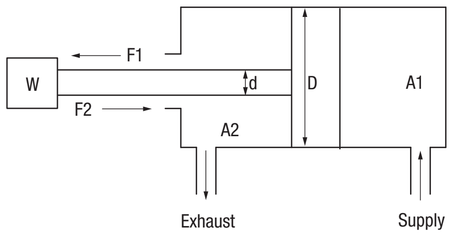
REFERENCE DATA

1. Selection Method of Internal Diameter of Cylinder

When determining the internal diameter of a cylinder, it is necessary to determine the degree of cylinder output depending on the load size (weight).



Forward : $F_1 = A_1 \times p \times \beta$ (kgf)
Backward : $F_2 = A_2 \times p \times \beta$ (kgf)
(Unit: cm)

- Formula

- A1 : Piston hydraulic pressure area (cm^2)
  (Forward direction)
  $A1 = (\pi \times D^2) / 4$
- A2 : Piston hydraulic pressure area (cm^2)
  (Reverse Direction)
  $A2 = \pi \times (D^2 - d^2) / 4$
- D : Internal Diameter of Cylinder (cm)
- d : Piston Rod Diameter (cm)
- P : Operating pressure (kgf/cm^2)
- β : Load factor (%)

→ The actual output is determined by considering the resistance of the cylinder slide and the loss of pressure in the piping and equipment. Load factor is the ratio of the actual load applied on the cylinder to the calculated theoretical force (the theoretical cylinder force) at the circuit set pressure and, in Single Rod, the following estimates are applied:

* Low inertia = 60~80%
* High inertia = 25~35%
* The calculation example in this catalog is calculated as load factor 80%.

Example

When using the "K-HS 70 • 140" type to obtain a 5000kgf cylinder force with a set pressure of $70kgf/cm^2$, what should be the "Cylinder Internal Diameter"?

Answer

Calculate the effective area of the piston. See P.92 for the effective area.

$$\text{The effective area of the piston } (cm^2) = \frac{\text{Cylinder force (kgf)} \div \text{Load factor}}{\text{Set Pressure } (kgf/cm^2)} = \frac{5000 \div 0.08}{70} \doteqdot 89.2\ (cm^2)$$

→ When the effective area of the piston is selected to be close to 89.2
- Push: Internal Diameter 125
- Pull side: 125 Internal Diameter or 140 Internal Diameter (when 'B' Rod is selected)
  125 Internal Diameter (when 'C' Rod is selected)

2. Selection Method of Piston Rod Diameter

When using hydraulic cylinder, consideration should be given to compression stress and buckling according to cylinder stroke. When the piston rod shaft is considered a long pole, the strength of this does not increase by using a high tensile force or heat treatment. As a method of maintaining the buckling strength of the piston rod, it is necessary to keep in mind that there is no other method except by the thickening of the piston rod.

The following diagram shows a maximum stroke when a minimum compression load is applied to each piston rod diameter based on the formula of "EULER" applied to a upright pole.

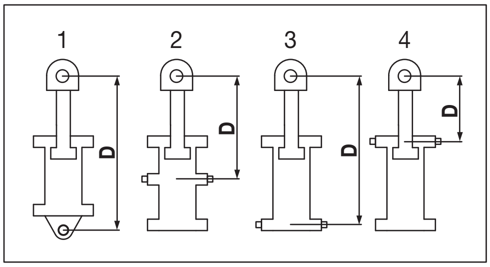
The stroke values need to be changed to accommodate the conditions of use under special mounting or impact load, such as vertical slopes, horizontal slopes etc. For example, vertical cylinders can be used to increase strokes by one-third when there is sufficient "GUIDE" or horizontal to apply as one-third of the reading when gravity load is applied.

3. Buckling Table View

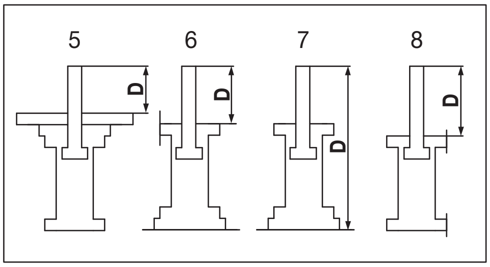
- Method of obtaining the maximum stroke according to the Internal Diameter of the cylinder.
  1. Determine cylinder mounting type, as shown in the figure 1 to 16.
  2. Once the installation type is determined, find the L value that matches it.
  3. Find the maximum load for the L type and internal diameter in the buckling table (No. 5/6) of each cylinder.
- Method of obtaining the maximum load according to the Internal Diameter of the cylinder.
  1. Determine cylinder mounting type, as shown in the figure 1 to 16.
  2. Obtain the L dimension from the maximum load and Internal Diameter according to the buckling table (No. 5/6) for each cylinder.
- Method of obtaining of Internal Diameter of the cylinder for the maximum load used.
  1. Determine cylinder mounting type, as shown in the figure 1 to 16.
  2. Once the mounting method is determined, find the L value that matches it.
  3. For each cylinder, find the cylinder bore according to L value and the maximum load as per buckling table (No. 5/6).

