CKD

SM－5677－A

INSTRUCTION MANUAL

MICRO CYLINDER

Position locking type

CMA2-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 2nd 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 application, 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.

INDEX

CMA2-Q
MICRO CYLINDER
Position locking type
Manual No. SM-5677-A

1. PRODUCT

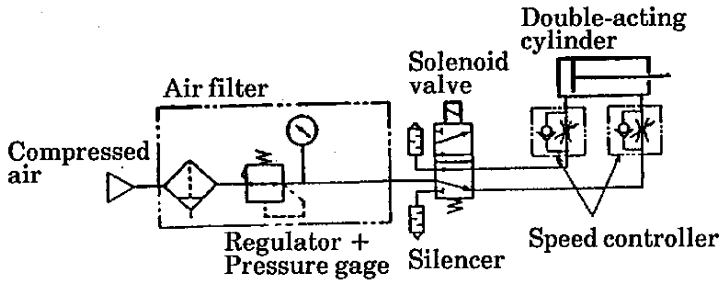
1-1. Specification

Service Fluid		Compressed Air
Operating Pressure Range kgf/cm² {MPa}		2.0 ~ 7.0 {0.2 ~ 0.7}
Withstanding Pressure kgf/cm² {MPa}		10.5 {1.05}
Ambient Temperature Range	(°C)	−10 ~ 60 (Not to be frozen)
Lubrication		Not required (Use class 1 ISO VG32 Turbine oil, if lubrication is preferred.)
Operating Piston Speed	(mm/sec)	50 ~ 500
Cushion		Rubber cushion
Installable Switch Model		R0, R1, R2, R3, R4, R5 and R6

NOTE : Cylinder switches are available to these cylinders.

1-2. Fundamental Circuit Diagram & Selection of Related Equipment

1) Fundamental Circuit Diagram of Double-acting Cylinder (Oilless Type)
The following is the fundamental circuit diagram.



2) Selection of Related Equipment with the Fundamental Circuit Diagram above:
The related equipment depends on the tube inner diameter and speed of the driving cylinder. Select equipment from the Selection Guide Table. (The table provided on the next page is an example of related equipment.)

Selection Guide Table for Related Equipment (an example)

Inner dia. of cylinder (mm)	Theoretical standard speed (mm/sec)	Required flow rate (ℓ/min) at p=5kgf/cm²	solenoid valve		Speed controller	Silencer	Distribution tube (1m)	F·R Kit
			Single solenoid	Double solenoid				
φ20,φ30,φ32	400	120	4KB110	4KB120	SC3G-6-6 SC1-6	SLW-6A	φ6×φ4	A7019-1C
φ40	300	130	4KB110	4KB120	SC1-6	SLW-6A	φ6×φ4	
φ40	400	180	4K210	4K220	SC1-8	SLW-6A	φ8×φ6	A7019-2C

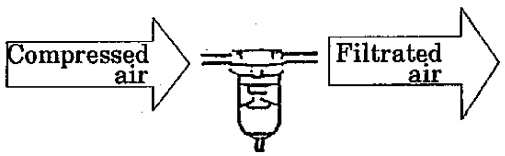
NOTE : Theoritical speed specifies the ratio of piston speed.
(Almost identical to the speed at no-load)
Refer pages 5~8 of general catalog as for the detail.

2
WARNING

2. CAUTION

2-1. FLUID

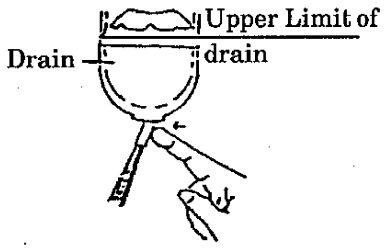
1) Use the compressed air, filtrated and dehumidified. Carefully select a filter of an adequate filtration rate (5μm or lower preferred), flow rate and its mounting location (as closest to directional control valve as possible).



