CKD

SM－188009－A

INSTRUCTION MANUAL

TIGHT CYLINDER

Position locking type

CMK2-Q

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

The 3rd edition

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (to the level pursuant to JIS B 8370 Pneumatic System Rules).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your applications, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this operation manual carefully for proper operation.**

Observe the cautions on handling described in this manual, as well as the following instructions:

⚠ CAUTION :

- Before performing an overhaul inspection on the actuator, deactivate residual pressure completely.
- While the actuator is operating, do not step into or place hands in the driving mechanism.
- To prevent an electric shock, do not touch the electric wiring connections (exposed live parts) of the actuator equipped with a solenoid valve or switch.
  Perform an overhaul inspection with the power off. Also, do not touch these live parts with wet hands.

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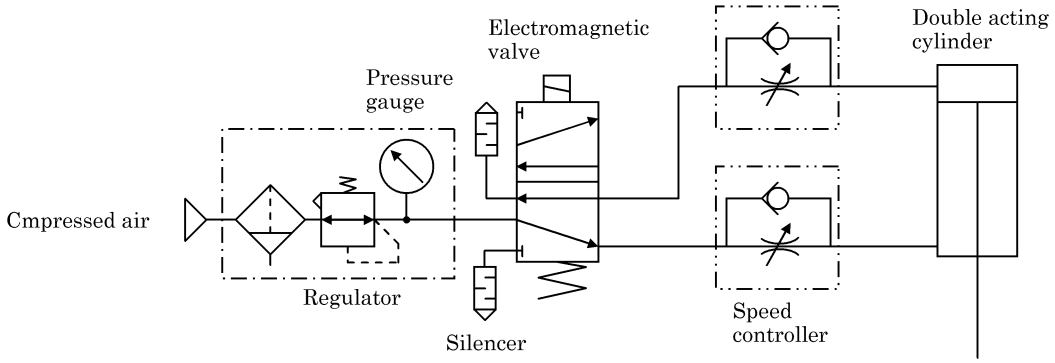
1. PRODUCT

1.1 Fundamental Circuit Diagram and Selection of Related Equipment

1) Fundamental circuit diagram of double-acting cylinder (no lubrication)
The illustration shows the basic circuit.



2) Selection of equipment for the basic circuit
Choose approriate equipment for the circuit from among those tabulated in the guide on the next page by taking into consideration such factors as cylinder bore sizes and cylinder speeds.

Equipment selection guide

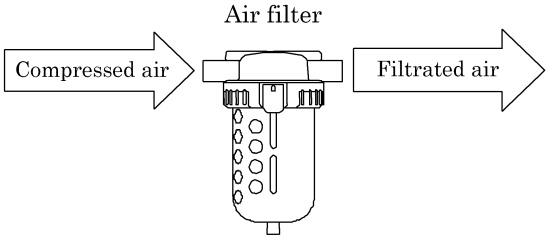
Bore size(mm)	Logical standard speed (mm/s)	Required fluid volume (/min)	Required effective cross-section area(mm^2)	Standard sustem No.
ϕ 20	250	29	0.5	B1
	400	46	1.6	B1
ϕ 25	250	44	0.8	B1
	400	70	1.9	B1
ϕ 32	250	73	1.3	B1
	400	120	3.1	B3
ϕ 40	250	110	2.0	B2
	400	180	4.9	B3

