



# CL Series

## *Liquid Ring Vacuum Pumps*

TURKEY;

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## 1. Description

CL series cone vacuum pump realize its suction and discharge by conical port structure, compared with the axial suction and discharge of flat port plate, it is characterized as wide sectional area and passage, small flow resistance, 18% energy saving when air is evacuated and 28% if saturated steam is pumped, besides, the impeller is well sealed and with high rigidity.

### When should select CL vacuum pump:

#### When liquid may carry over

Any design of vacuum pump is to deal with gas, such as air. Many types achieve to compress gas from low pressure to outlet ordinary pressure, but few are able to deal with “wet vacuum”. It is harmful if excessive liquid is compressed together with gas in the pump chamber.

Entrained liquid does not damage the CL vacuum pump, neither occasional silt or long-term droplet, nor influence to pump performance. Entrained liquid could be reclaimed if required.

#### When air carries solid contaminants

CL vacuum pumps also allow solid particles entraining, excluding big particles and abramer, because if they are present in the pumping fluid or liquid ring, pump life can be reduced, therefore they must be filtered in advance. But CL pumps allow other solid contaminants; this is an important reason to choose this series.

For example, vacuum line in paper mill may produce paper fibre, finishing device in textile mill must deal with textile fibre, besides paste and soft substance are usually contained in vacuum system of many industries like chemical, pharmacy and food. CL vacuum pumps are successfully applied in similar occasions.

#### When gas is corrosive

Many factors are in favor of corrosion resistance of CL pumps. Firstly, no parts need lubrication inside the casing, so that we may not consider chemical element destroy and grease emulsification, and other methods can also protect the pump from chemical erosion, one is to choose operating liquid, which has neutralization react with gas; the other is to use a relatively neutral liquid to the corrosive gas, and protect the metal parts by diluting the corrosive gas.

#### When vapor is to be reclaimed

The gas pumped is usually reclaimed, rather than exhausting into the air. This is mainly because the gas is the product or can be recycled. Explosive, aggressive and toxic gas must be reclaimed in case of air pollution.

If gas becomes vapor in vacuum state, CL vacuum pump can be used as condenser. The condensate cooled in the heat exchanger is operating liquid of the pump, some of which can be fed before entering suction port to cool the saturated vapor in advance. This promotes pump performance and efficiency.

#### When you want smooth operation

There is no pressure pulse in pump operation, so buffer tank is not necessary. On the other hand, stability results from the mechanical operation of pump, because it has only one rotating part-the rotor, this means reducing of the installation and basic cost.

#### When you need reliability

CL vacuum pump is often used on the occasion which shut down or maintenance cost may be tens of thousands. In many systems, they need neither spare parts nor spare pumps. Its reliability is also shown in the low maintenance cost.

Valves, whirling plate, piston or gears are not included in interior parts; usually sealing gasket and wear reducing bearing are connected externally. The material and design has been fully proved, and technology is advanced. Every pump passes strict factory test so that you can fully trust it.

## 2. Operating principle:

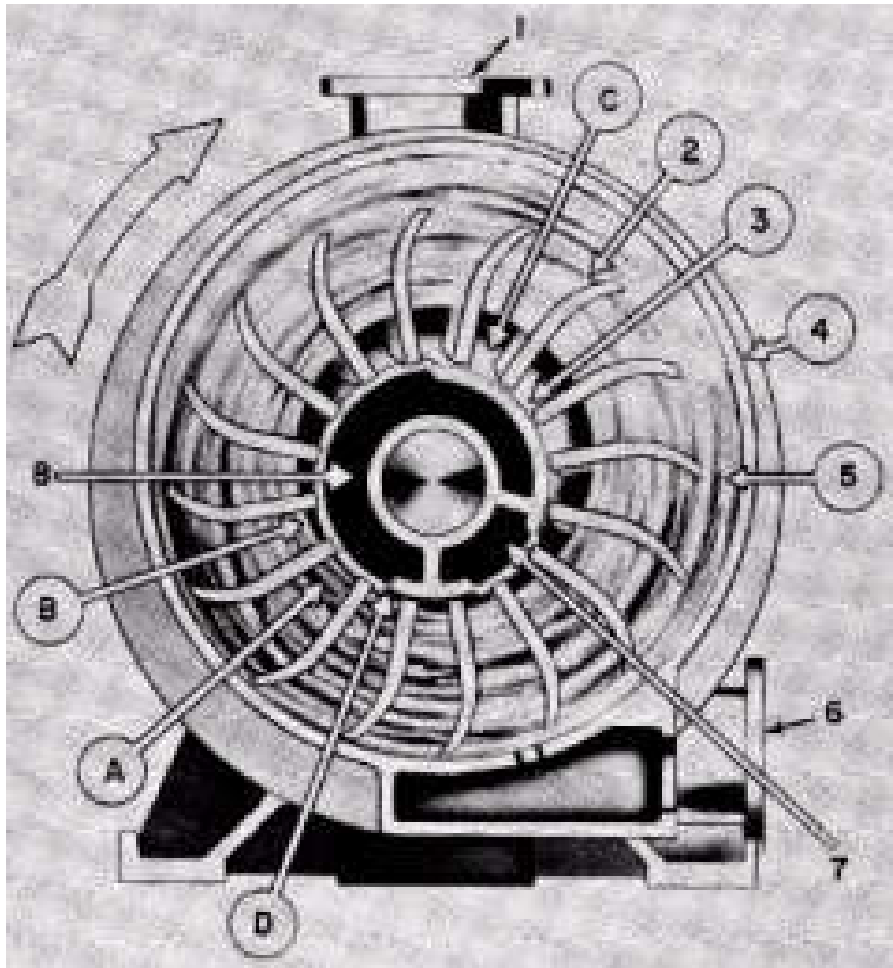


Fig.1 CL vacuum pump operating principle

Remark:

- |                      |                        |
|----------------------|------------------------|
| 1. Pump suction port | 5. Operating liquid    |
| 2. Rotor             | 6. Pump discharge port |
| 3. Conical port      | 7. Outlet port         |
| 4. Pump casing       | 8. Inlet port          |

As shown in fig.1, the rotor (2) is rotating in the casing (4) without metal contact, and the liquid piston (5) (usually water) is surrounded. The rotor (2) is made of a conical casting with hollow center and several blades surrounded. The shaft passed through the rotor hub, blades are confined in both ends into several chambers, and the edges of blades blend along the rotating direction of the rotor. In point A, the rotor cavity chamber is filled with water, which is followed to rotate along the casing internal surface. Due to centrifugal force, water is thrown to the pump casing till point C, when the chamber is empty.

Because the rotor is eccentrically mounted in the

lower part of casing, and with the rotor rotating, water recedes to the chamber owing to the force on the casing, and then refills each chamber at point D. During each rotation, the

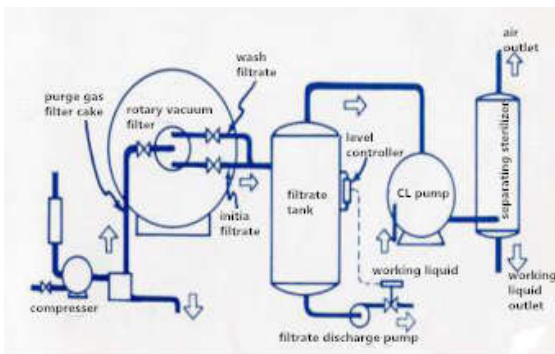
chamber is filled and evacuated once. At point B when water is gradually expelled from the chamber, air is drawn from the inlet port (8) on the conical port (3) and replaces water. After a rotation, water recedes to the chamber again, and expels the air via outlet port on the cone. In the process, water is functioned as liquid piston and seal liquid between rotor and the cone.

### 3. Wide application

Followed are some simple flow diagrams of NASH CL pumps in different systems; They are typical and similar with other application; Solutions for special cases can be provided. We will provide you the special design as your requirements.

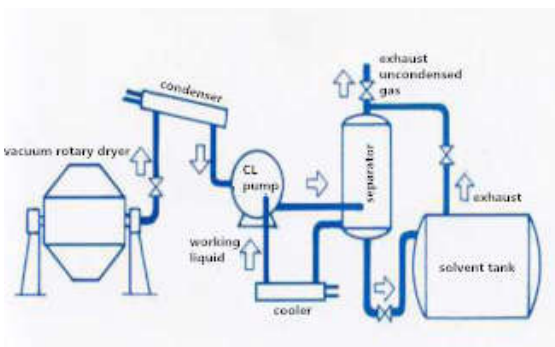
#### 3.1 Filtration

In filtration process, CL pumps are used to pump filtrate storage tank. The constant and pulseless vacuum makes the filter cake uniform and smooth. Small NASH compressors can be used to blow the filter cake.



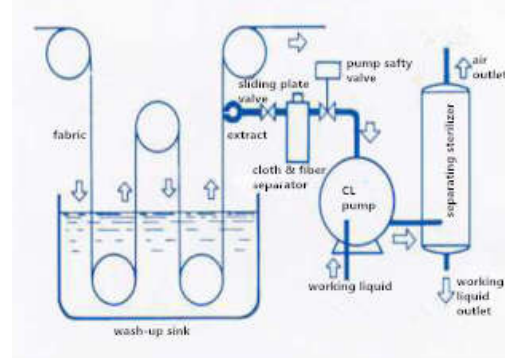
#### 3.2 Solvent recovery

Vacuum drying is to detach solvent vapor in solid particles. NASH CL pumps makes the solvent vapor and cold liquid solvent contact, the pump itself can be part of the condenser. The non-condensing vapor can be detached in mechanical way, and the recycled solvent can be storied for usage.



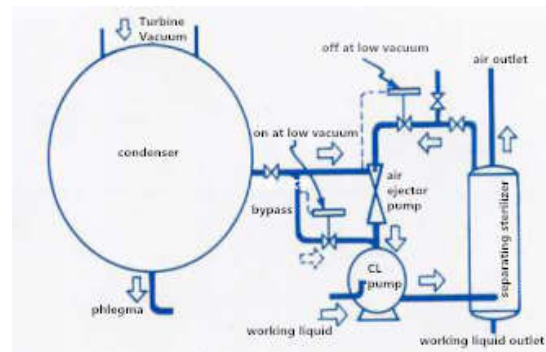
#### 3.3 Dehumidify

The fabric out of the sink is wet and surpassed slotted pipes. NASH CL vacuum pumps draw the wet and air out of extractor to guarantee constant vacuum, and no problems are caused by any textile fiber with mixture. It can be moved with the regular separator cleaning work.



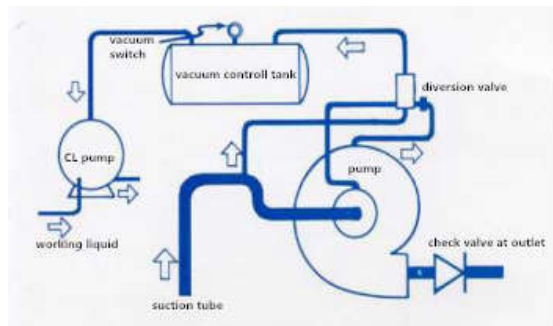
#### 3.4 Condenser pumping

Vacuum maintaining and extracting is connected with non-condensable gas rate. In high vacuum, CL vacuum pumps are often use in series with air ejector. In low vacuum, air ejector is used as by-pass, the CL vacuum pump extract from the condenser. Compared with steam jet system, NASH startup and operation switches automatically, while steam jet manually.



#### 3.5 Water diversion

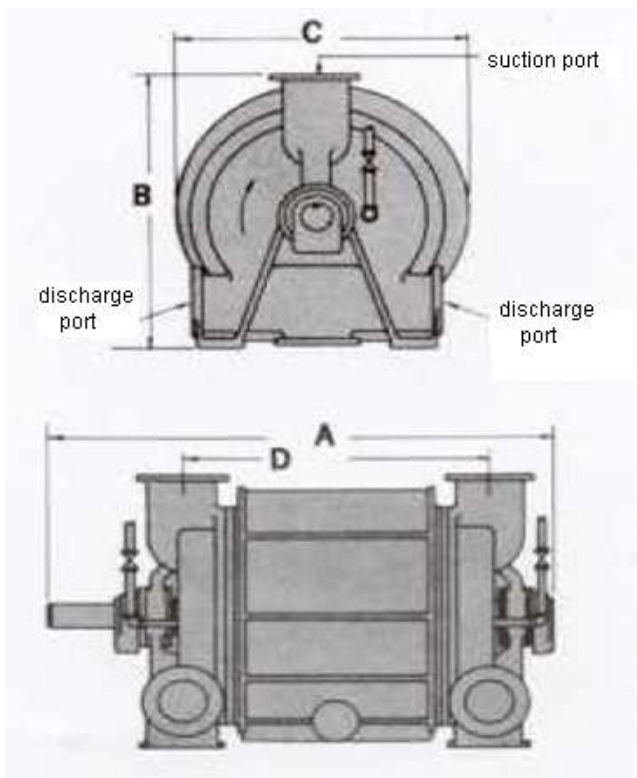
When centrifugal pump is higher than its inlet liquid port in position, the pump must be started with full liquid. Vacuum diversion system replaces the foot valve, NASH diversion valve matches with NASH start-up stem and centrifugal pump. The diversion valve is a float valve, when the liquid level rises the valve shuts. Discharge port is set on the top of centrifugal pump inlet and pump casing,; there are three connections with the diversion valve.



