWD3	CVU-32-SWD3	CVU-40-SWD3	CVU-50-SWD3
A	66,0 (2.60)	86,0 (3.39)	101,6 (4.00)	126,0 (4.96)	142,5 (5.61)
B	67,2 (2.65)	87,2 (3.43)	102,8 (4.05)	127,2 (5.01)	143,7 (5.66)
C	82,0 (3.23)	55,0 (2.17)	45,5 (1.79)	40,0 (1.57)	35,0 (1.38)
D	90,0 (3.54)	90,0 (3.54)	85,5 (3.37)	90,0 (3.54)	90,0 (3.54)
E	148,5 (5.85)	148,5 (5.85)	144,0 (5.67)	148.5 (5.85)	163.3 (6.43)
F	203,9 (8.03)	220,25 (8.67)	229,0 (9.00)	253,0 (9.96)	284,7 (11.21)
H	75,5 (2.97)	75,5 (2.97)	75,5 (2.97)	80,0 (3.15)	80,0 (3.15)
G bolts▲	4 x M8 x 100	4 x M12 x 75	4 x M16 x 75	4 x M20 x 75	4 x M20 x 75
Bolt torque Nm (lbf.ft)	35 (26)	110 (81)	285 (210)	50 (370)	500 (370)

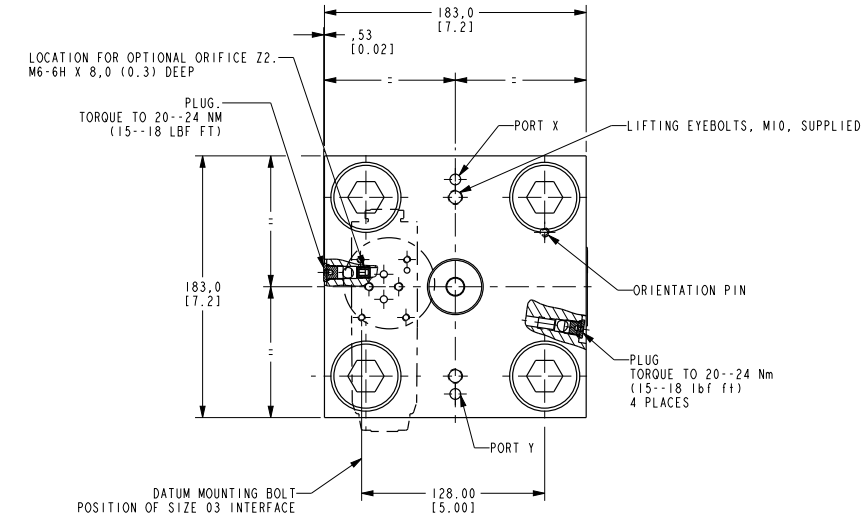
▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.

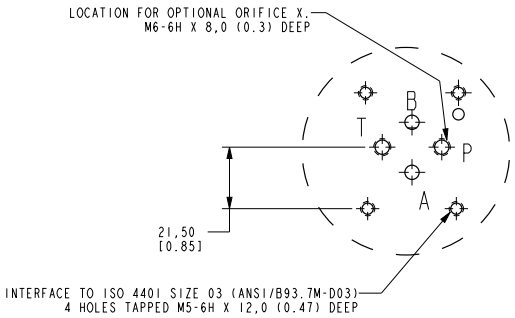
■ For details of equivalent inch/UNC bolts see page 119.

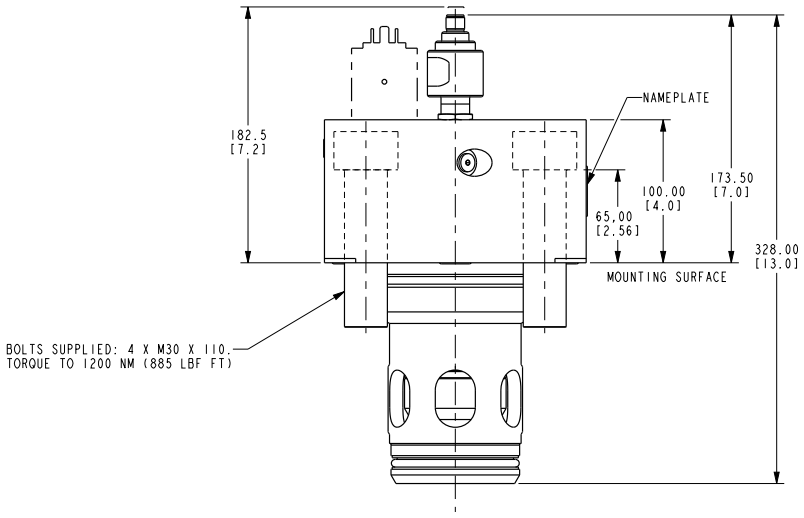
● Installation mounting surface including location of ports “X”, “Y”, “Z1” “Z2” and size/length of bolts “G”, common to requirements of ISO 7368 -- A (see page 123 for more information)

CVU-63-SWD3-*- Models**

Dimensions mm (inch)







(F3)-CVU-63-SWD3-*-20 MODEL

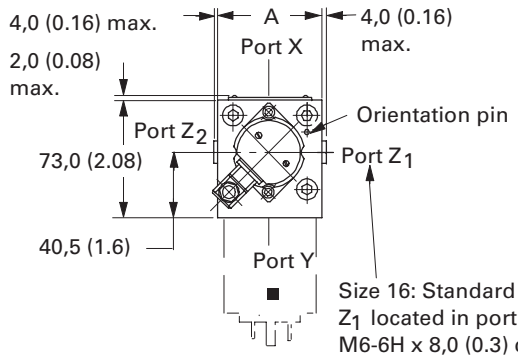
▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.

■ For details of equivalent inch/UNC bolts see next page.

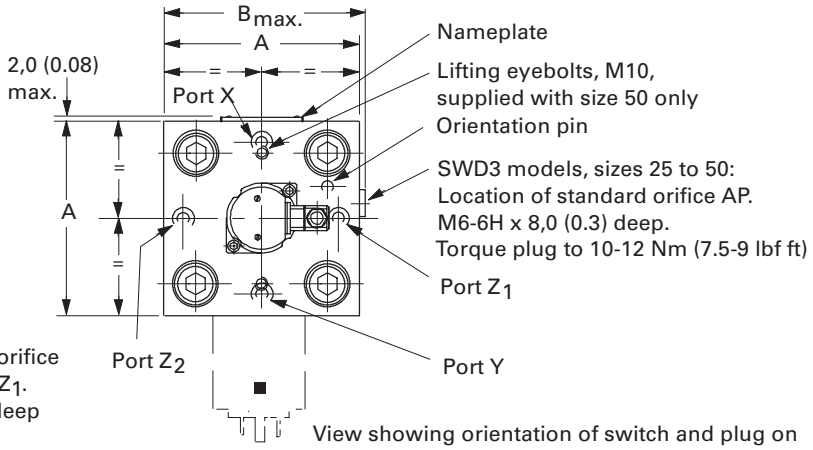
● Installation dimensions below mounting surface, including location of ports "X", "Y", "Z1 ", "Z2 " and size/length of bolts "G", conform to requirements of ISO 7368---A (see page 123).

CVU--ZSWD3-B29-*-1* models, sizes 16 to 40**

Dimensions mm (inch)



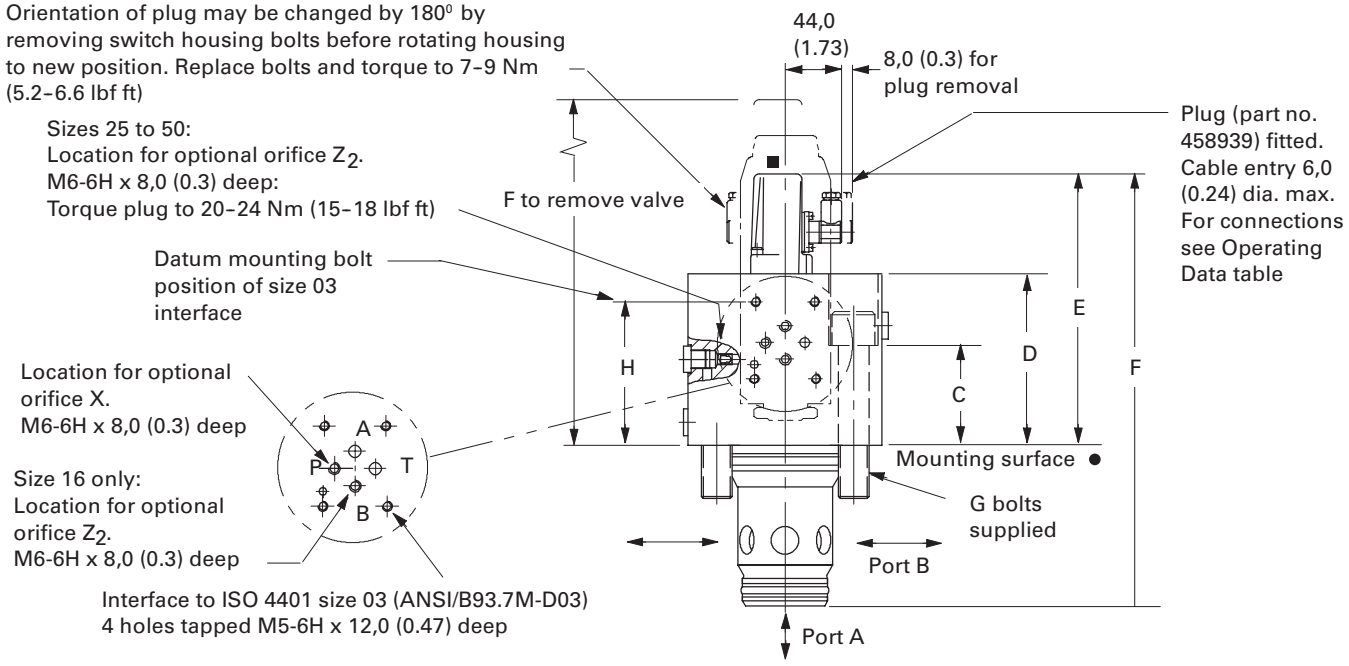
View showing orientation of switch and plug on CVU-16-(Z)SWD3 models



View showing orientation of switch and plug on CVU-**-SWD3 models sizes 25 to 50 and CVU-**-ZSWD3 models sizes 25 – 40

Orientation of plug may be changed by 180° by removing switch housing bolts before rotating housing to new position. Replace bolts and torque to 7–9 Nm (5.2–6.6 lbf ft)

Sizes 25 to 50:
Location for optional orifice Z_2.
M6-6H x 8,0 (0.3) deep:
Torque plug to 20–24 Nm (15–18 lbf ft)



Dimension	CVU-16-ZSWD3	CVU-25-ZSWD3	CVU-32-ZSWD3	CVU-40-ZSWD3	CVU-50-ZSWD3
A	73,0 (2.87)	85,0 (3.35)	102,0 (4.02)	125,0 (4.92)	142,5 (5.61)
B	75,5 (2.97)	90,0 (3.54)	106,5 (4.2)	130,0 (5.12)	147,0 (5.79)
C	82,5 (3.25)	54,0 (2.13)	72,0 (2.83)	55,0 (2.16)	42,0 (1.65)
D	90,0 (3.54)	90,0 (3.54)	90,0 (3.54)	100,0 (3.94)	100,0 (3.94)
E	68,5 (6.63)	168,5 (6.63)	168,5 (6.63)	178,5 (7.03)	178,5 (7.03)
F	223,9 (8.81)	240,0 (9.45)	253,2 (9.97)	282,8 (11.13)	300,0 (11.81)
G bolts▲	4 x M8 x 100	4 x M12 x 75	4 x M16 x 100	4 x M20 x 75	4 x M20 x 75
Bolt torque					
Nm (lbf.ft)	35 (26)	110 (81)	285 (210)	50 (370)	580 (430)
H	75,5 (3.0)	75,5 (3.0)	75,5 (3.0)	80,0 (3.1)	80,0 (3.1)
J	70,5 (2.76)	90,0 (3.54)	106,5 (4.2)	130,0 (4.9)	145,0 (5.7)

▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.

■ For details of equivalent inch/UNC bolts see page 119.

