

# Turbo Molecular Pumps



Osaka Vacuum, Ltd.



# Safety, Satisfaction, and Long Product Life -

## Business Objectives

### *Vacuum Systems that Cater to the Customer's Needs*

Osaka Vacuum, Ltd. was established in 1950 for the domestic production of vacuum systems in Japan. Since then, we have been committed to develop vacuum systems that incorporate the latest in science and technology to meet the requirements of our customers.

The scope of applications of vacuum technology has expanded so much that it now covers not only high tech areas, such as synchrotron orbital radiation, nuclear fusion, and space simulation, but general industrial sectors, such as steel, synthetic fiber, chemistry, electronics, semiconductor, and flat panel displays (FPDs) including liquid crystal displays (LCDs) and plasma display panels (PDPs). We have set four priorities in our operations to ensure high customer satisfaction,

- *Customer Support*
- *Customization*
- *Customer Safety*
- *Frontier orientation*

We are striving to expand and improve each of them.

# Our Testimonial to High Reliability.

## Corporate Motto

### *Safety and satisfaction*

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Our corporate motto charges us to develop "reliable, long-lasting products that assure the customer safety and satisfaction." Our commitment to product reliability is rooted in our pledge to provide products that satisfy our customers. We believe the greatest contribution we can make to our customers is to develop products that assure safety, satisfaction, and long life, while delivering the performance they expect. By designing rugged, highly reliable products, we guarantee our customers a low total operating cost.

### *Extended Product Life*

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Our mainstay turbo molecular pumps (TMPs) are widely used in the semiconductor and FPD fabrication industries. TMPs must pump large volumes of gases that, according to the application, are often harmful or corrosive, while simultaneously creating and sustaining an ultra-high vacuum environment. To fulfill such stringent requirements, we offer advanced maintenance services combined with a reliable production process from design to manufacture to inspection, ensuring a long life for our products.

# Versatile Product Applications from Simulated Outer Space Environments to

## Semiconductor Fabrication

Exposure, lithography, deposition, dry etching, ion implantation, and test and inspection are among many of the steps in the semiconductor fabrication process, which require production equipment that can be relied on to stand up under heavy use. Our vacuum systems satisfy these demands in diverse applications across the entire range from low to ultra-high vacuum pumping.



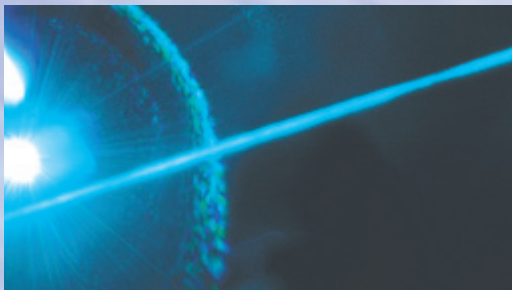
## FPD Production

FPD is a collective term for many different types of displays, including LCDs, PDPs, organic electroluminescence (EL) displays, and field emission displays (FEDs), with technological development constantly giving birth to new categories. Among the main applications are wide-screen TVs, projectors, mobile phones, car navigation systems, and video games. Our TMPs are used in many FPD production line processes.



## Optical Products

Lenses, prisms, optical filters—these data transmission products are now an integral part of life. Our TMPs are frequently used in the deposition process, the most important stage in their production.



## Miscellaneous

Other pumping applications include vacuum tube production, electron guns, ion sources, surface treatment/reforming and heat treatment.



# Medicine and Semiconductors.

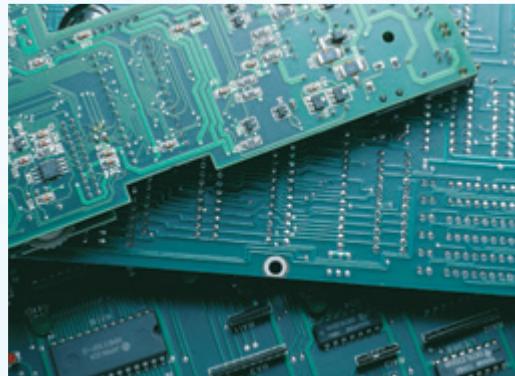
## Analysis, Examinations

Our TMPs, in combination with electron microscopes, mass spectrometers, spectral analyzers, leak detectors, and outer space environment testing machines, help collect data on universes across vast distances and at a microscopic nano scale.



