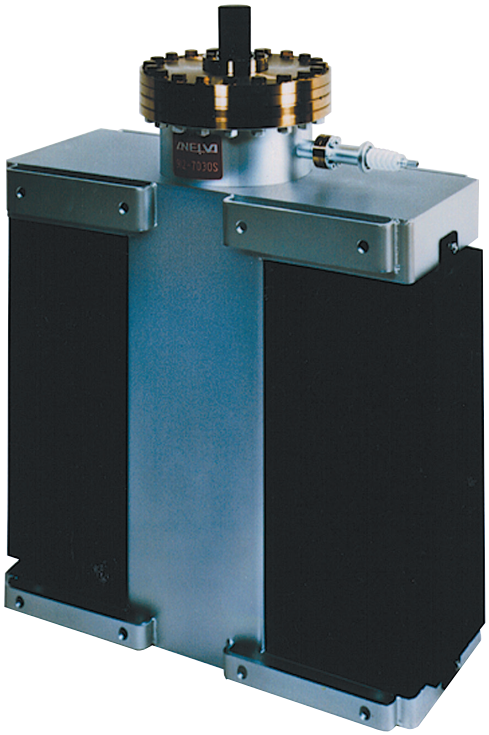
Ultra-High Vacuum Pump

Vacuum components

Ion Pump
Noble Pump
Titanium Sublimation Pump / Ti-Vac Pump
Combination Pump

CANON ANELVA CORPORATION

Ion Pump/Noble Pump



P-500 Series Controller

■ Summary

The ion and noble pumps are ultra-high vacuum pumps which utilize the gas adsorption properties of the cathode material sputtered by cold cathode discharge within a magnetic field and the continuous formation of active getter film by sputtering cathode material (Ti) during collision with the cathode.
Since no organic materials such as oil are used, a completely oil free, ultra-high vacuum can be obtained. Operation requires only electrical power and there is no vibration or noise because there are no moving parts. In addition, the pumps can be used safely for unattended operation at night because there is no need to worry about the pumped system becoming contaminated in case of an accident such as a sudden power failure or vacuum leak.
The noble and excel pumps are tripolar type ion pumps with improved inert gas pumping speed. They have all the features of an ion pump, but are capable of stable pumping of inert gas.

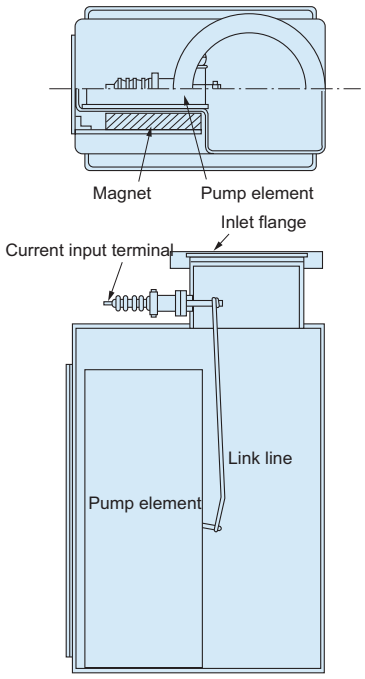
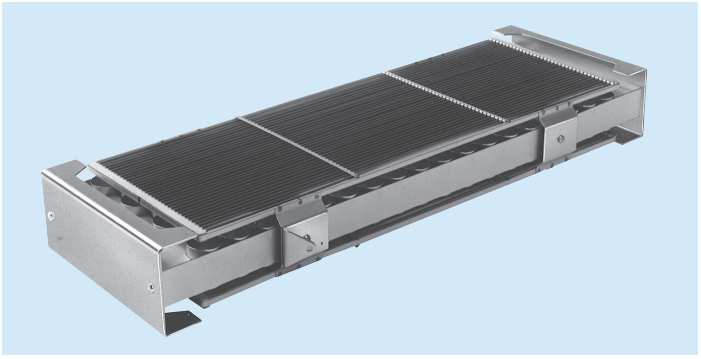
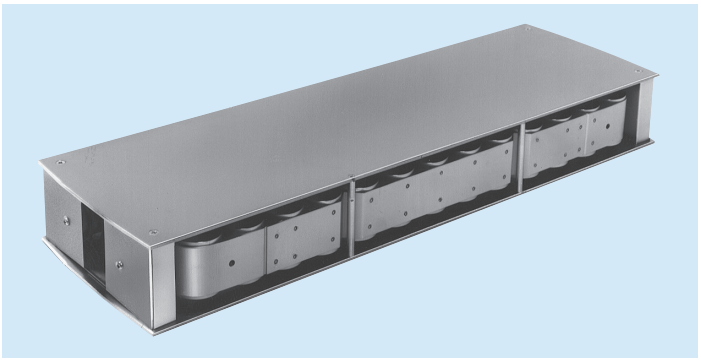


Fig. 1 Ion Pump/Noble pump external
(Example: 140 L/s Ion Pump, 110 L/s Noble Pump)



915-9520 Noble Pump element



915-9510 Ion Pump element

Fig. 2 Pump elements

Features

1. Completely oil free

A clean vacuum can be obtained without contaminating the system because no organic materials such as oil are used. In addition, there is no need to close the valve even in case of a power failure.

2. Ultra-high vacuum

The ion pump/noble pump is best suited for creating ultra-high vacuum in the range of 10^{-1} Pa to 10^{-9} Pa. Especially when used in combination with a titanium sublimation pump, a ultra-high vacuum of 10^{-9} Pa can be achieved quickly.

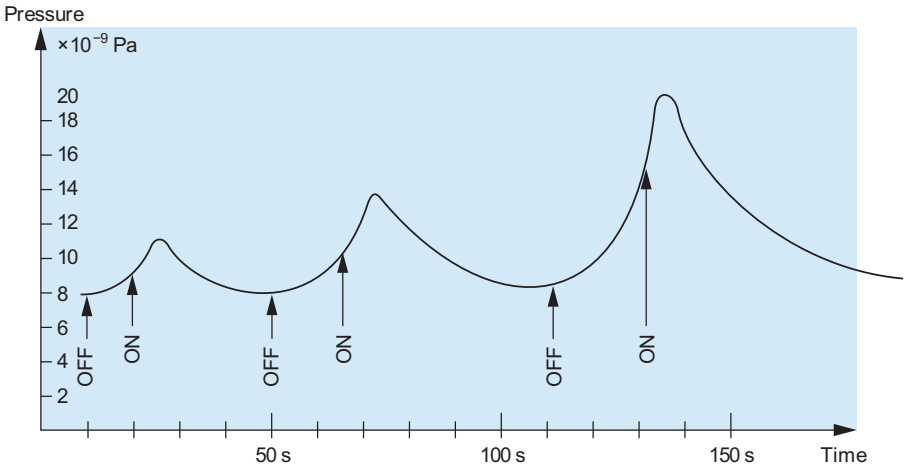


Fig. 3 Pressure change when ion pump is turned ON-OFF at 10^{-9} Pa
(The pressure rises immediately when the pump is turned OFF and drops within a few seconds after it is turned ON again. You can see that the ion pump is operating normally at 10^{-9} Pa.)

3. Quiet operation

Completely free of vibration and noise because there are no mechanical moving parts.

4. Energy saving

Because power consumption decreases in proportion to pressure, very little power is consumed except during startup.

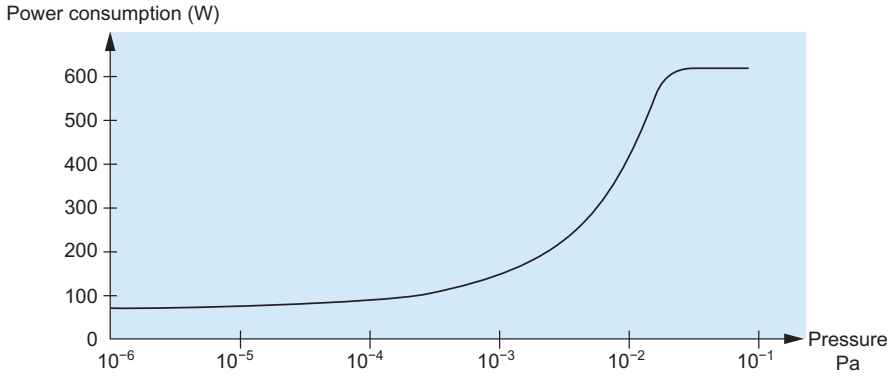


Fig. 4 Power consumption example (60 L/s ion pump)

5. Vacuum Gauge Function

The pressure within the pump can be determined from the discharge current which is proportional to the pressure. Therefore, the approximate pressure can be monitored simply by using the pump as a vacuum gauge.
[10^{-3} Pa to 10^{-6} Pa] region.

6. Inert gas pumping

(Noble Pump)

Improved inert gas pumping speed compared to diode ion pumps. (Approximately 21% of air with argon) In addition, argon instability is less likely to occur compared to ion pumps. Table 1 shows the pumping speed ratio of ion pumps and noble pumps for each gas.

Table 1 Pumping speed ratio of various gases against nitrogen (%)

	Ion pump	Noble pump
Hydrogen [10^{-4} Pa or less]	200 to 270 ※	200 to 270 ※
Nitrogen	100	100
Vapor	100	100
Carbon monoxide	100	100
Carbon dioxide [10^{-3} Pa or less]	100	100
Various hydrocarbon	90 to 160	90 to 160
Oxygen	57	57
Helium	10	30
Argon	1	21

※ 1100 to 110 for ion, noble, and excel pumps at pressures equal to or more than 10^{-3} Pa.

7. Free mounting direction

There is no restriction on the mounting direction; up, down, horizontal or diagonal.

8. Low leakage magnetic field

A ferrite magnet is used for 20 L/s or more pumps.
The leakage magnetic field decays close to geomagnetism at 30 cm from the flange.
(Refer Fig. 9 for details)

Principle

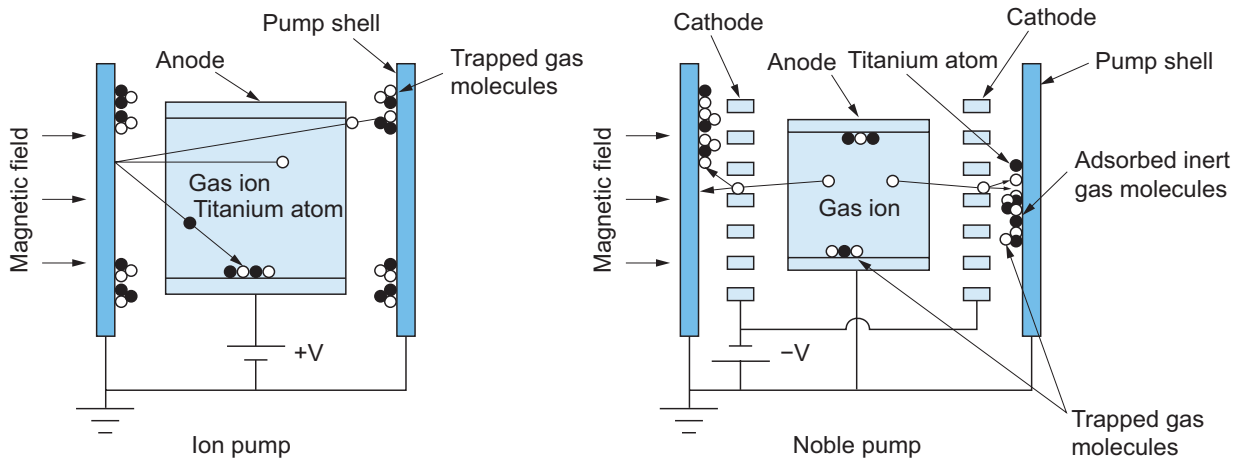


Fig. 5 Ion Pump / Noble Pump Pump pumping mechanism

Applications

- Completely oil free ultra-high vacuum pumping systems
- Ultra-high vacuum experimental equipment
- Pumping systems such as electron microscopes, surface and other analyzers
- Pumping systems such as particle accelerators, nuclear fusion experimental devices, and space environmental testing equipment
- Vacuum retention pump for electron tubes, etc.
- Heating pumping equipment such as electron tubes

etc.

■ 20 L/s Ion Pump / Noble Pump

●Specifications

	Name	20 L/s Ion Pump	20 L/s Noble Pump
Pump	Type	912-7125	912-7120
	Pumping speed (N_2 gas)	20 L/s	
	Operating range(Note 1)	$10^{-2} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	2×10^{-2} Pa or less	
	Capacity	1.4 L	
	Maximum heating temperature	250°C	
	Inlet	ϕ 70 ICF	
	Current input terminal	Non-replaceable	
	Element (replaceable)	Non-replaceable	
	Magnet	912-7121 (×1) included	
	Weight	10.5 kg	

Note 1 Values when using P-521IP/NP control device.