### 3.6 Other application:

- Vacuum for power plant condenser
- Wet flue gas desulfurization equipment of coal-fired power plant
- Compression of special inflammable and explosive gases such as acetylene
- Compression of ozone
- Gas recovery
- Reduced pressure distillation
- Vacuum dehydration
- Vacuum filtration
- Vacuum extrusion/ vacuum forming
- Vacuum impregnation
- Vacuum extraction

## 4. Dimension of CL series vacuum pump



Model	Nominal diameter		Size (mm)			
	inlet	outlet	A	B	C	D
CL 4000	250	200	1930	1245	1219	1321
CL 3000	200	150	1727	1118	1016	1041
CL 2000	150	125	1524	914	838	914
CL 1000	125	100	1219	660	610	686
CL 700	100	80	1041	584	508	559

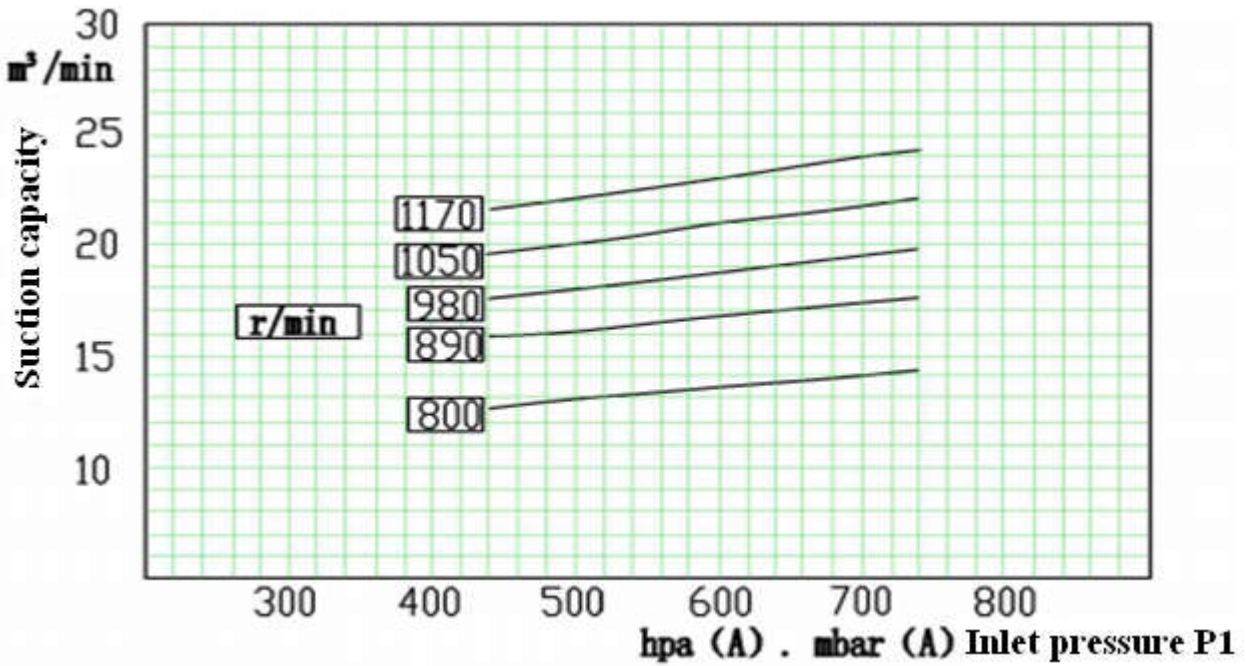


## 5. Pump unit configuration

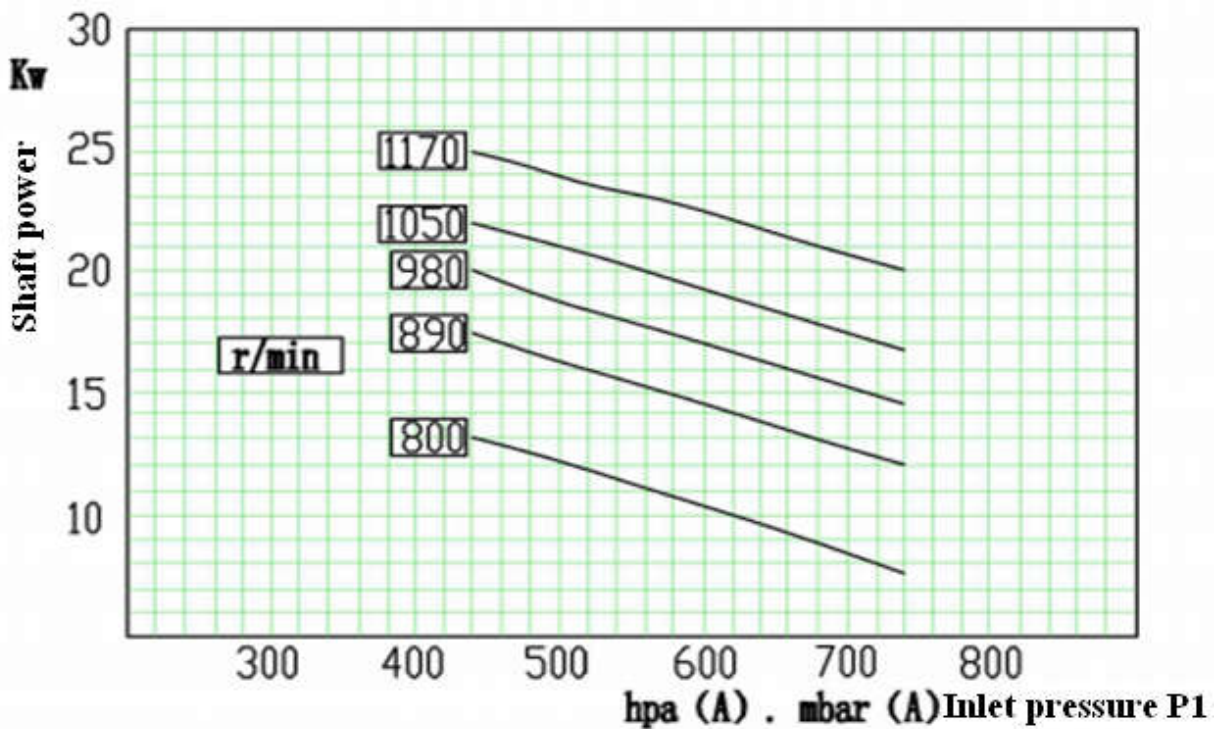
Model	Vacuum range (abs.mbar)	Suction capacity (m <sup>3</sup> /min)	Motor power	Speed (r/min)	Remark
CLA—701	800~400	18~17	30	980	Direct diving
CLA—702	450~240	19~18	37	980	Direct diving
CLA—703	270~80	17~13	37	980	Direct diving
CLA—1001	800~400	27~25	45	740	Direct diving
CLA—1002	450~240	26~24	45	740	Direct diving
CLA—1003	270~80	24~16	45	740	Direct diving
CLA—2001	800~400	58~56	90	590	Direct diving
CLA—2002	450~240	56~52	90	590	Direct diving
CLA—2003	270~80	55~45	90	590	Direct diving
CLA—3001	800~400	85~80	132	500	Belt / gear box
CLA—3002	450~240	82~78	132	500	Belt / gear box
CLA—3003	270~80	80~68	132	500	Belt / gear box
CLA—4001	800~400	115~110	185	400	Belt / gear box
CLA—4002	450~240	110~100	185	400	Belt / gear box
CLA—4003	270~80	105~85	185	400	Belt / gear box
CLA—6001	800~400	170~165	200	300	Belt / gear box
CLA—6002	450~240	165~158	200	300	Belt / gear box
CLA—6003	270~80	155~130	200	300	Belt / gear box

## 6. Suction speed and shaft power curve

### CL701 suction speed curve



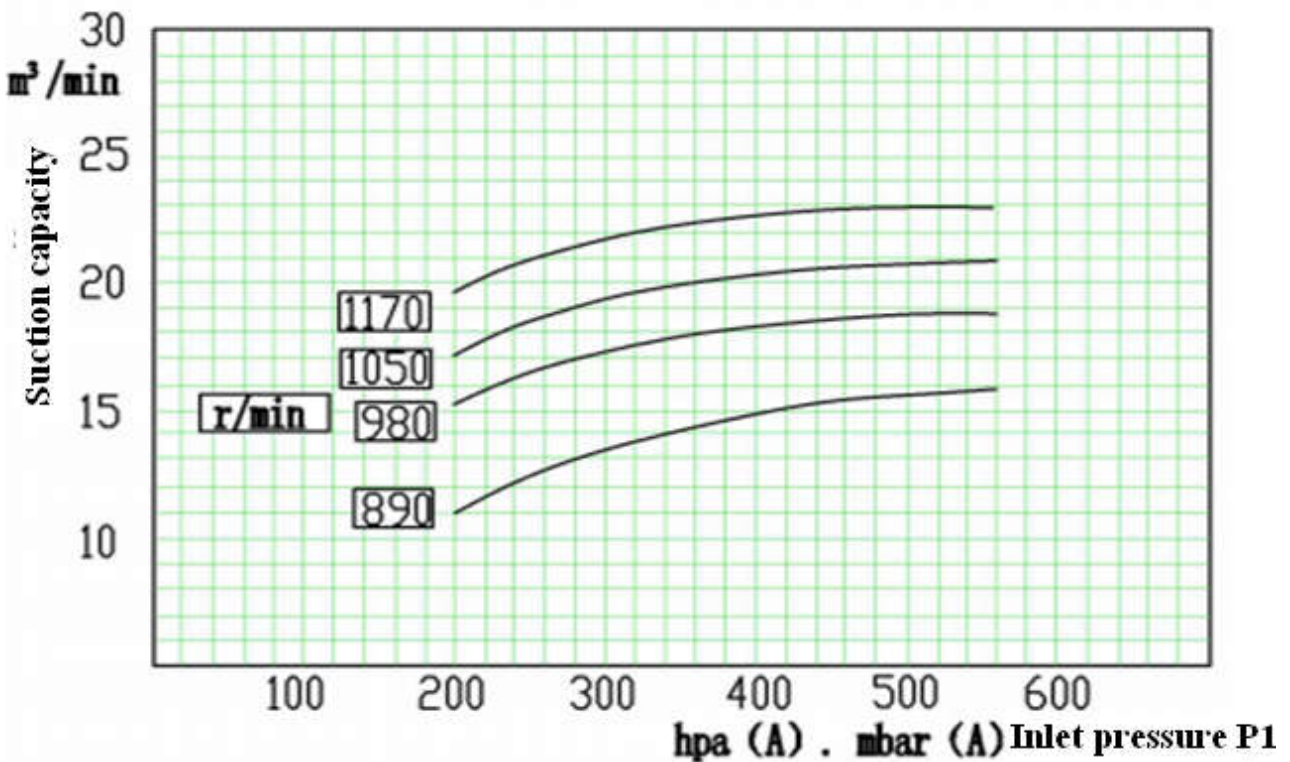
### CL701 shaft power curve



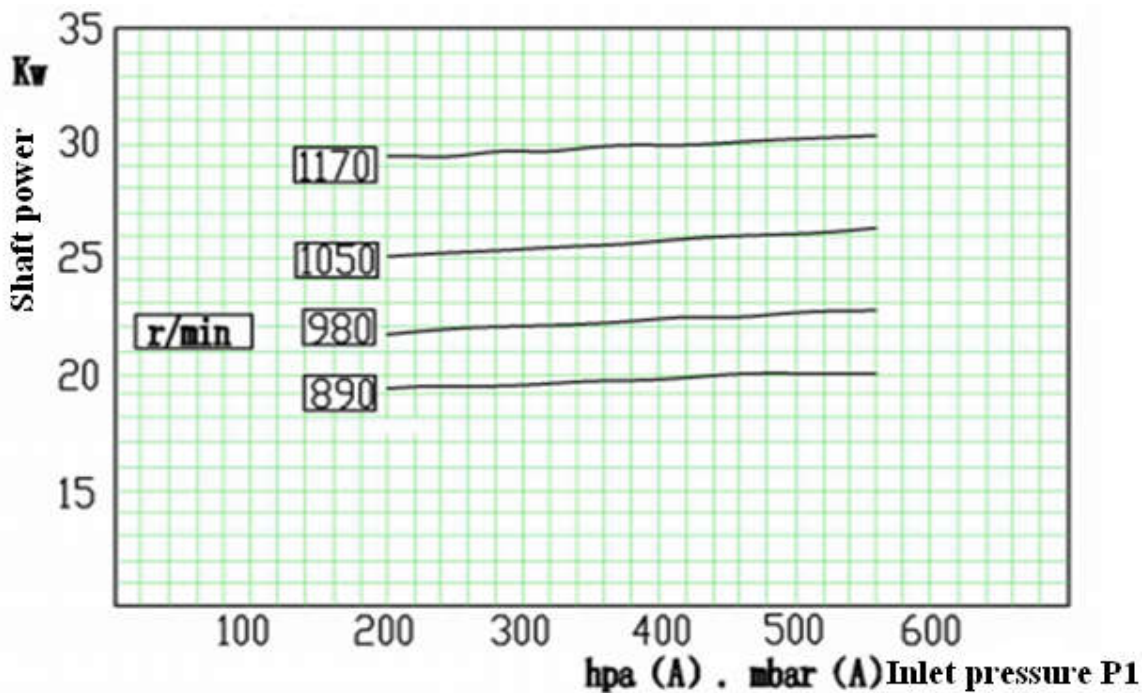
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL702 suction speed curve**



