I N D E X

About International System of Units (SI Units)
List of Circuit Symbols
Posted on the CKD website.
https://www.ckd.co.jp/kiki/en/

Rodless Cylinders >>> P. 1
Cylinders with Brake / with Lock >>> P. 289
Lock Unit >>> P. 613
Cylinders with Valve >>> P. 651
Clamp Cylinders >>> P. 733
Special Cylinders >>> P. 901
High Speed Cylinders >>> P. 1177
Swing/Rotary Cylinders >>> P. 1223
Related Components >>> P. 1377
Cylinder Switches >>> P. 1457

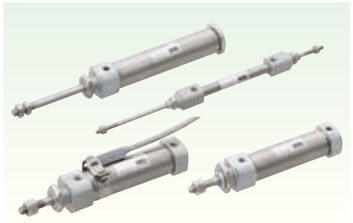
Search by Product System List

Products can be selected by series appearance and product overview.

General-type >>> Pneumatic Cylinder Catalog ① Catalog No.RJ-002AA

Standard, small Bore Size cylinders **(ø2.5 to ø16)**

Pencil type compact cylinder



Pencil Shaped Cylinders

SCP□3

Series	Also known as...	Bore Size (ø)
SCPD3	Single Rod Type	6, 10, 16
SCPS	Single Acting, Push Type	2.5, 4
SCPS3	Single Acting, Push Type	6, 10, 16
SCPH3	Single Acting, Retracting Type	
SCPD3-T	Heat resistant type	6, 10, 16
SCPD3-□C	With Rubber Air Cushion	
SCPD3-F	Low speed type	
SCPD3-O	Low Speed Type	
SCPD3-D	Double rod type	
SCPD3-Z	With Speed Controller	10, 16
SCP□3-M	Non-Rotating Type	
SCPD3-K	High Load Type	6, 10, 16
SCP□3-V	With Valve	10, 16

Standard, medium Bore Size cylinders **(ø20 to ø40)**

Stainless Steel tube for high corrosion resistance

Small Bore Size Cylinders

CMK2

Series	Also known as...	Bore Size (ø)
CMK2	Single Rod Type	20, 25, 32, 40
CMK2-S	Single Acting, Push Type	
CMK2-SR	Single Acting, Retracting Type	
CMK2-P	Stroke Adjustable Type (Push)	
CMK2-R	Stroke Adjustable Type (Pull)	
CMK2-T	Heat resistant type	
CMK2-□C	With Rubber Air Cushion	
CMK2-C	Air Cushion Type	
CMK2-Q	Drop prevention type	
CMK2-F	Low speed type	
CMK2-D	Double rod type	
CMK2-B	Back-to-Back Type	
CMK2-M	Non-Rotating Type	
CMK2-Z	Built-in Speed Controller Type	
CMK2-H	Low Hydraulic Pressure Type	
CMK2-G2/G3	Cutting Oil Resistant Type	
CMK2-JG2/JG3	Stainless Steel Type	

Standard, medium Bore Size cylinders **(ø20 to ø40)**

Serviceable type for maintenance

Small Bore Size Cylinders

CMA2

Series	Also known as...	Bore Size (ø)
CMA2	Single Rod Type	20, 30, 40
CMA2-E	Direct Type	

General Type/Medium Bore Cylinder **(ø20 to ø100)**

Smart type with abundant Bore Sizes and options

Round Shaped Cylinders

SCM

Series	Also known as...	Bore Size (ø)
SCM	Single Rod Type	20 to 100
SCM-X	Single Acting, Push Type	20 to 40
SCM-Y	Single Acting, Retracting Type	
SCM-P	Stroke Adjustable Type (Push)	20 to 63
SCM-R	Stroke Adjustable Type (Pull)	
SCM-T	Heat resistant type	20 to 100
SCM-Q	Drop prevention type	
SCM-F	Low speed type	20 to 40
SCM-O	Low Speed Type	20 to 100
SCM-U	Low Friction Type	
SCM-D	Double rod type	
SCM-B	Back-to-Back Type	20 to 63
SCM-W	Two-Stage Type	
SCM-W4	Tandem Type	
SCM-M	Non-Rotating Type	
SCM-LD	Direct Foot Type	

General Type/Medium Bore Cylinder **(ø32 to ø100)**

Environmentally friendly tie-rod cylinder

Tie Rod Cylinders

SCG

Series	Also known as...	Bore Size (ø)
SCG	Single Rod Type	32 to 100
SCG-Q	Drop prevention type	
SCG-O	Low Speed Type	
SCG-U	Low Friction Type	
SCG-D	Double rod type	
SCG-M	Non-Rotating Type	32 to 63
SCG-G	Heavy-Duty Scraper Type	32 to 100
SCG-G2/G3	Cutting Oil Resistant Type	40 to 100
SCG-G4	Sputter adhesion prevention type	32 to 100

General Type/Medium Bore Cylinder **(ø40 to ø100)**

Robust type with No. 1 reliability

Medium Bore Size Cylinder

SCA2

Series	Also known as...	Bore Size (ø)
SCA2	Single Rod Type	40, 50, 63, 80, 100
SCA2-P	Stroke Adjustable Type (Push)	
SCA2-R	Stroke Adjustable Type (Pull)	
SCA2-T	Heat resistant type	
SCA2-Q2	Drop prevention type	
SCA2-O	Low Friction Type	
SCA2-U	Low Friction Type	
SCA2-D	Double rod type	
SCA2-B	Back-to-Back Type	
SCA2-W	Two-Stage Type	
SCA2-K	Steel Tube Type	
SCA2-H	Low Hydraulic Pressure Type	
SCA2-G	Scraper Type	
SCA2-G2/G3	Cutting Oil Resistant Type	
SCA2-G1/G4	Sputter adhesion prevention type	
SCA2-V	With Valve	

Space-Saving Type >>> Pneumatic Cylinder ② Catalog No.RJ-003AA

General Type/Large Bore Cylinder **(ø125 to ø250)**

Rich variations and high rigidity

Large Bore Size Cylinders

SCS2

Series	Also known as...	Bore Size (ø)
SCS2	Lubricated Type	125, 140, 160, 180, 200, 250
SCS2-N	Non-Lube Type	
SCS2-P	Stroke Adjustable Type (Push)	
SCS2-T	Heat resistant type	
SCS2-D	Double Rod Type/Lubricated Type	
SCS2-ND	Double Rod Type/Non-Lube Type	
SCS2-B	Back-to-Back Type	
SCS2-W	Two-Stage Type	
SCS2-H	Low Hydraulic Pressure Type	
SCS2-G	Heavy-Duty Scraper Type	

Space-Saving/Super Compact **(ø12 to ø200)**

Abundant variations, compact type with switch mounting on 4 sides

Compact Cylinders

SSD2

Series	Also known as...	Bore Size (ø)
SSD2	Single Rod Type	12 to 200
SSD2-K	High Load Type	12 to 100
SSD2-L	Long stroke	
SSD2-X	Push Type	12 to 50
SSD2-Y	Retracting Type	
SSD2-T1	Heat resistant type	12 to 100
SSD2-T1L	With Heat Resistant Cylinder Switch	16 to 63
SSC2-K-□C	High Load Type/With Rubber Air Cushion	20 to 100
SSD2-Q	Drop prevention type	
SSD2-F/SSD2-KF	Fine Speed Type/High Load/Fine Speed Type	12 to 100
SSD2-O	Low Speed Type	
SSD2-KU	High Load/Low Friction Type	20 to 100
SSD2-D	Double rod type	12 to 200
SSD2-B	Back-to-Back Type	12 to 100
SSD2-W	Two-Stage Type	
SSD2-M	Non-Rotating Type	12 to 63
SSD2-DM	Double Rod/ Non-Rotating Type	
SSD2-G	Heavy-Duty Scraper Type	20 to 100
SSD2-G2/G3	Cutting Oil Resistant Type	16 to 100
SSD2-KG2/KG3	High Load/Cutting Oil Resistant Type	
SSD2-G1	Coil Scraper Type	25 to 100
SSD2-G4	Sputter adhesion prevention type	
SSD2-KG1	High Load/Coil Scraper Type	
SSD2-KG4	High Load/Spatter Adhesion Prevention Type	
SSD2-DG1	Double Rod/Coil Scraper Type	
SSD2-DG4	Double Rod/Spatter Adhesion Prevention Type	
SSD2-G5	Environment Resistant Scraper Type	20 to 100
SSD2-KG5	High Load/ Environment Resistant Scraper Type	
SSD2-L4	With Strong Magnetic Field Resistant Switch	40 to 100
SSD2-G1L4	With Strong Magnetic Field Resistant Switch/ With Coil Scraper	
SSD2-KL4	High Load/With Strong Magnetic Field Resistant Switch	
SSD2-KG1L4	High Load/With Strong Magnetic Field Resistant Switch/With Coil Scraper	

Space-Saving/Guided/Super Compact **(ø12 to ø100)**

SSD2 Series equipped with guide rod

Guided Compact Cylinders

SSG

Series	Also known as...	Bore Size (ø)
SSG	Single Rod Type	12 to 100

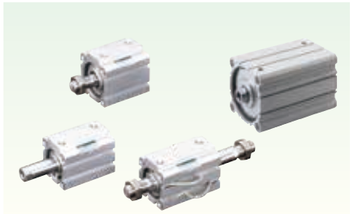
Search by Product System List

Products can be selected by series appearance and product overview.

Space-Saving Type >>> Pneumatic Cylinders ② Catalog No. RJ-003AA

Space-Saving/Super Compact **(ø12 to ø160)**

Compact type with abundant Bore Sizes and options



Compact Cylinders

SSD

Series	Also known as...	Bore Size (ø)
SSD	Single Rod Type	12 to 160
SSD-K	Single Rod High Load Type	12 to 100
SSD-X	Single Acting, Push Type	12, 16, 20, 25, 32, 40, 50
SSD-Y	Single Acting, Retracting Type	
SSD-T	Heat resistant type	12 to 100
SSD-T1L	With Heat Resistant Cylinder Switch	16 to 63
SSD-K-□C	High Load Type/With Rubber Air Cushion	32 to 100
SSD-Q	Drop prevention type	16 to 100
SSD-F	Low speed type	12 to 100
SSD-KF	High Load Type/ Fine Speed Type	
SSD-O	Low Speed Type	
SSD-KU	High Load/Low Friction Type	20 to 100
SSD-D	Double rod type	12 to 160
SSD-B	Back-to-Back Type	12 to 100
SSD-W	Two-Stage Type	
SSD-M	Non-Rotating Type	12 to 63
SSD-G2/G3	Cutting Oil Resistant Type	16 to 100
SSD-K G2/G3	High Load, Cutting Oil Resistant Type	
SSD-G1/G4	Sputter adhesion prevention type	25 to 100
SSD-K G1/G4	High Load, Spatter Adhesion Prevention Type	
SSD-D G1/G4	Double Rod, Spatter Adhesion Prevention Type	
SSD-G5	Environment Resistant Scraper Type	20 to 100
SSD-KG5	High Load/Environment Resistant Scraper Type	20 to 100
SSD-L4	With Strong Magnetic Field Resistant Switch	40 to 100
SSD-G1L4	With Strong Magnetic Field Resistant Switch/ With Coil Scraper	
SSD-KL4	High Load Type With Strong Magnetic Field Resistant Switch	
SSD-KG1L4	High Load Type With Strong Magnetic Field Resistant Switch/With Coil Scraper	

Space-Saving/Compact Single Acting Type **(ø6 to ø15)**

Thumb-sized with fully threaded outer diameter

Cartridge Cylinders

CAT

Series	Also known as...	Bore Size (ø)
CAT	Single Acting, Push Type	6, 10, 15

Space-Saving/Multi-Surface Mount Type **(ø6 to ø32)**

More compact than conventional products, direct mount

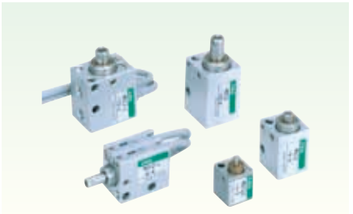
Compact Cylinders

SMG

Series	Also known as...	Bore Size (ø)
SMG	Single Rod Type	6 to 32
SMG-X	Push Type	
SMG-Y	Retracting Type	
SMG-F	Low speed type	
SMG-M	Non-rotating Type	

Space-Saving/Direct Mount Type **(ø4 to ø10)**

Direct mounting possible from 4 directions



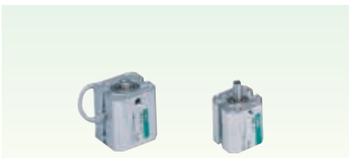
Compact Direct Cylinders

MDC2

Series	Also known as...	Bore Size (ø)
MDC2	Single Rod Type	4, 6, 8, 10
MDC2-X	Push Type	
MDC2-Y	Retracting Type	
MDC2-F	Low Speed Type	

Space-Saving/Compact Cylinder **(ø6 to ø16)**

SSD small bore series. With high-precision guide also available



Compact Cylinders

MSD

Series	Also known as...	Bore Size (ø)
MSD	Single Rod Type	6, 8
MSD-X	Single Acting, Push Type	
MSD-Y	Single Acting, Retracting Type	
MSD-K	High Load Type	6, 8, 12, 16
MSD-F	Low speed type	6, 8
MSD-KF	High Load Type/Fine Speed Type	6, 8, 12, 16

Space-Saving/Flat Type **(ø25 to ø63)**

Mountable even in narrow spaces. With rotation stop function

Flat Cylinder Compact Demi

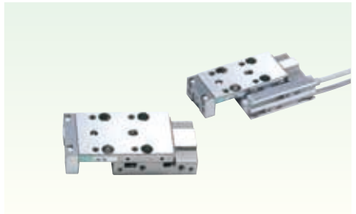
FC□

Series	Also known as...	Bore Size (ø)
FCS	Single Acting, Push Type	25, 32, 40, 50, 63 equivalent
FCH	Single Acting, Retracting Type	
FCD	Single Rod Type	
FCD-D	Double rod type	
FCD-K	With Cushion	

With Linear Guide >>> Pneumatic Cylinders ③ Catalog No. RJ-004AA

With High-Precision Guide **(ø4.5 to ø8)**

High precision and rigidity in a compact size



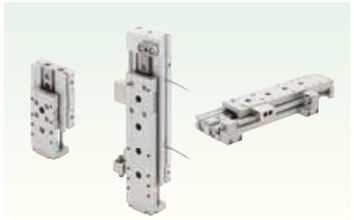
Linear Slide Cylinders

LCM

Series	Also known as...	Bore Size (ø)
LCM	Single rod type	4.5 to 8
LCM-P	Stroke Adjustable Type (Push)	
LCM-R	Stroke Adjustable Type (Push/ Retract)	
LCM-A	Side Mount Type	

With High-Precision Guide **(ø6 to ø25)**

Thorough weight reduction, increased rigidity



Linear Slide Cylinders

LCR

Series	Also known as...	Bore Size (ø)
LCR	Basic type	6 to 25
LCR-Q	Drop prevention type	8 to 25
LCR-F	Ultra Low Speed Type	12, 16, 20, 25

With High-Precision Guide **(ø6 to ø25)**

Emphasis on high precision and high rigidity. Easier to use

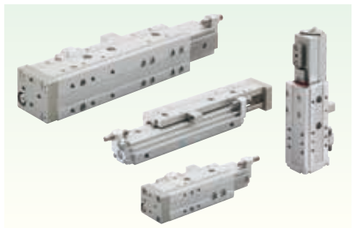
Linear Slide Cylinders

LCG

Series	Also known as...	Bore Size (ø)
LCG	Single rod type	6 to 25
LCG-Q	Drop prevention type	8 to 25

With High-Precision Guide **(ø12 to ø20)**

Standardly equipped with specs frequently used by customers



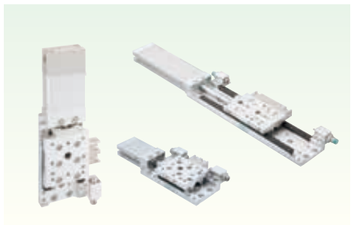
Linear Slide Cylinders

LCW

Series	Also known as...	Bore Size (ø)
LCW	Single rod type	12 to 20
LCW-Q	Drop prevention type	

With High-Precision Guide **(ø25, ø32)**

Ideal for space-saving applications due to thorough thinning



Low Profile Linear Slide Cylinders

LCX

Series	Also known as...	Bore Size (ø)
LCX	Single rod type	25, 32
LCX-Q	Drop prevention type	
LCX-□L	Long stroke	
LCX-Q-□L	Fall Prevention Type / Long Stroke	

Guided Compact Cylinder **(ø6 to ø16)**

SSD small bore series. With high-precision guide also available

Compact Linear Guided Compact Cylinders

MSDG

Series	Also known as...	Bore Size (ø)
MSDG-L	Guided Type	6, 8, 12, 16
MSDG-LF	Guided Type/Fine Speed Type	12, 16

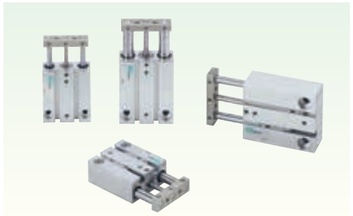
Search by Product System List

Products can be selected by series appearance and product overview.

