



# Installation and Operating manual EVT Series Vacuum pumps

High Performance Turbo molecular pumps



# Eurovacuum EVT Series

## High Performance Turbo molecular pumps

**Eurovacuum** Company is offering its various products to meet industrial vacuum needs.

**Eurovacuum** Company is founded in 2006, with over 30 year experiences in the vacuum Industry its founders have been putting their best efforts continuously to deliver high quality Turbo molecular Pumps, with diverse range of capacity.

Eurovacuum has chosen to deliver Turbo molecular pumps manufactured by **KYKY Technology Development Ltd.** from Beijing in China, because these pumps are build at world-class quality. To proof there quality these pumps are supplied with a 18 month warranty, the best warranty in the business. These pumps are the ideal solution for applications requiring rugged reliable and proven hardware.

### Advantages to the User

- 18 month warranty
- Very good price/quality level
- Instant exchange program available within Europe
- High pumping speed
- Low noise level
- Pumps are supplied with CE certificate
- Wide range of accessories available for easy adaptation

### Application Examples

- Furnaces and plants
- Laser technology
- Medicinal technology
- Metallurgy
- Space simulation
- Vacuum coating
- Semi-conductor
- Data storage

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### ⚠ 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 **18 Months** warranty period from the day of delivering. We guarantee all molecule pumps from our company during the warranty period, according to the warranty note.

No warranty 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 Eurovacuum molecular pumps, produced by KYKY, 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, Eurovacuum and 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 Eurovacuum reserves the final interpretation right. The intellectual property right caused, produced and included by this manual belongs to Eurovacuum.



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### 1 General

#### 1.1 Models and features

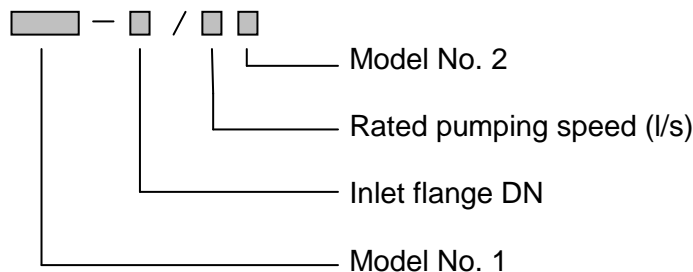
The models molecular pumps listed in the instruction are classified into 5 series according to the inlet flange DN from 100mm to 400mm (correspond from 110 l/s to 3500l/s) .

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

"T", indicates the pumps fitted with ceramic ball bearings different from the other models with generic bearings

"N", indicates corrosion-resistant pump

"Z", indicates grease lubricated 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.



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### 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  $10^{-2}$  mbar, and less than  $5 \cdot 10^{-2}$  mbar for hybrid pumps). Moreover, the pressure at the fore line port should be kept less than 0,1 mbar. So an appropriate backing pump and a controller matched with the molecular pump are needed.

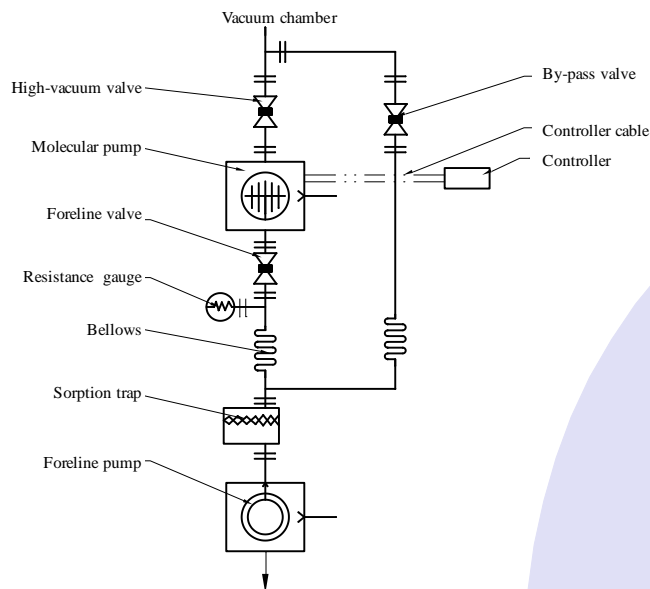


Figure 1-1 Application of the molecular pump (vacuum system principle)

