

機械式真空助力幫浦

真空排氣系統

MECHANICAL BOOSTER PUMPS
VACUUM PUMPING SYSTEMS



大豐





自1946年創立以來，大豐產品從早期的抽水機、空壓機以至於目前的工業用送排風機、魯氏鼓風機及真空幫浦，在在都由於品質優良、經久耐用而獲致工業界一致的好評，產品更行銷至中南美及東南亞諸國，也因此使“大豐牌”成為流體機械界之專業與信心的標誌。

真空技術在能源工業、電子工業、光電工業、新材料、生物科技、宇宙太空工業等尖端科技扮演著極為重要的角色，大豐在這方面除產製大小各型性能優異的真空幫浦外，並於廿年前先知卓見地憑藉既有的設計經驗與製造技術，開發出目前國內仍獨家產製的中高真空寵兒—機械式真空助力幫浦，其與傳統真空幫浦所組成的真空排氣系統，為工業界的品質提升、成本降低、能源節省提供了莫大的助力。今後大豐仍將秉持一貫的嚴謹態度，以創新開發的精神繼續提供高品質、高技術的產品及最佳的服務來報答客戶的愛護，並以「工業技術的先鋒、流體機械的權威」自我期許大步邁出大豐更燦爛輝煌的明天！

Ever since establishment in 1946, TAHONG started with manufacture of water pumps, air compressors, and the present industrial blowers, Roots blowers, and vacuum pumps. The superb quality and durability in our products have won unanimous praise from industry field. TAHONG's products cover many overseas markets such as Latin America and South-east Asia. In fact, "TAHONG Brand" has become a trademark signifying the confidence in the product quality on the part of fluid machinery industry.

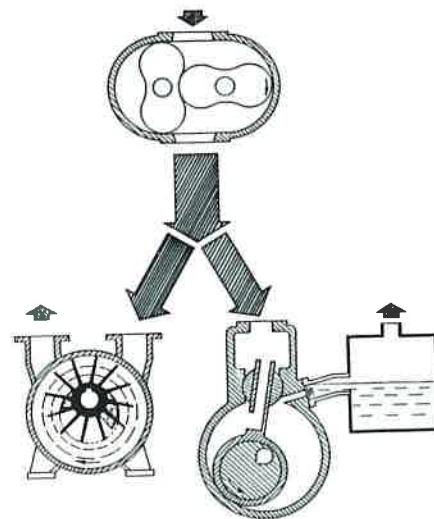
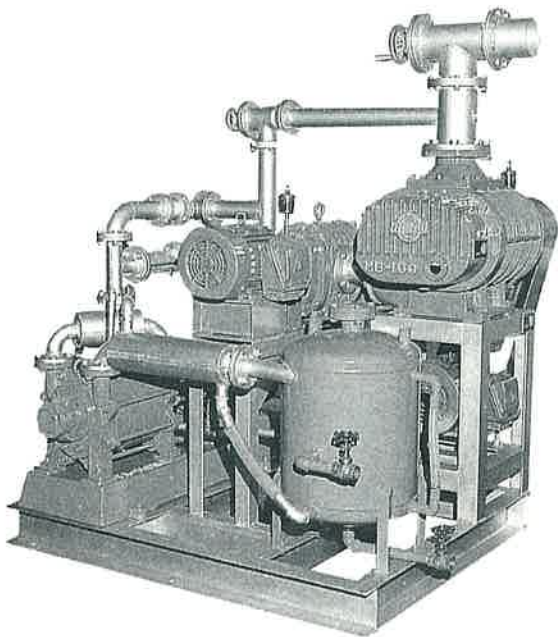
In consideration of a key role performed by vacuum techniques in the fields of petrol industry, electronic, photolight, new materials, biological technology, and space industry, TAHONG spared no effort in the development and production of vacuum pumps of different sizes and performances to meet with a variety of requirements in addition to development of mechanical booster vacuum pump - the first type of such outstanding product till this day in the Republic of China - that combines with conventional vacuum pump to form an integrated system. This system contributes a great deal to upgrading of product quality, reduced production cost, saving of energy. From now on, TAHONG will continuously adhere to the established policy to develop hi-tech quality products plus excellent customer service so as to reciprocate the support and patronage of our customers. We commit ourselves to the mission of "PIONEER OF INDUSTRIAL TECHNOLOGY, AUTHORITY OF FLUID MACHINERY". We are confident that we will see a brighter tomorrow.

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真空排氣系統 Vacuum Pumping Systems



何謂真空排氣系統？

機械式真空助力幫浦，在中高真空範圍具有大排氣速度，但却不能將氣體直接壓縮排出於大氣，而油迴轉真空幫浦及液封式真空幫浦能抽取真空直接排出於大氣，但是在中高真空範圍其效率却較低，因此若將機械式真空助力幫浦適當地配合選擇油迴轉真空幫浦或液封式真空幫浦做為輔助幫浦，能大量增加排氣速度並提高真空度，整個排氣系統配合真空計、真空開關、釋放閥、氣動真空閥及其他控制元件可自動化控制，操作簡單，而不必考慮機械式真空助力幫浦的起動時機及操作方法。

真空排氣系統的優點：

高真空度高品質

符合既需大排氣量且又要高真空度的操作條件，使產量增加、品質穩定。

縮短操作時間

在所需中高真空之下，仍具有特大的排氣速度，可縮短排氣時間提高設備的生產力。

節省能源

組合排氣系統的總馬力數僅為使用傳統機型所需的40~50%，節省長期的運轉成本。

購置成本低

組合排氣系統的購置成本約為欲達同一性能而並聯數台傳統真空幫浦所需的50~60%。

不佔空間操作簡便

組合結構堅固、配置美觀且不佔空間，方便日後的保養與維護。

What are the Vacuum Pumping Systems?

Vacuum pumps, oil rotary or liquid ring vacuum pumps, can pump the gas out to atmosphere, but efficiency decreases in medium-high vacuum, i.e., their pumping speed decreases rapidly. A mechanical booster with adequate gradation of the forepump is capable of achieving high pumping speed at this medium-high vacuum range. The whole pumping system with suitable vacuum switch, relief valve, pneumatic vacuum valve and other necessary control devices makes control and operation procedure automatic and simplified.

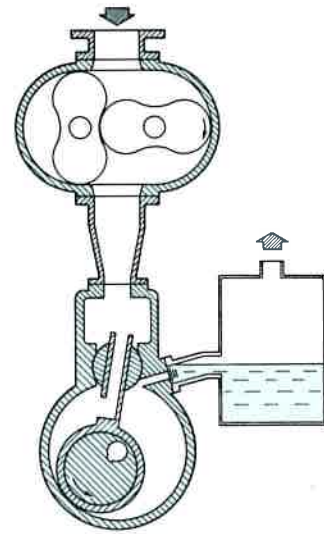
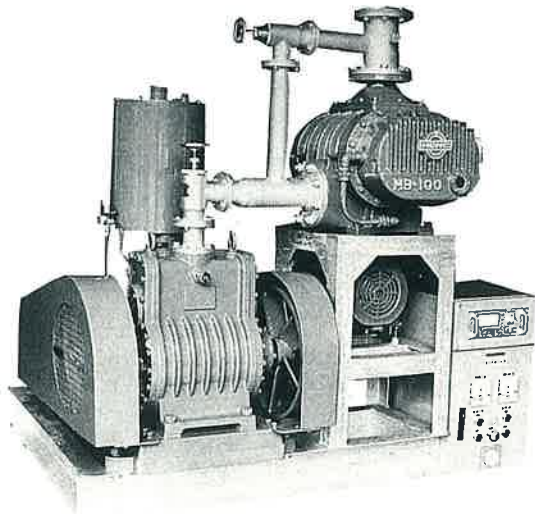
Features of Vacuum Pumping Systems

- High degree of vacuum and high quality:
It meets with the requirements for both voluminous pumping speed of air and high degree of vacuum for operation so as to boost productivity and stabilize product quality.
- Shortened operating time:
While the system maintains high degree of vacuum status, it still is capable of accelerated pumping speed so as to shorten the time for displacement of air that contributes greatly to productivity of facilities.
- Saving of energy:
Total HP of a combined vacuum pumping system is about 40 or 50% of the conventional pumping system, so that it assures saving of energy permanently.
- Low cost for procurement:
The procurement cost of combined vacuum pumping system is about 50-60% of several paralleled conventional vacuum pumps of identical performance.
- Compact dimensions and simplified operation:
TAHONG's vacuum pumping systems are characterized by rigid structure, elegant appearance, compact size, plus easy maintenance.



