Safety Notice & Caution For Pneumatic Cylinper

Please read this safety notice carefully before using and pay attention to the safety caution of this product.

Caution for design, selection

Warning

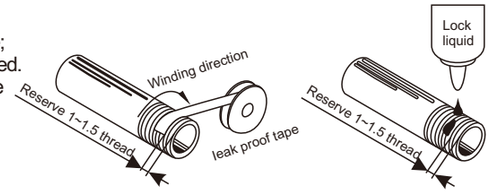
- Make thorough understanding to the characteristic of the compressed air and the application of this product while designing circuit.
- Please use only the fluid stated on the catalog, don't use the fluid other than limited, in order to prevent damage of product and affect the operation safety.
- The air used is compressed air, please note that expandable and unstable pressure will fly out, burst out, or leak.
- Please used as per specification and within the specified conditions; use exceed the specification may cause hazard. Please used as per the specification stated on the catalog, exceeding the pressure beyond the specification, temperature and condition will cause poor action and affect the operation safety.
- Due to the mechanical design with the variation of wobbling movement of the cylinder, please pay attention of flying objects and possible crash hazard of your limbs, resulting in body injury and mechanical damage and so on; so, take precaution upon designing.
- The movable range of cylinder may contact our body and cause injury, should be protected by safety guard to prevent direct contact of body hazard.
- For larger mechanism or long stroke object, the selected cylinder must equip with buffer device and provide with deceleration circuit to reduce and smooth the rigid impact of the mechanism device.
- Take the emergency or transient cut off power source, or power failure, air source circuit pressure drop causing holding force drop, vertical movement slip and resulting in damage of mechanical device, and human safety into account upon designing, so, safety countermeasure should be taken in design.
- Take the driving mechanism and circuit control system combination into account upon design to avoid residue pressure in circuit. Failure to completely positioning and lateral pressurized and other factors may cause high speed fly out of the object. These situations are very possible to cause body injury, limbs crashed, and damage of mechanism, countermeasure of protective circuit is necessary.
- Emergency stop device for mechanism is essential. In case of malfunction, in addition to protective device, emergency stop device should be provided in order to prevent body injury and damage of equipment.
- Re-start after emergency stop should confirm safety position of all mechanism, avoid interference and impact due to error position, affect human body and damage the equipment; there should have safety precaution countermeasure for restarting after emergency stop upon design.
- While applying three positions intermediate stop control in cylinder, take the expansion property of air and low hydraulic operation, the precise intermediate position difficulty into account. For long period stop position, consider the displacement cause by air leak; Please contact the sale unit of us in case of special application.
- Requirement of peripheral environment:

(1) Avoid to be used in environment with chemical, inflammable, corrosive and sea water, high temperature;
(2) Avoid to be used in the place with heating and irradiative heat;
(3) Follow the requirement stated in the specification for ambient temperature;
(4) Prevent poor action cause by frozen while use in cold climate;
(5) Avoid the environment in outdoor with sun and dusty place, which cause unstable in quality;
(6) Avoid to be used in oily, inflammable and explosion proof place.

Caution

- Prevent debris and dust from entering the cylinder while laying, which may cause failure and poor movement.
- The use of cylinder should follow the principle of not exceeding max. stroke, prevent the momentum force impact the front and rear cap of the piston.
- The in/outlet of the cylinder should be equipped with governor for controlling the traveling speed of the cylinder. It is preferable to control the cylinder by check out.
- The cylinder with long stroke should design with intermediate support, arbor and cylinder tube. If support on one side will cause static load deflection, in case of shock and loaded may tend to damage.
- Plural cylinder derices simultaneous moving structure, should be designed with guide rod to prevent interference and poor action.
- The axis of the cylinder should move consistence with load, no lateral load is allowed and will cause surface worn and damage of the arbor, and make the shaft seal packing damage resulting in leakage and poor action.
- At the portion of external guide rod or shaft end connection object, the shaft end connection must avoid connection interference, it is preferable to connect to floating coupling or angular adjustable device, prevent damage cause by imbalance action and single side rubbing.
- The inner wall of cylinder and arbor are precise machine, avoid scratch and knock to this portion, especially damage of the outer tube of the cylinder tube will lead to deformation of tube wall, this is the cause of malfunction and damage of cylinder.
- The cylinder is equipped with adjustment of buffer device, it should be adjusted according to the actual moving speed and max. load condition; the adjustment of the needle valve of the buffer device shouldn't be in full close, this will cause the damage of buffer packing.
- Prevent debris and leak proof tape residue from entering the pipe while pipe laying and assembling the connector. Reserve 1~1.5 thread not wound with tape while winding the tape.
- If the connector is locked by using anoxic glue, avoid excessive amount and fluid glue from flowing in the body, which may cause jammed and poor movement.
- Caution for installation and application of sensor

