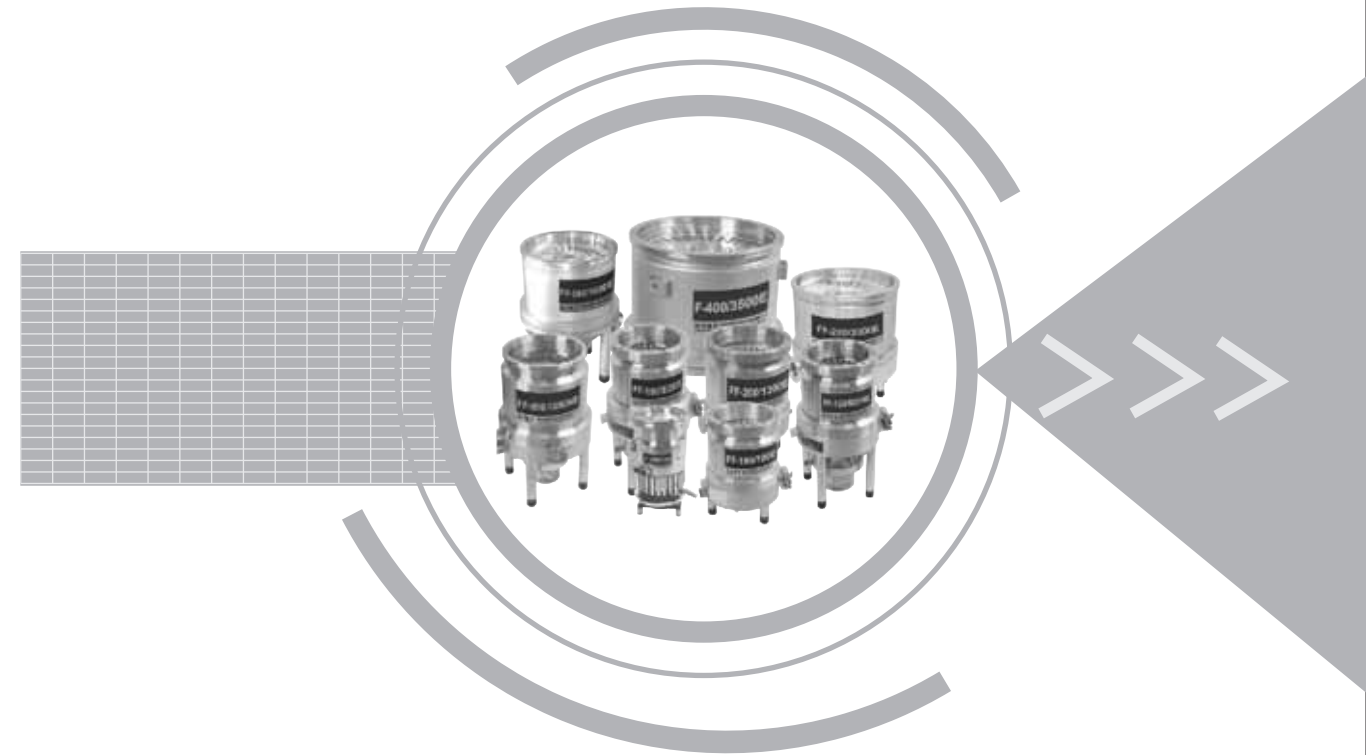


# KYKY



Operation Instructions for Molecular Pumps V2.3

# KYKY

**KYKY TECHNOLOGY CO., LTD.**

Address: No.13, Beiertiao, Zhongguancun, Haidian District, Beijing, P.R. China

Production base: #2, Second New Street, Beijing International Information Park,  
Huilongguan, Changping District, City of Beijing, China

Zip Code : 100190(Zhongguancun) 102206(Production base)

Tel: +86-10-62571592

Service center: 18611455288

Fax: +86-01-62617951

Email: sales@kyky.com.cn

Website : www.kyky.com.cn

**KYKY TECHNOLOGY CO., LTD.**

# Content

- 1 GENERAL** ..... 02
  - 1.1 MODELS AND FEATURES ..... 02
  - 1.2 APPLICATION..... 02
  - 1.3 MODEL AND IMPLICATION..... 02
  - 1.4 OPERATING CONDITIONS ..... 03
  - 1.5 PUMP AND STANDARD PARTS..... 04
  - 1.6 CHOOSE THE FITTINGS..... 04
- 2 TECHNICAL DATA**..... 05
  - 2.1 100 SERIES TURBO MOLECULAR PUMP TECHNICAL DATA..... 05
  - 2.2 160 SERIES HYBRID MOLECULAR PUMP TECHNICAL DATA..... 06
  - 2.3 200 SERIES HYBRID MOLECULAR PUMP TECHNICAL DATA..... 07
  - 2.4 250 SERIES MOLECULAR PUMP TECHNICAL DATA..... 09
  - 2.5 400 SERIES TURBO MOLECULAR PUMP TECHNICAL DATA..... 10
  - 2.6 THE CONTROLLERS MATCHED WITH THE MOLECULAR PUMPS.... 11
- 3 TRANSPORTATIONS AND STORAGE**..... 11
  - 3.1 TRANSPORTATIONS..... 11
  - 3.2 STORAGE..... 11
  - 3.3 MOVING..... 11
- 4 INSTALLATION**..... 12
  - 4.1 CONFORMING UTILIZATION ..... 12
  - 4.2 AMBIENT CONDITIONS..... 12
  - 4.3 INSTALLATION..... 13
    - 4.3.1 OPEN THE PACKAGE..... 13
    - 4.3.2 CONNECTING THE VACUUM CHAMBER..... 13
    - 4.3.3 CONNECTING THE BACKING PUMP..... 14
    - 4.3.4 CONNECTING THE AIRING DEVICE..... 14
    - 4.3.5 CONNECTING THE COOLING..... 15
    - 4.3.6 CONNECTING THE PURGE GAS OF  
CORROSION-RESISTANT PUMP..... 15
    - 4.3.7 CHARGING LUBRICANT..... 15
    - 4.3.8 CONNECTING THE CABLE..... 16
- 5 OPERATION**..... 17

**Important safety information**

Please read these operation instructions carefully before installing or operating the molecular pump, so as not to cause personnel to injure and damage with the apparatus.

**▲ Safe caution definitions**

**▲ Warning:** indicates item needing to bring height's attention and must be observed to prevent hazards to persons;

**▲ Caution:** indicates item needing to bring intermediate attention and must be observed to prevent damaging the pumps.

**▲ Note:** indicates item needing to bring slight attention and must be observed to achieve optimum efficiency.

**Maintenance declaration**

We offer a one-year guarantee period from the day of delivering. We guarantee all molecule pumps that our company produced during the guarantee period according to the warranty bill.

**No guarantee for the following cases:**

- ▲ Dismantlement without authorization;
- ▲ Improper storage and operation(for instance: impact, strong radiation, strong magnetic field conditions);
- ▲ Other damage made by users' improper operation.

**Legal disclaimer**

The KYKY molecular pumps are safe and efficient when used properly and in accordance with these operating instructions. The operator must read and observe all the terms in these instructions. Any injury and loss caused because users have not read the manual carefully, or not operated at the request of operation instructions, KYKY will not bear any responsibility.