● Installation mounting surface including location of ports "X", "Y", "Z1" "Z2" and size/length of bolts "G", common to requirements of ISO 7368 -- A (see page 123 for more information)

Mounting Bolts/Torques

Metric mounting bolts are supplied with these valves (see installation drawings for details and torques). The following table gives details of equivalent UNC bolts which must be to Grade 12.9 (ISO 898) or stronger.

Model	Bolt Details	Recommended Length	Torque to lbf ft
CVU-16-SWD	5/16″–18 UNC	2-1/4″	26
CVU-16-(Z)SWD3	5/16″–18 UNC	4″	26
CVU-25-SWD	1/2″–13 UNC	3″	81
CVU-25-(Z)SWD3	1/2″–13 UNC	3″	81
CVU-32-SWD	5/8″–11 UNC	3″	210
CVU-32-(Z)SWD3	5/8″–11 UNC	3″	210
CVU-40-SWD	3/4″–10 UNC	3″	370
CVU-40-(Z)SWD3	3/4″–10 UNC	3″	370
CVU-50-SWD	3/4″–10 UNC	3-1/4″	430
CVU-50-(Z)SWD3	3/4″–10 UNC	3″	430
CVU-63-SWD	11/4″–7 UNC	4-1/4″	885
CVU-63-(Z)SWD3	11/4″–7 UNC	4-1/4″	885

Mass

Valve complete with 4 mounting bolts; pilot valve not included in SWD3 models.

Model	Mass Kg	(lb)
CVU-16-SWD	2.2	4.7
CVU-16-SWD3	3.2	7.0
CVU-16-ZSWD3	3.3	7.3
CVU-25-SWD	4.4	9.7
CVU-25-SWD3	5.2	11.5
CVU-25-ZSWD3	4.9	10.8
CVU-32-SWD	6.7	14.7
CVU-32-SWD3	7.2	15.9
CVU-32-ZSWD3	7.3	16.0
CVU-40-SWD	10.1	22.4
CVU-40-SWD3	11.7	25.8
CVU-40-ZSWD3	12.3	27.1
CVU-50-SWD	14.3	31.4
CVU-50-SWD3	15.4	33.8
CVU-63-SWD	30.7	67.7
CVU-63-SWD3	30.8	67.9

Spare Seal Kits

Seal kits for sizes 16, 25, 32 and 40 cover all model types SWD, SWD3 and ZSWD3 (also proportional throttles type EFP1; see page 87) and may contain redundant seals for a particular model designation.

Nominal Size	Vickers by Danfoss Seal Kit Model Code: Standard Seals	"F3" Seals
CVU-16-SWD(3)	12006752	12006753
CVU-25-SWD(3)	12006754	12006755
CVU-32-SWD(3)	12006756	12006757
CVU-40-SWD(3)	12006758	12006759
CVU-50-SWD(3)	12006760	12006761
CVU-63-SWD(3)	12006762	12006763
CVU-16-ZSWD3	02-157167	02-157168
CVU-25-ZSWD3	02-157536	02-157537
CVU-32-ZSWD3	02-157165	02-157616
CVU-40-ZSWD3	02-157679	02-157680

Ordering Procedure

Order by model code and quantity. Note that size 03 pilot valves for mounting on to SWD3 and ZSWD3 models (and their mounting bolts) must be ordered separately.

General Information

Special function cartridge valves are:

- 1:0.25 area ratio cartridge for low pressure relief and
- Directional function model CV**-**-C025

This section of the catalog includes circuitry for applying hydrostat functions to flow control throttles, using standard cartridge relief components and control modules.

1:0.25 Area Ratio
Cartridge: Sizes 16 to 40

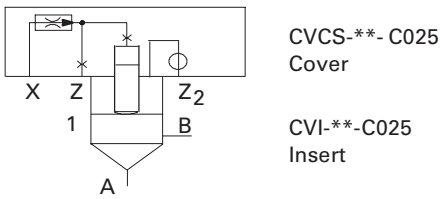
This cartridge arrangement has a 1:0.25 area ratio and operates with a pilot flow entering at X, the pilot flow rate being governed by the integral pressure compensated flow control. See Figure 44. Pilot flow passes out of Z1 to an appropriate pilot relief valve which creates pressure on the top of the pilot piston. This means the main valve will open at, and maintain, a pressure at A of 25% of pilot pressure.

When used with an electrohydraulic proportional pressure control (connected to Z1 port), pressures as low as 1,5 bar (22 psi) are controllable at port A, making it ideal for plastics injection molding machine applications. The area ratio of the large piston to sleeve seat is 1:1.1. The Z1 port should never be blocked; doing so could result in pressure intensification at this port. This low pressure relief valve can also be used as a directional control back pressure valve, or as a blocking valve.

When the back pressure function is operational, port Z2 must be drained to the reservoir. The valve can be locked shut by applying at Z2 a pressure greater than any at A.

The following models are available; insert and cover are ordered separately:

Cover	Insert
CVCS-16-C025-*-30	CVI-16-C025-60
CVCS-25-C025-*-30	CVI-25-C025-60
CVCS-32-C025-*-30	CVI-32-C025-60
CVCS-40-C025-*-30	CVI-40-C025-60



CVCS-**- C025
Cover

CVI-**-C025
Insert

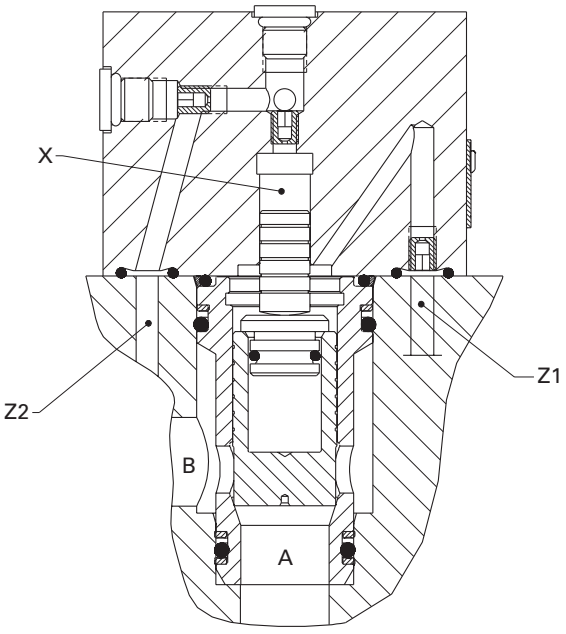
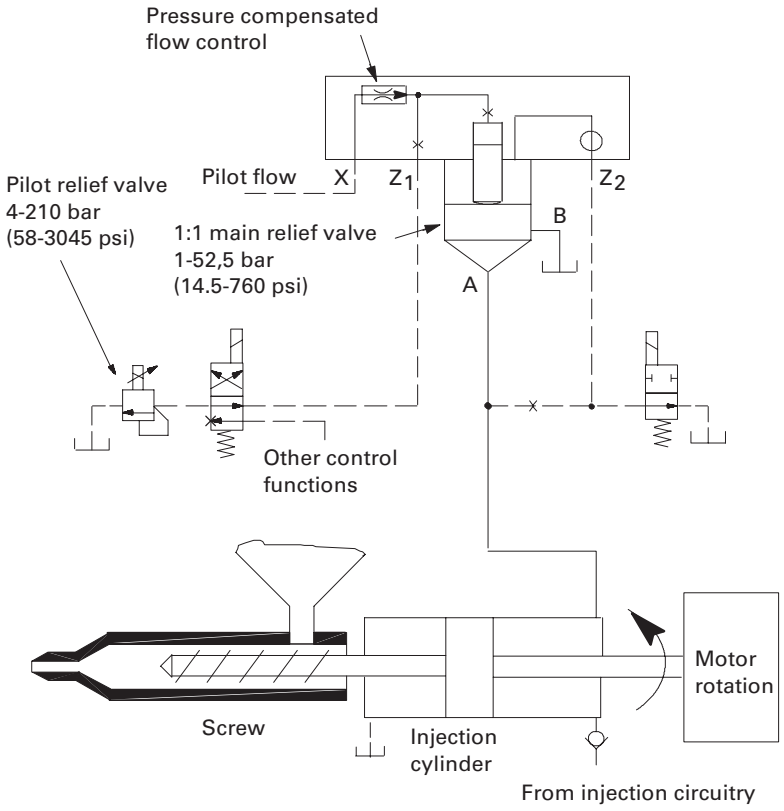


Figure 44

Typical Application
Plastics Injection Molding



Normally Open Prefill Valve:
Sizes 25, 32, 40, 50 and 63

Normally open cartridge valves require an external pilot signal to close the valve against system pressure. This valve range is ideally suited for applications requiring a prefill valve or decompression valve.

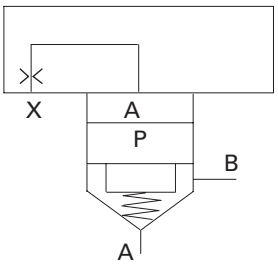
The main spool consists of a sleeve with a sharp edged seat and a piston. A spring holds the piston in the open position. Pressure at control port X forces the poppet against the spring to close the valve.

Sizes 25, 32, 40, 50 and 63

Area ratios are defined as 1:1.05. Pressure to close = 2,5 bar (36.3 psi) + P_A + 0.05 P_B.

Cover	Insert
CVCS-25-OD*-*-30	CVI-25-OD105-*-60
CVCS-32-OD*-*-30	CVI-32-OD105-*-60
CVCS-40-OD*-*-30	CVI-40-OD105-*-60
CVCS-50-OD*-*-30	CVI-50-OD105-*-60
CVCS-63-OD*-*-30	CVI-63-OD105-*-60

Sizes 25, 32, 40, 50 and 63



CVCS-**- OD
Cover

CVI-**-OD105
Insert

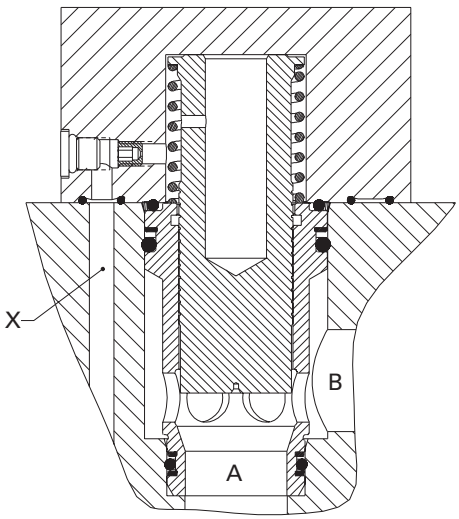


Figure 45

Hydrostat Functions for Use in Fixed Delivery Pump Systems

Where the flow rate through a throttle is required to be independent of variations in load and/or system pressure, a hydrostat function should be designed into the system. A 3-way, bleed-off hydrostat can be built from standard relief valve elements presented in this catalog. The adjacent diagrams, Figures 46, 47 and 48, show the circuitry of a 3-way hydrostat together with three control options.

Figure 46. The pressure drop across the proportional throttle can be varied by adjusting the setting of the pilot relief valve in the CVCS-**-C type cover (see page 41). Normally, with the flow rate through the proportional throttle being less than the pump delivery, excess pump flow will be by-passed through the cartridge insert (flow A to B) to reservoir.

Variations in load and/or system pressure will increase or decrease flow across the pilot relief valve, thereby causing the spool of the insert to move to either increase or decrease the by-pass flow to re-establish the correct differential pressure across the throttle.

A separate main system relief valve (not shown) should be provided for controlling the maximum system pressure.

Figure 47. The CVCS-**-C cover and CVI-**-D10 insert here act as the maximum pressure relief valve. A sensing line is taken from auxiliary port Z1 to a separate module which controls the pressure differential.

Figure 48. By using a type CVCS-**-C3 over (integral interface for size 3 pilot valve), a proportional pressure control valve KCG-3 allows the maximum pressure to be varied from a suitable electrical signal. A typical application would be where the final holding pressure on an actuator needs to be varied (e.g. curing/setting time).