(1) Confirm the specification and voltage value before usage;
(2) The fixation of tie band shouldn't be tilted and skew angled.
(3) When the sensor is connected to load with length of wire exceed 10m, equip one extra induction sensor nearby the sensor in order to prevent pulse and prevent contact fail to release.
(4) Please don't exceed the specified voltage and current.
(5) Add protective circuit when connected to induction load.
(6) If the lead wire of the solenoid switch is pulled by force, twisted, wobbled or put heavy object on top, serious condition will cause short and damage of mechanism.
(7) There is 0.5mm error between responses of solenoid switch.



- Pleass be careful and check all parts for securing before operation.

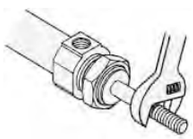
Caution for service and maintenance

Warning

- Shut off the power switch and air source properly before service and maintenance, confirm that there is no residue pressure in the pipeline and start work after confirming the status is safe.
- The cylinder is coated with small amount of oil at initial using state; it will decrease after a period of usage, and should be added up with appropriate amount of oil according to actual application condition. Lubricant is essential in high speed moving, feed by lubricator, may cause poor action if stop oiled when it is required.
- While removing the cylinder shaft end, it shall work at position with piston pushing in the cylinder (don't pull the cylinder shaft out to serve installing and removing turning), and apply the force evenly to tighten in balance, and push by hand to confirm there is no interference and then start to supply air.
- Service and maintenance should be perform regularly as schedule, and confirm the normal operation of following:

(1) Is the compressed air supplied stably?
(2) Is the front filter and draining device normal?
(3) Is the connection portion or piping loosen accompany moving of object? Is the pipe connection portion normal?
(4) Is the action condition of the cylinder normal? Is there any delay phenomena and exhaust normal? Any strange noise?
(5) Whether the piping system connected to solenoid valve (governor) normal? Terminal start and stop movement normal? Is the load system normal?
(6) Is the lubricant feeding system normal? Is the oil amount adjusted properly?

