

# DYNAMICS OF THE LINEAR PNEUMATIC ACTUATOR COMPUTER SIMULATION

SYMBOL	NAME	UNIT	VALUE
D	piston diameter	[m]	0.063
d	piston rod diameter	[m]	0.020
S	piston stroke	[m]	0.025
m	mass load	[kg]	parameter
F	force load	[N]	parameter
f	inlet area = outlet area	[m <sup>2</sup> ]	parameter
μ <sub>1</sub>	inlet flow coefficient (1)	[-]	parameter
μ <sub>2</sub>	outlet flow coefficient (2)	[-]	parameter
p <sub>Z</sub>	supply pressure	[Pa]	parameter
p <sub>a</sub>	ambient pressure	[Pa]	100000
p <sub>1</sub>	pressure in the inlet chamber (1)	[Pa]	result of simulation
p <sub>2</sub>	pressure in the outlet chamber (2)	[Pa]	result of simulation
s	piston position	[m]	result of simulation
v	piston velocity	[m/s]	result of simulation
t	time line	[s]	result of simulation

## MASS AIR-FLOW MODEL St. Venant-Wantzel

$$\dot{m} = \mu \cdot f \cdot p_A \cdot \sqrt{\frac{\kappa}{R \cdot T_0}} \cdot \sqrt{\frac{2}{\kappa - 1}} \cdot \Phi(\varepsilon) \quad \varepsilon = \frac{p_B}{p_A} \quad \Phi(\varepsilon) = \begin{cases} \sqrt{\frac{2}{\varepsilon^{\frac{\kappa}{\kappa-1}} - \varepsilon^{\frac{\kappa+1}{\kappa-1}}}} & \text{for } 0.52828 < \varepsilon \leq 1 \\ 0.25880 & \text{for } 0 < \varepsilon \leq 0.52828 \end{cases}$$

for the inlet chamber: μ = μ<sub>1</sub> p<sub>A</sub> = p<sub>Z</sub> p<sub>B</sub> = p<sub>1</sub>

for the outlet chamber: μ = μ<sub>2</sub> p<sub>A</sub> = p<sub>2</sub> p<sub>B</sub> = p<sub>a</sub>