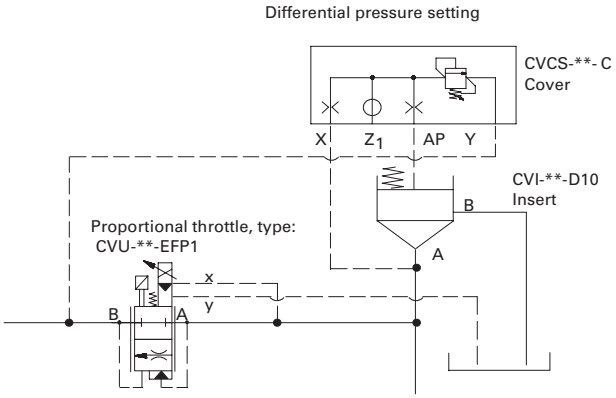


Figure 46

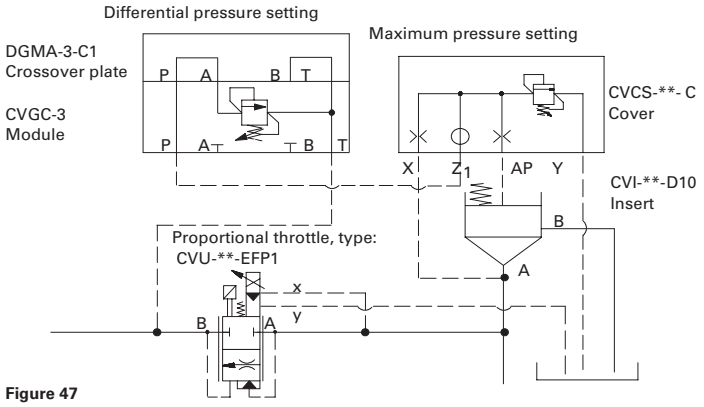


Figure 47

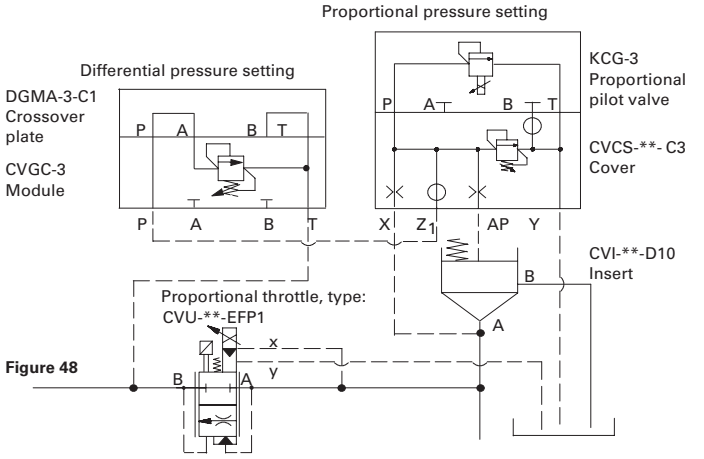


Figure 48

Model Codes Special Function Valves

CVCS Covers

Vickers by Danfoss type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and DIN 24342. All features must be specified when ordering; those in brackets ( ) are optional or apply only to specific models.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVCS-**-****-*-30-******

CVCS	**	****	*	30	****
1	2	3	4	5	6

1 Model

CVCS - Cartridge valve cover to ISO 7368

2 Nominal size to ISO 7368 (DIN 24342)

	C025	OD*
16 - 06 (NG16)	•	-
25 - 08 (NG25)	•	•
32 - 09 (NG32)	•	•
40 - 10 (NG40)	•	•
50 - 11 (NG50)	•	•
63 - 12 (NG63)	•	•

3 Function

C025 - 1:0.25 ratio (used with insert type C025)

OD - Normally open (prefill)

4 Seal Material

N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

5 Design number 30 series

See page 115 for sizes of factoryfitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Danfoss representative. Non-standard orifice requirements should be defined as follows:

6 Pilot control orifice location and size

See table below for pilot control orifice locations, as per Function selected. The letter 'S' in brackets specifies standard factory-fitted orifice associated with that location. The letter 'S' should be included in the model code wherever standard orifice is required. Letter 'Z' in brackets indicates that no orifice plug is fitted, whereas letter 'A' indicates blocked port.To specify non-standard orifice sizes, refer table on page 116.

Function	Location 1	Location 2	Location 3	Location 4
C025	AP(S)	Z1(S)	Z2(Z)	-
OD	X(S)	-	-	-
OD3	X(S)	A(Z)	Z1(Z)	Z2(Z)

Letter in brackets to be mentioned in the model code at appropriate orifice location.
Refer pages 6 and 7 for pictorial representation of orifice locations.

Model Codes Special Function Valves

CVI Inserts

For availability of inserts by size and function, see page 5. All features must be specified when ordering; those in brackets () are optional.

A hyphen '-' to be used for separating features in model code.
A generic model code would look like: **CVI-**-****-*-60**

CVI	**	****	*	60
1	2	3	4	5

1 **Model**

CVCS - Cartridge valve cover to ISO 7368

2 **Nominal size to ISO 7368 (DIN 24342)**
Applicable to function type

	C025	OD105
16 - 06 (NG16)	•	-
25 - 08 (NG25)	•	•
32 - 09 (NG32)	•	•
40 - 10 (NG40)	•	•
50 - 11 (NG50)	•	•
63 - 12 (NG63)	•	•

3 **Function**

C025 - 1:0.25 ratio (used with insert type C025)

OD105 - Normally open (prefill)

4 **Seal Material**

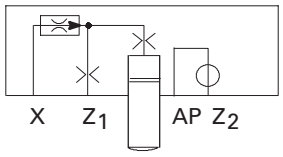
N - Nitrile Seal Material
V - Viton (FKM) Seal Material
See "Fluids and Seals" on page 15.

5 **Design number 60 series**

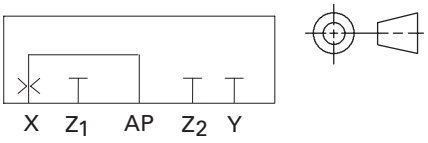
Note: A nameplate is supplied with each insert for fixing to the cover to identify insert in use

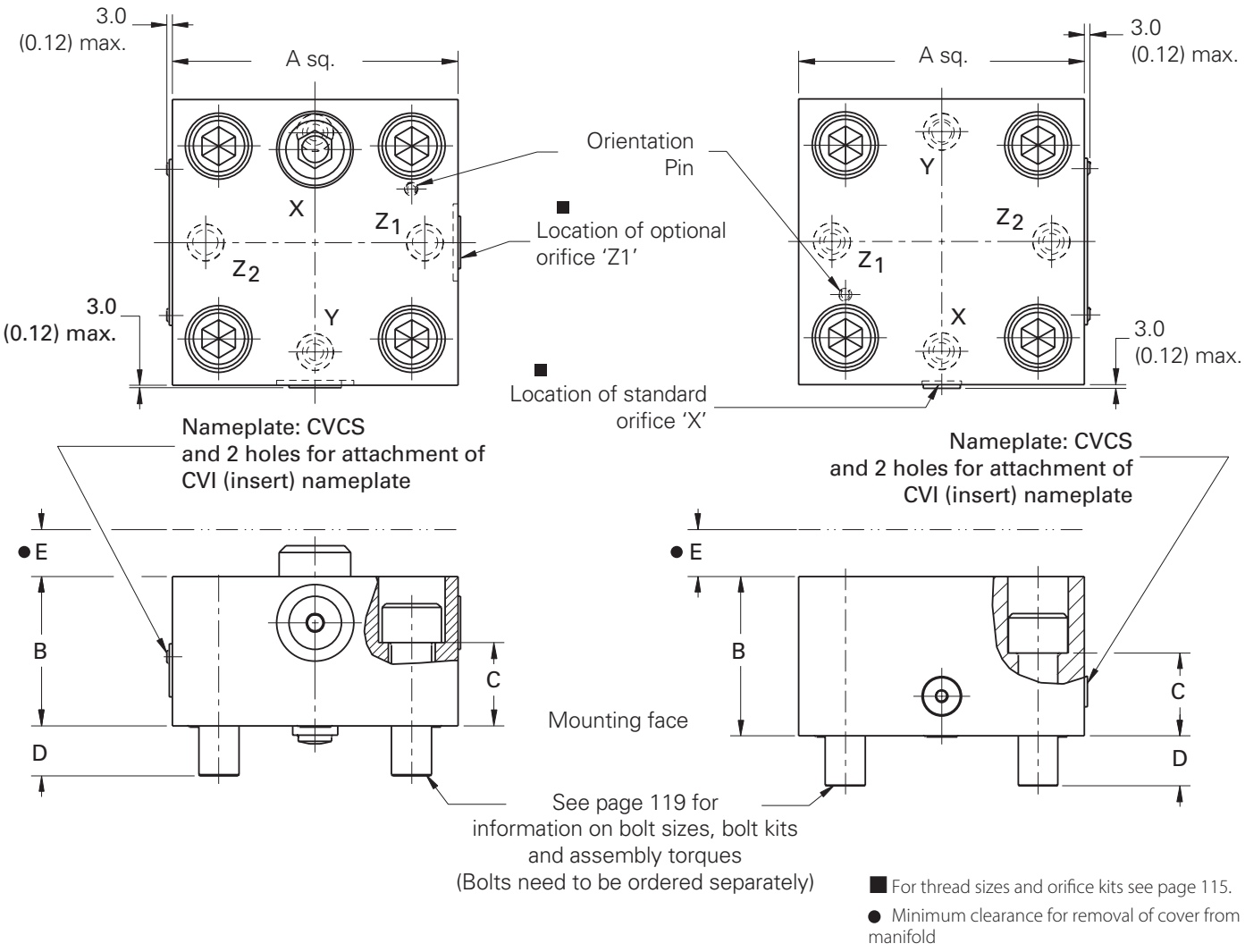
CVCS--C025**
Sizes 16 to 40

Dimensions
mm (inch)



CVCS--OD**
Sizes 25 to 63





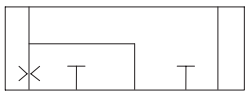
■ For thread sizes and orifice kits see page 115.

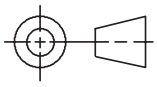
● Minimum clearance for removal of cover from manifold

