

October 1 2008



The company name
was changed to
TOKYO KEIKI INC.

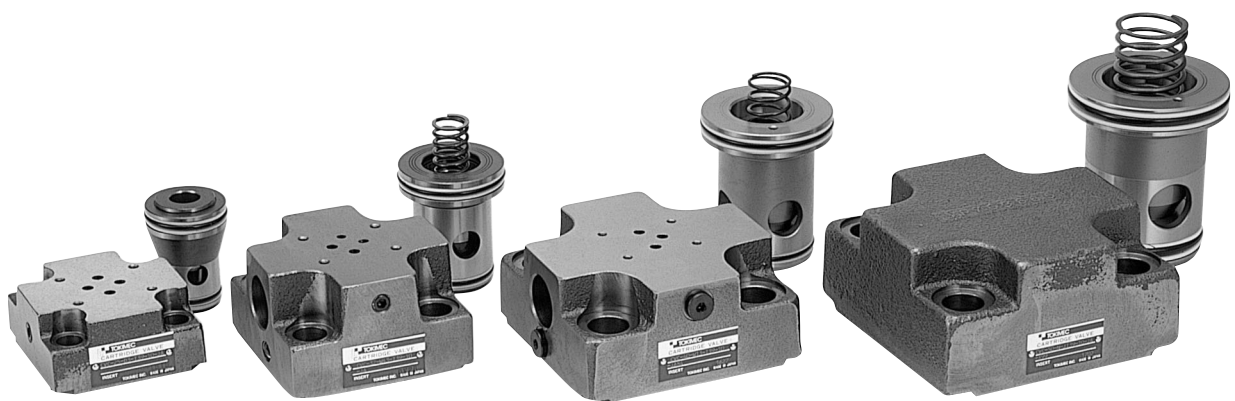
2-16-46, Minami-Kamata, Ohta-Ku,
Tokyo 144-8551, JAPAN
TEL.+81-3-3732-2111
FAX.+81-3-3736-0261
<http://www.tokyo-keiki.co.jp/>

Cartridge valves



Cartridge Valves

Function	Model	Maximum Working Pressure MPa	Rated Flow L/min											Page
			10	20	50	100	200	500	1000	2000	5000			
(Flow, Directional Control) Flow Control Valves Directional Valves Check Valves Pilot Operated Check Valves	CVI	35					16	25	32	40	50	63	80	H4
	CVC	21												H7



- Cartridge valves are composed of a combination of insert (main valve section) and various control covers to provide valve functions in a hydraulic circuit and can be incorporated in manifold blocks.
- Insert with check valve is controlled by pilot pressure to provide a combination of directional, flow, and pressure control.
- Valves come in seven sizes to match flow requirements.
- External dimensions of inserts which are fit into the manifold blocks are uniform. (ISO 7368)
- Hydraulic pilot control mechanisms are incorporated in covers to control spool movement. Additional functions such as solenoid switching valves, etc., can be stacked on top of applicable control covers.

Features of Cartridge Valve Hydraulic Control Systems

- Poppet-seat configuration of main valve inserts reduces internal leakage compared to spool type valves and non-overlap design provides superior response.
- Cartridge valve systems consisting of inserts and control covers incorporated in manifold blocks reduce control circuit piping and saves space. This also means that there are fewer problems associated with piping such as oil leakage and vibration, factors which improve system reliability.
- One cartridge valve can provide a variety of control functions and it is possible to create a simple hydraulic system utilizing a minimum of cartridge valves to match system requirements.
- Besides enabling independent switch timing of individual flow paths, valve sizes and control functions can be selected to suit each flow path which enable shockless operation and enhances circuit efficiency.