**The information contained in this document is subject to change without notice and obligation. This document is not warranted to be error-free and KYKY reserves the final interpretation right. The intellectual property right caused, produced and included by this manual belongs to KYKY.**

5.1 BEFORE SWITCHING ON..... 17

5.2 SWITCHING ON..... 17

5.2.1 PRESSURE AT SWITCHING ON..... 17

5.2.2 OPEN THE COOLING WATER SUPPLY..... 17

5.2.3 OPEN THE PURGE GAS SUPPLY..... 18

5.2.4 SWITCHING ON ..... 18

5.2.5 ACCELERATING..... 18

5.3 BAKE-OUT ..... 18

5.4 RUNNING..... 19

5.5 SWITCHING OFF ..... 19

5.6 VENTING AFTER SWITCHING OFF..... 19

**6 OPERATION UNDER SPECIAL CONDITIONS..... 21**

6.1 VIBRATION ISOLATING..... 21

6.2 SHIELDING STRONGLY MAGNETIC FIELD..... 21

6.3 ELECTROMAGNETIC INTERFERENCE..... 21

6.4 STRONG RADIATION..... 21

**7 MAINTENANCE AND REPAIR..... 22**

7.1 REPLACING THE LUBRICATING OIL..... 22

7.1.1 100 SERIES TURBO MOLECULAR PUMP..... 22

7.1.2 THE PUMPS WITH INLET DIAMETER  $\geq 160$ ..... 22

7.2 CLEANING THE PUMP..... 23

7.3 REPLACING THE BEARINGS..... 23

7.4 REMOVING THE PUMP FROM THE SYSTEM..... 23

**8 TROUBLESHOOTING ..... 23**

8.1 PUMP DOESN'T START..... 24

8.2 PUMP DOESN'T ATTAIN NOMINAL ROTATION SPEED IN A LONG-TIME 24

8.3 UNUSUAL OPERATING NOISES OR VIBRATIONS..... 24

8.4 LOW VACUUM..... 24

8.5 OTHER..... 25

APPENDIX I : FIGURE INDEX..... 26

APPENDIX II : TABLE INDEX ..... 26

APPENDIX III: CE CERTIFICATION..... 27

DECLARATION OF CONTAMINATION OF VACUUM EQUIPMENT AND COMPONENTS..... 30

# 1 General

## 1.1 Models and features

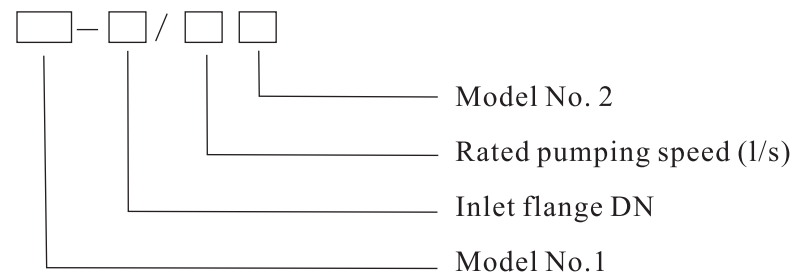
The 12 models molecular pumps listed in the instruction are classified into 5 series according to the inlet flange DN from 100mm to 400mm (correspond to from 110 l/s to 3500l/s).

In general, there are two types of molecular pumps, turbo molecular pump and hybrid molecular pump. Turbo molecular pump is composed by stator blades and rotor blades. Hybrid molecular pump is composed by turbine stage and Holweck stage. One of the characteristics of hybrid molecular pump is the improvement of pumping speed at high pressure stage, the other is the outlet pressure is increased. So the requirement on backing pumps is lowered and the investment capital of users is saved. According to bearings' lubricating method, molecular pumps can be classified into two kinds, oil lubricated and grease lubricated. In general, oil lubricated pumps should be mounted vertical (except F-100/110E could be mounted horizontal). Grease lubricated pumps can be mounted in any orientation.

## 1.2 Application

A molecular pump is used to create vacuum in a closed chamber under molecular flow and similar molecular flow conditions. It can achieve comparatively high vacuum without a baffle or cold trap. So it is used in a wide variety of areas including the surface analysis, accelerator technology, plasma technology, electron cube, etc.

## 1.3 Model and implication



## Description:

### Model No. 1:

- “F”, indicates turbo molecular pumps;
- “FF”, indicates hybrid molecular pumps.

### Model No. 2:

- “F”, indicates air cooling pump different from water cooling pump;
- “N”, indicates corrosion-resistant pump;
- “B”“C”, etc, indicates the improvement in the performance and the products. Please refer to the technical data tables for the corresponding features of each series.

## 1.4 Operating conditions

A molecular pump could work effectively only in molecular flow region (turbo molecular pump and hybrid molecular pump) and similar molecular flow region (hybrid molecular pump) (for molecular pumps, the continuous pressure at the inlet flange should be less than 1 Pa, and less than 5 Pa for hybrid pumps). Moreover, the pressure at the fore line port should be kept less than 10 Pa. So an appropriate backing pump and a KYKY controller matched with the molecular pump are needed.

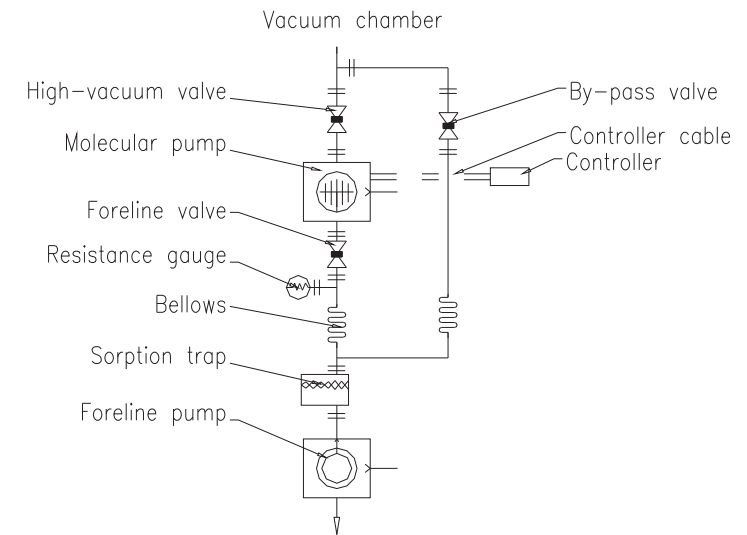


Figure 1-1 Application of the molecular pump (vacuum system principle)

### 1.5 Pump and standard parts

Please check carefully over the molecular pump and the accessories, after opening the package.

**Table 1-1 Standard parts**

Index	Name	Quantity	Remark
1	Molecular pump	1	
2	Inlet screen	1	
3	Operation instructions	1	
4	Certification	1	
5	Warranty bill	1	
6	CF copper gasket	2	Special for CF flanges
7	Blank-off flange and KF16 quick clamp at the purge port	1	Special for corrosion-resistant pumps
8	Lubricating oil	1	Special for oil lubricated pumps
9	o-ring Plank(including o-ring)	1	Special for LF flange Ports
10	Clamps(Special for LF flanges)	3	For LF inlet flanges in 100 series, 160 series, 200 series
		6	250 series
		9	400 series

### 1.6 Choose the fittings

If the users have the needs when installing the pump, the additional fittings should be ordered extra.

**Table 1-2 choose the fittings**

Index	Name	Specifications	Quantity	Remark
1*	Heater		1	100 series
				160 series
				200 series
2	Screw bold, nut, washer	M8×55	16	For pumps with CF100 high-vacuum flanges in 100 series
			20	For pumps with CF150 high-vacuum flanges in 160 series
		M8×60	24	For pumps with CF200 high-vacuum flanges in 200 series
		M8×65	32	For pumps with CF250 high-vacuum flanges in 250 series

\* If the users want to achieve ultra-high or higher vacuum or bake-out the pump shells, they may need the fittings.

## 2 Technical data

### 2.1 100 series turbo molecular pump technical data

100 series consists of three models of molecular pump, FF-100/110E, F-100/110E, and F-100/150E.

**Table 2-1 100 series turbomolecular pump technical data**

Model	FF-100/110E	F-100/110E	F-100/150E
Pumping speed(l/s)	110		150
Compression ration	N <sub>2</sub> : 10 <sup>8</sup> ; H <sub>2</sub> : 5×10 <sup>2</sup>		
Ultimate pressure(Pa)	≤6×10 <sup>-6</sup> (DN100LF)		
	≤6×10 <sup>-8</sup> ①; ≤6×10 <sup>-7</sup> ②(DN100CF)		
Fore line flange	KF25 (DN25 ISO-KF)		
Inlet flange	LF100 (DN100 ISO-K), CF100		
Bearings	Ceramic ball bearings	General ball bearings	
Rotational speed (rpm)	42300		
Run-up time (min)	<2		
Vibration value(μm)	≤0.1		
Recommended backing pump(l/s)	2		
Oil charge quantity(ml)	Grease lubricated	2×6	
Mounting position	Any	Vertical or horizontal	
Cooling method	Ambient temperature 5—32℃, air cooling; Ambient temperature 5—40℃, water cooling;		
Cooling water	temperature≤25 ℃ flow rate≥60 l/h		
Bake-out temperature	≤100℃ at pump shell		
Ambient temperature(℃)	5—40		
Weight (kg)	6	8	

① The ultimate pressure is achieved with a two-stage sliding vane rotary pump or a diffusion pump as the backing pump

② The ultimate pressure is achieved with water cooling.