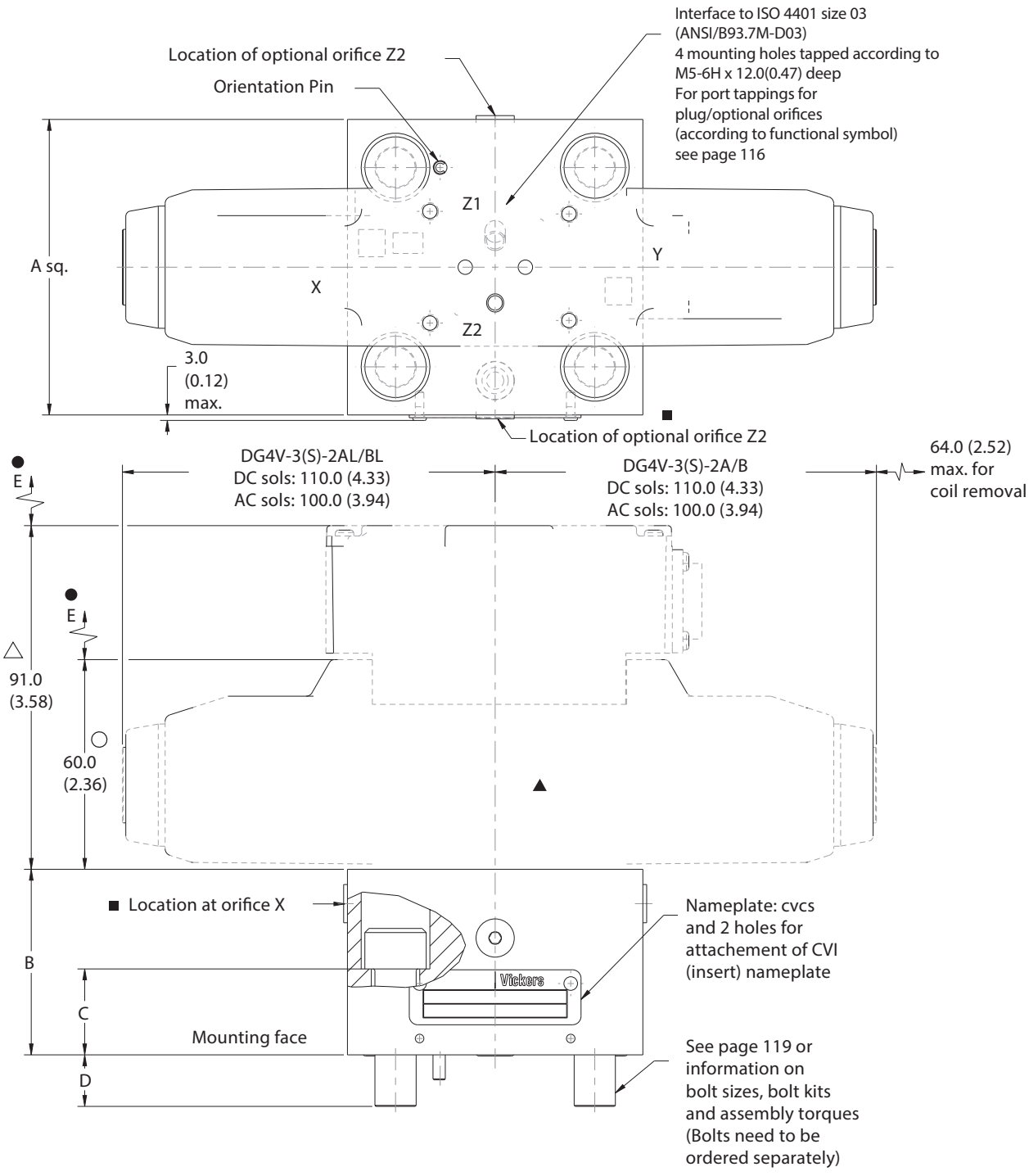
Size	A	B C025	B OD	C	D	E C025	E OD	Location for nameplates Type C025	Location for nameplates Type OD
16	66.0 (2.6)	48.0 (1.89)		36.0 (1.42)	14.0 (0.55)	17.0 (0.67)	7.0 (0.28)	Side Z2	
25	86.0 (3.39)	45.0 (1.77)	48.0 (1.89)	25.0 (0.98)	15.0 (0.59)	21.0 (0.83)	11.0 (0.43)	Side Z2	Side Z2
32	101.6 (4.00)	55.0 (2.17)	60.0 (2.36)	30.0 (1.18)	25.0 (0.98)	25.0 (0.98)	15.0 (0.59)	Side Z2	Side Z2
40	126.0 (4.96)	53.0 (2.09)	60.0 (2.36)	35.0 (1.38)	25.0 (0.98)	29.0 (1.14)	19.0 (0.75)	Side Z2	Side Z2
50	140.0 (5.51)		65.0 (2.56)	44.0 (1.73)	36.0 (1.42)		19.0 (0.75)		Side Z2
63	180.0 (7.09)		85.0 (3.35)	48.0 (1.89)	42.0 (1.65)		29.0 (1.14)		Side Z2

Special Function Valves

CVCS--OD3**
Sizes 25 to 63







■ For thread sizes and orifice kits see page 115.

● Maximum clearance for removal of cover from manifold.

▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers by Danfoss DG4V-3.

○ DG4V-3 with coil type U.

△ DG4V-3-70

Size	A	B	C	D	E	Location for Nameplates
25	86.0 (3.39)	54.0 (2.13)	25.0 (0.98)	15.0 (0.59)	22.0 (0.87)	Side Z2
32	101.6 (4.00)	70.0 (2.76)	30.0 (1.18)	25.0 (0.98)	31.0 (1.22)	Side Z2
40	126.0 (4.96)	70.0 (2.76)	35.0 (1.38)	25.0 (0.98)	33.0 (1.30)	Side Z2
50	140.0 (5.51)	78.0 (3.07)	44.0 (1.73)	36.0 (1.42)	34.0 (1.34)	Side Z2
63	180.0 (7.09)	90.0 (3.54)	48.0 (1.89)	42.0 (1.65)	43.0 (1.69)	Side Z2

Pilot Control Modules

Basic Characteristics

Max. pressure up to 350 bar(5000 psi) Flow ratings:

CVGC-3
CVGCA-3
CVGCPA-3
} 5 L/min (1.3 USgpm) max.

CVGMS1-3
CVGS1-3
CVGPC1-3
} 10 L/min (2.6 USgpm) at △p = 5 bar (72 psi)

Mounting interface ISO 4401 size 03 (with additional orientation pin); ANSI/B93.7M-D03

General Description

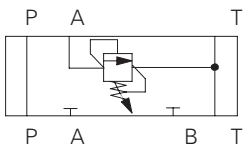
A range of pressure relief, shuttle and pilot operated check functions provide additional functions allowing pilot control circuitry to be directly mounted on to the size 03 mounting face of CVC(S) covers, either with, or independent of, a solenoid operated pilot valve. Their design and port connections are specific to their use in piloting cartridge valves.

These six modules were designed to satisfy the needs of Danfoss application and systems engineers in providing effective solutions to a wide variety of pilot control requirements in cartridge valve systems.

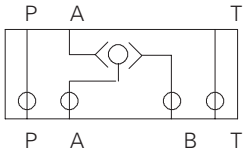
For other useful size 03 pilot control modules see Vickers by Danfoss SystemStakTM valves type DG**M-3, see GB-C-2027.

Functional Symbols

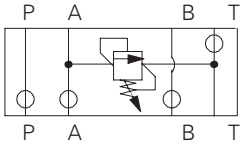
CVGC-3



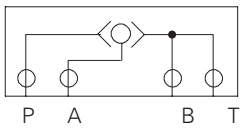
CVGMS1-3



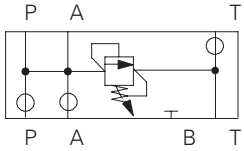
CVGCA-3



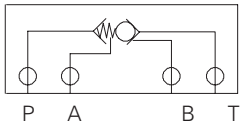
CVGS1-3



CVGCPA-3



CVGPC1-3



Application of Pilot Control Modules

The examples of uses for control modules shown on the next page are taken from actual applications, and serve to illustrate the types of control circuitry that can be built directly on to the size 03 interface of the cartridge valve covers. For assistance with other possible applications for size 03 control modules, contact your Danfoss representative.

Pressure Control with Remote Electrical Selection

Figures 51 and 56 show pressure relief functions based on the directional cover type D1/D3. In Figure 51 the system is vented when the solenoid of the pilot valve is de-energized; when the solenoid is energized the system pressure is limited to the setting of the CVGCA-3 module.

In Figure 52 the system is vented when both solenoids of the pilot valve are de-energized. The maximum system pressure is set at the CVGCPA-3 module and selected by energizing solenoid "b". A lower pressure is set by the CVGC-3 module and selected by energizing solenoid "a".

Direction Control Options

Several direction control functions are possible by using the shuttle and pilot-operated check modules.

In Figure 53 the cartridge valve insert functions as a pilot-operated check valve. At all times flow is possible from A to B. Flow from B to A is possible only when port Z2 is pressurized.

In Figure 54 flow is not possible from B to A. Flow from A to B is possible only when there is no pressure at port Z2; the insert is locked closed when pressure is applied at port Z2.

In Figure 55 the solenoid-operated pilot control valve is mounted directly on to the control module. Flow A to B is possible only when the solenoid is energized. At no time is flow from B to A possible.

Figure 56: The addition of the pilot-operated check module CVG-PC1-3 to the electrically monitored model type CVU-**- ZSWD3 adds a further degree of security to a gate guard control system. Pressure at port B holds the main spool tightly closed until an external pilot pressure is applied to port Z2. This pilot pressure unseats the pilot-operated check module to open AP to port Y, and at the same time opens the main poppet.

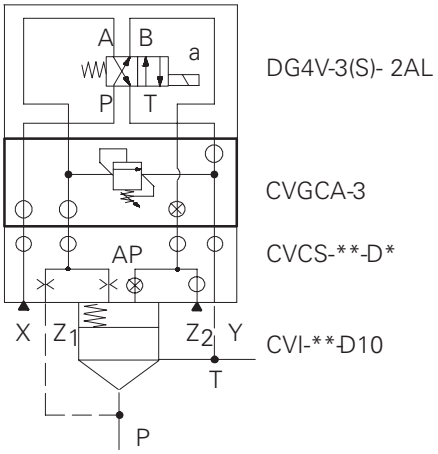


Figure 51

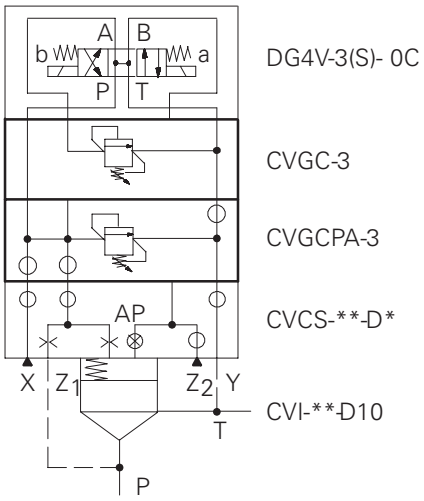


Figure 52

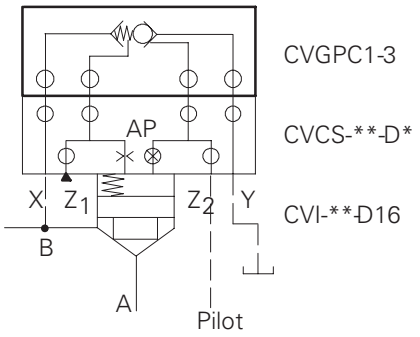


Figure 53

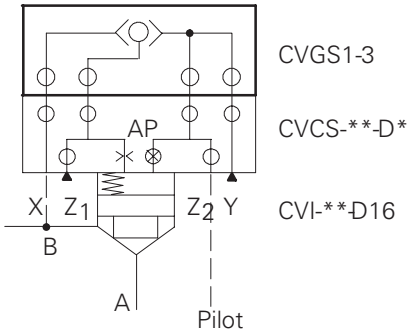


Figure 54

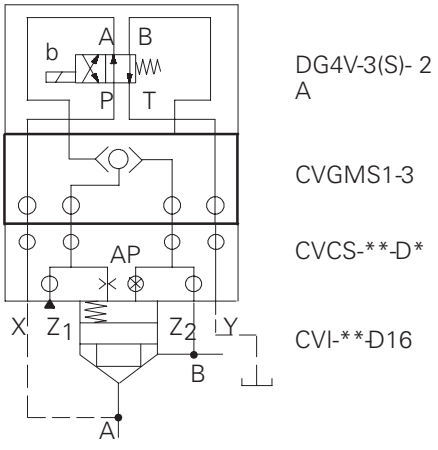


Figure 55

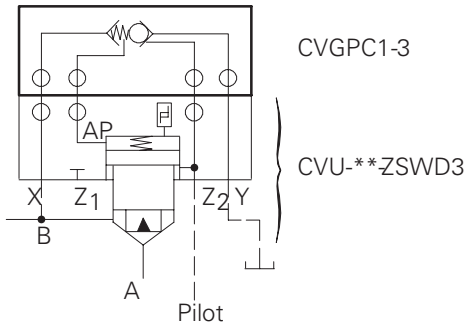


Figure 56

Model Codes Pilot Control Modules

Relief Functions

(F3-)	CVG	***	3	*	***	1*
1	2	3	4	5	6	7

1 Seal material

F3 - Special seals. See "Fluids and Seals" on page 15. Omit for standard seals.

2 Model

CVG - Cartridge valve module, gasket mounted

3 Function and circuitry

C - Relief module; function P-T

CA - Relief module; function A-T

CPA - Relief module, function P and A-T

4 Interface (ANSI/B93.7M-D03)

3 - ISO 4401, size 03

5 Type of pressure adjustment

K - Micrometer adjuster with keylock

M - Micrometer adjuster without lock

W - Wrench adjustment with hex locknut

6 Adjustable pressure range

125 - 3–125 bar (44–1800 psi)
250 - 5–250 bar (73–3600 psi)
350 - 8–350 bar (116–5000 psi)

7 Design number, 1* series

Subject to change. Installation dimensions unchanged for design numbers 10 to 19 inclusive.

