





		Char-Lyn	n° 🛁	Duffield		<b>BOSTON</b> WEATHERHEAD	,	Winner®		Arrùw Duro Dyne		HANSEN™ GROMELLE™		
19	911 19	68 1971	1999	2000	2001	2002	2004	2005	2006	2007	2008	2010	2011	
	Air	flex®		НУD		W	alterscheid®		Synflex <sup>®</sup>	) (	Integrated Hydraulics		NDRMEN	



There's a certain energy at Eaton. It's the power of integrating the competencies of some of the world's most respected names to build a brand you can trust to meet every power management need. The energy created supports our commitment to powering business worldwide.

As the world's demand for high-efficiency hydraulic systems for mobile and stationary applications increase, Eaton is helping to solve these challenges more reliably, efficiently, and sustainably. Our goal is simple; to provide unique solutions across a wide range of markets that keep businesses on the leading edge of change. Visit Eaton.com/hydraulics/fusion.

That's the power of One Eaton.

# Serving eight key segments - sharing one focus



#### **Alternative Energy**

Making energy sources technically practical and economically sound requires the kind of control made possible by high-quality components. When Eaton is on the inside, you will experience the reliable, consistent performance to create and capture energy making renewable energy an every-day energy.



#### **Discrete Manufacturing**

Produce at peak efficiency with the superior precision and repeatability of Eaton products. Eaton hydraulic components provide the precise control and consistent operation required for virtually every step in your manufacturing operation. With Eaton, we'll help you redefine the meaning of raw productivity.



#### Oil & Gas

As the oil & gas industry continues to face further globalization and consolidation, large-scale organizations that can meet your needs in every corner of the world are more difficult to find. At Eaton, our portfolio of products is only surpassed by our tremendous reach.



#### Processing

Whatever your industry, no matter which processes you manage, Eaton parts and systems help keep you up and running. Our components make equipment more efficient and easier to use, so you get optimal machine performance and maximum productivity.



#### **Agriculture & Forestry**

There's a reason farming and forestry are called "working the land." These segments involve some of the hardest work and longest hours of any sector in the economy. Your productivity and profitability depend on the way you manage time and tasks.



#### **Commercial Vehicles**

Eaton technologies can make your driving operation more successful. Greater comfort and productivity help increase driver retention, while reduced emissions, leaks, and noise improve environmental performance. Increased efficiencies overall mean lower costs and higher net revenue.



#### **Material Handling**

Eaton hydraulic systems provide the precise control and consistent operation required for material handling and utility work. With a broad selection of products and solutions built in, Eaton helps make you a master of your domain.



#### **Construction & Mining**

When you work on a large scale, even the details are big. You need to trust every part of the equipment that lets you handle construction and mining jobs. For reliable components that deliver consistent performance in extreme conditions, turn to Eaton.

# Eaton is a leading diversified power management company

Eaton provides reliable, efficient and safe power management for a growing number of industries.

#### Understanding and helping our customers succeed

- Listening and understanding to requirements and business drivers
- Delivering solutions with value propositions to solve the critical business needs

#### Knowing what's important to our customers and integrating that knowledge into the fabric of our business

- ...to deliver innovative, quality products
- ...to respond fast
- ...to provide dedicated customer service and support around the globe

# Our strength is global reach with local responsiveness and support

- Customers served in more than 150 countries
- Diverse channels ensure reliable availability and support
- Design and engineering teams provide support for standard products and custom solutions
- Eaton experts offer efficient product and application training

# **Table of Contents**

Availability Summary	
Covers	
Inserts	
CVU units	
Pilot control modules	
Functional Symbols	
Covers	
Inserts	
Introduction to Cartridge Valves	
Features and Benefits	
Cartridge Valve Design	14
Applications, Ratings and Characteristics	17
Filteration and Viscosity Requirement	
Check, Directional and Flow Restrictor Functions: Sizes 16 to 63	
Functional descriptions	
Model codes	
Performance data	
Installation dimensions	
Pressure Relief & Venting Functions	39
Functional descriptions	
Model codes	
Performance data	
Installation dimensions	
Pressure Unloading/Relief Functions	51
Functional descriptions	52
Model codes	53
Performance data	55
Installation dimensions	57
Pressure Reducing Functions	59
Functional descriptions	59
Model codes	
Performance data	
Installation dimensions	
Dynamic Functions	
Functional descriptions	
Model codes	
Performance data	
Installation dimensions	
Valvistor® Proportional Throttle Valves	
Functional descriptions	
Model code	
Operating data	

# **Table of Contents**

Installation dimensions	
Valvistor® Line Extension	87
Electrohydraulic Proportional Throttle Valves (Type EFP1)	89
Functional description	89
Model codes	
Operating and performance data	
Installation dimensions	
Directional Valves with Electrical Indication (Type SWD)	
Functional description	
Model codes	
Performance data	
Installation dimensions	
Mounting bolts, Seal kits, Mass, Ordering procedure	104
Special Function Valves	
1:0.25 area ratio cartridge unit	
Normally open prefill valve	106
Hydrostat functions	107
Model codes	108
Installation dimensions	110
Pilot Control Modules	112
Functional description	112
Applications	112
Model codes	
Installation dimensions	115
Supplementary Data	116
Standard orifice sizes and threads	116
Optional orifice kits, orifice plug assembly data	117
Orifice sizing guide	
Pressure drop at other viscosities	119
Mounting bolt data	120
Seal kits	122
Insert cavity dimensions to ISO 7368:	
Sizes 16 to 63	123
Ordering Procedure	125
Mass Summary	126
Service/Spares Policy	127

# 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
В	Blank	•	•	•	•	•	•	DC15
С	Relief	•	•	•	•			D10, C10F, R10, D10Z
C3	Relief with size 03 pilot interface	•	٠	•	•			D10, C10F, R10, D10Z
C025	1:0.25 area ratio	•	٠	•	•	•	•	C025
D3	Directional with size 03 pilot interface	•	٠	•	•	•	•	D15, R15
DC3	Dual check valve with size 03 pilot interface	•	٠	•	•	•	•	D15, R15
HFV	Valvistor proportional throttle HFV	•	٠	•	•	•	•	HFV
N	Basic	•	٠	•	•	•	•	D105, D15
OD	Prefill valve		٠	•	•	•	•	OD105
PC	Pilot operated check	•	٠	•	•	•	•	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		•	•	٠			(S)C, (S)C3
R10	Damping 1:1 area ratio	•	•	•	٠			(S)C, (S)C3
D105	1:1.05 area ratio	•	•	•	٠	•	•	A, D3, N
D105V	1:1.05 area ratio with variable orifice	•	•	•	٠	•	•	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	•	•	•	•	•	•	В
R15	Damping 1:1.5 area ratio	•	•	•	٠	•	•	A, A3, D3, N
F15	Flow control 1:1.5 area ratio	•	•	•	٠	•	•	A, A3, D3, N
D15Z	1: 1.5 area ratio -zero leak spool		•	•	٠	•	•	D3, N, PC, W, W13, W33
U	1:1 Unloading normally closed (sliding spoo)	•	•	•	٠			U, U3
X1	Reducing -Normally open	•	•	•	٠			Х, ХЗ
X2	Reducing -Normally closed	•	•	•	•			Х, ХЗ
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		•	•	٠	•	•	A, D3, N, PC, W, W13, W33
OD105	1:1.05 normally open (prefill)		•	•	٠	•	•	OD
HFV	Valvistor proportional throttle HFV	•	•	•	٠	•	•	HFV
ZD105	Dynamic 1:1.05. zero pilot leakage	•	•	•	٠	•	•	ZD*, ZDA*
ZDN105	Dynamic 1:1.05., fast response, low hysteresis	•	•	•	٠	•	•	ZD*, ZDA*

# Product Availability Summary - Units

#### Cartridge Valve Units (CVU-\*\*)

		Size						
Model Type	Description	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	•	٠	٠	•			

# 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-*-20 Sizes 16-63
	X AP Z1 Z2 Y	CVCS-**-A-*-2(9)-10 Sizes 80-100
Directional with size 03▲ pilot interface & stroke adjuster	P A B T	CVCS-**-A3-*-20 Sizes 16-63
Blank		CVCS-**-B-20 Sizes 16-63
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Relief ISO 7368A)	X Z1 AP Z2 Y	CVCS-**-C-*-*-20 Sizes 16-40
Relief with size 03 ▲ pilot interface ISO 7368A)		CVCS-**-C3-*-***-20 Sizes 16-40
	X Z1 AP Z2 Y	■ No orifice/plug tapping on this port on size 16
Directional with size 03 ▲ pilot nterface	$\begin{array}{c} P & A & B & T \\ \hline & & & & & & \\ \hline & & & & & & \\ \hline & & & &$	CVCS-**-D3-20 Sizes 16-63
Dual check valve with size 03 ▲ pilot interface		CVCS-**-DC3-20 Sizes 16-63
Valvistor® proportional throttle		CVCS-**-HFV*-W-*2(9)-10 For models without free reverse flow capability
	$\begin{array}{c c} X & Z_1 A P_1 A P_2 Z_2 & Y \\ \hline P & A & B & T \\ \hline \hline & & & & & \\ \hline & & & & & \\ \hline & & & &$	CVCS-**-HFV*-*2(9)-10 For models with free reverse flow capability Sizes 16-63
Directional	X Z <sub>1</sub> AP Z <sub>2</sub> Y	CVCS-**-N-20 Sizes 16-63
	X Z1 AP Z2 Y	CVCS-**-N-*2(9)-10 Sizes 80-100
Prefill	X Z1 AP Z2 Y	CVCS-**-0D-20 Sizes 25-63
Prefill with size 03▲ pilot interface	P T X Z1 AP Z2 Y	CVCS-**-0D3-20 Sizes 25-63

▲ ISO 4401, size 03 (ANSI/B93.7M-D03)

# Functional Symbols - Covers (continued)

Cover Type	Graphical Symbol	Cover Model
1:0.25 area ratio	X Z1 AP Z2 Y	CVCS-**-C025-20 Sizes 16-40
Pilot operated check		CVCS-**-PC-20 Sizes 16-63
Main system relief ISO 7368B)	X Z1 AP Z2 Y	CVCS-**-SC-*-***-20 Sizes 16-40
Main system relief with size 03 ▲ pilot interface (ISO 7368B)	$\begin{array}{c} P \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	CVCS-**SC3-*-**-20 Sizes 16-40 No orifice/plug tapping on this port on size 16
Unloading/relief	X Z1 AP Z2 Y	CVCS-**-U-*_***-20 Sizes 16-40
Unloading/relief with size 03 ▲ pilot interface	P B T P V Z1 AP Z2 Y	CVCS-**-U3-*-***-20 Sizes 16-40 No orifice/plug tapping on this port on size 16
Shuttle		CVCS-**-W-20 Sizes 16-63
Shuttle type 1 with size 03 ▲ pilot interface and W11/W13 function	P A B T X Z1 AP Z2 Y	CVCS-**-W13-20 Sizes 16-63
Shuttle type 3 with size 03 ▲ pilot interface and W31/W33 function	$\begin{array}{cccc} P & A & B & T \\ \hline                                  $	CVCS-**-W33-20 Sizes 16-63
Reducer		CVCS-**-X-*-**-20 Sizes 16-40
Reducer with size 03 ▲ pilot interface		■ No orifice/plug tapping on this port on size 16 CVCS-**-X3-*-***-20 Sizes 16-40
Dynamic with size 03▲ pilot interface	X Z1 AP Z2 Y See page 69	■ No orifice/plug tapping on this port on size 16 CVCS-**-ZD*-*2(9)-10 Sizes 16-63
Dynamic with stroke limiter with size 03▲ pilot interface	See page 69	CVCS-**-ZDA*-*2(9)-10 Sizes 16-63

# Functional Symbols - Inserts

Insert Type	Function	Functional Symbol	Area Ratio A <sub>A</sub> : A <sub>AP</sub>	Sizes/ Insert Model	Cracking Pressure bar (psi) A to B B to A
1:0.25 area ratio	C025	В	1:0.25	Sizes 16-40: CVI-**-C025-50	N/A – No spring used
Relief, standard	D10		1:1	CVI-16-D10-M-50 CVI-25-D10-H-50 CVI-32-D10-H-50 CVI-40-D10-H-50 <i>Zero leak options 'D10</i>	1.67 (24.2) ▲ 3.34 (48.4) ▲ 3.34 (48.4) ▲ 3.34 (48.4) ▲ 2' are available except size 16.
Relief with orifice	C10F	B A	1:1	CVI-16-C10F-M-50 CVI-25-C10F-H-50 CVI-32-C10F-H-50 CVI-40-C10F-H-50 <i>Zero leak options 'C10F</i>	1.67 (24.2) 3.34 (48.4) 3.34 (48.4) 3.34 (48.4) 3.34 (48.4) Z' are available except size 16.
Directional	D10	B	1:1	Sizes 16-63: CVI-**-D10-L-50 CVI-**-D10-M-50 CVI-**-D10-H-50 <i>Zero leak options 'D10</i> /	0.33 (4.8) ▲ 1.67 (24.2) ▲ 3.34 (48.4) ▲ Z' are available except size 16.
Directional	R10	B	1:1	Sizes 16-63: CVI-**-D10-L-50 CVI-**-D10-M-50 CVI-**-D10-H-50	0.33 (4.8) 1.67 (24.2) 3.34 (48.4)
Directional	D105	B	1:1.05	Sizes 16-63: CVI-**-D105-L-50 CVI-**-D105-M-50 CVI-**-D105-H-50 <i>Zero leak options 'D10</i> 5	0.35 (5.1) ▲ 1.75 (25.4) ▲ 3.5 (50.8) ▲ 5Z' are available except size 16.
Directional with orifice	D105V		1:1.05	Sizes 16-63: CVI-**-D105V-L-50 CVI-**-D105V-M-50 CVI-**-D105V-H-50 <i>Zero leak options 'D10</i> 5	0.35 (5.1) ▲ 1.75 (25.4) ▲ 3.5 (50.8) ▲ 5VZ' are available except size 16.
Directional	D15	B A	1:1.5	Sizes 16-63: CVI-**-D15-L-50 CVI-**-D15-M-50 CVI-**-D15-H-50 <i>Zero leak options 'D152</i> Sizes 80 & 100: CVI-**-D16-L-1* CVI-**-D16-M-1* CVI-**-D16-H-1*	0.5 (7.3) 0.75 (10.9) 2.5 (36.3) 3.75 (54.4) 5.0 (73) 7.5 (108.8) Z' are available except size 16. 0.3 (4.4) 0.48 (7) 1.0 (14.5) 1.6 (23.2) 2.0 (29) 3.2 (46.6)
Directional	D20	B	1:2	Sizes 16-63: CVI-**-D20-L-50 CVI-**-D20-M-50 CVI-**-D20-H-50	0.58 (8.4) 0.58 (8.4) 3.0 (44.0) 3.0 (44.0) 5.8 (84.7) 5.8 (84.7) Z' are available except size 16.
Direct check	DC15	B A	1:1.5	Sizes 16-63: CVI-**-DC15-L-50 CVI-**-DC15-M-50 CVI-**-DC15-H-50	0.5 (7.3) 0.75 (10.9) 2.5 (36.3) 3.75 (54.4) 5.0 (73) 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 <sub>A</sub> : A <sub>AP</sub>	Sizes/ Insert Model	Cracking P A to B	Pressure bar (psi) B to A
Flow restricting	F	B	1:1.5	Sizes 16-63: CVI-**-F-L-50 CVI-**-F-M-50 CVI-**-F-H-50	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	B	1:1.6	Sizes 80-100: CVI-**-F-L-1* CVI-**-F-M-1* CVI-**-F-H-1*	0.3 (4.4) 1.0 (14.5) 2.0 (29.0)	0.48 (7.0) 1.6 (23.2) 3.2 (46.6)
Flow restricting	F	B	1:2	Sizes 16-63: CVI-**-F-L-50 CVI-**-F-M-50 CVI-**-F-H-50	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	B	1:2	Sizes 16-63: CVI-**-HFV-20-A-***-1*	_	-
				Sizes 16-63: CVI-**-HFV-20-B-***-1*	_	-
Normally open	OD105		•	Sizes 25-63: CVI-**-0D105-5*	Normally ope Pilot pressure 2,5 (36.3) + P	e to close:
Damping	R20	B A	1:2	Sizes 16-63: CVI-**-R-L-5* CVI-**-R-M-5* CVI-**-R-H-5*	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	B	1:1.5	Sizes 16-63: CVI-**-R15-L-5* CVI-**-R15-M-5* CVI-**-R15-H-5*	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-50	3,5 (51.0)	-
Reducing	X2 & X1		1:1	Sizes 16-40: CVI-**-X2-50	_	1.8 (26.1)
			1:1	Sizes 16-40: CVI-**-X1-50		1.8 (26.1)
Dynamic, zero pilot leakage	ZD105	A   See page 69	•	Sizes 16-63: CVI-**-ZD105-L-1* CVI-**-ZD105-M-1* CVI-**-ZD105-H-1*	1.0 (14.5) 2.5 (36.3) 4.5 (62.2)	
Dynamic, fast response, low hysteresis	ZDN105	See page 69	•	Sizes 16-63: CVI-**-ZDN105-L-1* CVI-**-ZDN105-M-1* CVI-**-ZDN105-H-1*	0.5 (7.3) 2.0 (29.0) 4.0 (58.0)	

◆ Spool geometry based on 1:1.05 ratio spools.