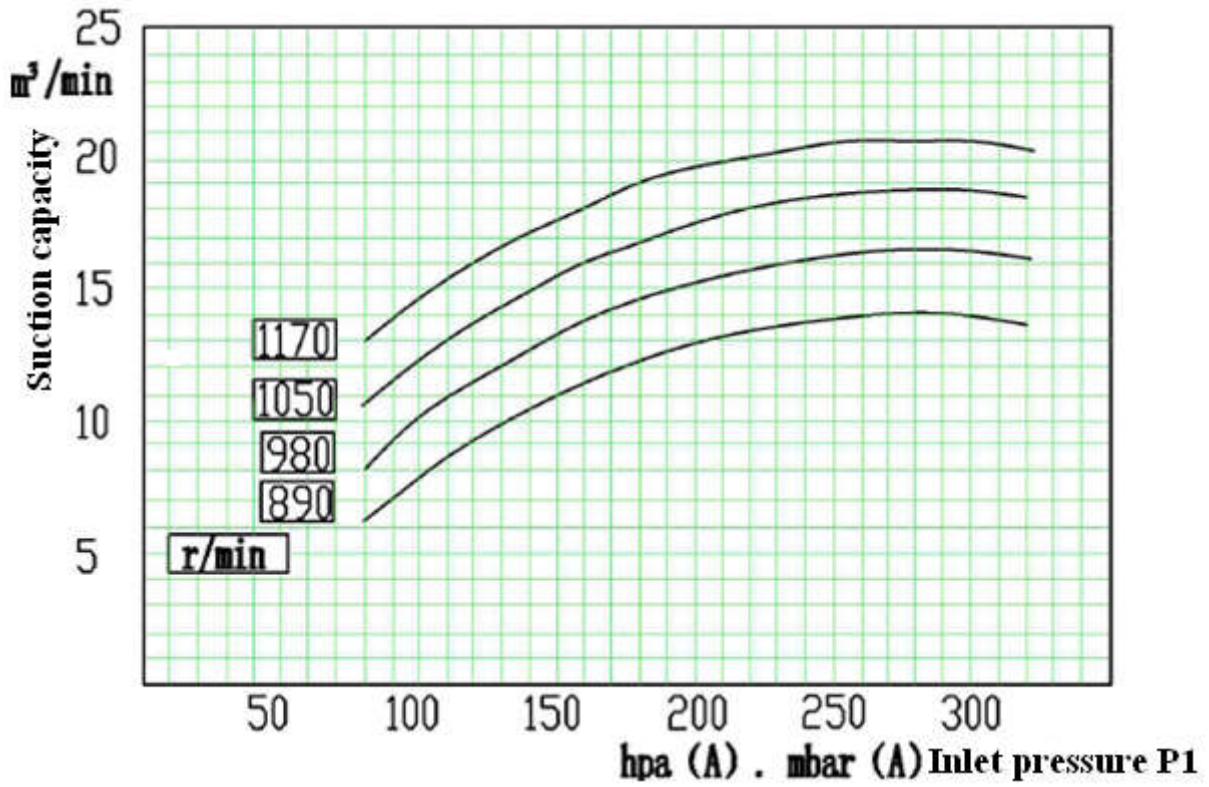
**CL702 shaft power curve**



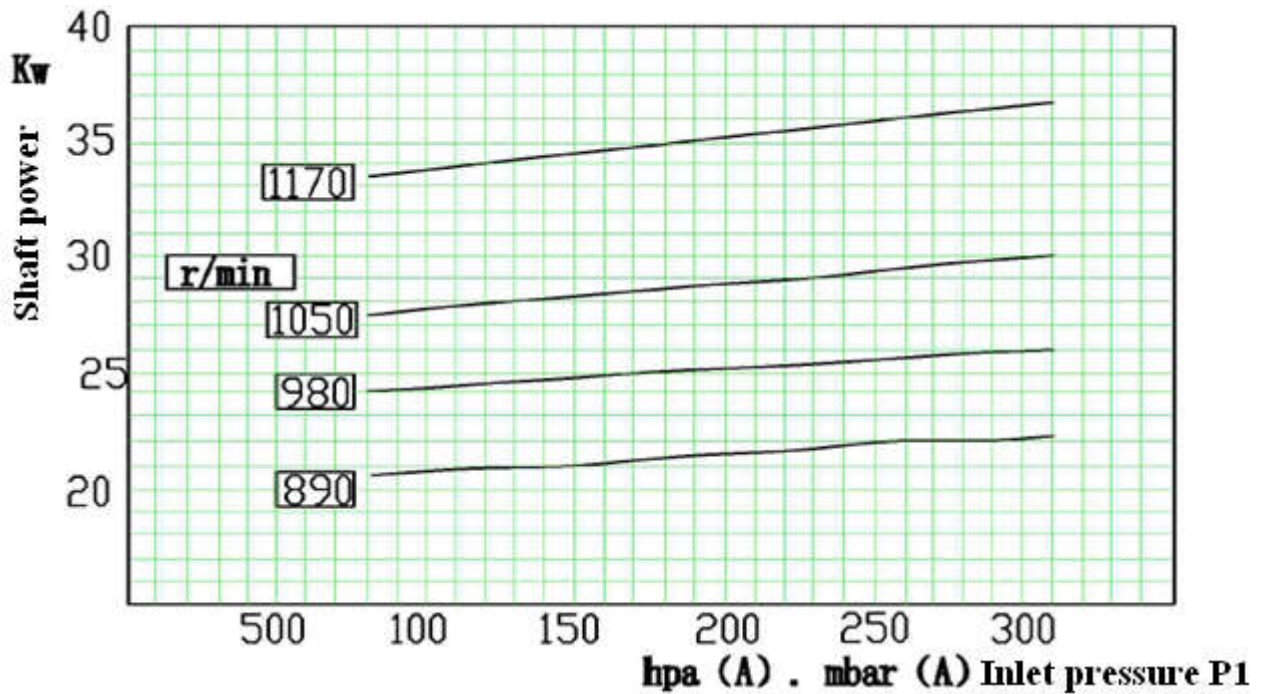
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL703 suction speed curve**



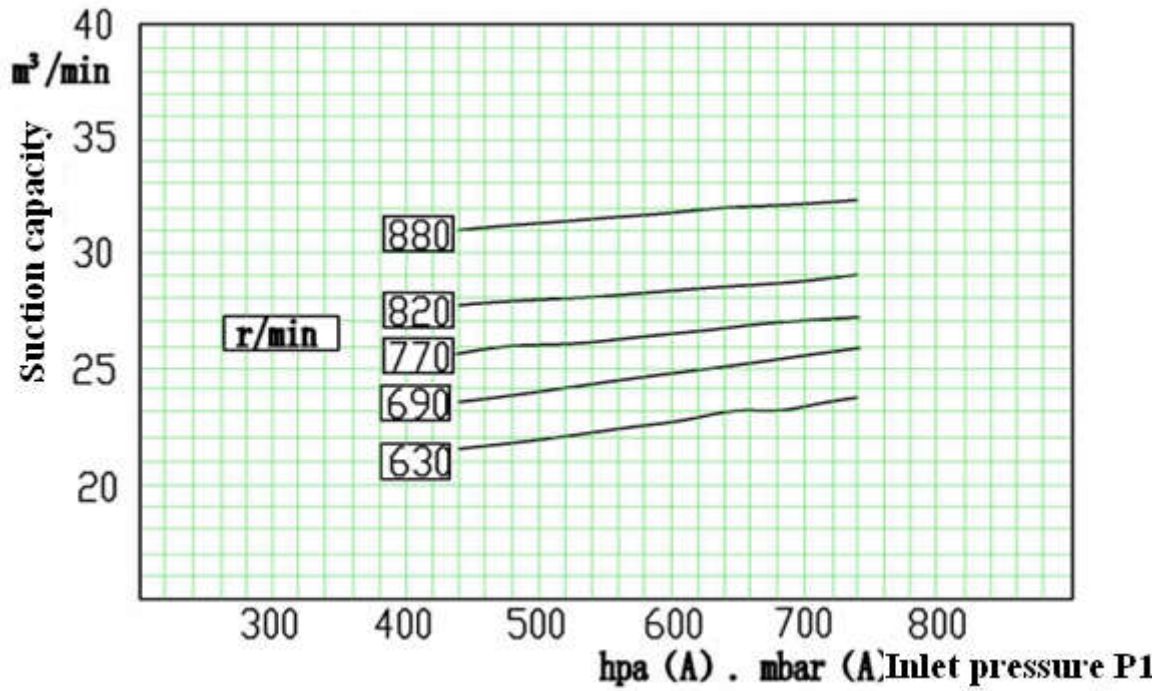
**CL703 shaft power curve**



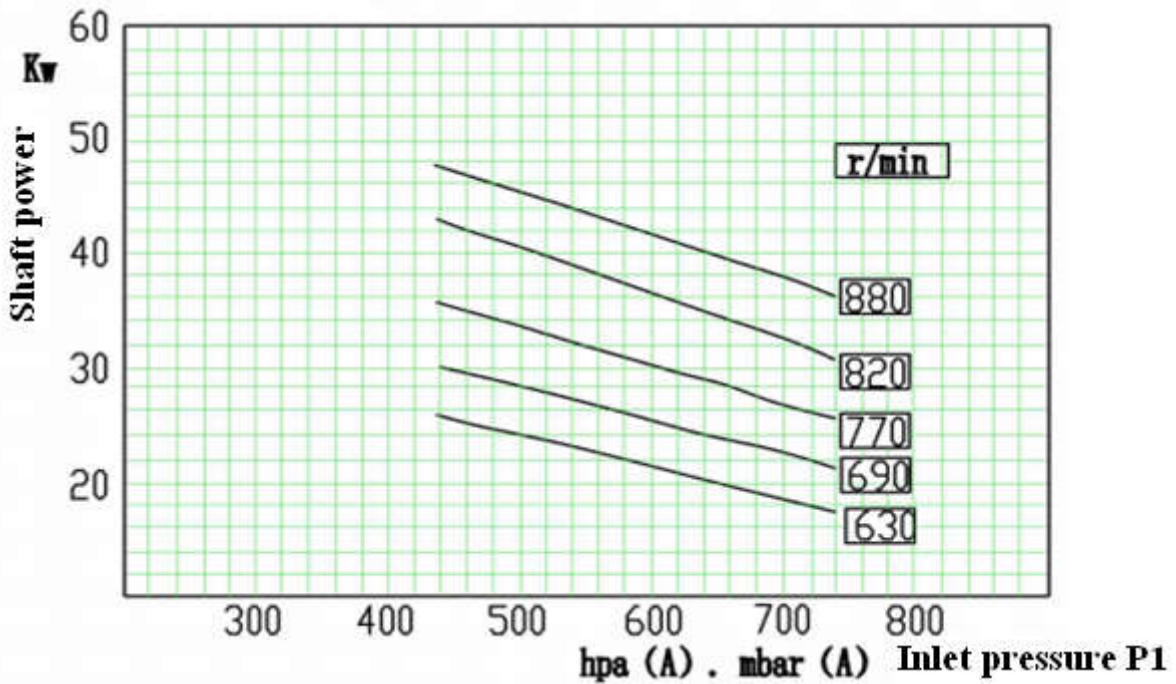
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL1001 suction speed curve**



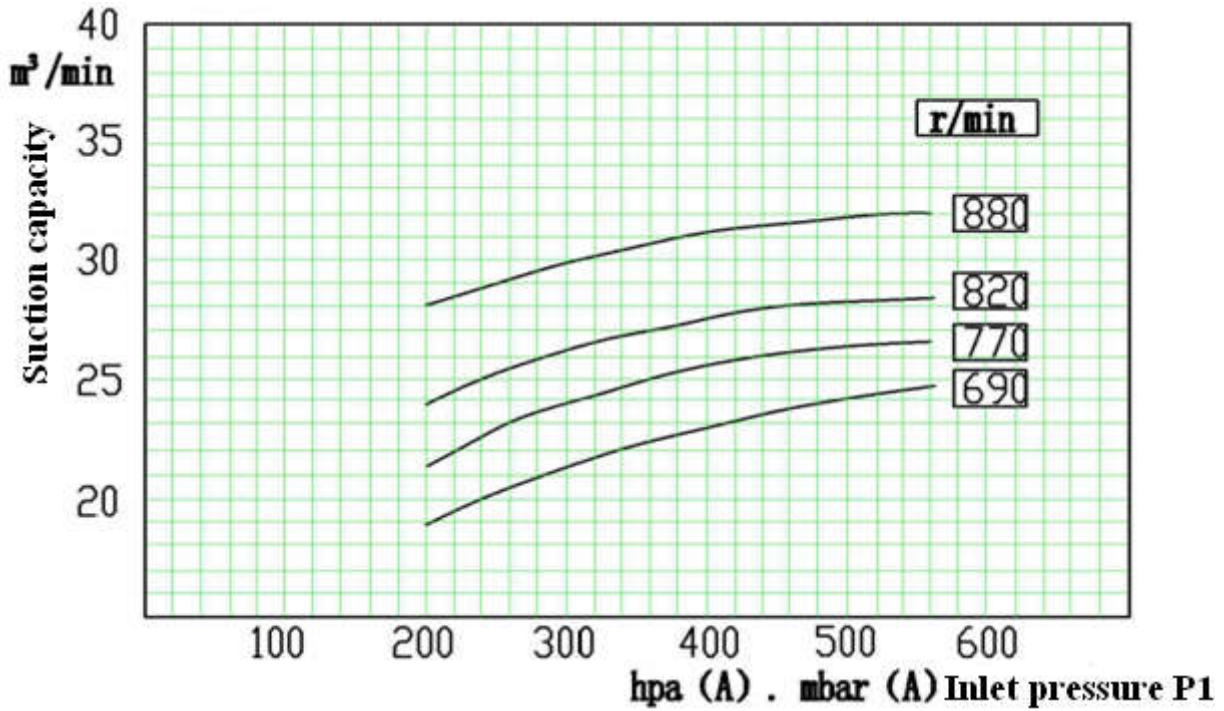
**CL1001 shaft power curve**



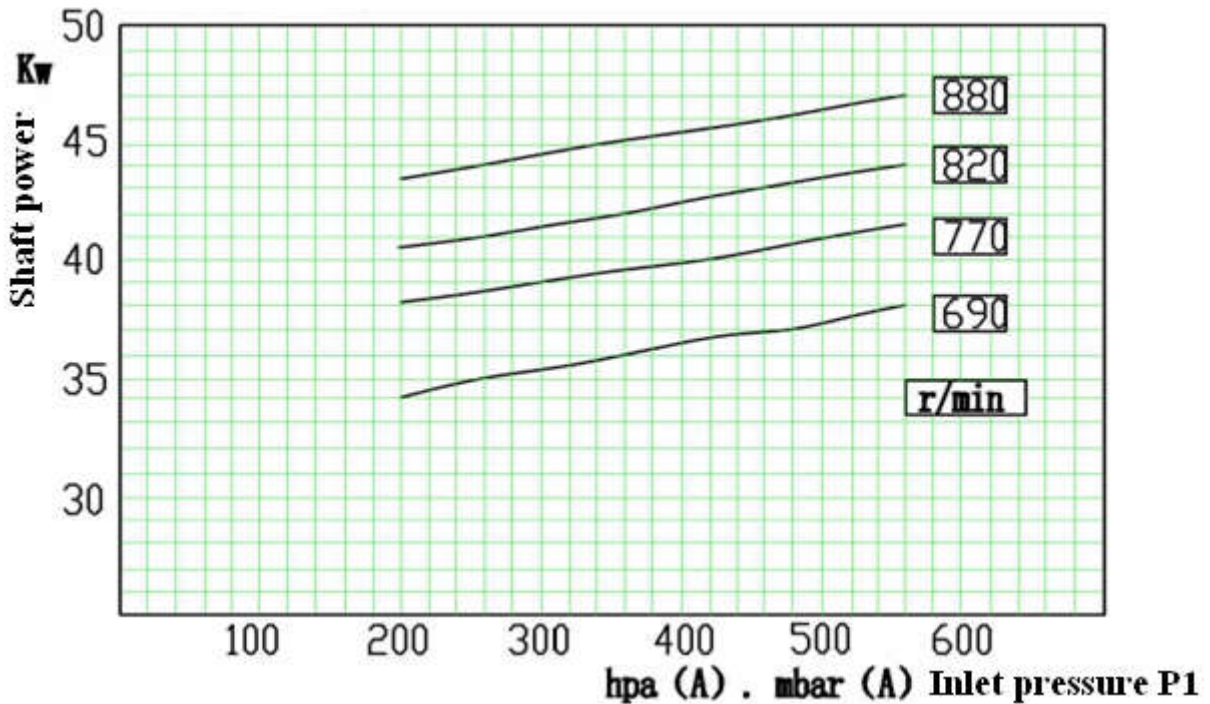
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL1002 suction speed curve**