Guided >>> Pneumatic Cylinders ③ Catalog No. RJ-004AA

Guided Cylinder **(ø6, ø10)**

Extremely small guided space-saving type



Compact Guided Cylinders

STM

Series	Also known as...	Bore Size (ø)
STM-M/B	Single rod type	6, 10

Guided Cylinder **(ø12 to ø100)**

Environmentally friendly product. Improved load resistance

Guided Cylinders

STG

Series	Also known as...	Bore Size (ø)
STG-M/B	Single rod type	12 to 100
STG-M/B-□C	Rubber Air Cushion Type	32 to 63
STG-M/B C	Air Cushion Type	16 to 63
STG-M/B Q	Drop prevention type	20 to 63
STG-M/B G	Heavy-Duty Scraper Type	
STG-M/B G1	Coil Scraper Type	
STG-MG2/MG3	Cutting Oil Resistant Type	
STG-M/B G4	Sputter adhesion prevention type	40 to 63
STG-MG5	Environment Resistant Scraper Type	20 to 100
STG-K	Heavy-Duty Guide Rod Type	32, 50

Guided Cylinder **(ø8 to ø100)**

Abundant Bore Sizes and variations

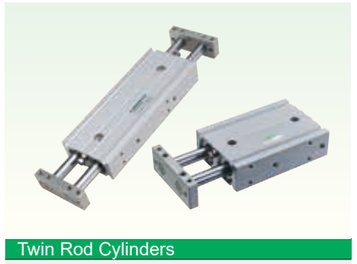
Guided Cylinders

STS/STL

Series	Also known as...	Bore Size (ø)
ST S/L-M/B	Single Rod Type	8 to 100
ST S/L-M/B P	Stroke Adjustable Type (Push)	8 to 80
ST S/L-M/B T	Heat resistant type	12 to 80
ST S/L-M/B T2	Packing Material: Fluoro Rubber	
ST S/L-M/B-□C	Rubber Air Cushion Type	32 to 80
ST S/L-M/B C	Air Cushion Type	25 to 80
ST S/L-M/B Q	Drop prevention type	20 to 80
ST S/L-M/B F	Low speed type	8 to 80
ST S/L-M/B O	Low Speed Type	
ST S/L-M/B G	Heavy-Duty Scraper Type/	20 to 80
ST S/L-M/B G1	Coil Scraper Type	
ST S/L-M/B G 2/3	Cutting Oil Resistant Type	
ST S/L-M/B G4	Sputter adhesion prevention type	40 to 80
ST S/L-M/B V	Valve Mounted Type	20 to 63

Twin Rod Cylinder **(ø6 to ø32)**

High non-rotating accuracy with twin rods. For P&P applications



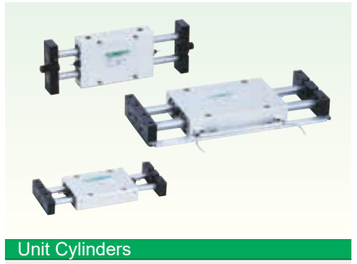
Twin Rod Cylinders

STR2

Series	Also known as...	Bore Size (ø)
STR2-M/B	Standard type	6, 10, 16, 20, 25, 32
STR2-M/B Q	Drop prevention type	16, 20, 25, 32
STR2-M/B O	Low Speed Type	6, 10, 16, 20, 25, 32
STR2-M/B F	Low speed type	10, 16, 20, 25, 32
STR2-M/B D	Double rod type	6, 10, 16, 20, 25, 32

Unit Cylinder **(ø10 to ø32)**

Stable positioning accuracy with double/double rod structure



Unit Cylinders

UCA2

Series	Also known as...	Bore Size (ø)
UCA2	Sleeve Bearing Type	10, 16, 25, 32
UCA2-B	Rolling Bearing Type	

Rodless Type >>> Pneumatic Cylinders ④ P. 1

Rodless Type/Basic Type **(ø12 to ø100)**

Abundant Bore Sizes and variations

Listed Page From P. 5

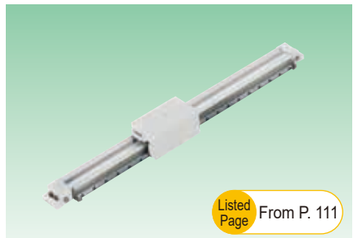
Super Rodless Cylinders

SRL3

Series	Also known as...	Bore Size (ø)	Page
SRL3	Standard type	12, 16, 20, 25, 32, 40, 50, 63, 80, 100 equivalent	10
SRL3-J	Full Cowl Type		70
SRL3-G	With Resin Guide		28
SRL3-Q	With Fall Prevention Function		42
SRL3-GQ	With Resin Guide / With Fall Preven-tion Function		58

Rodless Type/With High-Precision Guide **(ø12 to ø25)**

Integrated High Precision LM Guide



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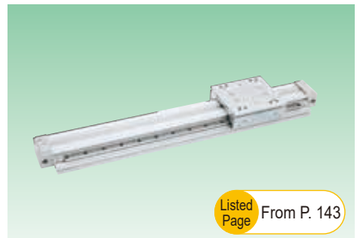
Super Rodless Cylinder with High Precision Guide

SRG3

Series	Also known as...	Bore Size (ø)	Page
SRG3	Standard Type	12, 16, 20, 25 equivalent	116

Rodless Type/With High-Precision Guide **(ø25 to ø63)**

High Precision LM Guide adopted on 2 axes. Increased rigidity



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Super Rodless Cylinder with High Precision Guide

SRM3

Series	Also known as...	Bore Size (ø)	Page
SRM3	Double Acting Type	25, 32, 40, 63 equivalent	146
SRM3-Q	Double Acting Type / Fall Prevention Type		146

Magnet Type With High-Precision Guide **(ø10 to ø25)**

High-precision LM guide integrated into MRL2

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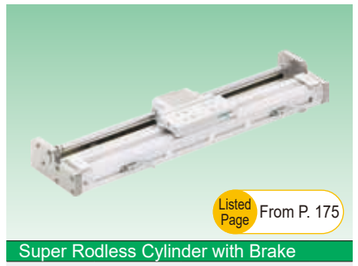
Magnet Type Super Rodless Cylinder High Precision Guide

MRG2

Series	Also known as...	Bore Size (ø)	Page
MRG2	Double Acting Type	10, 16, 25	242

Rodless Type/With Brake **(ø12 to ø63)**

Type with high-reliability brake



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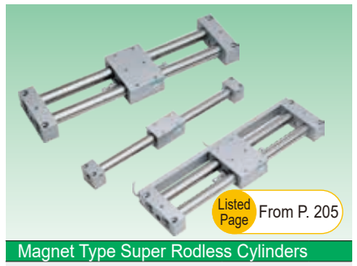
Super Rodless Cylinder with Brake

SRT3

Series	Also known as...	Bore Size (ø)	Page
SRT3	Double Acting Type	12, 16, 20, 25, 32, 42, 50, 63 equivalent	178

Rodless Type/Magnet Type **(ø6 to ø32)**

Rodless, further space-saving



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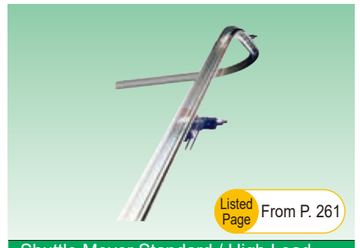
Magnet Type Super Rodless Cylinders

MRL2

Series	Also known as...	Bore Size (ø)	Page
MRL2	Basic type	6, 10, 16, 20, 25, 32	212
MRL2-G	Simple Guide Type / 1 Piston		212
MRL2-W	Simple Guide Type / 2 Piston		212
MRL2-F	Low speed type		212

Rodless Type/Shuttle Mover **(ø25)**

Rodless with a curve. Flexible layout possible



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Shuttle Mover Standard / High Load

SM-25

Series	Also known as...	Bore Size (ø)	Page
SM-25	Standard Type	25	264
	High Load Type		

Search by Product System List

Products can be selected by series appearance and product overview.

With Brake/With Lock >>> Pneumatic Cylinders ④ P. 289

Small/Medium Bore with Brake **(ø16 to ø40)**

High-performance compact brake for pencil type, etc.

Cell Top Cylinders (Small/Medium Bore)

ULK

Series	Also known as...	Bore Size (ø)	Page
ULK	Single Rod Type	20, 25, 32, 40	296
ULK-V	With Valve	20, 25, 32, 40	296

Small/Medium Bore with Brake **(ø20 to ø40)**

Reliable brake equipped on CMK2/CMA2

Cell Top Cylinders (Small/Medium Bore)

JSK2/JSM2

Series	Also known as...	Bore Size (ø)	Page
Crimped Type			
JSK2	Single Rod Type	20, 25, 32, 40	324
JSK2-V	With Valve		324
Disassembly Type			
JSM2	Single Rod Type	20, 30, 40	344
JSM2-V	With Valve		344

Medium Bore with Brake **(ø40 to ø100)**

Reliable brake mechanism equipped on SCG

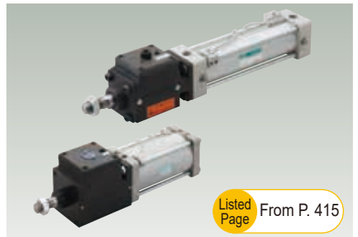
Tie Rod Cylinders with Brake

JSG

Series	Also known as...	Bore Size (ø)	Page
JSG	Single Rod Type	40, 50, 63, 80, 100	376
JSG-V	With Brake Release Valve		376

Medium/Large Bore with Brake **(ø40 to ø180)**

Brake equipped on reliable robust cylinder



Cell Top Cylinders (Medium/Large Bore)

JSC3/JSC4

Series	Also known as...	Bore Size (ø)	Page
JSC3	Single Rod Type	40 to 100	422
JSC4	Single Rod Type	125 to 180	422
JSC3-V	With Valve for Brake	40 to 100	460
JSC3-H	Low Hydraulic Pressure Type	40 to 100	470
JSC4-H	Low Hydraulic Pressure Type	125 to 180	470
JSC3-T	Heat resistant type	40 to 100	486
JSC4-T	Heat resistant type	125 to 180	486

With Fall Prevention **(ø20 to ø100)**

Fall prevention function equipped on compact SSD

Super Compact Cylinders with Fall Prevention

USSD

Series	Also known as...	Bore Size (ø)	Page
USSD	Single Rod Type	20, 25, 32, 40, 50, 63, 80, 100	514
USSD-K	High Load Type		514

With Fall Prevention **(ø25 to ø63)**

Fall prevention function equipped on Flat Cylinder FCD Series

Flat Cylinders with Free Position and Fall Prevention

UFCD

Series	Also known as...	Bore Size (ø)	Page
UFCD-KL	Single Rod Type/ With Cushion	25 to 63	566

With Fall Prevention **(ø40 to ø100)**

Fall prevention possible at any position

Selex Cylinders with Free Position and Fall Prevention

USC

Series	Also known as...	Bore Size (ø)	Page
USC	Single Rod Type	40 to 100	588
USC-G1	With Coil Scraper		588

Lock Unit >>> Pneumatic Cylinders ④ P. 613

Light. Slim lock unit

Fixing, "Improved safety", "Drop prevention" possible

Lock Units

UB

Series	Applicable Shaft Diameter	Page
UB	8, 16	620

Brake Unit

Only the brake part of the Brake Cylinder is unitized

Brake Units

JSB3

Series	Rod Diameter	Page
JSB3	16, 20, 25, 30, 35, 40, 45	628

Brake for LM Guide

Reliable brake mounted on LM Guide

Linear Guide Locks

LMB

Series	Page
LMB	636

Lock unit

Linear guide, compact and high holding force

Linear Guide Locks

LML

Series	Page
LML	643

With Valve >>> Pneumatic Cylinders ④ P. 651

With Valve/Medium Bore Cylinder **(ø20 to ø40)**

High performance solenoid valve mounted on CMK2 Series

Compact Cell Cylinders

CKV2

Series	Also known as...	Bore Size (ø)	Page
CKV2	Single Rod Type	20, 25, 32, 40	660
CKV2-M	Non-Rotating Type		670

With Valve **(ø50, 75, 100)**

Boasting long-standing reliability

Cell Cylinders

CAV2/COV$^{P}_{N}$2

Series	Also known as...	Bore Size (ø)	Page
CAV2	Double Solenoid/ Lubricated Type	50, 75, 100	694
COVP2	Single Solenoid / Push on Energization Type / Lubricated Type		694
COVN2	Single Solenoid / Retract on Energization Type / Lubricated Type		694
CAV2-N	Double Solenoid / Non-lube Type		694
COVP2-N	Single Solenoid / Push on Energization Type / Non-lube Type		694
COVN2-N	Single Solenoid / Retract on Energization Type / Non-lube Type		694

Other with valve

In addition, there is a lineup of "Cylinders with Valves" below.

Product Name	Series	Bore Size (ø)	Catalog No.
Pencil Shaped Cylinder	SCPS3-V SCPD3-V	10, 16	RJ-002AA
Medium Bore Size Cylinder	SCA2-V	40, 50, 63, 80, 100	RJ-002AA
Guided Cylinder	ST S/L-M/B V	20 to 63	RJ-004AA
Brake Cylinder	ULK-V	20, 25, 32, 40	P. 296
	JSK2-V	20, 25, 32, 40	P. 324
	JSM2-V	20, 25, 32, 40	P. 344
	JSG-V	40, 50, 63, 80, 100	P. 376
	JSC3-V	40, 50, 63, 80, 100	P. 460
Selex Rotary	RV3S V/W RV3D V/W	0.98 to 66.6 (Torque Size)	P. 1304

Search by Product System List

Products can be selected by series appearance and product overview.