## Electronic Components

Electronic components are everywhere around us. Their applications include discs, magnetic heads, crystal oscillators, small capacitors, and, more recently, micro electro mechanical systems (MEMs) and in-vehicle units. Our TMPs can be found at the production processes for these electronic components.



## Accelerators, Nuclear Fusion

Accelerators, synchrotron orbital radiation, nuclear fusion-our TMPs have played a key role in a series of large research facilities in Japan that incorporated state-of-the-art technology of their day. This is a testimony to the credibility of our engineering.



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Greater Intensity, Greater Elegance

In 1983, Osaka Vacuum Developed World's First

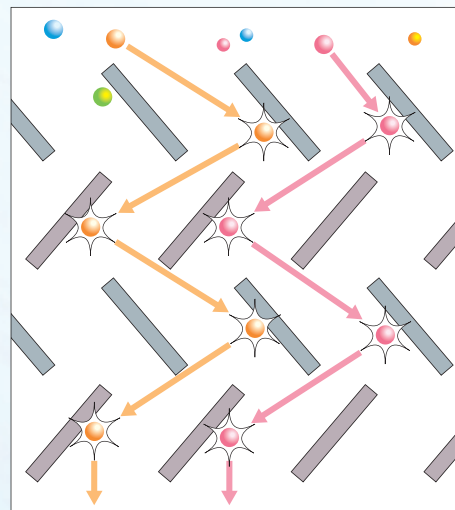
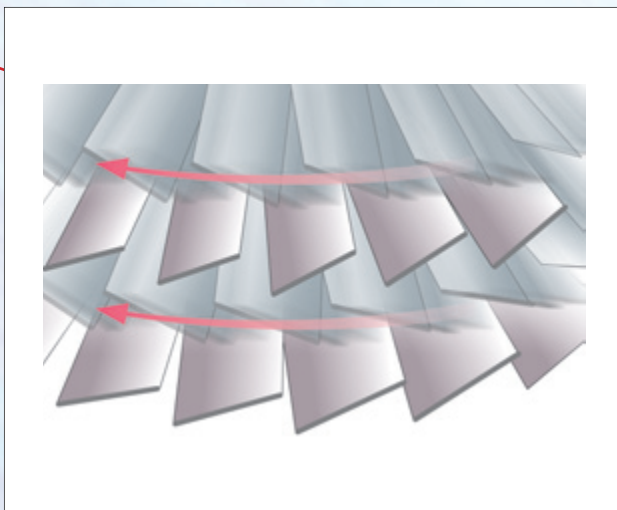


## Compound Molecular Pump.

We developed of Japan's first turbo molecular pump. Afterwards, it was followed by a series of technological breakthroughs that anticipated the needs of the market: the world's first compound molecular pump (turbine blades + helical grooves), magnetically suspended TMPs, the world's largest TMPs, extreme high vacuum (XHV) TMPs, TMPs with a flexible mounting position (grease-lubricated type: TG-F), TMPs that control by-product accumulation (thermal insulation structure: TG-MI), and extreme low vibration TMPs (TG-ML). Our engineering proficiency and wealth of experience allow us to customize our systems according to the customer's specific needs.

Structurally, a turbo molecular pump has a motor shaft at its center. Attached, at the shaft's top, is a rotor with many moving blades. As the shaft rotates at high speed, the rotor's peripheral velocity reaches approximately 300m/second. These fast-rotating multiple turbine blades pump and compress gases chiefly in the molecular flow range (where the mean free path of gas molecules is sufficiently greater than the largest sectional dimension of containers and pipes, so the gases are thin).

Our proprietary compound molecular pumps are equipped with a helical groove at the downstream side of the turbine blade, making it possible to do the pumping not only in the molecular flow range but also in the intermediate flow range, where gas density is higher.



TMPs are mechanical vacuum pumps that exhaust gas molecules via fast-rotating turbine blades. Since the transportation probability when gas molecules pass through the moving blade stages is greater in the forward than in the backward direction due to the rotation of the moving blades, gases are discharged to the downstream side. A fixed blade (stator blade) is inserted from the casing side between one moving blade and the other. Since most of the gas molecules increase acceleration through contact with the moving blade of the previous stage, they are given relative velocity to the stator blade, creating a pumping effect similar to that when they pass through the moving blade stages. Optimally designed moving and stator blades mean our TMPs maintain this pumping effect from the inlet through the outlet for efficient discharge of gases.