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

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

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



3. OPERATION

3-1. Principle of Mechanical Motion

1) Locking Motion

(a) Stopper piston⑤ is pushed up by the slant of sleeve tip③ as the piston① of cylinder approaches to its stroke end. (Fig. 1)

The stopper piston, however, is held up by the pressure when the pressure within the chamberⒶ is 1kgf/cm^2 or higher.

(b) When the piston of cylinder further comes closer to its stroke end and the grooveⒷ of sleeve matches to the tail of stopper piston⑤, the stopper piston drops back to the grooveⒷ due to expansion force of spring④, generating an effect of locking the piston of cylinder. (Fig. 2)

The excessive air within the head chamber is exhausted by pushing the check ball② up.

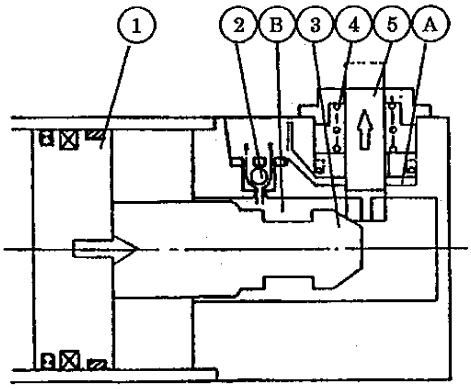


Fig. 1

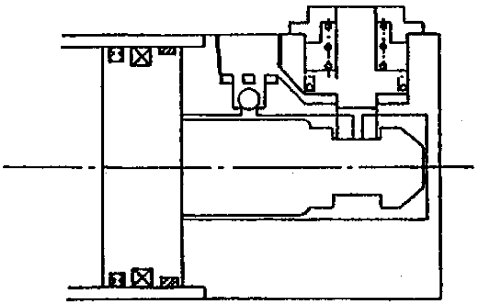


Fig. 2

2) Unlocking Motion

The stopper piston, when compressed air is supplied through the port, floats up against the force of the spring④ and comes off the groove Ⓑ of sleeve, generating an effect of unlocking the piston of cylinder. (Fig. 3)

Moreover, locking release is much more assured owing to a remarkable improvement of a sequential valve mechanism to have the locking device is completely released before pressurizing a main cylinder chamber.

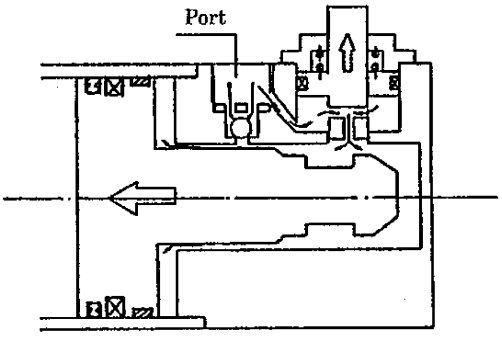
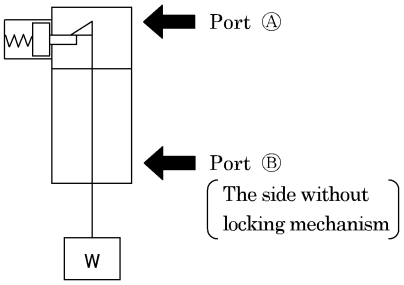
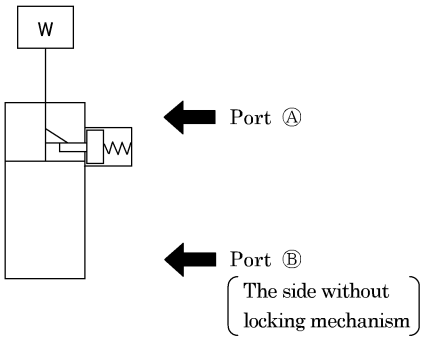


Fig. 3

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 pressure supply range is 2.0 to 7.0 kgf/cm². {0.2～0.7Mpa} 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.