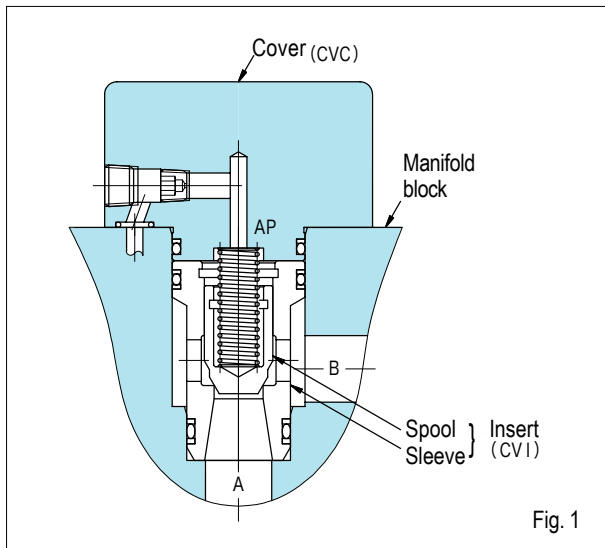


Fig. 1

Insert Operation and Types

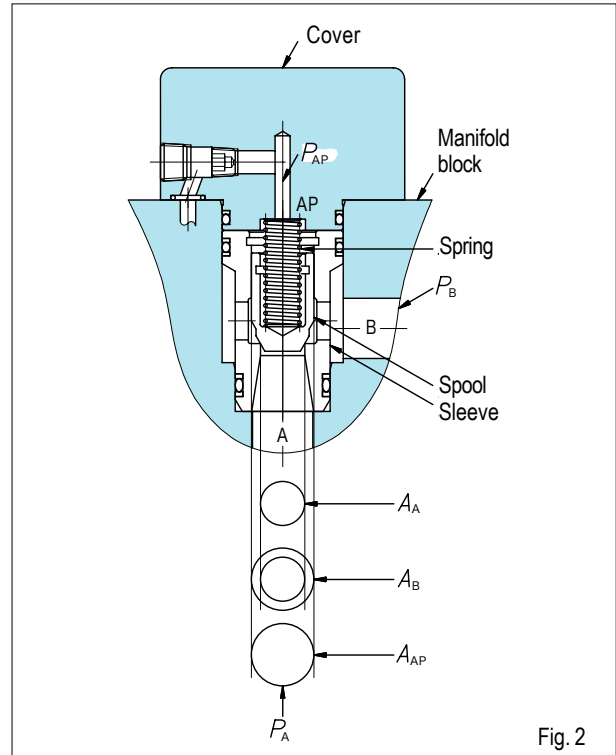
- As Fig. 2 shows, pressure at port A and B act on the spool to move it in the open direction. Port A pressure, P_A , acts on the valve seat diameter circular area A_A . Port B pressure, P_B , acts on the concentric circular area, A_B , within the valve seat and spool diameters. Pilot pressure, P_{AP} , from the control cover acts on the top of the spool to close it. The area of pressure is the area of the spool diameter ($A_p = A_A + A_B$). Valve opening and closing is determined by the balance of these pressures, spring force F_S , and

flow forces, F_f .

Therefore,

$$\frac{(P_{AP} \cdot A_{AP} + F_S)}{\text{valve closing force}} - \frac{(P_A \cdot A_A + P_B \cdot A_B + F_f)}{\text{valve opening force}} < 0 : \text{valve open}$$

$$> 0 : \text{valve close}$$



- A_A and A_{AP} area ratios - 5 types as below

Area Ratio $A_A : A_{AP}$	Function
1 : 2	Directional (flow) control
1 : 1.5	Directional (flow) control
(1 : 1.7)	(Normal open type)
1 : 1.1	Directional control or pressure control
1 : 1	Pressure control

- Spools with area ratios 1:2 and 1:1.5 are notched (throttled spool ends). Besides use in flow control they are used to reduce shock during valve opening and closing.

Control Cover Types (for Direction and Flow Control)

- A variety of covers are available to meet system requirements. In addition to covering the cartridge inserts, they control pilot pressure to the AP section of the inserts and integrate functions to adjust and control spool opening.
- Pilot pressure can be switched by selecting cover for stackable directional valve.
- Replaceable internal orifice plugs allow opening and closing speed adjustments of main valve (insert).