Clamp >>> Pneumatic Cylinders ④ P. 733

Clamp Cylinder **(ø40 to ø80)**

Cylinder exclusively for clamping

Clamp Cylinders

CAC4

Series	Also known as...	Bore Size (ø)	Page
CAC4	Single Rod Type	40, 50, 63, 80	742
CAC4-G4	Sputter adhesion prevention type	40, 50, 63, 80	756

Clamp Cylinder with Fall Prevention **(ø50, ø63)**

Drop prevention function equipped on clamp cylinder

Clamp Cylinders with Fall Prevention

UCAC2

Series	Also known as...	Bore Size (ø)	Page
UCAC2	Single Rod Type	50, 63	772

Clamp Cylinder **(ø32, ø40)**

Dedicated for clamping, contributes to weight reduction of welding jigs

Lightweight Clamp Cylinders

CAC-N

Series	Also known as...	Bore Size (ø)	Page
CAC-N	Single Rod Type	32, 40	792

Clamp Cylinder with Fall Prevention **(ø32, ø40)**

Equipped with free position fall prevention function

Lightweight Clamp Cylinders with Fall Prevention

UCAC-N

Series	Also known as...	Bore Size (ø)	Page
UCAC-N	With Fall Prevention	32, 40	798

Rotary Clamp **(ø12 to ø63)**

Simple design for compact clamping

Rotary Clamp Cylinders

RCS2

Series	Also known as...	Bore Size (ø)	Page
RCS2	Single Rod Type	12 to 63	816
RCS2-T2	Seal material Fluororubber		826
RCS2-G4	Sputter adhesion prevention type	32 to 63	832

Rotary Clamp **(ø16 to ø63)**

Ideal for clamping in limited spaces

Rotary Clamp Cylinders

RCC2

Series	Also known as...	Bore Size (ø)	Page
RCC2	Single Rod Type	16 to 63	846
RCC2-G4	Sputter adhesion prevention type	20 to 63	860

Pin Clamp Cylinder

Workpiece positioning and clamping possible with one unit

Pin Clamp Cylinders

PCC

Series	Also known as...	Bore Size (ø)	Page
PCC	Single Rod Type	50	878
PCC-Q	Drop prevention type		878

Special >>> Pneumatic Cylinders ④ P. 901

Space-Saving/Compact With Vacuum Pad **(ø6, ø10)**

Suction pad equipped on Rod End

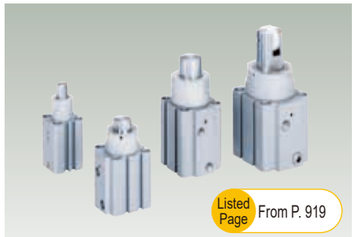
Compact Cylinders with Vacuum Suction

MVC

Series	Also known as...	Bore Size (ø)	Page
MVC	Single Rod Type	6, 10	908

Stopper Cylinder **(ø20 to ø50)**

Space saving type with excellent lateral load resistance



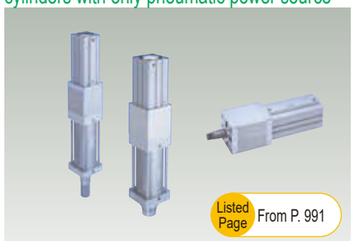
Stopper Cylinders

STK

Series	Also known as...	Bore Size (ø)	Page
STK	Rod End/Shape: Round Bar Type	20, 32, 40, 50	924
STK-Y	Single Acting / Retract Type / Rod End Round Bar Shape		932
STK-Y1	Spring Type / Rod End Round Bar Shape		940
STK-M	Rod End Chamfered Shape		948
STK-MY	Single Acting / Retract Type / Rod End Chamfered Shape		956
STK-MY1	Spring Type / Rod End Chamfered Shape		964
STK-JY	Single Acting / Retract Type / Rod End Roller Shape		972
STK-JY1	Spring Type / Rod End Roller Shape		978

Mechanical Power Cylinder

Achieves high thrust comparable to hydraulic cylinders with only pneumatic power source



Mechanical Power Cylinders

MCP

Series	Also known as...	Bore Size (ø)	Page
MCP-W	Fast Forward + Intensification	For 2t / For 5t	996
MCP-S	Intensification Part Only		996

Guideless Cylinder **(ø40 to ø100)**

Non-rotating without guide, excellent lateral load resistance

Guideless Cylinders

GLC

Series	Also known as...	Bore Size (ø)	Page
GLC	Single Rod Type	40 to 100	1018

Balancer Unit **(ø50 to ø100)**

Lightly supports heavy objects with only air source

Balancer Units

BBS

Series	Also known as...	Bore Size (ø)	Page
BBS-A	Automatic Pressure Adjustment Type	50 to 100	1038
BBS-O	Fixed Pressure Adjustment Type		1054

Unit Equipment XZ Axis Composite Unit

Selectable X axis (payload), selectable Z axis.

New Handling System

NHS

Series	Also known as...	Page
NSR	X Axis Module	1076
NHS-H	Z Axis Module (HRL)	1088
NHS-S	Z Axis Module (STL-B)	1100

Search by Product System List

Products can be selected by series appearance and product overview.

Special >>> Pneumatic Cylinders ④ P. 901

Guided Single Axis Unit

Low profile and high rigidity

Hybri-Robo

HRL

Series	Also known as...	Page
HRL-1	Guided Single Axis Unit	1120

With Length Measurement Function/Cylinder/Gripper

Compact cylinder/gripper equipped with length measuring function

Cylinder/Gripper with Linear Norm Sensor

LN

Series	Also known as...	Bore Size (ø)	Page
SSD-LN SSD-O-LN	Cylinder with Sensor Super Compact Type	12 to 50	1144
BHA-LN	Cross Roller Parallel Gripper with Sensor	12, 16, 20, 25	1150
BHG-LN	Cross Roller Parallel Gripper with Rubber Cover and Sensor	12, 16, 20, 25	1150
BHE-LN	Centering Gripper with Sensor	12, 16, 20, 25	1150

High Speed Type >>> Pneumatic Cylinders ④ P. 1177

High Speed Type/High Speed Cylinder **(ø20 to ø63)**

High speed operation at 2000 mm/s. High cushion capacity

High Energy Absorption Cylinders

HCM

Series	Also known as...	Bore Size (ø)	Page
HCM	Single Rod Type	20 to 63	1186

High Speed Type/High Speed Cylinder **(ø20 to ø100)**

High-speed operation at 3000 mm/s. High cushion capacity

High Speed Cylinders

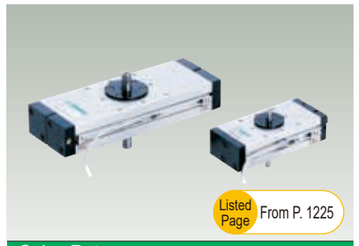
HCA

Series	Also known as...	Bore Size (ø)	Page
HCA	Single Rod	20, 25, 32, 40, 50, 63, 80, 100	1206

Swinging/Rotating Type >>> Pneumatic Cylinders ④ P. 1223

Swing/Rotary Type 0.7 to 5.6 N·m

Rack & pinion type, compact swinging type



Selex Rotary

RRC

Series	Also known as...	Torque Size	Page
RRC	Rack & Pinion Type	0.7 to 5.6	1230

*Torque size (N·m, at 0.5 MPa)

Swinging/Rotating Type 0.5 to 8.0 N·m

Table type actuator. High precision type also available

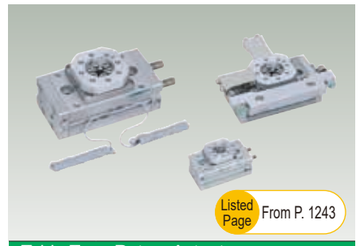


Table Type Rotary Actuators

GRC

Series	Also known as...	Torque Size	Page
GRC	Basic type	0.5 to 8.1	1248
GRC-K	High-Precision Type	1.0 to 8.1	1248
GRC-F	Low speed type	0.5 to 8.1	1262
GRC-KF	High-Precision Type/Low Speed Type	1.0 to 8.1	1262

*Torque size (N·m, at 0.5 MPa)

Swinging/Rotating Type 0.12 to 0.66 N·m

Vane type. Abundant torque sizes.

Selex Rotary Vane Type

RV3□

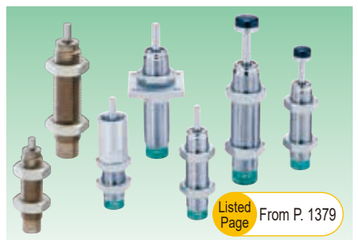
Series	Also known as...	Torque Size	Page
Compact			
RV3S	Single Vane Type	0.12 to 3.19	1288
RV3D	Double Vane Type	0.28 to 7.70	1288
RV3S V/W	Single Vane Type/With Valve	0.98 to 3.19	1304
RV3D V/W	Double Vane Type/With Valve	2.11 to 7.70	1304
RV3S	Angle Adjustable Single Vane Type	0.31 to 3.19	1312
RV3DA	Angle Adjustable Double Vane Type	0.71 to 7.70	1312
Large			
RV3S (Large)	Single Vane Type	4.7 to 102	1324
RV3D (Large)	Double Vane Type	10.1 to 206	1324
RV3S V/W	Single Vane Type with Valve	4.7 to 27.9	1334
RV3D V/W	Double Vane Type with Valve	10.1 to 66.6	1334
RV3SH	Single Vane Type Low Hydraulic Pressure Type	4.7 to 102	1344
RV3DH	Double Vane Type Low Hydraulic Pressure Type	10.1 to 206	1344
RVC	Shock absorber		1350

*Torque size (N·m, at 0.5 MPa)

Related Components >>> Pneumatic Cylinders ④ P. 1377

Shock Absorber **(Absorption Capacity 1 to 720 J)**

3 models available to suit application



Shock absorbers

SKL, NCK, SCK, FCK

Series	Also known as...	Absorption Energy	Page
Fixed Type			
SKL	–	0.2 to 3.6	1386
NCK	–	1 to 200	1392
Adjustable Type			
SCK	–	0.049 to 588	1404
FCK-L	Low Speed Type	1.5 to 79.3	1414
FCK-M	Medium Speed Type	1.8 to 720	1414
FCK-H	High Speed Type		

Absorption Energy: J

Free Joint **(Size M3 to M45)**

For preventing misalignment when mounting cylinder. 3 types available

Free Joints

FJ

Series	Page
FJ	1442

Simple Type Floating Connector

For preventing misalignment when mounting cylinder. Simple type.

Simple Floating Joint

FK

Series	Page
FK	1452

Cylinder Switch

>>> Pneumatic Cylinders ④ P. 1457

Abundant types available

Cylinder Switches

Series	Page
2-Color Indicator Solid State Cylinder Switch	1464
Strong Magnetic Field Resistant Cylinder Switch	1465
M Series	1468
R Series	1470
T Series	1472
Water Resistant Cylinder Switch	1476
Magnetic Environment Cylinder Switch	1478
K Series	1480
F Series	1482
H Series	1484
V Series	1485
E Series	1486

Search by Product System List

Products can be selected by series appearance and product overview.

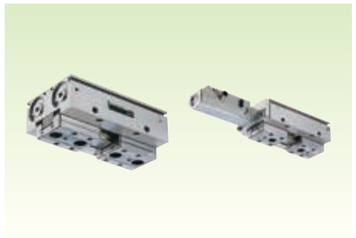
Hands (Grippers) >>> Pneumatic Cylinders ⑤ Catalog No. RJ-006AA

Wide variety including thin, lightweight, and wide types available

Parallel Grippers

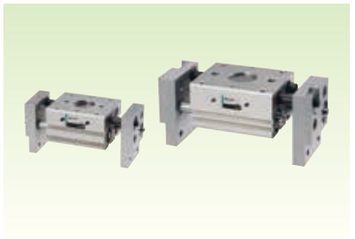
Series	Also known as...	Bore Size (ø)
LSH-HP1 LSHL-HP1	Linear Slide Gripper (HP Series)	6 to 32
LSHM-HP2	Linear Slide Gripper with Length Measurement Function (HP Series)	10 to 25
LSH	Linear Slide Gripper (Standard Type)	10 to 25
FH100	Feather Gripper (Mini Parallel Gripper)	10 to 25
BSA2	Ultra Compact Cross Roller Parallel Gripper	6
BHA	Compact Cross Roller Parallel Gripper	12 to 25
BHG	Compact Cross Roller Parallel Gripper with Rubber Cover	12 to 25

Series	Also known as...	Bore Size (ø)
BHE	Centering Gripper	12 to 32
LHA	Linear Guide Gripper	6 to 32
LHAG	Linear Guide Gripper with Rubber Cover	12 to 32
HAP-1C	Parallel Gripper	15
HAP	Parallel Gripper	20 to 40
HKP	Cross Roller Parallel Gripper	32 to 80
HCP	Horizontal Parallel Gripper	12 to 32
HGP	Long Stroke Parallel Gripper	25



Low Profile Parallel Grippers

Series	Also known as...	Bore Size (ø)
LST-HP1	Low Profile Long Stroke Gripper	8x2 to 20x2
LSTM-HP2	Low Profile Long Stroke Gripper with Length Measurement Function	12x2 to 20x2
HLF2	Long Stroke Thin Gripper	8x2 to 20x2
HLA/HLB	Low Profile Parallel Gripper	12 to 20
HLAG/ HLBG	Low Profile Parallel Gripper with Rubber Cover	12 to 20
HLC	Low Profile Long Stroke Parallel Gripper	8x2 to 30x2
HLD	Ultra Thin Parallel Gripper	8×4 to 20×4



Wide Parallel Grippers

Series	Also known as...	Bore Size (ø)
HMC-HP1	Wide Parallel Gripper	10x2 to 40x2
HMF	Compact Wide Parallel Gripper	12x2 to 40x2
HMF-G	Cutting Oil Resistant Specification Compact Wide Parallel Gripper	16x2 to 25x2
HMFB	Large Wide Parallel Gripper with Linear Guide	25x2 to 40x2
HFP	Wide Parallel Gripper	16×2 to 40×2

Fulcrum Grippers

Series	Also known as...	Bore Size (ø)
FH500	Feather Gripper (Mini Pivot Gripper)	10 to 20
HBL	Pivot Gripper	15 to 40
HJL	Toggle Gripper	32 to 63
HMD	180-degree Opening/Closing Thin Wide Angle Gripper	12 to 25
HDL	180-degree Opening/Closing Wide Angle Gripper	25 to 40
HJD	180-degree Opening/Closing High Gripping Force Wide Angle Gripper	32 to 63

Mechanical Grippers

Series	Also known as...	Cylinder Bore (ø)
BHA-FC	Mechanical Gripper	12 to 32

Chucks >>> Pneumatic Cylinders ⑤ Catalog No. RJ-006AA

Compact and powerful. Abundant types available

3-Jaw Chucks

Series	Also known as...	Bore Size (ø)
CKW-HP1	3-Jaw Chuck	16 to 50
CKWL-HP1	3-Jaw Long Stroke Chuck	16 to 40
CKL2	Powerful Chuck	16 to 100
CKLG2	Powerful Chuck with Rubber Cover	20 to 100
CKL2-HC	Drop Prevention Type Powerful Chuck	32 to 80
CKH2	High Gripping Force Powerful Chuck	50 to 100
CKLB2	2-Direction Powerful Chuck (Parallel Gripper)	20 to 100
CKG	3-Jaw Bearing Chuck	16 to 50
CK	3-Jaw Long Stroke Chuck	25 to 44
CKA	3-Direction Thin Chuck	16 to 100
CKS	Low Profile Chuck	8x3 to 32x3
CKS-F	Low Profile Chuck (Hollow Type)	16x3 to 50x3
CKF	Hollow Chuck	30 to 80
CKJ	Ultra Long Stroke Chuck	12×6 to 50×6

Mechanical Chucks

Series	Also known as...	Cylinder Bore (ø)
CKL2-FC	Mechanical Chuck	20 to 40

Robot Peripheral Components

>>> Pneumatic Cylinder ⑤ Catalog No. RJ-006AA

Auto Gripper Changers

Series	Also known as...
CHC	Auto Gripper Changer

Grippers for Collaborative Robots

>>> Pneumatic Cylinders ⑤ Catalog No. RJ-006AA

Compact and lightweight yet high gripping force due to air drive

Grippers for Collaborative Robots

Series	Also known as...	Bore Size (ø)
RLSH/RHLF/ RCKL-UR	UNIVERSAL ROBOTS Official Certified Gripper	RLSH: ø20 RHLF: ø16x2 RCKL: ø40
RLSH/RHLF/ RCKL-TM	OMRON ROBOT Official Certified Gripper	
RLSH/RHLF/ RCKL-TM	TECHMAN ROBOT Official Certified Gripper	
RLSH/RHLF/ RCKL-FN	FANUC Robot Gripper compatible with CRX Series	
RLSH/RHLF/ RCKL-YS	YASKAWA MOTOMAN Robot Gripper compatible with HC10DTP Series	
RLSH/RHLF/ RCKL-JK	JAKA Robot Gripper compatible with Zu Series	
RLSH/RHLF/ RCKL-KW	Kawasaki Robot duAro Series K-AddOn Registered Gripper	

CKD How to use CAD data

Free download!