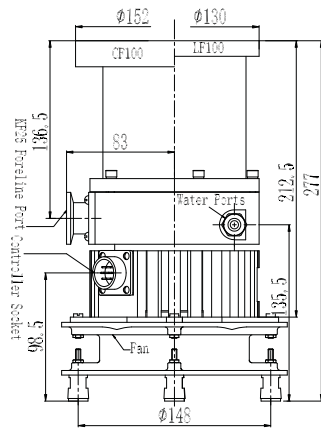


Figure 2-1 FF-100/110E dimensions

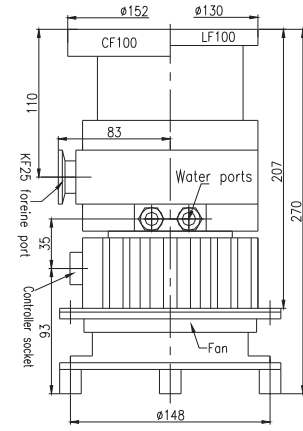


Figure 2-2 F-100/110E dimensions

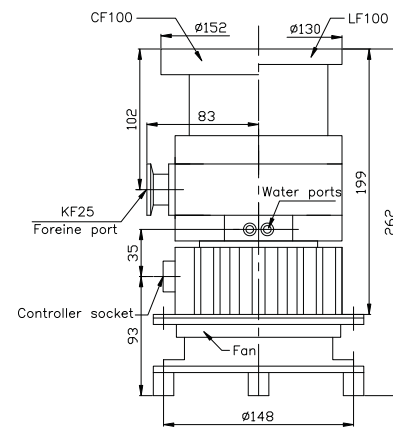


Figure 2-3 F-100/150E dimensions

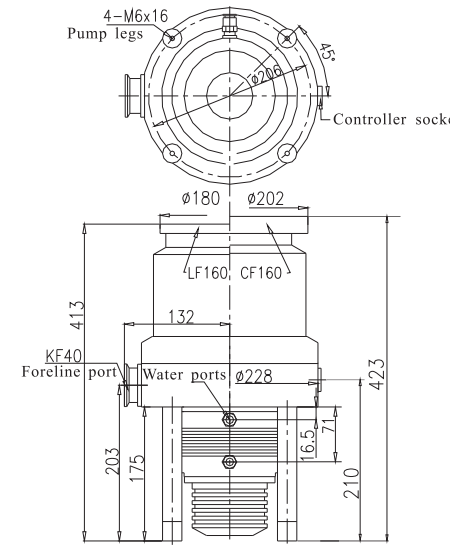


Figure 2-4 FF-160/620E dimensions

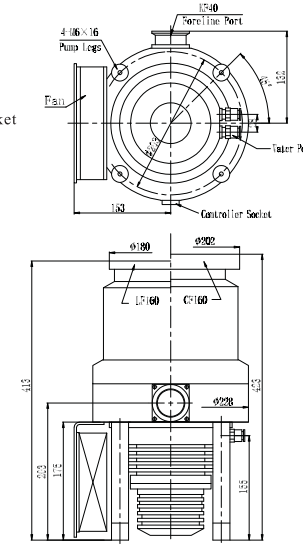


Figure 2-5 FF-160/620FE dimensions

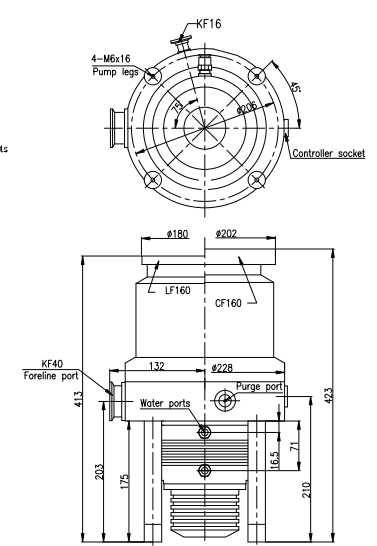


Figure 2-6 FF-160/620NE dimensions

## 2.2 160 series hybrid molecular pump technical data

160 series consists of seven models of hybrid molecular pump, FF-160/500GE, FF-160/620E, FF-160/620CE, FF-160/620NE, FF-160/620FE, FF-160/700E, and FF-160/700FE.

Table 2-2 160 series hybrid molecular pump technical data

Model	FF-160/500GE	FF-160/620E	FF-160/620FE	FF-160/620NE <sup>①</sup>	FF-160/620CE	FF-160/700E	FF-160/700FE
Pumping speed(l/s)	500			600			700
Compression ratio	N <sub>2</sub> : 10 <sup>9</sup> ; H <sub>2</sub> : 6×10 <sup>9</sup>			N <sub>2</sub> : 10 <sup>9</sup> ; H <sub>2</sub> : 6×10 <sup>9</sup>		N <sub>2</sub> : 10 <sup>9</sup> ; H <sub>2</sub> : 6×10 <sup>9</sup>	
Ultimate pressure(Pa)	≤6×10 <sup>-8</sup> (DN160LF)			≤6×10 <sup>-7</sup> (DN160LF)		≤6×10 <sup>-6</sup> (DN160LF)	
	≤6×10 <sup>-8.5</sup> ; ≤6×10 <sup>-7.5</sup> (DN160CF)			≤6×10 <sup>-8.5</sup> (DN160CF)			
Rotational speed (rpm)	27000			36000			
Run-up time (min)	<5			<6		<4	
Bearings	Ceramic ball bearings (corrosion-resistant pump must be operated with purge gas)						
Fore line flange	KF40 (DN40 ISO-KF)						
Inlet flange	LF160 (DN160 ISO-KF), CF160						
Vibration value(μm)	≤0.1						
Recommended backing pump(l/s)	4-8						
Cooling water	Temperature≤25 °C Flow rate≥60 l/h						
Bake-out temperature	≤100°C At pump shell						
Ambient temperature(°C)	5-40						
Oil charge quantity(ml)	150			Grease lubricated			
Mounting position	Vertical±5°			Any			
Weight (kg)	29		26	29		19	23

①The ultimate pressure is achieved with a two-stage sliding vane rotary pump or a diffusion pump as the backing pump;

②The ultimate pressure is achieved with water cooling;

③All blades had gone through anti-corrosive treatment, and the lubricating oil is corrosive-resistant.

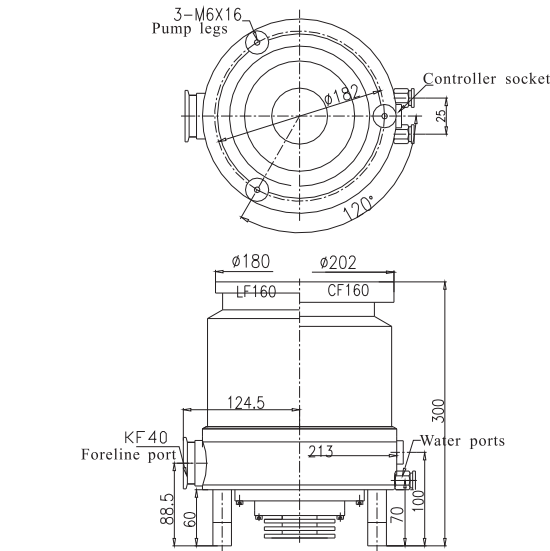


Figure 2-7 FF-160/700E dimensions

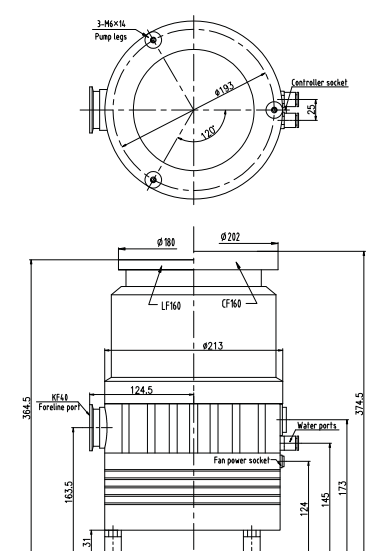


Figure 2-8 FF-160/700FE dimensions

## 2.3 200 series hybrid molecular pump technical data

200 series consists of six models of hybrid molecular pump, FF-200/1200CE, FF-200/1200NE, FF-200/1200E, FF-200/1300E, FF-200/1300FE, and FF-200/1300NE.