4. Cylinder Mounting Type

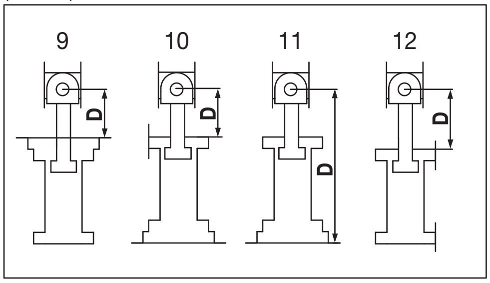
Case of Double-Ended Pin Connection (D=L)



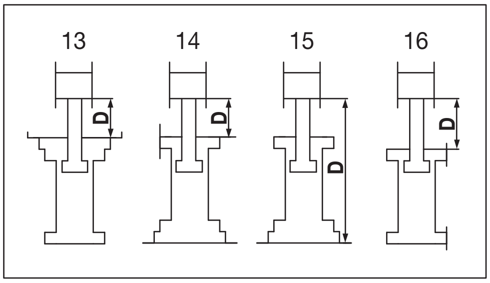
Case of Cylinder Fixing and Free End of Rod End (D=L/2)



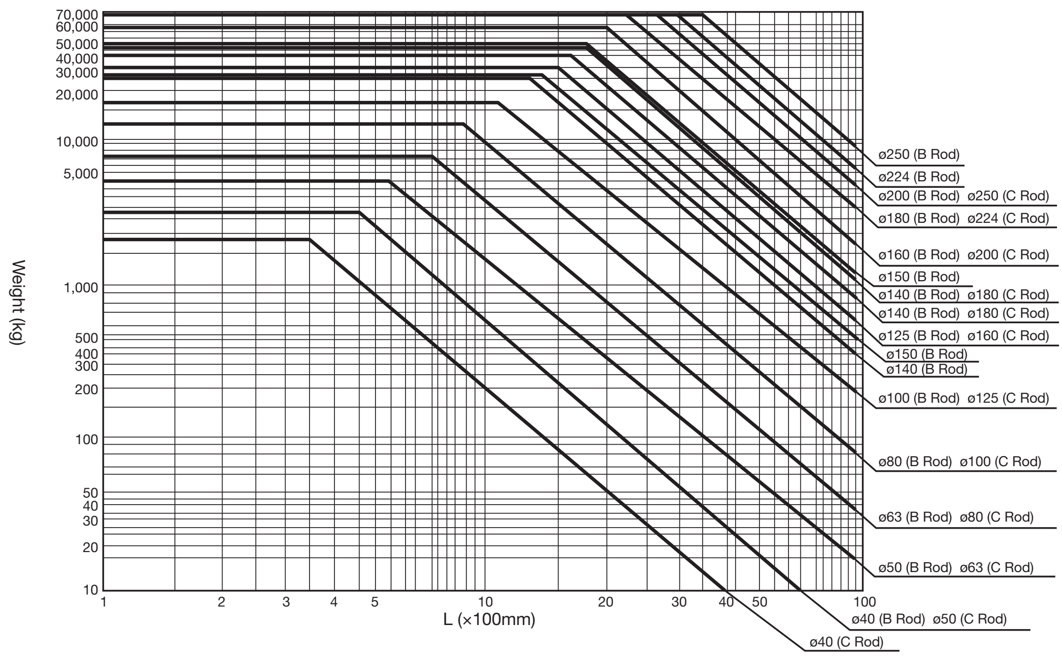
Case of Cylinder Fixing, Rod End Pin-Connection Guides (D=1.4L)