A hyphen '-' to be used for separating features in model code. A generic model code would look like: ****-CVG-***-3-*-***-1***

Auxiliary Functions

(F3-)	CVG	**1	3	[P*-T*-A*-B*]	**
1	2	3	4	5	6

1 Seal material

F3 - Special seals. See "Fluids and Seals" on page 15. Omit for standard seals.

2 Model

CVG - Cartridge valve module, gasket mounted

3 Function and circuitry

See "Functional Symbols" for precise circuitry connections

S1 - Shuttle valve with size 03 interface on one side only

MS1 - Modular shuttle valve (size 03 interface on both sides)

PC1 - Pilot operated check function with size 03 interface on one face only

4 Interface (ANSI/B93.7M-D03)

3 - ISO 4401, size 03

5 Orifice selections

Non-standard assemblies (e.g. modules with fitted orifices) may be supplied by special arrangement. Please consult your Danfoss representative before ordering.

Typical examples include:

P08 / PF - Orifice size 0,8 mm in P line

T06 / TD - Orifice size 0,6 mm in T line

B09 / BG - Orifice size 0,9 mm in B line

A10 / AH - Orifice size 1,0 mm in A line

Specify orifice requirements by port location(s) followed by orifice code or two numerals (see table on page 116) e.g. P07-B09.

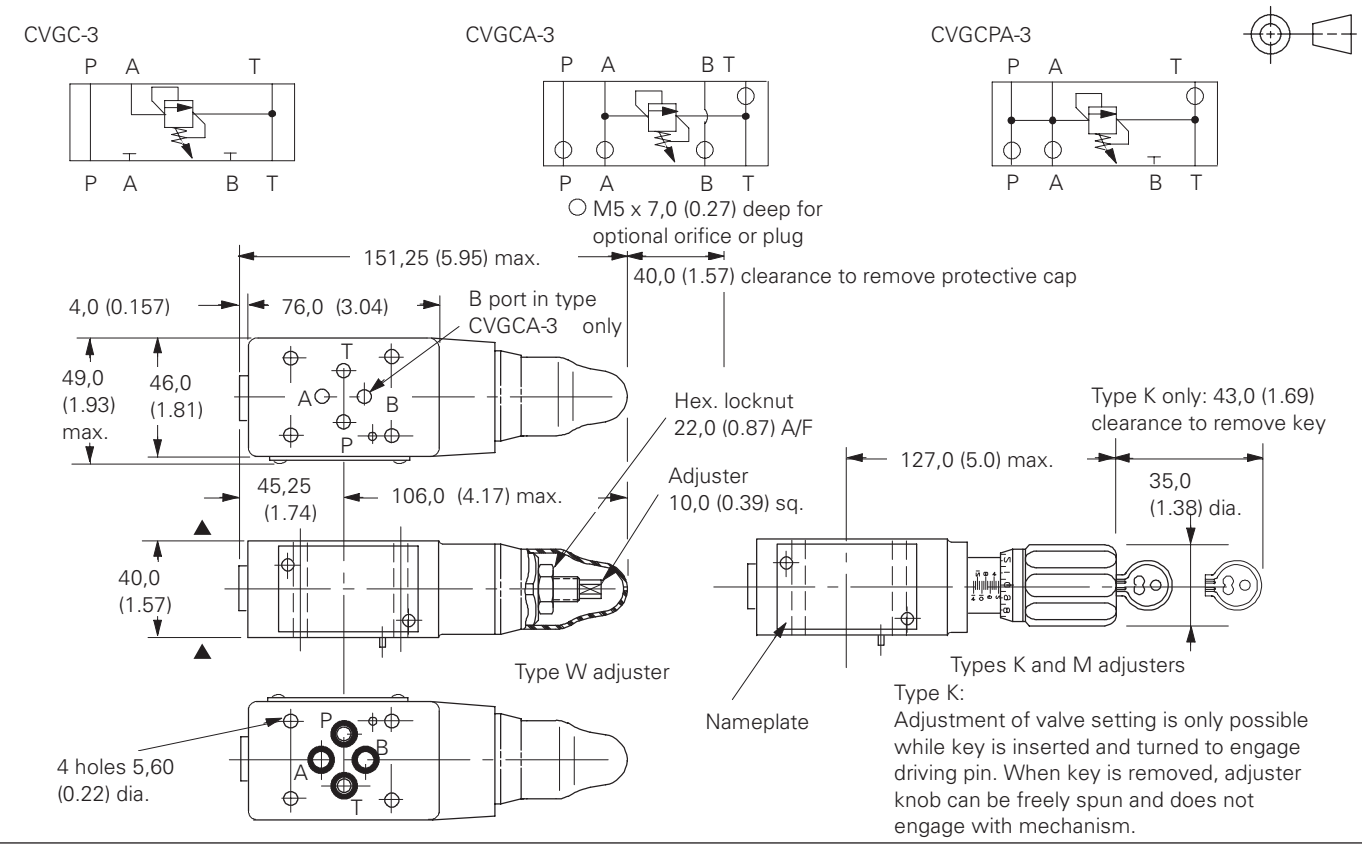
6 Design number

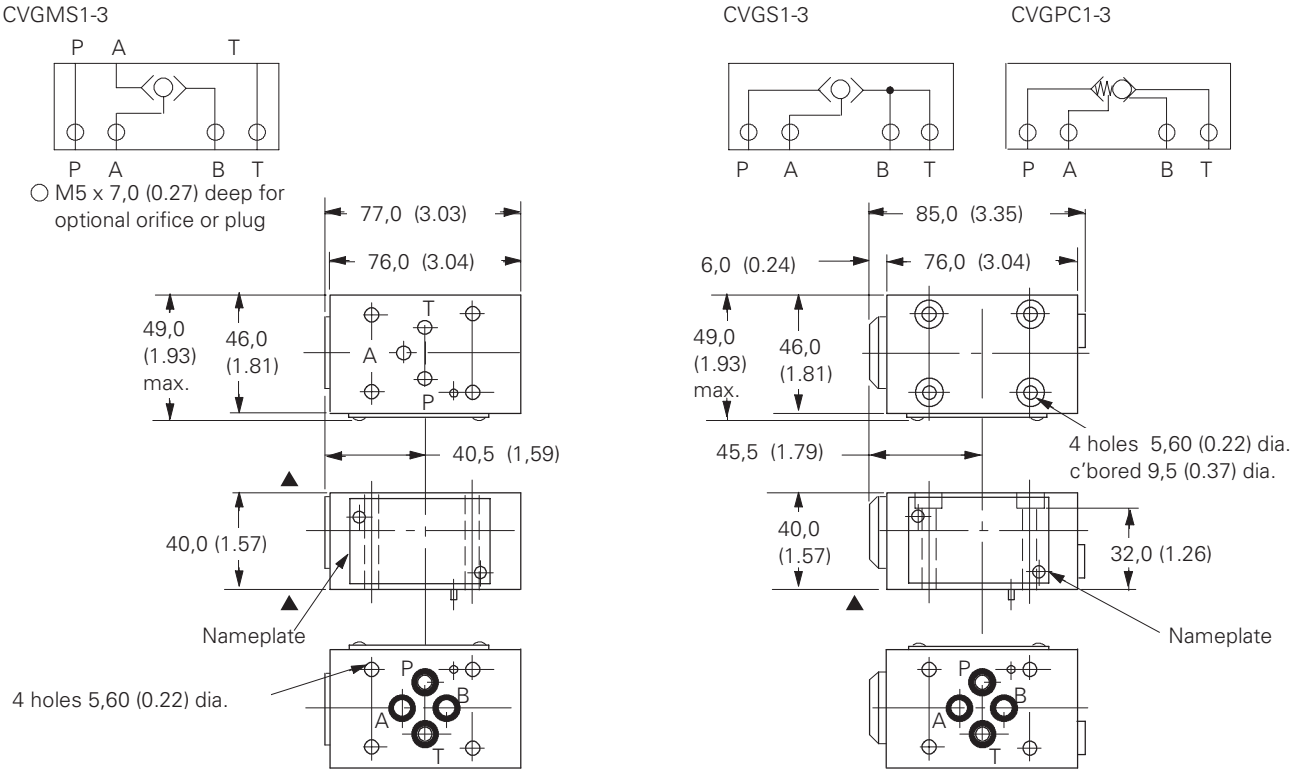
1* series - For types S and MS

2* series - For type PC Subject to change. Installation dimensions unchanged for design numbers 10 to 19, or 20 to 21 inclusive.

A hyphen '-' to be used for separating features in model code. A generic model code would look like: ****-CVG-**1-3-P*-T*-A*-B*-****

Pilot Control Modules





▲ Mounting surface conforms to ISO 4401, size 03 (with additional orientation pin/pin hole); ANSI/B93.7M-D03.

Supplementary Data

Standard Factory-Fitted Orifice Sizes (mm)

Sizes and locations of standard factory-fitted orifices. Other orifice sizes (and other locations) can be fitted by special arrangement with your Danfoss representative. Non-standard orifice requirements should be defined according to CVC(S and CVI model codes. For available orifice kits, which should be ordered separately, see next page.

		Orifice Size					
Function	**Port**	**16 mm**	**25 mm**	**32 mm**	**40 mm**	**50 mm**	**63 mm**
CVC(S) covers							
A	X	1,0	1,2	1,3	1,4	1,6	1,8
A3	AP_2	1,0	1,2	1,2	1,4	1,6	1,8
C and SC	AP	1,0	1,2	1,2	1,4	–	–
	X	0,9	0,8	0,9	1,0	–	–
C3 and	AP	1,0	1,2	1,2	1,4	–	–
SC3	X	0,9	0,8	0,9	1,0	–	–
C025	AP	1,0	0,8	0,8	0,8	–	–
	Z_1	1,0	1,0	1,0	1,0	–	–
D3	AP_1	1,0	1,2	1,3	1,4	1,6	1,8
DC3	AP	1,0	1,2	1,2	1,4	1,6	1,8
N	X	1,0	1,2	1,3	1,4	1,6	1,8
OD/OD3	–	–	1,2	1,2	1,4	1,6	1,8
PC	AP	1,0	1,2	1,3	1,4	1,6	1,8
U	AP	1,2	1,2	1,2	1,4	–	–
U3	AP	1,2	1,2	1,2	1,4	–	–
W	AP	1,0	1,2	1,3	1,4	1,6	1,8
W13	A	1,0	1,2	1,3	1,4	1,6	1,8
W33	A	1,0	1,2	1,3	1,4	1,6	1,8
X3	AP	1,0	1,0	1,2	1,4	–	–
CVI inserts							
C10F	–	0,8	0,8	0,9	1,0	1,4	1,4
D105V	–	1,0	1,2	1,2	1,4	1,4	1,4
U	–	0,8	0,8	1,0	1,4	–	–

Orifice Thread Sizes

Unless otherwise stated on installation drawings (e.g. dynamic covers CVCS-50-ZD(A)* and CVCS-63-ZD(A)* on page 73) the following thread sizes are provided at designated orifice locations.

		Cover Size					
Orifice Designation	**16**	**25**	**32**	**40**	**50**	**63**	
AP, AP1, AP2		M5	M6	M6	M6	M6	M6
P, A, B, T		M5	M6	M6	M6	M6	M6
X, Z1, Z2		M5	M6	M6	M6	M10	M10

Optional Orifice Kits For Fine Tuning of Cartridge Valve Systems

Orifice Code	Orifice Size	Valve Cover Size & Orifice Kit Number ■	
Metric Threads	(mm)	SIZE 16: 992747 ■ TAP M5	SIZE 25, 32, 40, 50 & 63: 992748 ■ TAP M6
A	SOLID PLUG	•	•
B	0.3		
C	0.5		
D	0.6		
E	0.7	•	•
F	0.8	•	•
G	0.9		
H	1.0	•	•
I	1.1		
J	1.2	•	•
K	1.3		
L	1.4		
M	1.5	•	•
P	1.6		
Q	1.8		
R	1.9		
S	STANDARD		
T	2.0		
U	2.2		
X	3.0		
Z	OPEN/ NO ORIFICE		

■ Order orifices/plugs by kit number. Kit contains three of each orifice and plug indicated

Fitting New Orifice Plugs

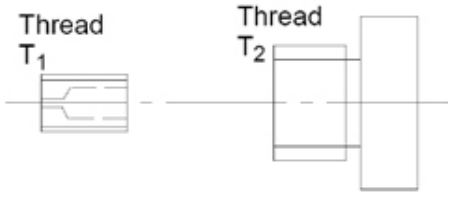
Fitting New Orifice Plugs When fitting new orifice plugs the following assembly instructions should be observed:

1. Do not re-use any orifice plug that has been removed from an assembly.
2. Parts must be assembled in dry conditions.
3. Apply a thin coating of Loctite grade 222 (or equivalent) to the internal thread only.
4. Do not apply Loctite (or equivalent) to the orifice plug.
5. Assemble the plug, tightening to the recommended torque level (see "Assembly Torques" tables).