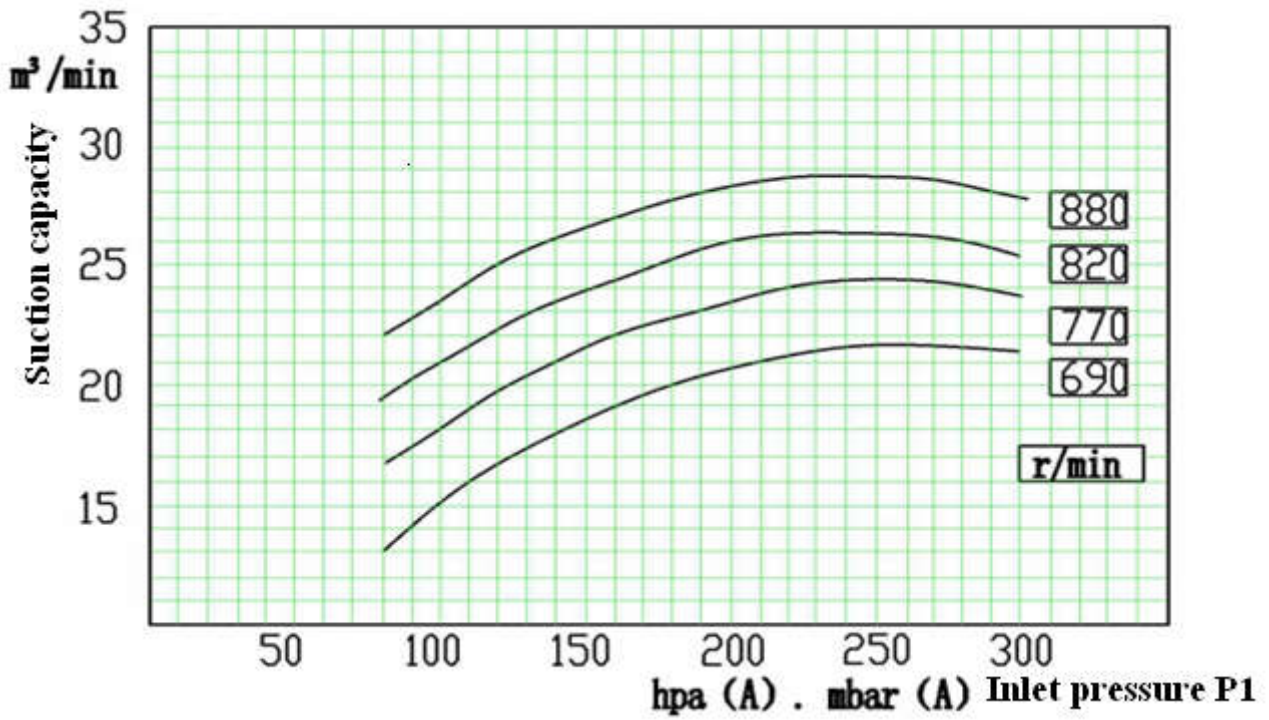
**CL1002 shaft power curve**



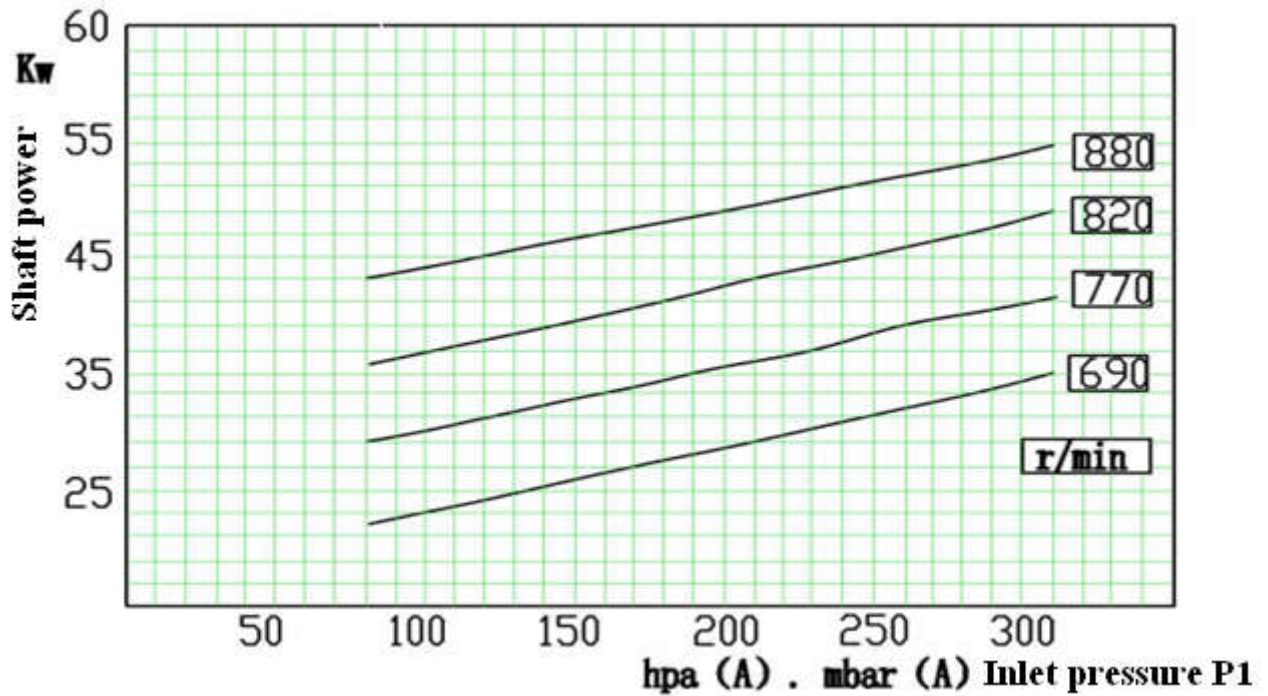
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL1003 suction speed curve**



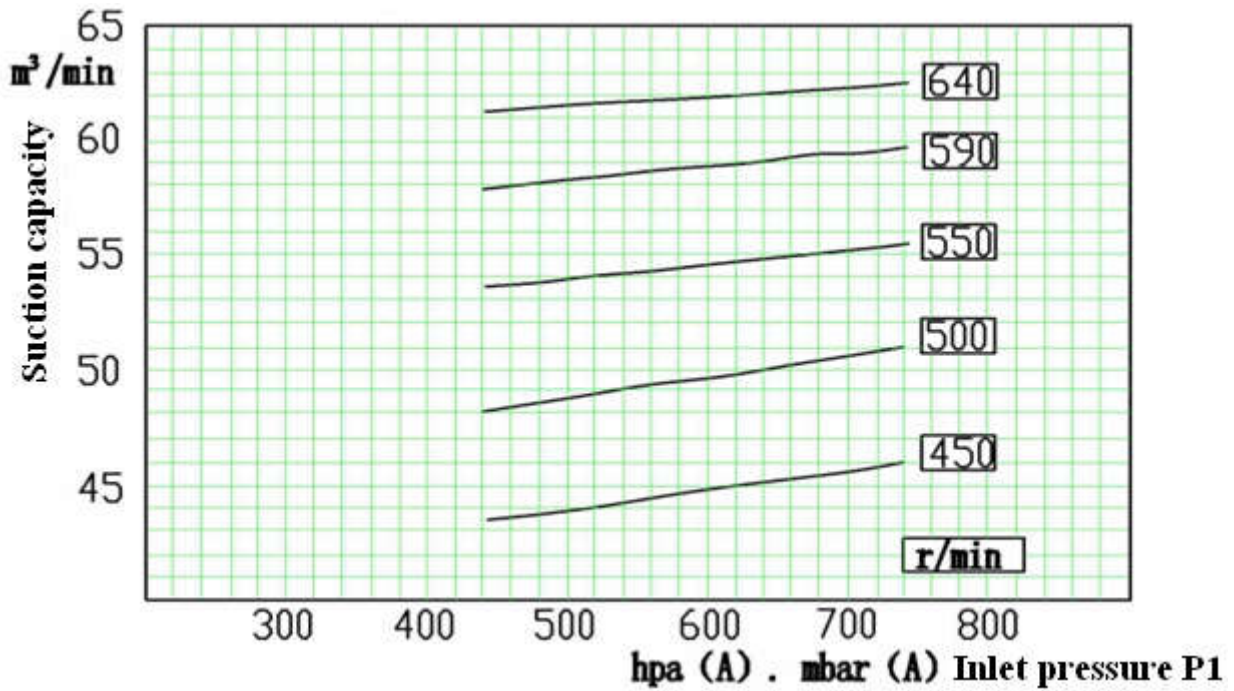
**CL1003 shaft power curve**



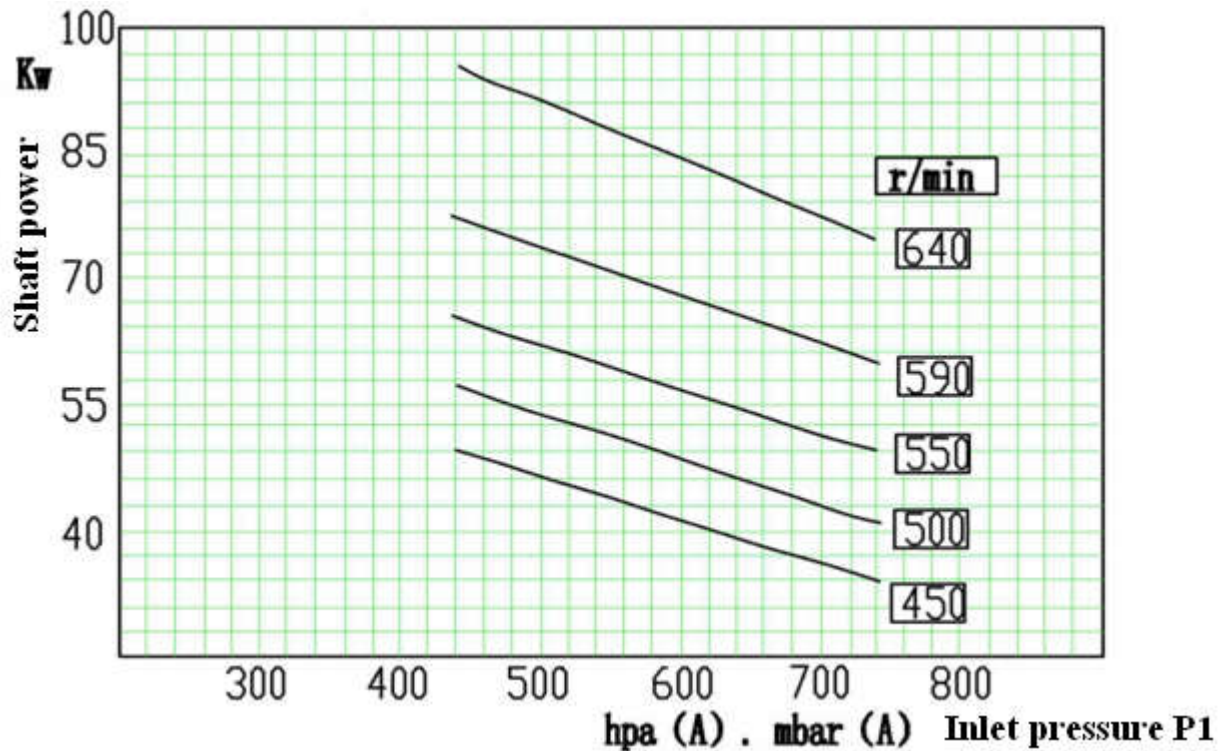
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL2001 suction speed curve**



