

Pneumatic Cylinder - Air Consumption & Extension Time

Sample document with complete example values. It shows the report the purchased export produces for YOUR input - it is not itself a report for any part.

Project: Sample project

Part/Position: no real part

Prepared by: Sample, not released

Air consumption per cycle 5.002 NI, per minute 150.07 NI/min at 30 cycles/min. Approximate extension time 0.0431 s.

Input

Piston diameter D	50 mm
Piston rod diameter d	20 mm
Stroke s	200 mm
Operating pressure p _g	6 bar
Moving mass m	5 kg
Opposing force F _{load}	100 N
Friction force F _{fric}	0 N
Stroke frequency f	30 1/min
Reference pressure	1.013 bar (standard)

Results

Piston area A _{out}	19.635 cm ²
Annulus area A _{in}	16.493 cm ²
Stroke volume extending	0.3927 L
Compression ratio ε	6.923
Air consumption extending Q _{out}	2.719 NI
Air consumption retracting Q _{in}	2.284 NI
Air consumption per cycle Q _{cycle}	5.002 NI
Air consumption per minute	150.07 NI/min
Extending force F _{press}	1,178.1 N
Resultant force F _{res}	1,078.1 N
Acceleration a (approximation)	215.6 m/s ²
Extension time t (approximation)	0.0431 s
Final velocity v (approximation)	9.287 m/s

Assessment

Criterion	Value	Limit	Status
Load ratio (F _{load} + F _{fric})/F _{press}	0.085	0.85	● within guideline

Calculation basis

The air consumption per stroke is the geometric stroke volume $A \cdot s$, converted to standard volume via the absolute pressure ratio $(p_g + p_{amb})/p_{amb}$ (standard 1.013 bar resp. catalog 1.0 bar). Extending uses the full piston area $A_{out} = \pi/4 \cdot D^2$, retracting the annulus area $A_{in} = \pi/4 \cdot (D^2 - d^2)$; the cycle sums both, and the per-minute consumption is multiplied by the stroke frequency.

The extension time is an approximation: from the force balance $F_{res} = p \cdot A_{out} - F_{load} - F_{fric} = m \cdot a$, assuming constant acceleration, follows $t = \sqrt{(2 \cdot s/a)}$. The flow restriction from valve and throttle as well as pressure build-up are not modeled; the real time is typically larger. The value serves as a rough sizing estimate.

About this sample

All values on these pages come from a freely chosen example calculation and belong to no real part. The purchased export contains the same sections with your input, your header data (project, part, prepared by) and as searchable text. Pricing and scope: maschinenbaurechner.de/en/pricing



Note: The results are design and orientation aids. They do not replace independent verification, calculation and approval by a qualified person. The terms of use at maschinenbaurechner.de apply.