MBK標準真空排氣系

Standard "MBK" Vacuum Pumping Systems



MBK標準真空排氣系統規格 Specifications Of Standard MBK Series

MBK I

Ultimate Pressure $1 \times 10^{-3} \sim 5 \times 10^{-4}$ Torr
 Working Pressure Range $5 \times 10^{-3} \sim 20$ Torr

型 式 Model	理論排氣速度 Displacement m ³ /h	最 終 壓 力 Ultimate Press. Torr	組 配 機 型 Combination of Pumps	馬 力 Power Required HP
MBK I-50	250	1×10^{-3}	MB50 + KV1500	2+3
MBK I-65	380	1×10^{-3}	MB65 + KV1500	2+3
MBK I-80	500	1×10^{-3}	MB80 + KV1500	3+3
MBK I-100	1000	5×10^{-4}	MB100+KV3000	5+5
MBK I-125	1500	5×10^{-4}	MB125+KV3000	7 ¹ / ₂ +5
MBK I-150	2500	5×10^{-4}	MB150+KV4500	10+10
MBK I-200	3500	5×10^{-4}	MB200+KV7500	15+15
MBK I-250	4500	5×10^{-4}	MB250+KV7500	20+15

MBK II

Ultimate Pressure $1 \times 10^{-4} \sim 8 \times 10^{-5}$ Torr
 Working Pressure Range $5 \times 10^{-4} \sim 5$ Torr

型 式 Model	理論排氣速度 Displacement m ³ /h	最 終 壓 力 Ultimate Press. Torr	組 配 機 型 Combination of Pumps	馬 力 Power Required HP
MBK II-80	500	4×10^{-4}	MB80 + MB50 + KV1500	3+2+3
MBK II-100	1000	1×10^{-4}	MB100+MB65 + KV1500	5+2+3
MBK II-125	1500	1×10^{-4}	MB125+MB80 + KV1500	7 ¹ / ₂ +3+3
MBK II-150	2500	1×10^{-4}	MB150 + MB80 + KV1500	10+3+3
MBK II-200	3500	8×10^{-5}	MB200+MB100+KV3000	15+5+5
MBK II-250	4500	8×10^{-5}	MB250 + MB100 + KV3000	20+5+5



MBK系列購置、運轉、維護成本較為便宜

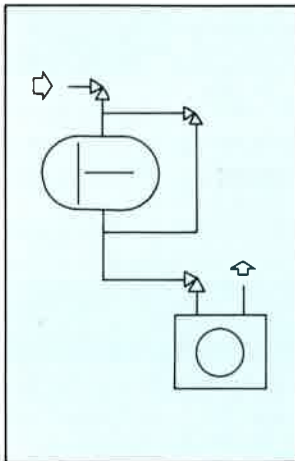
- 以油迴轉真空幫浦作為輔助幫浦，最終壓力可達 10^{-4} Torr 一般使用範圍在 $1\sim 10^{-3}$ Torr 之間最為合適。
- 若經常連續使用於壓力20Torr 以下，則MBK 系列比單台大型真空幫浦或其他排氣系統更能節省購置、運轉、維護等各項成本。
- MBK系列操作時由油迴轉真空幫浦單獨從大氣壓抽至20至60Torr 左右，然後，再起動機械式真空助力幫浦，此後排氣速度大為增加，更可達到 10^{-4} Torr，因此連續使用於真空度在20Torr至 10^{-3} Torr左右時，建議選用本MBK系列。
- 抽取氣體中若含有少量水蒸氣或其他凝結性氣體，可加裝氣體壓載閥(gas ballast valve)或水分離器等附件。

MBN Series has Wide Working Range

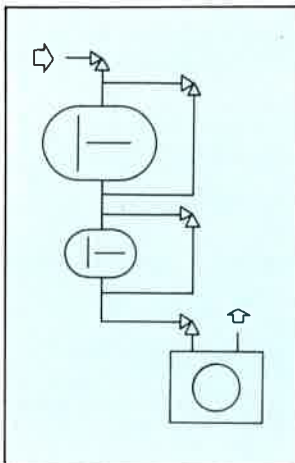
The oil rotary vacuum pump is used as forepump of MBK system Their ultimate pressure is in the 10^{-4} torr range, which can handle a little quantity of vapor or vapor-gas mixtures evolved in a vacuum process if the gas ballast is fitted on oil rotary vacuum pump.

流程圖 LAYOUT

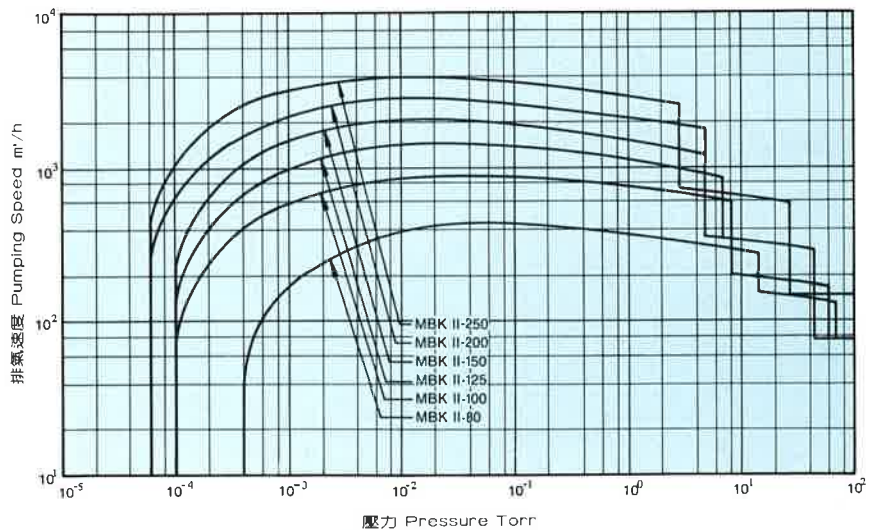
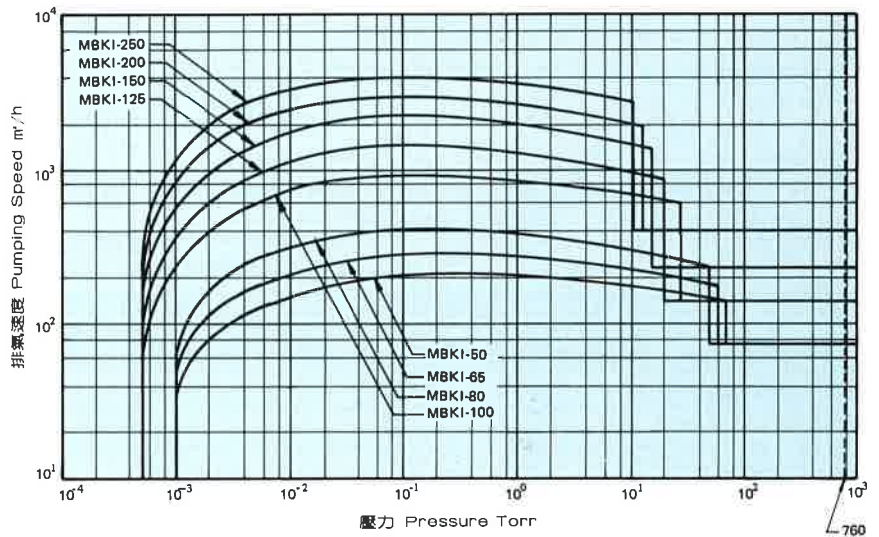
MBK I