#### **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.

#### **Eaton-Vickers New Design**

Eaton-Vickers 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. Eaton-Vickers 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 Eaton-Vickers 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	<ul> <li>Minimum internal valve leakage with little energy waste.</li> <li>Improved control of load holding enhances machine performance.</li> <li>Higher flow capacity results in more economical valve sizing. (Check type valve opening area is greater than that of equal port size spool valves.)</li> <li>Lower pressure drops with less heat generation provide greater machine efficiency.</li> <li>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.)</li> </ul>
Individual port control	<ul> <li>Each cartridge can be tuned to reduce system shock, resulting in smoother machine operation.</li> <li>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.</li> </ul>
Cartridges combine functions of direction, flow and/or pressure	<ul> <li>Multi-function reduces the number of valving components required, resulting in lower machine costs.</li> </ul>
Manifold block assemblies that are compact, neat and low in weight	<ul> <li>Machine system installation is easier and faster, thereby reducing assembly costs.</li> <li>Piping can be eliminated, providing leak free construction.</li> <li>Cartridges can be easily serviced without disturbing system piping, thereby increasing machine uptime and reducing maintenance time and costs.</li> </ul>
Headloss	Eaton-Vickers new "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	<ul> <li>Cartridge technology proven over several decades of use.</li> <li>All Eaton-Vickers valves undergo full fatigue and endurance tests before release.</li> <li>350 bar (5000 psi) rating.</li> </ul>

#### Construction

Eaton-Vickers 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 89.

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 Eaton-Vickers 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.

 $\mathbf{A} = Main port$ 

 $\mathbf{B} = Main port$ 

**AP** = Spring chamber

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

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

**A**<sub>AP</sub> = Area related to poppet diameter

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

### $(\mathbf{P}_{AP}\mathbf{x}\mathbf{A}_{AP})+\mathbf{F}_{S}-(\mathbf{P}_{A}\mathbf{x}\mathbf{A}_{A})-(\mathbf{P}_{B}\mathbf{x}\mathbf{A}_{B})-\mathbf{F}_{f}$

< 0.									. Valve opens
> 0 .									Valve closes

Where:

 $\mathbf{F}_{s} = \text{Spring force}$  $\mathbf{F}_{f} = \text{Flow force}$ 

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





Figure 3

# Eaton-Vickers 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 AAP is 1.5 x the A-port area. This valve is used primarily for directional control.
- 1:1.05 area ratio, where AAP is 1.05 x A-port area. This valve is used for directional control or pressure control.
- 1:1.1 area ratio, where AAP is 1.1 x A-port area. This valve is used for directional control or pressure control.
- 1:1 area ratio, where AAP 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 A. Flow is always from port B to 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.





Symbol showing circuitry of normally-closed reducer insert

Figure 6





Figure 7





Load port A

B(I

A(P2)

#### 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 118.

#### **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)

#### 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 seals are Buna-N. Water glycol, water-in-oil emulsion fluids and petroleum oil may be used with these standard seals. The use of synthetic fire-resistant fluids requires a valve with special seals. Add prefix "F3" to the model code when phosphate ester type fluids or their blends are to be used. Alkylbased or chlorinated hydrocarbon fluids are not to be used.

#### Sizes 80 and 100

Fluorocarbon seals (F3) are standard. These are compatible with water glycol, water-in-oil emulsion fluids, petroleum oil and synthetic fire-resistant fluids. Alkyl-based or chlorinated hydrocarbon fluids are not to be used.

#### All Sizes

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

#### Mounting Attitude

Unrestricted for cartridges. Good practice suggests that detented pilot valves, e.g. DG4V-3-2N models, be mounted so that their longitudinal axis is horizontal.

#### 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) D16 for sizes 13 and 14 (NG80 & 100)

Nominal Size ▲ ISO 7368 (DIN 24342)	Flow L/min	USgpm	Maximum Operating Pressure
06 (NG16) (approx. 5/8")	255	67	350 bar (5000 psi)
08 (NG25) (approx. 1")	590	155	350 bar (5000 psi)
09 (NG32) (approx. 1 1/4")	1250	330	350 bar (5000 psi)
10 (NG40) (approx. 1 9/16")	1700	450	350 bar (5000 psi)
11 (NG50) (approx. 2")	2350	620	350 bar (5000 psi)
12 (NG63) (approx. 2 1/2")	3650	965	350 bar (5000 psi)

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

#### 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 116 and 117.

- O: Standard (factory-fitted) orifice
- ⊗ Tapped port for installation of optional orifice

Plugged port



#### Figure 8

#### **Maximum Internal Leakages**

Fluid viscosity 36 cSt (168 SUS) Data for sizes 80 and 100 on request.

#### **Metric Design**

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 14). 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.



### **Filtration and Viscosity Requirements**

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

Product Line	Minimum Range	Optimum Range	Maximum Allowed Startup	ISO 4406:99 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-Al) 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	
Cartridge Valves	45 SUS (6 cSt)	100-200 SUS (20-43 cSt)	10,000 SUS (2158 cSt)	19/17/14	
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

### 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 Eaton-Vickers 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 28.

#### **Pressure Ratings**

Maximum pressure allowable at ports A and B is 350 bar (5000 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 28. The maximum pressure limit at pilot ports X, Z1, Z2 and AP and pilot valve interface ports P, T, A and B is generally 350 bar (5000 psi), dependent on the limit of any associated pilot valve or module. Pilot port Y maximum pressure limit is also 350 bar (5000 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 22. Pilot Control Modules Details of CVG\*\*\*-3 pilot control modules are shown on pages 112-115.

#### Solenoid Operated, Hydraulically Piloted Arrangements

For full technical data of pilot valves see appropriate Eaton-Vickers catalog:

Nominal Size	Nominal flo ∆ p = 1 bar	w at	Nominal flo Δ p = 5 bar	w at	
ISO 7368 (DIN 24342)	L/min	USgpm	L/min	USgpm	
06 (NG16)	128	34	255	67	
08 (NG25)	250	66	590	155	
09 (NG32)	300	80	1250	330	
10 (NG40)	500	132	1700	450	
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 cove	22
Direct-acting check valve using type B cover	22
Pilot operated check valve	22
2-way, 2-position, bi-directional control	23
2-way, 2-position, uni-directional control	23
Damping function	23
Pilot shuttle control	23
Adjustable stroke limiter; bi-directional control	26
Adjustable stroke limiter; uni-directional control	26

#### Solenoid controlled, pilot operated models

2-way, 2-position; single- and double-solenoid control; sizes 16 to 40	24
Shuttle type 1 (cover types W13)	25
Shuttle type 3 (cover types W33)	25
Dual check (cover types DC3)	25
Adjustable stroke limiter; bi-directional control	26

# **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.

#### 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 AAP, via drilled holes on the poppet, whereby any pressure at port B assists the spring in holding the poppet hard on to its seat.

#### 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.



# **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.

#### 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.



AP

Cover

Insert

CVCS-\*\*- N

Cover



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



**Basic poppet** 

Area ratio



#### 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

### AP X poppet. R15/R20 inserts may be used with any check or directional CVI-\*\*-R15/R20 function where a D15/D20 insert is ordinarily used. Insert R Figure 14 CVCS-\*\*-W Cover Z1 APZ2 х CVI-\*\*-D15 Insert

71 **Basic poppet** 

```
Area ratio
A_{A}:A_{AP}=1:1.5
```

#### Pilot Shuttle Control: Sizes 16 to 63

Damping Function: 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.





Figure 15

# **Pilot Operated Directional Valves**

#### 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 Eaton-Vickers soft shift pilot valves DG4V-3-\*\*\*\*2\*\* 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).

#### **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.



Figure 16

# 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 40. 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 nonreverse-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

#### **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 a notch for fine metering (reduced gain) flow control function. The F15 & F20 inserts has a larger notch for more coarse metering (high gain) flow control function.

The A insert stroke adjuster cover is available with three types of adjusters, micrometer (M), micrometer with keylock (K) & standard square end screw with hex. locknut (W).

#### 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



#### **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



#### 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



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

#### **CVCS Covers**

Eaton-Vickers 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**

**Seal Material** 

for standard seals.

"Fluids

2 Model

to ISO 7368

(DIN 24342)

16 - 06 (NG16)

25 - 08 (NG25)

32 - 09 (NG32)

40 - 10 (NG40)

50 - 11 (NG50)

63 - 12 (NG63)

4 Function

7368

F3 - Special seals. See

and Seals" on page 17. Omit

CVCS - Cartridge valve cover

**3 Nominal size to ISO** 

Metric bolt tappings and orifice threads; SAE plugs.

mounting face for size 03

B - Blanking cover

pilot valve

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,)

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

#### 5 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)

#### 6 Design number 20 series

#### **Normal function (for D3** only)

NC - Normally closed Blank - Normally open

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

#### 8 Pilot control orifice location

W13 functions from prior published information for cover types "CVC." For availability of covers by size and function

see page 6. All features must be specified when ordering;

Specify port location for nonstandard orifice, e.g. "AP", followed by orifice size code, see 9. Repeat as necessary for further non-standard requirements.

#### 9 Orifice size

Specify non-standard orifice size code, see tables on page 117.

(F3-) CVCS - \*\* - \*\*\* - \* - 20 - (NC) (- \*\*\* \*\*) 1 2 3 4 5 6 7 8 9

those in

EATON Slip-in Cartridge Valve Catalog E-VLSC-MC002-E March 2012

A3 - Stroke adjuster with

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

#### **CVI Inserts**

For availability of inserts by size and function see page 7. All features must be specified when ordering; those in brackets () are optional.



#### **1** Seal Material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

#### 2 Model

**CVI** - Cartridge valve insert

#### 3 Nominal size to ISO 7368 (DIN 24342)

<b>16</b> - 06	(NG16)
<b>25</b> - 08	(NG25)
<b>32</b> - 09	(NG32)
<b>40</b> - 10	(NG40)

**40** - 10 (NG40

**50** - 11 (NG50) **63** - 12 (NG63)

# 4 Function

o 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 damp-
ing
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

#### Cracking pressure, bar (psi)

For flow direction A to B

#### Sizes 16 to 63

Spring Code	Insert Code D10	D105(V)
L	0.33 (4.79)	0.35 (5.07)
M	1.67 (24.2)	1.75 (25.4)
Н	3.34 (48.4)	3.5 (50.76)

Spring Code	Insert Code D15, R15 DC15	D20, R20 F20
L	0.5 (7.3)	0.6 (8.7)
М	2.5 (36.3)	3.0 (43.5)
Н	5.0 (73)	5.8 (84.7)

#### 6 Design number 50 series Sizes 16 - 63

D10	50 design
	•
R10	50 design
D105	50 design
D105V	50 design
D15	50 design
D20	50 design
DC15	50 design
R15	50 design
R15	50 design
R20	50 design
F20	50 design

#### **7** Orifice size

Specify non-standard orifice size code, see tables on page 117 for D105V only.

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

**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 119.

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

= Rated flow point



Flow rate









# Pilot Operated Directional Valves (cont...)

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

• = Rated flow point



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

• = Rated flow point





EATON Slip-in Cartridge Valve Catalog E-VLSC-MC002-E March 2012

1000 2000 3000

500

4000 5000

1000

Flow rate

0

0

0

L/min

1500 USgpm

٦

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



For thread sizes and orifice kits see page 116.

						Location of Nameplates	
Size	Α	В	С	D	E	Туре В	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 116.

• Minimum clearance for removal of cover from manifold.

						Location of Nameplates	
Size	Α	В	С	D	E	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 116.

• Minimum clearance for removal of cover from manifold.

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

• DG4V-3 with coil type U.

△ *DG4V-3-70* 

В							Location of Nameplates	
Size	Α	D3	DC3	С	D	E	Type D3	Type DC3
16	66.0 (2.6)	48.0 (1.89)	48.0 (1.89)	36.0 (1.42)	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)	36.0 (1.42)	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



■ For thread sizes and orifice kits see page 116.

• Minimum clearance for removal of cover from manifold.

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

• DG4V-3 with coil type U.

△ *DG4V-3-70* 

		В					Location of Nameplates	
Size	Α	W13	DC3	С	D	E	Type W13	Type W33
16	66.0 (2.6)	48.0 (1.89)	48.0 (1.89)	36.0 (1.42)	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



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



cover

Hex. locknut

41.0 (1.61) A/F

Hex. locknut

36,0 (1.42) A/F
# Covers for Directional and Flow Control Functions "A3"



• For thread sizes and orifice kits see page 116.

• Minimum clearance for removal of cover from manifold. For adjuster type K allow 43,0 (1.69) for key removal, see page 36.

- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers DG4V-3.
- DG4V-3- with coil type U.
- △ DG4V-3-70

						F				Location for	
Size	Α	В	С	D	E	W	K&M	max.	min.	Н	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)	94.0 (3.70)	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"



■ For thread sizes and orifice kits see page 116.

• Minimum clearance for removal of cover from manifold. For adjuster type K allow 43,0 (1.69) for key removal, see page 36.

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

• DG4V-3- with coil type U.