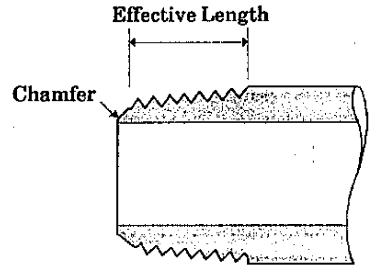
Table1

Tube bore (mm)	Tolerable energy absorption (J)
ϕ 20	0. 024
ϕ 30	0. 050
ϕ 40	0. 093

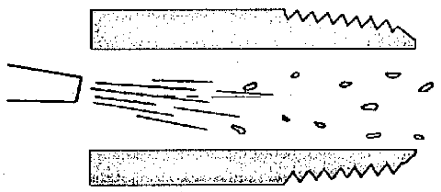
4. INSTALLATION

4-1. Piping

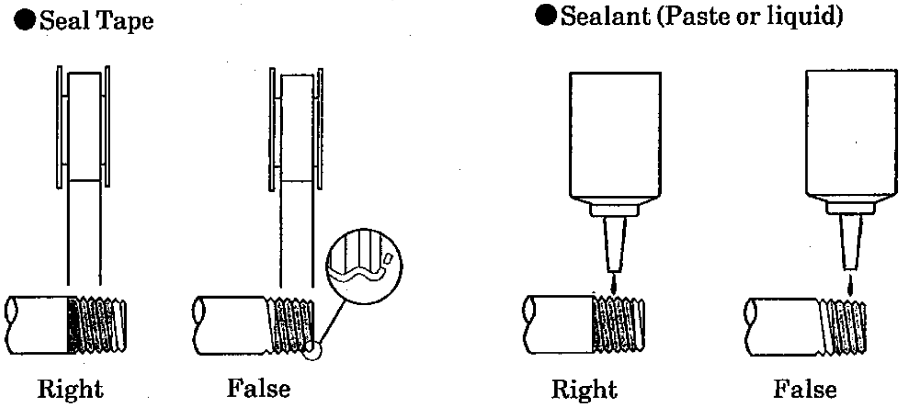
1) For piping beyond the filter, use pipes that hardly get corroded such as galvanized pipes, nylon tubes, rubber tubes, etc. (Refer to Selection Guide Table for Related Equipment.)
2) See to it that the pipe connecting cylinder and solenoid valve has effective sectional area needed for the cylinder to drive at specified speed. (Refer to Selection Guide Table for Related Equipment.)
3) Install filter preferably adjacent upper-stream to solenoid valve for eliminating rust, foreign substance and drain in the pipe.
4) Strictly observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.



5) Flush air into the pipe to blow out foreign substances and chips before piping.



6) Refrain applying sealant or sealing tape approx. two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.



7) Inspect against any external leakage at each threaded joint, upon completion of plumbing, by applying soapy water over it.

4.2 Installation

1) The ambient temperature range for this cylinder is -10 to 60℃ (To be unfrozen).

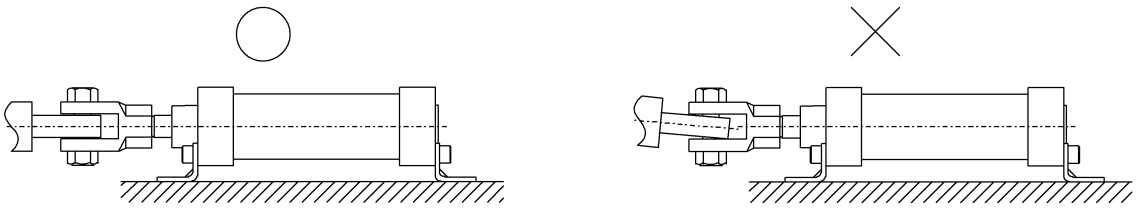
2) Consult CKD, when the cylinder is used in the dusty atmosphere, because there may be a case that foreign substances go inside through breathing hole of locking mechanism and cause malfunction.