**Table 2-3 200 series hybrid molecular pump technical data**

Model	FF-200/1200CE	FF-200/1200NE	FF-200/1200E	FF-200/1300E	FF-200/1300NE	FF-200/1300FE
Pumping speed(l/s)	1200			1300		
Compression ration	N <sub>2</sub> : 10 <sup>9</sup> ;H <sub>2</sub> : 6×10 <sup>3</sup>					
Ultimate pressure(Pa)	≤1×10 <sup>-6</sup> (DN200LF)		≤6×10 <sup>-6</sup> (DN200LF)			
	≤1×10 <sup>-7</sup> (DN200CF)		≤6×10 <sup>-8(1)</sup> ; ≤6×10 <sup>-7(2)</sup> (DN200CF)			
Rotational speed (rpm)	27000			24000		
Run-up time (min)	<6					
Bearings	Ceramic ball bearings (the corrosion-resistant pump must be operated with purge gas)					
Fore line flange	KF40(DN40 ISO-KF)					
Inlet flange	LF200(DN200 ISO-K), CF200					
Vibration value (μm)	≤0.1					
Recommended backing pump(l/s)	15					
Cooling water	Temperature≤25℃ Flow rate≥60 l/h					
Bake-out temperature	≤100℃ At pump shell					
Ambient temperature (℃)	5-40					
Oil charge quantity(ml)	150			Grease lubricated		
Mounting position	Vertical±5°			Any		
Weight (kg)	39			29		33

①The ultimate pressure is achieved with a two-stage sliding vane rotary pump or a diffusion pump as the backing pump;

②The ultimate pressure is achieved with water cooling;

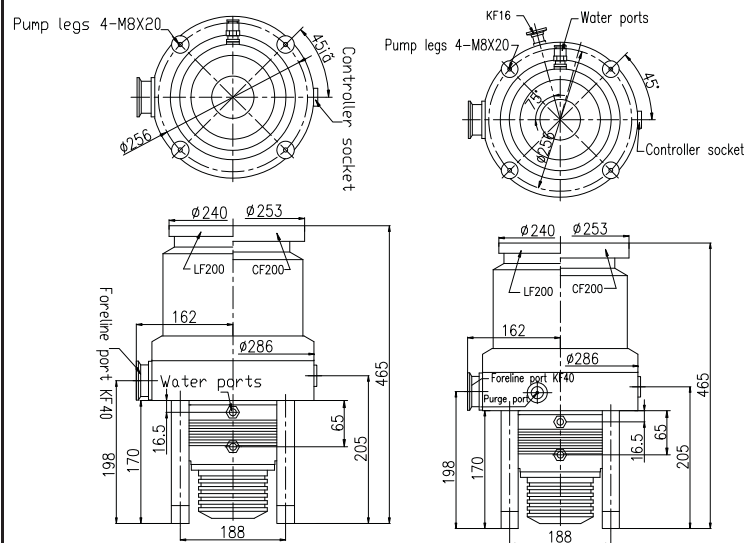


Figure 2-9 FF-200/1200CE 、FF-200/1200E dimensions

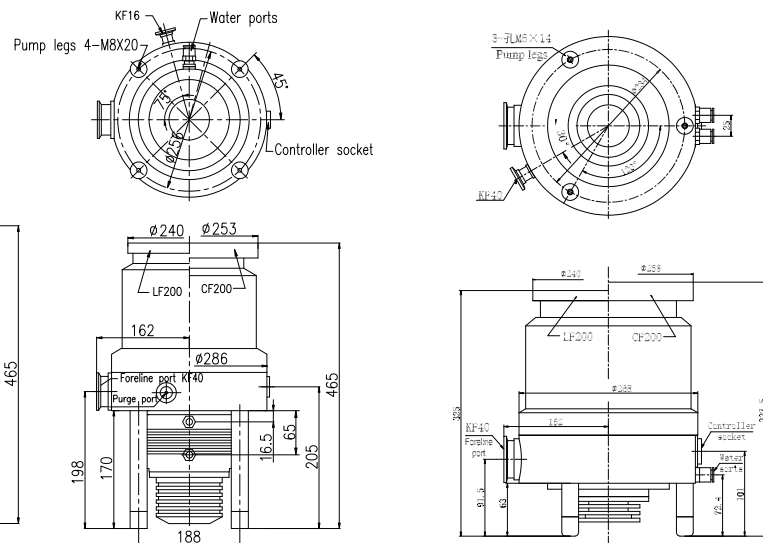


Figure 2-10 FF-200/1200NE 、FF-200/1200E dimensions

Figure 2-11 FF-200/1300E dimensions

**2.4 250 series molecular pump technical data**

250 series consists of four models of hybrid molecular pump, F-250/1500E, FF-250/1600E, FF-250/1600B, and FF-250/2000E.

**Table 2-4 250 series molecular pump technical data**

Model	F-250/1500E	FF-250/1600E	FF-250/1600BE	FF-250/2000E
Pumping speed(l/s)	1500	1600		2000
Compression ration	N <sub>2</sub> : 10 <sup>8</sup> ;H <sub>2</sub> : 5×10 <sup>3</sup>			
Ultimate pressure(Pa)	≤6×10 <sup>-7</sup>		≤1×10 <sup>-6</sup>	
Rotational speed (rpm)	21000	27000	24000	
Run-up time (min)	<8			
Bearings	Ceramic ball bearings			
Fore line flange	KF50(DN50 ISO-KF)			
Inlet flange	LF250(DN250 ISO-K)			
Vibration value (μm)	≤0.1			
Recommended backing pump(l/s)	15			
Cooling water	temperature≤25℃ Flow rate≥60 l/h			
Bake-out temperature	≤100℃ At pump shell			
Ambient temperature (℃)	5-40			
Oil charge quantity(ml)	150		Grease lubricated	
Mounting position	Vertical±5°		Any	
Weight (kg)	60	47	32	

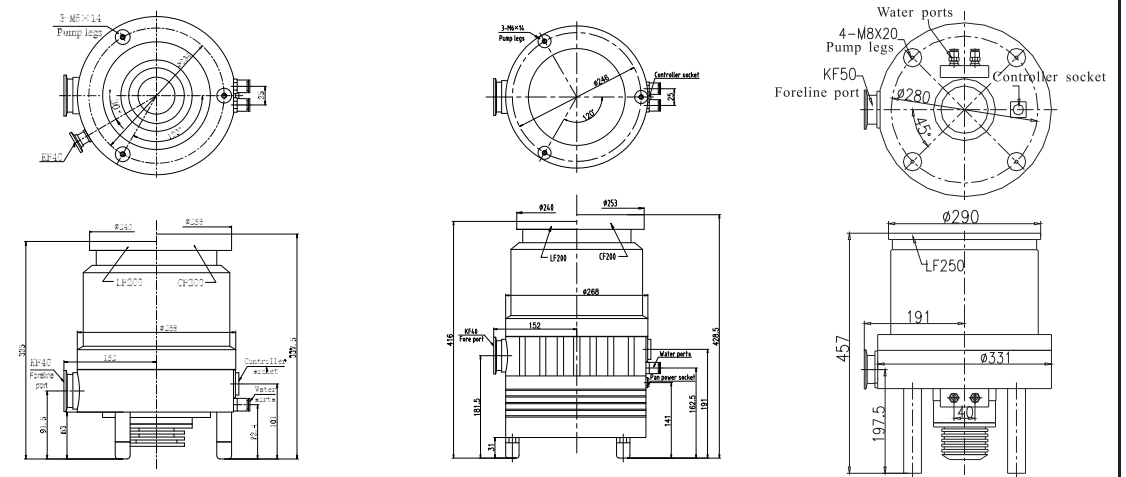


Figure 2-12 FF-200/1300NE dimensions

Figure 2-13 FF-200/1300FE dimensions

Figure 2-14 F-250/1500E dimensions

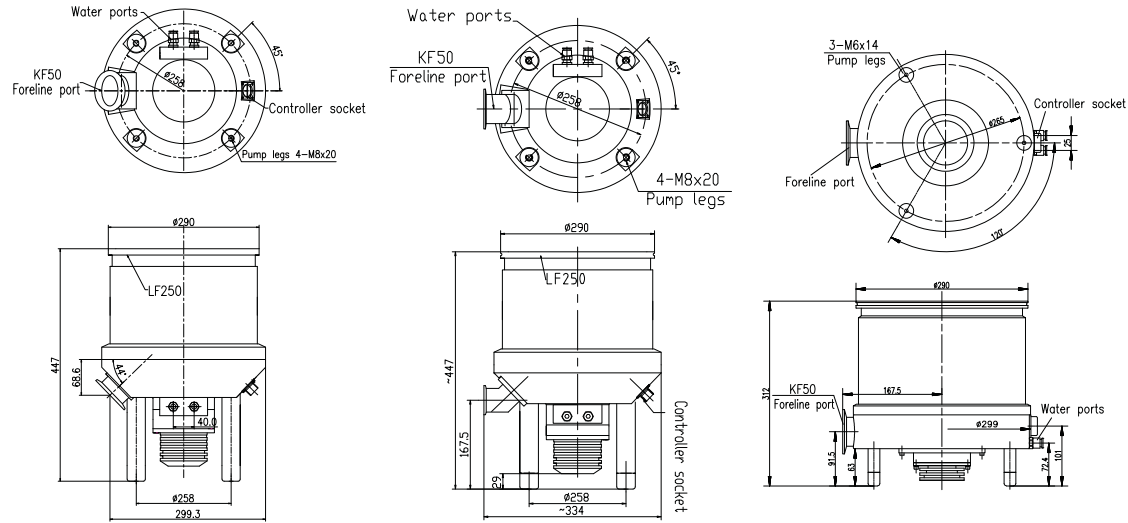


Figure 2-15 FF-250/1600E dimensions Figure 2-16 FF-250/1600BE dimensions Figure 2-17 FF-250/2000E dimensions

### 2.5 400 series turbo molecular pump technical data

400 series consists of three models of molecular pump, F-400/3500E, F-400/3500NE, and F-400/3600E.