△ DG4V-3-70

						F		G				Location for
Size	Α	В	С	D	E	w	K&M	max.	min.	Н	К	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

### **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 14). 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. Eaton-Vickers 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 350 bar (5000 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)

## **Maximum Recommended Flow Rates**

Nominal sizes ISO 7368 (DIN 243	342):
06 (NG16	255 L/min (67 Usgpm)
08 (NG25	590 L/min (155 Usgpm)
09 (NG32	1250 L/min (330 Usgpm)
10 (NG40	1700 L/min (450 Usgpm)

### **Control Data**

Manual pressure adjustment is located in the control cover. Adjustment options are shown starting on page 47. 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 47. For typical pilot flows, see chart below.

## **Pilot Control Modules**

Details of CVG\*\*\*-3 pilot control modules are shown on pages 112-115.

## **Pilot Control Flows for Maximum Pressure**

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

#### Pressure Relief Function: Sizes 16 to 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 Eaton-Vickers recommendations for selection of spring for each size of insert. See model code 5, page 43. 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 45 for override pressure versus flow rate.



#### 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.



#### 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 112-115.



■ 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 50.

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



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

Eaton-Vickers 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.



## **1** Seal material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

## 2 Model

**CVCS** - Cartridge valve cover to ISO 7368

## **3 Nominal size to ISO 7368 (DIN 24342)**

 - 06 (NG16) - 08 (NG25) - 09 (NG32) - 10 (NG40)

## 4 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

## **5** Adjuster mechanism

**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)

For proportional control ranges, see page 50.

## **Design number, 20 series**

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

## 8 Pilot control orifice location

Specify port location for nonstandard orifice, e.g. "AP", followed by orifice size code, see 9. Repeat as necessary for further non-standard requirements.

## **9** Orifice size

Specify non-standard orifice size code, see tables on page 117.

# Model Codes - Pressure Relief and Venting Functions

## **CVI Inserts**

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



## **1** Seal Material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

## 2 Model

**CVI** - Cartridge valve insert

## ③ Nominal size to ISO 7368 (DIN 24342)

 - 06 (NG16) - 08 (NG25) - 09 (NG32) - 10 (NG40)

## 4 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

## **5** Cracking pressure, bar (psi)

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

Size	Spring Code	Cracking Pressure bar (psi)
16	М	1.7 (24.6)
25	Н	3.3 (47.8)
32	Н	3.3 (47.8)
40	Н	3.3 (47.8)

# 6 Design number, 50 series

Note: A nameplate is supplied with each 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 50 C (122 F). For pressure drops at other viscosities, see page 119. 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-\*-\*\*\*-20 Inserts CVI-16-D10-M-50 and CVI-16-C10F-M-50



Cover CVCS-32-C-\*-\*\*\*-20 Inserts CVI-32-D10-H-50 and CVI-32-C10F-H-50



## **Pressure Override**

Cover CVCS-16-C-\*-\*\*\*-20





Flow rate

# Performance Data - Pressure Relief and Venting Functions

Cover CVCS-25-C-\*-\*\*\*-20 Inserts CVI-25-D10 -H-50 and CVI-25-C10F-H-50





Cover CVCS-32-C-\*-\*\*\*-20 Inserts CVI-32-D10-H-50 and CVI-32-C10F-H-50





Cover CVCS-40-C-\*-\*\*\*-20 Inserts CVI-40-D10-H-50 and CVI-40-C10F-H-50



## **Pressure Relief and Venting Functions**



					F					
Size	Α	В	С	D	E	w	K&M	G	Nameplates	
16	66.0 (2.6)	48.0 (1.89)	36.0 (1.42)	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



■ For thread sizes and orifice kits see page 116.

• Minimum clearance for removal of cover from manifold.

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

#### • DG4V-3 with coil type U.

△ DG4V-3-70

						Location for			
Size	Α	В	С	D	E	W	K&M	G	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)	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 48.

For dimensions of CVGC-3 module see page 115.



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 116.
- Minimum clearance for removal of cover from manifold. See previous page
- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers 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 48.

## 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 116).

Other orifice combinations can be provided to meet individual

AP Х Z<sub>1</sub> Y Size 16 Pilot mounting interface offset by 11.0 (0.43) to X port side 118.0 (4.65) 61.0 (2.4) max. for coil -7. removal 93.5 (3.68) with F type coil and terminal box 62.5 (2.46) with U type FATON Vickers Ф

Size	Pressure control	Cover max. pressure code,	Pilot valve model code For KCG models add required
	range	see CVCS model code 6,	coil connection and rating (See catalog GB-C-2162B for full
	bar (psi)	page 43	model code details of KCG-3)
16	5-40 (72-580)	125	KCG-3- <b>40</b> -D-Z-M10 (standard)
	6-100 (87-1450)	125	KCG-3- <b>100</b> -D-Z-M10- <b>P18-T15</b>
	7-160 (102-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>P15-T12</b>
	7,5-250 (109-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>P15-T10</b>
	7,5-350 (109-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>P15-T10</b>
25	5-40 (72-580)	125	KCG-3- <b>40</b> -D-Z-M10 (standard)
	6-100 (87-1450)	125	KCG-3- <b>100</b> -D-Z-M10- <b>P18-T15</b>
	7-160 (102-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>P15-T12</b>
	7,5-250 (109-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>P15-T10</b>
	7,5-350 (109-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>P15-T10</b>
32	7-40 (102-580)	1215	KCG-3- <b>40</b> -D-Z-M10 (standard)
	8,5-100 (124-1450)	125	KCG-3- <b>100</b> -D-Z-M10- <b>P18-T15</b>
	9,5-160 (138-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>P15-T12</b>
	10,5-250 (153-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>P15-T12</b>
	10,5-350 (153-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>P15-T12</b>
40	7-40 (102-580)	125	KCG-3- <b>40</b> -D-Z-M10- <b>T15</b>
	8,5-100 (124-1450)	125	KCG-3- <b>100</b> -D-Z-M10- <b>T15</b>
	9,5-160 (138-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>T15</b>
	10,5-250 (153-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>T15</b>
	10,5-350 (153-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>T15</b>

requirements of customer installations. Please contact your Eaton-Vickers representative.

R

т

K

A -

Р

KCG-3

Cover

CVCS-\*\*-C3

Proportional pilot valve

## 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**

350 bar (5000 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)

## **Nominal Flow Rates**

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

## Nominal sizes ISO 7368 (DIN 24342)

06 (NG16)	165 L/min (45 USgpm)	I
08 (NG25)		
09 (NG32)	580 L/min (153 USgpm)	
10 (NG40)	1000 L/min (264 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/on-loaded 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.





#### 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 Eaton-Vickers 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

Eaton-Vickers type "CVCS" cartridge covers featured in this catalog conform to installation requirements of ISO 7368 and  $\mbox{DIN}$ 

## **Metric Models**

Metric bolt tappings and orifice threads; SAE plugs.

(F3-) CVCS - \*\* - U (3) - \* - \*\*\* - 20 (-\*\*\* \*\*) 1 2 3 4 5 6 7 8 9

## **1** Seal material

**F3** - Special seals. See "Fluidsand Seals" on page 17. Omit for standard seals.

## 2 Model

**CVCS** - Cartridge valve cover to ISO 7368

## **3** Nominal size to ISO **7368 (DIN 24342)**

 - 06 (NG16) - 08 (NG25) - 09 (NG32) - 10 (NG40)

## 4 Function

U - Unloading relief

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

## **5** Adjuster mechanism

**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)

## **Design number, 20 series**

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

## 8 Pilot control orifice location

Specify port location for nonstandard orifice, e.g. "AP", followed by orifice size code, see 9. Repeat as necessary for further non-standard requirements.

## **9** Orifice size

Specify non-standard orifice size code, see tables on page 117.

24342. All features must be specified when ordering; those in brackets () are optional or apply only to specific models.

## Model Codes - Unloading/Relief Functions

## **CVI Inserts**

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



## 1 Seal Material

## 4 Function

ries

insert in use.

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals. **U** - 1:1 ratio unloading function, normally closed, sliding spool

## 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)

# 5 Design number, 50 se-

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

## Performance Data - Unloading/Relief Functions

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

• = Rated flow point





## CVI-32-U-50

CVI-40-U-50





# Performance Data - Unloading/Relief Functions

### **Pressure Override**



## **Unloading/Relief Functions**



						F			Location for
Size	Α	В	С	D	E	W	K&M	G	Nameplates
16	66.0 (2.6)	48.0 (1.89)	36.0 (1.42)	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**



• Maximum clearance for removal of cover from manifold.

Recommended model Eaton-Vickers DG4V-3.

△ DG4V-3-70

						Location for			
Size	Α	В	С	D	E	w	K&M	G	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)	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

(p = 12 bar / 175 psi)
145 L/min (38 USgpm)
550 L/min (145 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)

All ports are rated up to 350 bar (5000 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 (twoposition, 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.

## 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 68.

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

ΔP

A(P2) This X port orifice/plug tapping not on size 16.

R(P

KCG-3

CVCS-\*\*-X3 Cover

CVI-\*\*-X1/X2

Insert

Proportional pilot valve





# Model Codes - Pressure Reducing Functions

## **CVCS** Covers

Eaton-Vickers 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.



## **1** Seal Material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

## 2 Model

**CVCS** - Cartridge valve cover to ISO 7368

## ③ Nominal size to ISO 7368 (DIN 24342)

 - 06 (NG16) - 08 (NG25) - 09 (NG32) - 10 (NG40)

## 4 Function

X - Pressure reducing

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

## **5** Adjuster Mechanism

**K** - Micrometer adjuster with keylock

**M** - Micrometer adjuster without lock

 $\boldsymbol{W}$  - 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) For proportional control

ranges please see page 68

# Design number, 20 series

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

# **B** Pilot control orifice location

Specify port location for nonstandard orifice, e.g. "AP", followed by orifice size code, see 9. Repeat as necessary for further non-standard requirements.

## **9** Orifice size

Specify non-standard orifice size code, see tables on page 117.

# Model Codes - Pressure Reducing Functions

## **CVI Inserts**

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



## **1** Seal Material

## 4 Function

ries

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals. X1 - Pressure reducer, normally open, sliding spoolX2 - Pressure reducer,

normally closed, sliding spool

**5** Design number, 50 se-

**CVI** - Cartridge valve insert

2 Model

# **3** Nominal size to ISO

# 7368 (DIN 24342)

 - 06 (NG16) - 08 (NG25) - 09 (NG32) - 10 (NG40) 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 500 C (122 F). For pressure drops at other viscosities, see page 119.

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

Inlet pressure B(P1) = 350 bar (5000 psi)

• = Rated flow point

Cover CVCS-16-X\*-\*-\*\*-20 Insert CVI-16-X1/X2-50



Cover CVCS-25-X\*-\*-\*\*-20 Insert CVI-25-X1/X2-50



Cover CVCS-32-X\*-\*-\*\*-20 Insert CVI-32-X1/X2-50



Cover CVCS-40-X\*-\*-\*\*\*-20 Insert CVI-40-X1/X2-50



## Performance Data - Pressure Reducing **Functions**

## **Pressure Underride**







Spring

Spring

Spring

code 350

code 250

code 125

USgpm

## **Pressure Reducing Functions**



						F			Location for
Size	Α	В	С	D	E	w	K&M	G	Nameplates
16	66.0 (2.6)	49.0 (1.93)	36.0 (1.42)	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)	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)	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 116.
- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers DG4V-3.
- $\bigcirc$  DG4V-3 with coil type U.  $\triangle$  DG4V-3-70

 Maximum clearance for removal of cover from manifold.

				F Location				Location for	
Size	Α	В	С	D	E	W	K&M	G	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 115 and for adjustment types see page 36.



## 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 Eaton-Vickers DG4V-3.
- Minimum clearance for removal of cover from manifold. See table on previous page.

○ DG4V-3 with coil type U.

 $\triangle$  DG4V-3-70

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

For dimensions of CVCS-\*\*-X3 covers, and adjustment types, see page 66.

## 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 116).

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



Size	Pressure control	Cover max. pressure code,	Pilot valve model code
	range	see CVCS model code 6	For KCG models add required coil connection and rating
	bar (psi)	page 61	(See GB-C-2162 for full model code details of KCG-3)
16	5-40 (72-580)	125	KCG-3- <b>40</b> -D-Z-M10 (standard)
	6-100 (87-1450)	125	KCG-3- <b>100</b> -D-Z-M10 (standard)
	8-160 (116-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>P15-T12</b>
	10-250 (145-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>T09</b>
	12-350 (174-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>T09</b>
25	5-40 (72-580)	125	KCG-3- <b>40</b> -D-Z-M10 (standard)
	6-100 (87-1450)	125	KCG-3- <b>100</b> -D-Z-M10 (standard)
	8-160 (116-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>T11</b>
	10-250 (145-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>P10L-T12</b>
	12-350 (174-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>P10L-T12</b>
32	5-40 (72-580)	125	KCG-3- <b>40</b> -D-Z-M10 (standard)
	6-100 (87-1450)	125	KCG-3- <b>100</b> -D-Z-M10- <b>P18-T18</b>
	8-160 (116-2320)	250	KCG-3- <b>160</b> -D-Z-M10- <b>P18-T18</b>
	10-250 (145-3625)	250	KCG-3- <b>250</b> -D-Z-M10- <b>P15-T12</b>
	12-350 (174-5075)	350	KCG-3- <b>350</b> -D-Z-M10- <b>P15-T12</b>
40	5-40 (72-580)	125	KCG-3- <b>40</b> -D-Z-M10 (standard)
	6-100 (87-1450)	125	KCG-3- <b>100</b> -D-Z-M10 (standard)
	8-160 (116-2320)	250	KCG-3- <b>160</b> -D-Z-M10 (standard)
	10-250 (145-3625)	250	KCG-3- <b>250</b> -D-Z-M10 (standard)
	12-350 (174-5075)	350	KCG-3- <b>350</b> -D-Z-M10 (standard)

## **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**

ISO 7368		
(DIN 24342)	A to B	B to A
06 (NG16)	230 L/min (61 USgpm)	200 L/min (53 USgpm)
08 (NG25)	550 L/min (145 USgpm)	475 L/min (125 USgpm)
09 (NG32)	850 L/min (225 USgpm)	740 L/min (195 USgpm)
10 (NG40)	1200 L/min (317 USgpm)	1040 L/min (275 USgpm)
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 350 bar (5000 psi) depending on limits for relevant ports in any associated pilot valves or modules.

## **Functional Symbols**

Cover CVCS-\*\*-ZD\*-\*2\*-1\* Insert CVI-\*\*-ZD(N)105-\*-1\*



Cover CVCS-\*\*-ZDA\*-\*2\*-\*-1\* Insert CVI-\*\*-ZD(N)105-\*-1\*





## Dynamic Functions (cont...)

## **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.





#### Figure 36

- For fast response model CVI-\*\*-ZDN105---these seals are omitted.
- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Vickers DG4V-3.



Figure 37

## **Maximum Leakage**

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

Size	Max. leakage at 100 bar (1450 psi) cm3/min (in3/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 a AP to BP or BP to AP	at 350 bar (5000 psi) cm3/min (in3/min): 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.