●Standard configuration

	Name and Type / Components	20 L/s Ion Pump 912-7125	20 L/s Noble Pump 912-7120
Pump	Pump body	×1	
	Attachment gasket for ϕ 70 ICF	×2	

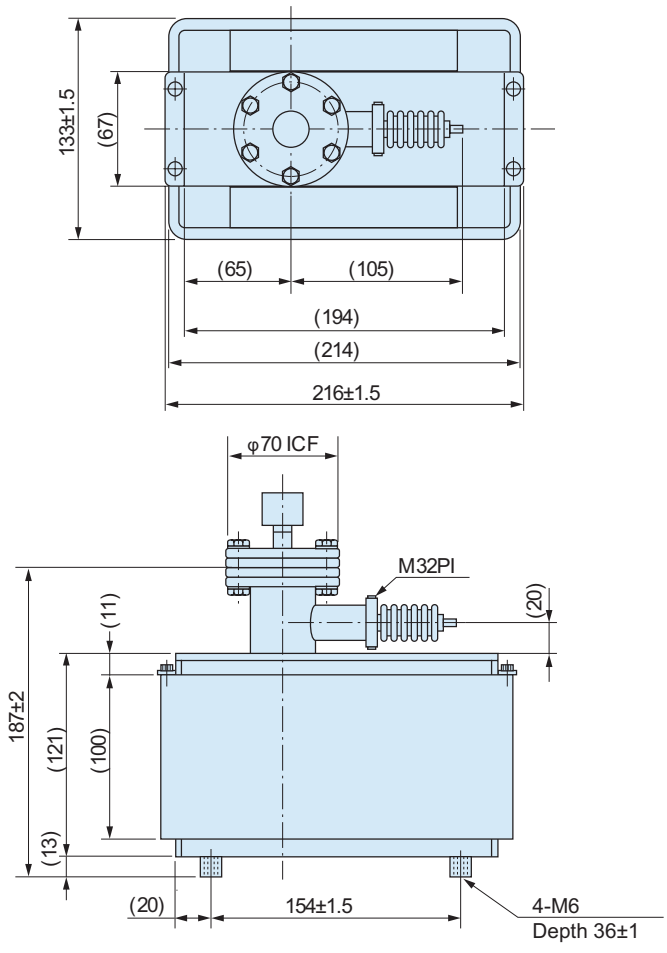


Fig. 6 (a) 20 L/s Ion Pump (912-7120)
20 L/s Noble Pump (912-7120)

■ 30 L/s Ion Pump / Noble Pump

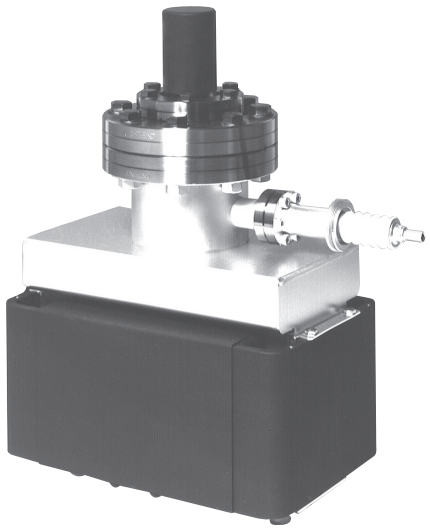
●Specifications

	Name	30 L/s Ion Pump	30 L/s Noble Pump
Pump	Type	912-7135	912-7130
	Pumping speed (N_2 gas)	30 L/s	
	Operating range(Note 1)	$10^{-2} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	2×10^{-2} Pa or less	
	Capacity	2.2 L	
	Maximum heating temperature	250°C	
	Inlet	ϕ 114 ICF	
	Current input terminal	954-7281	
	Element (replaceable)	Non-replaceable	
	Magnet	912-7121 (×1) included	
	Weight	12.5 kg	

Note 1 Values when using P-521IP/NP control device.

●Standard configuration

	Name and Type / Components	30 L/s Ion Pump 912-7135	30 L/s Noble Pump 912-7130
Pump	Pump body	×1	
	Attachment gasket for ϕ 114 ICF	×2	



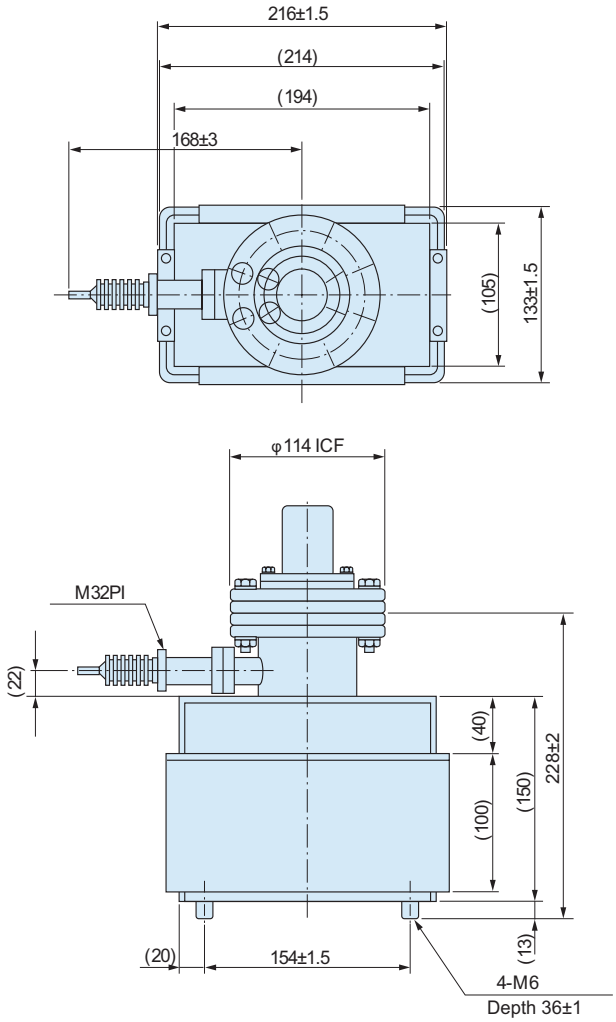


Fig. 6 (b) 30 L/s Ion Pump (912-7135)
30 L/s Noble Pump (912-7130)

■ 60 L/s Ion Pump / Noble Pump

●Specifications

	Name	60 L/s Ion Pump	60 L/s Noble Pump
Pump	Type	912-7165	912-7160
	Pumping speed (N_2 gas)	60 L/s	
	Operating range(Note 1)	$10^{-2} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	2×10^{-2} Pa or less	
	Capacity	6.2 L	
	Maximum heating temperature	250°C	
	Inlet	ϕ 152 ICF	
	Current input terminal	954-7281	
	Element (replaceable)	915-7027 (1 set)	915-9527 (1 set)
	Magnet	912-7121 (×2) included	
	Weight	25.6 kg	

Note 1 Values when using P-521IP/NP control device

●Standard configuration

	Name and Type / Components	60 L/s Ion Pump 912-7165	60 L/s Noble Pump 912-7160
Pump	Pump body	×1	
	Attachment gasket for ϕ 152 ICF	×2	

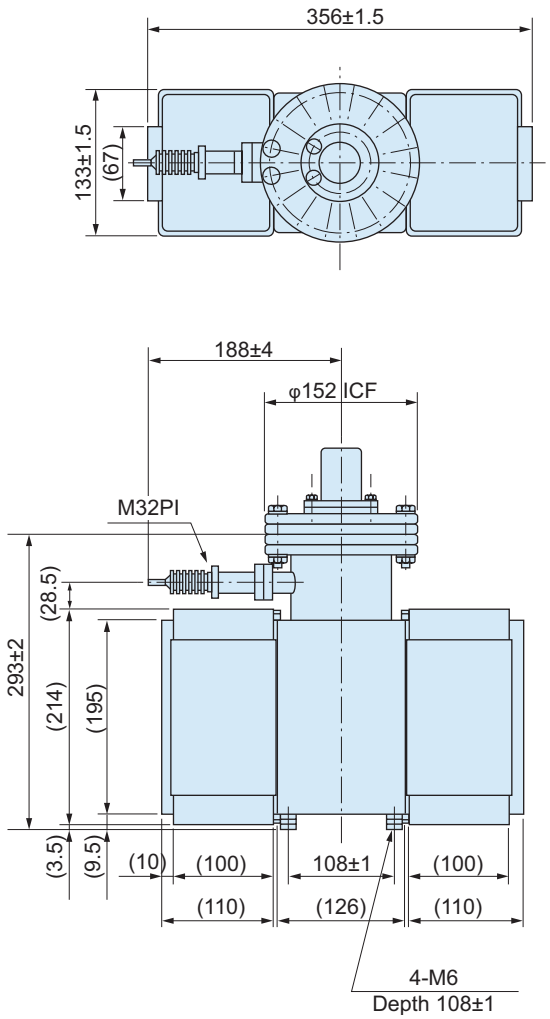


Fig. 6 (c) 60 L/s Ion Pump (912-7165)
60 L/s Noble Pump (912-7160)

■ 110 L/s Noble Pump • 140 L/s Ion Pump

●Specifications

	Name	110 L/s Noble Pump	140 L/s Ion Pump
Pump	Type	912-7020	912-7010
	Pumping speed (N_2 gas)	110 L/s	140 L/s
	Operating range(Note 1)	$10^{-2} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	1×10^{-2} Pa or less	
	Capacity	18 L	
	Maximum heating temperature	250°C	
	Inlet	ϕ 203 ICF	
	Current input terminal	954-7281	
	Element (replaceable)	915-9520 (1 set)	915-9510 (1 set)
	Magnet	912-7001 (×1) included	
	Weight	48 kg	

Note 1 Values when using P-521IP/NP control device

●Standard configuration

	Name and Type / Components	110 L/s Noble Pump 912-7020	140 L/s Ion Pump 912-7010
Pump	Pump body	×1	
	Attachment gasket for ϕ 203 ICF	×2	

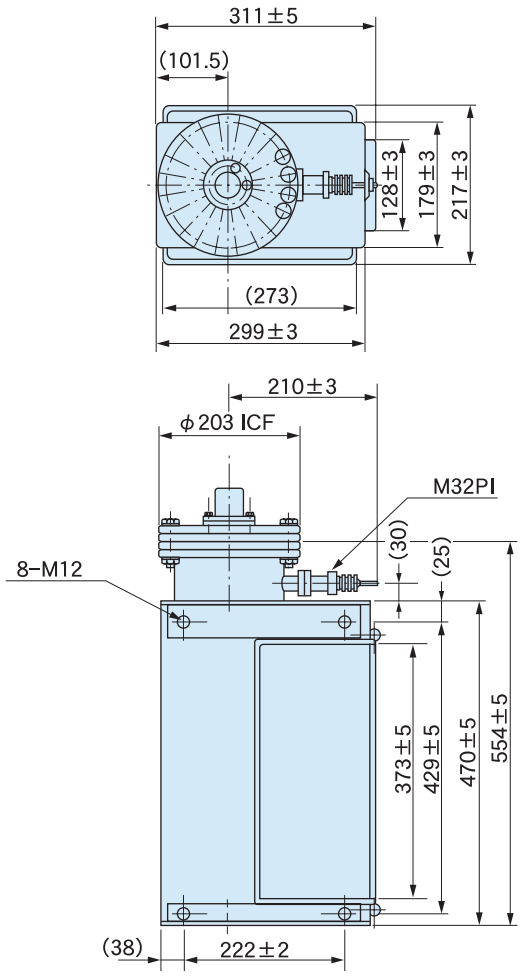


Fig. 6 (d) 110 L/s Noble Pump (912-7020)
140 L/s Ion Pump (912-7010)

■ 220 L/s Noble Pump

•Specifications

	Name	220 L/s Noble Pump	
Pump	Type	912-7040	912-7041
	Pumping speed (N_2 gas)	220 L/s	
	Operating range(Note 1)	$10^{-3} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	6×10^{-3} Pa or less	
	Capacity	26 L	28 L
	Maximum heating temperature	250°C	
	Inlet	ϕ 203 ICF	
	Current input terminal	954-7281	
	Element (replaceable)	915-9510 (×2)	
	Magnet	912-7002 (×1) included	912-7001 (×2) included
	Weight	85 kg	90 kg

Note 1 Values when using P-521IP/NP control device

•Standard configuration

	Name and Type / Components	220 L/s Noble Pump 912-7040	220 L/s Noble Pump 912-7041
Pump	Pump body	×1	
	Attachment gasket for ϕ 203 ICF	×2	

■ 270 L/s Ion Pump

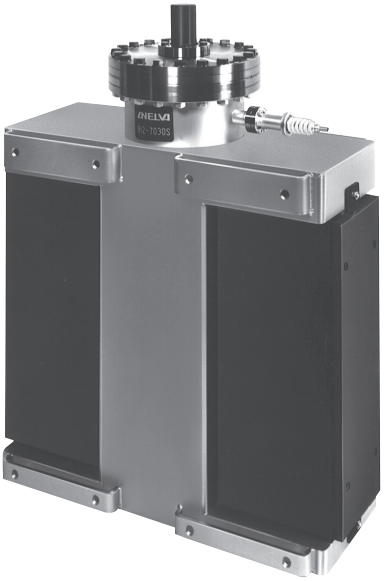
•Specifications

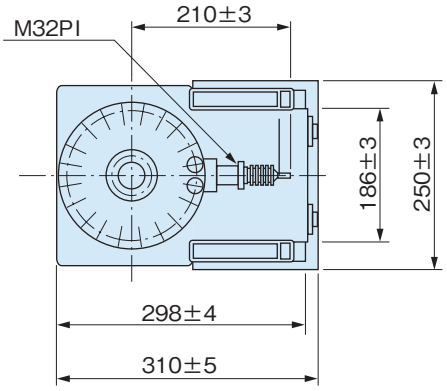
	Name	270 L/s Ion Pump	
Pump	Type	912-7030	912-7031
	Pumping speed (N_2 gas)	270 L/s	
	Operating range(Note 1)	$10^{-3} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	6×10^{-3} Pa or less	
	Capacity	26 L	28 L
	Maximum heating temperature	250°C	
	Inlet	ϕ 203 ICF	
	Current input terminal	954-7281	
	Element (replaceable)	915-9510 (×2)	
	Magnet	912-7002 (×1) included	912-7001 (×2) included
	Weight	85 kg	90 kg