Assembly Torques

Orifice plug

External closure plug as applicable



External closure plug, Torque, lbf ft inch thread T_2	
5/16"-24 UNF	7 to 7.5
3/8"-24 UNF	9 to 9.2
7/16"-20 UNF	11 to 12
1/2"-20 UNF	15 to 16
9/16"-18 UNF	21 to 23
3/4"-16 UNF	39 to 43
7/8"-14 UNF	55 to 61

Orifice plug, metric thread T_1	Torque, Nm
M5	2,8 to 3,2
M6	4,3 to 4,7
M8	7,0 to 9,0
M10	10,0 to 12,0

External closure plug, Torque, Nm BSPF thread T_2	
G 1/8"	9,8 to 10,2
G 1/4"	19,8 to 20,2
G 3/8"	38,8 to 39,2
G 1/2"	58,8 to 59,2

Orifice Sizing Guide

Use Figure 57 to approximate the opening and closing times of poppets with different size orifices. From the chart, determine the cartridge valve's insert poppet area, poppet stroke, and resultant displacement volume. The chart shows full stroke displacement of poppets having 1:1.5 and 1:1.05 area ratios.

From the curves, determine pressure drop across the orifice. For example, if there is a 140 bar (2000 psi) p across a 0,5 mm orifice in a 25 mm valve, the poppet will travel its full stroke in about 200 milliseconds.

The calculation provides a starting point for determining the right orifice for the application. The final determination is the application itself, and fine tuning should be done on the machine installation.

$$\frac{\text{Displacement } (in^3) \times 60 \text{ (sec/min)}}{\text{Flow rate } (in^3/min)}$$

$$\frac{(0.27\ in^3)\ (60\ sec/min)}{80\ (in^3/min)} = 0.200\ sec$$

$$\frac{\text{Displacement } (cm^3) \times 60 \text{ (sec/min)}}{\text{Flow rate } (cm^3/min)}$$

$$\frac{(4,42\ cm^3)\ (60\ sec/min)}{1300\ (cm^3/min)} = 0,200\ sec$$

Valve Size	Poppet area AP mm²	stroke▲ in²	Nominal poppet mm	Displacement in	cm³	in³
16	283.53	0.44	9.0	0.35	2.55	0.15
25	615.75	0.95	11	0.45	6.77	0.43
32	1017.88	1.58	14	0.55	14.25	0.87
40	1661.90	2.58	19	0.75	31.57	1.94
50	2463.01	3.82	21	0.83	51.72	3.17
63	3848.45	5.97	23	0.90	88.51	5.37

▲ The stroke of some poppet types varies slightly from the figures given. However, this data is valid for estimating response times for standard insert types C10F, D105(V) and **16, using above formulae. For response data of dynamic models type ZD(N)105, see page 69.

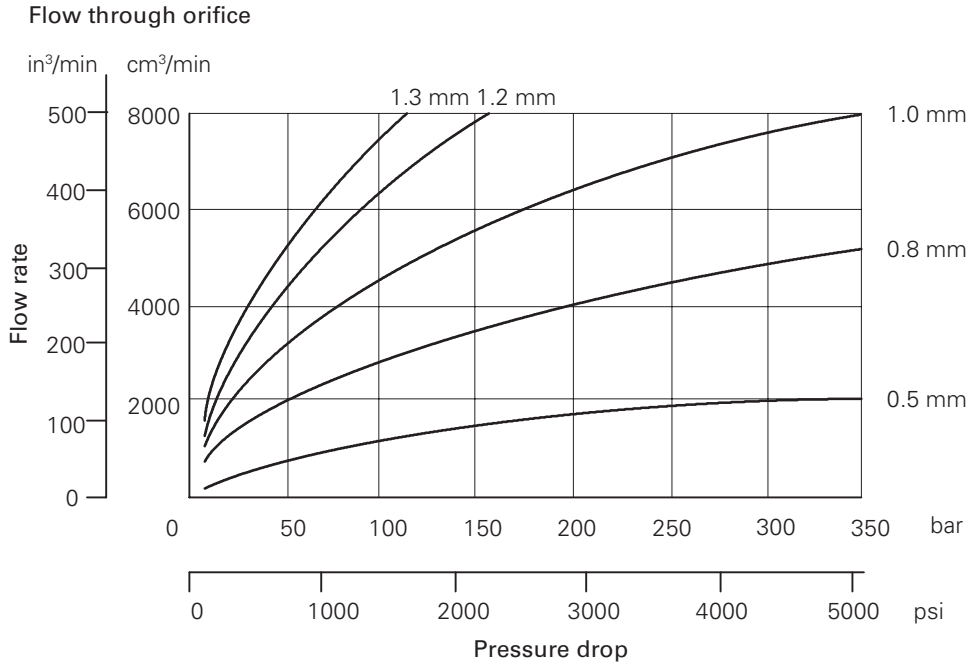


Figure 57

Pressure Drop at Other Viscosities

Pressure drop data in this catalog is generally given for a fluid viscosity of 36 cSt (168 SUS). For model types CVU-**(Z) SWD(3) the reference viscosity is 21 cSt (102 SUS). The graph shows the approximate change in pressure drop for a range of other viscosities. To determine the pressure drop for any given viscosity, multiply the published value by the factor applicable to the required viscosity.

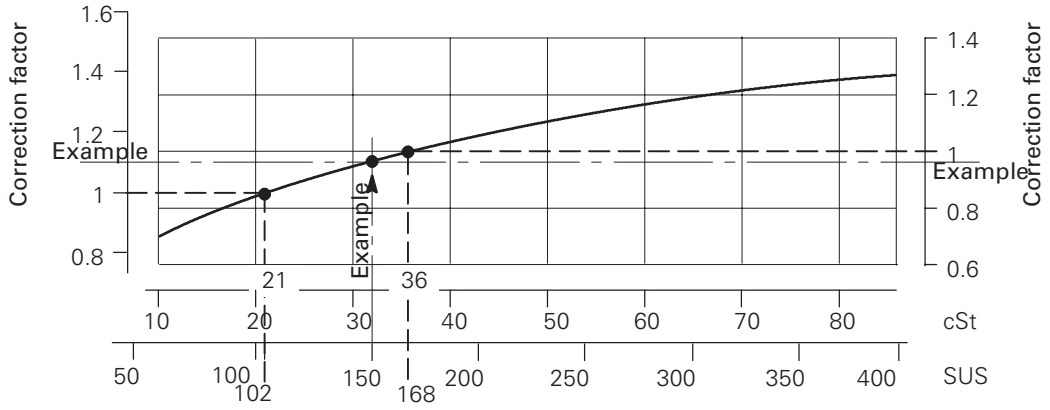
For an actual fluid viscosity of 32 cSt (150 SUS), the pressure drop correction factors are:

– approx. 1.1 to be applied to 21 cSt (102 SUS) data
– approx. 0.95 to be applied to 36 cSt (168 SUS) data

Example Shown

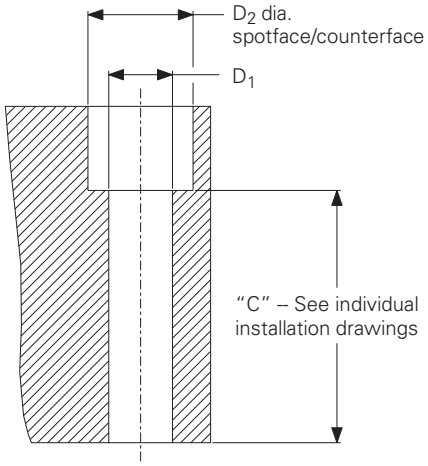
Apply to data given at
21 cSt (102 SUS)

Apply to data given at
36 cSt (168 SUS)



Mounting Bolt Data

Cover Size	D_1	D_2
16	9,0 (0.35)	15,0 (0.59)
25	14,0 (0.55)	20,0 (0.79)
32	18,0 (0.71)	26,0 (1.02)
40	22,0 (0.87)	33,0 (1.30)
50	22,0 (0.87)	33,0 (1.30)
63	33,0 (1.30)	49,0 (1.93)



Inch Bolt Kits
Bolts are UNC, grade 8 or better

Cartridge Valve Covers, CVC(S)

Cover Size	Bolt Size	Model Number	Used with Model Type	Recommended Bolt Torque lbf ft	(Nm)
Dynamic Models (CVCS--*ZD*-*2-1*) refer page 67**					
16	5/16" - 18 x 4	BKDNG16-712	ZD1/ZDA1	26	(35)
25	1/2" - 13 x 4	BK02-157290	ZD1/ZDA1	81	(110)
32	5/8" - 11 x 4 1/4"	BK02-157291	ZD1/ZDA1	210	(285)
40	3/4" - 10 x 5	BK02-157292	ZD1/ZDA1	370	(500)
50	3/4" - 10 x 6	BK02-157293	ZD1/ZDA1	429	(580)
63	1 1/4" - 7 x 6	BK02-300324	ZD1/ZDA1	1180	(1600)
Other Models					
16	5/16" - 18 x 1 1/2"	BKDNG16-700	All models	26	(35)
25	1/2" - 13 x 1 1/2"	BKDPNG25-704	All models	81	(110)
32	5/8" - 11 x 2	BKDNG32-713	All models	210	(285)
40	3/4" - 10 x 2 1/4"	BKDPNG40-706	All models	370	(500)
50	3/4" - 10 x 3	BKDNG50-708	All models	429	(580)
63	1 1/4" - 7 x 3 1/2"	BKDNG63-710	All models	1180	(1600)

Mounting Bolt Data

Metric Bolt Kits
Bolts are Class 12.9 (ISO 898) or stronger

Cartridge Valve Covers, CVC(S)

Cover Size	Bolt Size	Model Number	Recommended Bolt Torque Nm	(lbf ft)
Dynamic Models (CVCS--*ZD*-*2-1*) refer page 67**				
16	M8 x 100	Metric covers, sizes	35	(26)
25	M12 x 100	16 to 40, are supplied	110	(81)
32	M16 x 110	with mounting bolts	285	(210)
40	M20 x 130	(B29 in model code)	500	(370)
50	M20 x 150	BK02-157288	580	(429)
63	M30 x 150	BK02-157289	1600	(1180)
Other Models				
16*	M8 x 40	BKDNG16-701M	35	(26)
25*	M12 x 40	BKDPNG25-705M	110	(81)
32*	M16 x 55	BKDNG32-718	285	(210)
40*	M20 x 60	BKDPNG40707M	500	(370)
50	M20 x 80	BKDNG50-709M	580	(429)
63	M30 x 90	BKDNG63-711M	1600	(1180)

*Refer installation drawing on Page No. 84 for Valvistor

Pilot Valves

Pilot Valve	Bolt Size	Model Number	Recommended Bolt Torque Nm	(lbf ft)
Dynamic models (CVCS--*ZD*-20) refer page 67**				
DG4V-3	#10-24 1 1/4	BK590716	7-9	(63-80)
DG4V-3 + CVGC-3	#10-24 1 1/4	BK870017	7-9	(63-80)
Other models				
DG4V-3	M5 x 30	BK616452M	7-9	(63-80)
DG4V-3 + CVGC-3	M5 x 70	BK464125M	7-9	(63-80)
KCG-3	M5 x 50	BKDG3-699M	7-9	(63-80)
KBCG-3	M5 x 50	BKDG3-699M	7-9	(63-80)

