



## FAN AND BLOWER NON-DIMENSIONAL COEFFICIENTS

### INTRODUCTION

The following units are used in formulas for the non-dimensional coefficients. There are formulas listed below for both the Imperial and SI system of units.

Parameter	English	Metric
Volume flow rate	ft <sup>3</sup> /min	m <sup>3</sup> /s
Rotational speed	rpm	rpm
Total pressure	in wg	Pa
Density	lbm/ft <sup>3</sup>	kg/m <sup>3</sup>
Tip speed	ft/min	m/s
Diameter (length)	in	m

Conversions	
English	Metric
2118.88 ft <sup>3</sup> /min	1 m <sup>3</sup> /s
0.00401463 in wg	1 Pa
0.062428 lbm/ft <sup>3</sup>	1 kg/m <sup>3</sup>
196.85 ft/min	1 m/s
39.3701 in	1 m

### SPECIFIC SPEED

English:

$$N_s = \frac{NQ^{1/2}}{(0.075 P_t / \rho)^{3/4} K_p^{1/4}}$$

Where:

Parameter	Description	Units
Q	Volume flow rate	ft <sup>3</sup> /min
P <sub>t</sub>	Total pressure	in wg
ρ	Density	lbm/ft <sup>3</sup>
N	Rotational speed	rpm
K <sub>p</sub>	Compressibility factor	-

Metric:

$$N_s = 360.4571 \frac{NQ^{1/2}}{(0.075 P_t / \rho)^{3/4} K_p^{1/4}}$$

Where:

Parameter	Description	Units
Q	Volume flow rate	m <sup>3</sup> /s
P <sub>t</sub>	Total pressure	Pa
ρ	Density	kg/m <sup>3</sup>
N	Rotational speed	rpm
K <sub>p</sub>	Compressibility factor	-

## FLOW COEFFICIENT

English:

$$\Phi = 144 \frac{4QK_p}{\pi D^2 u_2}$$

Where:

Parameter	Description	Units
Q	Volume flow rate	ft <sup>3</sup> /min
D	Impeller diameter	in
u <sub>2</sub>	Tip speed	ft/min
K <sub>p</sub>	Compressibility factor	-

$$u_2 = \pi \left( \frac{D}{12} \right) N$$

Where:

Parameter	Description	Units
N	Rotational speed	Rpm

## PRESSURE COEFFICIENT

English:

$$\psi = 602566 \frac{P_t K_p}{\frac{1}{2} \rho u_2^2}$$

Where:

Parameter	Description	Units
P <sub>t</sub>	Total pressure	In wg
ρ	Density	lbm/ft <sup>3</sup>
u <sub>2</sub>	Tip speed	ft/min
K <sub>p</sub>	Compressibility factor	-

$$u_2 = \pi \left( \frac{D}{12} \right) N$$

Parameter	Description	Units
N	Rotational speed	rpm
D	Impeller diameter	in

Metric:

$$\Phi = \frac{4QK_p}{\pi D^2 u_2}$$

Where:

Parameter	Description	Units
Q	Volume flow rate	m <sup>3</sup> /s
D	Impeller diameter	m
u <sub>2</sub>	Tip speed	m/s
K <sub>p</sub>	Compressibility factor	-

$$u_2 = \frac{\pi DN}{60}$$

Where:

Parameter	Description	Units
N	Rotational speed	rpm

Metric:

$$\psi = \frac{P_t K_p}{\frac{1}{2} \rho u_2^2}$$

Where:

Parameter	Description	Units
P <sub>t</sub>	Total pressure	Pa
ρ	Density	kg/m <sup>3</sup>
u <sub>2</sub>	Tip speed	m/s
K <sub>p</sub>	Compressibility factor	-

$$u_2 = \frac{\pi DN}{60}$$

Parameter	Description	Units
N	Rotational speed	rpm
D	Impeller diameter	m