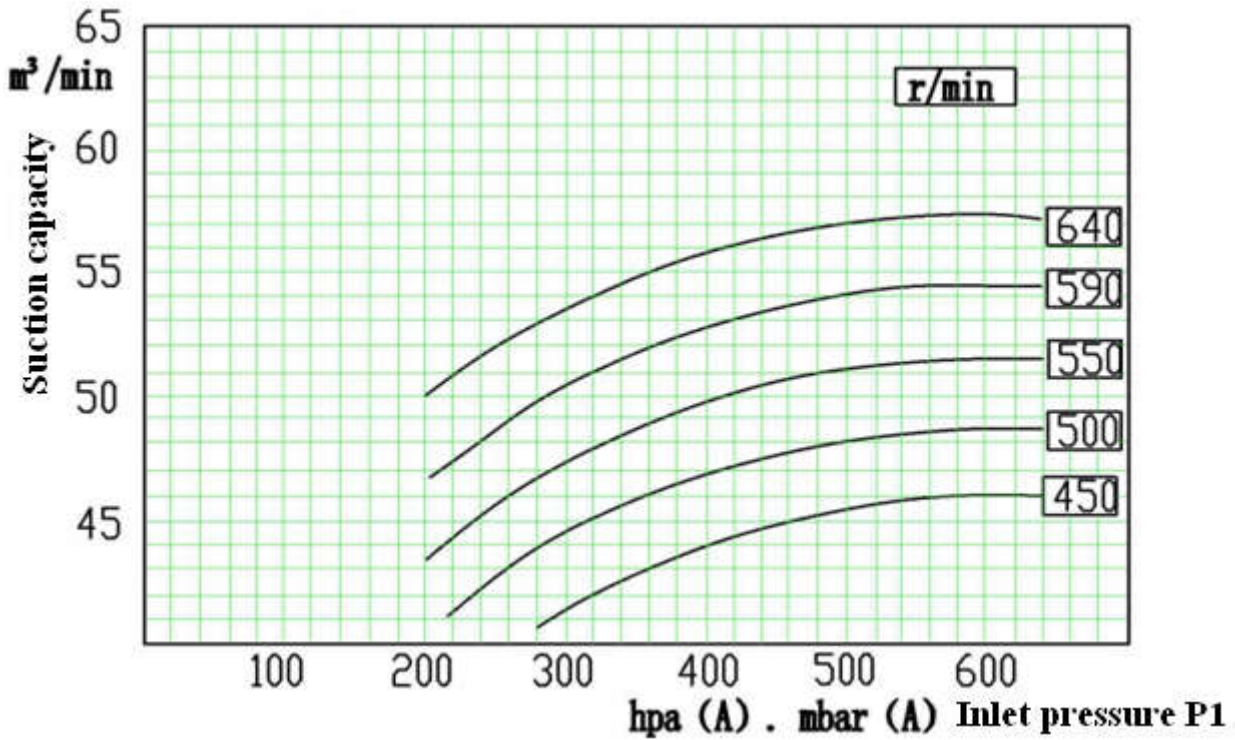
**CL2001 shaft power curve**



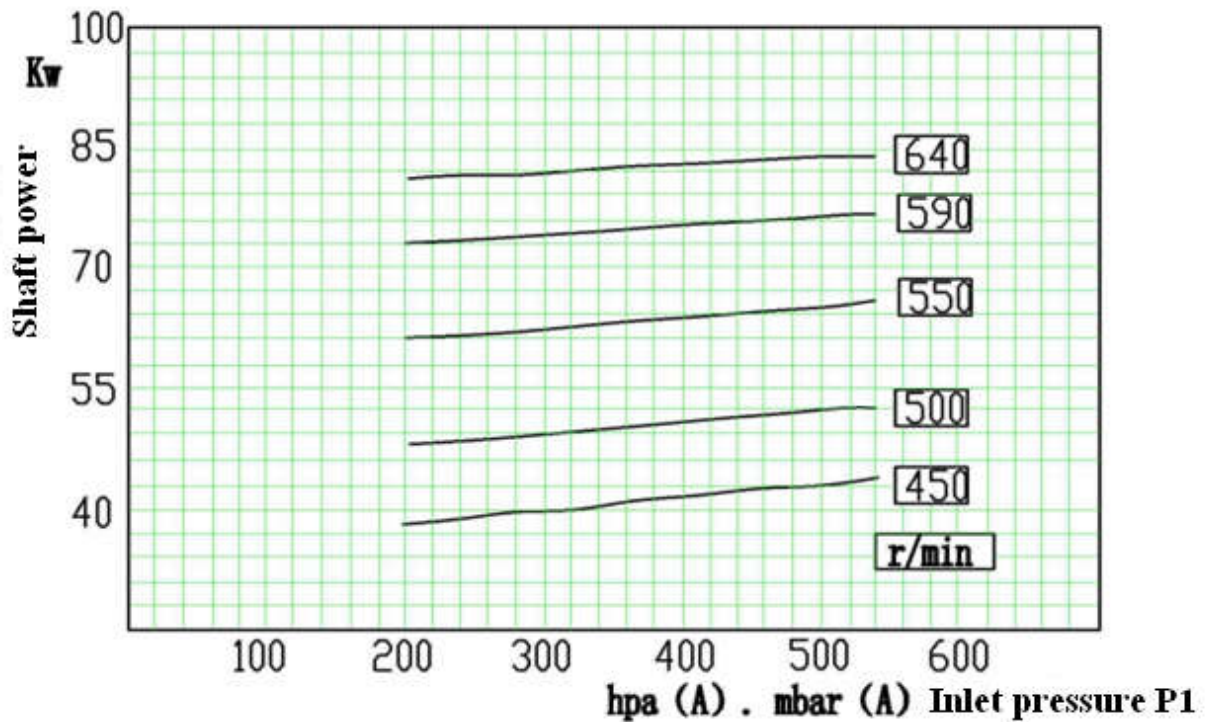
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL2002 suction speed curve**



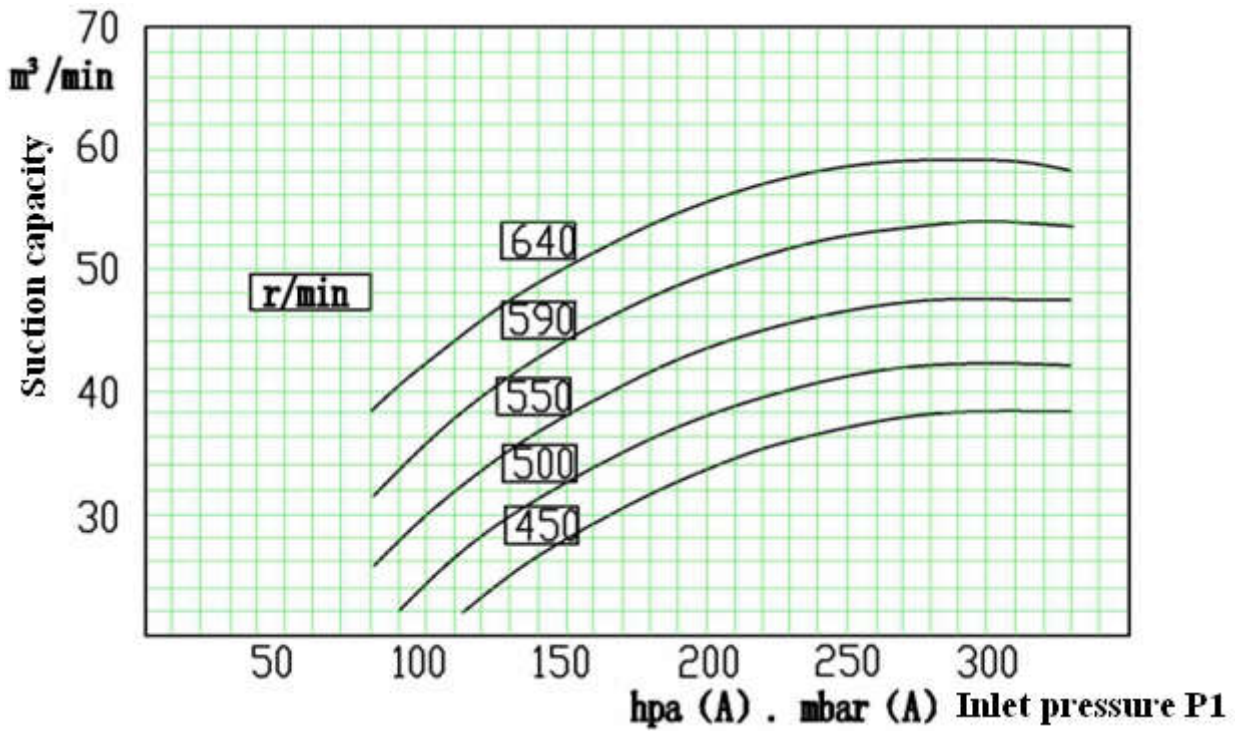
**CL2002 shaft power curve**



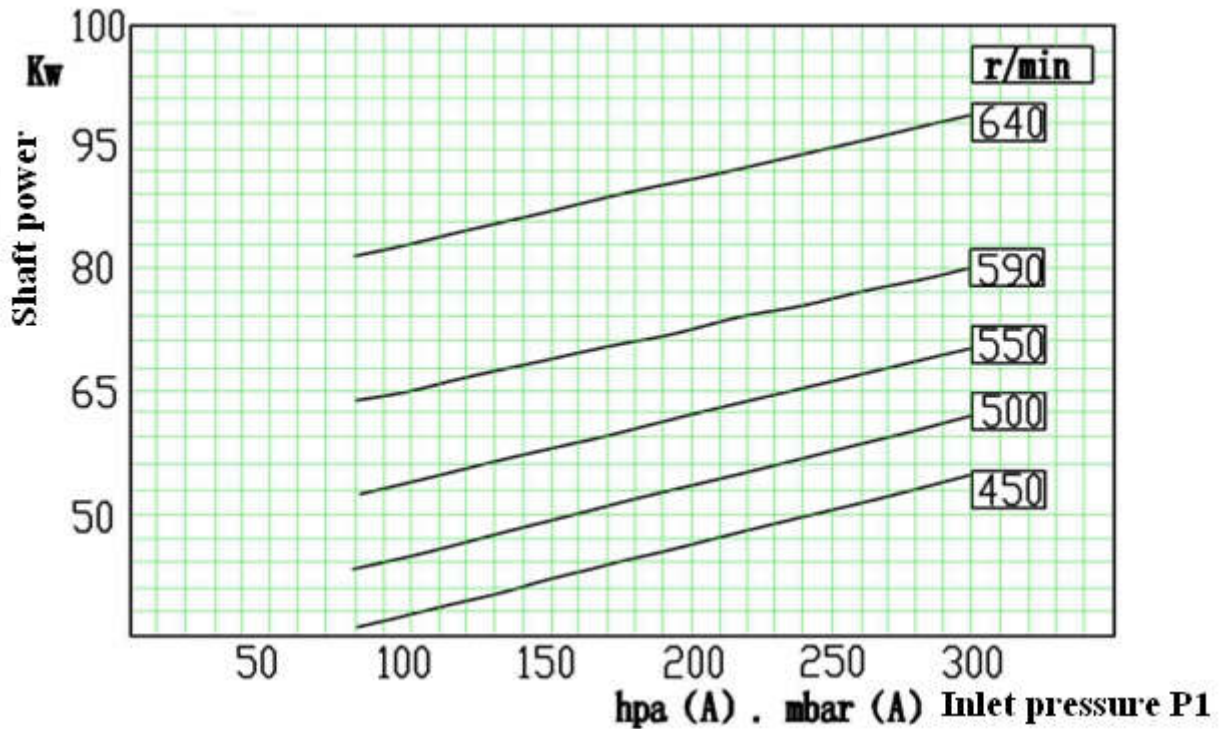
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

**CL2003 suction speed curve**



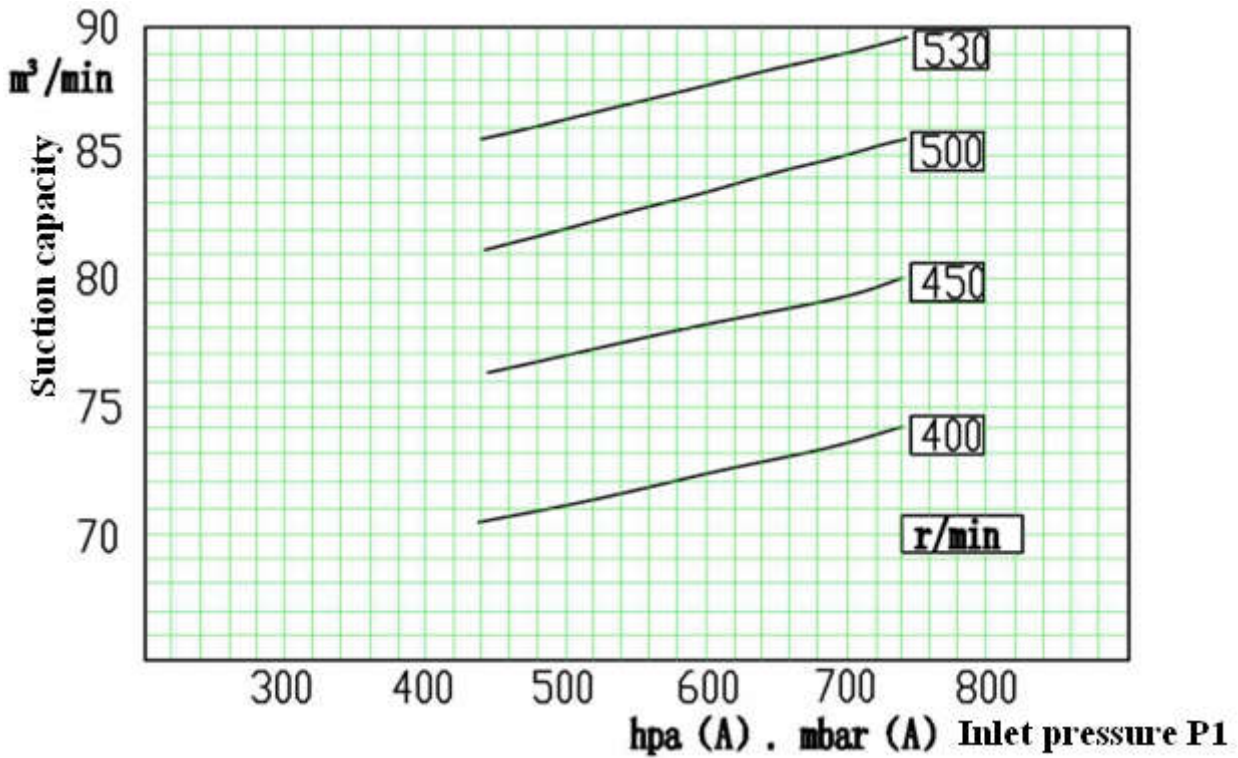
**CL2003 shaft power curve**



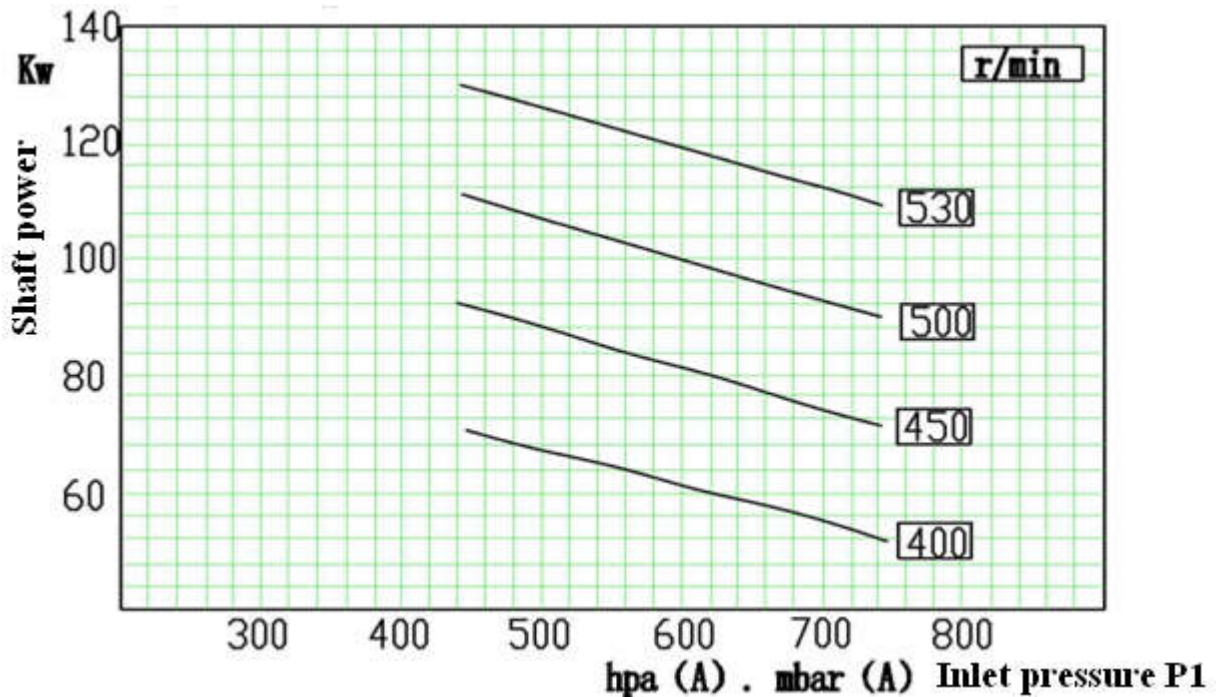
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL3001 suction speed curve