MBK II



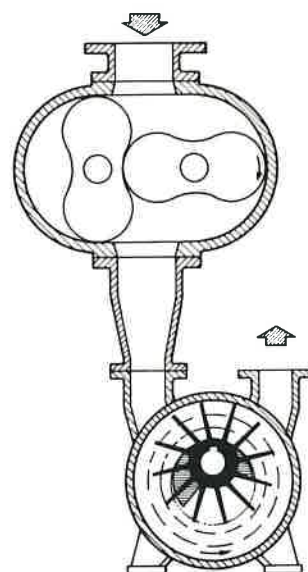
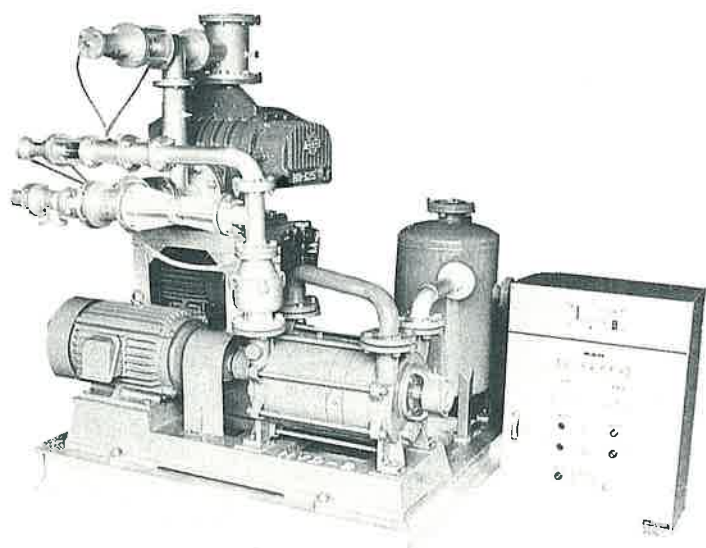
排氣速度曲線 Pumping Speed Curves





MBN標準真空排氣系統

Standard "MBN" Vacuum Pumping Systems



MBN標準真空排氣系統規格 Specifications Of Standard MBN Series

MBN I

Ultimate Pressure 2~0.5 Torr
Working Pressure Range 5~50 Torr

型式 Model	理論排氣速度 Displacement m ³ /h	最終壓力 Ultimate Press. Torr	組配機型 Combination of Pumps	馬力 Power Required HP
MBN I-50	250	2	MB50+NVD45	2 + 10
MBN I-65	380	2	MB65+NVD45	2 + 10
MBN I-80	500	2	MB80+NVD45	3 + 10
MBN I-100	1000	0.6	MB100+NVD50	7 1/2 + 25
MBN I-125	1500	0.6	MB125+NVD50	10 + 25
MBN I-150	2500	0.5	MB150+NVD80	15 + 50
MBN I-200	3500	0.5	MB200+NVD100	20 + 75

MBN II

Ultimate Pressure 0.1~0.04 Torr
Working Pressure Range 0.4~10 Torr

型式 Model	理論排氣速度 Displacement m ³ /h	最終壓力 Ultimate Press. Torr	組配機型 Combination of Pumps	馬力 Power Required HP
MBN II-50	250	0.1	MB50+ATM40+NVD45	2 + 10
MBN II-65	380	0.1	MB65+ATM40+NVD45	2 + 10
MBN II-80	500	0.08	MB80+ATM40+NVD45	3 + 10
MBN II-100	1000	0.04	MB100+ATM50+NVD50	5+0+25
MBN II-125	1500	0.04	MB125+ATM50+NVD50	7 1/2+0+25
MBN II-150	2500	0.04	MB150+ATM80+NVD80	10+0+25
MBN II-200	3500	0.04	MB200+ATM100+NVD100	20+0+75



MBN III

Ultimate Pressure $1 \times 10^{-2} \sim 7.5 \times 10^{-3}$ Torr
Working Pressure Range 0.08 ~ 5 Torr

型式 Model	理論排氣速度 Displacement m ³ /h	最終壓力 Ultimate Press. Torr	組配機型 Combination of Pumps	馬力 Power Required HP
MBN III-65	380	1×10^{-2}	MB65 + MB65 + ATM40 + NVD45	2 + 2 + 0 + 10
MBN III-80	500	1×10^{-2}	MB80 + MB50 + ATM40 + NVD45	3 + 2 + 0 + 10
MBN III-100	1000	7.5×10^{-3}	MB100 + MB65 + ATM40 + NVD45	5 + 2 + 0 + 10
MBN III-125	1500	7.5×10^{-3}	MB125 + MB80 + ATM50 + NVD50	7 1/2 + 3 + 0 + 25
MBN III-150	2500	7.5×10^{-3}	MB150 + MB100 + ATM50 + NVD50	10 + 5 + 0 + 25
MBN III-200	3500	7.5×10^{-3}	MB200 + MB100 + ATM80 + NVD80	15 + 5 + 0 + 40
MBN III-250	4500	7.5×10^{-3}	MB250 + MB100 + ATM80 + NVD80	20 + 5 + 0 + 40

1. 表中液封式真空幫浦“NVD”，其封液為20°C的水。
2. 如果在操作過程中，被抽氣體含有大量可凝結性氣體，尤其是水蒸氣時，配上冷凝器於系統中是最經濟的方法。

1. The temperature of service liquid used in “NVD” pumps is 20°C water.
2. To pump large quantity of vapor or vapor-gas mixtures evolved in a vacuum process, using condensers are the most economical method.

MBN系列最適合於水蒸氣及有機蒸氣等凝結性氣體的排氣

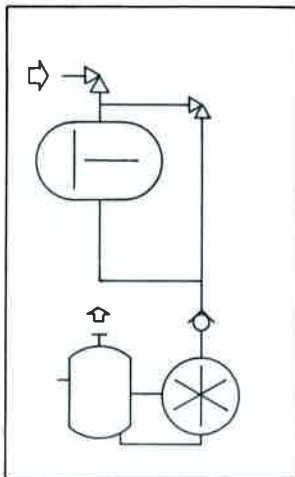
- 液封式真空幫浦最適於抽取含有大量水蒸氣或其他凝結性氣體因此若選擇液封式真空幫浦作為輔助幫浦的MBN系列亦將具有此項優點，特別適用於真空乾燥及真空蒸餾等工程。
- 一般使用範圍在20Torr~ 10^{-1} Torr之間最為適合，單台機械式真空助力幫浦的MBN系列，最終壓力達0.5Torr，加裝大氣助力器可達 10^{-2} Torr，二台機械式真空助力幫浦串聯並且加裝大氣助力器的MBN系統，不但排氣速度增加數倍，最終壓力亦可達 10^{-3} Torr。
- MBN系統中的液封式真空幫浦附有循環水桶，可避免排水的公害污染，特殊封液亦可回收循環使用，對於抽取腐蝕性氣體或爆炸性氣體，可依需要採用SUS材質或機械軸封等。

MBN Series is Particularly Suitable for Pumping Large Quantity of Vapor or Vapor-Gas Mixtures