Bore size (mm)	Air control 4/5 port		Air pressure support		Pipe
	Single solenoid	Double solenoid	Speed controller	silencer	Pipe (for electoromagnetic valve,cylinder)
ϕ 20	4KA110,4KB110	4KA120,4KB120	SC3G-6-6	SL-M5,SLW-6A	ϕ 6 × ϕ 4 nylon tube
	4KA110,4KB110	4KA120,4KB120	SC3G-6-6	SL-M5,SLW-6A	ϕ 6 × ϕ 4 nylon tube
ϕ 25	4KA110,4KB110	4KA120,4KB120	SC3G-6-6	SL-M5,SLW-6A	ϕ 6 × ϕ 4 nylon tube
	4KA110,4KB110	4KA120,4KB120	SC3G-6-6	SL-M5,SLW-6A	ϕ 6 × ϕ 4 nylon tube
ϕ 32	4KA110,4KB110	4KA120,4KB120	SC3G-6-6	SL-M5,SLW-6A	ϕ 6 × ϕ 4 nylon tube
	4KA210-06,4F110-06 4KB210-06,4F110-06	4KA220-06,4F120-06 4KB220-06,4F120-06	SC1-6	SLW-6A	ϕ 8 × ϕ 5.7 nylon tube
ϕ 40	4KB110,A4F010-06	4KB120,4F020-06	SC1-6	SLW-6A	ϕ 8 × ϕ 5.7 nylon tube
	4KA210-06,4F110-06 4KB210-06,4F110-06	4KA220-06,4F120-06 4KB220-06,4F120-06	SC1-6	SLW-6A	ϕ 8 × ϕ 5.7 nylon tube

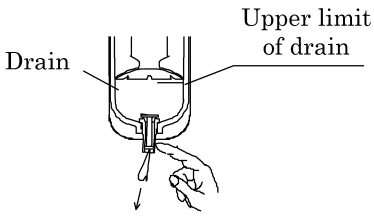
2. CAUTION

2.1 Fluid

1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5 μ m or less), flow rate and its mounting location (as nearest to the directional control valve as possible).



2) Be sure to drain out the accumulation in the filter periodically.



3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.

4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed.

3. OPERATION

3.1 Operation Principle

1) Locking

(a) When the piston ① of the cylinder approaches the stroke's end, the stopper piston ③ is pushed up along the slope of the sleeve ② (Fig.1).

(b) When the cylinder piston further nears the stroke's end and the stopper piston comes over the sleeve's groove Ⓐ, the spring ④ pushes down the stopper piston into the groove for locking (Fig.2).

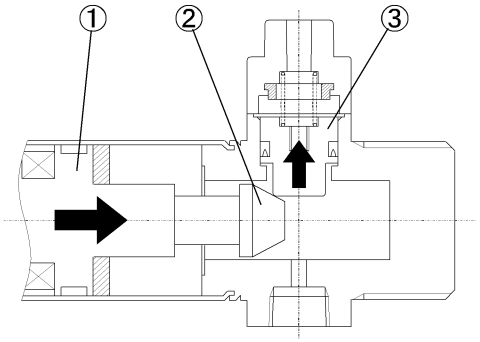


Fig.1

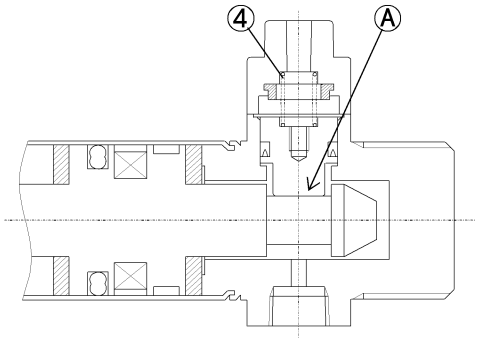


Fig.2

2) Lock release

The pressure supplied through the port pushes back the stopper piston, freeing the cylinder piston from the groove and releasing the lock (Fig.3).