Pressure Control Valve

- Relief function inserts and covers are available for sizes 16, 25, and 40 and reducing function for size 25. Consult Tokimec regarding dimensions and other details.

Cartridge insert CVI



Functional Symbols

Function	Graphical Symbol	$A_A : A_{AP}$ Area Ratio	Model	Remarks
Normally Closed		1 : 1	CVI-**-D10	Not applicable to valve sizes 32, 50, 63, 80
Normally Closed		1 : 1.1	CVI-**-D11	
		1 : 1.5	CVI-**-D15	
		1 : 2	CVI-**-D20	
Normally Open		1 : 1.7	CVI-**-OD17	Not applicable to valve sizes 50, 80
Normally Closed (with notch)		1 : 2	CVI-**-F	
		1 : 1.5	CVI-**-F15	

Model Code

F3 - CVI -25- D20 -3 -L -10-JA

1 2 3 4 5 6

- Fluid
Omit for mineral oil, water glycol
F3: phosphate ester
- Cartridge valve insert
- Size
16,25,32,40,50,63,80
- Function and Area Ratio

Code	Function	Area Ratio(A : A _{AP})
D10 ^{*1}	Normally closed	1 : 1
D11	Normally closed	1 : 1.1
D15	Normally closed	1 : 1.5
D20	Normally closed	1 : 2
F	Normally closed (with notch)	1 : 2
F15	Normally closed (with notch)	1 : 1.5
OD17 ^{*2}	Normally open	1 : 1.7

Notes: *1 Not applicable to sizes 32, 50, 63, 80.
*2 Not applicable to sizes 50, 80.

5. Cracking pressure MPa

	D10		D11		D15		D20		F		F15	
	A→B	B→A	A→B	B→A	A→B	B→A	A→B	B→A	A→B	B→A	A→B	B→A
L	0.03	—	0.03	0.27	0.04	0.08	0.05	0.05	0.05	0.05	0.04	0.08
M	0.13	—	0.14	1.4	0.19	0.37	0.25	0.25	0.25	0.25	0.19	0.37
H	0.25	—	0.27	2.7	0.37	0.75	0.5	0.5	0.5	0.5	0.37	0.75

6. Design no.

Specifications

Model	Size	Max. Working Pressure MPa	Rated Flow L/min	Weight kg
CVI	16	35	200	0.15
	25		450	0.35
	32		650	0.75
	40		1100	1.4
	50		1700	2.2
	63		2800	5.4
	80		4200	9.8

Note: *1 Rated flow at pressure drop 0.5 MPa.

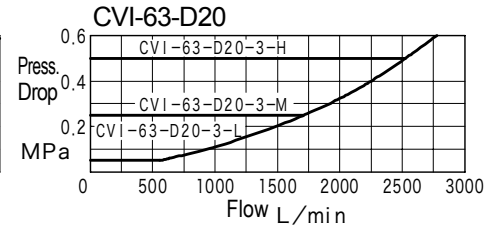
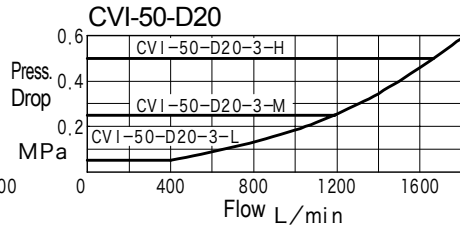
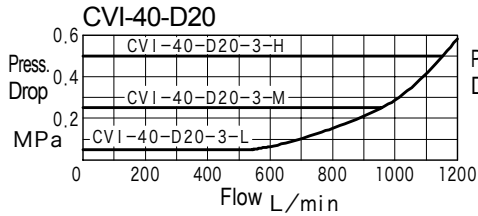
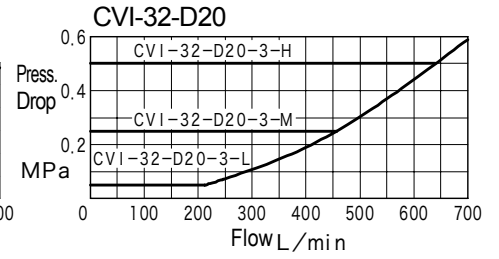
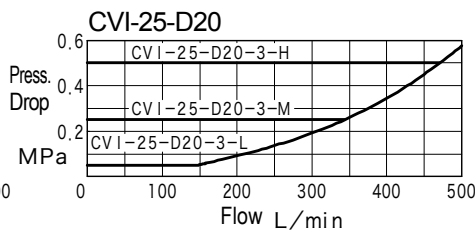
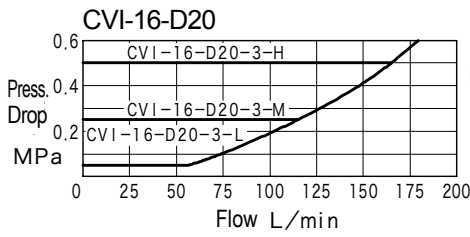
Notes on Use