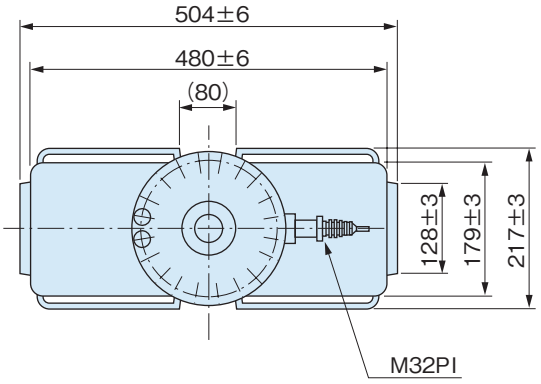
Note 1 Values when using P-521IP/NP control device

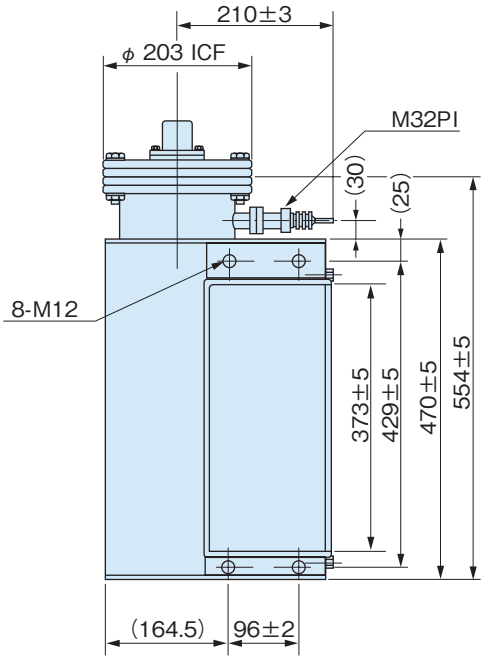
•Standard configuration

	Name and Type / Components	270 L/s Ion Pump 912-7030	270 L/s Ion Pump 912-7031
Pump	Pump body	×1	
	Attachment gasket for ϕ 203 ICF	×2	









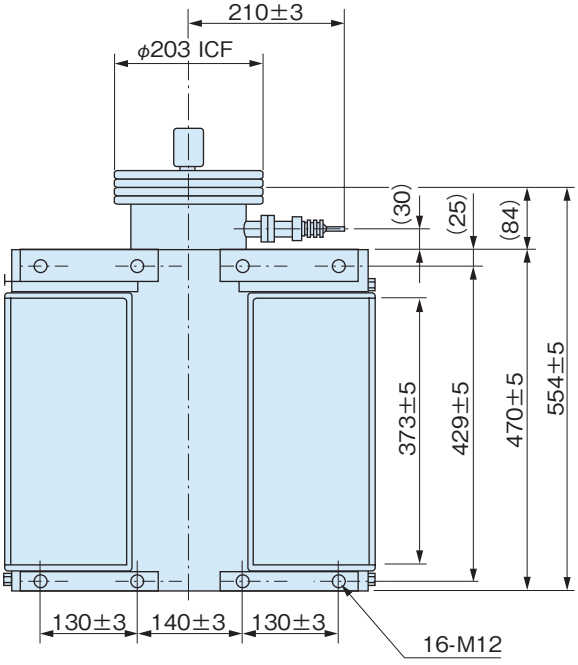


Fig. 6 (e) 220 L/s Noble Pump (912-7040)
270 L/s Ion Pump (912-7030)

Fig. 6 (f) 220 L/s Noble Pump (912-7041)
270 L/s Ion Pump (912-7031)

■ 400 L/s Noble Pump • 500 L/s Ion Pump

•Specifications

	Name	400 L/s Noble Pump	500 L/s Ion Pump
Pump	Type	912-7060	912-7050
	Pumping speed (N_2 gas)	400 L/s	500 L/s
	Operating range(Note 1)	$10^{-3} \sim 10^{-9}$ Pa	
	Ready to start pressure(Note 1)	3×10^{-3} Pa or less	
	Capacity	38 L	
	Maximum heating temperature	250℃	
	Inlet	ϕ 203 ICF	
	Current input terminal	954-7281	
	Element (replaceable)	915-9520 (×4)	915-9510 (×4)
	Magnet	912-7002 (×2) included	
	Weight	120 kg	

Note 1 Values when using P-521IP/NP control device

•Standard configuration

	Components \ Name and Type	400 L/s Noble Pump 912-7060	500 L/s Ion Pump 912-7050
Pump	Pump body	×1	
	Attachment gasket forφ203 ICF	×2	

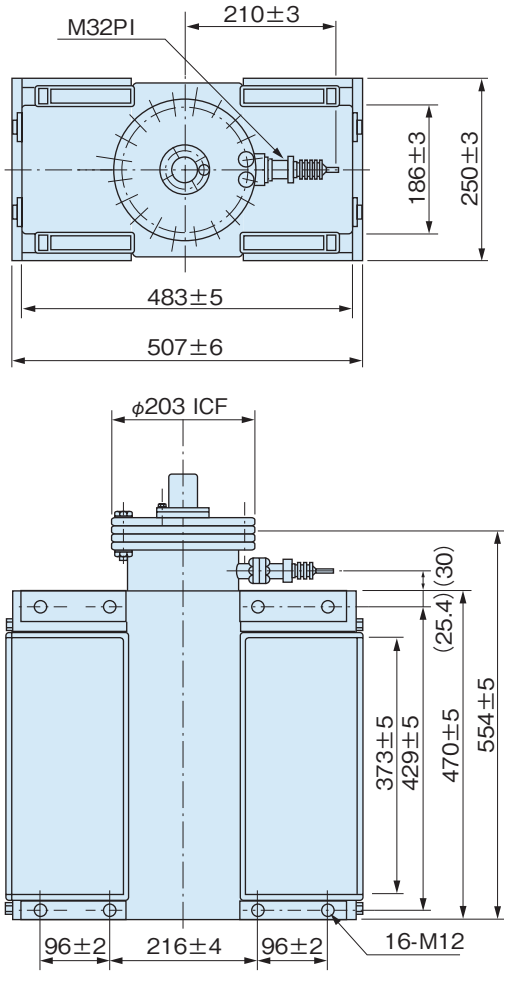


Fig. 6 (g) 400 L/s Noble Pump (912-7060)
500 L/s Ion Pump (912-7050)

■ 800 L/s Noble Pump • 1000 L/s Ion Pump

•Specifications

	Name	800 L/s Noble Pump		1000 L/s Ion Pump	
Pump	Type	912-9110	912-7190	912-9100	912-7195
	Pumping speed (N_2 gas)	800 L/s		1000 L/s	
	Operating range(Note 1)	$10^{-3} \sim 10^{-9}$ Pa			
	Ready to start pressure(Note 1)	2×10^{-3} Pa or less			
	Capacity	106 L			
	Maximum heating temperature	250°C			
	Inlet	ϕ 326CS flange	ϕ 356 ICF	ϕ 326CS flange	ϕ 356 ICF
	Current input terminal	954-7281			
	Element (replaceable)	912-9520 (×8)		915-9510 (×8)	
	Magnet	912-7003 (×2) included			
	Weight	257 kg			

Note 1 Values when using P-521IP/NP control device

•Standard configuration

	Name and Type / Components	800 L/s Noble Pump 912-9110	800 L/s Noble Pump 912-7190	1000 L/s Ion Pump 912-9100	1000 L/s Ion Pump 912-7195
Pump	Pump body	×1			
	Attachment gasket forφ203 ICF	×3 (gasket for ϕ 326 CS flange)	×3 (gasket for ϕ 356 ICF flange)	×2 (gasket for ϕ 326 CS flange)	×2 (gasket for ϕ 356 ICF flange)

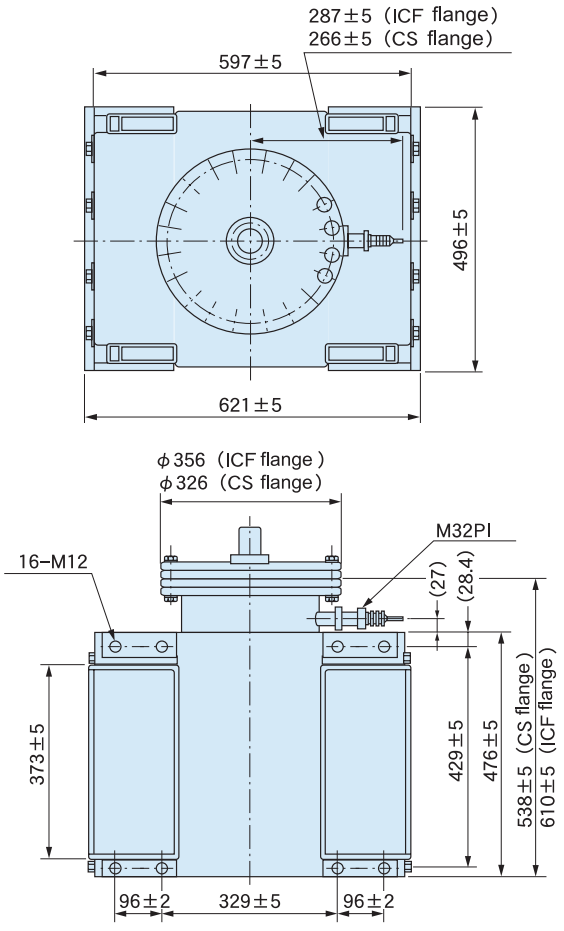
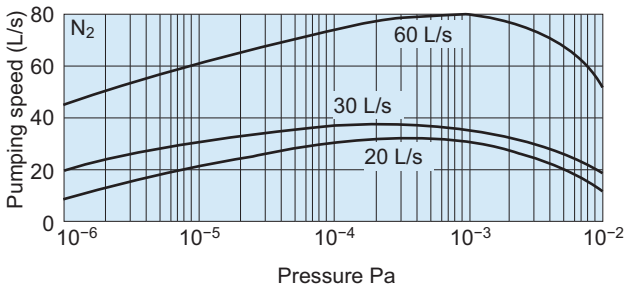
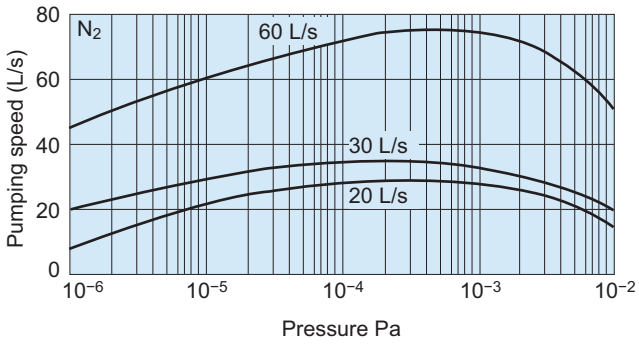


Fig. 6 (h) 800 L/s Noble Pump (912-9110)
800 L/s Noble Pump (912-7190)
1000 L/s Ion Pump (912-9100)
1000 L/s Ion Pump (912-7195)

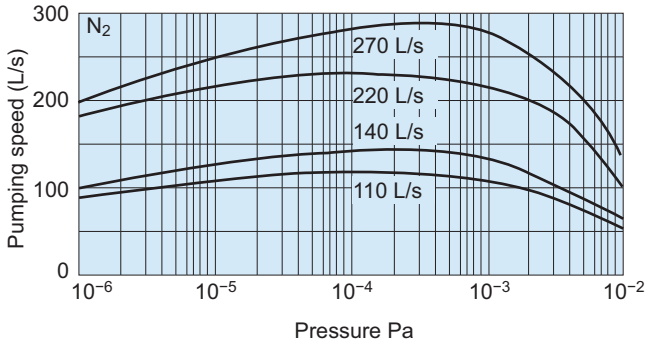
Pumping speed - pressure characteristics (Fig. 8)