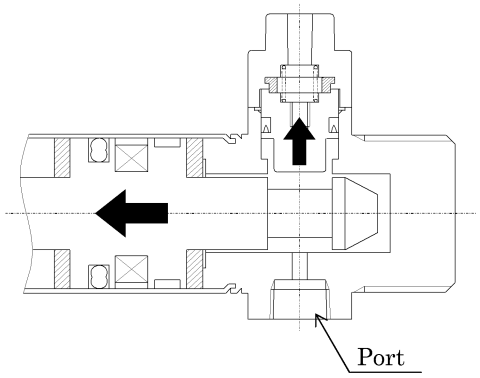
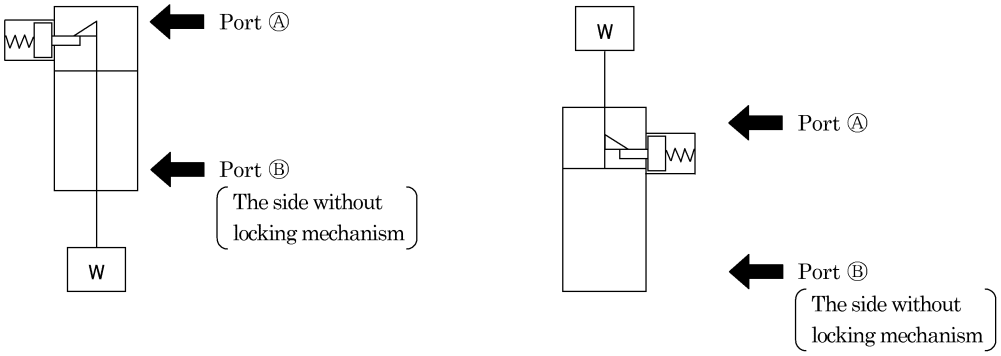


Fig.3

3.2 Operation

1) To release the locking, be sure to remove the load to locking mechanism by supplying pressure to the port Ⓑ first.
It is quite dangerous to supply pressure to the port Ⓐ direct while piston is being locked after both port Ⓐ and Ⓑ are exhausted because the piston rod is apt to pop out all the sudden due to the load on the tip of piston rod at the moment the port Ⓐ is pressurized as the pilot pressure simultaneous with the pressure to the port Ⓐ releases the locking mechanism.



2) There may be an occasion that stopper pin slides out of the position when having the locking mechanism hold the piston while locking mechanism is being pressurized.
Never intend to make use such solenoid valves as 3-position closed center type or 3-position PAB connecting type.

3.3 Allowable energy absorption

1) The working pressure for this type of cylinder is specified in "Product Specifications". Operate the system within this range.
Let the load factor of the cylinder be 50% or less.

2) If kinetic energy such as load is heavy or speed is too fast, exceeding the values given in Table 1, consider of providing a shock absorber.

Table1

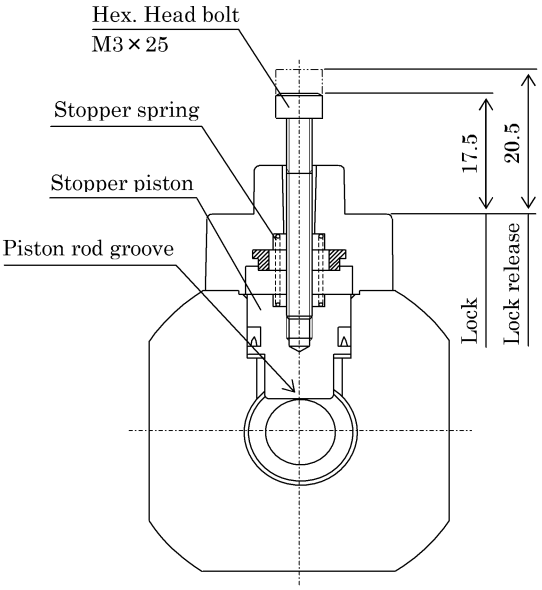
Bore size (mm)	Allowable energy absorption (J)
ϕ 20	0.089
ϕ 25	0.137
ϕ 32	0.179
ϕ 40	0.278

3) To adjust the working piston speed with the speed controller as indicated the basic circuit chart.

3.4 Manual Device Operation

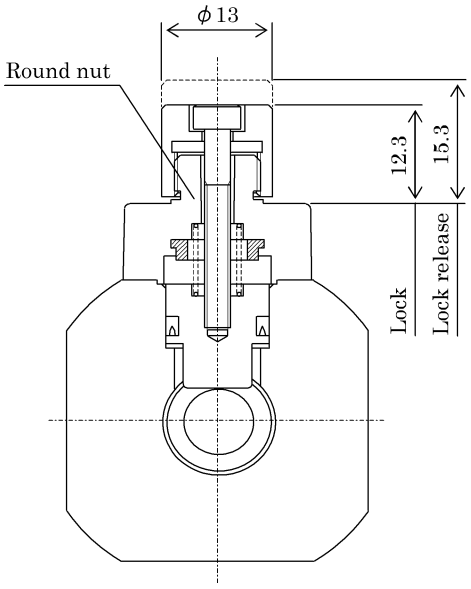
1) Non-lock manual device (option M0)