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

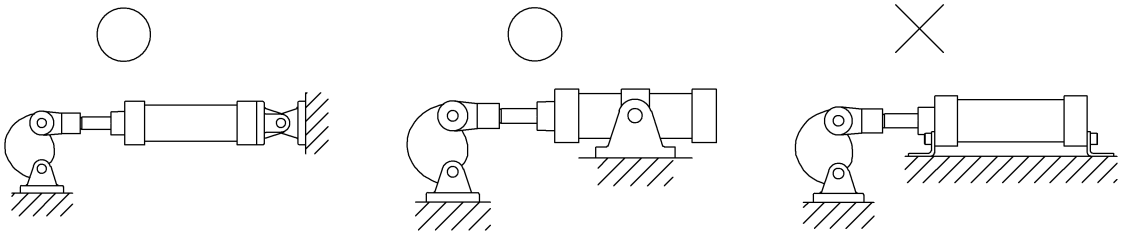
4) Assembly of supporting metal fittings:
The supporting metal fittings are supplied with the cylinder at the time of delivery.

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.
Hence, connect them with CKD's floating connector (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. Furthermore, install the rod and connecting metal (knuckle) so that it moves in the same direction as the cylinder main body does.



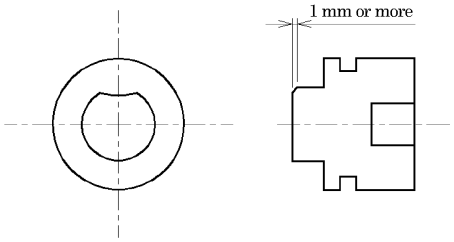
Clevis type　　Trunnion type　　Foot type

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.
   Before starting an inspection, take appropriate measures separately to prevent a load from falling down under its own weight.

2) Inspection items
   (1) Check the bolts and nuts fitting the piston rod end fittings and supporting fittings for slackening.
   (2) Check to see that the cylinder operates smoothly.
   (3) Check any change of the 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 (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 supporting system.
	Broken piston packing	Replace the packing.
Does not function smoothly.	Speed is below the low speed limit	Limit the load variation and consider the adoption of low pressure cylinder.
	Improper or misalignment of installation.	Correct the installation state and/or change the supporting system.
	Exertion of transverse (lateral) load.	Install a guide. Revise the installation state and/or change the supporting system.
	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 supporting system.

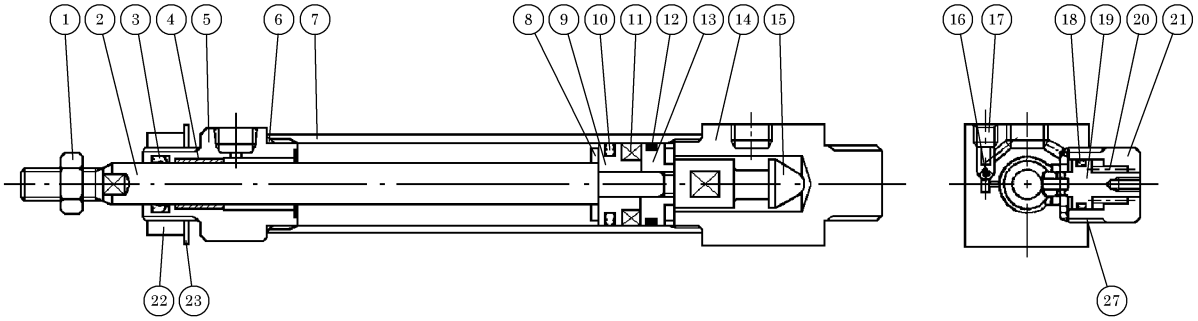
2) Psition locking mechanism

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 Does not operate.	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.
	No pressure: the pressure is insufficient.	Maintain the pressure source.
	Signal is not transmitted to direction control valve.	Correct the control circuit.
Does not function smoothly.	Broken stopper packing.	Replace the piston packing.
	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	Grease shortage.	Grease is spread.
	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.
Trouble No locking.	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.
	Causes	Remedies
	No operation up to the stroke end.	Operate the cylinder up to the stroke end.