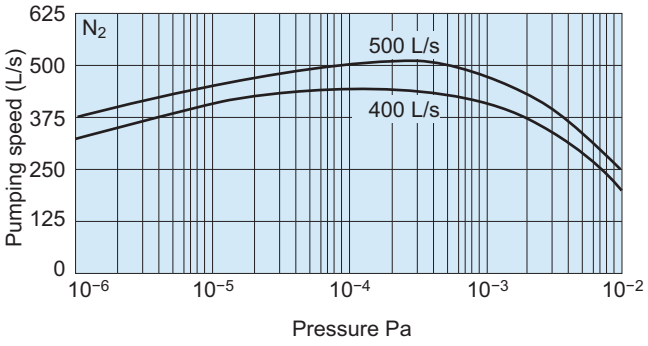
20 L/s • 30 L/s • 60 L/s Ion Pump



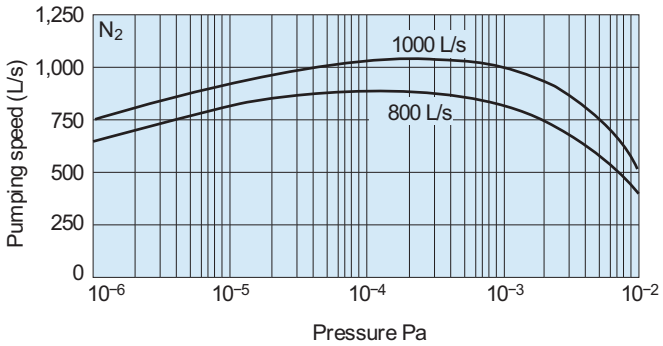
20 L/s • 30 L/s • 60 L/s Noble Pump



110 L/s Noble Pump • 140 L/s Ion Pump
220 L/s Noble Pump • 270 L/s Ion Pump

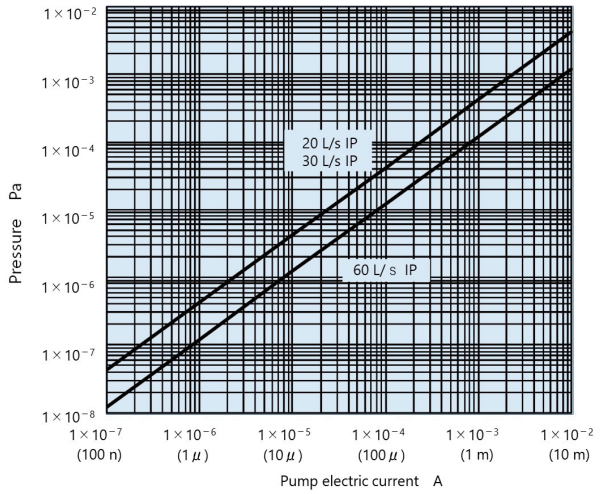


400 L/s Noble Pump • 500 L/s Ion Pump

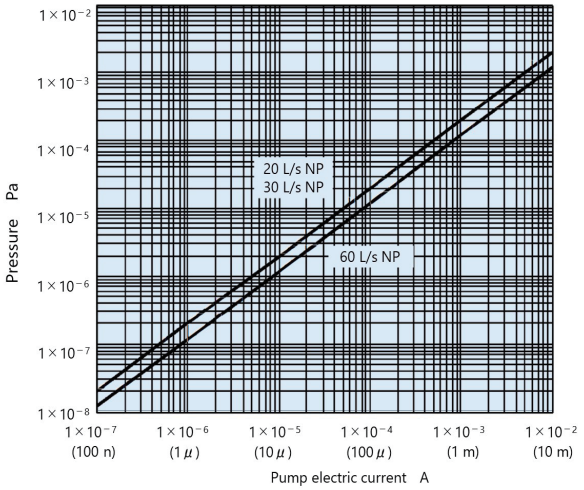


800 L/s Noble Pump • 1000L/s Ion Pump

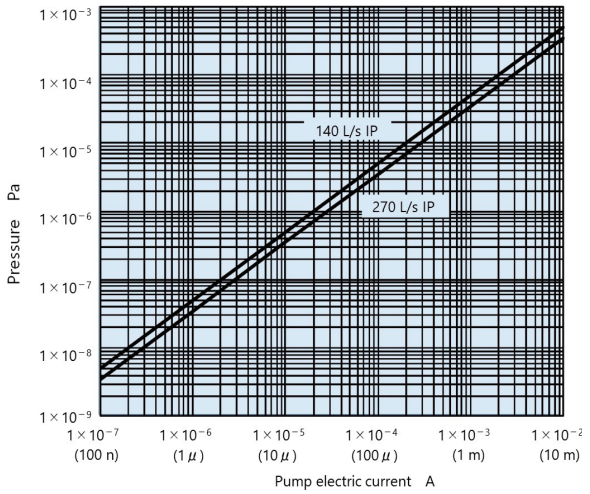
Pressure - pump current characteristics (Fig. 9)



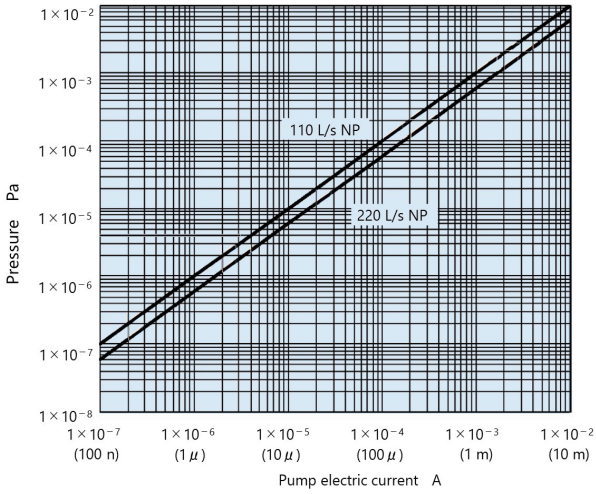
20 L/s • 30 L/s • 60 L/s Ion Pump



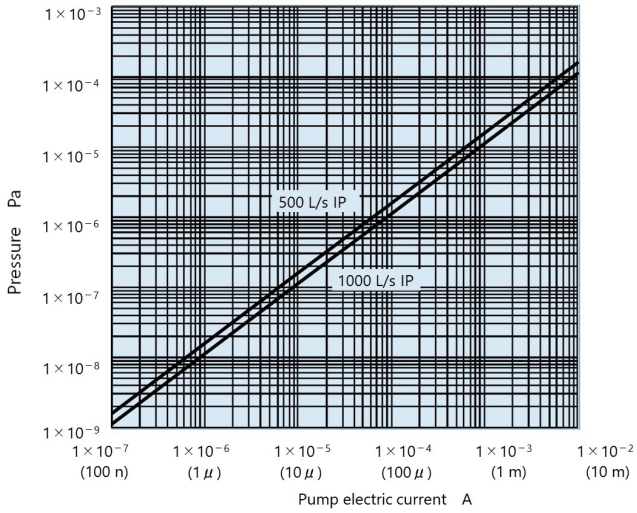
20 L/s • 30 L/s • 60 L/s Noble Pump

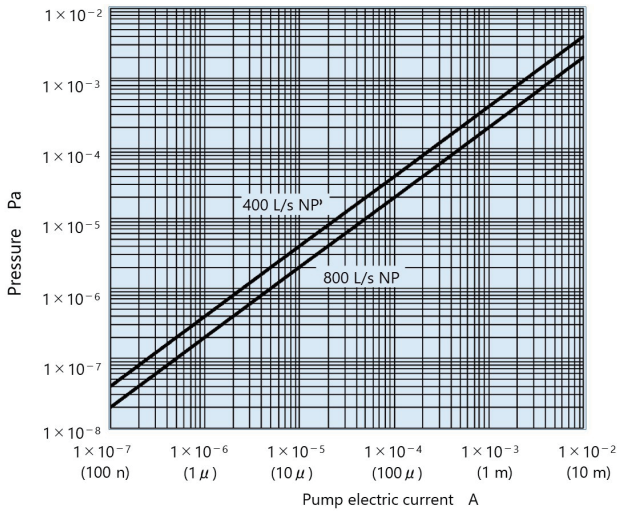


140 L/s • 270 L/s Ion Pump



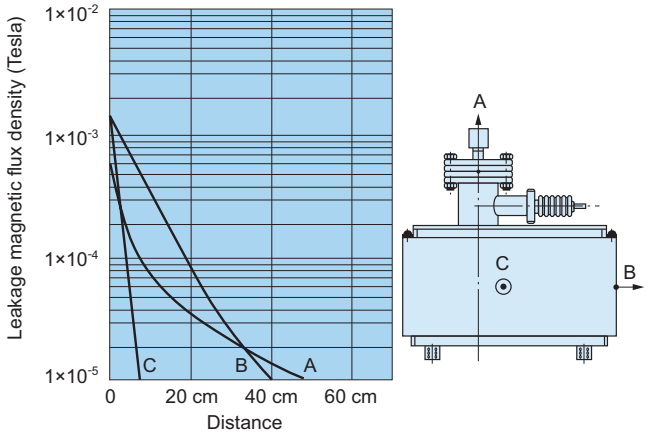
110 L/s • 220 L/s Noble Pump



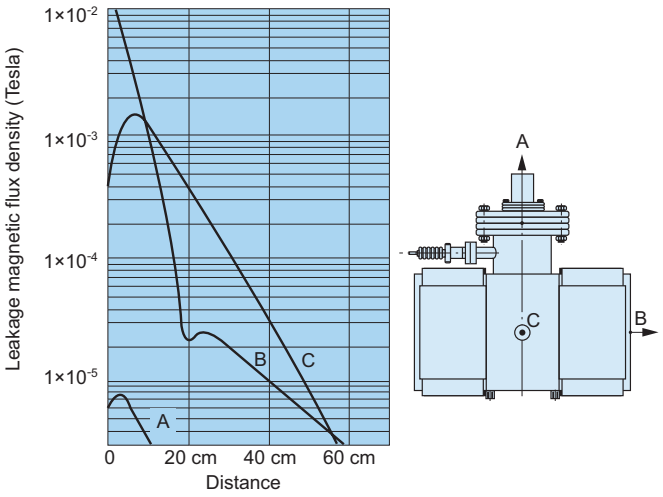


110 L/s • 220 L/s Noble Pump

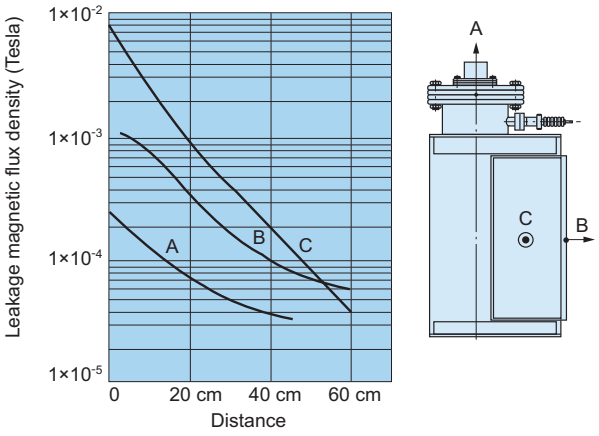
Leakage magnetic flux characteristics (Fig. 9)



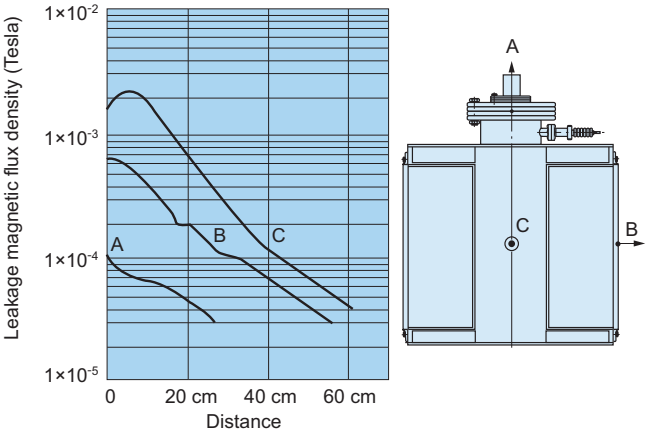
20 L/s Noble Pump
20 L/s Ion Pump



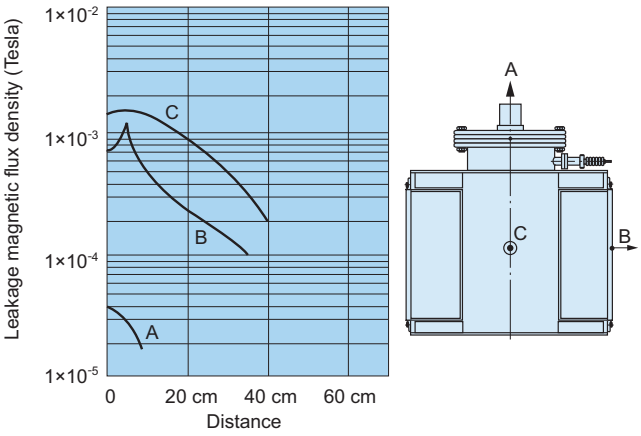
60 L/s Noble Pump
60 L/s Ion Pump



110 L/s Noble Pump
140 L/s Ion Pump



400 L/s Noble Pump
500 L/s Ion Pump



800 L/s Noble Pump
1000 L/s Ion Pump

■ Options

● Output cable assembly

The following options are available as an output cable assembly in addition to the standard 3 m.
Please specify when ordering controllers. Refer to the following notes when ordering. B type output plug is included.

Length	Type	Applicable pump	Applicable controller
3 m	954-7403	20 L/s to 1,000 L/s Ion Pump and Noble Pump	P-500 series Ion Pump controller Noble Pump controller
5 m	954-7405		
7 m	954-7407		
9 m	954-7409		

954-7403、7405、7407、7409 output cable assembly

● Maintenance/consumable parts

Replacement element

For ion and noble pumps of 60L/s or more, the element must be replaced at the end of its product life.
Refer to the ordering information for the element type and quantity.

Depending on the degree of contamination of the pump, simply replacing the element may not be enough to sufficiently restore the characteristics.

In this case, the container must be cleaned and heat pumped. Please contact us for details. (Refer to the section on application.)

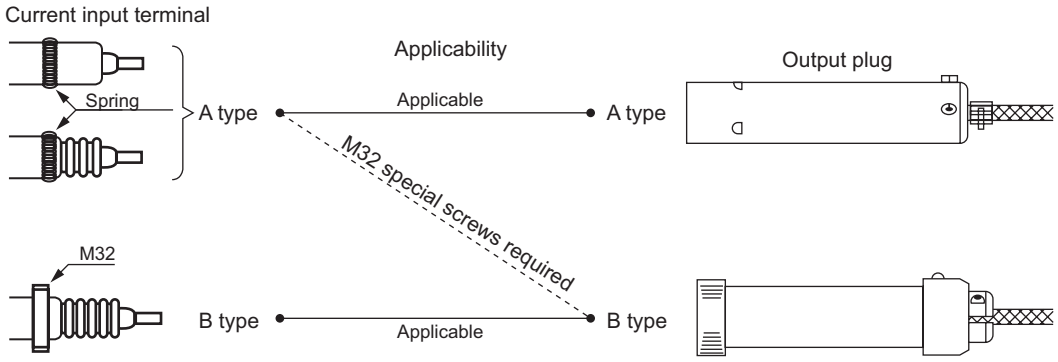
For pumps of 30L/s or less, the entire pump unit excluding the magnet must be replaced because it cannot be renewed.

Current input terminal

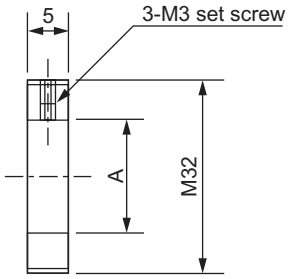
The current input terminal can be replaced for 30L/s or more pumps. Refer to the section on current input terminal.