Screw the hex. Head bold (M3×25) into the stopper bolt and pull it out 3 mm with the force of 20 N or more. This causes the stopper piston to move, releasing the lock (Non-load horizontal mount, opposite port pressured). Let go the bolt, and the spring inside the device pulls the piston back into the piston rod groove, locking the cylinder again.



2) Lock manual device (option M1)

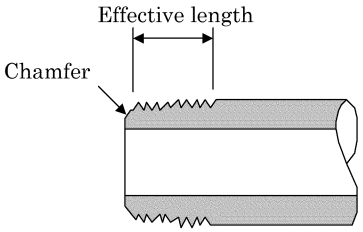
Turn the nut counterclockwise, and the stopper piston moves to release the lock. Turn the nut clockwise to the locking position, and the stopper piston returns back into the groove to lock the cylinder again.



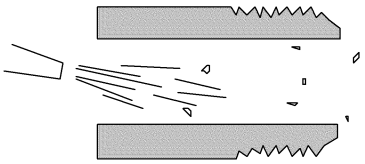
4. INSTALLATION

4.1 Piping

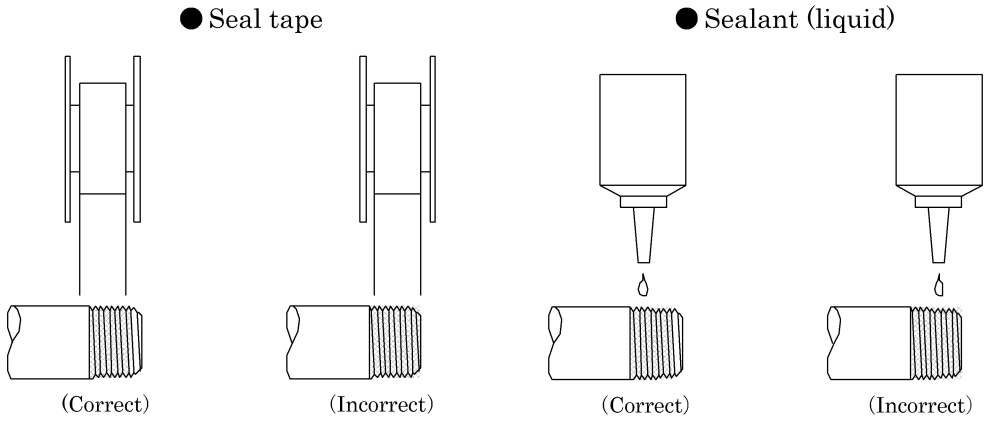
1) Be sure that the pipes and tubes in the circuit after the filter are og galvanized metal, nylon, rubber or other corrodion-resistant materials (galvanized material is also recommendedfor piping before the filter).
2) The pipe connecting the cylinder and the direction contorol valve ahould have an effective cross-sectional area that allows the cylinder piston to move with the required speed.
3) Install the filter for removing rust, foreign matters or draining the fluid from inside the pipe as near the direction control valve as possible.
4) Be sure that the gas pipe has the effective screwing length asshown in the drawing. The screw end should also have a 1/2-pich chamfer.



5) Before connecting the pipe, be sure to flash it (air blow) in order to remove chips and other foreign matters from the inside.



6) Sealing tape or a sealing agent is used for piping. Be careful about the amount of the agent or its applocation position or the taping position ao as to prevent fragments of the tape or the agent from entering the pipe or the equipment.



7) When the piping is over, check the joint for leak using soapy water. Wipe it clean after the check.