### 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

|   | Name                            | Quantit | Remark                                                     |
|---|---------------------------------|---------|------------------------------------------------------------|
| 1 | Molecular pump                  | 1       |                                                            |
| 2 | Inlet screen                    | 1       |                                                            |
| 3 | Operation                       | 1       |                                                            |
| 4 | Certification                   | 1       |                                                            |
| 5 | Warranty bill                   | 1       |                                                            |
| 6 | Gasket                          | 1       | Copper for CF and Centering for ISO-K                      |
| 7 | Blank-off flanges               | 1       | Special for corrosion-resistant                            |
| 8 | Lubricating oil                 | 1       | Special for oil lubricated pumps                           |
| 9 | Clamps (Special for LF flanges) | 3       | For LF inlet flanges in 100 series, 160 series, 200 series |
|   |                                 | 6       | 250 series                                                 |
|   |                                 | 9       | 400 series                                                 |



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### 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

| Inde | Name                          | Specificatio | Quantit | Remark                                                     |
|------|-------------------------------|--------------|---------|------------------------------------------------------------|
| 1*   | Heater                        |              | 1       | 100 series                                                 |
|      |                               |              |         | 160 series                                                 |
|      |                               |              |         | 200 series                                                 |
| 2    | Screw<br>bold, nut,<br>washer | M8x55        | 16      | For pumps with CF100 high-<br>vacuum flanges in 100 series |
|      |                               | M8x60        | 24      | For pumps with CF200 high-<br>vacuum flanges in 200 series |

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



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**2 Technical data**

2.1 100 series turbo molecular pump technical data  
 100 series consists of F-100/110E turbo molecular pump.

Table 2-1 100 series turbo molecular pump technical data

| Model                         | F-100/110E                                                                           |
|-------------------------------|--------------------------------------------------------------------------------------|
| Pumping speed(l/s)            | 110                                                                                  |
| Compression ration            | N <sub>2</sub> : 10 <sup>8</sup> ; H <sub>2</sub> : 5×10 <sup>2</sup>                |
| Ultimate pressure(mbar)       | ≤ 6×10 <sup>-8</sup> (DN100LF)                                                       |
|                               | ≤ 6×10 <sup>-10*</sup> ; ≤ 6×10 <sup>-9**</sup> (DN100CF)                            |
| Fore line flange              | KF25 (DN25 ISO-KF)                                                                   |
| Inlet flange                  | LF100 (DN100 ISO-K), CF100                                                           |
| 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)       | 2×6                                                                                  |
| Mounting position             | Vertical or horizontal                                                               |
| Cooling method                | Ambient temperature 5—32°C,Air cooling;<br>Ambient temperature 5—40°C,water cooling; |
| Cooling water temperature(°C) | ≤ 25                                                                                 |
| Bake-out temperature          | ≤ 100°C at pump shell                                                                |
| Ambient temperature(°C)       | 5 - 40                                                                               |
| Weight (kg)                   | 8                                                                                    |

\*The ultimate pressure is achieved with a two-stage sliding vane rotary pump;

\*\*The ultimate pressure is achieved with water cooling.

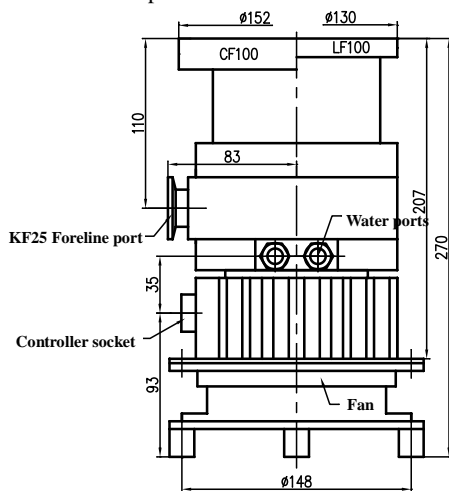


Figure 2-1 F-100/110E Dimensions





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## 2.2 160 series hybrid molecular pump technical data

160 series consists of four models of hybrid molecular pump, FF-160/620NE, FF-160/620ZE, FF-160/620E, and FF-160/700E.