Precautions before ordering

If you already have a controller and are only ordering a pump or you already have a pump and are only ordering a controller, check the compatibility of the pump side current input terminal with the controller side output plug.
When newly purchasing, the controller comes with B type output plug and the pump comes with B type current input terminal.



- The B type current input terminal does not match the A type output plug. If you have an old controller with A type output plug and are ordering a pump with B type current input terminal, be sure to also order an output cable assembly with B type output plug.
- The A type current input terminal can be made compatible with the B type output plug by using an M32 special screw. If you have a pump with A type current input terminal and are ordering a controller with B type output plug, be sure to also order an M32 special screw. (Please specify according to the pump type.)



M32 special screw

Type	Name	Applicable	Dimension A
954-7020	M32special screw(1)	110 L/s、140 L/s、220 L/s、270 L/s、400 L/s、500 L/s、800 L/s、1000 L/s pump	ϕ 20.2
954-7019	M32special screw(2)	1 L/s、8 L/s、20 L/s、60 L/s pump	ϕ 19.3

■ Application

When using an ion pump to create an ultra-high vacuum, the selection of the components of the vacuumsystem and internal processing of the vacuum chamber are also very important in addition to the ion pump selection.
If the appropriate components and pump are not selected carefully, the intended performance of the ion pump may not be able to be achieved. Please contact us when designing the vacuum system.
In general, the exhaust system configuration shown in Figure 10 is recommended.

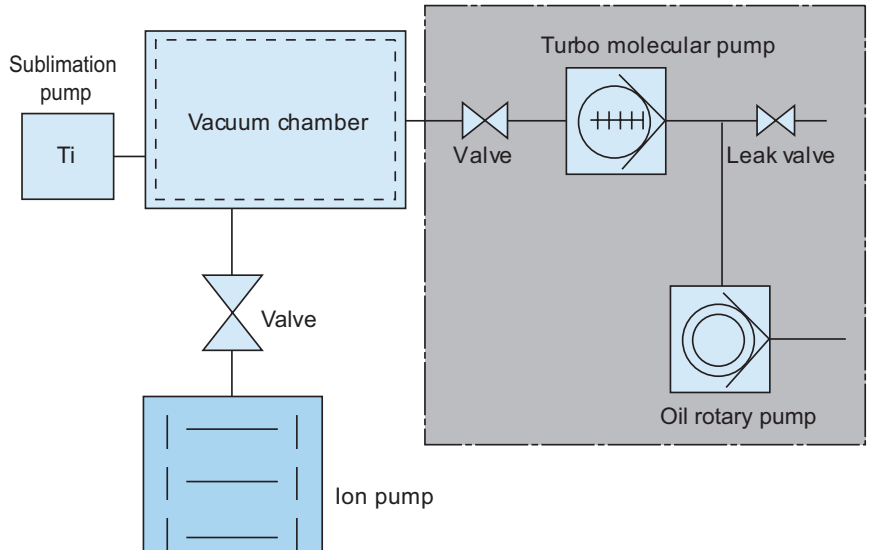


Fig. 10 Combining the roughing system with turbo molecular pump and oil rotary pump

Note) The pump may not start depending on the roughing system's ultimate pressure. Refer to page 40 for the ready to start pressure.

● To activate the ion/noble pump

Roughing must be performed with other pumps at atmosphere to 10^{-2} Pa or at 3×10^{-4} Pa or less depending on the pump and the controller. The following system is recommended as the roughing pump.

- **System combining the turbo molecular pump and oil rotary pump (Fig. 10)**

Currently, this is the most common method. Any ion pump/noble pump and controller can be used because the ultimate pressure of the roughing system is favorable. This is well suited for roughing of large capacity systems or ultra-high vacuum systems when low ultimate pressure is necessary because oil free roughing is possible.

● To obtain ultra-high vacuum

Oil-free rough pumping and baking of the vacuum chamber and pump body is essential.
We recommend using our titanium sublimation pump (956-7015) or tie-vac pump (956-7040) in combination as an auxiliary pump, when exhausting with the ion pump after baking.

● Overhaul

The life of the ion pump and noble pump varies greatly with the condition of use. Normally, however,it is about 30,000 to 40,000 hours at 1×10^{-4} Pa. The life will decrease in inverse proportion to the working pressure. In general, the end of product life should be assumed when the ultimate pressure drops or when the startup time increases. The following overhaul methods are available when the end of product life is reached.

- **Replace or restore the element**

The most simple restoration method is sufficient to restore the characteristics if the required ultimate pressure is not so high. In addition, clean the pump container with acetone.
Please contact us for details on restoring the element.

- **Replace the element and current terminal, clean and heat pump the pump container.**

Please specify under the name overhaul A. We will pick up the pump set and perform the abovementioned overhaul. The pump characteristics will be restored to as good as new. Periodic inspection of the power supply is recommended as well.

[Notes on use]

If you pump special gas specified in the "Ordinance on Prevention of Hazards Due to Specified Chemical Substances", the pump may cease to operate or overhaul may not be possible. Please contact us in advance.

■ Ordering information

Parts Number	Model	Description	Remarks	Code
8B1-0002-132	912-7125	20 L/s Ion Pump	With ϕ 70 ICF	10020
8G1-0501-425	912-7127	20 L/s Ion Pump	With ϕ 70 ICF without magnet	10021
8B1-0002-074	912-7135	30 L/s Ion Pump	With ϕ 114 ICF	10022
8B1-0005-011	912-7137	30 L/s Ion Pump	With ϕ 114 ICF without magnet	10023
8B1-0002-189	912-7165	60 L/s Ion Pump	With ϕ 152 ICF	10030
8B1-0002-349	912-7010	140 L/s Ion Pump	With ϕ 203 ICF	10040
8B1-0002-383	912-7030	270 L/s Ion Pump	With ϕ 203 ICF	10042
8B1-0002-073	912-7031	270 L/s Ion Pump	With ϕ 203 ICF, left-right symmetric	10043
8B1-0002-373	912-7050	500 L/s Ion Pump	With ϕ 203 ICF	10050
8B1-0005-089	912-9100	1000 L/s Ion Pump	With ϕ 326 CS flange	10060
8B1-0008-225	912-7195	1000 L/s Ion Pump	With ϕ 356 ICF	10062
8B1-0002-194	912-7120	20 L/s Noble Pump	With ϕ 70 ICF	10120
8B1-0001-989	912-7122	20 L/s Noble Pump	With ϕ 70 ICF without magnet	10121
8B1-0001-832	912-7130	30 L/s Noble Pump	With ϕ 114 ICF	10122
8B1-0004-018	912-7132	30 L/s Noble Pump	With ϕ 114 ICF without magnet	10123
8B1-0002-146	912-7160	60 L/s Noble Pump	With ϕ 152 ICF	10130
8B1-0002-343	912-7020	110 L/s Noble Pump	With ϕ 203 ICF	10140
8B1-0002-360	912-7040	220 L/s Noble Pump	With ϕ 203 ICF	10142
8B1-0002-379	912-7041	220 L/s Noble Pump	With ϕ 203 ICF, left-right symmetric	10143
8B1-0002-368	912-7060	400 L/s Noble Pump	With ϕ 203 ICF	10150
8B1-0010-097	912-9110	800 L/s Noble Pump	With ϕ 326 CS flange	10160
8B1-0010-100	912-7190	800 L/s Noble Pump	With ϕ 356 ICF	10162
8B1-0001-727	954-7403	Output Cable assembly	For 20 L/s-1000 L/s IP/NP (3 m)	10548
8B1-0001-728	954-7405	Output Cable assembly	For 20 L/s-1000 L/s IP/NP (5 m)	10549
8B1-0001-729	954-7407	Output Cable assembly	For 20 L/s-1000 L/s IP/NP (7 m)	10550
8B1-0001-730	954-7409	Output Cable assembly	For 20 L/s-1000 L/s IP/NP (9 m)	10551

Improved visibility and function!

Ion Pump/Noble Pump Controller

P-500 series

■ Summary

These controllers control the ion pump or noble pump from high vacuum of 10^{-2} Pa to 10^{-4} Pa or less. A large green LED display is used for improved visibility from a distance.
The controllers provide enhanced functions and CE, RoHS compatibility while maintaining compatibility with conventional models.
Supporting RS232C communications with the addition of an option board as well as abundant I/O functions, the controllers are ideal for automated equipment/remote operation equipment.
An ultra-high vacuum type and a high-power type are available for both the ion and noble pumps with the operable pressure range and ready to start pressure depending on the connected pump.

■ Features

1. High performance

Achieves basic functions necessary for high voltage power supply with improved minimum displayable values when monitoring current/voltage, addition of pressure display, and various protective functions

2. Rich functions

- Supports external control with various standard equipped I/Os such as two set points
- Auto recovery from power failure (selectable)
- Small current output (optional) allows to monitor the pump current at ultra-high vacuum.

3. High compatibility

Maintains remote connector, input cable, and output cable compatibility with conventional models

4. Communication support

RS232C (Option〔Assembled at the factory〕)

5. Applicable standards

CE marking, RoHS directive compliance

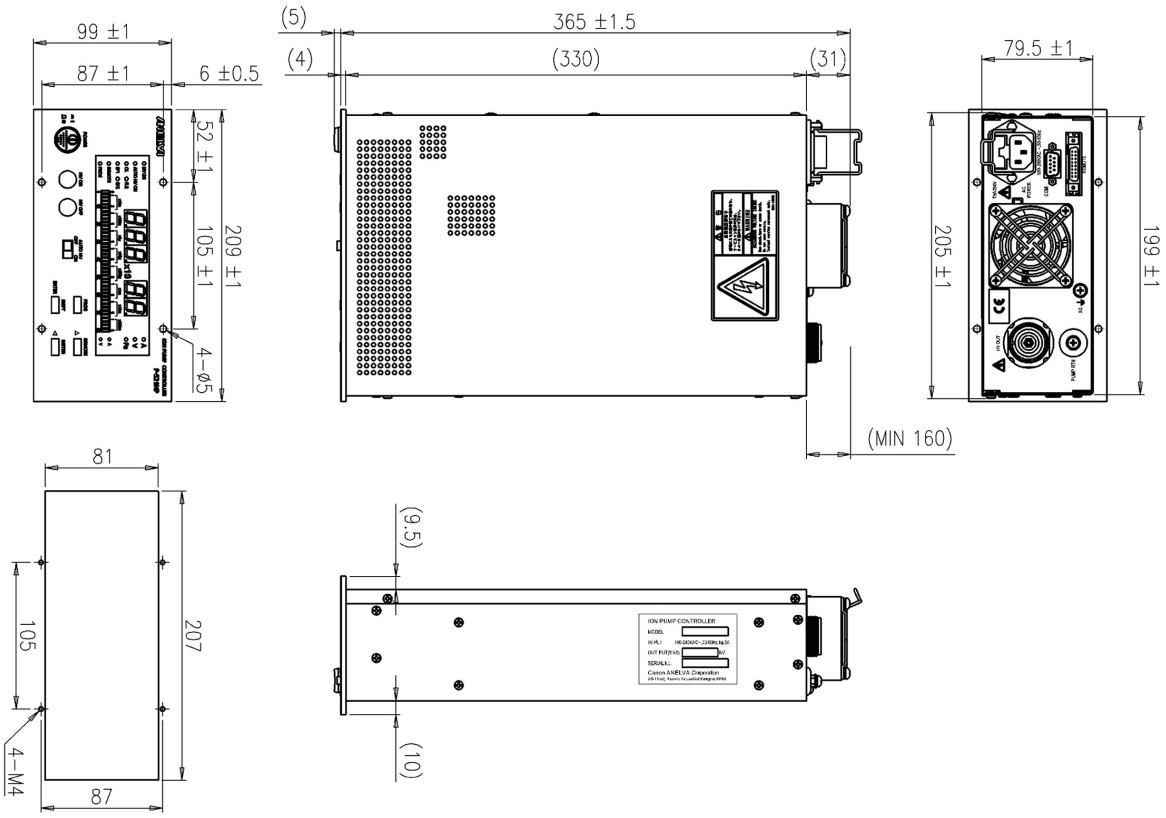
■ Applications

- Electron microscopes, electron beam lithography equipment
- Ion beam equipment, mask repair equipment
- Accelerator-related systems such as storage rings, beam lines, etc.
- Ultra-high vacuum equipment and various analyzers such as MBE, surface analysis equipment, etc.

■ Specifi cations

Type		P-511 IP	P-521 IP	P-511 NP	P-521 NP
Name		Ion Pump Controller		Noble Pump Controller	
Compatible pump		All ion pumps		All noble pumps, excel pumps, combination pumps	
Maximum output voltage		DC+5.2 kV±10% / DC+7.5 kV±10% / DC+3.5 kV±10% Switched in program mode		DC-5.2 kV±10% / DC-7.0 kV±10% Switched in program mode	
Maximum output current		43 mA or more	170 mA or more	43 mA or more	170 mA or more
		Limited to approx. 20 mA in the case of 8 L/s and 1 L/s			
Input voltage		AC100 ～ 240 V 50/60 Hz 1 ϕ (multi-voltage input)			
Power consumption		Approx. 500 VA maximum			
Dimensions		W209×H99×D370 mm (1/2 rack size)			
Weight		Approx. 6 kg (without option board)			
Operating temperature/ humidity		0 ～ 40°C / 85% RH or less (no condensation)			
Usage environment		Indoor use / altitude 2000 m or less / pollution level: 2 / Installation category: II			
Display range	Output voltage	0.1×10^{3} V (0.1 kV) ～ 8.0×10^{3} V (8.0 kV)			
	Output current	0.1×10^{-7} A (10 nA) ～ 5.0×10^{-1} A (500 mA)			
	Pressure	1.1×10^{-9} ～ 1.0×10^{-3} Pa (The display range varies depending on the connected pump) No display function in the case of 8 L/s and 1 L/s		1.1×10^{-9} ～ 1.0×10^{-3} Pa (The display range varies depending on the connected pump)	
Protection function		Various protective functions available Errors and error numbers are displayed on the display unit when the protective function is activated			
Pressure contact		Two points can be set between 1µA ～ 99 mA			
REMOTE mode		REMOTE/LOCAL switchable with the REMOTE switch on the front panel			
Conformity		CE、RoHS			

■ Dimensions diagram



■ Selection guide

An ultra-high vacuum type and high-power type are available for both the P-500 series ion pump controller and noble pump controller with different ready to start pressures when operating the same pump.
Use the following table to select the controller that meets your requirements.