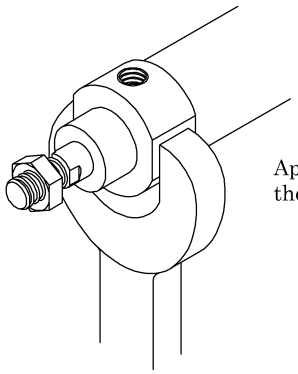
4.2 Installation

1) The ambient temperature for this cylinder is -10 to 60℃ (No freezing).

2) Consult CKD, when the cylinder is used in the dusty atmosphere, because there may be a case that foreign substances go inside through breathing hole of locking mechanism and cause malfunction.

3) Do not over tighten the tube of the cylinder or bump it against a hard object. The tube, when distorted, will cause malfunction.

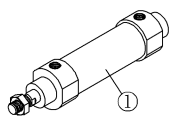
4) Assembly of mounting bracket:
Apply an open ended spanner onto double sided machined surface of mounting end cover as shown below when to hold the tube while attaching the mounting bracket.
The mounting brackets are supplied with the cylinder at the time of delivery. Please assemble them as shown by the number of the figure below.
Tighten the mount nut with the torque of 23 (N・m).



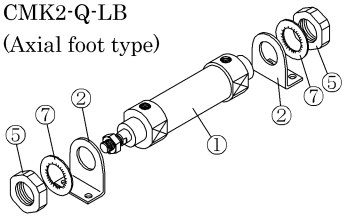
Apply an open ended spanner onto the double sided machined surface.

Assembly of mounting bracket

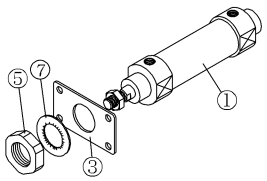
CMK2-Q-00 (Basic type)



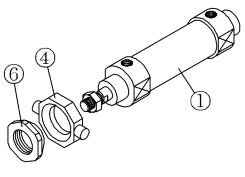
CMK2-Q-LB (Axial foot type)



CMK2-Q-FA(Flange type)

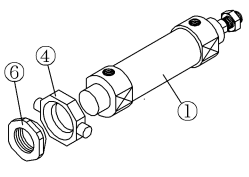


CMK2-Q-TA (Rod side trunnion type)



・Rod side position locking cannot be assembled.

CMK2-Q-TB (Head side trunnion type)

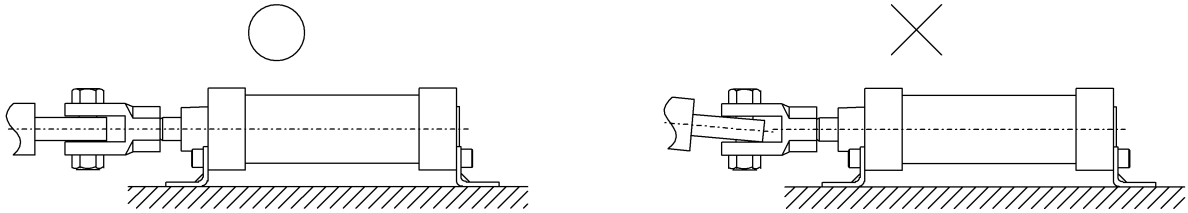


・Head side position locking cannot be assembled.

No.	Parts name	No.	Parts name
①	Cylinder body	⑥	Nut (for both TA type and TB type)
②	Foot bracket		
③	Flange	⑦	Mounting washer (for LB type and FA type)
④	Trunnion (Axis type)		
⑤	Nut (for both LB type and FA type)		

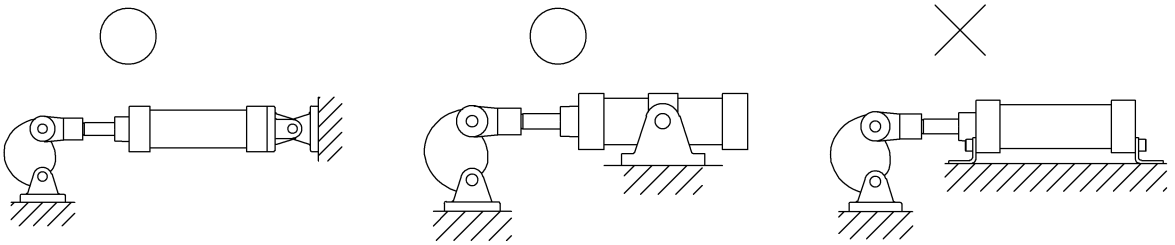
5) When cylinder is fixed and rod end is guided:
In case the piston rod of cylinder and the load are misaligned, the bushes and packings of the cylinder are extremely worn out.
Connect them with CKD's flow joint (spherical bearing).