# Market-Oriented Product Development

## Compound Molecular Pumps

### Grease Lubricated Ball Bearing Type

#### TG-F series

Ball bearing type, yet it can be mounted in any position. Its compact size and light weight add greater freedom to equipment layouts. Features a rugged structure with high resistance against rapid acceleration - can be operated as the entire apparatus moves. Also resists sudden air in-rush and other impacts - a feature not previously available in conventional TMPs. These flexible mounting-position models are available in a large variety of sizes.



#### Quick start up

These products attain short startup times.  
 ※ex.) 1-1.2 min with TG220F

#### Quick shut down

Quick shut down with air vent. Inert to the rise of rapid pressure. \*with some models

#### Maintenance free

O/H cycle 20,000 ~ 30,000 hours\*  
 \*Approx. 10 to 15 years, based on an actual operating time of 8 hours X 20 days per month.  
 \*The actual cycle varies with the operating conditions.

#### Serial communication

Remote operation possible from computer or other device. ※RS232C Serial interface

## TMP Units

The TMP unit is a general-purpose turbo molecular pump unit incorporating our TMP. The unit is portable, easy to operate, and includes a protection interlock. Valves, suction pipes and vacuum gauges are available as options.





## for Higher Customer Satisfaction.

### Compound Molecular Pumps

## Magnetically Levitated Type

### TG-M series

Magnetically levitated compound molecular pumps were developed to meet a broader range of applications. Controlling the rotating body magnetically without contact, the vacuum pump provides mounting position freedom, low vibration and oil-free operation. The absence of sliding components allows a longer maintenance cycle.



### *High throughput*

A large throughput and flow rate is crucial for some applications. The system is designed to withstand harsh loads.



### *All-Digital control*

Uses all-digital control mechanisms. Digital input/output enables precise control and monitoring of the interior, achieving such improved features as low vibration, maintenance alerts, auto-calibration and the addition of an abnormal condition memory function.



# A Diverse Product Lineup

## Compound Molecular Pumps

### Magnetically Levitated Type

#### TG-ML series *Ultra low vibration type*

The "vibration" should be avoided in cutting-edge processing like micro machining, and in length measurement and analysis of nano space. TG-ML eliminated the "vibration" that have a negative effect.



#### TG-MI series *Reaction by-product prevention*

Features our proprietary thermal insulating, auto-temperature rise mechanism (patent no. 3098140). By controlling the temperature inside the pump, condensation of pumped gases is reduced, minimizing reactive by products.



#### TG-MU series *Ultra high vacuum*

By our world-class proprietary technology, this TMP achieves an ultra high vacuum of  $10^{-9}$  Pa on its own.



#### TG-MR series *Radiation-hardened type*

The TG-MR series was developed for operation under a radiation environment. It has resistance against radioactive rays.



#### TGkine series

TGkine series is integrated controller and power supply with pump, and have a well-balanced performance for a wide range of vacuum processes. Also, installation and system maintenance has improved by locating access for all connections on one side of the pump.



## to Meet Customization Needs.

### Compound Molecular Pumps

## Oil Lubricated Ball Bearing Type

### TG series

This reliable TMP uses oil-lubricated bearings, but is designed to eliminate oil back streaming, during normal use. Use of fluorine oil enables aspiration of corrosive gases.



### Osaka Vacuum's Line-up

Turbo Molecular Pumps								
Magnetically Levitated Type							Grease Lubricated Type	Oil Lubricated Type
Inlet diameter	TG-M series / TGkine series						TG-F	TG series
	Standard	Corrosive resistant type	Ultra low vibration type	Reaction by-product prevention	Ultra high vacuum type	Radiation Hardened type	Standard	Standard/Chemical
65A							TG50F□□B TG60F□□B TG70F□□B	
100A	TG390M□□B	TG390M□□C TG420M□□C	TG390ML□□NB TG420ML□□NB	TG390MI□□WC TG420MI□□WC			TG220F□□B TG240F□□B TG350F□□B	TG203□□(*)
150A	TG420M□□B TG900M□□B	TG900M□□C	TG900ML□□NB	TG900MI□□WC	TG900MU□□B	TG900MR□□B	TG450F□□B TG800F□□B	TG553□□(*) TG1003□□(*)
200A	TG1300M□□B	TG1300M□□C	TG1300ML□□NB	TG1300MI□□WC	TG1300MU□□B	TG1300MR□□B	TG1100F□□B TG1400F□□B	TG1303□□(*)
250A	TG2400M□□B TGkine220※M□WB	TG2400M□□C TGkine220※M□WC		TG2400MI□□WC TGkine220※M□WC			TG2400F□□B TG2410F□□B	TG1813□□(*) TG2810□□
300A	TGkine330※M□WB	TGkine330※M□WC		TGkine330※M□WC				TG3210□□
350A	TGkine340※MVWB TGkine420※M□WB	TGkine340※MVWC		TGkine340※M□WC				TG3410□□
500A								TG5000□□ TG5500□□