Table 2-2 160 series hybrid molecular pump technical data

| Model                         | FF-160/620NE***                                                                  | FF-160/620ZE      | FF-160/620E                                                          | FF-160/700E                                                          |
|-------------------------------|----------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
| Pumping speed(l/s)            | 600                                                                              |                   |                                                                      | 700                                                                  |
| Compression ratio             | N <sub>2</sub> : 10 <sup>9</sup> ;H <sub>2</sub> : 6×10 <sup>3</sup>             |                   | N <sub>2</sub> : 10 <sup>9</sup> ;H <sub>2</sub> : 6×10 <sup>4</sup> | N <sub>2</sub> : 10 <sup>9</sup> ;H <sub>2</sub> : 6×10 <sup>6</sup> |
| Ultimate pressure(pa)         | ≤6×10 <sup>-6</sup> (DN160LF)                                                    |                   | ≤6×10 <sup>-7</sup> (DN160LF)                                        |                                                                      |
|                               | ≤6×10 <sup>-8</sup> ;≤6×10 <sup>-7</sup> ** (DN160CF)                            |                   | ≤6×10 <sup>-8</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(°C) | ≤25 (>2 l/min)                                                                   |                   |                                                                      |                                                                      |
| Bake-out temperature          | ≤100°C at pump shell                                                             |                   |                                                                      |                                                                      |
| Ambient temperature(°C)       | 5 - 40                                                                           |                   |                                                                      |                                                                      |
| Oil charge quantity(ml)       | 150                                                                              | Grease lubricated | 150                                                                  | Grease lubricated                                                    |
| Mounting position             | Vertical ±5°                                                                     | Any               | Vertical ±5°                                                         | Any                                                                  |
| Weight (kg)                   | 29                                                                               | 26                | 29                                                                   | 19                                                                   |

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

\*\* The ultimate pressure is achieved with water cooling;