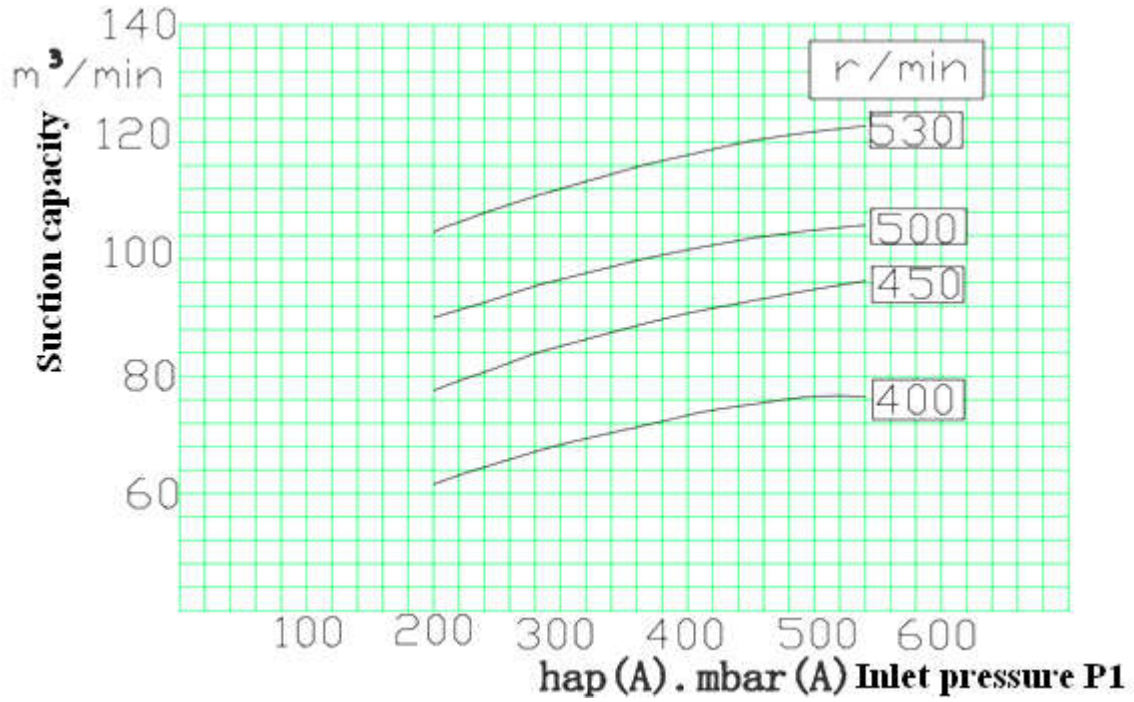
### CL3001 shaft power curve



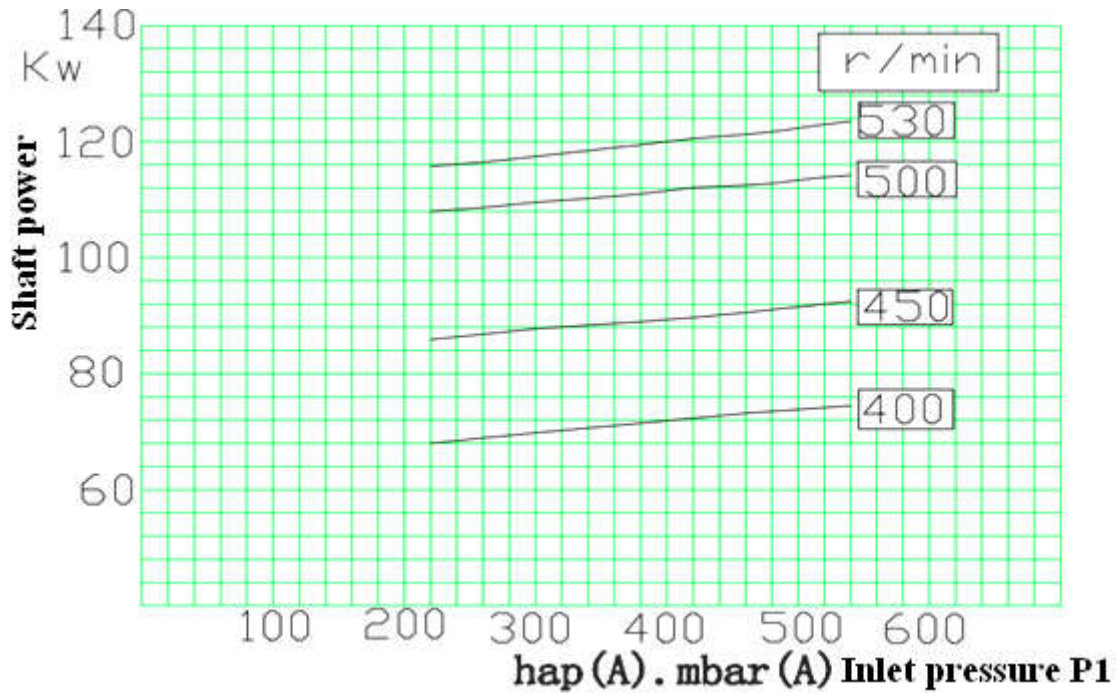
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL3002 suction speed curve



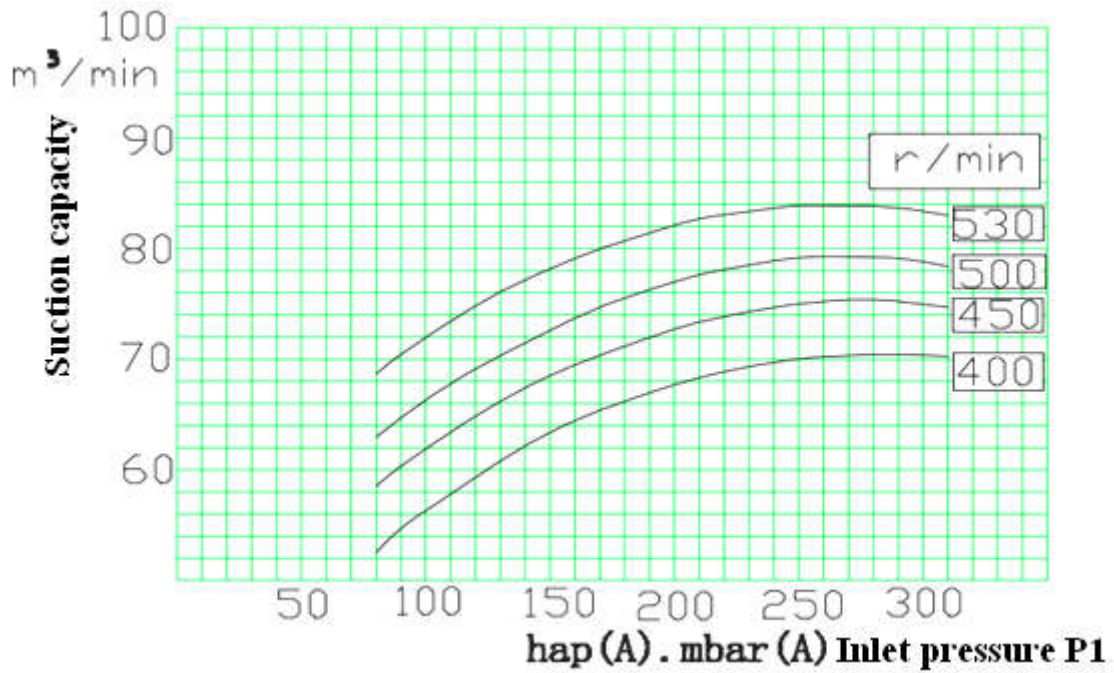
### CL3002 shaft power curve



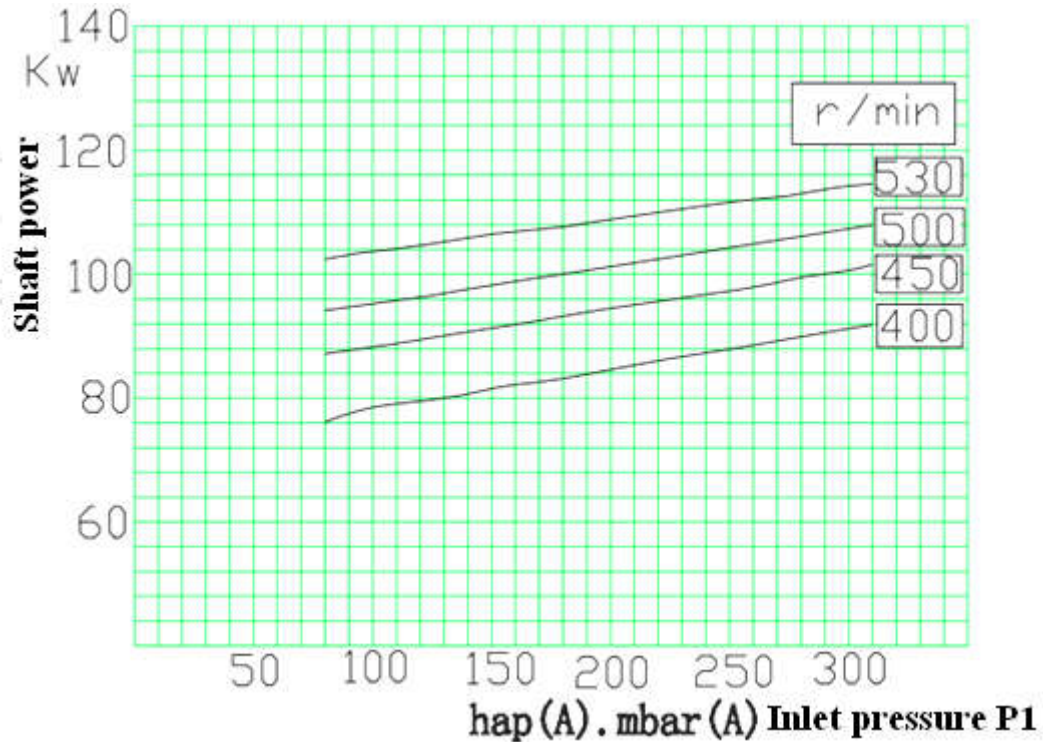
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL3003 suction speed curve



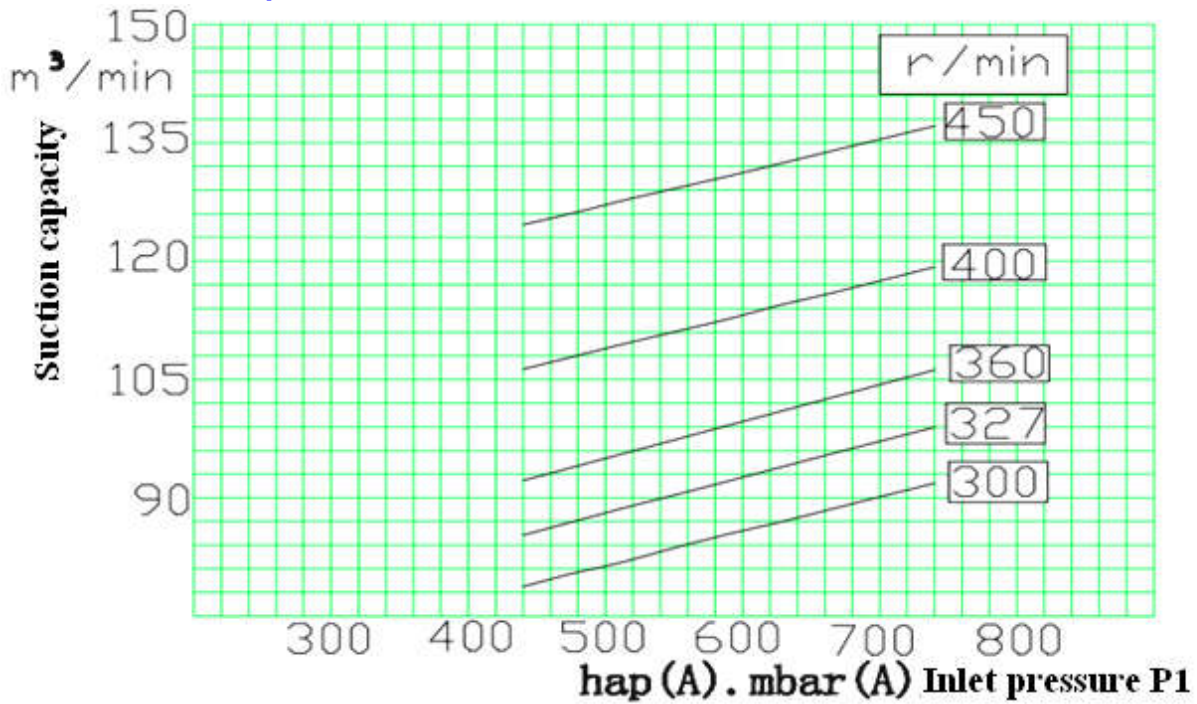
### CL3003 shaft power curve



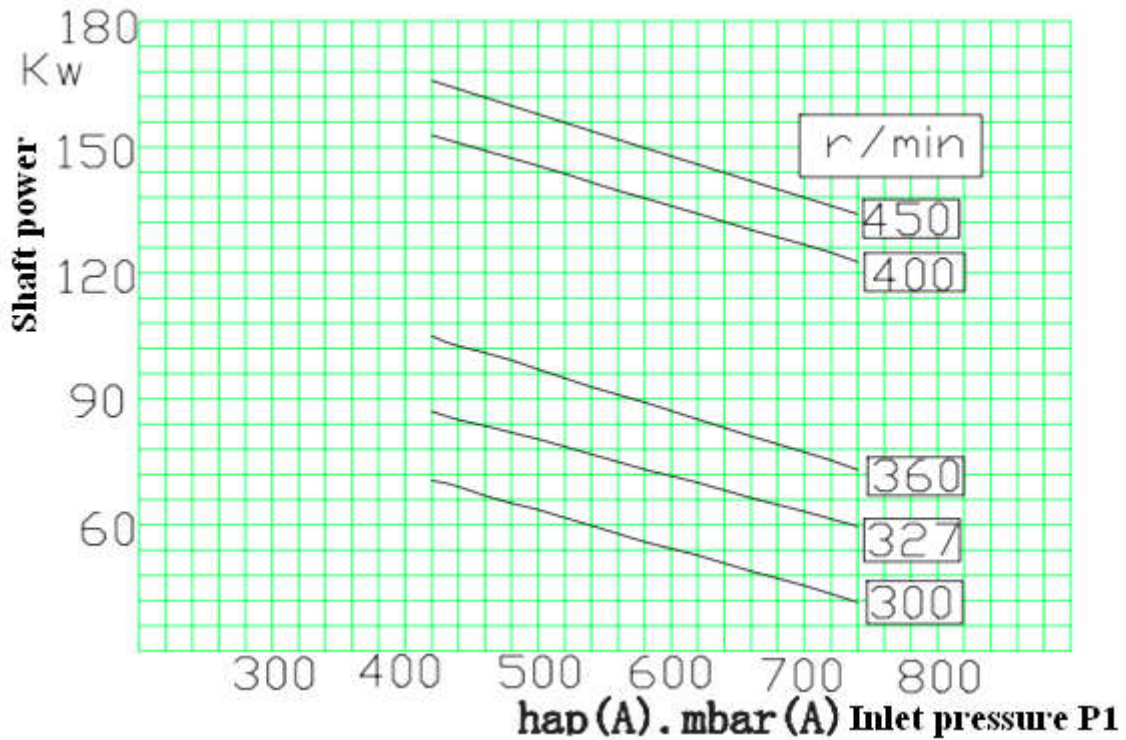
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL4001 suction speed curve