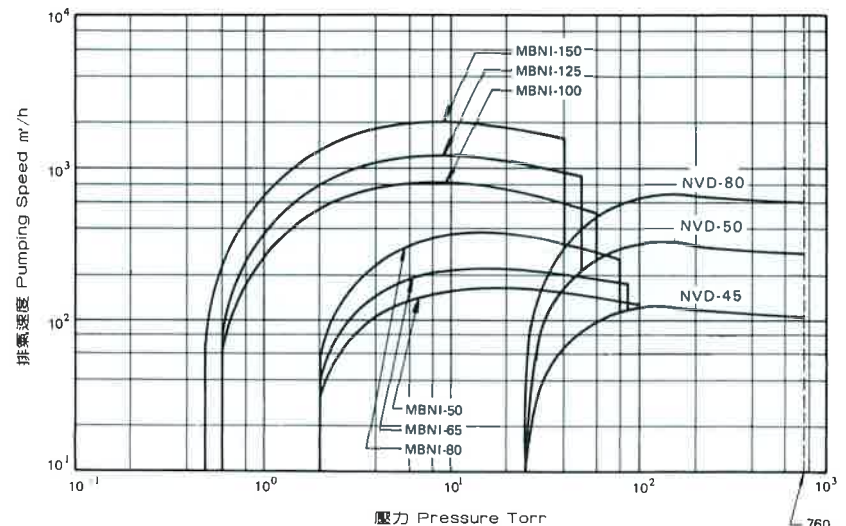
The liquid ring vacuum pump is used as forepump, of MBN system which is particularly suitable for large quantity of vapor or vaporgas mixtures evolved in a vacuum process to be pumped. Ultimate pressure for single-stage combinations is in 10^{-2} torr range. 10^{-3} torr could be arrived by two-stage combinations. Normal working range of above combinations is from 20 torr to 10^{-1} torr.

流程圖 Layout

MBN I

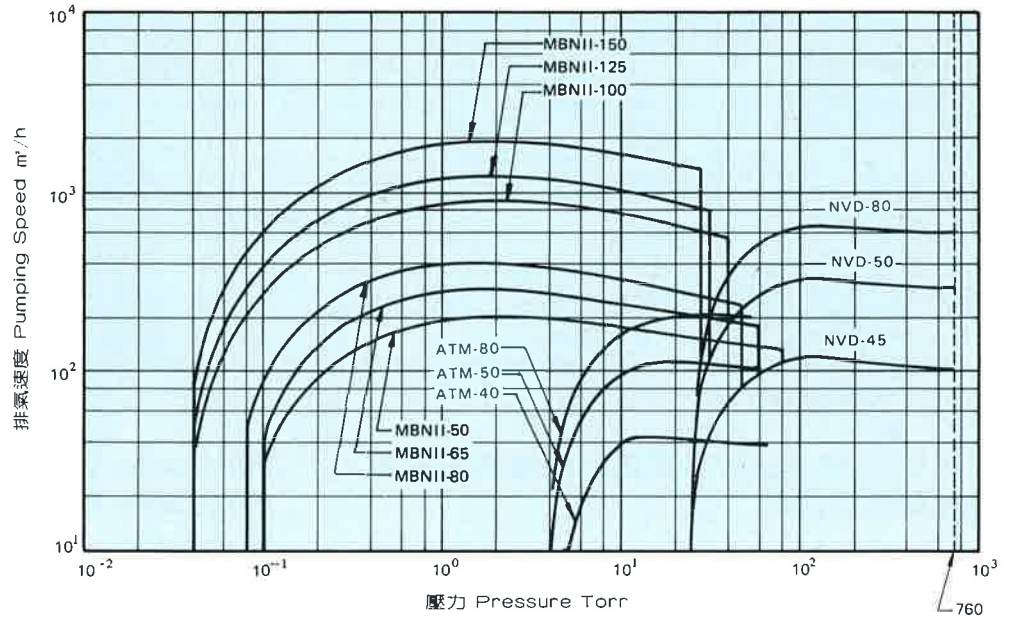
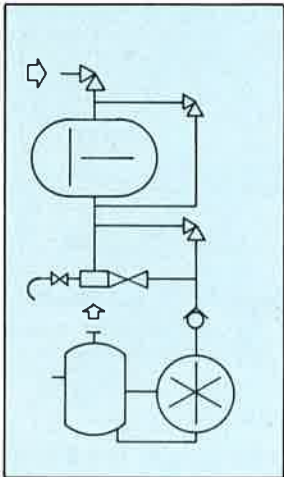


排氣速度曲線 Pumping Speed Curves

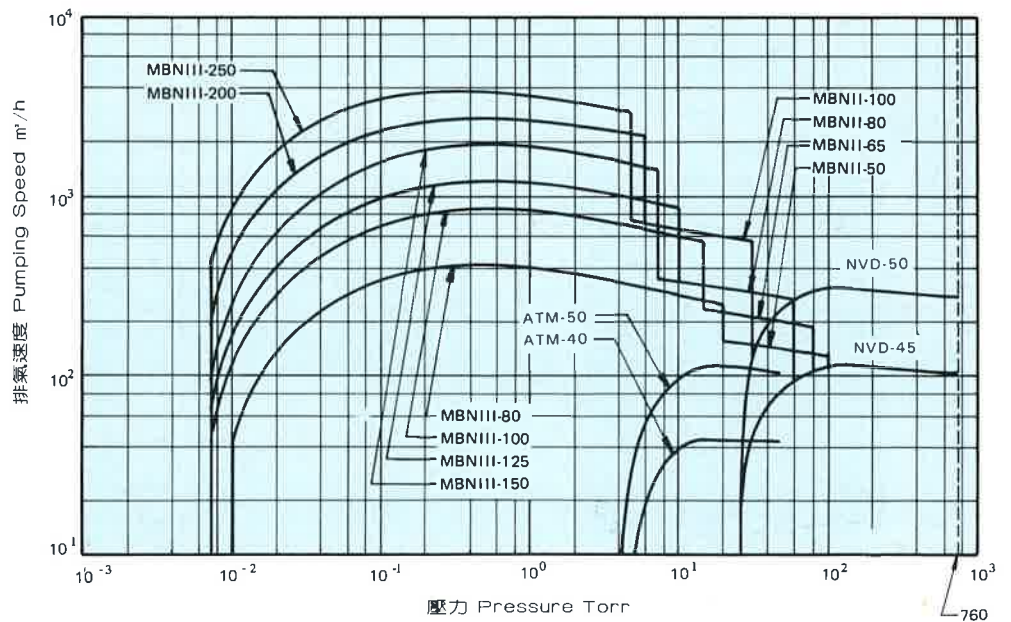
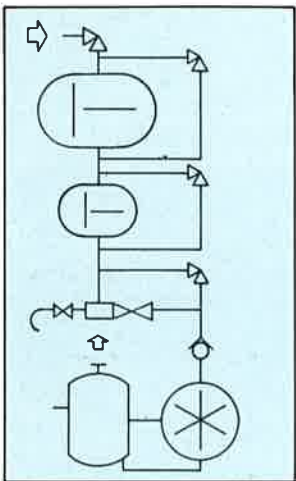




MBN II

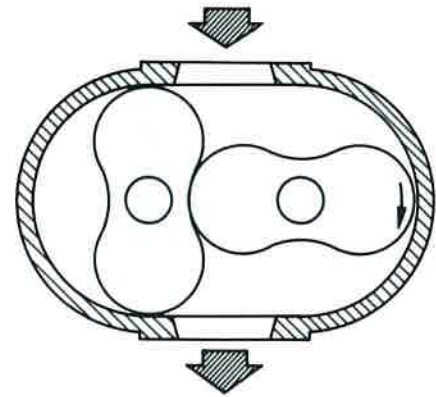
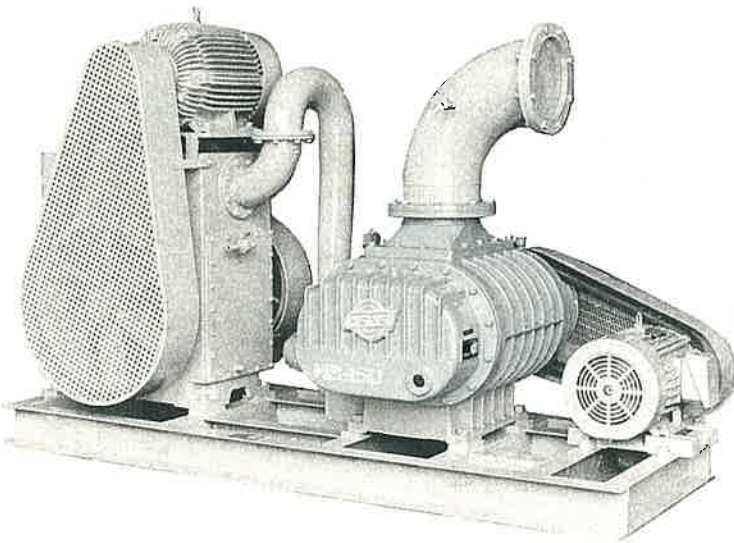