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

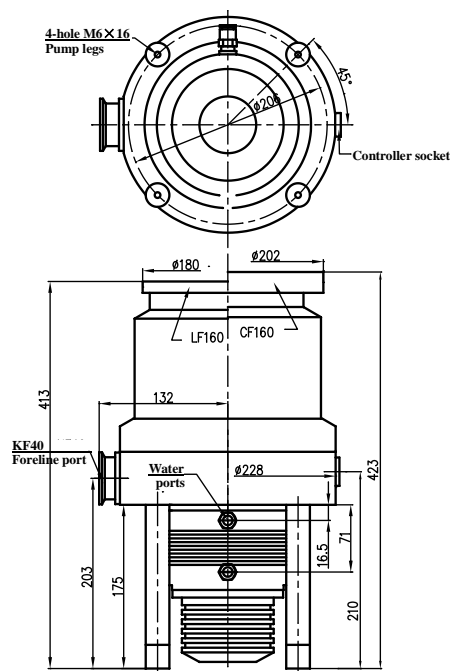


Figure 2-2 FF-160/620E dimensions

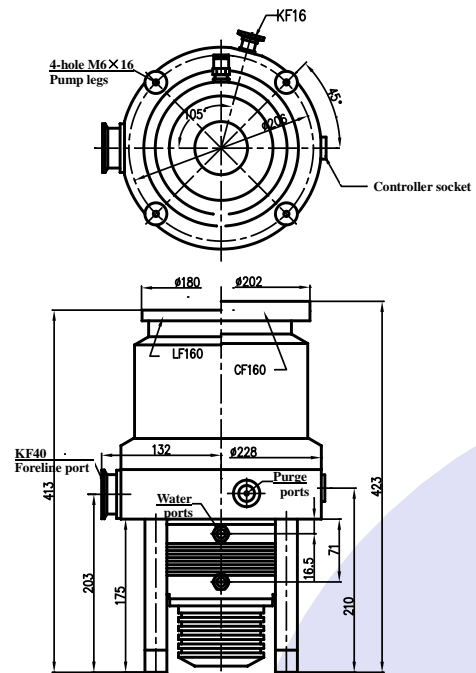


Figure 2-3 FF-160/620NE dimensions

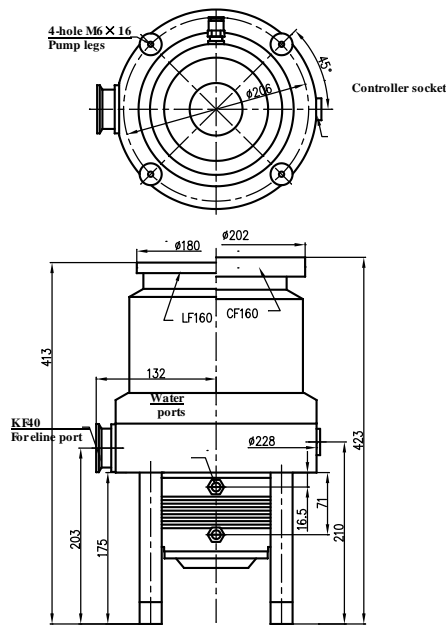


Figure 2-4 FF-160/620ZE dimensions

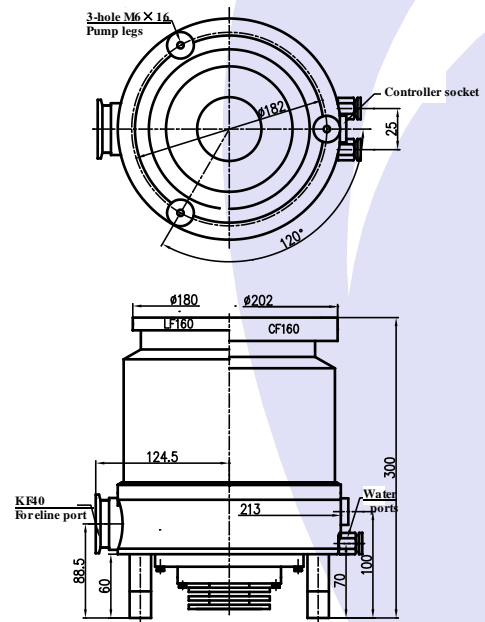


Figure 2-5 FF-160/700E dimensions



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### 2.3 200 series hybrid molecular pump technical data

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

Table 2-3 200 series hybrid molecular pump technical data

| Model                         | FF-200/1200CE                                                                        | FF-200/1200E                                           | FF-200/1300E |
|-------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------|--------------|
| 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</sup> ; ≤6×10 <sup>-7</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(°C) | ≤25 (>2 l/min)                                                                       |                                                        |              |
| 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)                   | 39                                                                                   | 29                                                     |              |

\* The ultimate pressure is achieved with a two-stage sliding vane rotary pump as the backing pump;

\*\* The ultimate pressure is achieved with water cooling;

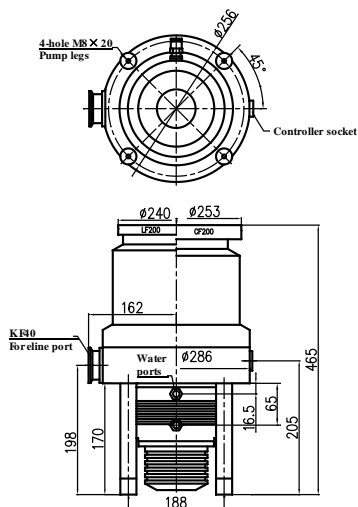


Figure 2-7 FF-200/1200CE、FF-200/1200E dimensions

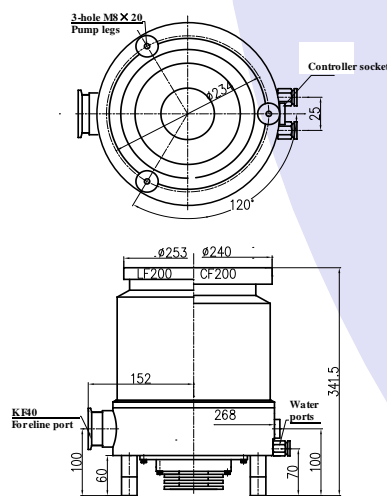


Figure 2-6 FF-200/1300E dimensions



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2.4 250 series molecular pump technical data