Table 2-5 400 series turbo molecular pump technical data

Model	F-400/3500E	F-400/3500NE	F-400/3600E
Pumping speed (l/s)	3500		3600
Compression ration	$N_2: 10^6; H_2: 5 \times 10^2$		
Ultimate pressure (Pa)	$\leq 6 \times 10^{-5}$		
Fore line flange	LF100 (DN100 ISO-K)		
Inlet flange	LF400 (DN400 ISO-K)		
Bearings	Ceramic ball bearings (the corrosion-resistant pump must be operated with purge gas)		
Rotational speed (rpm)	13500		15300
Run-up time (min)	<18		<15.5
Vibration value ( $\mu m$ )	$\leq 0.05$		
Recommended backing pump (l/s)	30		
Oil charge quantity (ml)	150		250
Mounting position	Vertical $\pm 5^\circ$		
Cooling water ( $^\circ C$ )	$\leq 25$		
Weight (kg)	136		130

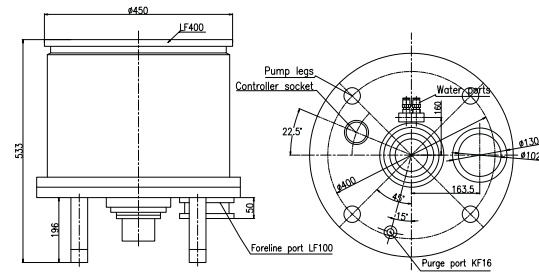


Figure 2-18 F-400/3500E dimensions

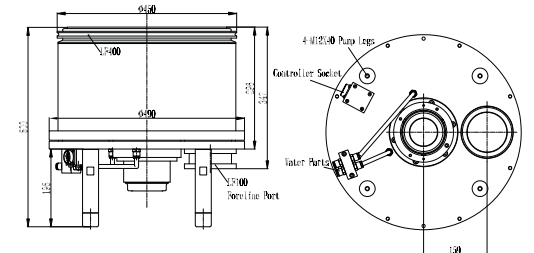


Figure 2-19 F-400/3600E dimensions

## 2.6 The controllers matched with the molecular pumps

Table 2-6 comparison table of the molecular pumps and the controllers

Pump model	Matched controller	
F-100/110, F-100/150	FD-110A	
FF-100/110	FD-110B	
FF-160/500G, FF-160/620, FF-160/620F	FD-II	FD-II B
FF-160/620N, FF-160/620C, FF-160/700		
FF-160/700F		
FF-200/1200, FF-200/1200N, FF-200/1200C	FD-II	FD-II B
FF-200/1300, FF-200/1300N, FF-200/1300F		
F-250/1500, F-250/1500N, FF-250/1600		
FF-250/1600B, FF-250/2000		
F-400/3500, F-400/3500N	FD-3500K	FD-III
F-400/3600	FD-3600K	

## 3 Transportations and storage

### 3.1 Transportations

The pumps have been packed in cases when they leave the factory. Handle with care, keep upright, not on its side, and avoid rain, sun, chillness and hard oscillation during transportation.

### 3.2 Storage

Before opening the package, the pump and the controller should be stored in conditions that is dry, ventilated, and without corrosive gases, and avoid rain, sun, and chillness. Storage ambient temperature scope:  $-20^\circ C \sim +55^\circ C$ ; relative humidity should be less than 95%.

### 3.3 Moving

When moving the pump, don't charge the pump upside down or incline it at a large angle (less than 45°). And care should be taken to provide protections on the flimsy parts, such as high-vacuum port, fore line port, water ports, and controller socket.

#### ⚠ Caution:

- a) Don't remove the plastic covers until required for use;
- b) Don't take extrusive parts as moving handles, such as the fore line port, water ports and controller socket;
- c) Attend to protecting the high-vacuum port and the fore line port to avoid scuffing as moving.

## 4 Installation

### 4.1 Conforming utilization

The molecular pump can only be used in molecular flow and similar molecular flow stages to evacuate a closed chamber to high vacuum.

The molecular pump can't work with either liquids or gases containing dust and solid particles.

Apart from "N" type pumps, any other pumps can't operate with corrosive gases. The "N" type pumps must be supplied purge gas when handling with corrosive gases, and the lubricating oil should be corrosive-resistant supplied by KYKY.

#### ⚠ Caution:

**Must use the controller specified in these instructions and matched with the pump. Our company is not responsible for any loss caused by this kind of improper operation.**

### 4.2 Ambient conditions

- 1) Magnetic density both in the radial and axial directions at the pump shell must not exceed 3mT(30Gs);
- 2) Max. Radiation strength  $10^5$ rad;
- 3) Ambient temperature 5-40°C;
- 4) Air relative humidity:  $\leq 85\%$ ;
- 5) Voltage: 220±22V, frequency: 50±1Hz;
- 6) Altitude:  $\leq 3000$ m.

### 4.3 Installation

#### 4.3.1 Open the package

Take out the pump from the package and check whether it is damaged or not during the transportation. Take down the plastic cover on the inlet flange, and toggle the rotor by your hands with gloves. Be sure the rotor can rotate flexible without hysteresis and seizing. Then cover the flange apron properly.

#### ⚠ Caution:

- a) If any impairment that may decrease the performance was found as opening the package, please contact with the supplier, don't deal with it by yourself;
- b) Pay attention to protecting the inlet and the fore line port from scuffing that may effect the vacuum performance;
- c) Don't make the high-vacuum flange and the fore line flange disclosed for a long-term. Prevent the dust and foreign substances' entry and keep the pump clean;
- d) Installation should be operated under the cleanest possible conditions.

#### 4.3.2 Connecting the vacuum chamber

High-vacuum flanges consist of CF metal sealed flange and LF rubber sealed flange conforming to ISO standard, (refer to technical data table for specifications).

In most applications the pump will be flanged direct to the high vacuum flange for the system. For the relatively weighty pump, it is necessary to use a backing board to decrease the influence of gravity and avoid pulling cracks at the weld joints. The pump should be mounted as close as possible to the vacuum chamber (see figure 4-1).

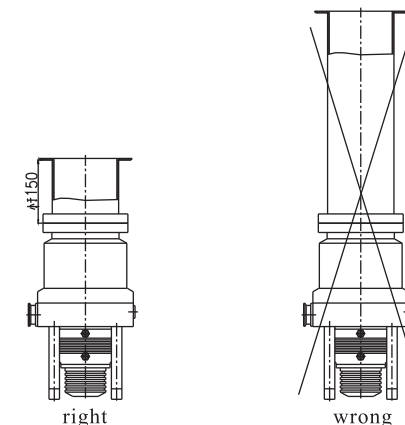


Figure 4-1 Diagrammatic sketch of pump and system connection

The inlet screen (mounted optionally) can prevent the entering of foreign objects, but the pumping speed through the inlet screen will decrease by approximately 15%.

For CF flange, the connectors between the pump and the vacuum are stainless bolts (non-standard). For LF flange, they are standard clamps.