MBN III





機械式真空助力幫浦 Mechanical Booster



構造及原理

機械式真空助力幫浦係由魯氏(ROOTS)鼓風機發展而來，是一種容積形真空幫浦，在汽缸內有兩個“8”字型的轉子由外部的兩個同步齒輪帶動，以相反方向轉動，達成排氣的動作，齒輪和軸承係以潤滑油來潤滑，由於油箱與汽缸內部隔絕，因此不會污染轉子，可保持內部乾淨，運轉時，轉子與轉子、轉子與汽缸間維持著極小的間隙(大約在十分之幾毫米)，彼此互不摩擦以高速運轉，造成出入口間的壓力差，因此在中高真空範圍下能有特優的排氣速度，機械式真空助力幫浦的容積效率隨著輔助幫浦的排氣速度大小而變化，一般兩者間的排氣速度比大約在5~10之間，視使用的場合以及壓力來決定。

大豐牌機械式真空助力幫浦的特徵

- 特佳的容積效率。
- 寬廣的使用範圍，高排氣速度。
- 運轉平穩，噪音極低。
- 運轉費用低。
- 潤滑油不會污染轉子和汽缸內部。
- 運轉可靠，維護簡單。
- 不受氣體、水氣及粉末影響。
- 因屬氣冷式，不需冷却水。
- 臨界背壓高，可提早起動，縮短排氣時間。
- 配合壓力控制開關，可自動操作。
- 軸承及齒輪均使用潤滑油潤滑。

應用

機械式真空助力幫浦在真空下，有相當廣的壓力使用範圍，一般而言，大致從 10^{-3} ~40Torr之間，如與油迴轉真空幫浦組成真空排氣系統，可在中高真空下得到大量之排氣速度。當被抽氣體中含有大量的水氣或其它可凝結性氣體時，可選擇液封式真空幫浦作為輔助幫浦，如此在低壓下仍可維持高的排氣速度，可節省馬力，同時又不會因有水份或其它凝結性氣體而損及幫浦。

Design and Working Principle

Mechanical booster is a kind of positive displacement vacuum pump, which developed from ROOTS blower. There are two symmetrical rotors which are synchronized by external gears and rotate in opposite directions within a stator. The gears and bearings are oil lubricated but are external to the cylinder so that the rotors run dry. A small clearance, generally between a few tenth millimeter, is maintained between the rotors and between each rotor and the stator wall. Volumetric efficiency of a typical mechanical booster varies with the pumping speed of forepumps. The ratio for mechanical booster and forepump is generally about 5 to 10.

Features of TA HONG Mechanical Boosters

- High volumetric efficiency
- Wide working range
- High pumping speed over a wide pressure range
- Quiet running, low noise
- Low operating cost
- Lubricant-free chamber
- Reliable operation and little maintenance
- Unaffected by contaminating gases, vapors and dusts
- Pressure switch can be fitted at intake for pressure controlled operation

Applications

Mechanical booster searches a wide range of applications in vacuum field. In combination with oil rotary vacuum pump as forepump their working range extends to medium-high vacuum. Where large quantity of vapor or vapor-gas mixtures evolved in a vacuum process to be pumped, the combination of liquid ring vacuum pump and mechanical booster is particularly suitable for,



規格表 Specifications

		MB-50	MB-65	MB-80	MB-100	MB-125	MB-150	MB-200	MB-250	
理論排氣速度 Displacement	m ³ /h	50Hz	200	320	410	1000	1500	2500	3500	4500
		60Hz	250	380	500	1000	1500	2500	3500	4500
出入口容許壓力差 Press. Diff. between Suc. and Dis.	Torr	50Hz	110	110	90	80	75	55	50	45
		60Hz	100	100	80	70	65	45	40	35
幫浦轉速 Rotating Speed	R.P.M.	50Hz	1450	1450	1450	1450	1550	1480	1200	1000
		60Hz	1750	1750	1750	1450	1550	1480	1200	1000
使用馬力 Power Required	HP	50Hz	2	2	3	5	7 1/2	10	15	20
		60Hz	2	2	3	5	7 1/2	10	15	20
入口尺寸 Suction Dia. φmm		50	65	100	150	150	200	250	350	
出口尺寸 Discharge Dia. φmm		50	65	80	100	125	150	200	250	
重量 Weight kg		70	80	90	230	275	455	800	950	

機械式真空助力幫浦運轉的保護裝置

機械式真空助力幫浦的設計著眼於中高真空的排氣，且出入口壓力差值有一定的限制範圍，所以排氣系統的運轉須先起動輔助幫浦至某一真空度再起動機械式助力幫浦，並且排氣系統中不允許突然有大量氣體產生或流入造成流量過大或壓力急驟升高的現象，使馬達超過負荷，保護措施有加裝真空開關、釋壓閥等，但使用流體聯軸器時，可提前起動機械式真空助力幫浦。

- 真空開關的作用即自動控制機械式真空助力幫浦可於壓力到達設定值時運轉，管壓力空然升高超過設定值則自動停機，俟壓力再度回到設定值後重新起動，可自動保護馬達，以免超過負荷。
- 釋壓閥裝在出入口相通的管路上，能調節出入口的壓力差防止馬達發生超載。
- 機械式真空助力幫浦若加裝流體聯軸器，可與輔助幫浦一起從大氣壓起動，不但操作簡單，更可縮短排氣時間，簡化配管工程。

Protective devices for operating mechanical boosters

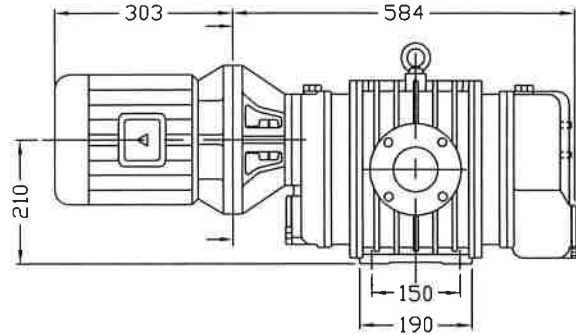
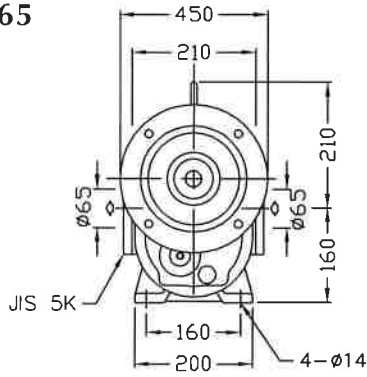
Mechanical boosters are designed for medium-high vacuum usage Pressure difference between suction and discharge has some limitation. Before switching on the mechanical booster, it must be waited that the pressure of suction of mechanical pump is pumped down to a certain value, which is performed by forepump or backing pump firstly. It is not permitted that the gas bursts into vacuum system while mechanical booster is pumping, otherwise the driving motor of mechanical booster will be overloaded or even the mechanical booster may be seized which caused by high pressure difference and temperature rise. There are some protective devices for operating mechanical boosters as follow:

- Vacuum switch – It is fitted at suction side of mechanical booster. While pressure down to the setting value of vacuum switch, the mechanical booster is switched on and running automatically, and vice versa.
- Relief valve – It is installed at by-pass between the suction and discharge of mechanical booster. While pressure difference over a certain value, the relief valve will be opened, and closed until pressure difference down to permissionable. It keeps the motor from overload and keeps the working temperature of mechanical booster within tolerable range.
- Fluid coupling – With fluid coupling, mechanical booster can be started from atmospher pressure together with fore-pump. By this, the pumpdown time can be shortened. Besides, the operating piping and maintenance procedure can be simplified.