※ : 4 = outlet 40A    5 = outlet 50A

(\*) Chemical only

### TG 220 F \* V A B

	1	2	3	4	5	6	7
1 Model	TG : Compound Molecular Pumps						
2 Size	Near Volume flow rate (N <sub>2</sub> )						
3 Bearing system	B*2 : Ball bearing (oil lubrication)		F : Ball bearing (grease lubrication)		M : Magnetically levitated		
4 Special Structure	(Not written) : Normal structure						
	I : Thermal insulation structure						
	L : Ultra low vibration type						
	R : Against radiation structure						
5 Inlet Flange*1	U : Ultra high vacuum type						
	C : CF						
	B : ISO-B						
6 Cooling system	R : ISO-R						
	V : VG						
7 Specification type	A : Air cooling						
	W : Water cooling						
	B*2 : Standard type						
	C : Corrosive resistant type						
	X : XHV type						

\*1 Standard Flange

CF / JVIS 003 Bakeable Flanges: Dimensions-Knife-edge sealed type

ISO-B / ISO1609:1986 Vacuum technology

-Flange dimensions (Bolted type)

ISO-R / ISO1609:1986 Vacuum technology

-Flange dimensions (Clamped or rotatable type)

VG / JISB2290:1998 Vacuum technology-Flange:

dimensions (Vacuum flange with O-ring groove)

KF / ISO2861/1:1974 Vacuum technology-Quick-release

couplings-Dimensions-Part 1 (Clamped type)

\*2 Some models are not written.

# We Help You Select the TMPs Best Suited to Your Specific Needs.

## *Tips on Selecting TMPs*

All molecules have a specific mean free path that changes greatly under pressure. For instance, the mean free path of air is only approximately  $0.05\mu\text{m}$  at atmospheric pressure, but increases to approximately 5mm under 1Pa, and to 500m under  $1 \times 10^{-5}\text{Pa}$ . Turbo molecular pumps capture these molecules via mechanical motion to achieve dynamic pumping. For greater customer satisfaction, we offer a choice of a broad range of high performance turbo molecular pumps to suit your specific application.

## *Check Your Application*

Two key considerations in selecting pumps are the application and the layout of the pumping system.

Applications for turbo molecular pumps can be broadly divided into two categories. One is pumping to achieve a high vacuum range. Under a high vacuum state (molecular flow range, in particular), gas molecules strike the inner walls of the container before colliding with each other. Under these conditions, it is necessary to calculate the surface area of the internal equipment and the container to which the gases are discharged, since the number of molecules discharged from the container's inner walls and internal equipment and those that penetrate the interior is far greater than the number of molecules flying about inside the container.

The other group of applications requires the discharge of large volumes of process gases that are fed to perform various processes in a vacuum. For these, pump selection must take into account such attributes of the gas as its molecular weight, viscosity, and corrosiveness.

In addition, the size and shape of the pipes that connect the container and the vacuum pump have a strong influence on conductance (ease of flow).