Applicable Pump Type / Name	Ready to Start Pressure		Remarks
＜ Ion Pump ＞	P-511 IP Ion Pump controller (ultra-high vacuum type)	P-521 IP Ion Pump controller (high-power type)	Set to +5.2 kV output voltage at shipment
912-7125 20 L/s Ion Pump	1×10^{-2} Pa or less	2×10^{-2} Pa or less	
912-7135 30 L/s Ion Pump	1×10^{-2} Pa or less	2×10^{-2} Pa or less	
912-7165 60 L/s Ion Pump	5×10^{-3} Pa or less	2×10^{-2} Pa or less	
912-7010 140 L/s Ion Pump	2×10^{-3} Pa or less	1×10^{-2} Pa or less	Output voltage must be changed to +7.5kV
912-7030 270 L/s Ion Pump 912-7031 270 L/s Ion Pump	1×10^{-3} Pa or less	6×10^{-3} Pa or less	
912-7050 500 L/s Ion Pump	5×10^{-4} Pa or less	3×10^{-3} Pa or less	
912-9100 1000 L/s Ion Pump 912-7195 1000 L/s Ion Pump	3×10^{-4} Pa or less	2×10^{-3} Pa or less	
913-0007 1 L/s Ion Pump 913-0008 1 L/s Ion Pump	1×10^{-2} Pa or less	—	Output voltage must be changed to +3.5kV
911-7000 8 L/s Ion Pump	1×10^{-2} Pa or less	—	
＜ Noble pump ＞	P-511NP Noble Pump controller (ultra-high acuum type)	P-521NP Noble Pump controller (high-power type)	Set to -5.2 kVoutput voltage at shipment
912-7120 20 L/s noble pump	1×10^{-2} Pa or less	2×10^{-2} Pa or less	
912-7130 30 L/s noble pump	1×10^{-2} Pa or less	2×10^{-2} Pa or less	
912-7160 60 L/s noble pump	5×10^{-3} Pa or less	2×10^{-2} Pa or less	
912-7020 110 L/s noble pump	2×10^{-3} Pa or less	1×10^{-2} Pa or less	
912-7040 220 L/s noble pump 912-7041 220 L/s noble pump	1×10^{-3} Pa or less	6×10^{-3} Pa or less	
912-7060 400 L/s noble pump	5×10^{-4} Pa or less	3×10^{-3} Pa or less	
912-9110 800 L/s noble pump 912-7190 800 L/s noble pump	3×10^{-4} Pa or less	2×10^{-3} Pa or less	
913-7000 400 L/s combination pump	1×10^{-2} Pa or less	2×10^{-2} Pa or less	
913-7001 800 L/s combination pump	1×10^{-2} Pa or less	2×10^{-2} Pa or less	
913-7002 1600 L/s combination pump	5×10^{-3} Pa or less	2×10^{-2} Pa or less	

Note) Note that the values depend on conditions such as the pumping history, pumping system configuration, and capacity.

■ Output cable

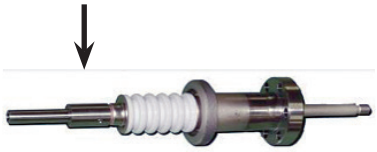
The main unit of the P-500 series ion pump/noble pump controller is CE compliant.
Therefore, CE compliant output cables are newly included.
Conventional type cables (CE non-compliant) can also be used.

Output cable assembly
L=139 mm

CE-compliant output cable assembly L=185 mm

A current terminal adapter is necessary to connect the CE-compliant output cable to the ion pump/noble pump.

Current terminal adapter



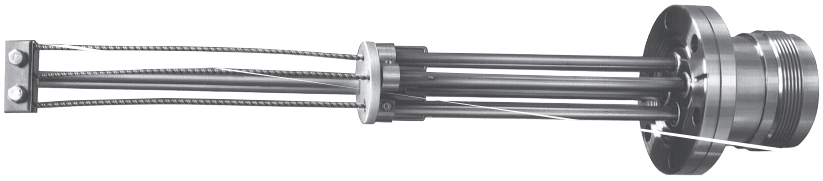
Current terminal equipped with adapter

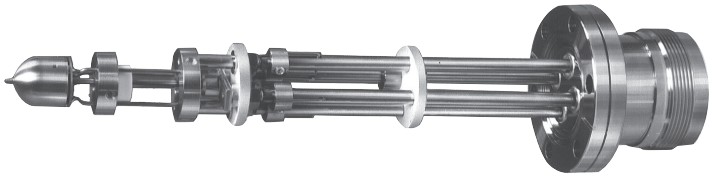
◆ The current terminal adapter is included with the CE-compliant output cable.

■ Ordering information

Parts Number	Model	Description	Remarks	Code
8B1-0000-756	P-511IP	Ion Pump Control Unit	For ultra-high vacuum	10261
8B1-0000-757	P-521IP	Ion Pump Control Unit	High output type	10262
8B1-0000-758	P-511NP	Noble pump Control Unit	For ultra-high vacuum	10361
8B1-0000-759	P-521NP	Noble pump Control Unit	High output type	10362
8B1-0007-418	P-511IP-RS	Ion Pump Control Unit with RS232C	For ultra-high vacuum, RS232C built-in	10263
8B1-0007-419	P-521IP-RS	Ion Pump Control Unit with RS232C	High output, RS232C built-in	10264
8B1-0007-420	P-511NP-RS	Noble pump Control Unit with RS232C	For ultra-high vacuum, RS232C built-in	10363
8B1-0007-421	P-521NP-RS	Noble pump Control Unit with RS232C	High output, RS232C built-in	10364
8B1-0000-761	501-003	CE- Output Cable assembly (3 m)	For both 20 L/s-1000 L/s IP/NP	10561
8B1-0000-762	501-005	CE- Output Cable assembly (5 m)	For both 20 L/s-1000 L/s IP/NP	10562
8B1-0000-763	501-007	CE- Output Cable assembly (7 m)	For both 20 L/s-1000 L/s IP/NP	10563
8B1-0000-764	501-009	CE- Output Cable assembly (9 m)	For both 20 L/s-1000 L/s IP/NP	10564
8B1-0001-727	954-7403	Output Cable assembly (3 m)	For both 20 L/s-1000 L/s IP/NP	10548
8B1-0001-728	954-7405	Output Cable assembly (5 m)	For both 20 L/s-1000 L/s IP/NP	10549
8B1-0001-729	954-7407	Output Cable assembly (7 m)	For both 20 L/s-1000 L/s IP/NP	10550
8B1-0001-730	954-7409	Output Cable assembly (9 m)	For both 20 L/s-1000 L/s IP/NP	10551

Titanium Sublimation Pump/Ti-Vac Pump





■ Summary

The titanium sublimation pump and Ti-Vac pump are getter pumps that heat and sublimate titanium within a vacuum to form a titanium evaporated film (getter surface) on the surrounding walls and use the getter effect of metal to absorb and discharge gas.

■ Features

1. Oil-free ultra-high vacuum

An oil-free ultra-high vacuum can be achieved when used together with an ion pump.

2. Economical

When used together with an ion pump, turbo molecular pump, or cryopump, the pumping rate and ultimate pressure can be improved signifi cantly making it extremely economical compared to a single large pump.

3. Compact design

The compact light weight design makes it possible to install the pump anywhere.

4. Excellent control function

The controller uses a unique control method that prevents the filament life from being reduced due to frequent ON-OFF.

5. Simple attachment and removal

The controller is connected to the pump with a connector to facilitate attachment and removal.

6. Easy replacement

The evaporation sources (titanium filament, Ti-Vac head) can be replaced easily.

■ Applications

Effective in reducing the pumping time and increasing the ultimate pressure and pumping capacity of your current vacuum pump systems (ion pump, cryopump, turbo molecular pump).
Effective when there is a large amount of gas emission while processing using equipment requiring an ultra-high vacuum such as deposition, annealing, or tube pumping equipment.

■ Specifi cations

● Pump body

Name	Titanium Sublimation Pump	Ti-Vac Pump
Type	956-7015	956-7040
Operating pressure	3 Pa or less	
Effective amount of titanium	Approx. 1g/pump	Approx. 15g
Number of filaments	×3	—
Amount of titanium evaporation	Approx. 0.07g/h (per pump) at 45 A power	Average 0.35g/h at 48 A power
Used fl ange	ϕ 70 ICF flange	
Weight	Approx. 580g	Approx. 680g
Dimensions	See Fig. 1	See Fig. 2

● Controller

Name	Sublimation controller
Type	922-9119
Input	AC200 V±20 V 1 ϕ 2 A 50 / 60 Hz
Output	Voltage: 2.8 to 10.8 V AC (with output open) Variable with slider Current: Up to 50A Power: Up to 430W
Control method	Evaporation - preheating control with two independent timers Output voltage during evaporation: Variable with slider Output voltage during preheating: Fixed at approx. 3.8 V Timer setting: Both evaporation and preheating time can be set to 0 or from 1 to 10 minutes Operation: Evaporation > preheating > OFF (not repeated)
Weight	Approx. 20.5 kg
Input cable	Length outside equipment Approx. 2 m
Output Cable	Length 2 m
Dimensions	See figure

● Standard configuration

Titanium sublimation pump (TSP)

Name		Configuration
956-7015 TSP cartridge (Titanium filament not attached)		×1
Attachiments	956-0010 titanium filament	×12 (1 pack)
	953-5014 gasket for ϕ 70 ICF flange	×5 (1 pack)
	10×10 combination wrench	×1
	7×8 both opening spanner	×1
	Dimension 2 hexagonal wrench	×1
	Moly paste (lubricant)	×1 (tube)
	M4x4 set screws (spare)	×4

Controller (for both TSP and Ti-Vac pump)

Name		Configuration
Controller body		×1
4P plug with output cable (2 m)		×1
Attachiments	Receptacle for 200 V input	×1
	5A fuse	×2
	50A fuse with tab	×1

Note) Cable connector heat-resistant temperature 125°C

Ti-Vac Pump

Name		Configuration
956-7030 Ti-Vac holder		×1
956-7035 Ti-Vac head		×1
Attachiments	Support fitting (included with Ti-Vac holder)	×1
	Insulation spacer (included with Ti-Vac head)	×1
	953-5014 gasket for ϕ 70 ICF flange	×5 (1 pack)
	10x10 combination wrench	×1
	Dimension 2 hexagonal wrench	×2
	Moly paste (lubricant)	×1 (tube)
	M4x4 set screws (spare)	×1

Sublimation pump controller

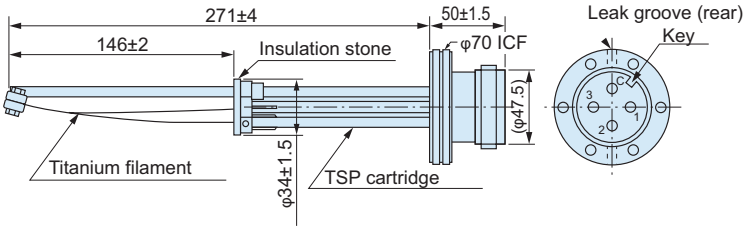


Fig. 1 Titanium sublimation pump

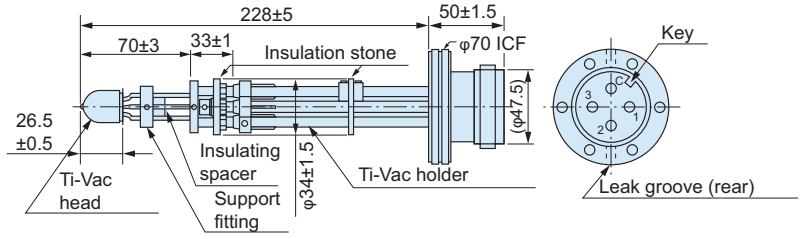


Fig. 2 Ti-Vac pump

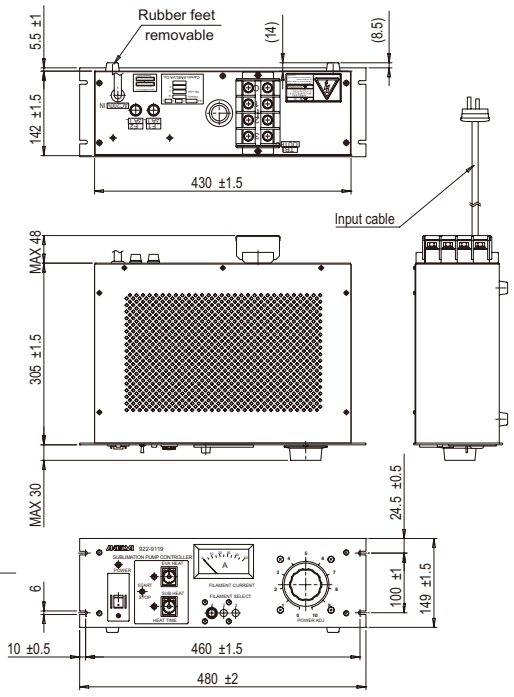
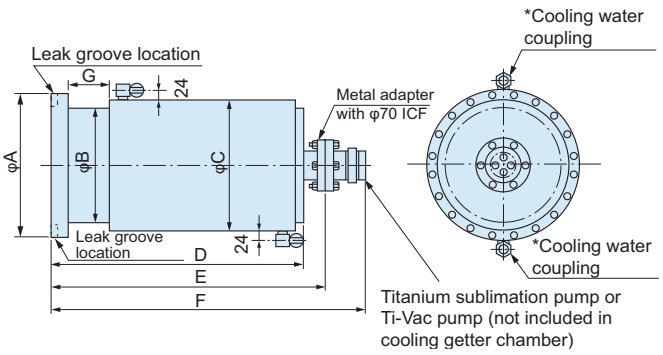


Fig. 3 Sublimation pump controller

■ Options

● Water-cooled getter chamber

Description	400 L/s Getter chamber	800 L/s Getter chamber	1600 L/s Getter chamber
ϕ A	ϕ 152 ICF	ϕ 203 ICF	ϕ 253 ICF
ϕ B	ϕ 101.6	ϕ 160	ϕ 203
ϕ C	ϕ 120	ϕ 180	ϕ 221
D	300	350	400
E	330	380	430
F	380	430	480
G	60	58	65
Weight	Approx. 5.5 kg	Approx. 10 kg	Approx. 15 kg



※This coupling is for 8mm outer diameter SUS pipe (bright annealed austenitic stainless steel) or copper pipe.