**⚠ Caution:**

- A) The high speed rotor stores very big energy, any improper operation or other reasons could loosen the connection to the vacuum chamber and damage the pump. So, the connectors must be eligible;**
- b) Under any circumstance, the molecular pump can't be energized and started alone. Must install the pump in the system, start after the conditions are qualified;;**
- C) When the pumps are suspended from the system, pay attention to the fastness of the welding positions, prevent pulling cracks. from the system.**

**4.3.3 Connecting the backing pump**

The fore line port conforms to ISO standard KF flange (refer to technical data for specifications);

We recommend choosing a metal bellow with damping capacity to connect the molecular pump and the backing pump;

We recommend choosing a backing pump that can charge gas in stopped stage or installing an anti-suck back valve that is simultaneous switch with the backing pump, to avoid oil vapors' back streaming to the vacuum chamber when the system is not running.

We recommend installing a sorption trap at the backing pump's inlet port to prevent oil vapors' back streaming farthest.

**4.3.4 Connecting the gas charging device**

For the corrosion-resistant pump and FF-250/1800E, the purge gas port can be used for charging gas in stopped stage. For the other models, the vacuum equipment manufacturer can design the port matching with the valve on the chamber or on the fore line pipe according to the end user's requirement.

Charging valve can be manual, magnetic or electric. Please refer to "5.5 switching off" for venting operation.



Figure 4- 2 Fore line flange

**4.3.5 Connecting the cooling**

- a) Air cooled pump: Be sure there is no thermal resource around the pump and no obstacle blocking air flow around the fan;
- b) Water cooled pump: The water ports are quick-insert ports located on one side of the pump body. They are connected to the water resource with fibrous reinforcement plastic hoses with 10mm outside diameter. The water inlet and outlet ports are indistinctive. The water resource should be clean, low-perceptibility tap water. The cooling water pressure should be 0.1–0.2 MPa, the temperature should be less than 25°C, the flux should be more than 1l/min. (Remark: there are slight differences between the water port locations of the pumps with different inlet flanges.)



Figure 4-3 Water ports

**⚠ Caution: high- perceptibility and corrosive water may block or rust the water channel.**

**4.3.6 Connecting the purge gas of corrosion-resistant pump**

Only corrosion-resistant pump and FF-250/1800E have purge port. The port conforms to ISO standard Kf16 flange and located on one side of the pump body. We recommend designing flow meter and deflation valve to control purge gas flux according to the pumped corrosive gases strength.

Nitrogen and argon are used as the purge gas usually.



Figure 4-4 Purge port of corrosion-resistant pump

**⚠ Note:**

**The purge gas should not rust aluminum alloy, stainless steel or react with the pumping gas, such as nitrogen and argon. The purge gas temperature should be in between 5-30°C. Under some special conditions, the dry filtrated air is usable (consistency of the filter mesh should be less than 1um).**

**4.3.7 Charging lubricant**

The grease lubricated pump has been charged with enough grease before it leave the factory, needn't charging again during the bearings life time. F-100/110E turbo molecular pumps have been charged with oil before they leave the factory. The

customers can use them directly. For safe transportation, the pumps that pumping speeds are more than 150 l/s have been discharged oil before they leave the factory. So, must charge the new pump with oil before operation.

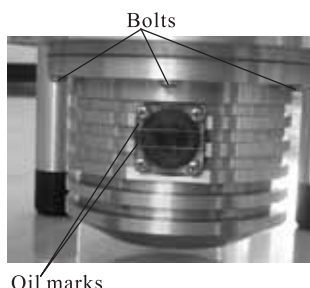


Figure 4-5 Oil sump of oil lubricated pump

**Charging process:**

- 1) Unscrew the trip bolts on the bottom of the pump body, and take down the oil sump;
- 2) Take out the accessory oil in the package, and charge the oil sump from the outside of the filter. Pay attention to controlling the quantity between the top and the bottom oil marks.
- 3) Fasten the oil sump to the pump body bottom.

**⚠ Caution:**

- a) The lubricating oil is special non-visible oil with low saturated vapor pressure. Don't make bold to replace it with other lubricating oil. Our company is not responsible for any loss caused by this kind of misuse;
- b) The lubricating oil should be clean, clarity and take strict precautions against dust and foreign substance's falling in. Otherwise, please recharge it;
- c) The corrosion-resistant pump must use the special matched oil.

**⚠ Note:** Be sure the sealing ring is aligned with the slot and the screws are circumferentially symmetrically fastened to avoid sealing failure.

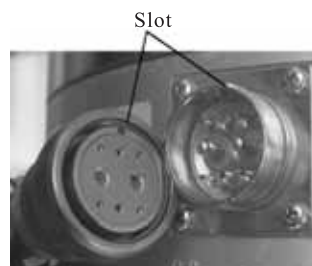


Figure 4-6 Controller slot

**4.3.8 Connecting the cable**

The controller slot is located on the lower side of the pump. The controller cable is matching with the pump. Please align the slot, and don't overexert to prevent the contact pins bending.

**⚠ Caution:** Please read the corresponding instructions of the controller details.

**5 Operation**

**5.1 Before switching on**

**⚠ Warning:**

When pumping flammable mixed gases, the pressure inside the pump is very low that there is no danger of ignition (at pressures below  $10^4$  Pa). Under the conditions that the pressure inside is relatively high (above  $10^4$  Pa) and the pump's temperature is more than  $120^{\circ}\text{C}$ , the pump could be damaged, as a result sparks could occur and then ignite explosive mixtures.

**⚠ Caution:**

- A) Turbo molecular pumps are not suitable for pumping gases containing dust and solid particles. Must install multilayer filter net at the inlet port, when pump the gases containing dust and particles.
- B) Apart from the "N" type pump, any other pumps can't be used to pump corrosive gas. The "N" type pump should be supplied purge gas when work with corrosive gases, and the lubricating oil should be corrosive-resistant oil appointed by KYKY.

**⚠ Note:**

Some media (e.g. aluminum chloride) can sublimate in the pump and form deposits. Thick deposits coatings can decrease the pumping speed. Heating the pump can prevent forming the deposits. Please send any query about it to the manufacturer.

**5.2 Switching on**

**5.2.1 Pressure at switching on**

Assume the system volume being pumped is  $V[\text{m}^3]$ , the fore line pumping speed is  $S_r[\text{m}^3/\text{h}]$ , In case  $S_r/V > 40[\text{h}^{-1}]$ , the molecular pump and the backing pump can be switched on at same time. In this situation, the molecular pump corresponds with a resistance valve that can prevent the back streaming of the oil vapor from the backing pump effectively.

In case  $S_r/V \leq 40[\text{h}^{-1}]$ , the system volume being pumped is so large that the backing pump should be switched on firstly. After the system pressure is less than  $200\text{pa}$  or  $e^{(S_r/6V)} \times 100[\text{pa}]$ , then switch on the pump.

**5.2.2 Open the cooling water supply**

Water cooling pump should be supplied with cooling water (the controller will alarm automatically for low water pressure). For air cooling pump, start the fan;

### 5.2.3 Open the purge gas supply

Control the purge flux according to the pumping corrosive gases strength. In general, it is 12—20sccm, but it should be increased properly when pumping the strongly corrosive gases.

### 5.2.4 Switching on

**⚠ Note: be sure the backing pump working normally;**

Switch on the pump by pressing the “启动(start)” button on the controller panel.

For grease lubricated pump, the brand-new pump and the pump idled for a long term (more than 3 months), We recommend the users operating as the followings:

1.Switch on the pump firstly. After the controller show it achieved the rated rotation speed, press the “停止(stop)” button. After the pump has come to a standstill for approximately 10 min, then switch on the pump again.

2.Perform the first step for 2-3 times, since then switch on the pump as normal each time;

Refer to the “instructions for molecular pump controllers” for detailed operation.

### 5.2.5 Accelerating

The run-up time should be equal to or less than the time listed in the technical data table. If the bearings are worn or the system is leaked, the run-up time will be prolonged. The users should pay attention to observing it. When abnormality is found, switch off the pump and search for the causes by experienced technician.

### 5.3 Bake-out

In general, an appropriate system can achieve a vacuum less than  $10^{-4}$ pa without bake-out, and a vacuum less than  $10^{-5}$ pa with baking on the system except the pump; to get an ultra-high vacuum, all parts of the system must be baked thoroughly at the same time including the pump. Meanwhile, the gauges should be degassed thoroughly to ensure the accuracy of measurement.

In the area of relatively higher air humidity, the system and the pump need baking sometimes to get a vacuum less than  $10^{-4}$ pa.

Baking out should go on when the pump is running. Refer to the technical data table for the bake-out temperature. Choose the bake-out time according to the pollution level and the ultimate pressure expected.