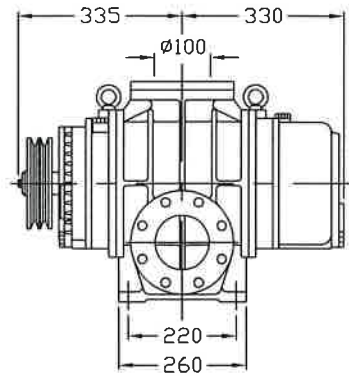
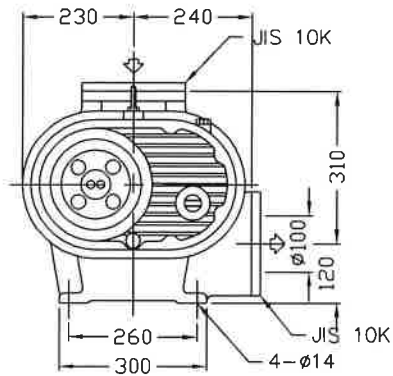


外形尺寸 Dimensions

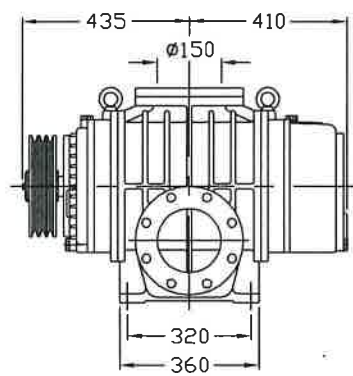
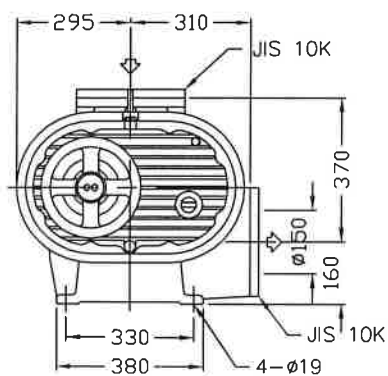
MB-65



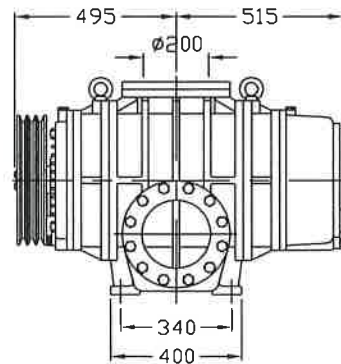
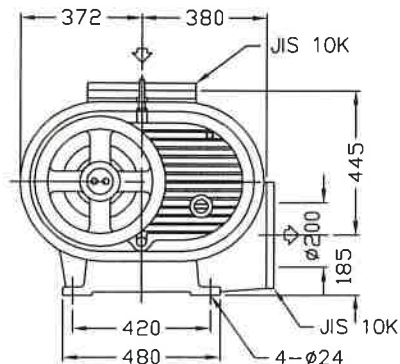
MB-100



MB-150

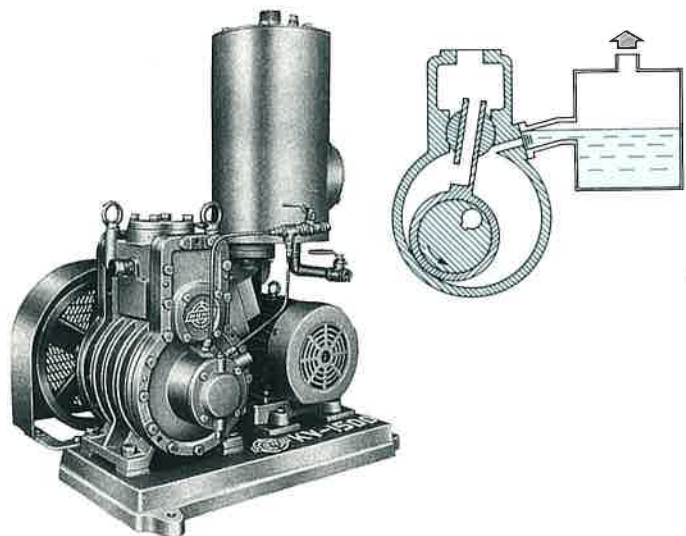


MB-200





油迴轉真空幫浦 Oil Rotary Vacuum Pumps



規格表 SPECIFICATIONS

	KV-1500	KV-3000	KV-4500	KV-7500
理論排氣速度 DISPLACEMENT l/min	1500	3000	4500	7500
最終壓力 ULTIMATE PRESSURE Torr	5×10^{-3}	5×10^{-3}	5×10^{-3}	5×10^{-3}
幫浦轉速 ROTATING SPEED RPM	450	380	440	440
使用馬力 MOTOR RATED HP x Pole	3 x 4	5 x 4	10 x 4	15 x 4
入口尺寸 SUCTION ϕ mm	50	80	80	100
出口尺寸 DISCHARGE ϕ mm	40	50	80	100

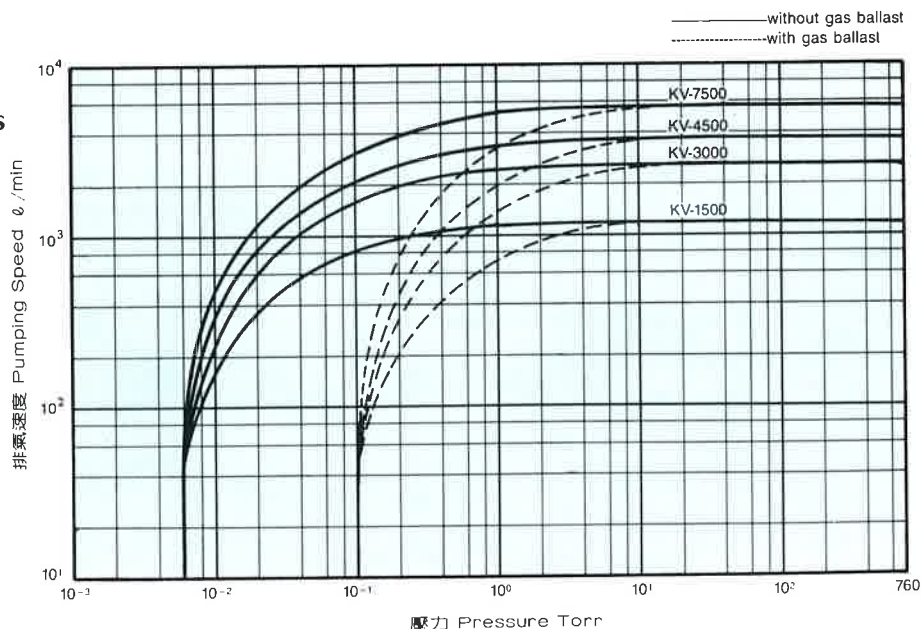
一般介紹

一般的葉片式油迴轉真空幫浦因葉片受離心力引起的磨損限制，所以其排氣速度大多限制在1200 l/min 以下，需要較大排氣速度時，則採用金尼式(Kinney Type) 油迴轉真空幫浦，因其構造不同，以同尺寸的機型而言，可以獲得較大的排氣速度，磨損亦少，一般金尼式油迴轉真空幫浦的設計排氣速度大多在1500 l/min 至7500 l/min，單段式的最終壓力可達 10^{-3} Torr左右，其使用壓力範圍則在40~0.01 Torr之間，如加裝氣體壓載閥，可處理一定量的水氣或其它凝結性氣體，而其最終壓力在 10^{-1} Torr 左右，若使壓力在 $1 \sim 10^{-2}$ Torr 之間，且需要更大之排氣速度者，可串聯機械式真空助力幫浦，如此不但在中高真空範圍具有大排氣速度且馬力亦可節省(可參改MBK系列)。