0.05

0.40

Figure 38 A A<sub>B</sub>  $\mathbf{A}_{_{\mathrm{BP}}}$ A, Area ratio

## **Areas and Strokes**

Valve size	Area mm2 (in²) A <sub>A</sub>	A <sub>B</sub>	A <sub>bp</sub>	A <sub>AP</sub>	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)

Size 16

Sizes 25-63

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

### 1. Metric Units

Flow rate AP =	Area A <sub>AP</sub> , mm <sup>2</sup> 100	×	Stroke, mm 10	×	$\frac{60}{t}$ =	= cm³∕min
Flow rate BP =	Area A <sub>BP</sub> , mm <sup>2</sup> 100	×	Stroke, mm 10	×	$\frac{60}{t}$ =	= cm³∕min

## 2. Inch Units

Flow rate AP = Area  $A_{AP}$ , in<sup>2</sup> × Stroke, in ×  $\frac{60}{t}$  = in<sup>3</sup>/min Flow rate BP = Area  $A_{BP'}$  in<sup>2</sup> × Stroke, in ×  $\frac{60}{t}$  = in<sup>3</sup>/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**

Eaton-Vickers 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; BSPF plugs.



#### **Non-Metric Models**

UNC bolt tappings; UNF orifice threads; SAE plugs; mounting bolts not supplied.



## **1** Seal Material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

## 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 Function

**ZD\*** - Dynamic with mounting

face for size 03 pilot valve

**ZDA\*** - Dynamic with stroke limiter and mounting face for size 03 pilot valve

\*Code for optional threads, see 5

# **5** Size 03 pilot valve mounting bolt tappings

#### **1** - Inch threads

**3** - Metric threads

## **6** Plugs and orifice threads

- **B** G (BSPF) threads for closure plugs; metric threads for orifices
- **S** SAE threads for closure plugs; UNF threads for orifices

## **7** Seals

**2** - Inch O-ring seals to ISO 3601

## **8 Mounting bolts**

Sizes 16 to 40 only

**9** - Metric mounting bolts supplied

## **9** Adjuster mechanism

For model type ZDA\* only **W** - Wrench adjustment with hex locknut

## O Design number, 1\* series

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

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

## **1** Pilot control orifice location

Specify port location for nonstandard orifice, e.g. "AP", followed by orifice size code, see 12. Repeat as necessary for further non-standard requirements.

## **12 Orifice size**

Specify non-standard orifice size code, see tables on page 117.
## **Model Codes - Dynamic Functions**

#### **CVI Inserts**

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



#### **1** Seal Material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

#### 2 Model

CVI - Cartridge valve insert

#### ③ Nominal size to ISO 7368 (DIN 24342)

 - 06 (NG16) - 08 (NG25) - 09 (NG32) - 10 (NG40) - 11 (NG50) - 12 (NG63)

#### 4 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)

# **5** 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)

# 6 Design number, 1\* series

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

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 119.

#### **Pressure Drop Through Insert**

• = Rated flow point







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











## **Dynamic Functions**



▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers 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)
В	68,8 (2.71)	89,0 (3.50)	106,0 (4.17)	129,0 (5.08)
С	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)	-
Н	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)
К	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)

#### Thread sizes for optional orifices

Model Code Position 6 7 8 (page 72)	Orifice Location	CVCS-**-ZD(A)* Covers: Sizes 16, 25, 32, 40
B 2 9	AP	
	Х	M6-6H x
	Z <sub>2</sub>	8,0 (0.31) deep
S 2	AP	
	Х	1⁄4"-28 UNF-3B x
	Z <sub>2</sub>	8,0 (0.31)deep



- 122,1 (4.81) clearance for removal of complete assembly.
- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers DG4V-3.
- Recess in cover for insert engagement.

Code Position 6 7 (page 72)	Location	Thread
B 2	AP X	M6-6H x 8.0 (0.31) deep
	Z <sub>2</sub>	M8-6H x 8.0 (0.31) deep
S 2	AP X	¼"-28 UNF-3B x 8.0 (0.31) deep
	Z <sub>2</sub>	3%"-24 UNF-2B x 11,0 (0.43) deep

# **Dynamic Functions**



- 155,1 (6.11) clearance for removal of complete assembly.
- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers DG4V-3(S), see GB-C- 2015.
- Recess in cover for insert engagement.

#### Thread sizes for optional orifices

Model Code Position 6 7 (page 72)	Orifice Location	Thread
B 2	AP X	M6-6H x 8,0 (0.31) deep
	Z <sub>2</sub>	M10-6H x 10,0 (0.39) deep
S 2	AP X	¼"-28 UNF-3B x 8,0 (0.31) deep
	Z <sub>2</sub>	34"-24 UNF-2B x 11,0 (0.43) deep

CVCS-\*\*-HFV, 1\* Series, Covers and CVI-\*\*-HFV-A/B, 1\* Series, Inserts

# **General Description**

Eaton's Vickers<sup>®</sup> HFV (Hydraulic Feedback Valvistor<sup>®</sup>) 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	

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:
	<ul> <li>Cylinder position control including lift/lower</li> </ul>
	<ul> <li>Rotary actuator dynamic control</li> </ul>
	<ul> <li>Velocity profile control</li> </ul>
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\*

Simplified symbol

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

Simplified symbol

#### Direction of controlled flow

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









# A = B P = T P = A B = T P = A B = T C = P A = B T = P A = B T = P A = B T = P

#### A to B

\*\*\*-1\* Use insert type CVI-\*\*-HFV-20-**B**-\*\*\*-1\*

B to A

# Model Codes Valvistor<sup>®</sup> Proportional Throttle Valves



(F3-) CVCS - \*\* - HFV - \* - \* - \* 2 (9) - 1\*

4 Flow direction

Valvistor

<sup>5</sup> Area ratio

20 - 1:2 area ratio

6 Flow direction A - For flow A to B

**B** - For flow B to A

HFV - Hydraulic feedback,

#### 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)

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

Valvistor

ina bolts

1 - Imperial threads

3 - Metric threads

6 **Control option** 

flow capability

out free reverse flow.

HFV - Hydraulic feedback,

5 Size 3 pilot valve mount-

W - Mainstage Valvistor with-

Omit for standard mainstage

Valvistor with free reverse

#### 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)

#### **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** 

**7** Flow capacity at p = 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

#### **Thread/seal combina**tion

- B G (BSPF) threads for gage ports; metric threads for orifices (only available when "3" specified at position 5 )
- SAE O-ring gage; inch threads for orifices (only available when "1" specified at position 5)

#### <sup>8</sup> 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

# Design number, 1\* series

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

For full technical details of this valve including types of electrical connections, see Eaton'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 83 and 84				
Pressure drop, free return flow	See graphs on page 85				
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%				
Repeatability 🔺	<3% <3% <3% <3% <3%				
Area ratio (all sizes)	2:1				
Hydraulic fluids See page 17					
Temperature limits	See page 17				
Filtration and viscosity requirements See page 19					
Mounting bolts and assembly torques See page 120					
Seal kits	See page 122				
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 87.

# **Pilot Valve Electrical Data**

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

Туре	KTG4V-3S60-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 87.

#### **Performance Characteristics**

The graphs on the following two pages show typical flow characteristics for different values of input current to pilot valve plotted 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/Pressure Drop vs Solenoid Current (% of max.)



# **Pressure Drops - Free Return Flow**



L/min

USgpm









# Installation Dimensions in mm (inches)



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

# Valvistor<sup>®</sup> Line Extension

Proportional Slip-in Cartridge Valve, Flow Control K(B)TG4V-3 Pilot Stage K(B)FTG4V-3 Pilot Stage

Eaton's Vickers<sup>®</sup> 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 onboard 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 mainstage LVDT.
- Pilot stage selected to meet specific requirements Costeffective 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 Cor	nfiguration	Extended Configurations OBE Valve KBFTG4V-3-2B13N-Z-M1-PE7-H7-11, 5996165-001 KBFTG4V-3-2B13N-Z-M2-PE7-H7-11, 5996350-001		
Pilot Valve Model Code & Part Number	Non-OBE Valve KFTG4V-3-2B13N-	Z-M-U-H7-10, 506834			
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 Cor	nfiguration	Extended Configurations			
Pilot Valve Model Code & Part Number	Non-OBE Valve KTG4V-3-2B08N-N Other configuratic Contact Eaton	A-U-H7-60-EN427, 02-398752 ns available.	OBE Valve 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 Model Code & Part Number	Non-OBE Valve KTG4V-3S-2B08N Other configurati Contact Eaton	OBE Valve I-M-U-H5-60-EN427, 02-154581 ions available. CONS available. CONS AVAILABLE CONS AVA		• • • • • • •
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	Model Code	Assembly Number
CVCS-16-HFV1-S2-10	02-311552	F3-CVCS-16-HFV3-W-B29-10	02-358045
CVCS-16-HFV1-W-S2-10	02-312313	F3-CVCS-25-HFV1-W-S2-10	02-333781
CVCS-16-HFV3-B29-10	02-310565	F3-CVCS-25-HFV3-W-B29-10	02-319363
CVCS-16-HFV3-W-B29-10	02-312336	F3-CVCS-32-HFV1-W-S2-10	02-312315
CVCS-25-HFV1-S2-10	02-311553	F3-CVCS-40-HFV1-W-S2-10	02-353592
CVCS-25-HFV1-W-S2-10	02-312312	F3-CVCS-50-HFV1-S2-10	02-325658
CVCS-25-HFV3-B29-10	02-157809	F3-CVCS-50-HFV1-W-S2-10	02-395045
CVCS-25-HFV3-W-B29-10	02-157811		
CVCS-32-HFV1-S2-10	02-311554	CVI-16-HFV-20-A-21-10	02-310564
CVCS-32-HFV1-W-S2-10	02-312310	CVI-16-HFV-20-B-21-10	02-310563
CVCS-32-HFV3-B29-10	02-310641	CVI-25-HFV-20-A-43-10	02-157670
CVCS-32-HFV3-W-B29-10	02-312335	CVI-25-HFV-20-B-32-10	02-157741
CVCS-40-HFV1-S2-10	02-312311	CVI-32-HFV-20-A-63-10	02-310643
CVCS-40-HFV1-W-S2-10	02-312314	CVI-32-HFV-20-B-63-10	02-310642
CVCS-40-HFV3-B29-10	02-157212	CVI-40-HFV-20-A-90-10	02-157234
CVCS-40-HFV3-W-B29-10	02-312121	CVI-40-HFV-20-B-81-10	02-157233
CVCS-50-HFV1-S2-10	02-312103	CVI-50-HFV-20-A-130-10	02-312101
CVCS-50-HFV1-W-S2-10	02-312104	CVI-50-HFV-20-B-130-10	02-312102
CVCS-50-HFV3-B2-10	02-311957	CVI-63-HFV-20-A-216-10	02-311063
CVCS-50-HFV3-W-B2-10	02-311959	CVI-63-HFV-20-B-216-10	02-311062
CVCS-63-HFV1-S2-10	02-312106		
CVCS-63-HFV1-W-S2-10	02-312107		
CVCS-63-HFV3-B2-10	02-311958		
CVCS-63-HFV3-W-B2-10	02-311960		

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

#### Basic Characteristics Valves

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

Max. operating pressure	315 bar (4500 psi)
Flow ratingsup to 900 l	_/min (238 USgpm)

#### Amplifier

Eaton-Vickers 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 Eaton-Vickers 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



# **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)

#### Wiring Connections

# **4** Туре

**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

#### Design number, 3\* series

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



#### 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.



- Customer's protective ground connection.



#### 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) n	nax.		
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 500 C (1220F) ambient				
Nominal	2.2A (13.6W)			
Max.	2.9A (18W)			
Solenoid coil resistance at 200C (680 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 CVI	U-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	4,1 kg	6,5 kg	8,0 kg
	(7.3 lb)	(9.0 lb)	(14.3 lb)	(17.7 lb)

#### **Flow/Stroke Characteristics**

At  $\Delta p = 10$  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:

$$\Delta p_{_{X}} = \Delta pr^{_{\bullet}} \left( \frac{Q_{_{X}}}{Q_{_{f}}} \right) 2$$

Where  $\Delta p_x$  = Pressure drop for required flow rate  $Q_x$ 

 $\Delta p_r$  = Pressure drop at rated current

 $Q_x =$  Flow rate for which  $\Delta p_x$  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  $\pm 10\%$ 

CVU-16-EFP1---3\*





#### Valve Area Ratios



#### **Hydraulic Fluids**

All cartridge valves can be used with antiwear hydraulic oils, and certain low viscosity fluids. Add prefix "F3" 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 min2	0°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 19.

#### **Drive Amplifier**

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

#### **Other Supporting Products**

See electronic accessories GB-C-2460.

# **Electrohydraulic Proportional Throttles**



#### **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 **bidirec-tional** 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.



#### **Basic Characteristics**

#### Valves

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

Nominal flow ratings,  $\Delta p = 10$  bar (145 psi):

CVU-16	210 L/min ( 55 USgpm)
CVU-25	400 L/min (105 USgpm)
CVU-32	600 L/min (158 USgpm)
CVU-40	900 L/min (236 USgpm)
CVU-50	1600 L/min (420 USgpm)
CVU-63	2500 L/min (660 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 pressuretight 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.

This product has been designed and tested to meet specific standards outlined in the European Electromagnetic Compat-



*ibility Directive (EMC). For instructions on installation requirements to achieve effective protection levels, see this leaflet and the Installation Wiring* 

Practices for Eaton-Vickers 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

CVU-32-ZSWD3





Wiring Connections





**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.

**Functional Symbols** 

CVU-\*\*-SWD

#### CVU-\*\*-SWD3





CVU-\*\*-ZSWD3



Standard factory-fitted orifice.

○ Tapped port for installation of additional orifices.



# **Special Seals for phosphate ester fluids**

Omit if not required

#### 2 Model

**CVU** - Cartridge valve unit

#### ③ Nominal size to ISO 7368 (DIN 24342) 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

#### **Typical Model Selection**

For applications requiring a valve for a flow rate of 400 L/ min (105 USgpm) with remote pilot, main spool cracking pressure of 2,5 bar (36.3 psi) and metric bolts, select: CVU-25-SWDB29-M-10 For applications requiring electrical indication of spool position for a flow rate of 1600 L/min (420 USgpm) with integral pilot operation, main spool cracking pressure of 5,0 bar (72.5 psi) and UNC bolts, select: CVU-50-SWD3-B29-H-10 bolt kit BKDNG50708 For applications requiring electrical indication of spool position with hydraulic pilot operation for opening and closing, a flow rate of 600 L/min (158 USgpm), 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: 315 bar (4500 psi) 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.

be specified at position 6 . Omit if not required

#### 5 Type

**SWD** - Spool position sensor, series D

#### 6 Function

Sizes 16, 25, 32 and 40 only: **Blank** - Spring return of main spool to closed position plus facility to hold spool closed by hydraulic pressure from a remote source.

Sizes 16 to 63 - SWD3

Sizes 16 to 40 - ZSWD3

**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)

**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

#### 8 Seals

**2** - Seals to ISO 3601

#### **9 Mounting bolts**

**9** - Metric bolts supplied with valve

#### Flow Rates

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.

CVU-16	210 L/min ( 55 USgpm)
CVU-25	400 L/min (105 USgpm)
CVU-32	600 L/min (158 USgpm)
CVU-40	900 L/min (236 USgpm)
CVU-50	1600 L/min (420 USgpm)
CVU-63	
-	

See pressure drop graphs for further data.

#### Area Ratios

CVU-\*\*-SWD

CVU-\*\*-SWD3 A<sub>A</sub>: A<sub>B</sub> : A<sub>P</sub> 1 : 1 : 2



B

10 Main spool opening/

(Ports A and B)

series

inclusive.