○ Correct



× Incorrect

Cylinper Theoretic Force

Unit: N

Bore size (mm)			8	10	12	16	20	25	32	40	50	63	80	100	125	160	200
Rod diameter (mm)			φ 4	φ 4	φ 6	φ 6	φ 6	φ 10	φ 12	φ 16	φ 20	φ 20	φ 25	φ 25	φ 32	φ 40	φ 40
Piston area (mm²)			50	78	113	201	314	491	804	1257	1963	3117	5027	7854	12271	20100	31410
Operating pressure (MPa)	0.1	A Push	5	7.85	11	20	31	49	80	126	196	312	502	785	1227	2010	3141
		B Pull	3.8	6.6	85	17	26	41	69	106	165	280	453	736	1131	1884	3015
	0.2	A Push	10	15.7	23	40	63	98	161	251	393	623	1005	1571	2454	4021	6283
		B Pull	7.5	13.2	17	35	53	82	138	211	330	561	907	1473	2262	3769	6031
	0.3	A Push	15.1	23.55	34	60	94	147	241	377	589	935	1508	2356	3681	6031	9424
		B Pull	11.3	19.8	25	52	79	124	207	317	495	841	1361	2209	3393	5654	9047
	0.4	A Push	20.1	31.4	45	80	126	196	322	503	785	1247	2011	3142	4908	8042	12566
		B Pull	15.1	26.4	34	69	106	165	276	422	660	1121	1814	2945	4524	7539	12062
	0.5	A Push	25.1	39.25	57	101	157	245	402	629	982	1559	2514	3927	6135	10053	15708
		B Pull	18.9	33	42	67	132	206	346	528	825	1402	2268	3682	5655	9424	15078
	0.6	A Push	30.1	47.1	68	121	189	294	482	754	1178	1870	3016	4712	7363	12063	18849
		B Pull	22.7	39.6	51	104	158	247	415	634	989	1682	2722	4418	6785	11309	18094
	0.7	A Push	35.1	54.95	79	141	220	343	563	880	1374	2182	3519	5498	8589	14074	21991
		B Pull	26.4	46.2	59	121	185	289	484	739	1154	1962	3175	5154	7916	13194	21109
	0.8	A Push	40.2	62.8	90	161	251	393	643	1006	1570	2494	4022	6283	9816	16084	25132
		B Pull	30.2	52.8	68	138	211	330	553	845	1319	2242	3629	5890	9047	15079	24125
	0.9	A Push	45.2	70.65	102	181	283	442	724	1131	1767	2805	4524	7069	11043	18095	28274
		B Pull	34	59.4	76	155	238	371	622	950	1484	2523	4082	6627	10178	16964	27141
	1.0	A Push	50.3	78.5	113	201	314	491	804	1257	1963	3117	5027	7854	12271	20102	31409
		B Pull	37.8	66	85	173	264	412	691	1056	1649	2803	4536	7363	11309	18846	30153

Note: Above data are for reference only. Actual practice, frictional force and the mechanical efficiency have to be taken into consideration.

Formula of cylinder acting force calculation

Double acting

Push : F1=A1 x P x B (kgf)

Pull : F2=A2 x P x B (kgf)

Single acting

Push (spring extended) : F3= (A1 x P-S) x B (kgf)

Pull (spring return) : F4=(A2 x P-S) x B (kgf)

A1 : Piston area for push

$A1 = \frac{\pi}{4} D^2$

A2 : Piston area for pull

$A2 = \frac{\pi}{4} (D^2 - d^2)$

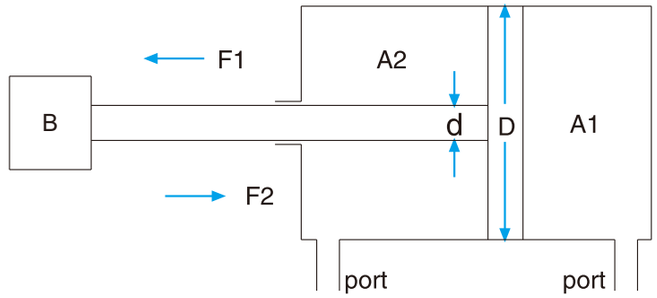
D : Bore size (mm)

d : Rod diameter (mm)

P : Operating pressure (kgf/cm²)

S : Spring force (kgf)

B : Output efficiency (Loading rate)



Output efficiency:

The output efficiency of air cylinder is depended upon the size of piping tubes, size of control valves, cylinder internal friction, and operating speed. It is difficult in solving these factors precisely so we must put more tolerance in design.

Low speed takes 80 percent.

High speed takes less than 50 percent.

Normal operating speed takes 65 percent.