Figure 5-1 Heater band

**⚠ Warning: The temperature of the heater and the pump shell is close to 100°C, so direct contact could cause injury.**

**⚠ Caution: The bake-out temperature should be strictly controlled. Too high temperature may transform the rotor blades, as a result caused damage.**

### 5.4 Running

**⚠ Caution: The pump rotor runs at very high speed, and the gap with the pump shell is small, so heavy shock, vibration, abruptly large gas load and foreign rigid objects' entering could cause damage.**

Please query to the manufacturer for special requirement.

### 5.5 Switching off

**⚠ Warning: if the pump has been used for pumping corrosive gases, before switching off, it should be purged with dry nitrogen or inert gases for 1 hour, and the flux should be 12-20sccm.**

Press the “停止(stop)” button on the controller panel, the pump will come to a standstill gradually. Refer to the pump controllers' instructions for the specifications.

Switch off the backing pump;

Close off the cooling water supply or turn off the fan;

**⚠ Caution:**

**A) Switch off the pump by pressing the “停止(stop)” button on the controller, don't shut-down the controller power supply. Pressing the “停止(stop)” button is to use controller " brake " function to stop the pump gradually, breaking the power supply may decrease the bearings life. When the indicated lamp is flickering, shut-down the controller.**

**B) Close off the cooling water supply, after the pump has come to a standstill, to avoid condensed water generating in the pump.**

**⚠ Note: venting after pressing the “停止(stop)” button before the pump come to a standstill could reduce oil vapor's back streaming from the backing pump. But too fast stepping up of the pressure in the pump will append stress on the shafting and decrease the bearings life.**

### 5.6 Venting after switching off

When venting after switching off, the pressure inside the pump should be stepped up to

atmospheric state gradually. In general, the pump should be vented to atmospheric pressure as it is shut down, in order to prevent pollution to the vacuum chamber and to the pump from the fore line. Most of the pumps produced by KYKY haven't a venting port, except the custom-made and some special models.

There are three methods for venting the pump:

- a) Postponing closing the purge port on corrosive-resistant pumps after switching off could improve the pressure gradually to atmospheric state. If use the inflation valve on chamber at the same time, please attend to postponing opening it so that the pressure in the pump is higher than that in the chamber. Thus the corrosive gases and the solid particles could be prevented from entering the pump.
- b) Use the inflation valve on chamber. Open the air inflation valve after the molecular pump has come to a standstill (if there is a valve between the molecular pump and the vacuum chamber, the valve should be in open state). cautiously venting as slowly as possible, to avoid the solid particles in the chamber entering the pump.
- c) Install a inflation valve between the pump and the backing pump. Please attend to venting slowly, to avoid the vapor and solid particles from the fore line entering the pump.

**⚠ Caution: The pressure in the pump mustn't be higher than the atmospheric.**

**⚠ Note: If the pump is in vacuum condition after switching off for a long term, the oil vapor near the bearings could return diffuse to the inlet port side and pollute the vacuum chamber.**

Venting with nitrogen or with dry air could markedly decrease the pumping time to achieve the final pressure in next operation. Keep the chamber in vacuum condition for long via the valve between the pump and the vacuum chamber, while don't keep the pump in vacuum condition for long.

## 6 Operation under special conditions

### 6.1 Vibration isolating

If the system vibrates intensely, a vibration damper is needed to reduce the destruction to the pump caused by the vibration.

### 6.2 Shielding strongly magnetic field

Using the molecular pump in a magnetic field may cause excessive rotor heating due to the eddy currents generated in this situation and weaken the aluminum intensity. So both the radial and the axial magnetic intensity at the pump should not exceed 3mT (30Gs). Magnetic conductor should be used to shield in the magnetic field that the intensity is higher than 3mT.

### 6.3 Electromagnetic interference

When running the pump and the controller will create electromagnetic field. The electromagnetic intensity conforms to international standards. Users could ask the manufacturer for the technical certification when using in special conditions (medical instrument, for instance).

### 6.4 Strong radiation

Most of materials will change performances in strong radiation conditions, especially organic materials (lubricating oil, sealing rubber, for instance) and semi-conductor parts. To prevent accident damage, the ambient radiation intensity must be less than  $10^5$ rad.

## 7 Maintenance and repair

**⚠ Warning:** Must shut-off the controller before any maintenance and repair process. Because any conductive part could be electrified under current supplying conditions;

**⚠ Caution:**

- a) Dismantlement without authorization is strictly prohibited and it must be operated by trained professionals.
- b) The pump has achieved precise dynamic balance. Unscrew , add or subtract gaskets could cause serious unbalance. Please return the pump to the manufacturer for balancing, if the misuses had been made.

### 7.1 Replacing the lubricating oil

#### 7.1.1 100 series turbomolecular pump

The lubricating-oil of brand-new pump should be replaced after 1000h running; Usually, after changing the oil for the first time, the pump of normal running replaces oil once a year.

#### Replacing process:

There are an oil filler hole and a drain out hole respectively near the upper and lower bearings. Unscrew the bolts in the two oil filler holes and the two drain out holes, and arrange the pump horizontal. Make the oil filler holes upward and use a syringe to provide 6 ml oil in each oil filler holes, then fasten the 4 M5 bolts, and wipe off the residual oil with oil absorption paper. The used oil that outflow from the drain out holes can't be recycled. Such the oil replacing process is finished.

**⚠ Caution:** Be cautious to align the o-ring around the bolts and screw tight to avoid leakage.

#### 7.1.2 The pumps with inlet diameter $\geq 160$

The lubricating-oil of brand-new pump should be replaced after 1000h running; Where routine operation is less than 4000h a year, the lubricating oil should be replaced once a year; where routine operation is more than 4000h a year, the lubricating oil should be replaced once per 4000h;

Where the pump is baked regularly, work with high gas load or corrosive gases, the lubricating oil should be replaced as soon as the turbidity or the color changing of the oil is observed;

#### Replacing process:

- 1) Unscrew the trip bolts on the bottom of the pump body, take down the oil sump and drain out the waste oil;
- 2) Scrub the sump with neutral detergent and attend to cleaning out the foreign substances and the sewage, then drying it (be sure no bead is residual);
- 3) The subsequent process of replacing is same with the charging process for brand-new pump, refer to 4.3.7.

**⚠ Caution:** Dispose the waste oil according to the local laws.

### 7.2 Cleaning the pump

If the pump can't resume its vacuum performance of vacuum after a long time bake-out, moreover vacuum system leaks and chamber severe pollution are excluded, then the pump can be affirmed polluted and should be cleaned.

Only KYKY company and appointed professionals are entitled to dismantle and clean the pump.

### 7.3 Replacing the bearings

The qualified products had achieved good overall machine dynamic balance via special equipment before they leave the factory. After replacing the bearings, the pumps need rebalancing refresh, so only KYKY and appointed professionals can complete the operations. Dismantlement without permission is strictly prohibited.

**⚠ Caution:** Dispose the waste parts and the waste neutral detergent in accordance with the local laws.

### 7.4 Removing the pump from the system

When removing the pump from the process, please:

Be sure the pump has come to a standstill, and the pressure of inside and of outside are equalled;

If the pump is used with corrosive gas, be sure the process gas has been eliminated cleanly from the vacuum chamber, pump, and the fore line pipe. Because deposit is hazard to human body, please use gloves, a breathing mask or protective clothing when necessary, and clean-out it as soon as possible, to avoid it reacting with humid air and producing volatile or corrosive acids and alkalis.

Please pack the pump with closed plastic bag immediately after removing.

## 8 Trouble shooting

**Warning:** Before return the pump previously used with corrosive gases to manufacturer, please state the gases' name, and fill in the 《Declaration of Contamination of Vacuum Equipment and Components》 (attached behind the instructions), to ensure the maintenance personal safety. Or, the manufacturer has the right to refuse to offer service of maintaining.

### 8.1 Pump doesn't start

- a) The controller interrupted. Refer to the controller instructions;
- b) No supply. Check the cable with electric meter;
- c) Contact the manufacturer for other causes.

### 8.2 Pump doesn't attain nominal rotation speed in a long-time

- a) Leaks in vacuum system. Search for leaks and tighten them.;
- b) Fore-vacuum pressure is higher than 10 Pa. Check the backing pump function and hunt the fore line pipe and the fore line system;
- c) Shortage or pollution of the lubricating oil. Switch off and replace the lubricating oil;
- d) Bearings damaged. Return the complete machine to the manufacturer.

