# **Compact Cylinders - Overview**

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MISUMI low profile air cylinders are designed to be compact to save space.

The general-purpose thin-type cylinders have been standardized.

Standard-stroke compact air cylinders can be shipped immediately, while those of selectable shape (with specified stroke) can be dispatched on the fifth day after receiving an order. Each of the MISUMI standard thin-type cylinders is equipped with a magnet rubber cushion.

#### Features of Compact Air Cylinder

For selectable shapes (with specified stroke), the stroke can be specified in 1mm increments, and the rod tip type can be selected The cylinder body can be fixed directly through four through holes

In addition, connecting parts can be selected from two shapes; Foot and U-Shaped Clevis Sensors can be installed at eight locations (Ø12: 3 locations: Ø16: 6 locations)

#### ■Selection of Cylinders

#### Define the requirements for the load.

- 1) Load (N) · · · · · · · · · · · · · Refer to "Load Calculation"
- 2) Operating Pressure (Mpa)
- 3) Stroke (mm)
- 4) Operating Time (s)

#### 2 Calculate the cylinder output. (for Double Acting Type)

1) Determine the cylinder output. (for Outstroke)

 $F1 = nxA_1xP$ 

F1 = Outstroke Thrust (N)

- A1 = Outstroke Pressure Area (mm²) · · · · · Refer to "Cylinder Pressure Area Table".
- $\eta = \text{Load Factor Meeting the Purpose (%)} \cdot \cdot \cdot \cdot \text{Refer to "Load Factor Coefficient Table"}$
- =Operating Pressure (Mpa)

2) Determine the cylinder output. (for Instroke)

F2 = nxA2xP

F2 -Thrust of Instroke (N)

- A2 = Instroke Pressure Area (mm²) · · · · · Refer to "Cylinder Pressure Area Table"
- $n = \text{Load Factor Meeting the Purpose (\%)} \cdot \cdot \cdot \cdot \cdot \cdot \text{Refer to "Load Factor Coefficient Table"}$
- P =Operating Pressure (Mpa)

#### Determine I.D. of the tube.

Determine the I.D. of the tube based on the cylinder output (N) and load (N).

Select a cylinder for required load to be within the \_\_\_\_\_ range in the table.

· · · · · Refer to "Tube I.D. Selection Table" and "Theoretical Output Table".

For example, if the operating pressure is 0.5MPa and the 105N cylinder is required, the cylinder diameter is selectable from following 3 sizes: Ø20 (load factor: approx. 70%), Ø25 (load factor: approx. 45%), and Ø32 (load factor: approx. 25%).

Load Factor = Theoretical Output

Theoretical Output (N) = Pressure Area (mm²) x Operating Pressure (MPa)

#### 4) Determine the theoretical reference speed.

• Determine the theoretical reference speed based on the stroke (mm) and operating time (s) · · · · · Refer to "Theoretical Reference Speed Selection Table".

### 5) Verify the cylinder cushion mechanism.

· Check allowable kinetic energy (J) when the load is to be stopped near the end of the cylinder stroke

E=m/2xV2 · · · · · Refer to the "Allowable Kinetic Energy Table."

E=Kinetic Energy (J) m=Mass (kg) V=Velocity (m/s) CAUTION: If load beyond the allowable kinematic energy (J) is applied to the cylinder,

1) Review the LD of the cylinder tube

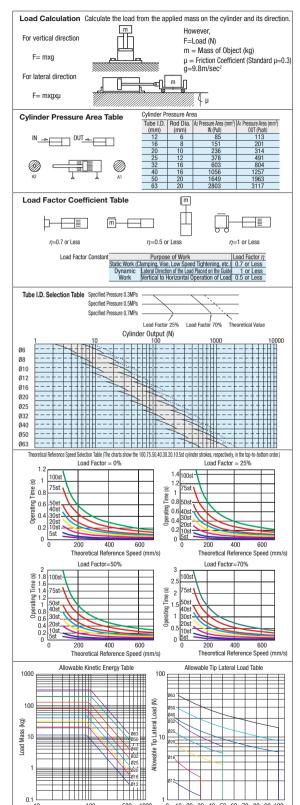
2) Install an external stopper.

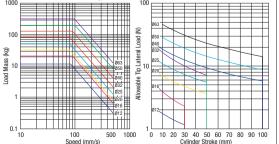
The measures above are required

#### 6) Verify the lateral load to be applied to the cylinder.

- If the lateral load is applied to the tip of the cylinder piston rod, check the allowable lateral
- Verify the load based on the following three conditions. • • Refer to the "Allowable Tip Lateral Load Table"
- 1) I.D. of Cylinder Tube
- 2) Cylinder Stroke (mm)
- 3) Lateral Load Applied to the Tip of the Rod (N)
- CAUTION: If load beyond the allowable lateral load (N) is applied to the tip of the cylinder
  - Review the LD of the cylinder tube.
- 2) Install a guiding mechanism on the piston rod to contain the applied load under the allowable lateral load. The measures above are required

## Theoretical Output Operating Operating Pressure (Mpa) Direction 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 Ø12 Ø16 025 Ø32 Ø50 Ø63





Above two tables (Allowable Kinetic Energy Table and Allowable Tip Lateral Load Table) are for Compact Type Cylinders ( P1485)

#### ■Air Consumption and Required Air Amounts

#### Air Consumption (per Reciprocating Motion of Double Acting Cylinder)

①Volume of the air consumed by the reciprocating motion of the air cylinder, in the cylinder or between the cylinder and the changeover valve. It is required to select an air compressor or to calculate the running costs. (Formulas)

 $Q_{CC}=(A1+A2)xLx \frac{P+0.1013}{0.1013}x10^{-6}$ 

 $Q_{cp}=2xax \ell x \frac{p}{0.1013} x 10^{-6}$ 

Qc=Qcc+Qcp

Occ= Air Consumption of Air Cylinder [0 (ANR)]

Oce- Air Consumption of Tube or Pine (r ((ANR))

A1 = Extruding End Pressure Area [mm²] · · · · · Refer to "Cylinder Pressure Area Table"

A2 = Retreating End Pressure Area [mm²] · · · · · Refer to "Cylinder Pressure Area Table".

=Operating Pressure [MPa]

\mathcal{l} = Pipe Length [mm]

(Formulas)

a = Inner Cross-sectional Area of Pipe [mm²]

 $Q_c$  = Air Consumption Required for One Reciprocating Motion of Air Cylinder [ $\ell$  (ANR)]

#### (2) Select a compressor that has enough capacity for the total amount of air consumed downstream by the air actuator.

Air is consumed due to leakages in the pins or in the drain valve or pilot valve. In addition, air volume decreases with the temperature decrease

Oc' = Ocxnx Number of Cylinders Used x Margin Ratio

Q<sub>c</sub>' = Compressor Discharged Flow Rate [\(\ell\)/min(ANR)

n = Cylinder Reciprocating Motions per Minute Margin Ratio=1.5 ~ (To be set by the user)

#### Required Air Volume (per Minute)

Amount of the air necessary for actuating the air cylinder at a predetermined speed. This is required for selecting a diameter of any pipe upstream of the changeover valve, or selecting the F, R and L equipment (filter, regulator and lubricator on F.1523)

 $Qr_1=60xA1xVx \frac{P+0.1013}{0.1013} x10^{-6}$ 

 $Qr_2=60xA2xVx \frac{P+0.1013}{0.1013} x10^{-6}$ 

Or1 = Extruding End Air Requirement [0/min(ANR)]

Or2 = Retreating End Air Requirement [0/min(ANR)

A1 = Extruding End Pressure Area [mm²] · · · · · Refer to "Cylinder Pressure Area Table".

A2 = Retreating End Pressure Area [mm²] - - - - - Refer to "Cylinder Pressure Area Table".

V =Maximum Piston Speed [mm/s]

P =Operating Pressure [MPa]

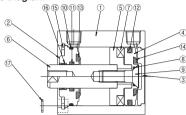
\* For Double Acting Cylinders, use one with larger Or1 and Or2

When there are multiple air cylinders downstream in selecting the plumbing or equipment, apply the maximum amount among all cylinders in simultaneous operation.

### Compact Cylinder Basic Specifications

Tube I.D. (mm)	12~25	32~40	50	63	
Operating Type	Double Acting				
Applicable Fluid	Air				
Min. Operating Pressure (MPa)	0.1				
Max. Operating Pressure (MPa)	1.0				
Pressure Resistance (MPa)	1.5				
Operating Temp. Range (°C)	5~60				
Piston Speed (mm/s)	50~500				
Cushion Mechanism	NBR				
Stroke Tolerance (mm)	0~+1.0 0~+2.			0~+2.0	
Lubrication	Lubrication Free				
Pipe Connection Bore Dia.	M5x0.8 Rc1/8 Rc1/4			1/4	

#### **■**Compact Cylinders Basic Structure Diagram



#### Compact Cylinders Parts Details

Number Part Name		M Material		S Surface Treatment			
Number   Tart Name		Ø12~32	Ø40~63				
1	Main Body	EN AW-6063-T5 Equiv.	EN AW-6063-T5 Equiv.	Clear Anodize			
2	Rod Cover	EN AW-4032 Equiv.	EN AW-6061-T6 Equiv.	Clear Anodize			
3	Head Cover	EN AW-6061-T6 Equiv.	EN AW-6061-T6 Equiv.	Clear Anodize			
4	Piston	EN AW-6061-T6 Equiv.	EN AW-6061-T6 Equiv.	Clear Anodize			
(5)	Piston R		EN AW-6061-T6 Equiv.				
6	Piston Rod	EN 1.4301 Equiv.	EN 1.1191 Equiv.	Hard Chrome Plating			
7	Magnet						
8	Piston Gasket	NBR	NBR				
9	Hex Socket Flat Head Cap Screw	EN 1.4301 Equiv.	EN 1.7220 Equiv.				
10	Body Gasket	NBR	NBR				
11)	Rod Gasket	NBR	NBR				
(12)	Piston Gasket	NBR	NBR				
13	Rod Cushion	NBR	NBR				
(14)	Head Cushion	NBR	NBR				
(15)	Stop Ring	EN 1.4301 Equiv.	EN 1.1525 Equiv.	Nickel Plating (Ø40 ~ 63)			
16	Rod Bushing		Oil Free Bushing				
17)	Washer	EN 1.0330 Equiv.	EN 1.0330 Equiv.	Nickel Plating			
Gaskets of MSCCN and MSCCA are NB (Nitrile Rubber).							

## Sensors for Cylinders Specifications

Part Number		MD13	ME33	MD14	ME34		
Cable Exit Direction	Rear	Rear	Тор	Rear	Тор		
Contact Type	Contact	No Contact					
Power Supply Voltage Range		5DC~28V					
Load Voltage Range	24VDC,110VAC	28VDC or Less		DC10~28V			
Load Current	24VDC:5~40mA	0.1~40mA		5~20mA			
Range	110VAC:5~20mA	0.1≈40IIA		3-20IIA			
Internal Voltage Drop	3V or Less	0.5V or Less		5V or Less			
Leakage Current	0 μ Α	50 μA or Less		1mA or Less (24VDC, 25°C)			
Consumption Current	10mA or Less						
Response Time	1ms or Less						
Reset Time	1ms or Less						
Insulation Resistance	100mΩ or more with 500 VDC (between Case and Code)						
Withstand Voltage	1 min. with 1500VAC (between Case and Code)						
Impact Resistance	294m/s²						
Vibration Resistance	Lateral Amplitude 1.5mm, 10 ~ 55Hz (1 sweep/min, 2 hours in each of X, Y, Z Directions)						
Ambient Temperature		0 ~ +60°C	Non-Freezing)				
Connection Method	PVC 0.2mm <sup>2</sup> 2 Conductors O.D. Ø2.6mm	PVC 0.15mm <sup>2</sup> 3 Conductors O.D. Ø2.6mm		PVC 0.2mm <sup>2</sup> 2 Conductors O.D. Ø2.6mm			
Lead Wire Length	1m, 3m						
Protection Structure	IP67 (IEC Standard), JIS0920 (Water Resistant Type)						
Protection Circuit	No	Yes					
Indicator Light	LED (Lights when ON)						
Applicable Load	Small Relay – PLC						
Electrical Circuit	Brown [+]	100 100 100 100 100 100 100 100 100 100	Brown [+] Black [OUT] Blue [-]		Brown [+] Blue [-]		