Pressure interchange chart

	Pa	kPa	MPa	bar	mbar	kgf/cm²	cmH₂O	mmH₂O	mmHg	p.s.i.
Pa	1	10^{-3}	10^{-6}	10^{-5}	10^{-2}	$10.2x10^{-6}$	$10.2x10^{-3}$	$101.97x10^{-3}$	$7.5x10^{-3}$	$0.15x10^{-3}$
kPa	10^{3}	1	10^{-3}	10^{-2}	10	$10.2x10^{-3}$	10.2	101.97	7.5	0.15
Mpa	10^{6}	10^{3}	1	10	10^{4}	10.2	$10.2x10^{3}$	$101.97x10^{3}$	$7.5x10^{3}$	$0.15x10^{3}$
bar	10^{5}	10^{2}	10^{-1}	1	10^{3}	1.02	$1.02x10^{3}$	$10.2x10^{3}$	750.06	14.5
mbar	10^{2}	10^{-1}	10^{-4}	10^{-3}	1	$1.02x10^{-3}$	1.02	10.2	0.75	$14.5x10^{-3}$
kgf/cm₂	98066.5	98.07	$98.07x10^{-3}$	0.98	980.67	1	1000	10000	735.56	14.22
cmH₂O	98.0665	$98.07x10^{-3}$	$98.07x10^{-6}$	$0.98x10^{-3}$	0.98	10^{-3}	1	10	0.74	$14.22x10^{-3}$
mmH₂O	9.80665	$9.807x10^{-3}$	$9.807x10^{-6}$	$98.07x10^{-6}$	$98.07x10^{-3}$	10^{-4}	0.1	1	$73.56x10^{-3}$	$1.42x10^{-3}$
mmHg	133.32	$133.32x10^{-3}$	$133.32x10^{-6}$	$1.33x10^{-3}$	1.33	$1.36x10^{-3}$	1.36	13.6	1	$19.34x10^{-3}$
p.s.i.	6894.76	6.89	$6.89x10^{-3}$	$68.95x10^{-3}$	68.95	$70.31x10^{-3}$	70.31	703.07	51.71	1

Compressed Air Consumption

Compressed air consumption

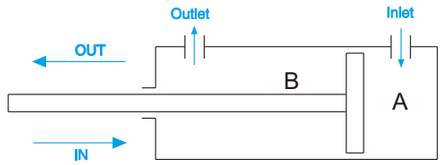
Unit:L(ANR)

Bore size(mm)		8	10	12	16	20	25	32	40	50	63	80	100	125	160	200
Rod diameter(mm)		ϕ4	ϕ4	ϕ6	ϕ6	ϕ6	ϕ10	ϕ12	ϕ16	ϕ20	ϕ20	ϕ25	ϕ25	ϕ32	ϕ40	ϕ40
Piston area (mm²)	A	50	78.5	113	201	314	491	804	1257	1963	3117	5027	7854	12271	17671	31410
	B	38	66	85	173	264	412	691	1056	1649	2803	4536	7363	11309	16415	30150
Operating pressure (MPa)	0.1	0.017	0.03	0.04	0.075	0.116	0.181	0.299	0.462	0.722	1.183	1.912	3.042	4.714	6.814	12.25
	0.2	0.026	0.043	0.059	0.112	0.173	0.271	0.448	0.693	1.083	1.775	2.867	4.563	7.071	10.221	18.345
	0.3	0.034	0.057	0.079	0.15	0.231	0.361	0.598	0.924	1.444	2.367	3.823	6.084	9.428	13.628	24.439
	0.4	0.043	0.072	0.099	0.187	0.289	0.451	0.747	1.156	1.805	2.959	4.779	7.605	11.785	17.035	30.534
	0.5	0.052	0.086	0.119	0.224	0.347	0.542	0.897	1.387	2.167	3.55	5.734	9.126	14.142	20.441	36.69
	0.6	0.061	0.100	0.138	0.262	0.405	0.632	1.046	1.618	2.528	4.142	6.69	10.647	16.499	23.848	42.723
	0.7	0.069	0.115	0.158	0.299	0.463	0.722	1.196	1.849	2.889	4.734	7.648	12.168	18.856	27.255	48.817
	0.8	0.078	0.13	0.178	0.366	0.52	0.812	1.945	2.08	3.25	5.325	8.602	13.689	21.213	30.662	54.912
	0.9	0.087	0.143	0.198	0.374	0.578	0.903	1.495	2.311	3.611	5.917	9.557	15.209	23.57	34.069	61.006
	1.0	0.095	0.158	0.218	0.411	0.636	0.993	1.644	2.542	3.972	6.509	10.513	16.927	25.927	37.476	67.101

Note: The table is for a complete cycle in 100mm stroke.