## TMP selection point

System used and intended application

Shape and capacity of chamber

Base pressure (Pa)

Process pressure (Pa)

Gas type (e.g., argon, Cl<sub>2</sub>, air)

Chamber material (e.g., SUS304)

Equipment inside chamber (e.g., electron gun, vapor-deposition source, transportation system)

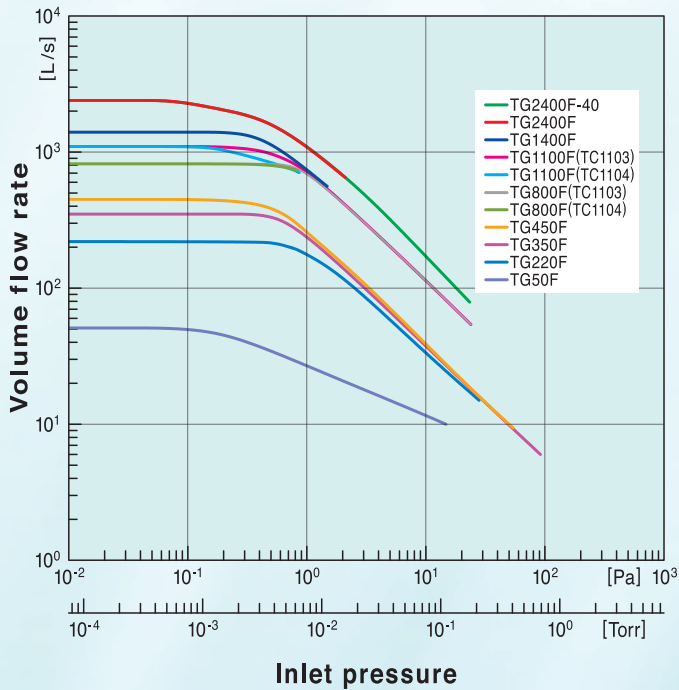
Desired time for evacuation to base pressure (min)

Desired time for evacuation to process pressure (min)

Gas flow (sccm)