**L** - 0,5 bar (7 psi)

M - 2.5 bar (36 psi)

**H** - 5,0 bar (72 psi)

11 Design number, 1\*

Subject to change. Installa-

tion dimensions unaltered

for design numbers 10 to 19

cracking nominal pressure



# Characteristics of Electrical Switch Input:

Supply voltage

Current, switch open Current, switch closed mA

#### Output:

Max. continuous current Voltage load 96 ohms 10 Hz

#### **Plug connections:**

<0,15 mm (0.006 in)

<0,02 mm (0.001 in)

≤3 µm/°C (0.0002 in/°F)

Pin 1 (output 1) Pin 2 tive 0V Normally closed

**Protection:** 

Pg 7 fitted

ted



Normally open Supply posi-Pin 3 Pin 4 (output 2)

Overload and short-circuit protected; self re-setting IEC 947 class IP65 with connector correctly fit-

+10 to +35V DC inclusive of a max.

4V peak-to-peak ripple

1V below input at max.

Max. switching frequency

Min. load impedance

5 mA

250 mA

255

#### Mechanical:

Switching hysteresis Repeatability Temperature drift of switching point Connector



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.

EATON Slip-in Cartridge Valve Catalog E-VLSC-MC002-E March 2012

## 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 119.

#### **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):

alve Size Max.	(USgpm)
	(0.53)
	(0.8)
	(1.06)
	(1.6)
	(3.2)
	(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<sup>3</sup> (in<sup>3</sup>)

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 – 200 C (– 40 F) Maximum +800 C (+1760 F)

#### Fluid temperature

#### Petroleum Oil Water-Containing

Min10 0C +10 0C	
(+140 F) (+500 F)	
Max.* +80 0C +54 0C	
(+1760 F) (+1290 F)	

#### Filtration Requirements

See page 19.

#### **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 Eaton-Vickers where limits are outside those for petroleum oil.

#### **Pressure Drops**

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

#### CVU-16-(Z)SWD(3)



#### CVU-32-(Z)SWD(3)



#### CVU-50-SWD3



CVU-25-(Z)SWD(3)



#### CVU-40-(Z)SWD(3)



#### CVU-63-SWD3



#### 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 Eaton-Vickers 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

#### 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 <sub>2</sub> 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



Dimension	CVU-16-SWD	CVU-25-SWD	CVU-32-SWD	CVU-40-SWD
A	65,0 (2.6)	85,0 (3.35)	102,0 (4.02)	125,0 (4.92)
В	69,0 (2.72)	90,0 (3.54)	106,5 (4.2)	130,0 (5.12)
С	26,0 (1.02)	25,0 (0.98)	47,0 (1.89)	49,0 (1.93)
D	40,0 (1.58)	60,0 (2.36)	65,0 (2.56)	70,0 (2.76)
E	118,5 (4.67)	141,25 (5.56)	143,5 (5.65)	148,5 (5.85)
F	173,9 (6.85)	210,1 (8.27)	228,2 (8.98)	253,0 (9.96)
G bolts ▲	4 x M8 x 40	4 x M12 x 45	4 x M16 x 75	4 x M20 x 80
Bolt torque	35 (26)	110 (81 )	285 (210)	500 (370)
Nm ( lbf ft)				

▲ For details of equivalent inch/UNC bolts see page 104.

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).



Dimension	CVU-16-(Z)SWD3	CVU-25-(Z)SWD3	CVU-32-(Z)SWD3	CVU-40-(Z)SWD3	CVU-50-SWD3
A	73,0 (2.87)	85,0 (3.35)	102,0 (4.02)	125,0 (4.92)	142,5 (5.61)
В	75,5 (2.97)	90,0 (3.54)	106,5 (4.2)	130,0 (5.12)	147,0 (5.79)
С	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 Eaton-Vickers DG4V-3.

■ For details of equivalent inch/UNC bolts see page 104.

• 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-B29-\*-1\* Models

Dimensions mm (inch)





- ▲ Size 03 pilot control valve to be ordered separately. Recommended model Eaton-Vickers 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).

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	Eaton-Vickers Bolt	Kit no. Torque to lbf ft
CVU-16-SWD	5/16"-18 UNC	11/2"	BKDNG16700	26
CVU-16-(Z)SWD3	5/16"-18 UNC	33/4"	On request	26
CVU-25-SWD	1/2"-13 UNC	13/4"	On request	81
CVU-25-(Z)SWD3	1/2"-13 UNC	3	BKCGV06603	81
CVU-32-SWD	5/8"-11 UNC	3	BK1015	210
CVU-32-(Z)SWD3	5/8"-11 UNC	4	BKFG06646	210
CVU-40-SWD	3/4"-10 UNC	31/4"	On request	370
CVU-40-(Z)SWD3	3/4"-10 UNC	31/2"	BKCG10616	370
CVU-50-SWD3	3/4"-10 UNC	3	BKDNG50708	430
CVU-63-SWD3	11/4"-7 UNC	53/4"	On request	885

#### Mass

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

Model	Mass Kg	(Ib)	
CVU-16-SWD	1,6	(3.4)	
CVU-16-(Z)SWD3	3,3	(7.3)	
CVU-25-SWD	3,5	(7.7)	
CVU-25-(Z)SWD3	4,9	(10.8)	
CVU-32-SWD	5,75	(12.3)	
CVU-32 (Z)SWD3	7,25	(16.0)	
CVU-40-SWD	9,6	(21.2)	
CVU-40-(Z)SWD3	12,3	(27.0)	
CVU-50-SWD3	15,7	(34.7)	
CVU-63-SWD3	37,9	(83.4)	

Nominal Size	Eaton-Vickers Seal Kit I Standard Seals	Model Code: "F3" Seals
CVU-16-(Z)SWD(3)	02-157167	02-157168
CVU-25-(Z)SWD(3)	02-157536	02-157537
CVU-32-(Z)SWD(3)	02-157165	02-157616
CVU-40-(Z)SWD(3)	02-157679	02-157680
CVU-50-SWD3	02-157675	02-157676
CVU-63-SWD3	02-157677	02-157678

#### **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.

#### **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 89) and may contain redundant seals for a particular model designation.

# **Special Function Valves**

#### **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-*2(9)-20	CVI-16-C025-50
CVCS-25-C025-*2(9)-20	CVI-25-C025-50
CVCS-32-C025-*2(9)-20	CVI-32-C025-50
CVCS-40-C025-*2(9)-20	CVI-40-C025-50



EATON Slip-in Cartridge Valve Catalog E-VLSC-MC002-E March 2012

#### 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) +  $P_{_{\rm A}}$  + 0.05  $P_{_{\rm B}}$ .

Cover	Insert
CVCS-25-0D-*-20	CVI-25-0D105-50
CVCS-32-0D-*-20	CVI-32-0D105-50
CVCS-40-0D-*-20	CVI-40-0D105-50
CVCS-50-0D-20	CVI-50-0D105-50
CVCS-63-0D-20	CVI-63-0D105-50

#### 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 43). 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).



Differential pressure setting Maximum pressure setting DGMA-3-C1 Crossover plate BT CVCS-\*\*- C CVGC-3 Cover Module Y х Ź1 AP CVI-\*\*-D10 Insert R Proportional throttle, type: CVU-\*\*-EFP1 Figure 47



# **Model Codes Special Function Valves**

#### **CVCS Covers**

Eaton-Vickers 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.



#### **1** Seal Material

4 Function

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals.

# 2 Model

**CVCS** - Cartridge valve cover to ISO 7368

# Nominal size to ISO7368 (DIN 24342)Applicable to function type

	CO25	OD*
16 - 06 (NG16)	•	-
25 - 08 (NG25)	•	•
32 - 09 (NG32)	•	•
40 - 10 (NG40)	•	•
50 - 11 (NG-50)	•	•
63 - 12 (NG-63)	•	•

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

**OD** - Normally open (prefill)

# **5** Design number, 20 series

See page 116 for sizes of factory-fitted standard orifices. Other orifice sizes and locations can be fitted by special arrangement with your Eaton-Vickers representative. Non-standard orifice requirements should be defined as follows:

# **6** Pilot control orifice location

Specify port location for nonstandard orifice, e.g. "AP", followed by orifice size code, see 7. Repeat as necessary for further nonstandard requirements.

#### **Orifice size**

Specify non-standard orifice size code, see tables on page 117.
## Model Codes Special Function Valves

#### **CVI Inserts**

For availability of inserts by size and function, see page 7. All features must be specified when ordering; those in brackets () are optional.



#### **1** Seal Material

**F3** - Special seals. See "Fluids and Seals" on page 17. Omit for standard seals. **C025** - 1:0.25 ratio (used with insert type C025) **OD105** - Normally open

4 Function

(prefill)

#### 2 Model

 $\ensuremath{\text{CVI}}$  - Cartridge value insert

# Nominal size to ISO7368 (DIN 24342)Applicable to function type

	CO25	OD105
16 - 06 (NG16)	•	-
25 - 08 (NG25)	•	•
32 - 09 (NG32)	•	•
40 - 10 (NG40)	•	•
50 - 11 (NG-50)	•	•
63 - 12 (NG-63)	•	•

## **5** Design number, 50 series

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



В						E		Location for nameplates	
Size	Α	C025	OD	С	D	C025	OD	Type C025	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**



- Recommended model Eaton-Vickers DG4V-3.
- Maximum clearance for removal of cover from manifold.

Location for Size В С D Е Nameplates Α 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 70.0 (2.76) 35.0 (1.38) 33.0 (1.30) Side Z2 126.0 (4.96) 25.0 (0.98) 50 78.0 (3.07) 44.0 (1.73) 36.0 (1.42) 34.0 (1.34) Side Z2 140.0 (5.51) 48.0 (1.89) 63 180.0 (7.09) 90.0 (3.54) 42.0 (1.65) 43.0 (1.69) Side Z2

△ DG4V-3-70

#### **Basic Characteristics**

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

CVGC-3 CVGCA-3 CVGCPA-3	5 L/min (1.3 USgpm) m	ax.
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 Eaton-Vickers 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 Eaton-Vickers SystemStakTM valves type DG\*\*M-3, see GB-C-2027.

#### **Functional Symbols**









Ρ А т

Æ

ጠ

R

В Т

В Т

#### 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 Eaton-Vickers 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 CVGPC1-3 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 53



Figure 54

Figure 52



Figure 55

Figure 56

113

#### **Relief Functions**

#### **1** Seal material

**F3** - Special seals. See "Fluids and Seals" on page 17. 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

#### **Auxiliary Functions**



#### (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

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

## Design number, 1\* series

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



#### 1 Seal material

**F3** - Special seals. See "Fluids and Seals" on page 17. 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

#### 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 Eaton-Vickers representative before ordering.

Typical examples include:

**P08** - Orifice size 0,8 mm in P line

**T06** - Orifice size 0,6 mm in T line

**B09** - Orifice size 0,9 mm in B line

**A10** - Orifice size 1,0 mm in A line

Specify orifice requirements by port location(s) followed by orifice code (see table on page 117) 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.



▲ 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 Eaton-Vickers representative. Nonstandard 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	Х	1,0	1,2	1,3	1,4	1,6	1,8
A1/A3	AP <sub>2</sub>	1,0	1,2	1,2	1,4	-	_
C and SC	AP X	1,0 0,9	1,2 0,8	1,2 0,9	1,4 1,0		
C1/C3 and SC1/SC3	AP X	1,0 0,9	1,2 0,8	1,2 0,9	1,4 1,0		-
C025	AP Z <sub>1</sub>	1,0 1,0	0,8 1,0	0,8 1,0	0,8 1,0		
D1/D3	AP <sub>1</sub>	1,0	1,2	1,3	1,4	_	_
D2/D5	AP	_	_	_	_	1,6	1,8
DC1/DC3	AP	1,0	1,2	1,2	1,4	_	_
N	Х	1,0	1,2	1,3	1,4	1,6	1,8
OD	_	_	1,2	1,2	1,4	-	_
PC	AP	1,0	1,2	1,3	1,4	-	_
U	AP	1,2	1,2	1,2	1,4	-	_
U1/U3	AP	1,2	1,2	1,2	1,4	-	_
W	AP	1,0	1,2	1,3	1,4	-	_
W11/W13	А	1,0	1,2	1,3	1,4	-	_
W31/W33	А	1,0	1,2	1,3	1,4	-	_
X1/X3	AP	1,0	1,0	1,2	1,4	_	_
CVI inserts							
C10F	_	0,8	0,8	0,9	1,0	_	_
D105V	_	1,0	1,2	1,2	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 75)

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		
Р, А, В, Т	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 Size (mm)	Orifice code	Valve Cover Size & Orifice Kit Number ∎					
Metric Threads		16: 992747 ∎ M5	25, 32 & 40: 992748 ■ M6	50 & 63: 992749 ■ M10			
0,7	07	•	•				
0,8	08	•	•	•			
0,9	09						
1,0	10	•	•	•			
1,2	12	•	•	•			
1,3	13						
1,4	14						
1,5	15	•	•	•			
1,6	16						
1,8	18			•			
Solid plug	00	•	•	•			

• 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



## External closure plug, Torque, lbf ft inch thread T<sub>2</sub>

inch thread T <sub>2</sub>		
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 threadT <sub>1</sub>	Torque, Nm	
M5	2,8 to 3,2	
M6	4,3 to 4,7	-
M8	7,0 to 9,0	

10,0 to 12,0

#### External closure plug, Torque, Nm

M10

BSPF thread T <sub>2</sub>	
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.

 $\frac{\text{Displacement (in^3) x 60 (sec/min)}}{\text{Flow rate (in^3/min)}}$   $\frac{(0.27 \text{ in}^3) (60 \text{ sec/min})}{80 (in^3/min)} = 0.200 \text{ sec}$   $\frac{\text{Displacement (cm}^3) x 60 (sec/min)}{\text{Flow rate (cm}^3/min)}$ 

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

Valve	Poppet area AP		Nominal poppet stroke▲		Displacement		
Size	mm2	in2	mm	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 71.



#### Flow through orifice

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.