5.3 Disassembling

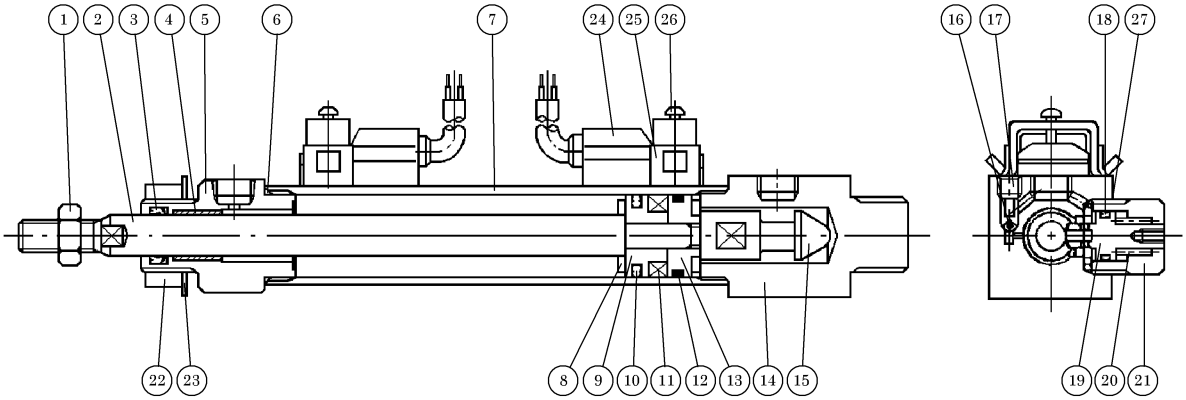
This type of cylinder is able to be disassembled for maintenance purpose.
Refer the following internal structure drawings to disassemble cylinder and replace parts listed on the expendable parts list.

1) The type without switch.



No.	Parts	Material	Remarks
1	Rod nut	SGD400	
2	Piston rod	S45C	Chrome plating,industrial grade
3	Rod packing	NBR	
4	Bushing	Dry bearing	ϕ 20
		SBK2118	ϕ 25 ϕ 32 ϕ 40
5	Rod cover	A2011BD	
6	Gasket	NBR	
7	Cylinder tube	A6063TD	Alumite process
8	Cushion rubber	U	
9	Piston (A)	A2017BD	
10	Piston packing (A)	NBR	
11	Piston magnet	Plastic magnet	
12	Wear ring	POM	
13	Piston (B)	A2017BD	
14	Head cover	A2011BD	
15	Sleeve	Special steel	Quenching,chromate plated
16	Check ball	U	
17	Check ball retainer	SCM	Black oxide finish
18	Piston packing (B)	NBR	
19	Stopper piston	Special steel	Quenching,chrome plated
20	Spring	SWP	lack oxide finish
21	Stopper cover	A2011BD	Zinc chromate
22	Nut	SS41	Zinc chromate
23	Toothed lock washer	SWRH	
27	Stopper gasket	NBR	

2) The type with switches.



No.	Parts	Material	Remarks
1	Rod nut	SGD400	
2	Piston rod	S45C	Chrome plating,industrial grade
3	Rod packing	NBR	
4	Bushing	Dry bearing	ϕ 20
		SBK2118	ϕ 25 ϕ 32 ϕ 40
5	Rod cover	A2011BD	
6	Gasket	NBR	
7	Cylinder tube	A6063TD	Alumite process
8	Cushion rubber	U	
9	Piston (A)	A2017BD	
10	Piston packing (A)	NBR	
11	Poston magnet	Plastic magnet	
12	Wear ring	POM	
13	Piston(B)	A2017BD	
14	Head cover	A2011BD	
15	Sleeve	Special steel	
16	Check ball	U	
17	Check ball retainer	SCM	
18	Piston packing (B)	NBR	
19	Stopper piston	Special steel	
20	Spring	SWP	
21	Stopper cover	A2011BD	
22	Nut	SS41	
23	Toothed lock washer	SWRH	
24	Switch body	—	
25	Band	SUS304	
26	Pan head machine screw	SWRH	
27	Stopper gasket	NBR	