Compressed air consumption calculation

$$Qn = (A1 + A2) \times L \times \frac{P+0.101}{0.101} \times n \times 10^{-6}$$



Qn: Compressed air consumption (l/min)

P: Air pressure (MPa)

A1: Area A on rod side (mm²)

n: Cycle of operation (cycle/min)

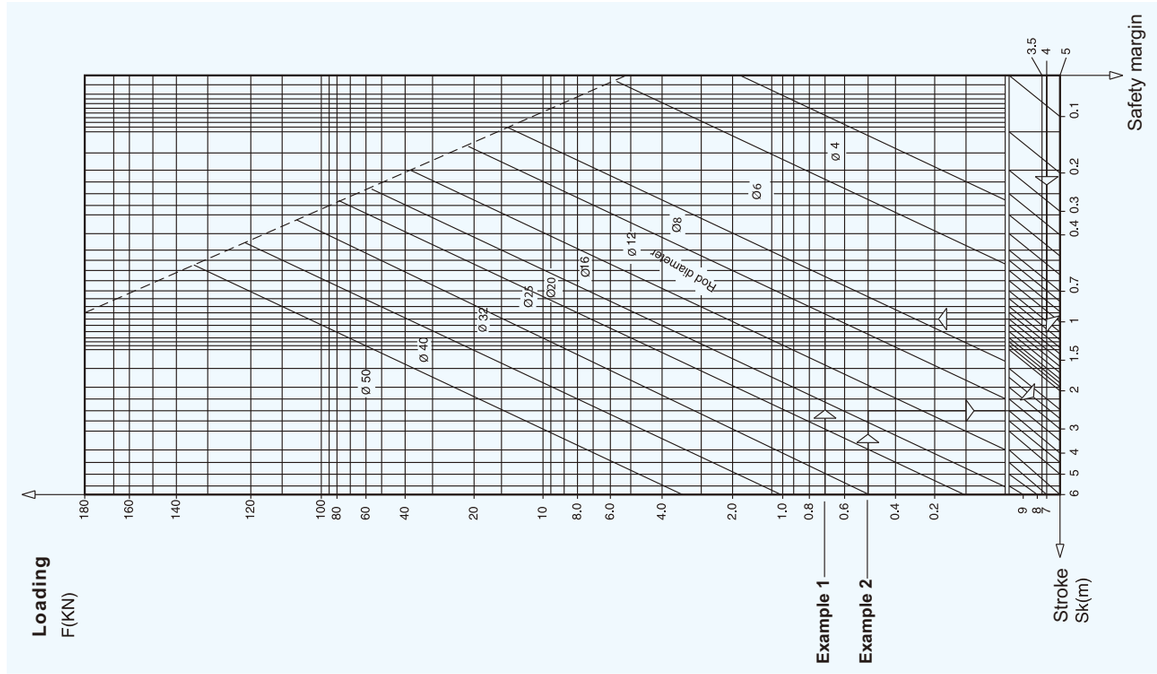
A2: Area B on head side (mm²)

L: Cylinder stroke (mm)