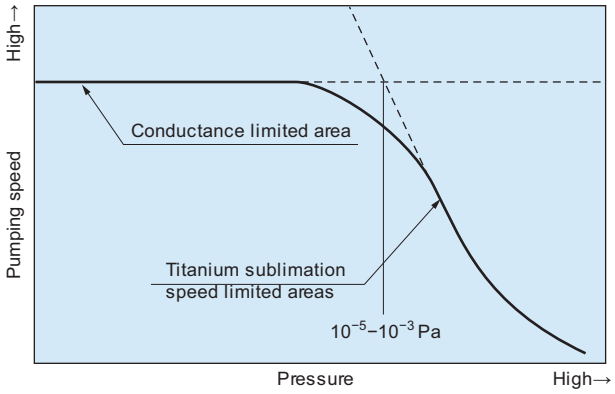
■ Application

The pumping speed of the getter pump (Ti-Vac pump and titanium sublimation pump) drops significantly at 10^{-2} Pa pressure and above.

Normally, it should be used at a pressure not exceeding 10^{-2} Pa.

When using it together with an ion pump, operating together with the ion pump at 1 to 10^{-1} Pa pressure or less is effective in reducing the startup time of the ion pump.

● Pressure/pumping speed characteristics



●Pumping speed per unit area of clean getter surface

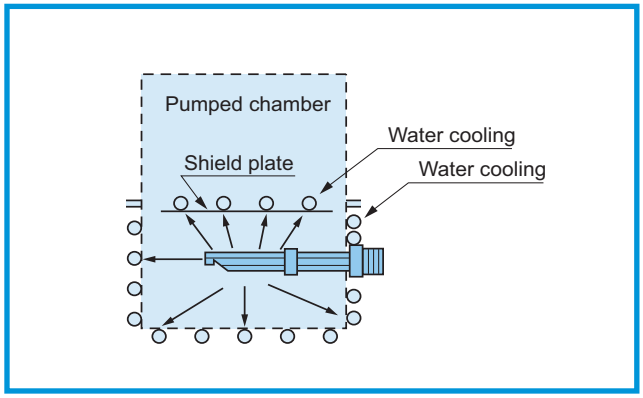
(Unit：L/s,cm^2)

Type of gas / Getter surface temperature	H_2	N_2	O_2	CO	CO_2	H_2O	Inert gas	Methane
20°C	2.6	3.5	8.8	8.3	4.7	7.3	0	0
-195°C	17.6	8.3	11.0	11.2	—	—	0	0

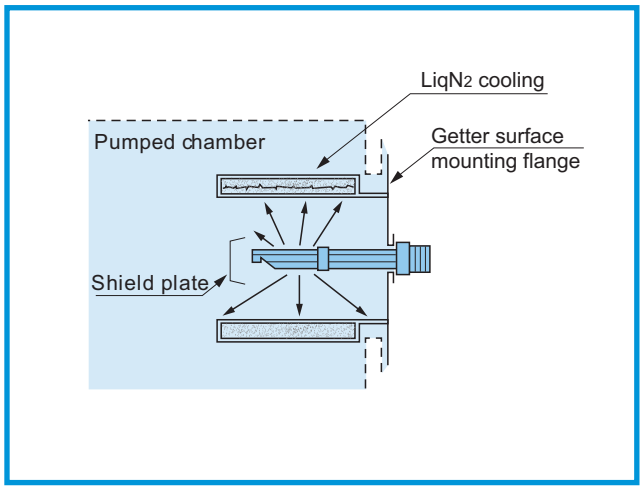
As shown above, the pumping speed of the getter pump varies significantly according to the pressure at the conductance limited area and titanium sublimation speed limited area.
The pumping speed at the conductance limited area is as shown above when the supply of titanium to the getter surface is sufficient and a clean getter surface is maintained.
Therefore, the pumping speed at that area is determined by the getter area and the conductance from the pumped chamber to the getter surface.
At the titanium sublimation limited area, titanium collides with gas molecules before it reaches the getter surface and combines chemically because the pressure is high. As a result, a clean getter surface cannot be obtained and the pumping speed will be inversely proportional to the pressure and proportional to the sublimation rate of titanium.

The following methods are available when using the getter pump.

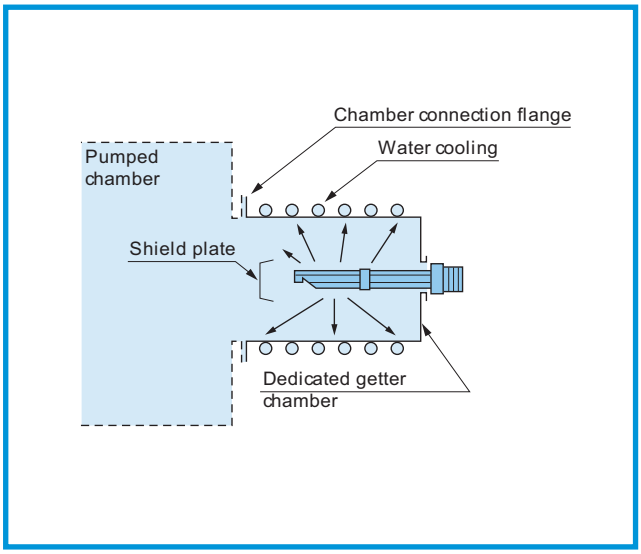
1. Using the inside wall of the pumped chamber as the getter surface
   (In order to obtain high pumping speed)



2. Creating a dedicated getter surface inside the pumped chamber
   (Effective when pumping hydrogen to obtain an ultra-high vacuum)



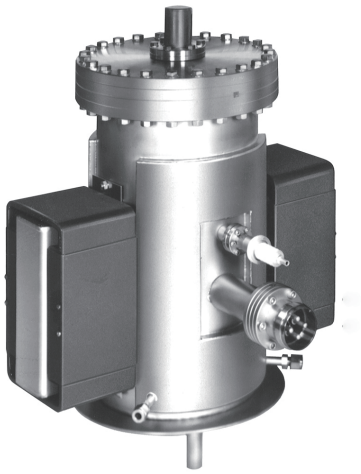
3. Installing a dedicated getter chamber inside the pumped chamber
   (Effective when pumping without contaminating the pumped chamber)
   Three types of water cooled getter chambers are available when using this method.



■ Ordering information

Parts Number	Model	Description	Remarks	Code
8B1-0001-982	956-7040	Ti-Vac Pump	With ϕ 70 ICF, Ti-Vac head x1	10720
8B1-0008-563	956-7035	Ti-Vac Head	TI Head	10730
8B1-0008-568	956-7015	TSP Cartridge	With ϕ 70 ICF, with filament/gasket/attachment tool	10700
8B1-0006-590	956-0010	TSP Filament	×12	10711
8G1-0527-966	956-7030	Ti-Vac Holder		10731
8B1-0006-399	922-9119	Sublimation Pump Control Unit	200V AC /1 ϕ , for both TSP and Ti-Vac pump	10771
8B1-0008-571		TSP Output Cable (2 m)	2 m	10780
8B1-0004-847		TSP Output Cable (3 m)	3 m	10781
8B1-0008-572		TSP Output Cable (5 m)	5 m	10782
8G1-0526-884		TSP Output Cable (7 m)	7 m	10783
8B1-0008-500	941-7104	400 L/s Getter Chamber	With ϕ 152 ICF	10752
8B1-0008-502	941-7108	800 L/s Getter Chamber	With ϕ 203 ICF	10753
8B1-0008-504	941-7116	1600 L/s Getter Chamber	With ϕ 253 ICF	10754

Combination Pump



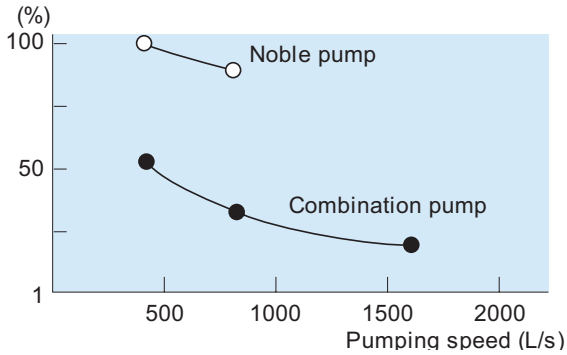


Fig. 1 Price to pumping speed ratio
(Assuming 400 L/s noble pump is 100%)

■ Summary

The combination pump combines a titanium sublimation pump and triode ion pump (noble pump) to achieve a fast pumping speed at very low cost, taking advantage of the ion pump features that enable a clean ultra-high vacuum to be achieved easily.

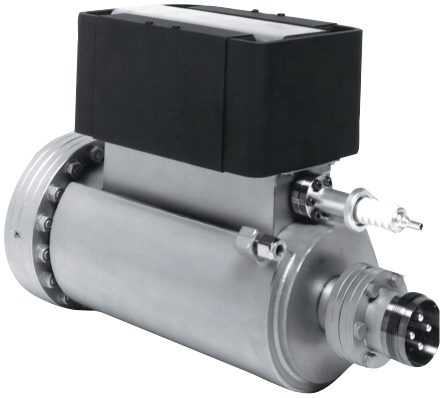
■ Features

1. **Increased pumping speed**
   Compared to ion pumps, the cost (including the cost of the control equipment) per pumping speed of 1L/s is approximately 1/2 to 1/3.
2. **Light weight and compact**
   Compared to ion pumps with the same pumping speed, the volume and weight are reduced to 1/5 to 1/10. Therefore, it can be easily attached/removed to/from the pumped system to achieve a fast pumping speed with minimum space.
3. **Safety design**
   A connector is used to connect the power supply for the sublimation pump to enable simple and secure connection. Flareless fitting is used for the cooling water inlet/outlet so that the metal tube can be connected easily without having to worry about water leaking.
4. **Clean ultra-high vacuum**
   An oil-free clean ultra-high vacuum can be obtained because no organic materials are used.
5. **No liquid nitrogen required**
   No trap is used. Runs on cooling water and AC power
6. **Easy operation and maintenance**
   Simple operation enabling unattended operation even during a power failure.
7. **Pump element replaceable**
   All models use a replaceable titanium evaporation source and noble pump element.

■ Applications

Deposition equipment, electron microscopes, mass spectrometers, vacuum furnaces, various analysis equipment, experimental equipment, pumping equipment and other ultra-high vacuum systems with large gas emission.