This is what makes CKD's CAD great!

Comprehensive list of CKD's leading products

Japanese, English, Chinese (Simplified and Traditional), and Korean are supported.

Simultaneous with new product launch

NEW Model No. AX1R

ABSODEX

Supports various data formats

More than 25 types of 2D and more than 35 types of 3D

Supports PDF and JPEG formats!

*To use 3D CAD, you must register as a CKD plus member.

CKD plus How to register as a member

STEP 1

From the CKD Components Product top page, click "New member registration"

STEP 2.

Enter your name, company name, contact information, and email address

Easy registration in 2 STEPS

Registration complete!

How to download CAD

STEP 1

Click on "3D CAD" from the product detail page

STEP 2.

Select model No.

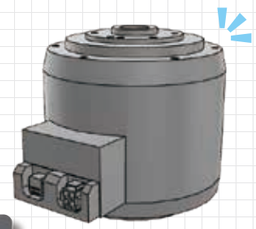
STEP 3

❶ Specify CAD format

❷ Generate CAD data

Download CAD

Download complete!

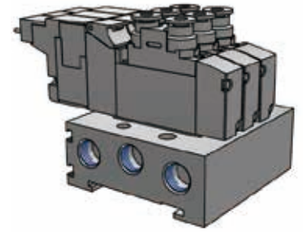


Pneumatic valve manifold specifications and CAD data are easily available on the Web.

Specifications are available

Manifold specifications for pneumatic valves can be prepared and shipped assembled to the customer.

Get CAD data

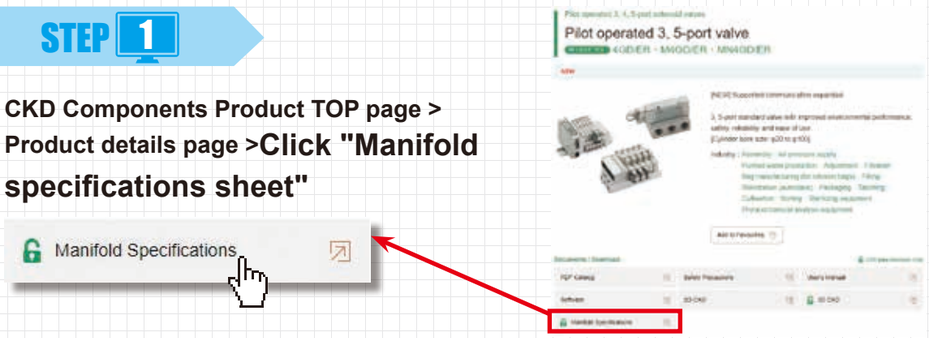


2D and 3D CAD data available for pneumatic valve manifold assemblies

Specifications and download method of CAD data

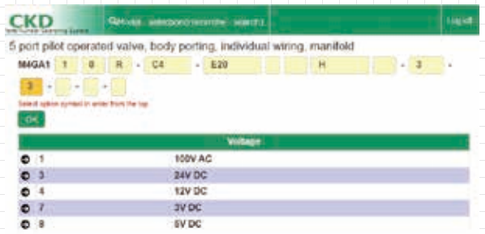
STEP 1

CKD Components Product TOP page > Product details page >Click "Manifold specifications sheet"



STEP 2.

Select model No.



STEP 3

Create specifications sheet

STEP 4

●For specifications output, Specification output Click

●If downloading CAD data 2D/3D CAD Click

Download complete!

Significantly reduces work time

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Website Guide

Various information is provided on our website.
Please make use of it.

Catalogs	CAD	Instruction Manuals
Maintenance Parts	Software	Model Selection
FAQ	Technical Information	Standard Compliant Product Information
Columns	Event Information	Seminars

You can find the information you need here.

You can search for desired products.

You can find suitable products by application.

You can check the latest news.

Each product page provides various information.

Various information is published by product axis and application.

Model Selection System Guide

About Using the Model Selection System

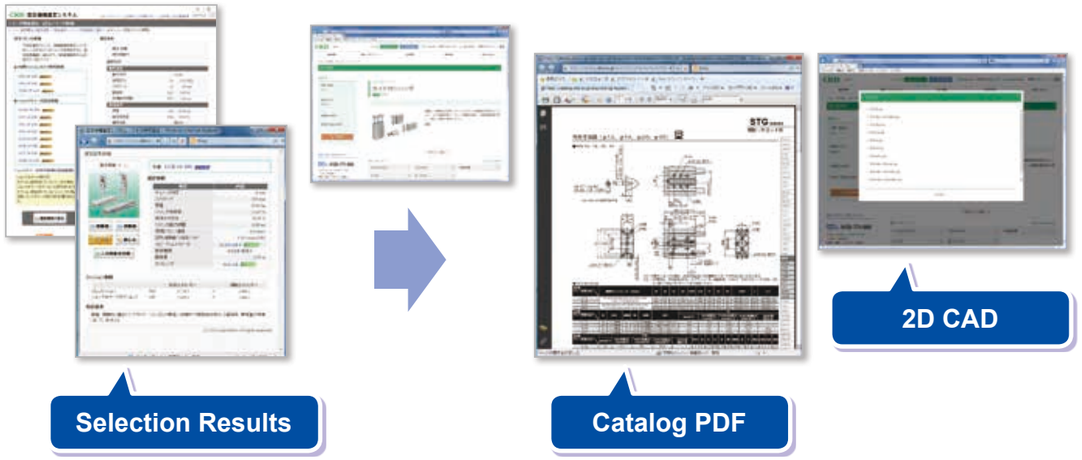
We provide a system that supports the selection of the following items. Please use it when selecting models and designing.

Published on our website

This system is for selecting products according to your application and operating conditions.

*Downloadable software may not be able to be downloaded due to your company's security policy. In that case, please contact us.

Link from selection results to catalog PDFs and CAD data!



No registration required, available anytime!

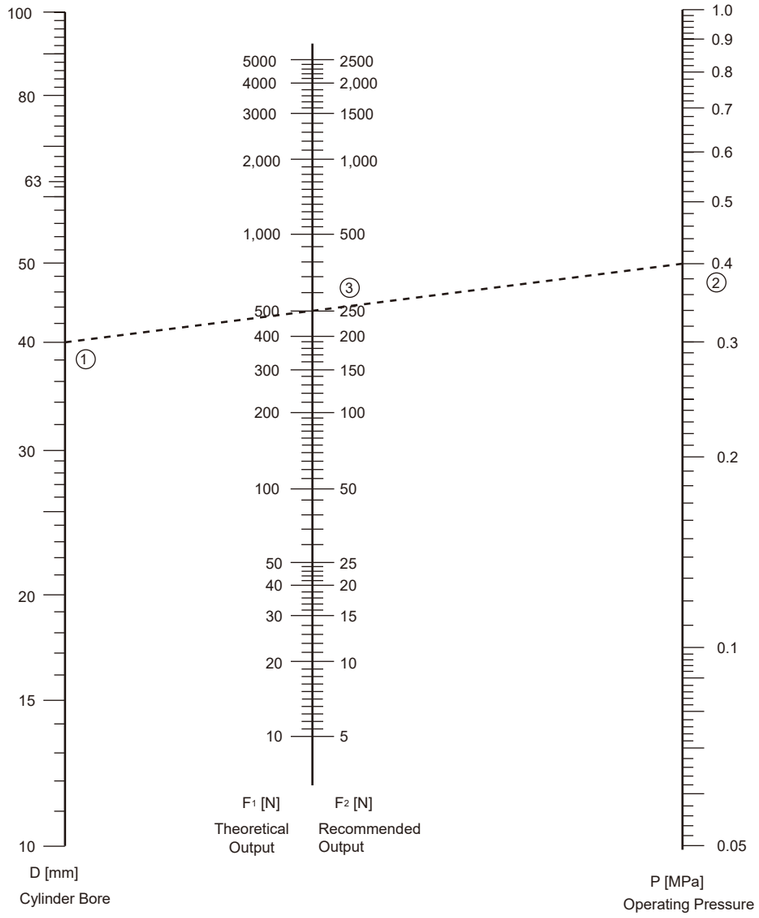
We offer various services for CKD products, including catalogs, PDFs, CAD data, and model selection. Please take a look.

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

Technical Data

Cylinder Bore Selection Nomogram

● For bore 10 mm to 100 mm, rod push direction



This nomogram was created using the following formula.

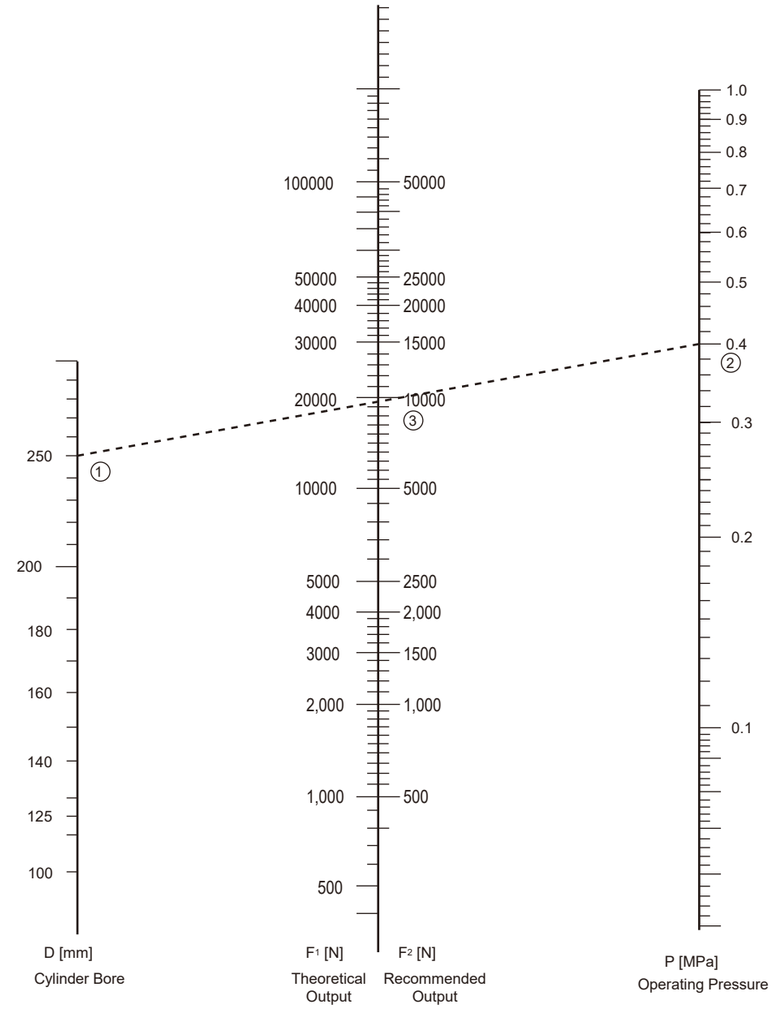
$$F1 = \frac{\pi}{4} \times D^2 \cdot P$$

However, F_1: Theoretical output [N]
F_2: Recommended output (at 50% efficiency) [N]
D: Cylinder bore [mm]
P: Operating Pressure [MPa]

(Example) What is the theoretical output when operating a ø40 bore cylinder at an air pressure of 0.4 MPa?
(Answer) Connect D and P to find the point on F, and obtain a theoretical output F ≈ 500 N.

Cylinder Bore Selection Nomogram

●For bore 100 mm to 250 mm, rod push direction



This nomogram was created using the following formula.

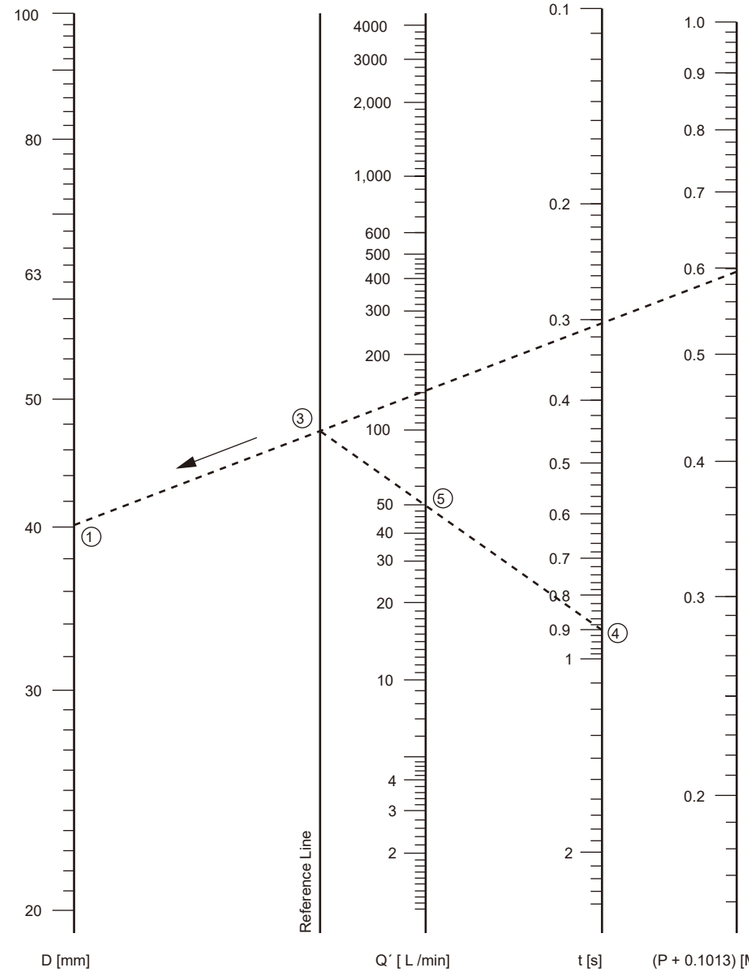
$$F1 = \frac{\pi}{4} \times D^2 \cdot P$$

However, F_1: Theoretical output [N]
F_2: Recommended output (at 50% efficiency) [N]
D: Cylinder bore [mm]
P: Operating Pressure [MPa]

(Example) What is the theoretical output when operating a ø250 bore cylinder at an air pressure of 0.4 MPa?
(Answer) Connect D and P to find the point on F, and obtain a theoretical output F ≈ 19000 N.

Required Flow Rate During Cylinder Operation (Bore Size Within 100 mm)

●Q: Required flow rate per 100 mm stroke L/min



1. Calculation Formula for Required Flow Rate during Cylinder Operation

The required flow rate is the instantaneous flow rate when the cylinder is operating. This is different from the cylinder's air consumption, so please do not confuse them.

$$Q = \frac{\pi}{4} \cdot D^2 \frac{L}{t} \cdot \frac{P+0.1013}{0.1013} \times 10^{-6} \times 60$$

Q: Flow rate [ℓ /min] (ANR)
D: Cylinder bore [mm]
L: Stroke [mm]
t: Stroke travel time [s]
P: Operating Pressure (MPa)

(Ex. 1, figure above) What is the required flow rate when operating a ø40 bore cylinder at an air pressure of 0.5 MPa with a stroke of 100 mm per 0.9 s?

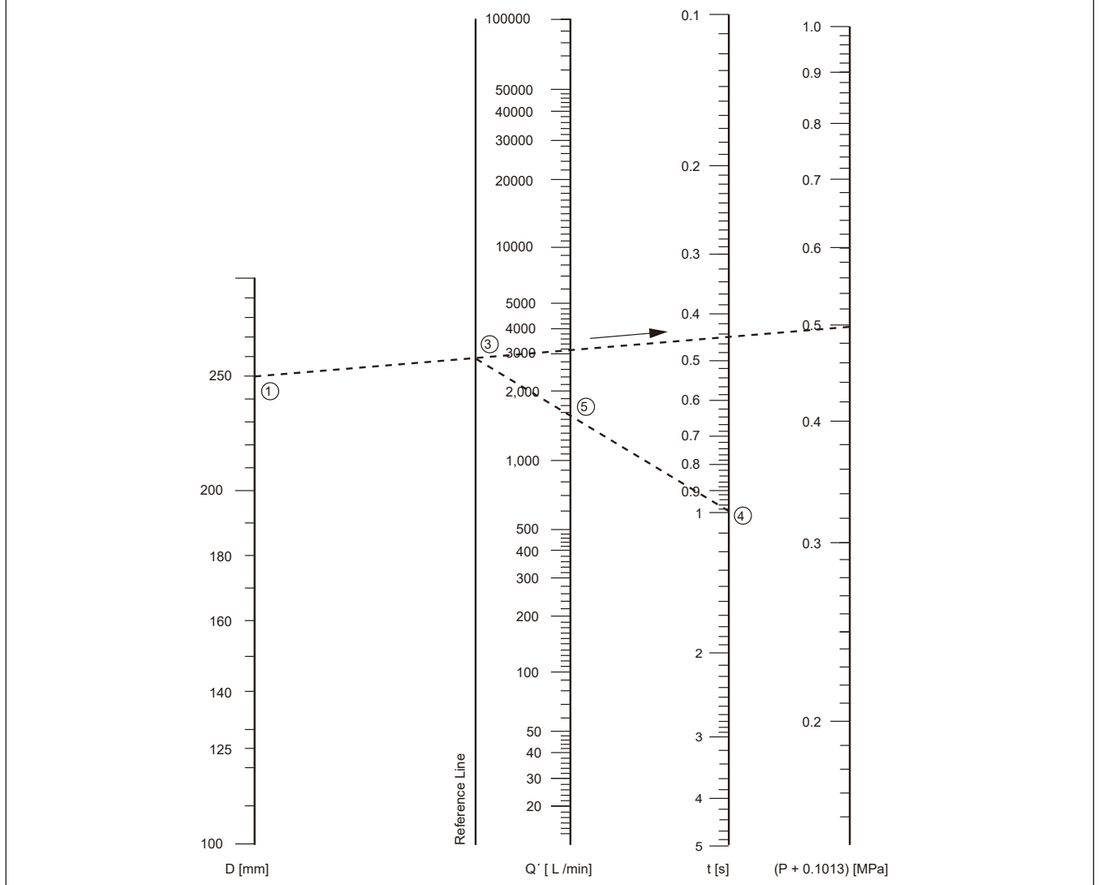
(Answer) Find the point on the relationship line from D and (P+0.1013), and obtain Q' = 50 (L/min) from the point on the relationship line and t.

(Ex. 2, figure right) What is the required air volume when operating a ø250 bore cylinder at an air pressure of 0.4 MPa with a stroke of 100 mm per 1 s?

(Answer) Find the point on the relationship line from D and (P+0.1013), and obtain Q' = 1450 (L/min) from the point on the relationship line and t.

Required Flow Rate During Cylinder Operation (Bore Size 100 to 250 mm)

●Q: Required flow rate per 100 mm stroke L/min



2. Cylinder Air Consumption Calculation Formula (per hour)

Air consumption per time is the air consumption caused by the cylinder operating within a certain period, which is the air volume consumed in the cylinder and in the piping between the cylinder and the switching valve. Regardless of the cylinder speed, it is different from the required air flow rate during operation.

$Q_T=(Q_1+Q_2+(2\times Q_3))\times n$ [For Double Acting cylinder]

Q_T : Air consumption per minute [L/min] (ANR)
n : Number of cylinder operations per minute [cycles/min]
Q_1 : Air consumption during push stroke [L] (ANR)
Q_2 : Air consumption during pull stroke [L] (ANR)
Q_3 : Piping volume from directional control valve to each port of the cylinder [L] (ANR)

$$Q1 = \frac{\pi}{4} \cdot D^2 \times L \times 10^{-6} \times \left(\frac{P+0.1013}{0.1013}\right)$$

$$Q2 = \frac{\pi}{4} \cdot (D^2 - d^2) \times L \times 10^{-6} \times \left(\frac{P+0.1013}{0.1013}\right)$$

$$Q_3 = \frac{\pi}{4} \cdot d_3^2 \times L_3 \times 10^{-6} \times \left(\frac{P}{0.1013}\right)$$

D: Cylinder bore [mm]
d: Piston Rod outer diameter [mm]
L: Cylinder Stroke [mm]
L_3 : Piping length from directional control valve to cylinder port [mm]
d_3 : Piping inner diameter from directional control valve to cylinder port [mm]
P: Working Pressure [MPa] (Gauge Pressure)
(Note: 1 L = 1 dm^3 .)

(Example) Cylinder bore 100 mm, Rod diameter 30 mm, Stroke 800 mm, Operating Pressure 0.5 MPa, 5 operations per minute
Piping tube inner diameter 7 mm, Piping tube length 2000 mm

$$Q_1 = \frac{\pi}{4} \times 100^2 \times 800 \times 10^{-6} \times \left(\frac{0.5+0.1013}{0.1013}\right) = 37.3$$

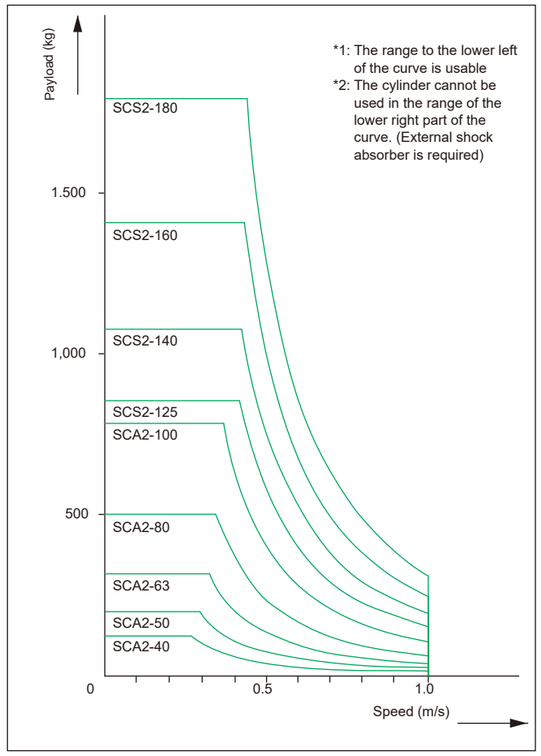
$$Q2 = \frac{\pi}{4} \times (100^2 - 30^2) \times 800 \times 10^{-6} \times \left(\frac{0.5+0.1013}{0.1013}\right) = 33.9$$

$$Q_3 = \frac{\pi}{4} \times 7^2 \times 2000 \times 10^{-6} \times \left(\frac{0.5}{0.1013}\right) = 0.4$$

Q_T = (37.3+33.9+(2×0.4))×5 = 360 [L/min] (ANR)

Allowable absorption energy value: With Cushion

Allowable Absorption Energy Value Graph with Cushion



●Cushion

The purpose of the cushion is to utilize the compressibility of air to absorb the kinetic energy held by the piston and prevent the piston from impacting the cover at the stroke end. Therefore, the cushion is not intended to operate the piston at low speed near the stroke end. The table below shows the kinetic energy that can be absorbed by the cushion. If the kinetic energy exceeds this value or if you want to avoid bouncing due to air compressibility, please consider a separate shock absorber.

$$\text{Kinetic energy (J)} = \frac{1}{2} \times \text{Payload (kg)} \times [\text{Speed (m/s)}]^2$$

Absorption Energy Value with Cushion

1.SCA2, JSC3

Bore Size (mm)	Effective Cushion Length (mm)	Allowable Absorption Energy (J)
ø40	14.6	4.29
ø50	16.6	8.37
ø63	16.6	15.8
ø80	20.6	27.9
ø100	23.6	49.8

2.SCG, SCM, JSG

Bore Size (mm)	Effective Cushion Length (mm)	Allowable Absorption Energy (J)	Remarks
ø20	8.1	0.8	SCM
ø25	8.1	1.2	only
ø32	8.6	2.5	
ø40	8.6	3.7	
ø50	13.4	8.0	
ø63	13.4	14.4	
ø80	15.4	25.4	
ø100	15.4	45.6	

3.SCS2, JSC4

Tube I.D. (mm)	Effective Cushion Length (mm)	Allowable Absorption Energy (J)
ø125	21.6	63.5
ø140	21.6	91.5
ø160	21.6	116
ø180	21.6	152
ø200	26.6	233
ø250	26.6	362

(Note)

About how to calculate kinetic energy

The average speed of the cylinder is calculated by $ua = \frac{L}{T}$.

ua : Average speed (m/s)
L : Cylinder stroke (m)
T : Operating Time (s)

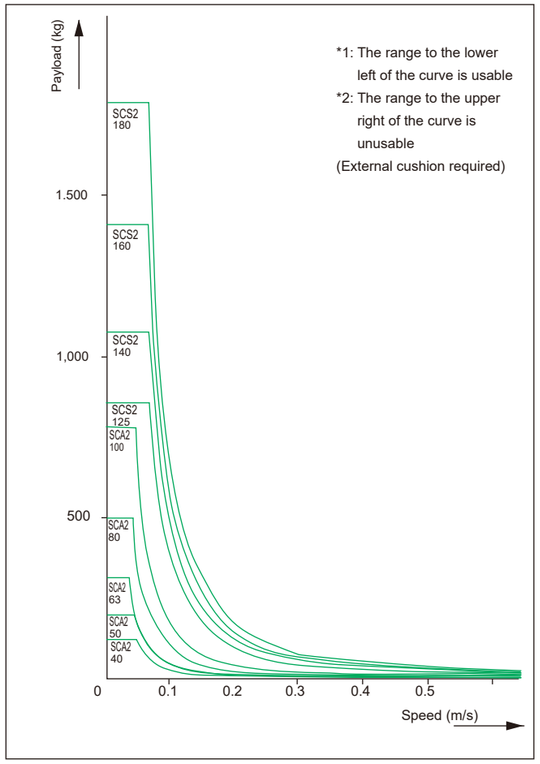
In contrast, the cylinder speed just before entering the cushion can be found with the following simple formula.

$um : = \frac{L}{T} \times (1+1.5 \times w)$

um : Speed just before entering the cushion (m/s)
w : Decimal value of cylinder load factor (0.3 for 30%, 0.5 for 50%)

When calculating kinetic energy or using a graph, use this value of um as the speed.

Allowable absorption energy value: Without Cushion



1. Allowable absorption energy without cushion
   The allowable absorption energy for each model is as shown in the table below.

Allowable absorption energy without cushion

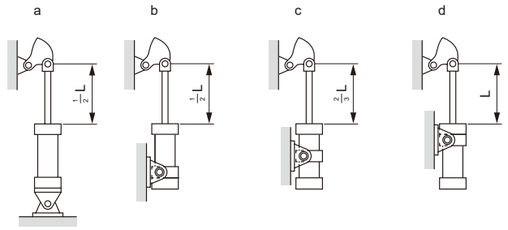
Unit: J

Code / Bore Size (mm)	SCM *1	SCA2	SCS2	CAV2/COV2
ø40	–	0.067	–	–
ø50	0.057	0.079	–	0.072
ø63	0.057	0.079	–	–
ø75	–	–	–	0.154
ø80	0.112	0.201	–	–
ø100	0.153	0.301	–	0.154
ø125	–	–	0.371	–
ø140	–	–	0.386	–
ø160	–	–	0.386	–
ø180	–	–	0.958	–
ø200	–	–	1.08	–
ø250	–	–	2.32	–

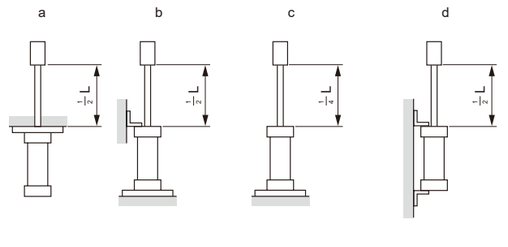
*1: This is the absorption energy without cushion for cushion codes "R" and "H".

Relationship between Dimensions by Mounting Type and Max Stroke (L)

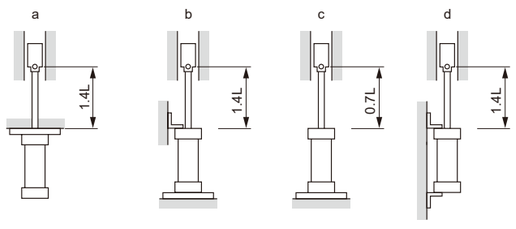
1 For double end pin joint



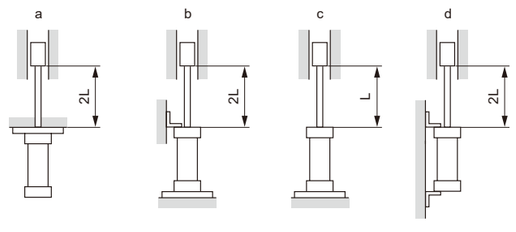
2 Rod End free



3 Rod End guided (pin joint)



4 Cylinder fixed, Rod End guided



Max Stroke

Pencil Shaped Cylinder SCP□3 Series			
D (mm) / F0 (N)	ø6	ø10	ø16
5	570		
10	405	720	
30	230	415	650
50		320	500
100			355

CMA2/CMK2/JSM2 Series			
D (mm) / F0 (N)	ø20	ø25, ø30, ø32	ø40
50	2020		
100	1440	2040	
200	1,000	1440	2,000
400		1,000	1500
600			1160
800			980

SCG/SCA2/JSG/JSC3					
D (mm) / F0 (N)	ø40	ø50	ø63	ø80	ø100
200	2600	4100			
400	1810	2900	2900		
600	1500	2400	2400	3600	
800	1280	2,000	2,000	3140	4500
1,000		1820	1820	2800	4000
1500			1480	2300	3300
2,000				1980	2840
2500				1760	2560
3000				1600	2300
3500					2140
4000					2,000
5000					1800

SCS2						
D (mm) / F0 (N)	ø125	ø140	ø160	ø180	ø200	ø250
1500	3700	3700				
2,000	3200	3200				
2500	2900	2900	4600			
3000	2600	2600	4100	5300		
3500	2400	2400	3800	5000	5900	
4000	2300	2300	3600	4600	5600	
5000	2,000	2,000	3200	4100	5000	7400
6000	1900	1900	2900	3800	4600	6800
7000	1700	1700	2700	3500	4200	6200
8000		1600	2500	3300	3900	5800
9000		1500	2400	3100	3700	5500
10000			2300	2900	3500	5200
15000				2400	2900	4200
20000					2500	3600
25000						3300
30000						3000

JSC4				
D (mm) / F0 (N)	ø125	ø140	ø160	ø180
1500	4600			
2,000	3900	3900		
2500	3500	3500	4600	
3000	3200	3200	4100	5300
3500	3000	3000	3800	5000
4000	2800	2800	3600	4600
5000	2500	2500	3200	4100
6000	2300	2300	2900	3800
7000	2100	2100	2700	3500
8000		2,000	2500	3300
9000		1880	2400	3100
10000			2300	2900
15000				2400

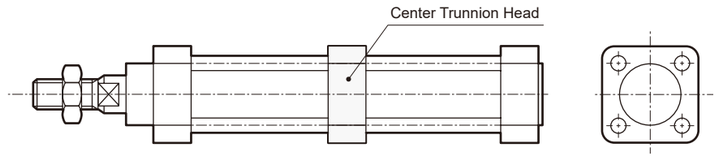
D: Cylinder bore [mm]
F0: Load [N]
L: Max Stroke [mm]

Request
The values in the table are calculated values. If the stroke exceeds the max stroke stated in the specifications section for each model, please consult us.