#### **Example Shown**

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

Apply to data given at

36 cSt (168 SUS)

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



Apply to data given at 21 cSt (102 SUS)

## **Mounting Bolt Data**

D <sub>1</sub>	D <sub>2</sub>
9,0 (0.35)	15,0 (0.59)
14,0 (0.55)	20,0 (0.79)
18,0 (0.71)	26,0 (1.02)
22,0 (0.87)	33,0 (1.30)
22,0 (0.87)	33,0 (1.30)
33,0 (1.30)	49,0 (1.93)
	9,0 (0.35) 14,0 (0.55) 18,0 (0.71) 22,0 (0.87) 22,0 (0.87)



#### Inch Bolt Kits Bolts are UNC, grade 8 or better

### Cartridge Valve Covers, CVC(S)

Cover	Bolt	Model	Used with	Recommende	ed Bolt Torque	
Size	Size	Number	<b>Model Type</b>	lbf ft	(Nm)	
Dynamic Mode	els					
16	<sup>5</sup> / <sub>16</sub> " - 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	<sup>3</sup> / <sub>4</sub> " - 10 x 5	BK02-157292	ZD1/ZDA1	370	(500)	
50	<sup>3</sup> / <sub>4</sub> " - 10 x 6	BK02-157293	ZD1/ZDA1	429	(580)	
63	1¹/₄″ - 7 x 6	BK02-300324	ZD1/ZDA1	888	(1200)	
Other Models						
16	<sup>5</sup> / <sub>16</sub> " - 18 x 1 <sup>1</sup> / <sub>2</sub> "	BKDNG16-700	All models	26	(35)	
25	1/2" - 13 x 1 1/2"	BKDPNG25-704	All models	81	(110)	
32	₅⁄/ <sub>8</sub> ″ - 11 x 2	BKDNG32-713	All models	210	(285)	
40	<sup>3</sup> / <sub>4</sub> " - 10 x 2 <sup>1</sup> / <sub>4</sub> "	BKDPNG40-706	All models	370	(500)	
50	<sup>3</sup> / <sub>4</sub> " - 10 x 3	BKDNG50-708	All models	429	(580)	
63	1 1/4" - 7 x 3 1/2"	BKDNG63-710	All models	888	(1200)	

#### **Metric Bolt Kits**

Bolts are Class 12.9 (ISO 898) or stronger

#### Cartridge Valve Covers, CVC(S)

		Recommende		
Bolt Size	Model Number	Nm	(lbf ft)	
M8 x 100	Metric covers, sizes	35	(26)	
M12 x 100	16 to 40, are supplied	110	(81)	
M16 x 110	with mounting bolts	285	(210)	
M20 x 130	(B29 in model code)	500	(370)	
M20 x 150	BK02-157288	580	(429)	
M30 x 150	BK02-157289	1200	(888)	
M8 x 40	BKDNG16-701M	35	(26)	
M12 x 40	BKDPNG25-705M	110	(81)	
M16 x 55	BKDNG32-718	285	(210)	
M20 x 60	BKDPNG40707M	500	(370)	
M20 x 80	BKDNG50-709M	580	(429)	
M30 x 90	BKDNG63-711M	1200	(888)	
	M8 x 100         M12 x 100         M16 x 110         M20 x 130         M20 x 150         M30 x 150         M8 x 40         M12 x 40         M16 x 55         M20 x 60         M20 x 80	M8 x 100         Metric covers, sizes           M12 x 100         16 to 40, are supplied           M16 x 110         with mounting bolts           M20 x 130         (B29 in model code)           M20 x 150         BK02-157288           M30 x 150         BK02-157289           M8 x 40         BKDNG16-701M           M12 x 40         BKDPNG25-705M           M16 x 55         BKDNG32-718           M20 x 60         BKDPNG40707M           M20 x 80         BKDNG50-709M	Bolt Size         Model Number         Nm           M8 x 100         Metric covers, sizes         35           M12 x 100         16 to 40, are supplied         110           M16 x 110         with mounting bolts         285           M20 x 130         (B29 in model code)         500           M20 x 150         BK02-157288         580           M30 x 150         BK02-157289         1200           M8 x 40         BKDNG16-701M         35           M12 x 40         BKDPNG25-705M         110           M16 x 55         BKDPNG32-718         285           M20 x 60         BKDPNG40707M         500           M20 x 80         BKDNG50-709M         580	M8 x 100         Metric covers, sizes         35         (26)           M12 x 100         16 to 40, are supplied         110         (81)           M16 x 110         with mounting bolts         285         (210)           M20 x 130         (B29 in model code)         500         (370)           M20 x 150         BK02-157288         580         (429)           M30 x 150         BK02-157289         1200         (888)           M8 x 40         BKDNG16-701M         35         (26)           M12 x 40         BKDPNG25-705M         110         (81)           M16 x 55         BKDNG32-718         285         (210)           M20 x 60         BKDPNG40707M         500         (370)           M20 x 80         BKDNG50-709M         580         (429)

\*Refer installation drawing on Page No. 86 for Valvistor

#### **Pilot Valves**

		Recommende	ed Bolt Torque	
Bolt Size	Model Number	Nm	(lbf ft)	
M5 x 30	BK616452M	7-9	(63-80)	
M5 x 70	BK464125M	7-9	(63-80)	
M5 x 50	BKDG3-699M	7-9	(63-80)	
M5 x 30	BK616452M	7-9	(63-80)	
	M5 x 30 M5 x 70 M5 x 50	M5 x 30         BK616452M           M5 x 70         BK464125M           M5 x 50         BKDG3-699M	Bolt Size         Model Number         Nm           M5 x 30         BK616452M         7-9           M5 x 70         BK464125M         7-9           M5 x 50         BKDG3-699M         7-9	M5 x 30         BK616452M         7-9         (63-80)           M5 x 70         BK464125M         7-9         (63-80)           M5 x 50         BKDG3-699M         7-9         (63-80)

