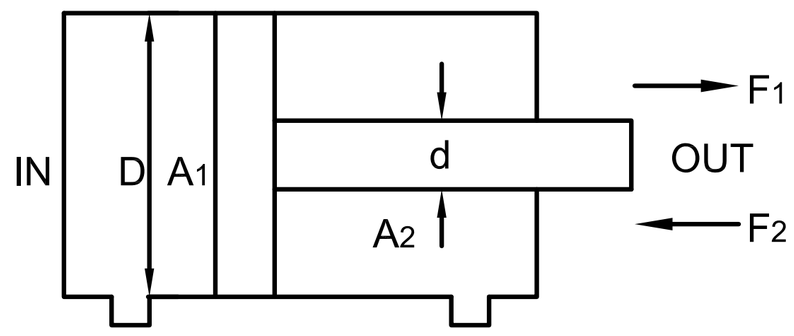
空壓缸 Pneu. Cylinder

氣缸理論出力之公式計算

Formula Calculating For Theoretical Cylinder Output



氣缸之理論出力一般計算是依照理想狀態下，其內部摩擦損失及壓力損失等不計，其公式如下：

In general,the theoretical cylinder output which is calculated under ideal condition and the inner friction loss & pressure loss etc,are not calculated.The calculating formula is as follows：

$F1=A1\cdot P \quad A1=\pi/4\ D^2$

$F2=A2\cdot P \quad A2=\pi/4\ (D^2-d^2)$

F12=氣缸理論出力/Theoretical cylinder output(kg)

A=氣缸面積/Area of cylinder(cm^2)

D=氣缸內徑/Bore dia.of cylinder(cm)

d=活塞桿外徑/Outside dia.of piston rod(cm)

P=壓力源(空氣壓源或油壓源)(kgf/cm^2)

Pressure source (Pnen, pressure source or hyd. pressure source)

[例]：設一氣缸內徑Ø40mm，使用壓力5kgf/cm^2，試求其往後理論出力多少？

For example：There is a cylinder dia.Ø40mm and output 5kgf/cm^2, how to derive the theoretical output？

$A1=\pi/4\times4^2=12.57cm^2$

$A2=\pi/4\times(4^2-1.6^2)=10.56cm^2$

$\therefore F1=12.57\times5=62.9kgf$

$F2=10.56\times5=52.8kgf$

[例]：設使用壓力5kgf/cm^2，其推力之理論出力40.2kgf時，試求其內徑？

For example：There is a operating pressure 5kgf/cm^2 and the theoretical output 40.2kgf. How to derive the bore dia. of cylinder：

$F1=40.2$

$\therefore A1=40.2\div5=8.04cm^2$

$\therefore D=(8.04\times4/\pi)^{1/2}=3.2cm$

空氣壓氣缸理論出力參照表

Theoretical Output Refer Table For Pneu.Cylinder

缸徑 Bore dia.	活塞缸 Rod size	使用壓力 Operating Pressure kgf/cm^2								
		2	3	4	5	6	7	8	9	10
		in out	in out	in out	in out	in out	in out	in out	in out	in out
Ø20	10	4.7 6.3	7.1 9.4	9.4 12.6	11.8 15.7	14.1 18.8	16.5 22.0	18.8 25.1	21.2 28.3	23.5 31.4
Ø25	12	7.7 9.8	11.3 14.7	15.1 19.6	18.9 24.6	22.7 29.5	26.4 34.4	30.2 39.3	34 44.2	37.8 49.1
Ø30	12	12.2 14.2	18.3 21.3	24.4 28.4	30.5 35.5	36.6 42.6	42.7 49.7	48.8 56.8	54.9 63.9	61.1 71.1
Ø40	16	21.1 25.1	31.7 37.7	42.2 50.3	52.8 62.8	63.3 75.4	73.9 88	84.4 101	95 113.1	105.6 125.7
Ø50	20	33 39.3	49.5 58.9	66 78.5	82.5 98.2	99 117.8	115.5 137.4	131.9 157.1	148.4 176.7	164.9 196.3
Ø63	20	56.1 62.3	84.1 93.5	112.1 124.7	140.2 155.9	168.2 187	196.2 218	224 249	252 281	280 312
Ø80	25	90.7 100.5	136.1 150.8	181.4 201	227 251	272 302	317 352	363 402	408 452	454 503
Ø100	30	142.9 157.1	214 236	286 314	357 393	429 471	500 550	572 628	643 707	715 785
Ø125	35	225 245	338 368	450 491	563 615	675 736	788 859	900 982	1013 1104	1125 1227
Ø150	35	377 402	565 603	754 804	942 1005	1131 1206	1319 1407	1508 1608	1696 1810	1885 2011
Ø200	50	589 628	884 942	1178 1257	1473 1571	1767 1885	2062 2190	2356 2513	2651 2827	2945 3142
Ø250	60	925 982	1388 1473	1850 1963	2313 2454	2776 2945	3238 3436	3701 3927	4163 4418	4626 4909
Ø300	70	1337 1414	2005 2121	2673 2827	3342 3534	4040 4241	4679 4948	5347 5655	6015 6362	6684 7069