General Introduction

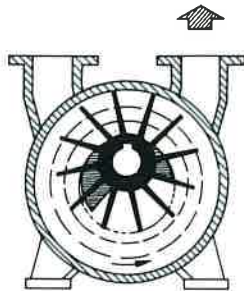
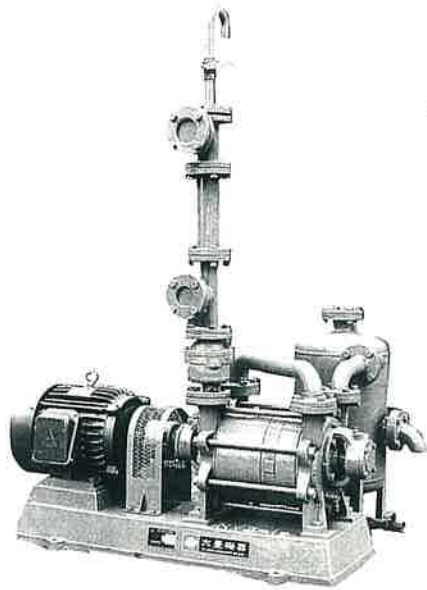
The rotary vane pump is generally adopted for small pumping speed (up to 1200 l/min) since there is a limit on the peripheral speed of steel blades due to friction and consequent oil break down. Therefore, the kinney type, also called oil rotary piston vacuum pump, is designed for wherever higher pumping speed (1500 ~ 7500 l/min generally) is required. By difference of construction, the pumping speed is higher than that of other types of pumps of the same size. With single stage, its ultimate pressure achieves 10^{-3} torr range, working pressure is at 40 ~ 0.01 torr. A certain quantity of vapor could be handled by adding a gas ballast valve, and its ultimate pressure is in 10^{-1} torr range. If working pressure is from $1 \sim 10^{-2}$ torr and higher pumping speed is required, mechanical booster back with oil rotary vacuum pumps is adequate and suggested (see MBK series).

排氣速度曲線 Pumping Speed Curves





液封式真空幫浦 Liquid Ring Vacuum Pumps



規格表 SPECIFICATIONS

1 atm = 760 Torr = 101.33 kPa = 1.0133 bar

	NVD-40	NVD-45	NVD-50	NVD-80	NVD-100	NVD-150
理論排氣速度 m ³ /h DISPLACEMENT	160 50Hz	330 280	640 510	1060 880	1930 1630	3660 3160
最終壓力 Torr ULTIMATE PRESSURE (ATMOSPHERE ADDED)	25 (3)	25 (3)	25 (3)	25 (3)	25 (3)	25 (3)
幫浦轉速 RPM ROTATING SPEED	1750 50Hz	1750 1460	1750 1460	1750 1460	1100 900	880 760
額定馬力 HP MOTOR RATED	5 50Hz	10 7.5	25 15	50 40	75 60	200 150
入口尺寸 mm SUCTION	40	40	50	80	100	150
出口尺寸 mm DISCHARGE	40	40	50	80	100	150
供給水量 l/min WATER SUPPLY	15 50Hz	25 20	50 40	75 65	120 100	240 200

一般介紹

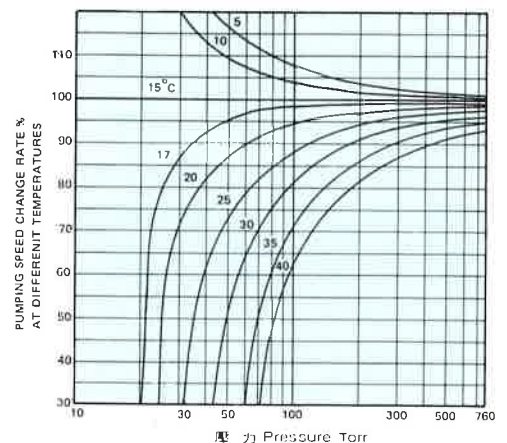
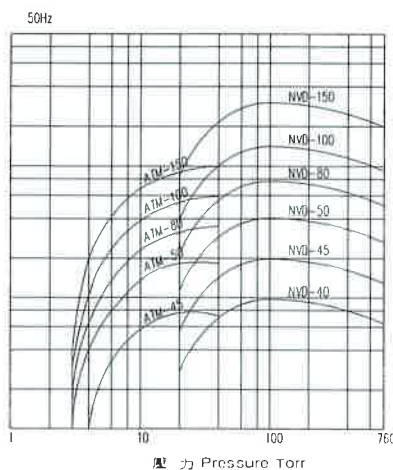
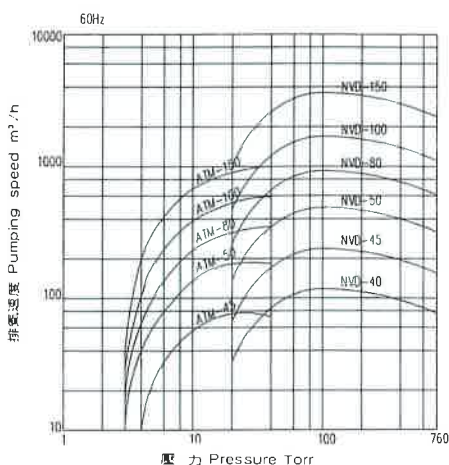
液封式真空幫浦是一種容積型真空幫浦，由於轉子的回轉，使汽缸內的封液在內壁形成水環，造成密封的效果，又轉子與汽缸相互偏心，因此水環在任兩葉片間如同一活潑上下運動，在入口側水環的位置由內往外移，兩葉片間的空間漸漸加大氣體因此被吸入，當此空間轉至最下方時容積最大，過此點後水環的位置開始往內移動空間內的氣體開始被壓縮至出口側而排出於大氣。一般以水當封液且可依使用狀況改用其他液體代替，適於被抽氣體含有大量水氣等凝結性氣體或氣體凝結後需回收使用者如被抽氣體具有腐蝕性時可選用耐蝕材質，亦可串聯機械式真空助力幫浦來增大排氣速度並提高真空度。

General Introduction

Liquid ring vacuum pumps is a displacement pumps. A vane wheel type impeller is arranged eccentrically in the circular pump casing which transmits the driving power to the service liquid. After start-up of the unit, liquid is raced along the inside of the casing in the form of a liquid ring. Due to the eccentricity of the impeller relative to casing and liquid ring, the latter is forced into a kind of reciprocating movement by alternately entering and leaving, like a piston in the individual cylinder chambers. Where the liquid recedes, the gas to be pumped away inhaled through an inlet slot. Where the liquid re-enters the chamber, the gas is compressed and discharged through an outlet slot.

Liquid ring vacuum pumps are used for the compression of dry or moist gases in plants of the chemical, pharmaceutical, food and confectionary industry, as well as in paper mills and electric power stations.