■ 400 L/s Combination Pump



● Specifications

Pumping rate/ Pumping flow	See Fig. 2
Operating pressure range	10^{-1} Pa ～ 10^{-9} Pa
Baking temperature	MAX 250°C
Weight	Approx. 15 kg
Intake flange	ϕ 152 ICF flange
Capacity	Approx. 4.5 L
Dimensions	See Fig. 3
Applicable controller	922-9119 Sublimation Pump Controller and P-511NP or P-521NP Noble Pump Controller

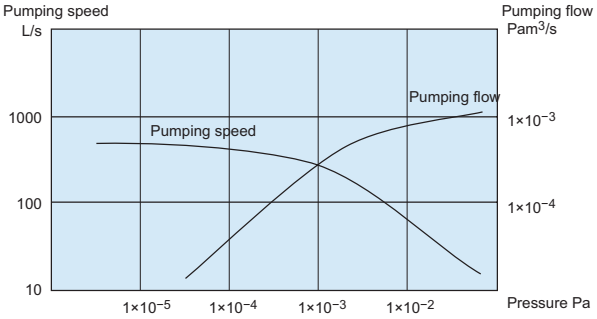
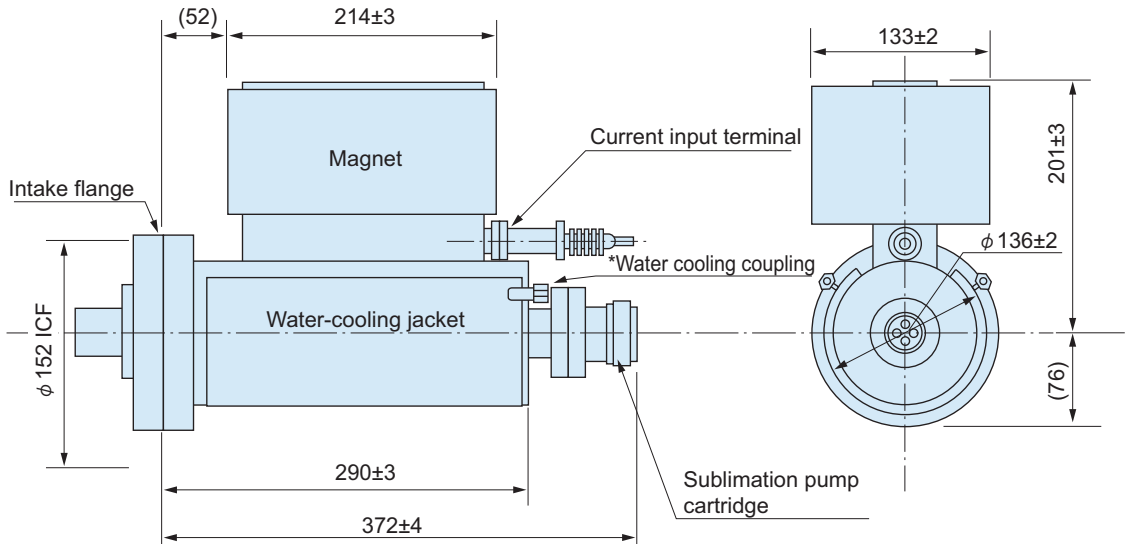


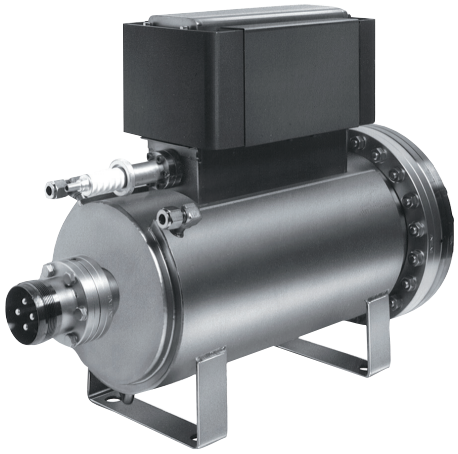
Fig. 2 Pumping speed/pumping flow - pressure characteristics



※This coupling is for 8mm outer diameter SUS pipe (bright annealed austenitic stainless steel) or copper pipe.

Fig. 3 400 L/s Combination Pump Dimensions diagram

■ 800 L/s Combination Pump



● Specifications

Pumping rate/ Pumping flow	See Fig. 4
Operating pressure range	10^{-1} Pa ～ 10^{-9} Pa
Baking temperature	MAX 250°C
Weight	Approx. 25 kg
Intake flange	ϕ 203 ICF flange
Capacity	Approx. 7.5 L
Dimensions	See Fig. 5
Applicable controller	922-9119 Sublimation Pump Controller and P-511NP or P-521NP Noble Pump Controller

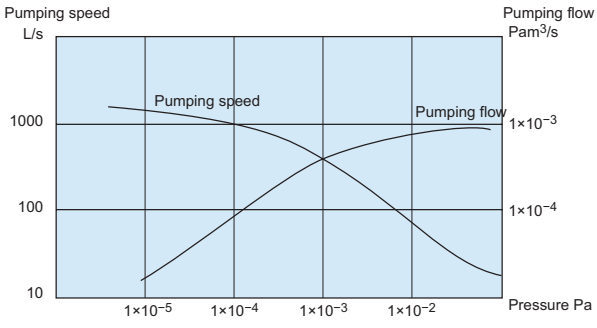
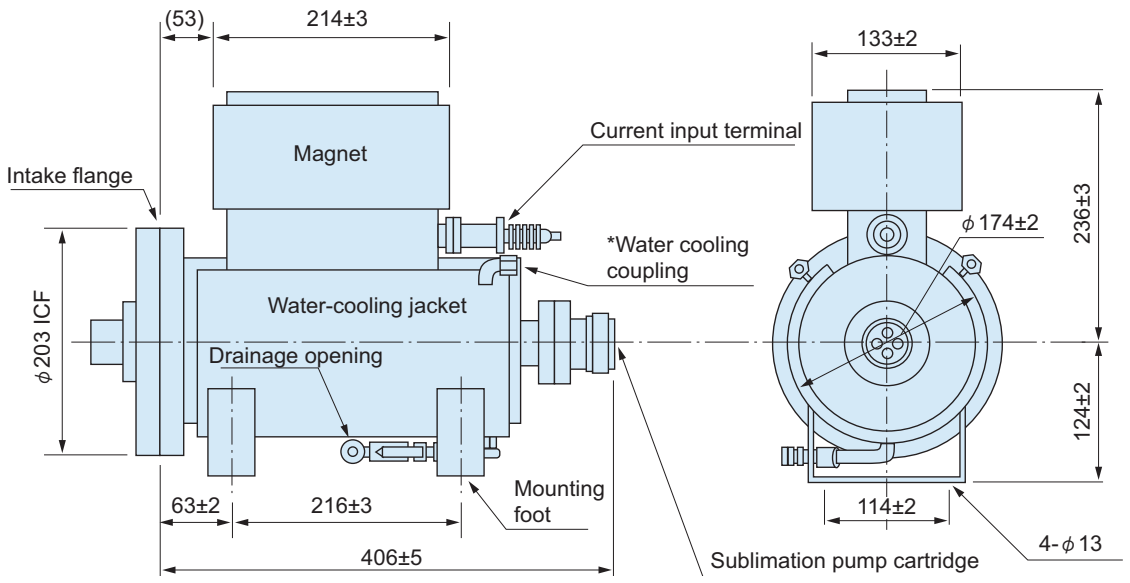


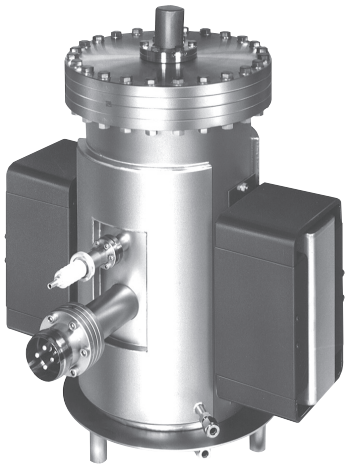
Fig. 4 Pumping speed/pumping flow - pressure characteristics



※ This coupling is for 8mm outer diameter SUS pipe (bright annealed austenitic stainless steel) or copper pipe.

Fig. 5 800 L/s Combination Pump Dimensions diagram

■ 1600 L/s Combination Pump



● Specifications

Pumping rate/ Pumping flow	See Fig. 6
Operating pressure range	10^{-1} Pa ～ 10^{-9} Pa
Baking temperature	MAX 250°C
Weight	Approx. 35 kg
Intake flange	ϕ 253 ICF flange
Capacity	Approx. 15.5 L
Dimensions	See Fig. 7
Applicable controller	922-9119 Sublimation Pump Controller and P-511NP or P-521NP Noble Pump Controller

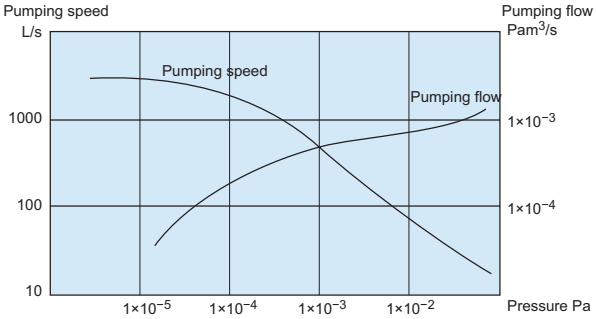
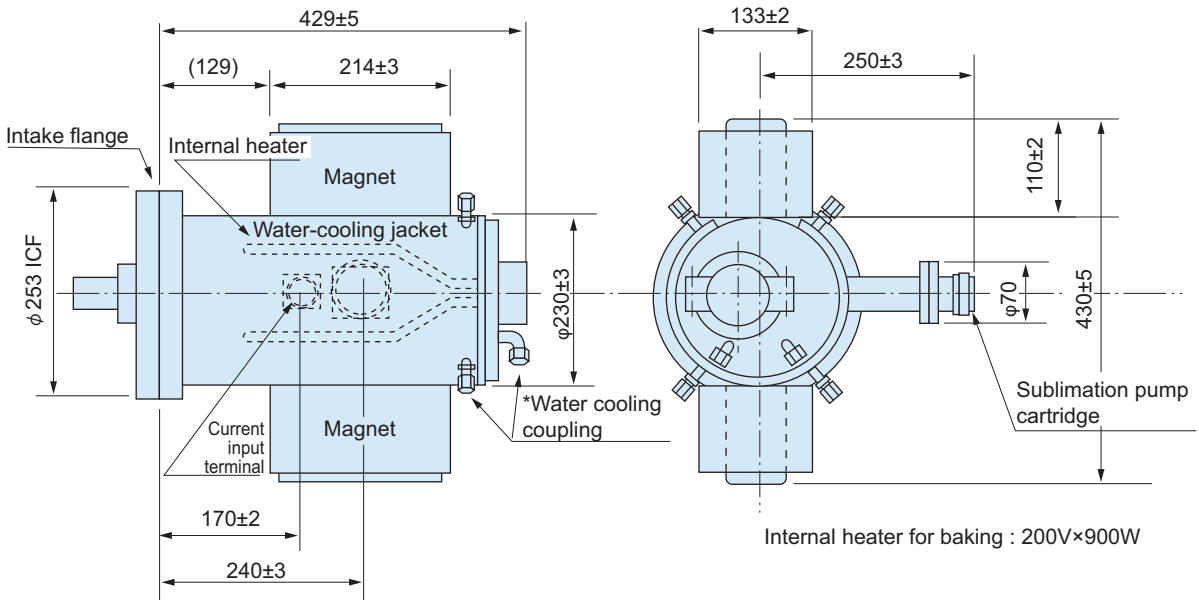


Fig. 6 Pumping speed/pumping flow - pressure characteristics



※his coupling is for 8mm outer diameter SUS pipe (bright annealed austenitic stainless steel) or copper pipe.

Fig. 7 1600 L/s Combination Pump Dimensions diagram

■ Options (maintenance and consumable parts)

Description		Type	Configuration	Remarks
Set filament		956-0010	1 set	For titanium sublimation pump, x12
Combination pump element	400 L/s 800 L/s 1600 L/s	913-7000 913-7001 913-7002	1 set 1 set 1 set	Connecting lines included
Current input terminal		954-7281	×1	With ϕ 34 mini flange, for ion pump
Ti-Vac pump		956-7040	1 set	Can be combined with a Ti-Vac pump as an option.

■ Application

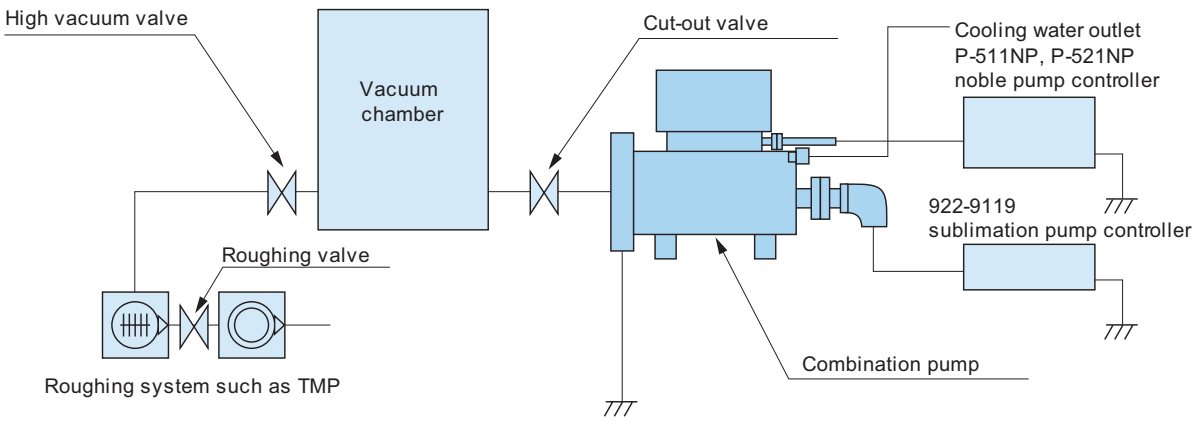


Fig. 8 Pumping system

● Pumping system and connection method

pumping system similar to the one shown above is recommended. An oil rotary pump and foreline trap combination can also be used instead of the adsorption pump. A turbo molecular pump and oil rotary pump combination is also popular.

The cutout valve may be omitted on systems not frequently exposed to atmosphere.

Connect the cooling water by inserting a ϕ 8mm metal tube (bright annealed austenitic stainless steel or copper) into the cooling water inlet and turning it 5/4 turns with a wrench.

● Pump element replacement

The sublimation pump filament can be replaced without removing the pump from the pumping system.

Remove just the cartridge.

The noble pump element can be removed simply by removing the pump from the pumping system.

■ Ordering information

Parts Number	Model	Description	Remarks	Code
8B1-0002-163	913-7000	400 L/s Combination Pump	With ϕ 152 ICF, with TSP・NP	10600
8B1-0001-975	913-7001	800 L/s Combination Pump	With ϕ 203 ICF, with TSP・NP	10610
8B1-0002-454	913-7002	1600 L/s Combination Pump	With ϕ 253 ICF, with TSP・NP	10620
8B1-0008-568	956-7015	TSP Cartridge	With ϕ 70 ICF, with filament/gasket/attachment tool	10700
8B1-0006-590	956-0010	TSP Filament	×12	10711
8B1-0001-892	956-7040	Ti-Vac Pump	With ϕ 70 ICF, Ti-Vac head x1	10720

April 2025

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