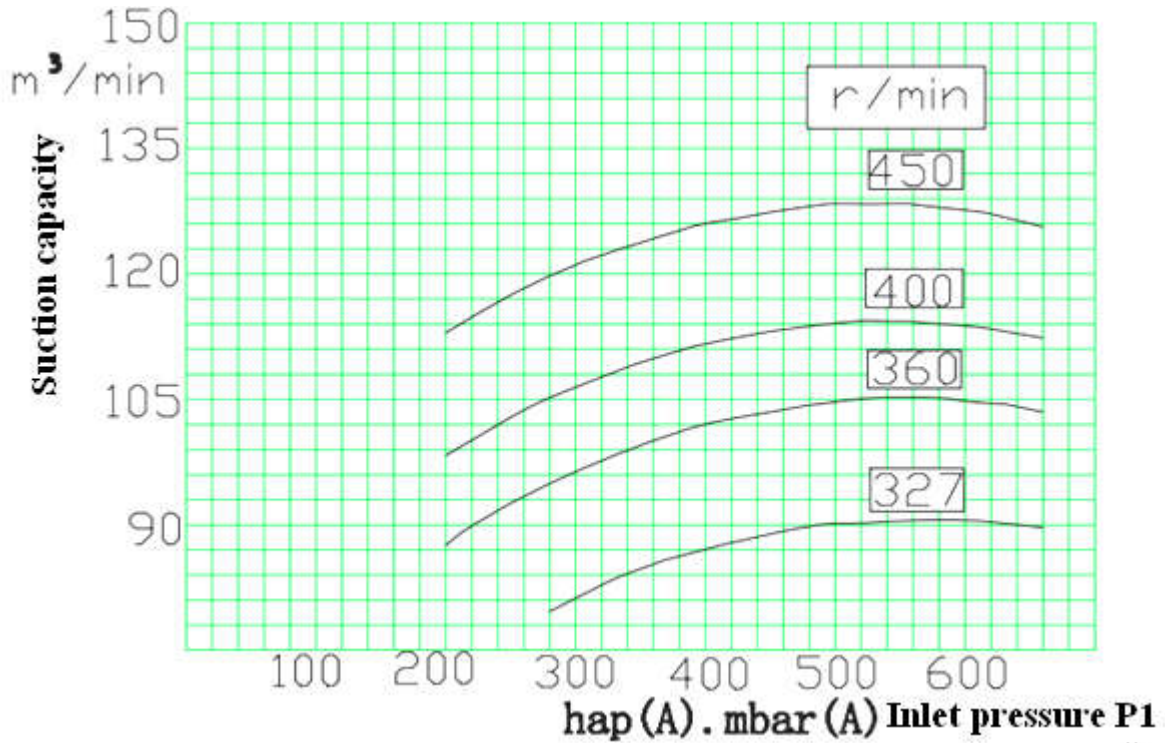
### CL4001 shaft power curve



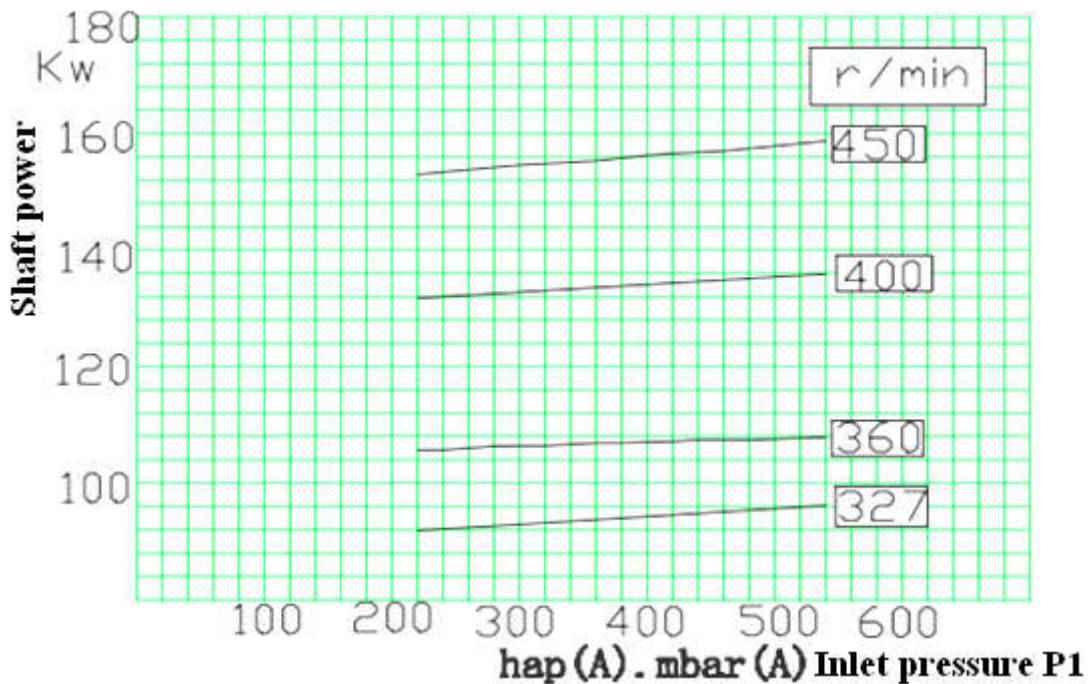
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL4002 suction speed curve



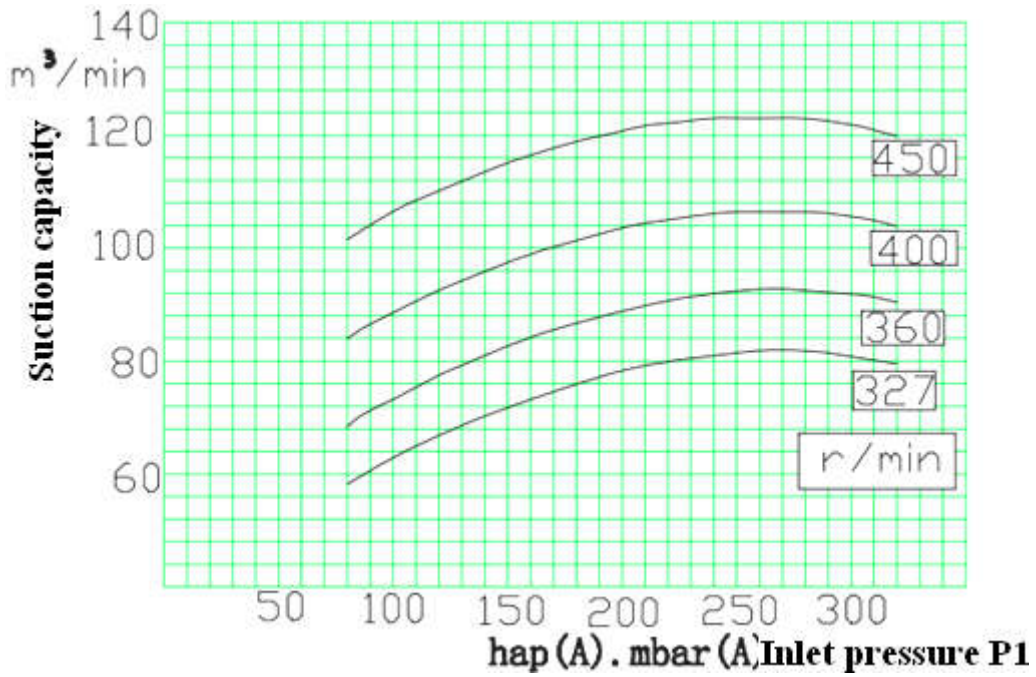
### CL4002 shaft power curve



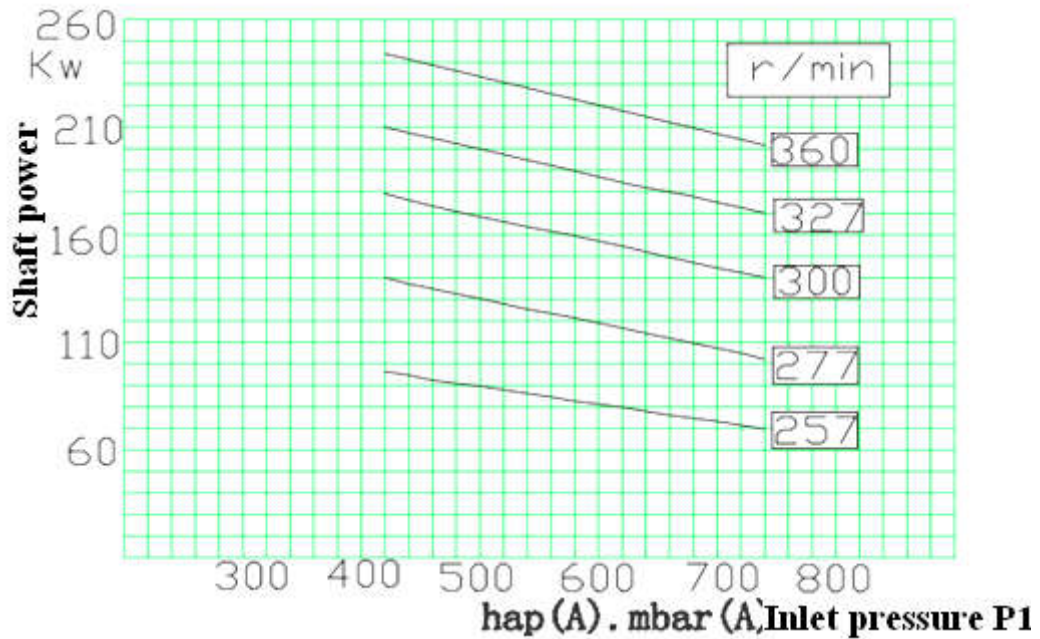
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL4003 suction speed curve



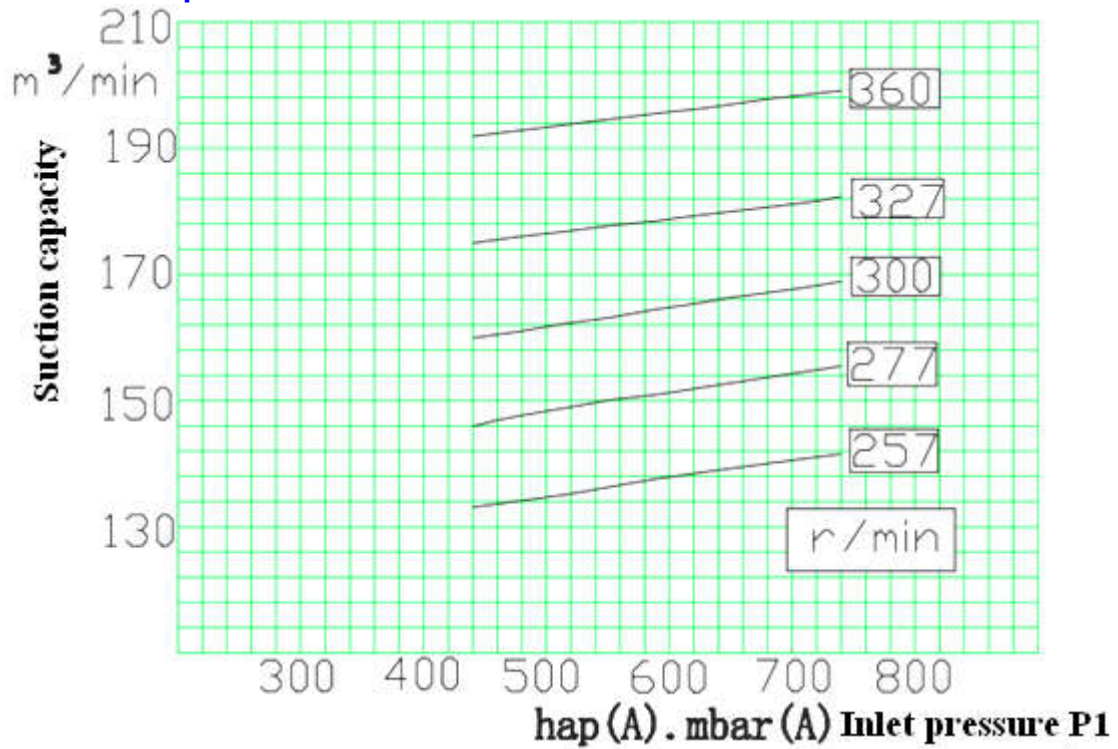
### CL4003 shaft power curve



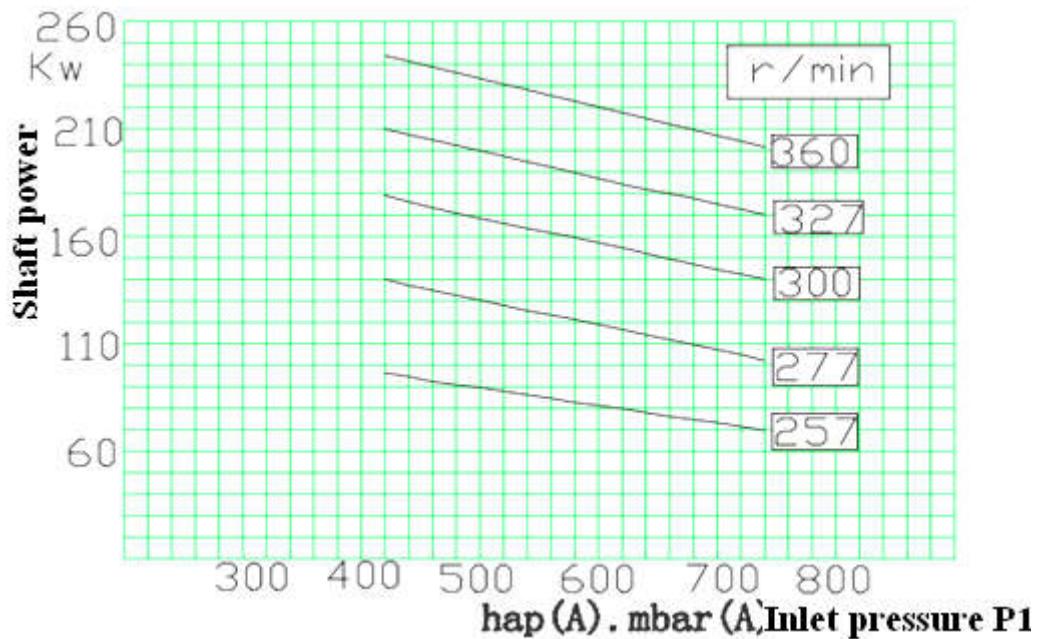
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL6001 suction speed curve