排氣速度曲線 Pumping Speed Curves





訂製資料 In Making Purchase or Enquiry

訂製資料

1. 用途及使用狀況
2. 使用壓力
3. 最終壓力
4. 排氣速度(在使用壓力下)
5. 入口溫度
6. 出口壓力
7. 周圍溫度
8. 氣體成份
9. 腐蝕性或侵蝕性物質
10. 操作控制方式(手動或自動)
11. 電源供給：
電壓，相數，頻率
12. 數量

決定真空幫浦大小尺寸的因素

依真空幫浦製造廠商的型錄來選擇—適當的真空幫浦以配合真空系統，且能達到預定的目標，似乎是很簡單，但實際上，並非很容易就可決定一部適當的真空幫浦，下面有幾項主要的因素必須考慮：

1. 使用壓力：這項因素可決定是否選用單部真空幫浦或需要組合式的真空排氣系統。
2. 抽氣時間：係指從大氣壓開始抽氣至最後使用壓力所需要的時間。
3. 真空系統中被抽氣體的體積，管路中的體積也應考慮。
4. 在操作過程中釋放出的凝結性及非凝結性氣體和允許從外界洩入系統中的氣體。以上均是決定使用壓力的主要因素之一。
5. 真空系統至真空排氣系統中的配管：由於配管的大小，長度或其中的孔洞，真空閥等等均會影響排氣速度。

真空幫浦名詞之意義

- 氣流通量(Q)
指在一特定溫度下，每單位時間內真空系統的某一部份(如管路等)之斷面上所通過的氣體量(即壓力P與排氣速度S之乘積)。
- 氣導(L)
在穩定狀況時，單位壓力差的氣流通量，即 $L = Q / \Delta P$
- 管路阻抗(W)
為氣導的倒數，即 $W = 1 / L$ ，隨管路長短，管徑大小及真空度而不同。
- 排氣速度(S)
真空系統中，某一點的排氣速度為該點的氣流通量與該點的壓力比，即 $S = Q / P$
- 排氣時間(t)
於一真空系統中，從大氣壓力抽取到預定真空度所需之時間。
- 最高真空度(P)
在入口封閉，排氣速度等於零時，所達到的真空度。意指無配管損失，無負載狀況下，僅為真空幫浦本體的最高真空度。

In making purchase or enquiry

1. Application and operating conditions
2. Working pressure
3. Ultimate pressure
4. Pumping speed (at working pressure)
5. Suction temperature
6. Discharge pressure
7. Ambient Temperature
8. Gas content
9. Corrosion or erosion material
10. Control method (Manual or Automatic)
11. Power supply:
Voltage, Phase, Frequency.
12. Quantity

Factors Determining Type and Size of Pump Required

The selection of the proper size pump for a given application is straight forward in principle but may not be so obvious in practice. The major factors which should be considered are:

1. The operating pressure required. This determines whether a single pump or a combination of pumps is required.
2. The pump down time from the initial pressure to the final desired pressure.
3. Volume of the system to be evacuated.
4. The gas load in terms of condensable and permanent type gases that will evolve from the process and are permitted to leak into the chamber.
5. The Vacuum manifold and its effect on reducing pumping speed as related to length, diameter and orifice effect.

Terminology of Vacuum

- Throughput (Q)
The amount of air which flows through any section of vacuum system in unit time interval at definite temperature. (Equal to the product of pressure and pumping speed.)
- Conductance (L)
The throughput per unit pressure drop under steady state condition.
 $L = Q / \Delta P$
- Impedance (W)
Reciprocal of conductance ($W = 1 / L$), varies with length of pipe line, diameter of pipe, and degree of vacuum.
- Pumping Speed (S)
Pumping Speed of a point in Vacuum system refers to the throughput at that point divided by the pressure. ($S = Q / P$)
- Pump-down Time (t)
The time interval which required to pump air out of vacuum system from atmosphere pressure to the degree of vacuum we want.
- Ultimate Vacuum (P)
The degree of Vacuum which vacuum pump can accomplish when in-hale hole closed, and the pumping speed equal to zero.



氣流的相關公式

Pertinent Equations Of Gas Flow

1. 氣流通量公式 Mass Flow

$$Q = PS \quad Q = \frac{C}{\Delta P}$$

2. 氣導公式 Conductance

a. 串聯管路 Conductance in series

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$$

b. 並聯管路 Conductance in parallel

$$C = C_1 + C_2 + C_3 + \dots$$

3. 真空系統中的排氣速度

Pumping speed of vacuum system

$$\frac{1}{S} = \frac{1}{S_p} + \frac{1}{C}$$

- Q : 氣流通量 Throughput
- S : 排氣速度 Pumping speed
- S_p : 真空幫浦排氣速度 Pumping speed of pump
- ΔP : 壓力差 Pressure difference
- C : 總氣導 Total conductance
- C_{1,2,3} : 各管路的氣導 Conductance of different pipe sizes

抽氣時間

Pumpdown Time

$$t = \frac{2.3V}{S_p} \times \log \frac{P_1}{P_2} \times K$$

K	壓力 Pressure
1	760~100Torr
1.25	100~10Torr
1.5	10~1 Torr
2	1~0.1Torr
4	0.1~0.01Torr

- t : 時間 Time
- V : 體積 Volume
- P₁ : 最初壓力 Initial pressure
- P₂ : 最終壓力 Final pressure
- K : 修正因數 Correction factor

註：以上公式只適用於空氣且壓力在760~0.01Torr
NOTE: The above equation is suitable for air and pressure between 760~0.01Torr

排氣速度單位 Pumping Speed Units

	m ³ /h	m ³ /min	l/min	l/sec	CFM
1 m ³ /h	1	1.67 × 10 ⁻²	16.67	2.78 × 10 ⁻²	5.89 × 10 ⁻²
1 m ³ /min	60	1	1000	16.67	35.31
1 l/min	6 × 10 ⁻²	1 × 10 ⁻³	1	1.67 × 10 ⁻²	3.53 × 10 ⁻²
1 l/sec	3.60	6 × 10 ⁻²	60	1	2.12
1 CFM	1.70	2.83 × 10 ⁻²	28.32	4.72 × 10 ⁻¹	1

壓力單位 Pressure Units

	Torr	Pa	bar	mbar	alm
1 Torr	1	1.3332 × 10 ²	1.3332 × 10 ⁻³	1.332	1.3158 × 10 ⁻³
1 Pa	7.5006 × 10 ⁻³	1	1 × 10 ⁻⁵	1 × 10 ⁻²	9.8692 × 10 ⁻⁶
1 bar	7.5006 × 10 ²	1 × 10 ⁵	1	1 × 10 ³	9.8692 × 10 ⁻¹
1 mbar	7.5006 × 10 ⁻¹	1 × 10 ²	1 × 10 ⁻³	1	9.8692 × 10 ⁻⁴
1 alm	760	1.0133 × 10 ⁵	1.0133	1.0133 × 10 ³	1

符號說明 Symbol

	機械式真空助力幫浦		壓力控制開關
	油迴轉式真空幫浦		手動閥
	液封式真空幫浦		氣動閥
	大氣助力器		電磁閥
	循環水桶		釋放閥
	真空計		止回閥

真空度區分 Degrees of Vacuum

	低真空 Rough Vacuum	中真空 Medium Vacuum	中高真空 Medium-High Vacuum	高真空 High Vacuum	超高真空 Ultra-High Vacuum
壓力範圍 Torr Pressure Range	760~100	100~1	1~10 ⁻¹	10 ⁻¹ ~10 ⁻⁷	10 ⁻⁷
平均自由行程 Mean Free Path cm at 20°C	5 × 10 ⁻⁶ ~ 5 × 10 ⁻⁵	5 × 10 ⁻⁵ ~ 5 × 10 ⁻⁴	5 × 10 ⁻⁴ ~ 5	5 ~ 5 × 10 ²	5 × 10 ⁴
氣體分子數 Number of Molecules cm ³ at 20°C	2.5 × 10 ¹⁹ ~ 3.3 × 10 ¹⁸	3.3 × 10 ¹⁸ ~ 3.3 × 10 ¹⁶	3.3 × 10 ¹⁶ ~ 3.3 × 10 ¹⁴	3.3 × 10 ¹⁴ ~ 3.3 × 10 ⁹	3.3 × 10 ⁹

主要產品：

- 工業用途排風機
- 魯氏鼓風機
- 真空幫浦
- 真空排氣系統

Main Products:

- Fans & Blowers
- Roots Blowers
- Roots Vacuum Pumps
- Vaccum Pumping Systems

ISO 9001 認可登錄工廠/日本川崎重工技術合作



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