Seal Kits

Product	Standard Nitrile 'N'	FKM 'V' / 'F3'
Dynamic Cover (CVCS--*ZD*-1*) refer page 67**		
CVCS-ZD(3) 16/25/32	11417596	11417602
CVCS-ZD(3) 40	11417603	11417604
CVCS-ZD(3) 50	02-156951	02-156952
CVCS-ZD(3) 63	02-156967	02-156968
Dynamic Insert (CVI--ZD(N)105-*-1*) refer page 67**		
CVI-16-ZD(N)105-10	11374812	11374655
CVI-25-ZD(N)105-10	11374804	11374683
CVI-32-ZD(N)105-10	11374794	11374659
CVI-40-ZD(N)105-10	11374815	11374660
CVI-50-ZD(N)105-10	02-156957	02-156958
CVI-63-ZD(N)105-10	02-156969	02-156970
Standard Inserts (incl. OD, OD3)		
CVI-16-**	11374651	11374655
CVI-25-**	11374656	11374683
CVI-32-**	11374684	11374659
CVI-40-**	11374694	11374660
CVI-50-**	02-420390	02-420391
CVI-63-**	02-420496	02-420497
Valvistor Insert (CVI--HFV-*-1*) refer page 76**		
CVI-16-**	456173	02-157617
CVI-25-**	456926	02-157618
CVI-32-**	479449	02-157619
CVI-40-**	478732	514808
CVI-50-**	478733	02-157620
CVI-63-**	456798	02-157621
Units (CVU-)**		
CVU-16-SWD(3)	12006752	12006753
CVU-25-SWD(3)	12006754	12006755
CVU-32-SWD(3)	12006756	12006757
CVU-40-SWD(3)	12006758	12006759
CVU-50-SWD(3)	12006760	12006761
CVU-63-SWD(3)	12006762	12006763
CVU-16-ZSWD3 / EFP1	02-157167	02-157168
CVU-25-ZSWD3 / EFP1	02-157536	02-157537
CVU-32-ZSWD3 / EFP1	02-157165	02-157616
CVU-40-ZSWD3 / EFP1	02-157679	02-157680

Product	Standard Nitrile 'N' Complete	Standard Nitrile 'N' Interface Only	FKM 'V' / 'F3': Complete	FKM 'V' / 'F3' Interface Only
Valvistor Cover Assembly (CVCS--HFV-*-1*) refer page 76**				
CVCS-16-**	02-157672	02-157613	02-157671	02-157614
CVCS-25-**	02-157674	456925	02-157673	02-157612
CVCS-32-**	02-157905	02-310967	02-157906	02-310968
CVCS-40-**	02-157712	02-310969	02-157713	02-310970
CVC(S)-50-**	02-310971	02-310972	02-310973	02-310974
CVC(S)-63-**	02-310975	456799	02-310976	02-310977

Product	Standard Nitrile 'N' Complete	Standard Nitrile 'N' Interface Only	FKM 'V' / 'F3': Complete	FKM 'V' / 'F3' Interface Only
Standard cover assemblies (incl. OD)				
CVCS-16-**	11417575	11417576	11417588	11417589
CVCS-25-**	11417578	11417579	11417559	11417560
CVCS-32-**	11417561	11417593	11417595	11417547
CVCS-40-**	11417548	11417590	11417580	11417591
CVCS-50-**	02-420587	02-420586	02-420575	02-420574
CVCS-63-**	02-420589	02-420588	02-420577	02-720576

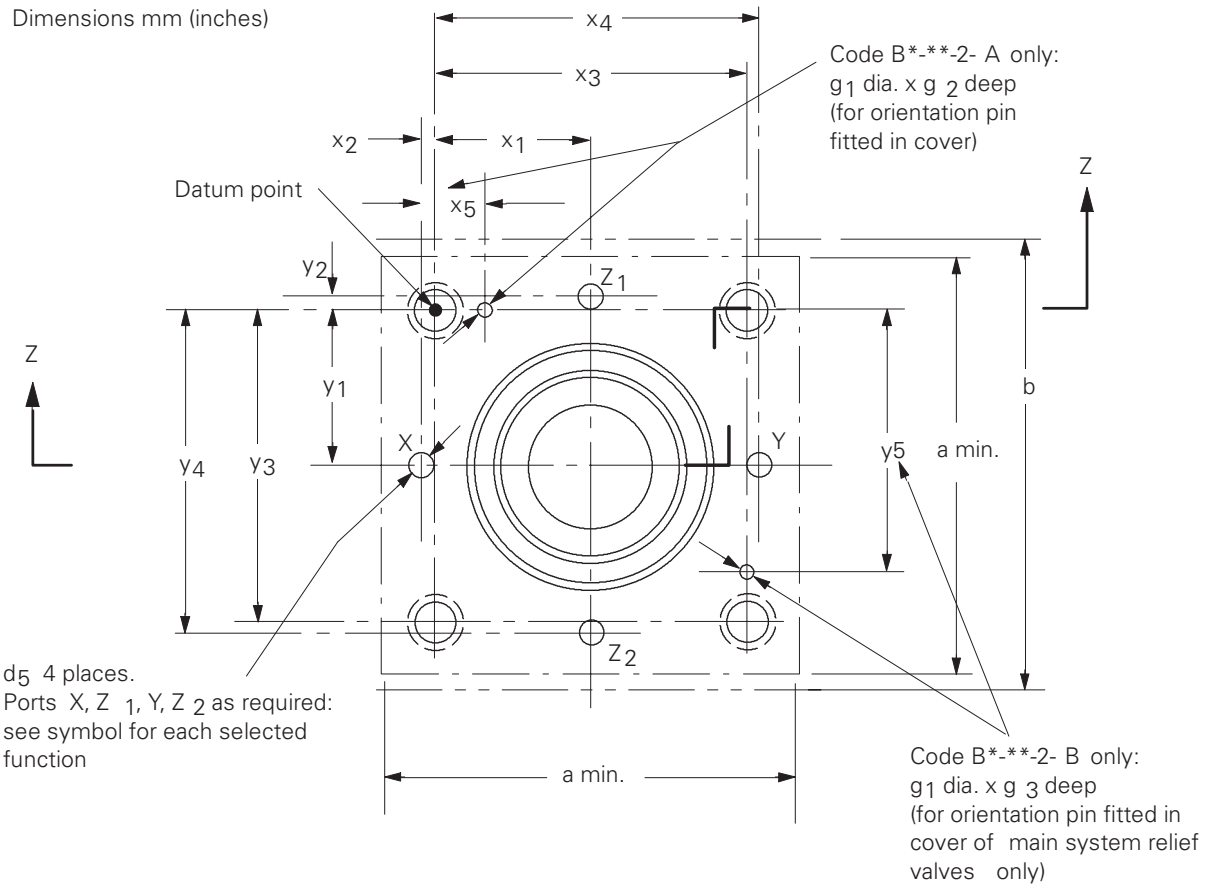
Springs

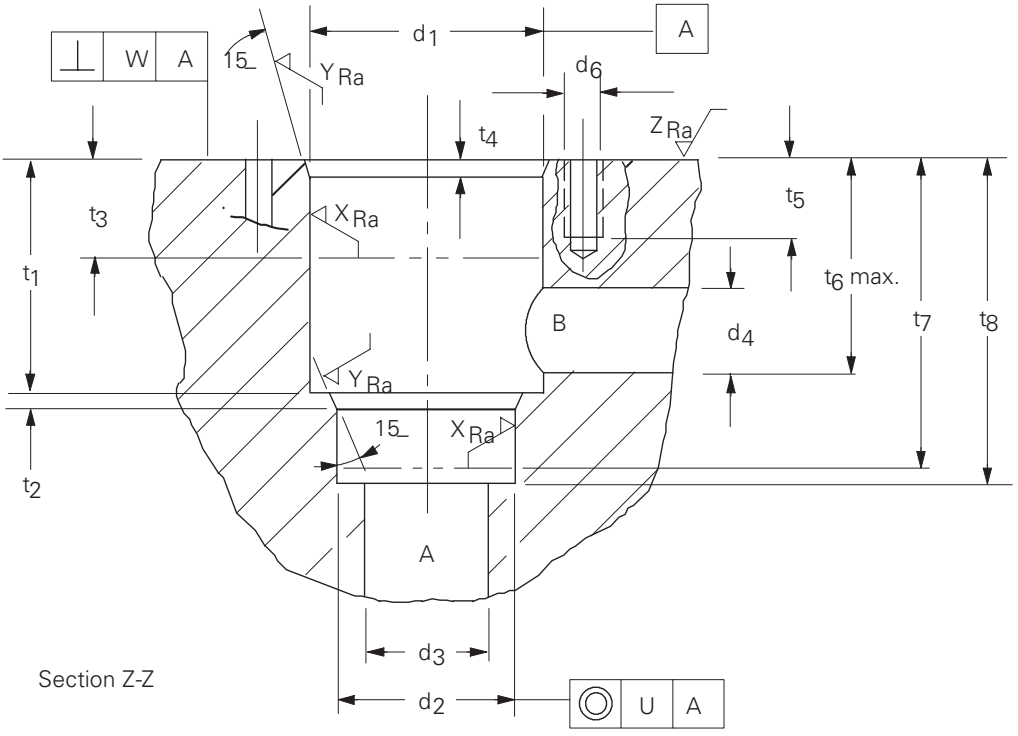
Valve Size	Description	Part No
Size - 16″	SPRING - L	12024447
	SPRING - M	12024450
	SPRING - H	12024452
	SPRING - U	872524
	SPRING - X2	872525
Size - 25″	SPRING - L	11372346
	SPRING - M	11372321
	SPRING - H	11372352
	SPRING - OD	02-420045
	SPRING - X2	872544
	SPRING - U	872543
Size - 32″	SPRING - L	11346473
	SPRING - M	11346467
	SPRING - H	11346468
	SPRING - U	02-420068
	SPRING - X2	02-420069
	SPRING - OD	02-420075
Size-40″	SPRING - L	12030469
	SPRING - M	12030470
	SPRING - H	12030472
	SPRING - U	02-420338
	SPRING - X2	02-420339
	SPRING - OD	02-420359
Size - 50″	SPRING - L	02-420374
	SPRING - M	02-420375
	SPRING - H	02-420376
	SPRING - OD	02-420485
Size - 63″	SPRING - L	02-420416
	SPRING - M	02-420417
	SPRING - H	02-420418
	SPRING - OD	02-420420

Insert Cavity Dimensions to ISO 7368, Sizes 16 to 63

Vickers by Danfoss cartridge valve covers (type CVCS), inserts (type CVI) and complete units (type CVU) conform to installation requirements of ISO 7368 and DIN 24342.

Dimensions mm (inches)