250 series consists of three models of molecular pump, FF-250/1500E, FF-250/1600E and FF-250/1800E.

Table 2-4 250 series molecular pump technical data

| Model                         | F-250/1500E                                                          | FF-250/1600E        | FF-250/1800E*     |
|-------------------------------|----------------------------------------------------------------------|---------------------|-------------------|
| Pumping speed(l/s)            | 1500                                                                 | 1600                | 1800              |
| 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>-6</sup>                                                  | ≤1×10 <sup>-6</sup> |                   |
| Rotational speed (rpm)        | 21000                                                                | 27000               |                   |
| Run-up time (min)             | <8                                                                   |                     |                   |
| Bearings                      | Ceramic ball bearings                                                |                     |                   |
| Fore line flange              | KF50(DN50 ISO-KF)                                                    |                     | KF40(DN40 ISO-KF) |
| Inlet flange                  | LF250(DN250 ISO-K)                                                   |                     |                   |
| Vibration value(mm)           | ≤0.1                                                                 |                     |                   |
| Recommended backing pump(l/s) | 15                                                                   |                     |                   |
| Cooling water temperature(°C) | ≤25                                                                  |                     |                   |
| 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)                   | 60                                                                   | 47                  | 42                |

\* purge port: KF10 (DN10 ISO-KF), venting port:Φ1

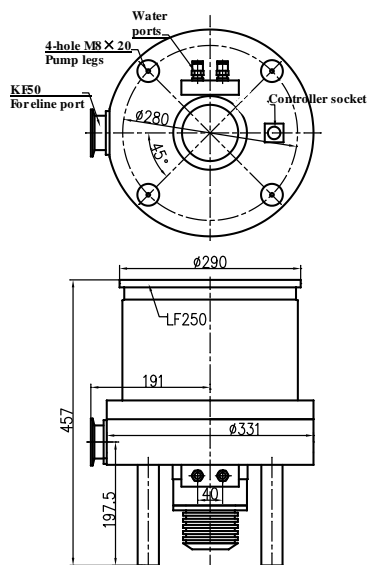
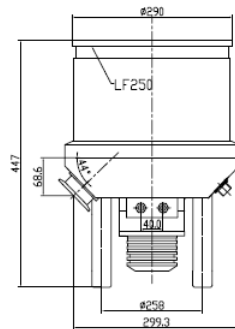
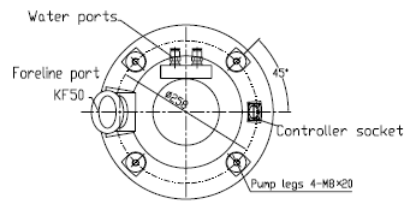
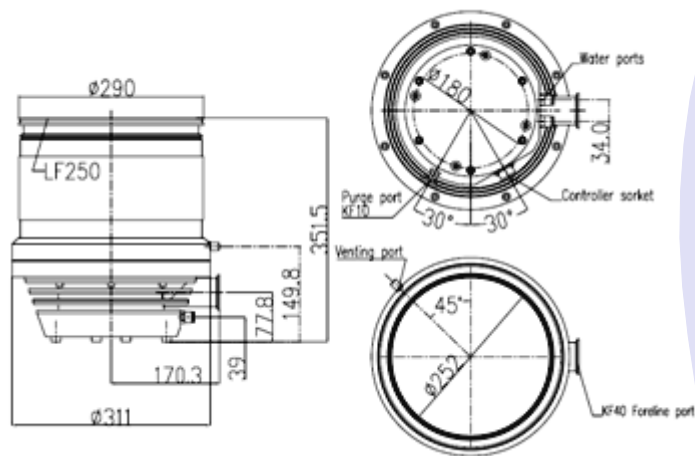


Figure 2-8 F-250/1500E dimensions



2-9 FF-250/1600E dimensions



2-10 FF-250/1800E dimensions



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## 2.5 400 series turbo molecular pump technical data

400 series consists of F-400/3500E turbo molecular pump.