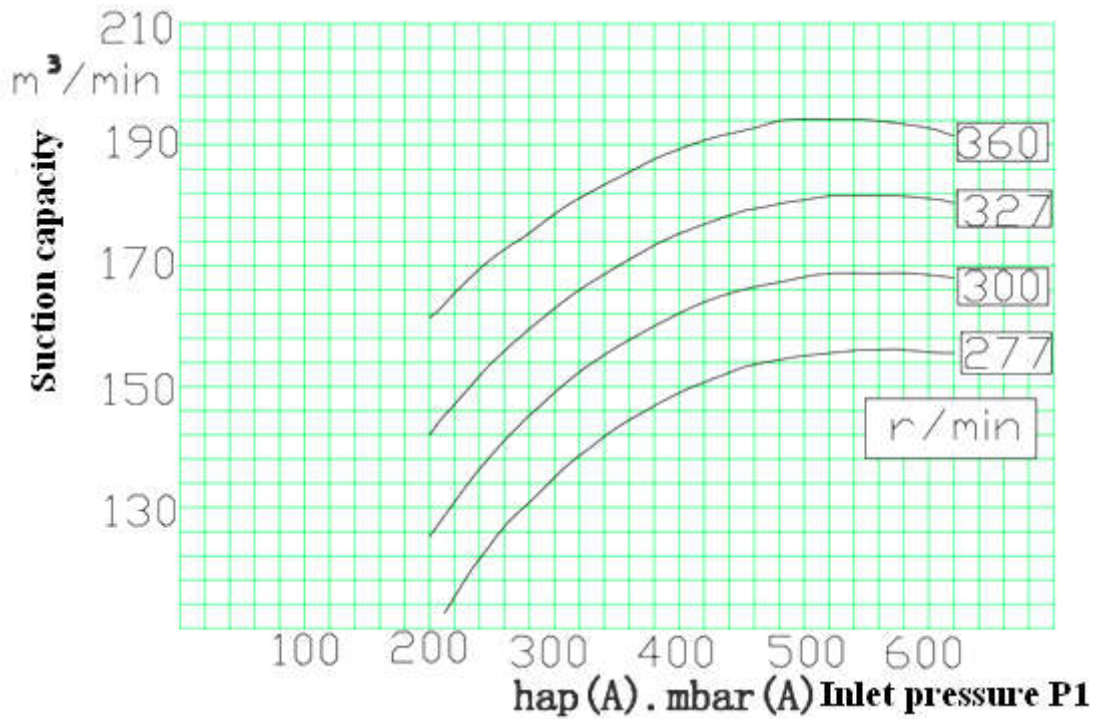
### CL6001 shaft power curve



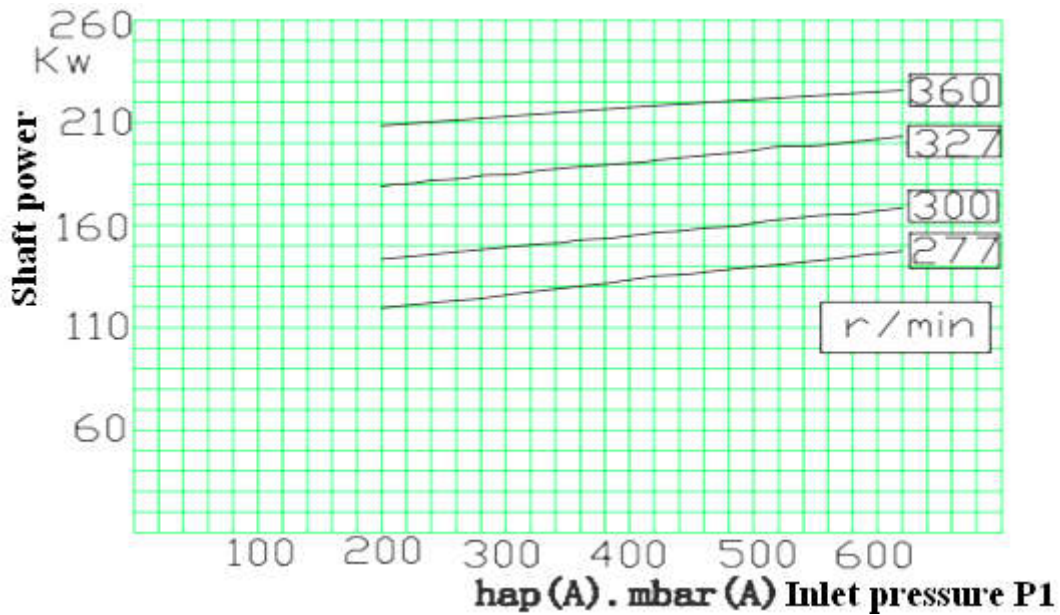
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL6002 suction speed curve



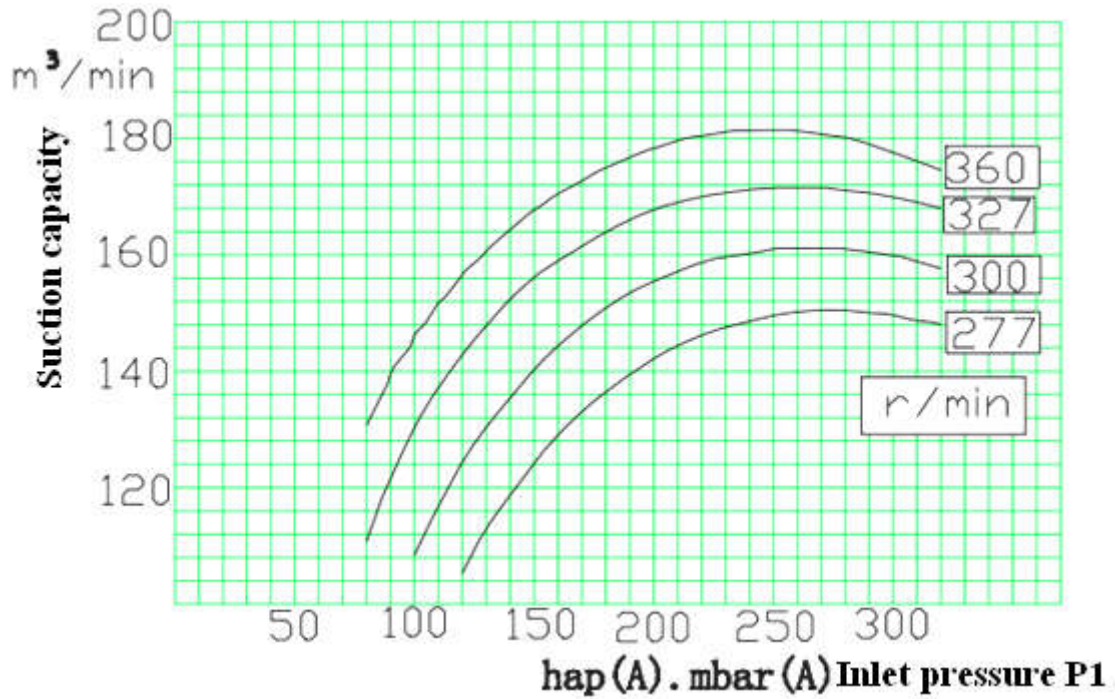
### CL6002 shaft power curve



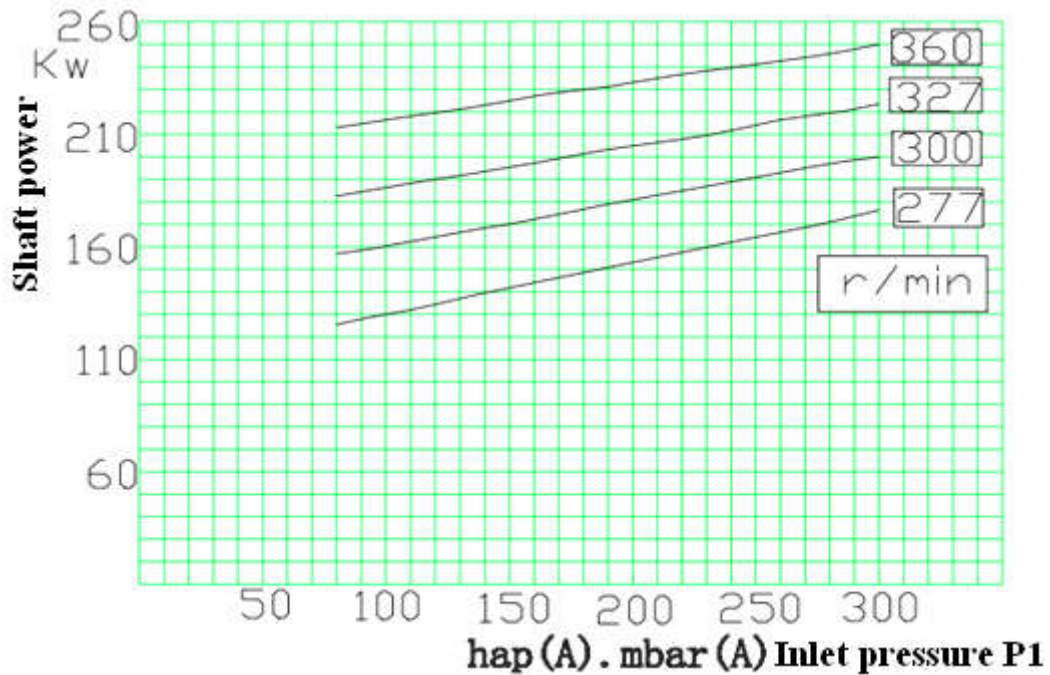
Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

### CL6003 suction speed curve



### CL6003 shaft power curve



Note: CL series vacuum pump curve is obtained under the following condition:

1. Suction temperature 20°C
2. Operating liquid temperature 15°C
3. Outlet pressure is a standard atmospheric pressure (1013mbar)
4. Suction medium is saturated air
5. Performance tolerance ±10%

## 7. Water flow

Other liquid is used as operating liquid in solvent recycling sometimes, but water is the most common choice of CL vacuum pumps. The table below is the water flow in rated state.

Water passes through the pore plate and communicates with the pump. Flow adjustment is controlled by the manual valve and pressure gauge on the pore plate pipe or extended pipe.

allow flow changes in wide range. Under some circumstance, lower the flow rate does not influence pump performance. In some application process, all or part of the operating liquid enter the pump from the pump inlet port.

The lower the water temperature, the better the pump performance. Performance curve data in this instruction is measured in 15°C water temperature.

Actually, CL vacuum pumps	Low vacuum		Medium vacuum		High vacuum	
	Vacuum pump	GPM	Vacuum pump	GPM	Vacuum pump	GPM
	CL4001	30	CL4002	60	CL4003	100
	CL3001	25	CL3002	50	CL3003	70
	CL2001	20	CL2002	25	CL2003	50
	CL1001	15	CL1002	20	CL1003	30
	CL701	10	CL702	15	CL703	20

## 8. Proposals for model selection

Selection usually begins with serial number, the nominal suction capacity of inlet port is listed after CL. Suction capacity is related to many factors, model can be chosen according to frequent vacuum range, special range is also available.

### 8.1 Conical inlet

The last number of CL model code means one of the three cone model, 1 for low vacuum, 2 for medium vacuum and 3 for high. The curves in this brochure present the ideal work range, with power increase, the suction capacity decrease.

### 8.2 Double stage pump

CL vacuum pumps reach the vacuum degree as high as 30mbar, the other method is adopting series connection of CL pump and air ejector, which is accepted by many special projects. In actual application,

if vacuum degree needed above the max. value on performance curve, we will provide the best program according to your demand.

### 8.3 Speed

The performance curve suggests max. speed, and shows performance in different speed. Many engineer choose system of low speed, the reason is to increase stability and prolong service life. This conventional method decrease suction capacity as well as corresponding energy consumption. Of course this method of retaining allowance is beneficial to future operation. If the suction capacity is added or flow changed, replace the motor, instead of change the whole equipment.

The combination with motor, v-belt or gear box produces different performance curve. To avoid

confusion, the suction capacity and power are shown only at rated speed, other detailed data please consult our company.

#### 8.4 Temperature

The performance curves are obtained at operating liquid temperature 15.6°C, lower temperature improves the performance. If saturated vapor is used as inlet gas, they may be condensate by operating liquid, in which way it enhances the pump capacity.

#### 8.5 Material

An effective method of anti-corrosion is to form a rotating zone; this structure means no necessary of

special material CL pump.

A rotor made of ductile iron is fitted on steel shaft; the cone and casing are made of cast iron; small pump adopts bronze rotor; small components also adopt bronze material.

Inner components of whole cast iron pump can be made in various sizes. Except special large pumps, acid proof bronze can be applied, and pumps under code CL2000 can be made of complete bronze, rotor of pump code under CL3000 can be made in bronze or both rotor and cone, ss304,316, 316L, or composite material of stainless steel and cast iron can also be adopted.