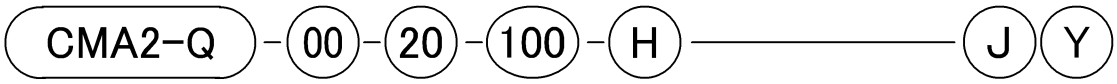
3) Expendable parts list

Specify the kit No. on your purchase order.

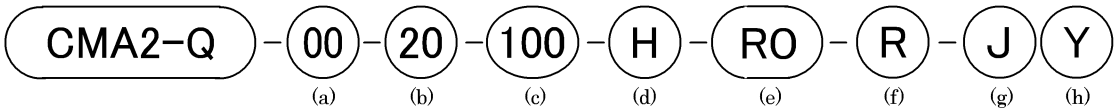
Tube bore(mm) / Parts name / Kit No. / Parts No.		3	6	10	12	19	27
		Rod packing	Gasket	Piston packing (A)	Wear ring	Piston packing (B)	Stopper gasket
φ 20	CMA2-Q-20K	PDU-10	AS568-018	PSD-20	F4-125610	MYN-9	AS568-015
φ 25	CMA2-Q-25K	PDU-12	AS568-021	PSD-25	F4-654958	MYN-9	AS568-015
φ 32	CMA2-Q-32K	PDU-12	AS568-026	PSD-32	F4-654960	MYN-9	AS568-015
φ 40	CMA2-Q-40K	PDU-14	AS568-029	PSD-40	F4-125614	MYN-9	AS568-015

6. HOW TO ORDER

● With out switch



● With switch



(a) Mounting style		(b) Tube bore (mm)		(c) Stroke (mm)		(d) Position locking mechanism	
00	Basic type	20	φ20	25	25	R	Rod side position locking
LB	Axial Foot type(single)	30	φ30	50	50	H	Head side position locking
FA	Rod side flange type	40	φ40	75	75		
FB	Head side flange type			100	100		
CA	Eye bracket type			150	150		
CB	Clevis bracket type			200	200		
TA	Rod side trunnion type			250	250		
TB	Head side trunnion type			300	300		

Note : Rod side position locking is not available for TA, while head side position locking is notavailable for TB.

(e) Switch model No.						※ Lead wire length		(f) Switch Qty.	
Grommet type	Terminal box type		contact	Display	Lead wire	Blank	1m(Standard)	R	One on Rod side
	Std. type	Splash-proof				3	3m(option)	H	One on head side
						5	5m(option)	D	Two
								T	Three
R1※	R1B	R1A	Proximity	1 color indicator	2 wire				
R2※	R2B	R2A							
R2Y※	R2YB	R2YA		2 color indicator					
R3※	R3B	R3A		1 color indicator	3 wire				
R3Y※	R3YB	R3YA		2 color indicator					
R0※	R0B	R0A	Reed	1 color indicator	2 wire				
R4※	R4B	R4A							
R5※	R5B	R5A							
R6※	R6B	R6A							

※ mark indicates the length of lead wire.

(g) Option (note1),(note2),(note3)		(h) Accessory	
J	Bellows:Nylon tarpaulin	I	Rod eye
K	Bellows:Neoprene sheet	Y	Rod clevis
M	Piston rod material change (stainless steel)	B2	Clevis bracket
N	Piston rod end thread length change		
M0	Non-locking manual override		
M1	Locking manual override		

Note 1: For bellows "J" type, stroke length should be more than 25 mm. When stroke length is less than 25mm, consult with CKD.