Table 2-5 400 series turbo molecular pump technical data

| Model                  | F-400/3500E                                   |                                                 |                                         |
|------------------------|-----------------------------------------------|-------------------------------------------------|-----------------------------------------|
| Pumping speed(l/s)     | 3500                                          | Vibration value(( $\mu\text{m}$ ))              | $\leq 0.5$                              |
| Compression ration     | $\text{N}_2: 10^8; \text{H}_2: 5 \times 10^2$ | Recommended backing pump(l/s)                   | 30                                      |
| Ultimate pressure(pa)  | $\leq 6 \times 10^{-6}$                       | Cooling water temperature( $^{\circ}\text{C}$ ) | $\leq 25$                               |
| Fore line flange       | LF100(DN100 ISO-K)                            | Bake-out temperature                            | $\leq 80^{\circ}\text{C}$ at pump shell |
| Inlet flange           | LF400(DN400 ISO-K)                            | Ambient temperature( $^{\circ}\text{C}$ )       | 5-40                                    |
| Bearings               | Ceramic ball bearings                         | Oil charge quantity(ml)                         | 150                                     |
| Run-up time (min)      | <18                                           | Mounting position                               | Vertical $\pm 5^{\circ}$                |
| Rotational speed (rpm) | 13500                                         | Weight (kg)                                     | 136                                     |

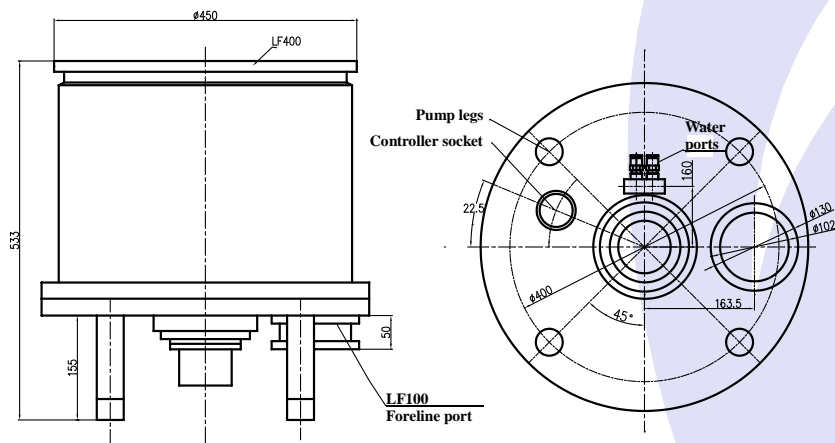


Figure 2-11 F-400/3500E dimensions



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## 2.6 The controllers matched with the molecular pumps

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

| Pump model                 | Matching controller |      |
|----------------------------|---------------------|------|
| F-100/110E                 | FD-110A             | FD-I |
| FF-160/620CE               | FD-II 600H          |      |
| FF-160/620NE, FF-160/620ZE | FD-II 600K          |      |
| FF-160/700E                | FD-II 700K          |      |
| FF-200/1200E               | FD-II 1200K         |      |
| FF-200/1200CE              | FD-II 1200H         |      |
| FF-200/1300                | FD-II 1300K         |      |
| F-250/1500E                | FD-II 1500K         |      |
| FF-250/1600E               | FD-II 1600H         |      |
| FF-250/1800E               | FD-II 1800K         |      |
| F-400/3500E                | FD-3500K            |      |



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### 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, cold and hard oscillations 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 cold. Storage ambient temperature temperatures:  $-20^{\circ}\text{C}\sim+55^{\circ}\text{C}$ ; relative humidity should be less than 95%.