Check the air cylinder specifications and use the cylinder within the allowed specification range. If the cylinder is used under pressure or temperature exceeding the specifications, or any fluid other than compressed air is used, there is a danger of personal injury or damage to the machine by broken or malfunctioning cylinders. Be sure to use the cylinder within the allowed specification

2) Please note that there may be potential damages to the machine or human body, e.g. hands and/ or leas being caught in the moving mechanisms.

If there are potential hazards to human body, install a protective cover as a safety measure. 3) Provide safety measures against possible injuries and equipment damages by air cylinder malfunctions due to power and air supply troubles.

4)The air cylinder and the coupling with other equipment must be fixed securely to avoid loosening.

Duse a filter and a dryer in order to supply clean and dry compressed air to the air cylinder. Impurities in the compressed air may cause malfunctions.

2) Use a speed controller to operate the air cylinder at a predetermined speed. 3A lateral load beyond the allowable range must not be applied to the piston rod. Otherwise, the air cylinder may operate improperly, or the gaskets may be damaged

4) The air cylinder can be operated without lubrication. For lubricating the cylinder, supply Category-1 turbine oil (ISO VG32). Once lubricated, continue to use the same lubricant. If lubrication is stopped, the initial lubricant may be lost, thus causing the cylinder to malfunction

## ensors for Cylinders) A DANGER

Never use the cylinder in an atmosphere containing explosion gas.

Otherwise, the sensor may cause an explosion because it does not have an explosion-proof structure. (Sensors for Cylinders) A CAUTION

After reviewing the specifications of sensors for cylinders, use them within the specifications. If the sensor is used with a load current, voltage, temperature, impact, or any other condition outside the range of the specifications, the sensor may break the sensor may break or operate improperly.

(2) Do not use the sensor under conditions such as: a magnetized area; an atmosphere containing an explosive gas; water or oil may be splashed to the cylinder; the temperature may change in an extremely wide range; an impact may occur; a dusty

area. Otherwise, the sensor may operate improperly or break. ③Perform wiring correctly according to the color-coded labels of the sensor lead wires.

<Contacting Sensor> · If the wiring is reversed, the lamp will not light, although the sensor operates. (24 VDC only)

<Two-wire Non-contact Sensor> · If the wiring is reversed, the lamp will continually stay ON

<Three-wire Non-contact Sensor>

· If the power and output lines are wired incorrectly, the sensor will break.

To connect a load that generates a surge voltage (e.g. relay), use a switch that contains a contact protection circuit, or use a protection circuit.

(5) If power is turned on without connecting a load such as relay, PLC (programmable controller) or a similar load to the two-wire sensor, the sensor will fail. Be sure to connect a load before turning the power on.

6Do not bundle sensor wires with power lines or high voltage circuits. Otherwise, noise may be generated, resulting in malfunction of the sensor.

(7) If the wire contains insulation faults, an over-current may flow through the sensor, causing the sensor to fail. Confirm that there is no insulation fault.

(8) If the sensor wire is too long, turning power on may generate a in-rush current, resulting in breakage of the contacts. If the wire length exceeds 5m, be sure to connect a contact protection circuit.

(9) Do not drop or bump the sensor, as the internal mechanism of the sensor may break.

(0.1 ~ 0.2Nm)

#### DANGER: A clearly dangerous state. Unless avoided, death or serious injuries might be caused. DANGER: A clearly dangerous state. Unless avoided, death or serious injuries might be caused. [IMPORTANT] PRECAUTIONS CAUTION: A potentially dangerous state depending on usage. Unless avoided, death or injuries might be caused. NOTE: A potentially dangerous state depending on usage. Unless avoided, low-grade to moderate injuries might be caused, or property might be damaged.