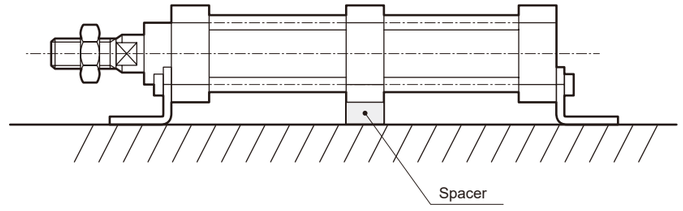
Precautions for Exceeding Max Stroke

⚠ Caution: If exceeding the Max stroke described on the "Specifications" page for each model, note the following points.

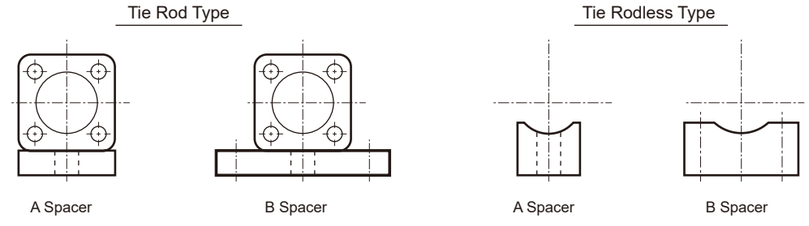
1. Min Operating Pressure
   Starting pressure increases due to deflection of the Piston Rod inside the cylinder.
2. Piston Rod Buckling
   Buckling risk increases unless the piston contacts the cylinder cover via the internal stopper. When stopping the piston with an external stopper, please refer to the technical data "Relationship between dimensions according to mounting type and maximum stroke (L) (Intro 29)".
3. Reinforcement of Tie Rods
   A center trunnion head is inserted to prevent the tie rod from deflecting and touching the cylinder tube.



4. Cylinder Tube Deflection Prevention
   When mounted horizontally, tube deflection prevention is necessary. Consider deflection prevention using the center trunnion head inserted for tie rod reinforcement.



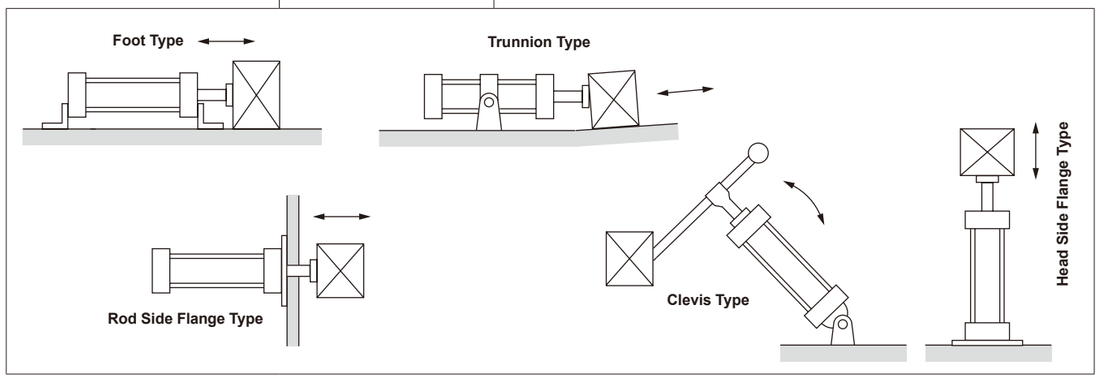
*The spacer in the diagram below is made to order.



How to Determine Cylinder Mounting Type

Since the piston of a cylinder moves in only one direction, select the cylinder mounting type according to the direction of load movement as shown below.

Direction of Load Movement	Mounting type	Precautions
During operation, the load moves linearly.	Foot Type Flange Type	Fix the Cylinder Body so that the direction of load movement and the direction of piston movement are parallel.
	Trunnion Type Clevis Type	Adopt the mounting type on the left if the stroke is long or if the direction of load movement and the direction of piston movement are not parallel and in the same direction. However, be careful not to apply lateral load to the Piston Rod or bushing.
During operation, the load swings within one plane.	Trunnion Type Clevis Type	Align the swinging direction of the clevis or trunnion supporting the cylinder with the swinging direction of the load. Also, align the swinging direction of the Rod End fitting. When a lateral load acts on the bushing, the value of the lateral load should be within 1/20 of the cylinder output.
During operation, the load swings in all directions.	Trunnion Type Clevis Type	Use a knuckle for the connecting fitting between the rod and the load. When a lateral load acts on the bushing, the value of the lateral load should be within 1/20 of the cylinder output.



Bellows Max Operating Temperature

Code	Bellows Material	Max Ambient Temperature	Instantaneous Max Temperature
J	Nylon Tarpaulin	60°C	100°C
	Polyolefin Elastomer	100°C	200°C
K	Neoprene Sheet	100°C	200°C
L	Silicone Rubber Glass Cloth	250°C	400°C

Instantaneous max temperature is the temperature when sparks, chips, etc. instantaneously hit the bellows.

Selection of Air Compressor and Air Tank

Air Compressor, Air Tank Selection

For compressors and tanks, it is necessary to select a model that accounts for 10 to 20% leakage loss in piping and switching valves in addition to the actual air consumption. Generally, the piston displacement described in compressor manufacturer catalogs is a theoretical value, so about 70% based on volumetric efficiency is the effective value. Therefore, select a compressor model with a piston displacement twice the air consumption.

Selection of Air Compressor for Intermittent Use (Operation)

For intermittent use, installing an air tank allows a small air compressor to perform a large amount of work. In other words, it is sufficient to install an air tank with a capacity that does not drop below the maximum cylinder operating pressure even if a pressure drop occurs due to high air consumption while cylinders, etc. are operating, and a compressor that can replenish compressed air by the time the cylinder performs its next operation.

Air Tank Capacity

$$Vt = \frac{Vs}{(Pt-Ps)\times 10.2}$$

Vt : Tank capacity (ℓ)
Vs : Air consumption per cycle (ℓ) (ANR)
Pt : Tank pressure (MPa)
Ps : Maximum cylinder Operating Pressure

Inspection of Type 2 pressure vessels

Based on the Ministry of Labour Ordinance, cylinders falling under the following must undergo inspection by the Japan Boiler Association.

① Cylinders with a rated pressure exceeding 0.2 MPa and an internal volume exceeding 0.04 m^3

② Cylinders with a rated pressure exceeding 0.2 MPa, a cylinder tube inner diameter of 200 mm or more, and a body length (cylinder tube length) of 1000 mm or more

$$V=\frac{D^2 \times S \times 3.14}{4\times 10^9}$$

V: Cylinder internal volume (m^3)
D: Tube inner diameter (mm)
S: Body Length (Cylinder Tube Length) (mm)

Japan Boiler Association Website Address
http://www.jbanet.or.jp/

[Technical Reference Data] Dimensional Tolerances for Commonly Used Fits, Excerpted from JIS B 0401:1998

MEMO

Tolerance used for shafts

Classification of Basic Dimensions (mm)		Shaft Tolerance Class Unit: μm								
Over	Up to and including	d9	e8	e11	f7	f8	h6	h7	h8	h9	p6
-	3	-20 -45	-14 -28	-14 -74	-6 -16	-6 -20	0 -6	0 -10	0 -14	0 -25	+12 +6
3	6	-30 -60	-20 -38	-20 -95	-10 -22	-10 -28	0 -8	0 -12	0 -18	0 -30	+20 +12
6	10	-40 -76	-25 -47	-25 -115	-13 -28	-13 -35	0 -9	0 -15	0 -22	0 -36	+24 +15
10	14	-50 -93	-32 -59	-32 -142	-16 -34	-16 -43	0 -11	0 -18	0 -27	0 -43	+29 +18
14	18										
18	24	-65 -117	-40 -73	-40 -170	-20 -41	-20 -53	0 -13	0 -21	0 -33	0 -52	+35 +22
24	30										
30	40	-80 -142	-50 -89	-50 -210	-25 -50	-25 -64	0 -16	0 -25	0 -39	0 -62	+42 +26
40	50										
50	65	-100 -174	-60 -106	-60 -250	-30 -60	-30 -76	0 -19	0 -30	0 -46	0 -74	+51 +32
65	80										
80	100	-120 -207	-72 -126	-72 -292	-36 -71	-36 -90	0 -22	0 -35	0 -54	0 -87	+59 +37

Tolerance used for holes

Classification of Basic Dimensions (mm)		Shaft Tolerance Class Unit: μm					
Over	Up to and including	F7	H6	H7	H8	H9	H10
-	3	+16 +6	+6 0	+10 0	+14 0	+25 0	+40 0
3	6	+22 +10	+8 0	+12 0	+18 0	+30 0	+48 0
6	10	+28 +13	+9 0	+15 0	+22 0	+36 0	+58 0
10	14	+34 +16	+11 0	+18 0	+27 0	+43 0	+70 0
14	18						
18	24	+41 +20	+13 0	+21 0	+33 0	+52 0	+84 0
24	30						
30	40	+50 +25	+16 0	+25 0	+39 0	+62 0	+100 0
40	50						
50	65	+60 +30	+19 0	+30 0	+46 0	+74 0	+120 0
65	80						
80	100	+71 +36	+22 0	+35 0	+54 0	+87 0	+140 0

Regarding Notation Method for Flow Characteristics

1. Display of Flow Characteristics

The flow rate display in the specifications section of the catalog is shown as follows.

Target Components	Display	Unit	Standard
Pneumatic Components	Display compliant with New JIS	C, b	ISO 6358:1989 "Pneumatics - Components for compressible fluids - Methods for testing flow-rate characteristics" JIS B 8390:2000 (ISO 6358 translation)
	Conventional Display	S	JIS B 8373:1993 'Pneumatic 2-port solenoid valves' JIS B 8374:1993 "Pneumatic 3-port solenoid valves" JIS B 8375:1993 "Pneumatic 4, 5-port solenoid valves" JIS B 8379:1995 "Pneumatic silencers"
		Cv	ANSI(NFPA)T3. 21. 3:1990

2. Explanation

The flow rate characteristics of solenoid valves were conventionally displayed using effective area S, but JIS was revised (JIS B 8390: 2000), and they are now displayed by a pair of sonic conductance C and critical pressure ratio b.

- Sonic Conductance C: Value obtained by dividing the weight flow rate passing through equipment in a choked flow state by the product of the upper limit absolute pressure and the density in the standard state. (sonic conductance) S ≈ 5.0 C (Conventional sizing is possible using C.)
- Critical Pressure Ratio b: Pressure ratio at which choked flow occurs if smaller than this value (downstream pressure / upstream pressure) (critical pressure ratio)
- Effective cross-sectional area S (mm^2): The cross-sectional area value of an ideal orifice without friction or contraction, derived by calculation from the pressure change within an air tank when air is released in a choked flow state from equipment included with the air tank.

*Choked flow: Flow where the upstream pressure is higher than the downstream pressure and the velocity reaches the speed of sound in some parts of the component. The weight flow rate of gas is proportional to the upstream pressure and does not depend on the downstream pressure. (Choked flow)

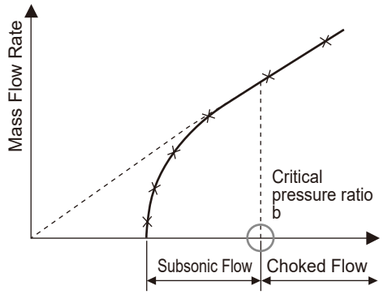


Fig. 1 Weight flow rate characteristics versus upstream pressure

Flow rate calculation formula

It is expressed as follows by practical units.

$\frac{P_2+0.1}{P_1+0.1}$ When ≤ b, Choked Flow

$$Q=600\times C\,(P_1+0.1)\sqrt{\frac{293}{273+t}} \quad \text{.....(1)}$$

$\frac{P_2+0.1}{P_1+0.1}$ When > b, Subsonic Flow

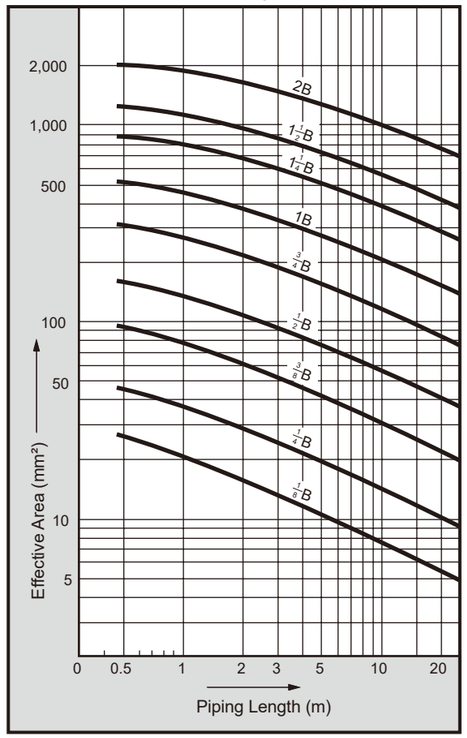
$$Q=600\times C\,(P_1+0.1)\sqrt{1-\left[\frac{\frac{P_2+0.1}{P_1+0.1}-b}{1-b}\right]^2}\sqrt{\frac{293}{273+t}} \quad \text{.....(2)}$$

Q : Air Flow Rate [dm^3/min(ANR)]: The SI unit dm^3 (cubic decimeter) may also be expressed as L (liter). $1dm^3 = 1$ L
C : Sonic conductance [$dm^3/(s\cdot bar)$]
b : Critical pressure ratio [−]
P_1 : Upstream pressure [MPa]
P_2 : Downstream pressure [MPa]
t : Temperature [°C]

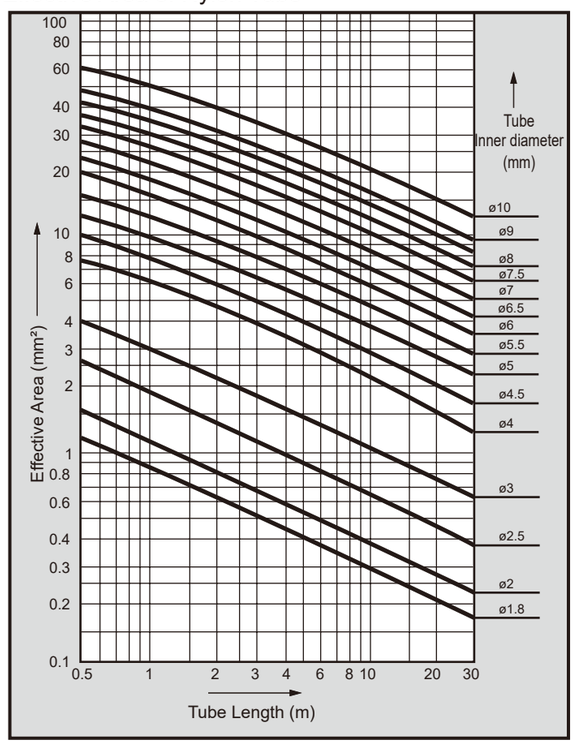
When calculating with effective cross-sectional area S, calculate C = S / 5 and substitute the value C into the above formula. For subsonic flow, substitute b = 0.5 into equation (2).

Effective Area of Steel Pipe/Nylon Tube and Recommended Maximum Flow Rate Table for Gas Pipe

Effective Area of Steel Pipe



Effective Area of Nylon Tube



Recommended Maximum Flow Rate Table for Gas Pipe

Nominal Size	1/8B	1/4B	3/8B	1/2B	3/4B	1B	1 1/4B	1 1/2B
Pressure Drop MPa(*1)	0.124	0.0707	0.0576	0.0425	0.0276	0.0209	0.0133	0.0105
Inlet Pressure MPa	Recommended Maximum Flow Rate (L/min)							
0.05	127	244	518	838	1,465	2,460	3,870	5,150
0.1	146	282	598	965	1,690	2,828	4,460	5,950
0.15	163	314	668	1,076	1,885	3,150	4,960	6,630
0.2	179	344	730	1,180	2,060	3,450	5,430	7,280
0.3	206	395	840	1,360	2,375	3,900	6,300	8,400
0.4	230	442	940	1,520	2,660	4,450	7,000	9,360
0.5	252	485	1,030	1,660	2,920	4,875	7,700	10,250
0.6	272	523	1,110	1,800	3,140	5,250	8,300	11,050
0.7	292	558	1,185	1,920	3,350	5,620	8,870	11,800
0.8	308	592	1,260	2,035	3,560	5,970	9,430	12,570
0.9	324	623	1,325	2,140	3,745	6,290	9,900	13,220
1.0	340	654	1,395	2,250	3,930	6,600	10,400	13,880
1.2	370	717	1,510	2,450	4,280	7,150	11,250	15,040
1.4	398	763	1,625	2,624	4,590	7,700	12,100	16,200
1.5	410	790	1,680	2,710	4,740	7,930	12,550	16,780

(*1: Inlet Pressure = 0.5 MPa
Gas Pipe Length: 10 m)

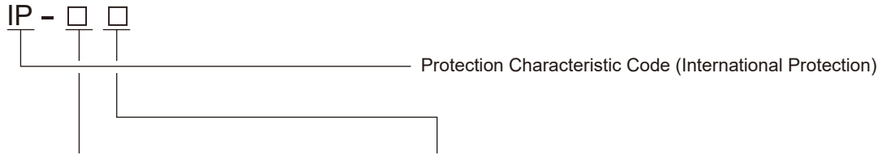
(Remarks)
For main lines where the piping distance is long, it is necessary to consider the degree of pressure drop that occurs at the end of the main line when air flows. Recommended maximum flow rate means the maximum flow rate that can be recommended within a range where the pressure drop relative to the piping length is acceptable, judged from practical use. Therefore, it does not mean that no more flow can pass, but that flowing more will result in a larger pressure drop.

About Protection Structure

● Protection Structure

■ IEC (International Electrotechnical Commission: International Electrotechnical Commission) Standard (IEC60529)

■ JIS C 0920 : 2003



First Characteristic Numeral (Protection class against ingress of foreign solid objects)

First Characteristic Numeral	Degree of Protection	
0	No protection	
1	ø50 mm	Solid objects with a diameter of 50 mm or more do not ingress.
2	ø12.5 mm	Solid objects with a diameter of 12.5 mm or more do not ingress.
3	2.5 mm	Solid objects with a diameter of 2.5 mm or more do not ingress.
4	1 mm	Solid objects with a diameter of 1.0 mm or more do not ingress.
5	Dust-protected type	Dust does not ingress in a quantity sufficient to interfere with the normal operation and safety of the equipment.
6	Dust-tight type	Dust does not enter the interior.

Second Characteristic Numeral (Degree of protection against ingress of water)

Second Characteristic Numeral	Degree of Protection	
0	No protection	
1	Protection against vertically falling water drops	No harmful effects from vertically falling water drops.
2	Protection against vertically dripping water when tilted up to 15 degrees	No harmful effects from water drops falling at an inclination of up to 15 degrees from vertical on either side.
3	Protection against spraying water	No harmful effects from water sprayed at an angle of up to 60 degrees from vertical on either side.
4	Protection against splashing water	No harmful effects from splashing water from any direction.
5	Protection against water jets	No harmful effects from water jets from a nozzle from any direction.
6	Protection against powerful water jets	No harmful effects from strong direct jets of water from any direction.
7	Protection against immersion in water	Water does not ingress when immersed in water under defined conditions.
8	Protection from continuous immersion in water	Can be used when continuously immersed in water.

MEMO

Safety Precautions

Be sure to read this section before use.

When designing and manufacturing equipment using CKD products, the manufacturer is obligated to ensure that the safety of the mechanism, pneumatic control circuit and/or water control circuit and the system that runs the electrical controls are secured. It is important to select, use, handle and maintain CKD products appropriately to ensure their safe usage. Observe warnings and precautions to ensure device safety. Check that device safety is ensured, and manufacture a safe device.

WARNING

1 This product is designed and manufactured as a general industrial machine part.
It must be handled by an operator having sufficient knowledge and experience.

2 Use this product in accordance with specifications.

This product must be used within its stated specifications. In addition, never modify or additionally machine this product.
This product is intended for use in general industrial machinery equipment or parts. It is not intended for use outdoors (except for products with outdoor specifications) or for use under the following conditions or environments.
(Note that this product can be used when CKD is consulted prior to its usage and the customer consents to CKD product specifications. The customer should provide safety measures to avoid danger in the event of problems.)

❶ Use for applications requiring safety, including nuclear energy, railways, aircraft, marine vessels, vehicles, medical devices, devices or applications in contact with beverages or foodstuffs, amusement devices, emergency cutoff circuits, press machines, brake circuits, or safety devices or applications.
❷ Use for applications where life or assets could be significantly affected, and special safety measures are required.

3 Observe organization standards and regulations, etc., related to the safety of the device design and control, etc.

ISO4414,JIS B 8370(Pneumatic fluid power - General rules and safety requirements for systems and their components)
JFPS2008(Principles for pneumatic cylinder selection and use)
Including the High Pressure Gas Safety Act, Industrial Safety and Health Act, other safety rules, organization standards and regulations, etc.

4 Do not handle, pipe, or remove devices before confirming safety.

❶ Inspect and service the machine and devices after confirming safety of the entire system related to this product.
❷ Note that there may be hot or charged sections even after operation is stopped.
❸ When inspecting or servicing the device, turn OFF the energy source (air supply or water supply), and turn OFF power to the facility. Discharge any compressed air from the system, and pay enough attention to possible water leakage and leakage of electricity.
❹ When starting or restarting a machine or device that incorporates pneumatic components, make sure to secure system safety, such as pop-out prevention measures.

5 Observe the warnings and cautions on the following pages to prevent accidents.

■ Precautions are ranked as “DANGER”, “WARNING”, and “CAUTION” in this section.

DANGER:	In the case where the product operation is mishandled and/or when the urgency of a dangerous situation is high, it may lead to fatalities or serious injuries.
WARNING:	A dangerous situation may occur if handling is mistaken, leading to fatal or serious injuries.
CAUTION:	A dangerous situation may occur if handling is mistaken, leading to minor injuries or property damage.

Note that some items indicated with “CAUTION” may lead to serious results depending on the conditions.
All items contain important information and must be observed.

Warranty

1 Warranty period

The product specified herein is warranted for one (1) year from the date of delivery to the location specified by the customer.

2 Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified above, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD’s facilities free of charge. However, following failures are excluded from this warranty:

1) Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or the Instruction Manual.
2) Failure caused by use of the product exceeding its durability (cycles, distance, time, etc.) or caused by consumable parts.
3) Failure not caused by the product.
4) Failure caused by use not intended for the product.
5) Failure caused by modifications/alterations or repairs not carried out by CKD.
6) Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
7) Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.
Note: For details on the durability and consumable parts, contact your nearest CKD sales office.

3 Compatibility check

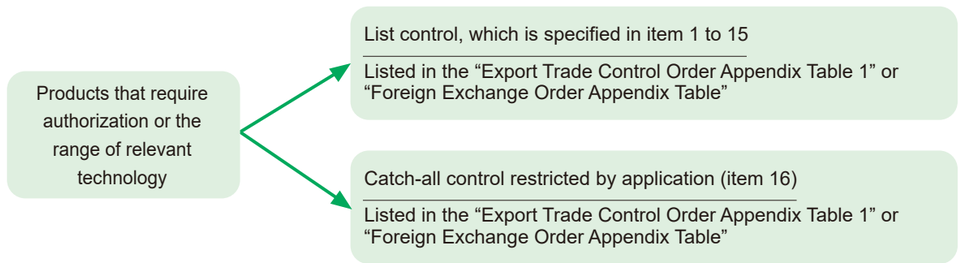
The customer is responsible for confirming the compatibility of CKD products with the customer’s systems, machines and equipment.

Precautions for export

1 Security Trade Control

The products in this catalog and their related technologies may require approval before export or provision. For the sake of maintaining world peace and safety, there may be cases in which approval under the Foreign Exchange and Foreign Trade Control Law is required in advance, depending on the country to where the product or related technology is being exported or provided. The scope of products and related technologies requiring approval are listed in the Export Trade Control Order Appendix Table 1 or Foreign Exchange Order Appendix Table. The Export Trade Control Order Appendix Table 1 and Foreign Exchange Order Appendix Table contain the following two types of information.

· “List controls” specified for items 1 to 15
· “Catch-all controls” that do not indicate specifications by item, but restriction by application (Section 16)



An application for approval is received by the Security Export Licensing Division of the Ministry of Economy, Trade and Industry or local bureaus of the Ministry of Economy, Trade and Industry.

2 Products and related technologies in this catalog

The products and related technologies in this catalog are subject to the catch-all control of the Foreign Exchange and Foreign Trade Control Law. When exporting or providing the products or related technologies in this catalog, ensure that they are not used for arms or weapons.

3 Contact

Contact your local CKD Sales Office for information on the Security Trade Control of products and related technologies in this catalog.

*For cylinder switches, please check P. 1512.

Design / Selection

1. Confirmation of Specifications

Warning

■Use within the product's specified operating range.
The products described in this catalog are designed to be used only in compressed air systems. Do not use outside the specified pressure or temperature range as it may cause damage or malfunction. (See specifications). If using fluids other than compressed air and low hydraulic pressure, please consult us.

■If product dimensional accuracy is required, please consult us separately.
The dimensional tolerance of pneumatic cylinders is set based on JIS B8368. If accuracy is required, please inquire in advance.

2. Design for Safety

Warning

■If the force changes due to twisting of the sliding parts of the machine, there is a danger that the cylinder's Piston rod may extend suddenly.
In such cases, there is a risk of injury to the human body, such as getting hands or feet caught, and damage to the machine, so make adjustments so that the machine moves smoothly and design it so that it does not cause injury to the human body.

■If there is a risk of danger to the human body, install a protective cover.
If the drive part of the cylinder poses a risk of danger to personnel, install a protective cover. Design the structure so that personnel cannot enter the cylinder's operating range or directly touch that area.

■Consider the possibility of circuit pressure drop due to power outages, etc.
When using a cylinder for a clamping mechanism, if the circuit pressure drops due to a power outage, etc., the clamping force will decrease and there is a risk that the workpiece may come off. Therefore, incorporate a safety device to prevent injury or damage to personnel or machinery. Lifting devices and lifts also require consideration for fall prevention.

■Consider the possibility of power source failure.
For equipment controlled by power sources such as pneumatic, hydraulic, or electric, take measures to prevent injury or damage to personnel or equipment even if these power sources fail.

■Design a circuit to prevent sudden projection.
When driving a cylinder with an exhaust center type directional control valve, or when starting after exhausting the residual pressure of the circuit, if pressure is applied to one side of the piston from a state where the air in the cylinder is exhausted, the driven object pops out at high speed. In such cases, there is a risk of causing injury to the human body such as pinching hands or feet, or causing damage to the machine, so please design a pop-out prevention circuit.

■Consider the operating state during an emergency stop.
Design so that injury to the human body and damage to equipment/devices due to cylinder operation do not occur when the safety device operates and the machine stops during system abnormalities such as emergency stop or power failure.

■Consider the operating state when restarting after an emergency stop or abnormal stop.
Design the system so that restarting does not cause harm to personnel or damage to equipment. Also, if it is necessary to reset the cylinder to the starting position, design a safe control device.

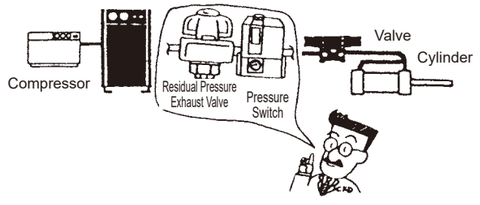
■Take necessary measures in advance to prevent adverse effects on people or things if this product malfunctions.

CAUTION

■Use within a range where the piston does not collide and break at the stroke end.
When a piston with inertial force collides with the cover at the stroke end and stops, use within the allowable absorption energy range.

■Install a speed controller on the cylinder.
Use within the operating piston speed range of each cylinder.

■Install a "pressure switch" and "residual pressure exhaust valve" on the compressed air supply side of the equipment.
● The pressure switch prevents operation if the set pressure is not reached. The residual pressure exhaust valve discharges the compressed air remaining in the pneumatic circuit and prevents accidents due to the operation of pneumatic equipment due to residual pressure.



■The load factor for fall prevention cylinders should be 50% or less.

3. Application Specific Design

Warning

■When a deceleration circuit or shock absorber is necessary.
If the speed of the driven object is high or its mass is large, it will be difficult to absorb the impact with only the cylinder's cushion. Therefore, provide a circuit to decelerate before entering the cushion, or use an external shock absorber to mitigate the impact. In this case, sufficiently consider the rigidity of the machinery.

■When inertia, vibration, etc. occur
When mounting the cylinder on a moving object (X-axis module, pallet, etc.), design considering the inertia, vibration, etc. generated when the moving object stops.

■About Intermediate Stop
When performing an intermediate stop of the cylinder piston with a 3-position closed center type directional control valve, accurate and precise positioning like low hydraulic pressure is difficult due to the compressibility of air. Also, since valves and cylinders do not guarantee zero air leakage, it may not be possible to hold the stop position for a long time. If long-term stop position holding is required, please consult us.

4. Operating Environment

Warning

■Install the product avoiding rain, water, direct sunlight, and high humidity.

■Do not use the product in an atmosphere where there is a risk of corrosion.
Use in such environments can cause damage and malfunction. Also, even for plated materials used for Piston Rods, tie rods, etc. in cylinders, plating is not applied to machined parts (thread width, cut surface). Rust can occur even in a general environment, so take necessary measures.

■In dusty places or places exposed to water droplets, oil droplets, cutting oil, or coolant, install a cover, etc.
If there is a lot of dust, please use the type with a powerful scraper. If liquid splashes, please use the coolant resistant type.

■If the Ambient Temperature is 5°C or less, moisture in the circuit may freeze, causing malfunctions such as operational defects. Therefore, remove moisture and prevent freezing.

CAUTION

■When using a cylinder with a valve with AC voltage, humming noise may occur depending on the operating conditions. If humming noise is a problem depending on the operating environment, select DC voltage.

■Some models use oil-impregnated bearings, and oil may be discharged to the outside of the cylinder. Be careful when using in locations where oil discharge is undesirable.

5. Durability

Warning

■Durability varies depending on usage conditions and model characteristics.

CAUTION

■Bellows are consumable parts.
Replace as necessary.

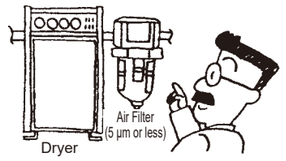
6. Pneumatic Source

Warning

■Use clean, dry compressed air.
Do not use compressed air containing chemicals, synthetic oil containing organic solvents, salt, corrosive gas, etc. as it may cause damage or malfunction.

CAUTION

■Use dry compressed air that does not generate drain in the piping.



● Drain occurs if there is a temperature drop inside pneumatic piping or pneumatic equipment.
● If the piping volume is larger than the cylinder volume (atmospheric pressure equivalent volume), condensed water droplets will accumulate as drain without the compressed air in the cylinder being completely discharged at each switching of the solenoid valve.
● Drain enters the air passages inside pneumatic equipment, momentarily blocking the passages and causing malfunction.
●Rust generated by drain will cause pneumatic equipment failure.
●Drain washes away lubricating oil, causing poor lubrication.

■Use of ultra-dry air is unsuitable for standard pneumatic equipment. Use equipment compatible with ultra-dry air.
● Ultra-dry compressed air shortens the life of pneumatic components.
● Use a solenoid valve for DC voltage drive.

■Use compressed air free from oxidized oil, tar, carbon, etc., from the air compressor.
● Oxidized oil, tar, carbon, etc., entering and adhering inside pneumatic equipment increases the resistance of sliding parts, causing malfunction.
● Lubricating oil mixed with oxidized oil, tar, carbon, etc., will wear down the sliding parts of pneumatic equipment.

■Use compressed air that does not contain solid foreign matter.
● Solid contaminants in the compressed air can enter pneumatic equipment, causing wear on sliding parts or sticking phenomena; 5 µm or less.
● Perform regular maintenance inspections of the compressor.

7. Usage Method

CAUTION

■It is initially lubricated, so it can be used without lubrication. If lubricating, use Turbine Oil Class 1 (additive-free) ISO-VG32. Also, if lubrication is stopped midway, malfunction will occur due to the loss of the initial lubricant, so be sure to continue lubrication. It is necessary to decide whether to adopt a non-lubricated or lubricated specification for pneumatic equipment and ensure that the chosen method is reliably managed.

■Provide intermediate support for long-stroke cylinders.
For long stroke cylinders, provide intermediate support to prevent rod sag, tube deflection, and rod damage due to vibration or external load.

■Use within the Max stroke of the mounting style.
Refer to Intro 30.

■Cylinders with air cushion experience a speed change at the beginning of movement.

For cylinders with air cushion, speed changes occur when the cushion ring comes off the cushion packing at the beginning of movement. Depending on conditions such as speed controller placement and adjustment, piping diameter, air pressure, and cushion needle opening, the change may become large. If it is necessary to prevent this, please consult us.

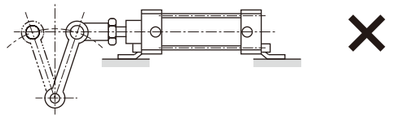
■Avoid using multiple cylinders in synchronization as much as possible.

Synchronization cannot be achieved, causing twisting of the Piston Rod and leading to malfunction. If synchronous operation is necessary, be sure to provide a separate guide device with rigidity.

■When installing clevises and trunnions, confirm that they can rotate freely without interference during the full stroke operation of the cylinder before use.

■If the direction of load movement changes with operation, use a swinging type cylinder (clevis type, trunnion type) where the cylinder itself can rotate by a certain angle. Also, install the connecting fitting at the Rod End so that it moves in the same direction as the Cylinder Body's movement.

■Do not connect a fixed type cylinder to an arm that performs circular motion. In this case, connect it to an oscillating type cylinder.



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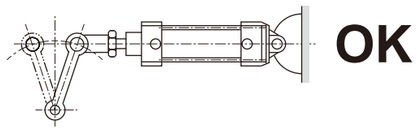
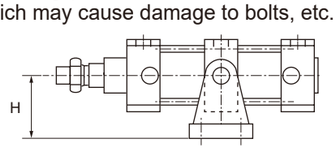


OK

■To prevent breakage of the Piston Rod End screw, wear of the bushing, seizure, etc., connect the Piston Rod End and the load with a free joint or simple flow controller, etc., so that there is no twisting at any position of the stroke.

■If the clearance between the clevis or trunnion and the mating bearing is large, a bending action will occur on the pin or shaft. Therefore, do not make this gap too large. (Recommended fit H10/e8)

■In the figure below, if the height H from the mounting surface of the bearing bracket to the bearing position is large, a large force will be generated on the mounting part of the bracket by the cylinder force, which may cause damage to bolts, etc.



■Cylinders may have slight oil seepage from sliding parts, packings, and gaskets. Be careful when using in locations where oil seepage is undesirable.

■Precautions for Using Relief Port
Exhaust treatment type (P72) cannot be used with vacuum scavenging. And vice versa. This will cause particle scattering or defects, so absolutely do not do it.

8. Securing Space

⚠CAUTION

■Ensure space around the cylinder for mounting, removal, wiring, and piping work.

9. Specification in Instruction Manual

⚠CAUTION

■Clearly state the maintenance conditions in the equipment's instruction manual.

● Product functionality may significantly decrease, and safety may not be ensured depending on usage status, operating environment, and maintenance. Proper maintenance allows the product to fully demonstrate its functions.

Installation / Mounting / Adjustment

1. Mounting

⚠Warning

■When mounting the cylinder, protect the load from falling or tipping over.

⚠Caution

■Do not remove the cylinder packaging bag or the dust-proof port seal for the piping port until just before performing piping.

● If the dust-proof port seal for the piping port is removed before piping connection work, foreign matter may enter the cylinder from the piping port, causing failure, malfunction, etc.

■If the cylinder weight is 15 kg or more, use lifting equipment.

■Do not hit or grip objects with the cylinder tube and Piston Rod sliding parts, causing scratches or dents.

The bore is manufactured with precise tolerances, so even slight deformation can cause a malfunction. Scratches or dents on the Piston Rod sliding part will damage packings and cause air leakage.

■If the direction of load movement is not parallel to the Piston Rod axis, twisting may occur in the Piston Rod and main body (tube), posing a risk of the Piston Rod flying out. Twisting also causes seizure, breakage, etc. Be sure to align the Piston Rod axis with the direction of load movement.

■Prevent seizure of rotating parts.

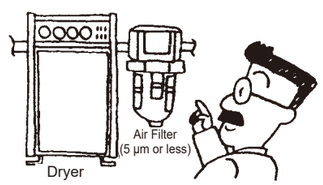
Apply grease to rotating parts (pins, etc.) to prevent seizure.

2. Pneumatic Source

⚠CAUTION

■Install a pneumatic filter immediately before the circuit using the pneumatic equipment.

● Install an air dryer and filter to remove moisture in the piping. Also, install a filter near the directional control valve (primary side) to remove rust, foreign matter, and drain.



■When supplying compressed air after completing pipe connections, supply it so that high pressure is not applied suddenly.

● Piping connections may come off, and piping tubes may spring out, causing accidents.

● If compressed air is supplied too slowly, sealing pressure may not be generated depending on the solenoid valve's internal seal mechanism, potentially causing air leakage.

●The cylinder may operate suddenly.

3. Piping

⚠CAUTION

■When piping, refer to the instruction manual and ensure connection ports, etc., are not mistaken.

● This will cause a malfunction.

■When connecting piping, wrap sealing tape clockwise from a position 2 threads or more inward from the tip of the pipe thread.

● If sealant tape protrudes beyond the threaded part of the piping, it will be cut by screwing in, and the cut piece will enter the interior, causing failure.

■Ensure that piping connected to the cylinder does not detach due to vibration, loosening, or pulling phenomena.

● If the exhaust side piping of the pneumatic circuit detaches, cylinder speed control will become impossible.

● In the case of a chuck holding mechanism, the chuck will release, creating a dangerous situation.

■When using nylon tubes or urethane tubes, pay attention to the following.

● In atmospheres where spatter scatters, use flame-resistant tubes or metal pipes.

■Use corrosion-resistant piping materials such as galvanized pipes, Stainless Steel pipes, nylon tubes, rubber hoses, etc.

■ Tighten with the appropriate torque during piping connection.

● The purpose is to prevent air leaks and screw damage.

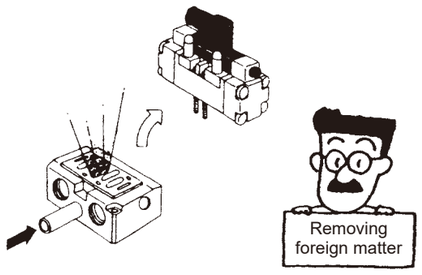
● To avoid damaging the threads, first tighten by hand, then use a tool.

[Reference Value] Please refer to the instruction manual.

Connection Thread	Tightening Torque (N·m)
M3	0.3 to 0.6
M5	1 to 1.5
Rc 1/8	3 to 5
Rc 1/4	6 to 8
Rc 3/8	13 to 15
Rc 1/2	16 to 18
Rc 3/4	19 to 40
Rc 1	41 to 70

■ When piping, be sure to perform flushing immediately before connecting to pneumatic equipment.

● It is necessary that foreign matter that entered during piping does not enter the pneumatic components.



4. Confirmation Before Operation

⚠ Warning

■ Before operating, confirm that there is no looseness or abnormality in the load or cylinder mounting fasteners.

■ Do not use until it is confirmed that the equipment operates properly.

After installation, repair, or modification, connect compressed air or electricity, perform appropriate functional tests and leak tests, and confirm that installation is normal.

■ Confirm that there is no mechanical interference or abnormality in the operating system.

■ Gradually increase and set the pressure while confirming that there is no abnormality in the operation of the equipment.

■ Starting with the exhaust side at atmospheric pressure is dangerous as the rod may extend suddenly. When starting, always apply pressure to the exhaust side cylinder chamber.

⚠ CAUTION

■ When piping connection is complete and compressed air is supplied, be sure to confirm that there are no air leaks in all parts of the piping connection.

● Apply leak detection fluid with a brush to the piping connection parts to confirm there are no air leaks.

■ Be sure to read the instruction manual.

Read carefully and understand the contents before using the product. Also, keep it so that you can check it at any time.

5. Adjustment

⚠ Warning

■ When adjusting speed with a speed controller, adjust by gradually opening the needle from the closed state. Starting speed adjustment in the open state is dangerous as the rod may extend suddenly.

■ The effect of the cushion with air cushion is adjusted at the time of shipment. However, re-adjust the cushion needle for use in accordance with the size of the load and piston speed.

Gradually open the needle from the closed state to adjust the cushioning effect. Note that if the cushion needle is loosened too much, there will be no cushioning effect, and it may fall off. After adjustment, tighten and fix the needle nut (Hexagon Nut). Use within the allowable kinetic energy value. If used exceeding the allowable value, the product may be damaged.

■ When the cylinder is in operation, do not enter or put your hand in its operating range.

Use / Maintenance

1. Maintenance and Inspection

⚠ Warning

■ Perform maintenance inspections carefully according to the instruction manual.

Mishandling will cause damage or malfunction of equipment or devices.

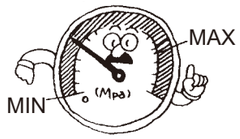
⚠ CAUTION

■ Implement daily and periodic inspections systematically so that maintenance management is performed correctly.

● Insufficient maintenance management will significantly impair product functionality, leading to reduced lifespan, damage, malfunction, and other defects or accidents.

1) Pressure management of supply compressed air

● Is the set pressure being supplied?
Does the pressure gauge indication during equipment operation show the set pressure?



2) Management of pneumatic filter

● Is drain being discharged normally?
Is the contamination status of the bowl and element normal?

3) Compressed air leakage management at piping connection parts

● Is the condition of the connection parts of moving parts, in particular, normal?

4) Solenoid Valve Operating Status Management

● Is there any delay in operation, and is the exhaust state normal?

5) Pneumatic Actuator Operating Status Management

● Is operation smooth?
Is the end-of-stroke stop status normal?
Is the connection with the load normal?

6) Management of lubricator

● Is oil level adjustment normal?

7) Lubricating Oil Management

● Is the supplied lubricating oil the correct type?

■ If air leakage increases or equipment does not operate normally, do not use.

● After repair or modification, connect compressed air or electricity, perform appropriate functional inspections and leak tests, and confirm normal operation.

■ After a long period of disuse, confirm normal operation when restarting.

■ Replace consumable parts that have exceeded their rated life with new ones during periodic inspections.

Do not use consumable parts that have been stored for 5 years or more.

■ Store consumable parts in a cool, dark place away from direct sunlight.

■ If lubrication of sliding surfaces deteriorates or they become dry, periodically apply lithium grease (general type) or fluorine grease (heat-resistant, low-speed, low-friction, P7 type, etc.). Also, be sure to remove foreign matter from the sliding surface before applying grease. If the type of grease used is unknown, please contact us.

2. Influence of Fluorine Grease

⚠ Warning

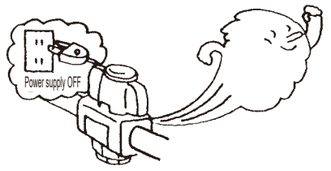
■ If you smoke cigarettes, etc., with hands that have fluorine grease from cylinders using fluorine grease (heat-resistant, low-speed, low-friction, P7, etc.), harmful gases will be generated, which may harm the human body, so please be careful.

3. Removal

⚠ Warning

■ Removal of Equipment and Supply/Exhaust of Compressed Air

When removing equipment, confirm that measures to prevent the driven object from falling or running away have been taken, then shut off the supply air and connected power, and exhaust the compressed air in the system before proceeding. When restarting, confirm that projection prevention measures have been taken, then proceed with caution.



■ When removing the load from a double-rod cylinder, be sure to do so with the Piston Rod width across flats on the load side fixed. Note that if you perform it without fixing the Piston Rod on the load side, the fastening part (screwed part) of the Piston Rod may loosen.

■ Perform cylinder removal work after taking measures to prevent the load from falling or tipping over.

4. Disassembly / Assembly

⚠ Warning

■ Disassemble the cylinder after removing it from the equipment.

■ When performing disassembly and assembly, ensure it is done by a worker who has acquired specialized knowledge.

After disassembly and reassembly, perform leak and operation tests before reassembling onto the equipment.

■When disassembling a single-acting cylinder, be very careful as parts may be ejected due to the spring.

■Install and remove the rod metal using appropriate pliers (C-type Retaining Ring installation tool).

■Even when using appropriate pliers (C-type Retaining Ring installation tool), the Retaining Ring may detach from the tip of the pliers, fly off, and cause damage to personnel and surrounding equipment, so be careful.
Also, when installing, confirm that it is securely in the Retaining Ring groove before supplying air.

⚠CAUTION

■When performing maintenance such as replacing consumable parts, disassemble and reassemble on a test bench, etc., in a clean atmosphere free of dust, and perform a functional inspection to ensure the equipment operates normally.

MEMO