#### 3.3 Moving

When moving the pump, don't hold the pump upside down or at a higher angle than  $45^{\circ}$ . And care should be taken to provide protections on the parts, such as high-vacuum port, fore line port, water ports, and controller socket.



**Caution:**

**Don't remove the plastic covers until required for use;**

**Don't use extending parts as moving handles, such as the fore line port, water ports and controller socket;**

**Attend to protect the high-vacuum port and the fore line port to avoid scratching while moving.**





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### 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 corrosive gases, and the lubricating oil should be corrosive-resistant supplied by Eurovacuum.



#### **Caution:**

**You must use the controller specified in these instructions and matching 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:  $220 \pm 22$ v, frequency:  $50 \pm 1$ hz;
- 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 that the rotor can rotate flexible without hysteresis and seizing. Then cover the flange apron properly.



#### **Caution:**

- a) **If any damage that may decrease the performance was found while opening the package, please contact the supplier, don't deal with it by yourself;**
- b) **Pay attention to protecting the inlet and the fore line port from scratches that may effect the vacuum performance;**
- c) **Don't leave the high-vacuum flange and the fore line flange unclosed for a long-period. Prevent dust and foreign substances' from entering 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 higher weight pumps, 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).

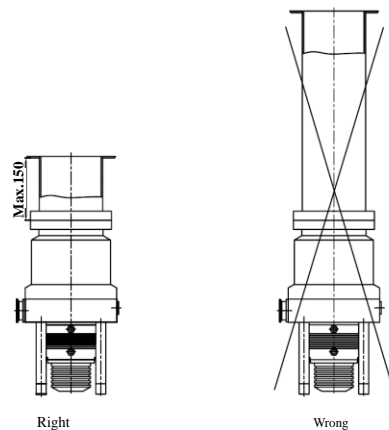


Figure 4-1 Diagrammatic sketch of pump and system connection

The inlet screen 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.**

#### 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 has an mechanical or electrical 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 when using an oil lubricated backing pump.



Figure 4-2 Fore line port

#### 4.3.4 Connecting the purge device

For the corrosion-resistant pump, 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 purge operation.

#### 4.3.5 Connecting the cooling

a) Air cooled pump: Be sure there is no thermal resource around the pump and no obstacle blocking the 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 by 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 1–2 bar, the temperature should be less than 25°C, the flux should be more than 1 l/min.

(Remark: there are slight differences between the water port locations of the pumps with different inlet flanges.)



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

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

Only corrosion-resistant pump has 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



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

#### 4.3.7 Charging lubricant

Grease lubricated pumps have been charged with enough grease before it leaves the factory, they do not need charging 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, pumps with pumping speeds over 150 l/s have been discharged from the oil before they leave the factory. So it will be needed to charge the new pump with oil before operation.

##### **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.



Figure 4-5 Oil sump of oil lubricated pump

##### **⚠ Caution:**

- a) The lubricating oil is special non-visible oil with low saturated vapour pressure. Don't 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) Corrosion-resistant pumps must use the special matching oil.

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

#### 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.**

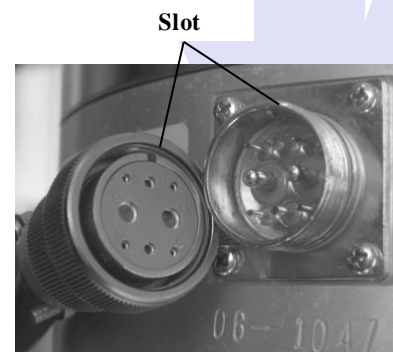


Figure 4-6 Controller slot



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### 5 Operation

#### 5.1 Before switching on



**Warning:**

When pumping flammable mixed gases, the pressure inside the pump must be very low so that there is no danger of ignition (at pressures below 100 mbar). Under the conditions that the pressure is relatively high (above 100 mbar) and the pump's temperature is more than 120°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. You must install a multilayer filter net at the inlet port, when pumping 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 with purge gas when work with corrosive gases, and the lubricating oil should be corrosive-resistant oil from Eurovacuum.