- When pilot pressure operates to close valve, pilot pressure P_{AP} may leak to B port via the space between the sleeve and spool.
- In circuit where cartridge valve is closed and A port is at high pressure and B port the low pressure side, if pilot pressure is not high enough, pilot pressure may fall due to leakage from AP port to B port and may cause instability. For sure valve operation, pilot pressure should be sufficiently high or circuit should be designed so that B port is the high pressure side when the valve is closed.

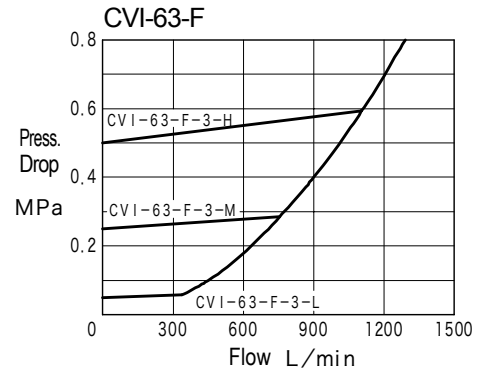
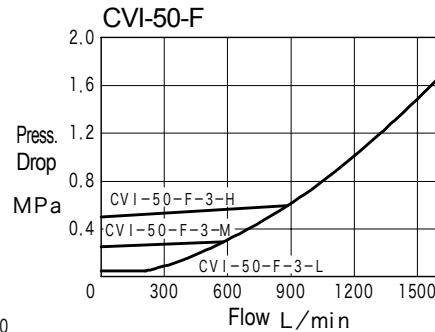
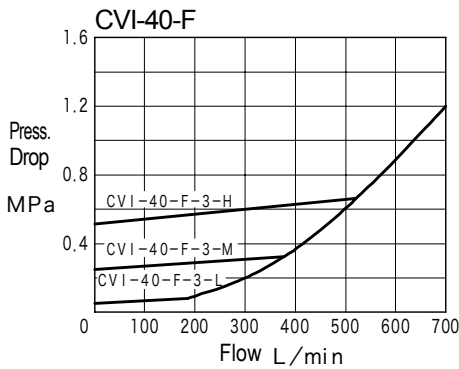
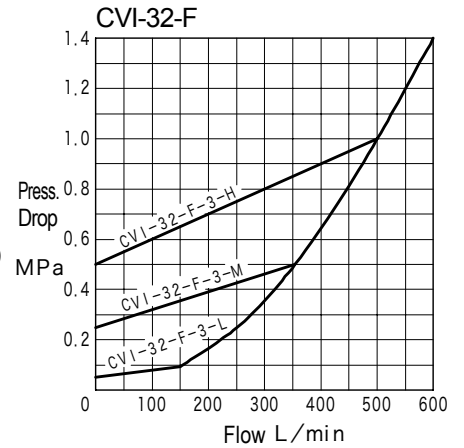
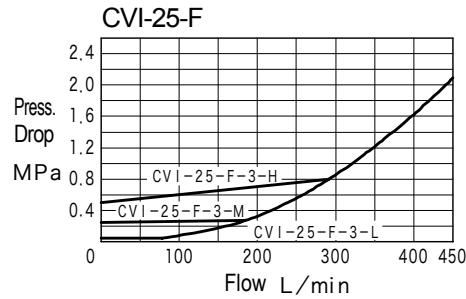
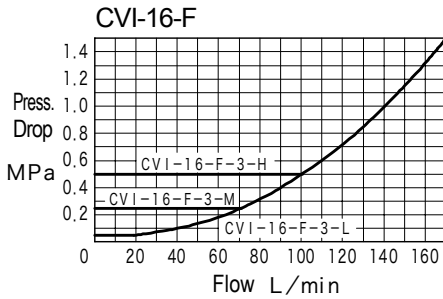
Performance Curves (at 20 mm²/s)

• Pressure Drop

CVI-D20 Insert

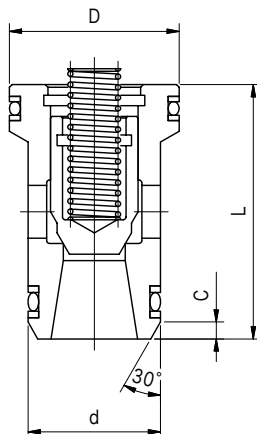


CVI-F Insert



Dimensions

• Insert

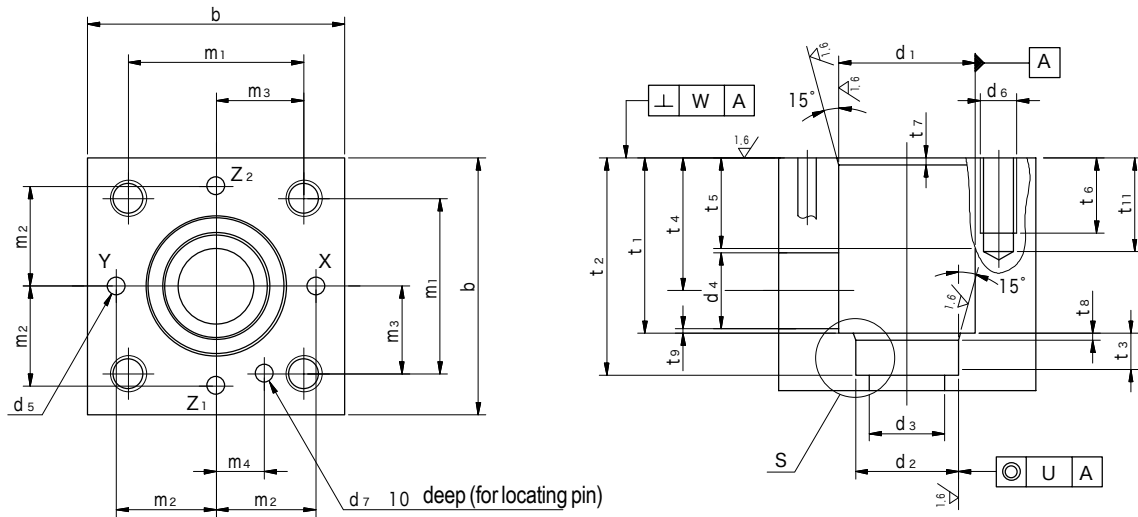


Dimensions

Size mm	D	d	L	C
16	φ 32	φ 25	48	3.2
25	φ 45	φ 34	61.5	2.9
32	φ 60	φ 45	72	3.0
40	φ 75	φ 55	90	4.0
50	φ 90	φ 68	104	4.0
63	φ 120	φ 90	135	4.0

Dimensions

• Cavity Dimensions (ISO 7368)



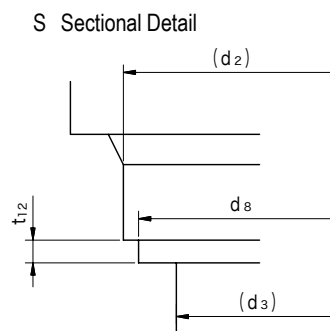
Size	16	25	32	40	50	63
b	65	85	102	125	140	180
d ₁ min.	32.000	45.000	60.000	75.000	90.000	120.000
max.	32.025	45.025	60.030	75.030	90.035	120.035
d ₂ min.	25.000	34.000	45.000	55.000	68.000	90.000
max.	25.021	34.025	45.025	55.030	68.030	90.035
d ₃ max.	16	25	32	40	50	63
d ₄ min.	16	25	32	40	50	63
max.	25	32	40	50	63	80
d ₅ max.	4	6	8	10	10	12
d ₆	M8	M12	M16	M20	M20	M30
d ₇	4	6	6	6	8	8
m ₁ ^{+0.2} ₀	46	58	70	85	100	125
m ₂ ^{+0.2} ₀	25	33	41	50	58	75
m ₃ ^{+0.2} ₀	23	29	35	42.5	50	62.5
m ₄ ^{+0.2} ₀	10.5	16	17	23	30	38
t ₁ ^{+0.1} ₀	43	58	70	87	100	130
t ₂ ^{+0.1} ₀	56	72	85	105	122	155
t ₃ ^{☆1}	11	12	13	15	17	20
t ₄	34	44	52	64	72	95
t ₄ ^{☆2}	29.5	40.5	48	59	65.5	86.5
t ₅ ^{☆1}	20	30	30	30	35	40
t ₆	20	25	35	35	40	55
t ₇	2	2.5	2.5	3	4	4
t ₈	2	2.5	2.5	3	3	4
t ₉ min.	1.5	1.5	1.5	3	3	3
t ₁₁ max.	25	31	42	53	53	75
U	0.03	0.03	0.03	0.05	0.05	0.05
W	0.05	0.05	0.1	0.1	0.1	0.2

Notes ☆1 : 1.6° range

d₂ bottom hole diameter should be of dimensions which does not interfere with chamfer C of insert (see bottom of previous page).

d₂ bottom hole dimensional examples shown in schematic below.

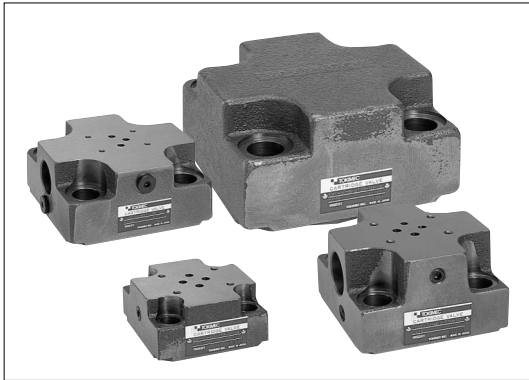
☆2 : d₄ dimension is max.



d₂ Bottom Hole Dimensions (Reference)

Size	d ₂ min.	t ₁₂ ± 0.2
16	24.6	2
25	33.6	2
32	44.6	2
40	54.6	3
50	67.6	3
63	89.6	3

Cartridge cover CVC



Functional Symbols

Cover Model & Type	Graphical Symbol	Available Sizes
CVC-**-N Basic Cover		All Sizes
CVC-**-A With Adjustable Valve Opening		All Sizes
CVC-**-PC With Pilot Operated Check Valve		16, 25, 32, 40
CVC-**-D3 Directional With ISO4401-03 Interface		25, 32, 40
CVC-**-D5 Directional With ISO4401-05 Interface		50, 63, 80
CVC-**-W With Shuttle Valve		16, 25, 32, 40

Note: Under graphical symbol, \approx denotes inserted orifice, and \oplus denotes position of insertable optional orifice.

Cover Model & Type	Graphical Symbol	Available Sizes
CVC-**-W13 Directional With ISO44-1-03 Interface and Shuttle Valve (Type 1)		25, 32, 40
CVC-**-W23 Directional With ISO4401-03 Interface and Shuttle Valve (Type 2)		25, 32, 40
CVC-**-W33 Directional With ISO4401-03 Interface and Shuttle Valve (Type 3)		25, 32, 40
CVC-**-W43 Directional With ISO4401-03 Interface and Shuttle Valve (Type 4)		25, 32, 40

Model Code

F3 - CVC -25- A - T39 (W) -10- JA - (XIO)

1 2 3 4 5 6 7 8

- 1 Fluid
Omit for mineral oil, water glycol
F3: phosphate ester
- 2 Cartridge valve cover
- 3 Size
16, 25, 32, 40, 50, 63, 80
- 4 Functions

Code	Function	Orifice	
		St'd	Option
N	Basic cover	X	—
A	With adjustable valve opening function	X	—
PC	With pilot operated check valve	AP	—
D3	Directional with ISO4401-03 interface	AP	X, Z1, Z2
D5	Directional with ISO4401-05 interface	AP	X, Z1, Z2
W	With shuttle valve	AP	Z2
W13	Directional with ISO4401-03 interface and shuttle valve (Type 1)	AP	Z2
W23	Same as above (Type 2)	AP	Z2
W33	Same as above (Type 3)	AP	X, Y, Z2
W43	Same as above (Type 4)	AP	X, Y, Z1
- 6 Adj. opening (for code type 'A' under 4)
W: Adj. screw (st'd)
M: Micrometer knob (option for sizes 16, 25 only)
K: Micrometer knob w/key (option for sizes 16, 25 only)
- 7 Design no.
- 8 Orifice (option)
For orifices other than standard, indicate port code and orifice diameter (2 digit, no decimal)

Notes: • Standard port for the orifice is as shown in table under 4. Orifice diameters as follows.

Size	16	25	32	40	50	63	80
Orifice Diameter	$\phi 1.0$	$\phi 1.2$	$\phi 1.2$	$\phi 1.4$	$\phi 1.6$	$\phi 1.8$	$\phi 3.0$

- Optional ports for orifices are shown in the table.
- Plug with no hole is indicated by "00".
- No orifice in standard orifice port is indicated by "99".
- Example: function D3 standard orifice port (AP) orifice not necessary, $\phi 1.0$ orifice in X and Z1 port with hole-less plug in Z2 port - AP99X10Z110Z200

- 5 Code T39: for 16, 25, 32, 40
JT39: for 50, 63, 80

Specifications

Model	Size	Max. Wkg. Pressure MPa	Weight kg	Size	A*	B*	C*	D	E	F*	G	H*	I*	J*	K	L	M	N	P	Mounting Bolts (Included)	Tightening Torque N·m
CVC	16	21 (※35)	0.8	16	65	23	46	13	4	3	35	14	7	3	73	10	22	—	—	M 8×40	31.5~38.5
	25		25	85	29	58	8	4	3	42	15	7	4	4	95	10	22	39	57	M12×40	99~121
	32		32	102	35	70	—	4	3	51	25	7	4	87	10	22	49	60	M16×55	153~187	
	40		40	125	42.5	85	—	4	3	61	25	7	4	104	10	22	58	58	M20×60	450~550	
	50		50	140	50	100	—	—	3	70	35	8	6	128	15	36	68	—	M20×80	522~638	
	63		63	180	62.5	125	—	—	3	86	42	8	6	153	17	41	83	—	M30×90	1080~1320	
	80		80	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Note : denotes common dimensions.

Consult Tokimec in case specifications call for 35 MPa maximum working pressure. Weight in () for W13 through W43.

Dimensions