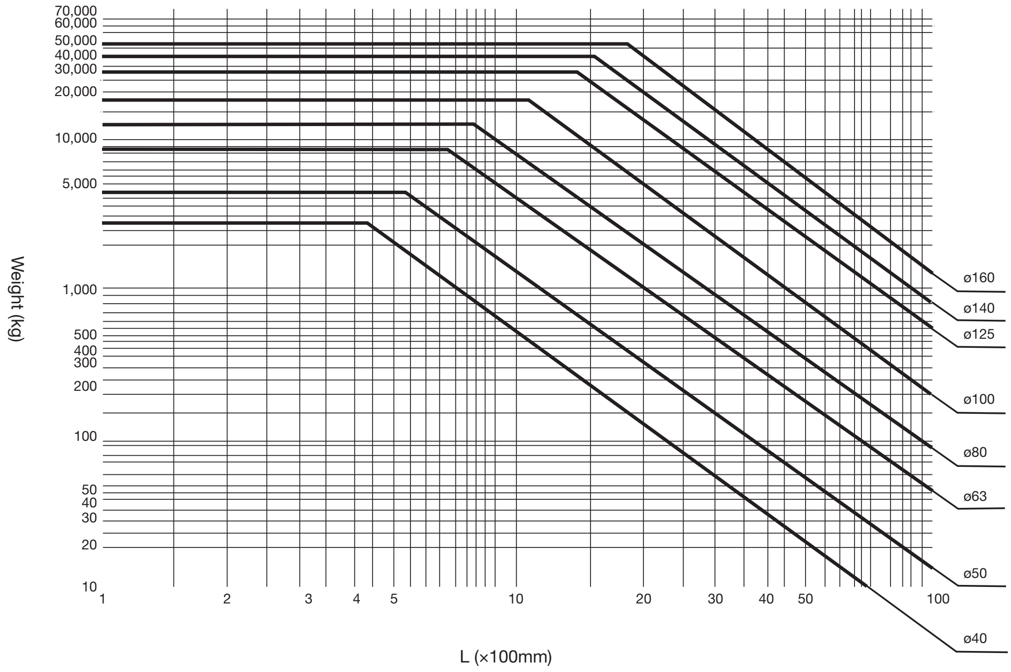
Case of Cylinder Fixing and Rod End Guides (D=2L)



5. 70·140kgf/cm² Buckling Table



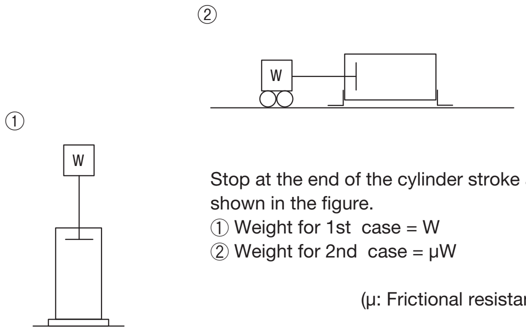
6. 210kgf/cm² Buckling Table



7. Points to be Noted While Calculating The Buckling of Piston Rod

The buckling calculation of the piston rod must first be looked at how the cylinder is stopped. There are two methods of stopping the cylinder: 'internal stop method' using both strokes to stop at the load cover and 'external stop method' which stops by the external stopper.

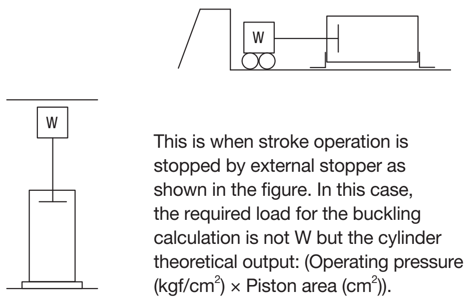
● Weight for internal stopping method



Stop at the end of the cylinder stroke as shown in the figure.
① Weight for 1st case = W
② Weight for 2nd case = μW

(μ: Frictional resistance)

● Weight for external stopping method



This is when stroke operation is stopped by external stopper as shown in the figure. In this case, the required load for the buckling calculation is not W but the cylinder theoretical output: (Operating pressure (kgf/cm²) × Piston area (cm²)).

If the cylinder rod is eccentric or the cylinder installation level is not aligned, then there is a risk of damaging the internal components.