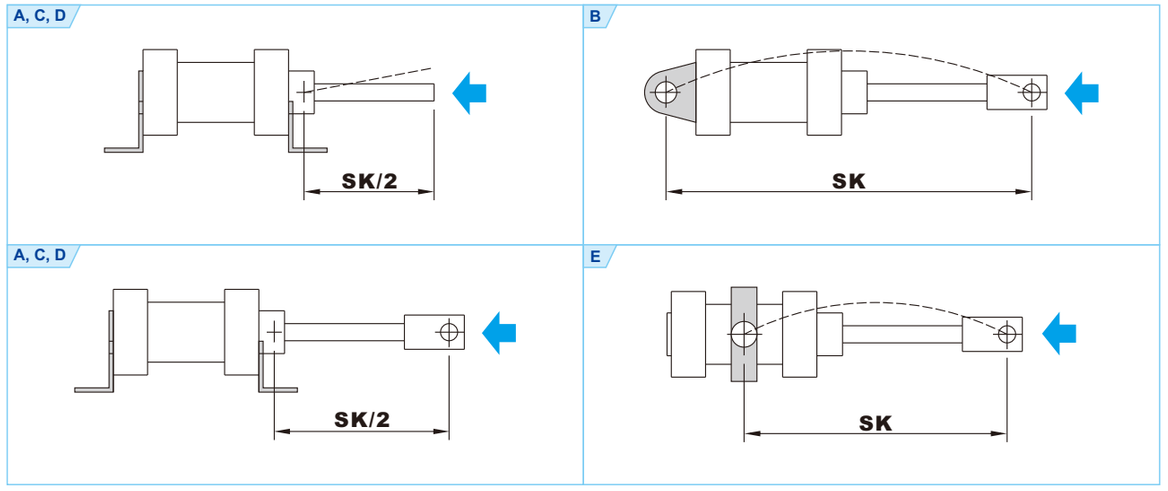
Flow Conversion Table

	m³ / s	l / s	cm³ /s	m³ / h	m³ / min	l / h	l / min	ft³ / min (scfm)	gallon min UK	gallon min USA
m³ / s	1	10^3	10^6	$3.6x10^6$	60	$3.6x10^6$	$60x10^3$	$2.12x10^3$	$13.2x10^3$	$15.85x10^3$
l / s	10^{-3}	1	10^3	3.6	$60x10^{-3}$	$3.6x10^3$	60	2.12	13.2	15.85
cm³ / s	10^{-6}	10^{-3}	1	$3.6X10^{-3}$	$60x10^{-6}$	3.6	$60X10^{-3}$	$2.12x10^{-3}$	$13.2x10^{-3}$	$15.8x10^{-3}$
m³ / h	$0.28x10^{-3}$	0.28	$0.28x10^3$	1	$16.67x10^{-3}$	10^3	16.67	0.59	3.67	4.4
m³ / min	$16.67x10^{-3}$	16.67	$16.67x10^3$	60	1	$60x10^3$	10^3	35.31	219.97	264.17
l / h	$0.28x10^{-6}$	$0.28x10^{-3}$	0.28	10^{-3}	$16.67x10^{-6}$	1	$16.67x10^{-3}$	$0.59x10^{-3}$	$3.67x10^{-3}$	$4.4x10^{-3}$
l / min	$16.67x10^{-6}$	$16.67x10^{-3}$	16.67	$60x10^{-3}$	10^{-3}	60	1	$35.31x10^{-3}$	$219.97x10^{-3}$	$264x10^{-3}$
ft³ / min(scfm)	$0.47x10^{-3}$	0.47	$0.47x10^3$	1.699	$28.32x10^{-3}$	$1.699x10^3$	28.32	1	6.23	7.48
gallon min UK	$75.79x10^{-6}$	$75.77x10^{-3}$	75.77	0.273	$4.55x10^{-3}$	$0.273x10^3$	4.55	0.16	1	1.2
gallon min USA	$63.09x10^{-6}$	$63.09x10^{-3}$	63.09	0.227	$3.79x10^{-3}$	$0.227x10^3$	3.79	0.13	0.83	1

Rod loading chart



Rod swing length



Example 1

Piston push force: 0.7Kn
Stroke: 1000mm
Pressure: Approx. 6 bar
Mounting: C
Ans: Referring to the rod loading chart, the rod diameter location between ϕ12~ϕ16. Consider the rod loading, the actual diameter is ϕ16mm, also, we can know the cylinder body diameter is ϕ40mm.

Example 2

Cylinder diameter: ϕ50mm
Rod diameter: ϕ20mm
Stroke: 1000mm
Piston push force: 0.5Kn
Mounting: B
Ans: Referring to the rod loading chart, Sk=2900mm
Max stroke=1450mm