Section Z-Z

Dimension	ISO 7368 ref. and Vickers by Danfoss Nominal Size BA-06-2-A BA-06-2-B Size 16	 BB-08-2-A BB-08-2-B Size 25	 BC-09-2-A BC-09-2-B Size 32	 BD-10-2-A BD-10-2-B Size 40	 BE-11-2-A BE-11-2-B Size 50	 BF-12-2-A BF-12-2-B Size 63
a	65 (2.56)	85 (3.35)	102 (4.02)	125 (4.92)	140 (5.51)	180 (7.09)
b ■	75 (2.95)	95 (3.74)	112 (4.41)	135 (5.31)	150 (5.91)	190 (7.48)
d1dia.	32,039 (1.2614) 32,000 (1.2598)	45,039 (1.7732) 45,000 (1.7717)	60,046 (2.3640) 60,000 (2.3622)	75,046 (2.9546) 75,000 (2.9528)	90,054 (3.5454) 90,000 (3.5433)	120,054 (4.7265) 120,000 (4.7244)
d2 dia.	25,033 (0.9856) 25,000 (0.9843)	34,039 (1.3401) 34,000 (1.3386)	45,039 (1.7732) 45,000 (1.7717)	55,046 (2.1672) 55,000 (2.1654)	68,046 (2.6790) 68,000 (2.6772)	90,054 (3.5454) 90,000 (3.5433)
d3 dia. max.	16 (0.63)	25 (0.98)	32 (1.26)	40 (1.57)	50 (1.97)	63 (2.48)
d4 dia.	16 (0.63)	25 (0.98)	31,5 (1.24)	40 (1.57)	50 (1.97)	63 (2.48)
d5 dia. max.	4 (0.157)	6 (0.236)	8 (0.315)	10 (0.394)	10 (0.394)	12 (0.472)
d6 thread●	M8	M12	M16	M20	M20	M30
g1 dia. nominal	4 (0.157)	6 (0.236)	6 (0.236)	6 (0.236)	8 (0.315)	8 (0.315)
g2 min.	8 (0.315)	8 (0.315)	8 (0.315)	8 (0.315)	8 (0.315)	8 (0.315)
g3 min.	4 (0.157)	6 (0.236)	6 (0.236)	6 (0.236)	8 (0.315)	8 (0.315)
t1	43,1 (1.697) 43,0 (1.693)	58,1 (2.287) 58,0 (2.283)	70,1 (2.760) 70,0 (2.756)	87,1 (3.429) 87,0 (3.425)	100,1 (3.941) 100,0 (3.937)	130,1 (5.122) 130,0 (5.118)
t2	2 (0.079)	2,5 (0.098)	2,5 (0.098)	3 (0.118)	3 (0.118)	4 (0.157)
t3 min. (XRa)	20 (0.79)	30 (1.18)	30 (1.18)	30 (1.18)	35 (1.38)	40 (1.57)
t4	2 (0.079)	2,5 (0.098)	2,5 (0.098)	3 (0.118)	4 (0.157)	4 (0.157)
t5 min. depth●	16 (0.63)	20 (0.79)	30 (1.18)	35 (1.38)	41 (1.61)	47 (1.85)
t6 max.	42,5 (1.67)	57 (2.24)	68,5 (2.70)	84,5 (3.33)	97,5 (3.84)	127 (5.00)
t7 min. (XRa)	54 (2.13)	70 (2.76)	83 (3.27)	102 (4.02)	117 (4.61)	150 (5.91)
t8	56,1 (2.209) 56,0 (2.205)	72,1 (2.839) 72,0 (2.835)	85,1 (3.350) 85,0 (3.346)	105,1 (4.138) 105,0 (4.134)	122,1 (4.807) 122,0 (4.803)	155,1 (6.106) 155,0 (6.102)
U	0,03 (0.0012)	0,03 (0.0012)	0,03 (0.0012)	0,05 (0.002)	0,05 (0.002)	0,05 (0.002)
W	0,05 (0.002)	0,05 (0.002)	0,1 (0.004)	0,1 (0.004)	0,1 (0.004)	0,2 (0.008)
x1	23 (0.906)	29 (1.142)	35 (1.378)	42,5 (1.673)	50 (1.969)	62,5 (2.461)
x2	2 (0.079)	4 (0.157)	6 (0.236)	7,5 (0.295)	8 (0.315)	12,5 (0.492)
x3	46 (1.811)	58 (2.283)	70 (2.756)	85 (3.346)	100 (3.937)	125 (4.921)
x	448 (1.89)	62 (2.441)	76 (2.992)	92,5 (3.642)	108 (4.252)	137,5 (5.413)
x5	12,5 (0.492)	13 (0.512)	18 (0.709)	19,5 (0.768)	20 (0.787)	24,5 (0.965)
y1	23 (0.906)	29 (1.142)	35 (1.38)	42,5 (1.673)	50 (1.969)	62,5 (2.461)
y2	2 (0.079)	4 (0.157)	6 (0.236)	7,5 (0.295)	8 (0.315)	12,5 (0.492)
y3	46 (1.811)	58 (2.283)	70 (2.756)	85 (3.346)	100 (3.937)	125 (4.921)
y4	48 (1.89)	62 (2.441)	76 (2.992)	92,5 (3.642)	108 (4.252)	137,5 (5.413)
y5	33,5 (1.319)	45 (1.772)	52 (2.047)	65,5 (2.579)	80 (3.150)	100,5 (3.957)
XRa	1,6 micron (63 microinches)					
YRa	3,2 micron (125 microinches)					
ZRa	0,8 micron (32 microinches)					

● Minimum space required for slip-in valve (insert) and its cover. Also minimum center line to center line distance for two identical cavities in a manifold block

■ Dimensional tolerance is ± 0,2 (0.008).

Ordering Procedure

Ask your Danfoss representative to present a quotation for a cartridge valve system tailored to your application, or to quote on the appropriate model numbers in this catalog. System components must be ordered by complete model numbers. Covers, inserts, pilot valves, modules, and mounting bolt kits must be specified separately.

Typical Examples
Check Valve

A check valve function for 200 L/min (53 USgpm) as seen in Figure 9, to metric standards, order:

– One (1) CVCS-16-N-20 cover
– One (1) CVI-16-D16-M-50 insert
– One (1) BKDNG16-700 bolt kit (for cover)

Relief Function

A proportional relief function for 450 L/min (119 USgpm) as seen in Figure 27, to inch standards with size 03 interface, and with a screw and locknut for up to 250 bar (3600 psi), order:

– One (1) CVI-25-D10-H-50 insert

– One (1) CVCS-25-C3-W250-20 cover

– One (1) KCG-3-250-U-H1-10 pilot valve

– One (1) BKDPNG25-704 bolt kit (for cover)

– One (1) BKDG3-699M bolt kit (for pilot valve)

Unloading Function

An unloading valve for 700 L/min (185 USgpm) as seen in Figure 31, with wrench adjuster for a range up to 125 bar (1800 psi), to metric standards and no size 03 interface, order:

– One (1) CVCS-40-U-W125-20 cover

– One (1) CVI-40-U-50 insert

– One (1) DG4V-3(S)-2A-60 pilot valve

– One (1) BKDPNG40-707M bolt kit (for cover)

Reducer Function

A reducing valve for 500 L/min (132 USgpm) as seen in Figure 32, with micrometer adjuster for a range up to 350 bar (5000 psi), to inch standard and with size 03 interface for venting, order:

– One (1) CVI-32-X2-50 insert

– One (1) CVCS-32-X3-M350-20 cover

– One (1) DG4V-3-2AL-60 pilot valve

– One (1) BKDNG32-713 bolt kit (for cover)

– One (1) BKDG3-699M bolt kit (for pilot valve)

Dynamic Function

A dynamic valve for 200 L/min (53 USgpm) as seen in Figure 36, without stroke adjuster, to inch standard, order:

– One (1) CVI-16-ZD105-M-10 insert

– One (1) CVCS-16-ZD1-S2-10 cover

– One (1) DG4V-3-2A-60 pilot valve

– One (1) BKDNG16-712 bolt kit (for cover)

– One (1) BK590716 bolt kit (for pilot valve)

Proportional Flow Control

A proportional throttle valve for 700 L/min (185 USgpm) as seen on page 87, order: (with extra standard seal kit)

– One (1) CVU-32-EFP1-B29-70-30

– One (1) BKDNG32-713

– One (1) 02-157615

Valvistor

The component parts of the Valvistor proportional throttle assembly, including the pilot control valve, must be ordered individually. In addition there is a choice of electronics: typically a Vickers Eurocard drive amplifier, alternatively a Vickers 12V DC or 24V DC proportional power plug. The full model code must be specified in all cases.

Typical Valvistor Component Selection

1 x CVI-**-HFV-20-*-**-10 insert, see V-VLPO-MC011
1 x CVCS-**-HFV**-*2*-10 cover, see V-VLPO-MC011
1 x cover mounting bolt kit u, see V-VLPO-MC011
1 x KTG4V-3S- - - 60-EN427, see product catalog 539
1 x pilot valve mounting bolt kit, see product catalog 539

Plus:

Drive Electronics for 24V DC System

1 x EEA-PAM-523-A-32 Eurocard amplifier, see catalog 2464

or

1 x EHH-AMP-702-*-10 proportional power plug, see catalog 2115

Drive Electronics for 12V DC System

1 x EHH-AMP-712-*-10 proportional power plug, catalog 2282

Mass Summary, kg (lb)

Covers CVCS

Model type	Size 16		25		32		40		50		63	
A	2.84	(6.27)	2.9	(6.40)	4.9	(10.81)	5.82	(12.84)	10.86	(23.96)	21.2	(49.78)
A3	3	(6.62)	3.2	(7.06)	6.9	(15.22)	6.20	(13.68)	14.22	(31.38)	24.9	(54.94)
B	0.86	(1.90)	1.37	(3.02)	2.24	(4.94)	4.00	(8.83)	6.20	(13.68)	10.94	(24.14)
C	2.8	(6.80)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
C3	2.9	(6.40)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
C025	1.49	(3.29)	2.22	(4.90)	3.7	(8.16)	5.62	(12.40)	-		-	
D3	1.9	(4.19)	2	(4.41)	2.5	(5.52)	3.94	(8.69)	6.20	(13.68)	10.94	(24.14)
D2/D5	-		-		-		-		-		-	
DC3	1.96	(4.32)	2.47	(5.45)	3.39	(7.48)	5.10	(11.25)	6.25	(13.79)	10.94	(24.14)
HFV	1.2	(2.6)	1.9	(4.2)	3.3	(7.3)	6.3	(13.9)	9.6	(21.0)	19.4	(42.7)
N	0.86	(1.90)	1.37	(3.02)	2.24	(4.94)	4.00	(8.83)	6.20	(13.68)	10.94	(24.14)
OD	-		2.16	(4.77)	3.52	(7.77)	5.36	(11.83)	7.30	(16.11)	14.77	(32.59)
OD3	-		2.42	(5.34)	4.1	(9.05)	6.30	(13.90)	8.90	(19.64)	15.65	(34.53)
PC	1.1	(2.43)	1.94	(4.28)	3.32	(7.33)	4.90	(10.81)	6.90	(15.22)	11	(24.27)
SC	2.8	(6.18)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
SC3	2.9	(6.4)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
U	2.8	(6.18)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
U3	2.9	(6.40)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
W	1.11	(2.45)	2	(4.41)	3.3	(7.28)	5.13	(11.32)	7.20	(15.89)	11.48	(25.33)
W13	1.96	(4.32)	2.47	(5.45)	4	(8.83)	6.25	(13.79)	8.00	(17.65)	12.75	(28.13)
W33	1.96	(4.32)	2.47	(5.45)	4	(8.83)	6.25	(13.79)	8.00	(17.65)	12.75	(28.13)
X	2.8	(6.18)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
X3	2.9	(6.40)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
ZD1 / ZD3	2.7	(5.96)	4.7	(10.37)	6.7	(14.78)	11.50	(25.37)	15.30	(33.76)	28	(61.78)
ZDA1/ZDA3	2.9	(6.40)	5	(11.03)	7.1	(15.67)	11.80	(26.04)	16.10	(35.52)	29	(63.99)

Inserts CVI

Model Type	Size 16	25	32	40	50	63
ZD(N)105	0.35 (0.77)	0.84 (1.85)	1.72 (3.79)	3.44 (7.58)	5.83 (12.85)	12.7 (28.0)
All other models	0.15 (0.33)	0.38 (0.84)	1.03 (2.27)	1.55 (3.42)	2.53 (5.58)	6.23 (13.75)
HFV	0.13 (0.29)	0.33 (0.73)	0.9 (1.98)	1.35 (3.0)	2.2 (4.8)	5.4 (11.9)

Pilot Control Module (CVG***)

Model Type	Description	
CVGC-3	Relief module: P-T	1,3 (2.9)
CVGCA-3	Relief module: A-T	1,3 (2.9)
CVGCPA-3	Relief module: P & A-T	1,3 (2.9)
CVGMS1-3	Shuttle module: P-T	1,0 (2.2)
CVGPC1-3	Pilot operated check valve	1,0 (2.2)
CVGS1-3	Shuttle valve	1,0 (2.2)

Pilot Valves

Model type "U" coils	
DG4V-3	
DC coil(s):	
Single solenoid valve	1, 6 (3.5)
Double solenoid valve	2, 2 (4.8)
AC coil(s):	
Single solenoid valve	1, 5 (3.3)
Double solenoid valve	1, 8 (4.0)
Proportional pilot valves	
KCG-3	1, 7 (3.8)

Weight of complete cartridge assembly is obtained by summing the separate values for cartridge parts and cover assembly.

Units

CVU-EFP1: See page 87
CVU-63-OD11: Contact your Eaton-Vickers representative
CVU-(Z)SWD(3): See page 92

Inserts

Vickers by Danfoss inserts are field serviceable when serviced by Danfoss personnel. Springs, seals, spools and poppets are available as defined in Danfoss service and spares literature.

Covers

All covers are field serviceable providing that correct parts and test facilities are available. Contact your Danfoss representative for further details.

Units

See individual service and repair policies, available from your Danfoss representative.

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