6) When cylinder is fixed and rod end is connected with pin joint:
In case the load acting direction is not parallel with the rod axial center, the rod and tube may get entangled causing seizure, etc. Hence, make sure that the rod axial center and the load transfer direction are aligned to each other.



7) When the load acting direction changes with the cylinder operation:
Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle.

7) When the load acting direction changes with the cylinder operation:
Use an oscillating cylinder (clevis type or trunnion type) capable of making revolution to a certain angle.



Clevis type　　Trunnion type　　Foot type

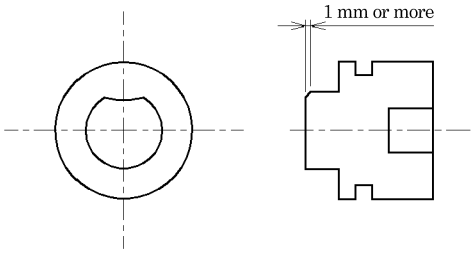
5. MAINTENANCE

5.1 Periodical Inspection

1) In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.
2) Inspection items

(1) Check the bolts and nuts fitting the piston rod end bracket and mounting bracket for slackening.
(2) Check to see that the cylinder operates smoothly.
(3) Check any change of the working piston speed and cycle time.
(4) Check for internal and/or external leakage.
(5) Check the piston rod for flaw (scratch) and deformation.
(6) Check the stroke for abnormality.
(7) Check if the position locking mechanism is securely locked.
(8) Check for scratches, wear and tear on the position locking mechanism

Check the stroke for abnormality.
(Sleeve, stopper piston, stopper packing, coil spring, etc.)
When a permanent deformation of 1 mm or more is observed on the stopper piston, the stopper piston needs to be replaced.
Since this may be caused by a permanent deformation of the sleeve, the sleeve also needs to be checked in this case.



See “Trouble shooting”, 5.2 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.
Since the position locking mechanism is a safety mechanism, disassemble it and check for scratches, wear and tear on it without fail.

5.2 Trouble shooting

1) Cylinder

Trouble	Causes	Remedies
Does not operate.	No pressure or inadequate pressure.	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve.	Correct the control circuit.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style.
	Broken piston packing	Replace the piston packing.
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation.
	Improper or misalignment of installation.	Correct the installation state and/or change the mounting style.
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state and/or change the mounting style.
	Excessive load.	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of “Meter in” circuit.	Change the meter-out circuit of the speed control valve.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Exertion of transverse load.	Install a guide. Reverse the installation state and/or change the mounting style.

2) Cylinder position locking mechanism

Trouble	Causes	Remedies
No locking.	No operation up to the stroke end.	Operate the cylinder up to the stroke end.
	Residual pressure is present inside the cylinder room on the locking mechanism side.	Reduce the residual pressure to zero.
No lock is released	The external force is applied to the stopper piston.	After pressurizing the cylinder side on the side without position locking unit, actuate the cylinder.
	No pressure: the pressure is insufficient.	Maintain the pressure source.
Does not operate.	No pressure: the pressure is insufficient.	Maintain the pressure source.
	Signal is not transmitted to direction control valve.	Correct the control circuit.
	Broken stopper packing.	Replace the piston packing.
Does not function smoothly.	Excessive load.	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of “Meter in” circuit.	Change the meter-out circuit of the speed control valve.
	Grease shortage.	Grease is spread.
Breakage and / or deformation	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or install a mechanism with more secured cushion effect (e.g.external cushion mechanism).
	Excessive load.	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of “Meter in” circuit.	Change the meter-out circuit of the speed control valve.
	Bounce on the end of stroke.	Eliminate a bounce on the end of stroke.