## Seal Kits

Dynamic Cover         U           VCS-2D(3) 16/25/32         0.2156955         0.2156966           VCS-2D(3) 40         0.2156953         0.2156954           VCS-2D(3) 50         0.2156951         0.2156952           VCS-2D(3) 50         0.2156967         0.2156968           VCS-2D(3) 63         0.2156965         0.2156966           VCS-2D(3) 63         0.2156965         0.2156966           VI-16-2D(N)105-10         0.2156963         0.2156962           VV1-32-2D(N)105-10         0.2156959         0.2156960           VV-4-32-ZD(N)105-10         0.2156959         0.2156960           VV-4-32-ZD(N)105-10         0.2156959         0.2156960           VV-4-32-ZD(N)105-10         0.2156959         0.2156970           Standard Inserts (incl. OD, OD3)         OV         OV-150270           VV-4-32-ZD(N)105-10         0.2156969         0.2420393           VV-32-**         0.2420394         0.2420393           VV-4-4-**         0.2420394         0.2420393           VV-32-**         0.2420398         0.2420391           VV-40-**         0.2420396         0.2420391           VV-40-**         0.2420396         0.2420391           VV-40-**         0.2157617         0.215761	Product	Standard	F3
CVCS-ZD[3] 40         02.156953         02.156954           CVCS-ZD[3] 50         02.156967         02.156952           CVCS-ZD[3] 63         02.156967         02.156962           CVCS-ZD[3] 63         02.156965         02.156966           CVI-16-ZD[N]105-10         02.156965         02.156966           CVI-15-ZD[N]105-10         02.156961         02.156962           CVI-32-ZD[N]105-10         02.156959         02.156956           CVI-40-ZD[N]105-10         02.156957         02.156958           CVI-40-ZD[N]105-10         02.156957         02.156958           CVI-63-ZD[N]105-10         02.156957         02.156957           Standard Inserts (incl. 0D, 0D3)         02.156958         02.156970           CVI-16-**         02.420392         02.420393           CVI-25.**         02.420394         02.420393           CVI-40-X0         02.420396         02.420393           CVI-40-X*         02.420390         02.420391           CVI-40-X*         02.420390         02.420391           CVI-56.**         02.420390         02.450791           CVI-16.**         456173         02.157617           CVI-16.**         02.450791         02.157619           CVI-26.***         4567	Dynamic Cover		
CVCS-ZD[3] 50         02.156951         02.156952           OVGS-ZD[3] 63         02.156967         02.156968           Dynamic Insert	CVCS-ZD(3) 16/25/32	02-156955	02-156956
CVCS-ZD(3) 63         02-156967         02-156968           Dynamic Insert         VI-16-ZD(N)105-10         02-156965         02-156964           CVI-32-ZD(N)105-10         02-156961         02-156962           CVI-32-ZD(N)105-10         02-156959         02-156962           CVI-42-ZD(N)105-10         02-156959         02-156950           CVI-32-ZD(N)105-10         02-156959         02-156958           CVI-42-ZD(N)105-10         02-156959         02-156958           CVI-43-ZD(N)105-10         02-156959         02-156958           CVI-43-ZD(N)105-10         02-156959         02-156958           CVI-43-ZD(N)105-10         02-156959         02-156957           Standard Inserts (incl. OD, OD3)         VI-45-**         02-420392         02-420395           CVI-42-**         02-420394         02-420395         02-420395           CVI-42-**         02-420398         02-420391         02-420391           CVI-45-**         02-420390         02-420391         02-420497           Valvistor Insert         VI-15-**         02-157619         02-157619           CVI-25-**         456926         02-157619         02-157619           CVI-40-**         478733         02-157619           CVI-40-**	CVCS-ZD(3) 40	02-156953	02-156954
Dynamic InsertCVI-16-ZD(N)105-1002-15696502-156966CVI-25-ZD(N)105-1002-15696302-156964CVI-32-ZD(N)105-1002-15695902-156962CVI-40-ZD(N)105-1002-15695702-156958CVI-50-ZD(N)105-1002-15695702-156958CVI-50-ZD(N)105-1002-15695902-156970Standard Inserts (incl. OD, OD3)CVI-52-X*02-420392CVI-52-X**02-42039402-420395CVI-52-**02-42039602-420399CVI-52-**02-42039602-420391CVI-53-**02-42039002-420391CVI-54-**02-42039002-420391CVI-54-**02-42039002-420391CVI-55-**02-42049602-157617CVI-55-**02-42049602-157618CVI-52-**45692602-157618CVI-52-**45692602-157619CVI-50-**02-15761902-157619CVI-50-**02-15761902-157620CVI-63-**478732514808CVI-50-**02-15763902-157621CVI-63-**45679802-157621CVI-63-**02-15763502-157636Size 2502-15753602-157616Size 4002-15763902-157616CVI-50-SWD3-**02-15767502-157616CVI-50-SWD3-**02-15767502-157676CVI-50-SWD3-**02-15767502-157676	CVCS-ZD(3) 50	02-156951	02-156952
CVI-16-ZD(N)105-10         02-156965         02-156966           CVI-25 ZD(N)105-10         02-156963         02-156964           CVI-32-ZD(N)105-10         02-156959         02-156950           CVI-40-ZD(N)105-10         02-156959         02-156958           CVI-50-ZD(N)105-10         02-156959         02-156958           CVI-50-ZD(N)105-10         02-156959         02-156970           Standard Inserts (incl. OD, OD3)         02-156959         02-420393           CVI-15-**         02-420394         02-420395           CVI-50-**         02-420396         02-420399           CVI-50-**         02-420396         02-420391           CVI-6-**         02-420390         02-420391           CVI-6-**         02-420390         02-420391           CVI-6-**         02-420390         02-420391           CVI-6-**         02-420496         02-420497           Valvistor Insert         VI-50-**         02-420497           VI-50-**         02-420496         02-420497           VI-50-**         02-157617         02-157618           CVI-63-**         456926         02-157618           CVI-50-**         476733         02-157619           CVI-60-**         476733	CVCS-ZD(3) 63	02-156967	02-156968
CVI-25-ZD(N)105-10         02-156963         02-156964           CVI-32-ZD(N)105-10         02-156959         02-156960           CVI-42-ZD(N)105-10         02-156957         02-156958           CVI-32-ZD(N)105-10         02-156959         02-156970           Standard Inserts (incl. OD, OD3)         02-420393         02-420393           CVI-32-ZVI(N)105-10         02-420392         02-420393           CVI-32-X**         02-420394         02-420395           CVI-42-**         02-420396         02-420397           CVI-40-**         02-420390         02-420391           CVI-50-**         02-420496         02-420497           Valvistor Insert         V         V           CVI-15-**         456926         02-157617           CVI-15-**         456926         02-157619           CVI-15-**         45698         02-157619           CVI-40-**         478733         02-157620           CVI-45-**         456798         02-157620 <td>Dynamic Insert</td> <td></td> <td></td>	Dynamic Insert		
CVI-32-ZD(N)105-10         02-156959         02-156960           CVI-40-ZD(N)105-10         02-156959         02-156958           CVI-50-ZD(N)105-10         02-156957         02-156958           CVI-60-ZD(N)105-10         02-156969         02-156970           Standard Inserts (incl. OD, OD3)         02-420392         02-420393           CVI-16**         02-420392         02-420395           CVI-52***         02-420396         02-420397           CVI-60**         02-420390         02-420391           CVI-63**         02-420390         02-420391           CVI-63**         02-420390         02-420391           CVI-63**         02-420390         02-420391           CVI-63**         02-420496         02-420497           Valistor Insert         02-420497         02-157618           CVI-16**         456173         02-157618           CVI-16**         456926         02-157619           CVI-40**         478732         514808           CVI-50**         478733         02-157619           CVI-63**         456798         02-157620           CVI-63**         456798         02-157616           Size 25         02-15765         02-157616	CVI-16-ZD(N)105-10	02-156965	02-156966
CVI-40-ZD(N)105-10         02-156959         02-156960           CVI-50-ZD(N)105-10         02-156957         02-156958           CVI-63-2D(N)105-10         02-156959         02-156970           Standard Inserts (incl. OD, OD3)         02-420392         02-420393           CVI-15**         02-420392         02-420395           CVI-55**         02-420396         02-420397           CVI-63**         02-420398         02-420399           CVI-65**         02-420390         02-420391           CVI-65**         02-420390         02-420391           CVI-63**         02-420390         02-420391           CVI-63**         02-420391         02-420391           CVI-63**         02-420497         Valvistor Insert           CVI-16**         456173         02-157617           CVI-16**         45626         02-157618           CVI-25**         456826         02-157618           CVI-40**         478732         514808           CVI-50**         478733         02-157619           CVI-63**         456798         02-157620           CVI-63***         456798         02-157616           Size 16         02-1577615         02-157616           Size	CVI-25-ZD(N)105-10	02-156963	02-156964
$\begin{array}{c c} CVI-50-ZD[N]105-10 & 02-156957 & 02-156958 \\ \hline CVI-63-ZD[N]105-10 & 02-156969 & 02-156970 \\ \hline \\ \hline \\ Standard Inserts (incl. OD, OD3) \\ \hline \\ CVI-16^{**} & 02-420392 & 02-420393 \\ \hline \\ CVI-25^{**} & 02-420394 & 02-420395 \\ \hline \\ CVI-25^{**} & 02-420396 & 02-420397 \\ \hline \\ CVI-30^{**} & 02-420398 & 02-420399 \\ \hline \\ CVI-50^{**} & 02-420398 & 02-420399 \\ \hline \\ CVI-63^{**} & 02-420496 & 02-420497 \\ \hline \\ \hline \\ VI-63^{**} & 02-420496 & 02-420497 \\ \hline \\ Valies^{**} & 02-420496 & 02-157617 \\ \hline \\ CVI-16^{**} & 456173 & 02-157618 \\ \hline \\ CVI-25^{**} & 456926 & 02-157618 \\ \hline \\ CVI-32^{**} & 479449 & 02-157619 \\ \hline \\ CVI-40^{**} & 478732 & 514808 \\ \hline \\ CVI-50^{**} & 456798 & 02-157620 \\ \hline \\ CVI-63^{**} & 456798 & 02-157621 \\ \hline \\ Inits (CVU^{**}) ▲ \\ \hline \\ Size 16 & 02-157167 & 02-15718 \\ \hline \\ Size 25 & 02-157536 & 02-157537 \\ \hline \\ Size 32 & 02-157615 & 02-157616 \\ \hline \\ Size 40 & 02-157679 & 02-157680 \\ \hline \\ CVI-50^{***} & 02-157616 \\ \hline \\ Size 40 & 02-157679 & 02-157680 \\ \hline \\ CVI-50^{***} & 02-157616 \\ \hline \\ Size 40 & 02-157679 & 02-157680 \\ \hline \\ CVI-50^{***} & 02-157616 \\ \hline \\ Size 40 & 02-157679 & 02-157680 \\ \hline \\ CVI-50^{***} & 02-157616 \\ \hline \\ \\ Size 40 & 02-157679 & 02-157680 \\ \hline \\ CVI-50^{***} & 02-157616 \\ \hline \\ \\ \\ \hline \\ CVI-50^{***} & 02-157675 & 02-157680 \\ \hline \\ CVI-50^{***} & 02-157676 \\ \hline \\ $	CVI-32-ZD(N)105-10	02-156961	02-156962
CVI-63-ZD[N]105-1002-15696902-156970Standard Inserts (incl. OD, OD3) $V$ CVI-16-**02-42039202-420393CVI-25-**02-42039402-420395CVI-32-**02-42039602-420397CVI-40-**02-42039802-420399CVI-50-**02-42039002-420391CVI-63-**02-42049602-420497Valuitor Insert $V$ CVI-25-**45617302-157617CVI-25-**45692602-157618CVI-32-**47944902-157619CVI-40-**478732514808CVI-50-**45679802-157620CVI-63-**45679802-157621Units (CVU-**) ▲Size 1602-157167Size 2502-15761502-157616Size 4002-15767902-157616CVU-50-SWD3-**02-15767902-157616Size 4002-15767902-157680CVU-50-SWD3-**02-15767502-157680	CVI-40-ZD(N)105-10	02-156959	02-156960
Standard Inserts (incl. OD, OD3) $CVI-16^{**}$ 02-420392       02-420393 $CVI-25^{**}$ 02-420394       02-420395 $CVI-32^{**}$ 02-420396       02-420397 $CVI-40^{**}$ 02-420398       02-420399 $CVI-50^{**}$ 02-420390       02-420391 $CVI-63^{**}$ 02-420390       02-420391 $CVI-63^{**}$ 02-420390       02-420497         Valvistor Insert       02-420496       02-420497 $CVI-16^{**}$ 02-420496       02-420497         Valvistor Insert       02-157617       02-157618 $CVI-25^{**}$ 456926       02-157618 $CVI-32^{**}$ 479449       02-157619 $CVI-40^{**}$ 478732       514808 $CVI-50^{**}$ 478733       02-157620 $CVI-50^{**}$ 478733       02-157620 $CVI-50^{**} A$ 02-157167       02-157168         Size 16       02-157167       02-157168         Size 25       02-157536       02-15737         Size 32       02-157615       02-157616         Size 40       02-157679       02-157680 $CVU-50-S$	CVI-50-ZD(N)105-10	02-156957	02-156958
CVI-16-**02-42039202-420393 $CVI-25-**$ 02-42039402-420395 $CVI-32-**$ 02-42039602-420397 $CVI-40-**$ 02-42039802-420399 $CVI-60-**$ 02-42039002-420391 $CVI-63-**$ 02-42049602-420497 <b>Valvistor Insert</b> VI-16-**02-420497 $CVI-16-**$ 45617302-157617 $CVI-25-**$ 45692602-157618 $CVI-32-**$ 47944902-157619 $CVI-40-**$ 478732514808 $CVI-50-**$ 45679802-157620 $CVI-50-**$ 45679802-157621 <b>Units (CVU-**)S</b> 02-157167Size 1602-15753602-157537Size 2502-15753602-157616Size 4002-15767902-157680 $CVI-50-$**$ 02-15767502-157680	CVI-63-ZD(N)105-10	02-156969	02-156970
$CVI-25^{**}$ $02-420394$ $02-420395$ $CVI-32^{**}$ $02-420396$ $02-420397$ $CVI-40^{**}$ $02-420398$ $02-420399$ $CVI-50^{**}$ $02-420390$ $02-420391$ $CVI-63^{**}$ $02-420496$ $02-420497$ Valvistor Insert $CVI-16^{***}$ $456173$ $02-157617$ $CVI-25^{***}$ $456926$ $02-157618$ $CVI-25^{***}$ $479449$ $02-157619$ $CVI-40^{***}$ $478732$ $514808$ $CVI-50^{***}$ $456798$ $02-157620$ $CVI-63^{***}$ $456798$ $02-157621$ Units (CVU-**) ▲ $Size 16$ $02-157765$ $02-157168$ Size 25 $02-157615$ $02-157616$ Size 40 $02-157679$ $02-157680$ $CVI-50-SWD3^{**}$ $02-157675$ $02-157676$	Standard Inserts (incl. OD, OD3)		
CVI-32.** $02.420396$ $02.420397$ $CVI-40.**$ $02.420398$ $02.420399$ $CVI-50.**$ $02.420390$ $02.420391$ $CVI-50.**$ $02.420497$ $02.420497$ Valvistor Insert $CVI-16.**$ $456173$ $02.157617$ $CVI-25.**$ $456926$ $02.157618$ $CVI-32.**$ $479449$ $02.157619$ $CVI-40.**$ $478732$ $514808$ $CVI-50.**$ $456798$ $02.157620$ $CVI-63.**$ $456798$ $02.157621$ Units (CVU-**) ▲Size 16 $02.157167$ $02.157537$ Size 25 $02.157615$ $02.157616$ Size 40 $02.157679$ $02.157680$ $CVI-50.SWD3.**$ $02.157675$ $02.157676$	CVI-16-**	02-420392	02-420393
CVI-40.**02-42039802-420399 $CVI-50.**$ 02-42039002-420391 $CVI-63.**$ 02-42049602-420497Valvistor InsertValvistor Insert $CVI-16.**$ 45617302-157617 $CVI-25.**$ 45692602-157618 $CVI-32.**$ 47944902-157619 $CVI-40.**$ 478732514808 $CVI-50.**$ 47679802-157620 $CVI-63.**$ 45679802-157621Units (CVU-**) ▲Size 1602-157167Size 2502-15763602-157537Size 3202-15761502-157616Size 4002-15767902-157680 $CVI-50.SWD3.**$ 02-15767502-157676	CVI-25-**	02-420394	02-420395
$CVI-50^{**}$ $02-420390$ $02-420391$ $CVI-63^{**}$ $02-420496$ $02-420497$ Valvistor Insert $V$ $CVI-16^{**}$ $456173$ $02-157617$ $CVI-25^{**}$ $456926$ $02-157618$ $CVI-32^{**}$ $479449$ $02-157619$ $CVI-40^{**}$ $478732$ $514808$ $CVI-50^{**}$ $456798$ $02-157620$ $CVI-63^{**}$ $456798$ $02-157621$ Units (CVU-**) ▲ $Size 16$ $02-157167$ Size 16 $02-157536$ $02-157637$ Size 25 $02-157615$ $02-157616$ Size 32 $02-157615$ $02-157616$ Size 40 $02-157679$ $02-157680$ $CVU-50-SWD3^{**}$ $02-157675$ $02-157676$	CVI-32-**	02-420396	02-420397
CVI-63.**02-42049602-420497Valvistor InsertV $CVI-16.**$ 45617302-157617 $CVI-25.**$ 45692602-157618 $CVI-32.**$ 47944902-157619 $CVI-40.**$ 478732514808 $CVI-50.**$ 47873302-157620 $CVI-63.**$ 45679802-157621Units (CVU.**) ▲Size 1602-15716702-157168Size 2502-15753602-157537Size 3202-15761502-157616Size 4002-15767902-157680 $CVI-50-SWD3.**$ 02-15767502-157676	CVI-40-**	02-420398	02-420399
Valvistor Insert $CVI-16^{**}$ 45617302-157617 $CVI-25^{**}$ 45692602-157618 $CVI-32^{**}$ 47944902-157619 $CVI-40^{**}$ 478732514808 $CVI-50^{**}$ 47873302-157620 $CVI-63^{**}$ 45679802-157621Dnits (CVU-**) ▲Size 1602-15716702-157168Size 2502-15753602-157537Size 3202-15761502-157616Size 4002-15767902-157680CVU-50-SWD3-**02-15767502-157676	CVI-50-**	02-420390	02-420391
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-**) ▲       Size 16       02-157167       02-157537         Size 25       02-157615       02-157616         Size 32       02-157615       02-157680         CVU-50-SWD3-**       02-157679       02-157680	CVI-63-**	02-420496	02-420497
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-**) ▲       Size 16       02-157167       02-157168         Size 25       02-157536       02-157537         Size 32       02-157615       02-157616         Size 40       02-157679       02-157680         CVU-50-SWD3-**       02-157675       02-157676	Valvistor Insert		
CVI-32-**       479449       02-157619         CVI-40-**       478732       514808         CVI-50-**       478733       02-157620         CVI-63-**       456798       02-157621         Units (CVU-**) ▲       Size 16       02-157167       02-157168         Size 25       02-157536       02-157537         Size 32       02-157615       02-157616         Size 40       02-157679       02-157680         CVU-50-SWD3-**       02-157675       02-157676	CVI-16-**	456173	02-157617
CVI-40-**       478732       514808         CVI-50-**       478733       02-157620         CVI-63-**       456798       02-157621         Units (CVU-**) ▲       Size 16       02-157167       02-157168         Size 25       02-157536       02-157537         Size 32       02-157615       02-157616         Size 40       02-157679       02-157680         CVU-50-SWD3-**       02-157675       02-157676	CVI-25-**	456926	02-157618
CVI-50-**       478733       02-157620         CVI-63-**       456798       02-157621         Units (CVU-**) ▲           Size 16       02-157167       02-157168         Size 25       02-157536       02-157537         Size 32       02-157615       02-157616         Size 40       02-157679       02-157680         CVU-50-SWD3-**       02-157675       02-157676	CVI-32-**	479449	02-157619
CVI-63-**       456798       02-157621         Units (CVU-**) ▲           Size 16       02-157167       02-157168         Size 25       02-157536       02-157537         Size 32       02-157615       02-157616         Size 40       02-157679       02-157680         CVU-50-SWD3-**       02-157675       02-157676	CVI-40-**	478732	514808
Units (CVU-**) ▲           Size 16         02-157167         02-157168           Size 25         02-157536         02-157537           Size 32         02-157615         02-157616           Size 40         02-157679         02-157680           CVU-50-SWD3-**         02-157675         02-157676	CVI-50-**	478733	02-157620
Size 16         02-157167         02-157168           Size 25         02-157536         02-157537           Size 32         02-157615         02-157616           Size 40         02-157679         02-157680           CVU-50-SWD3-**         02-157675         02-157676	CVI-63-**	456798	02-157621
Size 25         02-157536         02-157537           Size 32         02-157615         02-157616           Size 40         02-157679         02-157680           CVU-50-SWD3-**         02-157675         02-157676	Units (CVU-**) ▲		
Size 32         02-157615         02-157616           Size 40         02-157679         02-157680           CVU-50-SWD3-**         02-157675         02-157676	Size 16	02-157167	02-157168
Size 40         02-157679         02-157680           CVU-50-SWD3-**         02-157675         02-157676	Size 25	02-157536	02-157537
CVU-50-SWD3-** 02-157675 02-157676	Size 32	02-157615	02-157616
	Size 40	02-157679	02-157680
CVU-63-SWD3-** 02-157677 02-157678	CVU-50-SWD3-**	02-157675	02-157676
	CVU-63-SWD3-**	02-157677	02-157678

▲ Units include CVU-\*\*-ZSWD3, -SWD(3) and -EFP1

	Standard:		F3:	
Product	Complete	Interface Only	Complete	Interface Only
Valvistor Cover Asse	embly			
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:	Interface Only	F3:	Interface Only
	Complete		Complete	
Standard cover asse	02-420579	02-420578	02-420567	02-420566
CVCS-25-**	02-420581	02-420580	02-420569	02-420568
CVCS-32-**	02-420583	02-420582	02-420571	02-420570
CVCS-40-**	02-420585	02-420584	02-420573	02-420572
CVCS-50-**	02-420587	02-420586	02-420575	02-420574
CVCS-63-**	02-420589	02-420588	02-420577	02-720576