### 8.3 Unusual operating noises or vibrations

- a) Shortage or pollution of the lubricating oil. Switch off and replace the lubricating oil;
- b) Sympathetic vibration. Change the mounting position or the connection dimensions, fix the loose parts or add vibration damper;
- c) Dynamic balance damaged. Return the complete machine to the manufacturer;
- d) Bearings damaged. Return the complete machine to the manufacturer.

### 8.4 Low vacuum

- a) Fore-vacuum pressure is higher than 10 Pa, check the backing pump function and search for leaks in the fore line system pipe.
- b) Leaks in vacuum chamber. Search for leaks and tighten them.
- c) The gauge output shows a large amount of gas. Degas the gauge cathode (or bake-out the glass shell of the gauge) at 200°C for 2h.

- d) Rotation speed is lower and output frequency error is more than  $\pm 10\text{Hz}$  (for F-400/3500E,  $\pm 12\text{Hz}$ ). Check and repair the controller;
- e) Fore line pumping speed is inadequate or the fore line pipe is too long or too slender;
- f) Pump polluted. Clean it.

### 8.5 Other

Address KYKY for any other questions or technical supports.



**Appendix I Figure Index**

Figure 1-1 Application of the molecular pump (vacuum system principle) ..... 03  
 Figure 2-1 F-100/110E dimensions ..... 06  
 Figure 2-2 F-100/110E dimensions ..... 06  
 Figure 2-3 F-100/500E dimensions ..... 06  
 Figure 2-4 FF-160/620E dimensions ..... 07  
 Figure 2-5 FF-160/620FE dimensions ..... 07  
 Figure 2-6 FF-160/620NE dimensions ..... 07  
 Figure 2-7 FF-160/700E dimensions ..... 07  
 Figure 2-8 FF-160/700FE dimensions ..... 07  
 Figure 2-9 FF-200/1200CE、FF-200/1200E dimensions ..... 08  
 Figure 2-10 FF-200/1200NE、FF-200/1200E dimensions ..... 08  
 Figure 2-11 FF-200/1300E dimensions ..... 08  
 Figure 2-12 FF-200/1300NE dimensions ..... 09  
 Figure 2-13 F-200/1300FE dimensions ..... 09  
 Figure 2-14 F-250/1500E dimensions ..... 09  
 Figure 2-15 F-250/1600E dimensions ..... 10  
 Figure 2-16 FF-250/1600BE dimensions ..... 10  
 Figure 2-17 FF-250/2000E dimensions ..... 10  
 Figure 2-18 F-400/3500E dimensions ..... 11  
 Figure 2-19 F-400/3600E dimensions ..... 11  
 Figure 4-1 Diagrammatic sketch of pump and system connection ..... 15  
 Figure 4-2 Fore line flange ..... 15  
 Figure 4-3 Water ports ..... 16  
 Figure 4-4 Purge port of corrosion-resistant pump ..... 16  
 Figure 4-5 Oil sump of oil lubricated pump ..... 18  
 Figure 4-6 Controller slot  
 Figure 5-1 Heater band

**Appendix II Table index**

Table 1-1 standard parts ..... 04  
 Table 1-2 choose the fitting ..... 04  
 Table 2-1 100 series turbomolecular pump technical data ..... 05  
 Table 2-2 160 series hybrid molecular pump technical data ..... 06  
 Table 2-3 200 series hybrid molecular pump technical data ..... 08  
 Table 2-4 250 series molecular pump technical data ..... 09  
 Table 2-5 400 series turbomolecular pump technical data ..... 10  
 Table 2-6 comparison table of molecular pumps and controllers ..... 11



**CERTIFICATE**  
of Conformity  
EC Council Directive 89/336/EEC  
as last amended by EC Directive 93/68/EEC  
Electromagnetic Compatibility

**Registration No.:** AE 50092585 0001

**Report No.:** 15016730 001

**Holder:** KYKY TECHNOLOGY DEVELOPMENT LTD.  
No. 13, Beiertiao, Zhongguancun,  
Haidian District,  
Beijing 100080  
P.R. China

**Product:** Pump  
(Turbomolecular Pump[including TMP controller])

**Identification:** Type Designation: F-100/110E FF-160/620E FF-160/620FE  
FF-200/1200E FF-200/1200E FF-160/620FE  
F-250/1500E F-400/3500E FF-160/700  
FF-160/620  
Serial No. : Engineering Sample  
Remark : Refer to test report 15016730 001  
for details.

**Tested acc. to:** EN 51000-6-1:2001  
EN 51000-6-3:2001+A11  
EN 61000-3-2:2000+A2  
EN 51000-3-3:1995+A1

This certificate of conformity is based on an evaluation of a sample of the above mentioned product. Technical Report and documentation are at the Licence Holder's disposal. This is to certify that the tested sample is in conformity with all provisions of Annex III of Council Directive 89/336/EEC, in its latest amended version, referred to as the EMC Directive. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity. The holder of the certificate is authorized to use this certificate in connection with the EC declaration of conformity according to Article 10.1 of the Directive.



Cologne, 29.09.2006


Certification Body



Dipl.-Ing. P. Hartstein

**TÜV Rheinland Product Safety GmbH - Am Grauen Stein - D-51105 Köln**

CE The CE marking may only be used if all relevant and effective EC Directives are complied with. CE



**CERTIFICATE**

of Conformity  
EC Council Directive 98/37/EC  
Machinery

Registration No.: AM 50092584 0001  
Report No.: 15016729 001


**Holder:** KYKY TECHNOLOGY DEVELOPMENT LTD.  
No. 13, Beiertiao, Zhongguancun,  
Haidian District,  
Beijing 100080  
P.R. China

**Product:** Pump  
(Turbomolecular Pump)

**Identification:** Type Designation: FF-160/620 FF-160/620E FF-160/620NE  
FF-200/1300 FF-200/1200E FF-160/620ZE  
F-250/1500E F-400/3500E FF-160/700  
F-100/110E  
Serial No. : Engineering Samples  
Remark : Refer to test report 15016729\_001  
for details.

This certificate of conformity is based on an evaluation of a sample of the above mentioned product. This is to certify that the tested sample is in conformity with all provision of Annex I of Council Directive 98/37/EC, referred to as the Machinery Directive. This certificate does not imply assessment of the production of the product and does not permit the use of a TÜV Rheinland mark of conformity. The holder of the certificate is authorized to use this certificate in connection with the EC declaration of conformity according to Annex II of the Directive.

Cologne, 22.09.2006



Certification Body



Dipl.-Ing. P. Hartstein

**TÜV Rheinland Product Safety GmbH - Am Grauen Stein - D-51105 Köln**

CE The CE marking may be used if all relevant and effective EC Directives are complied with. CE

## Declaration of Contamination of Vacuum Equipment and Components

The repair and/or service of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay.

The manufacturer could refuse to accept any equipment without a declaration. This declaration can only be completed and signed by authorized and qualified staff.

### 1. Description of Vacuum Equipment and Components

Equipment type/model	
Code No.	
Serial No.	
Invoice No.	
Consign date	

### 2. Reason for Return:

repair <input type="checkbox"/>	charge <input type="checkbox"/>	maintenance period <input type="checkbox"/>
replacing <input type="checkbox"/>	free <input type="checkbox"/>	maintenance period after repair <input type="checkbox"/>
Error Description		

### 3. Condition of the Vacuum Equipment and Components

Has the equipment been used	
yes <input type="checkbox"/>	no <input type="checkbox"/>
Did the lubricated oil that was notsupplied by KYKY have been used?	
Is the equipment free from potentiallyharmful substances?	
yes <input type="checkbox"/>	(go to Section 5)
no <input type="checkbox"/>	(go to Section 4)

► **KYKY Operation Instructions for Molecular Pumps**

**4.Process related Contamination of Vacuum Equipment and Components:**

toxic	yes	no
corrosive		
explosive		
biological hazard		
radioactive		
other harmful substances		

**5. Vacuum equipment and components which have been contaminated by biological, explosive or radioactive substances will not be accepted without written evidence of decontamination! Please list all the materials, gases and side production that had contact with the equipment.**

Trade name Product name Manufacturer	Chemical name (or Symbol)	Dangerous Material class	Measures if spill	First aid in case of human contact
1.				
2.				
3.				
4.				
5.				

**6.Legally Binding Declaration**

I hereby declare that the information supplied on this form is complete and accurate. The despatch of the contaminated vacuum equipment and components are going to be in accordance with the appropriate regulations of covering packaging, transportation and labelling of dangerous substances.

**Name of organisation or company:**

Address:

Post code:

Tel:

Telex:

Fax:

Name:

Job title:

Date:

Legally binding signature:

Company stamp: