2 Searching by product series

Select from external appearance and product description of each series.

NEW indicates models added to the 9th edition.

Compact 2, 3-port solenoid valve P.1 on

For air/water/dry air/low vacuum

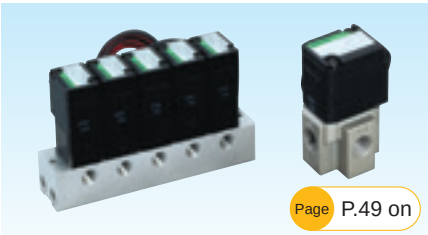
Page P.1 on

EXA/FWD/HNB/HNG/USB/USG

Model No.	Port size	Page
2-port solenoid valve		
EXA Push-in fitting	ø6.8.10.12 Push-in fitting	6
GEXA Push-in fitting manifold	ø6.8.10.12 Push-in fitting	10
EXA Aluminum body	Rc1/4,Rc3/8	14
FWD	Rc1/4 to Rc1	16
HNB1	M5×0.8	24
USB2	M5×0.8	28
USB3	Rc1/8	30
2-port solenoid valve (resin body)		
USB2 USB3	M6 barbed fitting	36
3-port solenoid valve		
HNG1	M5×0.8	26
USG2	M5×0.8	32
USG3	Rc1/8	34
3-port solenoid valve (resin body)		
USG2 USG3	M6 barbed fitting 1/4-28UNF	36

Dedicated fluid control direct acting 2, 3-port solenoid valve Special purpose P.49 on

For compressed air



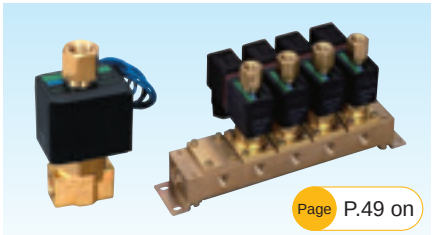
Page P.49 on

Special purpose

FAB/FAG

Model No.	Port size	Page
2-port solenoid valve		
FAB	Single unit M5, Rc1/8 to Rc1/2	52
GFAB	Manifold M5, Rc1/8 to Rc3/8	58
3-port solenoid valve		
FAG	Single unit M5, Rc1/8 to Rc3/8	64
GFAG	Manifold M5, Rc1/8, Rc1/4	68

For water



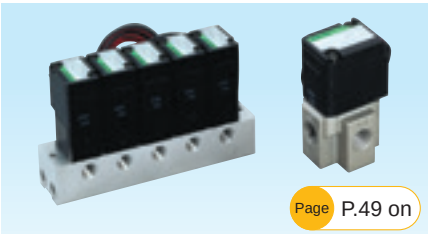
Page P.49 on

Special purpose

FWB/FWG

Model No.	Port size	Page
2-port solenoid valve		
FWB	Single unit Rc1/8 to Rc1/2	104
GFWB	Manifold Rc1/8 to Rc3/8	110
3-port solenoid valve		
FWG	Single unit Rc1/8 to Rc3/8	116
GFWG	Manifold Rc1/8 to Rc3/8	120

For dry air



Page P.49 on

Special purpose

FGB/FGG

Model No.	Port size	Page
2-port solenoid valve		
FGB	Single unit Rc1/8 to Rc1/2	74
GFGB	Manifold Rc1/8 to Rc3/8	78
3-port solenoid valve		
FGG	Single unit Rc1/8 to Rc3/8	84
GFGG	Manifold Rc1/8, Rc1/4	88

For hot water

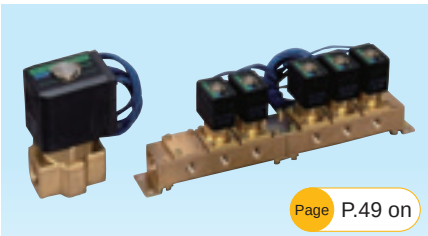
Page P.49 on

Special purpose

FHB

Model No.	Port size	Page
2-port solenoid valve		
FHB	Single unit Rc1/8 to Rc1/2	126

For medium vacuum



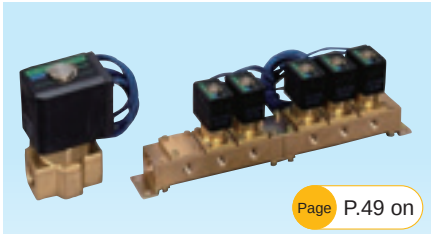
Page P.49 on

Special purpose

FVB

Model No.	Port size	Page
2-port solenoid valve		
FVB	Single unit Rc1/8 to Rc3/8	94
GFVB	Manifold Rc1/8 to Rc3/8	98

For oil



Page P.49 on

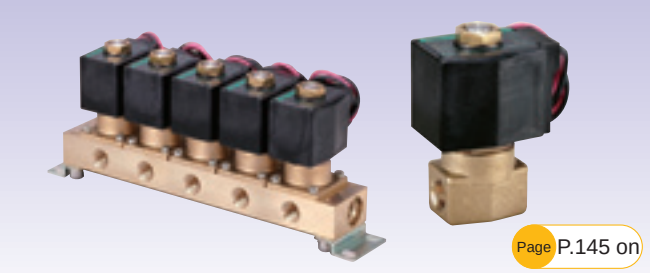
Special purpose

FLB

Model No.	Port size	Page
2-port solenoid valve		
FLB	Single unit Rc1/8 to Rc1/2	130
GFLB	Manifold Rc1/8 to Rc3/8	134

Multi-type fluid control 2, 3-port solenoid valve General purpose ▶▶▶ P.143 on

Direct acting 2-port solenoid valve
For air/low vacuum/water/kerosene/oil



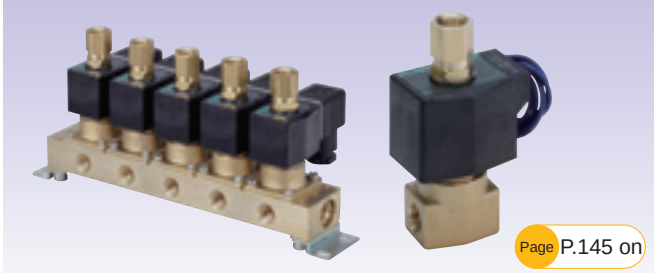
Page P.145 on

General purpose

AB

Model No.	Port size/orifice size	Actuation category	Page
Single valve			
AB21	Rc1/8, Rc1/4	NC	150
AB31/41	Rc1/8 to Rc1/2	NC	154
AB42	Rc1/4, Rc3/8	NO	154
AB71 (Large bore size)	Rc1/2 to Rc1	NC	168
Manifold			
GAB3*2/4*2	ø1.5 to ø7.0	NC	172
Manifold/actuator			
GAB422	ø1.5 to ø7.0	NO	182

Direct acting 3-port solenoid valve
For air/low vacuum/water/kerosene/oil



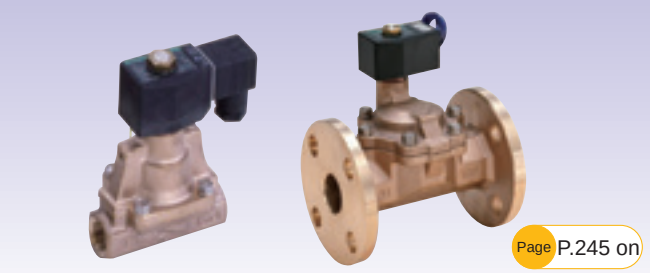
Page P.145 on

General purpose

AG

Model No.	Port size	Actuation category	Page
Single valve			
AG31/41	Rc1/8 to Rc3/8	Universal	190
AG33/43	Rc1/8 to Rc3/8	NC pressurization	208
AG34/44	Rc1/8 to Rc3/8	NO pressurization	226
Manifold			
GAG31*/35*	Rc1/8 to Rc3/8	Universal	198
GAG41*/45*			
GAG33*/43*	Rc1/8 to Rc3/8	NC pressurization	216
GAG34*/44*	Rc1/8 to Rc3/8	NO pressurization	234

Pilot operated 2-port solenoid valve
For air/water/kerosene/oil



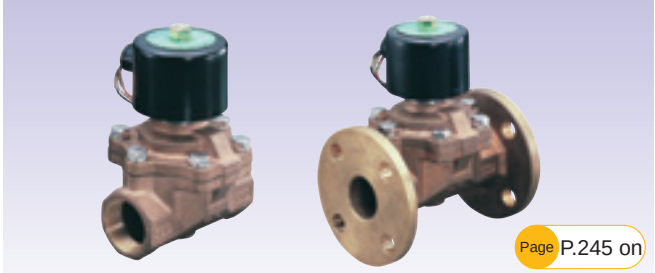
Page P.245 on

General purpose

AP/AD

Model No.	Port size	Actuation category	Page
Single valve/piston drive			
AP11/12	Rc1/4 to Rc1	NC/NO	252
AP21/22	Rc1¼ to Rc2 32 to 50 flange	NC/NO	262
Single valve/diaphragm drive			
AD11/12	Rc1/4 to Rc1	NC/NO	272
AD21/22	Rc1¼ to Rc2 32 to 50 flange	NC/NO	282

Pilot kick 2-port solenoid valve
For air/low vacuum/water/kerosene/oil



Page P.245 on

General purpose

APK/ADK

Model No.	Port size	Actuation category	Page
Single valve/piston drive			
APK11	Rc1/4 to Rc1	NC	292
APK21	Rc1¼ to Rc2 32, 40, 50 Flange	NC	300
Single valve/diaphragm drive			
ADK11/12	Rc1/4 to Rc1	NC/NO	306
ADK21	Rc1¼ to Rc2 32, 40, 50 Flange	NC	318

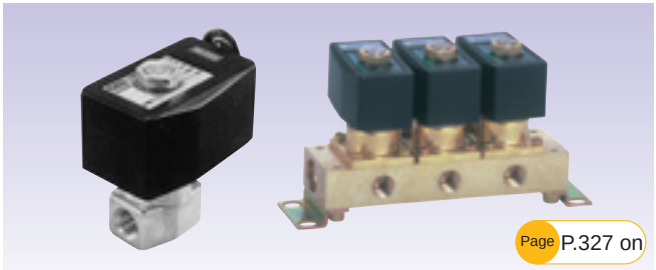
2 Searching by product series

Select from external appearance and product description of each series.

NEW indicates models added to the 9th edition.

2, 3-port solenoid valve for dry air General purpose ▶▶▶ P.327 on

Direct acting/pilot kick 2, 3-port solenoid valve
For dry air/inert gas/low vacuum



Page P.327 on

General purpose

AB*-Z/AG*-Z/ADK11-Z

Model No.	Port size	Actuation category	Page
Direct acting 2-port solenoid valve, discrete valve			
AB31/41-Z	Rc1/8 to Rc1/2	NC	332
Direct acting 2-port valve, manifold			
GAB312/412-Z		NC	338
GAB352/452-Z		NC	338
Direct acting 3-port solenoid valve, discrete valve			
AG31/41-Z	Rc1/8 to Rc3/8	Universal	342
AG33/43-Z	Rc1/8 to Rc3/8	NC pressurization	342
AG34/44-Z	Rc1/8 to Rc3/8	NO pressurization	342
Direct acting 3-port valve, manifold			
GAG31*/41*-Z		Universal	348
GAG35*/45*-Z		Universal	348
GAG33*/43*-Z		NC pressurization	352
GAG34*/44*-Z		NO pressurization	356
Pilot kick 2-port solenoid valve			
ADK11-Z	Rc1/4 to Rc1	NC	360

EX Explosion-proof multi-type fluid control 2, 3-port solenoid valve General purpose ▶▶▶ P.371 on

Explosion-proof direct acting 2, 3-port solenoid valve
For air/low vacuum/water/kerosene/oil/steam

Page P.371 on

General purpose

AB*EX4/AG*EX4/AB*EX2

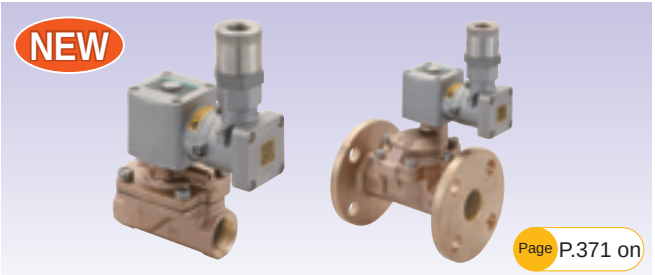
■ Pressure and explosion proof structure ExdIIBT4

Model No.	Port size	Actuation category	Page
2-port solenoid valve			
AB41/42EX4	Rc1/4, Rc3/8	NC	374
3-port solenoid valve			
AG41/43/44EX4	Rc1/4, Rc3/8	Universal/ NC pressurization/ NO pressurization	378

■ Pressure and explosion proof structure ExdIIBT2

Model No.	Port size	Actuation category	Page
2-port solenoid valve			
AB41EX2	Rc1/4, Rc3/8	NC	406

Explosion-proof pilot operated/pilot kick 2-port solenoid valve
For air/low vacuum/water/kerosene/oil/steam



Page P.371 on

General purpose

AP*EX4/AD*EX4/AP*EX2/ADK*EX4

■ Pressure and explosion proof structure ExdIIBT4

Model No.	Port size	Actuation category	Page
Piston drive			
AP11EX4	Rc1/2 to Rc1	NC	382
AP21EX4	Rc1 1/4 to Rc2 32, 40, 50 Flange	NC	386
Diaphragm drive			
AD11EX4	Rc1/2 to Rc1	NC	392
AD21EX4	Rc1 1/4 to Rc2 32, 40, 50 Flange	NC	396
ADK11EX4	Rc1/2 to Rc1	NC	402

■ Pressure and explosion proof structure ExdIIBT2

Model No.	Port size	Actuation category	Page
Piston drive			
AP11EX2	Rc1/2 to Rc1	NC	410
AP21EX2	Rc1 1/4 to Rc2 32, 40, 50 Flange	NC	414

Explosion-proof multi-type fluid control 2, 3-port solenoid valve General purpose ▶▶▶ P.421 on

Explosion-proof direct acting 2, 3-port solenoid valve
For air/low vacuum/water/kerosene/oil/steam

Page P.421 on

General purpose

AB*E4/AG*E4/AB*E2

■ Pressure and explosion proof structure d2G4

Model No.	Port size	Actuation category	Page
2-port solenoid valve			
AB41/42E4	Rc1/4, Rc3/8	NC/NO	424
AB41E4-Z	Rc1/4 / Rc3/8	NC	430
3-port solenoid valve			
AG41/43/44E4	Rc1/4, Rc3/8	Universal/ NC pressurization/ NO pressurization	434
AG4*E4-Z	Rc1/4, Rc3/8	Universal/ NC pressurization/ NO pressurization	438

■ Pressure and explosion proof structure d2G2

Model No.	Port size	Actuation category	Page
2-port solenoid valve			
AB41E2	Rc1/4, Rc3/8	NC	466

Explosion-proof pilot operated/pilot kick 2-port solenoid valve
For air/low vacuum/water/kerosene/oil/steam

Page P.421 on

General purpose

AP*E4/AD*E4/AP*E2/ADK*E4

■ Pressure and explosion proof structure d2G4

Model No.	Port size	Actuation category	Page
Piston drive			
AP11/12E4	Rc1/2 to Rc1	NC/NO	442
AP21/22E4	Rc1¼ to Rc2 32, 40, 50 Flange	NC/NO	446
Diaphragm drive			
AD11/12E4	Rc1/2 to Rc1	NC/NO	452
AD21/22E4	Rc1¼ to Rc2 32, 40, 50 Flange	NC/NO	456
ADK11/12E4	Rc1/2 to Rc1	NC/NO	462

■ Pressure and explosion proof structure d2G2

Model No.	Port size	Actuation category	Page
Piston drive			
AP11/12E2	Rc1/2 to Rc1	NC/NO	470
AP21/22E2	Rc1¼ to Rc2 32, 40, 50 Flange	NC/NO	474

Solenoid valve for high vacuum ▶▶▶ P.481 on

For air/vacuum/inert gas/nitrogen

Page P.481 on

HVB/HVL

Model No.	Working fluid	Page
HVB212/312/412/512	Vacuum/inert gas	484
HVB112		490
HVB612/712		492
HVL12	Air/nitrogen	496

2 Searching by product series

Select from external appearance and product description of each series.

NEW indicates models added to the 9th edition.

Air operated 2-port valve (cylinder valve) ▶▶▶ P.501 on

For air/water/gas/low vacuum/steam

Listed Page P.501 on

Cylinder valve

SAB/SVB/NAB

Model No.	Working fluid	Page
Air operated		
SAB*W	Water/liquid	506
SAB*A	Air/gas	510
SAB*V	Low vacuum/air/water	514
SAB*S	Steam/water/air	518
With solenoid valve		
SVB*W	Water/liquid	522
SVB*A	Air/inert gas	530
SVB*V	Low vacuum/air/water	534
SVB*S	Steam/water/air	538
Compact air operated		
NAB* (compact)	Air/gas/water	544
GNAB* (manifold)		548
NAB*V (compact)	Low vacuum/air/water	544
GNAB*V (manifold)		548

Diaphragm
For air/water/gas/low vacuum

Listed Page P.554 on

Cylinder valve

LAD/NAD

Model No.	Working fluid	Page
Single unit		
LAD*	Pure water/water/air/N_2 gas	556
NAD*	Air/gas/water	560
NAD*V	Low vacuum	560
Manifold		
GNAD*	Air/gas/water	562
GNAD*V	Low vacuum	562

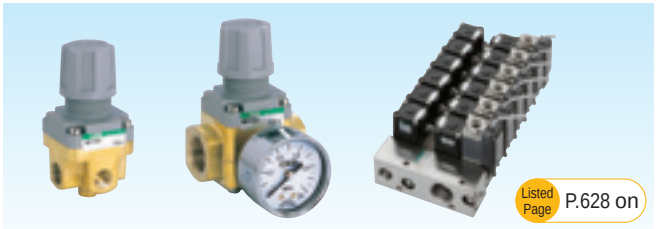
Related products for water ▶▶▶ P.575 on

Listed Page P.595 on

Capacitance flow sensor

WFC

Model No.	Model	Page
WFC	Capacitance flow sensor	595



Listed Page P.628 on

Regulator for water, etc.

WR*/YS/A/WXU

Model No.	Model	Page
WR1/WR2	Regulator for water	628
YS	Y-shaped strainer	632
A	Cable gland	1173
WXU	Integrated unit for water control	636

Listed Page P.577 on

Flow sensor for water (FLUEREX)

WFK2/WFK

Model No.	Model	Page
WFK2	Karman vortex flow rate sensor for water	577
WFK3000	Karman vortex flow rate sensor for water	611

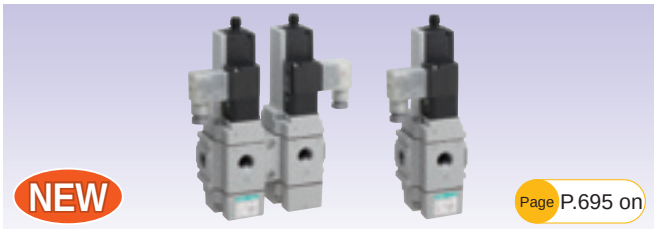
Large flow rate 3-port valve P.671 on

Page P.671 on

Pilot operated solenoid valve/external pilot operated air drive poppet valve

NP/NAP/NVP

Model No.	Working fluid	Page
Internal pilot with solenoid valve		
NP13/14	Air	674
Air operated 3-port valve air operated		
NAP11	Air/low vacuum	680
Air operated 3-port valve with solenoid valve		
NVP11	Air/low vacuum	684



NEW

Page P.695 on

3-port solenoid valve with spool position detection

SNP

Model No.	Working fluid	Page
SNP	Compressed air	696

Air operated 2, 3-port ball valve (compact rotary valve) P.703 on

For water/air/oil/steam

Page P.703 on

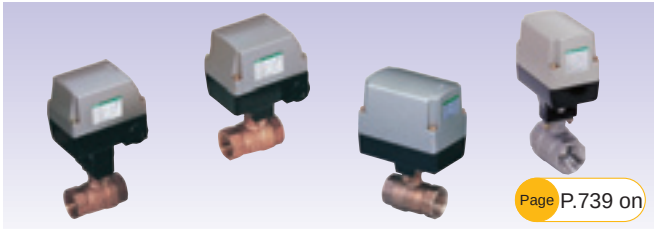
Compact rotary valve

CHB/CHG

Model No.	Working fluid	Number of ports	Page
Air operated			
CHB/CHBF (double acting)	Water/air/oil	2	706
CHB-R/CHBF-R* (single acting)		2	706
CHG (double acting)		3	712
CHG-R (single acting)		3	712
With solenoid valve			
CHB-V/CHBF-V (double acting)	Water/air/oil	2	718
CHB-X/CHBF-X (single acting)		2	718
CHG-V (double acting)		3	724
CHG-X (single acting)		3	724
Air operated/oil-prohibited specifications			
CHB (double acting)	Water/air	2	706
CHB-R (single acting)		2	706
CHG (double acting)		3	712
CHG-R (single acting)		3	712
Solenoid valve built-in/oil-prohibited specifications			
CHB-V (double acting)	Water/air	2	718
CHB-X (single acting)		2	718
CHG-V (double acting)		3	724
CHG-X (single acting)		3	724
For steam			
CSB/CSBF (double acting)	Steam/water	2	732
CSB-R/CSBF-R* (single acting)		2	732

Motorized 2-, 3-port ball valve P.739 on

For water/air/oil/steam



Page P.739 on

MXB/MXG

Model No.	Working fluid	Number of ports	Page
Standard			
MXB1/MXB1F	Water/air/oil	2	742
MXG1		3	746
Standard/relay			
MXB1D/MXB1DF	Water/air/oil	2	750
MXG1D		3	754
Oil-prohibited specifications			
MXB1-N	Water/air	2	758
MXG1-N		3	762
Oil-prohibited specifications/with relay			
MXB1D-N	Water/air	2	758
MXG1D-N		3	762
For steam			
MSB1/MSB1F	Steam/water	2	766
For steam/with relay			
MSB1D/MSB1DF	Steam/water	2	770
Proportional control			
MXBC2	Water	2	774
MXGC2		3	774
Miniature			
MHB4	Water/air/oil	2	778
MHG4		3	778

Other general purpose control systems P.789 on

NEW

Page P.789 on

Solenoid valve/pinch valve

SPK/PVS/KZV3/PK*/NPV2/HPV

Model	Working fluid	Number of ports	Page
Pilot operated 2-port solenoid valve			
KZV3	Steam/water/oil	2	792
PVS	Steam/water/air	2	798
Pilot kick 2-port solenoid valve			
SPK	Steam	2	790
PKA	Air	2	800
PKW	Water	2	802
PKS	Steam	2	804
Pinch valve			
NPV2	Gas/water/sludge/powder	2	806
HPV	Water/sludge/powder	2	807

2 Searching by product series

Select from external appearance and product description of each series.

NEW indicates models added to the 9th edition.

Weir diaphragm valve P.811 on

NEW

Page P.811 on

SWD/MWD

Model	Working fluid	Page
SWD	Water/pure water/chemical liquids (liquids that do not corrode wetted part materials)	814
MWD	Water/pure water/chemical liquids (liquids that do not corrode wetted part materials)	816

Air operated 2, 3-port valve (coolant valve) P.853 on

For coolant control

Page P.853 on

Coolant valve

CVE/CVSE

Model	Pressure	Classification	Page
For low pressure 2-port			
CVE2/CVE22-05	0.5 MPa	Air operated	856
CVE2/CVE22-10	1.0 MPa	Air operated	856
CVSE2/CVSE22-05	0.5 MPa	With solenoid valve	856
CVSE2/CVSE22-10	1.0 MPa	With solenoid valve	856
For medium pressure 2-port			
CVE2/CVE22-16	1.6 MPa	Air operated	866
CVE2/CVE22-30	3.0 MPa	Air operated	866
CVSE2/CVSE22-16	1.6 MPa	With solenoid valve	866
CVSE2/CVSE22-30	3.0 MPa	With solenoid valve	866
For high pressure 2-port			
CVE2/CVE22-70	7.0 MPa	Air operated	874
CVSE2/CVSE22-70	7.0 MPa	With solenoid valve	874
For medium-high pressure 3-port			
CVE3-35	3.5 MPa	Air operated	880
CVE3-70	7.0 MPa	Air operated	880
CVSE3-35	3.5 MPa	With solenoid valve	880
CVSE3-70	7.0 MPa	With solenoid valve	880
For low pressure 3-port			
CV3E-03	0.3 MPa	Air operated	892
CVS3E-03	0.3 MPa	With solenoid valve	892
Modular coolant valve 2-port			
GCVE2	0.5 MPa 1.0 MPa 1.6 MPa	Air operated	894
GCVSE2		With solenoid valve	894

Dust collection devices P.823 on

Large port size dust collector valve

Page P.823 on

Large port size dust collector valve

PD2/PD3

Model	Classification	Page
Air operated 2-port valve		
PD3	Pilot operated	824
PD2	Pilot operated	836
Solenoid valve built-in 2-port valve		
PDV3	Pilot operated	824
PDV2	Pilot operated	836
PJVB	Direct acting	842
PDVE4	Explosion-proof direct acting (Explosion proof structure: d2G4)	844
Controller		
OMC2	Output step No.: 6, 10	848

Peripheral components for coolant P.905 on

Check valve/sensors/pressure sensor

Page P.905 on

CCH/CPE/CPD

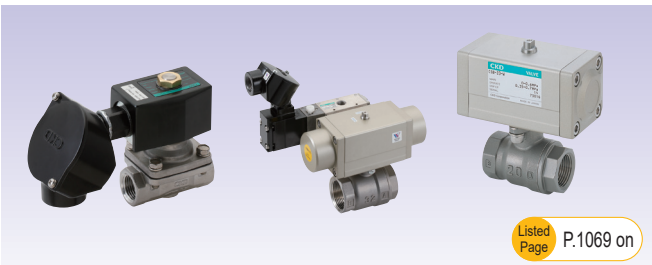
Model No.	Features	Page
CCH	Check valve	906
CPE	Mechanical pressure switch (for low pressure)	908
CPD	Electronic pressure switch (with digital display)	910

Components for Life Science ▶▶▶ P.923 on

For water/pure water/chemical liquids

Model No.	Port size	Seal/body material	Page
Metal-free 2-port solenoid valve			
MR10R	M5, M6, 1/4-28UNF	FKM/PEEK	927
MR16	M6, 1/4-28UNF	FKM/PEEK / EPDM/PEEK	932
MKB3	M6, 1/4-28UNF	FKM/PPS / EPDM/PPS	937
MAB1	M6	PTFE/PTFE	940
MYB1	M6	FKM/PPS	943
MYB2	Rc1/8	FKM/PPS	946
MYB3	Rc1/8 to Rc3/8	FKM/PPS	949
MEB2	Rc1/8	PTFE+FKM/PPS	952
MJB3	Tube connection porting Inner diameter × Outer diameter = ø4×ø8	FKM/PPS / PSU	955
EMB21	Rc1/4	PTFE/PTFE	957
EMB41	Rc3/8	PTFE/PTFE	959
EMB51	Rc3/8, Rc1/2	PTFE/PTFE	959
HMTB1	ø2 barbed fitting	NBR/FKM/EPDM/PPS	962
Metal-free 3-port solenoid valve			
MR10R	M5, M6, 1/4-28UNF	FKM/PEEK	927
MR16	M6, 1/4-28UNF	FKM/PEEK / EPDM/PEEK	932
MAG1	M6	PTFE/PTFE	940
MYG1	M6	FKM/PPS	943
MYG2	Rc1/8	FKM/PPS	946
MYG3	Rc1/8 to Rc3/8	FKM/PPS	949
MEG2	Rc1/8	PTFE+FKM/PPS	952
HMTG1	ø2 barbed fitting	NBR/FKM/EPDM/PPS	962
High corrosion resistant 2-port solenoid valve			
UMB1	Stainless steel pipe with O.D. ø1.26 x I.D. ø0.9	FKM/SUS304 or equiv.	965
HB11	M5	NBR/SUS316	967
HB21	Rc1/8		
HB31	Rc1/8, Rc1/4		
HB41	Rc1/4, Rc3/8		
High corrosion resistant 3-port solenoid valve			
UMG1	Stainless steel pipe with O.D. ø1.26 x I.D. ø0.9	FKM/SUS304 or equiv.	965
Fine pinch valve (2-port)			
HYN	M5	For silicone tube	971

Outdoor Series ▶▶▶ P.1069 on



Model No.	Model	Page
ADK11-W	Pilot kick 2-port solenoid valve	1072
CHB-W/CHB-WR*	Air operated 2-port ball valve	1076
CHG-W/CHG-WR*	Air operated 3-port ball valve	1080
CHB-WV1/CHB-WX1	Air operated 2-port ball valve	1084
CHG-WV1/CHG-WX1	Air operated 3-port ball valve	1088
CSB-W/CSB-WR*	Air operated 2-port ball valve	1092

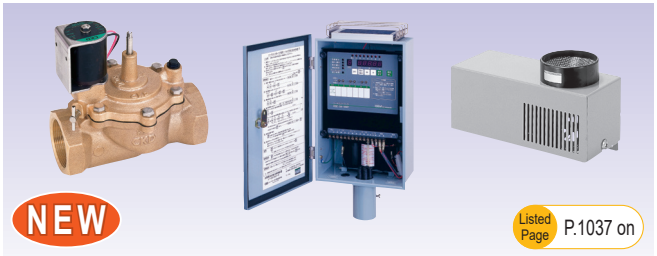
Gas combustion systems ▶▶▶ P.977 on

Direct acting valve for gas, combination valve

Model No.	Model	Page
GHV	Gas combination valve	980
GAV		984
DSG	Solenoid valve	986
DSG-W		990
VNA		992
VLA		998
VNA-R/RH		1002
VNR		1006
TAC-25	Medium pressure gas safety shutoff control system	1008
VNM		1012
VLM		1014
C25N-B		1016
VNM-25-K	Safety residual pressure exhaust valve	1018
HK1	Motorized valve	2020
HS		1024
GASB	Ball valve	1028

Automatic watering control systems ▶▶▶ P.1037 on

For watering of urban greenery, golf courses, grounds, protected horticulture, and farmlands, etc.



Model No.	Model	Page
RSC-S5	Controller	1040
RSC-G		1042
RSC-1WP		1044
RSC-1WP-C		1046
RSC-1WP-H		1047
RSC-2WP		1048
RS-6	Rain sensor	1050
RSV-K	Solenoid valve	1052
GSV2		1056
GSV		1058
RSV-W		1062

Special fluid control valve ▶▶▶ P.1097 on

Model	Working fluid	Page
AMD**3R	Chemical liquids/pure water/air/N ₂GAS	1098
LGD	Inert gas/process gas	1150

Recommended alternative products

Production and catalog listing of the series below have been discontinued. Select recommended alternative products instead.

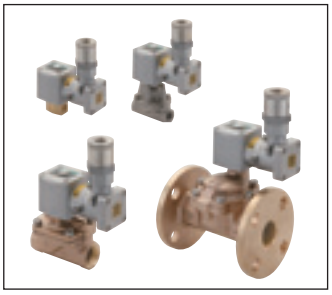
Products already discontinued or to be discontinued in near future	Recommended alternative product
Pilot operated 2-port solenoid valve for compressed air FAD	**Pilot operated 2-port solenoid valve for compressed air** **EXA/ADK11**
Direct acting 2-port solenoid valve for compressed air FAPB	**Pilot operated 2-port solenoid valve for compressed air** **EXA**
Fine rotary valve FR*	**Air operated ball valve** **CHB/CHG**
Gas combustion systems GSB	**Gas combustion systems** **GASB**
Explosion-proof direct acting 3-port solenoid valve LCE	**Explosion-proof direct acting 3-port solenoid valve** **AG41E4**
Direct acting 3-port solenoid valve LV	**Direct acting 3-port solenoid valve** **AG41**
Motorized 2-port ball valve for high corrosion resistance MXB1-C	**Motorized 2-port ball valve** **MXB1 option E/W**
Motorized 2-port ball valve with high corrosion resistance relay MXB1D-C	**Motorized 2-port ball valve** **MXB1D option E/W**
Explosion-proof pilot operated 2-port solenoid valve PVSE*	**Explosion-proof pilot operated 2-port solenoid valve** **AP11E4/E2,AP21E4/E2**
Karman vortex flow rate sensor for water FLUEREX WFK5000, 6000, 7000	**Karman vortex flow rate sensor for water FLUEREX** **WFK2**
Metal-free 2, 3-port solenoid valve for chemical liquids MR10	**Metal-free 2, 3-port solenoid valve for chemical liquids** **MR10R**
Gas shut-off valve MN	**Gas shut-off valve** **DSG/VNA**
Automatic pinch valve APV	We apologize. No alternative product is available.
Self-reset 2-port valve MHBR	
Manual pinch valve SPV	

Products no longer listed
Solenoid valve for high vacuum HVB41
Miniature 2, 3-port valve MHB3/MHG3
Solenoid valve for high vacuum HVL42
Direct acting 2-port valve LLO
2-port solenoid valve M
Solenoid ball valve MHBP
Automatic watering control systems WHL11
Watering controller RSC-W-2WP

New products

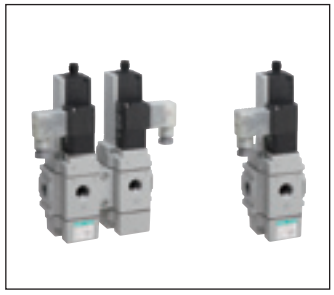
The new series below are now available.

■ Explosion-proof 2, 3-port solenoid valve
EX Series



■ Capacitance electromagnetic flow sensor
WFC Series

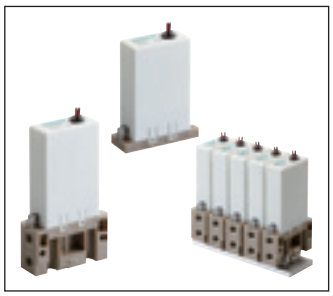
■ 3-port solenoid valve with spool position detection
SNP Series



■ Pilot operated 2-port solenoid valve
KZV3 Series

■ Weir diaphragm valve
SWD/MWDSeries

■ Metal-free 2, 3-port solenoid valve
MR16 Series



■ Metal-free 2-port solenoid valve
MKB3 Series

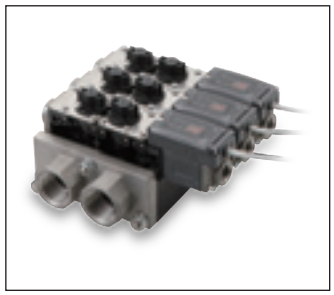
■ Automatic watering controller
RSC-1WP-C Series

■ Air operated valve for chemical liquids
AMD part 3R Series

■ Valve for process gases
LGD Series

■ Karman vortex flow rate sensor for water FLUEREX
WFK2 Series

■ Integrated unit for water control
WXU Series



■ Compact metal-free 2, 3-port solenoid valve
MR10R Series

■ Resin solenoid valve for automatic watering
GSV2 Series

Guide to CKD's CAD data

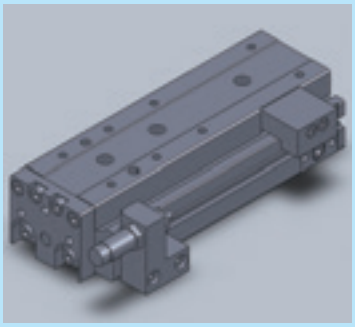
How to use CKD's CAD data

CKD's CAD data is provided as follows for your use in CAD design.

2D CAD data

Types of compatible CAD
- DXF
- Dedicated CAD types

3D CAD data



Types of compatible CAD
- DXF
- IGES
- SAT
- Parasolid
- Dedicated CAD types

Homepage

Catalog PDFs and CAD data of CKD products are available for download.

https://www.ckd.co.jp/en/

For PDF and DXF data of the general catalogs

CKD Website Component Products > Materials: Download digital catalogs/catalog PDFs

For PDF and DXF data of new products

CKD Website Component Products > Search for a product from the product list

For 2D/3D CAD data

CKD Website Component Products > Materials: Download 2D CAD data/3D CAD data

Guide to the model selection system

How to use the model selection system

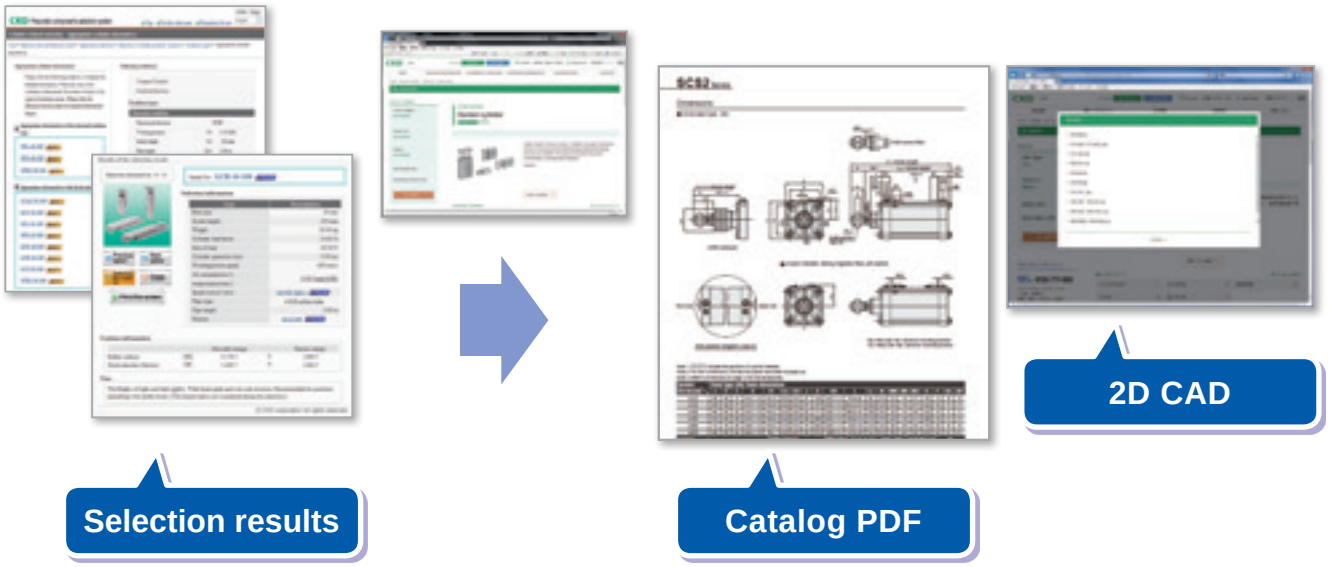
The CKD system supports selection of the following items.
For your use during model selection and design.

Available on our website

This system is used to select products according to your application and working conditions.

*Downloading Software may not be possible due to your security settings. If that is the case, contact CKD.

Selection results are linked with catalog PDFs and CAD data!



Registration not required - available at any time!

A variety of services such as CKD product catalogs, PDFs, CAD data, and model selection are available. Feel free to try them.

https://www.ckd.co.jp/en/

3 Types and characteristics of fluid control valves

A variety of CKD fluid control valves are available to ensure selection of a product that perfectly matches the working fluid and application.

Type (●: Ideal, ○: Adequate)		Space saving	Long life	Suitable for dry working fluid	Good responsivity	
Compact 2, 3-port solenoid valve	For compressed air EXA	●	●			
	For water FWD	●				
Direct acting solenoid valve	Special purpose valve FA*/FW*/FV*/FG*	●	●	● (FG*)	●	
	Direct acting general purpose valve AB/AG	○	●		●	
	General purpose valve for dry air AB*-Z/AG*-Z	○	●	●	○	
	Solenoid valve for high vacuum HVB	○		○	○	
	Components for Life Science MR10R/MR16/MKB3/MAB/MAG/MYB/MYG/MEB/MEG	○				
Pilot operated solenoid valve	Pilot operated general purpose valve AP/AD				○	
	Large port size dust collector valve PD3				○	
Pilot kick solenoid valve	Pilot kick operated general purpose valve ADK/APK				○	
EX explosion-proof solenoid valve	International standard compliant explosion-proof general purpose valve AB41EX4, AG41EX4, AP11EX4, AD11EX4					
Explosion-proof solenoid valve	Explosion-proof general purpose valve AB41E4, AG41E4, AP11E4, AD11E4					
Air operated valve	Cylinder valve SAB/SVB/NAB				○	
	Diaphragm cylinder valve LAD	○		●		
	Diaphragm cylinder valve NAD	●		●		
	Coolant valve CVE/CVSE				○	
Large flow rate 3-port valve	NP/NAP/NVP				○	
Air operated ball valve	Compact rotary valve CHB/CHG/CSB				○	
Motorized ball valve	MXB/MXG					
Pinch valve	NPV2					

Note: The ● and ○ marks in the table are guidelines only. Always check the product specifications carefully as there may be cases when use is not possible because of environment or conditions.

	Suitable for high frequency	Suitable for medium vacuum	Suitable for high vacuum	Resistant to foreign matter	Reduces water hammer noise	Suitable for large flow rate	Normal/reverse pressurization	Suitable for special working fluid	Suitable for explosion-proof atmospheres	Page
						●				4
					●					16
	○	● (FV*)								49
	○	○ (Option)								145
	○									327
		●	●			○	○			481
								●		923
						○				245
						○				778
						○				245
									●	371
									●	421
				●	○	○	○		○ (Air operated)	506
						●		●	○	556
						○		●	○	560
				●	○	○		●	○ (Air operated)	853
						●			○ (Air operated)	671
				●	○	●	● (2WAY)		○ (Air operated)	703
				○	●	●	● (2WAY)			739
				●						806

4 Searching by working fluid

Compressed air

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	HNB1	NC	○																24
	USB2/3	NC	○	○															28/30
	AB21	NC		○	○														150
	AB31/41/42	NC/NO		★	★	★	★												154
	FAB	NC/NO	○	○	○	○	○												52
	AB71	NC					○	○	○										168
	2-port valve/manifold																		
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
	GFAB	NC	Individual port: M5, Rc1/8, Rc1/4, common port: Rc1/8, Rc3/8																58
	PJVB	Control box manifold solenoid valve		○	○														842
	3-port valve/single unit																		
	HNG1	UNI	○																26
	USG2/3	UNI	○	○															32/34
	AG31/41	UNI		★	★	★													190
	AG33/43	NC pressurization		★	★	★													208
	AG34/44	NO pressurization		★	★	★													226
	FAG	UNI	○	○	○	○													64
	3-port valve/manifold																		
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
	GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
	GFAG	UNI	Individual port: M5, Rc1/8, Rc1/4, common port: Rc1/8, Rc1/4																68
	Pressure and explosion proof/2-port valve																		
	AB41EX4	EXdIIBT4 NC			○	○													374
	AB4*E4	d2G4 NC/NO			○	○													424
	Pressure and explosion proof/3-port valve																		
	AG4*EX4	ExdIIBT4 NC pressurization/NO pressurization/UNI			○	○													378
	AG4*E4	d2G4 NC press/NO press UNI			○	○													434

Compressed air Water Hot water Dry air Steam Oil/kerosene Low/medium vacuum
High vacuum Coolant Solvent Inert gas Sludge/powder/chemicals
Process gas Chemical liquid/pure water Gas Controller, etc.

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Pilot operated solenoid valve	**2-port valve/single unit**																		
	EXA	NC	Push-in fitting ø6, ø8, ø10, ø12																6
	EXA Aluminum body	NC			○	○													14
	AP11/21	Piston drive NC			★	★	★	★	★	◑	◑	◑							252/262
	AD11/21	Diaphragm drive/NC			★	★	★	★	★	◑	◑	◑							272/282
	AP12/22	Piston drive NO			★	★	★	★	★	◑	◑	◑							252/262
	AD12/22	Diaphragm drive/NO					★	★	★	◑	◑	◑							272/282
	PD3/PDV3	Diaphragm drive						○	○		○		○	○					824
		NC for dust collector																	
	PD2/PDV2	Diaphragm drive										○							836
		NC for dust collector																	
	PVS	Piston drive NC/NO					○	○	○	●	●	●	●	●					798
	2-port valve/manifold																		
	GEXA	NC	Push-in fitting ø6, ø8, ø10, ø12																10
	3-port valve																		
	NP13/14	Piston drive NC/NO				○	○	○	○	○	○	○							674
	Pressure and explosion proof/2-port valve																		
	AP11EX4	EXdIIBT4 NC					○	○	○										382
	AP21EX4	EXdIIBT4 NC								◑	◑	◑							386
	AD11EX4	EXdIIBT4 NC					○	○	○										392
	AD21EX4	EXdIIBT4 NC								◑	◑	◑							396
	AP11E4	d2G4 NC					○	○	○										442
	AP21E4	d2G4 NC								◑	◑	◑							446
	AP12E4	d2G4 NO					○	○	○										442
	AP22E4	d2G4 NO								◑	◑	◑							446
	AD11E4	d2G4 NC					○	○	○										452
	AD21E4	d2G4 NC								◑	◑	◑							456
	AD12E4	d2G4 NO					○	○	○										452
	AD22E4	d2G4 NO								◑	◑	◑							456
	PDVE4	d2G4 NC						○	○		○	○							844
Pilot kick solenoid valve	**2-port valve**																		
	APK11	Piston drive NC			★	★	★	★	★										292
	APK21	Piston drive NC								◑	◑	◑							300
	ADK11	Diaphragm drive NC			★	★	★	★	★										306
	ADK21	Diaphragm drive NC								◑	◑	◑							318
	ADK12	Diaphragm drive NO					★	★	★										306
	PKA	Piston drive NC					○	○	○	●	●	●							800
	Pressure and explosion proof/2-port valve																		
	ADK11EX4	EXdIIBT4 NC					○	○	○										402
	ADK11E4	d2G4 NC					○	○	○										462
	ADK12E4	d2G4 NO					○	○	○										462

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column ★: Rc, G and NPT ○: Rc ●: Flange ◑: Rc and flange

4 Searching by working fluid

Compressed air

	Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Air operated ball valve	**2-port valve**																		
	CHB/CHB-R*	NC/NO/CO				○	○	○	○	○	○	○							706
	CHB-V*/X*	With solenoid valve NC/NO/CO				○	○	○	○	○	○	○							718
	3-port valve																		
	CHG/CHG-R*	NC/NO/CO					○	○	○	○	○	○							712
	CHG-V*/X*	With solenoid valve NC/NO/CO					○	○	○	○	○	○							724
Air operated valve	**2-port valve/single unit**																		
	SAB*A	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑	●	●					510
	SVB*A	With solenoid valve NC/NO			○	○	○	○	○	◑	◑	◑	●	●					530
	SAB*S	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑							518
	SVB*S	With solenoid valve NC/NO			○	○	○	○	○	◑	◑	◑							538
	NAB* (compact)	Air operated valve NC/NO/CO			○	○													544
	2-port valve/manifold																		
	GNAB*	NC/NO/CO	Individual port: Rc1/4, common port: Rc3/8																548
	3-port valve																		
	NAP11	Air operated valve UNI				○	○	○	○	○	○	○							680
	NVP11	With solenoid valve UNI				○	○	○	○	○	○	○							684
Air operated diaphragm valve	**2-port valve/single unit**																		
	LAD	NC/NO/CO				○	○	○	○										556
	NAD	NC/NO/CO				○													560
	2-port valve/manifold																		
	GNAD	NC/NO/CO				○													562
Motor driven ball valve	**2-port valve**																		
	MXB1					○	○	○	○	○	○	○							742
	MXB1D	With relay				○	○	○	○	○	○	○							750
	MHB4	Miniature				○	○	○											778
	3-port valve																		
	MHG4	Miniature				○	○	○											778
	MXG1						○	○	○	○	○	○							746
	MXG1D	With relay					○	○	○	○	○	○							754
Others	**2-port valve**																		
	NPV2	Direct pressure automatic pinch valve							●		●	●	●	●	●				806
	Manual 2-port valve																		
	HPV	Pinch valve							●		●	●	●	●	●				807

Compressed air Water Hot water Dry air Steam Oil/kerosene Low/medium vacuum
High vacuum Coolant Solvent Inert gas Sludge/powder/chemicals
Process gas Chemical liquid/pure water Gas Controller, etc.

Water

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	UMB1	NC	Stainless steel pipe with O.D. ø1.26 x I.D. ø0.9																965
	HYN	NC/NO	Silicone tube (ø2 x ø0.5, ø3 x ø1, ø5 x ø3, ø8 x ø6)																971
	HMTB1	NC	ø2 barbed fitting																962
	HNB1	NC	○																24
	USB2/3	NC	○	○															28/30
	AB21	NC		○	○														150
	HB11/21/31/41	NC	○	○	○	○													967
	AB31/41/42	NC/NO		★	★	★	★												154
	FWB	NC/NO		○	○	○	○												104
	AB71	NC					○	○	○										168
	MAB1	NC Resin valve	M6																940
	MEB2	NC Resin valve		○															952
	MYB1/2/3	NC Resin valve	M6	○	○	○													943/946/949
	MJB3	NC	Tube connection porting I.D. x O.D. = ø4 x ø8																955
	EMB21/41/51	NC Resin valve			○	○	○	ø10 x ø8 PFA tube connection											957/959
	2-port valve/manifold																		
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
	GFWB	NC	Individual port: Rc1/8, Rc1/4, common port: Rc1/4, Rc3/8																110
	3-port valve/single unit																		
	UMG1	UNI	Stainless steel pipe with O.D. ø1.26 x I.D. ø0.9																965
	HMTG1	UNI	ø2 barbed fitting																962
	HYN	UNI	Silicone tube (ø2 x ø0.5, ø3 x ø1, ø5 x ø3, ø8 x ø6)																971
	HNG1	UNI	○																26
	USG2/3	UNI	○	○															32/34
	AG31/41	UNI		★	★	★													190
	AG33/43	NC pressurization		★	★	★													208
	AG34/44	NO pressurization		★	★	★													226
	FWG	UNI		○	○	○													116
	MAG1	UNI Resin valve	M6																940
	MEG2	UNI Resin valve		○															952
	MYG1/2/3	UNI Resin valve	M6	○	○	○													943/946/949
	3-port valve/manifold																		
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
	GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
	GFWG	UNI	Individual port: Rc1/8, Rc1/4, common port: Rc1/4, Rc3/8, NO port: Rc1/8, Rc1/4																120

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column ★ : Rc, G and NPT ☆ :R ○ : Rc ● : Flange ◑: Rc and flange

4 Searching by working fluid

Water

	Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**Pressure and explosion proof/2-port valve**																		
	AB4*E4	d2G4 NC/NO			○	○													424
	AB41E2	d2G2 NC			○	○													466
	Pressure and explosion proof/3-port valve																		
	AG4*E4	d2G4 NC press/NO press UNI			○	○													434
Pilot operated solenoid valve	**2-port valve/single unit**																		
	FWD	NC			☆	☆	☆	☆	☆										18
	AP11/21	Piston drive NC			★	★	★	★	★	◑	◑	◑							252/262
	AD11/21	Diaphragm drive/NC			★	★	★	★	★	◑	◑	◑							272/282
	AP12/22	Piston drive NO			★	★	★	★	★	◑	◑	◑							252/262
	AD12/22	Diaphragm drive/NO					★	★	★	◑	◑	◑							272/282
	PVS	Piston drive NC/NO					○	○	○	●	●	●	●	●					798
	RSV-W	Diaphragm drive/NC/latch					○	○	○	○	○	○							1062
	RSV (for agricultural water)	Diaphragm drive/NC/latch						○	○	○	◑	◑	◑	◑	●				1052
	GSV (for agricultural water)	Diaphragm drive/NC/latch							○			○							1058
	GSV2 (for agricultural water)	Diaphragm drive/NC/latch						○	○		○	○							1056
	Pressure and explosion proof/2-port valve																		
	AP11EX4	EXdIIBT4 NC					○	○	○										382
	AP21EX4	EXdIIBT4 NC								◑	◑	◑							386
	AD11EX4	EXdIIBT4 NC					○	○	○										392
	AD21EX4	EXdIIBT4 NC								◑	◑	◑							396
	AP11E4	d2G4 NC					○	○	○										442
	AP21E4	d2G4 NC								◑	◑	◑							446
	AP12E4	d2G4 NO					○	○	○										442
	AP22E4	d2G4 NO								◑	◑	◑							446
	AD11E4	d2G4 NC					○	○	○										452
	AD21E4	d2G4 NC								◑	◑	◑							456
	AD12E4	d2G4 NO					○	○	○										452
	AD22E4	d2G4 NO								◑	◑	◑							456
Pilot kick solenoid valve	**2-port valve**																		
	APK11	Piston drive NC			★	★	★	★	★										292
	APK21	Piston drive NC								◑	◑	◑							300
	ADK11	Diaphragm drive/NC			★	★	★	★	★										306
	ADK21	Diaphragm drive/NC								◑	◑	◑							318
	ADK12	Diaphragm drive/NO					★	★	★										306
	PKW	Piston drive NC					○	○	○	●	●	●							802
	Pressure and explosion proof/2-port valve																		
	ADK11EX4	EXdIIBT4 NC					○	○	○										402
	ADK11E4	d2G4 NC					○	○	○										462
	ADK12E4	d2G4 NO					○	○	○										462

Compressed air | Water | Hot water | Dry air | Steam | Oil/kerosene | Low/medium vacuum
High vacuum | Coolant | Solvent | Inert gas | Sludge/powder/chemicals
Process gas | Chemical liquid/pure water | Gas | Controller, etc.

	Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Air operated ball valve	**2-port valve**																		
	CHB/CHB-R*	NC/NO/CO				○	○	○	○	○	○	○							706
	CHB-V*/X*	With solenoid valve NC/NO/CO				○	○	○	○	○	○	○							718
	3-port valve																		
	CHG/CHG-R*	NC/NO/CO					○	○	○	○	○	○							712
	CHG-V*/X*	With solenoid valve NC/NO/CO					○	○	○	○	○	○							724
Air operated valve	**2-port valve/single unit**																		
	SAB*W	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑	●	●					506
	SVB*W	With solenoid valve NC/NO			○	○	○	○	○	◑	◑	◑	●	●					522
	SAB*S	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑							518
	SVB*S	With solenoid valve NC/NO			○	○	○	○	○	◑	◑	◑							538
	NAB* (compact)	Air operated valve NC/NO/CO			○	○													544
	2-port valve/manifold																		
	GNAB*	NC/NO/CO	Individual port: Rc1/4, common port: Rc3/8																548
Air operated diaphragm valve	**2-port valve/single unit**																		
	LAD	NC/NO/CO				○	○	○	○										556
	NAD	NC/NO/CO				○													560
	2-port valve/manifold																		
	GNAD	NC/NO/CO				○													562
Motor driven ball valve	**2-port valve**																		
	MHB4	Miniature				○	○	○											778
	MXBC2	Proportional control valve				○	○	○	○										774
	MXB1	Standard				○	○	○	○	○	○	○							742
	MXB1D	With relay				○	○	○	○	○	○	○							750
	3-port valve																		
	MHG4	Miniature				○	○	○											778
	MXGC2	Proportional control valve					○	○	○										774
	MXG1	Standard					○	○	○	○	○	○							746
	MXG1D	With relay					○	○	○	○	○	○							754
Others	**2-port valve**																		
	NPV2	Direct pressure automatic pinch valve							●		●	●	●	●	●				806
	Manual 2-port valve																		
	HPV	Pinch valve							●		●	●	●	●	●				807

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column ★: Rc, G and NPT ○: Rc ●: Flange ◑: Rc and flange

4 Searching by working fluid

Hot water

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	AB31/41/42	NC/NO		★	★	★	★												154
	FHB	NC		○	○	○	○												126
	2-port valve/manifold																		
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
	3-port valve/single unit																		
	AG31/41	UNI		★	★	★													190
	AG33/43	NC pressurization		★	★	★													208
	AG34/44	NO pressurization		★	★	★													226
	3-port valve/manifold																		
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
	GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
	Pressure and explosion proof/2-port valve																		
	AB41EX2	EXdIIBT2 NC			○	○													406
	AB41E2	d2G2 NC			○	○													466
Pilot operated solenoid valve	**2-port valve**																		
	AP11/21	Piston drive NC			★	★	★	★	★	◑	◑	◑							252/262
	AD11/21	Diaphragm drive/NC			★	★	★	★	★	◑	◑	◑							272/282
	AP12/22	Piston drive NO			★	★	★	★	★	◑	◑	◑							252/262
	AD12/22	Diaphragm drive/NO					★	★	★	◑	◑	◑							272/282
	Pressure and explosion proof/2-port valve																		
	AP11EX2	EXdIIBT2 NC					○	○	○										410
	AP21EX2	EXdIIBT2 NC								◑	◑	◑							414
	AP11E2	d2G2 NC					○	○	○										470
	AP12E2	d2G2 NO					○	○	○										470
	AP21E2	d2G2 NC								◑	◑	◑							474
	AP22E2	d2G2 NO								◑	◑	◑							474
Pilot kick solenoid valve	**2-port valve**																		
	APK11	Piston drive/NC			★	★	★	★	★										292
	APK21	Piston drive/NC								◑	◑	◑							300
	ADK11	Diaphragm drive/NC					★	★	★										306
	ADK12	Diaphragm drive/NO					★	★	★										306
Air operated ball valve	**2-port valve**																		
	CHB/CHB-R*	NC/NO/CO				○	○	○	○	○	○	○							706
	CHB-V*/X*	With solenoid valve NC/NO/CO				○	○	○	○	○	○	○							718
	CSB	NC/NO/CO				○	○	○	○	○	○	○							732
	CSBF	NC/NO/CO					○	○	○	○	○								732
	3-port valve																		
	CHG/CHG-R*	NC/NO/CO					○	○	○	○	○	○							712
	CHG-V*/X*	With solenoid valve NC/NO/CO					○	○	○	○	○	○							724
Air operated Valve	**2-port valve**																		
	SAB*W	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑	●	●					506
	SAB*S	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑							518
	SVB*S	With solenoid valve NC/NO			○	○	○	○	○	◑	◑	◑							538

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Motor driven ball valve	**2-port valve**																		
	MHB4	Miniature				○	○	○											778
	MXBC2	Proportional control valve				○	○	○	○										774
	MXB1	Standard				○	○	○	○	○	○	○							742
	MXB1D	With relay				○	○	○	○	○	○	○							750
	MSB1					○	○	○	○	○	○	○							766
	MSB1D	With relay				○	○	○	○	○	○	○							770
	3-port valve																		
	MHG4	Miniature				○	○	○											778
	MXGC2	Proportional control ball valve				○	○	○	○										774
	MXG1	Standard					○	○	○	○	○	○							746
	MXG1D	With relay					○	○	○	○	○	○							754

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column ★: Rc, G and NPT ○: Rc ●: Flange ◑: Rc and flange

4 Searching by working fluid

Dry air

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	AB31/41-Z	NC		★	★	★	★												332
	FGB	NC/NO		○	○	○	○												74
	2-port valve/manifold																		
	GAB3*2/4*2-Z	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																338
	GFGB	NC	Individual port: Rc1/8, Rc1/4, common port: Rc1/8, Rc3/8																78
	3-port valve/single unit																		
	AG3*/4*-Z	NC pressurization/NO pressurization UNI		★	★	★													342
	FGG	UNI/NC pressurization		○	○	○													84
	3-port valve/manifold																		
	GFGG	UNI	Individual port: Rc1/8, Rc1/4, common port: Rc1/8, Rc1/4																88
	Pressure and explosion proof/2-port valve																		
	AB41E4-Z	d2G4 NC			○	○													430
	Pressure and explosion proof/3-port valve																		
	AG4*E4-Z	d2G4 NC press/NO press UNI			○	○													438
Air operated diaphragm valve	**2-port valve/single unit**																		
	LAD	NC/NO/CO				○	○	○	○										556
	NAD	NC/NO/CO				○													560
	2-port valve/manifold																		
	GNAD	NC/NO/CO				○													562
Others	**Pilot kick 2-port solenoid valve**																		
	ADK11-Z	Diaphragm drive/NC			★	★	★	★	★										360

Steam

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	AB31/41/42	NC/NO		★	★	★													154
	2-port valve/manifold																		
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
	3-port valve/single unit																		
	AG31/41	UNI		★	★	★													190
	AG33/43	NC pressurization		★	★	★													208
	AG34/44	NO pressurization		★	★	★													226
	3-port valve/manifold																		
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
	GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
	Pressure and explosion proof/2-port valve																		
	AB41EX2	EXdIIBT2 NC			○	○													406
	AB41E2	d2G2 NC			○	○													466
Pilot operated solenoid valve	**2-port valve**																		
	AP11/21	Piston drive/NC			★	★	★	★	★	◑	◑	◑							252/262
	AP12/22	Piston drive/NO			★	★	★	★	★	◑	◑	◑							252/262
	PVS	Piston drive/NC/NO					○	○	○	●	●	●	●	●					798
	Pressure and explosion proof/2-port valve																		
	AP11EX2	EXdIIBT2 NC					○	○	○										410
	AP21EX2	EXdIIBT2 NC								◑	◑	◑							414
	AP11E2	d2G2 NC					○	○	○										470
	AP12E2	d2G2 NO					○	○	○										470
	AP21E2	d2G2 NC								◑	◑	◑							474
	AP22E2	d2G2 NO								◑	◑	◑							474
Others	**Pilot kick 2-port solenoid valve**																		
	APK11	Piston drive/NC			★	★	★	★	★										292
	APK21	Piston drive/NC								◑	◑	◑							300
	SPK	NC					○	○	○										790
	PKS	Piston drive/NC					○	○	○	●	●	●							804
	KZV3	100/200 VAC compatible NC					○	○	○	○	○	○							792
	External pilot operated valve/2-port valve																		
	SAB*S	Air operated valve NC/NO/CO			○	○	○	○	○	◑	◑	◑							518
	SVB*S	With solenoid valve NC/NO			○	○	○	○	○	◑	◑	◑							538
	Motorized ball valve																		
	MSB1	Standard				○	○	○	○	○	○	○							766
	MSB1D	With relay				○	○	○	○	○	○	○							770
	Air operated ball valve																		
	CSB	NC/NO/CO				○	○	○	○	○	○	○							732
	CSBF	NC/NO/CO					○	○	○	○	○								732

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting

* Port size column ★ : Rc, G and NPT ○ : Rc ● : Flange ◑: Rc and flange

4 Searching by working fluid

Oil/kerosene

⚠ Check that working fluid viscosity is within the product's specified range when making a selection.

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	USB2/3	NC	○	○															28/30
	AB21	NC		○	○														150
	AB31/41/42	NC/NO		★	★	★	★												154
	FLB	NC		○	○	○	○												130
	AB71	NC					○	○	○										168
	2-port valve/manifold																		
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
	GFLB	NC	Individual port: Rc1/8, Rc1/4, common port: Rc1/4, Rc3/8																134
	3-port valve/single unit																		
	USG2/3	UNI	○	○															32/34
	AG31/41	UNI		★	★	★													190
	AG33/43	NC pressurization		★	★	★													208
	AG34/44	NO pressurization		★	★	★													226
	3-port valve/manifold																		
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
	GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
	Pressure and explosion proof/2-port valve																		
	AB41EX4	EXdIIBT4 NC			○	○													374
	AB4*E4	d2G4 NC/NO			○	○													424
	Pressure and explosion proof/3-port valve																		
	AG4*EX4	ExdIIBT4 NC pressurization/NO pressurization/UNI			○	○													378
	AG4*E4	d2G4 NC pressurization/ NO pressurization UNI			○	○													434
Pilot operated solenoid valve	**2-port valve**																		
	AP11/21	Piston drive NC			★	★	★	★	★	◑	◑	◑							252/262
	AD11/21	Diaphragm drive/NC			★	★	★	★	★	◑	◑	◑							272/282
	AP12/22	Piston drive NO			★	★	★	★	★	◑	◑	◑							252/262
	AD12/22	Diaphragm drive/NO					★	★	★	◑	◑	◑							272/282
	Pressure and explosion proof/2-port valve																		
	AP11EX4	EXdIIBT4 NC					○	○	○										382
	AP21EX4	EXdIIBT4 NC								◑	◑	◑							386
	AD11EX4	EXdIIBT4 NC					○	○	○										392
	AD21EX4	EXdIIBT4 NC								◑	◑	◑							396
	AP11E4	d2G4 NC					○	○	○	◑	◑	◑							442
	AP21E4	d2G4 NC								◑	◑	◑							446
	AP12E4	d2G4 NO					○	○	○	◑	◑	◑							442
	AP22E4	d2G4 NO								◑	◑	◑							446
	AD11E4	d2G4 NC					○	○	○	◑	◑	◑							452
	AD21E4	d2G4 NC								◑	◑	◑							456
	AD12E4	d2G4 NO					○	○	○	◑	◑	◑							452
	AD22E4	d2G4 NO								◑	◑	◑							456

Compressed air Water Hot water Dry air Steam Oil/kerosene Low/medium vacuum
High vacuum Coolant Solvent Inert gas Sludge/powder/chemicals
Process gas Chemical liquid/pure water Gas Controller, etc.

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Pilot kick solenoid valve	**2-port valve**																		
	APK11	Piston drive NC			★	★	★	★	★										292
	APK21	Piston drive NC								◑	◑	◑							300
	ADK11	Diaphragm drive/NC			★	★	★	★	★										306
	ADK21	Diaphragm drive/NC								◑	◑	◑							318
	ADK12	Diaphragm drive/NO					★	★	★										306
	Pressure and explosion proof/2-port valve																		
	ADK11EX4	EXdIIBT4 NC					○	○	○										402
	ADK11E4	d2G4 NC					○	○	○										462
	ADK12E4	d2G4 NO					○	○	○										462
Air operated ball valve	**2-port valve**																		
	CHB/CHB-R*	NC/NO/CO				○	○	○	○	○	○	○							706
	CHB-V*/X*	With solenoid valve NC/NO/CO				○	○	○	○	○	○	○							718
	3-port valve																		
	CHG/CHG-R*	NC/NO/CO					○	○	○	○	○	○							712
	CHG-V*/X*	With solenoid valve NC/NO/CO					○	○	○	○	○	○							724
Motor driven ball valve	**2-port valve**																		
	MHB4	Miniature				○	○	○											778
	MXB1	Standard				○	○	○	○	○	○	○							742
	MXB1D	With relay				○	○	○	○	○	○	○							750
	3-port valve																		
	MHG4	Miniature				○	○	○											778
	MXG1	Standard					○	○	○	○	○	○							746
	MXG1D	With relay					○	○	○	○	○	○							754

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column ★ : Rc, G and NPT ○ : Rc ● : Flange ◑: Rc and flange

4 Searching by working fluid

Low/medium vacuum

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve/single unit**																		
	USB2/3	NC	○	○															28/30
	AB31/41/42	NC/NO		★	★	★	★												154
	FGB	NC		○	○	○	○												74
	FVB	NC		○	○	○													94
	2-port valve/manifold																		
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
	GFGB	NC	Individual port: Rc1/8, Rc1/4, common port: Rc1/8, Rc3/8																78
	GFVB	NC	Individual port: Rc1/8, Rc1/4, common port: Rc1/8, Rc1/4																98
	3-port valve/single unit																		
	USG2/3	UNI	○	○															32/34
	AG31/41	UNI		★	★	★													190
	AG33/43	NC pressurization		★	★	★													208
	AG34/44	NO pressurization		★	★	★													226
	FGG	UNI/NC pressurization		○	○	○													84
	3-port valve/manifold																		
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
	GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
	Pressure and explosion proof/2-port valve																		
	AB41EX4	EXdIIBT4 NC			○	○													374
	AB4*E4	d2G4 NC/NO			○	○													424
	Pressure and explosion proof/3-port valve																		
	AG4*EX4	ExdIIBT4 NC pressurization/NO pressurization/UNI			○	○													378
	AG4*E4	d2G4 NC press/NO press UNI			○	○													434
Pilot kick solenoid valve	**2-port valve**																		
	APK11	Piston drive NC			★	★	★	★	★										292
	APK21	Piston drive NC								◑	◑	◑							300
	ADK11	Diaphragm drive/NC			★	★	★	★	★										306
	ADK21	Diaphragm drive/NC								◑	◑	◑							318
	ADK12	Diaphragm drive/NO					★	★	★										306
	PKA	Piston drive NC					○	○	○	●	●	●							800
	Pressure and explosion proof/2-port valve																		
	ADK11E4	d2G4 NC					○	○	○										462
	ADK12E4	d2G4 NO					○	○	○										462

Compressed air Water Hot water Dry air Steam Oil/kerosene Low/medium vacuum
High vacuum Coolant Solvent Inert gas Sludge/powder/chemicals
Process gas Chemical liquid/pure water Gas Controller, etc.

	Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Air operated valve	**2-port valve/single unit**																		
	SAB*V	Air operated valve/NC/NO/CO			○	○	○	○	○	◑	◑	◑							514
	SVB*V	With solenoid valve/NC/NO			○	○	○	○	○	◑	◑	◑							534
	NAB*V (compact)	Air operated valve/NC/NO/CO			○	○													544
	2-port valve/manifold																		
	GNAB*V	NC/NO/CO	Individual port: Rc1/4, common port: Rc3/8																548
	3-port valve/single unit																		
	NAP11	Air operated valve/UNI				○	○	○	○	○	○	○							680
	NVP11	With solenoid valve/UNI				○	○	○	○	○	○	○							684
Air operated diaphragm valve	**2-port valve/single unit**																		
	NAD*V	NC/NO/CO				○													560
	2-port valve/manifold																		
	GNAD*V	NC/NO/CO				○													562

High vacuum

Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
		—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
		M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve/2-port valve																		
HVB212/312/412/512	NC		☆	☆	☆													484
HVB112	NC		▲															490
HVB612/712	NC				ø48 ●	ø52 ●												492
External pilot operated valve/2-port valve																		
AVB	Air operated valve							NW		NW	NW		NW					Ending Page 3

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column: ★: Rc, G and NPT ○: Rc ●: Flange ◑: Rc and flange ▲: NPT NW: Clamp fitting for vacuum
☆: NPT and JXR male and double barbed fitting

4 Searching by working fluid

Coolant

Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
		—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
		M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Air operated valve	**Air operated/2-port valve**																	
	CVE2-***-05	NC/NO 0.5 MPa				○	○	○	○	◑	◑	◑	●	●					856
	CVE2-***-10	NC/NO 1.0 MPa				○	○	○	○	◑	◑	◑	●	●					856
	CVE2-***-16	NC/NO 1.6 MPa				○	○	○	○										866
	CVE2-***-30	NC/NO 3.0 MPa				○	○	○	○										866
	CVE2-***-70	NC/NO 7.0 MPa				○	○	○	○										874
	Air operated (with solenoid valve)/2-port valve																	
	CVSE2-***-05	NC/NO 0.5 MPa				○	○	○	○	◑	◑	◑	●	●					856
	CVSE2-***-10	NC/NO 1.0 MPa				○	○	○	○	◑	◑	◑	●	●					856
	CVSE2-***-16	NC/NO 1.6 MPa				○	○	○	○										866
	CVSE2-***-30	NC/NO 3.0 MPa				○	○	○	○										866
	CVSE2-***-70	NC/NO 7.0 MPa				○	○	○	○										874
	Air operated/3-port valve																	
	CVE3-***-35	3.5 MPa				○	○	○	○	○	○	○							880
	CVE3-***-70	7.0 MPa				○	○	○	○										880
	Air operated (with solenoid valve)/3-port valve																	
	CVSE3-***-35	3.5 MPa				○	○	○	○	○	○	○							880
	CVSE3-***-70	7.0 MPa				○	○	○	○										880

Solvent-based

Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
		—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
		M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port solenoid valve/single unit**																	
	AB21	NC		○	○													150
	AB31/41/42	NC/NO		★	★	★	★											154
	2-port solenoid valve/manifold																	
	GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)															172
	GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)															182
	3-port solenoid valve/single unit																	
	AG31/41	UNI		★	★	★												190
	AG33/43	NC pressurization		★	★	★												208
	3-port solenoid valve/manifold																	
	GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)															198
	GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)															216
	Pressure and explosion proof/2-port valve																	
	AB4*E4	d2G4 NC/NO			○	○												424
	AB41E2	d2G2 NC			○	○												466
	Pressure and explosion proof/3-port valve																	
	AG4*E4	d2G4 NC press/NO press UNI			○	○												434

	Series name	Overview	Port size (upper: nominal, lower: bore size)															Description Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Pilot operated solenoid valve	**2-port valve**																		
	AP11/21	Piston drive NC			★	★	★	★	★	◑	◑	◑							252/262
	AD11/21	Diaphragm drive/NC			★	★	★	★	★	◑	◑	◑							272/282
	AP12/22	Piston drive NO			★	★	★	★	★	◑	◑	◑							252/262
	AD12/22	Diaphragm drive/NO					★	★	★	◑	◑	◑							272/282
	Pressure and explosion proof/2-port valve																		
	AP11E4/AP11E2	d2G4, d2G2 NC					○	○	○	◑	◑	◑							442/470
	AP21E4/AP21E2	d2G4, d2G2 NC								◑	◑	◑							446/474
	AP12E4/AP12E2	d2G4, d2G2 NO					○	○	○	◑	◑	◑							442/470
	AP22E4/AP22E2	d2G4, d2G2 NO								◑	◑	◑							446/474
	AD11E4	d2G4 NC					○	○	○	◑	◑	◑							452
	AD21E4	d2G4 NC								◑	◑	◑							456
	AD12E4	d2G4 NO					○	○	○	◑	◑	◑							452
	AD22E4	d2G4 NO								◑	◑	◑							456
Pilot kick solenoid valve	**2-port valve**																		
	APK11	Piston drive NC			★	★	★	★	★										292
	APK21	Piston drive NC								◑	◑	◑							300
	ADK11	Diaphragm drive/NC			★	★	★	★	★										306
	ADK21	Diaphragm drive/NC								◑	◑	◑							318
	ADK12	Diaphragm drive/NO					★	★	★										306
	Pressure and explosion proof/2-port valve																		
	ADK11E4	d2G4 NC					○	○	○										462
	ADK12E4	d2G4 NO					○	○	○										462
	External pilot operated valve/2-port valve																		
	SAB*S	Air operated valve/NC/NO/CO			○	○	○	○	○	◑	◑	◑							518
Others	**Air operated diaphragm cylinder valve**																		
	LAD	NC/NO/CO				○	○	○	○										556
	NAD	NC/NO/CO				○													560

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column ★ : Rc, G and NPT ○ : Rc ● : Flange ◑: Rc and flange

4 Searching by working fluid

Inert gas

	Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Solenoid valve	**Direct acting 2-port valve/single unit**																		
	AB31/41-Z	NC		★	★	★	★												332
	FGB	NC		○	○	○	○												74
	HVL12	N2/OFF delay solenoid valve		○	Fitting	NW	NW												496
	Direct acting 2-port valve/manifold																		
	GAB3*2/4*2-Z	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																338
	GFGB	NC	Individual port: Rc1/8, Rc1/4, common port: Rc1/8, Rc3/8																78
	Direct acting 3-port valve/single unit																		
	AG3*/4*-Z	NC press/NO press/UNI		★	★	★													342
	FGG	UNI/NC pressurization		○	○	○													84
	Direct acting 3-port valve/manifold																		
	GFGG	UNI	Individual port: Rc1/8, Rc1/4, common port: Rc1/8, Rc1/4																88
	Direct acting pressure and explosion proof/2-port valve																		
	AB41E4-Z	d2G4 NC			○	○													430
	Direct acting pressure and explosion proof/3-port valve																		
	AG4*E4-Z	d2G4 NC press/NO press UNI			○	○													438
	Pilot kick/2-port valve																		
	ADK11-Z	Diaphragm drive/NC			★	★	★	★	★										360
Air operated valve	**2-port valve/single unit**																		
	SAB*A	Air operated valve/NC/NO/CO			○	○	○	○	○				●	●					510
	SVB*A	With solenoid valve/NC/NO			○	○	○	○	○				●	●					530
	NAB* (compact)	Air operated valve/NC/NO/CO			○	○													544
	NPV2	Direct pressure automatic pinch valve							●		●	●	●	●	●				806
	AMDZ*/0*	Gas contact fluororesin		○						Fittings with O.D. ø3, ø6, 1/8" and 1/4"									Ending Page 2
	AMD0*2	Gas contact fluororesin		○	Fittings with O.D. ø6, ø6.35 and 1/4"														Ending Page 2
	AMDZ*3R	Gas contact fluororesin	Fittings with O.D. ø6, 1/8" and 1/4"																1098
	AMD0*3R	Gas contact fluororesin	Fittings with O.D. ø6, ø8, ø10, 1/4" and 3/8"																1100
	AMD3*3R	Gas contact fluororesin	Fittings with O.D. ø10, ø12, 3/8" and 1/2"																1104
	AMD4*3R	Gas contact fluororesin	Fittings with O.D. 3/4"																1108
	AMD5*3R	Gas contact fluororesin	Fittings with O.D. ø25 and 1"																1112
	2-port valve/manifold																		
	GNAB*	Manifold NC/NO/CO	Individual port: Rc1/4, common port: Rc3/8																548
	3-port valve																		
	AMGZ0/00	Gas contact fluororesin	Fittings with O.D. ø3, ø6, 1/8" and 1/4"																Ending Page 2
	AMGZ03R	Gas contact fluororesin	Fittings with O.D. ø6 and 1/4"																1116
	AMG003R	Gas contact fluororesin	Fittings with O.D. ø6, ø8, ø10, 1/4" and 3/8"																1118
	AMG*03R	Gas contact fluororesin	Fittings with O.D. ø10, ø12, ø25, 3/8", 1/2", 3/4" and 1"																1122
	Manual valve/2-port valve																		
	HPV	Pinch valve							●		●	●	●	●	●				807
	MMD303RN	Gas contact fluororesin	Fittings with O.D. ø10, ø12, 3/8" and 1/2"																Ending Page 2
	MMD403RN	Gas contact fluororesin	Fittings with O.D. 3/4"																Ending Page 2
	MMD503RN	Gas contact fluororesin	Fittings with O.D. ø25 and 1"																Ending Page 2
	Regulator																		
	PYM10	Nitrogen/stainless steel body		○	○														Ending Page 2
Others	**Air operated diaphragm cylinder valve**																		
	LAD	NC/NO/CO				○	○	○	○										556
	NAD	NC/NO/CO				○													560

Compressed air Water Hot water Dry air Steam Oil/kerosene Low/medium vacuum
High vacuum Coolant Solvent Inert gas Sludge/powder/chemicals
Process gas Chemical liquid/pure water Gas Controller, etc.

Sludge/powder/chemicals

Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
		—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
		M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
External pilot operated valve 2-port valve																		
NPV2	Direct pressure automatic pinch valve							●		●	●	●	●	●				806
Manual valve 2-port valve																		
HPV	Pinch valve							●		●	●	●	●	●				807

Process gas

Series name	Overview	Port size	Description Page
External pilot operated valve 2-port valve			
AGD0*R	Air operated valve/NC/NO	1/4" JXR male fitting/female fitting	Ending Page 3
AGD**R	Air operated valve/NC/NO	1/4" JXR male fitting/female fitting, 1/4" double barbed fitting, 3/8" JXR male fitting/female fitting, 3/8" double barbed fitting	Ending Page 3
LGD**	Air operated valve/NC/NO	1/4" JXR male fitting equivalent/female fitting equivalent, 1/4" double barbed fitting, 1/2" JXR male fitting equivalent/female fitting equivalent (3/8" compatibility), 3/8" double barbed fitting, 1/2" double barbed fitting	1150
Manual valve			
OGD*0R	90° rotation snap action type	1/4" JXR male fitting/female fitting, 1/4" double barbed fitting, 3/8" JXR male fitting/female fitting, 3/8" double barbed fitting	Ending Page 3
MGD*0R	270° rotation	1/4" JXR male fitting/female fitting, 1/4" double barbed fitting, 3/8" JXR male fitting/female fitting, 3/8" double barbed fitting	Ending Page 3
LGD*0	180° rotation	1/4" JXR male fitting equivalent/female fitting equivalent, 1/4" double barbed fitting, 1/2" JXR male fitting equivalent/female fitting equivalent (3/8" compatibility), 3/8" double barbed fitting, 1/2" double barbed fitting	1153

* Overview column: NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column: ★ : Rc, G and NPT ○ : Rc ● : Flange ◑: Rc and flange NW: Clamp fitting for vacuum

4 Searching by working fluid

Chemical liquid/pure water

	Series name	Overview	Port size (upper: nominal, lower: bore size)																Page
			—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
			M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
Direct acting solenoid valve	**2-port valve**																		
	USB resin body	NC	M6, barbed fitting (compatible tube size ø6 x ø4)																36
	UMB1	NC	Stainless steel pipe with O.D. ø1.26 x I.D. ø0.9																965
	HB11/21/31/41	NC	○	○	○	○													967
	HMTB1	NC	ø2 barbed fitting																962
	MR10R	NC/NO	M5, M6, 1/4-28UNF																927
	MAB1	NC	M6																940
	MEB2	NC		○															952
	MYB1/2/3	NC	M6	○	○	○													943/946/949
	EMB21	NC			○														957
	EMB41/51	NC				○	○	ø10 x ø8 PFA tube connection											959
	3-port valve																		
	USG resin body	UNI	M6, barbed fitting (compatible tube size ø6 x ø4)																36
	UMG1	UNI	Stainless steel pipe with O.D. ø1.26 x I.D. ø0.9																965
	HMTG1	UNI	ø2 Barbed fitting																962
	MR10R	UNI	M5, M6, 1/4-28UNF																927
	MAG1	UNI	M6																940
	MEG2	UNI		○															952
	MYG1/2/3	UNI	M6	○	○	○													943/946/949
	HYN	NC pressurization/NO pressurization UNI	Silicone tube (ø2 x ø0.5 / ø3 x ø1 / ø5 x ø3 / ø8 x ø6)																971
Air operated diaphragm valve	**2-port valve/single unit**																		
	LAD	NC/NO/CO				○	○	○	○										556
	NAD	NC/NO/CO				○													560
	2-port valve/manifold																		
	GNAD	NC/NO/CO				○													562
Air operated diaphragm valve	**2-port valve**																		
	AMDZ*/0*	Air operated valve/NC/NO/CO		○						Fittings with O.D. ø3, ø6, 1/8" and 1/4"									Ending Page 2
	AMSZ2/AMS022	Drip prevention valve		○	Fittings with O.D. ø3, ø6, 1/8" and 1/4"														Ending Page 2
	AMDSZ0/AMDS00	Air operated valve/ drip prevention valve integrated	Fittings with O.D. ø3, ø6, 1/8" and 1/4"																Ending Page 2 Ending Page 2
	AMDZ*3R	Wetted part fluororesin	Fittings with O.D. ø6, 1/8" and 1/4"																1098
	AMD0*3R	Wetted part fluororesin	Fittings with O.D. ø6, ø8, ø10, 1/4" and 3/8"																1100
	AMD3*3R	Wetted part fluororesin	Fittings with O.D. ø10, ø12, 3/8" and 1/2"																1104
	AMD4*3R	Wetted part fluororesin	Fittings with O.D. 3/4"																1108
	AMD5*3R	Wetted part fluororesin	Fittings with O.D. ø25 and 1"																1112
	3-port valve																		
	AMGZ0/00	Wetted part fluororesin	Fittings with O.D. ø3, ø6, 1/8" and 1/4"																Ending Page 2
	AMGZ03R	Wetted part fluororesin	Fittings with O.D. ø6 and 1/4"																1116
	AMG003R	Wetted part fluororesin	Fittings with O.D. ø6, ø8, ø10, 1/4" and 3/8"																1118
	AMG*03R	Wetted part fluororesin	Fittings with O.D. ø10, ø12, ø25, 3/8", 1/2", 3/4" and 1"																1122
Manual valve	**2-port valve**																		
	MMD303RN	Wetted part fluororesin	Fittings with O.D. ø10, ø12, 3/8" and 1/2"																Ending Page 2
	MMD403RN	Wetted part fluororesin	Fittings with O.D. 3/4"																Ending Page 2
	MMD503RN	Wetted part fluororesin	Fittings with O.D. ø25 and 1"																Ending Page 2
Others	**Regulator**																		
	PYM10	Stainless steel body		○	○														Ending Page 2
	PMP*02	Wetted part fluororesin	Fittings with O.D. ø6, ø10, 1/4", 3/8", 1/2", 3/4" and 1"																Ending Page 2
	Level switch																		
	KML50/60/703	Various fluids surface level switch																	Ending Page 2

Compressed air Water Hot water Dry air Steam Oil/kerosene Low/medium vacuum
High vacuum Coolant Solvent Inert gas Sludge/powder/chemicals
Process gas Chemical liquid/pure water Gas Controller, etc.

Combustion gas

Series name	Overview	Port size (upper: nominal, lower: bore size)															Page
		—	6A	8A	10A	15A	20A	25A	32A	40A	50A	65A	80A	100A	125A	150A	200A	
		M5	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	
2-port valve/single unit																		
AB31/41/42	NC/NO		★	★	★	★												154
2-port valve/manifold																		
GAB3*2/4*2	NC	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																172
GAB422	NO	Individual port: Rc1/4, common port: Rc3/8 (G/NPT available)																182
3-port valve/single unit																		
AG31/41	UNI		★	★	★													190
AG33/43	NC pressurization		★	★	★													208
AG34/44	NO pressurization		★	★	★													226
3-port valve/manifold																		
GAG31*/35*/41*/45*	UNI	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																198
GAG33*/43*	NC pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																216
GAG34*/44*	NO pressurization	Individual port: Rc1/4, common port: Rc3/8, NO port: Rc1/8, Rc1/4, Rc3/8 (G/NPT available)																234
Gas combination valve																		
GHV	Low pressure/intermediate pressure							◎	◎	◎	◎							980
GAV	Low pressure						◎	◎	◎	◎								984
Solenoid valve																		
DSG	Low pressure					◎	◎	◎										986
DSG-W	Low pressure						◎	◎										990
VNA	Low pressure/intermediate pressure					◎	◎	◎	◎	◎	◎	◎						992
VLA	Low pressure/intermediate pressure					◎	◎	◎	◎	◎	◎	◎						998
VNA-R/RH	Low press/interm press/med press						◎	◎	◎	◎								1002
VNR	Low pressure/intermediate pressure					◎	◎	◎	◎	◎								1006
Medium pressure gas safety shutoff control system																		
TAC-25	Medium pressure							IN side ●		OUT side ●								1008
VNM	Low press/interm press/med press							●										1012
VLM	Low press/interm press/med press							●										1014
C25N-B	Medium pressure							IN side ●		OUT side ●								1016
Safety shut off valve																		
VNM-25-K	Low press/interm press/med press							●										1018
Motorized valve																		
HK1	Low press/interm press/med press									◉	◉	◉	●	▲	▲	▲	▲	1020
HS	Low press/interm press/med press										●		●					1024
Ball valve																		
GASB	Low press/interm press/med press										●		●	●				1028

* Port size column: ◎ : RP ● : JIS flange ▲ : DIN flange ◉ : RP and JIS flange

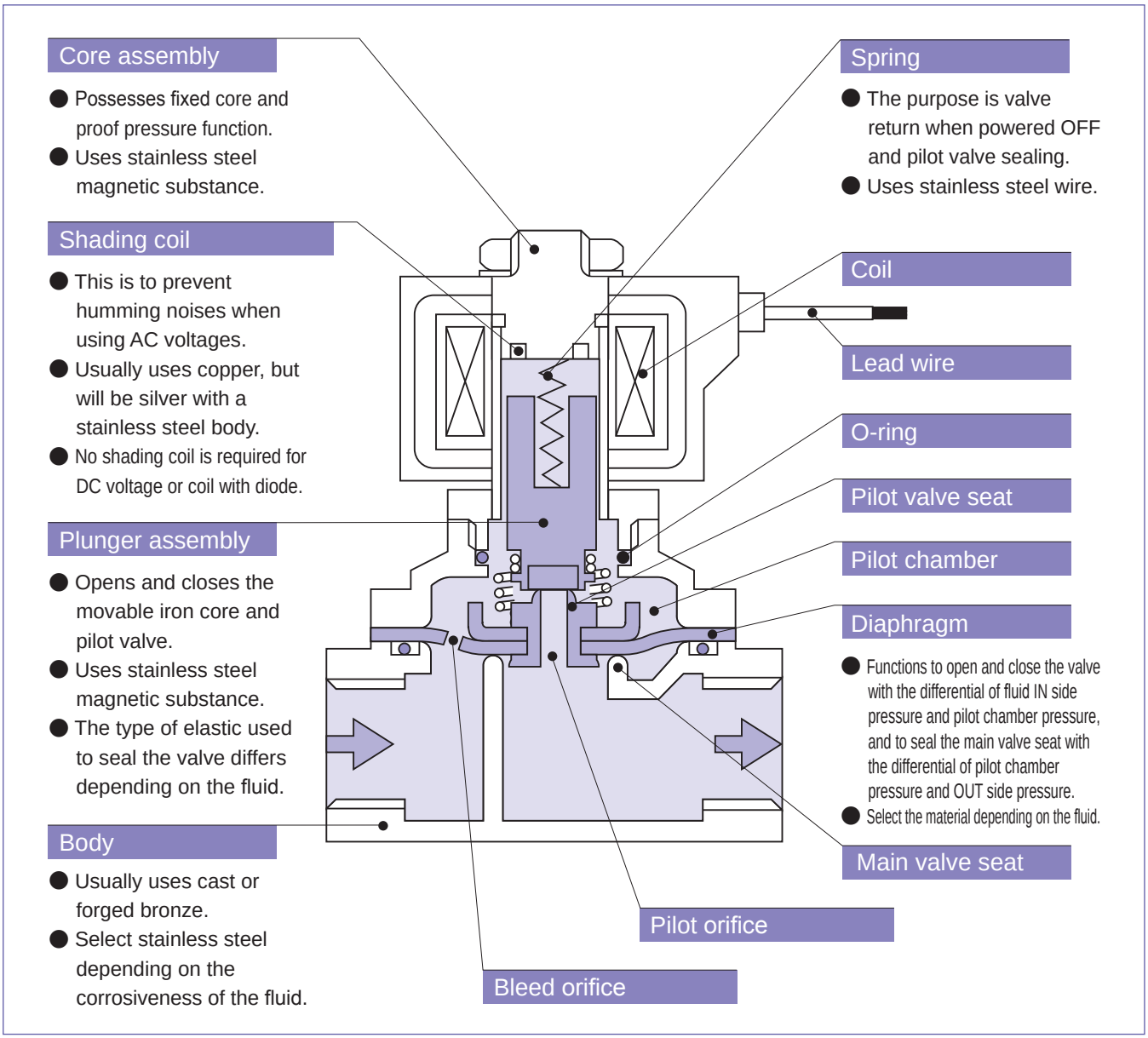
Controller, etc.

Series name	Applications	Page
RSC-S5	Automatic watering controller (solar power type) for golf course, greenbelts, farmlands, etc.	1040
RSC-G	Automatic watering controller (commercial power type) for greenbelts, parks, playgrounds, etc.	1042
RSC-1WP	Battery operated watering controller	1044
OMC2	Sequential fluid control components for large port size dust collector valve (PD3/PDV3)	848
RS-6	Rain sensor (automatically detects rainfall of 6 mm or more. No power unit is required.)	1050
RSC-2WP	Automatic watering controller for golf courses, greenbelts, parks, farmlands, etc.	1048

* Overview column : NC: NC (open when energized) NO: NO (closed when energized) NC pressurization: NC pressurization type
NO pressurization: NO pressurization type NC: NC (normally closed) type NO: NO (normally open) type UNI: Universal CO: Double acting
* Port size column: ★ : Rc, G and NPT ☆ :R ○ : Rc ● : Flange ◑: Rc and flange

Check list of material combination by working fluid

The CKD fluid control valves can be used with many different gases and liquids; the fluid wetted parts are shown below.
The effect of these fluids on the material must be carefully considered when selecting the model.
Refer to the working fluid check list for each valve.



* The above figure shows the pilot kick diaphragm drive NC (open when energized) 2-port valve (ADK11 Series).

Working fluid check list ❶

For multi-type fluid control 2, 3-port solenoid valves

⚠ CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. As there may be cases when general specifications do not apply, check the compatibility as needed and take the necessary safety measures on the equipment before use.

[Indicates the compatibility of sealant material, body material and working fluid.]

A Acetaldehyde to A Aqueous potassium chloride ●: Usable ▲: Usable with conditions ×: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination: [Body material] Copper alloy/Bronze – [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	[Body material] Stainless steel – [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	Note on model No. selection
A Acetaldehyde	Liquid	×	×	×	●	×	×	×	●	Flammable liquid. If explosion proof is specified by the surrounding environment, select explosion proof (d2G4).
Acetone	Liquid	×	×	●	●	×	×	●	●	Flammable liquid. If explosion proof is specified by the surrounding environment, select explosion proof (d2G4).
Acetylene	Gas	×	×	×	×	▲	▲	×	▲	Highly explosive gas. Contact CKD during model selection. If explosion proof (d3G2) is specified, CKD solenoid valves cannot be used. Instead use an air operated.
Acrylic/nitriles	Liquid	×	×	×	×	×	×	●	●	Highly flammable liquid. Toxic substance. Contact CKD during model selection.
AE solvent	Liquid (powder)	×	×	×	×	×	×	×	×	Cement hardener.
Ammonia	Gas	×	×	×	×	×	×	▲	▲	Specify a coil with a diode or the DC voltage model. (*1)
Amyl alcohols	Liquid	×	●	●	●	×	●	●	●	Ethylene propylene rubber is more suitable than fluoro-rubber.
Aniline	Liquid	×	×	×	×	×	●	●	●	Organic solvents used in paints or dyes.
Aqueous ammonia	Liquid	×	×	×	×	×	×	▲	▲	Same as above. AKA: Ammonium hydroxide.
Aqueous ammonium chloride	(Crystal)	×	×	×	×	×	×	×	×	Solenoid valves not suitable. Select a completely resin air operated valve.
Aqueous ammonium sulfate	(Solid)	×	×	×	×	×	×	×	×	AKA: Ammonium sulfate. Nitrogen fertilizer.
Aqueous calcium hydroxide	(Solid)	×	×	×	×	●	●	●	●	AKA: Slaked lime. Used as a neutralizing agent for wastewater treatment. Take note of viscosity. Strong alkali. This resists dissolving in water, so may not be appropriate for solenoid use if it leaves grains behind.
Aqueous copper sulfate	(Solid)	×	×	×	×	×	×	×	×	Used in agricultural chemicals, pigments, and copper plating.
Aqueous magnesium chloride	(Crystal)	×	×	×	×	×	×	×	×	Cannot be used with metal.
Aqueous nickel sulfate	(Solid)	×	×	×	×	×	×	×	×	Used as a nickel plating solution.
Aqueous potassium chloride	(Crystal)	×	×	×	×	×	×	×	×	Cannot be used with metal.

*1: AG, AB42, AP12, AP22, AD12, AD22, explosion-proof (excluding ADK) and PVS cannot be used even with a coil with diode or DC voltage.

Working fluid check list ❶

For multi-type fluid control 2, 3-port solenoid valves

[Indicates the compatibility of sealant material, body material and working fluid.]

A Aqueous potassium cyanide to B Butyl alcohol ●: Usable ▲: Usable with conditions ×: Unusable

	Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Copper alloy/Bronze [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	[Body material] Stainless steel [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	Note on model No. selection
A	Aqueous potassium cyanide		×	×	×	×	●	●	●	●	AKA: Cyanide potash. A poisonous chemical used in plating solutions.
	Aqueous potassium dichromate	(Solid)	×	×	×	×	×	●	●	●	-
	Aqueous potassium permanganate	(Crystal)	×	×	×	×	×	×	×	●	Used for analysis. Strong oxidant. Take care when using as crystals may form as it dries out.
	Aqueous silver nitrate	(Solid)	×	×	×	×	▲	▲	▲	▲	Used for analysis or as a photosensitive developing agent. Specify a coil with a diode or the DC voltage model. (*1)
	Aqueous sodium bicarbonate	(Solid)	×	×	×	×	●	●	●	●	AKA: baking soda. Used as a food additive.
	Aqueous sodium silicate	(Crystal)	●	●	●	●	●	●	●	●	AKA: waterglass. Used in phosphate-free detergents. Take note of viscosity and concentration. Select stainless steel for high concentrations, as it is classified as an alkaline aqueous solution.
	Aqueous sodium sulfate	(Solid)	×	×	×	×	×	×	×	×	AKA: Aqueous sodium sulfide.
	Argon	Gas	●	●	●	●	●	●	●	●	This is an inert gas so there is no corrosion. Specify oil-prohibited specifications. Select a dry air AB type solenoid (option code: Z) or a FGB special purpose valve.
B	Benzine	Liquid	×	×	×	●	×	×	×	●	Solvent. Volatile. Flammable liquid. This forms an explosive gas when mixed with air. Contact CKD during model selection.
	Benzol	Liquid	×	×	×	●	×	×	×	●	AKA: Benzene. Flammable liquid. Harmful substance. Limited to use in environments with well-equipped exhaust equipment. Contact CKD during model selection.
	Brake fluid	Liquid	×	×	●	●	×	×	●	●	-
	Butane gas	Gas	●	●	×	●	●	●	×	●	If explosion proof is specified by the surrounding environment, select explosion proof (d2G2) or (d2G4). This is a custom-made product as it generates sticky material. Refer to Intro Page 45 "⚠Using general purpose valves with flammable gas".
	Butyl acetate	Liquid	×	×	×	●	×	×	×	●	Flammable liquid. Acute toxic substance. Contact CKD about usage.
	Butyl alcohol	Liquid	×	●	●	●	×	●	●	●	AKA: Butanol. If explosion proof is specified by the surrounding environment, select explosion proof (d2G2) or (d2G4). Flammable liquid. Contact CKD during model selection.

*1: AG, AB42, AP12, AP22, AD12, AD22, explosion-proof (excluding ADK) and PVS cannot be used even with a coil with diode or DC voltage.

⚠ CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. As there may be cases when general specifications do not apply, check the compatibility as needed and take the necessary safety measures on the equipment before use.

[Indicates the compatibility of sealant material, body material and working fluid.]

C Carbon dioxide to E Ethylene oxide gas

●: Usable ▲: Usable with conditions ×: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination: [Body material] Copper alloy/Bronze [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	[Body material] Stainless steel [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	Note on model No. selection
C Carbon dioxide	Gas	●	●	●	●	●	●	●	●	-
Carbon tetrachloride	Liquid	×	×	×	●	×	×	×	●	Flame retardant. A solvent for dry cleaning. Acute toxic substance.
Carbonated water	Liquid	●	●	●	●	●	●	●	●	-
Castor oil	Non-drying	×	×	×	×	●	●	×	●	Used as a laxative. Vegetable oils.
Caustic soda	(Solid)	×	×	×	×	●	×	●	●	Take care when using as crystals may form as the fluid dries out. (Crystals may adhere to the OUT side of the valve, causing it to lock)
Chloroform	Liquid	×	×	×	●	×	×	×	●	AKA: Trichloromethane. Acute toxic substance. Contact CKD about usage.
City gas	Gas	●	●	×	●	●	●	×	●	We recommend a GASREX valve. Refer to Intro Page 45 "⚠Using general purpose valves with flammable gas".
Cottonseed oil	Semi-drying	×	●	×	●	×	●	×	●	For food products.
Cresol	Solid (liquid)	×	×	×	×	×	●	×	●	Disinfectant. AKA: Methyl phenol.
D Dichloride benzene	Liquid (solid)	×	×	×	●	×	×	×	●	AKA: Dichlorobenzene.
Dimethyl silicone oil	Liquid	●	●	●	●	●	●	●	●	In general, this is known as silicone oil.
Dry air	Gas	●	●	●	●	●	●	●	●	Select an AB type solenoid valve for dry air (option code: Z).
E Ethyl acetate	Liquid	×	×	×	●	×	×	×	●	A solvent for paint. If explosion proof is specified by the surrounding environment, select explosion proof (d2G2) or (d2G4).
Ethyl alcohol (industrial)	Liquid	×	×	●	●	×	×	●	●	AKA: Ethanol. If explosion proof is specified by the surrounding environment, select explosion proof (d2G2) or (d2G4).
Ethyl alcohol (pure)	Liquid	×	●	●	●	×	●	●	●	
Ethyl ether	Liquid	×	×	×	●	×	×	×	●	In general, these are known as ethers.
Ethylene chloride	Gas	×	×	×	×	×	×	×	●	AKA: Ethyl chloride. Requires dry conditions. Select a CKD air operated valve for chemical liquids if moisture is present. Flammable gas. Contact CKD during model selection.
Ethylene glycol	Liquid	●	●	●	●	●	●	●	●	Used as anti-freeze.
Ethylene oxide gas	Gas	×	×	×	×	×	×	×	×	AKA: E.O.G. Boils into gas at 10.4°C. Explosive gas.

Working fluid check list ❶

For multi-type fluid control 2, 3-port solenoid valves

[Indicates the compatibility of sealant material, body material and working fluid.]

F Formalin to K Kerosene

●: Usable ▲: Usable with conditions ×: Unusable

Fluid name		Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination [Body material] Copper alloy/Bronze [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	[Body material] Stainless steel [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	Note on model No. selection
F	Formalin	(Gas)	×	×	×	×	×	×	●	●	AKA: Formaldehyde.
Freon gas	R23	Liquid and gas	×	×	×	●	×	×	×	●	AKA: HFC23
	R32		×	×	●	●	×	×	●	●	AKA: HFC32
	R125		●	×	●	●	●	×	●	●	AKA: HFC125
	R134a		×	×	×	●	×	×	×	●	AKA: HFC134a
	R143a		●	×	●	●	●	×	●	●	AKA: HFC143a
	R404A		×	×	×	●	×	×	×	●	For HFC125/143a/134a mixtures
	R407C		×	×	×	●	×	×	×	●	For HFC32/125/134a mixtures
	R407E		×	×	×	●	×	×	×	●	For HFC32/125/134a mixtures
	R410A		×	×	●	●	×	×	●	●	For HFC32/125 mixtures
	R507A		●	×	●	●	●	×	●	●	For HFC125/143a mixtures
G	Gasoline	Liquid	×	▲	×	●	×	▲	×	●	Contact CKD during model selection, as it cannot be used even with fluoro-rubber in some cases.
	Glycerin	Liquid	●	●	●	●	●	●	●	●	Take note of viscosity. For direct acting 2-port valves, the fluid viscosity must be 50 mm2/s or less. Pilot operated solenoid valves cannot be used.
H	Heavy oil A	Liquid	▲	●	×	●	▲	●	×	●	Take care when selecting the sealant if an additive has been added.* 2
	Heavy oil B	Liquid	●	●	×	●	●	●	×	●	-
	Heavy oil C	Liquid	×	●	×	●	×	●	×	●	Take note of viscosity. We recommend the LLO solenoid for heavy oil.
	Helium	Gas	●	●	●	●	●	●	●	●	Inert gas. Non-corrosive.
	Heptane	Liquid	●	●	×	●	●	●	×	●	Flammable liquid. Contact CKD during model selection.
	Hexanol	Liquid	×	●	●	●	×	●	●	●	AKA: Hexyl alcohol.
	Hydrogen	Gas	●	●	●	●	●	●	●	●	This forms an explosive gas combination when mixed with air. Explosion proof (d3G1) specifications are not available. Contact CKD during model selection.
	Hydrogen peroxide solution	Liquid	×	×	×	×	×	×	×	▲	Oxidant. Used in disinfectants and sterilization agents. Usually 30 to 50% water soluble. Specify a coil with a diode or the DC voltage model. (*1)
	Hydrogen sulfide solution	Water + gas	×	×	×	×	×	×	×	×	Select a completely resin air operated valve.
I	Isopropyl acetate	Liquid	×	×	×	●	×	×	×	●	Flammable liquid. Acute toxic substance. Contact CKD about usage. Paint solvent.
	Isopropyl alcohol	Liquid	●	●	●	●	●	●	●	●	AKA: IPA. Used in semiconductor washers.
K	Kerosene	Liquid	●	●	×	●	●	●	×	●	AKA: kerosene. Jet fuel is known as kerosene.

*1: AG, AB42, AP12, AP22, AD12, AD22, explosion-proof (excluding ADK) and PVS have a shading coil and cannot be used even with a coil with diode or DC voltage.

*2: High calorie heavy oil A is increasingly used for small boilers, etc.
Nitrile rubber cannot be used with “high-calorie heavy oil A”.

⚠CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. As there may be cases when general specifications do not apply, check the compatibility as needed and take the necessary safety measures on the equipment before use.

[Indicates the compatibility of sealant material, body material and working fluid.]
●: Usable ▲: Usable with conditions ×: Unusable

L Lacquer to O Oxygen

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination: [Body material] Copper alloy/Bronze – [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	[Body material] Stainless steel – [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	Note on model No. selection
L Lacquer	Liquid	×	×	×	●	×	×	×	●	If explosion proof is specified by the surrounding environment, select explosion proof (d2G2) or (d2G4).
Lactic acid	Liquid	×	×	×	×	×	●	●	●	Used for brewing or drinking.
Light oil	Liquid	●	●	×	●	●	●	×	●	-
Linseed oil		×	×	×	×	●	●	×	●	Take note of viscosity. For direct acting 2-port valves, the fluid viscosity must be 50 mm2/s or less. Pilot operated solenoid valves cannot be used.
M Methane gas	Gas	●	●	×	●	●	●	×	●	Refer to Intro Page 45 "⚠Using general purpose valves with flammable gas".
Methyl acetate	Liquid	×	×	×	●	×	×	×	●	Flammable liquid. Acute toxic substance. Contact CKD about usage.
Methyl alcohol	Liquid	×	×	●	●	×	×	●	●	AKA: Methanol. Flammable liquid. Acute toxic substance. Contact CKD during model selection.
Methyl chloride	Gas	×	×	×	×	×	×	×	●	AKA: Chloromethane. Boils into gas at -23°C. Requires dry conditions. Select a CKD air operated valve for chemical liquids if moisture is present. Contact CKD during model selection.
Methyl ether	Gas	×	×	×	●	×	×	×	●	-
Methyl ethyl ketone	Liquid	×	×	●	●	×	×	●	●	AKA: MEK. Highly flammable liquid. Limited to use in environments with well-equipped exhaust equipment. Contact CKD during model selection.
Methylene chloride	Liquid	×	×	×	×	×	×	×	●	AKA: Dichloromethane. Contact CKD during model selection.
N Naphtha	Liquid	×	×	×	●	×	×	×	●	-
Natural gas	Gas	●	●	×	●	●	●	×	●	AKA: LNG. Specific gravity: 0.65. We recommend a GASREX/AB/AG valve. Refer to Intro Page 45 "⚠Using general purpose valves with flammable gas".
Nitric acid 30%	Liquid	×	×	×	×	×	×	×	×	Solenoid valves cannot be used. We recommend a CKD air operated valve for chemical liquids.
Nitrogen	Gas	●	●	●	●	●	●	●	●	Inert gas. Non-corrosive. Oil-prohibited specifications. We recommend an AB type solenoid valve for dry air (option code: Z) or an FGB special purpose valve.
O Oxygen	Gas	×	●	●	●	×	●	●	●	Oil-prohibited treatment is required as it may spontaneously ignite when exposed to oil. Contact CKD during model selection.

Working fluid check list ❶

For multi-type fluid control 2, 3-port solenoid valves

[Indicates the compatibility of sealant material, body material and working fluid.]

O Ozone (several ppm or less) to V Vacuum (medium vacuum)　●: Usable　▲: Usable with conditions　×: Unusable

Fluid name	Fluid properties (Displays the state of the raw material even if the fluid indicates water solubility)	Material combination: [Body material] Copper alloy/Bronze, [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	[Body material] Stainless steel, [Sealant material] Nitrile rubber	Fluoro rubber	Ethylene propylene	Tetrafluoroethylene resin	Note on model No. selection
O Ozone (several ppm or less)	Gas	×	×	×	×	×	▲	▲	▲	Specify a coil with a diode or the DC voltage model. (*1)
P Perchloroethylene	Liquid	×	×	×	×	×	●	×	●	AKA: Ethylene tetrachloride. Limited to use in environments with well-equipped exhaust equipment for acutely poisonous materials. A volatile solvent for dry cleaning. Contact CKD during model selection.
Phenol	(Crystal)	×	×	×	×	×	●	×	●	Used as a disinfectant and local anesthetic.
Phosphoric acid	Liquid	×	×	×	×	×	×	×	×	-
Propane gas	Gas	●	●	×	●	●	●	×	●	This is a custom-made product as it generates sticky material. We recommend a GASREX valve. Refer to Intro Page 45 "⚠Using general purpose valves with flammable gas".
Propyl alcohol	Liquid	×	●	●	●	×	●	●	●	-
S Sodium acetate	(Solid)	●	●	×	●	●	●	×	●	Dye.
Sodium borate	(Crystal)	×	×	×	×	●	●	●	●	AKA: Borax.
Sodium hydroxide (30% or more)	(Solid)	×	×	×	×	×	×	●	●	Same as above. Same conditions.
Sodium hydroxide (below 30%)(AKA: caustic soda)	(Solid)	×	×	×	×	●	×	●	●	Take care when using as crystals may form as the fluid dries out. (Crystals may adhere to the OUT side of the valve, causing it to lock)
Sodium perchlorate	Liquid	×	×	×	×	×	×	×	●	AKA: Perchlorate soda. Cannot be used with rubber.
T Table vinegar	Liquid	×	×	×	×	×	×	×	×	AKA: vinegar. This falls under the same conditions as "acetic acid".
Tannic acid	(powder)	×	×	×	×	●	●	●	●	-
Toluene	Liquid	×	×	×	●	×	×	×	●	If explosion proof is specified by the surrounding environment, select explosion proof (d2G2) or (d2G4). Note that it is volatile and take care with temperatures. Flammable liquid. Acute toxic substance. Contact CKD during model selection.
Trichloroethane	Liquid	×	×	×	▲	×	×	×	●	The corrosiveness increases when mixed with water.
Trichloroethylene	Liquid	×	×	×	▲	×	×	×	●	AKA: Trichlene. Acute toxic substance. Contact CKD during model selection.
Turpentine	Liquid	●	●	×	●	●	●	×	●	Rosin oil. Used in solvents and pharmaceutical products. Ignition point: 35°C.
V Vacuum (high vacuum)	-	×	×	×	×	×	×	×	×	We recommend a valve for high vacuum (HVB type).
Vacuum (medium vacuum)	-	●	●	×	×	●	●	×	×	We recommend a special purpose valve for medium vacuum (FVB).

*1: AG, AB42, AP12, AP22, AD12, AD22, explosion-proof (excluding ADK) and PVS have a shading coil and cannot be used even with a coil with diode or DC voltage.

⚠Using general purpose valves with flammable gas

When using with combustible gas, install an evaporator or provide drainage measures (raise the piping, install a trap, etc.) so that the liquefied gas does not enter the solenoid valve. Observe the laws and periodic inspections set forth for each gas device.
When using LPG (butane gas, propane gas), standard parts may not be available depending on the gas properties. Contact CKD to select the optimum model.

Working fluid check list ❷

- For air operated 2-port valves (cylinder valves)
- For motorized 2-port ball valves
- For air operated 2, 3-port ball valves (compact rotary valves)

⚠CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the valve performance. During actual use, there are unpredictable elements. There may be cases when general specifications do not apply, and since only certain greases can be used for initial lubrication of moving parts, which depend on the fluid or application, check the compatibility as needed and take the necessary safety measures on the equipment before use.

●: Usable ▲: Usable with conditions ×: Unusable -: No usage examples

*1: Usable with conditions means that use is possible if conditions given in ( ) after the fluid names are satisfied.

Material combination		Sub-plate material	-								Copper alloy		Stainless steel		Aluminum	
		Body material	Copper alloy/Bronze				Stainless steel				Polypropylene resin		Stainless steel		Polypropylene resin	
Fluid name		Sealant	NBR	FKM	PTFE	EPDM	NBR	FKM	PTFE	EPDM	NBR	FKM	NBR	FKM	NBR	FKM
A	Acetylene (Use an air operated for explosion proof specifications.)		×	×	×	×	●	●	●	×	×	×	●	●	×	×
	AE solvent		▲	▲	▲	×	●	●	●	×	▲	▲	●	●	×	×
	Aqueous sodium silicate		●	●	●	●	●	●	●	●	●	●	●	●	-	-
	Argon		●	●	●	-	●	●	●	-	●	●	●	●	●	●
C	Carbon dioxide		●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Carbonated water		-	-	-	-	▲	▲	▲	●	-	-	▲	▲	×	×
	Cresol		-	-	-	-	×	●	●	×	×	●	×	●	×	×
E	Ethylene glycol		●	●	●	●	●	●	●	●	●	●	●	●	●	●
G	Gasoline (pure gasoline)		×	▲	●	×	×	▲	●	×	×	×	×	▲	×	×
	Glycerin		-	-	-	-	●	●	●	●	●	●	●	●	-	-
H	H2 gas (not for high temp. Use air operated for explo-proof specs)		●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Heavy oil A (FKM is recommended if it contains additives)		▲	●	●	×	▲	●	●	×	▲	●	▲	●	-	-
	Heavy oil B		●	●	●	×	●	●	●	×	●	●	●	●	-	-
	Heavy oil C		×	●	●	×	×	●	●	×	×	●	×	●	-	-
K	Kerosene		●	●	●	×	●	●	●	×	●	●	●	●	-	-
L	Light oil		●	●	●	×	●	●	●	×	●	●	●	●	●	●
	Linseed oil		×	×	×	-	●	●	●	×	×	×	●	●	-	-
N	Natural gas		●	●	●	-	●	●	●	-	●	●	●	●	●	●
	Nitrogen gas		●	●	●	●	●	●	●	●	●	●	●	●	●	●
O	Ozone (low concentration. Several ppm or less)		×	×	×	×	×	▲	●	▲	×	▲	×	▲	-	-
P	Propane gas		●	●	●	×	●	●	●	×	●	●	●	●	●	●
	Pure water		-	-	-	-	×	●	●	-	-	-	×	●	×	×
S	Silicone oil		×	●	●	-	×	●	●	-	×	●	×	●	×	●
	Soapy water		-	-	-	-	●	●	●	●	-	-	●	●	×	×
	Sodium hydroxide		×	×	×	×	▲	×	●	●	×	×	▲	×	×	×
With/without options for each model ☆: Standard products ○: Option available	Cylinder valve	NAB1/2/3	☆	○	-	-	○	○	-	-	-	-	-	-	-	-
		NAB1V/2V/3V	☆	○	-	-	○	○	-	-	-	-	-	-	-	-
		GNAB1/2/3	-	-	-	-	-	-	-	-	☆	○	○	○	○	○
		GNAB1V/2V/3V	-	-	-	-	-	-	-	-	☆	○	○	○	○	○
		SAB1/2/3, SVB1/2	☆	○	-	○	☆	○	-	○	-	-	-	-	-	-
		SAB1S/2S/3S, SVB1S/2S	-	-	☆	-	-	-	☆	-	-	-	-	-	-	-
	Compact rotary valve	CHB	-	☆	-	-	-	☆	-	-						
		CHG	-	☆	-	-	-	☆	-	-						
	Motorized ball valve	MXB1/MSB1	-	☆	-	-	-	☆	-	-						
		MXG1	-	☆	-	-	-	☆	-	-						
		MHB4	-	☆	-	-	-	-	-	-						
		MHG4	-	☆	-	-	-	-	-	-						

Working fluid check list ❸

For pinch valve

⚠CAUTION

This check list displays guidelines for typical corrosion resistance, and does not guarantee the solenoid valve performance. During actual use, there are unpredictable elements. As there may be cases when general specifications do not apply, check the compatibility as needed and take the necessary safety measures on the equipment before use.

Rubber sleeve chemical resistance

●: Barely degrades ▲: May degrade but can be used depending on conditions
×: Degrades, unusable Test temperature shown in parentheses, 60 = 60°C RT = Room Temperature

	Chemical name	Chemical formula	Concentration	Rubber sleeve	
				Natural rubber	Chloroprene rubber
A	Acetic acid	CH_3COOH	30%	×(RT)	×
	Acetone	CH_3COCH_3		×(RT)	×(RT)
	Alum	$K_2SO_4Aℓ_2(SO_4)$	Each conc.	●(60)	●(70)
	Aluminum chloride	$AℓCℓ_3$	Each conc.	●(60)	●(70)
	Ammonium chloride	$NH_4Cℓ$	27%	●(60)	●(70)
	Ammonium nitrate	NH_4NO_2		×(RT)	●(70)
	Aqueous ammonia	NH_4OH	30%	×(60)	●(70)
	Asbestos			●	●
B	Barium chloride	$BaCl_2$ / $2H_2O$		●(60)	●(65)
	Bleach (Calcium hypochlorite)	$Ca(CℓO)_2$		×(60)	×(RT)
	Butyl cellulose			●(RT)	▲(RT)
C	Calcium	Ca		●	●
	Carbolic acid	C_6H_5OH		×(RT)	×(RT)
	Carbonic acid	H_2CO_3	Each conc.	●(60)	●(70)
	Caustic potash	KOH	25%	●(40)	●(70)
	Caustic soda	NaOH	50%	▲(RT)	●(RT)
	Cement			●	●
	Chromic acid	H_2CrO_4	10%	×(RT)	×(RT)
	Citric acid	$C_3H_4(OH)_3(CO_2H)_3$	10%	●(60)	●(70)
	Cottonseed oil			×(RT)	▲(60)
D	Developing solution			●(60)	▲(65)
E	Ethanol	C_2H_3OH		●(RT)	●(RT)
	Ethylene glycol	CH_2OHCH_2OH		●(RT)	●(RT)
F	Fatty acid			▲(RT)	×
	Formic acid	HCOOH		×(RT)	▲(RT)
G	Glue			●(60)	●(RT)
	Glycerin			●(RT)	●(RT)
	Grains			●	●
H	Hydrochloric acid	Hℓ	20%	×(80)	×(70)
	Hydrochloric acid	Hℓ	35%	▲(RT)	▲(RT)
	Hydrofluoric acid	HF	10%	●(RT)	●(RT)
	Hydrofluoric acid		40%	×(RT)	×(RT)
	Hydrogen sulfide solution	H_2S	Each conc.	×(60)	×(60)
	Hydroquinone	$C_6H_4(OH)_2$		●(RT)	●(RT)
L	Lactic acid	$CH_3CH(OH)COOH$	25%	●(RT)	●(60)

	Chemical name	Chemical formula	Concentration	Rubber sleeve	
				Natural rubber	Chloroprene rubber
L	Lime powder			●	●
M	Magnesium hydroxide	$Mg(OH)_2$		●(60)	●(65)
	Malic acid	$HOOCH_2CHOHCOOH$		●	▲(65)
	Methanol	OH_3OH		●(RT)	●(RT)
N	Nitric acid	HNO_3	10%	×(RT)	×(RT)
	Nitric acid	HNO_3	20%	×(RT)	×(RT)
	Nitric acid	HNO_3	30%	×(RT)	×(RT)
	Nitric acid 15%, hydrofluoric acid 6%	HNO_3 15% / HF 6%		▲(RT)	▲(RT)
O	Olive oil			×(RT)	▲(RT)
	Oxalic acid	$HO_2H{\cdot}CO_2H$	20%	▲(RT)	▲(RT)
P	Palm oil			×(RT)	●(RT)
	Phosphoric acid	H_3PO_4	80%	×(60)	▲(70)
	Phosphoric acid soda	Na_3PO_4	Each conc.	●(60)	●(70)
	Picric acid	$HOC_6H_2(NO2)_3$	10%	×(RT)	×(RT)
	Plating solution			×	×
	Potassium chlorate	$KCℓC_3$	Each conc.	●(60)	●(70)
	Potassium dichromate	$K_2Cr_2O_7$	Each conc.	×(RT)	●(RT)
	Potassium sulfide	K_2S	Each conc.	●(60)	●(70)
	Pulp			●	●
R	Raw nitrate solution			●(RT)	●(70)
S	Sewage			▲(RT)	●(RT)
	Soap			●(RT)	●(70)
	Sodium bicarbonate	$NaHCO_3$	Each conc.	●(60)	●(70)
	Sodium carbonate	Na_2CO_3	Each conc.	●(60)	●(70)
	Sodium chloride	$NaCℓ$		●(60)	●(70)
	Sodium cyanide	NaCN	Each conc.	●(60)	●(70)
	Sodium dichromate			●(RT)	●(RT)
	Sodium sulfate	Na_2SO_4		●(60)	●(70)
	Sulfur	S		×	●
	Sulfur dioxide	SO_2		▲(RT)	▲(RT)
	Sulfuric acid	H_2SO_4	20%	●(RT)	●(70)
	Sulfuric acid	H_2SO_4	50%	▲(RT)	×(RT)
	Sulfurous acid	H_2SO_3	10%	▲(RT)	×(RT)
T	Tartaric acid	$(CHOH{\cdot}COOH)_2$	50%	×(60)	×(70)
Z	Zinc sulfate	$ZnSO_4{\cdot}7H_2O$		●(60)	●(65)

The chemical resistance of the pinch valve may differ according to the working conditions, so its usability cannot be easily determined. Use this table as the initial selection guide. Note that improvements may be required depending on the test results.

Flow characteristics display method

1. Flow characteristics display

The catalog specifications indicate the flow rate as follows.

Applicable components	Indicator	Unit	Standards
Pneumatic components	JIS compliant display	C,b	ISO 6358:1989 "Pneumatic fluid power - Components using compressible fluids - Determination of flow-rate characteristics" JIS B 8390:2000 (ISO 6358 translation)
	Conventional indication	S	JIS B 8379:1995 "Pneumatic noise reduction device"
		Cv	ANSI(NFPA)T3. 21. 3 R1-2008
Fluid control components	JIS compliant display	Cv	IEC 60534-2-3: 2015 "Industrial process control valves-No. 2part: Flow rate -No.3 partTest procedure JIS B 2005-2-3: 2004 (IEC 60534-2-3 translation) JIS B 8471: 2004 "Solenoids for water" JIS B 8472: 2008 "Solenoids for steam" JIS B 8473: 2007 "Solenoids for fuel"
	Conventional indication		

2. Pneumatic components description

The flow characteristics of the pneumatic components were conventionally indicated with the effective cross-sectional area S and flow coefficient Cv. However, JIS was revised (JIS B 8390:2000), and these are now indicated with the sonic conductance C and critical pressure ratio b .

- Sonic conductance C: Value obtained by dividing the passage weight flow of the component in the choke flow by the sum of the upstream absolute pressure and standard state density. (sonic conductance) S ≈ 5.0 C (Conventional sizing is possible with C.)
- Critical pressure ratio b: Pressure ratio at which choked flow results if smaller than this value (downstream pressure/upstream pressure) (critical pressure ratio)
- Effective cross-sectional area S (mm^2): The value of the ideal restricted cross-sectional area without friction or compressed flow, calculated from the pressure changes inside the air tank when the choked flow is released from the components mounted on the air tank.

* Choked flow: Flow at which upstream pressure is higher than downstream pressure, and speeds at certain sections of components reach acoustic velocity. The fluid's mass flow rate is proportional to the upstream pressure, and is not dependent on downstream pressure.

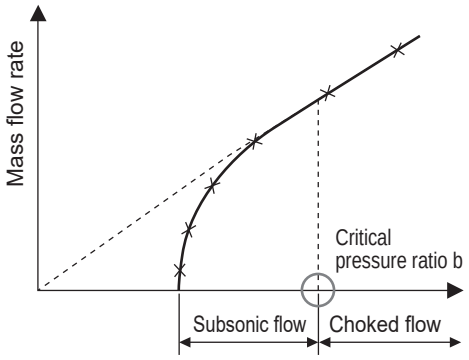


Fig. 1 Mass flow characteristics for upstream pressure

Flow rate formula

Depending on the actual unit, they are shown as follows.

- $\frac{P_2}{P_1}$ Choked flow when ≤ b

$$Q=600\times C\times P_1 \times \sqrt{\frac{293}{273+T}} \quad \text{.....(1)}$$

- $\frac{P_2}{P_1}$ Subsonic flow when >b

$$Q=600\times C\times P_1 \times \sqrt{1-\left[\frac{\frac{P_2}{P_1}-b}{1-b}\right]^2} \times \sqrt{\frac{293}{273+T}} \quad \text{.....(2)}$$

Q : Air flow rate [dm^3/min(ANR)], SI unit dm^3 (cubic decimeter) can also be expressed with ℓ (liter). $1dm^3 = 1\ell$
C : Sonic conductance [dm^3/(s·bar)]
b : Critical pressure ratio [-]
P_1 : Upstream pressure [MPa]
P_2 : Downstream pressure [MPa]
t : Temperature [°C]

When calculating with effective cross-sectional area S, substitute value C obtained with C = S/5 in the above formula. For subsonic flow, substitute b = 0.5 in formula (2).

Flow characteristics display method

3.Fluid control Components description

The flow characteristics of the fluid control valves were indicated by flow coefficient Cv. To comply with former IEC Standards, there was a move to indicate them with flow coefficient Av to unify indications into SI units. However, the Av value was eliminated from the control valve flow coefficient with “JIS B 2005-2-3:2004” revisions, so that only Kv and Cv are used. Thus, the Cv indication is still used to indicate the flow characteristics of fluid control valves. For Av values, converted values are listed for reference as needed.

● Flow coefficient Cv: This is a non-SI control valve flow coefficient, but is used commonly throughout the world. US gal value which indicates 40 to 100°F city water flow rate per minute passing through the valve (device under test) at pressure differential of 1 psi.

$$Cv=Q\sqrt{\frac{\rho}{\rho w}\frac{1}{\triangle P}} \quad \text{.....} \quad (3)$$

Cv : Flow coefficient
Q :Flow rate[U.S.gal/min](1U.S.gal/min=6 , 309x 10^{-5} m^3/s)
ρ : FluidDensity [1b/ft^3](1b/ft^3 = 16,018kg/m^3)
ρw : 40°F to 1 00°F(4°C to 38°C) water density [1b/ft^3]
△P : Pressure difference [psi] (1psi=6.8948 kPa)

● Flow coefficient Av: Value which indicates city water flow rate passing through the valve (device under test) in m^3/s unit at pressure difference 1 Pa. Calculated with the following formula:

$$Av=Q\sqrt{\frac{\rho}{\triangle P}} \quad \text{.....} \quad (4)$$

Av : Flow coefficient [m^2]
Q : Flow rate [m^3/s]
ρ : Fluid density [kg/m^3]
△P : Pressure difference [PA]

Flow rate formula

Depending on the actual unit, they are shown as follows.

● Flow coefficient Cv

For liquids:

$$Q=45.58\,Cv\sqrt{\frac{\triangle P}{G}} \quad \text{.....} \quad (5)$$

Cv : Flow coefficient
Q : Flow rate [ℓ /min]
△P : Pressure difference [MPa]
G : Specific gravity [Water G=1]

For steam:

$$P_2 \leq \frac{P_1}{2} \quad \text{For} \quad W=\frac{99\,Cv\,P_1}{K} \quad \text{.....} \quad (6)$$

$$P_2 > \frac{P_1}{2} \quad \text{For} \quad W=\frac{198\,Cv\sqrt{(P_1-P_2)P_2}}{K} \quad \text{.....} \quad (7)$$

Cv : Flow coefficient
W : Weight [kg/h]
P_1 : Primary side absolute pressure [MPa]
P_2 : Secondary side absolute pressure [MPa]
K : (1 + 0.0013 ts) ts: Degree of superheat
(Saturation steam K = 1)

Flow rate formula

Depending on the actual unit, they are shown as follows.

● Flow coefficient Av

For liquids:

$$Q=1.9\times10^{6}Av\sqrt{\frac{\triangle P}{G}} \quad \text{..... (8)}$$

Q : Flow rate [ℓ /min]
Av : Flow coefficient [m^2]
△P : Pressure difference [MPa]
G : Specific gravity [Water=1]

For steam:

$$Q=8.3\times10^{6}Av\sqrt{\triangle P(P_2+0.1)} \quad \text{..... (9)}$$

Q : Weight [kg/h]
Av : Flow coefficient [m^2]
△P : Pressure difference [MPa]
P_1 : Upstream pressure [MPa]:
$\triangle P = P_1 - P_2$
P_2 : Downstream pressure [MPa]

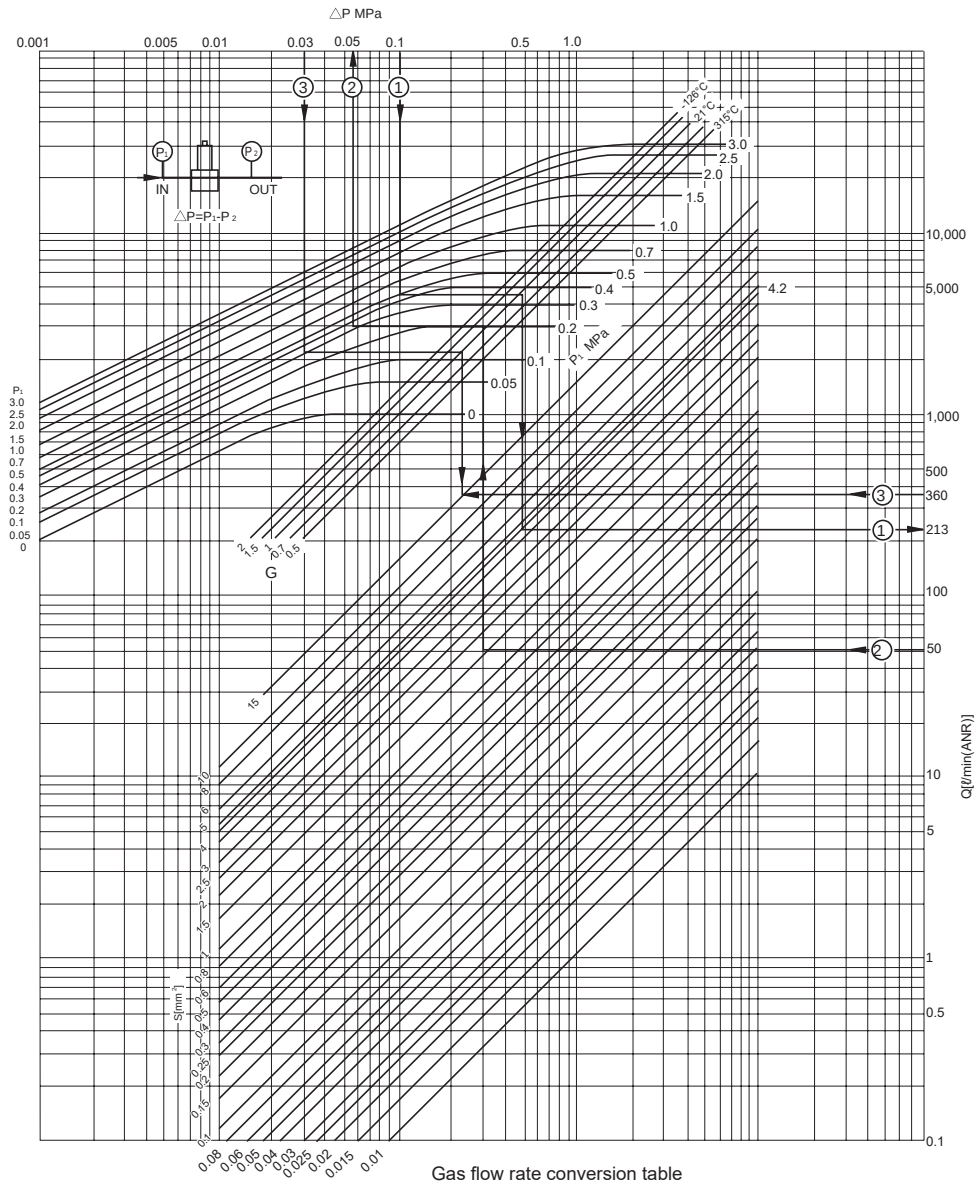
Flow coefficient conversion

$$Av=28\times10^{-6}\ Kv=24\times10^{-6}\ Cv \quad \text{..... (10)}$$

Kv : Value which indicates 5 to 40°C city water flow rate passing through the valve in m^3/h unit at pressure difference 1 bar.
Cv : Value which indicates 60°F city water flow rate passing through the valve in US gal/min. unit at pressure difference 1 lbf/in^2 (psi).
The Kv and Cv for air use different calculation methods, so the values do not match.

Flow rate conversion table — 1

Air



Gas flow rate conversion table

● Example1:
The flow rate when air is passed through with (S = 4.2 mm^2) P_1 = 0.5 MPa, P_2 = 0.4MPa (△P = P_1 - P_2 = 0.1 MPa) is

Q=226ℓ/min(ANR)

● Example 2:
The pressure loss when air is passed through a S = 1.5 mm^2 valve at 50 ℓ/min. (ANR) at P_1 = 0.3 MPa is

△P = 0.057 MPa

● Example3 :
What should the valve's effective cross-sectional area be to attain a 360 ℓ/min. (ANR) flow rate at P_1 = 0.3 MPa and △P = 0.03 MPa ?

S=16.7

*1: The table shows the effective cross-sectional area (S) up to 15. If this value is exceeded, multiply the effective cross-sectional area (S) and flow rate proportionally.
Example: If the effective cross-sectional area (S) is 20, refer to 2 and multiply the flow rate by 10.

*2: Assume the nitrogen temperature is 20°C.

Flow rate calculation method

When calculating from effective sectional area
SIUnit

● $P_2/P_1 \leq 0.5$With (choked flow)

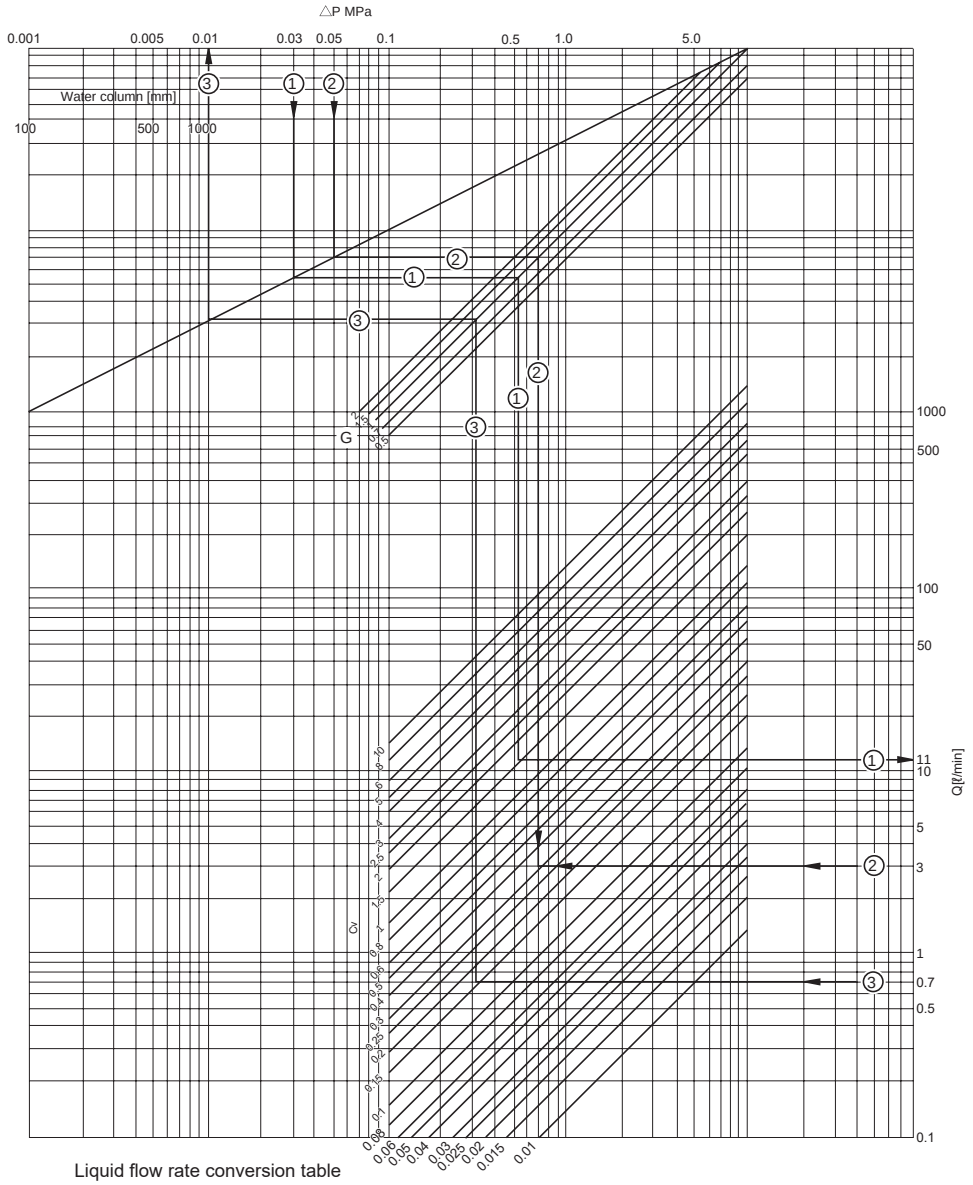
$$Q=120\times S\times P_1\times\sqrt{\frac{293}{273+T}}$$

● $P_2/P_1 > 0.5$With (subsonic velocity)

$$Q=240\times S\times\sqrt{P_2\times(P_1-P_2)}\times\sqrt{\frac{293}{273+T}}$$

Q : Flow rate ℓ/min (ANR)
P_1 : Primary side absolute pressure MPa (abs)
P_2 : Secondary side absolute pressure MPa (abs)
S : Effective cross-sectional area mm^2

Water



Liquid flow rate conversion table

● Example 1:
What is the flow rate when water (specific gravity =1) is passed through a Cv = 1.5 valve at △P = 0.03 MPa (P_1 - P_2)?

Q=11 ℓ/min

● Example 2:
Cv when water (specific gravity = 1) is passed at 3 ℓ/min. at △P = 0.05 MPa

Cv=0.29

● Example 3:
Pressure loss when water (specific gravity = 1) is passed through a Cv = 0.15 valve at 0.7 ℓ/min

P=0.01 MPa

*1: The table shows Cv up to 10. If this value is exceeded, multiply the Cv and flow rate Q proportionally.
Example: If the Cv is 15, refer to 1.5 and multiply the flow rate by 10.

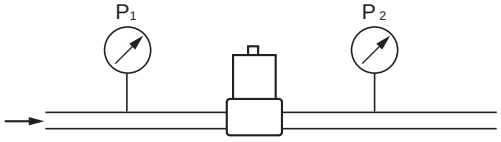
Flow rate calculation method

SI units

$$Q=45.58Cv\frac{\sqrt{P_1-P_2}}{\sqrt{G}}$$

Q : Flow rate ℓ/min

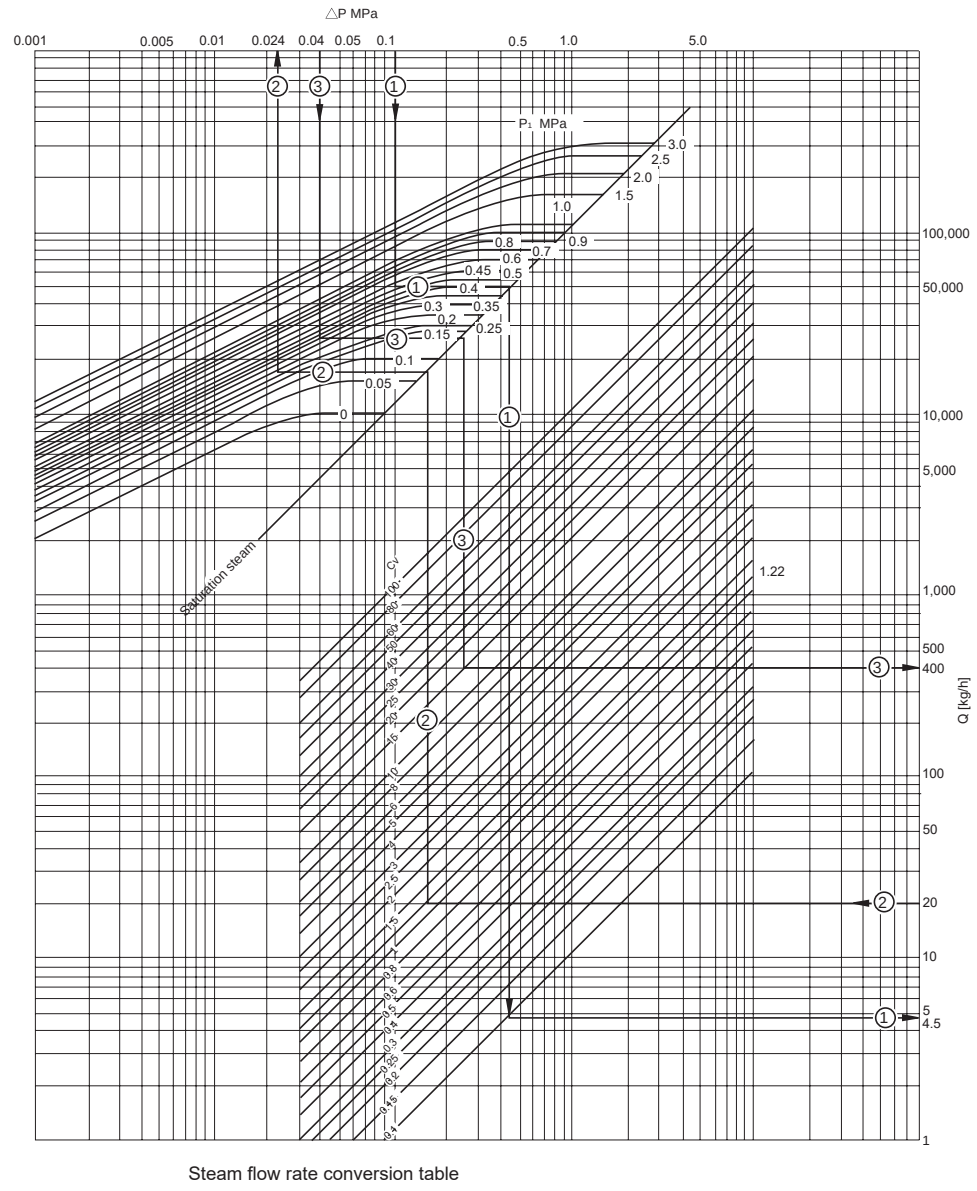
P_1 : Primary side pressure MPa
P_2 : Secondary side pressure MPa
G : Specific gravity (water = 1)
Cv: Flow coefficient



Pressure loss
△P
$\triangle P=P_1-P_2$

Flow rate conversion table — ❷

Steam



Steam flow rate conversion table

● Example1:
For solenoid valves with flow coefficient Cv = 0.1
P_1=0.5 MPa,
P_2=0.4 MPa
What is the flow rate when saturated steam is passed through ($P = P_1 - P_2$ = 0.1 MPa)?

Q=4.0kg/h

● Example 2:
What is the pressure loss when steam is passed through a Cv = 1.22 valve at 20 kg/h at P_1 = 0.2 MPa?

P = 0.024 MPa

● Example3 :
What flow rate is attained when a Cv = 150 valve is used at P_1 = 0.3 MPa and P = 0.04 MPa?

Q=3618kg/h

Note: The table shows Cv up to 100. If this value is exceeded, multiply the Cv and flow rate Q proportionally.
Example: If Cv is 150, refer to 15 and multiply the flow rate by 10.

Flow rate calculation method

$$W = \frac{100CvP_1}{K} \qquad \text{For } P_2 \leq \frac{P_1}{2}$$

$$W = \frac{201Cv\sqrt{(P_1-P_2)P_2}}{K} \qquad \text{For } P_2 > \frac{P_1}{2}$$

W : Flow rate [kg/h]
P_1 : Primary side absolute pressure MPa (abs)
P_2 : Secondary side absolute pressure MPa (abs)
K : (1 + 0.0013 ts) ts: Degree of superheat
(Saturation steam: K = 1)

Degree of protection

● Degree of protection

■ IEC (International Electrotechnical Commission) standards (IEC60529)

■ JIS C 0920 : 2003

IP-□ □

Protection characteristic codes (International Protection)

1st characteristic No. (degree of protection for foreign solid matter)

1st charact No.	Degree of protection	
0	No protection	Without protection
1	ø50 mm	Protection against inflow of solids 50 mm and over in diameter
2	ø12.5 mm	Protection against inflow of solids 12.5 mm and over in diameter
3	2.5 mm	Protection against inflow of solids 2.5 mm and over in diameter
4	1 mm	Protection against inflow of solids 1.0 mm and over in diameter
5	Dust-proof	No inflow of dust at levels adversely affecting normal device operation or safety
6	Dust resistant	No inflow of dust

2nd characteristic No. (degree of protection for water entry)

2nd charact No.	Degree of protection	
0	No protection	
1	Protection against water dripping	No harmful effects from water dripping vertically.
2	Protection against dripping water tilted at an angle of up to 15°	Water dripping vertically has no adverse effect when the product is tilted at an angle of up to 15° from its normal position.
3	Protection for watering	Water falling as a spray at any angle up to 60° from the vertical has no adverse effect.
4	Protection against splashing water	Water splashing against the product from any direction has no adverse effect.
5	Protection against water jets	No harmful effects occur even when water is sprayed with nozzles from all directions.
6	Protection against powerful jets	Water projected in powerful jets against the product from any direction has no adverse effect.
7	Protection against immersion	Water will not enter the product even when it is immersed in water under defined conditions.
8	Protection against immersion	The product can be used for continuous immersion in water.

Technical terms, standards and certification

Glossary

[Max. working pressure]

The max. working pressure means the maximum pressure that allows normal operation of the solenoid valve.

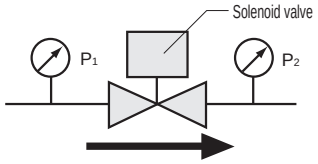
[Max. working pressure differential]

The max. working pressure differential refers to the allowable pressure at which the solenoid valve can be operated safely and accurately. This is the max. pressure differential between input pressure (P1) and output pressure (P2).

[Min. working pressure differential]

The min. working pressure differential refers to the min. pressure difference between inlet pressure (P1) and outlet pressure (P2) required to operate the solenoid valve safely and accurately. With the pilot operated solenoid valve, a pressure higher than the min. working pressure differential is required to open and close the valve. (Does not operate at zero pressure differential.)

▼ For example, if the max. working pressure is 2.0 MPa, the max. working pressure differential 0.7 MPa and the min. working pressure differential 0.03 MPa, operation is possible when the inlet pressure is 2.0 MPa and outlet pressure from 1.3 to 1.97 MPa.



$P_1 - P_2 = \triangle P$
P_1 = Inlet pressure (primary side)
P_2 = Outlet pressure (secondary side)
$\triangle P$ = Max. working pressure differential or min. working pressure differential

[Current value]

The apparent power and power consumption are indicated. Calculate the current as below.

● For alternating current: The apparent power values when starting (rush power) and during holding are indicated. Use the following formula to calculate the starting current (rush current) and holding current (steady current).

$$\text{Current value (A)} = \frac{\text{Apparent power (VA)}}{\text{Voltage (V)}}$$

● For direct current: The power consumption is indicated. Use the following formula to calculate the holding current (steady current).

$$\text{Current value (A)} = \frac{\text{Power consumption (W)}}{\text{Voltage (V)}}$$

[Ambient / fluid temperatures limits]

The solenoid valve's ambient / fluid temperatures are limited by the materials that configure the solenoid valve. These values are particularly determined by the heat proof temperature for the valve sealant material and coil thermal class. Refer to the detailed specifications for the working temperature range of each model.

[Oil-prohibited]

For the oil-prohibited products listed in this catalog, the wetted parts are cleaned before assembly.

Selection criteria for explosion-proof solenoid valves

Danger zones

Areas where explosive gases and air mix at a high enough level to cause an explosion or fire are called danger zones. These zones are classified into Class 0 zones, Class 1 zones and Class 2 zones according to the time and frequency at which the dangerous atmosphere is reached. The explosion-proof structure that can be used is determined according to these classes.

Class 0 zone

Zones where a dangerous atmosphere is or could be continuously generated, and where the concentration of explosive gas is maintained continuously or for a long time above the lower limit for explosions.

Example A: The open space above a flammable fluid inside a container or tank
Example B: Inside a combustible gas container or tank
Example C: Near flammable fluid in an open container

Class 1 zone

(1) Zones where explosive gas could accumulate to a dangerous concentration during normal operations such as the opening/closing of the lid for removing the product or operation of the safety valve, etc.
(2) Zones where explosive gases are likely to accumulate to dangerous concentrations during repair or maintenance or due to leakage, etc.

Example A: Near the opening of a tank lorry or drum can when filling the container with flammable fluid
Example B: Near the access opening when a pressure relief valve operates and discharges explosive gas
Example C: Near the opening of a gas vent in a tank
Example D: Near the access opening when releasing explosive gas for inspection or repair work
Example E: When explosive gas could be released indoors or in a poorly ventilated area
Example F: Inside the shell above the roof of the floating roof tank.
Example G: Zones where explosive gas could leak, and where gas could accumulate further in pits, etc.

Class 2 zone

(1) Zones where combustible gases or flammable fluids are regularly handled, but where the gases and fluids are sealed in a container or equipment, and where the gases and fluids could leak to dangerous concentrations only if the container or equipment breaks by accident or due to misoperation.
(2) Zones where measures to prevent the accumulation of explosive gases are taken with a reliable mechanical ventilation device, but where explosive gases could accumulate to dangerous concentrations if the ventilation device fails.
(3) Zones near or adjacent to a Class 1 zone where explosive gases could infiltrate at a dangerous concentration.

Example A: Zones where explosive gases could leak out if the explosive gas storage container is damaged due to corrosion, etc.
Example B: Zones where operator error could lead to explosive gas leakages or abnormal reactions causing high pressures and high temperatures, destroying the equipment and leaking explosive gases.
Example C: Zones where explosive gases could stagnate and cause a dangerous atmosphere if the forced ventilation system fails.

Explosive gas and explosion-proof structure

The degree of explosive gas danger is classified according to the ignitability and flame-proof grade. Gases with an equivalent risk are grouped into one group, and explosion-proof structure standards are set for each group.
Codes to indicate the type, flame-proof grade and ignitability must be indicated in this order on the electrical components of explosion-proof structures. These codes indicate which flame-proof grade and ignitability class the electrical components have been manufactured for, and which gases can be used.
For the example of explosion-proof solenoid valve of d2G4

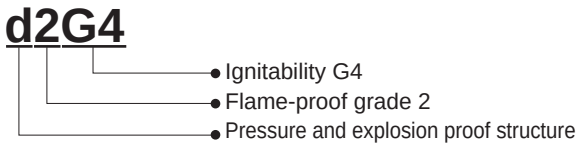


Table 2 indicates the classification of gases with a danger category of G4 ignitability to Grade 2 explosibility that are compatible with the product. Less dangerous gases are also listed that are guaranteed to be flame-proof.
Ignitability refers to the degree of igniting risk, and is classified into five grades according to the igniting point. The codes shown in Table 1 are used. Higher numbers indicate a higher risk that the gas will ignite at low igniting temperatures.
Flame-proof grade refers to the risk of fire leaping to the exterior from small gaps. The level is classified into three grades according to the gap, and the codes shown in Table 1 are used. It can be said that this flame-proof grade expresses the size of the explosive energy. Higher numbers indicate more dangerous gases with higher explosive energy that can cause flames to pass through small gaps and leap to the exterior.

Types of explosion-proof structures

The following six types of explosion-proof structures are available according to the type of device, type of explosive gas and danger zone, etc., Use the structure that matches the application.

(1) Pressure and explosion proof structure
(2) Internal pressure and explosion proof structure
(3) Hydraulic explosion proof structure
(4) Essential safety explosion-proof structure
(5) Increased safety explosion-proof structure
(6) Special explosion-proof structure

The CKD explosion-proof solenoid valves incorporate a pressure and explosion-proof structure having the highest safety and reliability within this type.

Selection procedure for explosion proof solenoid valves

(1) Identify the type of the explosive gas.
(2) Determine the flame-proof grade and ignitability of the explosive gas with Table 2.
(3) Determine the danger zone class.
(4) Determine the type of explosion-proof structure according to the danger zone class.

Class 0—— Essential safety explosion-proof structure
Class 1—— Pressure and explosion proof structure, essential safety explosion proof structure
Class 2—— Pressure and explosion proof structure, increased safety explosion proof structure, essential safety explosion proof structure

(5) Determine the explosion-proof performance.
(6) By determining the application, working fluid, fluid pressure, flow rate, port size, voltage, etc., in the same manner as general purpose solenoid valve selection, the required solenoid valve can be determined.

Note

There are various limits applied to the explosion-proof solenoid valves. When placing an order, verification must be obtained from a verifying agency each time the structure is changed. This will delay the delivery schedule, and can increase costs. Thus, use of the standard parts is recommended.
Do not disassemble or modify the delivered parts since they are already approved. If the part must be disassembled or modified, contact CKD.

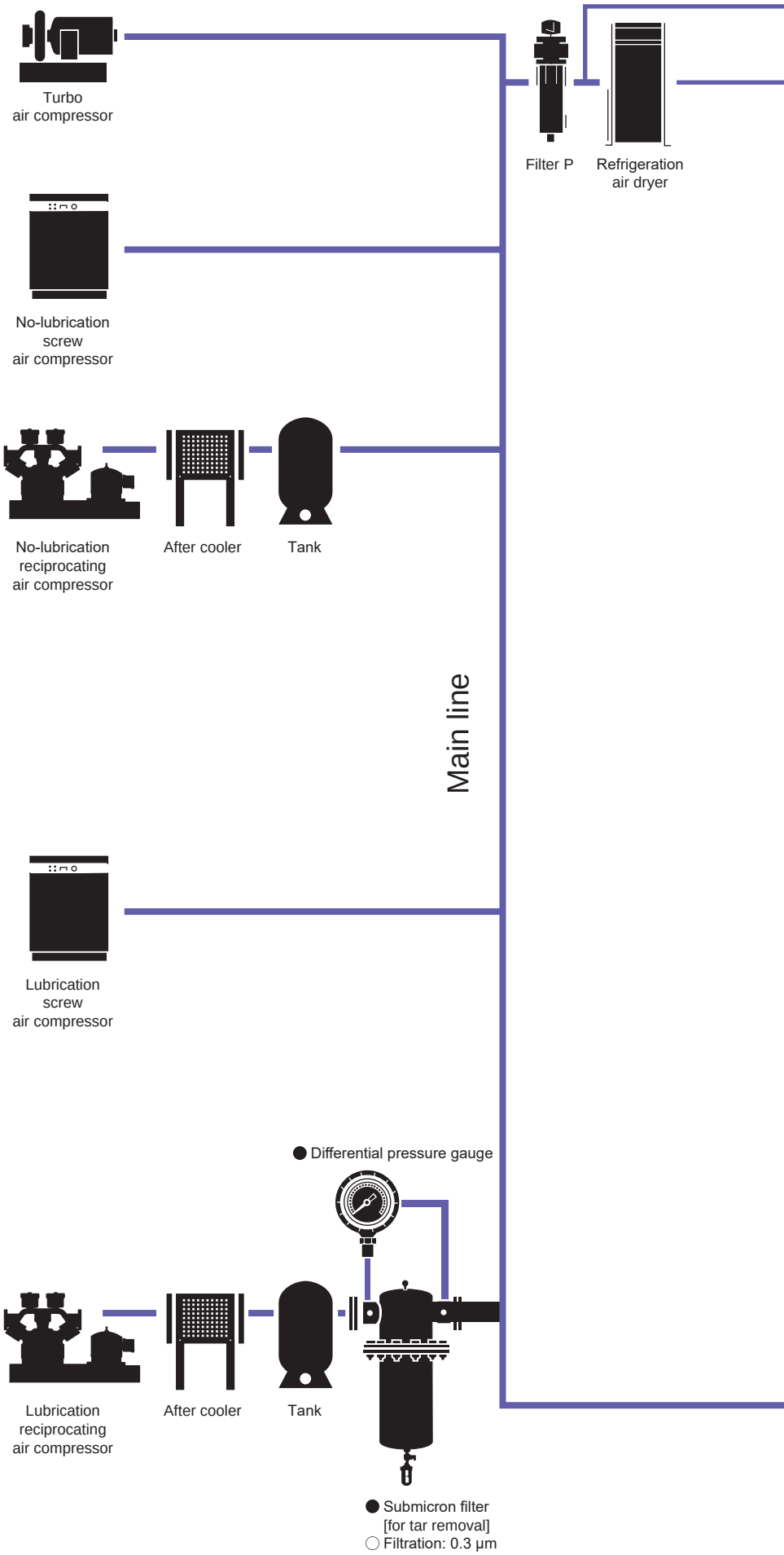
Table 1

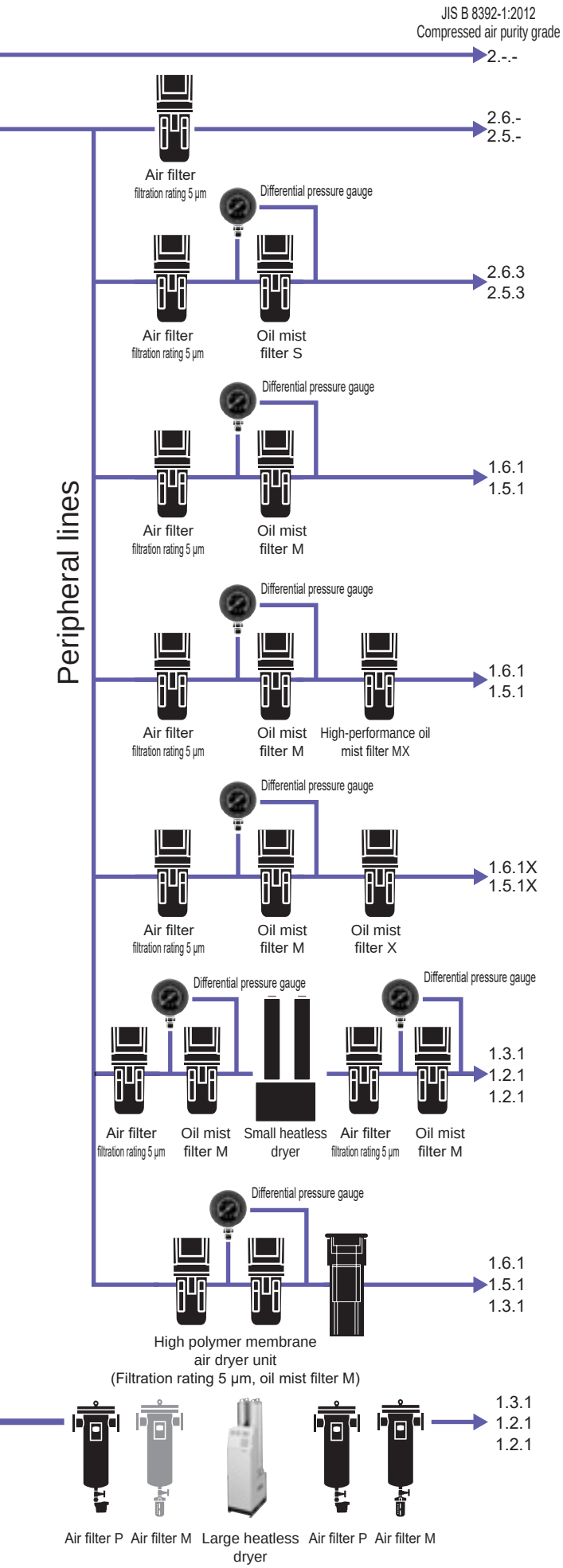
	Description	Code
Ignitability	Ignitability G1	G1
	" G2	G2
	" G3	G3
	" G4	G4
	" G5	G5
Flame-proof grade	Flame-proof grade 1	1
	" 2	2
	" 3	3

Table 2

Flame-proof grade	Ignitability				
	G1	G2	G3	G4	G5
1	Acetone Ammonia Carbon monoxide Ethane Acetic acid Ethyl acetate Toluene Propane Benzene Methanol Methane	Ethanol Isopentyl acetate 1-butanol butane Non-aqueous acetic acid	Gasoline Hexane	Acetaldehyde Ethyl ether	
2	Coal gas	Ethylene Ethylene oxide	Isoprene		
3	Water gas Hydrogen	Acetylene			Carbon disulfide

Compressed air cleaning guide





JIS B 8392-1:2012 Compressed air purity grade	Impurities in compressed air					Applications	General pneumatic	Dry air
	Solids (nominal value)	Moisture	2ndary side oil conc (21°C)	Odor				
2.-.-	1 µm	-	-	-	Remove water drops/ dust particles	· Construction, civil engineering machinery · Air for cleaning (dry air not required)	●	
2.6.3	0.3 µm	Pressure dew point 10°C	0.5 mg/m³	-	General dry air	· Air tool · Air drill · Air screwdriver · Air grinder · Labor-saving device · Pneumatic jigs and tools · Air chuck · Air vice · Precision part cleaning air blow	●	
2.5.3		Pressure dew point 7°C						
1.6.1	0.01 µm	Pressure dew point 10°C	0.01 mg/m³	-	Oil-free clean dry air	· Instrumentation · Measurement · Logic control · Luxury painting · Precision mining industry		●
1.5.1		Pressure dew point 7°C						
1.6.1	0.01 µm	Pressure dew point 10°C	0.001 mg/m³	-	Ultra-oil-free clean dry air	· Precise measurement · Luxury painting		●
1.5.1		Pressure dew point 7°C						
1.6.1	0.01 µm	Pressure dew point 10°C	0.003 mg/m³	None	Odorless air	· Food industry · Pharmaceutical industry · Stirring/ transportation/drying · Packing/brewing air		●
1.5.1		Pressure dew point 7°C						
1.3.1	0.01 µm	Pressure dew point -20°C	0.01 mg/m³	-	Ultra dry air	· Drying computer rooms · Drying furnace gas · Ozone generator · Drying the insulation gas of a high-voltage generator · Drying the air supply of a high-voltage breaker · Central control instrumentation		●
1.2.1		Pressure dew point -40°C						
1.2.1		Pressure dew point -60°C						

*1: The system No. is based on the class below.
X in the table below indicates odor removal. "-" indicates no specification.
*2: The table shows the highest compressed air purity grade that can be achieved by the CKD clean air system. The grade varies depending on the condition at the filter inlet.

JIS B 8392-1:2012 Compressed air purity grade

Grade	Solid particle				Humidity and moisture		Oil
	Max. number of particles per 1 m³ for particle diameter d (µm)			Mass concentration Cp	Pressure dew point	Water concentration Cw	Total oil concentration
	0.1 < d ≤ 0.5	0.5 < d ≤ 1.0	1.0 < d ≤ 5.0	mg/m³	°C	g/m³	mg/m³
0	Conditions stricter than Grade 1 to be specified by user or supplier.						
1	≤ 20,000	≤ 400	≤ 10	-	≤ -70	-	≤ 0.01
2	≤ 400,000	≤ 6,000	≤ 100	-	≤ -40	-	≤ 0.1
3	-	≤ 90,000	≤ 1,000	-	≤ -20	-	≤ 1
4	-	-	≤ 10,000	-	≤ +3	-	≤ 5
5	-	-	≤ 100,000	-	≤ +7	-	-
6	-	-	-	0 < Cp ≤ 5	≤ +10	-	-
7	-	-	-	5 < Cp ≤ 10	-	Cw ≤ 0.5	-
8	-	-	-	-	-	0.5 < Cw ≤ 5	-
9	-	-	-	-	-	5 < Cw ≤ 10	-
X	-	-	-	Cp>10	-	Cw>10	>5

JIS B 8392-1:2003 has been revised to JIS B 8392-1:2012.

For example,
What is Grade 1:2:1?

- Solid particles 0.1 to 0.5 µm are 20,000 particles or less, 0.5 to 1.0 µm are 400 particles or less, and 1.0 to 5.0 µm are 10 particles or less
- Pressure dew point -40°C or less
- Oil concentration 0.01 mg/m³ or less.