**Note:**

some media (e.g. aluminium chloride) can sublime 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 Eurovacuum.

#### 5.2 Switching on

##### 5.2.1 Pressure at switching on

Assume the system volume being pumped is  $V$  [ $m^3$ ], the fore line pumping speed is  $S_f$  [ $m^3/h$ ],

In case  $S_f/V > 40$  [ $h^{-1}$ ], 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  $S_r/V \leq 40$  [ $h^{-1}$ ], the system volume being pumped is so large that the backing pump should be switched on firstly. After the system pressure is less than 2 mbar or  $e^{(S_r/6V)}$  [mbar], 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 cooled 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—20 sccm, but it should be increased properly when pumping more strongly corrosive gases.



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#### 5.2.4 Switching on



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

Switch on the pump by pressing the “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 following:

1. Switch on the pump firstly. After the controller show it achieved the rated rotation speed, press the “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, after that you can switch on the pump as normal;

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  $10^{-6}$ mbar without bake-out, and a vacuum less than  $10^{-7}$ mbar 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.



Figure 5-1 Heater

In the area of relatively higher air humidity the system and the pump need baking sometimes to get a vacuum less than  $10^{-6}$ mbar.

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.



**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, causing serious damage.**



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### 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 “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 “stop” button on the controller, don't shut-down the controller power supply. Pressing the “stop” button the system is using the 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 “stop” button before the pump come to a standstill could reduce oil vapour'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 Eurovacuum turbo pumps haven't a venting port, except the custom-made and the FF-250/1800E.

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 vapour and solid particles from the fore line entering the pump.

 **Caution: the pressure in the pump shouldn'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 a long time via the valve between the pump and the vacuum chamber, while don't keep the pump in vacuum condition for a long time.





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## **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 aluminium 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.



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## 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) **Dismantling without authorization is strictly prohibited and it must be performed 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 Eurovacuum for balancing, if the misuses had been made.**

### 7.1 Replacing the lubricating oil

#### 7.1.1 100 series turbo molecular 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. Now 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 Pumps with pumping speed $\geq 200$

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, then drying it;
- 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.**



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### 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 Eurovacuum company and appointed professionals are entitled to dismantle and clean the pump.

### 7.3 Replacing the bearings

Qualified products passed good overall machine dynamic balancing with special equipment before they leave the factory. After replacing the bearings the pumps need rebalancing, so only Eurovacuum 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 inside and outside are equalized; If the pump is used with corrosive gas, be sure that the process gas has been eliminated cleanly from the vacuum chamber, pump and the fore line pipe. Deposit can be hazardous to human body, so please use gloves, a breathing mask or protective clothing when necessary and clean it as soon as possible to avoid it reacting with surrounded air and producing volatile or corrosive acids and alkalis. Please pack the pump inside a closed plastic bag immediately after removing.

## 8 Troubleshooting

**⚠ Warning: Before return a used pump to Eurovacuum, please state fill in the « Declaration of Contamination of Vacuum Equipment and Components» (attached behind these instructions), to ensure the safety of maintenance staff. Otherwise the manufacturer has the right to refuse to offer service of maintenance.**

### 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 after a long time

- a) Leaks in vacuum system. Search for leaks and tighten them.
- b) Fore-vacuum pressure is higher than  $10^{-1}$ mbar . Check the backing pump function and search for leaks in 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 Eurovacuum.

### 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 Eurovacuum;
- d) Bearings damaged. Return the complete machine to Eurovacuum.

### 8.4 Low vacuum

- a) Fore-vacuum pressure is higher than  $10^{-1}$ mbar, 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 2 hours.
- d) Rotation speed is lower and output frequency error is more than  $\pm 10$ Hz (for F-400/3500E,  $\pm 12$ 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 is dirty. Clean it.

### 8.5 Other

Address Eurovacuum for any other questions or technical supports.

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