[例]：實際出力計算

1.若空氣缸內徑Ø80mm時，查理論出力參照表得空氣缸推出時為251kg

2.因此實際出力為251kg×0.8=200.8kg

For Example：The calculating for practical output.

1.If the bore size is Ø80mm and from theoretical output refering data. The pneu.cylinder delivery is 251kg.

2.From above we can derived the practical output is 251kg×0.8=200.8kg

空壓缸之空氣消耗量

Air Consumption For Pneu.Cylinder

空壓缸之空氣消耗量可由下列公式計算：

The air consumption for pneu.cylinder can be calculated by following formula：

$Q_1=0.00076\times(D_1^2 \cdot L+d^2 \cdot \ell)\times(P+1.033)\times n(\ell/min)$

$Q_2=0.00076\times\{(D_1^2-D_2^2) \cdot L+d^2 \cdot \ell\}$

$Q = Q_1+Q_2(\ell/min)$

Q = 空壓缸每分鐘之空氣消耗量 / Air consumption per minute(ℓ/min)

Q_1 = 空壓缸推出時空氣消耗量 / Air consumption for forward stroke(ℓ/min)

Q_2 = 空壓缸退回時空氣消耗量 /Air consumption for backward stroke(ℓ/min)

D_1 = 空壓缸內徑 / Inside diameter of pneu.cylinder(cm)

D_2 = 活塞桿外徑 / Outside diameter of piston rod(cm)

d = 配管內徑 / Piping inside diameter(cm)

L = 空壓缸衝程長度 / Stroke of pneu.cylinder(cm)

ℓ = 配管長度 / Piping length(cm)

n = 空壓缸每分鐘往復次數 / Frequency of operation of pneu.cylinder(cycle/min)

p = 空氣管路壓力 / Air line pressure/Air line pressure(kgf/cm² G)

空壓缸每分鐘往復次數之空氣消耗量(ℓ/min)

Air Consumption For Reciprocating Times Of Pneu.Cylinder

次數 Frequency 缸徑 Bore dia.	1	2	3	4	5	8	10	15	20	25	30
Ø40	1.4	2.8	4.2	5.6	7	11.2	14	21	28	35	42
Ø50	2.1	4.2	6.3	8.4	10.5	16.8	21	31.5	42	52.5	63
Ø63	3.5	7	10.5	14	17.5	28	35	52.5	70	87.5	105
Ø80	5.6	11.2	16.8	22.4	28	44.8	56	84	112	140	168
Ø100	8.8	17.6	26.4	35.2	44	70.4	88	132	176	220	264
Ø125	13.8	27.6	41.4	55.2	69	110.4	138	207	276	345	414
Ø150	22.7	48.4	68.1	90.8	113.5	181.6	227	340.5	454	567.5	681
Ø200	35.5	71	106.5	142	177.5	284	355	532.5	710	887.5	1065
Ø250	55.7	111.4	167.1	222.8	278.5	445.6	557	835.5	1114	1392.5	1671
Ø300	80.3	160.6	240.9	321.2	401.5	642.4	803	1204.5	1606	2007.5	2409

註：本表之計算值係基於：

1.空氣壓力為5kgf/cm² G。

2.空壓缸衝程為100m/m，配管內徑，長度不算計在內。

Remarks：The above table's calculating value is based on

1.If the bore size is Ø80mm and from theoretical output refering data. The pneu.cylinder delivery is 251kg.

2.From above we can derived the practical output is 251kg×0.8=200.8kg