

## Unit Conversion of Vacuum Degree

	pa(N/m <sup>2</sup> )	bar	mbar	torr (mmHg)	micron (mtorr)	atm	psi (lbf/inch <sup>2</sup> )
1 pa=	1	1*10 <sup>-5</sup>	1*10 <sup>-2</sup>	7.5*10 <sup>-3</sup>	7.5	9.87*10 <sup>-6</sup>	1.45*10 <sup>-4</sup>
1 bar=	1*10 <sup>5</sup>	1	1*10 <sup>3</sup>	7.5*10 <sup>2</sup>	7.5*10 <sup>5</sup>	9.87*10 <sup>-1</sup>	1.45*10 <sup>1</sup>
1 mbar=	1*10 <sup>2</sup>	1*10 <sup>-3</sup>	1	7.5*10 <sup>-1</sup>	7.5*10 <sup>2</sup>	9.87*10 <sup>-4</sup>	1.45*10 <sup>-2</sup>
1 torr=	1.33*10 <sup>2</sup>	1.33*10 <sup>-3</sup>	1.33	1	1*10 <sup>3</sup>	1.32*10 <sup>-3</sup>	1.93*10 <sup>-2</sup>
1 micron=	1.33*10 <sup>-1</sup>	1.33*10 <sup>-6</sup>	1.33*10 <sup>-3</sup>	1*10 <sup>-3</sup>	1	1.32*10 <sup>-6</sup>	1.93*10 <sup>-5</sup>
1 atm=	1.01*10 <sup>5</sup>	1.01	1.01*10 <sup>3</sup>	7.6*10 <sup>2</sup>	7.6*10 <sup>5</sup>	1	1.47*10 <sup>1</sup>
1 psi=	6.89*10 <sup>3</sup>	6.89*10 <sup>-2</sup>	6.89*10 <sup>-1</sup>	5.17*10 <sup>-1</sup>	5.17*10 <sup>4</sup>	6.8*10 <sup>-2</sup>	1

## Unit Conversion of Temperature

	K	°C	°F
1 K=	1	°C+273.15	5/9*(°F+459.67)
1 °C=	K-273.15	1	5/9*(°F-32)
1 °F=	9/5-459.67	9/5 °C+32	1

## Unit Conversion of Length

	m	ft	in
1 m=	1	3.28	3.9*10
1 ft=	3.1*10 <sup>-1</sup>	1	1.2*10
1 in=	2.5*10 <sup>-2</sup>	8.3*10 <sup>-2</sup>	1

## Unit Conversion of Pumping Speed

	l/m	l/min	m <sup>3</sup> /h	cfm/min
1 l/m=	1	60	3.6	2.12
1 l/min=	1.67*10 <sup>-2</sup>	1	6*10 <sup>-2</sup>	3.54*10 <sup>-3</sup>
1 m <sup>3</sup> /h=	2.8*10 <sup>-1</sup>	1.67*10 <sup>-1</sup>	1	5.9*10 <sup>-1</sup>
1 cfm/min=	4.7*10 <sup>-1</sup>	2.83*10 <sup>-1</sup>	1.69	1

## Unit Conversion of Conductance & Leakage

	pa*m <sup>3</sup> /s	mbar*.l.s	torr*/l.s	sccm
1 pa*m <sup>3</sup> /s=	1	10	7.5	5.92*10 <sup>-2</sup>
1 mbar*.l.s=	1*10 <sup>-1</sup>	1	7.5*10 <sup>-1</sup>	5.92*10
1 torr*/l.s=	1.33*10 <sup>-2</sup>	1.33*10 <sup>-2</sup>	1	7.89*10
1 sccm=	1.69*10 <sup>-2</sup>	1.69*10 <sup>-3</sup>	1.27*10 <sup>-3</sup>	1

## Unit Conversion of Weight

	kg	lb	oz
1 kg=	1	2.2	3.5*10
1 lb=	4.5*10 <sup>-1</sup>	1	1.6*10
1 oz=	2.8*10 <sup>-2</sup>	6*10 <sup>-2</sup>	1

## Average free Path of Molecules in 43°F Air under Different Pressures

1 P(torr)=	1	10 <sup>-3</sup>	10 <sup>-4</sup>	10 <sup>-5</sup>	10 <sup>-6</sup>	10 <sup>-9</sup>
1 λ(cm)=	4.72*10 <sup>-3</sup>	4.72	4.72*10	4.72*10 <sup>2</sup>	4.72*10 <sup>3</sup>	4.72*10 <sup>6</sup>

## Molecular Density at Different Pressures

1 P(torr)=	1	10 <sup>-3</sup>	10 <sup>-4</sup>	10 <sup>-5</sup>	10 <sup>-6</sup>	10 <sup>-9</sup>
1 n <sub>v</sub> (psc/cm)=	4*10 <sup>16</sup>	4*10 <sup>13</sup>	4*10 <sup>12</sup>	4*10 <sup>11</sup>	4*10 <sup>10</sup>	4*10 <sup>7</sup>

## Vacuum Pump Selection Formula

$$T=(V/S)*2.303*\log(P1/P2)$$

T: exhaust time (s), V: volume (L), S: displacement (l/s), P1: initial pressure (Pa), P2: final pressure (Pa), for example:

1, 100 liters chamber, within 10 minutes from the atmosphere evacuated to 20Pa, how to do pump selection?

$$\begin{aligned} S &= (V/T) * 2.303 * \log(P1/P2) \\ &= (100/10) * 2.303 * \log(100,000/20) \\ &= 10 * 2.303 * 3.699 \\ &= 85 \text{ (l/min)} \\ &= 1.42 \text{ (l/s)} \end{aligned}$$

Need choose vacuum pump of 4l/s.

2, 100 liters chamber, use 8l/s vacuum pump, pumping from atmosphere to 200Pa, how long time will be spent?

$$\begin{aligned} T &= (V/S) * 2.303 * \log(P1/P2) \\ &= (100/8) * 2.303 * \log(100,000/200) \\ &= 77 \text{ s} \end{aligned}$$

Need 77 seconds.

## Evacuation Time Estimates Formula

$$T=8V/S$$

V: volume (L), S: displacement (l/s).

This formula is suitable for atmospheric pressure to estimate 133Pa, for example:

100 liters chamber, with 8l/s vacuum pump, pumping from atmosphere to 133Pa, how long time will be spent?

$$\begin{aligned} T &= 8V/S \text{ (empirical formula)} \\ &= 8 * 100/8 \\ &= 100 \text{ s, need 100 seconds.} \end{aligned}$$

## Conversion of Vacuum Meter Reading to Absolute Vacuum Degree

Absolute vacuum degree=100,000\*(1- X/0.1)Pa, X=absolute value of vacuum meter reading, for example:

Vacuum meter reading=-0.075, absolute vacuum degree=100,000\*(1-0.075/0.1)=25,000Pa

Vacuum meter reading=-0.097, absolute vacuum degree=100,000\*(1-0.097/0.1)=3,000Pa

Vacuum meter reading=-700mmHg, absolute vacuum degree=100,000\*(1-700/760)=7,900Pa

# GEOWELL VACUUM CO., LTD.

Add: 99A-18, Chuangxin 1st Rd, Hunnan Distr., Shenyang, 110169

Tel: +86-24-83685362

<https://www.geowellscroll.com>

Email: info@geowellscroll.com