Note : The cylinder of this type is unable to be disassembled because of being caulked type assembly.

Replace cylinder in its entirety when some trouble is discovered.

3) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly	Turn the speed down. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return.	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to +60℃
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

6. HOW TO ORDER

6.1 Product Number Coding

● With out switch

CMK2-Q – 00 – 20 NN – 100 – H ——————— J Y

● With switch

CMK2-Q – 00 – 20 NN – 100 – H – T0H – R – J Y

(a) (b) (c) (d) (e) (f) (g) (h) (i)

(a) Mounting style		(b) Bore size (mm)		(c) pipe thread type		(d) Stroke (mm)	
00	Basic type	20	20 dia.	Blank	Rc	25	25
LB	Axial foot type	25	25 dia.	NN	NPT (Custom order)	50	50
FA	Rod side flange type	32	32 dia.	GN	G (Custom order)	75	75
FB	Head side flange type	40	40 dia.			100	100
CA	Eye bracket					150	150
CB	Clevis bracket					200	200
TA	Rod side trunnion type					250	250
TB	Head side trunnion type					300	300

(e) Position locking mechanism		(f) Switch model No.				
R	Rod side position locking	Axial lead wire	Radial lead wire	Switch type	Indicator light	Lead wire
H	Head side position locking	T0H※	T0V※	Reed	1 color indicator	2 wire
		T5H※	T5V※		With out indicator light	
		T2H※	T2V※	solid state	1 color indicator	2 wire
		T3H※	T3V※			3 wire
		T2YH※	T2YV※		2 color indicator	2 wire
		T3YH※	T3YV※			3 wire
		T2YFH※	T2YFV※		2 color indicator	3 wire
		T3YFH※	T3YFV※		(With preventive maintenance out put)	4 wire
		T2YMH※	T2YMV※		2 color indicator	3 wire
		T3YMH※	T3YMV※		(With preventive maintenance out put(1 color))	4 wire
		T2JH※	T2JV※		Off delay type	2 wire

※ mark indicates the length of lead wire.

(g) Switch Qty	
R	One on rod side
H	One on head side
D	Two
T	Three

※ Lead wire length	
Blank	1m (standard)
3	3m (option)
5	5m (option)

(h) Option (Note1) (Note2) (Note3)			
		Max. ambient	Instant max.
J	Bellows	100℃	200℃
L	Bellows	250℃	400℃
F	Push in joint (straight)		
FE	Push in joint (elbow)		
M	Piston rod material change (stainless steel)		
P6	Copper and PTFE free		
M0	Non-locking manual override		
M1	Locking manual override		

(i) Accessory	
I	Rod eye
Y	Rod clevis (Pin, washer, split pin attached)
B2	Clevis bracket (Pin and stop ring attached)

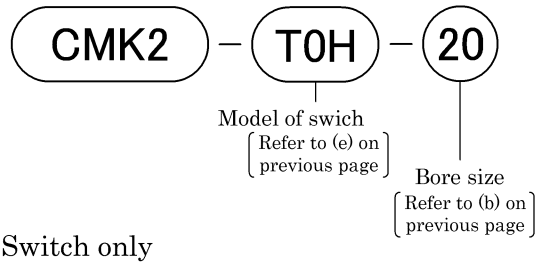
Note1. Applicable tube outer diameter of F; push in joint (straight), FE; push in joint (elbow) is 6 mm.

Note2. For bellows "J" type, stroke length should bemore than 25 mm.
When stroke length is shorter than 25 mm, consult with CKD.

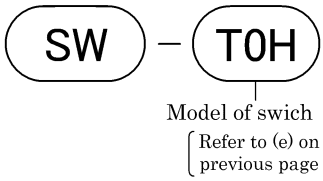
Note3. Instantaneous maximum temperature is thetemperature when spark and spatter etc. instantaneously contact to bellows.