## Insert Cavity Dimensions to ISO 7368, Sizes 16 to 63

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



a $65 (2.56)$ b $75 (2.95)$ d1dia. $32,039 (1.2614)$ $32,000 (1.2598)$ d2 dia. $25,033 (0.9856)$ $25,000 (0.9843)$ d3 dia. max. $16 (0.63)$ d4 dia. $16 (0.63)$ d5 dia. max. $4 (0.157)$ d6 threadM8g1 dia. nominal $4 (0.157)$ g2 min. $8 (0.315)$ g3 min. $4 (0.157)$ t1 $43,1 (1.697)$ $43,0 (1.693)$ t2 $2 (0.079)$ t3 min. (XRa) $20 (0.79)$ t4 $2 (0.079)$ t5 min. depth $16 (0.63)$ t6 max. $42,5 (1.67)$ t7 min. (XRa) $54 (2.13)$ t8 $56,1 (2.209)$ $56,0 (2.205)$ U $0,03 (0.0012)$ W $0,05 (0.002)$ x1 $23 (0.906)$ x2 $2 (0.079)$ x3 $46 (1.811)$	85 (3.35)         95 (3.74)         45,039 (1.7732)         45,000 (1.7717)         34,039 (1.3401)         34,000 (1.3386)         25 (0.98)         25 (0.98)         6 (0.236)         M12         6 (0.236)         8 (0.315)         6 (0.236)         58,1 (2.287)         58,0 (2.283)         2,5 (0.098)         30 (1.18)         2,5 (0.098)	102 (4.02) 112 (4.41) 60,046 (2.3640) 60,000 (2.3622) 45,039 (1.7732) 45,000 (1.7717) 32 (1.26) 31,5 (1.24) 8 (0.315) M16 6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	125 (4.92)         135 (5.31)         75,046 (2.9546)         75,000 (2.9528)         55,046 (2.1672)         55,000 (2.1654)         40 (1.57)         40 (1.57)         10 (0.394)         M20         6 (0.236)         8 (0.315)         6 (0.236)         87,1 (3.429)         87,0 (3.425)         3 (0.118)         30 (1.18)	140 (5.51) 150 (5.91) 90,054 (3.5454) 90,000 (3.5433) 68,046 (2.6790) 68,000 (2.6772) 50 (1.97) 50 (1.97) 10 (0.394) M20 8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118) 35 (1.38)	180 (7.09)         190 (7.48)         120,054 (4.7265)         120,000 (4.7244)         90,054 (3.5454)         90,000 (3.5433)         63 (2.48)         63 (2.48)         12 (0.472)         M30         8 (0.315)         8 (0.315)         130,1 (5.122)         130,0 (5.118)         4 (0.157)         40 (1.57)
d1dia. $32,039 (1.2614)$ $32,000 (1.2598)$ d2 dia. $25,033 (0.9856)$ $25,000 (0.9843)$ d3 dia. max. $16 (0.63)$ d4 dia. $16 (0.63)$ d5 dia. max. $4 (0.157)$ d6 thread•       M8         g1 dia. nominal $4 (0.157)$ g2 min. $8 (0.315)$ g3 min. $4 (0.157)$ t1 $43,1 (1.697)$ $43,0 (1.693)$ $t2$ t2 $2 (0.079)$ t3 min. (XRa) $20 (0.79)$ t4 $2 (0.079)$ t5 min. depth• $16 (0.63)$ t6 max. $42,5 (1.67)$ t7 min. (XRa) $54 (2.13)$ t8 $56,1 (2.209)$ $56,0 (2.205)$ $U$ $U$ $0,03 (0.0012)$ W $0,05 (0.002)$ x1 $23 (0.906)$ x2 $2 (0.079)$	45,039 (1.7732) 45,000 (1.7717) 34,039 (1.3401) 34,000 (1.3386) 25 (0.98) 25 (0.98) 6 (0.236) M12 6 (0.236) 8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	60,046 (2.3640) 60,000 (2.3622) 45,039 (1.7732) 45,000 (1.7717) 32 (1.26) 31,5 (1.24) 8 (0.315) M16 6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	75,046 (2.9546) 75,000 (2.9528) 55,0046 (2.1672) 55,000 (2.1654) 40 (1.57) 40 (1.57) 10 (0.394) M20 6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	90,054 (3.5454) 90,000 (3.5433) 68,046 (2.6790) 68,000 (2.6772) 50 (1.97) 50 (1.97) 10 (0.394) M20 8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	120,054 (4.7265) 120,000 (4.7244) 90,054 (3.5454) 90,000 (3.5433) 63 (2.48) 63 (2.48) 12 (0.472) M30 8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
$\begin{array}{c cccc} & 32,000 (1.2598) \\ \hline 32,000 (1.2598) \\ \hline 25,003 (0.9856) \\ 25,000 (0.9843) \\ \hline 33 dia. max. & 16 (0.63) \\ \hline 44 dia. & 16 (0.63) \\ \hline d4 dia. & 16 (0.63) \\ \hline d5 dia. max. & 4 (0.157) \\ \hline d6 thread \bullet & M8 \\ \hline g1 dia. nominal & 4 (0.157) \\ \hline g2 min. & 8 (0.315) \\ \hline g3 min. & 4 (0.157) \\ \hline t1 & 43,1 (1.697) \\ \hline 43,0 (1.693) \\ \hline t2 & 2 (0.079) \\ \hline t3 min. (XRa) & 20 (0.79) \\ \hline t4 & 2 (0.079) \\ \hline t5 min. depth \bullet & 16 (0.63) \\ \hline t6 max. & 42,5 (1.67) \\ \hline t7 min. (XRa) & 54 (2.13) \\ \hline t8 & 56,1 (2.209) \\ \hline 56,0 (2.205) \\ \hline U & 0,03 (0.0012) \\ \hline W & 0,05 (0.002) \\ \hline x1 & 23 (0.906) \\ \hline x2 & 2 (0.079) \\ \hline \end{array}$	45,000 (1.7717) 34,039 (1.3401) 34,000 (1.3386) 25 (0.98) 25 (0.98) 6 (0.236) M12 6 (0.236) 8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	60,000 (2.3622)           45,039 (1.7732)           45,000 (1.7717)           32 (1.26)           31,5 (1.24)           8 (0.315)           M16           6 (0.236)           8 (0.315)           6 (0.236)           70,1 (2.760)           70,0 (2.756)           2,5 (0.098)           30 (1.18)	75,000 (2.9528) 55,046 (2.1672) 55,000 (2.1654) 40 (1.57) 10 (0.394) M20 6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	90,000 (3.5433) 68,046 (2.6790) 68,000 (2.6772) 50 (1.97) 50 (1.97) 10 (0.394) M20 8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	120,000 (4.7244) 90,054 (3.5454) 90,000 (3.5433) 63 (2.48) 12 (0.472) M30 8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
$\begin{array}{c cccc} 25,000 & (0.9843) \\ \hline & d3 \ dia. \ max. & 16 & (0.63) \\ \hline & d4 \ dia. & 16 & (0.63) \\ \hline & d5 \ dia. \ max. & 4 & (0.157) \\ \hline & d5 \ dia. \ max. & 4 & (0.157) \\ \hline & d6 \ thread \bullet & M8 \\ \hline & g1 \ dia. \ nominal & 4 & (0.157) \\ \hline & g2 \ min. & 8 & (0.315) \\ \hline & g3 \ min. & 4 & (0.157) \\ \hline & g3 \ min. & 4 & (0.157) \\ \hline & t1 & 43,1 & (1.697) \\ \hline & 43,0 & (1.693) \\ \hline & t2 & 2 & (0.079) \\ \hline & t3 \ min. & (XRa) & 20 & (0.79) \\ \hline & t4 & 2 & (0.079) \\ \hline & t5 \ min. \ depth \bullet & 16 & (0.63) \\ \hline & t6 \ max. & 42,5 & (1.67) \\ \hline & t7 \ min. & (XRa) & 54 & (2.13) \\ \hline & t8 & 56,1 & (2.209) \\ \hline & 56,0 & (2.205) \\ \hline & U & 0,03 & (0.0012) \\ \hline W & 0,05 & (0.002) \\ \hline & x1 & 23 & (0.906) \\ \hline & x2 & 2 & (0.079) \\ \hline \end{array}$	34,000 (1.3386) 25 (0.98) 25 (0.98) 6 (0.236) M12 6 (0.236) 8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	45,000 (1.7717) 32 (1.26) 31,5 (1.24) 8 (0.315) M16 6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	55,000 (2.1654) 40 (1.57) 40 (1.57) 10 (0.394) M20 6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	68,000 (2.6772)         50 (1.97)         50 (1.97)         10 (0.394)         M20         8 (0.315)         8 (0.315)         8 (0.315)         100,1 (3.941)         100,0 (3.937)         3 (0.118)	90,000 (3.5433) 63 (2.48) 63 (2.48) 12 (0.472) M30 8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
d4 dia.       16 (0.63)         d5 dia. max.       4 (0.157)         d6 thread •       M8         g1 dia. nominal       4 (0.157)         g2 min.       8 (0.315)         g3 min.       4 (0.157)         t1       43,1 (1.697)         43,0 (1.693)       43,0 (1.693)         t2       2 (0.079)         t3 min. (XRa)       20 (0.79)         t4       2 (0.079)         t5 min. depth •       16 (0.63)         t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       U         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	25 (0.98) 6 (0.236) M12 6 (0.236) 8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	31,5 (1.24) 8 (0.315) M16 6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	40 (1.57) 10 (0.394) M20 6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	50 (1.97) 10 (0.394) M20 8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	63 (2.48) 12 (0.472) M30 8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
d5 dia. max.4 (0.157)d6 thread •M8g1 dia. nominal4 (0.157)g2 min.8 (0.315)g3 min.4 (0.157)t143,1 (1.697)43,0 (1.693)t22 (0.079)t3 min. (XRa)20 (0.79)t42 (0.079)t5 min. depth •16 (0.63)t6 max.42,5 (1.67)t7 min. (XRa)54 (2.13)t856,1 (2.209)56,0 (2.205)UU0,03 (0.0012)W0,05 (0.002)x123 (0.906)x22 (0.079)	6 (0.236) M12 6 (0.236) 8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	8 (0.315) M16 6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	10 (0.394) M20 6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	10 (0.394) M20 8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	12 (0.472) M30 8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
d6 thread       M8         g1 dia. nominal       4 (0.157)         g2 min.       8 (0.315)         g3 min.       4 (0.157)         t1       43,1 (1.697)         43,0 (1.693)       42         t2       2 (0.079)         t3 min. (XRa)       20 (0.79)         t4       2 (0.079)         t5 min. depth       16 (0.63)         t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       U         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	M12 6 (0.236) 8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	M16 6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	M20 6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	M20 8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	M30 8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
g1 dia. nominal4 (0.157)g2 min.8 (0.315)g3 min.4 (0.157)t143,1 (1.697)43,0 (1.693)t22 (0.079)t3 min. (XRa)20 (0.79)t42 (0.079)t5 min. depth •16 (0.63)t6 max.42,5 (1.67)t7 min. (XRa)54 (2.13)t856,1 (2.209)56,0 (2.205)UU0,03 (0.0012)W0,05 (0.002)x123 (0.906)x22 (0.079)	6 (0.236)         8 (0.315)         6 (0.236)         58,1 (2.287)         58,0 (2.283)         2,5 (0.098)         30 (1.18)         2,5 (0.098)	6 (0.236) 8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	6 (0.236) 8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	8 (0.315) 8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	8 (0.315) 8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
$g2 \text{ min.}$ $8 (0.315)$ $g3 \text{ min.}$ $4 (0.157)$ $t1$ $43,1 (1.697)$ $43,0 (1.693)$ $t2$ $t2$ $2 (0.079)$ $t3 \text{ min.} (XRa)$ $20 (0.79)$ $t4$ $2 (0.079)$ $t5 \text{ min.} depth \bullet$ $16 (0.63)$ $t6 \text{ max.}$ $42,5 (1.67)$ $t7 \text{ min.} (XRa)$ $54 (2.13)$ $t8$ $56,1 (2.209)$ $56,0 (2.205)$ $U$ $U$ $0,03 (0.0012)$ $W$ $0,05 (0.002)$ $x1$ $23 (0.906)$ $x2$ $2 (0.079)$	8 (0.315) 6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	8 (0.315) 6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	8 (0.315) 6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	8 (0.315) 8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	8 (0.315) 8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
g3  min.       4 (0.157)         t1       43,1 (1.697)         43,0 (1.693)       43,0 (1.693)         t2       2 (0.079)         t3 min. (XRa)       20 (0.79)         t4       2 (0.079)         t5 min. depth•       16 (0.63)         t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       U         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	6 (0.236) 58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	6 (0.236) 70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	6 (0.236) 87,1 (3.429) 87,0 (3.425) 3 (0.118)	8 (0.315) 100,1 (3.941) 100,0 (3.937) 3 (0.118)	8 (0.315) 130,1 (5.122) 130,0 (5.118) 4 (0.157)
t1 $43,1 (1.697)$ 43,0 (1.693)         t2       2 (0.079)         t3 min. (XRa)       20 (0.79)         t4       2 (0.079)         t5 min. depth•       16 (0.63)         t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       U         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	58,1 (2.287) 58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	70,1 (2.760) 70,0 (2.756) 2,5 (0.098) 30 (1.18)	87,1 (3.429) 87,0 (3.425) 3 (0.118)	100,1 (3.941) 100,0 (3.937) 3 (0.118)	130,1 (5.122) 130,0 (5.118) 4 (0.157)
43,0 (1.693)         t2       2 (0.079)         t3 min. (XRa)       20 (0.79)         t4       2 (0.079)         t5 min. depth●       16 (0.63)         t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       0         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	58,0 (2.283) 2,5 (0.098) 30 (1.18) 2,5 (0.098)	70,0 (2.756) 2,5 (0.098) 30 (1.18)	87,0 (3.425) 3 (0.118)	100,0 (3.937) 3 (0.118)	130,0 (5.118) 4 (0.157)
t3 min. (XRa)       20 (0.79)         t4       2 (0.079)         t5 min. depth●       16 (0.63)         t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,0 (2.205)         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	30 (1.18) 2,5 (0.098)	30 (1.18)			
t4     2 (0.079)       t5 min. depth●     16 (0.63)       t6 max.     42,5 (1.67)       t7 min. (XRa)     54 (2.13)       t8     56,1 (2.209)       56,0 (2.205)     0,03 (0.0012)       W     0,03 (0.0012)       W     0,05 (0.002)       x1     23 (0.906)       x2     2 (0.079)	2,5 (0.098)		30 (1.18)	35 (1.38)	40 (1 57)
t5 min. depth•16 (0.63)t6 max. $42,5$ (1.67)t7 min. (XRa) $54$ (2.13)t8 $56,1$ (2.209) $56,0$ (2.205)U $0,03$ (0.0012)W $0,05$ (0.002)x123 (0.906)x22 (0.079)		2 5 (0 098)			10 ( 1.07 )
t6 max.       42,5 (1.67)         t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       0         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	20 (0 70)	2/0 (0.000)	3 (0.118)	4 (0.157)	4 (0.157)
t7 min. (XRa)       54 (2.13)         t8       56,1 (2.209)         56,0 (2.205)       0,03 (0.0012)         W       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	20 (0.79)	30 (1.18)	35 (1.38)	41 (1.61)	47 (1.85)
t8       56,1 (2.209)         56,0 (2.205)         U       0,03 (0.0012)         W       0,05 (0.002)         x1       23 (0.906)         x2       2 (0.079)	57 (2.24)	68,5 (2.70)	84,5 (3.33)	97,5 (3.84)	127 (5.00)
56,0 (2.205)           U         0,03 (0.0012)           W         0,05 (0.002)           x1         23 (0.906)           x2         2 (0.079)	70 (2.76)	83 (3.27)	102 (4.02)	117 (4.61)	150 (5.91)
W         0,05 (0.002)           x1         23 (0.906)           x2         2 (0.079)	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)
x1 23 (0.906) x2 2 (0.079)	0,03 (0.0012)	0,03 (0.0012)	0,05 (0.002)	0,05 (0.002)	0,05 (0.002)
x2 2 (0.079)	0,05 (0.002)	0,1 (0.004)	0,1 (0.004)	0,1 (0.004)	0,2 (0.008)
	29 (1.142)	35 (1.378)	42,5 (1.673)	50 (1.969)	62,5 (2.461)
v3 /6 (1 811)	4 (0.157)	6 (0.236)	7,5 (0.295)	8 (0.315)	12,5 (0.492)
NJ 40 (1.011)	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 microi	inches)				
YRa 3,2 micron (125 micro	pinches)				
ZRa 0,8 micron (32 microi					

 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).

Ask your Eaton-Vickers 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-B29-20 cover

- One (1) CVI-16-D16-M-50 insert

#### **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) BKDG3-698 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) BK616452M bolt kit (for pilot valve)

#### **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) BK590716 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 89, 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 this catalog
1 x CVCS-\*\*-HFV\*\*-\*2\*-10 cover, see this catalog
1 x cover mounting bolt kit u, see this catalog
1 x KTG4V-3S- - 60-EN427, see product catalog Slip-in Cartridge.
1 x pilot valve mounting bolt kit, product catalog Valve Catalog.

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**

	Size											
Model type	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)
В	0.86	(1.90)	1.37	(3.02)	2.24	(4.94)	4.00	(8.83)	6.20	(13.68)	10.94	(24.14)
С	2.8	(6.80)	2.9	(6.40)	3.85	(8.49)	6.23	(13.75)	-		-	
С3	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 89 CVU-63-OD11: Contact your Eaton-Vickers representative CVU-(Z)SWD(3): See page 94

## Service/Spares Policy

#### Inserts

All Eaton-Vickers inserts are field serviceable when serviced by Eaton-Vickers approved personnel. Springs, seals, spools and poppets are available, as defined in Eaton-Vickers Service and Spares literature.

#### Covers

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

#### Units

See individual service and repair policies, available from your Eaton-Vickers representative.

Eaton Hydraulics Group USA 14615 Lone Oak Road Eden Prairie, MN 55344 USA Tel: 952-937-9800 Fax: 952-294-7722 www.eaton.com/hydraulics Eaton Hydraulics Group Europe Route de la Longeraie 7 1110 Morges Switzerland Tel: +41 (0) 21 811 4600 Fax: +41 (0) 21 811 4601 Eaton Hydraulics Group Asia Pacific Eaton Building 4th Floor, No. 3 Lane 280 Linhong Rd. Changning District Shanghai 200335 China Tel: (+86 21) 5200 0099 Fax: (+86 21) 5200 0400



© 2011 Eaton Corporation All Rights Reserved Printed in USA Document No. E-VLSC-MC002-E March 2012