8. Check Cylinder Speed and Piping Diameter

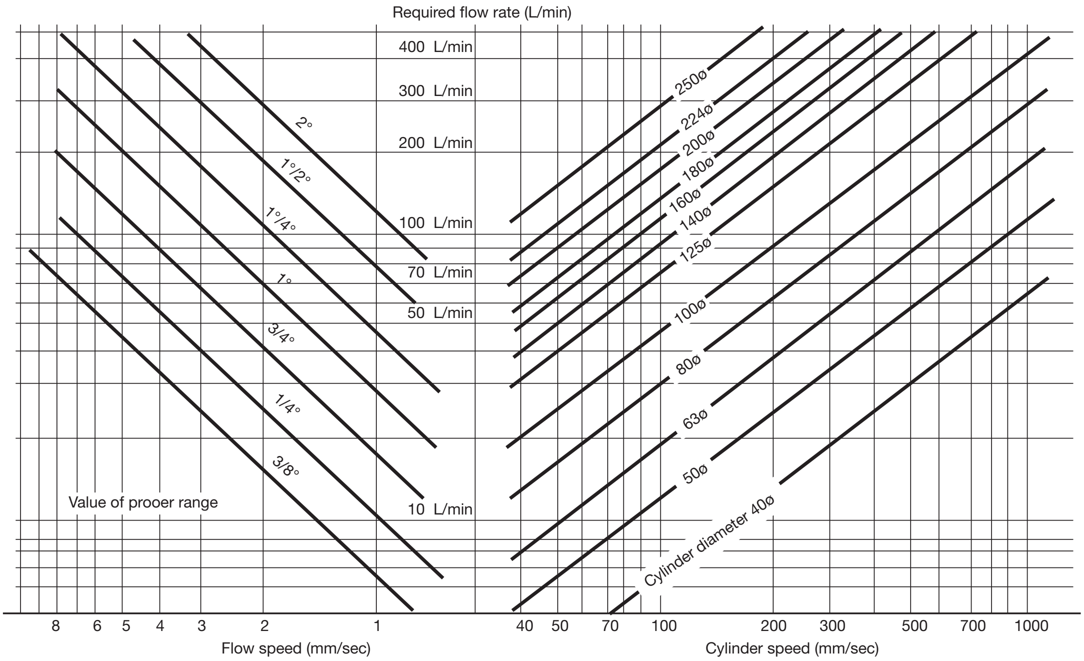
The speed of the cylinder is determined by the flow rate into the cylinder.

Calculation formula is V = QC/A(cm^2/sec)

QC: Supply flow rate in cylinder (cm^2/sec)

A : Piston area (cm^2)

The diagram below shows the relationship between required flow rate and speed for each cylinder size, pipeline diameter PT and intravascular flow rates.



Graph of Cylinder Speed-Required Flow Rate-Pipe Flow Speed

9. Cylinder Theoretical Area and Output Table

Internal Diameter of Cylinder	Piston Rod Diameter	Operating Direction	Effective Area	Output			At flow rate of 10 L/min Speed mm/sec	At speed 10mm/sec Flow Rate L/min	Speed Ratio	
				70kgf/cm^2	140kgf/cm^2	210kgf/cm^2			Advance	Junior
Ø40	ø22	Forward	12.56	879	1758	2637	132.6	0.8	1	1.43
		Reverse	8.76	613	1226	1839	190.2	0.6		
ø50	ø28	Forward	19.63	1374	2748	4122	84.9	1.2	1	1.46
		Reverse	13.47	942	1885	2828	123.7	0.8		
ø63	ø35	Forward	31.17	2181	4363	6545	53.4	1.9	1	1.45
		Reverse	21.55	1508	3017	4525	77.3	1.3		
ø80	ø45	Forward	50.26	3518	7036	10554	33.1	3.0	1	1.47
		Reverse	34.36	2405	4810	7215	48.5	2.1		
ø100	ø55	Forward	78.54	5497	10995	16493	21.2	4.8	1	1.43
		Reverse	54.78	3834	7669	11503	30.4	3.3		
ø125	ø70	Forward	122.71	8589	17179	25769	13.5	7.4	1	1.46
		Reverse	84.23	5896	11792	17688	19.7	5.1		

10. Compatibility of Operating Fluid and Packing Materials

Packing material	Suitable operating fluid				
	General mineral hydraulic oil	Water-soluble glycogel operating fluid	W/O operating fluid	O/W operating fluid	Phosphoric acid ester operating fluid
NBR	○	○	○	○	○
URETHANE	○	X	△	△	X
VITON	○	X	○	○	○

11. Usable Temperature Range and Speed Range of Packing Material

Packing material	Usable temperature range	Usable speed range mm/sec
NBR	80	8~500
URETHANE	80	8~500
VITON	120	8~300