6.2 Component parts Model coding

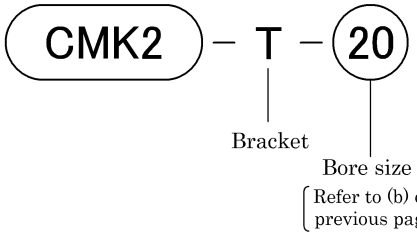
● Switch body + Mounting bracket



● Switch only



● Mounting bracket



7. SPECIFICATION

7.1 Product Specifications

Model / Item		CMK2-Q			
Bore size	mm	ϕ 20	ϕ 25	ϕ 32	ϕ 40
Actuation		Double acting / position locking type			
Working fluid		Compressed air			
Max. working pressure	Mpa	1.0			
Min. working pressure	Mpa	0.15			
Proof pressure	Mpa	1.6			
Ambient temperature	℃	−10 to +60 (No freezing)			
Port size		Rc1/8			
Stroke tolerance	mm	$^{+2.0}_{0}$(to 200), $^{+2.4}_{0}$(200 to)			
Working piston speed	mm/s	50 to 500			
Cushion		Rubber cushion			
Lubrication		Not required (when lubrication, use turbine oil Class 1 ISO VG32)			
Position locking mechanism		Head side or rod side			
Holding force	N	Max. thrust×0.7			
Allowable energy absorption	J	0.089	0.137	0.179	0.278

7.2 Switch Specification

Descriptions	Read 2 wire			
	T0H, T0V		T5H, T5V	
Applications	Programmable controller, relay		Programmable controller, relay, IC circuit (without indicator light), serial connection	
Load voltage	DC12/24V	AC110V	DC5/12/24V	AC110V
Load current	5 to 50mA (Note 2)	7 to 20mA (Note 2)	50mA or less	20mA or less
Current consumption	—			
Internal voltage drop	2.4V or less		0V	
Indicator light	LED (ON lighting)		Without indicator light	
Leakage current	0mA			
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code 2 conductor 0.2mm^2)			
Shock resistance	294m/s^2			
Insulation resistance	20MΩ over at DC500V megger			
Withstand voltage	No failure at AC100V inmressed for one minute			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance			

Descriptions	Solid state 2 wire		
	T2H, T2V	T2YH, T2YV	T2JH, T2JV
Applications	Programmable controller		
Power supply voltage	—		
Load voltage	DC10 to 30V		
Load current	5 to 20mA (Note 2)		
Current consumption	—		
Internal voltage drop	4V or less		
Off delay time	—		200±50ms
Indicator light	LED (ON lighting)	Red / green LED (ON lighting)	LED (ON lighting)
Leakage current	1mA or less		
Lead wire length (note 1)	1m (oil resistant cabtire code 2 conductor 0.2mm^2)	1m (oil resistant vinyl cabtire code 2 conductor 0.3mm^2)	1m (oil resistant cabtire code 2 conductor 0.3mm^2)
Shock resistance	980m/s^2		
Insulation resistance	20MΩ over at DC500V megger	100MΩ over at DC500V megger	
Withstand voltage	No failure at AC1000V impressed for one minute		
Ambient temperature	−10 to +60℃		
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance		

Descriptions	Solid state 3 wire	
	T3H, T3V	T3YH, T3YV
Applications	Programmable controller, relay	
Power supply voltage	DC10 to 28V	
Load voltage	DC30V or less	
Load current	100mA or less	50mA or less
Current consumption	10mA or less st DC24V	
Internal voltage drop	0.5V or less	
Off delay time	—	
Indicator light	LED (ON lighting)	Red/green LED (ON lighting)
Leakage current	10μA or less	
Lead wire length (note 1)	1m (oil resistant vinyl cabtire code 3 conductor, 0.2mm^2)	
Shock resistance	980m/s^2	
Insulation resistance	20MΩ over at DC500V megger	100MΩ over at DC500V megger
Withstand voltage	No failure at AC1000V impressed for one minute	
Ambient temperature	−10 to +60℃	
Degree of protection	IEC standards IP67, JIS C0920 (water tight type), oil resistance	