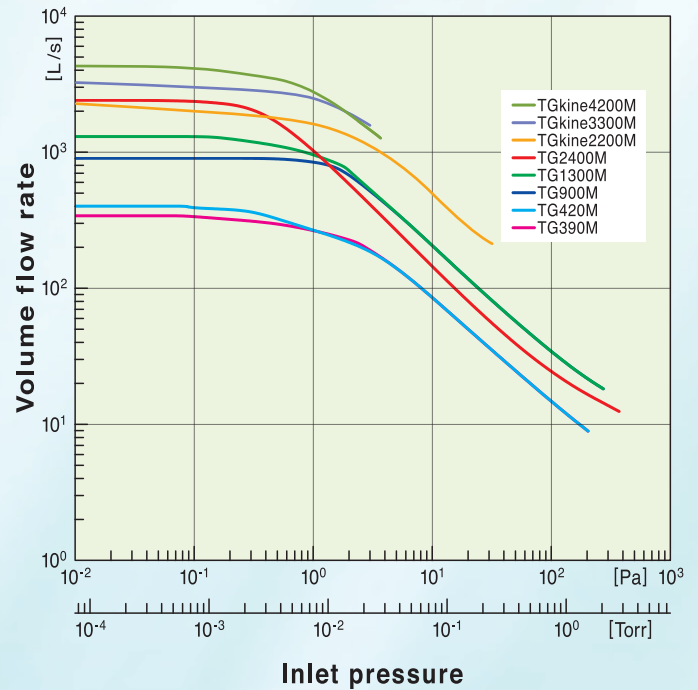
## Grease Lubricated Type

TG50F/TG220F/TG350F/TG450F/TG800F(TC1104)/TG800F(TC1103)/  
TG1100F(TC1104)/TG1100F(TC1103)/TG1400F/TG2400F/TG2400F-40



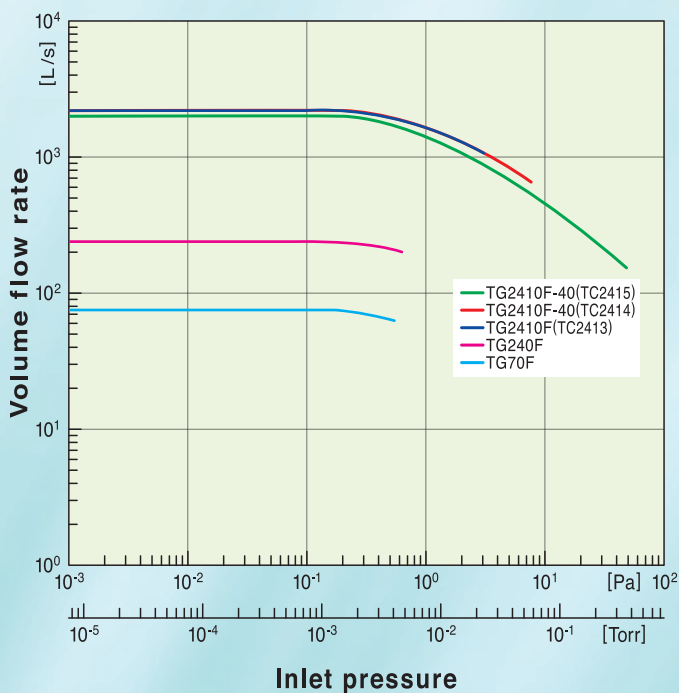
## Magnetically Levitated Type

TG390M/TG420M/TG900M/TG1300M/TG2400M/  
TGkine2200M/TGkine3300M/TGkine4200M



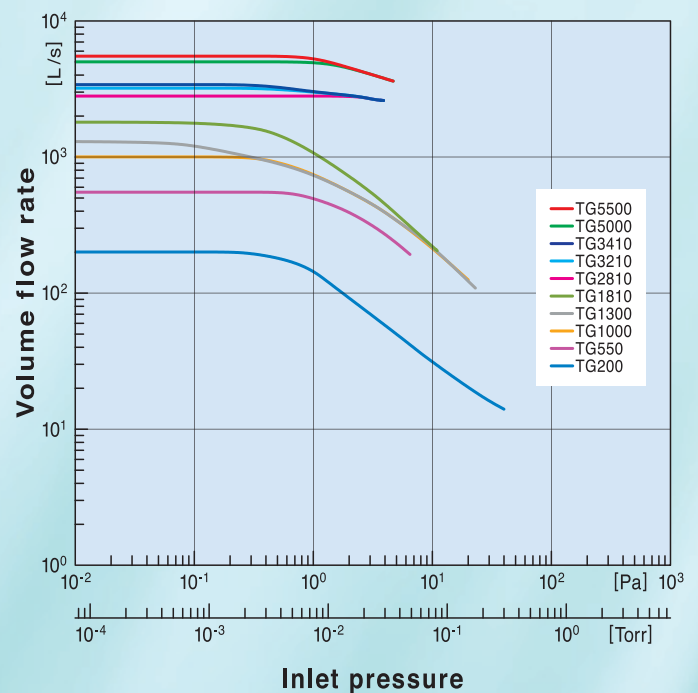
## Grease Lubricated Type

TG70F/TG240F/TG2410F(TC2413)/  
TG2410F-40(TC2414)/TG2410F-40(TC2415)



## Oil Lubricated Type

TG200/TG550/TG1000/TG1300/TG1810/  
TG2810/TG3210/TG3410/TG5000/TG5500











# Extensive Service Network for Worldwide





Osaka Vacuum, your reliable partner, provides total support, from consulting on your vacuum needs and suggesting the vacuum system that best suits your specific requirements, to after-sale service. To better serve our customers, we are in the process of expanding our overseas network of support centers. We currently operate centers in U.S.A., Europe, Korea, and China. And we have partner centers in Taiwan and Korea, where we provide the finest support services in the industry. Our goal is to build a network that supports our customers' production/R&D bases, regardless of their location, from our support centers in Japan, Korea, Taiwan, China, and U.S.A., Europe.

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-  Sales
-  Tel Support
-  Field Support
-  Maintenance
-  Local Stock
-  Liaison Service

## Customer Support.

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# Turbo Molecular Pumps



## Safety

To ensure proper usage of the products described in this catalogue, please make sure to read the instruction manual thoroughly prior to use.

Notice: Freight that is regulated by the Foreign Exchange and Foreign Trade Law may require official permission before shipment in accordance with the law.



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ISO9001



ISO14001



## Products of Osaka Vacuum

Turbo Molecular Pumps, Compound Molecular Pumps,  
Magnetically Suspended Turbo Molecular Pumps,  
Magnetically Suspended Compound Molecular Pumps,  
Helical Grooved Vacuum pumps, Turbo Molecular Pumping Units,  
Dry Running Vacuum pumps, Oil-sealed Rotary Vacuum Pumps,  
Roots Vacuum Pumps, Liquid-ring Vacuum Pumps, Ejectors,  
Plasma Application Vacuum systems, Other Vacuum systems,  
Vacuum Pumping Systems, Vacuum Parts, Vacuum Valves

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